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SYSTEMS OPERATION STUDIES FOR AUTOMATED GUIDEWAY TRANSIT SYSTEMS

SYSTEM AVAILABILITY MODEL PROGRAMMER'S MANUAL

GM Transportation Systems Division
General Motors Technical Center
Warren, MI 48090

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FINAL REPORT

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16. Abstract

The Programmer's Manual for the System Availability Model describes the program's functions, organization, variables, and processing algorithms. Debug tools built into the model, a global variable dictionary, subprogram logic tables, and subprogram descriptions are also described to aid maintenance and modification of this model.

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16. Abstract

In order to examine specific Automated Guideway Transit (AGT) development and concepts, and to build a better knowledge base for future decision-making, the Urban Mass Transportation Administration (UMTA), has undertaken a new program of studies and technology investigations known as the UMTA Automated Guideway Transit Technology (AGTT) program. The objectives of one segment of the AGTT program, the Systems Operations Studies (SOS), are to: 1) develop models for the analysis of system operations; 2) evaluate performance and cost; and 3) establish guidelines for the design and operation of AGT systems.

The programmer's manual for the System Availability Model (SAM) describes the program's functions, organization, variables, and processing algorithms. Debug tools built into the model, a global variable dictionary, subprogram logic tables, and subprogram descriptions are also described to aid maintenance and modification of this model.

The current SOS for AGT Systems reports in this group are: Feeder Systems Model (FSM) Functional Specification (UMTA-MA-06-0048-81-1); System Availability Model User's Manual (UMTA-MA-06-0048-81-2); Availability Model Functional Specification (UMTA-MA-06-0048-81-3); and Detailed Station Model Functional Specification (UMTA-MA-06-0048-81-5).

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PREFACE

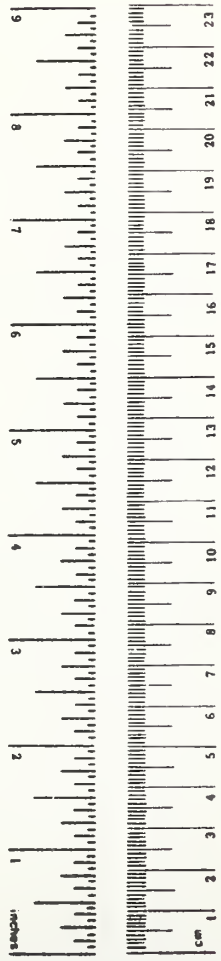
In order to examine specific Automated Guideway Transit (AGT) developments and concepts - and to build a better knowledge base for future decision-making - the Urban Mass Transportation Administration (UMTA) has undertaken a new program of studies and technology investigations called the UMTA Automated Guideway Transit Technology (AGTT) program. The objectives of one segment of the AGTT program, the System Operation Studies (SOS), are to develop models for the analysis of system operations, to evaluate performance and cost, and to establish guidelines for the design and operation of AGT systems. A team headed by GM Transportation Systems Division (GM TSD) has been awarded a contract by the Transportation Systems Center to pursue these objectives. The Technical Monitor for the Project at TSC was Arthur Priver, who was assisted by Li Shin Yuan and Thomas Dooley.

This document was prepared under the direction of the SOS Program Manager, James F. Thompson, at GM TSD. The report was authored by Robert Oglesby, GM TSD.

METRIC CONVERSION FACTORS

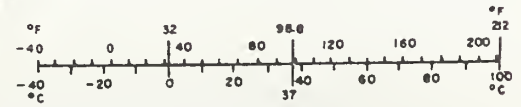
Approximate Conversions to Metric Measures

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



Approximate Conversions from Metric Measures

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



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1.0 INTRODUCTION

1.1 IDENTIFICATION

The System Availability Model (SAM) was designed by Robert Oglesby of General Motors Transportation Systems Division (GM TSD), and James Boldig, GM TSD. It was programmed by Eugene Mauch of Applied Systems Corporation. GM TSD Report No. EP-77056A, System Availability Model Technical Specification, September 1977, specifies the technical requirements for the SAM.

1.2 HARDWARE AND SOFTWARE FOR PROGRAM MODIFICATION

The following system software is required for program modification. The software listed in the SAM Users Manual is also assumed.

1. PARAFOR

2. FORTRAN IV (H extended)

3. Linkage editor compatible with the operating system used.

The model occupies approximately 1 MB of disk storage including both source files and execution files (test case).

2.0 PROGRAM DESCRIPTION

2.1 INPUT PROCESSOR

The input processor generates a structured data file that contains everything that the model processor needs. The data needed to generate this file comes from the user-provided (runtime) inputs, the trip logs generated by DESM, and optionally from an existing structured data file.

The inputs are initialized from the existing data file; if none is specified AIINIT initializes them to zero.

The user inputs are provided via GDIP. GDIP is invoked from AACCRD which does all control card processing. The single call to it processes the entire runtime input. The FAILURE control card is reprocessed later by rereading the temporary file used by AACCRD. The particular control card names are passed to AACCRD.

The trip log processing is controlled by AINPUT and actually done in AINUMT. Each FAILURE control card causes a trip log to be compared to the reference trip log. The passengers are accumulated in an array (NUMTRP) according to their delay. The FAILURE control card contains the region, demand period, and subsystem containing the failure and the failure level. These are used to select a cross section of NUMTRP to use as an accumulator. (The remaining dimension is delay threshold.) If more than one FAILURE card has the same parameters, the trip logs are averaged (Unweighted). First, AINPUT initializes NOFAIL to zero. NOFAIL is used to count the number of trip logs processed for each element of NUMTRP. It is the divisor for the average. Then, it reads the control card file and processes each FAILURE control card. If it is determined to be valid, the appropriate element of NOFAIL is incremented. If this is the first trip log in this element, the corresponding elements of NUMTRP are zeroed.

Now, NUMTRP reads each trip log (referenced and failed) comparing trips. This is similar to the usual merge technique; each trip log is ordered and this fact is utilized. ASCMPR is an ordering function which is used to determine which trip is first. Each trip in a trip log must come before the next record of the trip log according to ASCMPR. Unmatched trips are skipped. Unmatched trips in the reference trip log are accumulated in UNMTCH. Unmatched trips in the failed trip log are just ignored. For matching trips the termination time (arrival at destination) times are subtracted and compared to the thresholds to determine which if any of the accumulators should receive these passengers. (A trip may contain more than one passenger.)

TABLE 2-1. SAM INPUT PROCESSOR PROGRAM STRUCTURE

```
AINPUT          INPUT PROCESSOR MAIN PROGRAM
  AADATE        GET DATE AND TIME IN CHARACTER FORMAT
    DAYTIM      GET DATE AND TIME IN INTEGER FORMAT
      DTIMEL    GET DATE AND TIME FROM SYSTEM
  FASPAR        SAVE PARAMETER ADDRESS
  FAGETP        GET A PARAMETER FROM THE PARAMETER FIELD
  AIINIT        INITIALIZE
  AACCRD        READ AND PROCESS CONTROL CARDS
    AACOPY      COPY CARD IMAGES FROM ONE I/O UNIT TO ANOTHER
    NDBOR       READ GDIP INPUT
      XGDIPF4   FULL WORD INPUT ROUTINE
        FIERR   ROUTINE TO PROCESS UNKNOWN VARIABLE NAMES
  AINUMT        PROCESS A TRIPLOG TO DETERMINE PASSENGERS DELAYED
    ASCMPR      COMPARE TWO TRIPS TO DETERMINE WHICH IS 'FIRST'
  AIOUT         WRITE THE STRUCTURED DATA FILE
  AAINDX        WRITE THE INDEX FILE
    FAGETP      GET A PARAMETER FROM THE PARM= FIELD
    AAPNDX      PRINT ONE ENTRY IN THE INDEX FILE
      AACCPY    COPY CHARACTERS WHILE DELETING BLANKS
  AIRPTS        PRINT THE INPUT PROCESSOR REPORTS
    AISUMY      PRINT THE INPUT SUMMARY REPORT
      DAYTIM    GET THE DATE IN INTEGER FORMAT
        DTIMEL  GET THE DATE FROM THE SYSTEM
      AISBSR    PRINT THE SUBSYSTEM FAILURE RATES
        DAYTIM  GET THE DATE IN INTEGER FORMAT
          DTIMEL GET THE DATE FROM THE SYSTEM
    AONUMT      PRINT THE NUMBER OF TRIPS DELAYED REPORT
      DAYTIM    GET THE DATE IN INTEGER FORMAT
        DTIMEL  GET THE DATE FROM THE SYSTEM
    AODLTI      PRINT THE VEHICLE DELAY TIME REPORT
      DAYTIM    GET THE DATE IN INTEGER FORMAT
        DTIMEL  GET THE DATE FROM THE SYSTEM
```

2.2 MODEL PROCESSOR

All the model processor inputs are contained in the structured data file. After the program has read it and performed the initialization functions, ARGFAL computes the number of failures expected in each subsystem from the failure rates and system usage parameters. AVDEL computes the vehicle availability from the expected number of failures and the anticipated vehicle delay for each failure.

APDEL computes the passenger availability from the expected number of failures and the number of passengers delayed by each failure (computed from the trip log).

APZERO computes:

$$P_0 = \frac{1}{\frac{(m\rho)^m}{m!}\frac{1}{1-\rho} + \sum_{i=0}^{m-1}\frac{(m\rho)^i}{i!}}$$

AVFMF computes:

$$FMF = P_0\left(\frac{m^3 + (m - m^2)(m\rho)}{(m - m\rho)^2\frac{(m\rho)^m}{m!} + m\rho\sum_{i=0}^{m-2}\frac{(m\rho)^i}{i!}}\right)$$

AVPRB computes:

$$PROB = \begin{cases} P_0 \sum_{i=0}^{K-1}\frac{(m\rho)^i}{i!}, & K < m \\ 1 - P_0\left(\frac{\frac{(m\rho)^m}{m!}\left(\rho\right)^{K-m}}{1-\rho}\right), & K \geq m \end{cases}$$

The calculation of P_0, FMF, and PROB are carefully coded to avoid overflow. For reasonable input values the factorials and exponentials could exceed the range available with floating-point representation unless this were done.

TABLE 2-2. SAM MODEL PROCESSOR PROGRAM STRUCTURE

```
AMSUP          SUPERVISORY PORTION OF THE SAM MODEL PROCESSOR
  AADATE       GET THE DATE IN CHARACTER FORMAT
    DAYTIM     GET THE DATE IN INTEGER FORMAT
      DTIMEL   GET THE DATE FROM THE SYSTEM
  FASPAR       SAVE THE PARAMETERS FROM THE EXEC STATEMENT
  FAGETP       GET A PARAMETER FROM THE EXEC STATEMENT
  AREAD        READ THE STRUCTURED DATA FILE
  ASUBSR       COMPUTE THE SUBSYSTEM FAILURE AND FAILURE EFFECT RATES
  ARGFAL       COMPUTE THE FAILURES FOR EACH SUBSYSTEM BY REGION
  AVDEL        COMPUTE THE VEHICLE DELAY TIMES AND AVAILABILITY
  APHIST       COMPUTE THE PASSENGER AVAILABILITY FOR THE THRESHHOLDS
    APDEL      COMPUTE THE PASSENGER DELAY TIMES AND AVAILABILITY
  AVFLSZ       COMPUTE THE MAINTENANCE AND STANDBY FLEET MEASURES
    APZERO     COMPUTE P0
      AVPROD   COMPUTE (M RHO)**N/N!
      AVSUM    COMPUTE THE SUMMATION OF (M RHO)**I/I! FOR I=1,...,N
    AVFMF      COMPUTE THE FAILURE MAINTENANCE FLEET SIZE
      AVPROD   COMPUTE (M RHO)**N/N!
      AVSUM    COMPUTE THE SUMMATION OF (M RHO)**I/I! FOR I=1,...,N
    AVPRB      COMPUTE THE PROBABILITY OF THE STANDBY FLEET BEING
                 ADEQUATE TO MAINTAIN THE ACTIVE FLEET
      AVSUM    COMPUTE THE SUMMATION OF (M RHO)**I/I! FOR I=1,...,N
      AVPROD   COMPUTE (M RHO)**N/N!
  AMOUT        WRITE THE STATS FILE (RELIABILITY LEVEL DEPENDENT)
  AAINDX       GENERATE THE RUN INDEX FILE ENTRIES FOR THIS EXECUTION
    FAGETP     GET A PARAMETER FROM THE EXEC CARD
    AAPNDX     WRITE ONE ENTRY INTO THE RUN INDEX FILE
      AACCPY   COPY A CHARACTER STRING WHILE ELIMINATING BLANKS
```

2.3 OUTPUT PROCESSOR

The output processor reads the raw statistics file and generates standard reports. It also produces the performance summary file. Each report has a subroutine that generates it.

TABLE 2-3. SAM OUTPUT PROCESSOR PROGRAM STRUCTURE

```
AOUTPT          OUTPUT PROCESSOR MAIN PROGRAM
  AADATE        GET DATE IN CHARACTER FORMAT
    DAYTIM      GET DATE IN INTEGER FORMAT
      DTIMEL    GET DATE FROM SYSTEM
  FASPAR        SAVE THE PARAMETER FIELD OF THE EXEC CARD
  FAGETP        GET A PARAMETER FROM THE EXEC CARD
  AACCRD        READ AND PROCESS CONTROL CARDS
    AACOPY      COPY CARDS FROM ONE I/O UNIT TO ANOTHER
    NDBOR       READ GDIP INPUT
      XGDIPF4   PROCESS FULL WORD VARIABLES
        FIERR   PROCESS UNRECOGNIZED VARIABLE NAMES
  AOREAD        READ THE RELIABILITY LEVEL DEPENDENT PART OF RAW STATS
  AORELY        OUTPUT THE FAILURE RATE REPORTS
    DAYTIM      GET THE DATE IN INTEGER FORMAT
      DTIMEL    GET THE DATE FROM THE SYSTEM
    AOSBSR      WRITE THE SUBSYSTEM FAILURE RATE REPORT
      DAYTIM    GET THE DATE IN INTEGER FORMAT
        DTIMEL  GET THE DATE FROM THE SYSTEM
  AOPASS        PRINT THE PASSENGER AVAILABILITY REPORT
    DAYTIM      GET THE DATE IN INTEGER FORMAT
      DTIMEL    GET THE DATE FROM THE SYSTEM
  AOMAIN        PRINT THE MAINTENANCE FLEET REPORT
    DAYTIM      GET THE DATE IN INTEGER FORMAT
      DTIMEL    GET THE DATE FROM THE SYSTEM
  AOVEH         PRINT THE VEHICLE AVAILABILITY REPORT
    DAYTIM      GET THE DATE IN INTEGER FORMAT
      DTIMEL    GET THE DATE FROM THE SYSTEM
  AOPSUM        WRITE THE PERFORMANCE SUMMARY FILE
  AODLTI        PRINT THE VEHICLE DELAY TIME REPORT
    DAYTIM      GET THE DATE IN INTEGER FORMAT
      DTIMEL    GET THE DATE FROM THE SYSTEM
  AONUMT        PRINT THE NUMBER OF TRIPS DELAYED REPORT
    DAYTIM      GET THE DATE IN INTEGER FORMAT
      DTIMEL    GET THE DATE FROM THE SYSTEM
  AAINDX        RECORD THIS EXECUTION IN THE RUN INDEX FILE
    FAGETP      RETREIVE A PARAMETER FROM EXEC CARD
    AAPNDX      WRITE AN ENTRY INTO THE RUN INDEX FILE
      AACCPY    COPY CHARACTERS DELETING BLANKS
```

3.0 GLOBAL VARIABLE DICTIONARY

3.1 INPUT PROCESSOR

All common variables are in common block SAM which is described below:

Variable	Dimension	Type	Function
KNDM		I*4	GDIP Input (see User's Manual)
KNREG		I*4	
KNFL		I*4	
KNLVL		I*4	
KNDL		I*4	
KNCMP		I*4	
FLTSLT		I*4	
RRATE		R*4	
SMFREQ		R*4	
SMST		R*4	
DMND	KMDM	R*4	
DLTIME	KMREG	R*4	
	KMDM		
	KMSUB		
	KMFL		
FRATE	KMSUB	R*4	
	KMRD		
	KMLVL		
	KMFL		
GWMILE	KMREG	R*4	
NUMTRP	KMREG	I*4	
	KMDM		
	KMDL		
	KMSUB		
	KMFL		
SYSTIM	KMDM	R*4	
PNS	KMREG	R*4	
	KMDM		
VINSTA	KMREG	R*4	
	KMDM		
VN	KMREG	R*4	
	KMDM		
VM	KMREG	R*4	
	KMDM		

Variable	Dimension	Type	Function
VOPTIM	KMREG KMDM	R*4	
VTHRDM		R*4	
THRIND		R*4	

3.2 MODEL PROCESSOR

The model processor has no global variables.

3.3 OUTPUT PROCESSOR

All common variables are included in the common block AOPARM which is described below. All variables are GDIP inputs and are described in the user's manual.

Variable	Type
FDLTI	I*4
FMAIN	I*4
FNTRP	I*4
FPASS	I*4
FRELY	I*4
FSUBSR	I*4
FVEH	I*4
STATS	I*4

4.0 DEBUG TOOLS

4.1 ADDITIONAL DEBUG OUTPUT

Debugging output is turned on by adding the parameter DEBUG=ON to the EXEC statement in the JCL that executes the processor. The debugging output available is:

Input processor

Module	Message	Function
AINPUT	AIP003	Display the passenger delay threshholds
AINUMT	—	Display inputs to each comparison

Model processor

AVFLSZ	—	Various internal fleet size variables

Output processor

None

4.2 DEBUG IMPLEMENTATION

The catalogued procedure passes the contents of the DEBUG parameter to the program via the PARM= field. The main program retrieves it by the subroutine FAGETP and compares it to its legal value (ON) and sets the variable DEBUG to zero if output is to be omitted. Otherwise it is the I10 unit to receive the output. Anywhere DEBUG output is desired the following statement is used:

```
IF (DEBUG.NE.O) WRITE (DEBUG, format) list
```

5.0 SUBPROGRAM LOGIC TABLE

MODULE	CSECT	ENTRY	CALLS	CALLED BY	FUNCTION
AACCPY	AACCPY	AACCPY		AAPNDX	Copy characters deleting blanks
AACCRD	AACCRD	AACCRD	AACOPY	AINPUT	Read and process control cards
			NDBOR	AOUTPT	
AACOPY	AACOPY	AACOPY		AACCRD	Copy cards from one I/O unit to another
AADATE	AADATE	AADATE	DAYTIM	AINPUT	Get date in character format
				AMSUP	
				AOUTPT	
AAINDX	AAINDX	AAINDX	AAPNDX	AINPUT	Record this execution into the run index file
			FAGETP	AMSUP	
				AOUTPT	
AAPNDX	AAPNDX	AAPNDX	AACCPY	AAINDX	Write an entry into the run index file
AIGDIP	GDIPSECT	GDIP4	FIERR	NDBOR	Scan the list of GDIP variables for the current name
			GDIPF4		
AIINIT	AIINIT	AIINIT		AINPUT	Initialize
AINPUT	AINPUT	AINPUT	AACCRD		Input processor main program
			AADATE		
			AAINDX		
			AIINIT		
			AINUMT		
			AIOUT		
			AIRPTS		
			FAGETP		
			FASPAR		
AINUMT	AINUMT	AINUMT	ASCMPR	AINPUT	Process a TRIPLOG to determine passengers delayed
AIOUT	AIOUT	AIOUT		AINPUT	Write the structured data file
AIRPTS	AIRPTS	AIRPTS	AISUMY	AINPUT	Print the input processor reports
			AODLTI		
			AONUMT		
AISBSR	AISBSR	AISBSR	DAYTIM	AISUMY	Print the subsystem failure rates
AISUMY	AISUMY	AISUMY	AISBSR	AIRPTS	Print the input summary report
			DAYTIM		
AMOUT	AMOUT	AMOUT		AMSUP	Write the STATS file (reliability dependent portion only)
AMSUP	AMSUP	AMSUP	AADATE		Supervisory portion of the SAM model processor
			AAINDX		
			AMOUT		
			APHIST		
			AREAD		
			ARGFAL		
			ASUBSR		
			AVDEL		
			AVFLSZ		
			FAGETP		
			FASPAR		
AODLTI	AODLTI	AODLTI	DAYTIM	AIRPTS	Print the vehicle delay time report
				AOUTPT	
AOGDIP	GDIPSECT	GDIP4	FIERR	NDBOR	Scan the output processor GDIP table for the current variable
			GDIPF4		
AOMAIN	AOMAIN	AOMAIN	DAYTIM	AOUTPT	Print the fleet maintenance report
AONUMT	AONUMT	AONUMT	DAYTIM	AIRPTS	Print the number of trips delayed report
				AOUTPT	
AOPASS	AOPASS	AOPASS	DAYTIM	AOUTPT	Print the passenger availability
AOPSUM	AOPSUM	AOPSUM		AOUTPT	Write the performance summary file
AOREAD	AOREAD	AOREAD		AOUTPT	Read the reliability level dependent part of the raw statistics file
AORELY	AORELY	AORELY	AOSBSR	AOUTPT	Output the failure rate reports
			DAYTIM		
AOSBSR	AOSBSR	AOSBSR	DAYTIM	AORELY	Write the subsystem failure rate report

MODULE	CSECT	ENTRY	CALLS	CALLED BY	FUNCTION
AOUTPT	AOUTPT	AOUTPT	AACCRD		Output processor main program
			AADATE		
			AAINDX		
			AODLTI		
			AOMAIN		
			AONUMT		
			AOPASS		
			AOPSUM		
			AOREAD		
			AORELY		
			AOVEH		
			FAGETP		
			FASPAR		
AOVEH	AOVEH	AOVEH	DAYTIM	AOUTPT	Print the vehicle availability
APDEL	APDEL	APDEL		APHIST	Compute passenger delay times and passenger availability
APHIST	APHIST	APHIST	APDEL	AMSUP	Compute the passenger availability for the threshholds
APZERO	APZERO	APZERO	AVPROD	AVFLSZ	Compute P0
			AVSUM		
AREAD	AREAD	AREAD		AMSUP	Read the structured data file
ARGFAL	ARGFAL	ARGFAL		AMSUP	Compute the failures for each subsystem by region
ASCMPR	ASCMPR	ASCMPR		AINUMT	Compare two trips to determine which is FIRST
ASUBSR	ASUBSR	ASUBSR		AMSUP	Compute the subsystem failure and failure effect rates
AVDEL	AVDEL	AVDEL		AMSUP	Compute the vehicle delay times and availablity
AVFLSZ	AVFLSZ	AVFLSZ	APZERO	AMSUP	Compute the maintenance and standby fleet measures
			AVFMF		
			AVPRB		
AVFMF	AVFMF	AVFMF	AVPROD	AVFLSZ	Compute the failure maintenance fleet measures
			AVSUM		
AVPRB	AVPRB	AVPRB	AVPROD	AVFLSZ	Compute the probability of the standby fleet being adequate to maintain the active fleet
			AVSUM		
AVPROD	AVPROD	AVPROD		APZERO	Compute (M rho)**N/N!
				AVFMF	
				AVPRB	
AVSUM	AVSUM	AVSUM		APZERO	Compute the summation of (M rho)**I/I! where I=1,...,N
				AVFMF	
				AVPRB	
DAYTIM	DAYTIM	DAYTIM	TIMES	AADATE	Get the date in integer format
				AISBSR	
				AISUMY	
				AODLTI	
				AOMAIN	
				AONUMT	
				AOPASS	
				AORELY	
				AOSBSR	
				AOVEH	
DTIMEL	TIMESECT	TIMES		DAYTIM	Get the date from the system
FASPAR	FASPAR	FAGETP		AAINDX	Get a parameter from the PARM= field saved by FASPAR
				AINPUT	
				AMSUP	
				AOUTPT	
		FASPAR		AINPUT	Save the PARM= field from the EXEC statement of the JCL
				AMSUP	
				AOUTPT	
FIERR	FIERR	FIERR		GDIP4	Routine to process unknown variables
XGDIPF4	GDIPF4	GDIPF4	SUDOGO	GDIP4	Full word GDIP input routine
XNDBOR	NDBOR	NDBOR	GDIP4	AACCRD	Main GDIP read routine
XPSEUDO	PFIOCS	SUDOGO		GDIPF4	Pseudo read routine

6.0 SUBPROGRAM DESCRIPTIONS

6.1 AACCPY - Copy Character Strings Deleting Blanks

6.1.1 Identification

Language: PARAFOR

6.1.2 Calling Sequence

CALL AACCPY (TO, INTO, KMTO, FROM, KMFROM)

6.1.3 Local Variable Dictionary

NAME	TYPE	DIM	ARG	FUNCTION
BLANK	L1			CONSTANT
FROM	L1	KMFROM	ARG	STRING TO BE COPIED
INFROM	I4			INDEX FOR FROM
INTO	I4		ARG	FIRST CHARACTER TO COPY TO/NEXT EMPTY CHAR
KMFROM	I4		ARG	LENGTH OF STRING TO BE COPIED
KMTO	I4		ARG	LENGTH OF AREA TO COPY STRING TO
TO	L1	KMTO	ARG	AREA TO COPY STRING TO

6.1.4 Description

The purpose of this subprogram is to copy character strings while deleting blanks. KMFROM characters starting with FROM(1) are copied to TO' (INTO); INTO is updated to the next position beyond the last character copied. Blank characters are omitted. No characters may be copied beyond TO(KMTO). AACCPY may be called with subscripted arrays to start a position other than the beginning; KMTO should be adjusted to avoid array overflow. The parameters do not need to be LOGICAL*1; they are defined this way in AACCPY to permit individual characters to be manipulated.

6.1.5 PDL

```
SUBROUTINE AACCPY
  INFROM = 1
  WHILE
    INFROM <= KMFROM AND
    INTO <= KMTO
  DO
    IF
      FROM(INFROM) ¬= BLANK
    THEN
      TO(INTO) = FROM(INTO)
      INTO = INTO + 1
    ENDIF
    INFROM = INFROM + 1
  ENDDO
  RETURN
END
```

6.1.6 Algorithms

None

6.1.7 Notes or Remarks

This subprogram performs comparisons between logical variables containing characters; the FORTRAN IV (H extended) compiler generates correct code for this although an error message is generated.

6.2 AACCRD - Read and Process Control Cards

6.2.1 Identification

Language: PARAFOR

6.2.2 Calling Sequence

CALL AACCRD (SYSIN, TMPFIL, SYSPRT, ERRPRT, FINDEX, CCRDS, ACTION, KMCCRD, ERRFLG, MODEL, NDXFLG)

6.2.3 Local Variable Dictionary

NAME	TYPE	DIM	ARG	FUNCTION
ACTION	I4	KMCCRD	ARG	ACTION FOR CCRD (1-5)
CCRDS	I4	KMCCRD	ARG	CONTROL CARD TYPES (4 CHARACTERS)
CEFLG	L1			ERROR FLAG (COMMON WITH GDIP)
CEPRT	I4			ERROR OUTPUT UNIT (COMMON WITH GDIP)
CSPRT	I4			SYSTEM OUTPUT UNIT (COMMON WITH GDIP)
CSYSIN	I4			SYSTEM INPUT UNIT (COMMON WITH GDIP)
DONE	L1			FLAG FOR LOOP CONTROL
END	I4			CONSTANT 'END '
ENDFLG	I4			FIRST 3 CHARS WHILE LOOKING FOR 'END'
EOF	L1			FLAG FOR LOOP CONTROL
ERRFLG	L1		ARG	SET TO TRUE WHEN AN ERROR IS DETECTED
ERRPRT	I4		ARG	ERROR MESSAGE OUTPUT UNIT
FINDEX	I4		ARG	RUN INDEX FILE I/O UNIT
FIRST	L1			FLAG TO DETECT FIRST ENTRY TO SUBROUTINE
IMAGE	I4	20		BUFFER FOR CONTROL CARD (CHARACTER)
KMCCRD	I4		ARG	NUMBER OF CONTROL CARDS
MODEL	I2		ARG	MODEL ID (2 CHARACTERS)
NDXFLG	L1		ARG	SET TO TRUE WHEN INDEX CONTROL CARD PROCESSED
SYSIN	I4		ARG	INPUT UNIT FOR CONTROL CARDS
SYSPRT	I4		ARG	OUTPUT UNIT FOR CONTROL CARD LISTING
TMPFIL	I4		ARG	TEMPORARY FILE UNIT NUMBER (FOR CONTROL CARDS)
TYPE	I4			INDEX INTO CCRDS & ACTION ARRAYS (CURRENT)

6.2.4 Description

AACCRD does all processing of control cards except for special functions. It is called with CCRDS and ACTION. Each element of CCRDS contains the first four characters of the control card; the corresponding element of ACTION specifies the type of action performed by this routine.

Action 1 processes a comment block. Action 2 processes a GDIP block. Action 3 initializes the run index file. Action 4 terminates control card processing, i.e., AACCRD returns to the calling program. Action 5 ignores the control card to permit later processing. MODEL is AI for the input processor and AO for the output processor.

6.2.5 PDL

```
SUBROUTINE AACCRD
  < COPY THE ARGUMENTS THAT GDIP NEEDS TO COMMON >
  CSYSIN = SYSIN
  CSPRT = SYSPRT
  CEPRT = ERRPRT
  CEFLG = ERRFLG
  IF
    FIRST
  THEN
    CALL AACOPY <TO COPY CONTROL CARDS TO TEMP FILE>
  ENDIF
  DO
    READ A CONTROL CARD
    LIST THE CONTROL CARD
    FIND INCCRD SUCH THAT CCRDS(INCCRD) = CURRENT CONTROL CARD
    CASE ACTION(INCCRD) OF
      1:  < COMMENT HEADER >
          DO
            READ A CARD
            LIST THE CARD

            END CARD FOUND
          ENDDO
      2:  < DATA HEADER >
          CALL NDBOR <GDIP>
      3:  < INDEX HEADER >
          IF
            NDXFLG
          THEN
            ERROR - RUN INDEX ALREADY INITIALIZED
          ELSE
            DO
              READ A CARD
              LIST IT ON THE CONTROL CARD LISTING
              WRITE IT INTO THE RUN INDEX FILE
            UNTIL
              END CARD ENCOUNTERED
            ENDDO
            WRITE TITLES INTO RUN INDEX FILE
          ENDIF
      4:  < EOD CARD >
          SIMULATE EOF
      5:  < IGNORE CONTROL CARD FOR LATER PROCESSING >
    ENDCASE
  UNTIL
    END OF FILE
  ENDDO
  RETURN
END
```

6.2.6 Algorithms

None

6.2.7 Notes or Remarks

AACCRD communicates with FIERR via the common block ERRORS. This method is utilized because the GDIP routines are interposed between these routines, i.e., FIERR is not directly called by AACCRD. The control cards are copied to a temporary file because GDIP error recovery (via FIERR) backspaces the file which does not work with all possible input files, e.g., SYSIN datasets.

6.3 AACOPY - Copy Card Images from One File to Another

6.3.1 Identification

Language: PARAFOR

6.3.2 Calling Sequence

CALL AACOPY (FROM, TO)

6.3.3 Local Variable Dictionary

NAME	TYPE	DIM	ARG	FUNCTION
FROM	I4		ARG	I/O UNIT TO COPY CARDS FROM
LINE	I4	20		BUFFER FOR ONE 80 CHARACTER CARD IMAGE
TO	I4		ARG	I/O UNIT TO COPY CARDS TO

6.3.4 Description

All records on the data set reference number FROM to the data set reference number TO. The transfer is terminated by the end of the input data set.

6.3.5 PDL

```
SUBROUTINE AACOPY
  DO
    COPY A CARD IMAGE
  UNTIL
    END OF FILE
  ENDDO
  RETURN
END
```

6.3.6 Algorithms

None

6.3.7 Notes or Remarks

None

6.4 AADATE - Get Current Date in Printable Format

6.4.1 Identification

Language: PARAFOR

6.4.2 Calling Sequence

CALL AADATE (MMDDYY)

6.4.3 Local Variable Dictionary

NAME	TYPE	DIM	ARG	FUNCTION
COLON	L1			CONSTANT ':'
DAY	I2			DAY OF MONTH
DIGITS	L1	10		CONSTANT CONTAINING DIGITS IN CHARACTER FORMAT
HR	I2			HOUR OF DAY
MIN	I2			MINUTE OF HOUR
MMDDYY	L1	14	ARG	RESULT: 'MM/DD/YY HH:MM'
MO	I2			MONTH OF YEAR
SEC	I2			SECOND OF MINUTE
SLASH	L1			CONSTANT '/'
SPACE	L1			CONSTANT ' '
YR	I2			YEAR OF CENTURY

6.4.4 Description

The date and time are returned in MMDDYY.

6.4.5 PDL

```
SUBROUTINE AADATE
  CALL DAYTIM TO GET THE CURRENT DATE
  REFORMAT IT INTO CHARACTER FORMAT
  RETURN
END
```

6.4.6 Algorithms

None

6.4.7 Notes or Remarks

None

6.5 AAINDX - Generate The Run Index Entries

6.5.1 Identification

Language: FORTRAN

6.5.2 Calling Sequence

CALL AAINDX (FINDEX, ERRPRT, PARM, MMDDYY, LIB, TYPE, MEMBER, WRTFLG, ERRFLG, KMFILE)

6.5.3 Local Variable Dictionary

NAME	TYPE	DIM	ARG	FUNCTION
BLANKS	L1	14		CONSTANT 14*' '
ERRFLG	L1		ARG	SET TO TRUE IF ERROR DETECTED
ERRPRT	I4		ARG	UNIT FOR ERROR MESSAGE
FINDEX	I4		ARG	I/O UNIT FOR RUN INDEX FILE
FIRST	L1	8		FIRST INDEX LEVEL OF FILE NAME
FOURTH	L1	8		MEMBER NAME OF FILE NAME
KMFILE	I4		ARG	NUMBER OF ENTRIES TO WRITE TO RUN INDEX FILE
LIB	L1	8	ARG	SECOND LEVEL INDEX FOR THE ENTRIES
		KMFILE		(8 CHARACTER)
MEMBER	I4	KMFILE	ARG	PARAMETER NUMBER OF MEMBER NAME FOR EACH ENTRY
MMDDYY	L1	14	ARG	DATE TO ATTACH TO THE ENTRY (14 CHARACTERS)
PARM	I4		ARG	ADDRESS OF PARAMETER FIELD FROM 'EXEC' CARD
SECOND	L1	8		SECOND INDEX LEVEL OF FILE NAME
THIRD	L1	8		THIRD INDEX LEVEL OF FILE NAME
TYPE	L1	8	ARG	THIRD LEVEL INDEX FOR THE ENTRIES
		KMFILE		(8 CHARACTER)
WRTFLG	L1	KMFILE	ARG	IF FALSE OMIT CORRESPONDING ENTRY

6.5.4 Description

AAINDX generates the entries for the run index file. Each entry consists of the date and time and a file name. Each element of WRTFLG corresponds to a run index entry. If FALSE, the entry is not output; if TRUE, the corresponding elements of LIB, MEMBER, and TYPE, along with MMDDYY and FIRST are used to generate an entry in the file. All file names are assumed to be of the format: first.library.type(member).

PARM is returned from FASPAR. AADATE can be used to determine MMDDYY.

6.5.5 PDL

```
SUBROUTINE AAINDX
  IF
    ERRPRT ¬= 0
  THEN
    PRINT A TITLE ON THE PRINTED LISTING
  ENDIF
  CALL AAPNDX TO PRINT THE LOAD MODULE NAME
  FOR
    INFILE FROM 1 TO KMFILE
  DO
    IF
      WRTFLG(INFILE)
    THEN
      CALL AAPNDX TO PRINT THE INDEX ENTRY
    ENDIF
  ENDDO
  RETURN
END
```

6.5.6 Algorithms

None

6.5.7 Notes or Remarks

The disposition of the run index file must be MOD; this is accomplished by using DISP = MOD in the DD statement (JCL).

6.6 AAPNDX - Print Run Index Entry

6.6.1 Identification

Language: PARAFOR

6.6.2 Calling Sequence

CALL AAPNDX (FINDEX, SYSPRT, MMDDYY, FIRST, SECOND, THIRD, FOURTH)

6.6.3 Local Variable Dictionary

NAME	TYPE	DIM	ARG	FUNCTION
BLANK	L1			CONSTANT ' '
DOT	L1			CONSTANT '.'
FILNAM	L1	36		ASSEMBLED FILENAME WITH BLANKS COMPRESSED
FINDEX	I4		ARG	I/O UNIT FOR RUN INDEX FILE
FIRST	L1	8	ARG	FIRST INDEX LEVEL OF FILE NAME
FOURTH	L1	8	ARG	MEMBER NAME OF FILE NAME
LPAREN	L1			CONSTANT '('
MMDDYY	L1	14	ARG	DATE TO ATTACH TO THE ENTRY (14 CHARACTERS)
RPAREN	L1			CONSTANT ')'
SECOND	L1	8	ARG	SECOND INDEX LEVEL OF FILE NAME
THIRD	L1	8	ARG	THIRD INDEX LEVEL OF FILE NAME
SYSPRT	I4		ARG	UNIT FOR PRINTED LISTING

6.6.4 Description

One record is written in to the run index file containing the date (MMDDYY), and the file name. The file name is the concatenation of FIRST, SECOND, THIRD, and FOURTH with appropriate delimiters and with blanks eliminated. The file name is:

FIRST.SECOND.THIRD(FOURTH)

6.6.5 PDL

```
SUBROUTINE AAPNDX
  FILNAM = FIRST || '.' || SECOND || '.' || THIRD || '(' || FOURTH ||
    ')'    < WITH BLANKS ELIMINATED >
  WRITE THE TIME AND FILNAM INTO THE RUN INDEX FILE
  IF
    SYSPRT ¬= 0
  THEN
    WRITE THE TIME AND FILENAME TO SYSPRT
  ENDIF
  RETURN
END
```

6.6.6 Algorithms

None

6.6.7 Notes or Remarks

None

6.7 AIGDIP - Lookup GDIP Variable

6.7.1 Identification

Language: ASSEMBLER

6.7.2 Calling Sequence

CALL GDIP4 (NAME, FMT, IRAL, IRAH, IRBL, IRBH, IRCL, IRCH, IRDL, IRDH)

6.7.3 Local Variable Dictionary

None

6.7.4 Description

All GDIP variables acceptable to the input processor are defined here utilizing the GDIP macros.

6.7.5 PDL

None

6.7.6 Algorithms

None

6.7.7 Notes or Remarks

The array maximums are included in this routine as well as the main program; they are in different formats.

6.8 AIINIT - Read Structured Data File to be Updated

6.8.1 Identification

Language: PARAFOR

6.8.2 Calling Sequence

CALL AIINIT (FINIT, DMND, DLTIME, FLTSLT, FRATE, GWMILE, NUMTRP, PTHRDM, PNS, RRATE, SMFREQ, SMST, STATNS, SYSTIM, NOTHRD, THRIND, THRESH, VINSTA, VM, VN, VOPTIM, KNDM, KNREG, KNSUB, KNLVL, KNRD, KNFL, KNDL, KMDM, KMREG, KMSUB, KMLVL, KMRD, KMFL, KMDL, SYSPRT)

6.8.3 Local Variable Dictionary

NAME	TYPE	DIM	ARG	FUNCTION
DLTIME	R4	KMREG KMDM KMSUB KMFL	ARG	VEHICLE DELAY TIME RESULTING FROM FAILURES IN EACH REGION AND DEMAND PERIOD FOR EACH SUBSYSTEM AND FAILURE LEVEL
DMND	R4	KMDM	ARG	SYSTEM DEMAND IN EACH DEMAND PERIOD
FLTSLT	I4		ARG	ACTIVE FLEET SIZE (0 - AVERAGE, 1 - MAXIMUM)
FRATE	R4	KMSUB KMRD KMLVL KMFL	ARG	FAILURE RATES OF SYSTEMS PER UNIT TIME AS FUNCTIONS OF DIFFERENT CAUSAL FACTORS FOR EACH LEVEL OF RELIABILITY AND FAILURE LEVEL
FINIT	I4		ARG	I/O UNIT WITH OLD STRUCTURED DATA FILE
GWMILE	R4	KMREG	ARG	GUIDEWAY LENGTH IN EACH REGION
KMDL	I4		ARG	COMPILED MAXIMUM NUMBER OF DELAY THRESHHOLDS
KMDM	I4		ARG	COMPILED MAXIMUM NUMBER OF DEMAND PERIODS
KMFL	I4		ARG	COMPILED MAXIMUM NUMBER OF FAILURE LEVELS
KMLVL	I4		ARG	COMPILED MAXIMUM NUMBER OF RELIABLILTY LEVELS
KMRD	I4		ARG	COMPILED MAXIMUM NUMBER OF CAUSAL FACTORS
KMREG	I4		ARG	COMPILED MAXIMUM NUMBER OF REGIONS
KMSUB	I4		ARG	COMPILED MAXIMUM NUMBER OF SUBSYSTEMS
KNDL	I4		ARG	NUMBER OF DELAY THRESHHOLDS
KNDM	I4		ARG	NUMBER OF DEMAND PERIODS
KNFL	I4		ARG	NUMBER OF FAILURE LEVELS
KNLVL	I4		ARG	NUMBER OF RELIABLITY LEVELS
KNRD	I4		ARG	NUMBER OF CAUSAL FACTORS (5)
KNREG	I4		ARG	NUMBER OF REGIONS
KNSUB	I4		ARG	NUMBER OF SUBSYSTEMS (4)
NOTHRD	I4		ARG	NUMBER OF THRESHHOLDS
NUMTRP	R4	KMREG KMDL KMSUB KMDM	ARG	NUMBER OF TRIPS DELAYED BY EACH DELAY RANGE REGION AND DEMAND PERIOD RESULTING IN EACH FAILURE LEVEL.
PTHRDM	R4		ARG	MINIMUM PASSENGER DELAY THRESHHOLD
PNS	R4	KMREG KMDM	ARG	NUMBER OF PASSENGERS LEAVING STATIONS IN EACH REGION DURING EACH DEMAND INTERVAL
RRATE	R4		ARG	VEHICLE REPAIR RATE IN EACH BAY
SMFREQ	R4		ARG	SCHEDULED MAINTENANCE FREQUENCY
SMST	R4		ARG	SCHEDULED MAINTENANCE SERVICE TIME PER VEHICLE
STATNS	I4	KMREG	ARG	NUMBER OF STATIONS IN EACH REGION
SYSPRT	I4		ARG	UNIT FOR PRINTING ERROR MESSAGES
SYSTIM	R4	KMDM	ARG	SYSTEM OPERATING TIME BY DEMAND PERIOD
THRIND	R4		ARG	THRESHHOLD INCREMENT
THRESH	R4	KMDL	ARG	THRESHHOLDS
VINSTA	R4	KMREG KMDM	ARG	NUMBER OF VEHICLES THROUGH STATIONS IN EACH REGION AND DEMAND PERIOD
VM	R4	KMREG KMDM	ARG	VEHICLE DISTANCE IN EACH REGION DURING EACH DEMAND PERIOD
VN	R4	KMREG KMDM	ARG	AVERAGE NUMBER OF VEHICLES IN EACH REGION DURING EACH DEMAND PERIOD
VOPTIM	I4	KMREG KMDM	ARG	TOTAL VEHICLE OPERATING TIME IN EACH REGION AND DEMAND INTERVAL

6.8.4 Description

This routine initializies all the input variables. First, an attempt is made to read the structured data file to be updated. If it is null, i.e., an end of file is encountered, the variables are initialized to zero.

6.8.5 PDL

```
SUBROUTINE AIINIT
  SET ALL ELEMENTS OF NUMTRP TO 0
  IF
    FILE TO BE UPDATED IS NOT NULL
  THEN
    READ THE STRUCTURED DATA FILE
  ELSE
    KNREG = 0
    KMDM = 0
    KMDL = 0
    KMFL = 0
  ENDIF
  RETURN
END
```

6.8.6 Algorithms

None

6.8.7 Notes or Remarks

None

6.9 AINPUT - Input Processor Main Program

6.9.1 Identification

Language: PARAFOR

6.9.2 Calling Sequence

None; main program

6.9.3 Local Variable Dictionary

NAME	TYPE	DIM	ARG	FUNCTION
DLTIME	R4	KMREG, KMDM, KMSUB, KMFL	ARG	VEHICLE DELAY TIME RESULTING FROM FAILURES IN EACH REGION AND DEMAND PERIOD FOR EACH SUBSYSTEM AND FAILURE LEVEL
DMND	R4	KMDM	ARG	SYSTEM DEMAND IN EACH DEMAND PERIOD
FLTSLT	I4		ARG	ACTIVE FLEET SIZE (0 - AVERAGE, 1 - MAXIMUM)
FRATE	R4	KMSUB, KMRD, KMLVL, KMFL	ARG	FAILURE RATES OF SYSTEMS PER UNIT TIME AS FUNCTIONS OF DIFFERENT CAUSAL FACTORS FOR EACH LEVEL OF RELIABILITY AND FAILURE LEVEL
FINIT	I4		ARG	I/O UNIT WITH OLD STRUCTURED DATA FILE
GWMILE	R4	KMREG	ARG	GUIDEWAY LENGTH IN EACH REGION
KMDL	I4		ARG	COMPILED MAXIMUM NUMBER OF DELAY THRESHHOLDS
KMDM	I4		ARG	COMPILED MAXIMUM NUMBER OF DEMAND PERIODS
KMFL	I4		ARG	COMPILED MAXIMUM NUMBER OF FAILURE LEVELS
KMLVL	I4		ARG	COMPILED MAXIMUM NUMBER OF RELIABLILTY LEVELS
KMRD	I4		ARG	COMPILED MAXIMUM NUMBER OF CAUSAL FACTORS
KMREG	I4		ARG	COMPILED MAXIMUM NUMBER OF REGIONS
KMSUB	I4		ARG	COMPILED MAXIMUM NUMBER OF SUBSYSTEMS
KNDL	I4		ARG	NUMBER OF DELAY THRESHHOLDS
KNDM	I4		ARG	NUMBER OF DEMAND PERIODS
KNFL	I4		ARG	NUMBER OF FAILURE LEVELS
KNLVL	I4		ARG	NUMBER OF RELIABLITY LEVELS
KNRD	I4		ARG	NUMBER OF CAUSAL FACTORS (5)
KNREG	I4		ARG	NUMBER OF REGIONS
KNSUB	I4		ARG	NUMBER OF SUBSYSTEMS (4)
NOTHRD	I4		ARG	NUMBER OF THRESHHOLDS
NUMTRP	R4	KMREG, KMDL, KMSUB, KMDM	ARG	NUMBER OF TRIPS DELAYED BY EACH DELAY RANGE REGION AND DEMAND PERIOD RESULTING IN EACH FAILURE LEVEL.
PTHRDM	R4		ARG	MINIMUM PASSENGER DELAY THRESHHOLD
PNS	R4	KMREG, KMDM	ARG	NUMBER OF PASSENGERS LEAVING STATIONS IN EACH REGION DURING EACH DEMAND INTERVAL
RRATE	R4		ARG	VEHICLE REPAIR RATE IN EACH BAY
SMFREQ	R4		ARG	SCHEDULED MAINTENANCE FREQUENCY
SMST	R4		ARG	SCHEDULED MAINTENANCE SERVICE TIME PER VEHICLE
STATNS	I4	KMREG	ARG	NUMBER OF STATIONS IN EACH REGION
SYSPRT	I4		ARG	UNIT FOR PRINTING ERROR MESSAGES
SYSTIM	R4	KMDM	ARG	SYSTEM OPERATING TIME BY DEMAND PERIOD
THRIND	R4		ARG	THRESHHOLD INCREMENT
THRESH	R4	KMDL	ARG	THRESHHOLDS
VINSTA	R4	KMREG, KMDM	ARG	NUMBER OF VEHICLES THROUGH STATIONS IN EACH REGION AND DEMAND PERIOD
VM	R4	KMREG, KMDM	ARG	VEHICLE DISTANCE IN EACH REGION DURING EACH DEMAND PERIOD
VN	R4	KMREG, KMDM	ARG	AVERAGE NUMBER OF VEHICLES IN EACH REGION DURING EACH DEMAND PERIOD
VOPTIM	I4	KMREG, KMDM	ARG	TOTAL VEHICLE OPERATING TIME IN EACH REGION AND DEMAND INTERVAL

NAME	TYPE	DIM	ARG	FUNCTION
INDL	I4			Index specifying delay threshhold
INDM	I4			Index specifying demand period
INFL	I4			Index specifying failure level
INREG	I4			Index specifying repair
INSUB	I4			Index specifying subsystem 1 - vehicle 2 - stations 3 - guideways 4 - central management

NAME	TYPE	DIM	ARG	FUNCTION
ON	I4			Constant 'ON'
LIB	R8	2		Run index entry library name (8 characters)
PARM	I4			Address of parameter list from EXEC
TYPE	R8	2		Run index entry type name (8 characters)
DEBUG	I4			I/O unit for raw statistics
STRUC	I4			I/O unit with structured data
ERRFLG	L1			Error flag - set to true by any error
ERRPRT	I4			I/O unit to receive error messages
FINDEX	I4			I/O unit of run index file
MEMBER	I4	2		Index to parameter list for run index entries
MMDDYY	I2	7		Date in character format
MODULE	R8			Load module name
WRTFLG	L1	2		Flag to write
CCRDS	I4	6		Control card names (4 characters)
FDLTI	I4			Unit for vehicle delay time report
FNTRP	I4			Unit for number of trips delayed report (0 - omit report)
MODEL	I2			Model id: constant 'AI'
SYSIN	I4			Unit for run time inputs
ACTION	I4	6		Type of processing for the control cards described in CCRDS
FSUBSR	I4			Unit for subsystem reliability report (0 - omit report)
NDXFLG	L1			Not used (parameter)
TMPFIL	I4			Unit with scratch file
EOD	I4			Constant 'EOD' equivalenced to CCRDS (1)
FAIL	I4			Constant 'FAIL' equivalenced to CCRDS (8)
FSUMY	I4			I/O unit for input summary report
CTLCRD	I4			Type of current control card
DBGFLG	I4	2		Debug parameter from EXEC
FFAILD	I4			I/O unit with failure trip logs
FUNFAL	I4			I/O unit with reference trip log
INFILE	I4			Index of current failure trip log
NOFAIL	I2	KMREG KMDM KMFL		Number of trip logs processed into the corresponding elements of NUMTRP
UNMTCH	I4			Number of unmatched trips

6.9.4 Description

This is the main program of the input processor. The description of the input processor is in Section 2.1.

```
DECODE DEBUG FLAG
PRINT TITLE ON CONTROL CARD LISTING
SET ALL ELEMENTS OF NOFAIL TO 0
CALL AIINIT < INITIALIZATION >
CALL AACCRD <READ & PROCESS CONTROL CARDS>
IF
  ¬ NDXFLG
THEN
  ERROR ---- NO RUN INDEX CARD
ENDIF
IF
  ¬ ERRFLG
THEN
  FOR
    INDL FROM 1 TO KNDL
  DO
    THRESH(INDL) = PTHRDM + THRIND * INDL
  ENDDO
  IF
    ¬ ERRFLG
  THEN
    DO
      READ A CONTROL CARD
      IF
        IT IS A FAILURE CONTROL CARD
      THEN
        VALIDATE THE CONTROL CARD PARAMETERS
        IF
          NOFAIL(INREG, INDM, INSUB, INFL) = 0
        THEN
          CLEAR NUMTRP(INREG, INDM, *, INSUB, INFL) TO ZERO
        ENDIF
        UNMTCH = 0
        NOFAIL(INREG, INDM, INSUB, INFL) =
          NOFAIL(INREG, INDM, INSUB, INFL) + 1
        CALL AINUMT < PROCESS A TRIPLOG >
        WRITE THE NUMBER OF UNMATCHED TRIPS
      ENDIF
    UNTIL
      END OF FILE
    ENDDO
  ENDIF
   FOR
     INFL FROM 1 TO KNFL
   DO
     FOR
       INSUB FROM 1 TO KNSUB
     DO
       FOR
         INDM FROM 1 TO KNDM
       DO
         FOR
           INREG FROM 1 TO KNREG
         DO
           IF
             NOFAIL(INREG, INDM, INSUB, INFL) > 0
           THEN
             FOR
               INDL FROM 1 TO KNDL
             DO
               NUMTRP(INREG, INDM, INDL, INSUB, INFL) =
                 NUMTRP(INREG, INDM, INDL, INSUB, INFL) /
                 NOFAIL(INREG, INDM, INSUB, INFL)
             ENDDO
           ENDIF
         ENDDO
       ENDDO
     ENDDO
   ENDDO
 ENDIF
 IF
   ¬ ERR FLG
 THEN
   WRITE A NEW STRUCTURED DATA FILE
 ENDIF
 IF
   NDX FLG
 THEN
   CALL AAINDX <WRITE THE RUN INDEX ENTRIES>
 ENDIF
 CALL AIRPTS <PRINT THE REPORTS>
 STOP
END
```

6.9.6 Algorithms

None

6.9.7 Notes or Remarks

The input processor accepts the parameter from the PARM = field, the format of the parameter is

load module,run-index,prog-lib,prog-proj,data-proj,struc,debug

where

load module	is the name of the load module used for this execution
run index	is the distinguishing characters of the run index file (the last 7 characters of the third index level of the file name)
prog-lib	is the second-level of the STEPLIB file name
prog-proj	is the first-level of the STEPLIB file name
data-proj	is the first-level of all data files
struc	is the structure data file member name
debug	is used to turn on debugging output (see section 4.0)

6.10 AINUMT - Process a Trip log to Find Number of Trips Delayed

6.10.1 Identification

Language: PARAFOR

6.10.2 Calling Sequence

CALL AINUMT (FUNFAL, FFAILD, NUMTRP, INFILE, INREG, INDM, INSUB, INFL, KNDL, KMREG, KMDM, KMDL, KMSUB, KMFL, ERRPRT, ERRFLG, UNMTCH, PTHRDM, THRESH, DEBUG)

6.10.3 Local Variable Dictionary

NAME	TYPE	DIM	ARG	FUNCTION
DEBUG	I4		ARG	UNIT TO CONTAIN DEBUG OUTPUT (0 TO DISABLE)
DELAY	R4			DELAY TIME FOR THE CURRENT TRIP
ERRFLG	L1		ARG	SET TO TRUE WHEN AN ERROR HAS BEEN DETECTED
ERRPRT	I4		ARG	UNIT FOR ERROR MESSAGES
FDESTS	I4			DESTINATION STATION (FAILED TRIPLOG)
FFAILD	I4		ARG	UNIT CONTAINING THE FAILED TRIPLOG
FNOPNS	I4			NUMBER OF PASSENGERS (FAILED TRIPLOG)
FORIGS	I4			ORIGIN STATION (FAILED TRIPLOG)
FSTRTT	R4			TRIP START TIME (FAILED TRIPLOG)
FTERMT	R4			TRIP TERMINATION TIME (FAILED TRIPLOG)
FUNFAL	I4		ARG	UNIT CONTAINING THE UNFAILED TRIPLOG
INDM	I4		ARG	DEMAND INTERVAL CONTAINING FAILURE
INFILE	I4		ARG	FILE NUMBER OF FAILED TRIPLOG
INFL	I4		ARG	DEGREE OF FAILURE IN FAILED TRIPLOG
INREG	I4		ARG	REGION CONTAINING FAILURE
INSUB	I4		ARG	SUBSYSTEM WHICH FAILED
KMDL	I4		ARG	COMPILED MAXIMUM NUMBER OF DELAY THRESHHOLDS
KMDM	I4		ARG	COMPILED MAXIMUM NUMBER OF DEMAND PERIODS
KMFL	I4		ARG	COMPILED MAXIMUM NUMBER OF FAILURE LEVELS
KMREG	I4		ARG	COMPILED MAXIMUM NUMBER OF REGIONS
KMSUB	I4		ARG	COMPILED MAXIMUM NUMBER OF SUBSYSTEMS
KNDL	I4		ARG	NUMBER OF DELAY THRESHHOLDS
KNFILE	I4		ARG	NUMBER OF LAST FILE PROCESSED
NUMTRP	R4	KMREG KMDM KMDL KMSUB KMFL	ARG	NUMBER OF TRIPS DELAYED BY FAILURES
PTHRDM	R4		ARG	MINIMUM PASSENGER DELAY THRESHHOLD
THRESH	R4	KMDL	ARG	THRESHHOLDS
UDEST	I4			DESTINATION STATION (UNFAILED TRIPLOG)
UNMTCH	I4		ARG	NUMBER OF UNMATCHED TRIPS
UNOPNS	I4			NUMBER OF PASSENGERS (UNFAILED TRIPLOG)
UORIGS	I4			ORIGIN STATION (UNFAILED TRIPLOG)
USTRTT	R4			TRIP START TIME (UNFAILED TRIPLOG)
UTERMT	R4			TRIP TERMINATION TIME (UNFAILED TRIPLOG)

6.10.4 Description

This routine computes the number of passengers delayed for a particular failure (but several delay thresholds) by comparing two trip logs. Both trip logs must be sorted (Section 2.1).

6.10.5 PDL

```
SUBROUTINE AINUMT
  REWIND UNFAILED TRIPLOG
  VALIDATE INDICES INTO NUMTRP
  VERIFY THAT THE NEXT FILE IS TO BE PROCESSED
  KNFILE =INFILE
  < THE FOLLOWING IS THE STANDARD METHOD OF UPDATING A MASTER FILE >
  READ A TRIP FROM THE UNFAILED TRIPLOG
  READ A TRIP FROM THE FAILED TRIPLOG
  DO
    IF
      FAILED TRIP START TIME IS LATER THAN THE UNFAILED TRIP
    THEN
      READ A TRIP FROM THE UNFAILED TRIPLOG
      UNMTCH = UNMTCH + 1
    ELSE
      IF
        THE FAILED AND UNFAILED TRIPS ARE NOT THE SAME TRIP
      THEN
        READ A TRIP FROM THE FAILED TRIPLOG
      ELSE
        DELAY = MAX (0, FTERMT - UTERMT) /60
        INDL = 0
        IF
          DELAY > PTHRDM
        THEN
          DO
            INDL = INDL + 1
          UNTIL
            DELAY <= THRESH(INDL) !
            INDL = KNDL
          ENDDO
          NUMTRP(INREG, INDM, INDL, INSUB, INFL) =
            NUMTRP(INREG, INDM, INDL, INSUB, INFL) + 1
        ENDIF
        READ A TRIP FROM THE UNFAILED TRIPLOG
        READ A TRIP FROM THE FAILED TRIPLOG
      ENDIF
    ENDIF
  UNTIL
    END OF FILE ON EITHER FILE
  ENDDO
  IF
    END OF FILE ON FAILED TRIP LOG
  THEN
    COUNT REMAINING TRIPS IN UNFAILED TRIPLOGS AS UNMATCHED (UNMTCH)
  ELSE
    READ REMAINING TRIPS FROM FAILED TRIPLOG <TO POSITION THE FILE>
  ENDIF
  RETURN
END
```

6.10.6 Algorithms

None

6.10.7 Notes or Remarks

The unit containing the failed trip logs is a concatenation of all the failed trip logs to be processed; each call to AINUMT processes the next trip log. An end of file separates the trip logs. Upon return from this routine, the failed trip log is positioned at the beginning of the next trip log.

6.11 AIOUT - Write the Structured Data File

6.11.1 Identification

Language: PARAFOR

6.11.2 Calling Sequence

CALL AIOUT (STRUC, DMND, DLTIME, FLTSLT, FRATE, GWMILE, NUMTRP, PTHRDM, PNS, RRATE, SMFREQ, SMST, STATNS, SYSTIM, NOTHRD, THRIND, THRESH, VINSTA, VM, VN, VOPTIM, KNDM, KNREG, KNSUB, KNLVL, KNRD, KNFL, KNDL, KNDM, KMREG, KMSUB, KMLVL, KMRD, KMFL, KMDL)

6.11.3 Local Variable Dictionary

NAME	TYPE	DIM	ARG	FUNCTION
DLTIME	R4	KMREG KMDM KMSUB KMFL	ARG	VEHICLE DELAY TIME RESULTING FROM FAILURES IN EACH REGION AND DEMAND PERIOD FOR EACH SUBSYSTEM AND FAILURE LEVEL
DMND	R4	KMDM	ARG	SYSTEM DEMAND IN EACH DEMAND PERIOD
FLTSLT	I4		ARG	ACTIVE FLEET SIZE (0 - AVERAGE, 1 - MAXIMUM)
FRATE	R4	KMSUB KMRD KMLVL KMFL	ARG	FAILURE RATES OF SYSTEMS PER UNIT TIME AS FUNCTIONS OF DIFFERENT CAUSAL FACTORS FOR EACH LEVEL OF RELIABILITY AND FAILURE LEVEL
GWMILE	R4	KMREG	ARG	GUIDEWAY LENGTH IN EACH REGION
KMDL	I4		ARG	COMPILED MAXIMUM NUMBER OF DELAY THRESHHOLDS
KMDM	I4		ARG	COMPILED MAXIMUM NUMBER OF DEMAND PERIODS
KMFL	I4		ARG	COMPILED MAXIMUM NUMBER OF FAILURE LEVELS
KMLVL	I4		ARG	COMPILED MAXIMUM NUMBER OF RELIABLILTY LEVELS
KMRD	I4		ARG	COMPILED MAXIMUM NUMBER OF CAUSAL FACTORS
KMREG	I4		ARG	COMPILED MAXIMUM NUMBER OF REGIONS
KMSUB	I4		ARG	COMPILED MAXIMUM NUMBER OF SUBSYSTEMS
KNDL	I4		ARG	NUMBER OF DELAY THRESHHOLDS
KNDM	I4		ARG	NUMBER OF DEMAND PERIODS
KNFL	I4		ARG	NUMBER OF FAILURE LEVELS
KNLVL	I4		ARG	NUMBER OF RELIABLITY LEVELS
KNRD	I4		ARG	NUMBER OF CAUSAL FACTORS (5)
KNREG	I4		ARG	NUMBER OF REGIONS
KNSUB	I4		ARG	NUMBER OF SUBSYSTEMS (4)
NOTHRD	I4		ARG	NUMBER OF THRESHHOLDS
NUMTRP	R4	KMREG KMDL KMSUB KMDM	ARG	NUMBER OF TRIPS DELAYED BY EACH DELAY RANGE REGION AND DEMAND PERIOD RESULTING IN EACH FAILURE LEVEL.
PTHRDM	R4		ARG	MINIMUM PASSENGER DELAY THRESHHOLD
PNS	R4	KMREG KMDM	ARG	NUMBER OF PASSENGERS LEAVING STATIONS IN EACH REGION DURING EACH DEMAND INTERVAL
RRATE	R4		ARG	VEHICLE REPAIR RATE IN EACH BAY
SMFREQ	R4		ARG	SCHEDULED MAINTENANCE FREQUENCY
SMST	R4		ARG	SCHEDULED MAINTENANCE SERVICE TIME PER VEHICLE
STATNS	I4	KMREG	ARG	NUMBER OF STATIONS IN EACH REGION
STRUC	I4		ARG	I/O UNIT WITH NEW STRUCTURED DATA FILE
SYSTIM	R4	KMDM	ARG	SYSTEM OPERATING TIME BY DEMAND PERIOD
THRIND	R4		ARG	THRESHHOLD INCREMENT
THRESH	R4	KMDL	ARG	THRESHHOLDS
VINSTA	R4	KMREG KMDM	ARG	NUMBER OF VEHICLES THROUGH STATIONS IN EACH REGION AND DEMAND PERIOD
VM	R4	KMREG KMDM	ARG	VEHICLE DISTANCE IN EACH REGION DURING EACH DEMAND PERIOD
VN	R4	KMREG KMDM	ARG	AVERAGE NUMBER OF VEHICLES IN EACH REGION DURING EACH DEMAND PERIOD
VOPTIM	I4	KMREG KMDM	ARG	TOTAL VEHICLE OPERATING TIME IN EACH REGION AND DEMAND INTERVAL

6.11.4 Description

This routine writes the entire structured data files from its parameters.

6.11.5 PDL

```
SUBROUTINE AIOUT
  WRITE THE STRUCTURED DATA FILE
  RETURN
END
```

6.11.6 Algorithms

None

6.11.7 Notes or Remarks

The entire main section of code is included from AFSTRC; it is shared with in-model processor so that any change to the structured data file changes both the input and the model processor code. If the file structure is modified, the version number in AFSTRC should be incremented. The statements starting with % are PL/1 preprocessor statements that permit this sharing of code.

6.12 AIRPTS - Write the Reports

6.12.1 Identification

Language: PARAFOR

6.12.2 Calling Sequence

CALL AIRPTS (FSUMY, FSUBSR, FNTRP, FDLTI, FRATE, RRATE, SMFREQ, SMST, FLTSLT, GWMILE, PNS, STATNS, DMND, VOPTIM, SYSTIM, VINSTA, VM, VN, NUMTRP, THRESH, KMLVL, KMREG, KMDM, KMSUB, KMFL, KMRD, KMDL)

6.12.3 Local Variable Dictionary

NAME	TYPE	DIM	ARG	FUNCTION
DLTIME	R4	KMREG	ARG	
		KMDM		VEHICLE DELAY TIME RESULTING FROM FAILURES IN
		KMSUB		EACH REGION AND DEMAND PERIOD FOR EACH
		KMFL		SUBSYSTEM AND FAILURE LEVEL
DMND	R4	KMDM	ARG	SYSTEM DEMAND IN EACH DEMAND PERIOD
FDLTI	I4		ARG	I/O UNIT FOR DELAY TIME REPORT
FLTSLT	I4		ARG	ACTIVE FLEET SIZE (0 - AVERAGE, 1 - MAXIMUM)
FNTRP	I4		ARG	I/O UNIT FOR NUMBER OF TRIPS DELAYED REPORT
FRATE	R4	KMSUB	ARG	FAILURE RATES OF SYSTEMS PER UNIT TIME AS
		KMRD		FUNCTIONS OF DIFFERENT CAUSAL FACTORS FOR EACH
		KMLVL		LEVEL OF RELIABILITY AND FAILURE LEVEL
		KMFL		
FSUBSR	I4		ARG	I/O UNIT FOR FAILURE RATES REPORT
FSUMY	I4		ARG	I/O UNIT FOR INPUT SUMMARY FILE
GWMILE	R4	KMREG	ARG	GUIDEWAY LENGTH IN EACH REGION
KMDL	I4		ARG	COMPILED MAXIMUM NUMBER OF DELAY THRESHHOLDS
KMDM	I4		ARG	COMPILED MAXIMUM NUMBER OF DEMAND PERIODS
KMFL	I4		ARG	COMPILED MAXIMUM NUMBER OF FAILURE LEVELS
KMLVL	I4		ARG	COMPILED MAXIMUM NUMBER OF RELIABLILTY LEVELS
KMRD	I4		ARG	COMPILED MAXIMUM NUMBER OF CAUSAL FACTORS
KMREG	I4		ARG	COMPILED MAXIMUM NUMBER OF REGIONS
KMSUB	I4		ARG	COMPILED MAXIMUM NUMBER OF SUBSYSTEMS
KNDL	I4		ARG	NUMBER OF DELAY THRESHHOLDS
KNDM	I4		ARG	NUMBER OF DEMAND PERIODS
KNFL	I4		ARG	NUMBER OF FAILURE LEVELS
KNLVL	I4		ARG	NUMBER OF RELIABLITY LEVELS
KNRD	I4		ARG	NUMBER OF CAUSAL FACTORS (5)
KNREG	I4		ARG	NUMBER OF REGIONS
KNSUB	I4		ARG	NUMBER OF SUBSYSTEMS (4)
NUMTRP	R4	KMREG	ARG	NUMBER OF TRIPS DELAYED BY EACH DELAY RANGE
		KMDL		REGION AND DEMAND PERIOD RESULTING IN EACH
		KMSUB		FAILURE LEVEL.
		KMDM		
PNS	R4	KMREG	ARG	NUMBER OF PASSENGERS LEAVING STATIONS IN EACH
		KMDM		REGION DURING EACH DEMAND INTERVAL
RRATE	R4		ARG	VEHICLE REPAIR RATE IN EACH BAY
SMFREQ	R4		ARG	SCHEDULED MAINTENANCE FREQUENCY
SMST	R4		ARG	SCHEDULED MAINTENANCE SERVICE TIME PER VEHICLE
STATNS	I4	KMREG	ARG	NUMBER OF STATIONS IN EACH REGION
SYSTIM	R4	KMDM	ARG	SYSTEM OPERATING TIME BY DEMAND PERIOD
THRESH	R4	KMDL	ARG	THRESHHOLDS
VINSTA	R4	KMREG	ARG	NUMBER OF VEHICLES THROUGH STATIONS IN EACH
		KMDM		REGION AND DEMAND PERIOD
VM	R4	KMREG	ARG	VEHICLE DISTANCE IN EACH REGION DURING
		KMDM		EACH DEMAND PERIOD
VN	R4	KMREG	ARG	AVERAGE NUMBER OF VEHICLES IN EACH REGION
		KMDM		DURING EACH DEMAND PERIOD
VOPTIM	I4	KMREG	ARG	TOTAL VEHICLE OPERATING TIME IN EACH REGION
		KMDM		AND DEMAND INTERVAL

6.12.4 Description

This routine produces all the reports by calling the appropriate subprograms.

6.12.5 PDL

```
SUBROUTINE AIRPTS
  CALL AISUMY  <PRINT INPUT SUMMARY REPORT>
  CALL AONUMT  <PRINT NUMBER OF TRIPS DELAYED REPORT>
  CALL AODLTI  <PRINT VEHICLE DELAY TIME REPORT>
  RETURN
END
```

6.12.6 Algorithms

None

6.12.7 Notes or Remarks

None

6.13 AISBSR - Print the Subsystem Failure Rates

6.13.1 Identification

Language: PARAFOR

6.13.2 Calling Sequence

CALL AISBSR (FSUBSR, FRATE, KNLVL, KNSUB, KNFL, KNRD, KMLVL, KMSUB, KMFL, KMRD)

6.13.3 Local Variable Dictionary

NAME	TYPE	DIM	ARG	FUNCTION
DAY	I2			DAY OF MONTH - FOR THE TITLE
FRATE	R4	KMSUB KMRD KMLVL KMFL	ARG	FAILURE RATES OF SYSTEMS PER UNIT TIME AS FUNCTIONS OF DIFFERENT CAUSAL FACTORS FOR EACH LEVEL OF RELIABILITY AND FAILURE LEVEL
FSUBSR	I4		ARG	I/O UNIT FOR FAILURE RATES REPORT
HR	I2			DUMMY ARGUMENT
KMFL	I4		ARG	COMPILED MAXIMUM NUMBER OF FAILURE LEVELS
KMLVL	I4		ARG	COMPILED MAXIMUM NUMBER OF RELIABLILTY LEVELS
KMRD	I4		ARG	COMPILED MAXIMUM NUMBER OF CAUSAL FACTORS
KMSUB	I4		ARG	COMPILED MAXIMUM NUMBER OF SUBSYSTEMS
KNFL	I4		ARG	NUMBER OF FAILURE LEVELS
KNLVL	I4		ARG	NUMBER OF RELIABLITY LEVELS
KNRD	I4		ARG	NUMBER OF CAUSAL FACTORS (5)
KNSUB	I4		ARG	NUMBER OF SUBSYSTEMS (4)
MIN	I2			DUMMY ARGUMENT
MO	I2			MONTH OF YEAR - FOR THE TITLE
SUBSYS	R8	4		CONSTANT - COLUMN TITLES FOR THE REPORT
YR	I2			YEAR OF CENTURY - FOR THE TITLE

6.13.4 Description

The subsystem failure rate report is formatted and written.

6.13.5 PDL

```
SUBROUTINE AISBSR
  IF
    FSUBSR -= 0
  THEN
    CALL DAYTIM <GET DATE FOR TITLE>
    WRITE THE TITLE
    WRITE THE REPORT
  ENDIF
  RETURN
END
```

6.13.6 Algorithms

None

6.13.7 Notes or Remarks

None

6.14 AISUMY - Print the Input Summary

6.14.1 Identification

Language: PARAFOR

6.14.2 Calling Sequence

CALL AISUMY (FSUMY, FSUBSR, FRATE, RRATE, SMFREQ, SMST, FLTSLT, GWMILE, PNS, STATNS, DMND, VOPTIM, SYSTIM, VINSTA, VM, VN, KNLVL, KNREG, KNDM, KNSUB, KNFL, KNRD, KMLVL, KMREG, KMDM, KMSUB, KMFL, KMRD)

6.14.3 Local Variable Dictionary

NAME	TYPE	DIM	ARG	FUNCTION
DAY	I2			DAY OF MONTH - FOR THE TITLE
DMND	R4	KMDM	ARG	SYSTEM DEMAND IN EACH DEMAND PERIOD
FLTSLT	I4		ARG	ACTIVE FLEET SIZE (0 - AVERAGE, 1 - MAXIMUM)
FRATE	R4	KMSUB KMRD KMLVL KMFL	ARG	FAILURE RATES OF SYSTEMS PER UNIT TIME AS FUNCTIONS OF DIFFERENT CAUSAL FACTORS FOR EACH LEVEL OF RELIABILITY AND FAILURE LEVEL
FSUBSR	I4		ARG	I/O UNIT FOR FAILURE RATES REPORT
FSUMY	I4		ARG	I/O UNIT FOR INPUT SUMMARY FILE
GWMILE	R4	KMREG	ARG	GUIDEWAY LENGTH IN EACH REGION
HR	I2			DUMMY ARGUMENT
KMDM	I4		ARG	COMPILED MAXIMUM NUMBER OF DEMAND PERIODS
KMFL	I4		ARG	COMPILED MAXIMUM NUMBER OF FAILURE LEVELS
KMLVL	I4		ARG	COMPILED MAXIMUM NUMBER OF RELIABLILTY LEVELS
KMRD	I4		ARG	COMPILED MAXIMUM NUMBER OF CAUSAL FACTORS
KMREG	I4		ARG	COMPILED MAXIMUM NUMBER OF REGIONS
KMSUB	I4		ARG	COMPILED MAXIMUM NUMBER OF SUBSYSTEMS
KNDM	I4		ARG	NUMBER OF DEMAND PERIODS
KNFL	I4		ARG	NUMBER OF FAILURE LEVELS
KNLVL	I4		ARG	NUMBER OF RELIABLITY LEVELS
KNRD	I4		ARG	NUMBER OF CAUSAL FACTORS (5)
KNREG	I4		ARG	NUMBER OF REGIONS
KNSUB	I4		ARG	NUMBER OF SUBSYSTEMS (4)
MIN	I2			DUMMY ARGUMENT
MO	I2			MONTH OF YEAR - FOR THE TITLE
PNS	R4	KMREG KMDM	ARG	NUMBER OF PASSENGERS LEAVING STATIONS IN EACH REGION DURING EACH DEMAND INTERVAL
RRATE	R4		ARG	VEHICLE REPAIR RATE IN EACH BAY
SMFREQ	R4		ARG	SCHEDULED MAINTENANCE FREQUENCY
SMST	R4		ARG	SCHEDULED MAINTENANCE SERVICE TIME PER VEHICLE
STATNS	I4	KMREG	ARG	NUMBER OF STATIONS IN EACH REGION
SYSTIM	R4	KMDM	ARG	SYSTEM OPERATING TIME BY DEMAND PERIOD
TYPE	R8	2		CONSTANT - FLTSLT CONVERSION TABLE (CHARACTER)
VINSTA	R4	KMREG KMDM	ARG	NUMBER OF VEHICLES THROUGH STATIONS IN EACH REGION AND DEMAND PERIOD
VM	R4	KMREG KMDM	ARG	VEHICLE DISTANCE IN EACH REGION DURING EACH DEMAND PERIOD
VN	R4	KMREG KMDM	ARG	AVERAGE NUMBER OF VEHICLES IN EACH REGION DURING EACH DEMAND PERIOD
VOPTIM	I4	KMREG KMDM	ARG	TOTAL VEHICLE OPERATING TIME IN EACH REGION AND DEMAND INTERVAL
YR	I2			YEAR OF CENTURY - FOR THE TITLE

6.14.4 Description

This routine formats and prints the input summary report and utilizes AISBSR to produce the subsystem failure rate report.

6.14.5 PDL

```
SUBROUTINE AISUMY
  IF
    FSUMY = 0
  THEN
    CALL DAYTIM <GET THE CURRENT DATE FOR THE TITLE>
    WRITE THE INPUT SUMMARY REPORT
  ENDIF
  CALL AISBSR <PRINT THE SUBSYSTEM FAILURE RATE REPORT>
  RETURN
END
```

6.14.6 Algorithms

None

6.14.7 Notes or Remarks

None

6.15 AMOUT - Output Values for Files

6.15.1 Identification

Language: PARAFOR

6.15.2 Calling Sequence

CALL AMOUT (SUBFAL, DLPDM, VOP, VDLTM, DMND, DLTIME, FLTSLT, FRATE, GWMILE, NUMTRP, PNS, STATNS, STDMND, SYSTIM, VINSTA, VM, VN, VOPTIM, NOTHRD, DLPSTD, VOPD, PTHRDM, RRATE, SMFREQ, SMST, THRESH, THRIND, VAVAIL, TRPS, TRPDMN, PAVAIL, AVSMF, MMBAYS, VFFREQ, MNV, AVNV, AFLSZ, NETRAT, AVMFLT, FMF, PROB, BAYS, SF, INLVL, KNDM, KNREG, KNSUB, KNLVL, KNRD, KNDL, KNFL, KNSFS, KNSB, KMDM, KMREG, KMSUB, KMRD, KMDL, KMFL, KMSFS, KMSB, STATS)

6.15.3 Local Variable Dictionary

NAME	TYPE	DIM	ARG	FUNCTION
DLTIME	R4	KMREG KMDM KMSUB KMFL		Vehicle delay time resulting from failures in each region and demand period for each subsystem and failure level
DMND	R4	KMDM		System demand in each demand period
FLTSLT	I4			Active fleet size (0 - average, 1 - maximum)
FRATE	R4	KMSUB KMRD KMLVL KMFL	ARG	Failure rates of systems per unit time as functions of different causal factors for each level of reliability and failure level
GWMILE	R4	KMREG	ARG	Guideway length in each region
KMDL	I4		ARG	Compiled maximum number of delay threshholds
KMDM	I4		ARG	Compiled maximum number of demand periods
KMFL	I4		ARG	Compiled maximum number of failure levels
KMLVL	I4		ARG	Compiled maximum number of reliability levels
KMRD	I4		ARG	Compiled maximum number of causal factors
KMREG	I4		ARG	Compiled maximum number of regions
KMSUB	I4		ARG	Compiled maximum number of subsystems
KNDL	I4		ARG	Number of delay threshholds
KNDM	I4		ARG	Number of demand periods
KNFL	I4		ARG	Number of failure levels
KNLVL	I4		ARG	Number of reliability levels
KNRD	I4		ARG	Number of causal factors (5)
KNREG	I4		ARG	Number of regions
KNSUB	I4		ARG	Number of subsystems (4)
NOTHRD	I4		ARG	Number of threshholds
NUMTRP	R4	KMREG KMDL KMSUB KMDM	ARG	Number of trips delayed by each delay range region and demand period resulting in each failure level
PTHRDM	R4		ARG	Minimum passenger delay threshhold
PNS	R4	KMREG KMDM	ARG	Number of passengers leaving stations in each region during each demand interval
RRATE	R4		ARG	Vehicle repair rate in each bay
SMFREQ	R4		ARG	Scheduled maintenance frequency
SMST	R4		ARG	Scheduled maintenance service time per vehicle
STATNS	I4	KMREG	ARG	Number of stations in each region
SYSTIM	R4	KMDM	ARG	System operating time by demand period
THRIND	R4		ARG	Threshhold increment
THRESH	R4	KMDL	ARG	Threshholds
VINSTA	R4	KMREG KMDM	ARG	Number of vehicles through stations in each region and demand period

NAME	TYPE	DIM	ARG	FUNCTION
VM	R4	KMREG KMDM	ARG	Vehicle distance in each region during each demand period
VN	R4	KMREG KMDM	ARG	Average number of vehicles in each region during each demand period
VOPTIM	I4	KMREG KMDM	ARG	Total vehicle operating time in each region and demand interval
STATS	IR		ARG	Data set reference number to receive raw statistics file
AFLSZ	R4		ARG	Average fleet size
AVNV	R4		ARG	Average number of vehicles
AVSMF	R4		ARG	Average scheduled maintenance fleet size
DLPSTD	R4		ARG	Vehicle delay per day
INDL	I4			Index specifying delay threshhold
INDM	I4			Index specifying demand periods
INFL	I4			Index specifying failure level
INLVL	I4		ARG	Index specifying level of reliability
INREG	I4			Index specifying region
INSB	I4			Index specifying number of service bays
INSFS	I4			Index specifying standby fleet size
KMSB	I4		ARG	Maximum number of different numbers of service bays
KMSFS	I4		ARG	Maximum number of standby fleet sizes
KNSB	I4		ARG	Number of different numbers of service bays
KNSFS	I4		ARG	Number of standby fleet sizes
MMBAYS	I4		ARG	Minimum maintenance bays
STDMND	R4		ARG	Daily system demand
VAVAIL	R4		ARG	Vehicle availability
VFFREQ	R4		ARG	Average vehicle failure frequency
VOPD	R4		ARG	Daily vehicle operating time
INSUB	I4			Index specifying subsystem 1 - vehicles 2 - stations 3 - guideways 4 - central management
AVMFLT	R4	KMSB	ARG	Average total maintenance fleet sizes for ten numbers of service bays
BAYS	I4	KMSB	ARG	Number of service bays being considered
DLPDM	R4	KMDM	ARG	Vehicle delay caused by failures occurring in each demand period
FMF	R4	FMSB	ARG	Failure maintenance fleet sizes for different numbers of maintenance bays
MNV	R4		ARG	Maximum number of vehicles

NAME	TYPE	DIM	ARG	FUNCTION
NETRAT	R4		ARG	Net rate of vehicle failures using a single bay
PAVAIL	R4	KMDL	ARG	Passenger availability
PROB	R4	KMSB KMSFS	ARG	The probabilities that ten different standby fleet sizes are adequate given ten different numbers of service bays
SF	I4	KMSFS	ARG	Service fleet size being considered
SUBFAL	R4	KMREG KMDM KMSUB KMFL	ARG	Subsystem failures in each region and demand period (Total - not single subsystem element) 1 - stoppage failures, 2 - degradation failures
TRPDMN	R4	KMDM KMDL	ARG	Number of trips delayed by failures occurring in each demand period
TRPS	R4	KMDL	ARG	Number of trips delayed above each threshhold
VDLTM	R4	KMREG KMDM		Total vehicle delay caused by failures occurring in each region and demand period
VOP	R4	KMDM	ARG	Vehicle operating time in each demand period

6.15.4 Description

This routine outputs the second section of the raw statistics file. The first section is input variables only and the second section contains all computed results.

6.15.5 PDL

```
PROC: AMOUT <OUTPUT VALUES FOR FILES>
      WRITE THE VARIABLE PART OF THE RAW STATISTICS FILE
ENDPROC
```

6.15.6 Algorithms

None

6.15.7 Notes or Remarks

The actual output statements are in AFSTAT. AFSTAT is also used by the output processor to read the raw statistics file which should result in a consistent format. If the file format is changed, the version number in AFSTAT should be incremented.

6.16 AMSUP - Supervisory Portion of the SAM Model Processor

6.16.1 Identification

Language: PARAFOR

6.16.2 Calling Sequence

None; main program

6.16.3 Local Variable Dictionary

NAME	TYPE	DIM	ARG	FUNCTION
DLTIME	R4	KMREG KMDM KMSUB KMFL	ARG	Vehicle delay time resulting from failures in each region and demand period for each subsystem and failure level
DMND	R4	KMDM	ARG	System demand in each demand period
FLTSLT	I4		ARG	Active fleet size (0 - average, 1 - maximum)
FRATE	R4	KMSUB KMRD KMLVL KMFL	ARG	Failure rates of systems per unit time as functions of different causal factors for each level of reliability and failure level
GWMILE	R4	KMREG	ARG	Guideway length in each region
KMDL	I4		ARG	Compiled maximum number of delay threshholds
KMDM	I4		ARG	Compiled maximum number of demand periods
KMFL	I4		ARG	Compiled maximum number of failure levels
KMLVL	I4		ARG	Compiled maximum number of reliability levels
KMRD	I4		ARG	Compiled maximum number of causal factors
KMREG	I4		ARG	Compiled maximum number of regions
KMSUB	I4		ARG	Compiled maximum number of subsystems
KNDL	I4		ARG	Number of delay threshholds
KNDM	I4		ARG	Number of demand periods
KNFL	I4		ARG	Number of failure levels
KNLVL	I4		ARG	Number of reliability levels
KNRD	I4		ARG	Number of causal factors (5)
KNREG	I4		ARG	Number of regions
KNSUB	I4		ARG	Number of subsystems (4)
NOTHRD	I4		ARG	Number of threshholds
NUMTRP	R4	KMREG KMDL KMSUB KMDM	ARG	Number of trips delayed by each delay range, region, and demand period resulting in each failure level
PTHRDM	R4		ARG	Minimum passenger delay threshhold
PNS	R4	KMREG KMDM	ARG	Number of passengers leaving stations in each region during each demand interval
RRATE	R4		ARG	Vehicle repair rate in each bay
SMFREQ	R4		ARG	Scheduled maintenance frequency
SMST	R4		ARG	Scheduled maintenance service time per vehicle
STATNS	I4	KMREG	ARG	Number of stations in each region
SYSTIM	R4	KMDM	ARG	System operating time by demand period
THRIND	R4		ARG	Threshhold increment
THRESH	R4	KMDL	ARG	Threshholds
VINSTA	R4	KMREG KMDM	ARG	Number of vehicles through stations in each region and demand period

NAME	TYPE	DIM	ARG	FUNCTION
VM	R4	KMREG KMDM	ARG	Vehicle distance in each region during each demand period
VN	R4	KMREG KMDM	ARG	Average number of vehicles in each region during each demand period
VOPTIM	I4	KMREG KMDM	ARG	Total vehicle operating time in each region and demand interval
AVMFLT	R4	KMSB		Average total maintenance fleet sizes for ten number of service bays
BAYS	I4	KMSB		Number of service bays being considered
DLPDM	R4	KMDM		Vehicle delay caused by failures occurring in each demand period
FERATE	R4	KMSUB KMRD		Failure effect rates of subsystems (failures of a single subsystem element as opposed to system-wide)
		KMLVL KMFL		Per unit time as functions of different causal factors for each level of reliability 1 - stoppage failures, 2 - degradation failures
FMF	R4	KMSB		Failure maintenance fleet sizes for different numbers of maintenance bays
FRATET	R4	KMSUB KMRD KMLVL		Failure rates of subsystems (failures of a single subsystem element as opposed to system-wide) per unit time as functions of different causal factors for each level of reliability
MNV	R4			Maximum number of vehicles
NETRAT	R4			Net rate of vehicle failures using a single bay
PAVAIL	R4	KMDL		Passenger availability
PROB	R4	KMSB KMSFS		The probabilities that ten different standby fleet sizes are adequate given ten different numbers of service bays
SF	I4	KMSFS		Service fleet size being considered
SUBFAL	R4	KMREG KMDM KMSUB KMFL		Subsystem failures in each region and demand period (total - not single subsystem element) 1 - stoppage failures, 2 - degradation failures
TRPDMN	R4	KMDM KMDL		Number of trips delayed by failures occurring in each demand period
TRPS	R4	KMDL		Number of trips delayed above each threshhold
VDLTM	R4	KMREG KMDM		Total vehicle delay caused by failures occurring in each region and demand period
VOP	R4	KMDM		Vehicle operating time in each demand period
AFLSZ	R4			Active fleet size
AVNV	R4			Average number of vehicles

NAME	TYPE	DIM	ARG	FUNCTION
AVSMF	R4			Average scheduled maintenance fleet size
DLPSTD	R4			Vehicle delay per day
INDL	I4			Index specifying delay threshhold
INDM	I4			Index specifying demand period
INFL	I4			Index specifying failure level
INLVL	I4			Index specifying level of reliability
INREG	I4			Index specifying region
INSB	I4			Index specifying number service bays
KMSB	I4			Maximum number of different numbers of service bay
KMSFS	I4			Maximum number of standby fleet sizes
KNSB	I4			Number of different numbers of service bay
KNSFS	I4			Number of standby fleet sizes
MMBAYS	I4			Minimum maintenance bays
STDMND	R4			Daily system demand
VAVAIL	R4			Vehicle availability
VFFREQ	R4			Average vehicle failure frequency
VOPD	R4			Daily vehicle operating time
INSUB	I4			Index specifying subsystem 1 - vehicles 2 - stations 3 - guideways 4 - central management
ON	I4			Constant 'ON'
LIB	R8	2		Run index entry library name (8 chars)
INRD	I4			Index specifying causal factor
PARM	I4			Address of parameter list from EXEC
TYPE	R8	2		Run index entry type name (8 chars)
DEBUG	I4			I/O unit to receive debug info (0 - disable)
PARAM	I4	2		Parameter from EXEC card (8 chars)
STATS	I4			I/O unit for raw statistics
STRUC	I4			I/O unit with structured data
ERRFLG	L1			Error flag-set to TRUE by any error
ERRPRT	I4			I/O unit to receive error messages
FINDEX	I4			I/O unit of run index file
MEMBER	I4	2		Index to parameter list for run index
MMDDYY	I2	7		Date in character format
MODULE	R8			Load module name
SYSPRT	I4			I/O unit for reports
WRTFLG	L1	2		Flag to write run index entry

6.16.4 Description

This is the supervisory portion of the model processor. Section 2.2 describes the model processor.

6.16.5 PDL

```
PROC: AMSUP  <SUPERVISORY PORTION OF THE SAM MODEL PROCESSOR>
  PRINT HEADER FOR ERROR MESSAGE LISTING
  SET UP DEBUG FLAG
  RUN AREAD  <READ ALL REQUIRED VALUES>
  RUN ASUBSR <OUTPUT SUBSYSTEM FAILURE RATES AND EFFECT RATES>
  WRITE CONSTANT PART OF RAW STATISTICS FILE
  FOR
    EACH SET OF FAILURE RATES (INLVL)
  DO
    RUN ARGFAL <COMPUTE FAILURES FOR EACH SUBSYSTEM IN EACH REGION
                AND DEMAND PERIOD>
    RUN AVDEL <COMPUTE VEHICLE DELAY TIMES AND VEHICLE AVAILABILITY>
    RUN APHIST <COMPUTE PASSENGER AVAILABILITY FOR DIFFERENT
                THRESHOLDS>
    RUN AVFLSZ <COMPUTE MAINTENANCE AND STANDBY FLEET MEASURES>
    RUN AMOUT <OUTPUT MISCELANEOUS VALUES>
  ENDDO
  RUN AAINDX <WRITE RUN INDEX ENTRIES>
ENDPROC
```

6.16.6 Algorithms

None

6.16.7 Notes or Remarks

The model processor accepts the parameter from the PARM = field on the EXEC statement; the format of the parameter is:

load-module, run-index, prog-lib, prog-proj, data-proj, struc, stats, debug

where

load-module	is the name of the load module used for this execution
run-index	is the distinguishing characters of the run index file. (the last seven characters of the third index level of the file name)
prog-lib	is the second level of the STEPLIB file name
prog-proj	is the first level of the STEPLIB film name
data-proj	is the first level of all data files
struc	is the structured data file member name
stats	is the raw statistics file member name
debug	is used to tum on debugging output (see Section 4.0)

6.17 AODLTI - Print the Vehicle Delay Time Report

6.17.1 Identification

Language: PARAFOR

6.17.2 Calling Sequence

CALL AODLTI (DLTIME, KNREG, KNDM, KNFL, KNSUB, KMREG, KMDM, KMFL, KMSUB, FDLTI)

NAME	TYPE	DIM	ARG	FUNCTION
DLTIME	R4	KMREG KMDM KMSUB KMFL	ARG	Vehicle delay time resulting from failures in each region and demand period for each subsystem and failure level
KMDM	I4		ARG	Compiled maximum number of demand periods
KMFL	I4		ARG	Compiled maximum number of failure levels
KMREG	I4		ARG	Compiled maximum number of regions
KMSUB	I4		ARG	Compiled maximum number of subsystems
KNDM	I4		ARG	Number of demand periods
KNFL	I4		ARG	Number of failure levels
KNREG	I4		ARG	Number of regions
KNSUB	I4		ARG	Number of subsystems (4)
FDLTI	I4		ARG	I/O unit to receive vehicle delay time report
HR	I2			Current time
MO	I2			Current date
YR	I2			Current date
DAY	I2			Current date
MIN	I2			Current time
INDM	I4			Index specifying demand period
INFL	I4			Index specifying failure level
INREG	I4			Index specifying reliability region
INSUB	I4			Index specifying subsystem

6.17.4 Description

This routine produces the Vehicle Delay Time report.

6.17.5 PDL

```
          <PRINT THE VEHICLE DELAY TIME REPORT>
SUBROUTINE AODLTI
  IF
    FDLTI ¬= 0
  THEN
    CALL DAYTIM TO GET THE CURRENT DATE FOR THE TITLES
    WRITE THE REPORT
  ENDIF
  RETURN
END
```

6.17.6 Algorithms

None

6.17.7 Notes or Remarks

None

6.18 AOGDIP - Lookup GDIP Variables

6.18.1 Identification

Language: Assembler

6.18.2 Calling Sequence

CALL GDIP4 (NAME, FMT, IRAL, IRAH, IRBL, IRBH, IRCL, IRCH, IRDL, IRDH)

6.18.3 Local Variable Dictionary

None

6.18.4 Description

All GDIP variables acceptable to the output processor are defined here utilizing the GDIP macros.

6.18.5 PDL

None

6.18.6 Algorithms

None

6.18.7 Notes or Remarks

None

6.19 AOMAIN - Print the Maintenance Report

6.19.1 Identification

Language: PARAFOR

6.19.2 Calling Sequence

CALL AOMAIN (AFLSZ, AVMFLT, AVSMF, FMF, PROB, FLTSLT, MMBAYS, RRATE, SMFREQ, SMST, SYSTIM, VFFREQ, VN, VOPD, SF, BAYS, INLVL, KNSFS, KNSB, KNREG, KNDM, KMSFS, KMSB, KMREG, KMDM, FMAIN)

6.19.3 Local Variable Dictionary

NAME	TYPE	DIM	ARG	FUNCTION
FLTSLT	I4		ARG	Active fleet size (0 - average, 1 - maximum)
KMDM	I4		ARG	Compiled maximum number of demand periods
KMREG	I4		ARG	Compiled maximum number of regions
KNDM	I4		ARG	Number of demand periods
KNREG	I4		ARG	Number of regions
RRATE	R4		ARG	Vehicle repair rate in each bay
SMFREQ	R4		ARG	Scheduled maintenance frequency
SMST	R4		ARG	Scheduled maintenance service time per vehicle
SYSTIM	R4	KMDM	ARG	System operating time by demand period
VN	R4	KMREG	ARG	Average number of vehicles in each region
FMAIN	I4		ARG	Data set reference number to receive Maintenance Measures report
HR	I2			Current date and time
MO	I2			Current date and time
YR	I2			Current date and time
DAY	I2			Current date and time
MIN	I2			Current date and time
TYPE	R8	2		Character constant: active fleet size types
AVMFLT	R4	KMSB	ARG	Average total maintenance fleet sizes for ten numbers of service bays
BAYS	I4	KMSB	ARG	Number of service bays being considered
FMF	R4	FMSB	ARG	Failure maintenance fleet sizes for different numbers of maintenance bays
PROB	R4	KMSB KMSFS	ARG	The probabilities that ten different standby fleet sizes are adequate given ten different numbers of service bays
SF	I4	KMSFS	ARG	Service fleet size being considered
AFLSZ	R4		ARG	Active fleet size
AVSMF	R4		ARG	Average scheduled maintenance fleet size
INDM	I4			Index specifying demand period
INLVL	I4		ARG	Index specifying level of reliability
INREG	I4		ARG	Index specifying region
INSB	I4			Index specifying number of service bays
KMSB	I4		ARG	Maximum number of different numbers of service bays
KMSFS	I4		ARG	Maximum number of standby fleet sizes
KNSB	I4		ARG	Number of different numbers of service bays
KNSFS	I4		ARG	Number of standby fleet sizes
MMBAYS	I4		ARG	Minimum maintenance bays
VFFREQ	R4		ARG	Average vehicle failure frequency
VOPD	R4		ARG	Daily vehicle operating time
INSUB	I4			Index specifying subsystem 1 - vehicles 2 - stations 3 - guideways 4 - central management

6.19.4 Description

This routine produces the Maintenance Fleet Measures report.

6.19.5 PDL

```
SUBROUTINE AOMAIN
  IF
    FMAIN ¬= 0
  THEN
    CALL DAYTIM TO GET THE CURRENT DATE FOR THE TITLES
    WRITE THE TITLES AND THE SUMMARY
    WRITE THE PROBABILITY OF FLEET SIZE BEING ADEQUATE TABLE
    PRINT THE NUMBER OF VEHICLES BY REGION
  ENDIF
  RETURN
END
```

6.19.6 Algorithms

None

6.19.7 Notes or Remarks

None

6.20 AONUMT - Print the Number of Trips Delayed Report

6.20.1 Identification

Language: PARAFOR

6.20.2 Calling Sequence

CALL AONUMT (NUMTRP, THRESH, KNREG, KNDM, KNFL, KNSUB, KNDL, KMREG, KMDM, KMFL, KMSUB, KMDL, FNTRP)

6.20.3 Local Variable Dictionary

NAME	TYPE	DIM	ARG	FUNCTION
KMDL	I4		ARG	Compiled maximum number of delay threshholds
KMDM	I4		ARG	Compiled maximum number of demand periods
KMFL	I4		ARG	Compiled maximum number of failure levels
KMREG	I4		ARG	Compiled maximum number of regions
KMSUB	I4		ARG	Compiled maximum number of subsystems
KNDL	I4		ARG	Number of delay threshholds
KNDM	I4		ARG	Number of demand periods
KNFL	I4		ARG	Number of failure levels
KNREG	I4		ARG	Number of regions
KNSUB	I4		ARG	Number of subsystems (4)
NUMTRP	R4	KMREG KMDL KMSUB	ARG	Number of trips delayed by each delay range region and demand period resulting in each failure level.
THRESH	R4	KMDL	ARG	Threshholds
FNTRP	I4		ARG	Data set reference number to receive the passengers delayed report (0 to omit report)
HR	I2			Current date and time
MO	I2			Current date and time
YR	I2			Current date and time
DAY	I2			Current date and time
MIN	I2			Current date and time
SUBNAM	R8	4		Subsystem names (character constants)

6.20.4 Description

This routine produces the Passengers Delayed report.

6.20.5 PDL

```
SUBROUTINE AONUMT
  IF
    FNTRP ¬= 0
  THEN
    CALL DAYTIM TO GET THE CURRENT DATE FOR THE TITLES
    WRITE THE REPORT
  ENDIF
  RETURN
END
```

6.20.6 Algorithms

None

6.20.7 Notes or Remarks

None

6.21 AOPASS - Print the Passenger Availability Report

6.21.1 Identification

Language: PARAFOR

6.21.2 Calling Sequence

CALL AOPASS (FPASS, DMND, PAVAIL, TRPS, TRPDMN, THRESH, STDMND, INLVL, KNDL, KNDM, KNFL, KNREG, KNSUB, KMDL, KMDM, KMFL, KMREG, KMSUB)

6.21.3 Local Variable Dictionary

NAME	TYPE	DIM	ARG	FUNCTION
DMND	R4	KMDM	ARG	System demand in each demand period
KMDL	I4		ARG	Compiled maximum number of delay threshholds
KMDM	I4		ARG	Compiled maximum number of demand periods
KMFL	I4		ARG	Compiled maximum number of failure levels
KMREG	I4		ARG	Compiled maximum number of regions
KMSUB	I4		ARG	Compiled maximum number of subsystems
KNDL	I4		ARG	Number of delay threshholds
KNDM	I4		ARG	Number of demand periods
KNFL	I4		ARG	Number of failure levels
KNREG	I4		ARG	Number of regions
KNSUB	I4		ARG	Number of subsystems (4)
THRESH	R4	KMDL	ARG	Threshholds
FPASS	I4		ARG	Data set reference number to receive the passenger availability report
HR	I2			Current date and time
MO	I2			
YR	I2			
DAY	I2			
MIN	I2			
PAVAIL	R4	KMDL	ARG	Passenger availability
TRPDMN	R4	KMDM KMDL	ARG	Number of trips delayed by failures occurring in each demand period
TRPS	R4	KMDL	ARG	Number of trips delayed above each threshhold
INDL	I4			Index specifying delay threshhold
INDM	I4			Index specifying demand period
INLVL	I4		ARG	Index specifying level of reliability
STDMND	R4		ARG	Daily system demand

6.21.4 Description

This routine produces the Passenger Availability report.

6.21.5 PDL

```
SUBROUTINE AOPASS
  IF
    FPASS ¬= 0
  THEN
    CALL DAYTIM TO GET THE CURRENT DATE FOR THE TITLES
    WRITE THE REPORT TITLE
    WRITE THE BODY OF THE REPORT
    WRITE THE TOTALS
    WRITE THE PASSENGER AVAILABILITY NUMBERS
  ENDIF
  RETURN
END
```

6.21.6 Algorithms

None

6.21.7 Notes or Remarks

None

6.22 AOPSUM - Write the Performance Summary File

6.22.1 Identification

Language: PARAFOR

6.22.2 Calling Sequence

CALL AOPSUM (FPSUM, AFLSZ, AVMFLT, AVSMF, BAYS, DLPSTD, FLTSLT, FMF, FRATET, PAVAIL, PROB, SF, STDMND, SYSTIM, THRESH, TRPS, VAVAIL, VOPD, INLVL, KNDL, KNSFS, KNSB, KNDM, KMDL, KMSFS, KMSB, KMDM, KMRD, KMLVL, KMSUB)

6.22.3 Local Variable Dictionary

NAME	TYPE	DIM	ARG	FUNCTION
FLTSLT	I4		ARG	Active fleet size (0 - average, 1 - maximum)
KMDL	I4		ARG	Compiled maximum number of delay threshholds
KMDM	I4		ARG	Compiled maximum number of demand periods
KMLVL	I4		ARG	Compiled maximum number of reliability levels
KMRD	I4		ARG	Compiled maximum number of causal factors
KMSUB	I4		ARG	Compiled maximum number of subsystems
KNDL	I4		ARG	Number of delay threshholds
KNDM	I4		ARG	Number of demand periods
SYSTIM	R4	KMDM	ARG	System operating time by demand period
THRESH	R4	KMDL	ARG	Threshholds
FPSUM	I4		ARG	Data set reference number to which the performance summary is written
SOPTIM	R4			Total system operation time (per day)
AVMFLT	R4	KMSB	ARG	Average total maintenance fleet sizes for ten numbers of service bays
BAYS	I4	KMSB	ARG	Number of service bays being considered
FMF	R4	FMSB	ARG	Failure maintenance fleet sizes for different numbers of maintenance bays
FRATET	R4	KMSUB KMRD KMLVL	ARG	Failure rates of subsystems (failures of a single subsystem element as opposed to system-wide) per unit time as functions of different causal factors for each level of reliability
PAVAIL	R4	KMDL	ARG	Passenger availability
PROB	R4	KMSB KMSFS	ARG	The probabilities that ten different standby fleet sizes are adequate given ten different numbers of service bays
SF	I4	KMSFS	ARG	Service fleet size being considered
TRPS	R4	KMDL	ARG	Number of trips delayed above each threshhold
AFLSZ	R4		ARG	Active fleet size
AVSMF	R4		ARG	Average scheduled maintenance fleet size
DLPSTD	R4		ARG	Vehicle delay per day
INSB	I4			Index specifying number of service bays
INSFS	I4			Index specifying standby fleet size
KMSFS	I4		ARG	Maximum number of standby fleet sizes
KNSB	I4		ARG	Number of different numbers of service bay
KNSFS	I4		ARG	Number of standby fleet sizes
STDMND	R4		ARG	Daily system demand
VAVAIL	R4		ARG	Vehicle availability
VOPD	R4		ARG	Daily vehicle operating time

6.22.4 Description

This routine writes the performance summary file.

6.22.5 PDL

```
SUBROUTINE AOPSUM
  <COMPUTE THE TOTAL SYSTEM OPERATION TIME>
  SOPTIM = 0
  FOR
    EACH DEMAND INTERVAL(INDM)
  DO
    SOPTIM = SOPTIM + SYSTIM(INDM)
  ENDDO
  <FIND THE STANDBY FLEET REQUIRED FOR 95% AVAILABILITY>
  INSFS = 1
  WHILE
    INSFS < KNSFS &
    PROB(1, INSFS) < 95%
  DO
    INSFS = INSFS + 1
  ENDDO
  <COMPUTE THE NUMBER OF SERVICE BAYS REQUIRED FOR 95% AVAILABILITY>
  INSB = 1
  WHILE
    INSB < KNSB &
    PROB(INSB, 1) < 95%
  DO
    INSB = INSB + 1
  ENDDO
  WRITE THE PERFORMANCE SUMMARY FILE
  RETURN
END
```

6.22.6 Algorithms

None

6.22.7 Notes or Remarks

The sequence of variables output into the performance summary file must correspond to the name in AGT.IANDD.FORMS (SAM).

6.23 AOREAD - Read the Values of the Statistics for a Reliability Level

6.23.1 Identification

Language: PARAFOR

6.23.2 Calling Sequence

CALL AOREAD (SUBFAL, DLPDM, VOP, VDLTM, DMND, DLTIME, FLTSLT, FRATE, GWMILE, NUMTRP, PNS, STATNS, STDMND, SYSTIM, VINSTA, VM, VN, VOPTIM, NOTHRD, DLPSTD, VOPD, PTHRDM, RRATE, SMFREQ, SMST, THRESH, THRIND, VAVAIL, TRPS, TRPDMN, PAVAIL, AVSMF, MMBAYS, VFFREQ, MNV, AVNV, AFLSZ, NETRAT, AVMFLT, FMF, PROB, BAYS, SF, INLVL, KNDM, KNREG, KNSUB, KNLVL, KNRD, KNDL, KNFL, KNSFS, KNSB, KMDM, KMREG, KMSUB, KMLVL, KMRD, KMDL, KMFL, KMSFS, KMSB, STATS, SYSPRT)

6.23.3 Local Variable Dictionary

NAME	TYPE	DIM	ARG	FUNCTION
DLTIME	R4	KMREG KMDM KMSUB KMFL	ARG	Vehicle delay time resulting from failures in each region and demand period for each subsystem and failure level
DMND	R4	KMDM	ARG	System demand in each demand period
FLTSLT	I4		ARG	Active fleet size (0 - average, 1 - maximum)
FRATE	R4	KMSUB KMRD KMLVL KMFL	ARG	Failure rates of systems per unit time as functions of different causal factors for each level of reliability and failure level
GWMILE	R4	KMREG	ARG	Guideway length in each region
KMDL	I4		ARG	Compiled maximum number of delay threshholds
KMDM	I4		ARG	Compiled maximum number of demand periods
KMFL	I4		ARG	Compiled maximum number of failure levels
KMLVL	I4		ARG	Compiled maximum number of reliability levels
KMRD	I4		ARG	Compiled maximum number of causal factors
KMREG	I4		ARG	Compiled maximum number of regions
KMSUB	I4		ARG	Compiled maximum number of subsystems
KNDL	I4		ARG	Number of delay threshholds
KNDM	I4		ARG	Number of demand periods
KNFL	I4		ARG	Number of failure levels
KNLVL	I4		ARG	Number of reliability levels
KNRD	I4		ARG	Number of causal factors (5)
KNREG	I4		ARG	Number of regions
KNSUB	I4		ARG	Number of subsystems (4)

NAME	TYPE	DIM	ARG	FUNCTION
NOTHRD	I4		ARG	Number of threshholds
NUMTRP	R4	KMREG KMDL KMSUB KMDM	ARG	Number of trips delayed by each delay range region and demand period resulting in each failure level
PTHRDM	R4		ARG	Minimum passenger delay threshhold
PNS	R4	KMREG KMDM	ARG	Number of passengers leaving stations in each region during each demand interval
RRATE	R4		ARG	Vehicle repair rate in each bay
SMFREQ	R4		ARG	Scheduled maintenance frequency
SMST	R4		ARG	Scheduled maintenance service time per vehicle
STATNS	I4	KMREG	ARG	Number of stations in each region
SYSPRT	I4		ARG	Unit for printing error messages
SYSTIM	R4	KMDM	ARG	System operating time by demand period
THRIND	R4		ARG	Threshhold increment
THRESH	R4	KMDL	ARG	Threshhold
VINSTA	R4	KMREG KMDM	ARG	Number of vehicles through stations in each region and demand period
VM	R4	KMREG KMDM	ARG	Vehicle distance in each region during each demand period
VN	R4	KMREG KMDM	ARG	Average number of vehicles in each region during each demand period
VOPTIM	I4	KMREG KMDM	ARG	Total vehicle operating time in each region and demand interval
STATS	I4		ARG	Data set reference number of raw statistics file
AVMFLT	R4	KMSB	ARG	Average total maintenance fleet sizes for ten numbers of service bays
BAY	I4	KMSB	ARG	Number of service bays being considered
DLPDM	R4	KMDM	ARG	Vehicle delay caused by failures occurring in each demand period
FMF	R4	FMSB	ARG	Failure maintenance fleet sizes for different numbers of maintenance bays
MNV	R4		ARG	Maximum number of vehicles
NETRAT	R4		ARG	Net rate of vehicle failures using a single bay
PAVAIL	R4	KMDL	ARG	Passenger availability
PROB	R4	KMSB KMSFS	ARG	The probabilities that ten different standby fleet sizes are adequate given ten different number of service bays
SF	I4	KMSFS	ARG	Service fleet size being considered
SUBFAL	R4	KMREG KMDM KMSUB KMFL	ARG	Subsystem failures in each region and demand period (Total - not single subsystem element) 1 - stoppage failures, 2 - degradation failures
TRPDMN	R4	KMDM KMDL	ARG	Number of trips delayed by failures occurring in each demand period

NAME	TYPE	DIM	ARG	FUNCTION
TRPS	R4	KMDL	ARG	Number of trips delayed above each threshhold
VDLTM	R4	KMREG KMDM	ARG	Total vehicle delay caused by failures occurring in each region and demand period
VOP	R4	KMDM	ARG	Vehicle operating time in each demand period
AFLSZ	R4		ARG	Active fleet size
AVNV	R4		ARG	Average number of vehicles
AVSMF	R4		ARG	Average scheduled maintenance fleet size
DLPSTD	R4		ARG	Vehicle delay per day
INDL	I4			Index specifying delay threshhold
INDM	I4			Index specifying demand period
INFL	I4			Index specifying failure level
INLVL	I4		ARG	Index specifying level of reliability
INREG	I4		ARG	Index specifying region
INSB	I4			Index specifying number of service bays
INSFS	I4			Index specifying standby fleet size
KMSB	I4		ARG	Maximum number of different numbers of service bays
KMSFS	I4		ARG	Maximum number of standby fleet sizes
KNSB	I4		ARG	Number of different numbers of service bays
KNSFS	I4		ARG	Number of standby fleet sizes
MMBAYS	I4		ARG	Minimum maintenance bays
STDMND	R4		ARG	Daily system demand
VAVAIL	R4		ARG	Vehicle availability
VFFREQ	R4		ARG	Average vehicle failure frequency
VOPD	R4		ARG	Daily vehicle operating time
INSUB	I4			Index specifying subsystems 1 - vehicles 2 - stations 3 - guideways 4 - central management

6.23.4 Description

This routine inputs the second section of the raw statistics file. The first section is input variables only and the second section contains all computed results.

6.23.5 PDL

```
SUBROUTINE AOREAD
  READ THE RAW STATISTICS FILE
  RETURN
END
```

6.23.6 Algorithms

None

6.23.7 Notes or Remarks

The actual input statements are in AFSTAT. AFSTAT is also used by the model processor to write the raw statistics file which should result in a consistent format. If the file format is changed, the version number in AFSTAT should be incremented.

6.24 AORELY - Print the Reliability Parameters Report

6.24.1 Identification

Language: PARAFOR

6.24.2 Calling Sequence

CALL AORELY (FRELY, FSUBSR, FERATE, FRATE, FRATET, GWMILE, PNS, STATNS, SUBFAL, SYSTIM, VINSTA, VM, VOPTIM, INLVL, KNREG, KNDM, KNSUB, KNFL, KNRD, KMLVL, KMREG, KMDM, KMSUB, KMFL, KMRD)

6.24.3 Local Variable Dictionary

NAME	TYPE	DIM	ARG	FUNCTION
FRATE	R4	KMSUB KMRD KMLVL KMFL	ARG	Failure rates of systems per unit time as functions of different causal factors for each level of reliability and failure level
GWMILE	R4	KMREG	ARG	Guideway length in each region
KMDM	I4		ARG	Compiled maximum number of demand periods
KMFL	I4		ARG	Compiled maximum number of failure levels
KMLVL	I4		ARG	Compiled maximum number of reliability levels
KMRD	I4		ARG	Compiled maximum number of causal factors
KMREG	I4		ARG	Compiled maximum number of regions
KMSUB	I4		ARG	Compiled maximum number of subsystems
KNFL	I4		ARG	Number of failure levels
KNRD	I4		ARG	Number of causal factors (5)
KNREG	I4		ARG	Number of regions
KNSUB	I4		ARG	Number of subsystems (4)
PNS	R4	KMREG KMDM	ARG	Number of passengers leaving stations in each region during each demand interval
STATNS	I4	KMREG	ARG	Number of stations in each region
SYSTIM	R4	KMDM	ARG	System operating time by demand period

NAME	TYPE	DIM	ARG	FUNCTION
VINSTA	R4	KMREG KMDM	ARG	Number of vehicles through stations in each region and demand period
VM	R4	KMREG KMDM	ARG	Vehicle distance in each region during each demand period
VOPTIM	I4	KMREG	ARG	Total vehicle operating time in each region and demand interval
FRELY	I4		ARG	Data set reference number for Reliability Parameters report
FSUBSR	I4		ARG	Data set reference number for Subsystem Failure Rate report
HR	I2			Current date and time
MO	I2			Current date and time
YR	I2			Current date and time
DAY	I2			Current date and time
MIN	I2			Current date and time
FERATE	R4	KMSUB KMRD KMLVL KMFL	ARG	Failure effect rates of subsystems (failures of a single subsystem element as opposed to system-wide) per unit time as functions of causal factors for each level of reliability 1 - stoppage failures, 2 - degradation failures
FRATET	R4	KMSUB KMRD KMLVL	ARG	Failure rates of subsystems (failures of a single subsystem element as opposed to system-wide) per unit time as functions of different causal factors for each level of reliability
SUBFAL	R4	KMREG KMDM KMSUB KMFL	ARG	Subsystem failures in each region and demand period (total - not single subsystem element) 1 - stoppage failures, 2 - degradation failures
INDM	I4			Index specifying demand period
INFL	I4			Index specifying failure level
INLVL	I4		ARG	Index specifying level of reliability
INREG	I4			Index specifying region
INSUB	I4			Index specifying subsystem 1 - vehicles 2 - stations 3 - guideways 4 - central management

6.24.4 Description

This routine prints Reliability Parameters report, i.e., the expected number of failures for each subsystem and the parameters used to derive them. Then it calls AOSBSR to print the subsystem failure rates.

6.24.5 PDL

```
SUBROUTINE AORELY
  IF
    FRELY ¬= 0
  THEN
    CALL DAYTIM TO GET THE CURRENT DATE FOR THE TITLES
    WRITE THE REPORT TITLE
    WRITE THE BODY OF THE REPORT
  ENDIF
  CALL AOSBSR TO PRINT THE SUBSYSTEM FAILURE RATES
  RETURN
END
```

6.24.6 Algorithms

None

6.24.7 Notes or Remarks

None

6.25 AOSBSR - Print the Failure Rates Report

6.25.1 Identification

Language: PARAFOR

6.25.2 Calling Sequence

CALL AOSBSR (FSUBSR, FERATE, FRATE, FRATET, INLVL, KNSUB, KNFL, KNRD, KMLVL, KMSUB, KMFL, KMRD)

6.25.3 Local Variable Dictionary

NAME	TYPE	DIM	ARG	FUNCTION
FRATE	R4	KMSUB KMRD KMLVL KMFL	ARG	Failure rates of systems per unit time as functions of different causal factors for each level of reliability and failure level
KMFL	I4		ARG	Compiled maximum number of failure levels
KMLVL	I4		ARG	Compiled maximum number of reliability levels
KMRD	I4		ARG	Compiled maximum number of causal factors
KMSUB	I4		ARG	Compiled maximum number of subsystems
KNFL	I4		ARG	Number of failure levels

NAME	TYPE	DIM	ARG	FUNCTION
KNRD	I4		ARG	Number of causal factors (5)
KNSUB	I4		ARG	Number of subsystems (4)
FSUBSR	I4		ARG	Data set reference number for subsystem failure rates
HR	I2			Current date and time
MO	I2			Current date and time
YR	I2			Current date and time
DAY	I2			Current date and time
MIN	I2			Current date and time
SUBSYS	R8	4		Character constants: subsystem names
FERATE	R4	KMSUB KMRD KMLVL KMFL	ARG	Failure effect rates of subsystems (failures of a single subsystem element as opposed to system-wide) per unit time as functions of different causal factors for each level of reliability 1 - stoppage failures, 2 - degradation failures
FRATET	R4	KMSUB KMRD KMLVL	ARG	Failure rates of subsystems (failures of a single subsystem element as opposed to system-wide) per unit time as functions of different causal factors for each level of reliability
INLVL	I4		ARG	Index specifying level of reliability

6.25.4 Description

This routine prints the subsystem failure rates report.

6.25.5 PDL

```
SUBROUTINE AOSBSR
  IF
    FSUBSR ¬= 0
  THEN
    CALL DAYTIM TO GET THE CURRENT DATE FOR THE TITLES
    WRITE THE TITLES
    WRITE THE BODY OF THE REPORT
  ENDIF
  RETURN
END
```

6.25.6 Algorithms

None

6.25.7 Notes or Remarks

None

6.26 OUTPT - Output Processor Main Program

6.26.1 Identification

Language: PARAFOR

6.26.2 Calling Sequence

None; main program

6.26.3 Local Variable Dictionary

NAME	TYPE	DIM	ARG	FUNCTION
DLTIME	R4	KMREG KMDM KMSUB KMFL	ARG	Vehicle delay time resulting from failures in each region and demand period for each subsystem and failure level
DMND	R4	KMDM	ARG	System demand in each demand period
FLTSLT	I4		ARG	Active fleet size (0 - average, 1 - maximum)
FRATE	R4	KMSUB KMRD KMLVL KMFL	ARG	Failure rates of systems per unit time as functions of different causal factors for each level of reliability and failure level
GWMILE	R4	KMREG	ARG	Guideway length in each region
KMDL	I4		ARG	Compiled maximum number of delay threshholds
KMDM	I4		ARG	Compiled maximum number of demand periods
KMFL	I4		ARG	Compiled maximum number of failure levels
KNDL	I4		ARG	Number of delay threshholds
KNDM	I4		ARG	Number of demand periods
KNFL	I4		ARG	Number of failure levels
KNLVL	I4		ARG	Number of reliability levels
KNRD	I4		ARG	Number of causal factors (5)
KNREG	I4		ARG	Number of regions
KNSUB	I4		ARG	Number of subsystems (4)
NOTHRD	I4		ARG	Number of threshholds
NUMTRP	R4	KMREG KMDL KMSUB KMDM	ARG	Number of trips delayed by each delay range region and demand period resulting in each failure level.
PTHRDM	R4		ARG	Minimum passenger delay threshhold
PNS	R4	KMREG KMDM	ARG	Number of passengers leaving stations in each region during each demand interval
RRATE	R4		ARG	Vehicle repair rate in each bay

NAME	TYPE	DIM	ARG	FUNCTION
SMFREQ	R4		ARG	Scheduled maintenance frequency
SMST	R4		ARG	Scheduled maintenance service time per vehicle
STATNS	I4	KMREG	ARG	Number of stations in each region
SYSTIM	R4	KMDM	ARG	System operating time by demand period
THRIND	R4		ARG	Threshhold increment
THRESH	R4	KMDL	ARG	Threshholds
VINSTA	R4	KMREG KMDM	ARG	Number of vehicles through stations in each region and demand period
VM	R4	KMREG KMDM	ARG	Vehicle distance in each region during each demand period
VN	R4	KMREG KMDM	ARG	Average number of vehicles in each region during each demand period
VOPTIM	I4	KMREG KMDM	ARG	Total vehicle operating time in each region and demand interval
AVMFLT	R4	KMSB		Average total maintenance fleet sizes for ten numbers of service bays
BAYS	I4	KMSB		Number of service bays being considered
DLPDM	R4	KMDM		Vehicle delay caused by failures occurring in each demand period
FERATE	R4	KMSUB KMRD KMLVL KMFL		Failure effect rates of subsystems (failures of a single subsystem element as opposed to system-wide) per unit time as functions of different causal factors for each level of reliability 1 - stoppage failures, 2 - degradation failures
FMF	R4	FMSB		Failure maintenance fleet sizes for different numbers of maintenance bays
FRATET	R4	KMSUB KMRD KMLVL		Failure rates of subsystems (failures of a single subsystem element as opposed to system-wide) per unit time as functions of different causal factors for each level of reliability
MNV	R4			Maximum number of vehicles
NETRAT	R4			Net rate of vehicle failures using a single bay
PAVAIL	R4	KMDL		Passenger availability
PROB	R4	KMSB KMSFS		The probabilities that ten different standby fleet sizes are adequate given ten different numbers of service bays
SF	I4	KMSFS		Service fleet size being considered
SUBFAL	R4	KMREG KMDM KMSUB KMFL		Subsystem failures in each region and demand period (total - not single subsystem element) 1 - stoppage failures, 2 - degradation failures
TRPDMN	R4	KMDM KMDL		Number of trips delayed by failures occurring in each demand period
TRPS	R4	KMDL		Number of trips delayed above each threshhold
VDLTM	R4	KMREG KMDM		Total vehicle delay caused by failures occurring in each region and demand period
VOP	R4	KMDM		Vehicle operating time in each demand period

NAME	TYPE	DIM	ARG	FUNCTION
AFLSZ	R4			Active fleet size
AVNV	R4			Average number of vehicles
AVSMF	R4			Average scheduled maintenance fleet size
DLPSTD	R4			Vehicle delay per day
INDL	I4			Index specifying delay threshhold
INDM	I4			Index specifying demand period
INFL	I4			Index specifying failure level
INLVL	I4			Index specifying level of reliability
INREG	I4			Index specifying region
KNSB	I4			Number of different numbers of service bay
KNSFS	I4			Number of standby fleet sizes
MMBAYS	I4			Minimum maintenance bays
STDMND	R4			Daily system demand
VAVAIL	R4			Vehicle availability
VFFREQ	R4			Average vehicle failure frequency
VOPD	R4			Daily vehicle operating time
INSUB	I4			Index specifying subsystems 1 - vehicles 2 - stations 3 - guideways 4 - central management
LIB	R8	2		Run index entry library name (8 characters)
INRD	I4			Index specifying causal factor
PARM	I4			Address of parameter list from EXEC
TYPE	R8	2		Run index entry tape name (8 characters)
STATS	I4			I/O unit for raw statistics
ERRFLG	L1			Error flag - set to TRUE by any error
ERRPRT	I4			I/O unit to receive error messages
FINDEX	I4			I/O unit of run index file
MEMBER	I4	2		Index to parameter list for run index
MMDDYY	I2	7		Date in character format
MODULE	R8			Load module name
SYSPRT	I4			I/O unit for reports
WRTFLG	L1	2		Flag to write run index entry
FVEH	I4			Unit for vehicle availability report (0 - omit report)
CCRDS	I4	6		Control card names (4 characters)
FDLTI	I4			Unit for vehicle delay time report (0 - omit report)
FMAIN	I4			Unit for maintenance report (0 - omit report)
FNTRP	I4			Unit for Number of Trips Delayed report (0 - omit report)
FPASS	I4			Unit for Passenger Availability report (0 - omit report)
FPSUM	I4			Unit for Performance Summary file
FRELY	I4			Unit for Reliability report (0 - omit)
INDEX	I4	2		Name of run index file

NAME	TYPE	DIM	ARG	FUNCTION
MODEL	I2			Model id: constant 'AO'
SYSIN	I4			Unit for run time inputs
ACTION	I4	6		Type of processing for the control cards described in CCRDS
FSUBSR	I4			Unit for Subsystem Reliability report (0 - omit report)
NDXFLG	L1			Not used (parameter)
TMPFIL	I4			Unit with scratch file

6.26.4 Description

This is the supervisory portion of the output processor. Section 2.3 describes the output processor.

6.26.5 PDL

```
CALL AADATE TO GET THE TITLE IN CHARACTER FORMAT
PRINT THE CONTROL CARD LOG TITLE
CALL AACCRD TO READ AND PROCESS CONTROL CARDS
READ THE COMMON PART OF THE RAW STATISTICS FILE
CALL FAGETP TO GET THE RUN INDEX FILE NAME
WRITE THE HEADER LINE OF THE RUN INDEX FILE
FOR
  EACH RELIABILITY LEVEL(INLVL)
DO
  CALL AOREAD TO READ THE FIRST DATA GROUP FROM THE RAW STATISTIC FILE
  CALL AORELY TO PRINT THE RELIABILITY REPORT
  CALL AOPASS TO PRINT THE PASSENGER AVAILABILITY REPORT
  CALL AOMAIN TO PRINT THE MAINTAINENCE REPORT
  CALL AOVEH TO PRINT THE VEHICLE AVAILABILITY REPORT
  IF
    - ERRFLG
  THEN
    CALL AOPSUM TO WRITE THE PERFORMANCE SUMMARY FILE
  ENDIF
ENDDO
CALL AODLTI TO PRINT THE VEHICLE DELAY TIMES
CALL AONUMT TO PRINT THE NUMBER OF PASSENGERS DELAYED
CALL AAINDX TO RECORD THIS RUN IN THE RUN INDEX FILE
STOP
END
```

6.26.6 Algorithms

None

6.26.7 Notes or Remarks

The output processor accepts the parameter from the PARM = field on the EXEC JCL statement; the format of the parameter is:

load-module, run-index, prog-lib, prog-proj, data-proj, stats, persum

where

load-module	is the name of the load module used for this execution
run-index	is the distinguishing characters of the run index file (the last seven characters of the third index level of the file name)
prog-lib	is the second level of the STEPLIB file name
prog-proj	is the first level of the STEPLIB file name
data-proj	is the first level of all data files
stats	is the raw statistics file member name
persum	is the performance summary file member name

6.27 AOVEH - Print the Vehicle Availability Report

6.27.1 Identification

Language: PARAFOR

6.27.2 Calling Sequence

CALL AOVEH (FVEH, DLPDM, DLPSTD, VAVAIL, VDLTM, VOP, VOPD, VOPTIM, INLVL, KNREG, KNDM, KNFL, KNSUB, KMREG, KMDM, KMFL, KMSUB)

6.27.3 Local Variable Dictionary

NAME	TYPE	DIM	ARG	FUNCTION
KMDM	I4		ARG	Compiled maximum number of demand periods
KMFL	I4		ARG	Compiled maximum number of failure levels
KMREG	I4		ARG	Compiled maximum number of regions
KMSUB	I4		ARG	Compiled maximum number of subsystems
KNDM	I4		ARG	Number of demand periods
KNFL	I4		ARG	Number of failure levels
KNREG	I4		ARG	Number of regions
KNSUB	I4		ARG	Number of subsystems (4)
VOPTIM	I4	KMREG	ARG	Total vehicle operating time in each region

NAME	TYPE	DIM	ARG	FUNCTION
FVEH	I4		ARG	Data set Reference Number for Vehicle Availability report
HR	I2			Current date time
MO	I2			
YR	I2			
DAY	I2			
MIN	I2			
DLPDM	R4	KMDM	ARG	Vehicle delay caused by failures occurring in each demand period
VDLTM	R4	KMREG KMDM	ARG	Total vehicle delay caused by failures occurring in each region and demand period
VOP	R4	KMDM	ARG	Vehicle operating time in each demand period
DLPSTD	R4		ARG	Vehicle delay per day
INDM	I4			Index specifying demand period
INLVL	I4		ARG	Index specifying level of reliability
INREG	I4			Index specifying region
VAVAIL	R4		ARG	Vehicle availability
VOPD	R4		ARG	Daily vehicle operating time

6.27.4 Description

This routine prints the Vehicle Availability report

6.27.5 PDL

```
SUBROUTINE AOVEH
  IF
    FVEH ¬= 0
  THEN
    CALL DAYTIM TO GET THE CURRENT DATE
    WRITE THE TITLE
    FOR
      EACH DEMAND INTERVAL (INDM)
    WRITE THE BODY OF THE REPORT
    WRITE THE TOTALS
  ENDIF
  RETURN
END
```

6.27.6 Algorithms

None

6.27.7 Notes or Remarks

None

6.28 APDEL - Compute Passenger Delay Times and Passenger Availability

6.28.1 Identification

Language: PARAFOR

6.28.2 Calling Sequence

CALL APDEL (DMND, NUMTRP, PAVAIL, SUBFAL, STDMND, TRPDMN, TRPS, IND, KNDL, KNDM, KNREG, KNSUB, KNFL, KMDL, KMDM, KMREG, KMSUB, KMFL)

6.28.3 Local Variable Dictionary

NAME	TYPE	DIM	ARG	FUNCTION
DMND	R4	KMDM	ARG	System demand in each demand period
KMDL	I4		ARG	Compiled maximum number of delay threshholds
KMDM	I4		ARG	Compiled maximum number of demand periods
KMFL	I4		ARG	Compiled maximum number of failure levels
KMREG	I4		ARG	Compiled maximum number of regions
KMSUB	I4		ARG	Compiled maximum number of subsystems
KNDL	I4		ARG	Number of delay threshholds
KNDM	I4		ARG	Number of demand periods
KNFL	I4		ARG	Number of failure levels
KNREG	I4		ARG	Number of regions
KNSUB	I4		ARG	Number of subsystems (4)
NUMTRP	R4	KMREG	ARG	Number of trips delayed by each delay range
IND	I4		ARG	Index specifying delay threshhold above which trips are considered delayed
PAVAIL	R4	KMDL	ARG	Passenger availability
SUBFAL	R4	KMREG KMDM	ARG	Subsystem failures in each region and demand period (Total - not single subsystem element)
TRPDMN	R4	KMDM KMDL	ARG	Number of trips delayed by failures occurring in each demand period
TRPS	R4	KMDL	ARG	Number of trips delayed above each threshhold
INDL	I4			Index specifying delay threshhold
INDM	I4			Index specifying demand period
INFL	I4			Index specifying failure level
INREG	I4			Index specifying region
STDMND	R4		ARG	Daily system demand
INSUB	I4			Index specifying subsystem 1 - vehicles 2 - stations 3 - guideways 4 - central management

6.28.4 Description

This routine computes the passenger availability. The number of trips delayed by demand period and delay threshhold (TRPDMN) is computed from the number of trips delayed per failure (NUMTRP) and the expected number of failures. This and the system demand are totaled across demand periods which are used to compute passenger availability.

6.28.5 PDL

```
PROC: APDEL(IND)

  TRPS(IND):=0
  STDMND:=0
  FOR
    EACH DEMAND PERIOD(INDM)
  DO
    TRPDMN(INDM,IND):=0
    FOR
      EACH REGION(INREG)
    DO
      FOR
        EACH SUBSYSTEM(INSUB)
      DO
        FOR
          EACH DELAY INTERVAL AFTER THE DESIRED
          THRESHOLD(INDL BEGINNING WITH IND)
        DO
          FOR
            EACH FAILURE LEVEL(INFL)
          DO
            TRPDMN(INDM,IND) = TRPDMN(INDM, IND) +
              NUMTRP(INREG,INDM,INDL,INSUB,INFL)*
              SUBFAL(INREG,INDM,INSUB,INFL)
          ENDDO
        ENDDO
      ENDDO
    ENDDO
    STDMND:=STDMND+DMND(INDM)
    TRPS(IND):=TRPS(IND)+TRPDMN(INDM,IND)
  ENDDO
  PAVAIL(IND):=(STDMND-TRPS)/STDMND
ENDPROC
```

6.28.6 Algorithms

Passenger availability is defined in the User's Manual (Section 5.2.7).

6.28.7 Notes or Remarks

None

6.29 APHIST - Compute Passenger Availability for Different Threshhold Levels

6.29.1 Identification

Language: PARAFOR

6.29.2 Calling Sequence

CALL APHIST (DMND, NUMTRP, PAVAIL, SUBFAL, STDMND, TRPDMN, TRPS, KNDL, KNDM, KNREG, KNSUB, KNFL, KMDL, KMDM, KMREG, KMSUB, KMFL)

6.29.3 Local Variable Dictionary

NAME	TYPE	DIM	ARG	FUNCTION
DMND	R4	KMDM	ARG	System demand in each demand period
KMDL	I4		ARG	Compiled maximum number of delay threshholds
KMDM	I4		ARG	Compiled maximum number of demand periods
KMFL	I4		ARG	Compiled maximum number of failure levels
KMREG	I4		ARG	Compiled maximum number of regions
KMSUB	I4		ARG	Compiled maximum number of subsystems
KNDL	I4		ARG	Number of delay threshholds
KNDM	I4		ARG	Number of demand periods
KNFL	I4		ARG	Number of failure levels
KNREG	I4		ARG	Number of regions
KNSUB	I4		ARG	Number of subsystems (4)
NUMTRP	R4	KMREG KMDL KMSUB KMDM	ARG	Number of trips delayed by each delay range Region and demand period resulting in each failure level.
PAVAIL	R4	KMDL	ARG	Passenger availability
SUBFAL	R4	KMREG	ARG	Subsystem failures in each region and demand period
TRPDMN	R4	KMDM KMDL	ARG	Number of trips delayed by failures occurring in each demand period
TRPS	R4	KMDL	ARG	Number of trips delayed above each threshhold
INDL	I4			Index specifying delay threshhold
STDMND	R4		ARG	Daily system demand

6.29.4 Description

This routine computes passenger availability for each of the delay threshholds requested. It does this in calling APDEL for each delay threshhold.

6.29.5 PDL

```
PROC: APHIST

  FOR
    EACH DELAY THRESHOLD(INDL)
  DO
    RUN APDEL(INDL)
  ENDDO
ENDPROC
```

6.29.6 Algorithms

None

6.29.7 Notes or Remarks

None

6.30 APZERO - Compute the Probability of No Failures Being Repaired at Same Time

6.30.1 Identification

Language: PARAFOR

6.30.2 Calling Sequence

CALL PZERO = P0 (MRHO, M)

6.30.3 Local Variable Dictionary

NAME	TYPE	DIM	ARG	FUNCTION
M	I4		ARG	Number of maintenance bays
M RHO	R4		ARG	Failure rate of active fleet/repair rate (per bay)

6.30.4 Description

This function computes an intermediate result utilized in the maintenance fleet measures.

6.30.5 PDL

```
PROC: APZERO

  RUN AVSUM
  RUN AVPROD
  P0 = 1/(PROD/(1 - MRHO/M) + SUM)
ENDPROC
```

6.30.6 Algorithms

None

6.30.7 Notes or Remarks

This is a statement function which is included in the calling routine.

6.31 AREAD - Read All Values

6.31.1 Identification

Language: PARAFOR

6.31.2 Calling Sequence

CALL AREAD (STRUC, DMND, DLTIME, FLTSLT, FRATE, GWMILE, NUMTRP, PTHRDM, PNS, RRATE, SMFREQ, SMST, STATNS, SYSTIM, NOTHRD, THRIND, THRESH, VINSTA, VM, VN, VOPTIM, KNDM, KNREG, KNSUB, KNLVL, KNRD, KNFL, KNDL, KMDM, KMREG, KMSUB, KMLVL, KMRD, KMFL, KMDL, SYSPRT)

6.31.3 Local Variable Dictionary

NAME	TYPE	DIM	ARG	FUNCTION
DLTIME	R4	KMREG KMDM KMSUB KMFL	ARG	Vehicle delay time resulting from failures in each region and demand period for each subsystem and failure level
DMND	R4	KMDM	ARG	System demand in each demand period
FLTSLT	I4		ARG	Active fleet size (0 - average, 1 - maximum)
FRATE	R4	KMSUB KMRD KMLVL KMFL	ARG	Failure rates of systems per unit time as functions of different causal factors for each level of reliability and failure level

NAME	TYPE	DIM	ARG	FUNCTION
GWMILE	R4	KMREG	ARG	Guideway length in each region
KMDL	I4		ARG	Compiled maximum number of delay threshholds
KMDM	I4		ARG	Compiled maximum number of demand periods
KMFL	I4		ARG	Compiled maximum number of failure levels
KMLVL	I4		ARG	Compiled maximum number of reliability levels
KMRD	I4		ARG	Compiled maximum number of causal factors
KMREG	I4		ARG	Compiled maximum number of regions
KMSUB	I4		ARG	Compiled maximum number of subsystems
KNDL	I4		ARG	Number of delay threshholds
KNDM	I4		ARG	Number of demand periods
KNFL	I4		ARG	Number of failure levels
KNLVL	I4		ARG	Number of reliability levels
KNRD	I4		ARG	Number of causal factors (5)
KNREG	I4		ARG	Number of regions
KNSUB	I4		ARG	Number of subsystems (4)
NOTHRD	I4		ARG	Number of threshholds
NUMTRP	R4	KMREG KMDL KMSUB KMDM	ARG	Number of trips delayed by each delay range Region and demand period resulting in each failure level.
PTHRDM	R4		ARG	Minimum passenger delay threshhold
PNS	R4	KMREG KMDM	ARG	Number of passengers leaving stations in each region during each demand interval
RRATE	R4		ARG	Vehicle repair rate in each bay
SMFREQ	R4		ARG	Scheduled maintenance frequency
SMST	R4		ARG	Scheduled maintenance service time per vehicle
STATNS	I4	KMREG	ARG	Number of stations in each region
SYSPRT	I4		ARG	Unit for printing error messages
SYSTIM	R4	KMDM	ARG	System operating time by demand period
THRIND	R4		ARG	Threshhold increment
THRESH	R4	KMDL	ARG	Threshholds
VINSTA	R4	KMREG KMDM	ARG	Number of vehicles through stations in each region and demand period
VM	R4	KMREG KMDM	ARG	Vehicle distance in each region during each demand period
VN	R4	KMREG KMDM	ARG	Average number of vehicles in each region during each demand period
VOPTIM	I4	KMREG KMDM	ARG	Total vehicle operating time in each region and demand interval
STRUC	I4		ARG	Data set reference number containing structured data file
INRD	I4			Index specifying causal factor
INDL	I4			Index specifying delay threshhold
INDM	I4			Index specifying demand period

NAME	TYPE	DIM	ARG	FUNCTION
INFL	I4			Index specifying failure level
INLVL	I4			Index specifying level of reliability
INREG	I4			Index specifying region
INSUB	I4			Index specifying subsystems 1 - vehicles 2 - stations 3 - guideways 4 - central management

6.31.4 Description

This routine reads the structured data file which contains all the inputs of the model processor.

6.31.5 PDL

```
PROC: AREAD
  READ STRUCTURED DATA FILE
ENDPROC
```

6.31.6 Algorithms

None

6.31.7 Notes or Remarks

All the statements for actually reading the file are contained in AFSTRC. AFSTRC is also used by the input processor to write the file to simplify maintaining a consistant format. The version number (contained in AFSTRC) must be incremented if the format of the file is changed.

6.32 ARGFAL - Compute Failures for each Subsystem

6.32.1 Identification

Language: PARAFOR

6.32.2 Calling Sequence

CALL ARGFAL (SUBFAL, VOPTIM, FRATE, PNS, SYSTIM, STATNS, VINSTA, GWMILE, VM, INLVL, KNREG, KNDM, KNFL, KMREG, KMDM, KMSUB, KMLVL, KMRD, KMFL)

6.32.3 Local Variable Dictionary

NAME	TYPE	DIM	ARG	FUNCTION
FRATE	R4	KMSUB KMRD KMLVL KMFL	ARG	Failure rates of systems per unit time as functions of different causal factors for each level of reliability and failure level
GWMILE	R4	KMREG	ARG	Guideway length in each region
KMDM	I4		ARG	Compiled maximum number of demand periods
KMFL	I4		ARG	Compiled maximum number of failure levels
KMLVL	I4		ARG	Compiled maximum number of reliability levels
KMRD	I4		ARG	Compiled maximum number of causal factors
KMREG	I4		ARG	Compiled maximum number of regions
KMSUB	I4		ARG	Compiled maximum number of subsystems
KNDM	I4		ARG	Number of demand periods
KNFL	I4		ARG	Number of failure levels
KNREG	I4		ARG	Number of regions
PNS	R4	KMREG KMDM	ARG	Number of passengers leaving stations in each region during each demand interval
STATNS	I4	KMREG	ARG	Number of stations in each region
SYSTIM	R4	KMDM	ARG	System operating time by demand period
VINSTA	R4	KMREG KMDM	ARG	Number of vehicles through stations in each region and demand period
VM	R4	KMREG KMDM	ARG	Vehicle distance in each region during each demand period
VOPTIM	I4	KMREG KMDM	ARG	Total vehicle operating time in each region and demand interval
SUBFAL	R4	KMREG	ARG	Subsystem failures in each region and demand period (total - not single subsystem element)
INDM	I4			Index specifying demand periods
INFL	I4			Index specifying failure level
INLVL	I4		ARG	Index specifying level of reliability
INREG	I4			Index specifying region

6.32.4 Description

This routine computes the expected number of failures (SUBFAL) from the failure rates (FRATE) and various system parameters. The failures are computed separately for each subsystem, reliability level, region, and demand period.

6.32.5 PDL

```
PROC: ARGFAL

  FOR
    EACH REGION(INREG)
  DO
    FOR
      EACH DEMAND PERIOD(INDM)
    DO
      FOR
        EACH FAILURE LEVEL(INFL)
      DO
        <COMPUTE VEHICLE FAILURES>
        SUBFAL(INREG,INDM,1,INFL):=
          VOPTIM(INREG,INDM)*FRATE(1,1,INLVL,INFL)
        <COMPUTE STATION FAILURES>
        SUBFAL(INREG,INDM,2,INFL):=
          PNS(INREG,INDM)*FRATE(2,2,INLVL,INFL)+
          SYSTIM(INDM)*STATNS(INREG)*FRATE(2,3,INLVL,INFL)+
          VINSTA(INREG,INDM)*FRATE(2,4,INLVL,INFL)
        <COMPUTE GUIDEWAY FAILURES>
        SUBFAL(INREG,INDM,3,INFL):=
          SYSTIM(INDM)*GWMILE(INREG)*FRATE(3,3,INLVL,INFL)
          +VM(INREG,INDM)*FRATE(3,5,INLVL,INFL)
        <COMPUTE CENTRAL MANAGEMENT FAILURES>
        SUBFAL(INREG,INDM,4,INFL):=SYSTIM(INDM)*FRATE(4,3,INLVL,INFL)
      ENDDO
    ENDDO
  ENDDO
ENDPROC
```

6.23.6 Algorithms

Vehicle Failures = a_1 * vehicle operating time

Station Failures = a_2 * passengers +
a_3 * operating time * stations +
a_4 * vehicles through station

Guideway Failures = a_5 * guideway length * operating time +
a_6 * vehicle-miles travelled

Central Management Failures = a_7 * system operating time

where

a_i are user selected failure rates

6.32.7 Notes or Remarks

None

6.33 ASCMPR - Compare Trips in the Trip Log

6.33.1 Identification

Language: PARAFOR

6.33.2 Calling Sequence

```
LOGICAL ASCMPR, LT

LT = ASCMPR (TSTRT1, TSTRT2, TORIG1, TORIG2, TDEST1, TDEST2,
     TNPNS1, TNPNS2)
```

6.33.3 Local Variable Dictionary

NAME	TYPE	DIM	ARG	FUNCTION
TDEST1	I2		ARG	Destination station of trip 1
TDEST2	I2		ARG	Destination station of trip 2
TNPNS1	I2		ARG	Number of passengers in trip 1
TNPNS2	I2		ARG	Number of passengers in trip 2
TORIG1	I2		ARG	Origin station of trip 1
TORIG2	I2		ARG	Origin station of trip 2
TSTRT1	R4		ARG	Start time of trip 1
TSTRT2	R4		ARG	Start time of trip 2

6.33.4 Description

This function returns TRUE if trip 1 comes before trip 2.

6.33.5 PDL

```
FUNCTION ASCMPR
  IF
    TSTRT1 = TSTRT2
  THEN
    IF
      TORIG1 = TORIG2
    THEN
      IF
        TDEST1 = TDEST2
      THEN
        ASCMPR = TNPSNS1 .LT. TNPSNS2
      ELSE
        ASCMPR = TDEST1 .LT. TDEST2
      ENDIF
    ELSE
      ASCMPR = TORIG1 .LT. TORIG2
    ENDIF
  ELSE
    ASCMPR = TSTRT1 .LT. TSTRT2
  ENDIF
  RETURN
END
```

6.33.6 Algorithms

None

6.33.7 Notes or Remarks

None

6.34 ASUBSR - Compute Subsystem Failure Rates and Effect Rates

6.34.1 Identification

Language: PARAFOR

6.34.2 Calling Sequence

CALL ASUBSR (FRATE, FRATET, FERATE, KNSUB, KNRD, KNLVL, KNFL, KNDM, KNREG, KNLVL, KNDL, KMSUB, KMRD, KMLVL, KMFL, KMDM, KMREG, KMLVL, KMDL)

6.34.3 Local Variable Dictionary

NAME	TYPE	DIM	ARG	FUNCTION
FRATE	R4	KMSUB KMRD KMLVL KMFL	ARG	Failure rates of systems per unit time as functions of different causal factors for each level of reliability and failure level
KMDL	I4		ARG	Compiled maximum number of delay threshholds
KMDM	I4		ARG	Compiled maximum number of demand periods
KMFL	I4		ARG	Compiled maximum number of failure levels
KMLVL	I4		ARG	Compiled maximum number of reliability levels
KMRD	I4		ARG	Compiled maximum number of causal factors
KMREG	I4		ARG	Compiled maximum number of regions
KMSUB	I4		ARG	Compiled maximum number of subsystems
KNDL	I4		ARG	Number of delay threshholds
KNDM	I4		ARG	Number of demand periods
KNFL	I4		ARG	Number of failure levels
KNLVL	I4		ARG	Number of reliability levels
KNRD	I4		ARG	Number of causal factors (5)
KNREG	I4		ARG	Number of regions
KNSUB	I4		ARG	Number of subsystems (4)
INRD	I4			Index specifying causal factor 1 - vehicle operating time 2 - passengers through stations 3 - system elapsed time 4 - vehicles through stations 5 - vehicles-miles traveled on the guideway
FERATE	R4	KMSUB KMRD KMLVL KMFL	ARG	Failure effect rates of subsystems (failures of a single subsystem element as opposed to system-wide) per unit time as functions of different causal factors for each level of reliability 1 - stoppage failures, 2 - degradation failures
FRATET	R4	KMSUB KMRD KMLVL	ARG	Failure rates of subsystems (failures of a single subsystem element as opposed to system-wide per unit time as functions of different causal factors for each level of reliability
INFL	I4			Index specifying failure level
INLVL	I4			Index specifying level of reliability
INSUB	I4			Index specifying subsystem 1 - vehicles 2 - stations 3 - guideways 4 - central management

6.34.4 Description

This routine computes the subsystem failure rates and the distribution of failures between failure levels (e.g., degraded and failed).

6.34.5 PDL

```
PROC: ASUBSR
  FOR
    EACH SUBSYSTEM(INSUB)
  DO
    FOR
      EACH CAUSAL FACTOR (INRD)
    DO
      FOR
        EACH LEVEL OF RELIABILITY (INLVL)
      DO
        FRATET(INSUB, INRD, INLVL) = 0.0
        FOR
          EACH FAILURE LEVEL
        DO
          FRATET(INSUB, INRD, INLVL) = FRATET(INSUB, INRD, INLVL) +
            FRATE(INSUB, INRD, INLVL, INFL)
        ENDDO
        FOR
          EACH FAILURE LEVEL
        DO
          IF
            FRATET(INSUB, INRD, INLVL) = 0
          THEN
            ferate(insub, inrd, inlvl, infl) = 0
          ELSE
            FERATE(INSUB, INRD, INLVL, INFL) =
              FRATE(INSUB, INRD, INLVL, INFL)/
              FRATET(INSUB, INRD, INLVL)
          ENDIF
        ENDDO
      ENDDO
    ENDDO
  ENDDO
ENDPROC
```

6.34.6 Algorithms

None

6.34.7 Notes or Remarks

None

6.35 AVDEL - Compute Vehicle Delay Times and Vehicle Availability

6.35.1 Identification

Language: PARAFOR

6.35.2 Calling Sequence

CALL AVDEL (DLPSTD, VOPD, DLPDM, VOP, VDLTM, SUBFAL, DLTIME, VOPTIM, VAVAIL, KNDM, KNREG, KNSUB, KNFL, KMDM, KMREG, KMSUB, KMFL)

6.35.3 Local Variable Dictionary

NAME	TYPE	DIM	ARG	FUNCTION
DLTIME	R4	KMREG KMDM KMSUB KMFL	ARG	Vehicle delay time resulting from failures in each region and demand period for each subsystem and failure level
KMDM	I4		ARG	Compiled maximum number of demand periods
KMFL	I4		ARG	Compiled maximum number of failure levels
KMREG	I4		ARG	Compiled maximum number of regions
KMSUB	I4		ARG	Compiled maximum number of subsystems
KNDM	I4		ARG	Number of demand periods
KNFL	I4		ARG	Number of failure levels
KNREG	I4		ARG	Number of regions
KNSUB	I4		ARG	Number of subsystems (4)
VOPTIM	I4	KMREG KMDM	ARG	Total vehicle operating time in each region and demand interval
DLPDM	R4	KMDM	ARG	Vehicle delay caused by failures occurring in each demand period
SUBFAL	R4	KMREG KMDM KMSUB KMFL	ARG	Subsystem failures in each region and demand period (total - not single subsystem element) 1 - stoppage failures, 2 - degradation failures
VDLTM	R4	KMREG KMDM	ARG	Total vehicle delay caused by failures occurring in each region and demand period
FOP	R4	KMDM	ARG	Vehicle operating time in each demand period
DLPSTD	R4		ARG	Vehicle delay per day
INDM	I4			Index specifying demand period
INFL	I4			Index specifying failure level
INREG	I4			Index specifying region
VAVAIL	R4		ARG	Vehicle availability

NAME	TYPE	DIM	ARG	FUNCTION
VOPD	R4		ARG	Daily vehicle operating time
INSUB	I4			Index specifying subsystem 1 - vehicles 2 - stations 3 - guideways 4 - central management

6.35.4 Description

The expected vehicle delay (for each region and for each demand period) is computed from the expected number of failures (SUBFAL) and the delay expected for each failure. Vehicle delay and vehicle operating time are accumulated over all regions and all demand periods. The total vehicle delay and total operating time are used to compute vehicle availability.

6.35.5 PDL

```
PROC: AVDEL
  DLPSTD:=0
  VOPD:=0
  FOR
    EACH DEMAND PERIOD(INDM)
  DO
    DLPDM(INDM):=0
    VOP(INDM):=0
    FOR
      EACH REGION(INREG)
    DO
      VDLTM(INREG,INDM):=0
      FOR
        EACH SUBSYSTEM(INSUB)
      DO
        FOR
          EACH FAILURE LEVEL(INFL)
        DO
          VDLTM(INREG,INDM):=VDLTM(INREG,INDM) +
            SUBFAL(INREG,INDM,INSUB,INFL)*DLTIME(INREG,INDM,INSUB,INFL)
        ENDDO
      ENDDO
      DLPDM(INDM):=DLPDM(INDM)+VDLTM(INREG,INDM)
      VOP(INDM):=VOP(INDM)+VOPTIM(INREG,INDM)
    ENDDO
    DLPSTD:=DLPSTD+DLPDM(INDM)
    VOPD:=VOPD+VOP(INDM)
  ENDDO
  VAVAIL:=(VOPD-DLPSTD)/VOPD
ENDPROC
```

6.35.6 Algorithms

Vehicle availability is computed as shown in the User's Manual.

6.35.7 Notes or Remarks

None

6.36 AVFLSZ - Compute Maintenance and Standby Fleet Measures

6.36.1 Identification

Language: PARAFOR

6.36.2 Calling Sequence

CALL AVFLSZ (SYSTIM, AVSMF, VOPD, SMFREQ, SMST, SUBFAL, MMBAYS, VFFREQ, RRATE, MNV, VN, AVNV, FLTSLT, AFLSZ, NETRAT, AVMFLT, FMF, PROB, KNDM, KNREG, KNSUB, KNFL, KNSFS, KNSB, KMDM, KMREG, KMSUB, KMFL, KMSFS, KMSB, DEBUG, SYSERR, BAYS, SF)

6.36.3 Local Variable Dictionary

NAME	TYPE	DIM	ARG	FUNCTION
FLTSLT	I4		ARG	Active fleet size (0- average, 1 - maximum)
KMDM	I4		ARG	Compiled maximum number of demand periods
KMFL	I4		ARG	Compiled maximum number of failure levels
KMREG	I4		ARG	Compiled maximum number of regions
KMSUB	I4		ARG	Compiled maximum number of subsystems
KNDM	I4		ARG	Number of demand periods
KNFL	I4		ARG	Number of failure levels
KNREG	I4		ARG	Number of regions
KNSUB	I4		ARG	Number of subsystems (4)
RRATE	R4		ARG	Vehicle repair rate in each bay
SMFREQ	R4		ARG	Scheduled maintenance frequency
SMST	R4		ARG	Scheduled maintenance service time per vehicle
SYSTIM	R4	KMDM	ARG	System operating time by demand period
VN	R4	KMREG	ARG	Average number of vehicles in each region
DEBUG	I4		ARG	I/O unit for debug output (0 - omit debug output)
STD	R4			Length of operating day
TNV	R4			Temporary variable
DMNV	R4			Temporary variable

NAME	TYPE	DIM	ARG	FUNCTION
INCR1	I4			Temporary variable
INCR2	I4			Temporary variable
PZERO	R4			P_0
PRCENT	R4			Temporary variable
VFAILD	R4			Temporary variable
BAYS	I4	KMSB	ARG	Number of service bays being considered
FMF	R4	FMSB	ARG	Failure maintenance fleet sizes for different numbers of maintenance bays
MNV	R4		ARG	Maximum number of vehicles
NETRAT	R4		ARG	Net rate of vehicle failures using a single bay
PROB	R4	KMSB KMSFS	ARG	The probabilities that ten different standby fleet sizes are adequate given ten different numbers of service bays
SF	I4	KMSFS	ARG	Service fleet size being considered
SUBFAL	R4	KMREG	ARG	Subsystem failures in each region and demand period
AFLSZ	R4		ARG	Active fleet size
AVNV	R4		ARG	Average number of vehicles
AVSMF	R4		ARG	Average scheduled maintenance fleet size
INDM	I4			Index specifying demand period
INFL	I4			Index specifying failure level
INREG	I4			Index specifying region
KMSB	I4		ARG	Maximum number of different numbers of service bays
KMSFS	I4		ARG	Maximum number of standby fleet sizes
KNSB	I4		ARG	Number of different numbers of service bays
KNSFS	I4		ARG	Number of standby fleet sizes
MMBAYS	I4		ARG	Minimum maintenance bays
VFFREQ	R4		ARG	Average vehicle failure frequency
VOPD	R4		ARG	Daily vehicle operating time

6.36.4 Description

This routine computes maintenance and standby fleet measures. First, the operating day length, the average scheduled maintenance fleet, the average failure maintenance fleet, and the active fleet size are computed. From these the minimum number of bays required to complete the maintenance work is computed. Finally, the probability of various fleet sizes and service facility sizes being adequate to maintain the active fleet is computed.

```
PROC: AVFLSZ
  STD:=0  <COMPUTE LENGTH OF STANDARD DAY>
  FOR
    EACH DEMAND PERIOD(INDM)
  DO
    STD:=STD+SYSTIM(INDM)
  ENDDO
  <COMPUTE AVERAGE SCHEDULED MAINTANENCE FLEET SIZE>
  AVSMF:=VOPD*SMFREQ*SMST/STD
  <COMPUTE AVERAGE FLEET FAILURE RATE>
  VFAILD:=0
  FOR
    EACH DEMAND PERIOD(INDM)
  DO
    FOR
      EACH REGION(INREG)
    DO
      FOR
        EACH FAILURE LEVEL(INFL)
      DO
        VFAILD:=VFAILD+SUBFAL(INREG,INDM,1,INFL)
      ENDDO
    ENDDO
  ENDDO
  VFFREQ:=VFAILD/STD
  MMBAYS:=INTEGER(AVSMF+VFFREQ*RRATE+1) <OBTAIN NEXT HIGHER INTEGER>
  MNV:=0
  TNV:=0
  FOR
    EACH DEMAND PERIOD(INDM)
  DO
    DMNV:=0
    FOR
      EACH REGION(INREG)
    DO
      DMNV:=DMNV+VN(INREG,INDM)
    ENDDO
    TNV:=TNV+DMNV*SYSTIM(INDM)
    MNV = MAX (DMNV, MNV)
  ENDDO
  AVNV:=TNV/STD
  IF <USER SELECTS MAXIMUM FLEET SIZE>
    FLTSLT=1
  THEN
    AFLSZ:=MNV
  ELSE
    AFLSZ:=AVNV
  ENDIF
  NETRAT:=VFFREQ*RRATE
  FOR <BAYS IN INCREMENTS OF 20 PERCENT>
    BAYS:=MMBAYS+MMBAYS*.2*INCR1 AS INCR1 GOES FROM 0 TO 9 IN STEPS OF 1
  DO
    PRCENT:=0
    INCR2:=0
    RUN APZERO
    RUN AVFMF
    AVMFLT(INCR1):=FMF(INCR1)+AVSMF
    DO
      INCR2:=INCR2+1
      IF
        PRCENT<2
      THEN
        PRCENT:=PRCENT+1
      ELSE
        IF
          PRCENT >= 2 AND PRCENT < 10
        THEN
          PRCENT:=PRCENT+2
        ELSE
          PRCENT:=PRCENT+10
        ENDIF
      ENDIF
      SF:=AFLSZ*PRCENT/100.
      RUN PRBCMP
    UNTIL
      PRCENT .GE. 50
    ENDDO
  ENDDO
ENDPROC
```

6.36.6 Algorithms

The equations utilized are discussed in Section 2.2.

6.36.7 Notes or Remarks

None

6.37 AVFMF - Compute failure maintenance fleet

6.37.1 Identification

Language: PARAFOR

6.37.2 Calling Sequence

FMF = AVFMF (M RHO, M)

6.37.3 Local Variable Dictionary

NAME	TYPE	DIM	ARG	FUNCTION
M	I4		ARG	Number of maintenance bays
M RHO	R4		ARG	Failure rate of active fleet/repair rate (per bay)

6.37.4 Description

This function computes the failure maintenance fleet size, i.e., the number of vehicles that are inoperable.

6.37.5 PDL

```
PROC: AVFMF
  CALL AVPROD
  CALL AVSUM
  AVFMF = P0*((M**3 + (M-M**2)*MRHO)/(M - MRHO)**2 * PROD + MRHO * SUM)
ENDPROC
```

6.37.6 Algorithms

See Section 2.2.

6.37.7 Notes or Remarks

This is a statement function and is included in the calling program.

6.38 AVPRB - Compute the Probability that the Standby Fleet SF is adequate to maintain the Active Fleet Size Chosen

6.38.1 Identification

Language: PARAFOR

6.38.2 Calling Sequence

PROB = AVPRB (K, M, M RHO, P_0)

6.38.3 Local Variable Dictionary

NAME	TYPE	DIM	ARG	FUNCTION
K	I4		ARG	Standby fleet size +1
M	I4		ARG	Number of maintenance bays
M RHO	R4		ARG	Failure rate of active fleet/repair rate (per bay)
P_0	R4		ARG	P_0

6.38.4 Description

This function computes the probability that the standby fleet size will be adequate to maintain the active fleet, i.e., a spare vehicle will be available when needed.

6.38.5 PDL

```
PROC: AVPRB

  IF <STANDBY FLEET RELATIVE TO NUMBER OF BAYS>
    K<M
  THEN
    CALL AVSUM
    AVPRB = P0 * SUM
  ELSE
    CALL AVPROB
    AVPRB = 1 - P0 * PROD*(MRHO/M)**(K-M)/(1-MRHO/M)
  ENDIF
ENDPROC
```

6.38.6 Algorithms

See Section 2.2.

6.38.7 Notes or Remarks

None

6.39 AVPROD - Compute MRHO**N/N!

6.39.1 Identification

Language: PARAFOR

6.39.2 Calling Sequence

PROD = AVPROD (MRHO, N)

6.39.3 Local Variable Dictionary

NAME	TYPE	DIM	ARG	FUNCTION
AVPROD	R4			Partial product and result
I	I4			Index
MRHO	R4		ARG	See definition
N	I4		ARG	See definition

6.39.4 Description

This function computes MRHO**N/N! in a manner that avoids overflow for reasonable values.

6.39.5 PDL

```
FUNCTION AVPROD
  AVPROD = 1
  IF
    N > 0
  THEN
    FOR
      I FROM 1 TO N
    DO
      AVPROD = AVPROD * MRHO/I
    ENDDO
  ENDIF
  RETURN
END
```

6.39.6 Algorithms

$$AVPROD = \frac{(M\ RHO)^N}{N!}$$

6.39.7 Notes or Remarks

None

6.40 AVSUM - Compute the Summation of MRHO**I/I! for I = 1,...,N

6.40.1 Identification

Language: PARAFOR

6.40.2 Calling Sequence

SUM = AVSUM (M RHO, N)

6.40.3 Local Variable Dictionary

NAME	TYPE	DIM	ARG	FUNCTION
AVSUM	R4			Partial sum and result
I	I4			Index
M RHO	R4		ARG	Input parameter
N	I4		ARG	Input parameter
PROD	R4			M RHO **I/I!

6.40.4 Description

This function computes the summation of M RHO**N/N! in a manner that avoids overflow for reasonable values.

6.40.5 PDL

```
SUBROUTINE AVSUM
  AVSUM = 0
  PROD = 1
  IF
    N > 0
  THEN
    FOR
      I FROM 1 TO N
    DO
      PROD = PROD * MRHO/I
      AVSUM = AVSUM + PROD
    ENDDO
  ENDIF
  RETURN
END
```

6.40.6 Algorithms

$$\text{AVSUM} = \sum_{i=1}^{N} \frac{(\text{M RHO})^{I}}{I!}$$

6.40.7 Notes or Remarks

None

6.41 DAYTIM - Obtain Date and Time

6.41.1 Identification

- DAYTIM - Convert Date and Time
- IBM/FSD - July 1, 1977
- PARAFOR

6.41.2 Argument Dictionary

NAME	TYPE	DIM	ARG	FUNCTION
MM	I*2			(OUTPUT) MONTH
DD	I*2			(OUTPUT) DAY
YY	I*2			(OUTPUT) YEAR
HH	I*2			(OUTPUT) HOURS
MM	I*2			(OUTPUT) MINUTES
SS	I*2			(OUTPUT) SECONDS

6.41.3 Local Variable Dictionary

NAME	TYPE	DIM	ARG	FUNCTION
YEAR	I*4	2		Century and year of century
HMS	I*4	3		Hours, minutes, seconds
SS	I*4			Seconds
LEAP	I*4			Indicates leap year

6.41.4 Description

The purpose of DAYTIM is to obtain the Julian date and time from the system clock and return the calendar date and time. DAYTIM calls DTIMEL via entry point TIMES to obtain the Julian date and time from the system clock. The returned year is then tested for leap year with the MOD function to determine which calendar conversion to use. The calendar conversion then uses the day of the year to find the month of the year and the day of the month.

6.41.5 PDL

None

6.41.6 Algorithms

None

6.41.7 Notes or Remarks

None

6.42 DTIMEL - Read System Clock

6.42.1 Identification

- DTIMEL - Read System Clock for Date and Time
- IBM/FSD - July 1, 1977
- ASM

6.42.2 Argument Dictionary

NAME	TYPE	DIM	ARG	FUNCTION
TIMES:				
YEAR	I*4	2		(OUTPUT) YEAR, JULIAN DAY
HMS	I*4	3		(OUTPUT) HOURS, MINUTES, AND SECONDS
SEC	I*4			(OUTPUT) TIME OF DAY IN SECONDS
DELT	I*4			(OUTPUT) ELAPSED TIME SINCE LAST CALL TO TIMES IN SECONDS)

6.42.3 Local Variable Dictionary

NAME	TYPE	DIM	ARG	FUNCTION
TA	I*4			Seconds of the day
DBL	I*4	2		Packed decimal date and time
YIM	I*4	2		Century and year of century
HIM	I*4	3		Hours, minutes, seconds

6.42.4 Description

DTIMEL is called by DAYTIM to read the system clock and return the current Julian date and time. DTIMEL calls the system TIME macro to get the date and time in EBCDIC. The routine then converts the date and time to binary and returns to the calling program.

6.42.5 PDL

None

6.42.6 Algorithms

None

6.42.7 Notes or Remarks

None

6.43 FASPAR - Parameter Field Processing

6.43.1 Identification

Language: Assembler

6.43.2 Calling Sequence

```
INTEGER, ADDR, FASPAR
ADDR = FASPAR (0)
CALL FAGETP (ADDR, PARMNO, PARM, LENGTH)
```

6.43.3 Local Variable Dictionary

None

6.43.4 Description

FASPAR returns the address of the parameter passed to the main program by the system. It does this by tracing back through the save areas. It must be called from the main program to operate correctly. Its result is only useful to FAGETP.

FAGETP returns a subfield from the parameter pointed to by ADDR (obtained from FASPAR). The subfields are separated by commas. PARMNO is the number of the subfield to return. All characters between the commas will be returned unless LENGTH is exceeded, in which case, the first LENGTH characters are returned. If LENGTH is omitted from the parameter list, a length of eight is assumed.

6.43.5 PDL

None

6.43.6 Algorithms

None

6.43.7 Notes or Remarks

None

6.44 FIERR - Process Undefined GDIP Variables

6.44.1 Identification

Language: PARAFOR

6.44.2 Calling Sequence

CALL FIERR (LVL, PGM, LEN, MSG)

6.44.3 Local Variable Dictionary

NAME	TYPE	DIM	ARG	FUNCTION
CHAR	I2			First character of input record
DIGIT	I2	11		Digits in EBCDIC (constant)
ERRFLG	L1			Flag set upon error
ERRPRT	I4			Unit for error message
FILL	L1	4		Constant for error message
IMAGE	I4	20		Image of input record (character)
LEN	I4		ARG	Length of error message
LVL	I2		ARG	Level of error (character)
MSG	L1	LEN	ARG	The error message itself
PGM	I2		ARG	The program ID (2 characters)
PURGED	L1			Flag to determine end of purge
SYSIN	I4			Not used
SYSPRT	I4			Unit to which to echo purged cards

6.44.4 Description

This routine generates the error message if a GDIP error occurs, and skips cards until another variable name is found.

6.44.5 PDL

```
PROC FIERR
  WRITE MSG TO SYSPRT
   IF
     SYSPRT  ≠ ERRPRT
   THEN
     WRITE MSG TO ERRPRT
  ENDIF
  ERRFLG = TRUE
  DO
    READ IMAGE FROM UNIT 5
    IF
      FIRST CHARACTER IS NOT ALPHABETIC
    THEN
      WRITE IMAGE TO ERRPRT
      IF
        ERRPRT ≠ SYSPRT
      THEN
        WRITE IMAGE TO SYSPRT
      ENDIF
    ENDIF
  UNTIL
    FIRST CHARACTER IS ALPHABETIC
  ENDDO
  BACK SPACE UNIT 5 ONE RECORD
END
```

6.44.6 Algorithms

None

6.44.7 Notes or Remarks

The common block ERRORS is used to communicate error parameters to a higher level program because FIERR is called from GDIP which does not accept these parameters.

6.45 XGDIPF4 - Read Full Word GDIP Data

6.45.1 Identification

- XGDIPF4 - Read Full Word GDIP Data
- IBM/FSD - July 1, 1977
- PARAFOR

6.45.2 Argument Dictionary

VARIABLE	DIM	TYPE	DESCRIPTION
ARRAY	IDA, IDB, IDC, IDD	I*4	Array into which the data is to be read
IDA	-	I*4	Maximum value of first dimension
IDB	-	I*4	Maximum value of second dimension
IDC	-	I*4	Maximum value of third dimension
IDD	-	I*4	Maximum value of fourth dimension
FMT	2	I*4	Format of data on input record
JRAL	-	I*4	Beginning value of first dimension
JRAH	-	I*4	Ending value of first dimension
JRBL	-	I*4	Beginning value of second dimension
JRBH	-	I*4	Ending value of second dimension
JRCL	-	I*4	Beginning value of third dimension
JRCH	-	I*4	Ending value of third dimension
JRDL	-	I*4	Benginning value of fourth dimension
JRDH	-	I*4	Ending value of fourth dimension

6.45.3 Local Variable Dictionary

VARIABLE	DIM	TYPE	DESCRIPTION
BUFFER	20	I*4	Input buffer
DUMP	-	I*4	The characters 'DUMP'
ENT	78	I*4	Contents of input buffer in specified format
FORMAT	4	I*4	Format of data on input record
IRAH	-	I*4	Ending value of first dimension
IRAL	-	I*4	Beginning value of first dimension
IRBH	-	I*4	Ending value of second dimension
IRBL	-	I*4	Beginning value of second dimension
IRCH	-	I*4	Ending value of third dimension
IRCL	-	I*4	Beginning value of third dimension
IRDH	-	I*4	Ending value of fourth dimension
IRDL	-	I*4	Beginning value of fourth dimension
LENGTH	-	I*2	Defined length of input buffer in bytes
NBYTES	-	I*2	Number of bytes currently usable in input buffer
NCOPY	-	I*4	Number of times an input record is to be read
NOENT	-	I*4	Number of entries in input buffer

6.45.4 Description

This routine reads data in GDIP format into full word variables. The input record is read as a replication factor (first two columns) followed by a character string into the input buffer. A pseudo read is then performed on the input buffer to format the data and store it into the specified variable. The replication factor controls the number of times the pseudo read is performed.

6.45.5 PDL

None

6.45.6 Algorithms

None

6.45.7 Notes or Remarks

None

6.46 XNDBOR - Generalized Data Input Processing

6.46.1 Identification

- XNDBOR - Generalized Data Input Processing
- IBM/FSD - July 1, 1977
- PARAFOR

6.46.2 Argument Dictionary

6.46.3 Local Variable Dictionary

VARIABLE	DIM	TYPE	DESCRIPTION
END	-	R*8	The characters 'END'
FMT	-	R*8	Format of the data
IRAH	-	I*4	Ending value of first dimension
IRAL	-	I*4	Beginning value of first dimension
IRBH	-	I*4	Ending value of second dimension
IRBL	-	I*4	Beginning value of second dimension
IRCH	-	I*4	Ending value of third dimension
IRCL	-	I*4	Beginning value of third dimension
IRDH	-	I*4	Ending value of fourth dimension
IRDL	-	I*4	Beginning value of fourth dimension
NAME	-	R*8	Name of the variable

6.46.4 Description

This routine reads the name card of data that is defined in the GDIP format. The name card contains the name of the variable to be initialized, the format of the data and the lower and upper bounds of up to four dimensions which define the portion of the variable to be initialized. This information is passed to routine GDIP4 (see subsection 6.1.16), which determines the type of the variable and calls the proper routine to read the data into the variable. Routine XNDBOR continues until a record containing the characters END in the first three columns is read.

6.46.5 PDL

None

6.46.6 Decision Tables and Algorithms

None

6.46.7 Notes or Remarks

None

6.47 XPSEUDO - I/O Intercept Routine

6.47.1 Identification

- XPSEUDO - I/O Intercept Routine
- IBM/FSD - July 1, 1977
- ASM

6.47.2 Argument Dictionary

ENTRY	VARIABLE	DIM	TYPE	DESCRIPTION
PFIOCS	PARM 1	-	L*1	Type of I/O operation requested
	PARM 2	4	L*1	Data set reference number
	PARM 3	-	L*1	Type of I/O
SUDOGO	LENGBUF	-	I*2	Current number of characters in buffer
	BUFSIZ	-	I*2	Defined size of buffer
	BUFFER	20	I*4	The buffer

6.47.3 Local Variable Dictionary

VARIABLE	DIM	TYPE	DESCRIPTION
ASUDOBF	-	I*4	Address of COMMON/SUDOBF/
BUFLOC	-	I*4	Current I/O position in buffer
CURUNIT	-	L*1	Current data set reference number
FIOCSB	-	I*4	Address of true FIOCS routine
I256	-	I*4	The value 256
ONE	-	I*4	The value 1
SAVE	16	I*4	Register save area
SIX	-	I*4	The value 6

6.47.4 Description

This routine provides pseudo input operations for the simulation, which are performed during the read of data in the Generalized Data Input Package (GDIP) format. Entry SUDOGO is called by one of the GDIP read routines (XGDIPF4, XGDIPH4, XGDIPX4) to receive the location and size of the pseudo input buffer. SUDOGO also alters IBCOM so that all calls to FIOCS will come to entry point PFIOCS in this routine first. Then, for each FORTRAN I/O request, entry PFIOCS will be called. If the data set reference number in the READ or WRITE statement is not zero, PFIOCS calls the normal FIOCS routine. If the data set reference number in a READ statement is zero, pseudo input is required and PFIOCS supplies the character string in the pseudo input buffer as the result of the read operation. The character string is formatted as in a normal read to convert it to numerical data. The following major steps occur during a GDIP read:

1. A GDIP read routine calls SUDOGO to define the pseudo input buffer and intercept normal FORTRAN I/O calls.

2. The GDIP read routine performs a normal read (data set reference equal to five) of one record which consists of a replication factor (columns 1 and 2) and 78 columns of data. The data is read as a character string into the pseudo input buffer.

3. The GDIP read routine then performs a read with the data set reference number equal to zero. PFIOCS recognizes this as a pseudo read and returns the contents of the pseudo input buffer in the specified format as the result of the read operation. The GDIP read routine performs the pseudo read the number of times indicated by the replication factor and then continues at step 2 until all of the data for the specified array has been read.

6.47.5 PDL

None

6.47.6 Algorithms

None

6.47.7 Notes or Remarks

None

7.0 GLOSSARY

Asynchronous

Operation of vehicles under velocity control or in the vehicle-follower mode with speed changes allowed to prevent potential merge conflicts.

Automated Guideway Transit (AGT)

Computer-controlled transit system operating in demand or scheduled service on a fixed, exclusive guideway.

Automated Rail Transit (ART)

A class of AGT systems which provides multiple-stop service, carries at least 100 passengers in its minimum train consists, operates at speeds equal to or greater than 55 km/h, and generally runs at headways of more than 1 minute.

Availability-Factor Relationships

The sensitivity of the vehicle and passenger availability measures to changes in parameters which affect either system reliability or failure management strategy.

Average Queue Transit Time (TQ)

Average time required to move through a platform boarding queue during a period of congestion such as the peak hour. For a particular station the value is calculated as the difference between the average wait time and one-half the average route headway.

Capital Cost (base year)

The initial cost of deploying a system expressed in base year (1977) dollars. Capital cost is the sum of guideway construction cost, passenger station construction and equipment cost, AGT vehicle cost, central control construction and equipment cost, maintenance facility construction and equipment cost, power distribution system installation cost, and feeder system costs including vehicles, maintenance facilities, and control facilities.

Catalogued Procedure

A pre-coded set of Job Control Language (JCL) statements that is assigned a name, placed in a data set, and may be retrieved and executed by one JCL statement.

Central Business District (CBD)

The downtown retail trade area of a city. As defined by the Census Bureau, the CBD is an area of very high land valuation characterized by a high concentration of retail business offices, theaters, hotels, and service businesses, and by a high traffic flow.

Central City (CC) of an SMSA

The largest city in an SMSA. One or two additional cities may be secondary Central Cities in the SMSA.

Central City (CC) of an Urbanized Area (UA)

A city of at least 50,000 persons within closely settled incorporated and unincorporated areas that meet the criteria for urbanized ring (fringe) areas. A few UA's contain twin cities with a combined population of at least 50,000.

Central City Ring (CCR)

The portion of a Central City not included in the CBD.

Checkpoint File

A file created at a user-specified time by the Model Processor and containing all data necessary to restart the MP from that time.

Closed-Loop Control

Advancement of vehicles under generated control based upon the estimated system state.

Control Block

A specific section of guideway corresponding to a single control segment of a fixed block vehicle regulation and/or headway protection system.

Cruise Speed

The constant velocity at which a vehicle travels after acceleration and prior to braking. This velocity is usually less than the maximum design speed, but can be equal to it.

Crush Load Capacity

The maximum total capacity which a vehicle is designed to accommodate. This limitation is defined by either a vehicle weight limitation or a passenger comfort criterion.

Demand Activated Service Policy

A service policy in which routes, which may include intermediate station stops, are generated in real time on the basis of passenger demand, i.e., point-to-point routing with demand stop.

Demand Responsive Service Policy

A service policy in which non-stop routes are generated in real time on the basis of passenger demand, i.e., point-to-point routing with no intermediate stops.

Demand Stop Service Policy

A service policy in which vehicles travel on predetermined routes but stop at stations along the route only in response to specific passenger demand.

Demand Type

A system deployment parameter which specifies the demand environment on which a detailed demand model will be specified. Three metropolitan area demands and four activity center demand types are identified:

1. Metropolitan area - high CBD, high reverse commutation
2. Metropolitan area - high CBD, low reverse commutation
3. Metropolitan area - low CBD, low reverse commutation

1. Activity Center Line-Haul
2. Activity Center Circulation
3. Activity Center in High Demand CBD
4. Activity Center in Low Demand CBD

Design Load per Vehicle

The nominal passenger capacity of each vehicle.

Deterministic

A strategy by which all merge conflicts are resolved before launch, and barring failures, each vehicle is assured of traversing the network in a predetermined time.

Dial-A-Ride Service

Transit service operated by generating vehicle paths in continual response to demand.

Downtown People Mover (DPM)

An AGT system deployed in a CBD environment, or the UMTA demonstration program to implement such systems.

Empty Vehicle Management (EVM)

A set of strategies which govern the disposition of active, empty vehicles not assigned to a fixed route nor enroute to service a passenger demand. Alternative strategies include:

Circulation

Vehicles are circulated on the network until needed to satisfy a demand. The distribution of circulating vehicles may be based on historical demand or on current demand patterns.

Station storage - historical

Vehicles are routed to stations for storage based on historical demand data.

Station storage - real time

Vehicles are either stored in the station when they become empty or are routed to other stations and stored based on current demand patterns.

Event Model

A representation of an entity (a subsystem or process) in terms of discrete states of the entity and the time required to change from one state to another for use in a discrete event simulation.

Fixed Block

A longitudinal control or headway protection mechanization wherein blocks are hardwired to the guideway and each block transmits velocity or braking commands to the vehicle based on the occupancy of preceding blocks. For longitudinal control, the commands may be altered by central or local control. For headway protection the blocks transmit either braking or velocity limit commands to vehicles which establish upper bounds for any other commands.

Fixed Route Service

Transit service operated on predetermined paths.

Flow Capacity (P_c)

A measure of system capacity in terms of passenger spaces per second past a point; the ratio of traveling unit capacity to average route headway.

Fully Connected Grid (FG)

A grid network in which vehicles proceed directly from one station to any other station without retracing any one-or two-directional portion of the guideway.

Global Variables

Variables stored in a common area and known by one name to all segments included in the program.

Grid

Any guideway on which vehicles are presented with a choice of paths during normal operation.

Grid Transit (GT)

A transit system deployed in any demand environment which uses an FG or PG network and has more extensive operational switching capability than on MSLT. Generally shorter headways result than in MSLT. This category includes PRT systems and many systems which are often referred to as Group Rapid Transit (GRT).

Guideway Interface

The vehicle components which contact the guideway for support. Usually the interface is wheels but in some cases it is an air or magnetic levitation force.

Headway

A frequency of service measure: the mean time between vehicles passing a point along a route of known configuration.

Headway Equation

An analytic function which expresses the relationship between minimum headway and system parameters such as traveling unit (vehicle or train) length, cruise speed, acceleration, communication delay, and expected position error.

Intermediate Vehicle Group Rapid Transit (IGRT)

A class of AGT systems which provides multiple-stop service and carries from 25 to 69 passengers in its minimum train consist. Low speed IGRT systems have a maximum operating speed of 13 to 54 km/h and tend to run at 15 to 60 s headways. High speed IGRT systems operate at speeds greater than 54 km/h and at headways which usually fall between 15 and 90 s.

Intersection

An X-type merge with 2 input links, 2 output links, 4 ramp links, 4 through paths, and either 2 or 4 queuing areas.

Large Vehicle Group Rapid Transit (LGRT)

A class of AGT systems which provides multiple-stop service, has a minimum train consist capacity of 70 to 109 passengers, operates at a maximum speed of 13 to 54 km/h, and usually runs at headways of 30 to 90 s.

Lateral Control Interface

Vehicle and guideway components that interface to control the vehicle's lateral movement.

Loop

A guideway on which motion is unidirectional during normal operation (except possibly at short station segments or at ends of runs) and which is defined by a closed path.

Loop of Closed Geometry (S)

A simple loop as defined above which encircles no area.

Macro

A standard code segment that is generated in-line at compile time by specification of single statement.

Maximum Operating Speed

The maximum speed at which a vehicle can travel. This limit is imposed by vehicle and propulsion system design constraints.

Merge Strategy

A strategy for resolving merge conflicts. Three strategies are considered:

1. FIFO (first-in, first-out)
2. Prescheduled
3. Priority

Metro Shuttle Loop Transit (MSLT)

A transit system deployed in a metropolitan environment and having high speed capability but no or limited operational switching capability. The network may be of any type. If it is a grid network, however, the switching is of limited capability. This category includes most guideway transit systems currently deployed in metropolitan areas.

Minimum Traveling Unit

The minimum number of vehicles with which a train can operate. For some systems the minimum traveling unit is a single vehicle.

Minimum Traveling Unit Capacity

The nominal capacity (not crush capacity) of a single vehicle times the number of vehicles in a minimum train consist.

Moving Block

A headway protection mechanization wherein an emergency protection zone which moves along with the vehicle is established around each vehicle. Emergency braking commands are issued to the traveling vehicle whenever its emergency protection zone infringes upon that of a leading vehicle.

Multiple Loop (ML)

Any network consisting of two or more loops and requiring that passengers transfer from a vehicle constrained to one loop to a vehicle constrained to another loop if they wish to travel between two points not served by a single loop.

Network Element

Either a link, merge, or an intersection modeled in the DOCM.

Network Type

A system deployment parameter which specifies network configuration. Seven network types are identified:

1. Shuttles (S)
2. Loop of closed geometry (L)
3. Open loop, one-way (L1)
4. Open loop, two-way (L2)
5. Multiple loop (ML)
6. Partially connected grid (PG)
7. Fully connected grid (FG)

Nominal Capacity

Vehicle capacity including seated and standing passengers as specified by the manufacturer according to a passenger comfort criterion. The average area allotted to each standee is generally at least 2.5 square feet.

Non-deterministic

A strategy by which potential conflicts at merges are not considered before launch but are resolved locally in the vicinity of each merge.

Off-Vehicle Feeder Travel Time for Access

The mean time per person enroute to a specific AGT station for delay or non-vehicle travel (including any walking to feeder route or waiting for feeder bus, transferring between vehicles, parking a car, or walking all the way), while going from zone centroids to a specific station.

Off-Vehicle Feeder Travel Time for Egress

The mean time per person enroute from a specific AGT station for delay or non-vehicle travel (including waiting at stations for bus, walking from route to destination, transferring between vehicles, or walking all the way), while going from a specific station to zone centroids.

On-Vehicle Feeder Time for Access

The mean time per person enroute to a specific AGT station spent aboard a feeder vehicle (including feeder bus or private auto), while going from zone centroids to a specific station.

On-Vehicle Feeder Travel Time for Egress

The mean time per person enroute from a specific AGT station spent aboard a feeder vehicle (including the feeder bus or private auto), while going from a specific station to zone centroids.

Open-Loop Control

Advancement of vehicles by user-specified control independent of system state.

Open Loop, One-Way (L1)

A single loop encircling an area and providing one-way circulation.

Open Loop, Two-Way (L2)

Two loops deployed side-by-side encircling an area and providing two-way circulation.

PARAFOR

A superset of FORTRAN utilizing PL/1 macros to add structured programming facilities to standard FORTRAN.

Partially Connected Grid (PG)

A grid network which does not qualify as a Fully Connected Grid (FG).

Partitioned Data Set

A type of file organization in which independent groups of sequentially organized records, called members, are on direct-access storage.

Path

A sequence of guideway links used by a vehicle to travel between two points on a network.

Personal Rapid Transit (PRT)

A class of PRT systems which provides non-stop point-to-point service, has a minimum traveling unit capacity of 3 to 6 passengers, and runs at very short headways, usually 3 s or less. Low speed PRT has a maximum operating speed of 13 to 54 km/h, while high speed PRT has a maximum operating speed exceeding 54 km/h.

Platoon Movement

Simultaneous advancement of a row of vehicles or trains.

Practical Minimum Headway

The minimum headway at which vehicles can operate under normal conditions.

Prescheduled Pathing

A vehicle pathing strategy in which the primary path from origin to destination is predetermined and specified for all station pairs.

Precision Stopping Tolerance

The tolerance within which a vehicle can stop at a given point.

Quasi-deterministic

A strategy by which merge conflicts are not resolved prior to launch, but information about the future state of the network is used to launch vehicles at times that provide a high probability of efficient merging.

Quasi-synchronous

Operation of vehicles under point-follower control but with change of control points allowed to resolve potential merge conflicts by advancing or slipping one or more slots.

Reliability Block Diagram

A diagram that illustrates what equipment or combinations of equipment are required for successful system operation.

Representative System

A collection of values for the following system characteristics and strategies:

1. Vehicle characteristics
2. Guideway characteristics
3. System management strategies
4. Reliability characteristics
5. Cost characteristics

Representative System (continued)

The range of values are chosen to be interrelated in such a way as to represent a general class of state-of-the-art systems for the purpose of conducting system analyses within the SOS program.

Representative System Deployment

A specific combination of a representative system, demand type, and network configuration defined for the purpose of conducting system analyses within the SOS program.

Response Time

A frequency of service measures the mean time between a request for and the arrival of a dial-a-ride service vehicle.

Ripple Movement

Advancement of vehicles and trains one at a time for a row of stationary vehicles/trains.

Route

A designated set of destinations, usually defined by stations, to which a vehicle must travel. The path, or links, to be traversed between any two destinations is not specified.

Routing Strategy

A strategy which identifies routes for vehicles/trains. Two alternatives are fixed routing and real time select routing. Real time routing is used only with demand responsive service and demand activated service, while fixed routing is employed for demand stop and fixed route service policies.

Rural and Scattered Urban (R&SU)

The remaining rural and urban portions of counties not included as part of the urbanized ring of the UA, but still within the boundaries of the SMSA. Thus, with the exception of the New York and Los Angeles SMSA's, the SMSA consists of two components - the UA and the Rural and Scattered Urban. Both New York and Los Angeles Urbanized Areas (UA's) extend into counties outside the boundaries of the SMSA.

Scheduled, Real Time Pathing

A vehicle pathing strategy in which the primary path from origin to destination is selected from among specified alternatives just prior to departure from the origin station on the basis of current traffic conditions on the network.

Sector

An area serviceable by one vehicle in subscription service during a prescribed time interval for a specific demand density.

Service Type

Either non-stop (personal transit) or multiple-stop (group transit) service.

Shuttles (S)

A guideway on which bi-directional motion occurs during normal operation and which is defined by a single curve connecting two distinct end points. Also, any network consisting of two or more simple shuttles, either following the same path or different paths.

Shuttle Loop Transit (SLT)

A low speed AGT system deployment in an activity center demand environment having any non-grid type of network. Thus, SLT system deployments require no operational switching but may require passenger transfers.

Small Vehicle Group Rapid Transit (SGRT)

A class of AGT systems which provides multiple-party service, has a capacity of 7 to 24 passengers in its minimum train consist, and usually operates at headways between 3 and 15 s. Low speed SGRT has a maximum operating speed of 16 to 54 km/h, and high speed SGRT a maximum of over 54 km/h.

Standard Metropolitan Statistical Area (SMSA)

A county or group of counties containing at least one city (or twin cities) with a population of 50,000 or more, plus adjacent counties which are metropolitan in character and integrated economically and socially within the central city.

Switching Mechanism

The mechanism, located either on the vehicle or the guideway, by which vehicles/trains are switched.

Synchronous

Operation of vehicles under point-follower control with no changes allowed in control points during a given guideway trip.

Theoretical Minimum Headway

The minimum headway at which two vehicles can travel, assuming there are no merges or on-line stations.

Total Value Capital Cost

The sum of all capital costs except interest expense over the life cycle period expressed in base-year dollars.

Urbanized Area (UA)

An area containing a central city (or twin cities) of 50,000 or more population, plus the surrounding closely settled incorporated and unincorporated areas which meet certain criteria of population size and density (urbanized ring). UA's differ from SMSA's in that UA's exclude the rural portions of counties composing the SMSA's, as well as places that were separated by rural territory from the densely populated fringe around the central city. The components of the UA's include the central city, as defined above, and the urbanized rings, as defined below.

Urbanized Ring (UR)

Various areas contiguous to a central city or cities, which together constitute its urbanized ring, or "urban fringe," as termed by the Census Bureau.

Variable Cost (base year)

The annual cost of operating and maintaining a system expressed in base year (1977) dollars. Variable costs include maintenance costs, energy costs, and administrative costs for both the AGT and feeder systems.

Vehicle Capacity

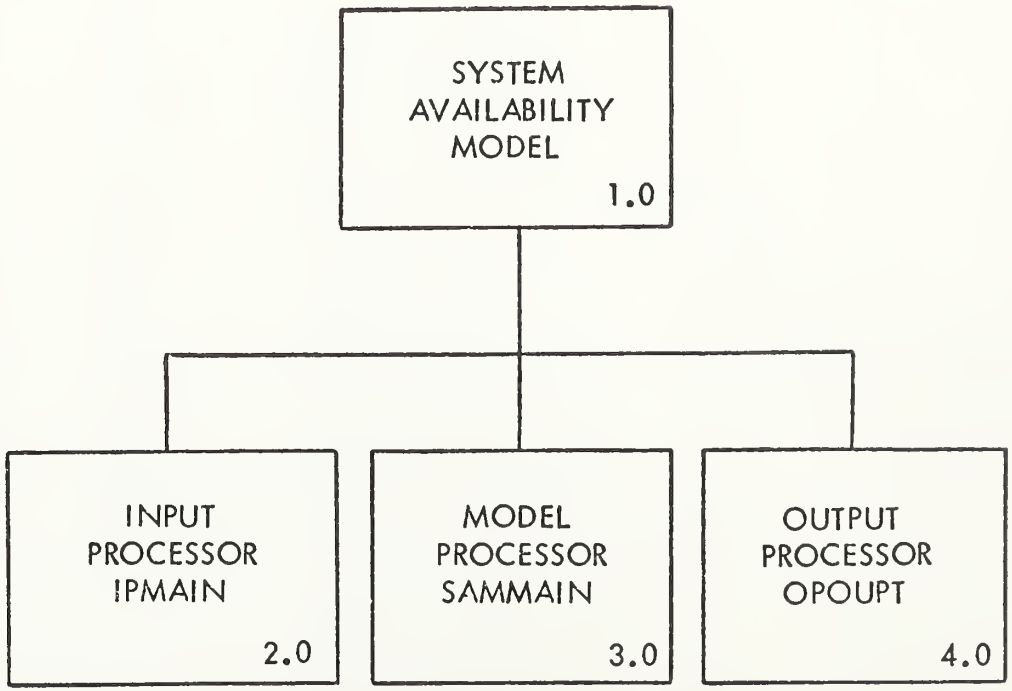
When used in correlations of vehicle dimensions and cost to capacity, nominal vehicle capacity is assumed. However, the system simulations interpret vehicle capacity as the maximum number of passengers which can occupy a vehicle at one time.

APPENDIX A

HIPO DIAGRAMS

Author: _____ System/Program: _____ Date: _____ Page: 1 of 1

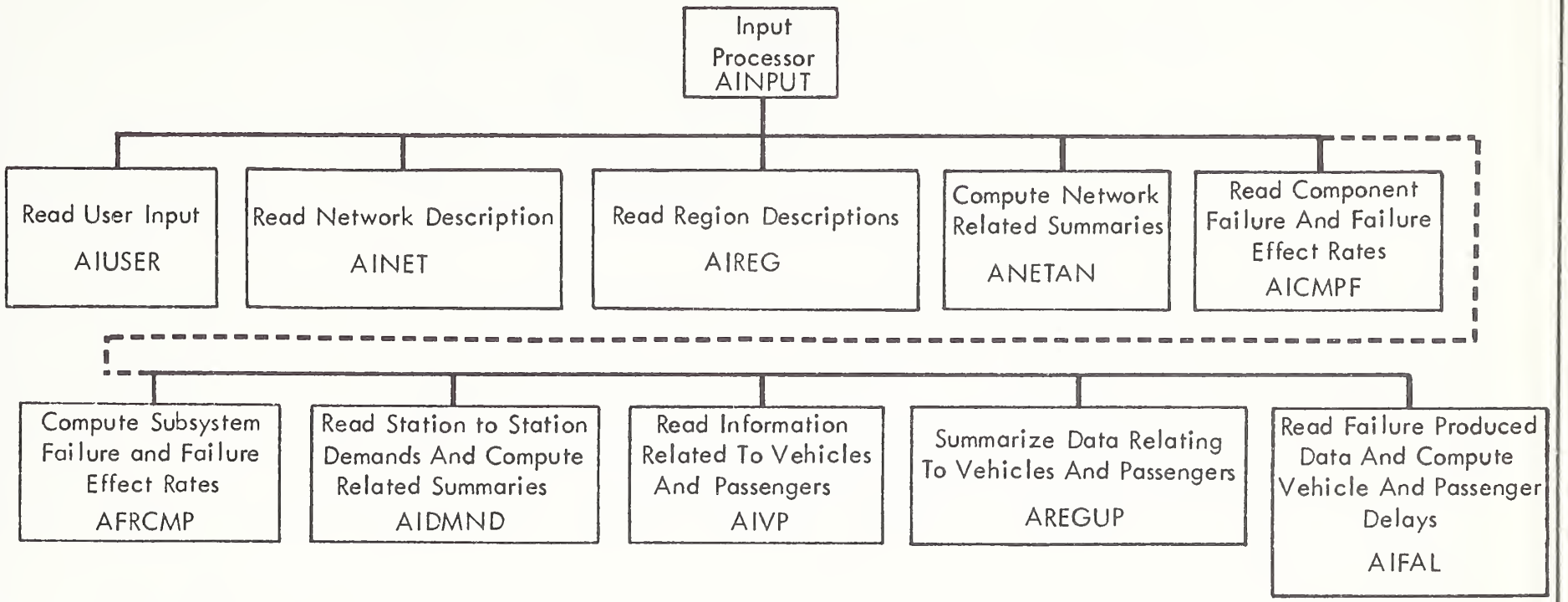
Diagram ID: VTOC Name: Visual Table of Contents Description: System Availability Model



Author: _____ System/Program: AGT-SOS/SAM Date: _____ Page: 1 of 1

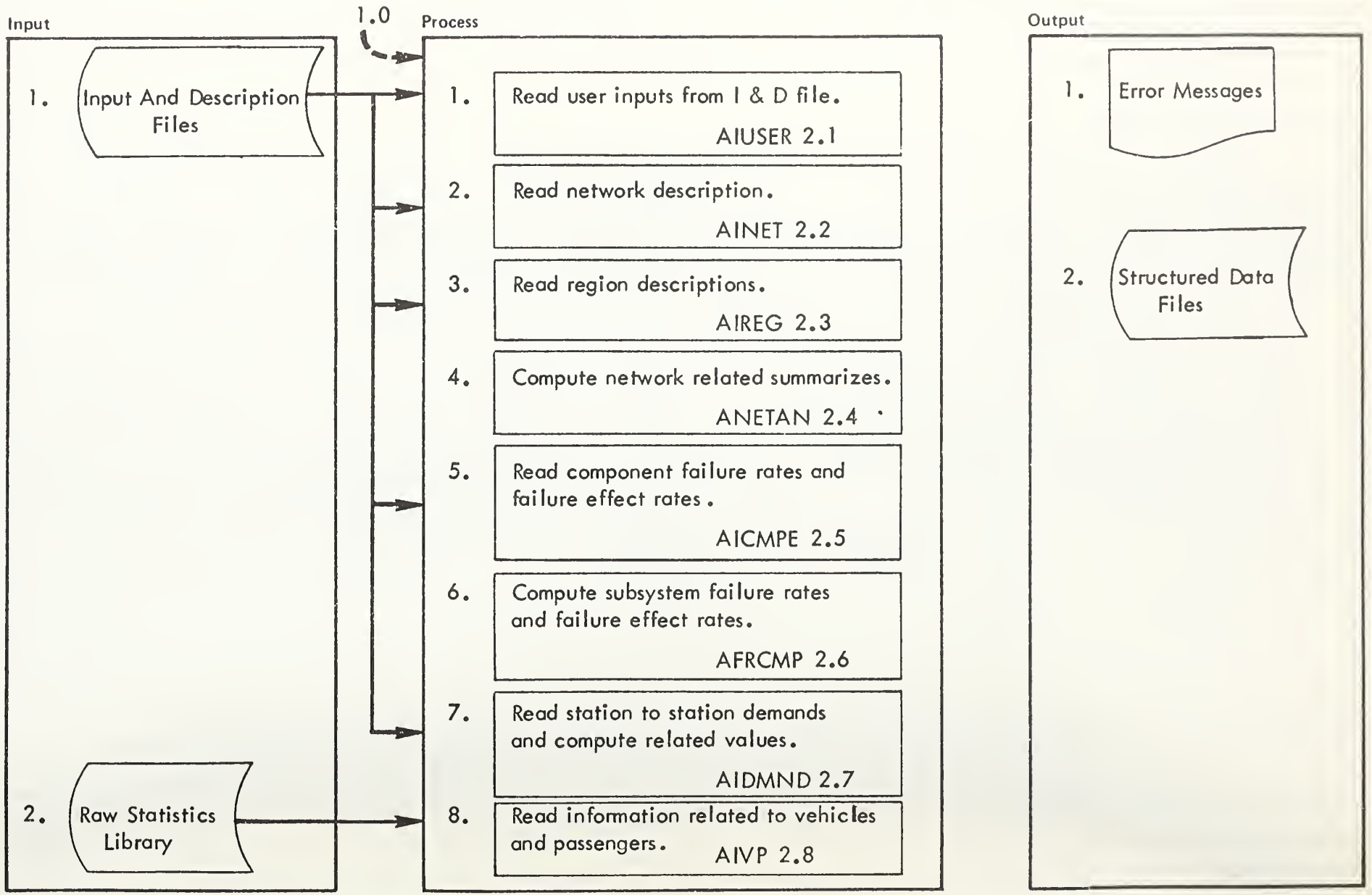
Diagram ID: VTOC Name: Visual Table of Contents Description: Input Processor

Input | Process | Output



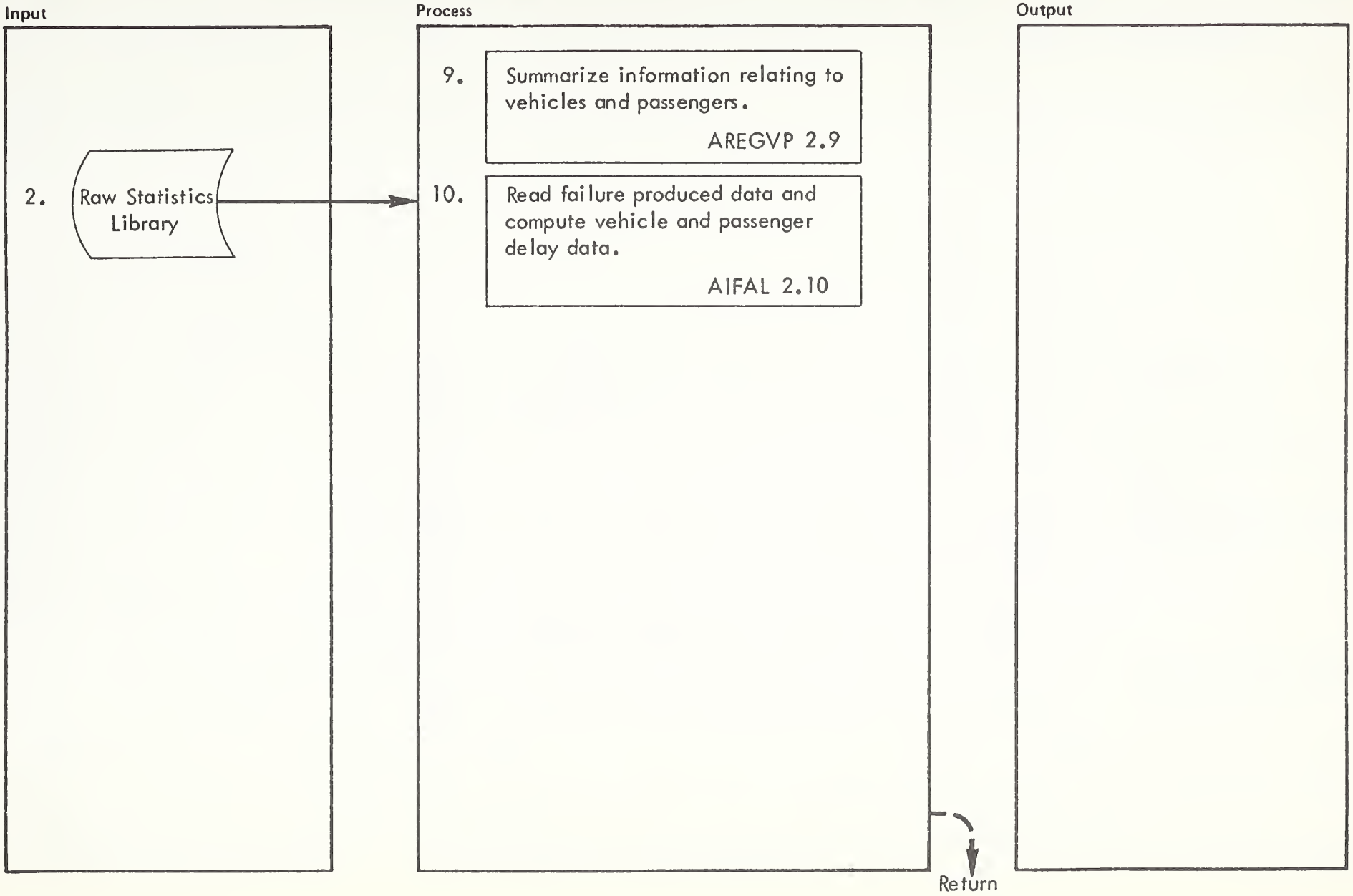
Author: _____ System/Program: AGT-SOS/SAM Date: _____ Page: 1 of 2

Diagram ID: 2.0 Name: AINPUT Description: Input Processor



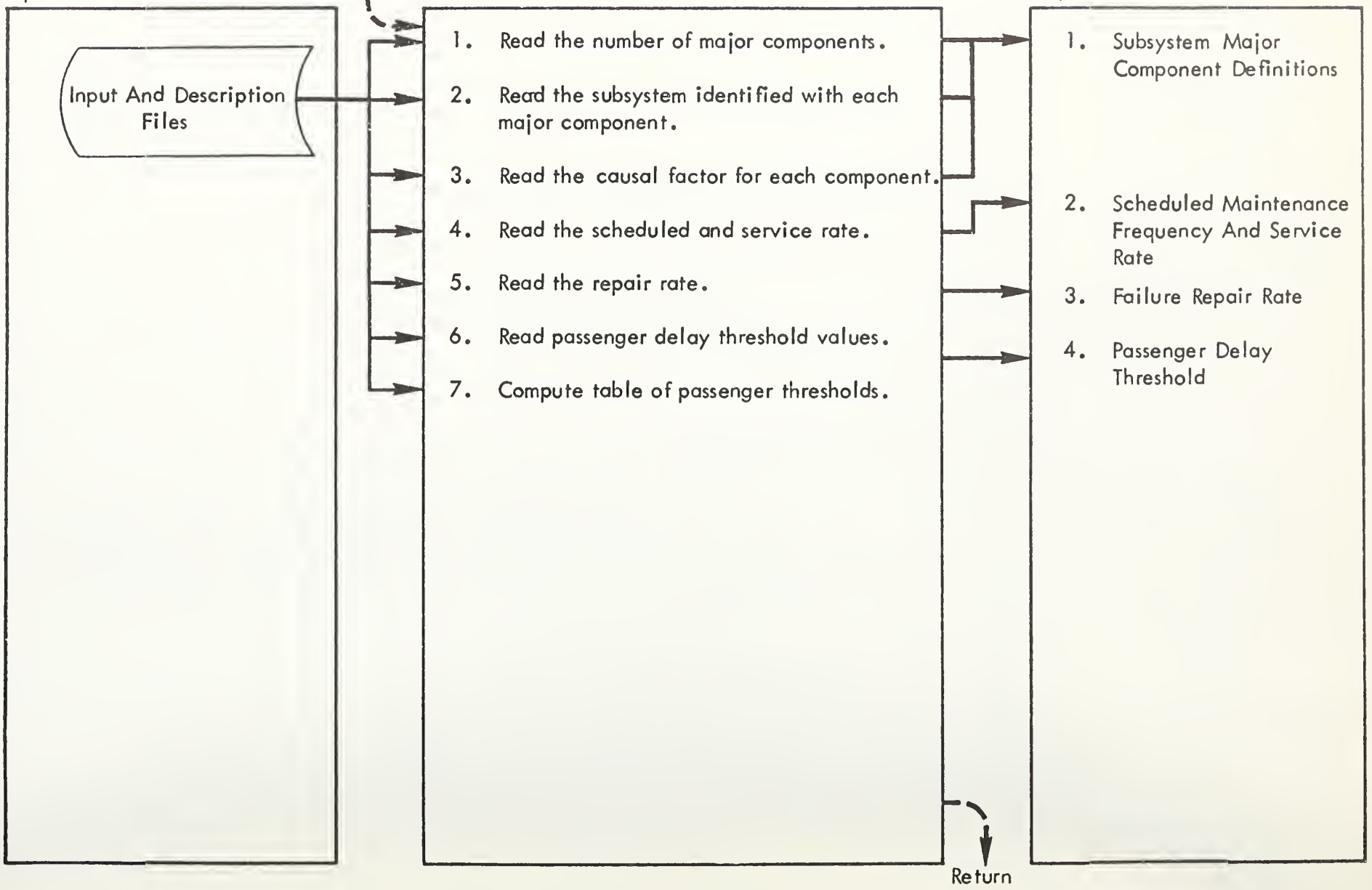
Author: _____ System/Program: AGT-SOS/SAM Date: _____ Page: 2 of 2

Diagram ID: 2.0 Name: AINPUT Description: Input Processor



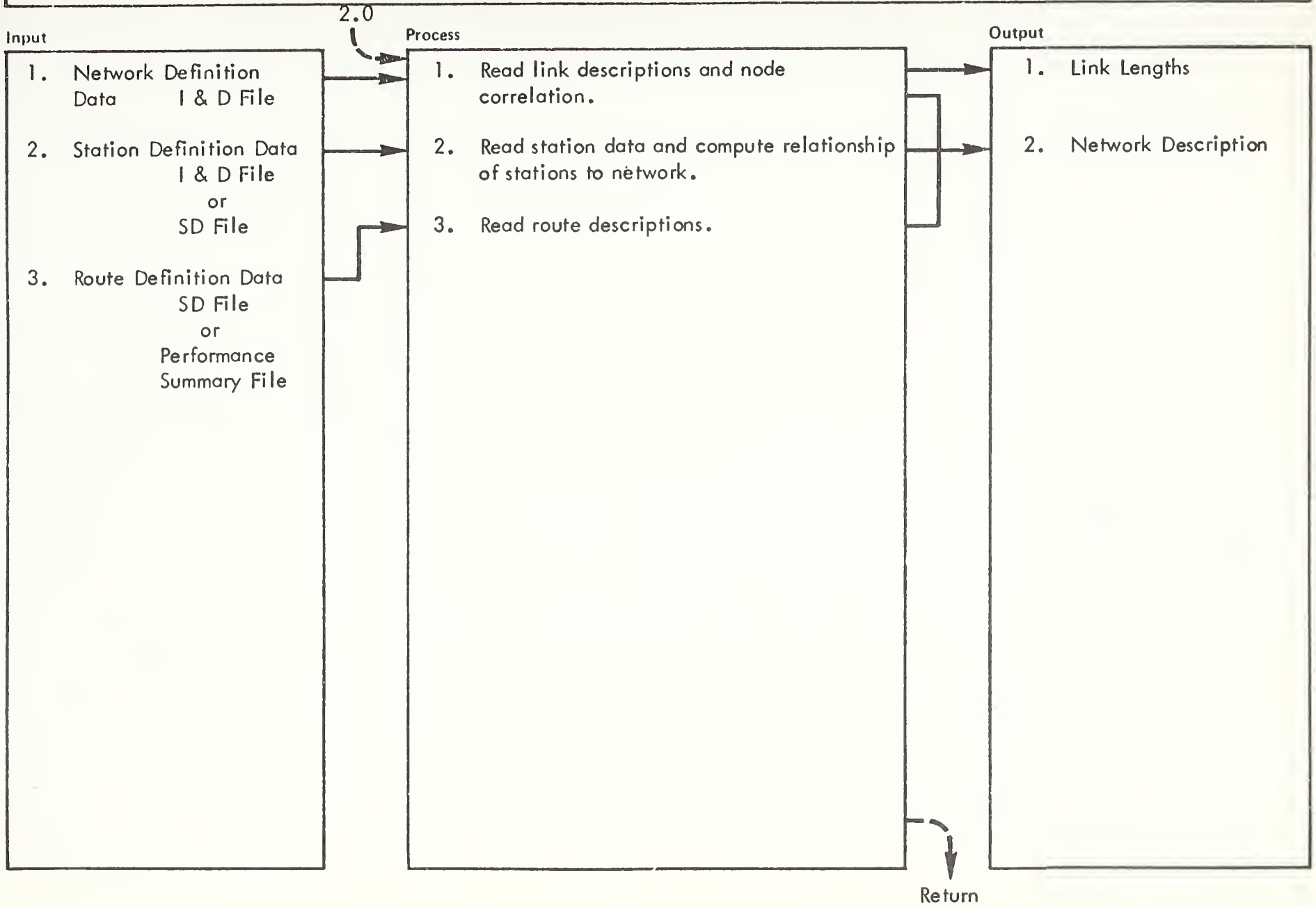
Author: _____ System/Program: AGT-SOS/SAM Date: _____ Page: 1 of 1

Diagram ID: 2.1 Name: AIUSER Description: Read User Inputs



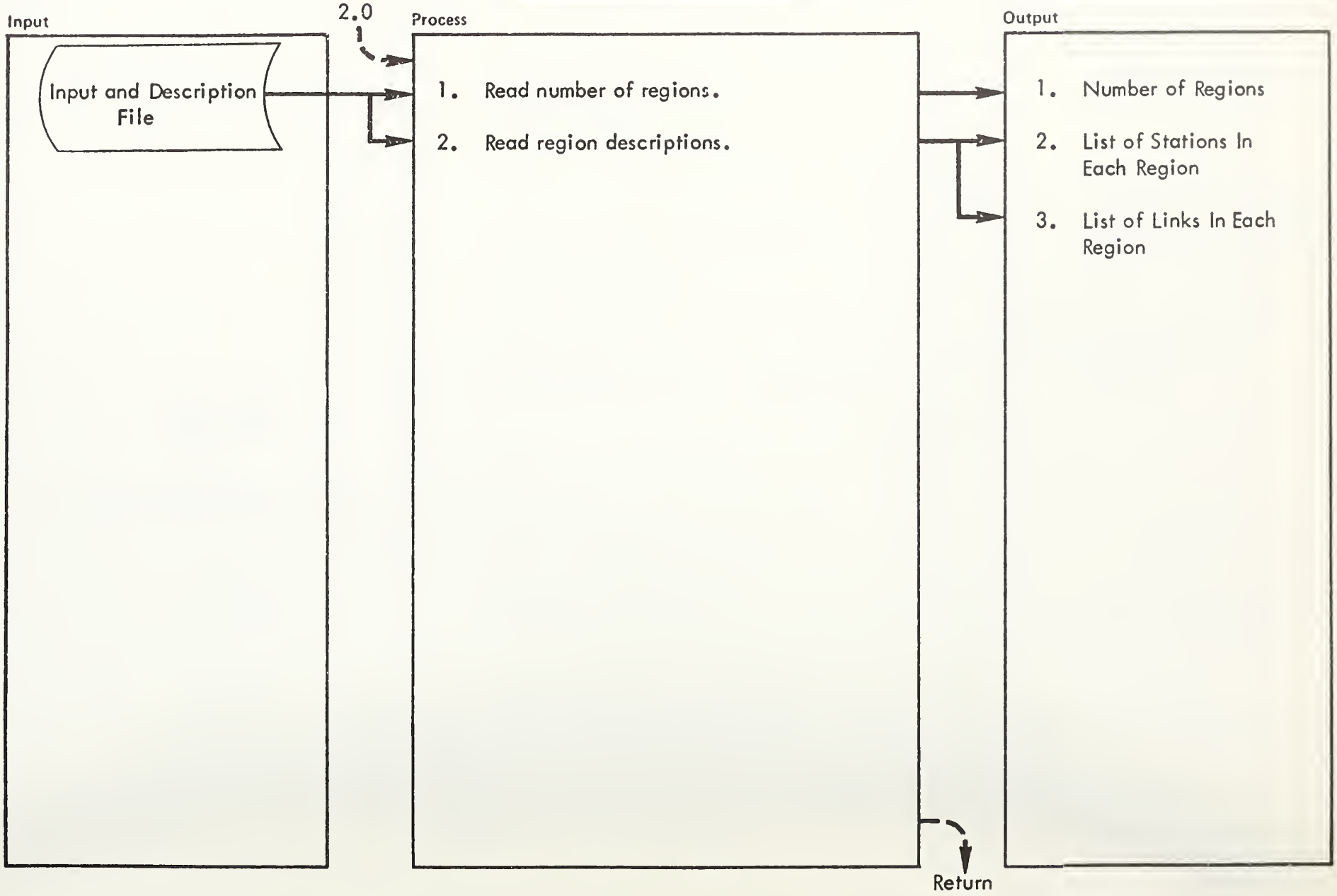
Author: _____ System/Program: AGT-SOS/SAM Date: _____ Page: 1 of 1

Diagram ID: 2.2 Name: AINET Description: Read Network Description



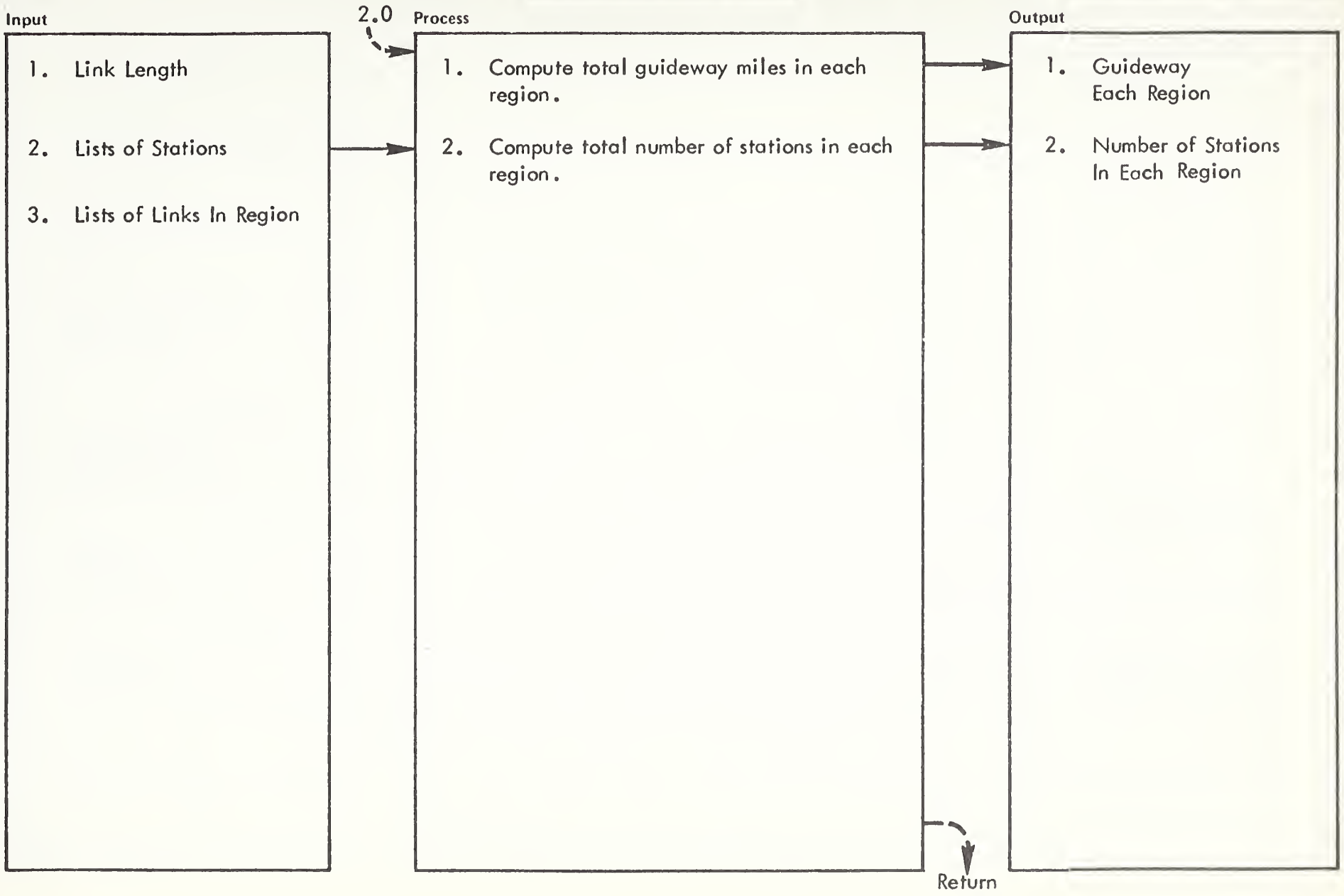
Author: _____ System/Program: AGT-SOS/SAM Date: _____ Page: 1 of 1

Diagram ID: 2.3 Name: AINREG Description: Read Region Descriptions



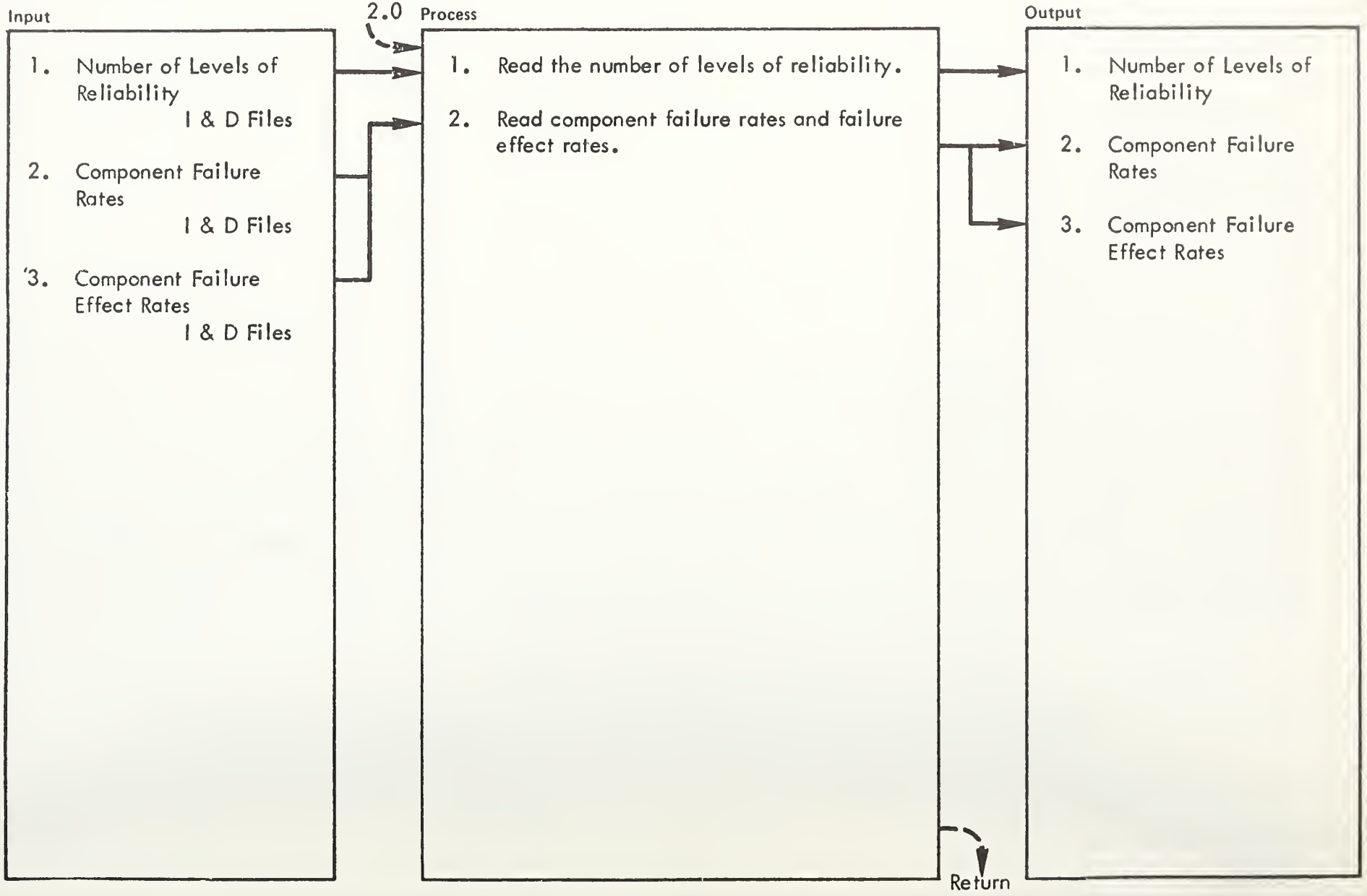
Author: _____ System/Program: AGT-SOS/SAM Date: _____ Page: 1 of 1

Diagram ID: 2.4 Name: ANETAN Description: Analyze Network



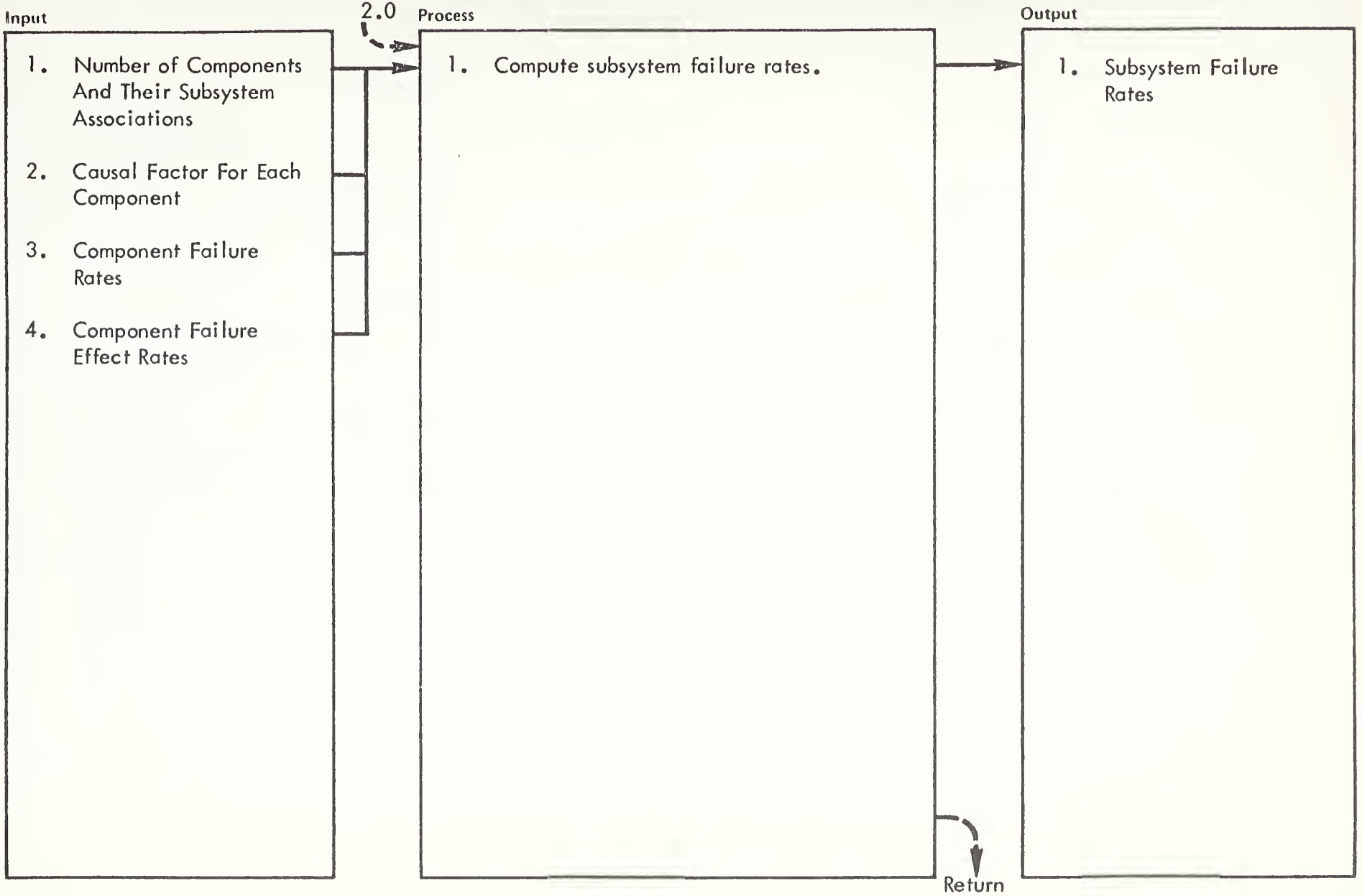
Author: _____ System/Program: AGT-SOS/SAM Date: _____ Page: 1 of 1

Diagram ID: 2.5 Name: AICMPF Description: Read Component Failure Data



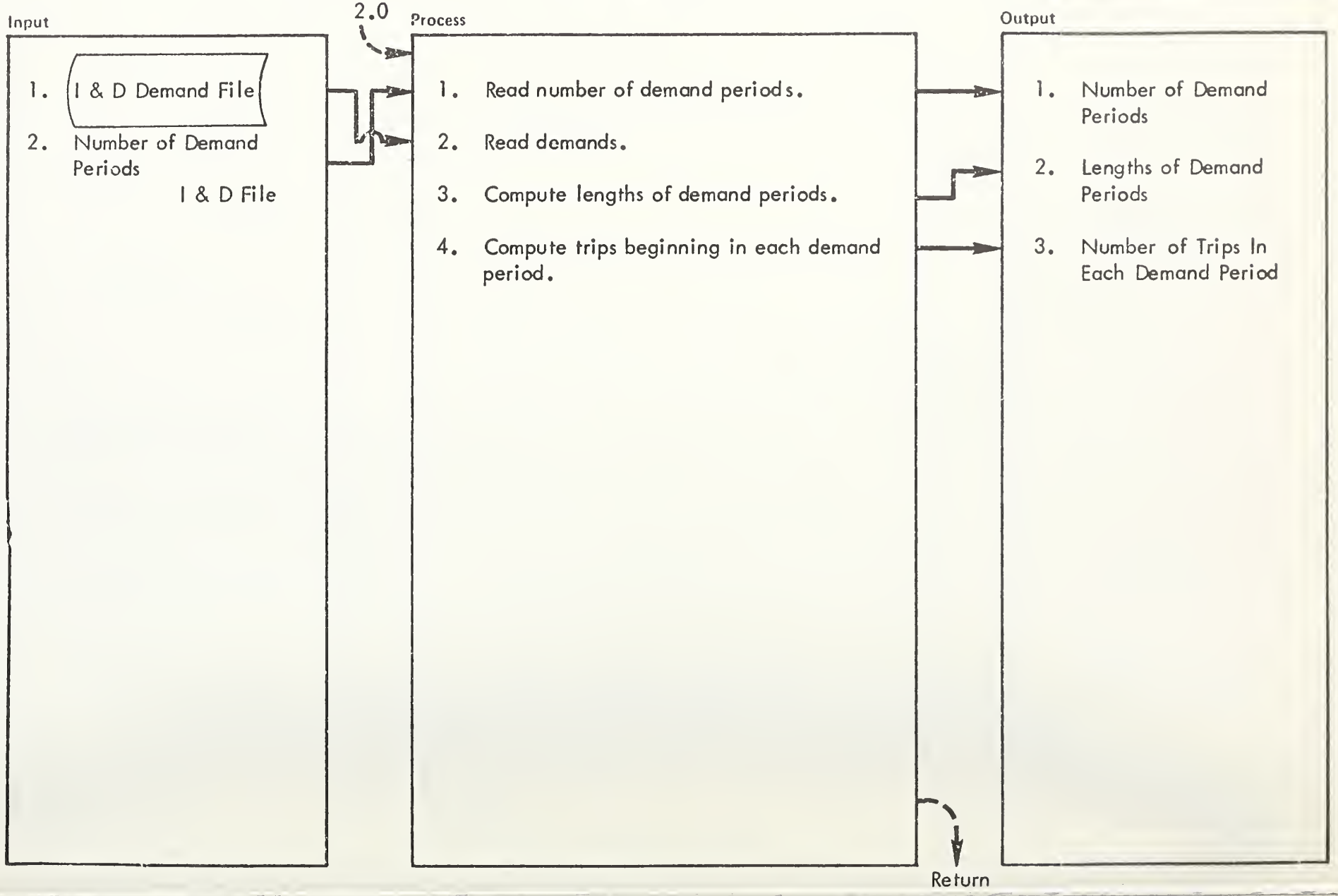
Author: _____ System/Program: AGT-SOS/SAM Date: _____ Page: 1 of 1

Diagram ID: 2.6 Name: AFRCMP Description: Compute Subsystem Failure Rates



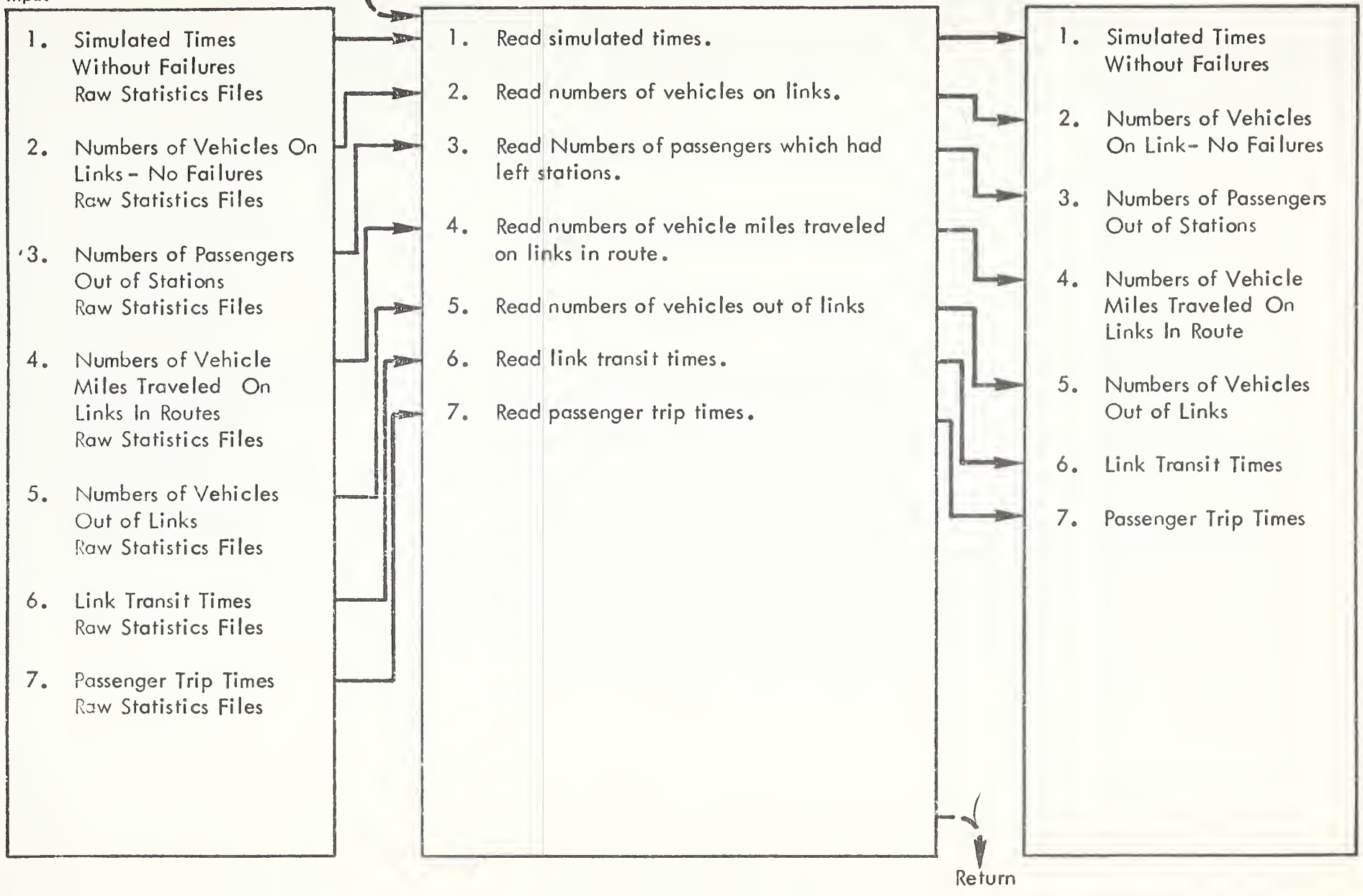
Author: _____ System/Program: AGT-SOS/SAM Date: _____ Page: 1 of 1

Diagram ID: 2.7 Name: AIDMND Description: Demand Processing



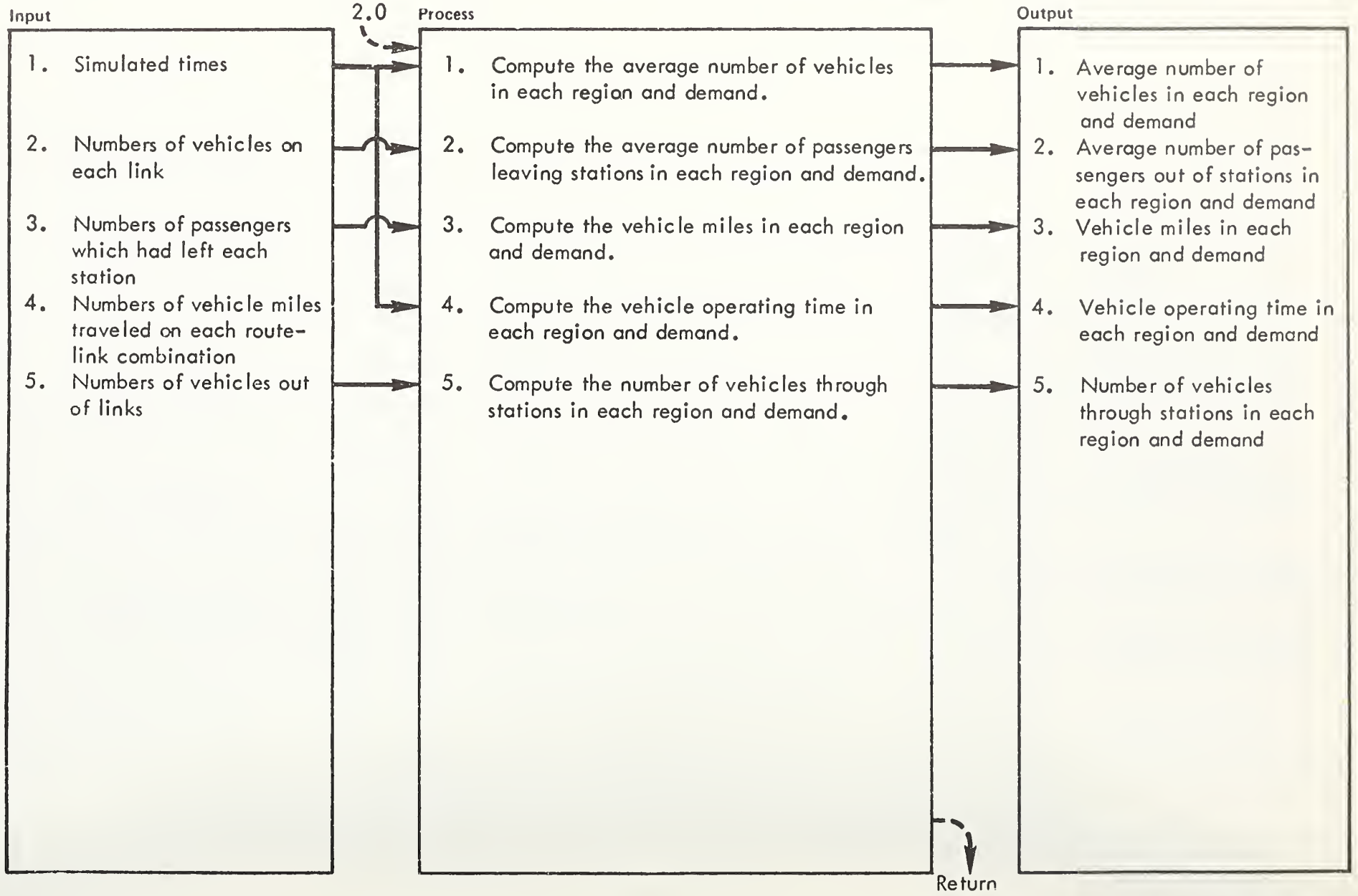
Author: _____ System/Program: AGT-SOS/SAM Date: _____ Page: 1 of 1

Diagram ID: 2.8 Name: AIVP Description: Read Vehicle And Passenger Data



Author: _____ System/Program: AGT-SOS/SAM Date: _____ Page: 1 of 1

Diagram ID: 2.9 Name: AREGVP Description: Collect Vehicle and Passenger Data



Author: _____ System/Program: AGT-SOS/SAM Date: _____ Page: 1 of 1

Diagram ID: 2.10 Name: AIFAL Description: Compute Delays

Input

1. Simulated times for each failure Raw Statistic File
2. Link transit times for each failure and link Raw Statistic File
3. Vehicle rates into links for each failure and link Raw Statistic File
4. Passenger trip times for each failure Raw Statistic File
5. Link transit times for each link without failures
6. Passenger trip times without failures

2.0

Process

1. Read simulated times for each failure.
2. Read link transit times for each failure.
3. Read vehicle rates into each link for each failure.
4. Compute average vehicle delays.
5. Read passenger trip times for each type of failure.
6. Compute average number of trips delayed within each delay interval for each type of failure.

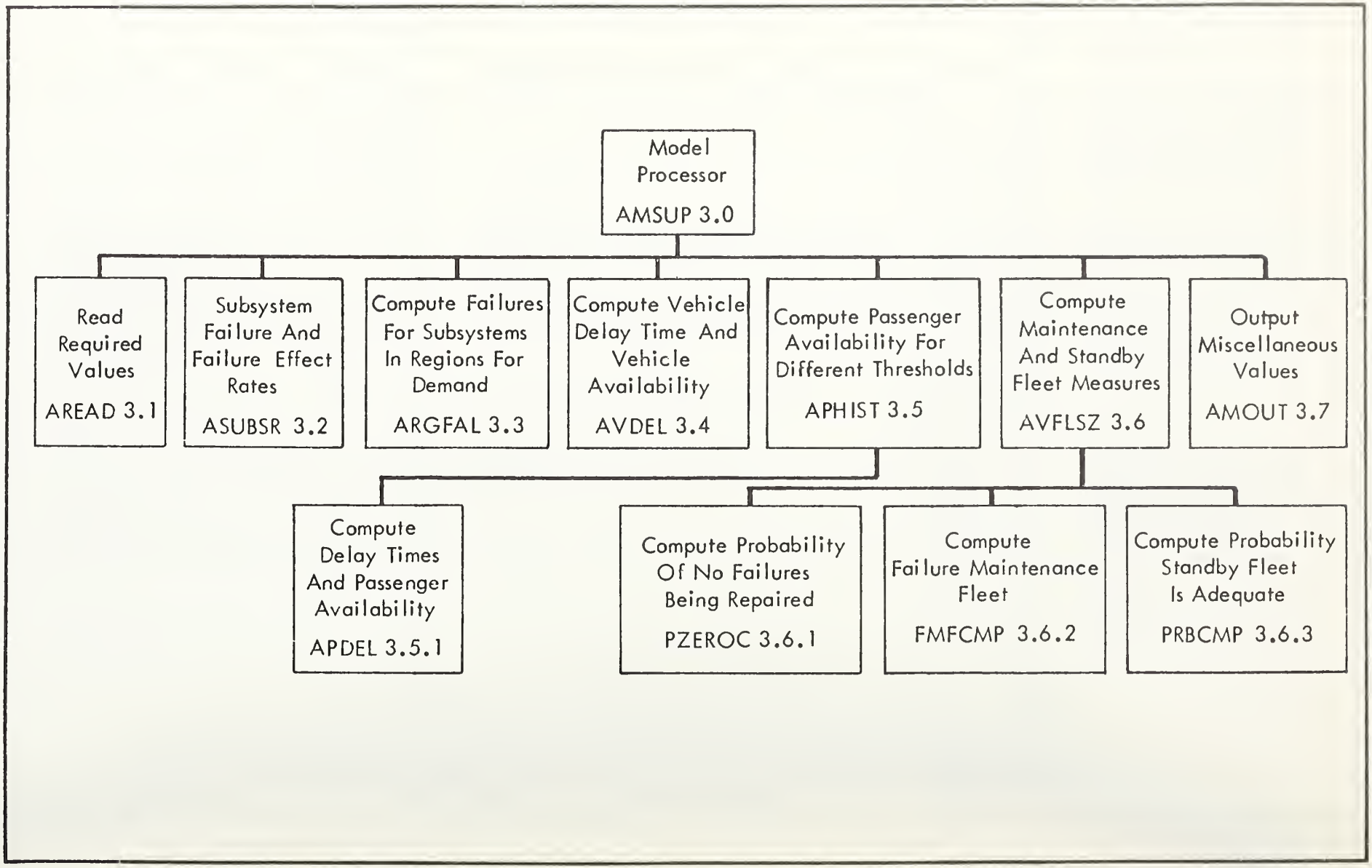
Return

Output

1. Average vehicle delay time for each type of failure
2. Average number of passengers delayed within each delay interval for each type of failure

Author: _____ System/Program: AGT-SOS/SAM Date: _____ Page: 1 of 1

Diagram ID: VTOC Name: Visual Table of Contents Description: Model Processor



Author: _____ System/Program: AGT-SOS/SAM Date: _____ Page: 1 of 1

Diagram ID: 3.0 Name: AMSUP (Section 2.2.2.1) Description: Model Processor

1.0

Input

Structured Data File

Process

1. Read required values.
   Sec. 2.2.2.1.1 AREAD
2. Output subsystem failure rates and effect rates.
   Sec. 2.2.2.1.2 ASUBSR
3. Compute failures for each subsystem in each region and demand period.
   Sec. 2.2.2.1.3 ARGFAL
4. Compute vehicle delay times and vehicle availability.
   Sec 2.2.2.1.4 AVDEL
5. Compute passenger availability for different thresholds.
   Sec. 2.2.2.1.5 APHIST
6. Compute maintenance and standby fleet measures.
   Sec. 2.2.2.1.6 AVFLSZ
7. Output miscellaneous values.
   Sec. 2.2.2.1.7 AMOUT

Output

Raw Statistics File

Initial Condition Report

Author: _____ System/Program: AGT-SOS/SAM Date: _____ Page: 1 of 1

Diagram ID: 3.1 Name: AREAD Description: Read All Required Values

3.0

Input

Structured Data File

Process

1. Read Failure Rates of Subsystem
2. Read Subsystem Failure Effect Rates
3. Read Time Average of the Number of Vehicles in Each Region During Each Demand Period
4. Read Time Average of the Number of Passengers Leaving Stations in Each Region During Each Demand Period
5. Read Number of Vehicle Miles in Each Region During Each Demand Period
6. Read Total Time of System Operating in Each Demand Period
7. Read Total Operating Time in Each Region & Each Demand Period
8. Read Vehicle Delay Time in Each Region & Demand for Each Subsystem Failure
9. Read Scheduled Maintenance Frequency
10. Read Average Rate of Vehicle Repairs in a Single Bay
11. Read Minimum Passenger Delay Threshold
12. Read Desired Passenger Delay Threshold
13. Read Scheduled Maintenance Service Time for 1 Veh.
14. Read Number of Stations in Each Region
15. Read Number of Vehicles Through Stations in Each Region and Demand Period
16. Read Number of Guideway Miles in Each Region
17. Read Number of Passenger Trips Beginning in Each Demand Period
18. Read System Demand in Each Demand Period
19. Read Thresholds
20. Read Threshold Increment

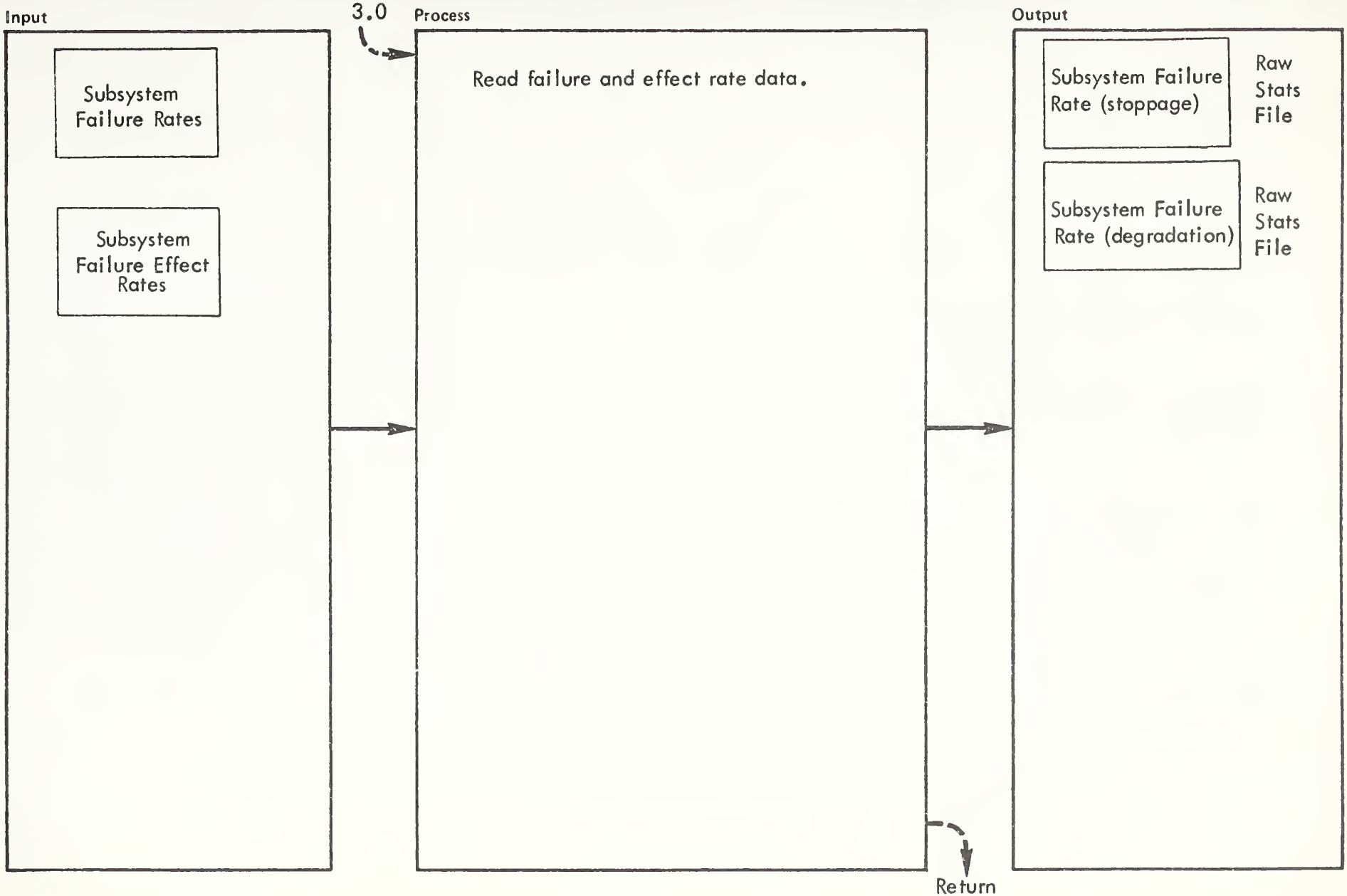
Return

Output

Raw Statistics File

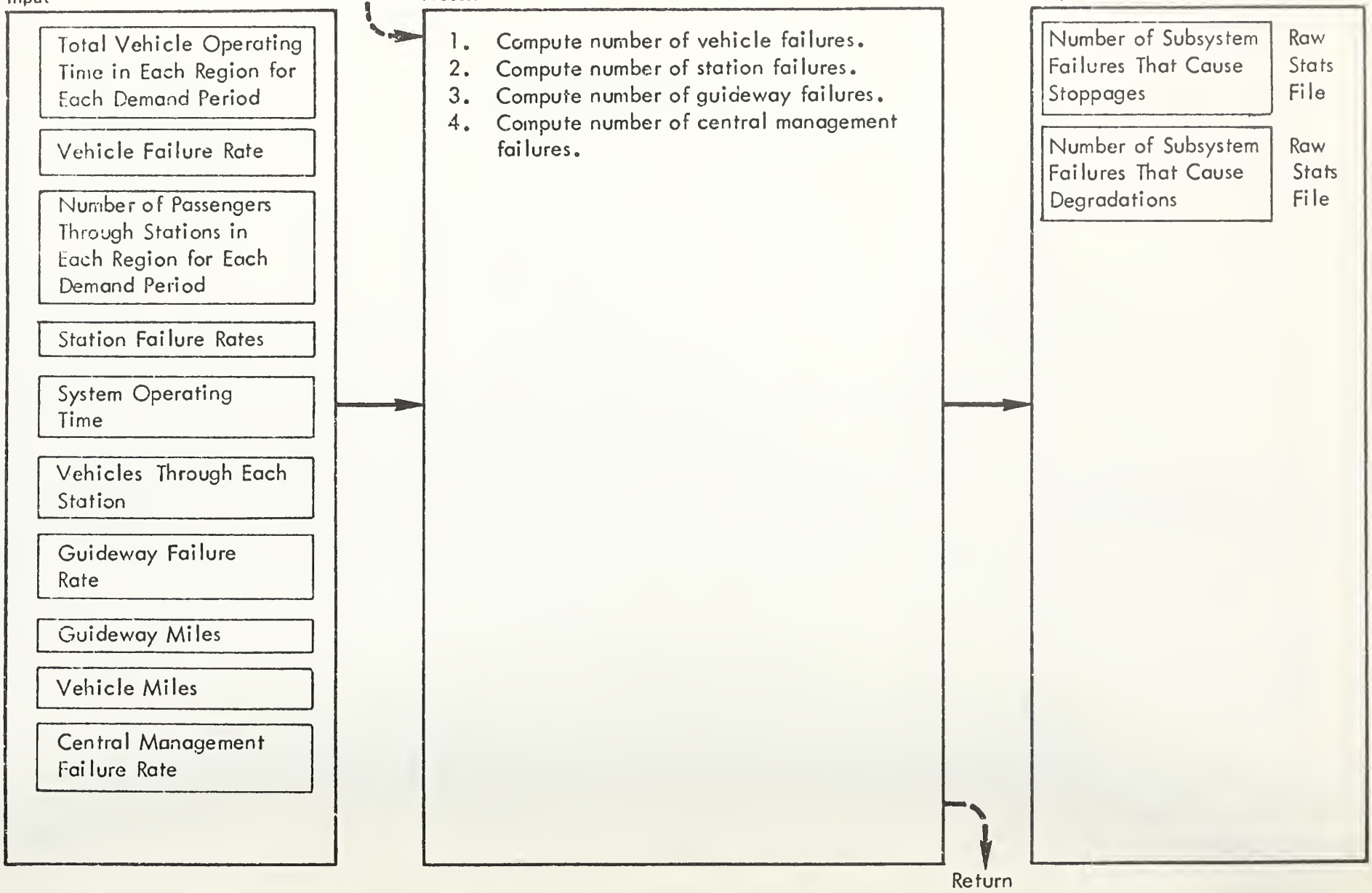
Author: _____ System/Program: AGT-SOS/SAM Date: _____ Page: 1 of 1

Diagram ID: 3.2 Name: ASUBSR Description: Output Subsystem Failure Rates and Effect Rates



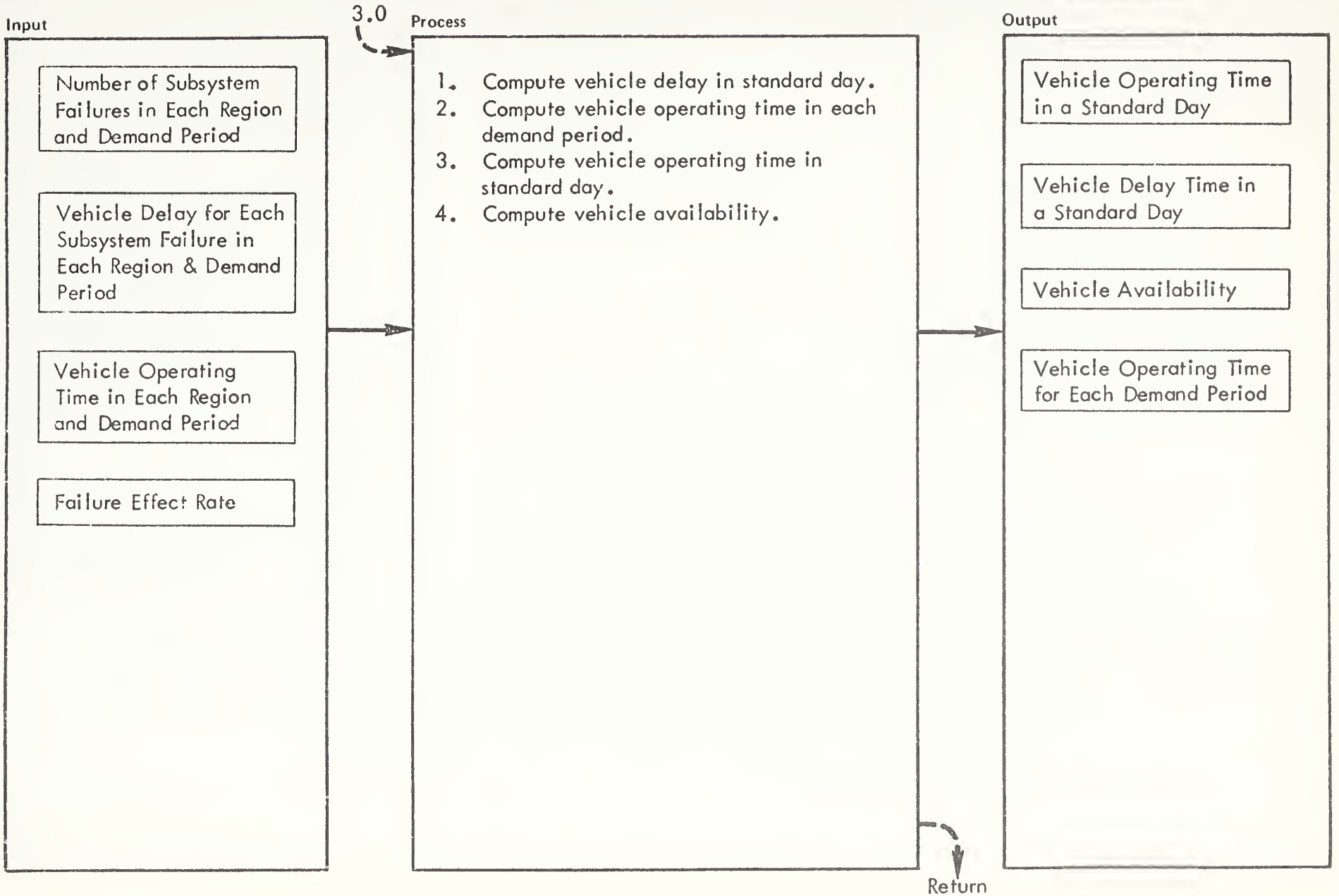
Author: _____ System/Program: AGT-SOS/SAM Date: _____ Page: 1 of 1

Diagram ID: 3.3 Name: ARGFAL Description: Compute Failures for Each Subsystem In Each Region and Demand Period



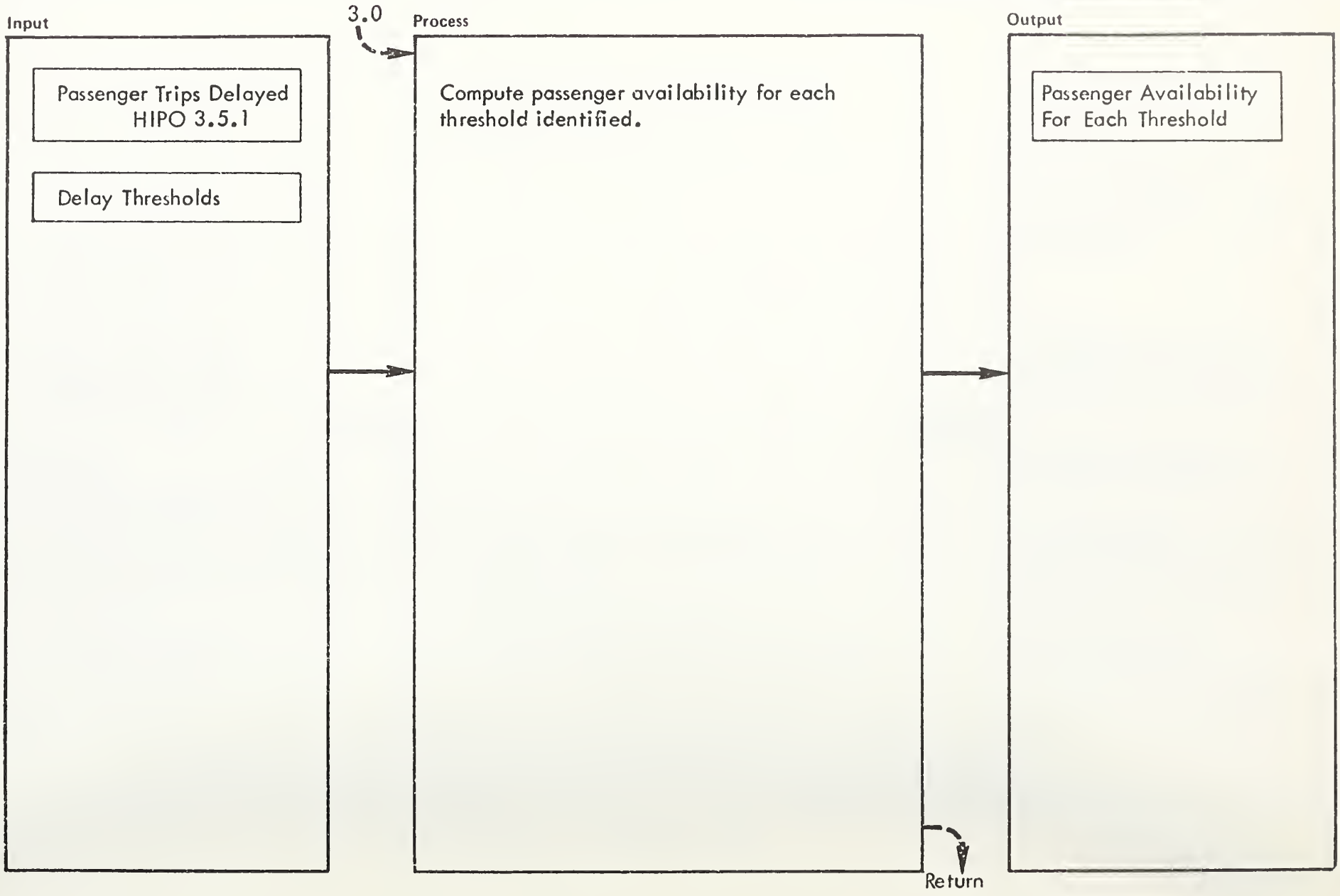
Author: _____ System/Program: AGT-SOS/SAM Date: _____ Page: 1 of 1

Diagram ID: 3.4 Name: AVDEL Description: Compute Vehicle Delay Times and Vehicle Availability



Author: _____ System/Program: AGT-SOS/SAM Date: _____ Page: 1 of 1

Diagram ID: 3.5 Name: APHIST Description: Compute Passenger Availability For Different Threshold Levels



Author: _____ System/Program: AGT-SOS Date: _____ Page: 1 of 1

Diagram ID: 3.5.1 Name: APDEL Description: Compute Passenger Delay Time and Passenger Availability

3.5

Input

- Subsystem Failures in Each Region and Demand Period
- Trips Delayed for Demand Period
- Trips Beginning for Each Demand Period
- Failure Effect Rate

Process

1. Compute system demand for a standard day.
2. Compute number of trips delayed above threshold.
3. Compute passenger availability.

Output

- Passenger Trips in a Standard Day
- Trips Delayed above the Threshold in a Standard Day
- Passenger Availability

Return

Author: _____ System/Program: AGT-SOS/SAM Date: _____ Page: 1 of 1

Diagram ID: 3.6 Name: AVFLSZ Description: Compute Maintenance & Standby Fleet Measures

3.0

Input

- Total Time of System Operation in Each Demand Period
- Scheduled Maintenance Frequency
- Scheduled Maintenance Service for 1 Vehicle
- Vehicle Failures in Each Region & Each Demand Period
- Time Average of the Number of Vehicles in Each Region in Each Demand Period

Process

1. Compute length of standard day
2. Compute the average scheduled maintenance fleet size
3. Compute the average vehicle failure frequency
4. Compute the minimum number of service bays
5. Compute the active fleet size
6. Compute probability that no failures are being repaired PZEROC 3.6.1
7. Compute the average failure maintenance fleet size PMFCMP 3.6.2
8. Compute the average total maintenance fleet size
9. Compute the standby fleet size
10. Compute the probability that the standby fleet will be adequate PRBCMP 3.6.2

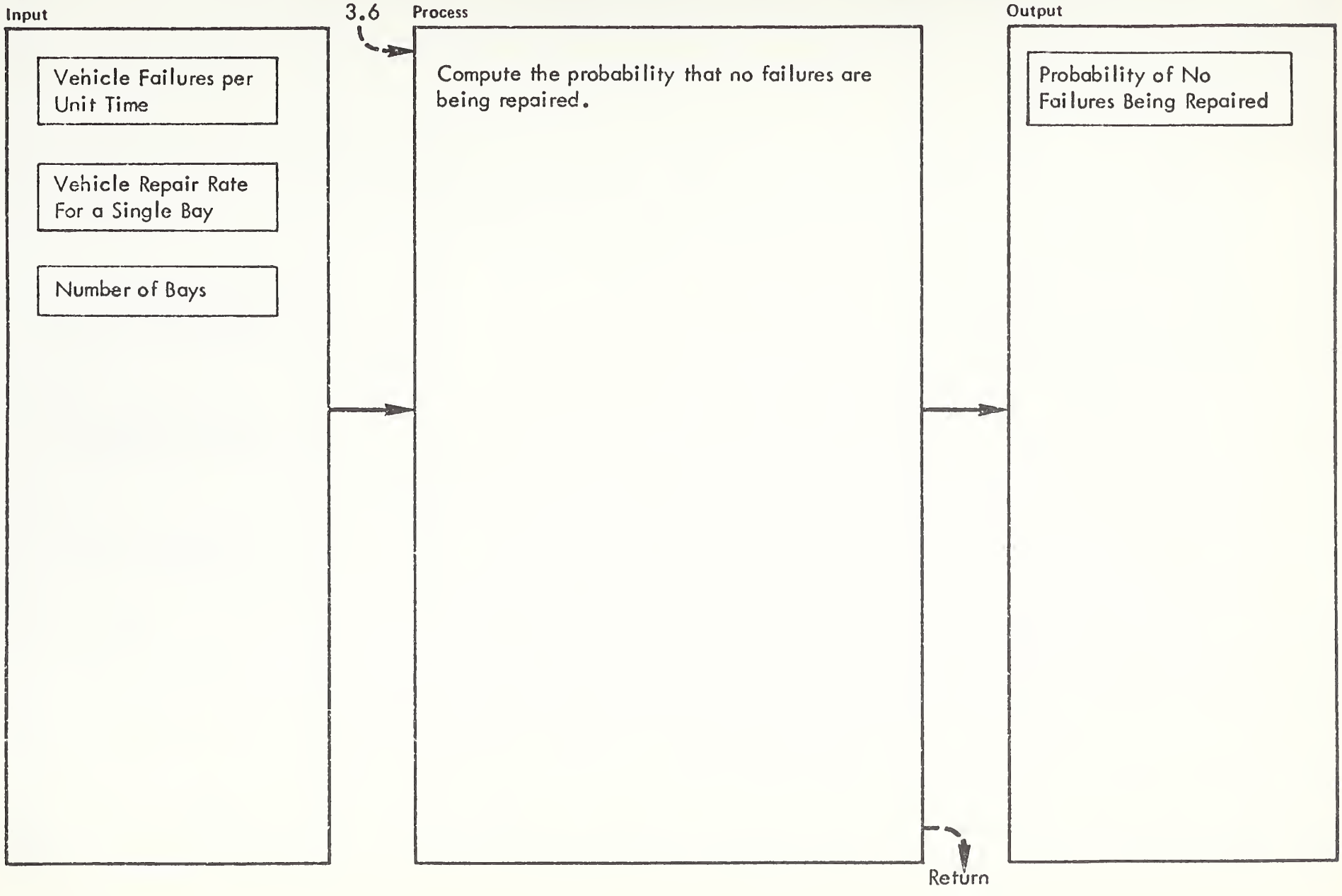
Return

Output

- Length of Standard Day
- Average Vehicle Failure Frequency
- Average Scheduled Maintenance Fleet Size
- Maintenance Fleet Size
- Standby Fleet Size
- Probability of Standby Fleet Size
- Number of Service Bays
- Active Fleet Size

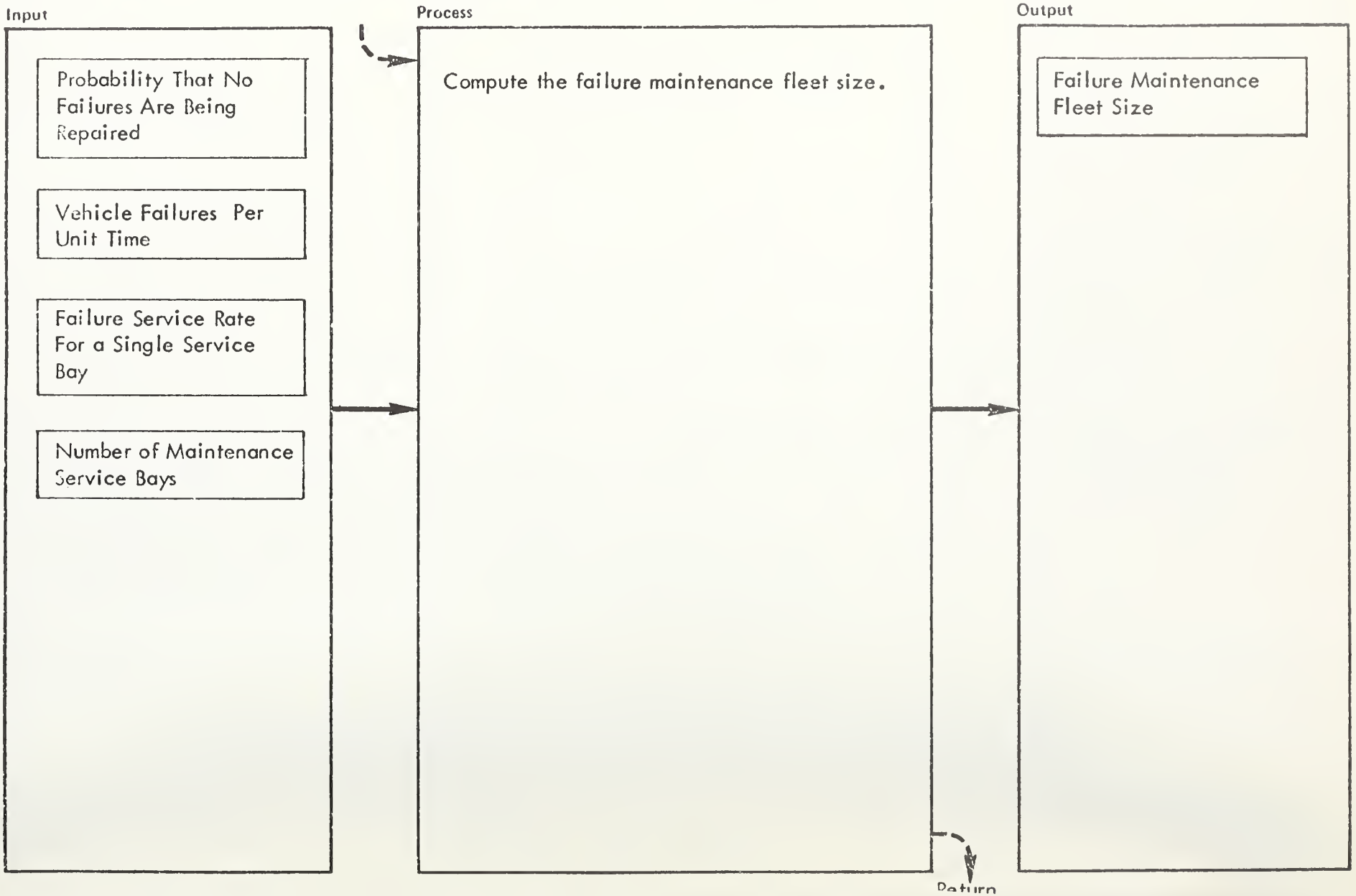
Author: _____ System/Program: AGT-SOS/SAM Date: _____ Page: 1 of 1

Diagram ID: 3.6.1 Name: PZEROC Description: Compute Probability That No Failures Are Being Repaired



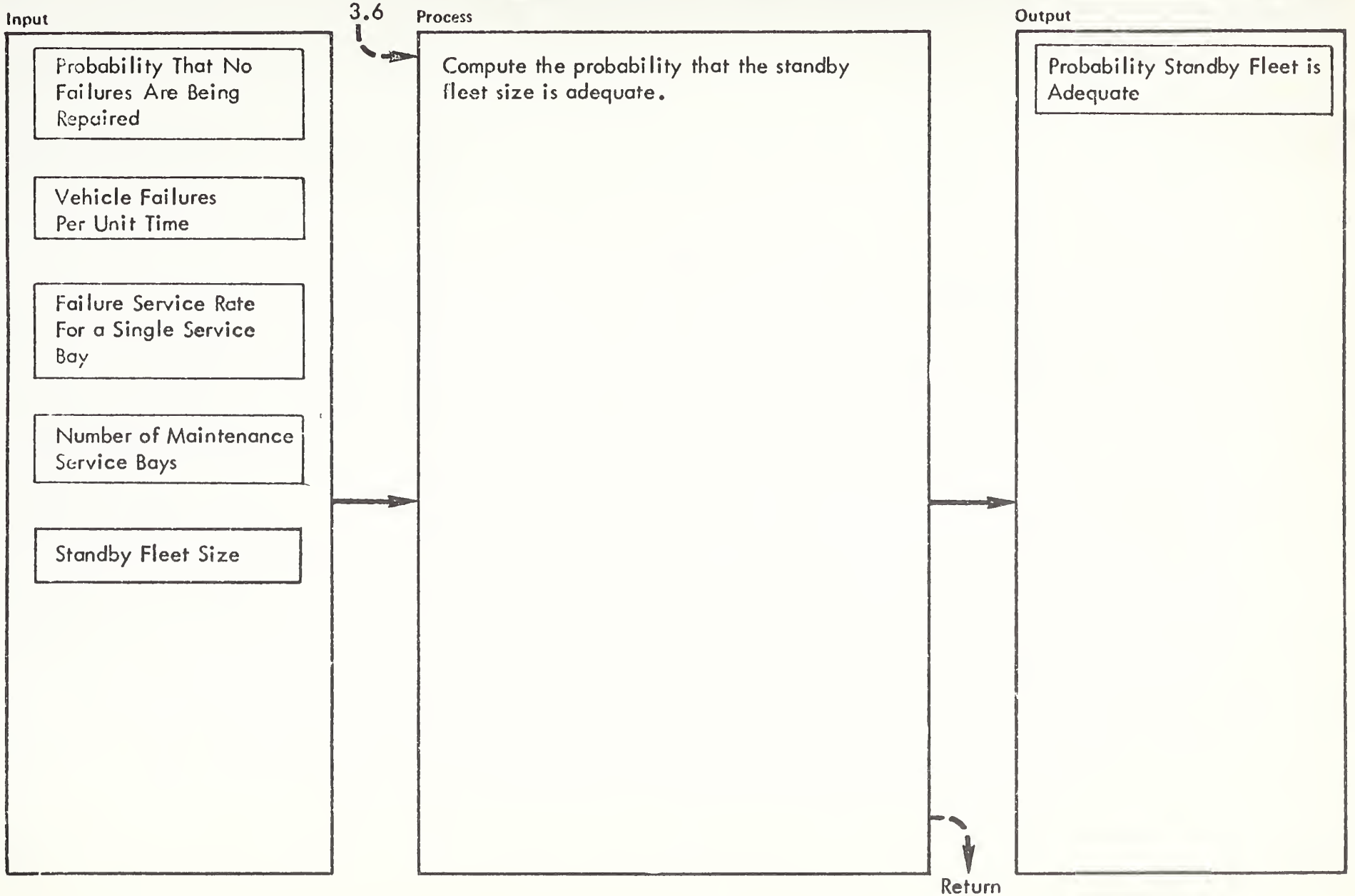
Author: _____ System/Program: AGT-SOS/SAM Date: _____ Page: 1 of 1

Diagram ID: 3.6.2 Name: FMFCMP Description: Compute Failure Maintenance Fleet



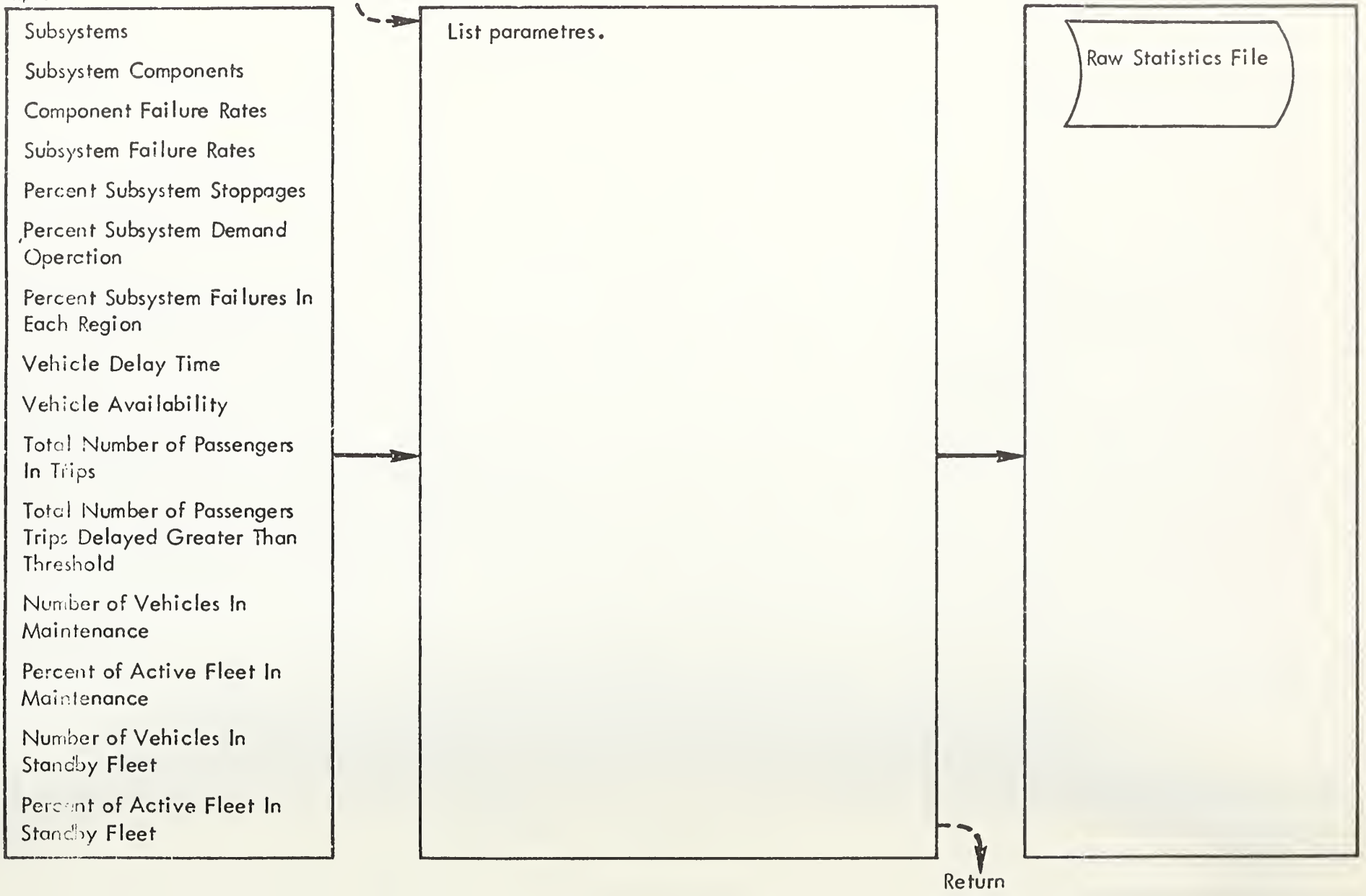
Author: _____ System/Program: AGT-SOS/SAM Date: _____ Page: 1 of 1

Diagram ID: 3.6.3 Name: PRBCMP Description: Compute The Probability That The Standby Fleet is Adequate To Maintain The Active Fleet Size Chosen



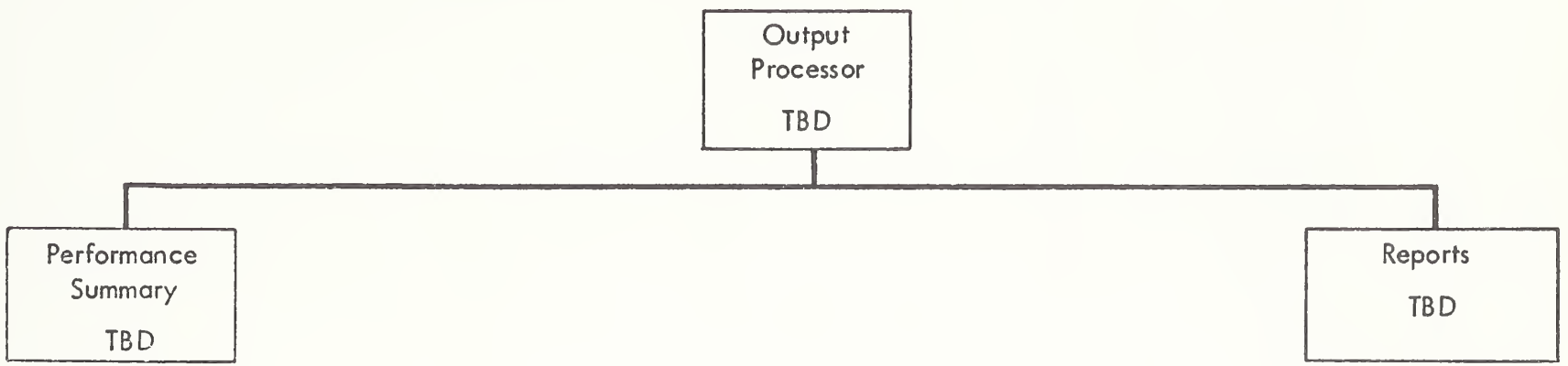
Author: _____ System/Program: AGT-SOS/SAM Date: _____ Page: 1 of 1

Diagram ID: 3.7 Name: AMOUT Description: Output Values For File



Author: _____ System/Program: AGT-SOS/SAM Date: _____ Page: 1 of 1

Diagram ID: VTOC Name: Visual Table of Contents Description: Output Processor



APPENDIX B

REPORT OF NEW TECHNOLOGY

The System Availability Model (SAM) provides two system-level availability measures and fleet size data for Automated Guideway Transit (AGT) systems. The first availability measure is the percentage of vehicle operational time. The second availability measure is the percentage of passengers whose wait is below a specified threshold.

The fleet sizing data establishes the number of maintenance and stand-by vehicles.

The SAM operates in conjunction with the Discrete Event Simulation Model (DESM). The DESM output provides the delay information for the SAM analysis.