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Freeway Data for Incident and Nonincident Conditions Volume 3: FORTRAN Program Documentation for Analyzing Individual Data Sets

California State Dept of Transportation, Los Angeles

Prepared for

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FREEWAY DATA FOR INCIDENT AND NON-INCIDENT CONDITIONS

Vol. 3 FORTRAN Program Documentation for Analyzing Individual Data Sets

December 1977
Final Report

Prepared for
FEDERAL HIGHWAY ADMINISTRATION
Offices of Research & Development
Washington, D. C. 20590

FOREWORD

This report describes a FORTRAN IV computer program for analyzing incident and non-incident data collected from freeways in Los Angeles, California. The data was used in the development of freeway incident detection algorithms. The data has been collected from freeway loop detectors every 20 seconds. In that the data may be of use in many other applications, it has been retained on magnetic data tapes. If a user wishes to use any of the available magnetic data tapes or computer program, they should contact the Federal Highway Administration, HRS-33, Washington, D. C. 20590.

This report is being distributed on a limited basis to selected researchers, a few Washington Headquarters specialists, and NTIS.

Charles F. Scheffey
Director, Office of Research

NOTICE

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16. Abstract
The results of the project to collect freeway traffic data for use in developing and verifying incident detection algorithms are presented in three volumes. This volume contains instructions on the usage of a FORTRAN program to analyze data collected in Volumes 1 and 2.

Vol. No.	FHWA No.	Title
1	RD-76-175	Traffic Data Sets from Widely Spaced Detectors
2	RD-76-176	Traffic Data Sets from Closely Spaced Detectors

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1. INTRODUCTION

The Los Angeles Area Freeway Surveillance and Control Project (LAAFSCP) provided the basis for this data collection study. Figure 1 shows the freeways that are under LAAFSCP's control. The California Department of Transportation had already installed loop detectors in the freeway lanes at about one-half mile spacing on 42 miles of urban freeway. The detectors were connected, over phone lines, to a central computer which polls each loop 15 times a second in order to build summaries of vehicle counts and occupancy to be used in ramp metering control and incident detection.

This report volume contains instructions on the usage of a FORTRAN IV program to analyze the individual data sets in Volumes 1 and 2. Both Volumes 1 and 2 involved the collection of incident and non-incident data. Data for Volume 1 was collected from various locations on the 42-mile loop, and data for Volume 2 was collected from a 1-mile highly instrumented section on the San Diego Freeway.

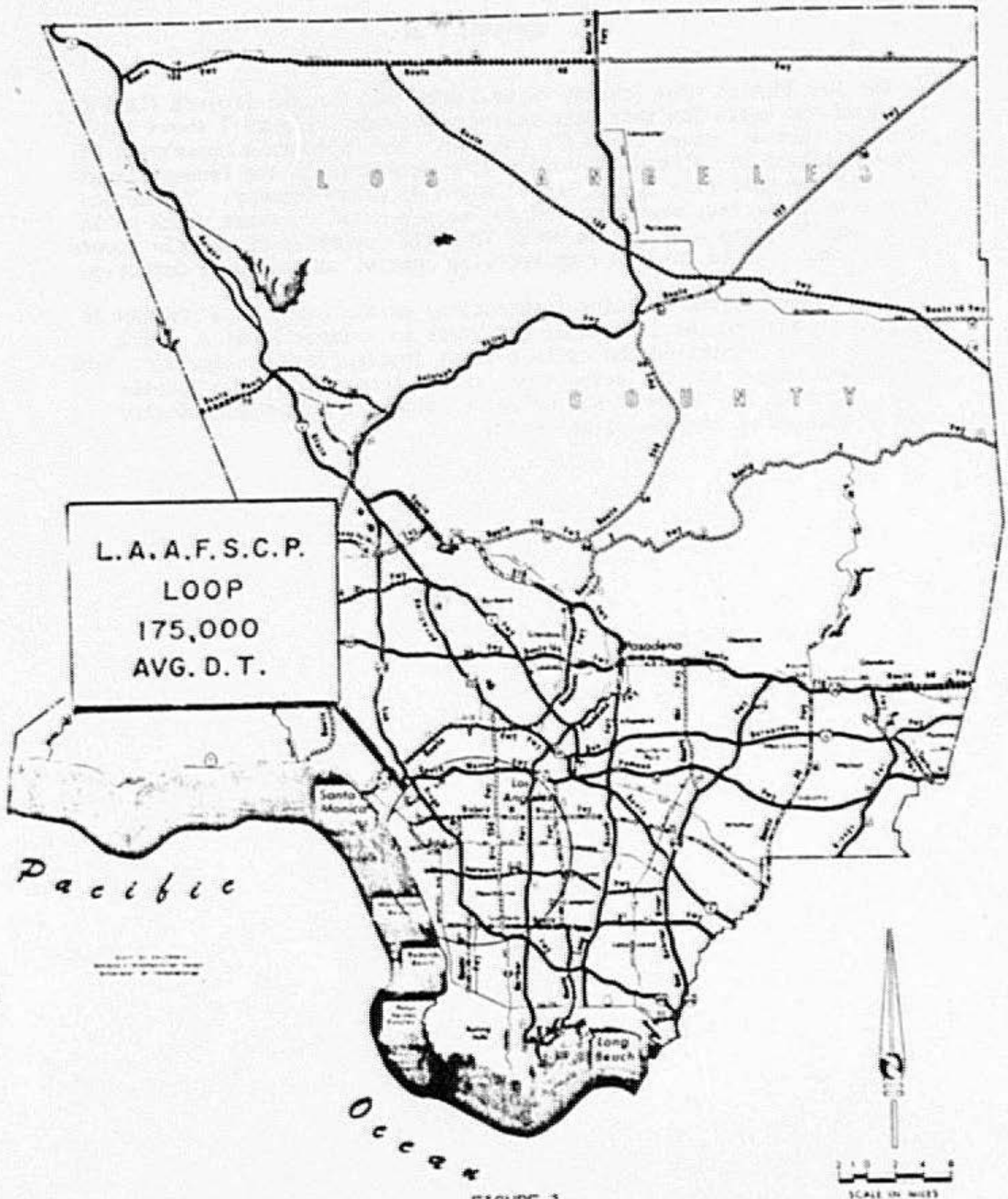

FIGURE 1

L.A.A.F.S.C.P. LOCATION

2. LAAFSCP DATA TAPE ANALYSIS PROGRAM

2.1 PURPOSE

This FORTRAN IV program was written to process computer collected pulse counts and durations from sensors on selected segments of 42 miles of Los Angeles freeways from nine-track magnetic tapes.

Computations of average occupancy percent and total volume counts are performed for each sensor for which there is input data.

Estimates of volume per lane per hour, density, and average speed are calculated for each sensor from occupancy percent and/or total volume counts. Also, averages of active mainline sensors are computed for each freeway station.

This FORTRAN IV data analysis program is to be used with 800bpi, nine-track magnetic data tapes that the Los Angeles Area Freeway Surveillance and Control Project (LAAFSCP) real-time system has generated from loop sensors imbedded in the roadway of the 42 miles of freeway under control of LAAFSCP using a 1/15th second sampling rate.

The input data tapes consist of three files as seen in Figure 2. The first file (Header Block) contains the documentation information. The second file contains the binary coded Lane Sensor Table (Lane Sensor Table Block). The third file consists of binary coded vehicular detector crossing record blocks (Continuous Time Series Data Blocks).

This program will convert the input data tape Continuous Time Series Data Block Records to time serial data for lane occupancies, volumes, velocities and density.

The program allows the user the option of using default values or changing key control parameters that control the time period, the time intervals, and the freeway stations for which the time serial data is to be calculated. In addition, the user can specify that the documentation information, Lane Sensor Table, and computed statistics be output to a storage device and/or output to a listing device. The sample rate and the density conversion factor is also changeable.

This program is written in modular form. Most of the routines used in this program can be used to build other programs.

2.2 REMARKS

This program was written exclusively in FORTRAN IV. The program is composed of a main calling or scheduling program with many small subroutines and functions. (Figures 7 and 8 show the relationships of the different routines.) Extensive use of Labeled Common areas is employed. Input-output subroutines were held to a minimum.

HEADER BLOCK - PACKED ALPHANUMERIC CHARACTERS

1 - 4096 BYTE RECORD
-(4096 BYTE BLOCK)

END OF FILE MARK

LANE SENSOR TABLE BLOCK

- BINARY RECORDS
341 - 12 BYTE RECORDS
1 - 4 BYTE RECORD
-(4096 BYTE BLOCK)

END OF FILE MARK

CONTINUOUS TIME SERIES DATA BLOCK

- BINARY RECORDS
1 - 4 BYTE RECORD
341 - 12 BYTE RECORDS
-(4096 BYTE BLOCK)

.
.
.

CONTINUOUS TIME SERIES DATA BLOCK

- BINARY RECORDS
1 - 4 BYTE RECORD
341 - 12 BYTE RECORDS
-(4096 BYTE BLOCK)

END OF FILE MARK

END OF FILE MARK

FIGURE 2

INPUT DATA TAPE FILE ORDER
9-TRACK MAGNETIC TAPE (800BPI)

FORTRAN was chosen to write this program because it seemed to offer the best probability of being executable in most installations and there is also a considerable amount of "number crunching" involved in computing the average sensor and station values from the input data tape.

Subroutines and functions are used whenever a process or procedure is one or more of the following:

(1) Used in more than one place.
(2) Either input or output is involved:

    (A) Input from a tape device.
    (B) Output to a tape device.
    (C) Output to a listing device.
    (D) User-program communication.

(3) Subject to installation limits.
(4) Subject to change or modification.
(5) Naturally or logically similar or related tasks.

Input-output was limited to a few subroutines because the FORTRAN IV Library READ and WRITE routines used by LAAFSCP would not allow input or output of more than one Line Printer line without modification of the FORTRAN Library or without using an Extended FORTRAN IV Library routine.

Labeled Common areas are used for most arrays. When more than two (2) arguments would have to be passed to another program or when an argument is passed to one program and then passed to another program, Labeled Common is used.

There are approximately 11,250 words in Labeled Common.

The following order of specification statements was used in the FORTRAN program modules and should be acceptable for most FORTRAN IV compilers:

Type

DIMENSION

Labeled Common

FORMAT

all executable statements

END

2.3 ANALYSIS PROGRAM OUTPUT FORMAT

Hardcopy generated by the analysis program includes the documentation information and summarized traffic statistics as shown in Figures 3 through 5. The documentation information is fixed for each data set but the traffic data summaries can be varied by the user to get the time intervals or locations that he wishes.

Figure 3 illustrates the documentation information that is contained on the tape. The entries on this printout will be:

Tape No. - This is the identification number assigned to each tape and is in the format YYMMDDNN, where:

- YY - refers to the year
- MM - is the month
- DD - is the day
- NN - is a number used to differentiate between data sets collected on the same day

Traffic Code - The traffic density level as explained in the Data Classification section of this volume.

Time Limits - These are the time limits for which data was collected for this data set. Time is based on a 24-hour clock.

Incident Location - Used only on incident data sets to indicate the two freeway stations between which the incident occurred. Format is FFSSD, where:

FF - indicates the freeway involved or speed trap

- ST - Speed Trap
- SD - San Diego Freeway

SS - gives the freeway station

D - gives the direction of travel

- N - North
- S - South

Affected Segments - This entry gives the number of and locations of the freeway segments from which data was collected. Freeway segments are in the same format as for the incident location.

Incident Type - Used only for incident data sets to indicate what occurred to affect traffic. Possible entries are:

- TCOL - Traffic collision
- DISL - Disabled vehicle

TAPE NO. 76073001 TRAFFIC CODE - 1 FROM 12:10:00 to 14:30:00

INCIDENT LOCATION: ST08N TO ST09N

AFFECTED SEGMENTS: 2

SEGMENT (1) FROM ST01N TO ST10N
SEGMENT (2) FROM SD31S TO SD29S

INCIDENT TYPE: TOOL

VEHICLES INVOLVED: 4

LIGHT DUTY VEHICLES - 4

WEATHER AND ROAD CODES:

WEATHER - C
VISIBILITY - S
PAVEMENT - D

DETECTION AND VERIFICATION: DETECTED AT 12:46:00 BY CODE S
VERIFIED AT 12:42:00 BY CODE V

LAND MARKS: POST MILE - 28.21

INCIDENT FREEWAY GEOMETRY

	M	1	2	3	4	5	6	S	R	S	C	C	S	COMMENTS
GEOMETRY	1	1	1	1	1	0	0	1	0	0	0	0	0	

INCIDENT SCENARIO EVENT TIMES

TIME	M	1	2	3	4	5	6	S	R	S	C	C	S	COMMENTS
12:42:00	0	0	0	1	0	0	0	0	0	0	0	0	0	4 CAR ACCIDENT IN LA
12:42:00	0	0	0	1	0	0	0	0	0	0	0	0	0	CHP ON SCENE. 1 INJU
12:50:00	0	0	0	1	0	0	0	1	0	0	0	0	0	3 CARS MOVED TO RT S
12:51:00	0	0	0	1	0	0	0	1	0	0	0	0	0	TOW TRUCK ARRIVED.
13:04:00	0	0	0	0	0	0	0	1	0	0	0	0	0	TOW TRUCK MOVED CAR
13:04:00	0	0	0	0	0	0	0	1	0	0	0	0	0	LANE 3 TO RT SHOULDE
13:16:00	0	0	0	0	0	0	0	0	0	0	0	0	0	ALL CLEAR OF CARS ON

TRAFFIC VOLUME COUNTS: NONE

ADDITIONAL COMMENT LINES:

4 CAR T/C IN LANE 3.

FIGURE 3

ILLUSTRATION OF DOCUMENTATION INFORMATION

SPIL - Spilled load
GAWK - Gawking where people are looking at something either on or off the freeway
NOTH - No apparent reason for the incident

Vehicles Involved - Indicates the total number of vehicles actively involved in the incident. The total is then broken down into three classes:

LIGHT DUTY VEHICLES - Cars, motorcycles and pickups
LIGHT TRUCKS - Vans and delivery trucks
HEAVY TRUCKS - Trucks larger than delivery van size

Weather and Road Codes - Weather codes can be:

C - Clear
L - Light rain
H - Heavy rain

Visibility can be:

S - Sunny
H - Hazy
O - Overcast
F - Foggy
D - Dark

Pavement can be:

D - Dry
P - Damp
W - Wet

Detection and Verification - Detection is an indication if the incident was detected by the existing LAAFSCP incident detection logic. A code of "C" indicates that the computer detected the incident at the time indicated.

Verification is the method used to certify that there actually was an incident and not just a false alarm. The time indicates when verification was made and the code indicates the manner:

H - Helicopter
C - California Highway Patrol
V - Verification driver

Land Marks - This section gives physical reference points to where the incident occurred.

CALL BOX - Indicates the nearest freeway trouble phone and

is the format FFNNN, where "FF" indicates the freeway, the same as under incident location, and "NNN" indicates the call box number.

LOOP STATION - Shows the closest loop station in the same format as used under incident location.

POST MILE - Indicates the actual position according to post mile measurements.

Incident Freeway Geometry - This section gives the lane configuration at the incident site. The heading M123456SRSCCS is broken up into three sections, M123456S, R and SCCS, where the first is the freeway proper, the next is used to indicate a ramp and the last a collector-distributor road.

In the freeway section, the M refers to a median shoulder and the 1 through 6 indicate freeway lanes with the lanes numbered from left to right when facing in the direction of travel. The S refers to an outside shoulder.

The R in the ramp section indicates the presence or absence of either an on or off-ramp.

The collector-distributor road can show an S for the left-hand shoulder, two traffic lanes and a right-hand shoulder.

A 1 placed under the letter or number indicates that the item is present while a zero indicates that it is not.

For example:

M123456SRSCCS
1111100100000

This is a four-lane freeway with a median shoulder and right-hand shoulder, no ramps and no collector-distributor.

M123456SRSCCS
1111110110000

This five-lane section has both a median and right-hand shoulder and there is either an on or off-ramp.

M123456SRSCCS
1111100101101

This four-lane freeway with both shoulders also has a one lane collector-distributor with shoulders on both sides.

Incident Scenario Event Times - The meaning of the geometry heading is the same for this section as for the Incident Freeway Geometry.

Entries are arranged chronologically with a 1 in the columns that the comments refer to.

As an example, in Figure 3, the first entry is a 1 in column 3. This indicates that when the four cars involved collided, they blocked one of the outside lanes. The CHP arrived at the scene at the same time the incident was verified which as 1242. Although at 1250 three cars were moved to the right shoulder as indicated by a 1 in the S column, one car remained in the roadway as indicated by a 1 in column 3. At 1251 the tow truck arrived and at 1304 removed the vehicle from the outside lane to the right shoulder. At 1316 the right shoulder was clear of all vehicles.

Traffic Volume Counts - If manual traffic counts were taken within the incident location, they will be recorded in this section. The duration is time in seconds and the count is for all freeway lanes.

Additional Comment Lines - Any comments that could not be fit into the Incident Scenario section will be placed here using the same abbreviations and codes.

Figure 4 is an example of the sensor index table. These figures give a listing of all the active loops from which data was collected. The table is broken up into separate sections for each of the segments and for the environmental sensors.

The entries in the table are:

Sensor Index Number - This is the logical index number used to identify this sensor on this particular data set. This is the number used to select records from the data set and will not be needed by a user, unless he writes his own programs to access data on the tapes.

Freeway Station, Direction, Lane Type and Number - This section identifies the physical location of the loop on the freeway. The FWY STA DIR part follows the same format as used for the affected segment.

Within the lane type codes, the on-ramps, off-ramps, connectors and collector-distributor codes use suffixes of "A" and "B". The suffixes are needed to establish a unique identification because occasionally two separate on-ramps, etc., are associated with the same freeway station.

SEGMENT (1) FROM ST01N TO ST10N SENSORS 1 TO 58

SENSOR INDEX NO.	FWY	STA	DIR	LANE TYPE	LANE NO.	MBAI CODE	STATION INDEX NO.
1	ST	1	N	LANE	1	1	1
2	ST	1	N	LANE	2	1	
3	ST	1	N	LANE	3	1	
4	ST	1	N	LANE	4	1	
5	ST	2	N	LANE	1	1	
6	ST	2	N	LANE	2	1	
7	ST	2	N	LANE	3	1	
8	ST	2	N	LANE	4	1	
9	ST	2	N	SPD	1	1	
10	ST	2	N	SPD	2	1	
11	ST	2	N	SPD	3	1	
12	ST	2	N	SPD	4	1	
13	ST	3	N	LANE	1	1	3
14	ST	3	N	LANE	2	1	
15	ST	3	N	LANE	3	1	
16	ST	3	N	LANE	4	1	
17	ST	4	N	LANE	1	1	4
18	ST	4	N	LANE	2	1	
19	ST	4	N	LANE	3	3	
20	ST	4	N	LANE	4	1	
21	ST	4	N	SPD	1	1	
22	ST	4	N	SPD	2	1	
23	ST	4	N	SPD	3	1	
24	ST	4	N	SPD	4	1	
25	ST	5	N	LANE	1	1	5
26	ST	5	N	LANE	2	1	
27	ST	5	N	LANE	3	1	
28	ST	5	N	LANE	4	1	
29	ST	6	N	LANE	1	1	6
30	ST	6	N	LANE	2	1	
31	ST	6	N	LANE	3	1	
32	ST	6	N	LANE	4	1	
33	ST	6	N	SPD	1	1	

FIGURE 4

ILLUSTRATION OF SENSOR INDEX TABLE

SENSOR INDEX NO.	FWY	STA	DIR	LANE TYPE	LANE NO.	MBAI CODE	STATION INDEX NO.
34	ST	6	N	SPD	2	1	
35	ST	6	N	SPD	3	1	
36	ST	6	N	SPD	4	1	
37	ST	7	N	LANE	1	1	7
38	ST	7	N	LANE	2	1	
39	ST	7	N	LANE	3	1	
40	ST	7	N	LANE	4	1	
41	ST	8	N	LANE	1	1	8
42	ST	8	N	LANE	2	1	
43	ST	8	N	LANE	3	1	
44	ST	8	N	LANE	4	1	
45	ST	8	N	SPD	1	1	
46	ST	8	N	SPD	2	1	
47	ST	8	N	SPD	3	1	
48	ST	8	N	SPD	4	1	
49	ST	9	N	LANE	1	1	10
50	ST	9	N	LANE	2	1	
51	ST	9	N	LANE	3	1	
52	ST	9	N	LANE	4	1	
53	ST	10	N	LANE	1	1	10
54	ST	10	N	LANE	2	1	
55	ST	10	N	LANE	3	1	
56	ST	10	N	LANE	4	1	
57	ST	10	N	SPD	1	1	
58	ST	10	N	SPD	2	1	

SEGMENT (2) FROM SD31S TO SD29S SENSORS 59 64

SENSOR INDEX NO.	FWY	STA	DIR	LANE TYPE	LANE NO.	MBAI CODE	STATION INDEX NO.
59	SD	31	S	LANE	1	1	11
60	SD	31	S	LANE	3	1	
61	SD	30	S	LANE	1	1	12
62	SD	30	S	LANE	3	1	

FIGURE 4 (CONTINUED)

ILLUSTRATION OF SENSOR INDEX TABLE

SENSOR INDEX NO.	FWY	STA	DIR	LANE TYPE	NO.	MBAI CODE	STATION INDEX NO.
63	SD	29	S	LANE	1	1	13
64	SD	29	S	LANE	2	1	

ENVIRONMENTAL SENSORS 65 TO 70

SENSOR INDEX NO.	FWY	STA	DIR	LANE TYPE	NO.	MBAI CODE	STATION INDEX NO.
65	SM	18	E	ENVT	1	1	
66	SM	18	E	ENVL	1	1	
67	SM	18	E	ENVW	1	1	
68	HA	20	N	ENVT	1	1	
69	HA	20	N	ENVL	1	1	
70	HA	20	N	ENVW	1	1	

FIGURE 4 (CONTINUED)

ILLUSTRATION OF SENSOR INDEX TABLE

Possible lane type codes are:

LANE - Mainline freeway
ONA, ONB - Freeway on-ramp
OFFA, OFFB - Freeway off-ramp
CONA, CONB - Freeway-to-freeway connector
CDA, CDB - Collector-distributor road
ENVT - Environmental sensor for temperature
ENVL - Environmental sensor for light
ENVW - Environmental sensor for moisture

Lane number indicates the lane position within the station and is numbered from left to right when facing in the direction of travel.

MBAI Code - Modified, bad, active and inactive state code for the sensor.

Modified - The sensor was recently changed from the inactive state to the active state, or vice versa.

Bad - A malfunction was detected for this sensor.

Active - The sensor was collecting data at this time.

Inactive - The sensor was not collecting data at this time.

Code Number	Meaning
0	Inactive
1	Active
2	Bad, inactive
3	Bad, active
4	Modified, inactive
5	Modified, active
6	Modified, bad, inactive
7	Modified, bad, active

Station Index No. - These are the index numbers that the user must input, when starting the program, if he wishes to get a summary of only some of the stations.

For example, using Figure 4:

If ST01N to ST03N is desired, then 13 00 00 00 00 would be used in the input parameters.

If ST01N and ST03N to ST05N were desired, then 11 35 00 00 would be input.

Figure 5 is an example of the traffic data summaries that will be printed out. The heading for each segment gives the time interval and the station limits of the subtotal.

The vertical format of the date entries is:

HEADING

Mainline lane
.
.
.

Mainline station summary

Ramp, collector and connector individual lane data
.
.
.
Ramp, collector and connector individual lane data

HEADING
.
.
.

The mainline station summary gives an average of the individual lane values for occupancy, VOL/LN/HR, DENSITY and SPEED and a total of the individual lane values for volume.

The data entries are:

OCCUPANCY - This represents the percent of time that a vehicle was actually within the influence area of the loop.

VOLUME - The count of vehicles that pass over the loop.

VOL/LN/HR - Hourly volume per lane.

DENSITY - Vehicles per lane per mile. This value is calculated by using occupancy and an assumed average vehicle length.

SPEED - A calculated speed (MPH) from hourly lane volume, occupancy and assumed average vehicle length, e.g., Speed = Volume/(2.8 x occupancy).

TIME IS 12:15:00 FROM STATION ST 1N TO STATION ST10N

	OCCUPANCY	VOLUME	VOL/LN/HR	DENSITY	SPEED
ST 1NLANE1	12.09	125.00	1500.00	33.85	44.31
ST 1NLANE2	13.58	134.00	1608.00	38.02	42.30
ST 1NLANE3	14.16	126.00	1512.00	39.64	38.15
ST 1NLANE4	16.22	131.00	1572.00	45.42	34.61
ST 1N	14.01	516.00	1548.00	39.23	39.84

	OCCUPANCY	VOLUME	VOL/LN/HR	DENSITY	SPEED
ST 2NLANE1	10.67	125.00	1500.00	29.87	50.22
ST 2NLANE2	12.27	137.00	1644.00	34.35	47.86
ST 2NLANE3	14.80	119.00	1428.00	41.44	34.46
ST 2NLANE4	17.56	135.00	1620.00	49.16	32.96
ST 2N	13.82	516.00	1548.00	38.70	41.38
ST 2NSPD 1	10.80	125.00	1500.00	30.24	49.60
ST 2NSPD 2	11.96	135.00	1620.00	33.48	48.39
ST 2NSPD 3	15.16	119.00	1428.00	42.44	33.65
ST 2NSPD 4	17.89	137.00	1644.00	50.09	32.82

	OCCUPANCY	VOLUME	VOL/LN/HR	DENSITY	SPEED
ST 3NLANE1	11.24	127.00	1524.00	31.48	48.40
ST 3NLANE2	12.47	136.00	1632.00	34.91	46.75
ST 3NLANE3	13.11	128.00	1536.00	36.71	41.84
ST 3NLANE4	14.60	134.00	1608.00	40.88	39.33
ST 3N	12.86	525.00	1575.00	36.00	44.08

	OCCUPANCY	VOLUME	VOL/LN/HR	DENSITY	SPEED
ST 4NLANE1	10.96	127.00	1524.00	30.68	49.68
ST 4NLANE2	10.47	132.00	1584.00	29.31	54.05
ST 4NLANE3	96.69	41.00	492.00	270.73	1.82
ST 4NLANE4	13.51	132.00	1584.00	37.83	41.87
ST 4N	32.91	432.00	1296.00	92.14	36.85
ST 4NSPD 1	9.44	125.00	1500.00	26.44	56.72
ST 4NSPD 2	10.78	133.00	1596.00	30.18	52.89
ST 4NSPD 3	12.87	132.00	1584.00	36.03	43.97
ST 4NSPD 4	13.09	132.00	1584.00	36.65	43.22

FIGURE 5

ILLUSTRATION OF TRAFFIC DATA SUMMARIES

	OCCUPANCY	VOLUME	VOL/LN/HR	DENSITY	SPEED
ST 5NLANE1	12.56	128.00	1536.00	35.16	43.69
ST 5NLANE2	13.11	130.00	1560.00	36.71	42.49
ST 5NLANE3	15.82	132.00	1584.00	44.30	35.75
ST 5NLANE4	12.78	98.00	1176.00	35.78	32.87
ST 5N	13.57	488.00	1464.00	37.99	38.70

	OCCUPANCY	VOLUME	VOL/LN/HR	DENSITY	SPEED
ST 6NLANE1	11.58	128.00	1536.00	32.42	47.38
ST 6NLANE2	10.20	124.00	1488.00	28.56	52.10
ST 6NLANE3	14.58	141.00	1692.00	40.82	41.45
ST 6NLANE4	14.60	131.00	1572.00	40.88	38.45
ST 6N	12.74	524.00	1572.00	35.67	44.85
ST 6NSPD 1	11.60	128.00	1536.00	32.48	47.29
ST 6NSPD 2	10.13	125.00	1500.00	28.37	52.87
ST 6NSPD 3	15.53	142.00	1704.00	43.49	39.18
ST 6NSPD 4	15.11	134.00	1608.00	42.31	38.00

	OCCUPANCY	VOLUME	VOL/LN/HR	DENSITY	SPEED
ST 7NLANE1	10.56	125.00	1500.00	29.56	50.75
ST 7NLANE2	14.24	130.00	1560.00	39.88	39.11
ST 7NLANE3	14.91	151.00	1812.00	41.75	43.40
ST 7NLANE4	15.93	149.00	1788.00	44.61	40.08
ST 7N	13.91	555.00	1665.00	38.95	43.34

	OCCUPANCY	VOLUME	VOL/LN/HR	DENSITY	SPEED
ST 8NLANE1	12.31	125.00	1500.00	34.47	43.51
ST 8NLANE2	12.93	138.00	1656.00	36.21	45.73
ST 8NLANE3	16.82	148.00	1776.00	47.10	37.71
ST 8NLANE4	16.80	141.00	1692.00	47.04	35.97
ST 8N	14.72	552.00	1656.00	41.21	40.73
ST 8NSPD 1	12.42	125.00	1500.00	34.78	43.13
ST 8NSPD 2	13.20	137.00	1644.00	36.96	44.48
ST 8NSPD 3	16.69	150.00	1800.00	46.73	38.52
ST 8NSPD 4	17.49	143.00	1716.00	48.97	35.04

FIGURE 5 (CONTINUED)

ILLUSTRATION OF TRAFFIC DATA SUMMARIES

	OCCUPANCY	VOLUME	VOL/LN/HR	DENSITY	SPEED
ST 9NLANE1	9.51	124.00	1488.00	26.63	55.87
ST 9NLANE2	10.16	139.00	1668.00	28.44	58.66
ST 9NLANE3	14.73	151.00	1812.00	41.25	43.92
ST 9NLANE4	15.09	145.00	1740.00	42.25	41.18
ST 9N	12.37	559.00	1677.00	34.64	49.91

	OCCUPANCY	VOLUME	VOL/LN/HR	DENSITY	SPEED
ST10NLANE1	10.09	127.00	1524.00	28.25	53.95
ST10NLANE2	10.93	136.00	1632.00	30.61	53.31
ST10NLANE3	22.58	168.00	2016.00	63.22	31.89
ST10NLANE4	14.78	149.00	1788.00	41.38	43.21
ST10N	14.59	580.00	1740.00	40.86	45.59
ST10NSPD 1	10.13	127.00	1524.00	28.37	53.71
ST10NSPD 2	10.98	136.00	1632.00	30.74	53.09

FIGURE 5 (CONTINUED)

ILLUSTRATION OF TRAFFIC DATA SUMMARIES

Figure 6 is an example of the calculated speeds for the speed trap locations:

ST 2N
ST 4N
ST 6N
ST 8N
ST10N

Each page has a standard heading and each line is the calculated speed of the speed trap station as encountered on the input data tape. The time columns are the "on-times" of the sensors in military time, seconds, and milliseconds. The location columns show the station and lane. The speed columns show the calculated speed for the current "on-times" and the average speed up to and including the current value.

Figure 7 is an example of the average speeds for the speed trap location printed at the end of the program.

TIME		LOCATION		SPEED	
UPSTREAM	DOWNSTREAM	STATION	LANE	CURRENT	AVERAGE
1214:55.266	1214:55.466	ST 2N	1	61.36	68.11
1214:55.200	1214:55.466	ST 2N	4	46.14	56.10
1214:55.400	1214:55.533	ST 6N	1	92.28	67.81
1214:55.666	1214:55.800	ST10N	1	91.59	65.17
1214:55.666	1214:55.866	ST 6N	3	61.36	59.05
1214:55.600	1214:55.866	ST 4N	4	46.14	56.53
1214:55.666	1214:55.866	ST10N	2	61.36	62.84
1214:55.666	1214:55.933	ST 2N	3	45.97	63.16
1214:55.866	1214:56.066	ST 2N	2	61.36	63.20
1214:56.000	1214:56.200	ST 4N	1	61.36	65.82
1214:56.466	1214:56.666	ST 6N	1	61.36	67.76
1214:56.533	1214:56.666	ST 4N	2	92.28	63.65
1214:56.533	1214:56.733	ST 2N	1	61.36	68.05
1214:56.600	1214:56.800	ST10N	2	61.36	62.83
1214:56.800	1214:57.000	ST 8N	2	61.36	62.27
1214:56.933	1214:57.133	ST 8N	1	61.36	64.53
1214:57.133	1214:57.333	ST 6N	4	61.36	52.52
1214:57.333	1214:57.600	ST 4N	4	45.97	56.44
1214:57.600	1214:57.800	ST 6N	4	61.36	52.60
1214:57.666	1214:57.866	ST 6N	1	61.36	67.70
1214:57.666	1214:57.866	ST 6N	3	61.36	59.07
1214:57.600	1214:57.866	ST 2N	4	46.14	56.02
1214:57.800	1214:57.933	ST 8N	1	92.28	64.77
1214:57.800	1214:58.000	ST 6N	2	61.36	64.70
1214:57.933	1214:58.066	ST 8N	4	92.28	58.21
1214:57.866	1214:58.066	ST 2N	2	61.36	63.18
1214:58.133	1214:58.333	ST10N	2	61.36	62.82
1214:58.533	1214:58.733	ST 8N	3	61.36	56.98
1214:58.800	1214:59.000	ST 2N	1	61.36	68.00
1214:58.733	1214:59.000	ST 2N	3	45.97	63.01
1214:58.866	1214:59.133	ST 2N	4	45.97	55.94
1214:59.000	1214:59.200	ST 8N	1	61.36	64.74
1214:59.133	1214:59.266	ST 6N	1	92.28	67.90
1214:59.133	1214:59.400	ST 4N	4	45.97	56.35
1214:59.200	1214:59.400	ST 4N	1	61.36	65.78
1214:59.400	1214:59.600	ST 6N	2	61.36	64.67
1214:59.866	1215:00.000	ST 8N	2	91.59	62.50

FIGURE 6

ILLUSTRATION OF CALCULATED SPEEDS
FOR SPEED TRAP LOCATIONS

LOCATION STATION	LANE	AVERAGE SPEED
ST 2N	1	68.00
ST 2N	2	63.18
ST 2N	3	63.01
ST 2N	4	55.94
ST 4N	1	65.78
ST 4N	2	63.65
ST 4N	3	85.83
ST 4N	4	56.35
ST 6N	1	67.90
ST 6N	2	64.67
ST 6N	3	59.07
ST 6N	4	52.60
ST 8N	1	64.74
ST 8N	2	62.50
ST 8N	3	56.98
ST 8N	4	58.21
ST10N	1	65.17
ST10N	2	62.82

STOP 0
!FIN

FIGURE 7

ILLUSTRATION OF AVERAGE SPEEDS
FOR SPEED TRAP LOCATIONS

2.4 DEFINITIONS OF CONSTANTS AND VARIABLES

2.4.1 COMMON /CNSTNT/ PROGRAM CONSTANTS

These scalar quantities are used throughout the program and consist mainly of factors used in computing the statistical data. All of the constants are either calculated or read directly as input parameters except for NOSENS, which is part of the Header Block.

Keyword	Type	Purpose
GFACTR	R	Density conversion factor. Default value of 2.80 (one of the changeable input parameters)
CFACTR	R	Hourly lane volume conversion factor calculated from the updating interval.
PFACTR	R	Occupancy percent conversion factor calculated from the updating interval and sampling rate.
UFACTR	I	Updating time interval in milliseconds.
AFACTR	I	Averaging time interval in milliseconds.
DFACTR	I	Occupancy duration conversion factor calculated from the sampling rate.
NOSENS	I	Total number of sensors included in the input data tape including the environmental sensors (part of the Header Block information).
MFACTR	I	The number of update intervals in an averaging interval.
MAXUP	I	Total number of complete updating time intervals (calculated from the starting time, ending time, and the update interval).
MPTR	I	The maximum number of raw occupancy duration and volume count tables used to compute the statistical date (MPTR = MFACTR + 1).
OUTPUT	I	Integer value specifying the form of output.
LFACTR	I	Listing time interval in milliseconds.

2.4.2 COMMON /VRBL/ PROGRAM VARIABLES

This Labeled Common area variable is defined in two different parts of the program, as follows:

These variables are pointers to the current raw occupancy duration and volume count tables, update interval and current time indicators. These variables are all initialized in subroutine FRMTRS.

Keyword	Type	Purpose
LPTR	I	Points to the current raw occupancy duration and volume count tables.
NPTR	I	Points to the next raw occupancy duration and volume count tables.
IUPDTM	I	The counter for the current update interval.
UPDTIM	I	The current update time in milliseconds.
AVDTIM	I	The current averaging time in milliseconds.
LSTIME	I	The current listing time in milliseconds.

These variables are used for the speed trap portion on the program.

Keyword	Type	Purpose
LPTR	I	Points to the current speed trap lane data array entry.
NPTR	I	Accumulative counter of the number of speed trap calculations. Used in SPDPRN to determine top of page.
IUPDRN	I	The logical record count output to tape.
IUPDST	I	The first on time of the logical record.
IUPDET	I	The last on time of the logical record.
LASTR	I	The last logical record flag. Zero if not last, one if last.

2.4.3 COMMON /BLOCK0/ INTEGER BYTE CONSTANTS

These integer values are used to decode the binary coded data blocks on the input date tape.

Keyword	Type	Purpose
IBYTE	I	Integer constant used to isolate one byte (8 bits) from a four-byte word.
IHW	I	Integer constant used to isolate two bytes (16 bits) from a four-byte word.

2.4.4 COMMON /BLOCK1/ DATE AND TIME PERIOD

Keyword	Type	Purpose
DATE	I	The input data tape date.
STIME	I	Initially the input data tape starting time. It is changed to the time of the first averaging time.
ETIME	I	Initially the input data tape ending time. It is changed to the time of the last averaging time, if different.

2.4.5 COMMON /BLOCK2/ PROGRAM CONSTANTS

These values are used only in subroutines PRMTRS and LSTPRM. In TAPEOU the values are written to the output data tape, if requested. These values are equivalent forms of the time period and time interval parameters plus the sample rate.

Keyword	Type	Purpose
ISTART	I	The start time in the HHMMSS[1] format. One of the changeable input parameters.
TSTART	I	The start time in seconds.
IFINAL	I	The end time in the HHMMSS[1] format. One of the changeable input parameters.
TFINAL	I	The end time in seconds.
SMPLTR	I	The number of samples per second. One of the changeable input parameters.
AVGINT	I	The averaging time interval in seconds. One of the changeable input parameters.

1. HHMMSS: HH is the hour, MM is the minute and SS is the second.

Keyword	Type	Purpose
UPDINT	I	The update time interval in seconds. One of the changeable input parameters.
LSTINT	I	The listing time interval in seconds. One of the changeable input parameters.

2.4.6 COMMON /BLOCK3/

This common area is used to pass arguments between subroutines CTSDBR and OCCVOL.

Keyword	Type	Purpose
NUMBER	I	The record number of the current Continuous Time Series Data Block to be decoded.
IONOFF	I	The on-off state of the record.
IMBAI	I	The sensor status of the record.
ISENS	I	The sensor index number of the record.
ITIME	I	The on-off time in milliseconds of the record.

2.4.7 COMMON /ARRAY1/ STATION AND SENSOR CROSS-REFERENCE DATA

Most of the Sensor and Station Cross-Reference Data is part of the Header Block on each input data tape. These scalar quantities and arrays contain integer values that allow the isolation, selection, identification and output of selected freeway segments, stations or individual lane sensors by sensor index numbers and/or station index numbers.

Keyword	Type	Purpose
IASGMT	I(2,5)	Affected Freeway Segment Sensor Limit. Table contains the beginning and ending sensor index numbers of the affected freeway segments and environmental stations.
TOTSTA	I	The total number of freeway stations including environmental stations.
SINDEX	I(170)	Freeway Station Beginning Sensor Index Number Table. The beginning sensor index number for a station index number.

Keyword	Type	Purpose
MLSTAS	I(2,4)	Affected Freeway Segment Station Limit Table. Contains the beginning and ending station index numbers of the corresponding affected freeway segments.
MLSTOT	I	The total number of freeway stations excluding environmental stations.
ACTLNS	I(170)	Total number of mainline sensors for each freeway station.
NSENS	I(170)	Freeway Station Total Sensor Table. The total number of sensors for each freeway station.
INDEX	I(341)	Lane Sensor Index Number Table. The sequential sensor index number. If the corresponding entry is zero, the sensor data is not to be included in the statistical data.

2.4.8 COMMON /ARRAY2/ SENSOR DEFINITION DATA

The Sensor Definition Data is part of the Header Block on each input data tape. The scalar quantities contain integer values that give the dimension of the literal arrays. These arrays are used in establishing part of the Sensor Indexed Identification Arrays in Labeled Common /ARRAY3/.

Keyword	Type	Purpose
NOFWYS	I	The number of possible different complete freeway segments. This is always eight.
FRWYS	I(8)	A two-character code and a one-character code, respectively, representing the freeway and direction. (1) SM E Santa Monica Freeway - E/B (2) SM W Santa Monica Freeway - W/B (3) SD N San Diego Freeway - N/B (4) SD S San Diego Freeway - S/B (5) HA N Harbor Freeway - N/B (6) HA S Harbor Freeway - S/B (7) ST N San Diego Freeway closely spaced loops - N/B (8) -- Not Used --
NLANTP	I	The number of possible different complete lane sensor types. This is always 20.

Keyword	Type	Purpose
LNTPCD	I(20)	A four character code representing the lane sensor types as follows:

Type Number Code	Type Character Code	Description of Sensor Type
1	LANE	Mainline
2	CDA	Collector distributors
3	CDB	Collector distributors
4	CONA	Freeway connectors
5	CONB	Freeway connectors
6	OFFA	Off-ramp
7	OFFB	Off-ramp
8	ONA	On-ramp
9	ONB	On-ramp
10	VIOA	Violation counter for metered on-ramps
11	VIOB	Violation counter for metered on-ramps
12	ENVT	Environment - temperature
13	ENVL	Environment - light
14	ENVW	Environment - moisture
15	QUE	On/off-ramp queue, not used
16	SPD	Speed trap (ST)
17	POOL	Bus and pool car lane only (SM)
18	Blank	Reserved for future use

2.4.9 COMMON /ARRAY3/ SENSOR INDEXED IDENTIFICATION DATA

These arrays are initialized by subroutine LSTIN by decoding the binary values of the Lane Sensor Table Block records and the Sensor Definition Data (/ARRAY2/). These arrays are used to print the identification of a lane sensor.

Keyword	Type	Purpose
IFWY	I(341)	A two-character code representing the freeway of the lane sensor.
ISTA	I(341)	A two-character integer value representing the freeway station number of the lane sensor.
IDIR	I(341)	A one-character code representing the direction of travel of the lane sensor.

Keyword	Type	Purpose
ILNTYP	I(341)	A four-character code representing the type of lane sensor.
ILNO	I(341)	A one-character integer value (1-6).

2.4.10 COMMON /ARRAY4/

This Labeled Common area variable is defined in two different parts of the program, as follows:

COMMON /ARRAY4/ SENSOR INDEXED STATUS ARRAYS

These arrays contain integer values pertaining to the on-off state, status and on-off time for a lane sensor.

Keyword	Type	Purpose
MBAI	I(341)	A one-character integer value representing the status of the last lane sensor decoded from a Continuous Time Series Data Block Record.
LITIME	I(341)	An integer value representing the last on-off time in milliseconds of the last lane sensor decoded from a Continuous Time Series Data Block Record.
STATUS	I(341)	A one-character integer value representing the on-off status of the last lane sensor decoded from a Continuous Time Series Data Block Record. It is either the value one for on or the value zero for off.

2.4.11 COMMON /ARRAY4/ SPEED TRAP DATA ARRAY

These arrays contain the last on time, accumulated speed and total number number of speed calculations for speed trap locations.

Keyword	Type	Purpose
MTIMES	I(341)	The last on time of the speed trap sensors.
TSPD	R(341)	The total accumulated speed for the speed trap sensors.
TCNT	R(341)	The total number of accumulated speeds for the speed trap sensors.

2.4.12 COMMON /ARRAY5/ RAW VALUE ACCUMULATORS

These two-ring buffers contain the integer values of occupancy duration and volume counts derived from the Continuous Time Series Data Block Records. There are a maximum of 16 tables corresponding to an update interval for both occupancy duration and volume counts.

Keyword	Type	Purpose
IUPOCC	I(341,16)	The raw occupancy duration accumulator tables.
IUPUOL	I(341,16)	The raw volumes count accumulator tables.

2.4.13 COMMON /ARRAY6/

This Labeled Common area variable is defined in two different parts of the program, as follows:

COMMON /ARRAY6/ STATISTICAL DATA ACCUMULATORS

These ten arrays contain the average and total statistical values computed from the Raw Value Accumulators. The values are for the averaging time interval for each lane sensor or for each station.

Keyword	Type	Purpose
ROCC	R(341)	The average lane sensor occupancy percent.
RVOL	R(341)	The total lane sensor volume count.
RVLH	R(341)	The average lane sensor volume per lane per hour.
RDEN	R(341)	The average lane sensor density.
RSPD	R(341)	The average lane sensor speed.
AOCC	R(170)	The average occupancy percent of the mainline sensors at a freeway station.
AVOL	R(170)	The total volume count of the mainline sensors at a freeway station.
AVLH	R(170)	The average volume per lane per hour of the mainline sensors at a freeway station.

Keyword	Type	Purpose
ADEN	R(170)	The average density of the mainline sensors at a freeway station.
ASPD	R(170)	The average speed of the mainline sensors at a freeway station.

COMMON /ARRAY6/ SPEED TRAP DATA ARRAY

These arrays contain the speed trap sensor number, mainline and trap sensor on times, calculated speed value, accumulated speed, number of speed values in accumulated speed and the accumulated average speed.

Keyword	Type	Purpose
NISENS	I(365)	The sensor index number of the downstream sensor.
NSTIME	I(365)	The on time of the upstream sensor of the speed trap lane.
NETIME	I(365)	The on time of the downstream sensor of the speed trap lane.
SPEEDS	R(365)	The calculated speed of the speed trap lane.
TSPDS	R(365)	The calculated accumulated speed of the speed trap lane.
TCNTS	R(365)	The total number of accumulated speeds of the speed trap lane.
ASPDS	R(365)	The average speed calculated from TSPDS divided by TCNTS.

2.4.14 COMMON /ARRAY7/

This common area is used to pass arguments between subroutines PRMTRS, LSTPRM, NEWLIM and LSTLMT.

Keyword	Type	Purpose
BEGSTA	I(4)	The beginning station index numbers of the freeway segments.
ENDSTA	I(4)	The ending station index numbers of the freeway segments.

Keyword	Type	Purpose
LIMITS	I	The station limit option. A value of zero indicates use of all the stations on the input data tape. A value of one indicates that the user wants to delete some of the stations from the computed statistical data. One of the changeable input parameters.

2.4.15 COMMON /BLANK/

This common area is the input buffer for the data blocks. This common area is used in four different subroutines with the elements defined as follows:

Subroutine TAPEIN

Keyword	Type	Purpose
IOBUT	I(1024)	Contains either the Lane Sensor Table Block or a Continuous Time Series Data Block.

Subroutine PSTNTP and CTSDBR

Keyword	Type	Purpose
NULL	I	Contains the number of records in the data block.
CTSDR	I(3,341)	Contains the data block.

Subroutine LSTIN

Keyword	Type	Purpose
LST	I(3,341)	Contains the Lane Sensor Table Block.
NULL	I	Contains nothing.

2.4.16 COMMON /ALLIO/ SYMBOLIC UNIT NUMBERS

These values are initialized in subroutine NTL2.

Keyword	Type	Purpose
PUT	I	Listing or display device. Outputs changeable parameter values for user verification.
GET	I	Input device. Gets the new values of the changeable parameters.
LP	I	Listing device. Outputs documentation information, lane sensor table and the computed statistics, if requested.
TPIN	I	Tape device. Input data tape.
TPOUT	I	Tape device. Output data tape.

2.5 USER-DEFINED VARIABLES

OUTPUT - An integer value code specifying the form of program output. The default value is zero (0). The following values can be used:

- = 0 - List documentation information and stop.
- = 1 - List documentation information and computed statistics.
- = 2 - Write documentation information and computed statistics to tape.
- = 3 - Both 1 and 2.
- = 4 - List documentation information and speed trap statistics.
- = 5 - Write documentation information and speed trap statistics to tape.
- = 6 - Both 4 and 5.

LIMITS - An integer value specifying whether or not changes are to be made to the station limits of the freeway segments. Default is no change (zero).

- = 0 - Use existing station limits.
- = 1 - Changes are to be made to the station limits (see subroutines LSTLMT (3.8) and NEWLMT (3.11) for details).

UPDINT* - An integer value designating the updating time interval in seconds. Default value is 20 seconds.

*NOTE: (AVGINT/UPDINT) must be a value of 1 through 15.

AVGINT* - An integer value designating the averaging time interval in seconds. Default value is 60 seconds. AVGINT must be equal to or multiple of UPDINT.

LSTINT - An integer value designating the listing time interval in seconds. Default value is 20 seconds. Minimum value is UPDINT and maximum value is AVGINT. Valid parameter only when OUTPUT is one (1) or three (3).

ISTART - A maximum of a six (6) digit integer value designating the first averaging time for which statistics are to be averaged. Default value is the starting time of the input data tape (STIME). The program may adjust ISTART if it is less than (STIME + AVGINT) to the greater of (STIME + AVGINT) or (ISTART - AVGINT). The time is in the format HHMMSS[1]. Leading zeroes are optional and imbedded blanks are not allowed.

IFINAL - A maximum of a six (6) digit integer value designating the last averaging time for which statistics are to be averaged. Default value is the input data tape ending time (ETIME). The format is the same as ISTART.

SMPLRT - An integer value designating the number of sensor samples per second for which the Continuous Time Series Data Records were collected. Default value of 15 times per second.

GFACTR - A real value designating a factor used in estimating density and speed. Default value of 2.8.

2.6 RUNNING THE PROGRAM

The program will output the nine (9) key parameters with the default values and the message 'DEFAULT VALUES' to a display or listing device (PUT) as follows:

```
DEFAULT VALUES

OUTPUT   LIMITS    UPDINT    AVGINT    LSTINT
     0        0        20        60        20
  ISTART   IFINAL   SMPLRT   GFACTR
  070000   083000       15    2,800
```

*NOTE: (AVGINT/UPDINT) must be a value of 1 through 15.

[1]HHMMSS: HH is the hour; MM is the minute and SS is the second.

INPUT REVISED VALUES

The program now expects any changes to be input through the input device (GET). At this point, changes to the above key parameters can be made, if desired. The following FORTRAN READ and FORMAT statements are used:

```
READ(GET,225) OUTPUT,LIMITS,UPDINT,AVGINT,

LSTINT,ISTART,IFINAL,SMPLRT,GFACTR

225 FORMAT (2I5,6I10,F10.3)
```

OUTPUT and LIMITS are unconditionally replaced by the values read. If the other values are greater than zero, the value read is the new value of the parameter. Otherwise, the above default values are retained.

If any errors are detected, the program will output all of the parameters, with the errored parameters multiplied by a factor of minus (-1) for identification, preceded by the message, 'IRRECOVERABLE ERROR'. The program then continues as if it had just listed the default values. See section above. In other words, it is still possible to make the correction and continue the program. All of the parameters should be input.

When the key parameters are verified correct, the program will output the parameters as follows:

Values to be Used

OUTPUT	LIMITS	AVGINT	LSTINT
0	0	60	20
ISTART	IFINAL	GFACTR	
070100	083000	2.800	

The above will output the documentation information, the lane sensor table information and rewind the input data tape and stop.

The following will allow changes to be made to the station limits (LIMITS=1) as follows:

Values to be Used

OUTPUT	LIMITS	UPDINT	AVGINT	LSTINT
0	1	20	60	20
ISTART	IFINAL	SMPLRT	GFACTR	
070100	083000	15	2.800	

```
Default Station Index Numbers
Beginning-Ending
      16      20
      20      16
       0       0
       0       0
```

```
INPUT REVISED STATION LIMITS
```

The new station limits are input using the following FORTRAN READ and FORMAT statement:

```
 READ(GET,230) (BEGSTA(I),ENDSTA(I),I=1,4)

230 FORMAT (8I5)
```

If, for instance, only the second segment was wanted, the following would be input:

```
20    16    0    0    0    0    0    0
```

and the following would be output:

```
REVISED STATION INDEX NUMBERS

Beginning-Ending
      20      16
       0       0
       0       0
       0       0
```

From this point in the program, no other user-program communication is initiated. Processing of the input data tape proceeds according to the code of OUTPUT. At the end of the program, the input data tape and the output data tape, if present, is rewound to the beginning of tape.

2.7 PROGRAMMER'S NOTES

To change the number of tables in the raw occupancy duration and pulse count ring buffers, three subprograms will have to be changed. The assignment statement MCHECK=16 in subroutine PRMTRS will have to be changed to the new maximum number of tables. The dimension statements for the tables, arrays IUPOCC and IUPVOL, will have to be changed in subroutines OCCVOL and CNVRT.

The CONDENSED OUTPUT DATA TAPE is a nine-track magnetic tape created with the FORTRAN binary WRITE statement. All files consist of one or more logical records, of the internal binary form, and consist of Labeled Common areas, as indicated. The format for this tape is as follows:

Static File One: (one logical record)

BLOCK1 - Date

BLOCK2 - Constants not used in computing the statistical data

ARRAY1 - Sensor and station cross-reference data

ARRAY2 - Freeway descriptors

HEAD - Documentation information

END OF FILE MARK

Static File Two: (one logical record)

CNSTNT - Constants used in computing the statistical data

ARRAY3 - Sensor index data arrays

ARRAY4 - Sensor status data arrays

END OF FILE MARK

Variable File (first):

VRBL - Variable scalars used in computing the statistical data

ARRAY6 - Computed statistical data for each update time interval (UPDTIM)

Variable File (last):

VRBL - Variable scalars used in computing the statistical data

ARRAY6 - Computed statistical data for each update time interval (UPDTIM)

END OF FILE MARK

END OF FILE MARK

2.8 AUTHOR

The LAAFSCP DATATAPE ANALYSIS PROGRAM was written and tested by:

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2.9 FLOWCHARTS

Figure 8 illustrates the processing flow of the LAAFSCP DATATAPE ANALYSIS PROGRAM. Figure 9 is an illustration of the functional relationship between subroutines with report section numbers of routines indicated.

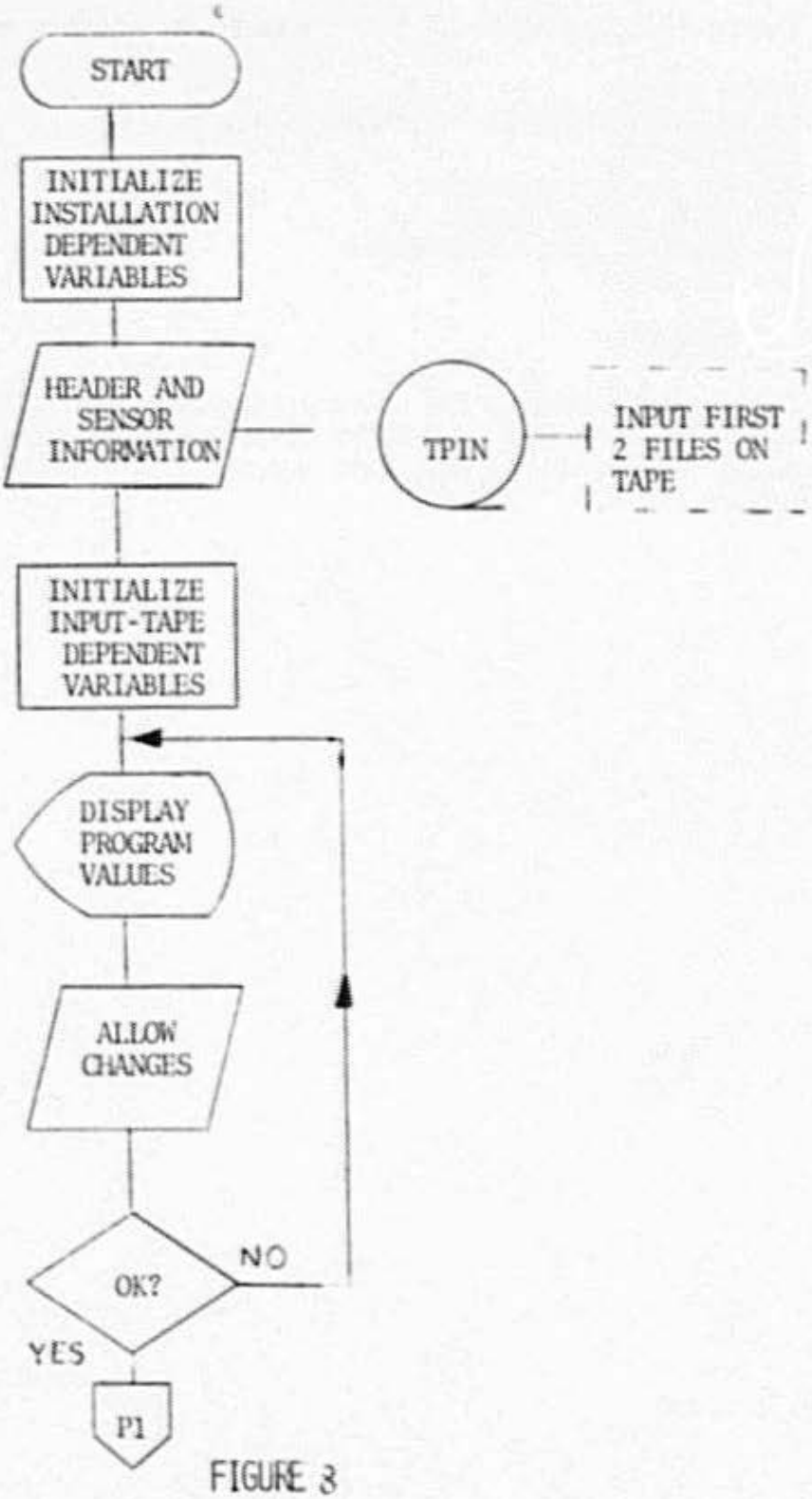

FIGURE 3

PROGRAM FLOWCHART

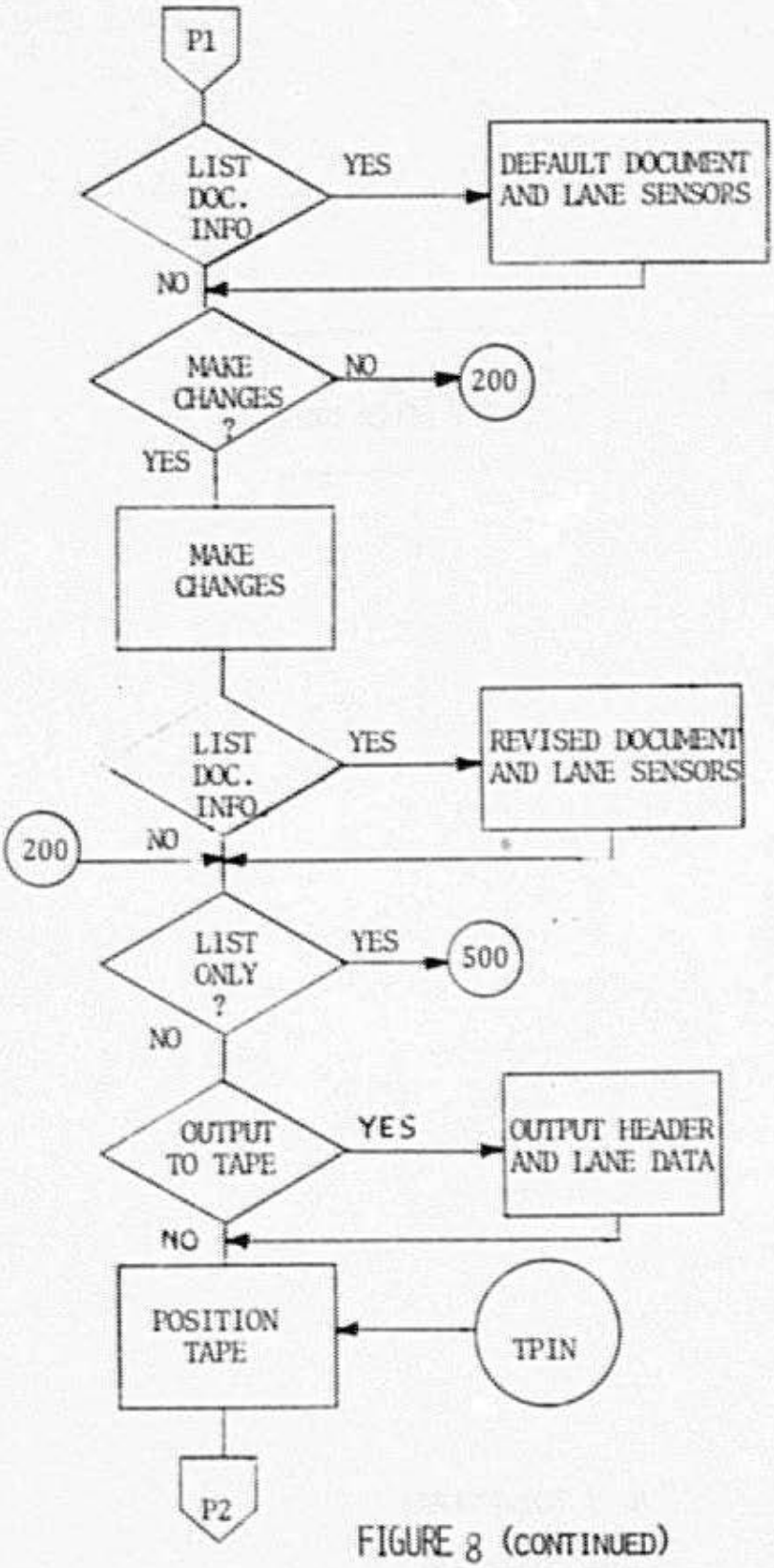

FIGURE 8 (CONTINUED)

PROGRAM FLOWCHART

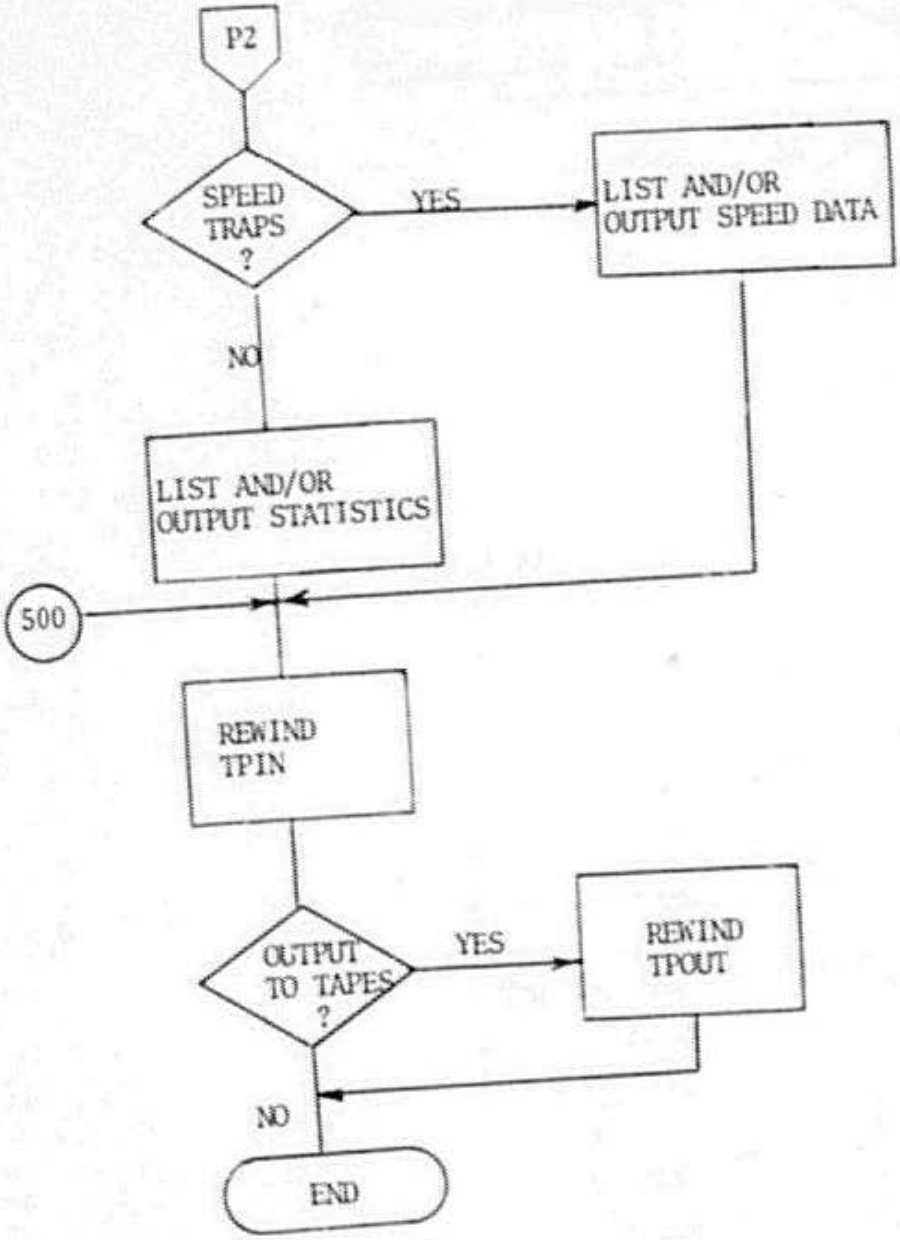

FIGURE 8 (CONTINUED)

PROGRAM FLOWCHART

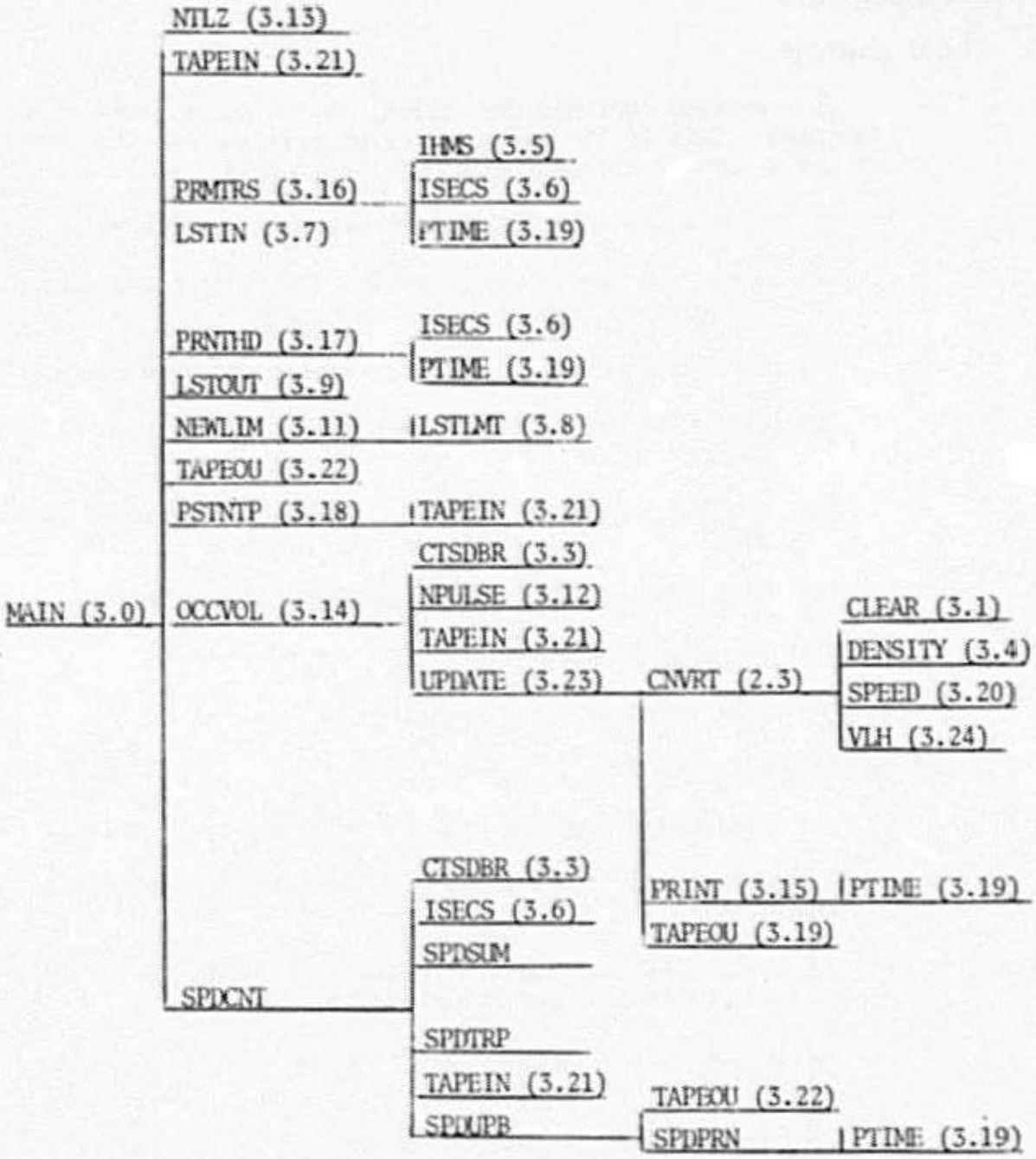

FIGURE 9

RELATIONSHIP OF PROGRAM ROUTINES

3. PROGRAM MAIN; SUBROUTINES AND FUNCTIONS

3.0 PROGRAM MAIN

3.0.1 PURPOSE

This routine controls the calling of the subprograms to be executed. This is the main control program and executes calls to the 8 major functional parts of the program:

(1) Initialize the installation dependent variables.

(2) Input and decode documentation information and control information from the input data tape.

(3) Input and output of user changeable key parameters.

(4) Output of documentation information and control information.

(5) Positioning of the input data tape to the proper position.

(6) Computation and output of the statistical data.

(7) Speed trap data.

(8) Data tape rewinding.

3.0.2 SUBROUTINES CALLED

The following subroutines may be called by this routine:

Subroutine NTLZ - Initializes the installation dependent variables.

Subroutine TAPEIN - Input of documentation information, control information and rewinding the tape.

Subroutine LSTIN - Decode the binary coded Lane Sensor Table Block.

Subroutine PRMTRS - Input and output of the key parameters.

Subroutine NEWLIM - Input and output of the Station Index Numbers.

Subroutine PRNTHD - Output of the documentation information.

Subroutine LSTOUT - Output of the Lane Sensor Table information.

Subroutine PSTNTP - Positions the input data tape to the proper position.

Subroutine OCCVOL - In conjunction with subroutine UPDATE, these routines control the computation and output of the statistical data.

Subroutine SPDCNT - In conjunction with subroutine SPDUPD, these routines control the computation and output of speed trap data.

3.0.3 PROGRAM SYNOPSIS

The first call is made to subroutine NTLZ to initialize the installation dependent variables. The second and third calls are to subroutine TAPEIN to input the first two files from the tape. The first file contains the documentation and control information, and the second file contains the Lane Sensor Table. (See Figure 2 for input data tape format.)

Subroutine PRMTRS (MTIME) is called to permit changes to be made to the default options and calculate program variables. Then the Lane Sensor Table Block is decoded. If hard copy has been requested, the documentation information and Lane Sensor Table are output by calling subroutine PRNTHD and LSTOUT, respectively.

If the station limit option has been set, a call is made to subroutine NEWLIM to permit changes to be made to the station for which the data is to be computed. And if hard copy has been requested, the new documentation information and Lane Sensor Table are output again by calling subroutines PRNTHD and LSTOUT.

Now if the output to tape option is set, the documentation information, program constant and Lane Sensor Tables are output to a storage device.

Then subroutine PSTNTP inputs the Continuous Time Series Data Blocks until it gets a record that is greater than or equal to the computed absolute starting time (MTIME).

Subroutine OCCVOL is then called to compute and output the statistical data or subroutine SPDCNT to compute and output the speed trap data. After the input tape is processed, calls are made to subroutine TAPEIN to rewind the input data tape and calls subroutine TAPEOU to rewind the storage device if used.

3.0.4 PROGRAM WORK AREAS

3.0.4.1 Switches - None

3.0.4.2 Counters and Accumulators

MTIME - The absolute starting time in milliseconds. Calculated by subroutine PRMTRS and passed to subroutine PSTNTP and LSTIN.

ITEMP0 - The record number in the first Continuous Time Series Data Block containing a time that is greater than or equal to MTIME. Found by subroutine PSTNTP and passed to subroutine OCCVOL.

3.0.4.3 Labeled Common

Area: /CNSTNT/

Variable: OUTPUT - Used

Area: /ARRAY7/

Variable: LIMITS - Used

3.0.5 FLOWCHARTS

Figure 10 illustrates the processing flow for PROGRAM MAIN.

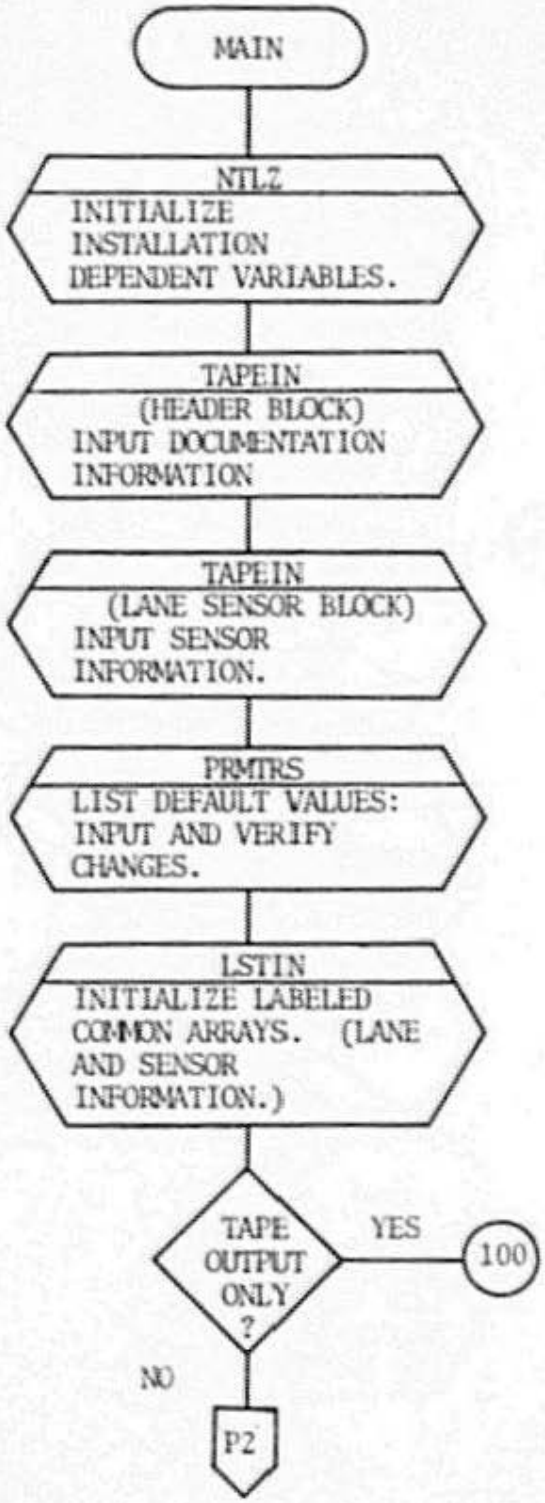

FIGURE 10

PROGRAM MAIN FLOWCHART

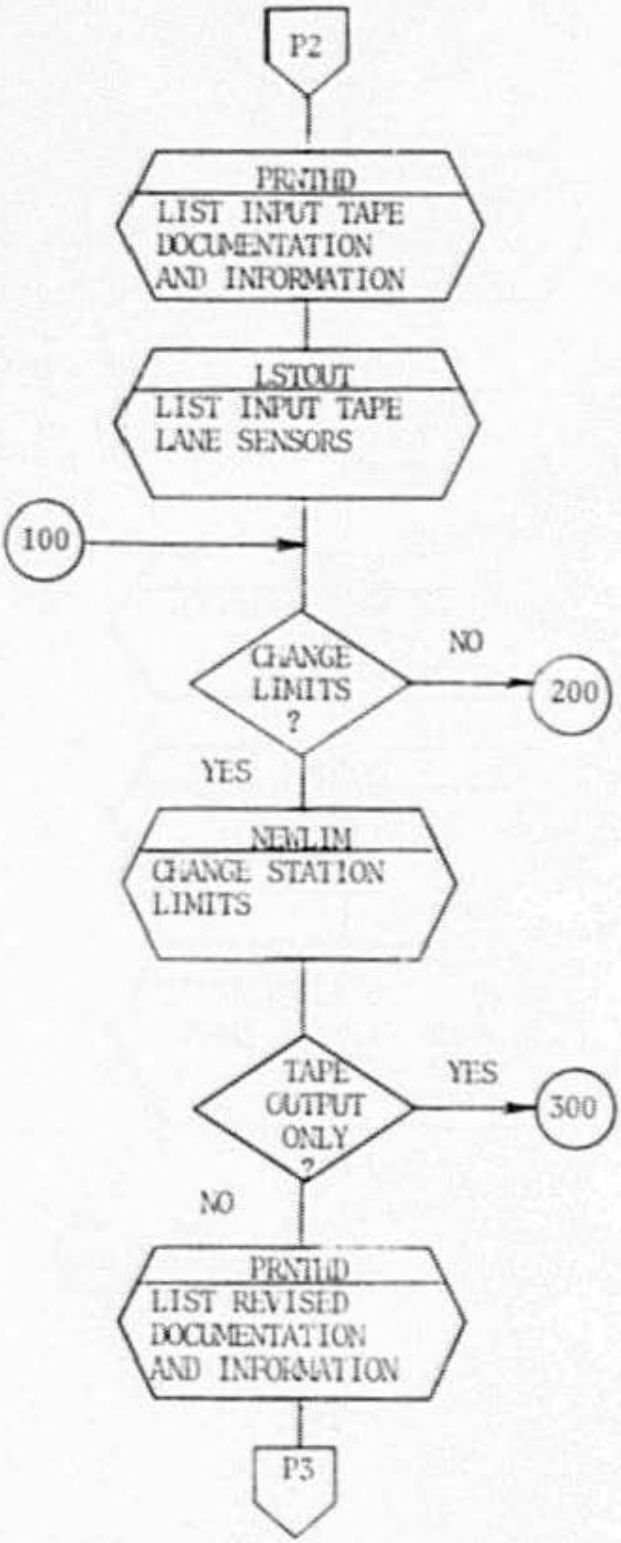

FIGURE 10 (CONTINUED)

PROGRAM MAIN FLOWCHART

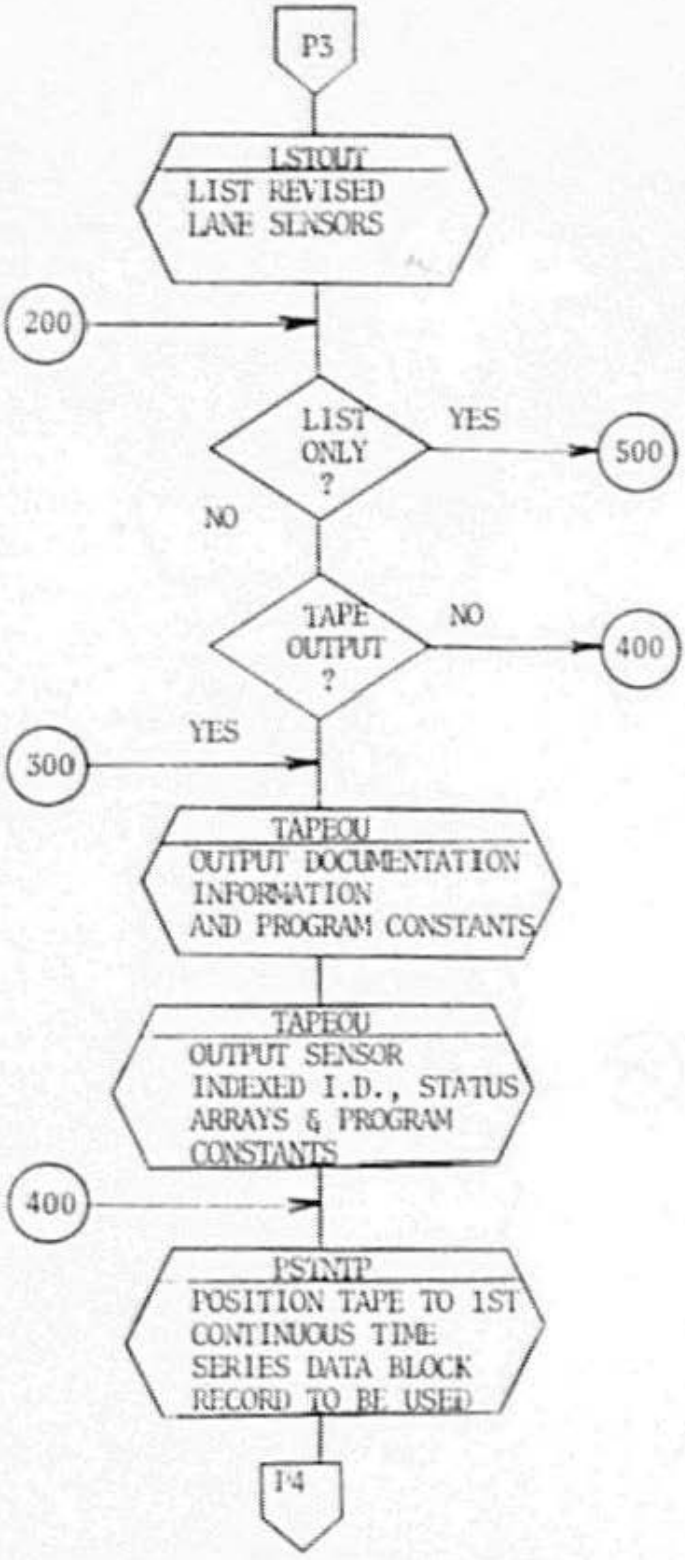

FIGURE 10 (CONTINUED)

PROGRAM MAIN FLOWCHART

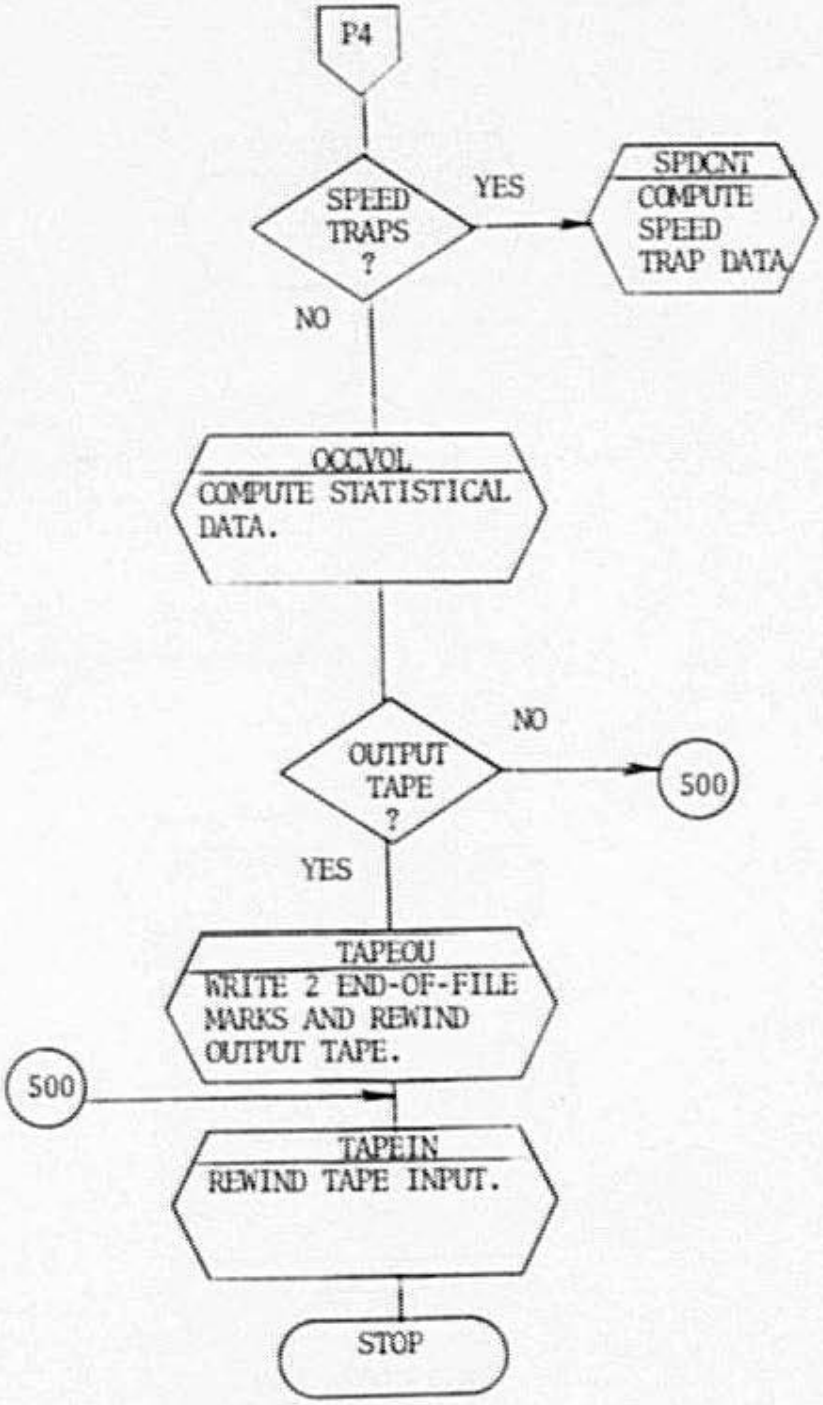

FIGURE 10 (CONTINUED)

PROGRAM MAIN FLOWCHART

3.1 SUBROUTINE CLEAR

3.1.1 PURPOSE

This routine is called to clear the Statistical Data accumulators prior to calculating the statistics at the update time interval.

This routine is called from subroutine CNVRT.

3.1.2 PROGRAM SYNOPSIS

This routine consists of two DO LOOPS. The first DO LOOP resets the sensor accumulators to zero and the second DO LOOP resets the station accumulators to zero.

3.1.3 PROGRAM WORK AREAS

3.1.3.1 Switches - None

3.1.3.2 Counters and Accumulators - I - DO LOOP pointer

3.1.3.3 Labeled Common

Area: /ARRAY6/

Variable: All of the variables are reset to zero.

3.1.4 FLOWCHARTS

Figure 11 illustrates the processing flow for subroutine CLEAR.

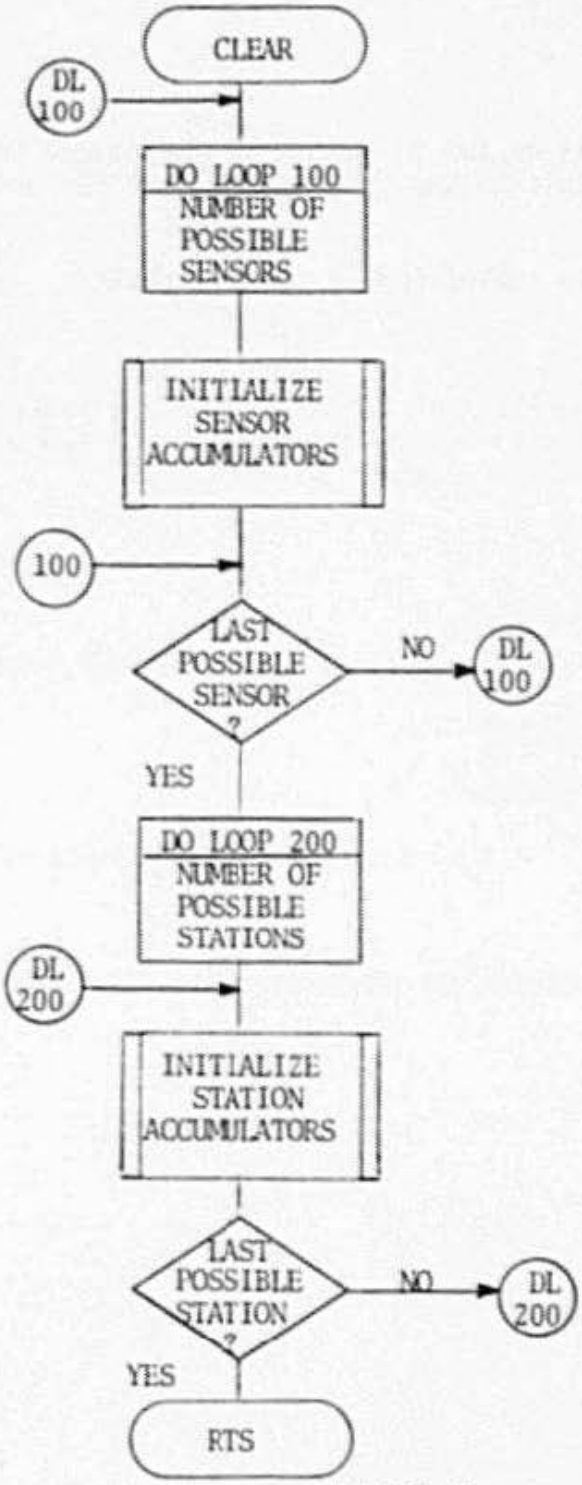

FIGURE 11

SUBROUTINE CLEAR FLOWCHART

3.2 SUBROUTINE CNVRT

3.2.1 PURPOSE

Computes estimated average and total statistical values from the raw occupancy duration and volume counts. Values are computed at each update time interval for the averaging time interval for each sensor and for each station.

This routine is called by subroutine UPDATE. The following functions are called:

VLH - Calculates hourly volume from sensor volume count.
DENSTY - Calculates density from sensor occupancy percent.
SPEED - Calculates speed from sensor occupancy percent and volume count.

Subroutine CLEAR is called to clear the output accumulators each time this routine is called.

3.2.2 PROGRAM SYNOPSIS

After the output accumulators are reset to zero and a few pointers are initialized, there are two (2) nested DO LOOPS and three (3) pointers that control the order to calculating the statistical values. The first pointer (I), the current sensor index number, is the pointer for the outside DO LOOP. The second pointer (JPTR) is used in the inside DO LOOP for the raw occupancy duration and volume count ring buffers. The third pointer (IDEX) is for the current station. The five (5) values computed for the sensors and stations are the occupancy percent (ROCC, AOCC), the total volume counts (RVOL, AVOL), the estimated hourly volumes (RVLH, AVLH), the estimated density (RDEN, ADEN) and the estimated speed (RSPD, ASPD). Temporary accumulators are used in computing the statistics to minimize computing time.

The steps involved for each sensor are as follows:

The temporary sensor accumulators (TROCC, TRVOL, TRVLH, TRDEN and TRSPD) are set to zero.

If the sensor is the first sensor of a freeway sensor, the temporary station accumulators (TAOCC, TAVOL, TAVLH, TADEN and TASPD) are set to zero, the current lane counter (CNOLNS) is set to zero, and the total number of mainline sensors for the station is set.

The inner DO LOOP then calculates and sums the statistical values from the raw occupancy duration and volume count ring buffers for the number of update times in the averaging interval (MFACTR) using the temporary sensor accumulators.

The temporary sensor accumulators are then divided by the number of update intervals in the averaging intervals (FACTRM) except for the volume count (TRVOL) since the total is wanted.

The sensor accumulator arrays are then set to the temporary sensor accumulators.

The current lane counter is increased by one. If the current lane counter is greater than the number of mainline sensors for a station, the next sensor is processed; otherwise, the temporary sensor accumulators are added to the temporary station accumulators.

If the current lane counter is equal to the number of mainline sensors for the station, the station accumulator arrays are set equal to the temporary station accumulators divided by the number of mainline sensors for the station and the station pointer is incremented by one. Processing continues until the total number of sensors (NOSENS) have been processed.

3.2.3 PROGRAM WORK AREAS

3.2.3.1 Switches - None

3.2.3.2 Counters and Accumulators

FACTRM - Floating point value of the number of update times in an averaging time interval.

IDEX - The current station pointer.

TNOLNS - The total number of mainline sensors for a station.

CNOLNS - The current number of mainline sensors.

I - The current sensor index number.

TROCC - Temporary sensor accumulator for occupancy percent.

TRVOL - Temporary sensor accumulator for volume count.

TRVLH - Temporary sensor accumulator for estimated hourly volume.

TRDEN - Temporary sensor accumulator for estimated density.

TRSPD - Temporary sensor accumulator for speed.

TAOCC - Temporary station accumulator for average occupancy percent.

TAVOL - Temporary station accumulator for total volume count.

TAVLH - Temporary station accumulator for average estimated hourly volumes.

TADEN - Temporary station accumulator for average estimated density.

TASPD - Temporary station accumulator for average estimated speed.

3.2.3.3 Labeled Common

The variables listed below are used and not changed except as noted in /ARRAY6/.

Area: /CNSTNT/

Variables: NOSENS
MFACTR
MPTR

Area: /VRBL/

Variables: NPTR

Area: /ARRAY1/

Variables: SINDEX(171)
ACTLNS(170)

Area: /ARRAY5/

Variables: IUPOCC(341,16)
IUPVOL(341,16)

Area: /ARRAY6/

Variables: All of the variables are reset to the new computated values.

3.2.4 FLOWCHARTS

Figure 12 illustrates the processing flow for subroutine CNVRT.

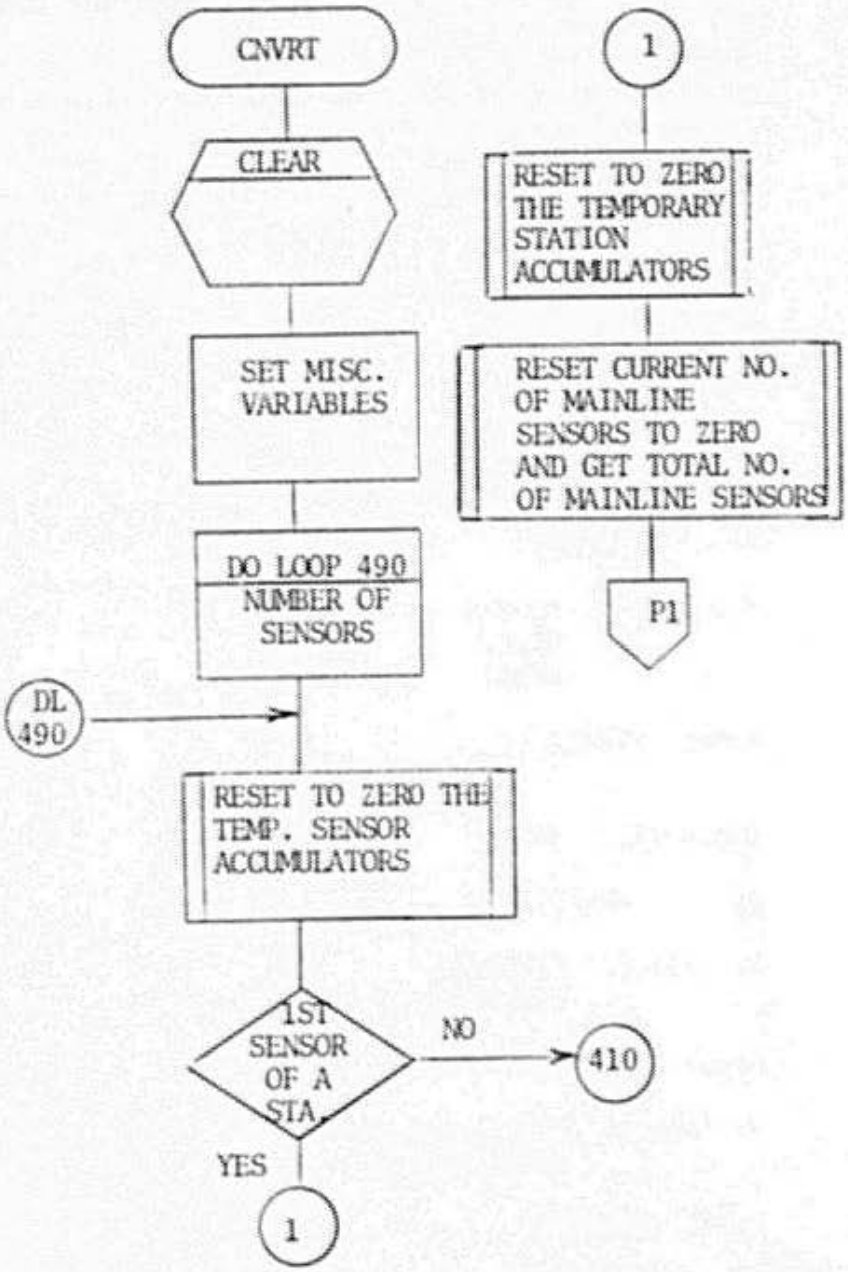

FIGURE 12

SUBROUTINE CNVRT FLOWCHART

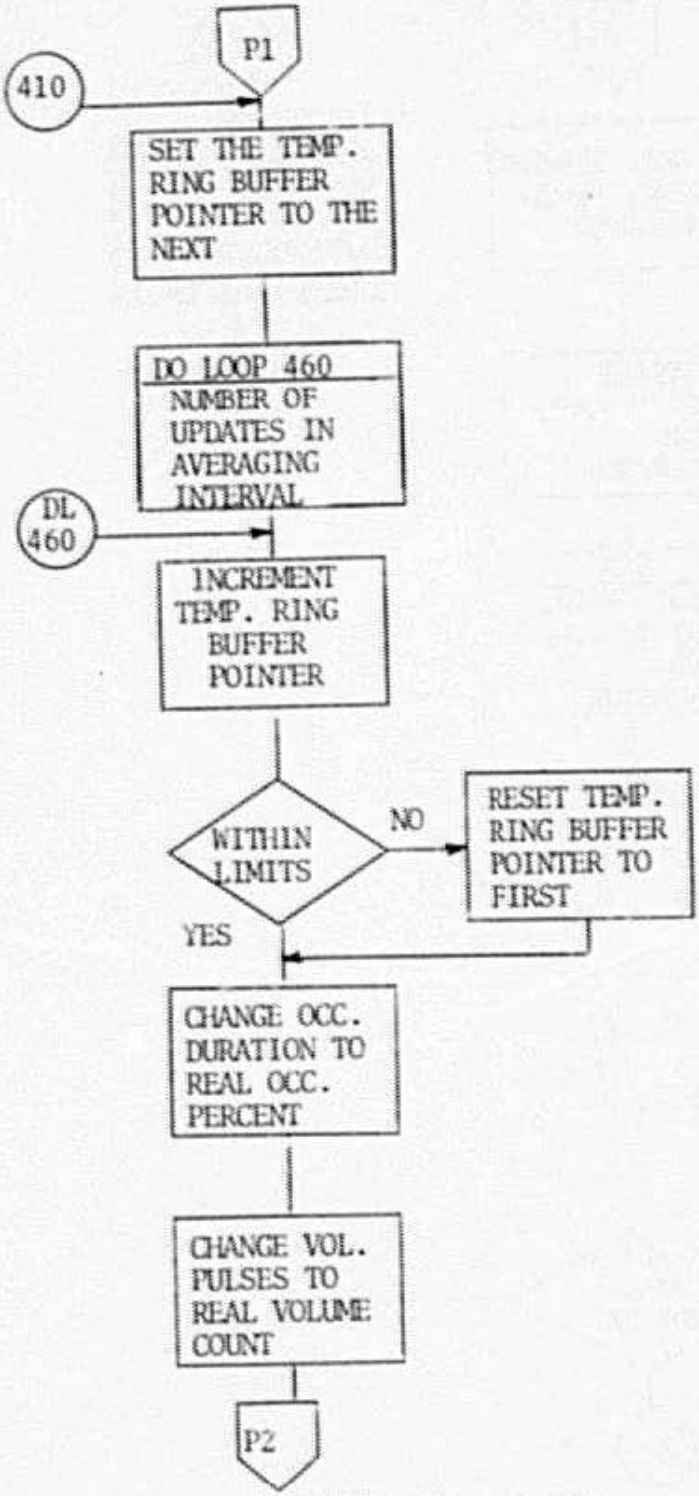

FIGURE 12 (CONTINUED)

SUBROUTINE CNVRT FLOWCHART

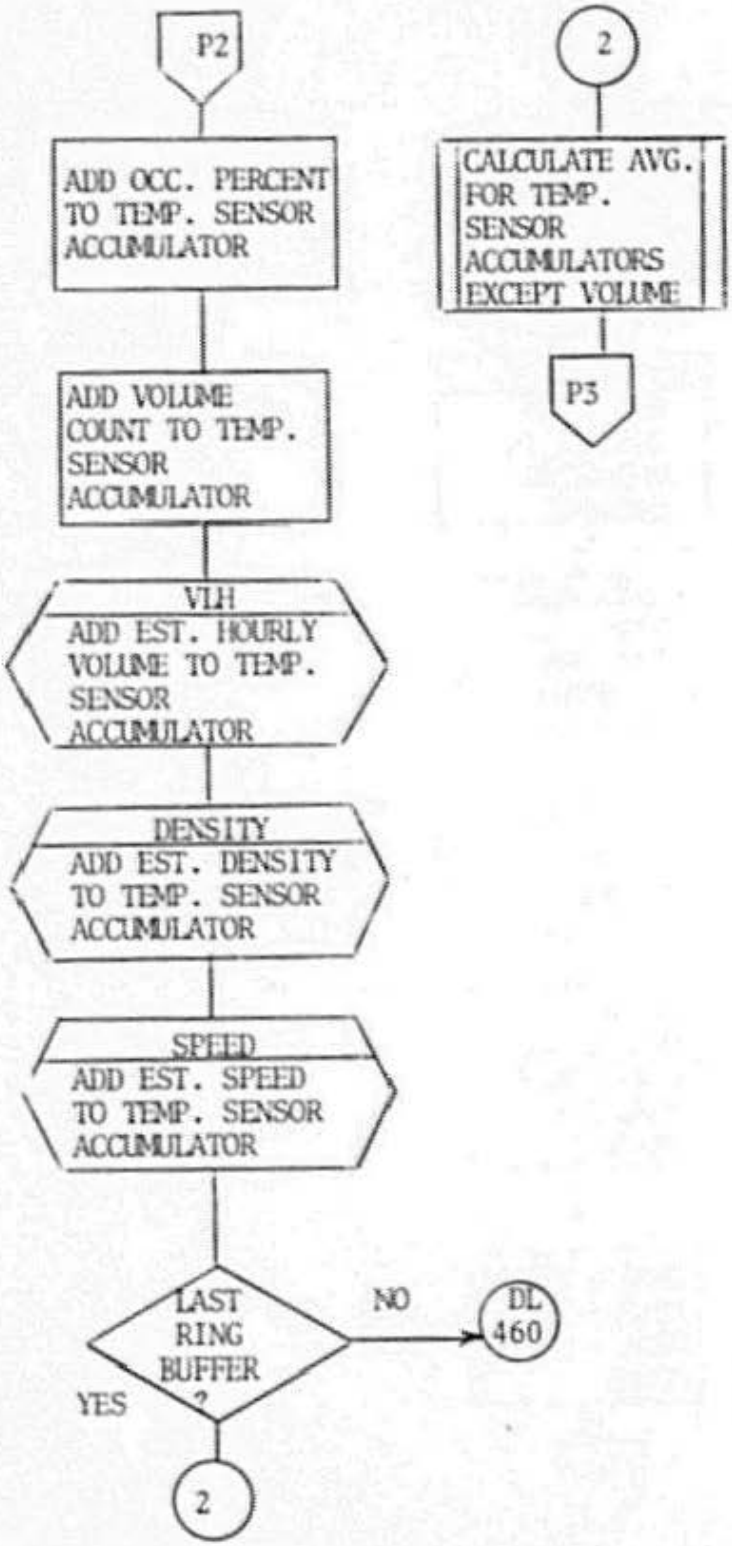

FIGURE 12 (CONTINUED)

SUBROUTINE CNVRT FLOWCHART

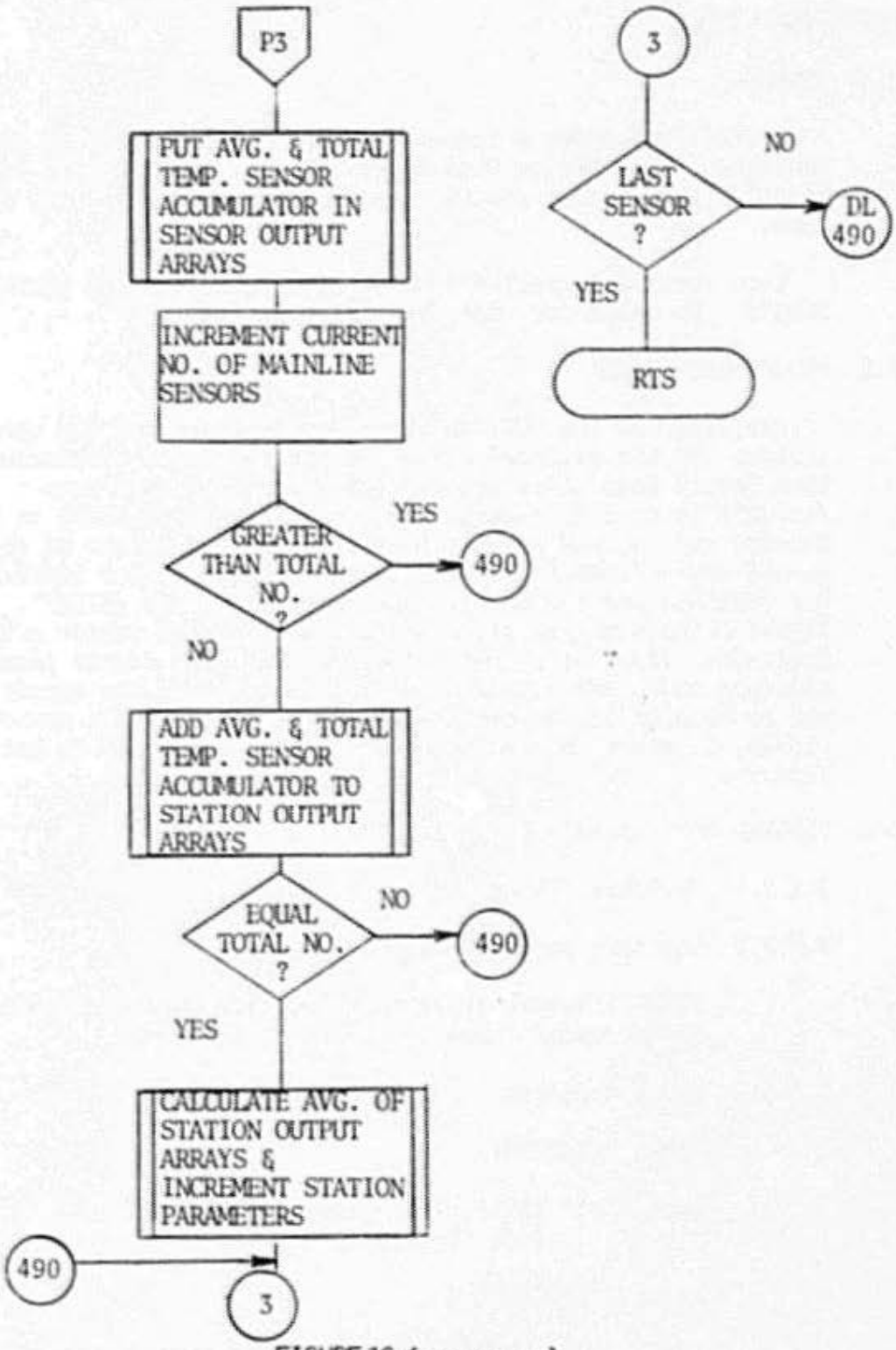

FIGURE 12 (CONTINUED)

SUBROUTINE CNVRT FLOWCHART

3.3 SUBROUTINE CTSDBR

3.3.1 PURPOSE

Partially decodes a requested record from the binary coded Continuous Time Series Data Block. The values isolated are the on-off state, sensor status, sensor index number and the on-off time.

This routine is called from subroutine OCCVOL and subroutine SPDCNT. No calls are made from this routine.

3.3.2 PROGRAM SYNOPSIS

Division and the FORTRAN remainder function MOD are used to isolate the binary coded values of the requested Continuous Time Series Data Block Record. The Labeled Common area /BLOCK3/ is used to receive the record number (NUMBER) to be decoded and is used to pass back the isolated values of the on-off state (IONOFF), sensor status (MBAI), sensor index number (ISENS), and the on-off time in milliseconds (ITIME). Figure 13 shows the relationship of the isolated values and the Continuous Time Series Data Block Record. The sensor identification codes are not decoded or isolated. If the sensor is not to be used in the computations, the sensor index number (ISENS) is reset to zero. Section 2.5 explains how to exclude sensors.

3.3.3 PROGRAM WORK AREAS

3.3.3.1 Switches - None

3.3.3.2 Counters and Accumulators

ITEMP - Temporary storage location used to decode binary coded values.

3.3.3.3 Labeled Common

Area: /BLOCK0/

Variable: IBYTE, IHW - These values are used to decode the binary record.

Area: /BLOCK3/

Variables: NUMBER - Contains the record number to be decoded.

IONOFF - The record's on-off state.

	FREEWAY AND DIRECTION	STATION NUMBER	SENSOR TYPE	SENSOR TYPE NUMBER	ON OR OFF SENSOR STATUS	MODIFIED, BAD, ACTIVE STATUS	SENSOR INDEX NUMBER		VEHICLE ON OR OFF TIME IN MILLISECONDS			
BYTE	1	2	3	4	5	6	7	8	9	10	11	12
WORD	1				2				3			

FIGURE 13

CONTINUOUS TIME SERIES DATA BLOCK RECORD

IMBAI - The record's modified, bad and active state.

ISENS - The record's sensor number.

ITIME - The record's on or off time in milliseconds.

Area: /ARRAY1/

Variable: INDEX(341) - Values of the sensor index numbers.

Area: /BLANK/

Variable: CTSDB(3,341) - Contains the Continuous Time Series Data Block records.

3.3.4 FLOWCHARTS

Figure 14 illustrates theprocessing flow for subroutine CTSDBR.

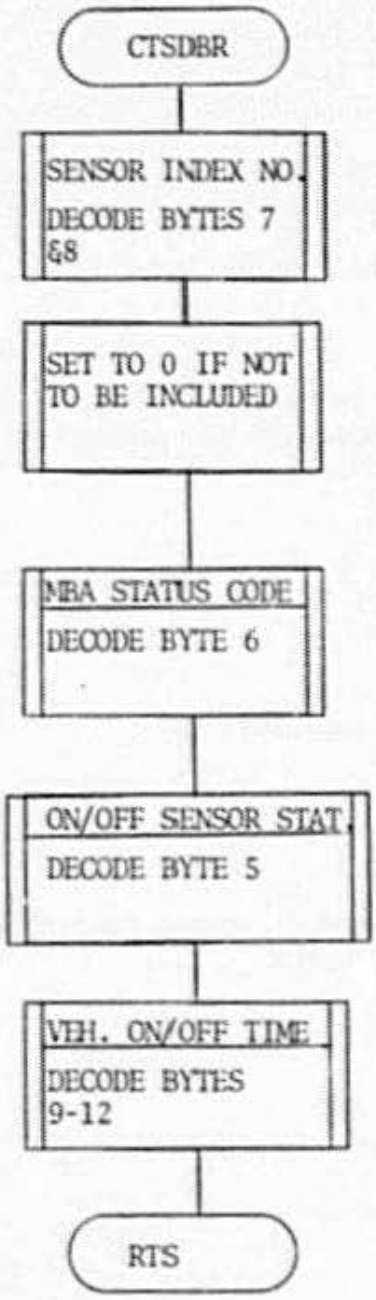

FIGURE 14

SUBROUTINE CTSDBR FLOWCHART

3.4 FUNCTION DENSTY (TVOL)

3.4.1 PURPOSE

Calculates the estimated density from the average occupancy percent for a single sensor for an update time interval.

This function is called by subroutine CNVRT.

3.4.2 PROGRAM SYNOPSIS

The average occupancy percent for a sensor for an update interval (TOCC) is multiplied by the conversion factor (CFACTR). The formula used is as follows:

DENSTY = GFACTR*TOCC

3.4.3 PROGRAM WORK AREAS

3.4.3.1 Switches - None

3.4.3.2 Counters and Accumulators

TOCC - The average occupancy percent for a single sensor for an update time interval. The value is unchanged.

DENSTY - Calculated estimated density value returned to the calling program.

3.4.3.3 Labeled Common

Area: /CNSTNT/

Variable: GFACTR - Used.

3.4.4 FLOWCHARTS

None.

3.5 FUNCTION IHMS (ITIME)

3.5.1 PURPOSE

Changes the time in seconds to a six digit integer value in the HHMMSS format where:

HH is the hours
MM is the minutes
SS is the seconds

Called by subroutines PRMTRS and PRNTHD.

3.5.2 PROGRAM SYNOPSIS

The FORTRAN remainder function MOD, division, multiplication and addition are used to change the time from seconds to the HHMMSS format.

3.5.3 PROGRAM WORK AREAS

3.5.3.1 Switches - None

3.5.3.2 Counters and Accumulators

ITIME - The time in seconds. The value is unchanged.

ITEMPO- The time in minutes.

IHMS - The time in the HHMMSS format returned to the calling program.

3.5.3.3 Labeled Common - None

3.5.4 FLOWCHARTS

Figure 15 illustrates the processing flow for function IHMS (ITIME)

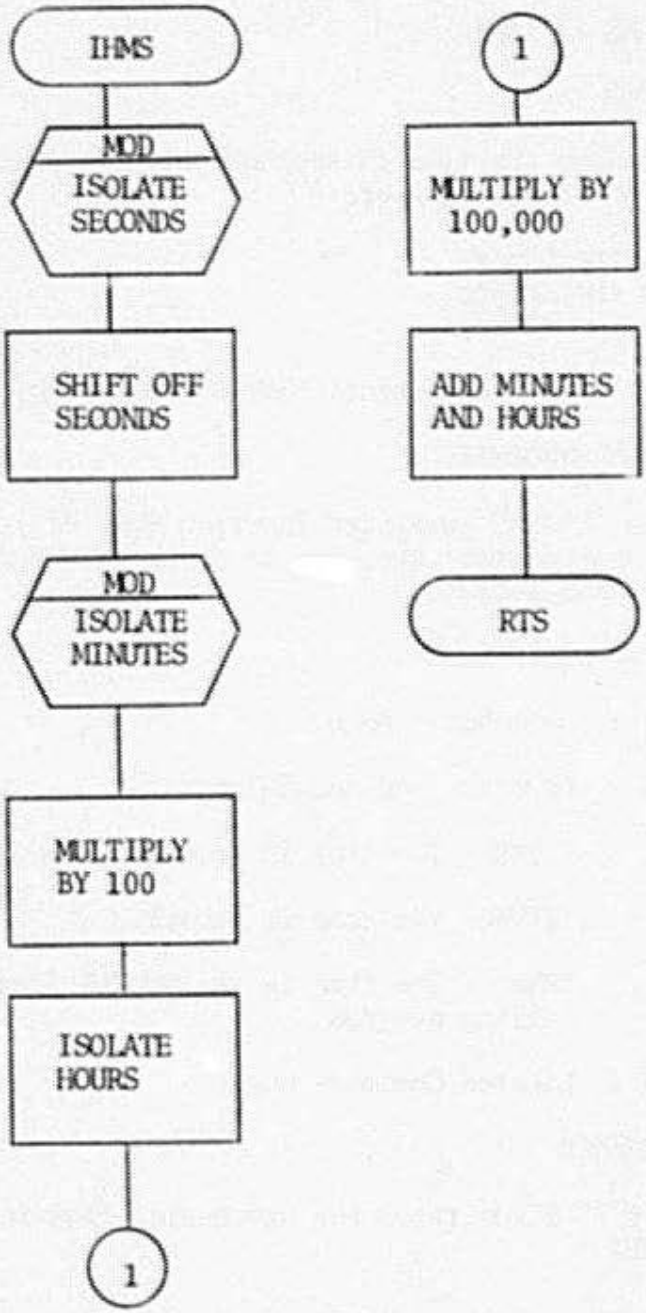

FIGURE 15

FUNCTION IHMS (ITIME) FLOWCHART

3.6 FUNCTION ISECS (ITIME)

3.6.1 PURPOSE

Changes the time in the HHMMSS format to the time in seconds where:

HH is the hours
MM is the minutes
SS is the seconds

This function is called by subroutine PRMTRS.

The easiest format for inputting time variables is the HHMMSS format, however, this format is awkward for calculations.

The HHMMSS format time variables are changed to seconds by a call to function ISECS.

3.6.2 PROGRAM SYNOPSIS

The FORTRAN remainder function MOD, division, multiplication and addition are used to change the time from the HHMMSS format to the time in seconds.

3.6.3 PROGRAM WORK AREAS

3.6.3.1 Switches - None

3.6.3.2 Counters and Accumulators

ITIME - The time in the HHMMSS format. The value is unchanged.

ITEMPO - The time in a HHMM format.

ISECS - The time in seconds returned to the calling program.

3.6.3.3 Labeled Common - None

3.6.4 FLOWCHARTS

Figure 16 illustrates the processing flow for function ISECS (ITIME).

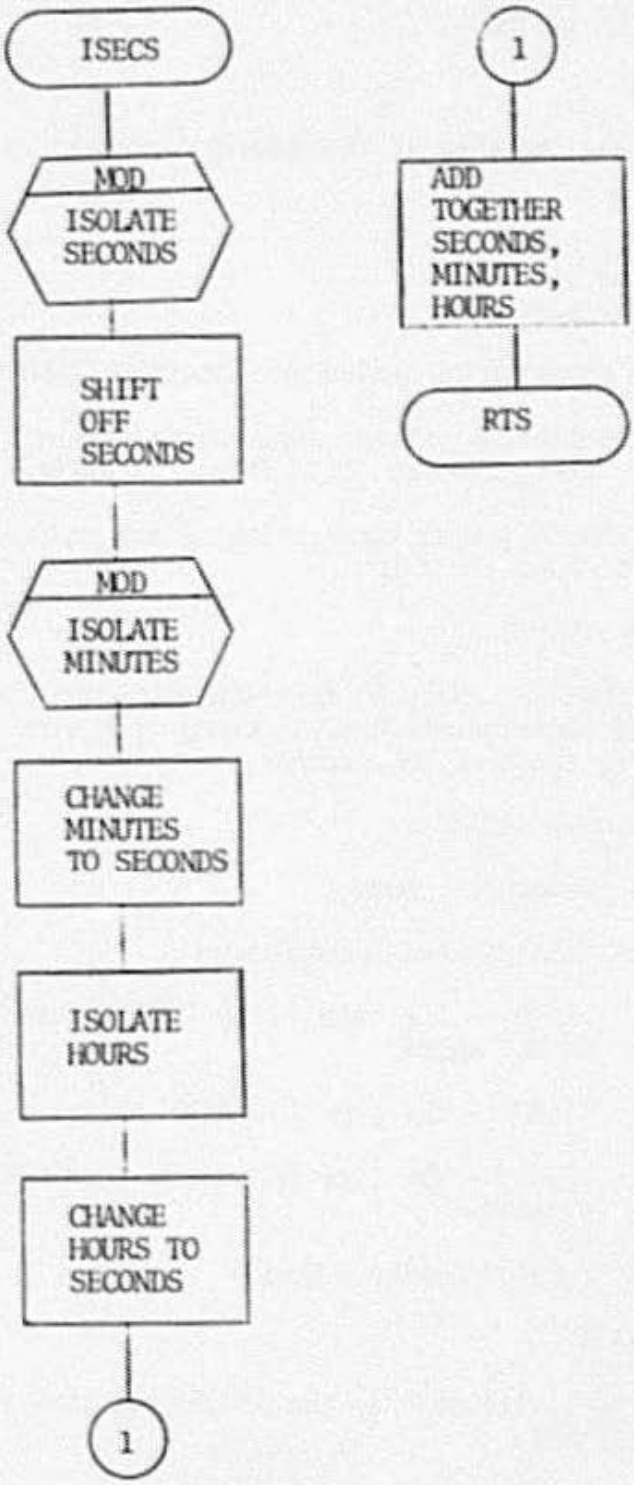

FIGURE 16

FUNCTION ISECS (ITIME) FLOWCHART

3.7 SUBROUTINE LSTIN (MTIME)

3.7.1 PURPOSE

Initializes the Sensor Indexed Identification Arrays from the binary coded Lane Sensor Table Block according to the character coded Sensor Definition Arrays from the Header Block. In addition, the Sensor Indexed Status Arrays are initialized.

This subroutine is called from the main control program.

3.7.2 PROGRAM SYNOPSIS

The first DO LOOP does the initialization of the Sensor Indexed Identification Arrays, the Sensor Indexed Status Arrays, and part of the Station/Sensor Cross-Reference Arrays.

Division and the FORTRAN remainder function MOD are used to isolate the binary coded values of the Lane Sensor Table Block record. See Figure 17 for illustration of record.

The Sensor Indexed Identification Arrays (/ARRAY3/,IFWY, ISTA,IDIR,ILNTYP,ILNO) are either set equal directly to the isolated binary coded value or indirectly by the corresponding Sensor Definition Arrays (/ARRAY2/,FRWYS,DIRCTS,LNTPCD). The station number (ISTA) and the lane type number (ILNO) are set directly. The freeway segment (IFWY), freeway direction (IDIR) and lane type (ILNTYP) are set indirectly to freeway segment code (FRWYS), freeway direction code (DIRCTS) and lane type code (LNTPCD), respectively.

Next the Sensor Indexed Status Arrays are initialized. The sensor state (MBAI) and the sensor on-off status (STATUS) are set directly to the isolated binary coded value. The last time of change (LITIME) is set to the absolute starting time (MTIME).

The input/output sensor cross-reference array (INDEX) is set to the current sensor counter (ISENS).

Processing continues until the current sensor counter (ISENS) is the total number of sensors (NOSENS) in the Lane Sensor Table Block.

The second DO LOOP then calculates the number of sensors per station (NSENS) for the total number of stations.

3.7.3 PROGRAM WORK AREAS

3.7.3.1 Switches - None

BYTE	1	2	3	4	5	6	7	8	9	10	11	12
	FREEWAY AND DIRECTION	STATION NUMBER	SENSOR TYPE	SENSOR TYPE NUMBER	NOT APPLICABLE	MODIFIED, BAD STATUS	SENSOR INDEX NUMBER		NOT APPLICABLE			
WORD	1				2				3			

FIGURE 17

LANE SENSOR TABLE BLOCK RECORD

3.7.3.2 Counters and Accumulators

ITEMP - Used to hold temporary values while decoding the binary coded Lane Sensor Table Block.

ISENS - DO LOOP pointer indicating the sensor index NUMBER.

IDEX - DO LOOP pointer indicating the station index number.

3.7.3.3 Labeled Common

Area: /CNSTNT/

Variable: NOSENS - Uses.

Area: /BLOCK0/

Variables: IBYTE - Uses.

IHW - Uses.

Area: /ARRAY1/

Variables: NSENS(170) - Calculates the values.

INDEX(341) - Sets the value.

Area: /ARRAY2/

Variables: FRWYS (8) - Uses these literals.

DIRCTS (8) - Uses these literals.

LNTPCD (20)- Uses these literals.

Area: /ARRAY3/

Variables: IFWY(341) - Sets these constants to their corresponding literal values.

ISTA(341) - Sets these constants to their corresponding literal values.

IDIR(341) - Sets these constants to their corresponding literal values.

ILNTYP(341)- Sets these constants to their corresponding literal values.

ILNO(341) - Sets these constants to their corresponding literal values.

Area: /ARRAY4/

Variables: MBAI(341) - Sets these values.

LITIME(341)- Sets these values.

STATUS(341)- Sets these values.

Area: /BLANK/

Variable: LST(3,341) - Used.

3.7.4 FLOWCHARTS

Figure 18 illustrates the processing flow for subroutine LSTIN (MTIME).

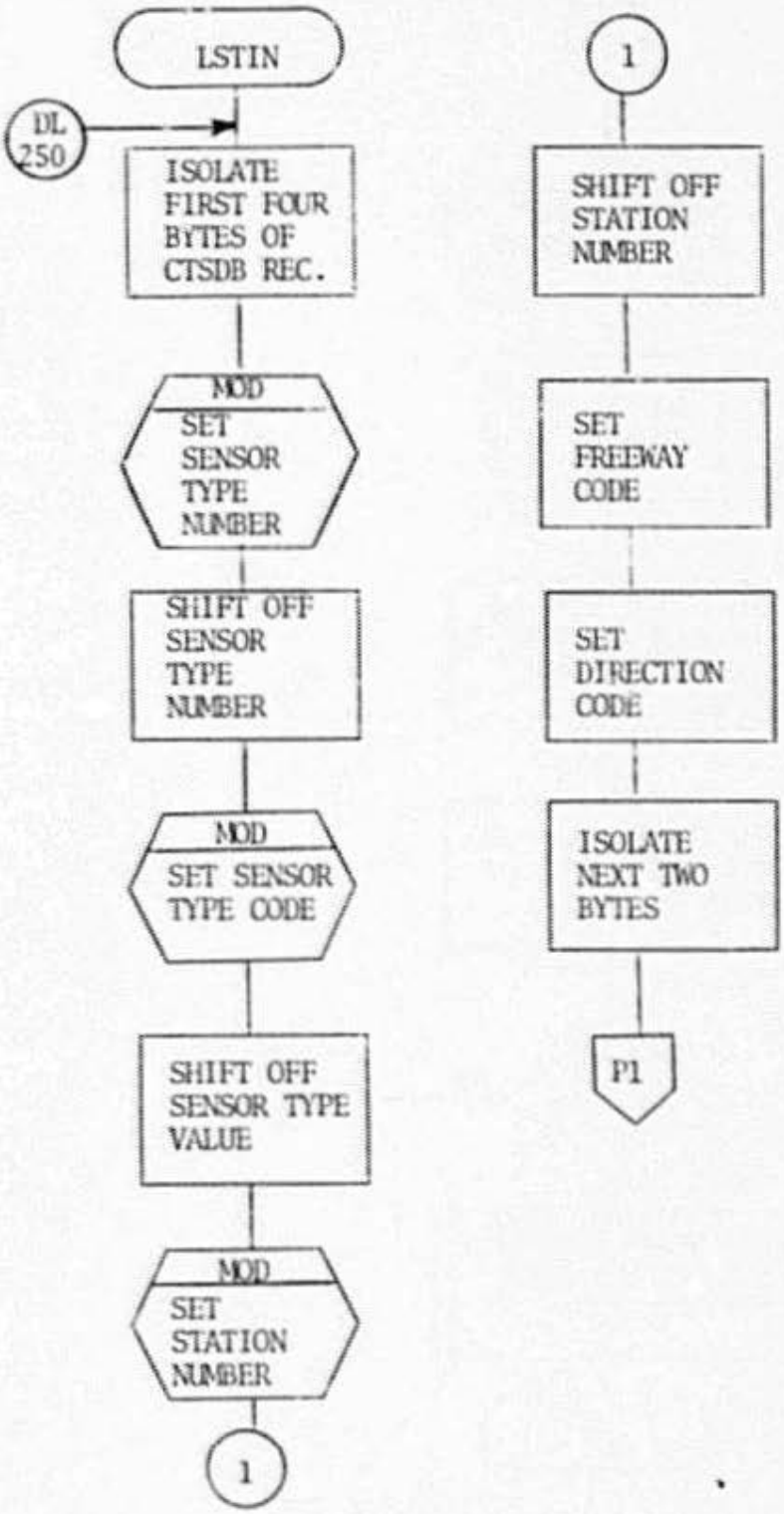

FIGURE 18

SUBROUTINE LISTIN (MTIME) FLOWCHART

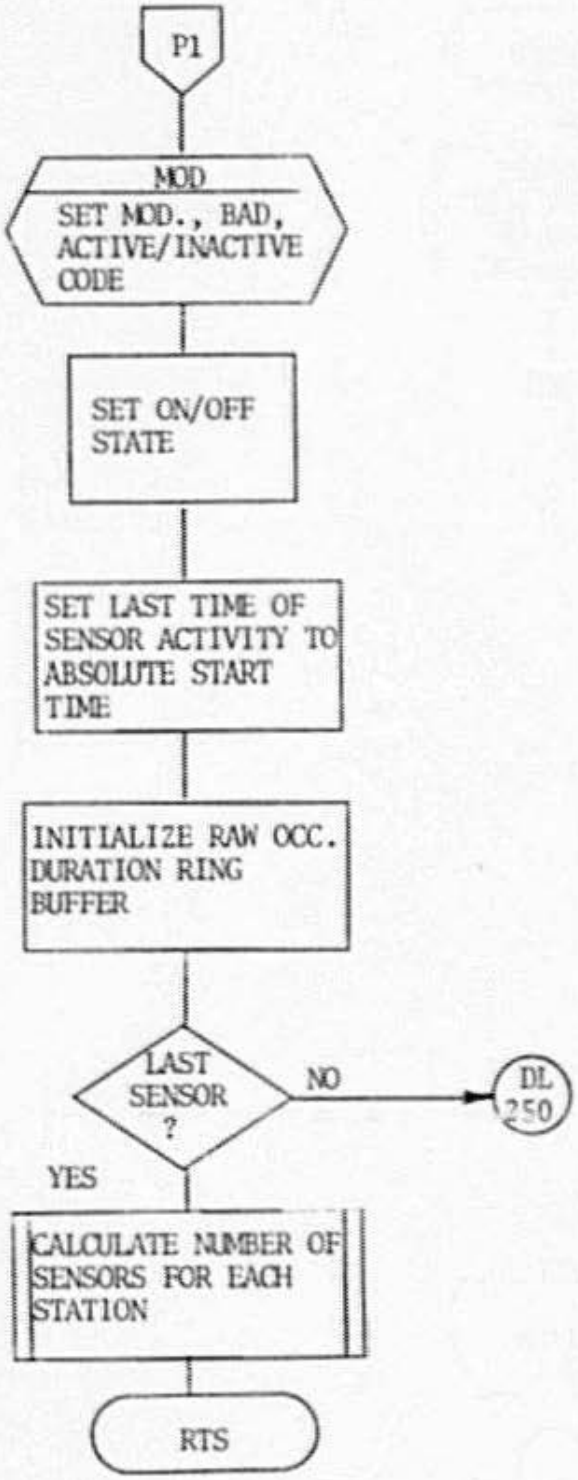

FIGURE 18 (CONTINUED)

SUBROUTINE LISTIN (MTIME) FLOWCHART

3.8 SUBROUTINE LSTLMT (LISTCD)

3.8.1 PURPOSE

This subroutine handles all of the I/O for listing and changing the station index number. It is called by subroutine NEWLIM only to list and/or allow changes to be made to the station index numbers.

Since the type of I/O devices vary greatly from installation to installation and the type of program input and output depends upon preference of the user, changes will probably be made to the reading and writing of the station index numbers. All of the I/O for inputting and outputting of the station index numbers has been isolated in this subprogram to facilitate easy modification or changes.

3.8.2 PROGRAM SYNOPSIS

This subroutine will do one of three processes according to the value of the listing code (LISTCD) received from the calling program.

When the listing code value is zero (0), the message 'DEFAULT VALUES' and the values of the station index numbers are output to a listing or display device (PUT). At this point, changes to the station index numbers can be made, if desired, on the input device (GET).

When the listing code value is less than zero (0), the message 'IRRECOVERABLE ERROR' and the values of the station index numbers are output to the listing or display device. The station index numbers that were determined to be in error are indicated by the negative value of these parameters. At this point, changes should be made to correct the errored values.

When the listing code value is greater than zero (0), the message 'VALUES TO BE USED' is output to the listing or display device and the new station index numbers are output for the last time.

All of the new station index numbers to be used must be input since a value of less than or equal to zero signifies that a freeway segment is to be deleted.

3.8.3 PROGRAM WORK AREAS

3.8.3.1 Switches

LISTCD - Argument received from the calling program. Lists message and key parameters and may allow

changes to be made according to the value.

0 - Message is 'IRRECOVERABLE ERROR'. Expects input to change parameters.

= 0 - Message is 'DEFAULT VALUES'. Allows input to change parameters.

0 - Message is 'VALUES TO BE USED'. Input is not allowed.

3.8.3.2 Counters and Accumulators

I - Array subscript pointer.

3.8.3.3 Labeled Common

Area: /ARRAY7/

Variables: BEGSTA(4), ENDSTA(4) - These arrays contain the beginning and ending station index numbers. These values are output to device PUT, then changed to new values from device GET.

Area: /ALLIO/

Variables: GET, PUT - These devices are used for input and output, respectively.

3.8.4 FLOWCHARTS

Figure 19 illustrates the processing flow for subroutine LSTLMT (LISTCD).

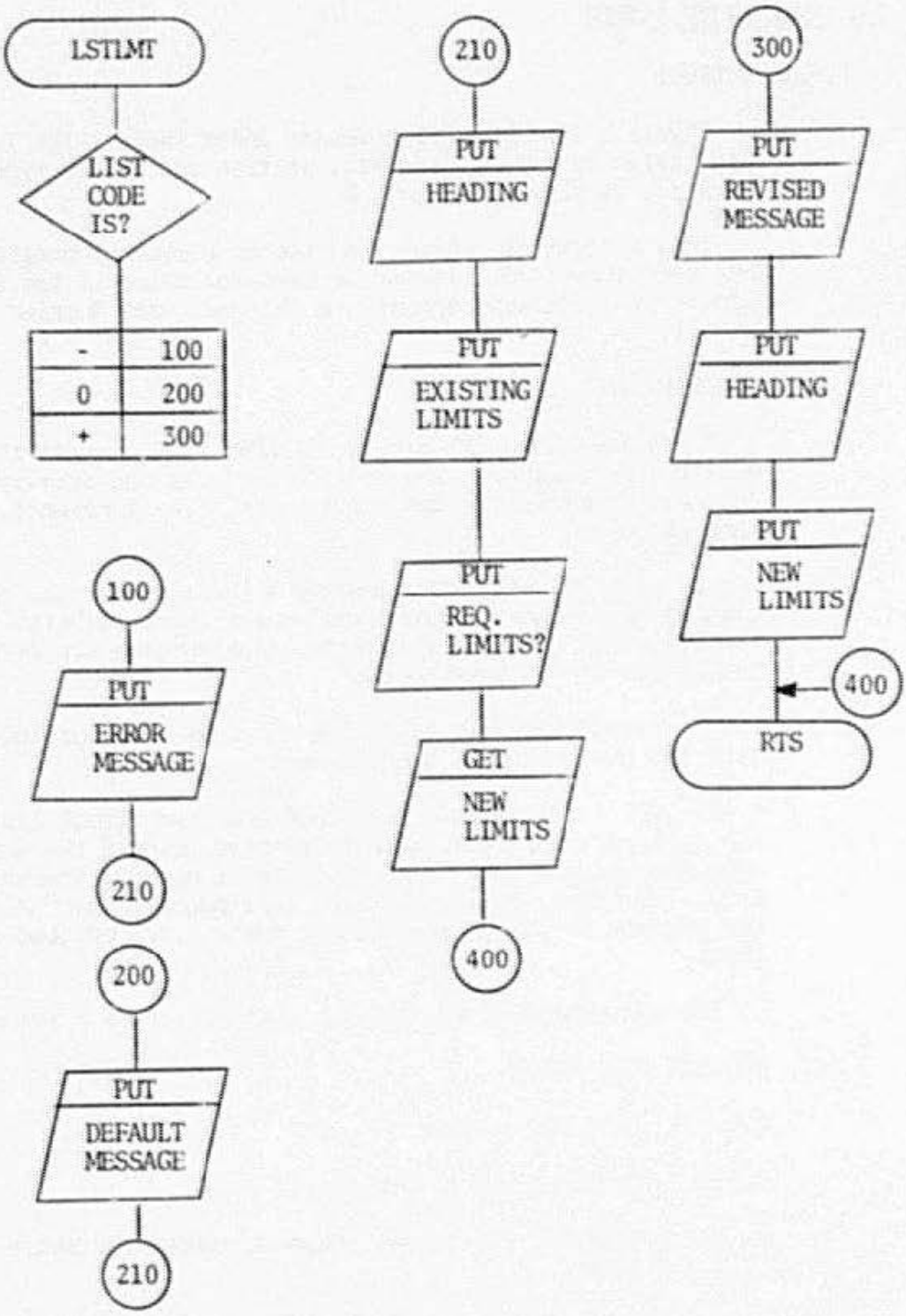

FIGURE 19

SUBROUTINE LSTLMT (LISTCD) FLOWCHART

3.9 SUBROUTINE LSTOUT

3.9.1 PURPOSE

Prints a listing of the Sensor Index Table. The lane sensors are listed by freeway segment, station and sensor type when requested, as shown in Figure 4.

This program is called from the main control program if it has been requested. It may be executed twice if the station limits of a freeway segment are changed. See Section 3.0.2 for details.

3.9.2 PROGRAM SYNOPSIS

There are three (3) nested DO LOOPS that control the listing of the lane sensors. The outside controls the freeway segment. The next controls the freeway station. The innermost lists the lane sensors.

The outside prints the freeway segment number and the beginning and ending stations and sensor index numbers. Also, the beginning and ending station index numbers are derived for the limits of the next DO LOOP.

The second gets the beginning and ending sensor index numbers for the limits of the innermost.

The third and innermost DO LOOP does the actual listing of the sensors. One blank line is printed between the sensors of each freeway station. The sensor index number, freeway, station, direction, lane type, lane type number, the MBAI code of the sensors and the station index numbers are printed on each line.

The environmental sensors are listed last as a group.

3.9.3 PROGRAM WORK AREAS

3.9.3.1 Switches - None

3.9.3.2 Counters and Accumulators

ISGMTS - The freeway segment number currently being listed.

JBEG, JEND - The beginning and ending sensor index numbers of the freeway segment being listed.

IBEG, IEND - The beginning and ending station index number used to set the limits of the stations of the freeway segment.

IDEX - The pointer indicating the station index number of the station currently being printed.

ISENS1, ISENS2 - The beginning and ending sensor index number of the station currently being printed.

ISENS - The pointer indicating the sensor index number of the sensor currently being listed.

3.9.3.3 Labeled Common

Area: /ARRAY1/

Variables: IASGMT(2,5) - These variables are used
SINDEX(171) to control the listing.
MLSTAS(2,4)

Area: /ARRAY3/

Variables: IFWY(341) - All of these literals and
ISTA(341) values are printed.
IDIR(341)
ILNTYP(341)
ILNO(341)

Area: /ARRAY4/

Variables: MBAI(341) - These initial values are printed.

Area: /ALLIO/

Variable: LP - Symbolic unit number used for output.

3.9.4 FLOWCHARTS

Figure 20 illustrates the processing flow for subroutine LSTOUT.

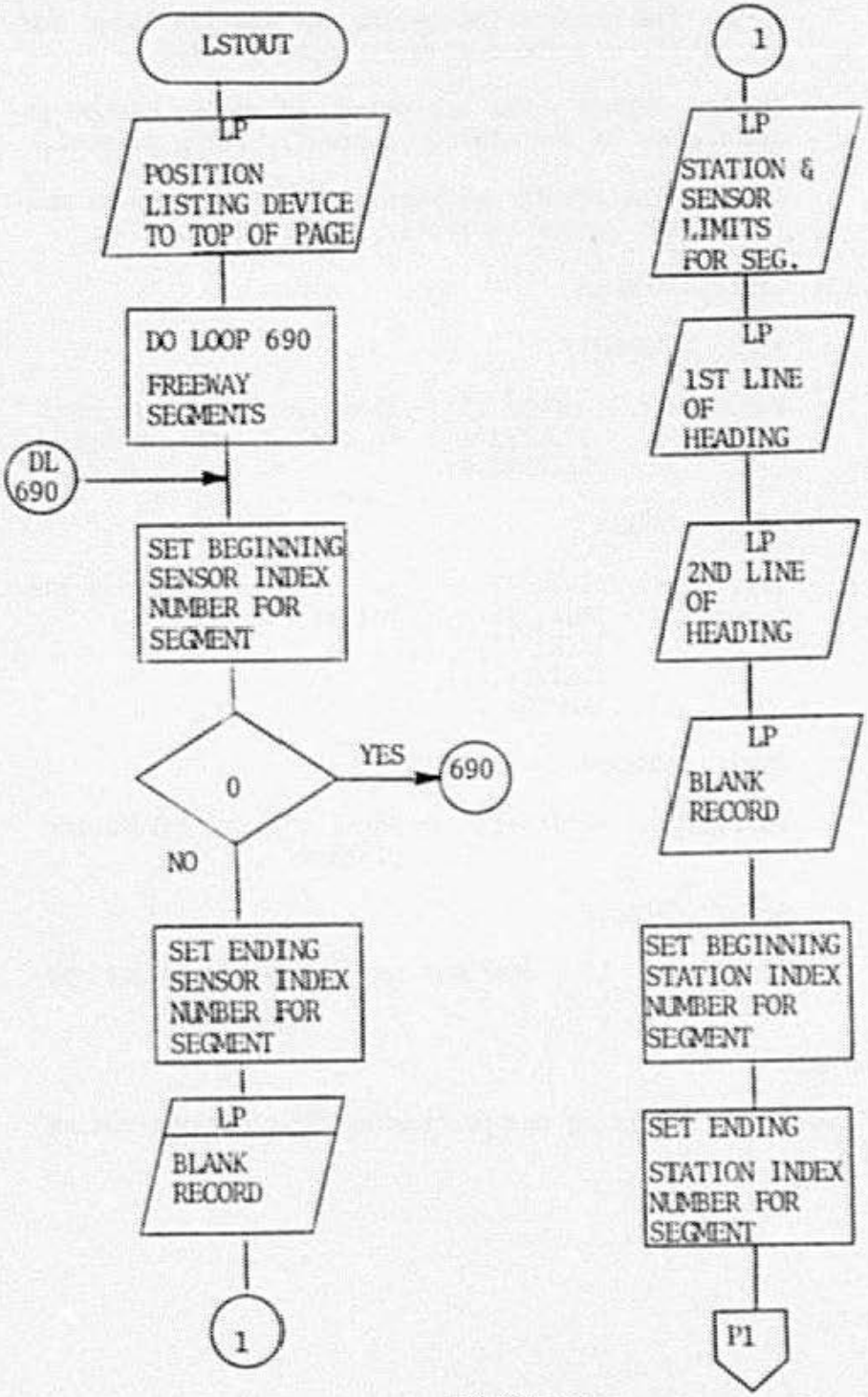

FIGURE 20

SUBROUTINE LSTOUT FLOWCHART

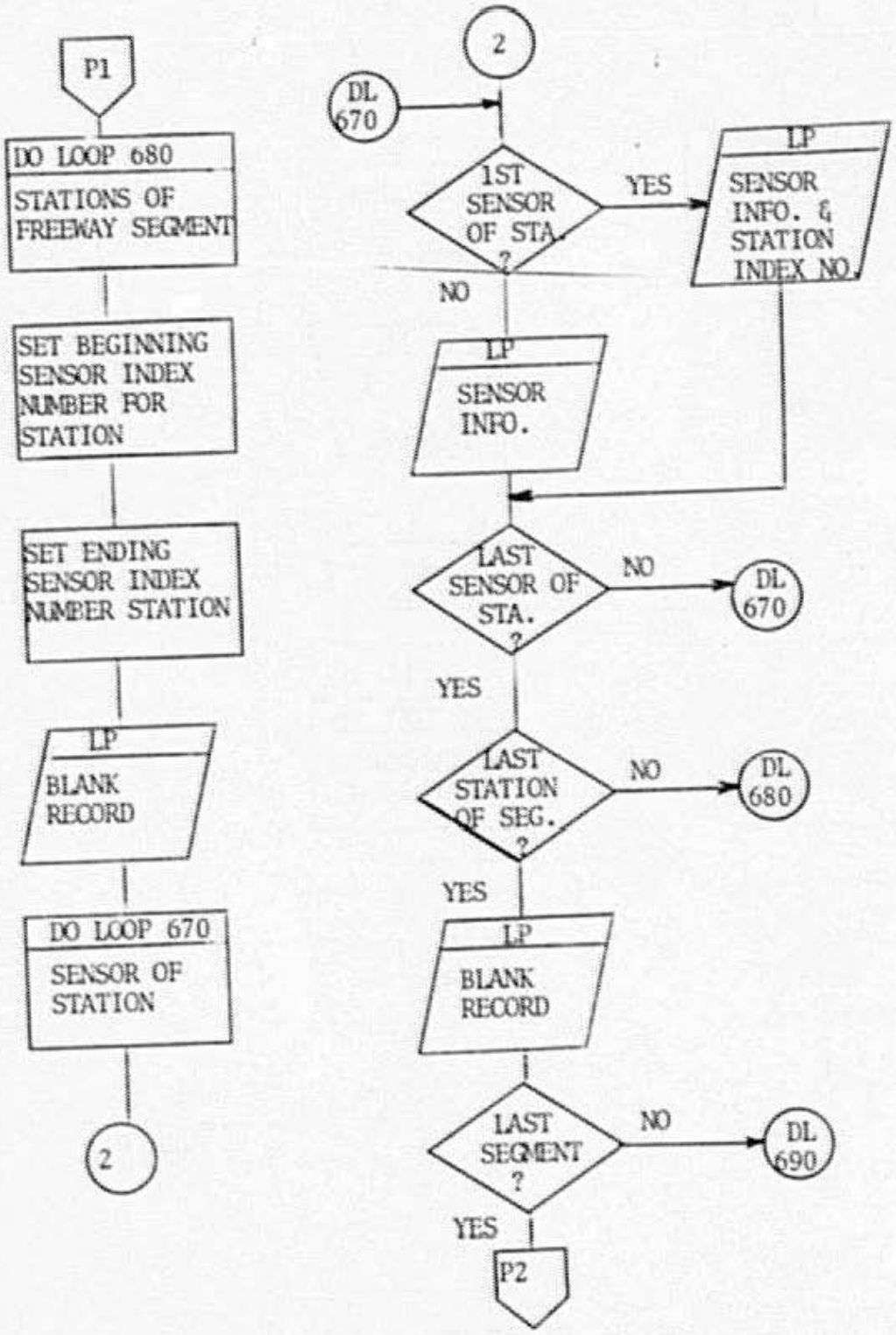

FIGURE 20 (CONTINUED)

SUBROUTINE LSTOUT FLOWCHART

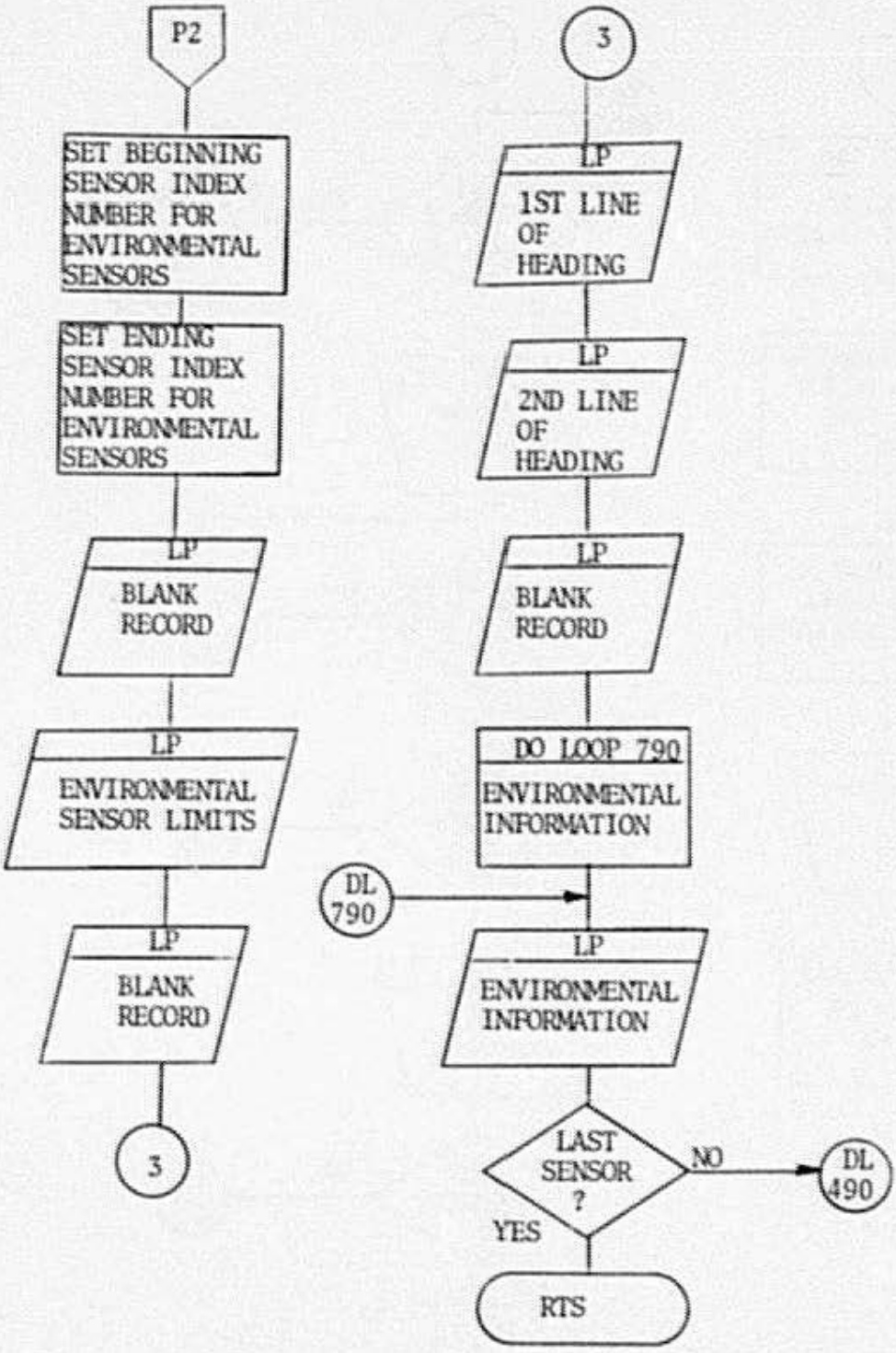

FIGURE 20 (CONTINUED)

SUBROUTINE LSTOUT FLOWCHART

Area: /CNSTNT/

Variables: GFACTR

OUTPUT - Will be changed to whatever is read.

Area: /BLOCK2/

Variables: All except TSTART and TFINAL.

Area: /ARRAY7/

Variable: LIMITS

Area: /ALLIO/

Variables: GET - Used for input device.

PUT - Used for listing device.

3.10.4 FLOWCHARTS

Figure 21 illustrates the processing flow for subroutine LSTPRM.

3.10 SUBROUTINE LSTPRM (LISTCD)

3.10.1 PURPOSE

This subroutine handles all of the I/O for listing and changing the key parameters that control the output of the documentation information; the output of the computed statistics; the time period, freeway stations and intervals for which the statistics are computed. Section 2.5 describes the complete procedure.

This subprogram is called by subroutine PRMTRS to list and/or allow changes to be made to the key parameters.

All of the I/O for the input and output of the key parameters has been isolated in this subprogram to facilitate easy modification or changes.

Since the type of I/O devices vary greatly from installation to installation and the type of program input and output depends upon preference of the user, changes will probably be made to the reading and writing of the key parameters.

3.10.2 PROGRAM SYNOPSIS

This subroutine will do one of three processes according to the value of the listing code (LISTCD) received from the calling program.

When the listing code value is zero (0), the message 'DEFAULT VALUES' and the values of the key parameters are output to a listing or display device (PUT). At this point, changes to the key parameters can be made, if desired, on the input device (GET).

When the listing code value is less than zero (0), the message 'IRRECOVERABLE ERROR' and the values of the key parameters are output to the listing or display device. The key parameters that were determined to be in error are indicated by the negative value of the parameters. At this point, changes should be made to correct the errored parameters.

When the listing code value is greater than zero (0), the message 'VALUES TO BE USED' is output to the listing or display device and the key parameters are output to the listing or display device.

The key parameters are read into temporary storage except for the output code (OUTPUT) and the change station limits code (LIMITS). The temporary values are compared to zero for each of the remaining key parameters. If the value read

is greater than zero, the corresponding key parameter is set to the value read. Otherwise, the original value of the key parameter is preserved.

3.10.3 PROGRAM WORK AREAS

3.10.3.1 Switches

LISTCD - Argument received from the calling program. Lists message and key parameters and may allow changes to be made according to the value.

- 0 - Message is 'IRRECOVERABLE ERROR'. Expects input to change parameters.
- = 0 - Message is 'DEFAULT VALUES'. Allows input to change parameters.
- 0 - Message is 'VALUES TO BE USED'. Input is not allowed.

3.10.3.2 Counters and Accumulators

The following temporary storage locations are used to store the new key parameter values input via device GET:

ITEMP1 - UPDINT

ITEMP2 - AVGINT

ITEMP3 - LSTINT

ITEMP4 - ISTART

ITEMP5 - IFINAL

ITEMP6 - SMPLRT

RTEMP1 - GFACTR

3.10.3.3 Labeled Common

The following variables, except where noted, contain their default values from subroutine PRMTRS and can be reset to a new value greater than zero by inputting new values through the input device (GET).

Area: /CNSTNT/

Variables: GFACTR

OUTPUT - Will be changed to whatever is read.

Area: /BLOCK2/

Variables: All except TSTART and TFINAL.

Area: /ARRAY7/

Variable: LIMITS

Area: /ALLIO/

Variables: GET - Used for input device.

PUT - Used for listing device.

3.10.4 FLOWCHARTS

Figure 21 illustrates the processing flow for subroutine LSTPRM.

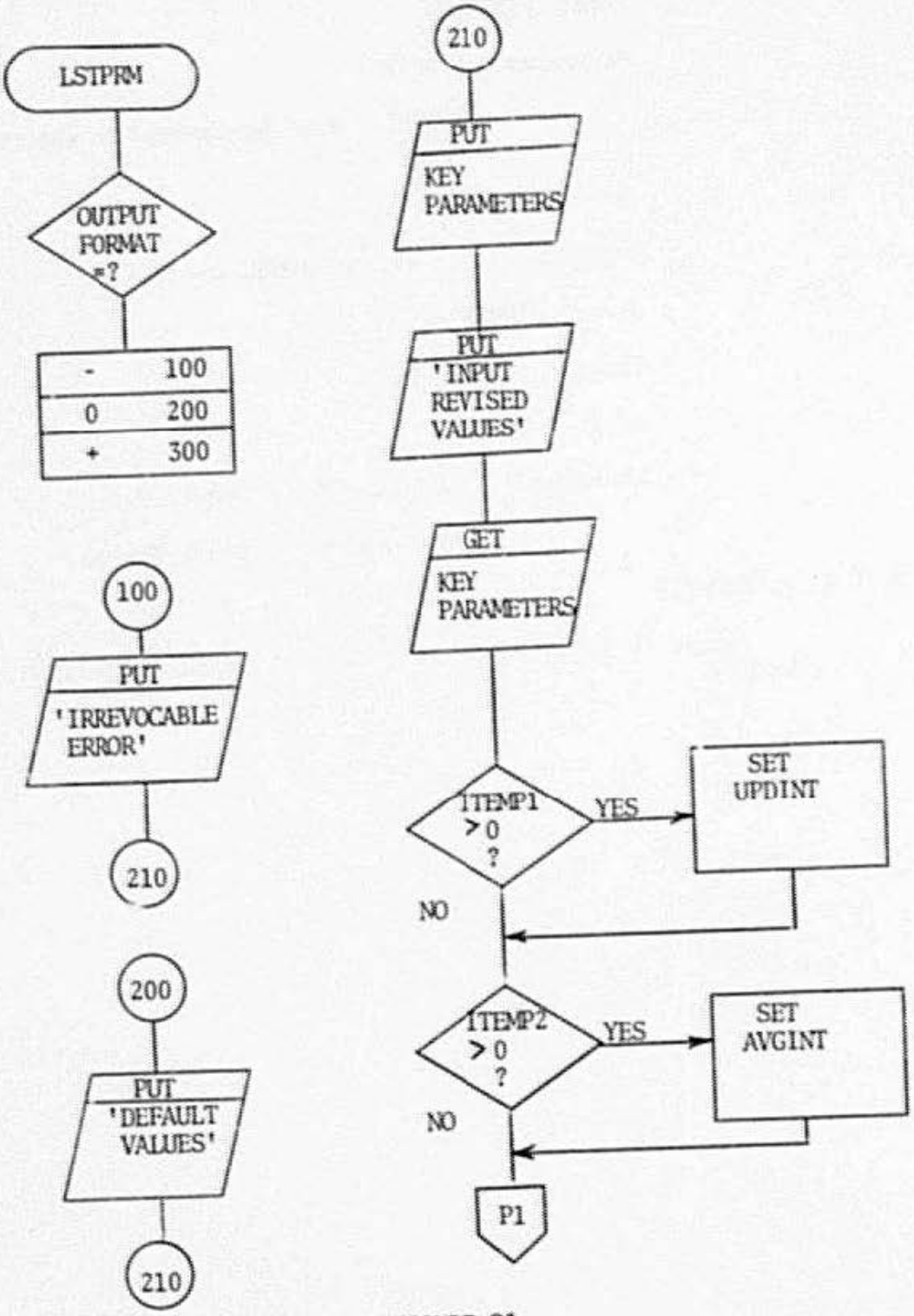

FIGURE 21

SUBROUTINE LSTPRM (LISTCD) FLOWCHART

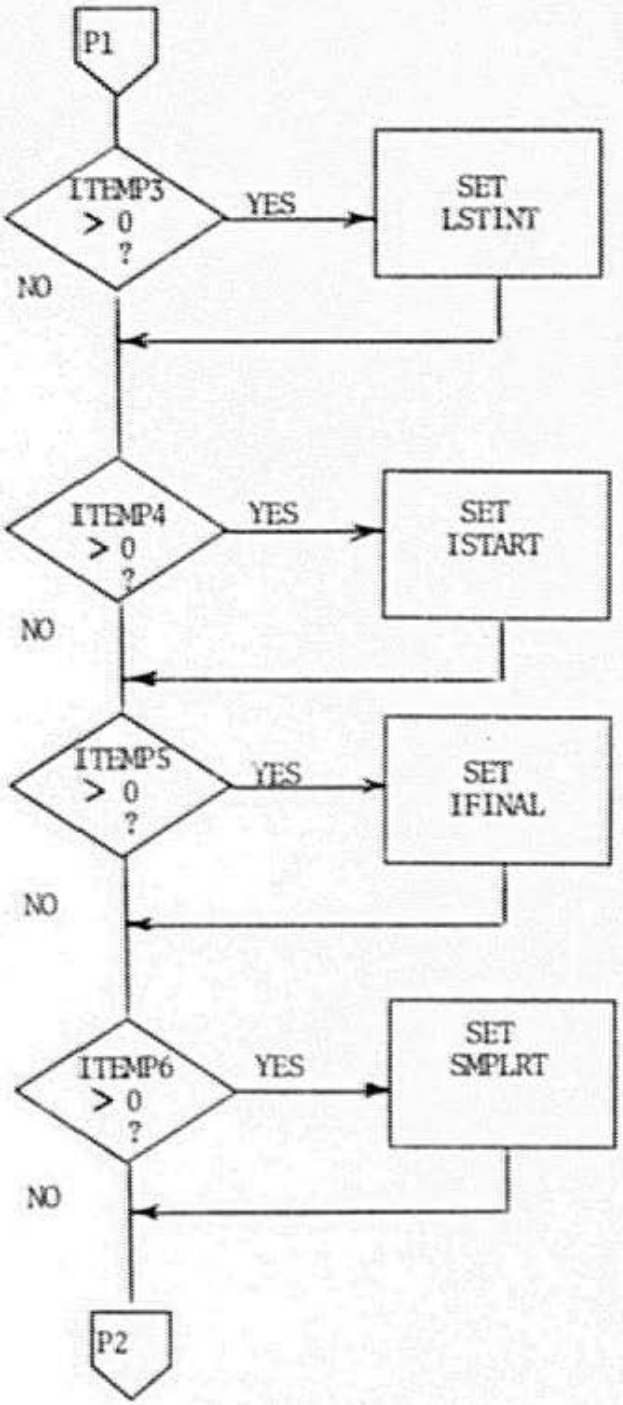

FIGURE 21 (CONTINUED)

SUBROUTINE LSTPRM (LISTCD) FLOWCHART

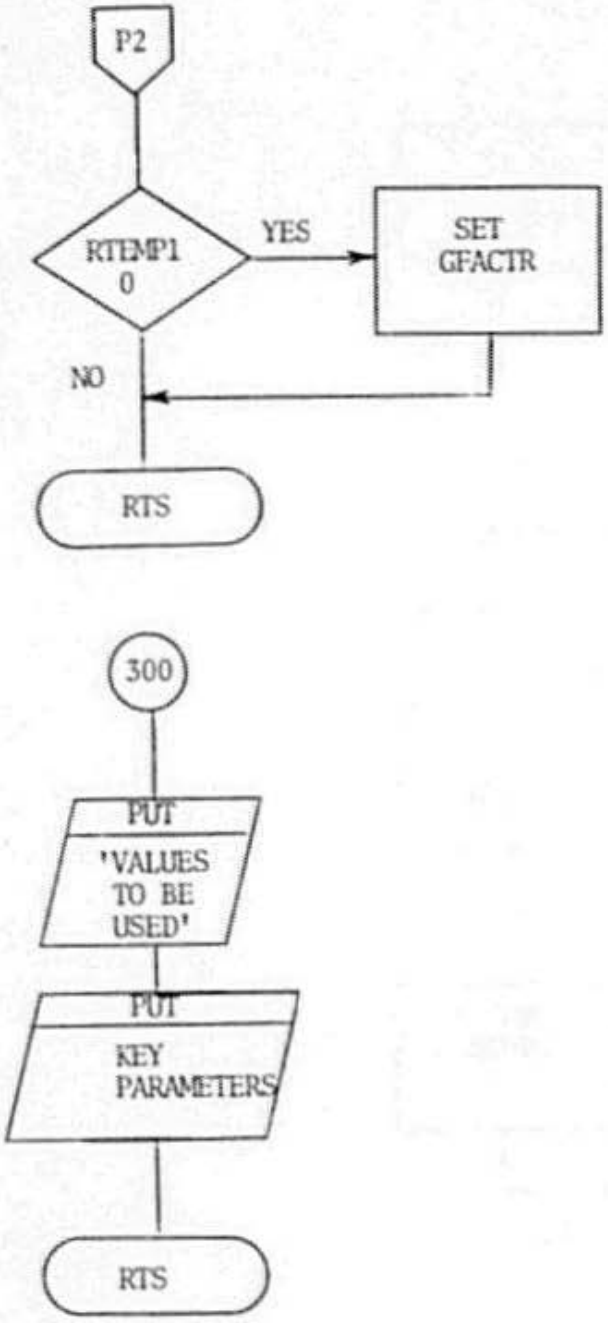

FIGURE 21 (CONTINUED)

SUBROUTINE LSTPRM (LISTCD) FLOWCHART

3.11 SUBROUTINE NEWLIM

3.11.1 PURPOSE

Determines and verifies new station limits for the incident segments. Permits the user the capability of changing the number of sensors, stations and incident segments for which statistics are to be computed, if requested. Changes all of the Sensor and Station Cross-Reference Arrays.

This routine is called only if the stations for which the statistical values are calculated are to be changed. Calls to subroutine LSTLMT are made for the actual I/O.

3.11.2 PROGRAM SYNOPSIS

The Station and Sensor Cross-Reference Arrays, the Sensor Indexed Identification Arrays and the Freeway Segment Identification Arrays are saved in temporary storage and reset to zero in the first three DO LOOPS. The listing code (LISTCD) is set to display the values of the existing station index numbers for the freeway segments. Then a call is made to subroutine LSTLMT to display the station index numbers and allow changes to be made. After returning from subroutine LSTLMT, the listing code (LISTCD) is reset to indicate an error and allow changes.

The fourth DO LOOP then computes the new number of segments (NSGMTS), the temporary beginning and ending station index numbers of the segments (NMLSTA) and the total number of freeway stations (MLSTOT). If either the beginning or ending station index numbers of a freeway segment is less than or equal to zero, all of the stations for the segment are deleted.

This fourth DO LOOP also verifies the new station index numbers and it is an error if the number of segments (NSGMTS) is equal to zero; the ending station index number is less than the beginning; or if an ending station index number is greater than the original number of stations (NMLSTO). If an error is detected for any of the above, the station index numbers of the corresponding segment number are multiplied by a factor of negative one; a call is then made to subroutine LSTLMT to display the values and allow corrections.

The next three nested DO LOOPS reset the Station and Sensor Cross-Reference Arrays, the eighth DO LOOP resets the Sensor Indexed Identification Arrays, and the last DO LOOP resets the Freeway Segment Identification Arrays.

Then the listing code (LISTCD) is reset to indicate verification of the new station index numbers and the last call to subroutine LSTLMT is made to display the final values used. Control is then returned to the main control program.

3.11.3 PROGRAM WORK AREAS

3.11.3.1 Switches

LISTCD - The listing code passed to subroutine LSTLMT to display and/or allow changes to the station index numbers of a freeway segment.

- < 0 - Print 'IRRECOVERABLE ERROR' message and list station index number values. Expects changes to be made.
- = 0 - Print 'DEFAULT VALUES' message and list station index number values. Allows changes to be made.
- > 0 - Print 'VALUES TO BE USED' message and list station index number values. Neither expects nor allows changes to be made.

3.11.3.2 Counters and Accumulators

The following scalars and arrays are temporary storage locations for the original Station and Sensor Cross-Reference Data:

NMLSTO - Total number of freeway stations (MLSTOT).

NTOTST - Total number of stations including environmental stations (TOTSTA).

NSINDE(171) - Sensor index number of the first sensor at a freeway station (SINDEX).

NMLSTA(2,4) - Beginning and ending station index number of a segment MLSTAT).

NACTLN(170) - Number of active lanes at a freeway station (ACTLNS).

NNSENS(170) - Total number of sensors at a freeway station.

NIASGM(2,5) - Beginning and ending sensor index number of a segment (IASGMT).

The following arrays are temporary storage locations for the original Sensor Indexed Identification Arrays:

NIFWY(341) - Literal code for freeway (IFWY).

NISTA(341) - Integer value for station number (ISTA).

NIDIR(341) - Literal code for direction (IDIR).

NLNTYP(341) - Literal code for sensor lane type (ILNTYP).

NILNO(341) - Integer value for the sensor lane type count (ILNO).

I - Miscellaneous DO LOOP pointer.

IDEX - New station index number.

ISENS - New sensor index number.

NSTA1, NSTA2 - Original beginning and ending station index numbers.

NSTA - Original station index number.

ISENS1, ISENS2 - Original beginning and ending sensor index numbers.

ISENS0 - Original sensor index number.

J - New sensor index pointer for Printable Sensor Index Arrays.

3.11.3.3 Labeled Common

Area: /ARRAY1/

Variables: All of the variables are reset.

Area: /ARRAY3/

Variables: All of the variables are reset.

Area: /ARRAY7/

Variables: BEGSTA(4) - Initially set to the original segment station limit. May be reset to user specified value.
ENDSTA(4)

3.11.4 FLOWCHARTS

Figure 22 illustrates the processing flow for subroutine NEWLIM.

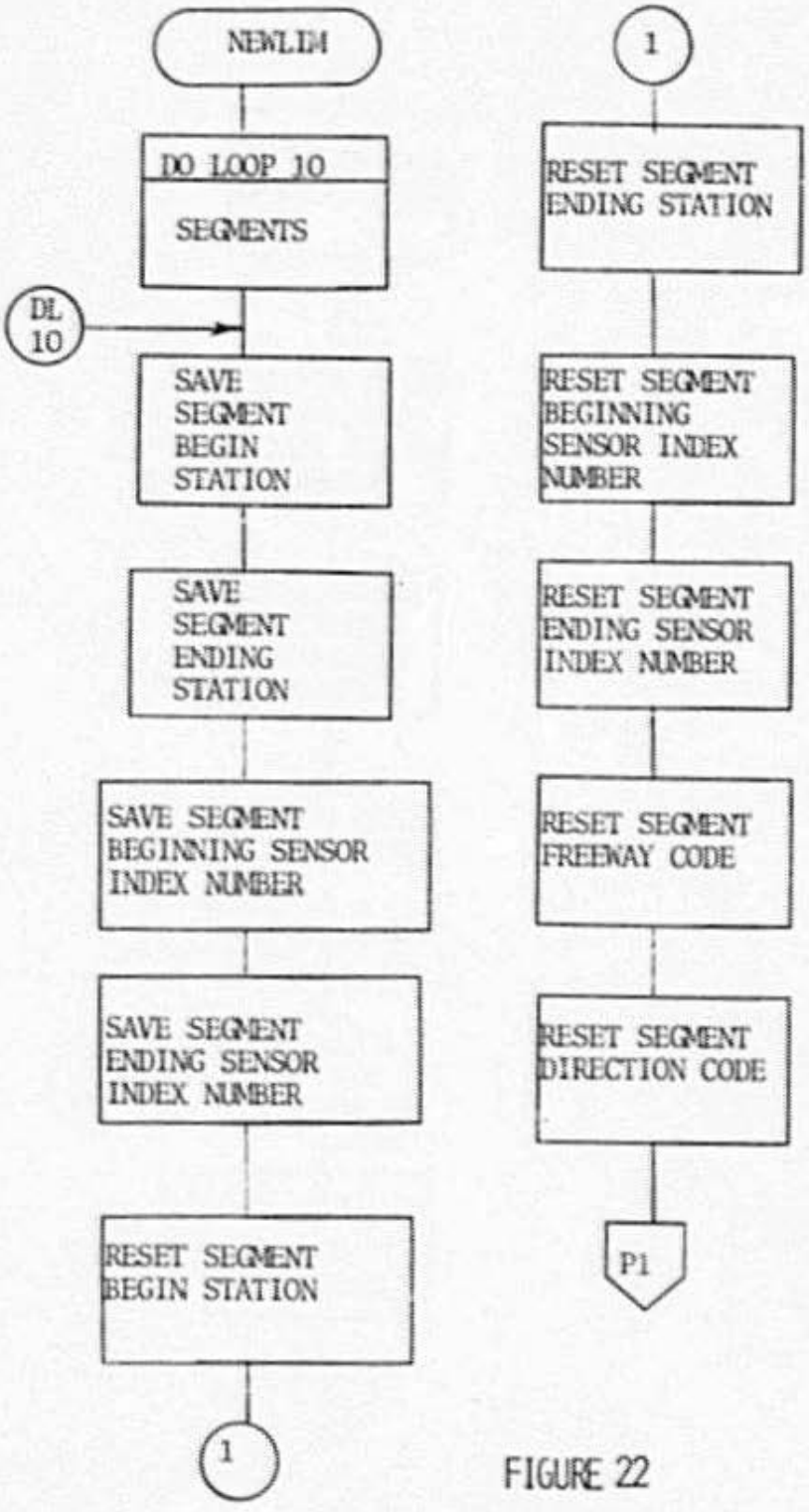

FIGURE 22

SUBROUTINE NEWLIM

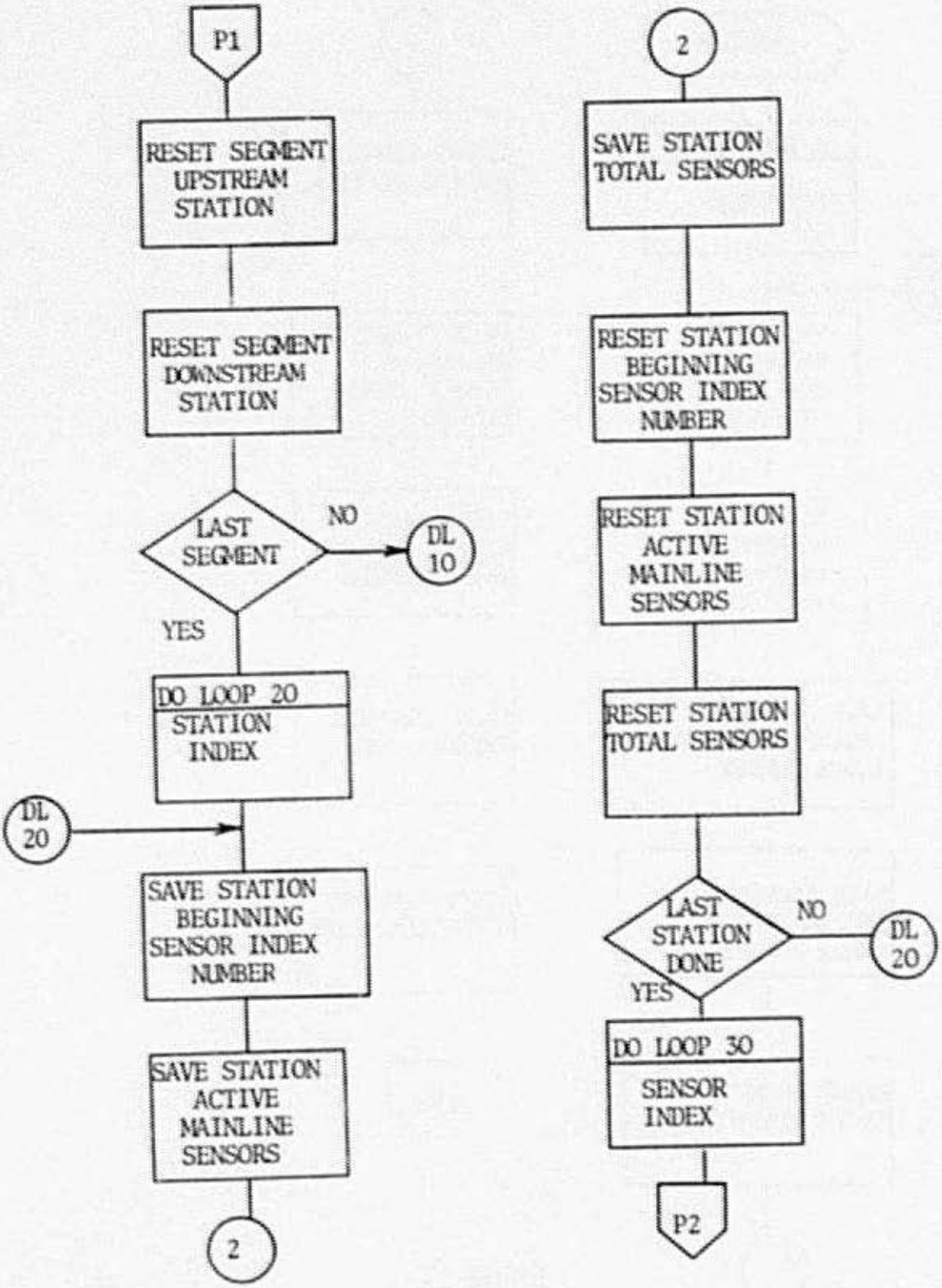

FIGURE 22 (CONTINUED)

SUBROUTINE NEWLIM

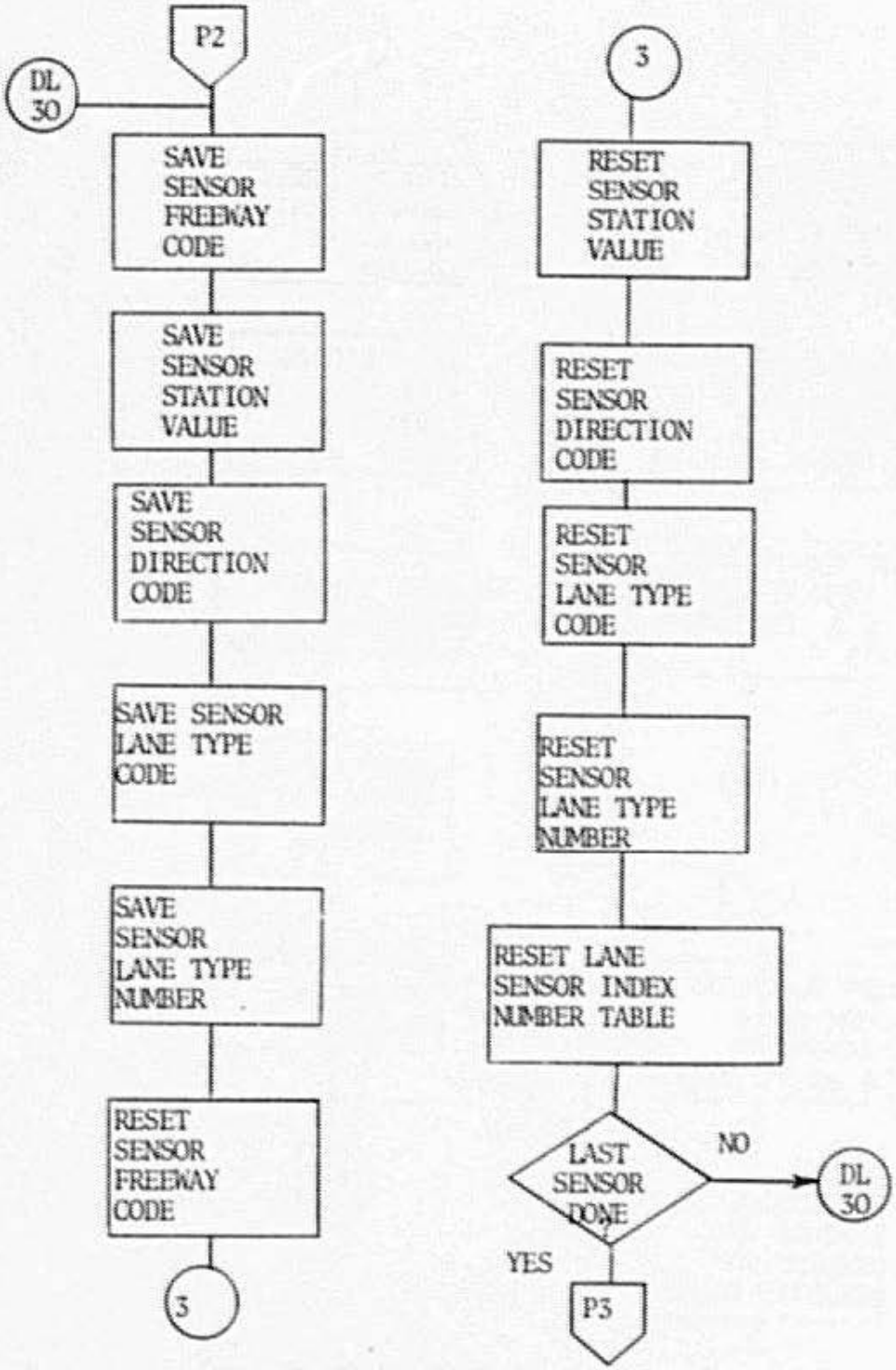

FIGURE 22 (CONTINUED)

SUBROUTINE NEWLIM

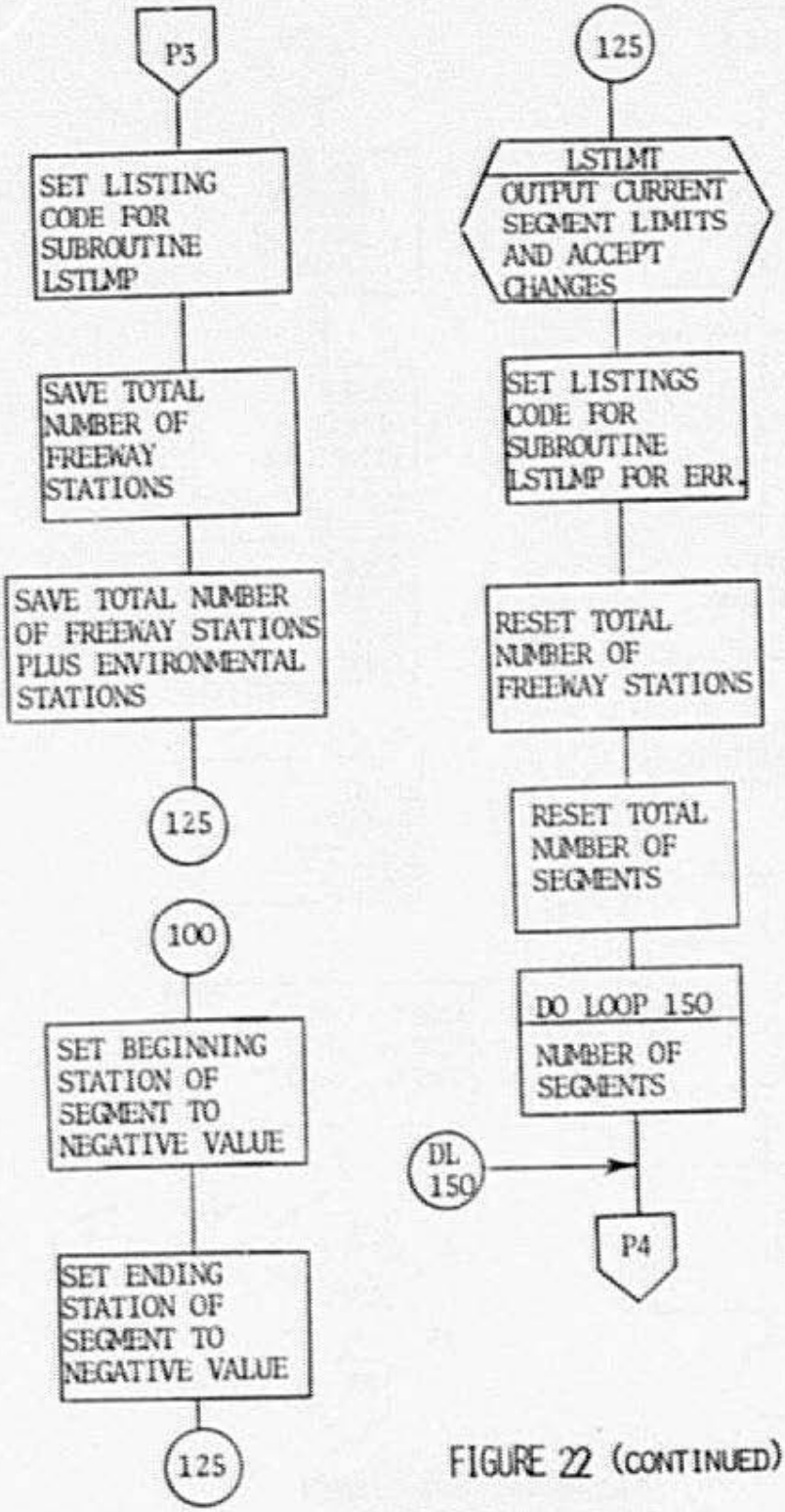

FIGURE 22 (CONTINUED)

SUBROUTINE NEWLIM

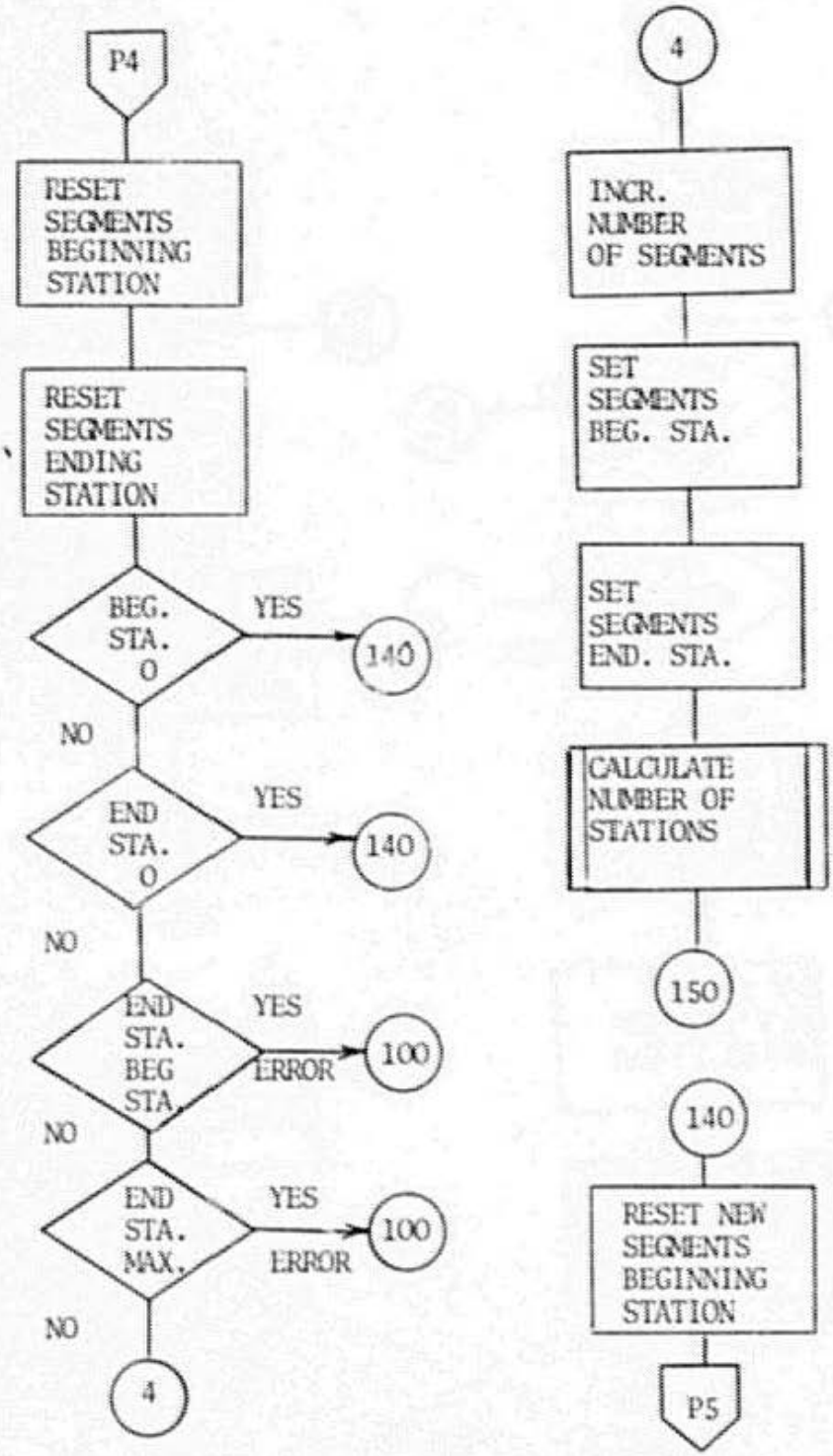

FIGURE 22 (CONTINUED)

SUBROUTINE NEWLIM

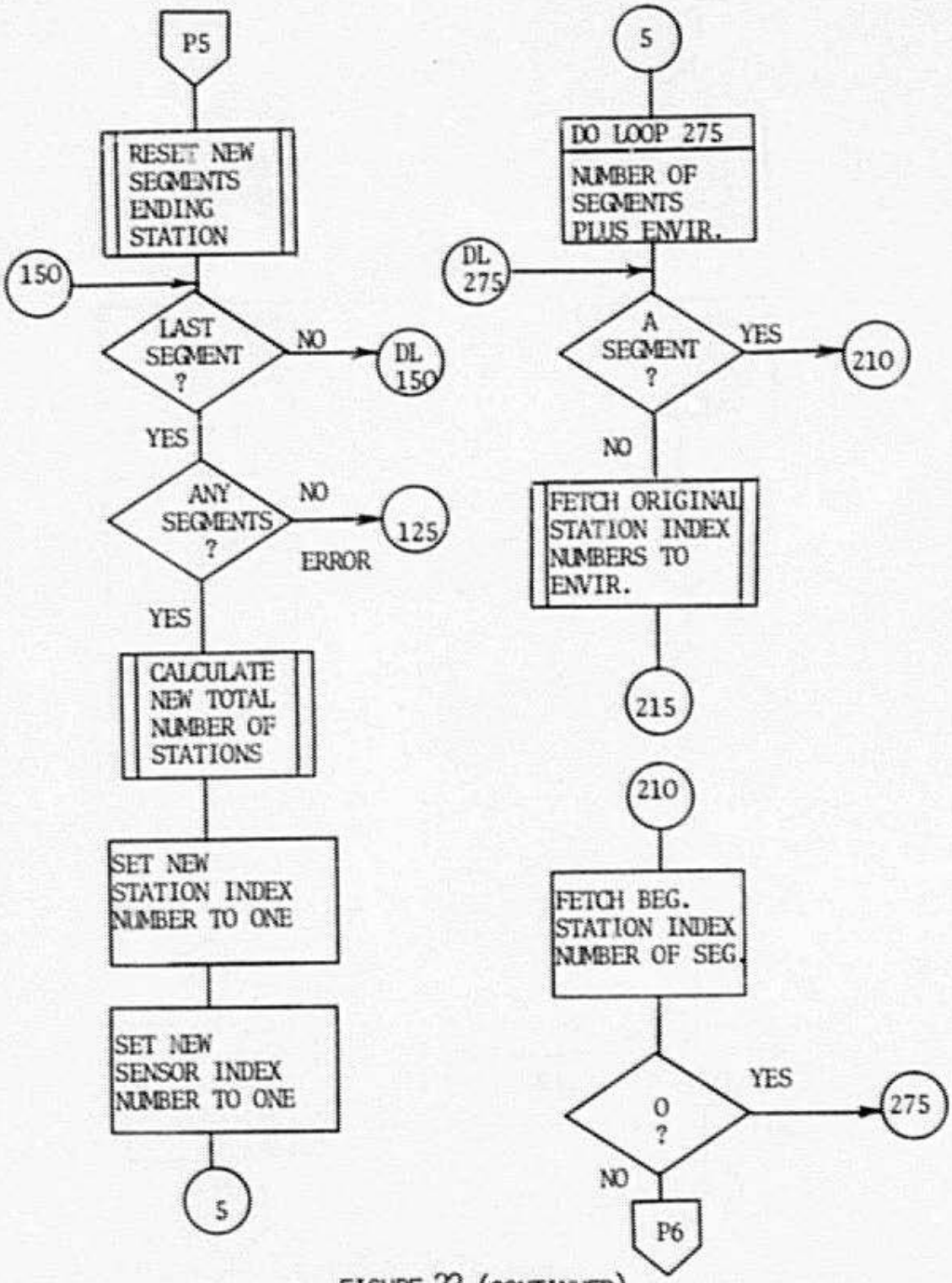

FIGURE 22 (CONTINUED)

SUBROUTINE NEWLIM

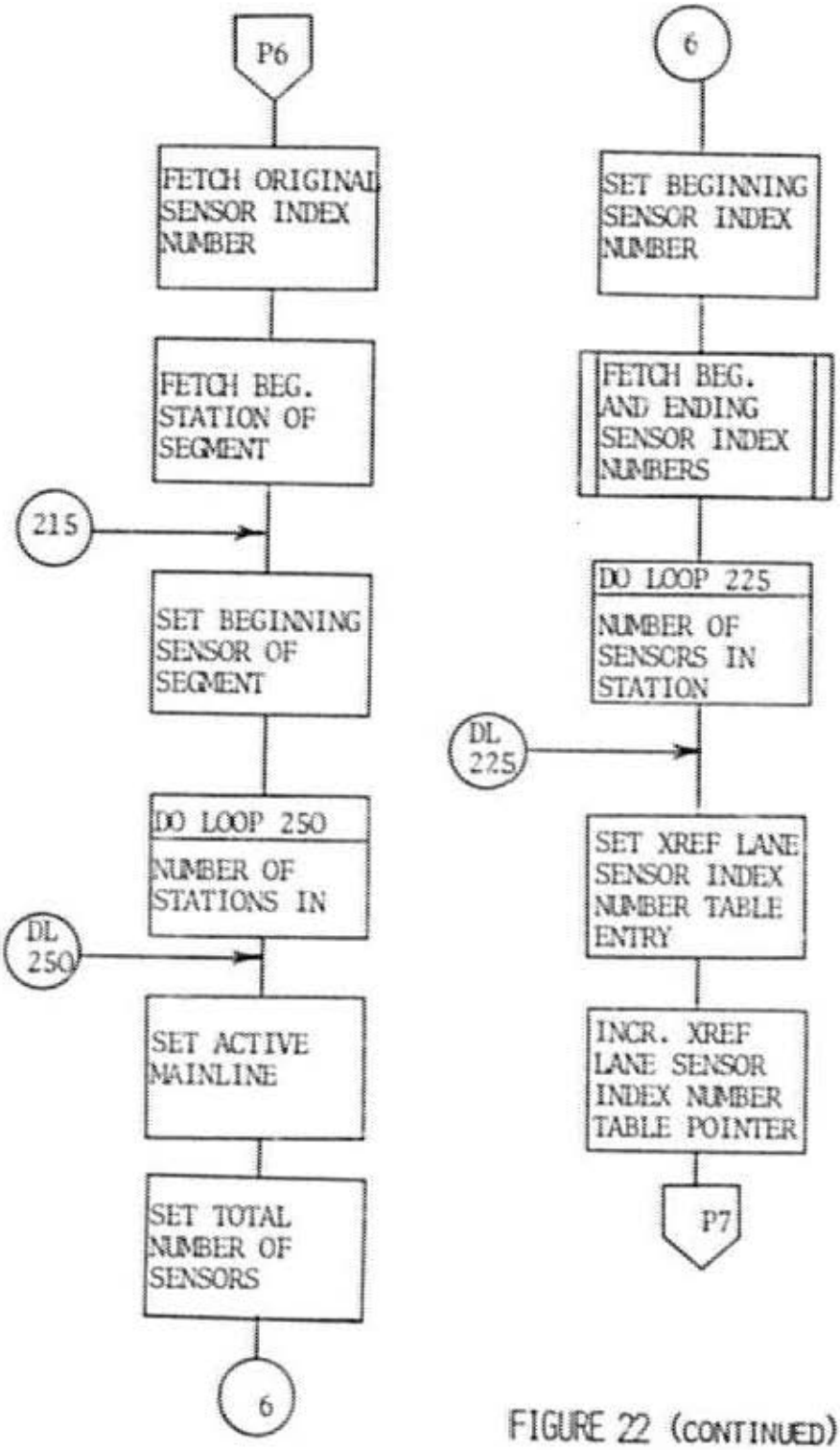

FIGURE 22 (CONTINUED)

SUBROUTINE NEWLIM

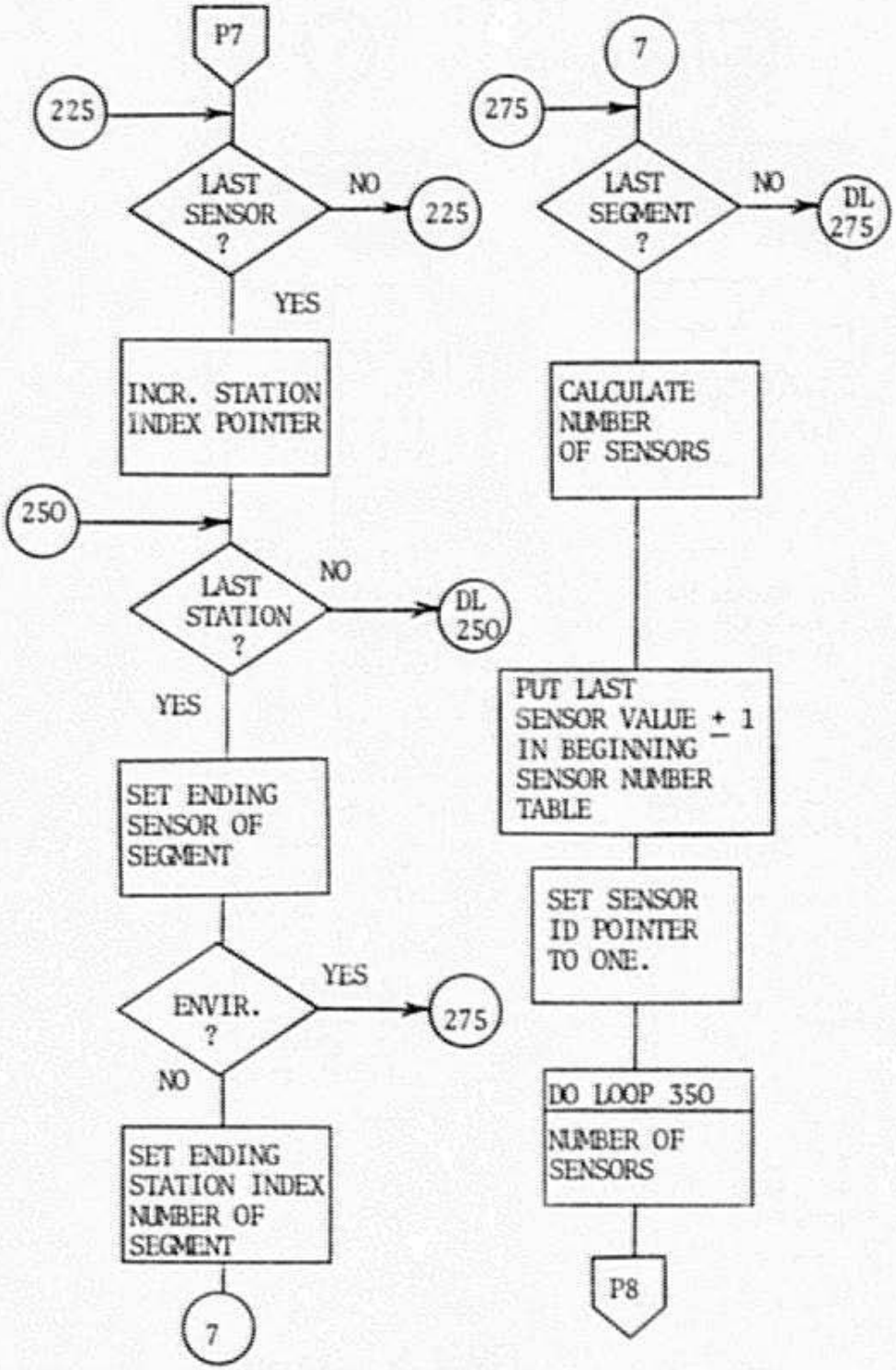

FIGURE 22 (CONTINUED)

SUBROUTINE NEWLIM

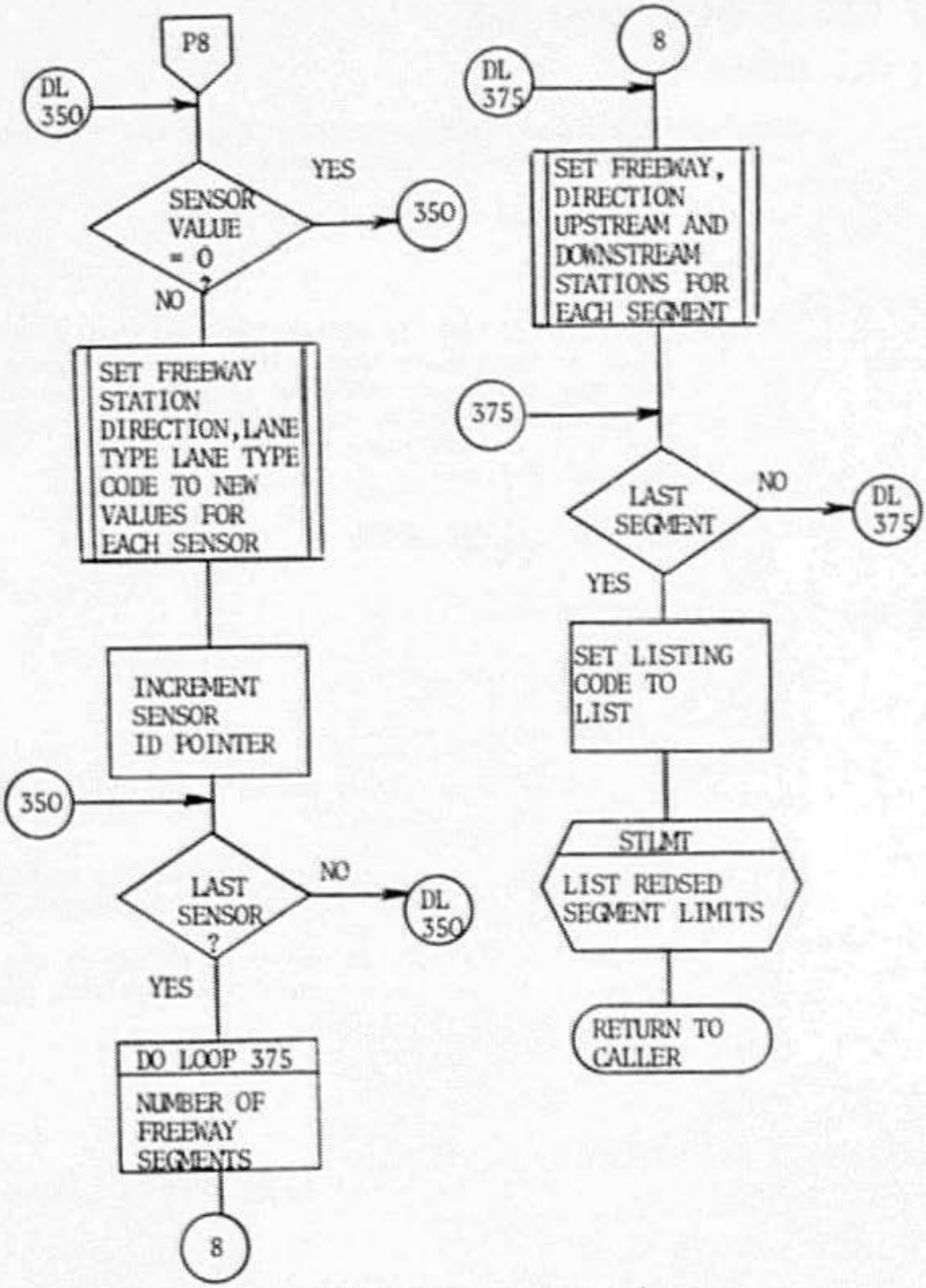

FIGURE 22 (CONTINUED)

SUBROUTINE NEWLIM

3.12 FUNCTION NPULSE (ISENS, ITIME)

3.12.1 PURPOSE

Calculates the pulse duration (number of pulses) from vehicular on-off times for a designated sensor.

This routine is called from subroutine OCCVOL.

3.12.2 PROGRAM SYNOPSIS

The sensor off-time (ITIME) is either the time that a vehicle left the sensor or the update time. The pulse duration is the difference between the sensor off-time (ITIME) and the on time (LITIME) of a sensor divided by the number of milliseconds per pulse (DFACTR). On and off times are in milliseconds. The formula used is as follows:

$$NPULSE = \frac{ITIME - LITIME(ISENS)}{DFACTR}$$

3.12.3 PROGRAM WORK AREAS

3.12.3.1 Switches - None

3.12.3.2 Counters and Accumulators

ISENS - The sensor index number. The value is unchanged.

ITIME - Either the sensor off-time or the update time in milliseconds. The value is unchanged.

NPULSE - The calculated number of pulses or the pulse duration value returned to the calling program.

3.12.3.3 Labeled Common

Area: /CNSTNT/

Variable: DFACTR - Used in the formula. Value not changed.

Area: /ARRAY4/

Variables: LITIME(341) - The on-time for the sensor.

3.12.4 FLOWCHARTS

None.

3.13 SUBROUTINE NTLZ

3.13.1 PURPOSE

This subroutine initializes symbolic unit numbers of the I/O devices and integer constants used to decode both the binary coded Lane Sensor Table and the Continuous Time Series Data Blocks from the input data tapes.

This subroutine is the first subprogram called by the control program (Section 3.1).

3.13.2 PROGRAM SYNOPSIS

Since each computer uses different FORTRAN symbolic unit numbers for the I/O devices, and to be consistent with the users environment and avoid special job control, it is expected that these unit numbers will be changed.

The bulk of the input data tape consists of binary coded bytes, with 12 bytes per logical record. The decoding subroutines LSTIN and CTSDBR use integer constants to isolate bytes of a record. These constants are set assuming a 4 byte (32 bit) word length.

The simple way would be to use a DATA BLOCK subprogram or use DATA statements. However, these are considered to be FORTRAN Extensions. The solution used was to use variables for the I/O symbolic unit numbers and the integer byte constants. These were put in Labeled Common areas /ALLIO/ and /BLOCK0/ and are initialized by a call to this subroutine.

The variables are assigned a constant value by using the FORTRAN assignment statements.

3.13.3 PROGRAM WORK AREAS

3.13.3.1 Switches - None

3.13.3.2 Counters and Accumulators - None

3.13.3.3 Labeled Common Areas

/BLOCK0/IBYTE,IHW

IBYTE is set to 256 for 9-track tape

IHW is set to 65536 for 9-track tape.

/ALLIO/PUT,GET,LP,TPIN,TPOUT

GET is set to 101 and is the input device used to read changes to the key parameters and station index numbers.

PUT is set to 102 and is the output device used to list or display the key parameters and station index numbers.

TPIN is set to 104 and is the input data tape device.

TPOUT is set to 106 and is the output device used to save the documentation information, Labeled Common areas and the computed statistics to be used as input for user written programs.

LP is set to 108 and is the output device used for listing the documentation information, Lane Sensor Table and the computed statistics.

3.13.4 FLOWCHARTS

Figure 23 illustrates the processing flow for subroutine NTLZ.

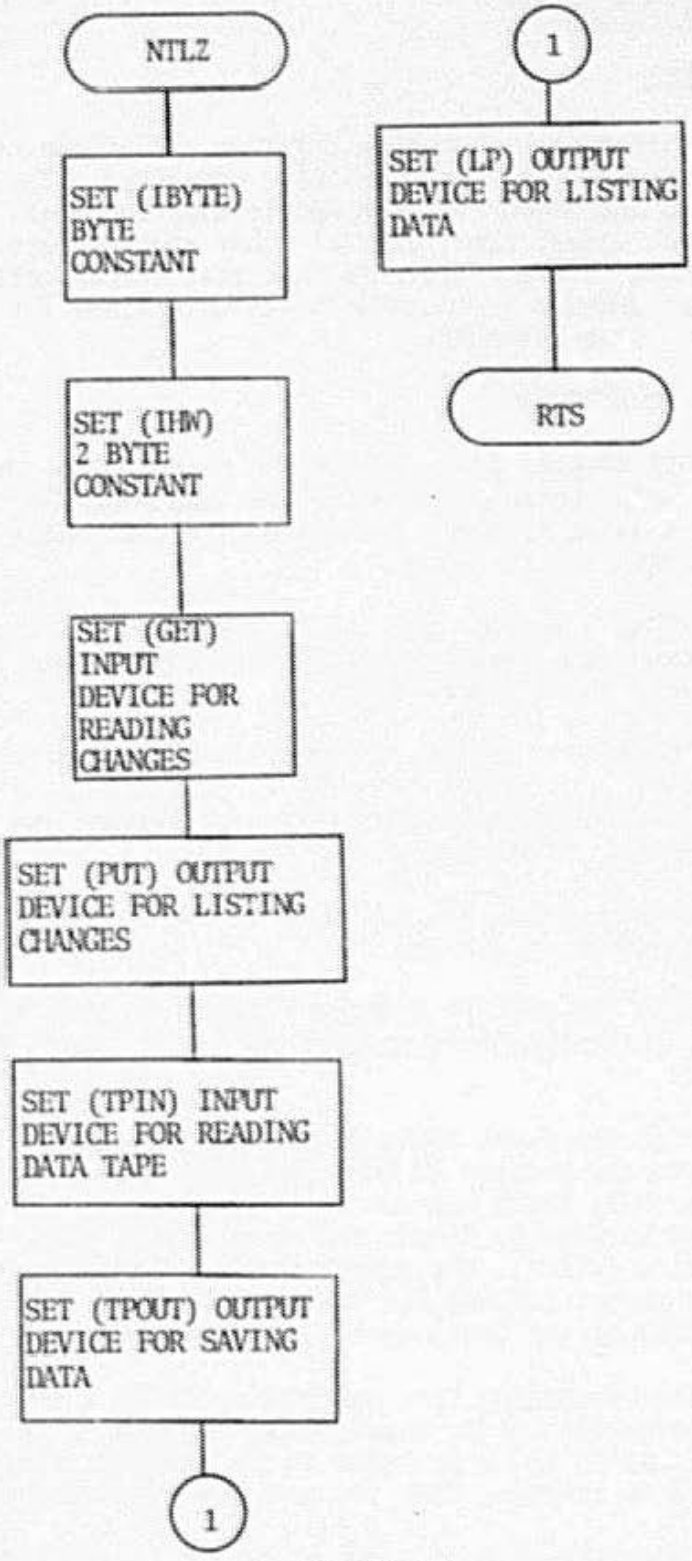

FIGURE 23

SUBROUTINE NTLZ

3.14 SUBROUTINE OCCVOL (I)

3.14.1 PURPOSE

Collects raw occupancy duration and volume counts for lane sensors that have had vehicular crossings. The data is collected and saved for each update time interval. At the end of each update time interval other routines are initiated to compute, list and write to tape statistical data. Also, Sensor Indexed Status ARRAYS are maintained for the current update time interval.

3.14.2 PROGRAM SYNOPSIS

This routine is called by the main control program with the first Continuous Time Series Data Block Record number (I) passed as an argument. This routine then makes calls to the subroutine listed below:

CTSDBR - Derives the on-off state, on-off time, sensor status and sensor index number from the Continuous Time Series Data Block record.

NPULSE - Calculates the pulse duration for a lane sensor.

UPDATE - Controls the computing, listing and writing to tape of the statistical data.

TAPEIN - Reads the Continuous Time Series Data Block from the input data tape.

There are two (2) nested DO LOOPS and several conditional Go To statements that control the execution of the subroutine logic.

After the first table of each of the ring buffers are set to zero the outside DO LOOP processes a Continuous Time Series Data Block one record at a time. A call to subroutine CTSDBR is made to decode the on-off state (IONOFF), the on-off time (ITIME), the sensor status (IMBAI), and the sensor index number (ISENS) for the record number and loop pointer (NUMBER) of the Continuous Time Series Data Block.

After returning from subroutine CTSDBR a check is made comparing the sensor index number (ISENS) of the record to see if it is to be included in the computed statistics. If its value is zero, then the next record is processed.

A check is then made comparing the on-off time with the update time (UPDTIM). When the record on-off time is greater than or equal to the update time, it is time to do the computation of the statistical data but first the raw occupancy

sensor entry is incremented by one. If the on-off state is off, the raw occupancy ring buffer sensor entry is increased by the occupancy duration computed from the last sensor activity indicator (LITIME) and the record on-off time (ITIME). In either case, the Indexed Status Arrays (LITIME, STATUS, MBAI) are unconditionally changed to reflect respectively the record on-off time (ITIME), on-off state (IONOFF) and the sensor state (IMBAI).

The sensor state (IMBAI) for the record should have the value of one (1) for the values of the corresponding sensor to be valid. There is not any logic for verifying this status code in this program.

When all of the records of the Continuous Time Series Data Block have been processed the next data block is read from the input data tape. If an end-of-file is read instead of a data block the subprogram returns to the main program for end of program clean-up. Otherwise, the subroutine continues to process the records as explained above.

3.14.3 PROGRAM WORK AREAS

3.14.3.1 Switches - None

3.14.3.2 Counters and Accumulators

I - Initially indicates the first record of the first C.T.S.D.B. to be processed. Thereafter is reset to one (1).

NUMB - Is set to three (3) before calling subroutine TAPEIN. Returns with the number of records in the C.T.S.D.B. or zero (0) if an end-of-file was encountered.

J - Indicates the sensor index number for the DO LOOP that does the occupancy duration housekeeping at the update time interval.

3.14.3.3 Labeled Common Areas

Area: /CNSTNT/

Variables: NOSENS - DO LOOP maximum range constant. Value is not changed.

MAXUP - Used in a conditional return statement.

Area: /VRBL/

Variables: LPTR, NPTR - Used as constants

UPDTIM - Used as a constant

Area: /BLOCK3/

Variables: NUMBER - DO LOOP pointer

IONOFF, IMBAI, ISENS, ITIME - Set by a call to subroutine CTSDBR

Area: /ARRAY4/

Variables: All of the variables are updated to their respective values for the last record and/or last update time interval.

Area: /ARRAY5/

Variables: These tables are maintained by this routine.

3.14.4 FLOWCHARTS

Figure 24 illustrates the processing flow for subroutine OCCVOL(I).

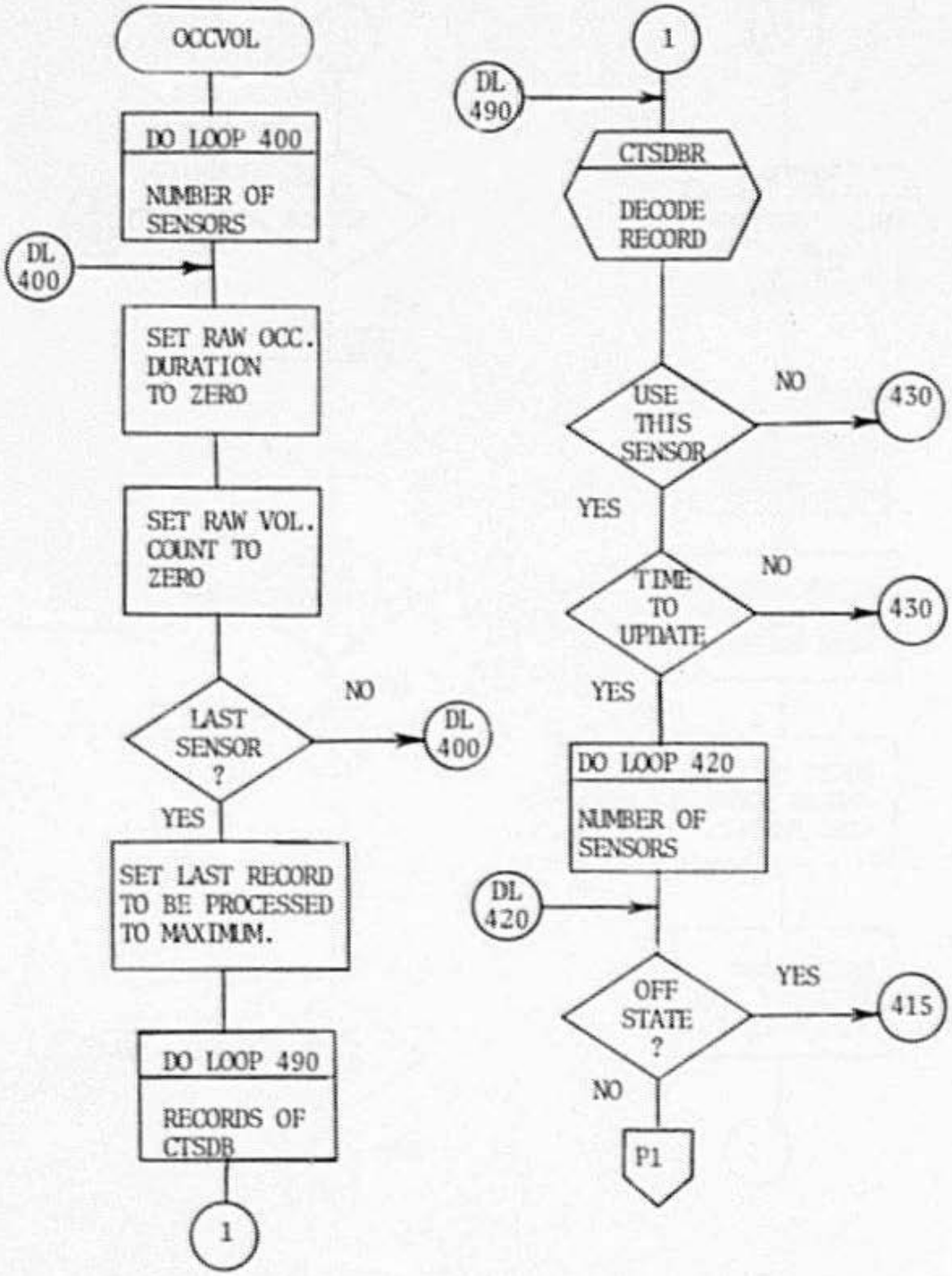

FIGURE 24
SUBROUTINE OCCVOL FLOWCHART

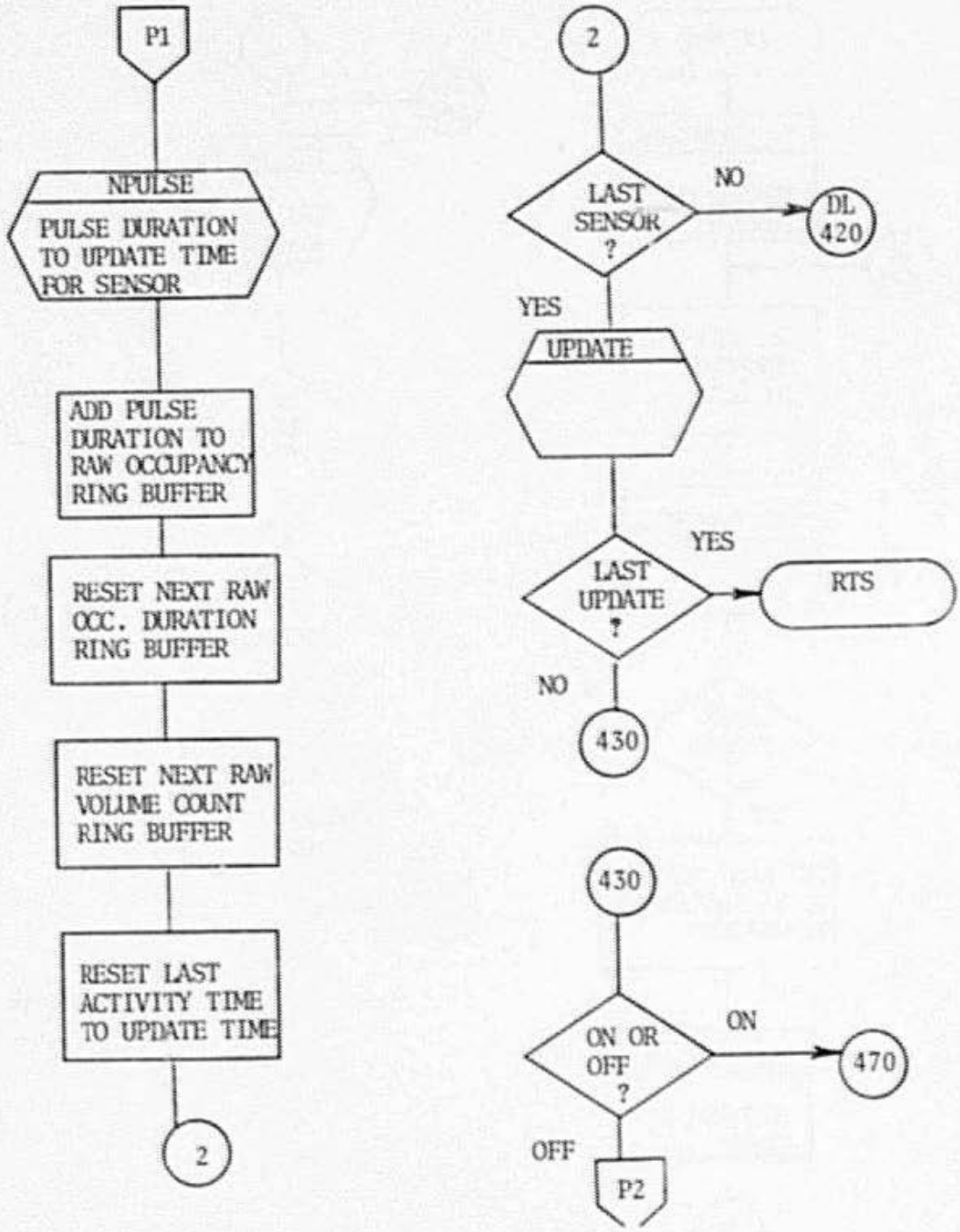

FIGURE 24 (CONTINUED)

SUBROUTINE OCCVOL FLOWCHART

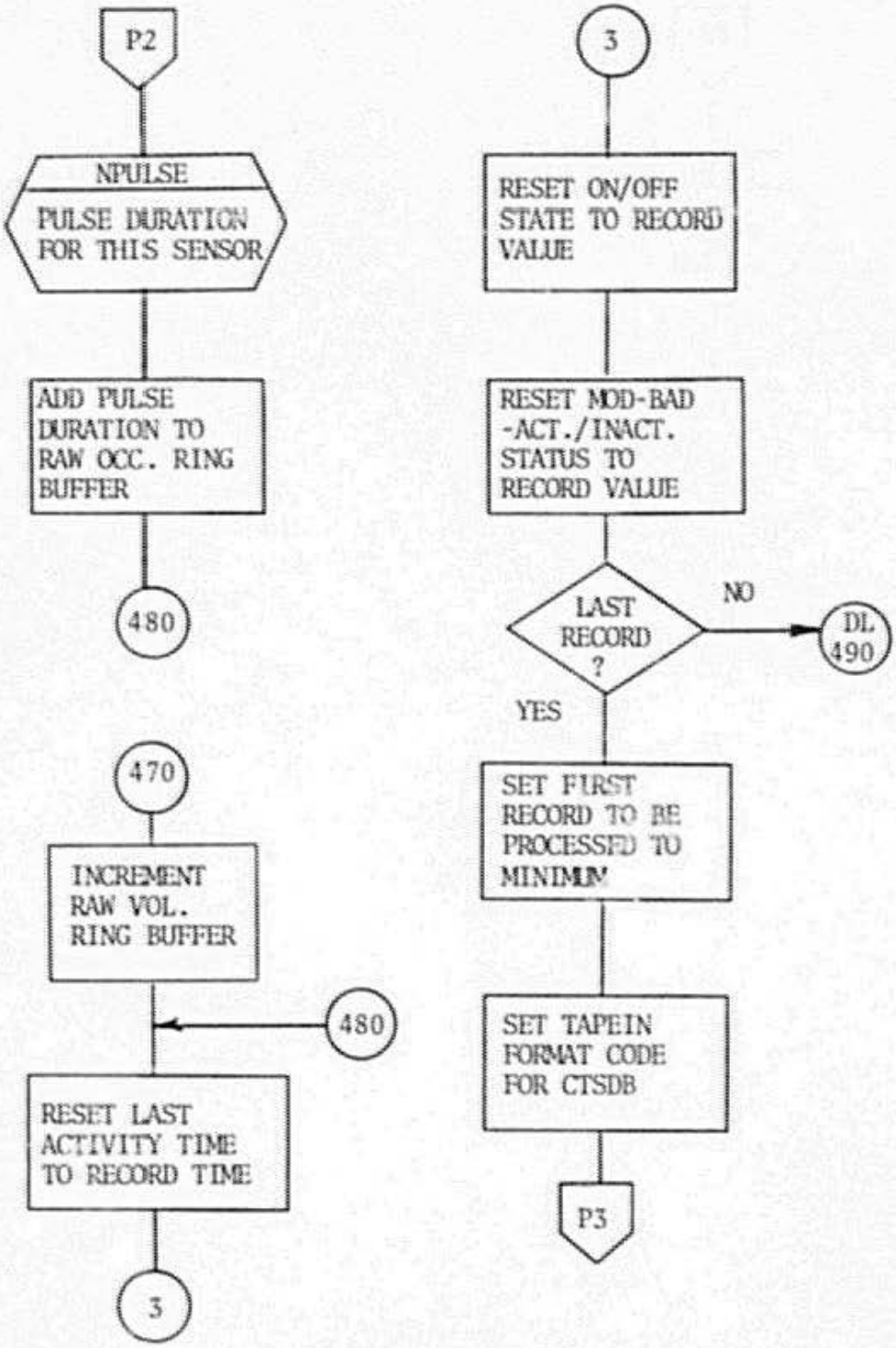

FIGURE 24 (CONTINUED)
SUBROUTINE OCCVOL FLOWCHART

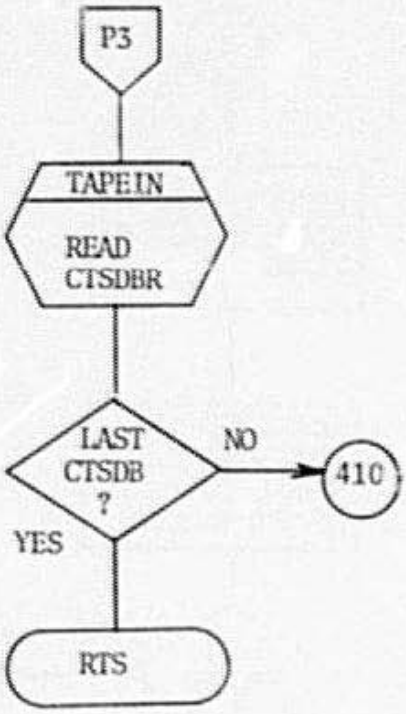

FIGURE 24 (CONTINUED)
SUBROUTINE OCCVOL FLOWCHART

3.15 SUBROUTINE PRINT

3.15.1 PURPOSE

This subroutine lists the computed statistical data. See Figure for illustration of listing. It may be called by subroutine UPDATE if the user has requested a hard copy of the data to be output. It calls subroutine PTIME.

3.15.2 PROGRAM SYNOPSIS

Subroutine PRINT is called every listing time interval from subroutine UPDATE if the printing of the values has been requested (see OUTPUT, Appendix A). Values are printed by segment, freeway station and sensor.

There are three (3) nested DO LOOPS and three (3) pointers that control the order of printing. The first DO LOOP and pointer control the printing of each segment. The second DO LOOP and pointer control the printing of the stations of the current segment and the average of the mainline stations. The third DO LOOP and pointer control the printing of each sensor.

The first DO LOOP starts each segment on a new page, with the interval end time, beginning station and ending station printed. It also gets the beginning and ending station index for the limits of the next DO LOOP.

The second DO LOOP sets up the pointers and counters for the third DO LOOP. It gets the number of active lanes for each station and the beginning and ending sensor index number for the limits of the next DO LOOP. It also prints the heading for the values to be printed.

The third DO LOOP does the printing of the sensor and average values. The average values are separated from the mainline sensors and the non-mainline sensors by one blank line.

3.15.3 PROGRAM WORK AREAS

3.15.3.1 Switches - None

3.15.3.2 Counters and Accumulators

ITEMP0 - The listing time in seconds of the statistics to be printed. This argument passed to subroutine PTIME.

ITEMP1, ITEMP2, ITEMP3 - The hour, minutes and

seconds, respectively, for listing the time of the statistics to be printed.

ISGMTS - The freeway segment number currently being listed.

JBEG, JEND - The beginning and ending sensor index number used to print the beginning and ending station of the segment being printed.

IBEG, IEND - The beginning and ending station index number used to print the beginning and ending station of the segment being printed.

IDEX - The pointer indicating the station index number of the station currently being printed.

CNOLNS - The counter that indicates the current mainline sensor being printed.

TNOLNS - The total number of mainline sensors for the station currently being printed.

ISENS1, ISENS2 - The beginning and ending sensor index number of the station currently being printed.

ISENS - The pointer indicating the sensor index number of the sensor currently being printed.

3.15.3.3 Labeled Common

Area: /VRBL/

Variable: UPDTIM - The time for which the data is printed.

Area: /ARRAY1/

Variable: IASGMT(2,5) - Used for the beginning and ending sensor index number printed in the heading for each segment.

SINDEX(171) - Used for the first sensor of the station to be printed.

MLSTAS(2,4) - Used for the first and last station index number for the second DO LOOP.

ACTLNS(170) - Used for the number of active mainline sensors for a station.

Area: /ARRAY3/

Variables: All of the variables may be printed.

Area: /ARRAY6/

Variables: All of the variables are printed.

Area: /ALLIO/

Variable: LP - Used for output device.

3.15.4 FLOWCHARTS

Figure 25 illustrates the processing flow for subroutine PRINT.

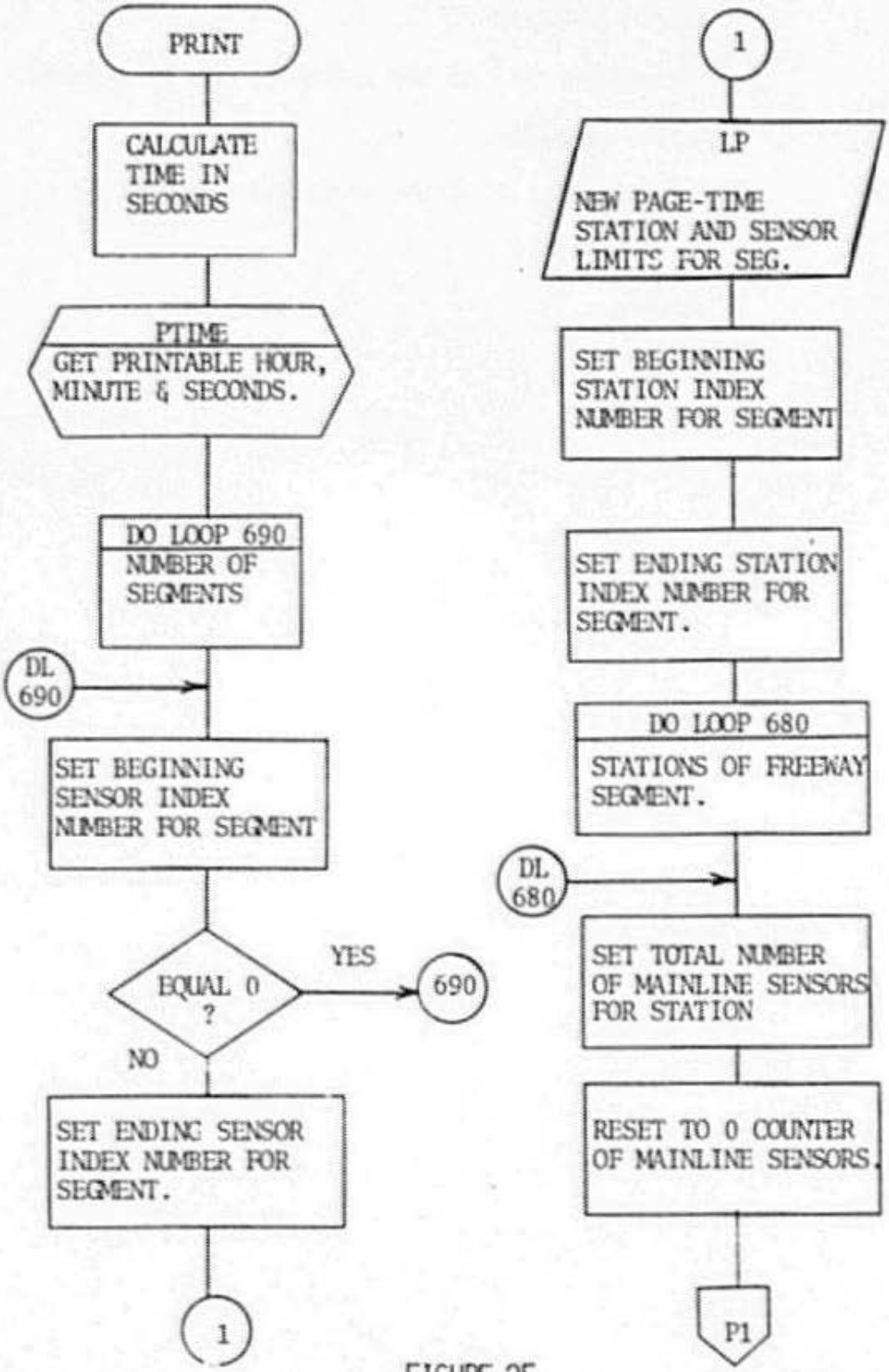

FIGURE 25

SUBROUTINE PRINT

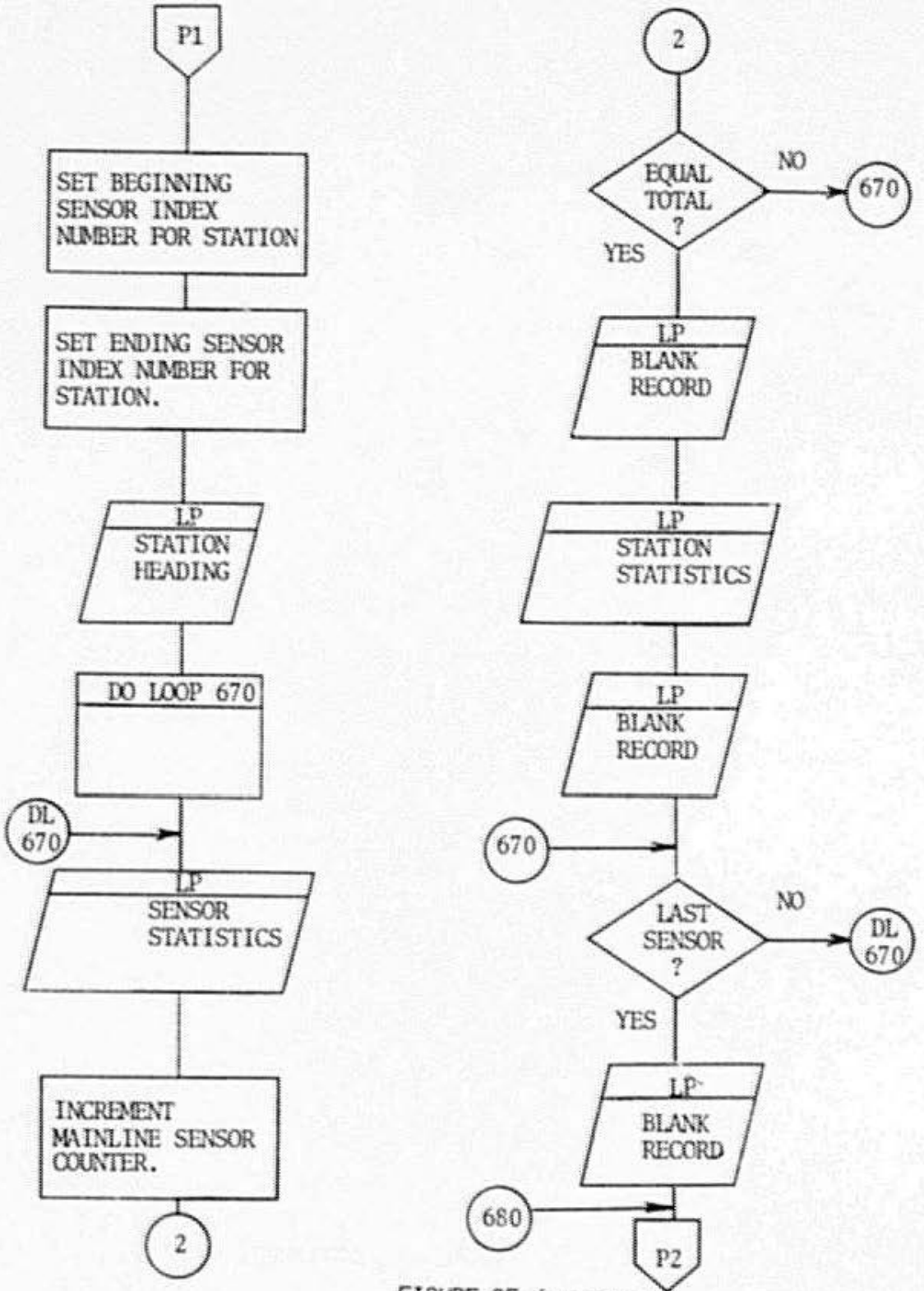

FIGURE 25 (CONTINUED)

SUBROUTINE PRINT

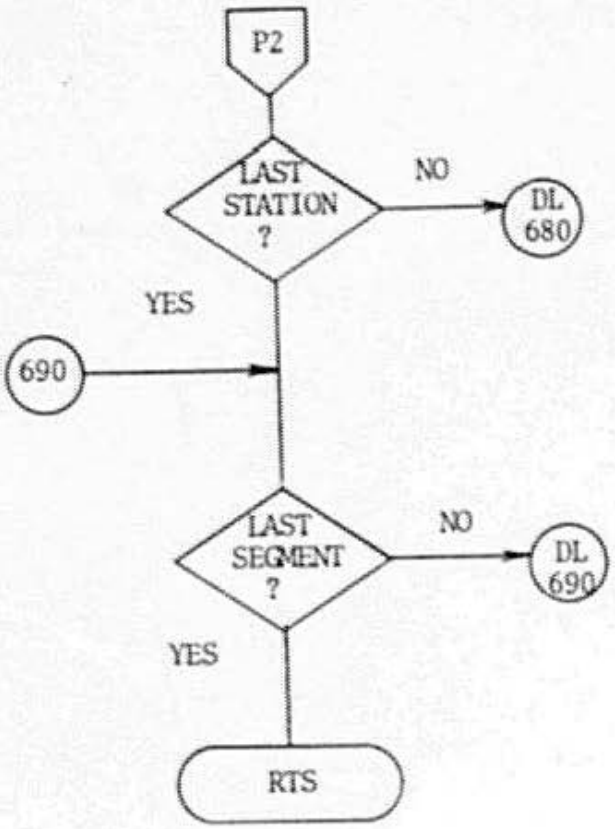

FIGURE 25 (CONTINUED)

SUBROUTINE PRINT

3.16 SUBROUTINE PRMTRS (MTIME)

3.16.1 PURPOSE

This subroutine determines and verifies the program control constants and variables from key parameters. It gives the user the capability of specifying the key parameters and displays the values of the key parameters. The key parameters control: the output of the documentation information; the output of the computed statistics; the time period and intervals for which the statistics are computed; whether or not all of the stations on the input data tape are to be included in computing the statistics; and the calculation of program dependent constants.

3.16.2 PROGRAM SYNOPSIS

This routine is called once from the main control program. Calls are made to subroutine LSTPRM to display and/or allow changes to be made to the key parameters. Calls to the Functions ISECS and IHMS to change a time from the HHMMSS format to the time in seconds and the time in seconds to the HHMMSS format. Also, the FORTRAN library Functions MOD and FLOAT are used.

The maximum number of ring buffers (MCHECK) is set to its default value, the listing code (LISTCD) is set to display the default values of the key parameters, the key parameters are set to their default values, then a call is made to subroutine LSTPRM to display the key parameters and allow changes to be made. After returning from subroutine LSTPRM, the listing code (LISTCD) is reset to indicate an error and allow changes. Then the program constants and variables that are dependent upon some of the key parameters are determined in four distinct sections: average (AVGINT) and update (UPDINT) intervals; starting (ISTART) and final (IFINAL) time period; listing interval (LSTINT); and miscellaneous.

The average (AVGINT) and update (UPDINT) time interval dependent parameters are determined and verified first. They are the factors for the hourly volume conversion (CFACTR), the updating interval (UFACTR) in milliseconds, the averaging interval (AFACTR) in milliseconds, the number of updating intervals in the averaging interval (MFACTR), the maximum number of raw value collection ring buffers (MPTR) and the update time interval counter (IUPDTM). The error logic is executed with the average and update time intervals (AVGINT, UPDINT) reset to their negative values if either the averaging interval is not a multiple of the updating interval or if the maximum number of ring buffers is greater than the number allotted (MCHECK).

The time period (ISTART, IFINAL) dependent parameters are determined and verified next. First, the minimum starting time (MTIME) is determined from the input data tape start time (STIME) and the average time interval (AVGINT). The start time in seconds (TSTART) is determined from the requested starting time (ISTART) and must not be less than the minimum start time (MTIME). If it is less than both of the start time parameters (ISTART, TSTART) both are reset to their equivalent values of the minimum start time (MTIME). The remainder of the time period dependent parameters are now determined. They are the current averaging time in milliseconds (UPDTIM), the absolute starting time in milliseconds (MTIME), the ending time in seconds (TFINAL) and the maximum number of update time intervals (MAXUP). The error logic is executed with the time period parameters (ISTART, IFINAL) reset to their negative values if either the ending time is less than the starting time or greater than the input data tape ending time.

The listing interval time (LSTINT) dependent parameters are now determined and verified even if the listing of output is not desired. They are the listing interval factor in milliseconds (LFACTR) and the current listing time in milliseconds (LSTIME) is set equal to the current averaging time. The error logic is executed with the listing time interval (LSTINT) reset to its negative value if either the listing time interval is less than or is not a multiple of the update time interval.

Now the remaining key changeable parameters are verified and miscellaneous parameters are determined. If an error is detected during verification of one of the key parameters, it is reset to its negative value and the error logic is executed. The parameters and verification limits are the output code (OUTPUT) and must be within the range of zero through six (0 - 6), if 4, 5 or 6 the minimum start time is readjusted, the sample rate per second (SMPLRT) and the density conversion factor (GFACTR) must both be greater than zero. The occupancy duration conversion factor (DFACTR) is calculated, the occupancy percent conversion factor (PFACTR), the input data tape start time (STIME) and ending time (ETIME) are reset to ISTART and IFINAL, respectively, and the ring buffer pointers (LPTR, NPTR) are initialized.

The key parameters are checked to be within certain limits described above. If any of the key parameters are not within the specified limits, they are multiplied by negative one (-1), a call is made to subroutine LSTPRM to display the key parameters and allow corrections, and all the program constants and variables are redetermined and the key parameters are verified again.

When all the parameters are verified to be correct, the listing code (LISTCD) is set to indicate verification of the parameters. The last call to subroutine LSTPRM is then made to display the final values of the key parameters. Control is then returned to the main program.

3.16.3 PROGRAM WORK AREAS

3.16.3.1 Switches

LISTCD - The listing code passed to subroutine LSTPRM to display and/or allow changes to the key parameters.

= 0 - Print 'DEFAULT VALUES' message and list key parameter values. Allows changes to be made.

0 - Print 'IRRECOVERABLE ERROR' message and list key parameter values. Expects changes to be made.

0 - Print 'VALUES TO BEUSED' message and list key parameter values. Neither expects nor allows changes to be made.

MCHECK - The maximum number of Raw Occupancy Duration and Vehicle Count Ring Buffers. Is set equal to 16. If the size of the ring buffers are changed, in Common Area /ARRAY5/, this should be changed.

MTIME - Is initially set equal to the minimum starting time in seconds and is used to verify the requested start time. It is reset to the absolute starting time in milliseconds and returned to the calling program.

3.16.3.2 Counters and Accumulators - None

3.16.3.3 Labeled Common Areas

The key parameters referred to reside in different Labeled Common Areas as follows:

/CNSTNT/ GFACTR, OUTPUT

/BLOCK2/ ISTART, IFINAL, SMPLRT, AVGINT, UPDINT, LSTINT

/ARRAY7/ LIMITS

Area: /CNSTNT/

Variables: All of the variables in this common area are initialized in this subprogram except NOSENS.

Area: /VRBL/

Variables: All of the variables in this common area are initialized in this subprogram.

Area: /BLOCK1/

Variables: Date is not used.

STIME and ETIME are initially equal to the input data tape beginning and ending times. They are reset to the requested times.

Area: /BLOCK2/

Variables: All of the variables in this common area are initialized in this subprogram.

Area: /ARRAY7/

Variables: Only LIMITS is used. It is initially set to zero, to indicate that all of the detector stations are to be used. It can be reset to indicate that only some of the freeway stations are to be used.

3.16.4 FLOWCHARTS

Figure 26 illustrates the processing flow for subroutine PRMTRS (MTIME).

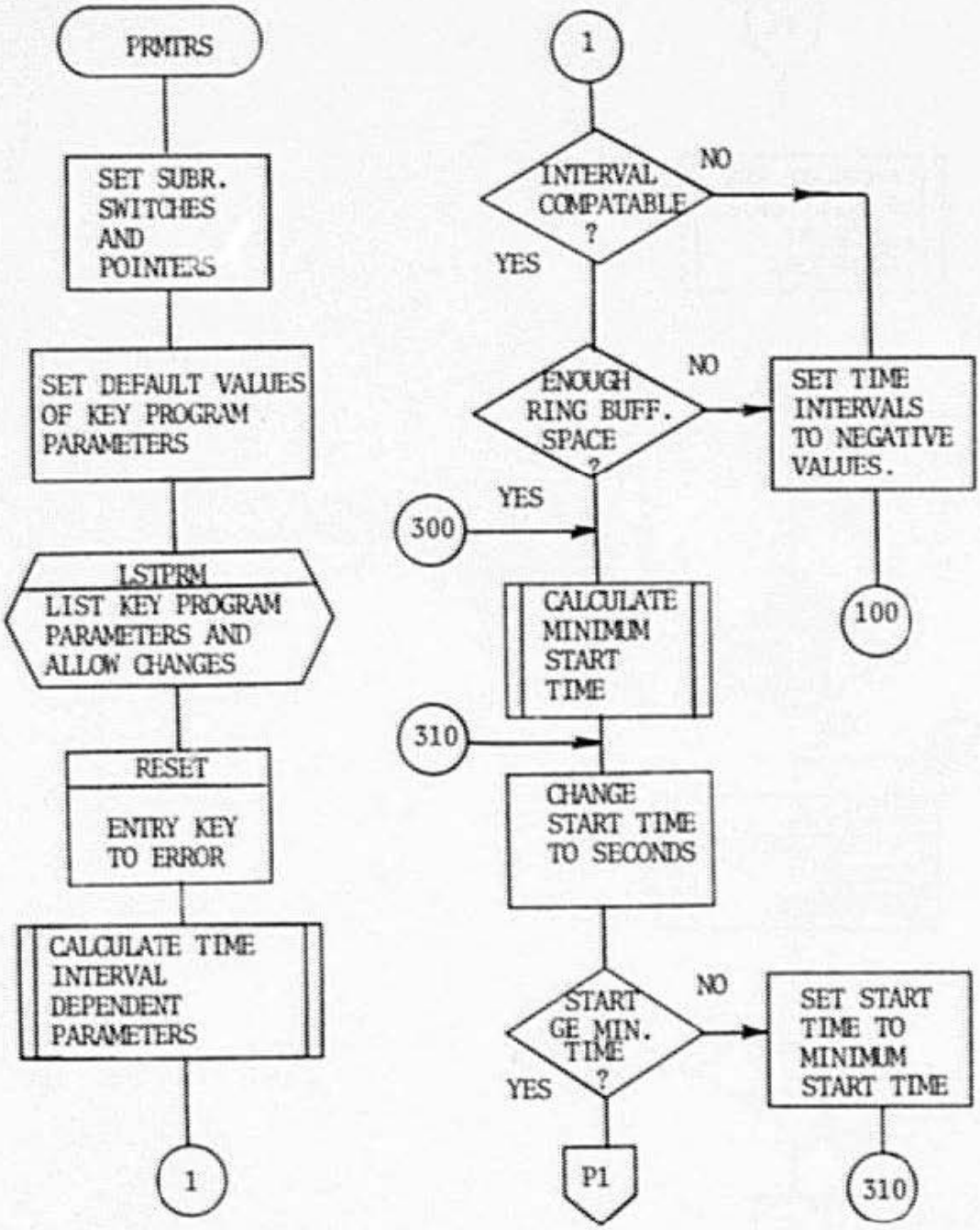

FIGURE 26

SUBROUTINE PRMTRS (MTIME)

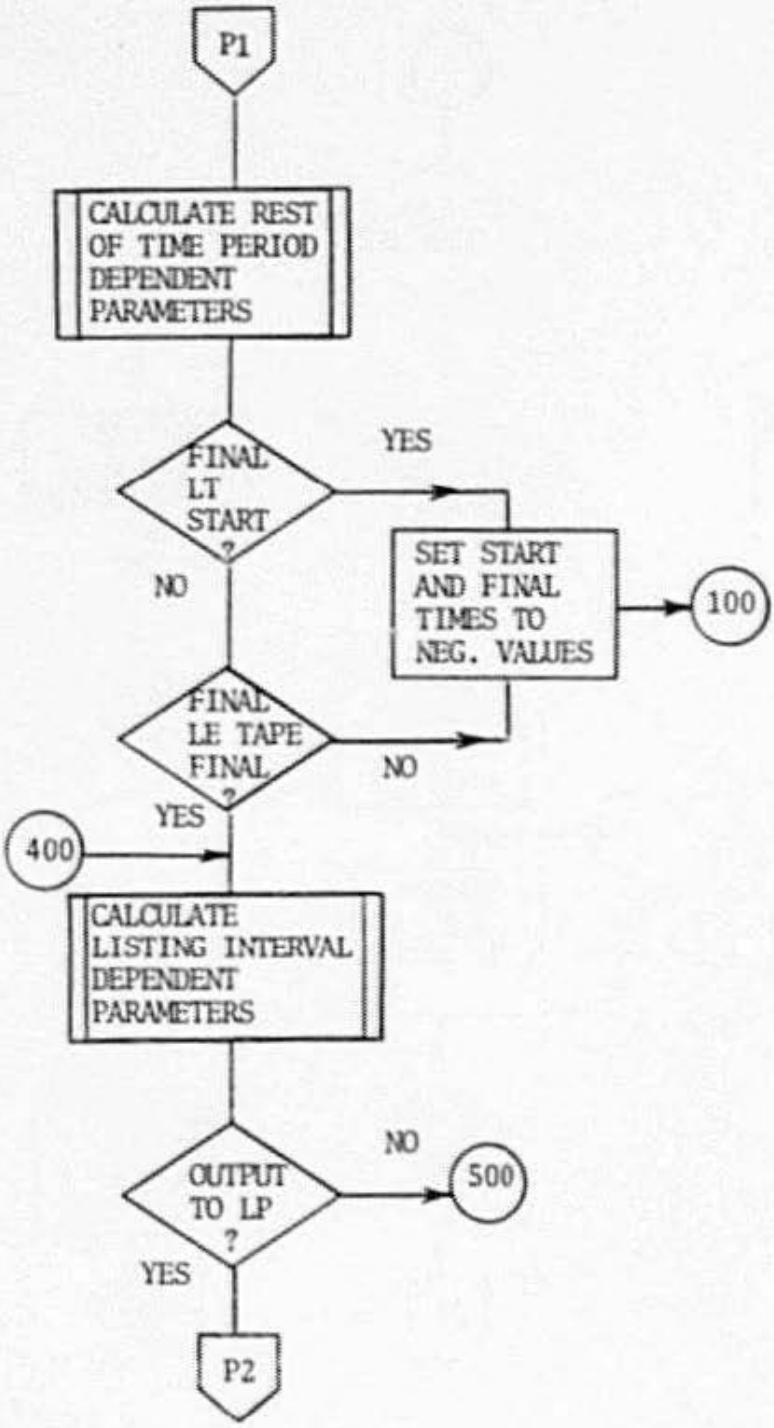

FIGURE 26 (CONTINUED)

SUBROUTINE PRMTRS (MTIME)

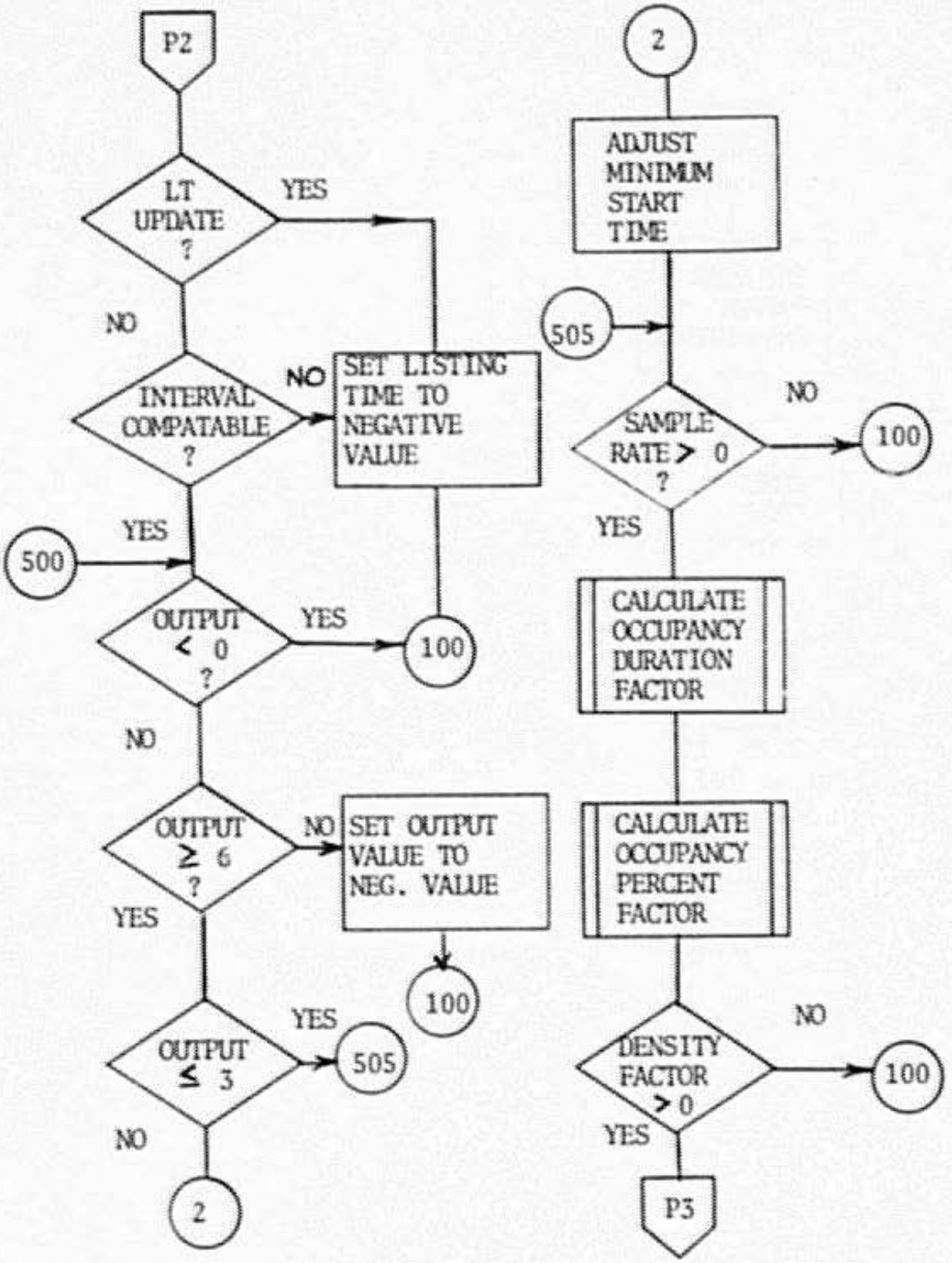

FIGURE 26 (CONTINUED)

SUBROUTINE PRMTRS (MTIME)

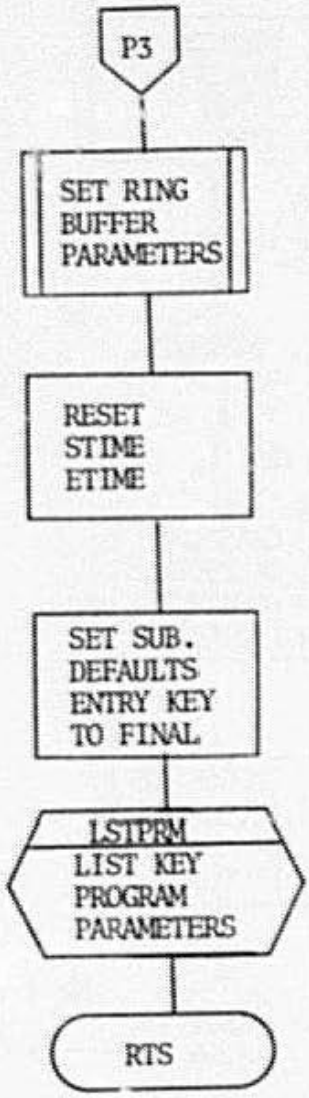

FIGURE 26 (CONTINUED)

SUBROUTINE PRMTRS (MTIME)

3.17 SUBROUTINE PRNTHD

3.17.1 PURPOSE

This subroutine lists the input data tape documentation information. See Figure 2 for sample listing.

This subroutine is called from the main control program if it has been requested. It may be executed twice if the station limits are to be changed. Calls are made to function ISECS and subroutine PTIME for the time parameters.

This subroutine will list the important documentation information, except for the Lane Sensor Table.

3.17.2 PROGRAM SYNOPSIS

This routine lists the tape identification number, traffic code, time period, incident location, incident type, vehicles involved, weather and road codes, times and codes for incident verification and detection, land marks, incident freeway geometry, incident scenario, traffic volume counts and additional comment lines. Lane Sensor information is listed by subroutine LSTOUT.

If the information is not present in the Header Block, it is usually indicated with a message indicating 'NONE'. The time values are increased by 100 so that leading zeros are printed where applicable.

3.17.3 PROGRAM WORK AREAS

3.17.3.1 Switches - None

3.17.3.2 Counters and Accumulators

I, J, K - DO LOOP pointers and temporary storage of output variables.

ITEMP0 through ITEMP6 - Temporary storage of output variables.

3.17.3.3 Labeled Common

Area: /BLOCK1/

Variables: All the variables are listed.

Area: /HEAD/

Variables: All the variables are listed if present.

Area: /ALLIO/

Variables: LP - output device

3.17.4 FLOWCHARTS

Figure 27 illustrates the processing flow for subroutine PRNTHD.

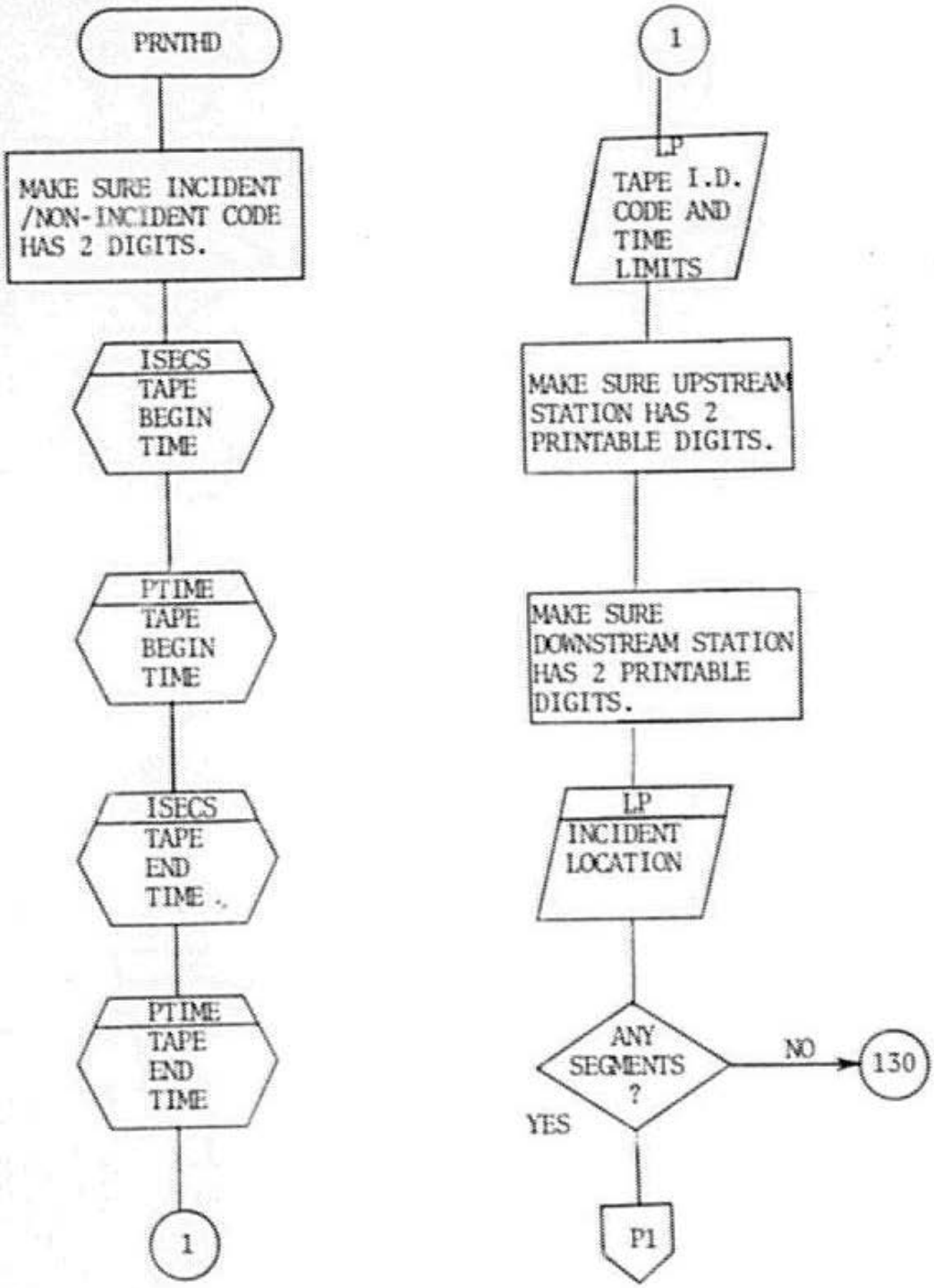

FIGURE 27

SUBROUTINE PRNTHD

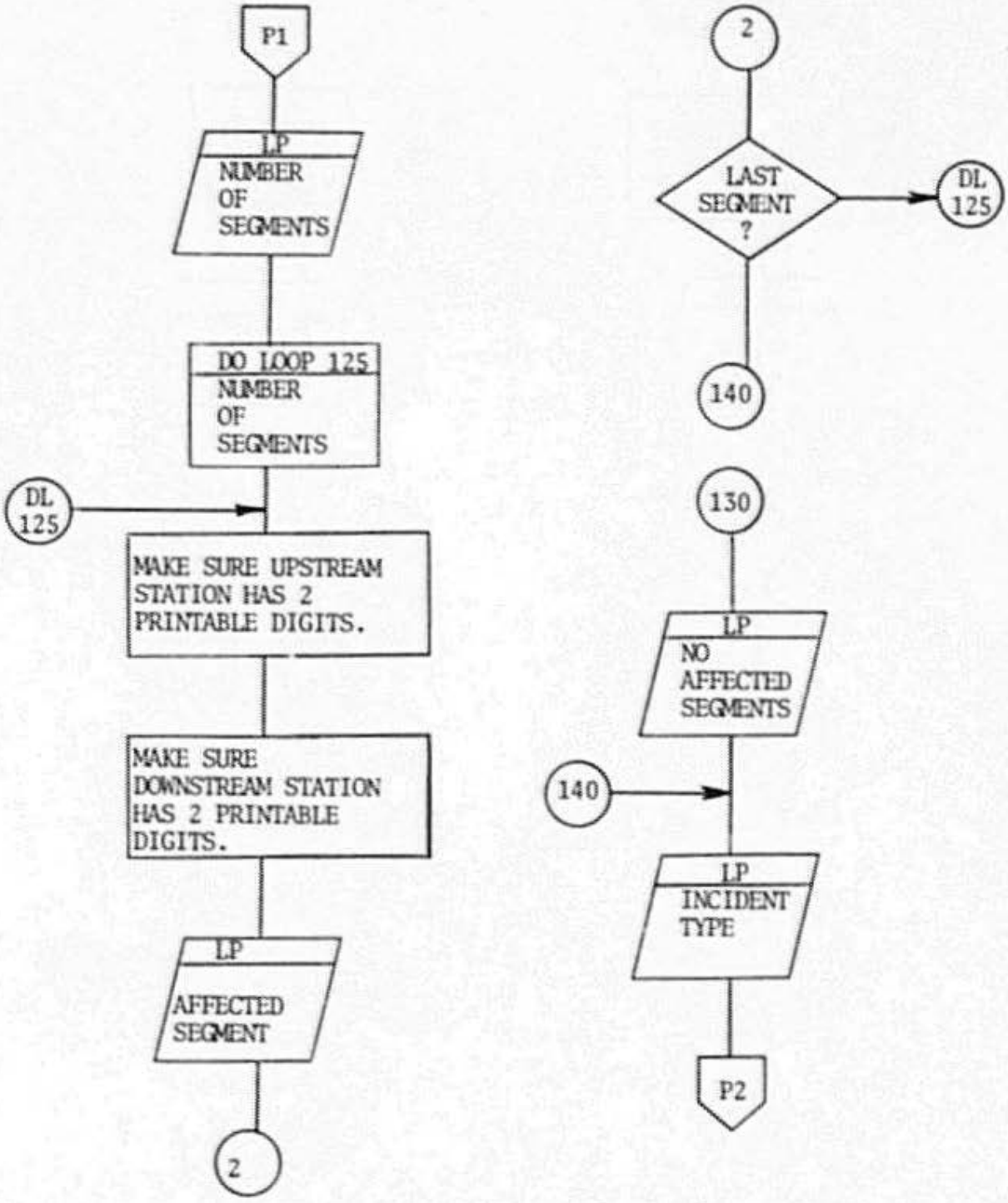

FIGURE 27 (CONTINUED)

SUBROUTINE PRNTHD

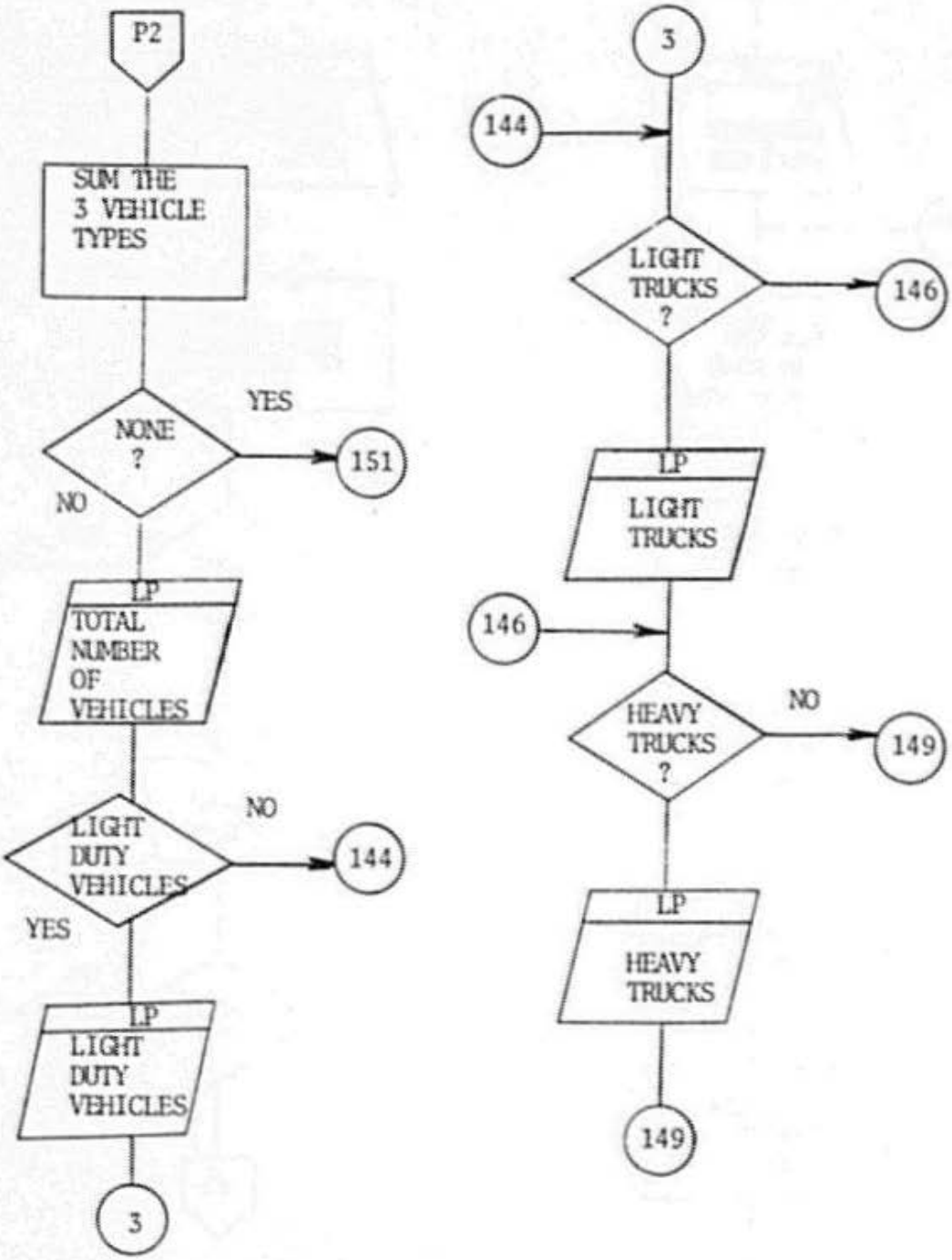

FIGURE 27 (CONTINUED)

SUBROUTINE PRNTHD

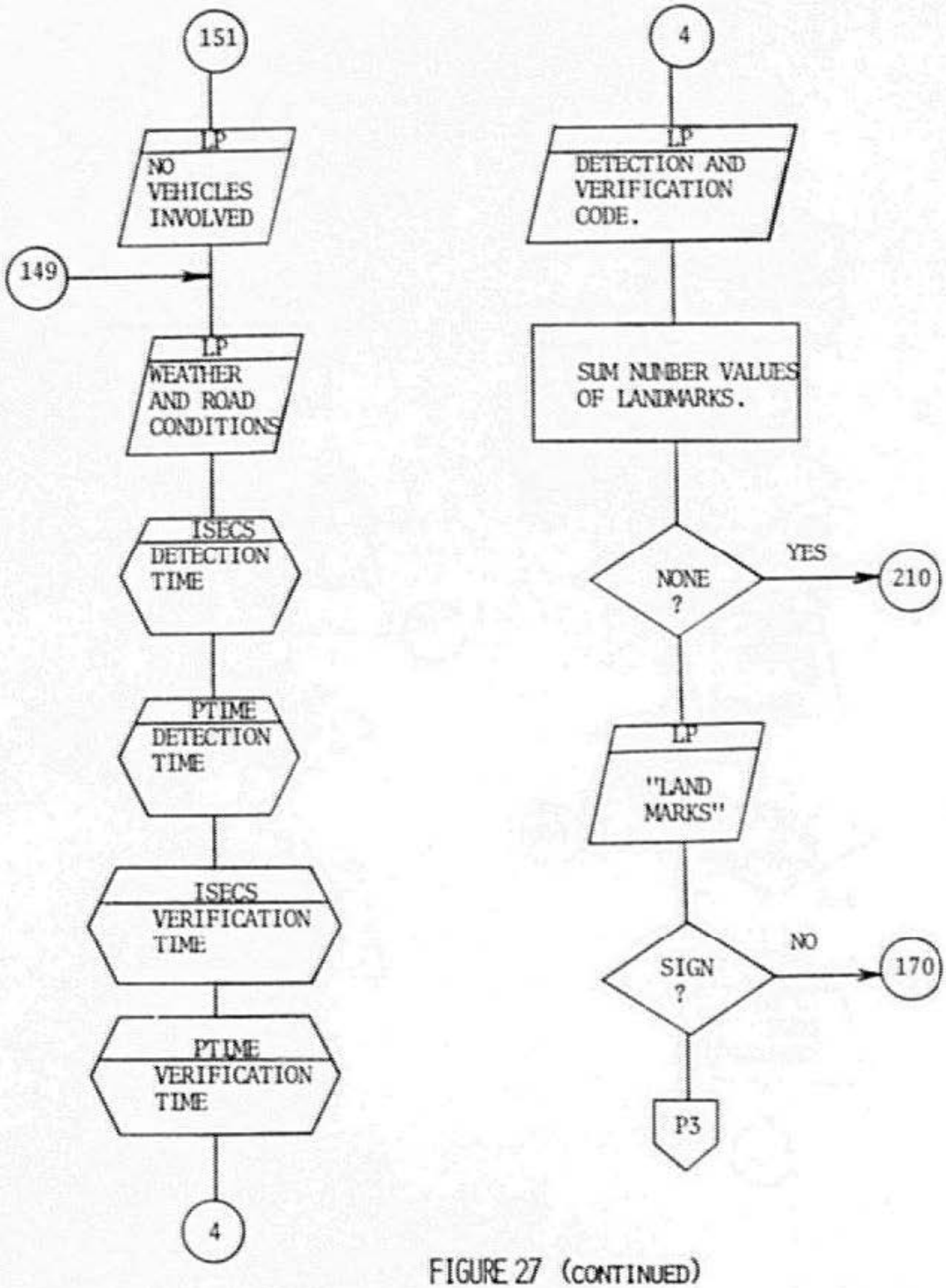

FIGURE 27 (CONTINUED)

SUBROUTINE PRNTHD

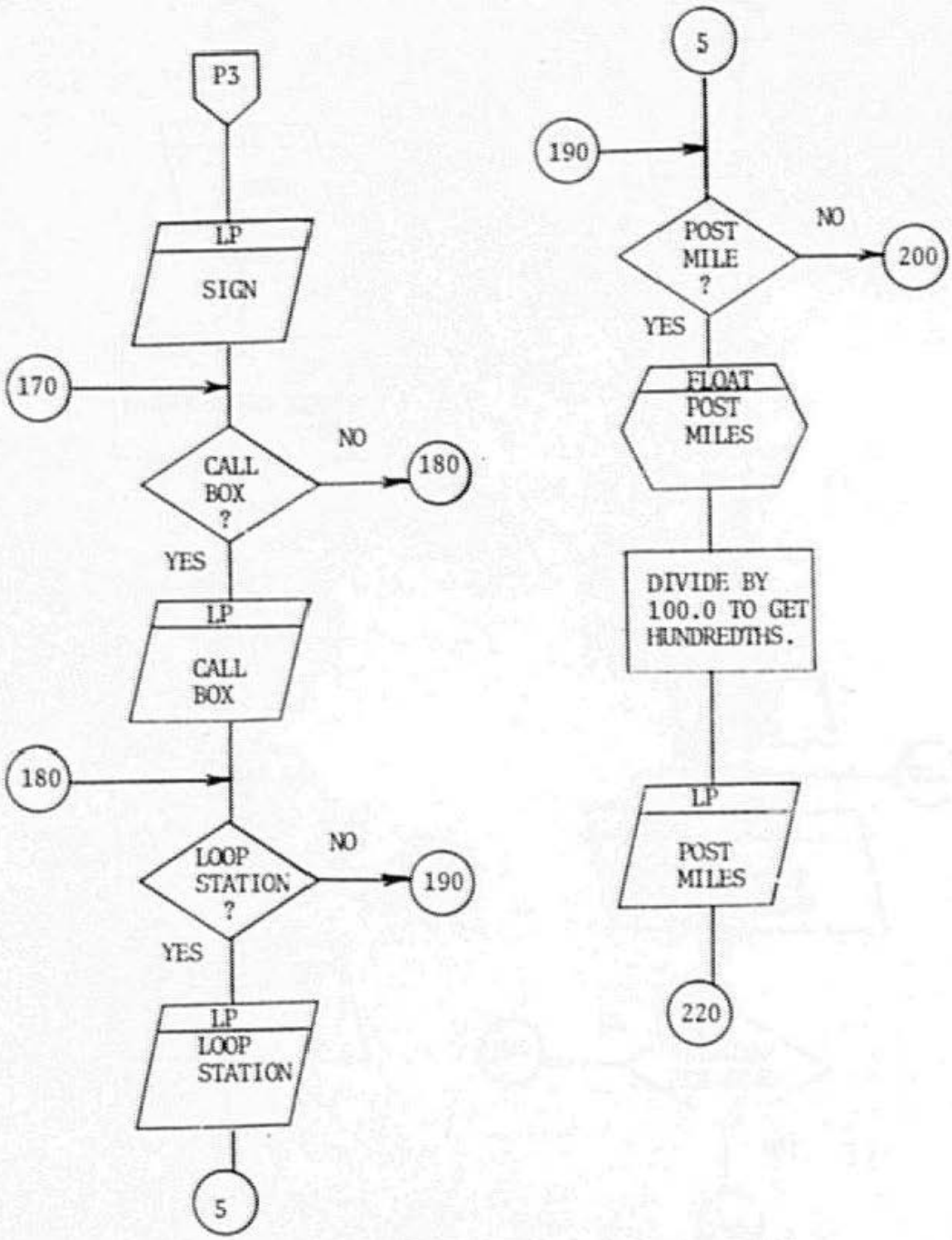

FIGURE 27 (CONTINUED)

SUBROUTINE PRNTHD

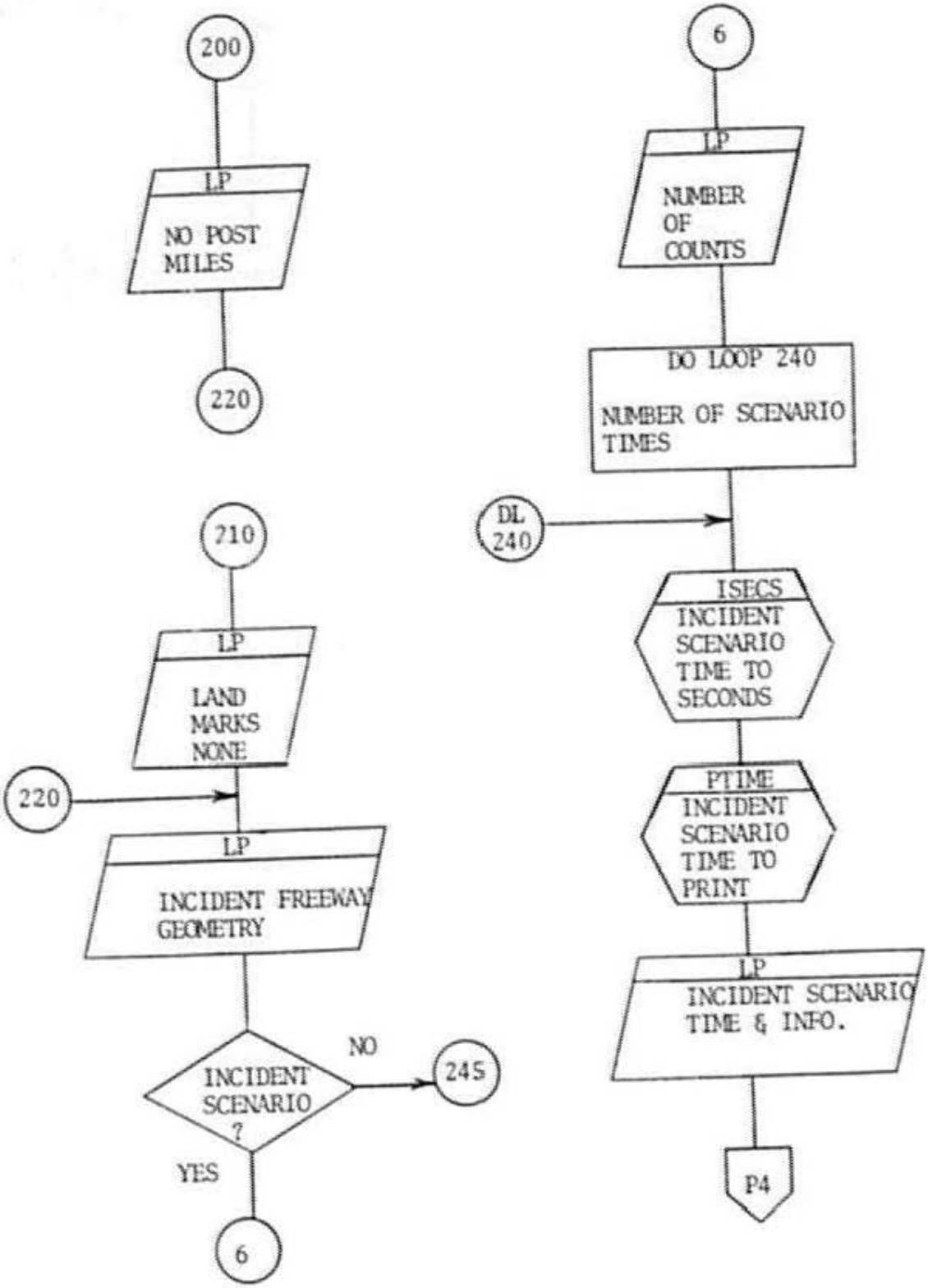

FIGURE 27 (CONTINUED)

SUBROUTINE PRNTHD

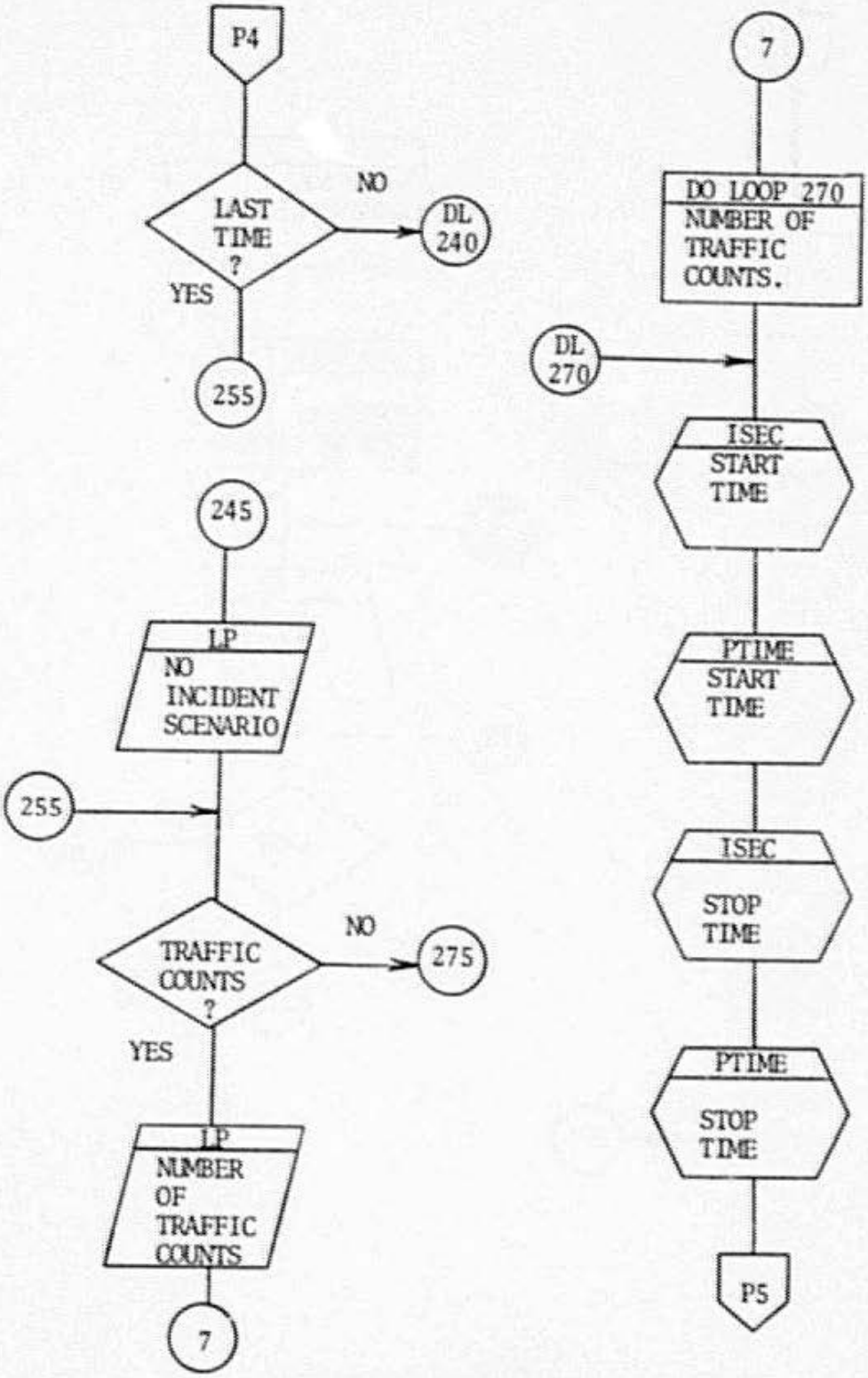

FIGURE 27 (CONTINUED)

SUBROUTINE PRNTHD

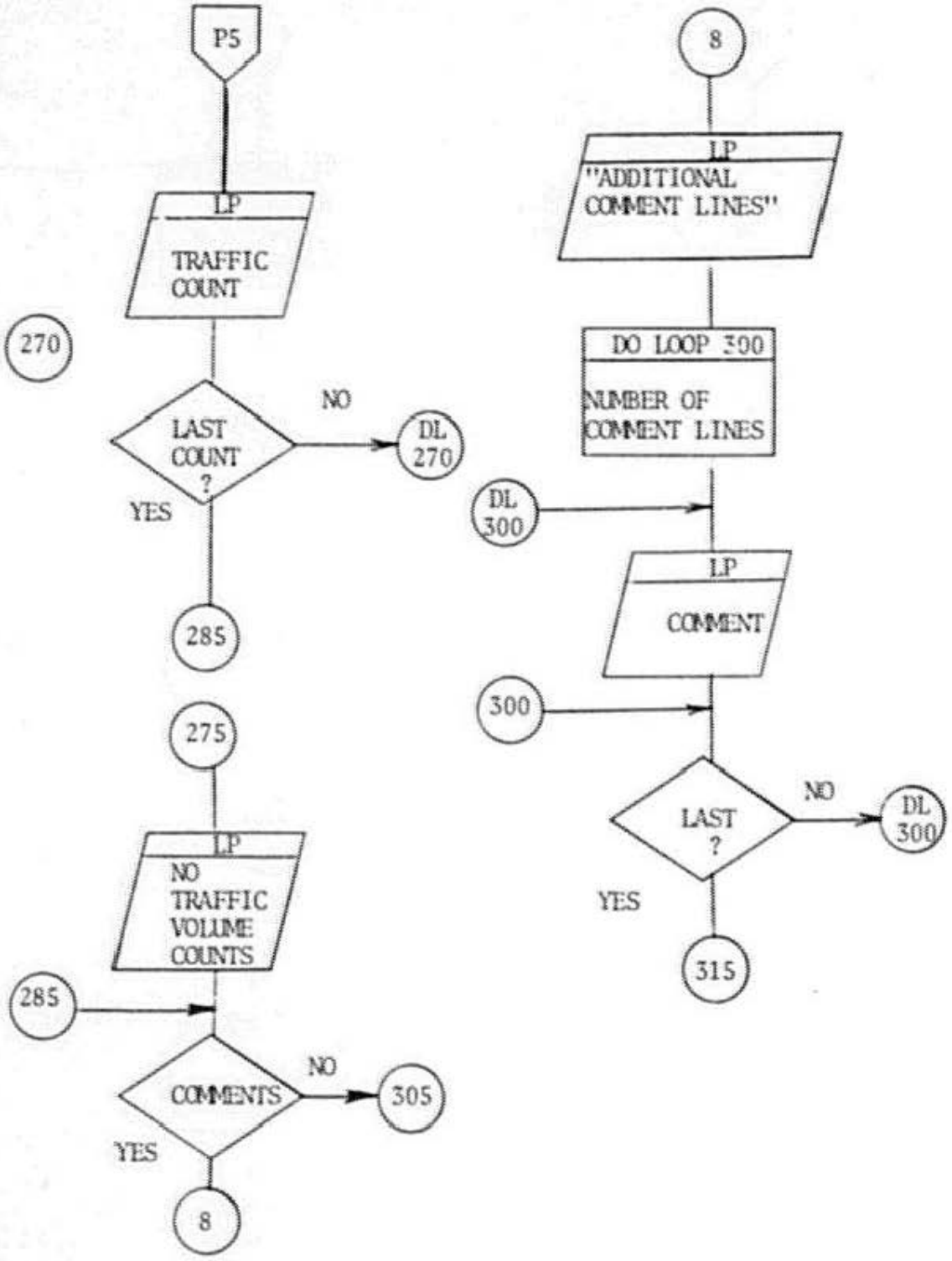

FIGURE 27 (CONTINUED)

SUBROUTINE PRNTHD

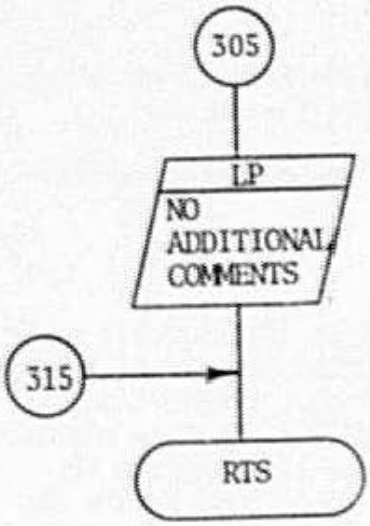

FIGURE 27 (CONTINUED)

SUBROUTINE PRNTHD

3.18 SUBROUTINE PSTNTP(ITEMP0, MTIME)

3.18.1 PURPOSE

Finds the first Continuous Time Series Data Block Record to be used in compiling the statistics for the sensors.

This routine is called by the main control program and calls subroutine TAPEIN.

3.18.2 PROGRAM SYNOPSIS

The Continuous Time Series Data Blocks (C.T.S.D.B.) are read from the input data tape until either the end of tape is encountered or a data block is found with a record that has an on-off time greater than or equal to the absolute starting time. This subroutine returns to the calling program the number of this record and the tape is positioned before the next Continuous Series Data Block to be input. If an end-of-file is encountered, the record number is set to zero (0).

A call to subroutine TAPEIN is made to read a C.T.S.D.B. A check is made to see if it is the end of tape. If it is, the record number indicator is set to zero and the subprogram returns to the calling program.

If not the end of tape, the last record of the block is checked to see if it is less than the absolute starting time. If it is less, then processing continues as in the above paragraph.

When the last record time is greater than or equal to the absolute starting time, a DO LOOP is started to check each record, from the first to the last, until a record has an on-off time greater than or equal to the absolute starting time. The pointer of the DO LOOP is the record number of the block and is passed back to the calling program.

3.18.3 PROGRAM WORK AREAS

3.18.3.1 Switches

NUMB - Integer value passed to subroutine TAPEIN indicating format of input and returns with the number of records in the C.T.S.D.B.

MTIME - Absolute starting time in milliseconds.

3.18.3.2 Counters and Accumulators

ITEMP0 - Is set equal to the first record to be processed or to zero if an end-of-file mark is read.

3.18.3.3 Labeled Common

Area: /BLANK/

Variable: CTSDR (3,341) - Contains the Continuous Time Series Data Block from the input data tape.

3.18.4 FLOWCHART

Figure 28 illustrates the processing flow for subroutine PSTNTP(ITEMP0, MTIME).

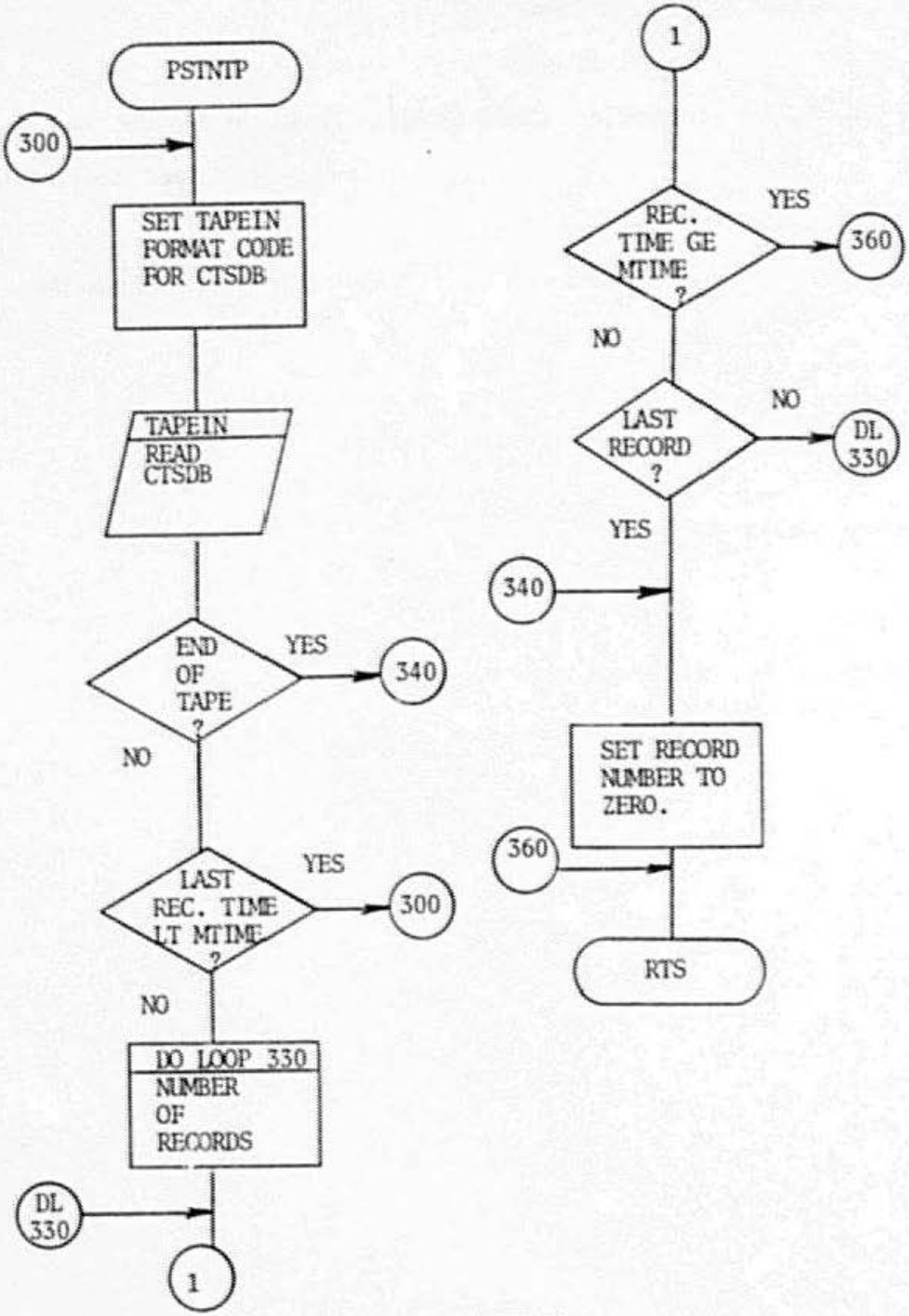

FIGURE 28

SUBROUTINE PSTNTP (ITEMP0, MTIME)

3.19 SUBROUTINE PTIME (ITEMP0, ITEMP1, ITEMP2, ITEMP3)

3.19.1 PURPOSE

Takes the time in seconds and determines the hours, minutes and seconds with leading zeroes for printing.

This subroutine is called by subroutine PRNTHD, PRINT, and SPDPRN.

The time variable is incremented by a millisecond constant. When the time variable is to be printed, the time is converted to seconds and a call is made to this subroutine to get the hour, minute and second.

3.19.2 PROGRAM SYNOPSIS

The FORTRAN remainder function MOD and division are used to determine the hours (ITEMP1), the minutes (ITEMP2) and seconds (ITEMP3) from the time in seconds (ITEMP0). The value of 100 is added to the printable times so leading zeroes can be printed.

3.19.3 PROGRAM WORK AREAS

3.19.3.1 Switches - None

3.19.3.2 Counters and Accumulators

ITEMP0 - The time in seconds received from the calling program. The value is unchanged.

ITEMP1 - The hours plus 100 determined from the time in seconds. The previous value is destroyed.

ITEMP2 - The minutes plus 100 determined from the time in seconds. The previous value is destroyed.

ITEMP3 - The seconds plus 100 determined from the time in seconds. The previous value is destroyed.

ITEMP - Temporary value of the time in minutes determined from the time in seconds.

3.19.3.3 Labeled Common - None

3.19.4 FLOWCHART

Figure 29 illustrates the processing flow for subroutine PTIME (ITEMP0, ITEMP1, ITEMP2, ITEMP3).

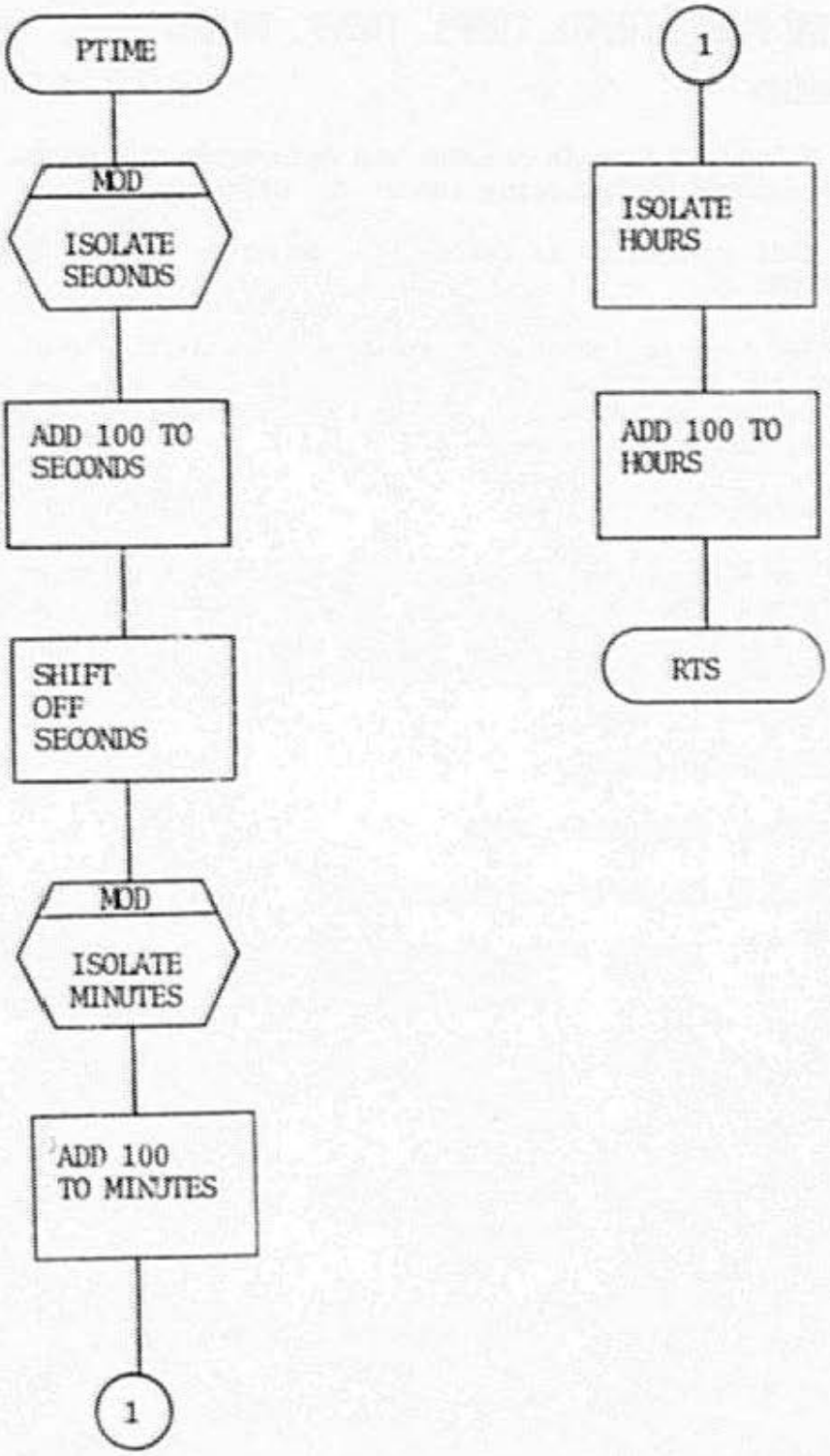

FIGURE 29

SUBROUTINE PTIME (ITEMP0, ITEMP1, ITEMP2, ITEMP3)

3.20 FUNCTION SPEED (TVOL, TOCC)

3.20.1 PURPOSE

Calculates the estimated speed from the total volume count and average occupancy percent for a sensor for an update interval.

This routine is called by subroutine CNVRT.

3.20.2 PROGRAM SYNOPSIS

The estimated speed is calculated by dividing the estimated hourly volume (the total volume count (TVOL) multiplied by the number of update intervals per hour (CFACTR) by the estimated density (the average occupancy percent TOCC multiplied by the conversion factor (GFACTR)). The formula is as follows:

$$SPEED = \frac{CFACTR*TVOL}{GFACTR*TOCC}$$

3.20.3 PROGRAM WORK AREAS

3.20.3.1 Switches - None

3.20.3.2 Counters and Accumulators

TOCC - The average occupancy percent for a single sensor for an update time interval. The value is unchanged.

TVOL - The total volume count for a single sensor for an update time interval. The value is unchanged.

SPEED - Calculate estimated speed returned to the calling program.

3.20.3.3 Labeled Common

Area: /CNSTNT/

Variables: CFACTR - Used

GFACTR - Used

3.20.4 FLOWCHART

None.

3.21 SUBROUTINE TAPEIN (NUMBER)

3.21.1 PURPOSE

This subroutine handles all of the I/O from the input data tape. The documentation information, Lane Sensor Table and Continuous Time Series Data Blocks are read by this subroutine. End-of-file mark verification and rewinding of the tape are also done in this subroutine.

This subroutine is called by the main control program to read the Header Block and Lane Sensor Table Block and to rewind the input data tape. Subroutines PSTNTP, OCCVOL, and SPDCNT call this routine to read the Continuous Time Series Data Blocks.

Since computers handle the I/O for tapes differently, modification or changes to the reading, end-of-file mark verification and rewinding of the tape will probably be made for each installation using this program.

All of the I/O for the input data tape has been isolated in this subprogram to facilitate easy modification or changes.

3.21.2 PROGRAM SYNOPSIS

The other routines needing I/O from the input data tape call this subroutine passing an integer constant (NUMBER). NUMBER will be reset to zero if and end-of-file mark is not in its expected position on the tape.

The form of the input statement used for reading data blocks and end-of-file verification for the input data tape is:

```
READ (TPIN,n,END = s) list
```

TPIN is the symbolic unit number defined by subroutine NTLZ (Section 3.13) in Labeled Common Area ALLIO for the input data tape device.

n is the number of a FORMAT statement which applies to the requested data block to be read from the tape.

END = s is a common extended FORTRAN procedure which allows the reading of an end-of-file mark and control to be transferred to statements during the processing of the READ statement.

List is an ordered series of variable names, subscripted or not, in one or more Labeled Common Areas.

The form for reading or skipping end-of-file marks is the same as reading the data blocks. List, in this case, uses the integer counters for the subscripted arrays to be consistent in form only and data transfer should not occur if an end-of-file is encountered.

3.21.3 PROGRAM WORK AREAS

3.21.3.1 Switches

NUMBER is received from the calling program with an integer value of 1 to 4 designating the type of I/O to be performed.

1 - Reads the Header Block and sets all or part of labeled common areas BLOCK1, HEAD, ARRAY1, ARRAY2 and CNSTNT.

2 - Reads the Lane Sensor Table Block into common area BLANK.

3 - Reads a Continuous Time Series Data Block into common area BLANK and resets NUMBER to the number of records in the data block.

4 - Rewinds the tape.

3.21.3.2 Counters and Accumulators

I, J, K - Counters for subscripted arrays and dummy variables for end-of-file mark verification.

3.21.3.3 Labeled Common

See Appendix A for definitions of variables.

Area: /CNSTNT/

Variables: NOSENS is the only variable in this common area initialized from the Header Block.

Area: /BLOCK1/

Variables: All of the variables in this common area are initialized from the Header Block.

Area: /ARRAY1/

Variables: All of the variables except NSENS(170) and INDEX(341) are initialized from the Header Block.

Area: /ARRAY2/

Variables: All of the variables in this common area are initialized from the Header Block.

Area: /BLANK/

Variables: IOBUR(1024) contains the binary coded Lane Sensor Table Block or a Continuous Time Series Data Block.

Area: /HEAD/

Variables: All of the variables in this common area are initialized from the Header Block.

Area: /ALLIO/

Variables: TPIN is the only variable in this common area used.

3.21.4 FLOWCHARTS

Figure 30 illustrates the processing flow for subroutine TAPEIN (NUMBER).

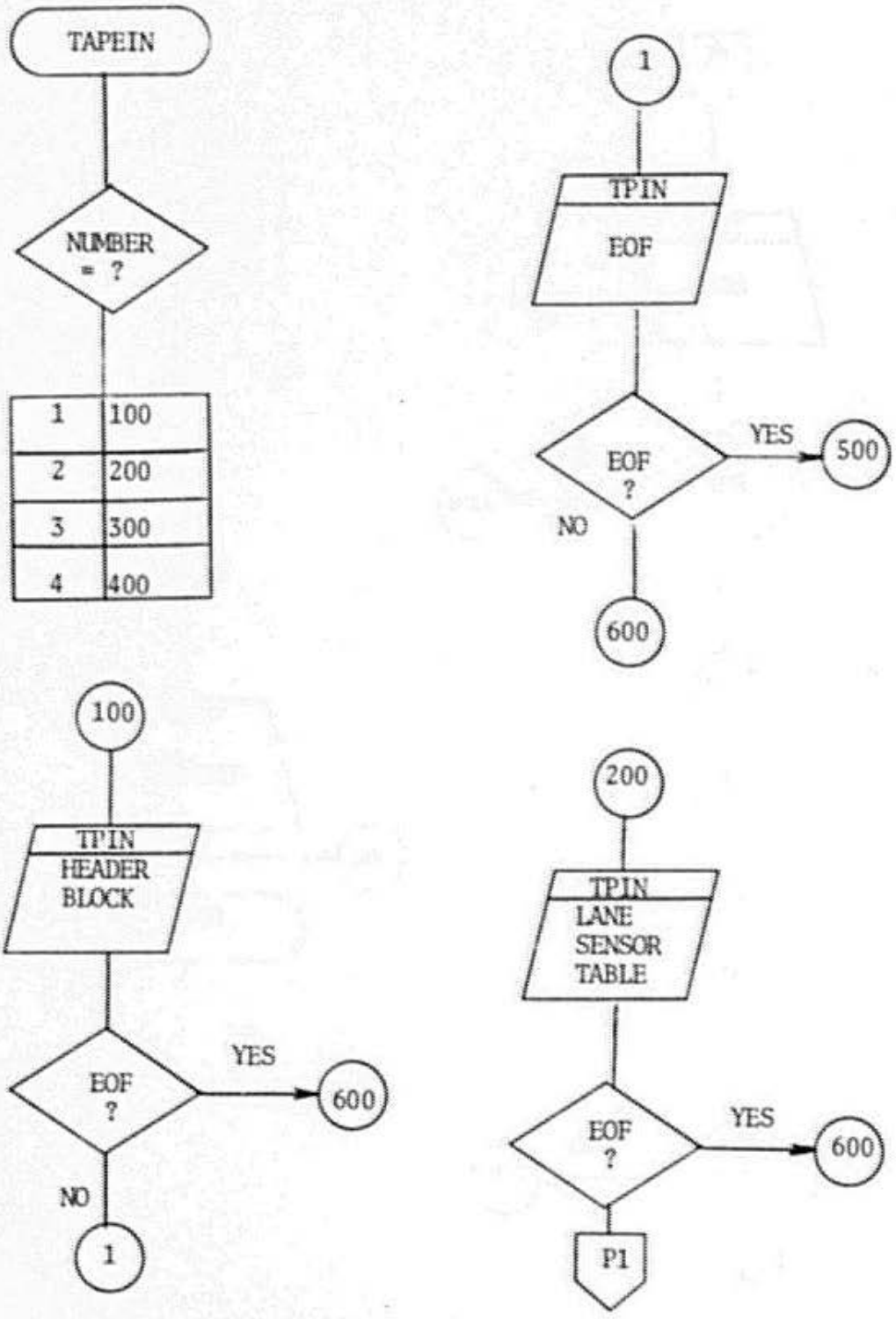

FIGURE 30

SUBROUTINE TAPEIN (NUMBER)

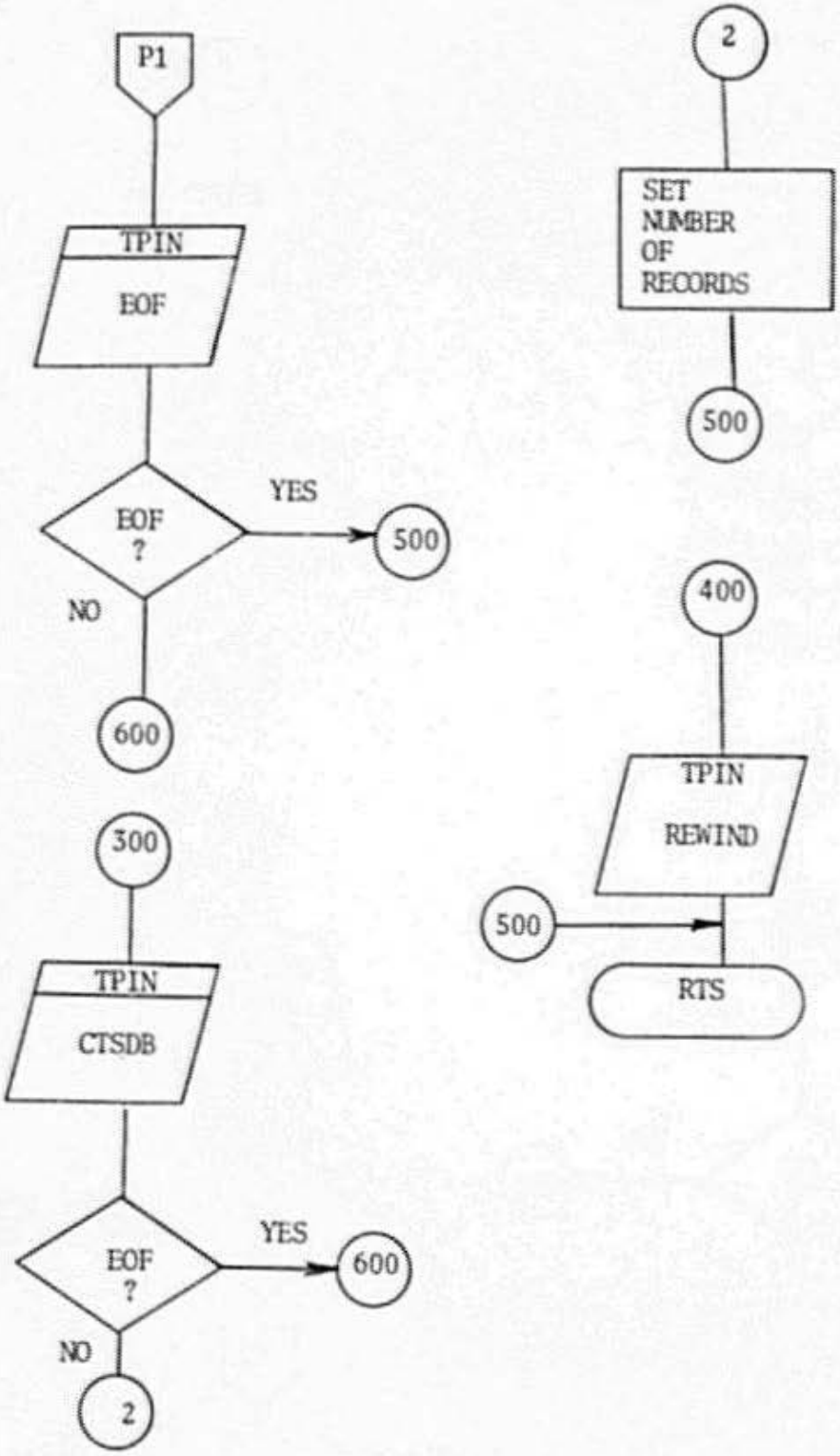

FIGURE 30 (CONTINUED)

SUBROUTINE TAPEIN (NUMBER)

3.22 SUBROUTINE TAPEOU (NUMBER)

3.22.1 PURPOSE

Performs all of the output to the condensed data tape. The documentation information, relevant program variables, and the computed statistical data is written to the tape. In addition end-of-file marks and the rewinding of the tape are controlled by this subprogram.

This subroutine is called by the main control program to output the documentation information, relevant program constants, and rewinding the tape. The secondary control programs, subroutines UPDATE and SPDUPD, call this subprogram to output the relevant program variables and the computed statistical data.

It is assumed that the condensed data tape is to be used to provide intermediate or temporary storage between this program and a user written program to process the computed statistical data. Since computers handle the I/O for tapes differently, modification or changes to the writing, end-of-file mark and rewinding of the tape will probably be made for each installation using this program.

All of the I/O for the input data tape has been isolated in this subprogram to facilitate easy modification or changes.

The binary WRITE statement is used to write data to the tape in internal binary form. The statement used is: WRITE(TPOUT)list. Where TPOUT is the output device and list is all of the items to be written to tape. This WRITE statement should write one logical record, as a string of binary digits, arranged into words and depends on the size of the items in the list.

3.22.2 PROGRAM SYNOPSIS

The other routines needing I/O to the output data tape call this subroutine passing an integer constant (NUMBER) which specifies the format of the data to be written to the tape or the end indicator that rewinds the tape.

3.22.3 PROGRAM WORK AREAS

3.22.3.1 Switches

NUMBER - Integer number indicating the format of the data to be written to the output data tape, and/or write an end-of-file mark, or rewinds the tape. This subroutine does the following output according to the following values:

1 - Outputs the documentation information, program constants and an end-of-file mark. The Labeled Common areas are: BLOCK1, BLOCK2, ARRAY1, ARRAY2, HEAD.

2 - Outputs the Sensor Indexed Identification Arrays, Sensor Indexed Status Arrays, Program constants and an end-of-file mark.

3 - Outputs the computed statistical values and program variables.

4 - Outputs two end-of-file marks and rewinds the tape.

3.22.3.3 Labeled Common

All of the following Labeled Common areas are output.

Areas: CNSTNT, VRBL, BLOCK1, BLOCK2, ARRAY1, ARRAY2, ARRAY3, ARRAY4, ARRAY6, HEAD

Variables: All

Area: /ALLIO/

Variables: TPOUT - Output data tape device

3.22.4 FLOWCHARTS

Figure 31 illustrates the processing flow for subroutine TAPEOU (NUMBER).

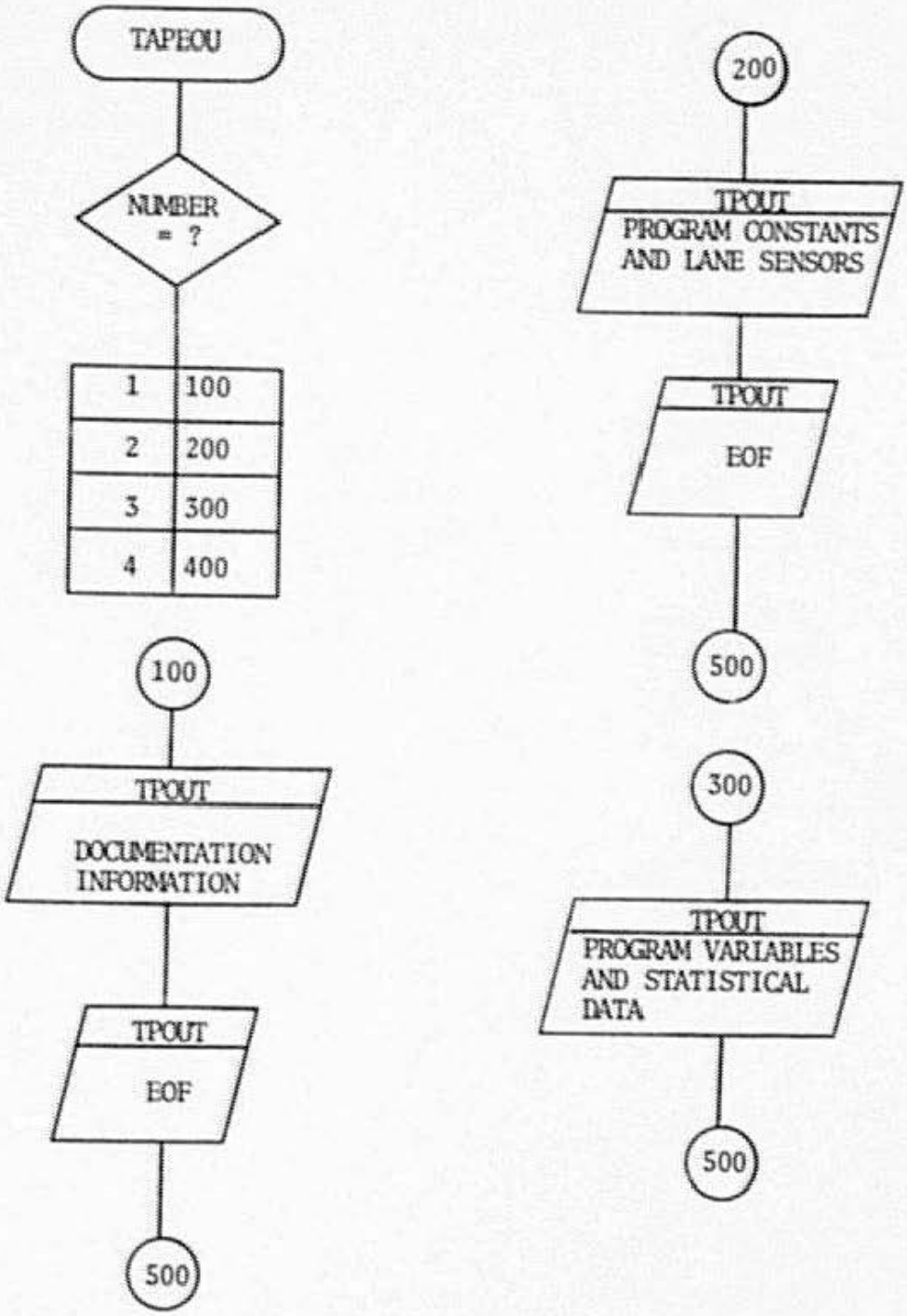

FIGURE 31

SUBROUTINE TAPEOU (NUMBER)

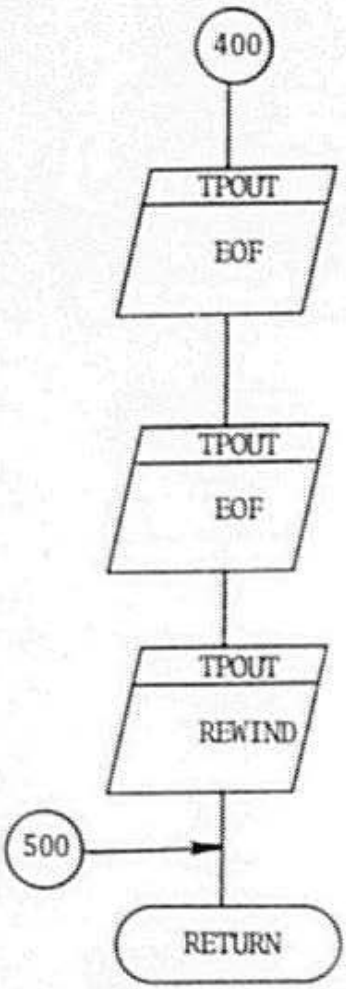

FIGURE 31 (CONTINUED)

SUBROUTINE TAPEOU (NUMBER)

3.23 SUBROUTINE UPDATE

3.23.1 PURPOSE

Controls the computation of the statistical data. If requested, the data is output to a listing device and/or a magnetic tape. The time interval and table pointers are incremented.

This routine is called by subroutine OCCVOL at the end of the update time interval. The following routines are called:

CNVRT - Computes the statistical values from Raw Occupancy Duration and Volume Count Ring Buffers.

PRINT - Lists the computed statistics if requested.

TAPEOU - Writes the computed statistics to tape if requested.

3.23.2 PROGRAM SYNOPSIS

Conditional GO TO statements control the execution of the calls to the subroutines that compute the statistics, prints the statistics and writes the statistical data to tape. This routine is called whenever the on-off time of the current Continuous Time Series Data Block record is greater than or equal to the update time.

First the update time interval counter (IUPDTM) is incremented by one. If this counter is less than one, there is not enough raw occupancy duration and volume count ring buffers to compute the statistical data for the averaging time interval, therefore, the procedure described in the following paragraph is bypassed and only the critical time pointers and counters are incremented as in the last paragraph.

A call is made to subroutine CNVRT to compute the statistical values. If the data is only to be output to the tape, a call is made to subroutine TAPEOU and the procedure described in the rest of this paragraph is bypassed. If printing of the computed values is requested, a check is made to see if the listing time (LSTIME) is the same as the update time (UPDTIM). If they are the same, subroutine PRINT is called to list the statistical values. The listing time is incremented by the listing time interval (LFACTR). If the data is to be written to the output tape subroutine TAPEOU is called.

Then the update time is incremented by the update time interval (UFACTR). The Raw Occupancy Duration and Volume Count

Ring Buffer pointers are incremented by one. These pointers are incremented whether or not output of the statistical values is done.

3.23.3 PROGRAM WORK AREAS

3.23.3.1 Switches - None

3.23.3.2 Counters and Accumulators - None

3.23.3.3 Labeled Common

Area: /CNSTNT/

Variables: UFACTR, LFACTR - Used to increment time interval pointers.

OUTPUT - Used

MPTR - Used

Area: /VRBL/

Variables: IUPDTM, LPTR, NPTR - Increment by one each time the routine is called.

UPDTIM, LSTIME - Increment by their respective time increments.

3.23.4 FLOWCHARTS

Figure 32 illustrates the processing flow for subroutine UPDATE.

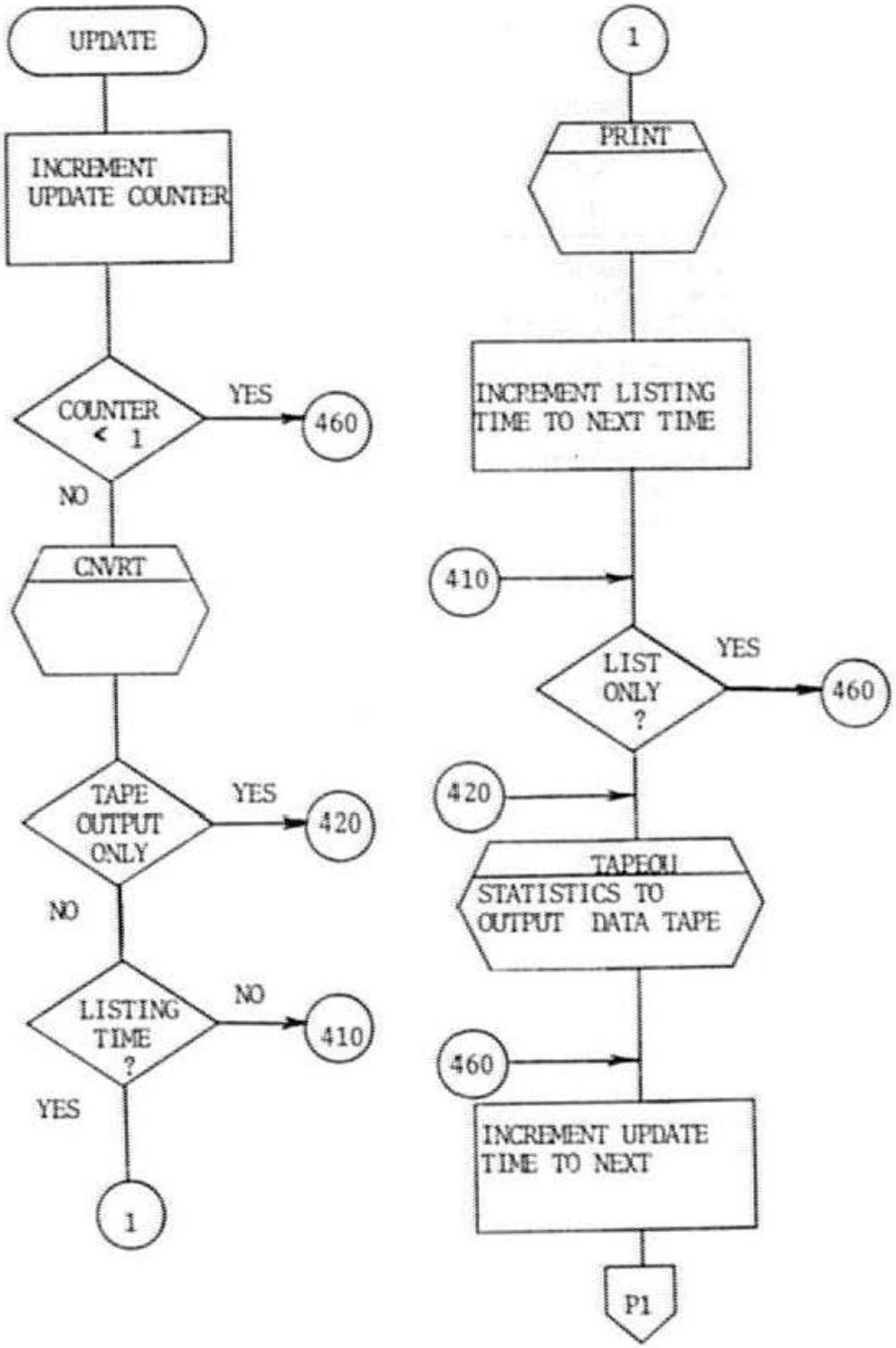

FIGURE 32

SUBROUTINE UPDATE

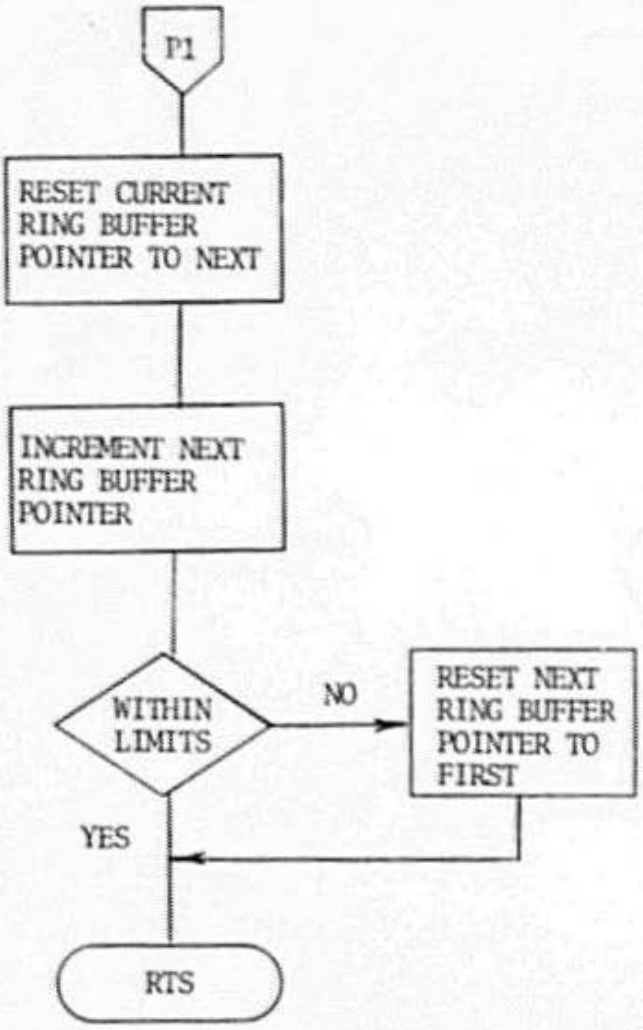

FIGURE 32 (CONTINUED)

SUBROUTINE UPDATE

3.24 FUNCTION VLH(TVOL)

3.24.1 PURPOSE

Calculates the estimated hourly lane volumes or volume per lane per hour from the total volume count for a single sensor for an update interval.

This function is called by subroutine CNVRT.

3.24.2 PROGRAM SYNOPSIS

The total volume count for a sensor for an update interval (TVOL) is multiplied by the number of update intervals in an hour (CFACTR). The formula used is as follows:

VLH = CFACTR*TVOL

3.24.3 PROGRAM WORK AREAS

3.24.3.1 Switches - None

3.24.3.2 Counters and Accumulators

TVOL - The total volume count for a single sensor for an update time interval. The value is unchanged.

VLH - Calculates estimated hourly lane volume. Volume returned to the calling program.

3.24.3.3 Labeled Common

Area: /CNSTNT/

Variable: CFACTR - Used

3.24.4 FLOWCHARTS

None.

3.25 SUBROUTINE SPDCNT (ITEMPO)

3.25.1 PURPOSE

This routine controls the speed trap calculation portion of this program. If requested, the data is output to a listing device and/or a magnetic tape.

3.25.2 PROGRAM SYNOPSIS

This routine is called by the main control program with the first Continuous Time Series Data Block Record number (ITEMPO) passed as an argument. This subroutine makes calls to the subroutines and functions described below:

CTSDBR - Derives the on-off state, on-off time, sensor status and sensor index number from the Continuous Time Series Data Block Record.

ISECS - Changes a time variable (HHMMSS format) to time in seconds.

SPDSUM - Lists the average speeds.

SPDTRP - Calculates the speed value.

SPDUPD - Lists and/or outputs to tape the speed values.

TAPEIN - Reads the next Continuous Time Series Data Block from the input tape.

After the end time is changed to milliseconds (IDONE) the output pointers (LPTR, NPTR, IUPDRN, LASTR) and the summary arrays (MTIMES, TSPD, TCNT) are initialized to zero. The last record indicator (NUMB) is set to the default value 341, which is the maximum number of records possible in a block.

Next and after each data block has been input from the data tape, the output data arrays are initialized to zero. There is then one DO LOOP that is repeated until an end of tape is detected or until the on-off time of a sensor is greater than the ending time. A call to subroutine CTSDBR is made to decode the on-off state (IONOFF), the sensor status (IMBAI) which is included but not used, the on-off time (ITIME), the sensor index number (ISENS) for the record number and loop pointer (NUMBER) of the Continuous Time Series Data Block

After returning from subroutine CTSDBR, a check is made comparing the on-off time (ITIME) to the end time (IDONE). If the on time is greater than the end time, a branch is made

to the clean-up logic, otherwise, if the sensor index number (ISENS) is zero, or the freeway identification (IFWY(ISENS)) is not the speed trap freeway section, or the sensor state (IONOFF) is off, the current record is not processed any further. Then the lane type is checked for being a mainline or speed trap sensor.

If it is not a mainline or speed trap sensor, the next record is processed. If it is a mainline sensor, the on-time is saved (MTIMES), the total count (TCNT) is incremented by one and the next record is processed. If it is a speed trap sensor, the corresponding mainline sensor is checked for an on-time value. If it is zero, the next record is processed. Next the difference between the mainline and speed trap sensor is calculated. If the speed trap's on-time is less than or equal to the mainline's on-time, the next record is processed. When it is greater than the mainline's on-time, the on-time (MTIMES) is saved, the total count (TCNT) is incremented by one, the speed is calculated by a call to function SPDTRP and the total speed (TSPD) is incremented by the current speed value. A call is then made to subroutine SPDUPD to print and/or output to tape the speed value, the mainline on-time is reset to zero and the next record is processed.

When all of the records of a block have been processed, the first record indicator (ITEMP0) is set to one and the next block is read by calling subroutine TAPEIN with the passed parameter (NUMB) set to the value 3. If the passed parameter (NUMB) is returned with a non-zero value, the DO LOOP is repeated as described above. If the value is zero an end of tape was detected.

When an end of tape has been detected or a record on-time is greater than the end time, a call is made to subroutine SPDUPD if the tape output option is on (OUTPUT = 5 or 6) to write any partial logical records and/or subroutine SPDSUM if the print option is on (OUTPUT = 4 or 6) to output a summary listing. A return to the main calling routine is then made to terminate the program.

3.25.3 PROGRAM WORK AREAS

3.25.3.1 Switches

IDONE - Ending time in milliseconds.

3.25.3.2 Counters and Accumulators

ITEMP0 - Initially the first record of the Continuous Time Series Data Block to be used. Set to one after first block processed.

NUMB - The last record of the block to be processed. Initially set to 341. Will be equal to last record in after calls to subroutine TAPEIN.

I - DO LOOP counter.

SPD - Speed value.

3.25.3.3 Labeled Common

Area: /CNSTNT/

Variable: OUTPUT - Used.

Area: /VRBL/

Variables: LPTR, NPTR, IUPDRN, LASTR - are all initialized. LASTR is set to one when all records processed.

Area: /BLOCK1/

Variable: ETIME - Used.

Area: /BLOCK3/

Variables: All are used.

Area: /ARRAY2/

Variables: FRWYS(7), NLANTP(1), LNTPCD(16) - Used to isolate speed trap sensors.

Area: /ARRAY3/

Variables: IFWY(ISENS), ILNTYP(ISENS) - Used to isolate speed trap sensors.

Area: /ARRAY4/

Variables: All are used.

3.25.4 FLOWCHART

Figure 33 illustrates the processing flow for subroutine SPDCNT(ITEMP0).

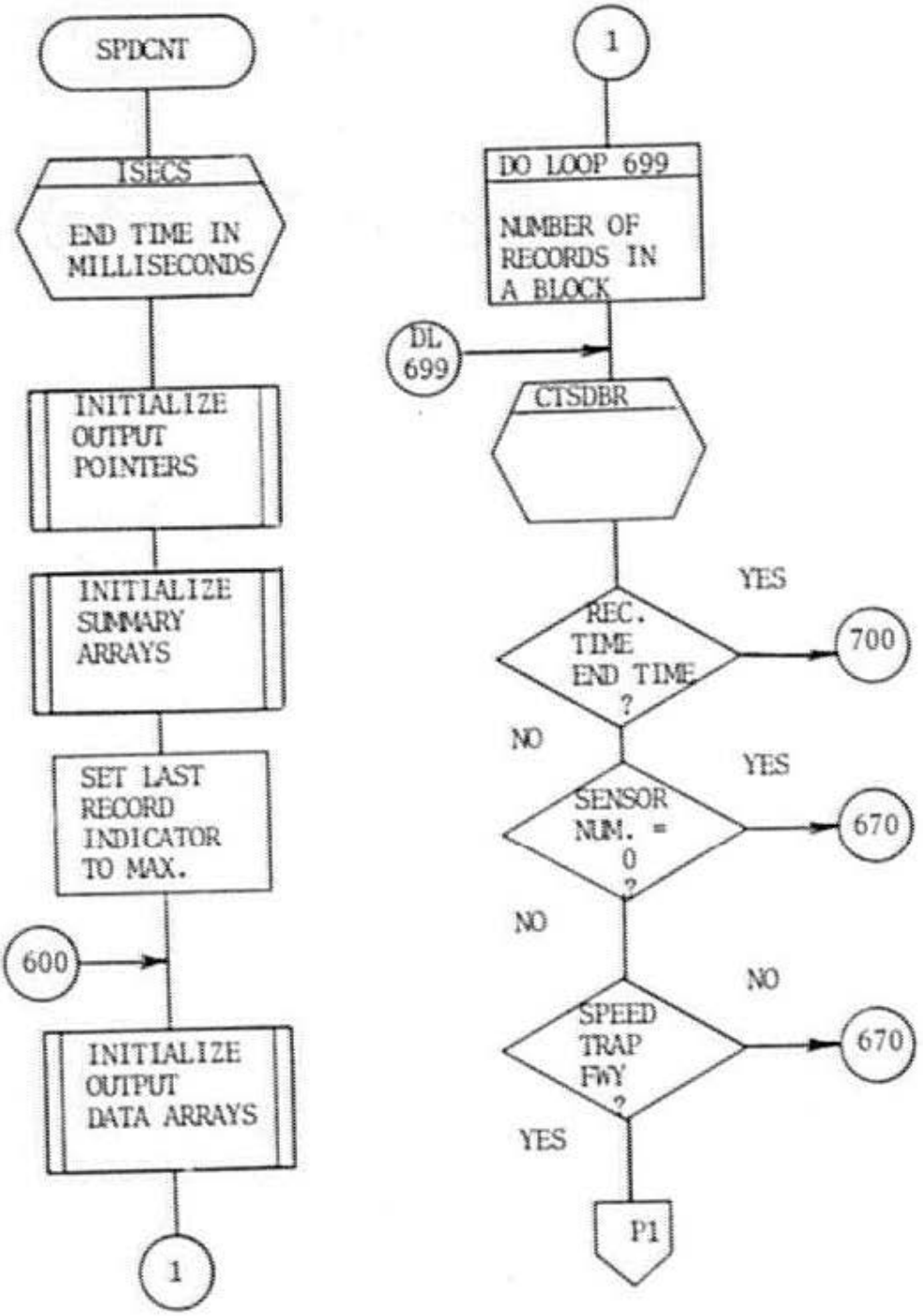

FIGURE 33

SUBROUTINE SPDCNT(ITEMP0)

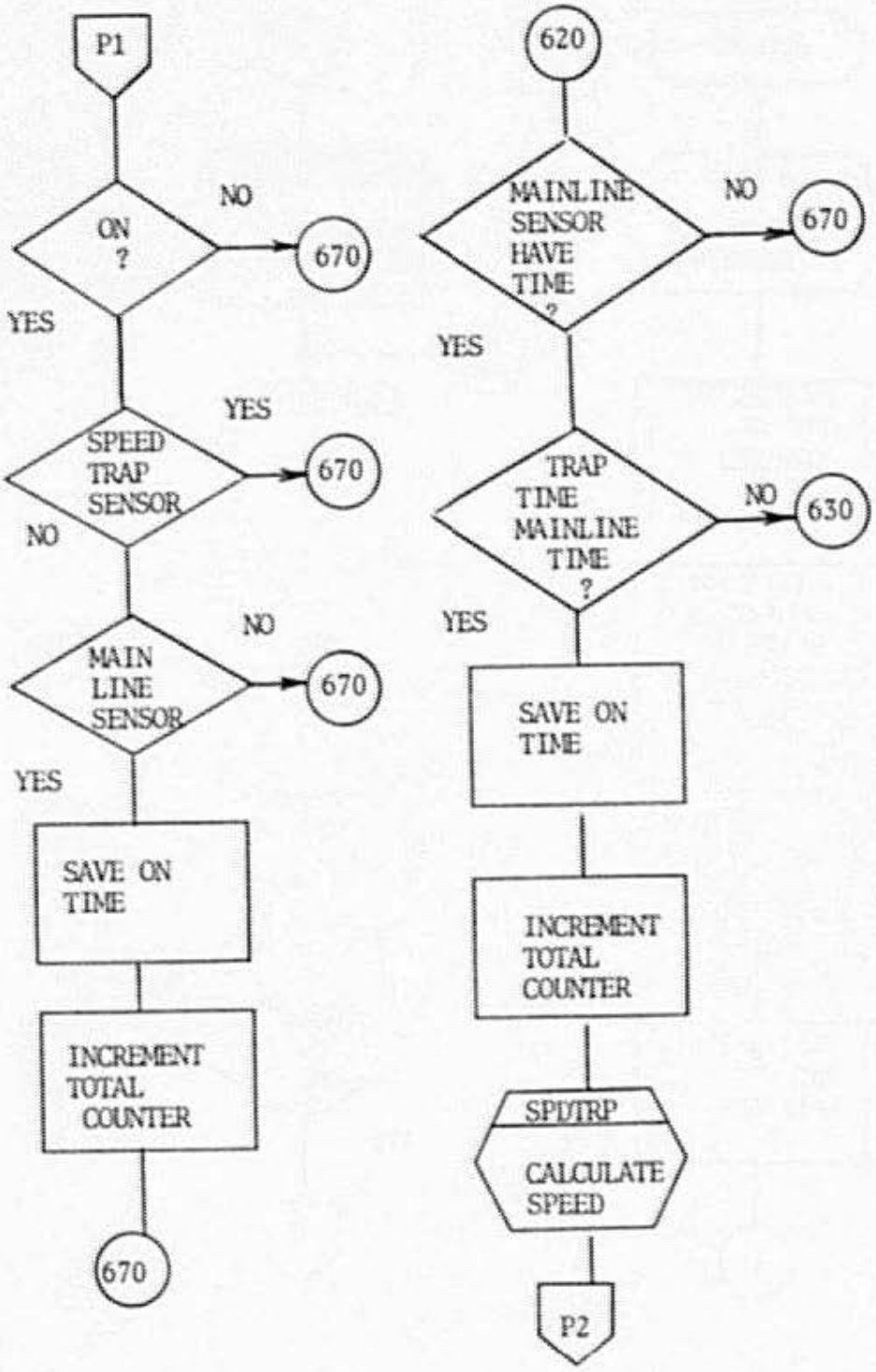

FIGURE 33 (CONTINUED)

SUBROUTINE SPDCNT(ITEMP0)

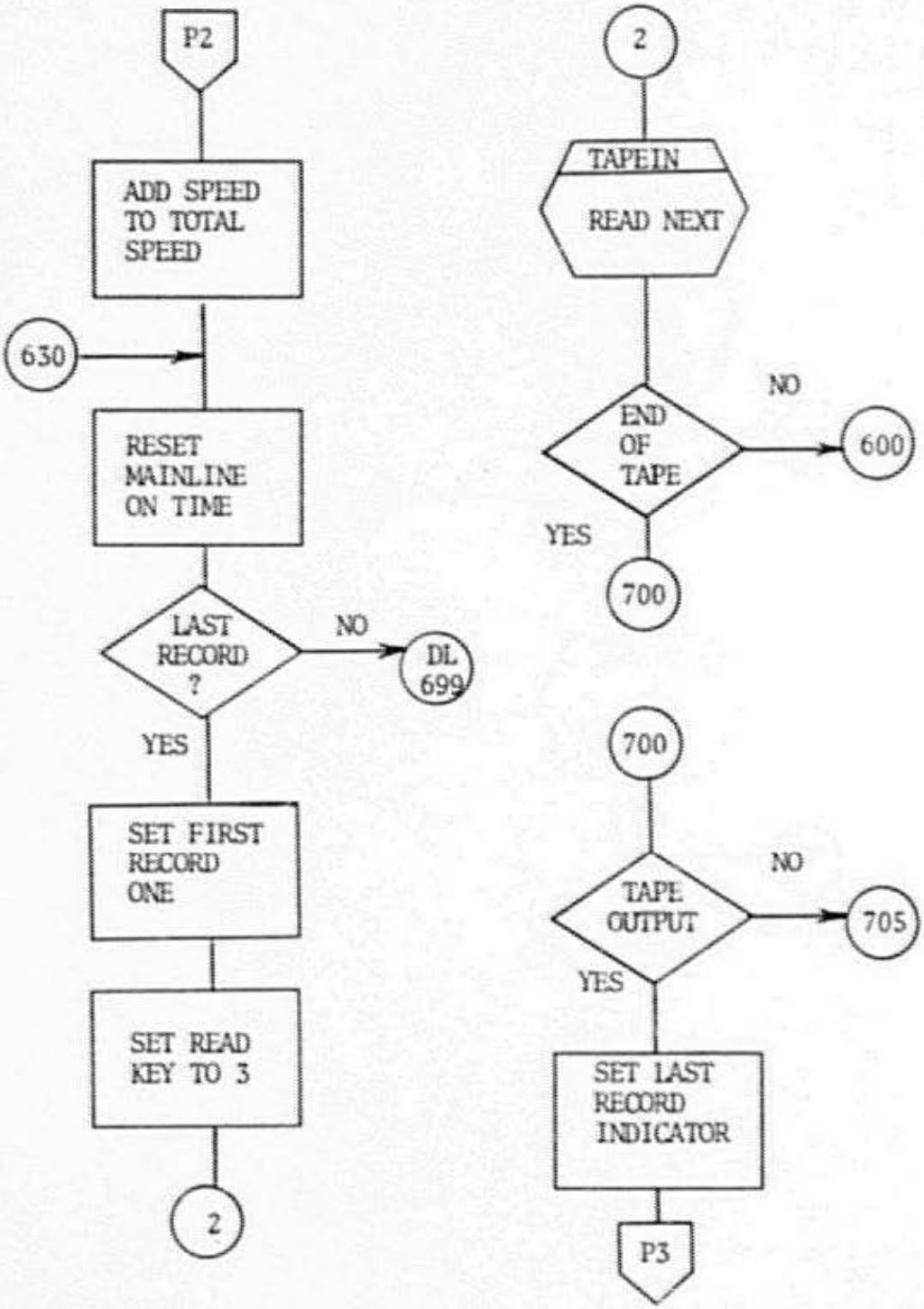

FIGURE 33 (CONTINUED)

SUBROUTINE SPDCNT(ITEMP0)

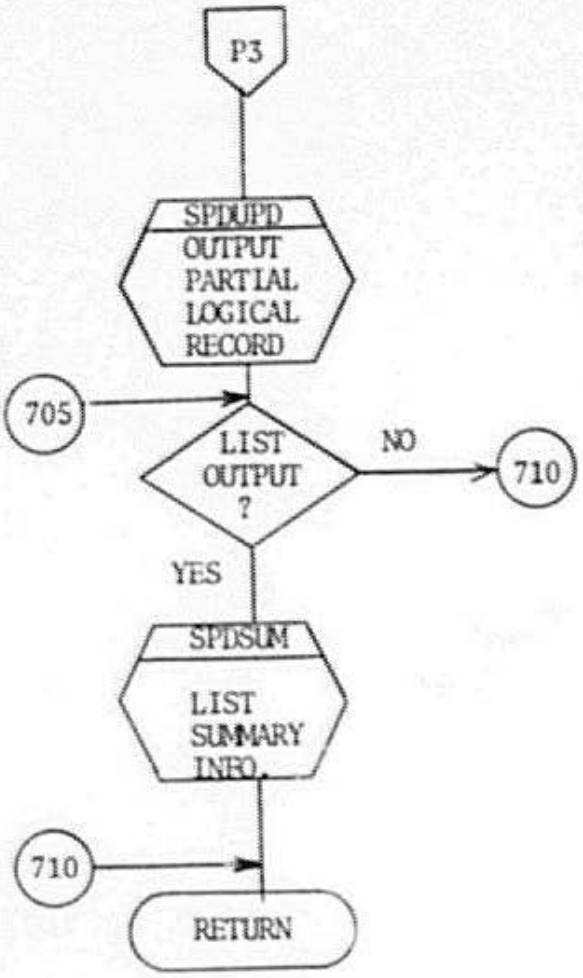

FIGURE 33 (CONTINUED)

SUBROUTINE SPDCNT(ITEMP0)

3.26 SUBROUTINE SPDPRN

3.26.1 PURPOSE

This routine lists the speed information calculated from the on times of the speed traps, positions listing device to top of page and outputs the column headings. This routine is called by subroutine SPDUPD if the user has requested a hard copy of the speed data. Calls are made to subroutine PTIME and the MOD function is used.

3.26.2 PROGRAM SYNOPSIS

After the upstream sensor index number (JSENS) is calculated, the on times of the sensors (MTIMES) are converted to printable values by calling subroutine PTIME and the MOD function. The current page line pointer is determined from the total data calculation counter (NPTR) by using module 46 arithmetic. If the remainder is one, a new page with the column headings is output. Then the speed data information is output and a return is made to the calling routine.

3.26.3 PROGRAM WORK AREA

3.26.3.1 Switches

ICOUNT - The current page line number.

3.26.3.2 Counters and Accumulators

JSENS - The upstream sensor index number.

ITEMP0, ITEMP1, ITEMP2 - Used in determining the sensor on times in calls to subroutine PTIME.

I1, I2, I3 - The hours and minutes, the seconds and the time in milliseconds of the upstream sensor on time.

I4, I5, I6 - The hours and minutes, the seconds, and the time in milliseconds of the downstream sensor on time.

3.26.3.3 Labeled Common

Area: /ALLIO/

Variables: LP - Used for output device.

Area: /ARRAY3/

Variables: The following are printed to identify the lane sensor:

IFWY(JSENS) - 'SD'

ISTA(JSENS) - integer number 2, 4, 6, 8 or 10 corresponding to the station number.

IDIR(JSENS) - 'N'

ILNO(JSENS) - integer number 1 through 4 corresponding to the lane number.

Area: /ARRAY6/

Variables: The following variables are printed:

SPEEDS(LPTR) - the speed value for this lane.

ASPDS(LPTR) - the average speed for this lane.

Area: /ARRAY4/

Variable: MTIMES(JSENS & ISENS) - the on times of the upstream and downstream lane sensors.

Area: /VRBL/

Variables: LPTR - points to the current array element in /ARRAY6/.

NPTR - used to determine if a new page and heading is to be output.

Area: /BLOCK3/

Variable: ISENS - downstream sensor index number.

3.26.4 FLOWCHART

Figure 34 illustrates the processing flow for subroutine SPDPRN.

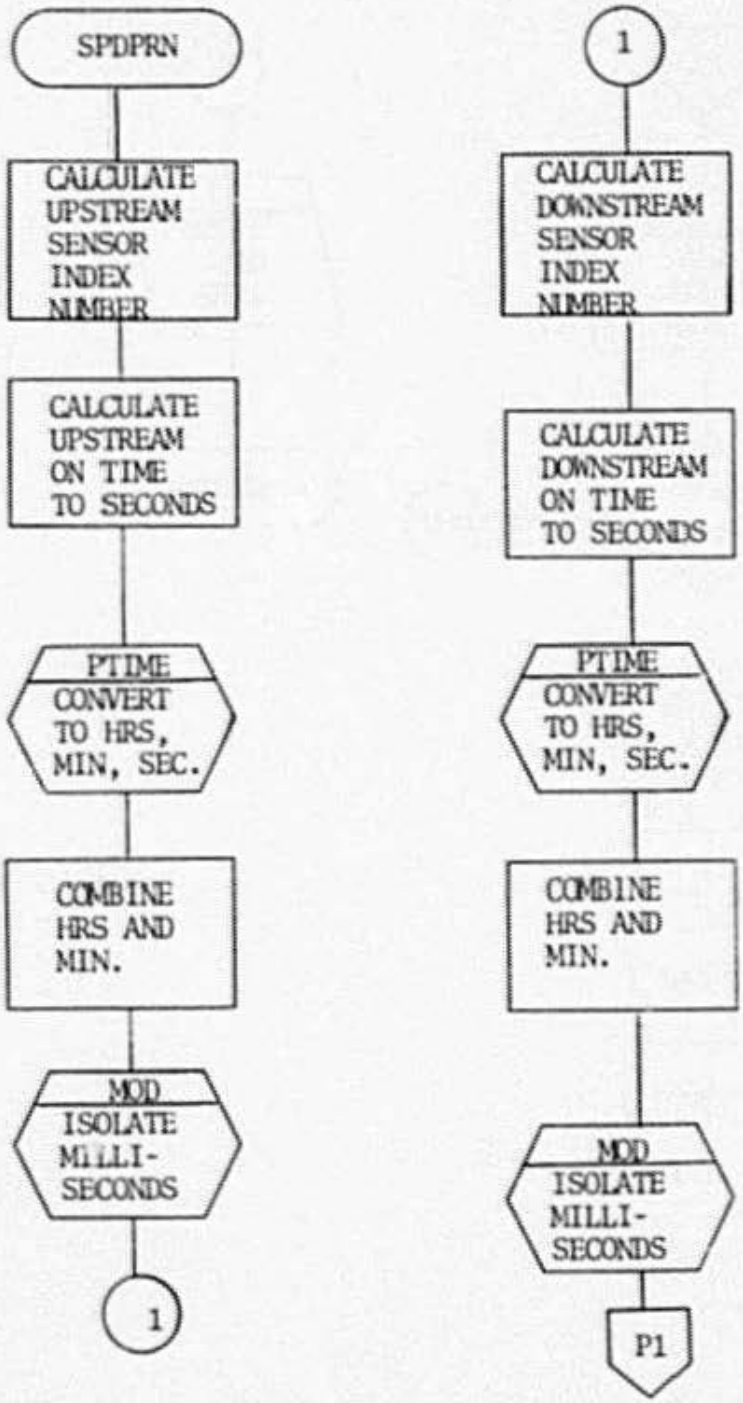

FIGURE 34

SUBROUTINE SPDPRN

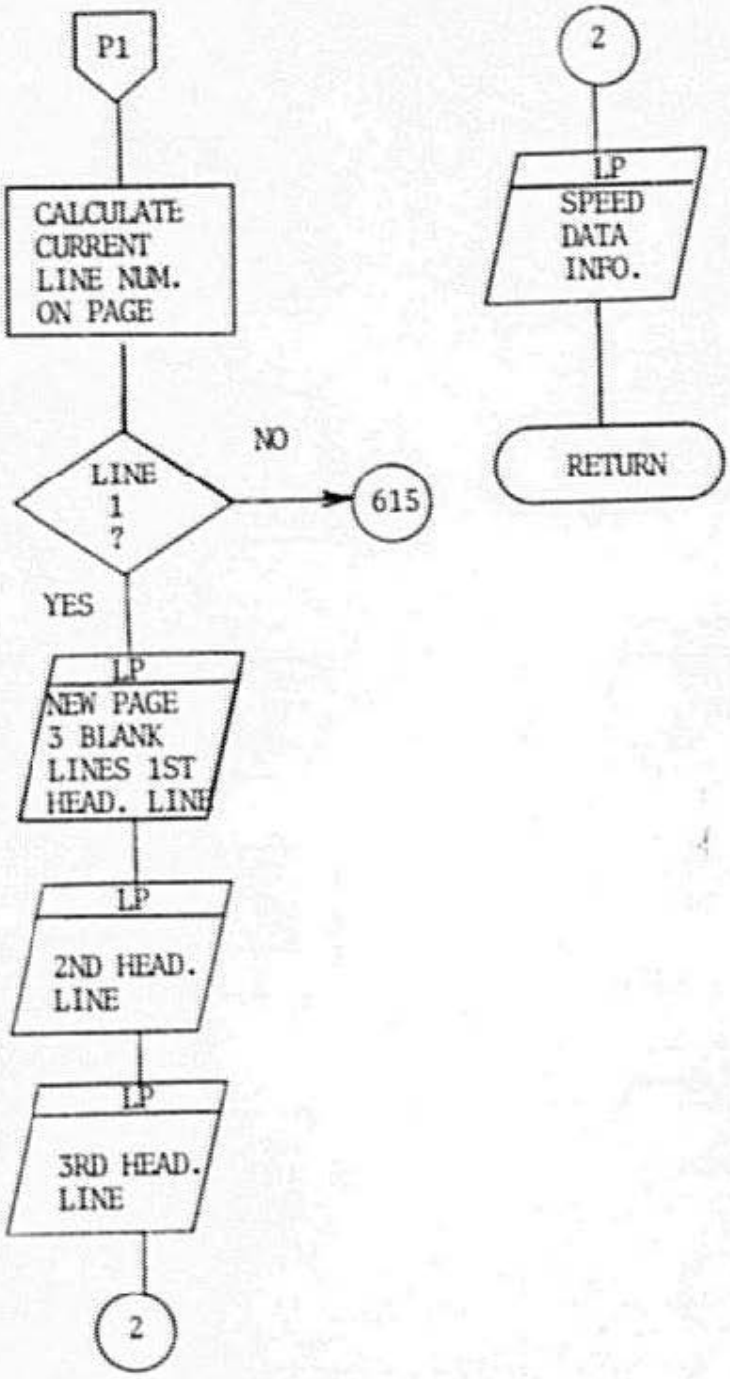

FIGURE 34 (CONTINUED)

SUBROUTINE SPDPRN

3.27 SUBROUTINE SPDSUM

3.27.1 PURPOSE

This routine lists the average speeds for the speed trap locations after all of the individual speed calculations are output. This routine is called by subroutine SPDCNT if the user has requested a hard copy of the speed data.

3.27.2 PROGRAM SYNOPSIS

A new page is started, the column headings are output and the station check variable (ICHECK) is initialized. A DO LOOP is then executed for every possible entry in the total speed array (TSPD). If the total speed value is not zero, the average speed (ASPD) is calculated, a blank line is output if the station number of the sensor is different from the last sensor, and the average speed is output. This DO LOOP is executed 341 times and then a return is made to the calling program.

3.27.3 PROGRAM WORK AREAS

3.27.3.1 Switches - None.

3.27.3.2 Counters and Accumulators

I - DO LOOP counter

ASPD - Average speed calculated from TSPD(I)/TCNT(I)

3.27.3.3 Labeled Common

The following variables are used and not changed:

Area: /ALLIO/

Variable: LP - output device

Area: /ARRAY3/

Variables: All except ILNTYP are printed.

Area: /ARRAY4/

Variables: TSPD and TCNT are used to calculate the average speed (ASPD).

3.27.4 FLOWCHART

Figure 35 illustrates the processing flow for subroutine SPDSUM.

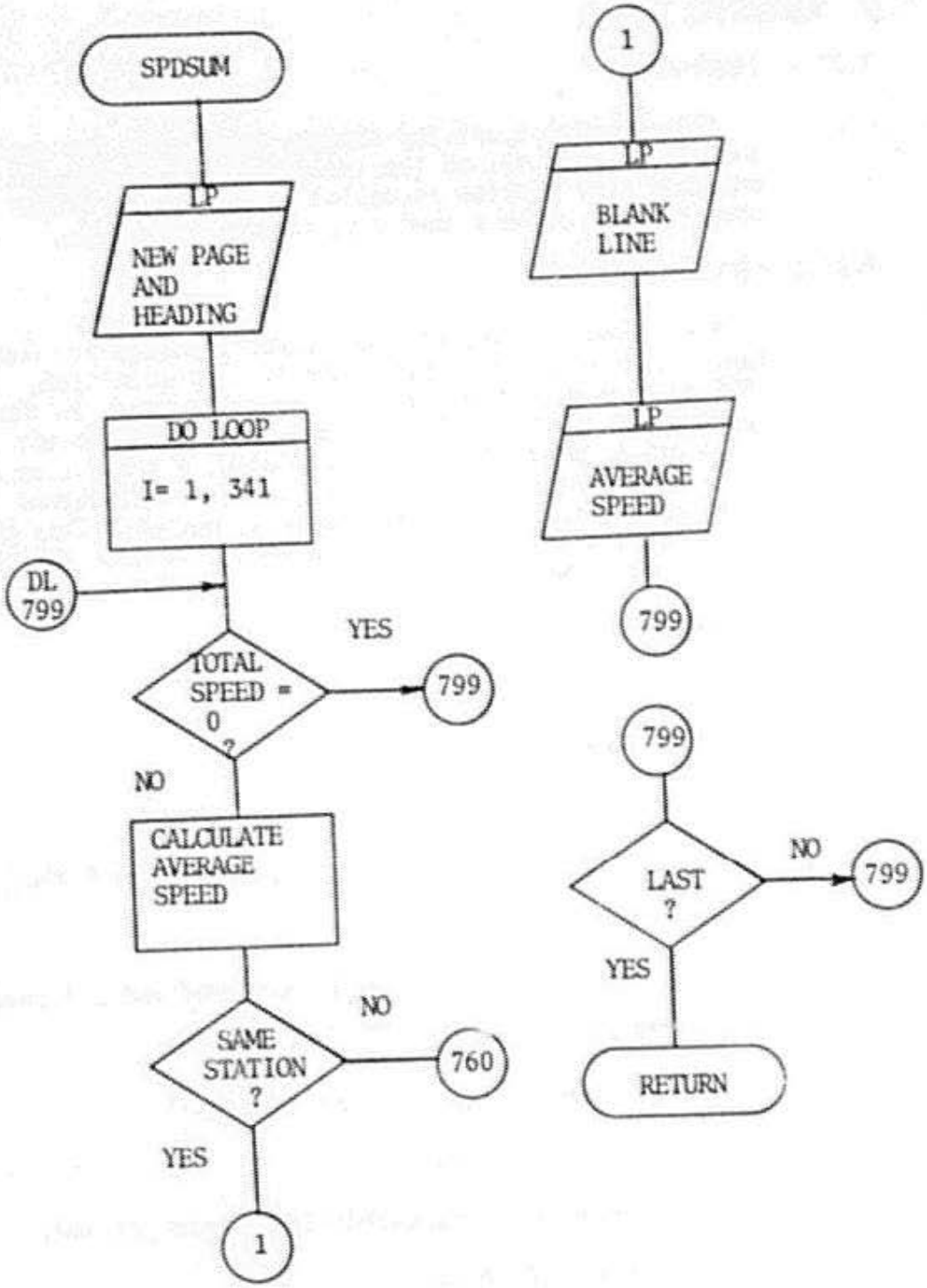

FIGURE 35

SUBROUTINE SPDSUM

3.28 FUNCTION SPDTRP (ISENS)

3.28.1 PURPOSE

Calculates the speed from the on times of two sensors spaced 18 feet apart (leading edge to leading edge). This routine is called by subroutine SPDCNT.

3.28.2 PROGRAM SYNOPSIS

The following formula is used to calculate the speed where t is the time difference in milliseconds between the on times of the trap sensors:

$$\text{speed} = \frac{18 \text{ ft.}}{t \text{ ms}} \times \frac{1000 \text{ ms}}{1 \text{ sec.}} \times \frac{3600 \text{ sec.}}{1 \text{ hr.}} \times \frac{1 \text{ mile}}{5280 \text{ ft.}} = \frac{135000}{11t}$$

3.28.3 PROGRAM WORK AREA

3.28.3.1 Switches - None.

3.28.3.2 Counters and Accumulators

SPDTRP - Calculated speed value returned to calling program.

3.28.3.3 Labeled Common

Area: /ARRAY4/

Variable: MTIMES - Used.

3.28.4 FLOWCHART

None.

3.29 SUBROUTINE SPDUPD (SPD)

3.29.1 PURPOSE

This subroutine will print and/or output to tape the speed information calculated for the speed trap locations. The speed trap data arrays and pointers are maintained by this routine. Subroutines SPDPRN and TAPEOU may be called depending upon the output option specified.

3.29.2 PROGRAM SYNOPSIS

Upon entry a check is made to see if this is the end of the program by checking the last request flag (LASTR). If it is not the last request, the current data array pointer (LPTR) and the total data calculation counter (NPTR) are incremented by one. Next the current speed information is transferred to the data arrays (/ARRAY6/) and the logical record time limits (IUPDST and IUPDET) are updated. If the print option is on (OUTPUT = 4 or 6) a call is made to subroutine SPDPRN. Next if the data arrays are not full (LPTR 365) a return to the calling routine is made.

When the data arrays are full or it is the end of the program, the logical record number counter (IUPDRN) is incremented by one. If the tape output option is on (OUTPUT = 5 or 6) a call is made to subroutine TAPEOU. Next the current data array pointer (LPTR) is reset and the routine returns to the calling routine.

3.29.3 PROGRAM WORK AREAS

3.29.3.1 Switches - None.

3.29.3.2 Counters and Accumulators - None.

3.29.3.3 Labeled Common

Area: /VRBL/

All of the variables of this common area are modified by this routine except for LASTR which is only checked.

Area: /ARRAY6/

All of the arrays are reset to new values.

3.29.4 FLOWCHART

Figure 36 illustrates the processing flow for subroutine SPDUPD (SPD).

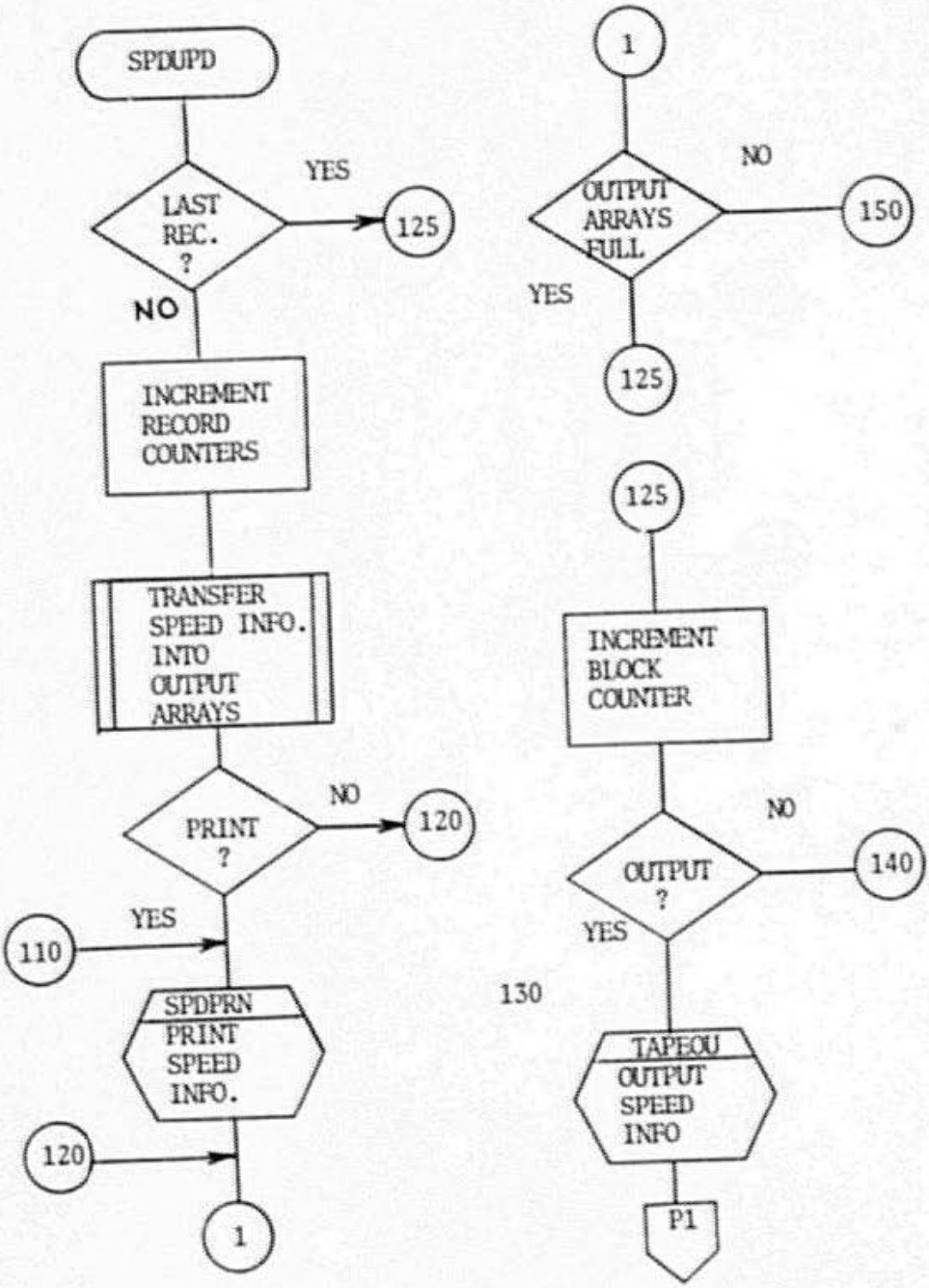

FIGURE 36

SUBROUTINE SPDUPD

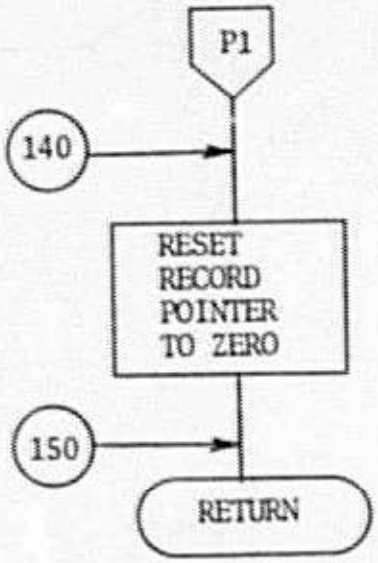

FIGURE 36 (CONTINUED)

SUBROUTINE SPDUPD

APPENDIX A

This appendix contains an alphabetical list of definitions of constants, variables and array names used in Labeled Common areas and primary parameters passed to subroutines. Word length is four bytes of eight bits per byte.

The Keyword column is the name of the constant, variable or array. The Type and Dimension column defines the format specification and the number of elements if it is an array, where

A - Alphanumeric
I - Integer
R - Real

indicate the parameter use in the program. The Labeled Common column designates the Labeled Common area if present or a parameter passed between subroutines if absent. The Purpose column defines the keyword and explains the format or use in the program.

Keyword	Type and Dimension	Labeled Common	Purpose
ACTLNS	I(170)	ARRAY1	The total number of active mainline sensors for each freeway station.
ADEN	R(170)	ARRAY6	The average station density for the averaging time interval (AVGINT).
AFACTR	I	CNSTNT	The Factor used in subroutine UPDATE for updating the current averaging time interval (AVGTIM). AFACTR is in milliseconds and is equal to the averaging time interval in milliseconds per second. AFACTR = (AVGINT) x (1000)
AFFDIR	A(4)	HEAD	A one (1) character alpha code representing the direction of travel of the affected segment. (See NOFWYS for codes.)
AFFDWN	I(4)	HEAD	A two (2) character integer value that is the downstream station for the affected segment.
AFFFWY	A(4)	HEAD	A two (2) character alpha code that represents the freeway of the affected segment. (See NOFWYS for codes.)
AFFUP	I(4)	HEAD	A two (2) character integer value that is the upstream station for the affected segment.
AOCC	R(170)	ARRAY6	The average station occupancy percent for the averaging time interval (AVGINT).
ASPD	R(170)	ARRAY6	The average station speed for the averaging time interval (AVGINT).
AVGINT	I	BLOCK2	The averaging time interval in seconds. One of the values that can be changed in subroutine PRMTRS and DEFLTS. Default value of 60 seconds is initialized in subroutine PRMTRS.
AVGTIM	I	VRBL	The current averaging time in milliseconds. This variable is included in Labeled Common and is incremented by the averaging time interval factor (AFACTR) in subroutine UPDATE. Even

Keyword	Type and Dimension	Labeled Common	Purpose
AVGTIM (Cont.)			though AVGTIM has no current significant function after it has been calculated and used in subroutine DEFLTS, it does, however, provide program consistency with respect to the updating and listing time variables and allows the programming of alternate statistical computations with a minimum of modification.
AVLH	R(170)	ARRAY6	The average station volume per lane per hour for the averaging time interval (AVGINT).
AVOL	R(170)	ARRAY6	The average station volume for the averaging time interval (AVGINT).
BEGSTA	I(4)	ARRAY7	The beginning station index numbers of the freeway segments.
CALLBX	A,I(2)	HEAD	The call box code closest to the incident location. The first word of the array is a two (2) character alpha code that represents the freeway. (See NOFWYS for codes.) The second word of the array is a three (3) character integer value that represents the location and direction. (See Appendix B.)
CFACTR	F	CNSTNT	The Factor used in functions VLH and SPEED for converting volume counts to estimated hourly lane volumes. CFACTR is equal to 3600.0 seconds per hour divided by the number of seconds in the updating interval (UPDINT). $CFACTR = \frac{3600.0}{UPDINT}$
COMMNT	A(17,20)	HEAD	Additional comment lines. Each line contains up to 68 (4 x 17) alphanumeric characters. A maximum of twenty lines is possible. Unused lines contain blank characters. The number of comment lines (NOCOM) will be zero if there are not any comments. If comment lines are desired, NOCOM will contain the number of lines.

Keyword	Type and Dimension	Labeled Common	Purpose
CTSDR	A(3,341)	BLANK	Contains the Continuous Time Series Data Records read from the input data tape. Used in subroutines CTSDBR and PSTNTP.
DATE	I	BLOCK1	The input data starting date in the format YYMMDD. YY is the year; MM is the month; DD is the day,i.e., June 30, 1974 would be 740630.
DETIME	I	HEAD	The time in the format HHMMSS that the incident was detected by the DETSRC. HH is the hour; MM is the minute; SS is the second.
DETSRC	A	HEAD	A one (1) character alpha code representing the incident detection source. The characters used are: H - Helicopter C - CHP V - Verification patrol unit R - Radio monitor S - Computer
DFACTR	I	CNSTNT	The Factor used in function NPULSE for calculating occupancy duration. DFACTR is the number of milliseconds in one sensor status sample and is equal to 1000 milliseconds per second divided by the number of sensor status samples per second (SMPLRT). $DFACTR = \frac{1000}{SMPLRT}$
DIRCTS	A(8)	ARRAY2	A one (1) character alpha code that represents the appropriate direction of travel for a segment. (See NOFWYS for codes.)
DURATN	I(5)	HEAD	The duration of time in seconds for the respective traffic volume counts.
ENDSTA	I(4)	ARRAY7	The ending station index numbers of the freeway segments.
ETIME	I	BLOCK1	The input data tape ending time in the format HHMMSS. HH is the hour; MM is the minute; SS is the second.

Keyword	Type and Dimension	Labeled Common	Purpose
FRWYS	A(8)	ARRAY2	A two (2) character alpha code that represents the appropriate freeway. (See NOFWYS for codes).
GET	I	ALLIO	The logical or device unit number assigned to where the program will get operator input.
GFACTR	F	CNSTNT	The factor used in functions DENSITY and SPEED for estimating density from occupancy percent. One of the values that can be changed in subroutine PRMTRS. Default value of 2.80 is initialized in subroutine PRMTRS.
GMTRYC	A(5)	HEAD	Comments pertaining to the incident freeway segment geometry indicators (GMTRLY). Twenty (20) characters maximum (5A4).
GMTRLY	I(13)	HEAD	The incident freeway segment geometry indicators. Each word of the array contains either a one (1) or a zero (0) integer value. This array is sequenced in the same order as the incident freeway segment geometry (IFSG) format. (See Section 2.3 for details.) If a value of one (1) is in the array word, then the corresponding sensor type in the IFSG format is present. If the value of zero (0) is in the array word, then the corresponding sensor type in the IFSG format is not present.
IASGMT	I(2.5)	ARRAY1	The beginning and ending sensor index numbers of the affected freeway segments. Each pair, IASGMT (1,I) and IASGMT (2,I) where I equals 1 through 4, is respectively the beginning and ending sensor index numbers of the corresponding affected freeway segments. The last pair, IASGMT (1,5) and IASGMT (2,5), are the beginning and ending numbers for the environmental stations.
IBYTE	I	BLOCK0	Integer value equal to the decimal

Keyword	Type and Dimension	Labeled Common	Purpose
IBYTE (Cont.)			value of one (1) byte plus one (1) (i.e., one hexadecimal byte of 'FF' is 255 plus one (1) or 256).
ICMNT	A(5,20)	HEAD	Twenty (20) alphanumeric characters for each incident clearance scenario event. This array is used to clarify the nature of the event.
IDIR	A(341)	ARRAY3	A one (1) character alpha code used for printing the sensor direction in subroutine PRINT.
IFINAL	I	BLOCK2	The time in the format HHMMSS for which the last average sensor values and average station values are to be calculated. One of the values that can be changed in PRMTRS. Default value of the input data ending time (ETIME) is initialized in subroutine PRMTRS. HH is the hour; MM is the minute; SS is the second.
IFWY	A(341)	ARRAY3	Two (2) character alpha code used for printing the sensor freeway in subroutine PRINT.
IHW	I	BLOCK0	Integer value equal to the decimal value of two (2) bytes plus one (1) (i.e., one hexadecimal byte of 'FFFF' is 65,535 plus one (1) or 65,536).
ILANES	I(13,20)	HEAD	The incident clearance scenario vehicle movement indicators. The leftmost dimension of the array is sequenced in the same order as the incident freeway segment geometry (IFSG) format and is a sequence of zeros (0) and ones (1). A one denotes presence of a vehicle. (See Section 2.3 for details.)

Keyword	Type and Dimension	Labeled Common	Purpose
ILNO	I(341)	ARRAY3	Integer value for printing the sensor type lane number in subroutine PRINT.
ILNTYP	A(341)	ARRAY3	A four (4) character alpha code for printing the sensor type identification. (See LNTCPD for codes.)
IMBAI	I	BLOCK3	The sensor status of the record.
INCDIR	A	HEAD	A one (1) character alpha code that represents the direction of travel of the primary incident location.
INCDWN	I	HEAD	A two (2) character integer value that is the station downstream of the station that is closest to the incident.
IOBUF	A(1024)	BLANK	Contains either the lane Sensor Tape Block or a Continuous Time Series Data Block.
INCFWY	A	HEAD	A two (2) character alpha code that represents the freeway of the primary incident location. (See NOFWYS for codes.)
ITIME	I	BLOCK3	The on-off time in milliseconds of the record.
INCTIM	I(20)	HEAD	The incident clearance scenario event time in the format HHMMSS. HH is the hour; MM is the minute; SS is the second.
ISENS	I	BLOCK3	The sensor index number of the record.
INCTYP	A	HEAD	A four (4) character alpha code that represents the incident type code. The codes are as follows: TCOL - Traffic collision DISL - Disabled vehicle SPIL - Spilled load GAWK - Gawking (rubber necking) NOTH - No apparent reason for incident (Blank) - Special or non-incident input data tape

Keyword	Type and Dimension	Labeled Common	Purpose
INCUP	I	HEAD	A two (2) character integer value that is the station upstream of the station that is closest to the incident.
INDEX	I(341)	ARRAY1	Lane Sensor Index Number Table. The sequential sensor index number. If the corresponding entry is zero, the sensor data is not to be included in the statistical data.
ISTA	I(200)	ARRAY3	A two (2) character integer value used for printing the sensor station in subroutine PRINT.
ISTART	I	BLOCK2	The time in the format HHMMSS for which the first complete average sensor values and average station values can be calculated. One of the values that can be changed in subroutine PRMTRS. Default value of the input data start time (STIME) is initialized in subroutine PRMTRS. HH is the hour; MM is the minute; SS is the second.
IUPDRN	I	VRBL	The logical record count output to tape.
IUPDTM	I	VRBL	The pointer corresponding to the current update time interval. (IUPDTM = 1,2,3,...,MAXUP).
IUPDST	I	VRBL	The first on time of the logical record.
IUPOCC	I(341,16)	ARRAY5	The raw occupancy duration ring buffers for the updating time interval (UPDINT). (See subroutine OCCVOL.)
IUPDET	I	VRBL	The last outline of the logical record.
IUPVOL	I(341,16)	ARRAY5	The raw volume count ring buffers for the updating time interval (UPDINT). (See subroutine OCCVOL.)

Keyword	Type and Dimension	Labeled Common	Purpose
LISTCD	I		Key parameter listing code value. Argument passed between subroutines PRMTRS and DEFLTS. Subroutine DEFLTS lists a message and the key changeable parameters according to the value. < 0 - Message is 'IRRECOVERABLE ERROR'. Allows input to change parameters. = 0 - Message is 'DEFAULT VALUE'. Allows input to change parameters. > 0 - Message is 'VALUES TO BE USED'. Input is not allowed.
LASTR	I	VRBL	The last logical record flag, zero if not last, one if last.
LFACTR	I	CNSTNT	The factor used in subroutine UPDATE for updating the current listing time interval (LSTIME). LFACTR is in milliseconds and is equal to the listing time interval in seconds (LSTINT) multiplied by 1000 milliseconds per second. LFACTR = (LSTINT) x (1000)
LITIME	I(341)	ARRAY4	The last time in milliseconds that the sensor detected a vehicle entering or leaving a sensor or the last update time interval.
LIMITS	I	ARRAY6	The station limit option. A value of 0 indicates use of all the stations on the input data tape.
LNTPCD	A(20)	ARRAY2	A four (4) character alpha code with trailing blanks that represent the appropriate sensor type. Purpose Sensor Type Code / Type Character Code / Description of Sensor Type 1 / LANE / Mainline

Keyword	Type and Dimension	Labeled Common	Purpose

LNTPCD (Cont.) Purpose

Sensor Type Code	Type Character Code	Description of Sensor Type
2	CDA	Collector-distributors
3	CDB	Collector-distributors
4	CONA	Freeway connectors
5	CONB	Freeway connectors
6	OFFA	Off-ramp
7	OFFB	Off-ramp
8	ONA	On-ramp
9	ONB	On-ramp
10	VIOA	Violation counter for metered on-ramps
11	VIOB	Violation counter for metered on-ramps
12	ENVT	Environment - temperature
13	ENVL	Environment - light
14	ENVW	Environment - moisture
15	QUE	On/off-ramp queue
16	SPD	Speed trap
17 - 20	Blank -	Reserved for future use

Some of the sensor types have an appendage code of A or B. These two (2) subcodes are used to differentiate

Keyword	Type and Dimension	Labeled Common	Purpose
LNTPCD (Cont.)			multiple sensor types, in proximity, in the direction of travel, encountered at a freeway station.
LP	I	ALLIO	The logical (or device) unit number assigned to where the program will list the program output.
LPSTA	A,I,A	HEAD	The freeway station closest to the incident. The first word of the array is a two (2) character alpha code that represents the freeway. The second word of the array is a two (2) character integer value that is the station number. The third word of the array is one (1) character alpha code that represents the direction of travel. (See NOFWYS for codes.)
LPTR	I	VRBL	The pointer to the current raw occupancy and volume count ring buffers.
LSTINT	I	BLOCK2	The listing time interval in seconds. One of the values that can be changed in subroutines PRMTRS and DEFLTS. Default value of twenty (20) seconds is initialized in subroutine PRMTRS.
LSTIME	I	VRBL	The listing time interval in milliseconds. LSTIME is incremented by the printing time interval (LFACTR) in subroutine UPDATE if the average sensor and station values are printed.
MAXUP	I	CNSTNT	The total number of complete updating time intervals. MAXUP is equal to one (1) plus the quantity of the ending time interval in seconds (TFINAL) minus the beginning time in seconds (TSTART) divided by the updating time interval in seconds (UPDINT). $MAXUP = \frac{TFINAL - TSTART}{UPDINT} + 1$

Keyword	Type and Dimension	Labeled Common	Purpose
MBAI	I(341)	ARRAY4	Modified, bad, active and inactive state code for the sensor. Modified - the sensor was recently changed from the inactive state to the active state, or vice versa. Bad - a malfunction was detected for this sensor. Active - the sensor was collecting data at this time. Inactive - the sensor was not collecting data at this time.

Code Number	Binary Bits	State
0	0000	inactive
1	0001	active
2	0010	bad, inactive
3	0011	bad, active
4	0100	modified, inactive
5	0101	modified, active
6	0110	modified, bad, inactive
7	0111	modified, bad, active

Keyword	Type and Dimension	Labeled Common	Purpose
MFACTR	I	CNSTNT	The number of raw occupancy duration and volume count ring buffers to be used for calculating the average sensor values and average station values in subroutine CNVRT. MFACTR is the number of updating time intervals in an averaging time interval and is equal to the averaging time interval in seconds (AVGINT) divided by the updating time interval in seconds (UPDINT). $MFACTR = \frac{AVGINT}{UPDINT}$

Keyword	Type and Dimension	Labeled Common	Purpose
MLSTAS	I(2,4)	ARRAY1	The beginning and ending station index numbers of the affected freeway segments. Each pair, MLSTAS (1,I) and MLSTAS (2,I), where I equals 1 through 4, is respectively the beginning and ending station index numbers of the corresponding affected freeway segments.
MLSTOT	I	ARRAY1	The total number of freeway stations excluding the environmental stations.
MPTR	I	CNSTNT	The maximum number of raw occupancy duration and volume count ring buffers used in processing the data set. MPTR is equal to the number of raw occupancy duration and volume count ring buffers used in calculating the average sensor values and average station values (MFACTR) plus one (1). MPTR = MFACTR + 1.
MTIME	I		Absolute starting time in milliseconds calculated by subroutine PRMTRS and passed to subroutines PSTNTP and LSTIN. This is the very first time of a Continuous Time Series Data Block Record for which raw occupancy duration and raw pulse counts are to be collected. This time value is normally set equivalent to the requested start time (ISTART) minus the averaging time interval (AVGINT). If this time is less than the input data tape start time (STIME), it is unconditionally set equivalent to STIME.
MTIMES	I(341)	ARRAY4	The last on time of the speed trap sensors.
NCOUNT	I	HEAD	The number of traffic volume counts at or near the incident site. The maximum is five (5).
NEVENTS	I	HEAD	The number of events in the incident clearance scenario. A maximum of twenty (20) is possible.

Keyword	Type and Dimension	Labeled Common	Purpose
NETIME	I(365)	ARRAY6	The on time of the downstream sensor of the speed trap lane.
NHT	I	HEAD	A two (2) character integer value that is the number of heavy trucks (5 or more axles) involved in the incident.
NI	I	HEAD	A two (2) character integer value code. Attached as an appendage to the DATE, it is the input data type identification. This value is the number of incident and non-incident data tapes made for this particular day, where the numbers less than 50 are for incidents and the numbers greater than or equal to 50 are for non-incidents.
NLANTP	I	ARRAY2	The number of possible different sensor types. There are twenty (20) different sensor types.
NISENS	I(365)	ARRAY6	The sensor index number of the downstream sensor.
NLDV	I	HEAD	A two (2) character integer value that is the number of light duty vehicles (2 axles) involved in the incident.
NLT	I	HEAD	A two (2) character integer value that is the number of light trucks (3 or 4 axles) involved in the incident.
NOCOMM	I	HEAD	The number of additional comment lines in the input data tape header block. A maximum of twenty (20) lines is possible.
NOFWYS	I	ARRAY2	The number of possible different freeway segments. There are eight (8) different freeway segments.

Segment Num.	Freeway	Direction	Upstream Station	Downstream Station
1	SM	E	1	27
2	SM	W	28	1

Keyword	Type and Dimension	Labeled Common	Purpose

NOFWYS (Cont.)

Segment Num.	Freeway	Direction	Upstream Station	Downstream Station
3	SD	N	1	32
4	SD	S	32	1
5	HA	N	1	25
6	HA	S	25	1
7	ST	N	1	10
8		- NOT USED -		

NOSENS	I	CNSTNT	The total number of sensors included in the data set, (includes the environmental sensors).
NSTIME	I(365)	ARRAY6	The on time of the upstream sensor of the speed trap lane.
NPTR	I	VRBL	The pointer to the next raw occupancy and volume count ring buffers.
NSENS	I(170)	ARRAY1	Freeway Station Total Sensor Table. The total number of sensors for each freeway station.
NSGMTS	I	HEAD	The total number of affected segments on the input data tape. A maximum of four (4) segments is possible.
NUMBER	I	BLOCK3	The record number of the Current Continuous Time Series Data Block to be decoded.
OUTPUT	I	CNSTNT	An integer value specifying the form of output wanted. 0 - Listing of Header Block and Lane Sensor Table only. 1 - Listing of Header Block, Lane Sensor Table and computed sensor and station data. 2 - Write the input tape Header Block, Lane Sensor Table and computed sensor and station data to output tape.

Keyword	Type and Dimension	Labeled Common	Purpose
OUTPUT (Cont.)			3 - Both 1 and 2. One of the values that can be changed in subroutine PRMTRS. Default value of zero (0) is initialized in subroutine DEFLTS.
PFACTR	R	CNSTNT	A factor used in subroutine CNVRT for calculating occupancy percent from the occupancy duration. PFACTR is equal to 100 percent divided by the number of sensor status samples per second (SMPLRT) multiplied by the number of seconds in the updating interval (UPDINT). $PFACTR = \frac{100}{(SMPLRT) \times (UPDINT)}$
PSTML	I	HEAD	A five (5) character integer value of the estimated post mile of where the incident occurred. The value is 100 times the real value.
PUT	I	ALLIO	The logical (or device) unit number assigned to where the program will write error and verification messages.
RDEN	R(341)	ARRAY6	The average sensor density for the averaging time interval (AVGINT).
ROAD	A	HEAD	A one (1) character alpha pavement condition code. D - dry P - damp W - wet
ROCC	R(341)	ARRAY6	The average sensor occupancy percent for the averaging time interval (AVGINT).
RSPD	R(341)	ARRAY6	The average sensor speed for the averaging time interval (AVGINT).
RVLH	R(341)	ARRAY6	The average sensor volume per lane per hour for the averaging time interval (AVGINT).
RVOL	R(341)	ARRAY6	The average sensor volume for the averaging time interval (AVGINT).

Keyword	Type and Dimension	Labeled Common	Purpose
SIGN	A,I	HEAD	F.A.S.S. sign code closest to the incident location. The first word of the array is a one (1) character alpha code that represents the freeway direction. (See NOFWYS for code.) Note: As of June 30, 1974, the Santa Monica Freeway is the only freeway with changeable message signs. The second word of the array is a two (2) character integer value that is the number of the sign. See Appendix B.
SINDEX	I(171)	ARRAY1	The beginning sensor index number for each freeway station including environmental stations. The last entry in SINDEX (TOTSTA + 1) is NOSENS + 1.
SMPLRT	I	BLOCK2	The number of sensor samples per second at which the CTSDR were collected. One of the values that can be changed in subroutine PRMTRS. Default value of 15 (for LAAFSCP loop freeways: Santa Monica, San Diego and Harbor) is initialized in subroutine PRMTRS.
SPEEDS	R(365)	ARRAY6	The calculated speed of the speed trap lane.
STARTM	I(5)	HEAD	The start time of the traffic volume counts in HHMMSS where HH is the hour; MM is the minute; and SS is the second.
STATUS	I(341)	ARRAY4	The on or off status code for the sensors. One (1) indicates that a vehicle is currently on the sensor. Zero (0) indicates that a vehicle is currently not on the sensor.
STIME	I	BLOCK1	The input data tape starting time in the format HHMMSS where HH is the hour; MM is the minute; and SS is the second.
STOPTM	I(5)	HEAD	The stop time of the traffic volume counts in HHMMSS format where HH is the hour; MM is the minute; and SS is the second.

Keyword	Type and Dimension	Labeled Common	Purpose
TCNT	R(341)	ARRAY4	The total number of accumulated speeds for the speed trap sensors.
TFINAL	I	BLOCK2	The time in seconds for which the last average sensor values and average station values are to be calculated.
TOTSTA	I	ARRAY1	The total number of freeway stations including the environmental stations.
TPIN	I	ALLIO	The logical (or device) unit number the program will read the input data tape.
TPOUT	I	ALLIO	The logical (or device) unit number the program will write.
TRAFF	I	HEAD	One (1) character integer value code indicating the traffic conditions. Incident data sets: 1 -- stop-and-go, speeds < 30 mph, occupancy > 24%. 2 -- free-flowing, ≥ 1400 vph. 3 -- free-flowing, ≥ 700 vph and ≤ 1400 vph. 4 -- free-flowing, < 700 vph. Non-incident data sets: 5 -- congested, occupancy up to 40%. 6 -- non-congested, occupancy up to 30%, ≥ 1400 vph. 7 -- non-congested, occupancy up to 20%, ≥ 700 vph and ≤ 1400 vph. 8 -- non-congested, occupancy up to 10%, < 700 vph.
TSPD	R(341)	ARRAY4	The total accumulated speed for the speed trap sensors.
TSTART	I	BLOCK2	The time in seconds for which the first complete average sensor values and average station values can be calculated.

Keyword	Type and Dimension	Labeled Common	Purpose
TSPDS	R(365)	ARRAY6	The calculated accumulated speed of the speed trap lane.
UFACTR	I	CNSTNT	The factor used in subroutine UPDATE for updating the current update time interval (UPDTIM). UFACTR is in milliseconds and is equal to the update time interval in seconds (UPDINT) multiplied by 1000 milliseconds per second. UFACTR = (UPDINT) x (1000)
UPDINT	I	BLOCK2	The updating time interval in seconds. One of the values that can be changed in subroutine PRMTRS. Default value of 20 seconds is initialized in subroutine PRMTRS.
UPDTIM	I	VRBL	The updating time interval in milliseconds. UPDTIM is incremented by the updating time interval factor (UFACTR) in subroutine UPDATE.
VCOUNT	I(5)	HEAD	The number of vehicles counted during the traffic volume counts.
VERSRC	A	HEAD	A one (1) character alpha code representing the incident verification source. H - Helicopter C - CHP V - Verification patrol unit R - Radio monitor S - Computer
VERTIM	I	HEAD	The time in the format HHMMSS that the incident was verified by the VERSRC.
VISBL	A	HEAD	A one (1) character alpha code representing the visibility. S - Sunny H - Hazy O - Overcast F - Foggy D - Dark

Keyword	Type and Dimension	Labeled Common	Purpose
WETHER	A	HEAD	A one (1) character alpha code representing the weather condition. C - Clear L - Light rain H - Heavy rain

APPENDIX B

INPUT DATA TAPE HEADER BLOCK

/COMMON/	VARIABLE NAME	INPUT FORMAT	REL. BYTE LOC.
BLOCK1	DATE	I6	1-6
HEAD	NI	I2	7,8
	TRAFF	I1	9
BLOCK1	STIME	I6	10-15
	ETIME	I6	16-21
HEAD	NSGMTS	I2	22,23
	AFFFWY(1)	A2	24,25
	AFFDIR(1)	A1	26
	AFFUP(1)	I2	27,28
	AFFDWN(1)	I2	29,30
	⋮		31,44
	AFFFWY(4)	A2	45,46
	AFFDIR(4)	A1	47
	AFFUP(4)	I2	48,49
	AFFDWN(4)	I2	50,51
	WETHER	A1	52
	VISBL	A1	53
	ROAD	A1	54
	INCFWY	A2	55,56
	INCDIR	A1	57
	INCUP	I2	58,59
	INCDWN	I2	60,61
	SIGN(1)	A1	62
	SIGN(2)	I2	63,64
	CALLBX(1)	A2	65.66
	CALLBX(2)	I3	67-79
	PSTML	I5	70-74
	LPSTA(1)	A2	75,76
	LPSTA(2)	I2	77,78
	LPSTA(3)	A1	79
	DETSRC	A1	80
	DETIME	I6	81-86
	VERSRC	A1	87
	VERTIM	A6	88-93
	INCTYP	A4	94-97
	NLDV	I2	98.99
	NLT	I2	100,101
	NHT	I2	102,103
	NEVNTS	I2	104,105
	GMTRYL(1)	I1	106
	⋮		(107-117)
	GMTRYL(13)	I1	118
	GMTRYC(1)	A4	119-122
	⋮		(123-134)
	GMTRYC(5)	A4	135-138

/COMMON/	VARIABLE NAME	INPUT FORMAT	REL. BYTE LOC.
HEAD	INCTIM(1)	I6	139-144
	ILANES(1,1)	I1	145
	:		(146-156)
	ILANES(13,1)	I1	157
	ICMMNT(1,1)	A4	158-161
	:		(162-173)
	ICMMNT(5,1)	A4	174-177
	: : :		178-879
	INCTIM(20)	I6	880-885
	ILANES(1,20)	I1	886
	:		(887-897)
	ILANES(13,20)	I1	898
	ICMMNT(1,20)	A4	899-902
	:		(903-914)
	ICMMNT(5,20)	A4	915-918
	NCOUNT	I2	919,920
	STARTM(1)	I6	921-926
	STOPTM(1)	I6	927-932
	DURATN(1)	I3	933-935
	VCOUNT(1)	I4	936-939
	:		(940-996)
	STARTM(5)	I6	997-1002
	STOPTM(5)	I6	1003-1008
	DURATN(5)	I3	1009-1011
	VCOUNT(5)	I4	1012-1015
ARRAY2	NOFWYS	I2	1016,1017
	FRWYS(1)	A2	1018,1019
	:		(1020-1031)
	FRWYS(8)	A2	1032,1033
	DIRCTS(1)	A1	1034
	:		(1035-1040)
	DIRCTS(8)	A1	1041
	NLANTP	I2	1043,1043
	LNTPCD(1)	A4	1044-1047
	:		(1048-1119)
	LNTPCD(2)	A4	1120-1123
NCSTNT	NOSENS	I3	1124-1126
HEAD	NOCOMM	I2	1127,1128
	COMMNT(1,1)	A4	1129-1132
	: :		(1133-1192)
	COMMNT(17,1)	A4	1193-1196
	: : : :		(1197-2420)
	COMMNT(1,20)	A4	2421-2424
	:		(2425-2484)
	COMMNT(17,20)	A4	2485-2488

/COMMON/	VARIABLE NAME	INPUT FORMAT	REL. BYTE LOC.
ARRAY1	IASGMT(1,1)	I3	2489-2491
	IASGMT(2,1)	I3	2492-2494
	: :		(2495-2512)
	IASGMT(1,5)	I3	2513-2515
	IASGMT(2,5)	I3	2516-2518
	TOTSTA	I3	2519-2521
	SINDEX(1)	I3	2521-2524
	:		(2525-3031)
	SINDEX(171)	I3	3032-3034
	MLSTAS(1,1)	I3	3035-3037
	MLSTAS(2,1)	I3	3038-3040
	: :		(3041-3052)
	MLSTAS(1,4)	I3	3053-3055
	MLSTAS(2,4)	I3	3056-3058
	MLSTOT	I3	3059-3061
	ACTLNS(1)	I1	3062-
	:		(3063-3230)
	ACTLNS(170)		-3231

FEDERALLY COORDINATED PROGRAM OF HIGHWAY RESEARCH AND DEVELOPMENT (FCP)

The Offices of Research and Development of the Federal Highway Administration are responsible for a broad program of research with resources including its own staff, contract programs, and a Federal-Aid program which is conducted by or through the State highway departments and which also finances the National Cooperative Highway Research Program managed by the Transportation Research Board. The Federally Coordinated Program of Highway Research and Development (FCP) is a carefully selected group of projects aimed at urgent, national problems, which concentrates these resources on these problems to obtain timely solutions. Virtually all of the available funds and staff resources are a part of the FCP, together with as much of the Federal-aid research funds of the States and the NCHRP resources as the States agree to devote to these projects.*

FCP Category Descriptions

1. Improved Highway Design and Operation for Safety

Safety R&D addresses problems connected with the responsibilities of the Federal Highway Administration under the Highway Safety Act and includes investigation of appropriate design standards, roadside hardware, signing, and physical and scientific data for the formulation of improved safety regulations.

2. Reduction of Traffic Congestion and Improved Operational Efficiency

Traffic R&D is concerned with increasing the operational efficiency of existing highways by advancing technology, by improving designs for existing as well as new facilities, and by keeping the demand-capacity relationship in better balance through traffic management techniques such as bus and carpool preferential treatment, motorist information, and rerouting of traffic.

3. Environmental Considerations in Highway Design, Location, Construction, and Operation

Environmental R&D is directed toward identifying and evaluating highway elements which affect the quality of the human environment. The ultimate goals are reduction of adverse highway and traffic impacts, and protection and enhancement of the environment.

4. Improved Materials Utilization and Durability

Materials R&D is concerned with expanding the knowledge of materials properties and technology to fully utilize available naturally occurring materials, to develop extender or substitute materials for materials in short supply, and to devise procedures for converting industrial and other wastes into useful highway products. These activities are all directed toward the common goals of lowering the cost of highway construction and extending the period of maintenance-free operation.

5. Improved Design to Reduce Costs, Extend Life Expectancy, and Insure Structural Safety

Structural R&D is concerned with furthering the latest technological advances in structural designs, fabrication processes, and construction techniques, to provide safe, efficient highways at reasonable cost.

6. Prototype Development and Implementation of Research

This category is concerned with developing and transferring research and technology into practice, or, as it has been commonly identified, "technology transfer."

7. Improved Technology for Highway Maintenance

Maintenance R&D objectives include the development and application of new technology to improve management, to augment the utilization of resources, and to increase operational efficiency and safety in the maintenance of highway facilities.

* The complete 7-volume official statement of the FCP is available from the National Technical Information Service (NTIS), Springfield, Virginia 22161 (Order No. PB 242037, price $45 postpaid). Single copies of the introductory volume are obtainable without charge from: Program Analysis (HRD-2), Offices of Research and Development, Federal Highway Administration, Washington, D.C. 20590.