REST AREA SIMULATION MODEL

LAST COPY
DO NOT REMOVE FROM LIBRARY

MICHIGAN DEPARTMENT OF STATE HIGHWAYS

REST AREA SIMULATION MODEL

L. E. DeFrain

Research Laboratory Section
Testing and Research Division
Research Project 71 TI-58
Research Report No. R-864

Michigan State Highway Commission
E. V. Erickson, Chairman; Charles H. Hewitt,
Vice-Chairman, Claude J. Tobin, Peter B. Fletcher
Lansing, June 1973

The information contained in this report was compiled exclusively for the use of the Michigan Department of State Highways. Recommendations contained herein are based upon the research data obtained and the expertise of the researchers, and are not necessarily to be construed as Department policy. No material contained herein is to be reproduced—wholly or in part—without the expressed permission of the Engineer of Testing and Research.

A model of Rest Area use by freeway motorists has been developed. Using Monte Carlo techniques, an attempt has been made to characterize the individual movements of people within the park. Since these movements cannot be expressed in a deterministic equation, approximate solutions may be obtained by simulating a stochastic process whose movements and probability density functions have been determined.

Simulation makes it possible to study and experiment with the complex internal interactions of the rest area by making alterations in the model and observing the effects of these changes on the system behavior. Simulation can also yield valuable insight into which variables are more important than others.

Since this model is an abstraction of the real world a certain number of simplifying assumptions have been made. Only through use of the model and comparison with measured data can these assumptions be verified.

Although the model is complete, the user should not feel that input or output variables and format are fixed. The program has been written to facilitate modifications. If costs can be applied to such things as extra rest rooms or drinking fountains or park maintenance; an economic analysis can also be included in the model.

The program is written in FORTRAN IV for the Burroughs B5500 time sharing system. The program currently exists on disc under file name "QD1261/QTANDR."

The execution time is approximately 3 minutes per hour of simulation. The output is to remote unit. It is recommended that the program be run using the schedule option with process time set at 3600 sec. If the user wishes to run program in batch mode, the program can be easily modified.

The following assumptions have been incorporated into the design of the model.

1. An individual can use only one service at a time.
2. Selection of services by an individual are independent; but ordered.
3. The times required to enter and exit the rest area are ignored.
4. Vehicle arrival times are Poisson distributed with exponential arrival times.
5. An individual is dissatisfied with a service or facility only if it is not available.
6. An individual will wait in line for a service until it is available.
7. Individuals are assigned to desired services on a first-come - first-serve basis.
8. A vehicle cannot leave rest area until all individuals within the vehicle have used all services desired.

Model Input Parameters

The following variables are selectable by the user. Their values are a function of the rest area type, hour of day, and day of week. Values for facility service times and number of services required have been obtained through measurements taken at six rest areas by the Transportation Planning Division. Photographs of each rest area in the 1972 study are included. Partial results of measurements obtained at each site are presented in Table 1. The model input parameters in order of input follow:

1. Number of hours the user wishes to simulate.
2. The hourly vehicle volumes on the highway and the percent that turn in to the rest area for each hour of simulation.
3. The availability of a facility, the number of units, mean service times, standard deviation, and percent of people using each facility.
    a) Picnic table
    b) Men's rest room
    c) Women's rest room
    d) Sleep or rest facility
    e) Jug filling
    f) Drinking fountain
    g) Information booth
    h) Telephone
    i) Vehicles parking - overnight or out-of-order
4. Number of parking spaces available.
5. Percent of vehicle types using highway.
    a) Passenger car
    b) Passenger car with trailer
    c) Pick-up camper
    d) Trucks
    e) Other
6. The expected number of services required and standard deviation.

Model Output Parameters

The model is designed to output several different types of information.

Type 1 - Arrivals and Departures for each hour

The arrival times of vehicles together with the vehicle type, number of passengers, and total number of each service desired are given. Number is assigned to each vehicle for reference purposes.

The vehicle number and total time in rest area is given for each vehicle as it departs.

Type 2 - Input Data

Input data used for that hour of simulation are given along with the following:

a) Number using services at end of hour
b) Total use time for the hour
c) Waiting time for each service
d) Number of people served
e) Number of people dissatisfied (service not available).

Type 3 - Facility Use Histograms

A histogram of facility use is given for each service. The histogram gives the distribution of individual use times in seconds. This information accumulates over the period of simulation.

Type 4 - Facility Waiting Time Histograms

A frequency distribution is also given for waiting times at each of the facilities. The times are given in seconds and the cell counts accumulate during the simulation period.

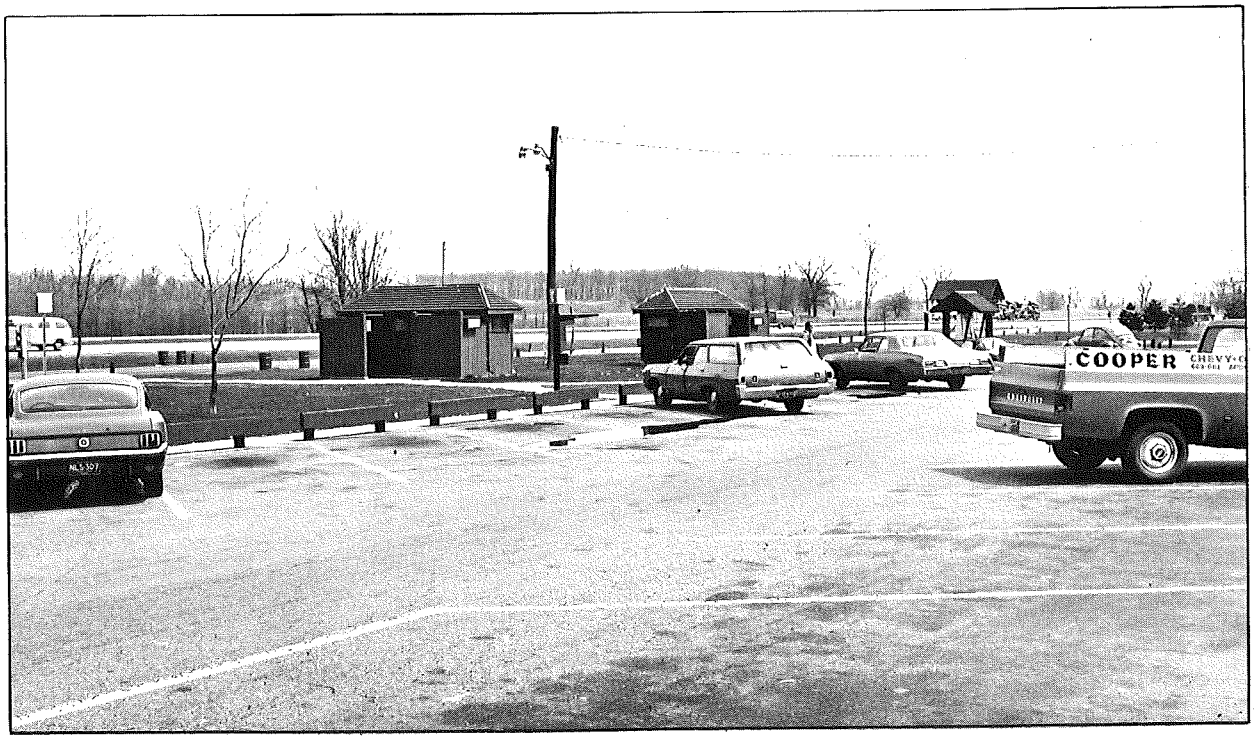
Type 5 - Rest Area Time Histogram

A histogram of total time in the rest area is given. The times do not include vehicle entrance and exit.

SUMMER 1972 REST AREA SERVICE TIMES IN SECONDS

Service Used		Park Number																	
		236			403			707			814			817			905		
		Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun
Length Stay	$\bar{m}$	838	1234	1280	850	760	748	1011	986	1100	698	890	898	683	2124	800	1020	661	680
	s	1033	1729	1459	810	749	723	957	1143	1414	725	953	1080	739	6253	1046	1332	853	1263
	N	130	197	208	198	191	191	172	174	188	147	163	272	202	228	214	108	207	172
Mens R. R.	$\bar{m}$	62	68	61	117	98	120	128	124	131	118	114	113	65	71	60	64	63	64
	s	38	50	37	76	64	96	116	79	89	101	75	75	74	85	35	44	50	44
	N	96	144	143	171	172	199	188	332	302	212	221	234	260	288	301	160	167	162
Womens R. R.	$\bar{m}$	86	87	79	168	156	164	180	206	207	154	185	172	90	88	80	86	92	92
	s	53	54	57	83	78	93	93	103	360	79	106	72	57	47	50	40	62	46
	N	72	93	117	149	150	174	149	263	230	133	159	200	155	211	223	43	96	99
Picnic Table	$\bar{m}$	775	1872	2644	1126	938	1374	1383	1451	1475	827	967	1245	955	3403	1713	1076	1564	2292
	s	732	1158	2927	800	563	853	861	788	1543	942	839	1742	593	6660	2358	918	1451	2710
	N	9	65	75	52	34	58	79	74	88	50	70	117	37	87	93	23	53	59
Telephone	$\bar{m}$	256	389	227	274	165	288	164	269	284	201	217	290	323	172		233	211	129
	s	139	335	113	212	96	145	100	170	203	167	180	221	260	92	0	180	186	102
	N	10	9	5	10	9	10	21	13	10	35	13	25	18	2		62	24	16
Fountain	$\bar{m}$	8	8	8	8	7	8	8	8	8	8	6	8	8	8	8	8	8	8
	s	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	N	107	162	255	264	174	281	86	36	82	251	348	410	359	497	599	96	449	581
Jug Filling	$\bar{m}$	53	53	53	41	41	41	55	55	55	36	36	36	35	35	35	33	33	33
	s	44	44	44	26	26	26	41	41	41	26	26	26	20	20	20	17	17	17
	N	0	38	0	0	27	0	0	38	0	0	25	0	0	115	0	0	63	0
Information	$\bar{m}$				44	49	43							62	78	102			88
	s	0	0	0	38	44	43	0	0	0	0	0	0	80	62	150	0	0	75
	N				183	135	190							36	56	36			45
Number Services	$\bar{m}$	2.1	3.1	3.6	3.0	2.5	2.7	3.4	2.8	3.0	2.1	2.3	2.6	1.3	2.1	2.0	1.4	2.4	2.3
	s	1.9	2.5	2.7	2.5	2.0	2.0	2.5	1.8	2.3	2.1	2.0	2.5	1.3	1.6	1.9	1.7	2.2	1.9
	N	48	38	32	67	64	67	49	72	69	98	79	86	93	87	78	59	55	60
Percent Used	TEL	2	1	0	1	0	1	2	2	2	2	2	2	1	0	0	8	1	2
	WAT	20	32	35	19	5	11	30	20	23	18	15	18	30	22	39	32	44	51
	INFO	1	4	3	12	9	16	5	8	10	9	6	10	2	4	6	7	6	7
	MRR	42	38	31	29	36	38	29	35	30	44	40	36	50	43	34	38	28	25
	WRR	34	20	25	35	46	31	29	30	30	22	32	30	16	29	18	10	16	13
	PIC	1	5	6	4	4	3	5	5	5	5	5	4	1	2	3	5	5	2

Eastbound I 94, south of New Buffalo (Park No. 707).



Eastbound I 94, west of Ann Arbor (Park No. 817).

Figure 1. Rest Area Classification I (Normal).

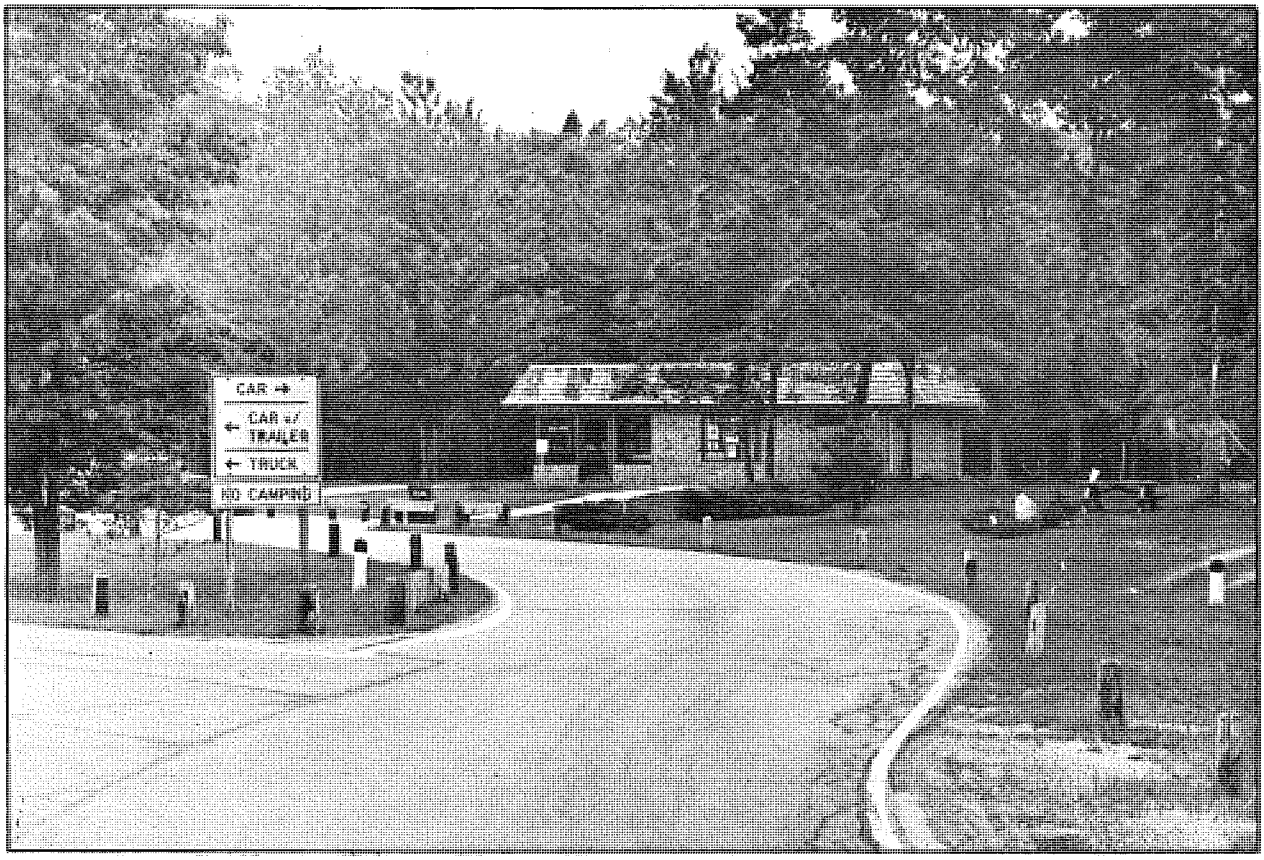


Figure 2. Rest Area Classification II (Tourist). Northbound I 75, south of Grayling (Park No. 403).

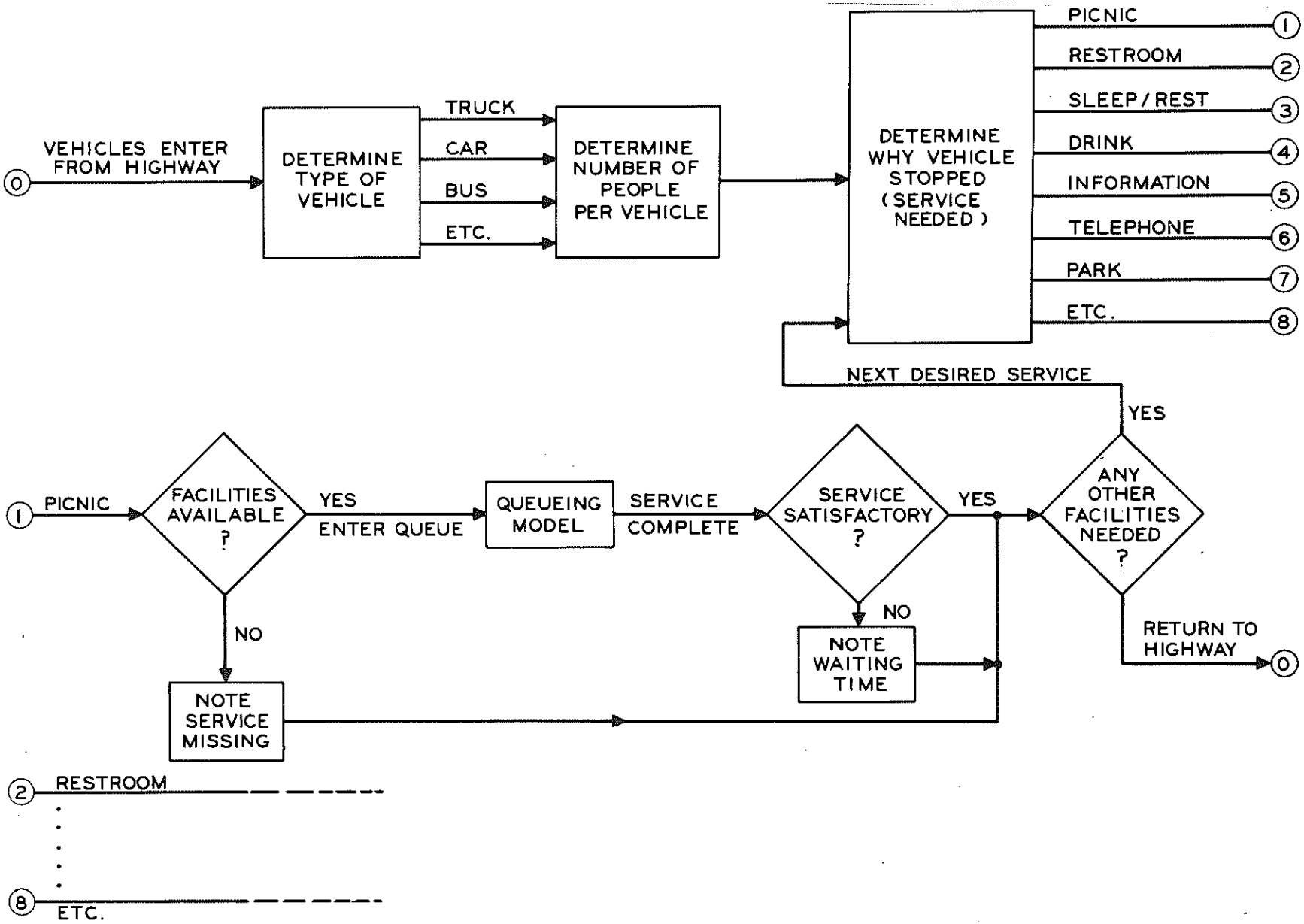
Eastbound I 96, west of Novi (Park No. 905).

Southbound US 23, north of Ann Arbor (Park No. 814).

Figure 3. Rest Area Classification III (Metropolitan).

Figure 4. Rest Area Classification IV (Rustic). Northbound I 75, south of Sault Ste. Marie (Park No. 236).

FLOW CHART OF COMPUTER SIMULATION MODEL


VEHICLES ENTER FROM HIGHWAY
0
DETERMINE TYPE OF VEHICLE
TRUCK
CAR
BUS
ETC.
DETERMINE NUMBER OF PEOPLE PER VEHICLE
DETERMINE WHY VEHICLE STOPPED (SERVICE NEEDED)
PICNIC 1
RESTROOM 2
SLEEP/REST 3
DRINK 4
INFORMATION 5
TELEPHONE 6
PARK 7
ETC. 8
NEXT DESIRED SERVICE
YES
1 PICNIC
FACILITIES AVAILABLE ?
YES
ENTER QUEUE
QUEUEING MODEL
SERVICE COMPLETE
SERVICE SATISFACTORY ?
YES
ANY OTHER FACILITIES NEEDED ?
NO
NOTE SERVICE MISSING
NO
NOTE WAITING TIME
RETURN TO HIGHWAY
0
2 RESTROOM
8 ETC.

TYPICAL OUTPUT FORMAT
Computer Simulation Results for the First Hour

```
 1
 2  RUN QD1261 WITH PROCESS=3600
 3  COMPILING.
 4
 5
 6  END COMPILE 35.5 SEC.
 7
 8  RUNNING
 9
10
11  HOW MANY HOURS DO YOU WANT TO SIMULATE ?
12 ? 6
13  INPUT HOURLY VOLUME AND % TURN IN FOR EACH HOUR
14 ? 1290,3.0,1932,3.4,2568,3.0,2901,4.6,2972,2.8,3203,3.0,
15           INDICATE WHAT SERVICES ARE AVAILABLE WITH A 1
16           NO. OF SERVICES, SERVICE TIME(SEC),STD. DEV.
17           AND THE PERCENT OF USAGE(INDIVIDUAL)
18  AVAIL=NUMB=SERTME=STD DEV= PERCENT
19  PICNIC TABLES
20 ? 1,24,2644,2927,6
21  MENS REST ROOM FACILITIES
22 ? 1,8,61,37,31
23  WOMENS REST ROOM FACILITIES
24 ? 1,8,78,57,25
25  SLEEP OR REST FACILITIES
26 ? 0,0,0,0,0
27  WATER JUG FILLING
28 ? 1,1,60,30,1
29   DRINKING FOUNTIAN DATA
30 ? 1,1,11,9,35
31  INFORMATION SERVICE FACILITIES
```

```
32 ? 0,0,0,0,0
33  TELEPHONE BOOTH DATA
34 ? 1,2,227,113,2
35  VEHICLES PARKING OVERNIGHT
36 ? 0,0,0,0,0
37  HOW MANY PARKING SPACES IN R.A.?
38 ? 78
39  GIVE % FOR EACH VEHICLE TYPE IN FOLLOWING ORDER
40  CAR,CAR/TR, PICK-UPS , TRUCKS , OTHER
41 ? 80,11,5,2,2
42  GIVE AVERAGE NUMB SER WANTED AND STD DEV
43 ? 3.2,1.2
44 1                    BEGIN SIMULATION FOR   1 HOUR
45      1  VEHICLE TYPE= 1   TIME=  16.00
46  0   2   4   0   1   2   0   2   0      4
47      2  VEHICLE TYPE= 1   TIME=  16.42
48  0   2   1   0   1   2   0   0   0      2
49      3  VEHICLE TYPE= 1   TIME=  17.42
50  1   1   4   0   0   4   0   0   0      4
51      4  VEHICLE TYPE= 1   TIME=  17.75
52  0   3   3   0   0   3   0   0   0      3
53      5  VEHICLE TYPE= 1   TIME=  18.42
54  0   2   4   0   0   3   0   0   0      4
55                                          2 LEAVING  TIME=    5.42
56                                          4 LEAVING  TIME=    5.92
57                                          5 LEAVING  TIME=    5.67
58      6  VEHICLE TYPE= 1   TIME=  24.42
59  1   1   1   0   0   3   0   0   0      3
60      7  VEHICLE TYPE= 1   TIME=  25.33
61  1   2   2   0   0   1   0   0   0      3
62      8  VEHICLE TYPE= 3   TIME=  25.92
63  1   2   2   0   0   1   0   0   0      3
64      9  VEHICLE TYPE= 1   TIME=  28.50
```

```
65  1   3   3   0   0   2   0   0   0       3
66                                              1 LEAVING  TIME=   12.92
67     10  VEHICLE TYPE= 1   TIME=  29.67
68  3   4   4   0   0   4   0   1   0       5
69     11  VEHICLE TYPE= 3   TIME=  35.75
70  0   1   1   0   0   1   0   0   0       1
71                                              6 LEAVING  TIME=   15.08
72     12  VEHICLE TYPE= 1   TIME=  41.17
73  3   5   3   0   0   4   0   0   0       5
74     13  VEHICLE TYPE= 1   TIME=  41.42
75  1   2   3   0   0   3   0   0   0       3
76                                             11 LEAVING  TIME=    8.08
77     14  VEHICLE TYPE= 1   TIME=  49.25
78  1   1   2   0   0   1   0   0   0       2
79     15  VEHICLE TYPE= 2   TIME=  49.50
80  0   3   3   0   0   1   0   0   0       3
81     16  VEHICLE TYPE= 1   TIME=  49.67
82  0   2   2   0   0   1   0   0   0       2
83     17  VEHICLE TYPE= 1   TIME=  52.42
84  0   1   2   0   0   2   0   0   0       2
85     18  VEHICLE TYPE= 1   TIME=  53.75
86  0   4   4   0   0   6   0   1   0       6
87     19  VEHICLE TYPE= 1   TIME=  54.75
88  0   0   1   0   0   2   0   1   0       2
89                                             16 LEAVING  TIME=    5.17
90                                             15 LEAVING  TIME=    5.50
91     20  VEHICLE TYPE= 1   TIME=  55.75
92  0   1   1   0   0   1   0   0   0       1
93     21  VEHICLE TYPE= 3   TIME=  57.33
94  0   3   1   0   0   1   0   0   0       3
95                                             17 LEAVING  TIME=    4.92
96     22  VEHICLE TYPE= 1   TIME=  58.17
97  1   2   1   0   0   2   0   0   0       2
```

```
98 1          REST AREA SIMULATION
99
100           RESULTS FOR   1 HOUR
101           TIME INCREMENT=5.00SECONDS
102
103           THE EXPECTED NUMBER OF VEHICLES ENTERING R.A./HR=     39
104           VEHICLES ON HIGHWAY=  1290
105           PERCENT TURN IN =3.00
106           EXPECTED TIME BETWEEN TURN IN=  93 SEC
107           NUMBER OF VEHICLES THAT LEFT
108           BECAUSE OF LACK OF PARKING SPACES=   0
109                     INPUT DATA
110
111
112                PIC  M RR  F RR  SLP  JUG FILL  DRK  INFO   T   PK
113  SER AVAILABLE   1    1    1    0       1       1    0    1    0
114  NUMB OF FACIL  24    8    8    0       1       1    0    2    0
115  EXPT SER TIME 2644   61   78    0      60      11    0  227    0
116  STD DEV SEC   2927   37   57    0      30       9    0  113    0
117  % USE SER        6   31   25    0       1      35    0    2    0
118  NUMBER SERVICES REQD= 0.0STD DEV= 0.0
119
120
121                     RESULTS OF SIMULATION FOR   1  HOUR
122
123
124               PICNIC  M RR  F RR   SLP  JUG FILL   DRK   INFO  TEL  PARK
125
126  NUMBER USING    10     1     2     0        0       1     0     0
127 SERVICE AT END OF HOUR
128
129  FACILITY USE   760    40    55     0        0       7     0    11
130  TIME DURING HOUR...MIN
```

```
WAITING TIME     0     0     0     0        0        3     0     0
FOR FACILITY...MIN

NUMB SERVED      4    41    42     0        2       37     0     3

NUMB DISSAT      0     0     0     0        0        0     0     0
SERVICE NOT AVAILABLE

TOTAL VEHICLE TIME IN R.A.FOR VEH LEAVING DURING HOUR =    1.14  HR.

NUMBER OF CARS IN R.A.=   13
NUMBER OF PEOPLE IN R.A. =   42
1          FACILITY HISTOGRAM DATA FOR SERVICE TIMES


PICNIC TABLES
       2       2       0       2       0       1       1       2       1       0
     571    1142    1713    2284    2855    3426    3997    4568    5139    5710

       0       2       1       0       0       0       0       0       0       0
    6281    6852    7423    7994    8565    9136    9707   10278   10849   11420

MENS REST ROOM
       4       3       2       3       2       6       1       0       2       4
       8      16      24      32      40      48      56      64      72      80

       5       4       2       0       3       0       0       0       0       1
      88      96     104     112     120     128     136     144     152     160

WOMENS REST ROOM
       4       5       4       1       3       2       2       6       4       5
      12      24      36      48      60      72      84      96     108     120
```

```
       2       0       3       2       0       0       0       1       0       0
     132     144     156     168     180     192     204     216     228     240

SLEEP-AND-REST
       0       0       0       0       0       0       0       0       0       0
       0       0       0       0       0       0       0       0       0       0

       0       0       0       0       0       0       0       0       0       0
       0       0       0       0       0       0       0       0       0       0

       0       1       0       0       0       1       0       0       0       0
       7      14      21      28      35      42      49      56      63      70

       0       0       0       0       0       0       0       0       0       0
      77      84      91      98     105     112     119     126     133     140

DRINKING FOUNTIAN
       7       2       1       0       0       0       2       0       2       0
       1       2       3       4       5       6       7       8       9      10

       2       2       0       3       2       5       2       1       0       7
      11      12      13      14      15      16      17      18      19      20

INFORMATION SERVICE
       0       0       0       0       0       0       0       0       0       0
       0       0       0       0       0       0       0       0       0       0

       0       0       0       0       0       0       0       0       0       0
       0       0       0       0       0       0       0       0       0       0

TELEPHONE BOOTH
```

```
197      0     0     0     0     0     0     0     2     0     1
198     28    56    84   112   140   168   196   224   252   280
199
200      0     0     0     0     0     0     0     0     0     0
201    308   336   364   392   420   448   476   504   532   560
202
203  PARKING SPACES
204      0     0     0     0     0     0     0     0     0     0
205      0     0     0     0     0     0     0     0     0     0
206
207      0     0     0     0     0     0     0     0     0     0
208      0     0     0     0     0     0     0     0     0     0
209
210          FACILITY HISTOGRAM DATA FOR WAITING TIMES
211
212
213  PICNIC TABLES
214      0     0     0     0     0     0     0     0     0     0
215    571  1142  1713  2284  2855  3426  3997  4568  5139  5710
216
217      0     0     0     0     0     0     0     0     0     0
218   6281  6852  7423  7994  8565  9136  9707 10278 10849 11420
219
220  MENS REST ROOM
221      0     0     0     0     0     0     0     0     0     0
222      8    16    24    32    40    48    56    64    72    80
223
224      0     0     0     0     0     0     0     0     0     0
225     88    96   104   112   120   128   136   144   152   160
226
227  WOMENS REST ROOM
228      0     0     0     0     0     0     0     0     0     0
229     12    24    36    48    60    72    84    96   108   120
```

```
230
231      0     0     0     0     0     0     0     0     0     0
232    132   144   156   168   180   192   204   216   228   240
233
234  SLEEP-AND-REST
235      0     0     0     0     0     0     0     0     0     0
236      0     0     0     0     0     0     0     0     0     0
237
238      0     0     0     0     0     0     0     0     0     0
239      0     0     0     0     0     0     0     0     0     0
240
241  JUG FILLING
242      0     0     1     0     0     0     0     0     0     0
243      7    14    21    28    35    42    49    56    63    70
244
245      0     0     0     0     0     0     0     0     0     0
246     77    84    91    98   105   112   119   126   133   140
247
248  DRINKING FOUNTIAN
249      0     0     0     0     4     0     0     0     0     0
250      1     2     3     4     5     6     7     8     9    10
251
252      0     0     0     0     2     0     0     0     0     4
253     11    12    13    14    15    16    17    18    19    20
254
255  INFORMATION SERVICE
256      0     0     0     0     0     0     0     0     0     0
257      0     0     0     0     0     0     0     0     0     0
258
259      0     0     0     0     0     0     0     0     0     0
260      0     0     0     0     0     0     0     0     0     0
261
262  TELEPHONE BOOTH
```

```
263        0      0      0      0      0      0      0      0      0      0
264       28     56     84    112    140    168    196    224    252    280
265
266        0      0      0      0      0      0      0      0      0      0
267      308    336    364    392    420    448    476    504    532    560
268
269  PARKING SPACES
270        0      0      0      0      0      0      0      0      0      0
271        0      0      0      0      0      0      0      0      0      0
272
273        0      0      0      0      0      0      0      0      0      0
274        0      0      0      0      0      0      0      0      0      0
275
276            HISTOGRAM DATA FOR TOTAL TIME IN R.A.
277
278
279        0      6      1      0      1      1      0      0      0      0
280
281      180    360    540    720    900   1080   1260   1440   1620   1800
282
283        0      0      0      0      0      0      0      0      0      0
284     1980   2160   2340   2520   2700   2880   3060   3240   3420   3600
285
286 1                      BEGIN SIMULATION FOR   2 HOUR
287    23  VEHICLE TYPE= 1   TIME=  61.50
288 0   1   2   0   0   1   0   0   0      2
289                                          20 LEAVING  TIME=    6.17
290    24  VEHICLE TYPE= 3   TIME=  62.25
291 1   2   2   0   0   3   0   0   0      4
292    25  VEHICLE TYPE= 1   TIME=  63.75
293 0   1   2   0   0   1   0   0   0      2
294                                          21 LEAVING  TIME=    6.75
295    26  VEHICLE TYPE= 1   TIME=  64.42
```

REST AREA SIMULATION PROGRAM LISTING
Burroughs B5500 Time Sharing System
(FORTRAN IV)

```
C              REST AREA SIMULATION PROGRAM
C  WRITTEN BY W. M. AND L. D.
C  MARCH 1,1972
FILE  1=Q12OUT,UNIT=REMOTE
FILE  2=Q12IN,UNIT=REMOTE
      COMMON ICELL,NUMPRK,IOTL,ICAR,IUTIME,IOTPUP,KNT
      DIMENSION MAIN(300,15),NGEND(10),TYP(5),ORD(12),ISER(10,10)
      DIMENSION IDELTA(10),ICELL(2,10,20)
      DIMENSION PERCNT(12),IVEH(12)
      IOTL=1
      IOTPOP=0
      NOROOM=0
      IAT=0
      NUM=0
      ICAR=0
      NUMPRK=0
      T=0.0
C  TIME INCREMENT=5 SEC
      ITIME=720
      DT=5.
      WRITE(1,200)
200   FORMAT(1X,"HOW MANY HOURS DO YOU WANT TO SIMULATE ?")
      READ(2,/) IALL
      WRITE(1,210)
210   FORMAT(1X,"INPUT HOURLY VOLUME AND % TURN IN FOR EACH HOUR")
      READ(2,/) ((IVEH(I),PERCNT(I)),I=1,IALL)
      CALL DATA(ISER,ORD,DT,TYP,IDELTA,ISPACE)
5     AVERG=(IVEH(IOTL)*PERCNT(IOTL)*.01)
      LAMACR=3600/AVERG
C
C   BEGIN EXECUTION OF SIMULATION FOR 1 HOUR
C
      WRITE(1,220) IOTL
220   FORMAT(1H1,20X,"BEGIN SIMULATION FOR",I4," HOUR")
      DO 100 TME=1,ITIME
      T=T+DT
      CALL CAR(IAT,ARVT,LAMACR,T,IANS)
      IF(IANS) 30,30,10
30    IF(ICAR .EQ. 0) GO TO 100
      GO TO 20
10    IF(NUMPRK .EQ. ISPACE) GO TO 35
      CALL TYPE(TYP,IVETYP)
      CALL PASS(IVETYP,NPEP,NGEND)
      CALL REASON(NPEP,NGEND,NUM,ORD,MAIN,T)
      CALL PRINT(MAIN,NPEP,NUM,T,IVETYP)
20    CALL FACILL(NPEP,NUM,MAIN,ISER,T,DT,IDELTA)
      CALL CAROUT(MAIN,NUM,NPEP)
100   CONTINUE
      CALL STAT(ISER,MAIN,LAMACR,IDELTA,DT,NUM,ORD
     -,AVERG,IVEH,PERCNT,NOROOM)
      IF(IOTL .EQ. IALL) GO TO 40
      IOTL=IOTL+1
      GO TO 5
35    NOROOM=NOROOM+1
      GO TO 20
40    STOP
      END
C
C                  DETERMINE IF A VEHICLE IS ENTERING
C
      SUBROUTINE CAR(IAT,ARVT,LAMACR,T,IANS)
5     IF(IAT.EQ.1) GO TO 10
      CALL EXPENT(LAMACR,X)
      ARVT=X+T
10    IF(T.GE. ARVT) GO TO 15
      IAT=1
      IANS=0
      GO TO 20
15    IANS=1
      IAT=0
20    RETURN
      END
C
C                  DETERMINE TYPEOF CAR ENTERING
C
      SUBROUTINE TYPE(TYP,IVETYP)
      DIMENSION TYP(5)
      R=RND(1)
      IF(R.GT.TYP(1)) GO TO 5
      IVETYP=1
C  1=CAR,2=TRUCK,ETC
      GO TO 25
5     IF(R.GT. TYP(2)) GO TO 10
      IVETYP=2 ;GO TO 25
10    IF(R.GT. TYP(3)) GO TO 15
      IVETYP=3 ; GO TO 25
15    IF(R.GT. TYP(4)) GO TO 20
      IVETYP=4 ;GO TO 25
20    IVETYP=5
25    RETURN
      END
C
C                  DETERMINE NUMBER OF PASS AND GENDER
C
      SUBROUTINE PASS(IVETYP,NPEP,NGEND)
C     ASSUME NORMAL DISTR. EXCEPT FOR TRUCKS
      COMMON ICELL,NUMPRK,IOTL,ICAR,IOTIME,IOTPUP,KNT
      DIMENSION NGEND(10)
      GO TO (5,10,15,20,25) , IVETYP
5     CALL NORM(2.7,1.2,N)
      GO TO 50
10    CALL NORM(3.2,1.2,N)
      GO TO 50
15    CALL NORM(2.7,1.5,N)
      GO TO 50
20    R=RND(1)
      IF(R .LT. .8)GO TO 12
      N=2
      GO TO 50
12    N=1
      GO TO 50
25    CALL NORM(2.0,1.0,N)
50    IF(N.LT. 1) N=1
      IF(N.GT. 9) N=9
      NPEP=N
C                              DETERMINE GENDER
      DO 80 KNT=1,N
      R=RND(1)
      IF(R.GT. .60) GO TO 60
C                                1=GIRL   2=BOY
```

```
      NGEND(KNT)=1
      GO TO 80
60    NGEND(KNT)=2
80    CONTINUE
      RETURN
      END
C
C                  DETERMINE REASON FOR ENTERING
C
      SUBROUTINE REASON(NPEP,NGEND,NUM,ORD,MAIN,T)
      COMMON ICELL,NUMPRK,IOTL,ICAR,IOTIME,IOTPUP,KNT
      DIMENSION NGEND(10),MAIN(300,15),ORD(12),ICELL(2,10,20)
      DO 6 I=NUM+1,NUM+NPEP
      DO 5 J=1,15
5     MAIN(I,J)=0
6     CONTINUE
      J=0
      ICAR=ICAR+1
      NUMPRK=NUMPRK+1
      MAIN(NUM+1,12)=T
      DO 60 I=NUM+1,NUM+NPEP
      MAIN(I,11)=ICAR
      J=J+1
      MAIN(I,1)=NGEND(J)
C                        DETERMINE NUMBER OF SERVICES DESIRED
      CALL NORM(ORD(11),ORD(12),NS)
      DO 50 K=1,NS
      R=RND(1)
      IF(R.LE. ORD(2)) GO TO 10
      IF(R.LT.ORD(3)) GO TO 15
      IF(R.LT.ORD(4)) GO TO 20
      IF(R.LT.ORD(5)) GO TO 25
      IF(R.LT.ORD(6)) GO TO 30
      IF(R.LT.ORD(7)) GO TO 35
      IF(R.LT.ORD(8)) GO TO 40
      IF(R.LT.ORD(9)) GO TO 45
      MAIN(I,10)=1
      GO TO 50
10    MAIN(I,2)=1 ;GO TO 50
15    IF(MAIN(I,1).EQ.2) MAIN(I,3)=1
      MAIN(I,4)=1; GO TO 50
20    IF(MAIN(I,1).EQ.1) MAIN(I,4)=1
      MAIN(I,3)=1;GO TO 50
25    MAIN(I,5)=1 ;GO TO 50
30    MAIN(I,6)=1 ;GO TO 50
35    MAIN(I,7)=1 ;GO TO 50
40    MAIN(I,8)=1 ;GO TO 50
45    MAIN(I,9)=1 ;GO TO 50
50    CONTINUE
60    CONTINUE
      RETURN
      END
C
C                     SUBROUTINE PRINT
C
      SUBROUTINE PRINT(MAIN,NPEP,NUM,T,IVETYP)
      COMMON ICELL,NUMPRK,IOTL,ICAR,IOTIME,IOTPUP,KNT
      DIMENSION MAIN(300,15),ISUM(10),ICELL(2,10,20)
100   FORMAT(1X,9(I1,3X),2X,I2)
      DO 5 K=2,10
5     ISUM(K)=0
      RT=T/60.
      NUMB=NUM+NPEP
      WRITE(1,105) ICAR,IVETYP,RT
105   FORMAT(1X,I4,"  VEHICLE TYPE=",I2,"   TIME IN=",F7.2,I5)
      DO 20 LM = 2,10
      DO 10 K=NUM+1,NUM+NPEP
      ISUM(LM) = ISUM(LM) + MAIN(K,LM)
10    CONTINUE
20    CONTINUE
      WRITE(1,100)(ISUM(LM),LM= 2,10),NPEP
      RETURN
      END
C                  SUBROUTINE NORMAL DIST
C
      SUBROUTINE NORM(EX,STDX,N)
      SUM=0.0
      DO 5 I=1,12
      R=RND(1)
5     SUM=SUM+R
      N=STDX*(SUM-6.0)+EX+.5
      RETURN
      END
C
C                     SUBROUTINE EXPENT
C
      SUBROUTINE EXPENT(EX,X)
      R=RND(1)
      X=-EX*ALOG(R)
      RETURN
      END
C
C                     FUNCTION RANDOM
C
      REAL FUNCTION RND(X)
      DATA I/2407/
      W=(2**10+1)*I+101
      I=AMOD(W,2**36)
      RND=I/2.**36
      RETURN
      END
      SUBROUTINE POISSN(P,X)
      X=0.0
      B=EXP(-P)
      TR=1.0
5     R=RND(1)
      TR=TR*R
      IF(TR-B) 10,8,8
8     X=X+1.0
      GO TO 5
10    RETURN
      END
C                  SUBROUTINE  FACILLITY
      SUBROUTINE FACILL(NPEP,NUM,MAIN,ISER,T,DT,IDELTA)
C ISER=1=1 IF SERVICE IS AVAILABLE
C ISER=2= NUMBER OF FACILLITIES OF EACH TYPE AVAILABLE
C ISER=3=EXPECTED SERVICE TIME
C ISER=4=STANDARD DEVIATION(NORMAL DIST) FOR EACH SERVICE
C ISER=5=PRECENT OF PEOPLE USING FACILITY
C ISER=6=NUMBER OF PEOPLE USING SER. AT END OF HOUR(NOT DONE)
```

```
C ISER=7=ACTUAL SERVICE TIME(SEC)FOR THE HOUR
C ISER=8=TOTAL WAITING TIME FOR THAT HOUR
C ISER=9=NUMBER OF PEOPLE SERVED DURING THE HOUR
C ISER=10=NUMB OF DISSATISFIED PEOPLE/HR(SERVICE NOT AVAILABLE)
C ISER=11=ISER=7 ACCUMULATED
C ISER=12=ISER=8      "
C ISER=13=ISER=9      "
C ISER=14=ISER=10     "
      COMMON ICELL,NUMPRK,IOTL,ICAR,IOTIME,IOTPUP,KNT
      DIMENSION MAIN(300,15),ISER(14,10),IDELTA(10),ICELL(2,10,20)
      IFINSH=0
      ICOUNT=1
      LINE=MAIN(1,11)
      IT=T
      DO 15 LP=1,NUM+NPEP
      IDONE=0
      IF(MAIN(LP,11).NE.LINE) GO TO 60
4     IF (MAIN(LP,13) .EQ. 1) GO TO 15
      IF(MAIN(LP,13) .EQ. 2) GO TO 8
5     DO 10 L=2,10
      IF(MAIN(LP,L).EQ. 0) GO TO 10
      IDONE=1
      IFINSH=1
      IF(MAIN(LP,L).NE. 1) GO TO 20
      MAIN(LP,13)=4
C
C     COMPUTE WALKING TIME TO SERVICE
C
      CALL NORM(60.0,30.0,NS)
      MAIN(LP,15)=IT+NS
      GO TO 15
      GO TO 30
10    CONTINUE
      IF(IDONE.EQ. 0) MAIN(LP,13)=1
      GO TO 15
20    IF(IT.LT.MAIN(LP,L)) GO TO 15
      ISER(9,L)=ISER(9,L)+1
      ISER(6,L)=ISER(6,L)-1
      MAIN(LP,L)=0
      MAIN(LP,13)=0
      GO TO 15
30    IF(ISER(1,L).EQ. 0) GO TO 50
      IF(ISER(6,L).EQ. ISER(2,L)) GO TO 40
      IF(MAIN(LP,14).NE. 0)CALL CELL(2,L,IDELTA,MAIN,LP,ICOUNT)
      MAIN(LP,14)=0
      EX=ISER(3,L)
      STDX=ISER(4,L)
      CALL NORM(EX,STDX,N)
      ISER(7,L)=ISER(7,L)+N
      MAIN(LP,L)=N
      CALL CELL(1,L,IDELTA,MAIN,LP,ICOUNT)
      MAIN(LP,L)=N+IT
      ISER(6,L)=ISER(6,L)+1
      MAIN(LP,13)=2
      GO TO 15
40    ISER(8,L)=ISER(8,L)+DT
      MAIN(LP,14)=MAIN(LP,14)+DT
      GO TO 15
50    ISER(10,L)=ISER(10,L)+1
      MAIN(LP,L) =0
      GO TO 15
60    IF(IFINSH.EQ. 0) GO TO 70
      IDONE=0
      LINE=MAIN(LP,11)
      ICOUNT=LP
      IFINSH=0
      GO TO 4
8     IFINSH=1
      GO TO 5
80    IF(IT.LT.MAIN(LP,15)) GO TO 15
      GO TO 30
70    MAIN(ICOUNT,12)=IT-MAIN(ICOUNT,12)
      MAIN(ICOUNT,13)=3
      CALL CELL(3,1,IDELTA,MAIN,LP,ICOUNT)
      ICOUNT=LP
      LINE=MAIN(LP,11)
      IF(LP .GE. NUM + NPEP) GO TO 17
      LP=LP-1
      IFINSH=0
15    CONTINUE
      IF(IFINSH .EQ. 0) GO TO 70
17    RETURN
      END
C           SUBROUTINE TO READ IN SIMULATION DATA
      SUBROUTINE DATA(ISER,ORD,DT,TYP,IDELTA,ISPACE)
      DIMENSION ISER(14,10),TYP(5),ITYP(5),ORD(12),SER(10)
      DIMENSION IDELTA(10)
      WRITE(1,20)
20    FORMAT(10X,"INDICATE WHAT SERVICES ARE AVAILABLE WITH A 1")
      WRITE(1,21)
21    FORMAT(10X,"NO. OF SERVICES, SERVICE TIME(SEC),STD. DEV.")
      WRITE(1,22)
22    FORMAT(10X,"AND THE PERCENT OF USAGE(INDIVIDUAL)")
      WRITE(1,23)
23    FORMAT(1X,"AVAIL-NUMB-SERTME-STD DEV- PERCENT")
      WRITE(1,25)
25    FORMAT(1X,"PICNIC TABLES")
      READ(2,/)(ISER(K,2),K=1,5)
      IDELTA(2)=(ISER(3,2)+3*ISER(4,2))/20
      WRITE(1,30)
30    FORMAT(1X,"MENS REST ROOM FACILITIES")
      READ(2,/)(ISER(K,3),K=1,5)
      IDELTA(3)=(ISER(3,3)+3*ISER(4,3))/20
      WRITE(1,35)
35    FORMAT(1X,"WOMENS REST ROOM FACILITIES")
      READ(2,/)(ISER(K,4),K=1,5)
      IDELTA(4)=(ISER(3,4)+3*ISER(4,4))/20
      WRITE(1,40)
40    FORMAT(1X,"SLEEP OR REST FACILITIES")
      READ(2,/)(ISER(K,5),K=1,5)
      IDELTA(5)=(ISER(3,5)+3*ISER(4,5))/20
      WRITE(1,45)
45    FORMAT(1X,"WATER JUG FILLING")
      READ(2,/)(ISER(K,6),K=1,5)
      IDELTA(6)=(ISER(3,6)+3*ISER(4,6))/20
      WRITE(1,50)
50    FORMAT(1X," DRINKING FOUNTIAN DATA")
      READ(2,/)(ISER(K,7),K=1,5)
      IDELTA(7)=(ISER(3,7)+3*ISER(4,7))/20
      WRITE(1,55)
```

```
55    FORMAT(1X,"INFORMATION SERVICE FACILITIES")
      READ(2,/)(ISER(K,8),K=1,5)
      IDELTA(8)=(ISER(3,8)+3*ISER(4,8))/20
      WRITE(1,60)
60    FORMAT(1X,"TELEPHONE BOOTH DATA")
      READ(2,/)(ISER(K,9),K=1,5)
      IDELTA(9)=(ISER(3,9)+3*ISER(4,9))/20
      WRITE(1,65)
65    FORMAT(1X,"VEHICLES PARKING OVERNIGHT")
      READ(2,/)(ISER(K,10),K=1,5)
      IDELTA(10)=(ISER(3,10)+3*ISER(4,10))/20
      WRITE(1,67)
67    FORMAT(1X,"HOW MANY PARKING SPACES IN R.A.?")
      READ(2,/) ISPACE
      WRITE(1,70)
70    FORMAT(1X,"GIVE % FOR EACH VEHICLE TYPE IN FOLLOWING ORDER")
      WRITE(1,71)
71    FORMAT(1X,"CAR,CAR/TR, PICK-UPS , TRUCKS , OTHER ")
      READ(2,/)(ITYP(I),I=1,5)
      DO 80 I=1,5
      RTYP=ITYP(I)
      TOT=TOT+RTYP/100.
80    TYP(I)=TOT
      WRITE(1,75)
75    FORMAT(1X,"GIVE AVERAGE NUMB SER WANTED AND STD DEV")
      READ(2,/) ORD(11),ORD(12)
C  COMPUTE PROB. DATA FOR SUBROUTINE REASON
C
      ISUM=0
      DO 90 I=2,10
      SER(I)=ISER(5,I)
90    ISUM=ISUM+ISER(5,I)
      SUM=ISUM
      ORD(2)=SER(2)/SUM
      DO 100 I=3,10
100   ORD(I)=ORD(I-1)+SER(I)/SUM
      RETURN
      END
C                        SUBROUTINE TO PRINT RESULTS
C
      SUBROUTINE OUTPUT(ISER,MAIN,ORD,NUM)
      COMMON ICELL,NUMPRK,IOTL,ICAR,IOTIME,IOTPUP,KNT
      DIMENSION ISER(14,10),MAIN(300,15),ICELL(2,10,20),ORD(12)
      WRITE(1,5)
5     FORMAT(15X,"PIC  M RR  F RR  SLP  JUG FILL  DRK  INFO   T   PK")
      WRITE(1,1)(ISER(1,L),L=2,10)
1     FORMAT(1X,"SER AVAILABLE",4(2X,I3),2(5X,I3),3(2X,I3))
      WRITE(1,2)(ISER(2,L),L=2,10)
2     FORMAT(1X,"NUMB OF FACIL",4(2X,I3),2(5X,I3),3(2X,I3))
      WRITE(1,3)(ISER(3,L),L=2,10)
3     FORMAT(1X,"EXPT SER TIME",4(1X,I4),2(4X,I4),3(1X,I4))
      WRITE(1,4)(ISER(4,L),L=2,10)
4     FORMAT(1X,"STD DEV SEC  ",4(1X,I4),2(4X,I4),3(1X,I4))
      WRITE(1,6)(ISER(5,L),L=2,10)
6     FORMAT(1X,"% USE SER    ",4(1X,I4),2(4X,I4),3(1X,I4))
      WRITE(1,7) ORD(11),ORD(12)
7     FORMAT(1X,"NUMBER SERVICES REQD=",F4.1,"   STD DEV=",F4.1)
      WRITE(1,8)IOTL
8     FORMAT(//20X,"RESULTS OF SIMULATION FOR",I4," HOUR",//)
      WRITE(1,9)
```

```
9     FORMAT(14X,"PICNIC  M RR  F RR   SLP  JUG FILL"
     -"   DRK   INFO  TEL  PARK",/)
      WRITE(1,10)(ISER(6,L),L=2,10)
10    FORMAT(1X,"NUMBER USING",4(2X,I4),2(5X,I4),3(2X,I4))
      WRITE(1,11)
11    FORMAT("SERVICE AT END OF HOUR",/)
      DO 20 K=7,8
      DO 20 L=2,10
      ISER(K,L)=ISER(K,L)/60
20    ISER(K+4,L)=ISER(K+4,L)+ISER(K,L)
      DO 22 K=9,10
      DO 22 L=2,10
22    ISER(K+4,L)=ISER(K+4,L)+ISER(K,L)
      WRITE(1,25)(ISER(7,L),L=2,10)
25    FORMAT(1X,"FACILITY USE",4(2X,I4),2(5X,I4),3(2X,I4))
      WRITE(1,26)
26    FORMAT(1X,"TIME DURING HOUR...MIN",/)
      WRITE(1,30)(ISER(8,L),L=2,10)
30    FORMAT(1X,"WAITING TIME",4(2X,I4),2(5X,I4),3(2X,I4))
      WRITE(1,31)
31    FORMAT(1X,"FOR FACILITY...MIN",/)
      WRITE(1,35)(ISER(9,L),L=2,10)
35    FORMAT(1X,"NUMB SERVED ",4(2X,I4),2(5X,I4),3(2X,I4),/)
      WRITE(1,40)(ISER(10,L),L=2,10)
40    FORMAT(1X,"NUMB DISSAT ",4(2X,I4),2(5X,I4),3(2X,I4))
      WRITE(1,41)
41    FORMAT(1X,"SERVICE NOT AVAILABLE",/)
      TT=IOTIME/3600.
      WRITE(1,45) TT
45    FORMAT(1X,"TOTAL VEHICLE TIME IN R.A.FOR VEH ",
     -"LEAVING DURING HOUR =",F8.2," HR.",/)
      WRITE(1,50)NUMPRK
50    FORMAT(1X,"NUMBER OF CARS IN R.A.= ",I4)
      WRITE(1,52) NUM
52    FORMAT(1X,"NUMBER OF PEOPLE IN R.A. = "I4)
      IF(IOTL .EQ.1) GO TO 65
      WRITE(1,55)
55    FORMAT(//20X,"ACCUMULATED REST AREA DATA")
      WRITE(1,8)
      WRITE(1,25)(ISER(11,L),L=2,10)
      WRITE(1,27)
27    FORMAT(1X,"TIME...MIN")
      WRITE(1,28)
28    FORMAT(1X,"TOTAL ACCUMULATED")
      WRITE(1,30)(ISER(12,L),L=2,10)
      WRITE(1,28)
      WRITE(1,35)(ISER(13,L),L=2,10)
      WRITE(1,28)
      WRITE(1,40)(ISER(14,L),L=2,10)
      WRITE(1,60) ICAR
60    FORMAT(/,1X,"TOTAL NUMBER OF VEHICLES THAT ENTERED R.A.=",I6)
      CARR=KNT
      AVGSTY=TT/CARR*60.
      WRITE(1,62) AVGSTY
62    FORMAT(1X,"AVERAGE LENGTH OF STAY IN R.A./HR.=",F6.2," MIN")
65    DO 70 I=7,10
      DO 70 J=2,10
70    ISER(I,J)=0
      IOTIME=0
      RETURN
```

```
      END
C
      SUBROUTINE CAROUT(MAIN,NUM,NPEP)
C
C     RECORDS TOTOAL TIME IN R.A. , REARRANGES POSITIONS OF
C   PEOPLE IN WAITING LINE AND DECREMENTS PARKING LOT
      COMMON ICELL,NUMPRK,IOTL,ICAR,IOTIME,OITPUP,KNT
      DIMENSION MAIN(300,15),ICELL(2,10,20)
100   FORMAT(40X,I4," LEAVING , TIME IN RA= ",F6.1)
      L=1
      DO 10 K=1,NUM+NPEP
      IF(MAIN(K,13).EQ.3) GO TO 30
      L=L+1
10    CONTINUE
11    L=L-1
      GO TO 80
30    NUMPRK=NUMPRK-1
      IOTIME=IOTIME+MAIN(K,12)
      KNT=KNT+1
      TTT=MAIN(K,12)/60.
      MAIN(K,13)=0
      WRITE(1,100) MAIN(K,11),TTT
      IF(K.EQ. NUM+NPEP) GO TO 45
32    K=K+1
      IF(K.EQ.NUM+NPEP) GO TO 50
      IF(MAIN(K,11).EQ.MAIN(K-1,11)) GO TO 32
      IF(MAIN(K,13).EQ.3) GO TO 30
35    DO 40 J=1,15
40    MAIN(L,J)=MAIN(K,J)
      IF(K.EQ.NUM+NPEP) GO TO 80
      IF((MAIN(K+1,11).NE.MAIN(K,11)).AND.(MAIN(K+1,13).EQ.3))GO TO 70
      K=K+1
      L=L+1
      GO TO 35
45    IF(L.EQ.1) GO TO 75
      GO TO 11
      IF(L.EQ.1) GO TO 75
50    IF(MAIN(1,11).EQ.MAIN(K,11)) GO TO 75
      DO 60 J=1,15
60    MAIN(L,J)=MAIN(K,J)
      NUM=L-1
      GO TO 90
70    K=K+1
      L=L+1
      GO TO 30
75    ICAR=0
      NUM=0
      NPEP=0
      GO TO 95
80    NUM=L
90    CONTINUE
      NPEP=0
95    RETURN
      END
C     SUBROUTINE  CELL
C
C     SUBROUTINE TO CLASSIFY WAITING TIME,SERVICE TIME FOR
C     EACH PERSON AND TOTAL TIME IN R.A. FOR EACH CAR.
      SUBROUTINE CELL(ISWT,L,IDELTA,MAIN,LP,ICOUNT)
      DIMENSION IDELTA(10),ICELL(2,10,20),MAIN(300,15)
      COMMON ICELL,NUMPRK,IOTL,ICAR,IOTIME,IOTPUP,KNT
C  3RD DIMENSION OF ICELL IS THE CELL NUMBER
C 2ND DIMENSION IS THE FACILLITY(1 WILL BE TIME IN R.A.)
C THE OTHERS 2 THROUGH 10 WILL BE SAME AS ISER
C  1ST DIMENSION: 1 WILL BE FOR SERVICE TIME, 2 FOR WAITING TIME
C  IDELTA(10) IS CELL WIDTH FOR EACH SERVICE
C  IDELTA(1)  IS CELL WIDTH FOR TOTAL TIME IN R.A.(SECONDS)
      IDELTA(1)=180
      GO TO (10,20,30),ISWT
C   STORE SERVICE TIME
10    IFAC=0
      I=0
11    IFAC=IFAC+IDELTA(L)
      I=I+1
      IF(I.EQ.20) GO TO 15
      IF(IFAC.LT.MAIN(LP,L)) GO TO 11
15    ICELL(1,L,I)=ICELL(1,L,I)+1
      GO TO 40
20    IFAC=0
      I=0
21    IFAC=IFAC+IDELTA(L)
      I=I+1
      IF(I.EQ. 20) GO TO 25
      IF(IFAC.LT.MAIN(LP,14)) GO TO 21
25    ICELL(2,L,I)=ICELL(2,L,I)+1
      GO TO 40
30    IFAC=0
      I=0
31    IFAC=IFAC+IDELTA(1)
      I=I+1
      IF(I.EQ. 20) GO TO 35
      IF(IFAC.LT.MAIN(ICOUNT,12)) GO TO 31
35    ICELL(1,1,I)=ICELL(1,1,I)+1
40    RETURN
      END
C                  SUBROUTINE STAT
C   PRINTS COMPLETE RESULTS OF SIMULATION
      SUBROUTINE STAT(ISER,MAIN,LAMACR,IDELTA,OT,NUM,ORD
     -,AVERG,IVEH,PERCNT,NOROOM)
      COMMON ICELL,NUMPRK,IOTL,ICAR,IOTIME,IOTPOP,KNT
      DIMENSION ISER(14,10),MAIN(300,15),IDELTA(10),MNT(20)
      DIMENSION ICELL(2,10,20),IVEH(12),PERCNT(12),ORD(12)
      WRITE(1,1) IOTL,OT,AVERG
1     FORMAT(1H1,10X,"REST AREA SIMULATION",//10X,
     -"RESULTS FOR  ",I2," HOUR",/10X,"TIME INCREMENT=",
     -F4.2,"SECONDS",//10X,
     -"THE EXPECTED NUMBER OF VEHICLES ENTERING R.A./HR=",I6)
      WRITE(1,29) IVEH(IOTL),PERCNT(IOTL)
29    FORMAT(10X,"VEHICLES ON HIGHWAY=",I6,//10X,
     -"PERCENT TURN IN =",F4.2)
      WRITE(1,30) LAMACR
30    FORMAT(10X,"EXPECTED TIME BETWEEN TURN IN=",I4," SEC")
      WRITE(1,31) NOROOM
31    FORMAT(10X,"NUMBER OF VEHICLES THAT LEFT",
     -/10X,"BECAUSE OF LACK OF PARKING SPACES=",I4)
      WRITE(1,2)
2     FORMAT(20X,"INPUT DATA",//)
      CALL OUTPUT(ISER,MAIN,ORD,NUM)
      WRITE(1,3)
3     FORMAT(1H1,10X,"FACILITY HISTOGRAM DATA FOR SERVICE TIMES",//)
```

```
      N=1
25    WRITE(1,4)
      WRITE(1,100)(ICELL(N,2,K),K=1,10)
100   FORMAT(1X,10(3X,I4))
4     FORMAT(1X,"PICNIC TABLES")
      MNT(1)=IDELTA(2)
      DO 5 K=2,20
5     MNT(K)=MNT(K-1)+IDELTA(2)
      WRITE(1,6)(MNT(K),K=1,10)
6     FORMAT(1X,10(2X,I5),/)
      WRITE(1,7)(ICELL(N,2,K),K=11,20)
7     FORMAT(1X,10(3X,I4))
      WRITE(1,6)(MNT(K),K=11,20)
      WRITE(1,8)
      WRITE(1,100)(ICELL(N,3,K),K=1,10)
8     FORMAT(1X,"MENS REST ROOM")
      MNT(1)=IDELTA(3)
      DO 9 K=2,20
9     MNT(K)=MNT(K-1)+IDELTA(3)
      WRITE(1,6)(MNT(K),K=1,10)
      WRITE(1,7)(ICELL(N,3,K),K=11,20)
      WRITE(1,6)(MNT(K),K=11,20)
      WRITE(1,10)
      WRITE(1,100)(ICELL(N,4,K),K=1,10)
10    FORMAT(1X,"WOMENS REST ROOM")
      MNT(1)=IDELTA(4)
      DO 11 K=2,20
11    MNT(K)=MNT(K-1)+IDELTA(4)
      WRITE(1,6)(MNT(K),K=1,10)
      WRITE(1,7)(ICELL(N,4,K),K=11,20)
      WRITE(1,6)(MNT(K),K=11,20)
      WRITE(1,12)
      WRITE(1,100)(ICELL(N,5,K),K=1,10)
12    FORMAT(1X,"SLEEP-AND-REST")
      MNT(1)=IDELTA(5)
      DO 13 K=2,20
13    MNT(K)=MNT(K-1)+IDELTA(5)
      WRITE(1,6)(MNT(K),K=1,10)
      WRITE(1,7)(ICELL(N,5,K),K=11,20)
      WRITE(1,6)(MNT(K),K=11,20)
      WRITE(1,14)
      WRITE(1,100)(ICELL(N,6,K),K=1,10)
14    FORMAT(1X,"JUG FILLING")
      MNT(1)=IDELTA(6)
      DO 15 K=2,20
15    MNT(K)=MNT(K-1)+IDELTA(6)
      WRITE(1,6)(MNT(K),K=1,10)
      WRITE(1,7)(ICELL(N,6,K),K=11,20)
      WRITE(1,6)(MNT(K),K=11,20)
      WRITE(1,16)
      WRITE(1,100)(ICELL(N,7,K),K=1,10)
16    FORMAT(1X,"DRINKING FOUNTIAN")
      MNT(1)=IDELTA(7)
      DO 17 K=2,20
17    MNT(K)=MNT(K-1)+IDELTA(7)
      WRITE(1,6)(MNT(K),K=1,10)
      WRITE(1,7)(ICELL(N,7,K),K=11,20)
      WRITE(1,6)(MNT(K),K=11,20)
      WRITE(1,18)
      WRITE(1,100)(ICELL(N,8,K),K=1,10)
```

```
18    FORMAT(1X,"INFORMATION SERVICE")
      MNT(1)=IDELTA(8)
      DO 19 K=2,20
19    MNT(K)=MNT(K-1)+IDELTA(8)
      WRITE(1,6)(MNT(K),K=1,10)
      WRITE(1,7)(ICELL(N,8,K),K=11,20)
      WRITE(1,6)(MNT(K),K=11,20)
      WRITE(1,20)
      WRITE(1,100)(ICELL(N,9,K),K=1,10)
20    FORMAT(1X,"TELEPHONE BOOTH")
      MNT(1)=IDELTA(9)
      DO 21 K=2,20
21    MNT(K)=MNT(K-1)+IDELTA(9)
      WRITE(1,6)(MNT(K),K=1,10)
      WRITE(1,7)(ICELL(N,9,K),K=11,20)
      WRITE(1,6)(MNT(K),K=11,20)
      WRITE(1,22)
      WRITE(1,100)(ICELL(N,10,K),K=1,10)
22    FORMAT(1X,"PARKING SPACES")
      MNT(1)=IDELTA(10)
      DO 23 K=2,20
23    MNT(K)=MNT(K-1)+IDELTA(10)
      WRITE(1,6)(MNT(K),K=1,10)
      WRITE(1,7)(ICELL(N,10,K),K=11,20)
      WRITE(1,6)(MNT(K),K=11,20)
      IF(N.EQ.2) GO TO 26
      WRITE(1,24)
24    FORMAT(10X,"FACILITY HISTOGRAM DATA FOR WAITING TIMES",//)
      N=2
      GO TO 25
26    WRITE(1,27)
27    FORMAT(10X,"HISTOGRAM DATA FOR TOTAL TIME IN R.A."//)
      WRITE(1,6)(ICELL(1,1,K),K=1,10)
      MNT(1)=IDELTA(1)
      DO 28 K=2,20
28    MNT(K)=MNT(K-1)+IDELTA(1)
      WRITE(1,6)(MNT(K),K=1,10)
      WRITE(1,7)(ICELL(1,1,K),K=11,20)
      WRITE(1,6)(MNT(K),K=11,20)
      RETURN
      END
```