1. Report No. UM-HSRI-BI-73-8	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle HSRI software package.		5. Report Date December 31, 1973
		6 Performing Organization Code
7 Author(s) D. H. Robbins and R. O. Bennett, editors		8 Performing Organization Report No UM-HSRI-BI-73-8
9. Performing Organization Name and Address Highway Safety Research Institute University of Michigan Huron Parkway and Baxter Road Ann Arbor, Michigan 48105		10 Work Unit No
		11. Contract or Grant No.
		13 Type of Report and Period Covered
12. Sponsoring Agency Name and Address Motor Vehicle Manufacturers Association 320 New Center Building Detroit, Michigan 48202		
		14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

Many computer programs have been developed at HSRI since its formation. These cover subjects as diverse as the disciplines represented in the Institute. Among the major collections of programs are:
1. human kinematics and impact data analysis programs;
2. vehicle motion and tire simulations;
3. statistical research package;
4. accident data files and the associated software; and
5. vehicle lighting and vision programs.
This report describes all software available at HSRI.

17. Key Words	18. Distribution Statement UMLIMITED

19. Security Classif. (of this report) UNCLASSIFIED	20. Security Classif. (of this page) UNCLASSIFIED	21. No. of Pages 114	22. Price

Form **DOT F 1700.7** (8-69)

UM-HSRI-BI-73-8

HSRI SOFTWARE PACKAGE

Highway Safety Research Institute
The University of Michigan
Huron Parkway and Baxter Road
Ann Arbor, Michigan 48105

Edited by: D. H. Robbins, Head,
             Biomathematics Department
             R. O. Bennett
             Senior Research Associate

DATE: December 31, 1973

CONTENTS

BIOMATHEMATICS DEPARTMENT

BIOMECHANICS DEPARTMENT

BIOMEDICAL DEPARTMENT

iv

HUMAN FACTORS DEPARTMENT

PHYSICAL FACTORS DEPARTMENT

ACKNOWLEDGMENTS

INTRODUCTION

Many computer programs have been developed at HSRI since its formation. These cover subjects as diverse as the disciplines represented in the Institute. Among the major collections of programs are:

1. human kinematics and impact data analysis programs;

2. vehicle motion and tire simulations;

3. statistical research package;

4. accident data files and the associated software; and

5. vehicle lighting and vision programs.

A few of these have been gathered together and presented as coordinated packages but the majority are buried in individual project reports.

This summary document has been written to describe all software available at HSRI. For each case the following data is included.

1. program title;

2. short description of the function of the program;

3. input and output features and requirements;

4. computational language;

5. candidate computer systems on which the program could operate and program availability;

6. past and potential applications; and,

7. references to published documentation.

One or two pages of text are used to describe each software entry.

The objectives of this compilation are:

1. coordination of the dissemination of HSRI research results and analytical tools; and,

2. establishment of a package of technology for use by the automotive and safety community.

The compilation is organized in a simple manner. The primary parts are the Index of Programs cataloged by HSRI department and the entries themselves. Because the interdisciplinary structure of HSRI tends to divide the collection of programs into logical topical units, no further breakdown has been made. The collection of programs entitled "Statistical Research System" has been grouped together under the Systems Analysis Department as have the accident data files.

PROGRAM AVAILABILITY

All programs included in this compilation are available for use by organizations and individuals outside HSRI.

Listings of the programs will be made available upon receipt of a written request addressed to the HSRI Library: K. B. Weber, Highway Safety Research Institute Library, The University of Michigan, Huron Parkway and Baxter Road, Ann Arbor, Michigan 48105.

Detailed information concerning use, documentation, input, output, or installation of individual programs may be obtained by contacting the appropriate department head:

Biomathematics	- D. H. Robbins	- 764-3109
Biomechanics	- J. W. Melvin	- 763-3462
Biomedical	- R. G. Snyder	- 763-3582
Human Factors	- R. G. Mortimer	- 764-4158
Physical Factors	- L. Segel	- 764-2168
Systems Analysis	- J. O'Day	- 764-0248

All these individuals have a common address, Highway Safety Research Institute, The University of Michigan, Huron Parkway and Baxter Road, Ann Arbor, Michigan 48105.

Program Title   Automated Data Access and Analysis System (ADAAS)

Program Function   ADAAS is a program to provide easy access to HSRI accident
files and the analysis capability of the Statistical Research System.

Source of Program   Developed by J. Green.   Sponsored by MVMA and NHTSA.

Input and Output Features and Requirements   Input is user control parameters
and HSRI accident files.   Output is   one of a number of user-selected
analysis outputs (data set list, ANOVA, bivariate, univariate, histogram)
Program access is limited to authorized system users.

Computational Language   Fortran IV, 360 assembler.

Operational Status   Written for IBM 360/67 MTS.   Convertible only with
difficulty to other systems.   Available from J. Green.

Past and Potential Applications   Provides simplified means of analyzing the
accident data stored in the HSRI file system.

Documentation   Documentation is available from J. A. Green   Room 232 HSRI,
764-0248.

Program Title PH760 Automatic Interaction Detector (AID)

Program Function The AID program provides a description of interaction
between a dependent variable and a set of predictors. The program inspects
all possible 2-way splits of the data and determines which split yields the
greatest reduction in the sum of squares. The program splits the data and
then selects as the new "parent" the group with the greatest total sum of
squares. The process continues until no more splits can be made. Output
is a printout describing the splits and optionally, a Statistical Research
System (SRS)* data set containing the residuals. Restriction: The maximum
total number of classes or resulting recoded values for all predictors to-
gether must not exceed 400.

Source of Program The Statistical Research System (SRS) based on OSIRIS II
which was developed at the Institute for Social Research at the University
of Michigan. Further revision and extension was carried out by HSRI.

Input and Output Features and Requirements Input is either batch or interactive
mode for control information and SRS standard data sets for data set information.

Computational Language Fortran IV.

Operational Status Written for operation under MTS on the IBM 360/67.
Extensive revision would be required to operate under 360 or 370 OS.

Past and Potential Applications Used to determine which of all possible
two-way splits of the data based on all of the predictors yields the
greatest reduction of squares. Used with the SR system.

Documentation Wood, D. E., Hafner, C. D., "The Statistical Research System,"
July 1, 1971, Highway Safety Research Institute.

*SRS, SR system and SR are used in this report to denote Statistical Research System.

2

<u>Program Title</u> Analysis of Variance (ANOVA)

<u>Program Function</u> ANOVA is a general program to perform analysis of variance on a wide variety of balanced experimental designs incorporating up to ten independent variables. The program can be used with equal cell frequencies, or can perform unweighted-mean analyses using unequal cell frequencies. ANOVA accepts many types of crossed and nested designs, and selects appropriate error terms automatically to form necessary $\underline{F}$ ratios. Significance tests may be performed on post hoc comparisons between main-effect means, either on an overall basis, within each level of a second variable, or within each combination of levels of two other variables. Either the Newman-Keuls or the Tukey (b) method may be selected.

<u>Source of Program</u> ANOVA was originally adapted by William L. Carlson, Systems Analysis Group, H.S.R.I., from material presented by Hartley in 1962. Jerold S. Lower, Human Factors Group, H.S.R.I., made extensive revisions to put the program in its present form. Carole D. Hafner, Computer Services Group, H.S.R.I., wrote the routines for performing Newman-Keuls and Tukey tests on main-effect and interaction means.

<u>Input and Output Features and Requirements</u> ANOVA may be used in either batch or terminal mode. Different logical units are used to 1) input data, 2) input program commands, 3) output results, and 4) output prompt lines. Data to be analyzed must be in card image form. The user has the option to select several numerical transformations and can specify constants to be added to or multiplied by his data. Two data input sorting procedures are available.

Output from ANOVA includes a listing of all main-effect means, an analysis summary table including sums of squares, degrees of freedom,

3

mean squares, and $\underline{F}$-ratios, and at the users option, a complete table of cell means, tables of two-, three-, or four-way interactions, and results of selected post hoc tests.

Restrictions of the program are:

1. The number of independent variables may not exceed ten.

2. The number of cells in the design may not exceed 10,000. There is no limitation of the number of observations per cell.

3. The number of levels of each independent variable must be such that, if we let k_i equal $1+n_i$, where n_i is the number of levels of variable$_i$, the product of all the k_i is less than or equal to 60,000. No variable may have more than 99 levels.

4. Experimental designs must be balanced and have no missing cells.

5. Only one independent variable may be a random factor.

6. Only one variable may be a nested factor. This factor must be random and may be nested under not more than two fixed factors. The number of levels of the nested factor must be constant for all factors or combinations of factors under which it is nested.

Computational Language   Fortran IV.

Operational Status   The program is stored under MTS user number SAYM in the read-only file ANOVA.

Past and Potential Applications   The Human Factors Group, H.S.R.I., has used ANOVA to perform essentially all analyses of variance done since 1969.

While this program is designed to accomodate a large majority of types of balanced designs found in the behavioral sciences, it can also be used for other designs if they are capable of being rationalized into

4

complete factorial designs. For instance, designs with one factor nested under three or more others can be analyzed by this method, though at some additional cost due to the manual computation required to construct the resulting variance table.

<u>Documentation</u> 1. Lower, J. S., "Analysis of Variance Program (ANOVA)," Human Factors Group, H.S.R.I., Technical Memorandum HUF-TM-3, August 1, 1972.

Program Title   Anti-locking Models (ANTILOCK)

Program Function   The antilock simulation provides a general framework in which the characteristics of different existing antilock systems can be modeled.

Source of Program   Developed under Fancher and MacAdam.   Sponsored by MVMA.

Input and Output Features and Requirements   Input is wheel sensor, control logic, and pressure modulator information.   Output is wheel pressure.

Computational Language(s)   Fortran IV

Operational Status   Written for IBM 360/67 MTS.   Compatible with other Fortran IV systems.   Program is available from C. MacAdam and J. Bernard.

Past and Potential Applications   Used as part of Phase II Directional Response Neck/Tractor-Trailer Simulation.

Documentation   MacAdam, C., "A General Purpose Mathematical Model for Simulating Anti-lock Systems,"internal memo, H.S.R.I.

<u>Program Title</u> Linear Analysis of Automobile Stability Steering Performance (AUTOSTEER)

<u>Program Function</u> Computes time trajectory together with eigenvalues, eigenvectors and steady state for lateral dynamics of an automobile.

<u>Source of Program</u> Developed under the direction of Moncarz. Sponsored by DOT.

<u>Input and Output Features and Requirements</u> Input is vehicle description, speed and steering angle. Output is printout of trajectory, eigenvalues, eigenvectors and steady state.

<u>Computational Language</u> Fortran IV.

<u>Operational Status</u> Written for IBM 360/67 MTS. Easily convertible for any Fortran system. Available from H. Moncarz.

<u>Past and Potential Applications</u> Used to give initial indication of those vehicle parameters which are important in stability considerations.

<u>Documentation</u> Report to be issued December 1974.

Program Title Bar Graph Plotter (BARGRAPH)

Program Function BARGRAPH is a data display program that produces histograms of user inputted data. The program provides a great deal of flexibility in setting up the formats of the graphs produced.

Source of Program Developed under the direction of Green. Sponsored by MVMA.

Input and Output Features and Requirements Input is interactive. Control parameters together with data sources are specified by the user. Output is printout of graphs.

Computational Language Fortran IV.

Operational Status Written for IBM 360/67 MTS. Convertible only with difficulty to other systems. Available from J. Green.

Past and Potential Applications Useful for report production or any requirement for easily producing histograms.

Documentation Documentation is available from J. A. Green, Room 232 HSRI. 764-0248.

Program Title Bivariate Table Cleaning Program (BICLEAN)

Program Function BICLEAN is a program designed to take the output of the
Statistical Research System bivariate programs and reformat it to the
user's specifications.

Source of Program Developed under the direction of Green. Sponsored by
MVMA.

Input and Output Features and Requirements Input is interactive. Control
parameters and S?S tables are supplied by the user. Output is reformatted
table data.

Computational Language   Fortran IV.

Operational Status Written for IBM 360/67 MTS. Convertible with difficulty
to other interactive systems. Available from J. Green.

Past and Potential Applications Used primarily to reformat the bivariate
output tables for use with other programs.

Documentation Documentation is available from J. A. Green, HSRI, Room 232.
764-0248.

Program Title Brake Dynamics and Variable Braking Vehicle (BRAKDYN)

Program Function Simulates the transient-response of a complete brake system.

Source of Program Developed as a part of the research project for Ph.D. Thesis by Fisher.

Input and Output Features and Requirements Input is various parameters describing brake pedal and linkage, vacuum assist, master cylinder, brake line, and brake chamber pressure together with brake pedal force. Output is computed brake line pressure command to rear brakes.

Computational Language Analog and Hybrid.

Operational Status No longer in use. Kept as a source of techniques for similar future problems.

Past and Potential Applications Used in the analysis and prediction of brake system performance. Used in brake system design.

Documentation Fisher, D. K., "The Dynamic Characteristics of Vehicle Braking Systems," 1970, Ph.D. Thesis, University of Michigan.

Program Title Brake Models and Brake Fading (BRAKEFADE)

Program Function Subroutine which computes brake temperatures with a view
to estimating brake fade.

Source of Program Developed under direction of Fancher, Bernard, and Post.

Input and Output Features and Requirements Input is line pressure as a
function of time. Output is torque as a function of time.

Computational Language Fortran IV.

Operational Status Written for IBM 360/67. Easily adapted to other Fortran
systems.

Past and Potential Applications Used for improved brake torque calculations.

Documentation Report will be published in June, 1974.

Program Title PA020 File Building (BUILD)

Program Function The program converts data stored on cards, card image
tape, or in a line file into a standard SR dictionary and data file on
either tape or disk. The output from BUILD may be used as input to SR
analysis programs. Restrictions: The logical record length of the input
records must be 80. The maximum number of output variables per case is
1600, or output characters per case 3600.

Source of Program The Statistical Research System (SRS) based on OSIRIS II
which was developed at the Institute for Social Research at the University
of Michigan. Further revision and extension was carried out by HSRI.

Input and Output Features and Requirements Input is either batch or inter-
active mode for control information and SR standard data sets for data set
information.

Computational Language Fortran IV.

Operational Status Written for operation under MTS on the IBM 360/67.
Extensive revision would be required to operate under 360 or 370 OS.

Past and Potential Applications Used as part of the SR system to construct
a data file in the proper format for use in that system.

Documentation Wood, D. E., Hafner, C. D., The Statistical Research System,
July 1, 1971, Highway Safety Research Institute.

Program Title Bus Steering and Braking Response (BUSSTEER)

Program Function A predecessor of TRUCKBRAKE, specialized for busses and independent suspension front axle trucks.

Source of Program Developed under direction of Fancher and Bernard. Sponsored by A. M. General.

Input and Output Features and Requirements Input is bus and braking parameters. Output is computed acceleration.

Computational Language Fortran IV

Operational Status No longer in use, has been absorbed in later work. Available from J. Bernard.

Past and Potential Applications Used for bus braking computations.

Documentation No reports are published.

Program Title   Conversational Aggregation of Data (CAD)

Program Function   CAD is a data manipulation program that can aggregate or sum variables in a column-wise fashion, check the order of sequential variables and fill in missing cases, and add tables together. It is intended as an interim processor to transform data into a more useful form for subsequent analysis.

Source of Program   Developed under the direction of Green. Sponsored by MVMA.

Input and Output Features and Requirements   Input is interactive. Control parameters and a data set are supplied by the user. Output is new data set which has been manipulated as specified by the user.

Computational Language   Fortran IV

Operational Status   Written for IBM 360/67 MTS. Convertible with difficulty to other interactive systems. Available from J. Green.

Past and Potential Applications   Used as an interim processor to transform data into more useful forms.

Documentation   Documentation is available from J.A. Green, Rm 232, HSRI, 764-0248.

Program Title Calspan Three-Dimensional Crash Victim Simulation (CAL3D)

Program Function A 12-mass three-dimensional model of a crash victim recently

developed by Calspan, is operational. It includes an airbag.

Source of Program Developed under direction of Bartz at Calspan. Sponsored

by MVMA and NHTSA.

Input and Output Features and Requirements Input is variety of parameters

describing crash victim, vehicle structure, and crash event. Output is

computed crash victim kinematics together with forces acting on the crash

victim. Optional plots are available.

Computational Language Fortran IV.

Operational Status Operational on IBM 360/67 MTS and IBM 370 OS. Easily

convertible to any Fortran system. Available from Calspan, NHTSA, or

MVMA.

Past and Potential Applications Used in studies of crash victim kinematics,

design of vehicle interiors and restraint systems, or accident reconstruc-

tion.

Documentation Bartz, J. A., "A Three-Dimensional Computer Simulation of a

Motor Vehicle Crash Victim, Phase 1 - Development of the Computer Program,"

July 1971, Report No. Calspan VJ-2978-V-1.

Program Title   Passenger Car Steering and Braking Response (CARSTEER)

Program Function   Simulates an automobile's response in limit maneuvers. This is a specialization of TRUCKDIRT.

Source of Program   Developed under direction of Fancher and Bernard.   Sponsored by NHTSA.

Input and Output Features and Requirements   Input is car and brake parameters. Output is computed accelerations, velocities, and displacements.

Computational Language   Fortran IV.

Operational Status   Written for the IBM 360/67.   Easily convertible to other Fortran systems.

Past and Potential Applications   Used as a specialization of TRUCKDIRT for car steering problems.

Documentation   Report to be issued in December, 1974.

Program Title MDAI Case Summary Writer (CASEWRITER)

Program Function This program produces a summary table of accident inform-
ation recorded by the various Multidisciplinary Accident Investigation
teams. The summary information is printed in a standard format.

Source of Program Developed under the direction of J. Marsh and J. Green.
Sponsored by the NHTSA.

Input and Output Features and Requirements The required input information
is abtained from the HSRI CPIR Revision 3 occupant file. Control inform-
ation is supplied by the user in an interactive mode.

Output is a printed case summary table in standard format. Access to
the CPIR accident file is limited to authorized users.

Computational Language Fortran IV

Operational Status Written for IBM 360/67 MTS. Convertible only with
difficulty to other systems. Available from J. Green.

Past and Potential Application Used   to obtain summary information for
MDAI cases in an easily readable form. It is especially useful when a
limited number of cases are under consideration.

Documentation Documentation is available from J. A. Green, Rm 232, HSRI
764-0248.

Data File Title   Cornell Level I and II Data File (CORNELL)

Data File Function   SR Data files on accidents, vehicles, and occupants.

Data File Summary   Accident information from police reports, driver records, and vehicle registration records has been built into a Level I accident file representing the eight western counties of New York State.

Level II data from police reports have been built into accident, vehicle and occupant files. Both Level I and Level II data were collected by Cornell Aeronautical Laboratories, funded by the MVMA. All files are useful for analyses of a large multi-county area.

Operational Status   Usable only in conjunction with the SR system, SPAD, or ADAAS.

Past and Potential Applications   Used in statistical research into accident causation and related topics.

Documentation   SPAD Newsletters publish current additions and corrections to maintained data files. Contact James O'Day, HSRI, 764-0248.

Data File Title   CPIR Revision 2 and 3 Data Files (CPIR23)

Data File Function   SR Data Files for Vehicles, Occupants, and Injuries.

Data File Summary   Data based on the General Motors Collision Performance
and Injury Report (Long Form) Revision 2 and 3 have been built into two sets
of Level III files. Accident information obtained from Revision 3 report
forms have been built into vehicle, injury, and occupant files, while the
Revision 2 data have been built into a vehicle and an occupant file.

Revision 3 data originate from reports submitted by Multidisciplinary
Accident Investigation teams sponsored by the National Highway Traffic Safety
Administration and the Motor Vehicle Manufacturers Association. A significant
sampling bias accompanies the case study investigation opportunities that
the file offers. Since the data are obtained from case studies, the file
is definitely biased, and does not represent a sample of cases from each
submitting area.

Accident investigation funded by the Motor Vehicle Manufacturers
Association and conducted by Donald Huelke at University of Michigan and
Arnold Siegel of the Trauma Research Group at UCLA is the source of the
Revision 2 data.   Like the Revision 3 data, the Revision 2 data are
also biased in that they reflect case studies, rather than a sample of cases
in one locale.

Operational Status   Usable only in conjunction with the SR system, SPAD,
or ADAAS.

Past and Potential Applications
Used in statistical research into the accident causation and related
topics.

<u>Documentation</u> SPAD Newsletters publish current additions and corrections to maintained data files. Contact James O'Day, HSRI, 764-0248.

Program Title   Crashworthiness Model (CRASH)

Program Function   Computes the crash response of individual vehicle components using a finite element approach.

Source of Program   Developed by Wang and McIvor.   Sponsored by NHTSA.

Input and Output Features and Requirements   Input is various parameters describing the vehicle components and their material properties.   Output is printout of computed deflection, force, and moments.   Auxiliary output optional.

Computational Language   Fortran IV.

Operational Status   Operational on IBM 360/67 MTS.   Easily convertible to other Fortran systems.   Available from I. McIvor (Department of Applied Mechanics and Engineering Science).

Past and Potential Applications   Used in studies of vehicle crashworthiness.

Documentation   McIvor, I. K., Wineman, A. S., Anderson, W. J., Wang, H. C., "Modeling, Simulation and Verification of Impact Dynamics,   Vol. 4., Three Dimensional Plastic Hinge Frame Simulation Module," August 25, 1973, HSRI Report No. UM-HSRI-BI-73-4-4.

Program Title Motorcycle Handling and Roll Stability (CYCLEHAND)

Program Function Simulates a man-motorcycle system for purposes of handing and roll stability.

Source of Program Developed by D. Eaton as part of the research project for Ph.D. Thesis. Sponsored by HSRI and American Honda Motor Co.

Input and Output Features and Requirements Input is various parameters describing vehicle and initial conditions. Output is vehicle kinematics, zeroes of transfer function numerator and a plot of vehicle response versus time.

Computational Language Fortran IV and Hybrid.

Operational Status Written for the IBM 1800, AD/4 and hybrid interface.

Past and Potential Applications Used in studying the dynamic behavior of the single track vehicle. Used in single track vehicle design.

Documentation Eaton, D.J., "Man-machine dynamics in the stabilization of single-track vehicles," 1973, Ph.D. Thesis, University of Michigan.

Program Title Tape Deblocking Program (DEBLK)

Program Function This program reads a blocked tape in SRS format, and
writes the data,record by record,on the output.

Sources of Program Developea as part of the SR System, a modified and
expanded version of OSIRIS II which was developed at the Institute for
Social Research.

Input and Output Features and Requirements Input is a blocked tape
in SRS format and control parameters Output is unblocked data on a user
specified I/O unit.

Computational Language Fortran IV

Operational Status Written for IBM 360/67 MTS. Convertible only with
difficulty to other systems. Available from J. Green.

Past and Potential Applications Useful in copying blocked data on magnetic
tapes to a sequential line file for further manipulation.

Documentation Documentation is available from J.A. Green, Rm. 232,
HSRI, 764-0248.

<u>Data File Title</u> Denver County Data Files (DENVER)

<u>Data File Function</u> SR Data file for accidents

<u>Data File Summary</u> Level I accident files have been built from data obtained from the State of Colorado Department of Revenue. The data represent the Denver city and entire Denver County, Colorado area. The file offers analysis capabilities for a metropolitan area, and contains extensive variable documentation for each accident case entry.

<u>Operational Status</u> Usable only in conjunction with the SR system, SPAD, or ADAAS.

<u>Past and Potential Applications</u> Used in statistical research into the accident causation and related topics.

<u>Documentation</u> SPAD newsletters publish current additions and corrections to maintained data files. Contact James O'Day, 764-0248.

Program Title Hybrid Executive Program (DF2A)

Program Function A general purpose hybrid executive program which may be used for the setup and checkout of analog programs and the execution of hybrid programs.

Source of Program Developed under direction of Fisher.

Input and Output Features and Requirements Input is a description of analog components and how they are connected. No output is produced by this program. This program sets up and starts the hybrid or analog program.

Computational Language Fortran IV, Hybrid, Analog.

Operational Status Written for the IBM 1130, AD/FØUR, and hybrid interface. Easily convertable to other similar systems. Can be obtained from J. Dunne of Computer Services Department.

Past and Potential Applications Used for running analog and hybrid programs. Used for setting up analog programs.

Documentation Fisher, D.,"Some Useful Digital Programs," November 30, 1970, HSRI Memo PF-70-189.

Program Title BODE Diagram for Control Systems (DF3)

Program Function This program calculates and plots the BODE diagram for control systems having up to twenty poles and zeros.

Source of Program Developed under the direction of Fisher.

Input and Output Features and Requirements All inputs are entered through IBM 1130 keyboard in response to questions from the program. Input information includes the location of the poles and zeros, the static loop sensitivity, and the transport lag.

Computational Languages Fortran IV, Hybrid, Analog

Operational Status Written for the IBM 1130, AD/FOUR, and hybrid interface. Can be converted to other similar systems with difficulty. Can be obtained from J. Dunne of Computer Services Dept.

Past and Potential Applications Used to plot BODE diagrams for control systems.

Documentation Fisher, D., "Some Useful Digital Programs," November 30, 1970, HSRI Memo PF-70-189.

Program Title Frequency Response Evaluation (DF4)

Program Function This is a frequency response evaluation program which may be used to plot frequency response data or to fit a first order log or quadratic log transfer function to experimental frequency response data.

Source of Program Developed under the direction of Fisher.

Input and Output Features and Requirements Input is data cards containing the frequency, amplitude, and phase angle for each data point. The curve-fit results are tabulated along with the original data points and may be plotted at option.

Computational Languages Fortran IV, Hybrid, Analog

Operational Status Written for the IBM 1130, AD/FOUR, and hybrid inter-face. Can be converted to other similar systems with difficulty. Can be obtained from J. Dunne of Computer Services Dept.

Past and Potential Applications Used to obtain transfer functions for experimental frequency data.

Documentation Fisher, D., "Some Useful Digital Programs," November 30, 1970, HSRI Memo PF-70-189.

<u>Program Title</u>   Root Locus Plot (DF5)

<u>Program Function</u>   Tabulates and plots the root locus plot for any given linear closed loop control system having up to ten poles and ten zeros.

<u>Source of Program</u>   Developed under the direction of Fisher.

<u>Input and Output Features and Requirements</u>   Input is through keyboard in response to questions from program.   Data includes location of poles and zeros of system and limits of plot.   All output is printed.   Static loop sensitivity and closed loop damping ratio are tabulated for each point on root locus.

<u>Computational Languages</u>   Fortran IV, Hybrid, Analog

<u>Operational Status</u>   Written for the IBM 1130, AD/FOUR, and hybrid interface.   Can be converted to other similar systems with difficulty.   Can be obtained from J. Dunne of Computer Services Dept.

<u>Past and Potential Applications</u>   Used to obtain root locus plots.

<u>Documentation</u>   Fisher, D., "Some Useful Digital Programs," November 30, 1970, HSRI Memo PF-70-189.

Program Title Nonlinear Differential System (DF6)

Program Function This program solves a system of N not greater than fifty nonlinear first order differential equations using Runge-Kutta-Merson integration.

Source of Program Developed under the direction of Fisher.

Input and Output Features and Requirements Input is through console keyboard and data cards and contains physical constants, initial conditions, and integration controls. Results are optionally plotted.

Computational Language Fortran IV

Operational Status Written for the IBM 1130, AD/FOUR, and hybrid interface. Can be converted to other similar systems with difficulty. Can be obtained from J. Dunne of Computer Services Dept.

Past and Potential Applications Used to find solutions of a system of nonlinear first order differential equations in cases where more accuracy is needed than possible with analog procedures.

Documentation Fisher, D., "Some Useful Digital Programs," November 30, 1970, HSRI Memo PF-70-189.

Program Title General Purpose Plotting Routine (DF8)

Program Function This program is a rectangualr coordinate plotting program and may be used to plot data or curve fit data up to a third order polynomial.

Source of Program Developed under the direction of Fisher.

Input and Output Features and Requirements Input is eight sets of rectangular coordinates together with control and selection information. Output is fitted polynomial coefficients or plots.

Computational Language Fortran IV

Operational Status Written for the IBM 1130, AD/FOUR, and hybrid interface. Can be converted to other similar systems with difficulty. Can be obtained from J. Dunne of Computer Services Dept.

Past and Potential Applications Useful for curve fitting or plotting of combinations of up to eight sets of points.

Documentation Fisher, D., "Some Useful Digital Programs," November 30, 1970, HSRI Memo PF-70-189.

Program Title   Diagnostic Check of AD/FOUR Computer (DIAG)

Program Function   A hybrid program which performs a diagnostic check of the AD/FOUR computer using special preprogrammed analog and logic boards.

Source of Program   Developed under the direction of Fisher.

Input and Output Features and Requirements   Input is control parameters. Output is diagnostic readout.

Computational Languages   Fortran IV, Hybrid, Analog

Operational Status   Written for the IBM 1130, AD/FOUR, and hybrid interface.   Easily convertible to other similar systems.   Can be obtained from J. Dunne of Computer Services Dept.   This program has been expanded and rewritten for the PDP 11/45, AD/FOUR, and interface.

Past and Potential Applications   Used for diagnostic purposes.

Documentation   Fisher, D., "Some Useful Digital Programs," November 30, 1970, HSRI Memo PF-70-189.

Program Title Display for Driving Simulator (DRIVSIM)

Program Function Using input from a driver simulator, the program computes a simulated display of situation and vehicle response.

Source of Program Developed under direction of Fancher and MacAdam.

Input and Output Features and Requirements Input is from a driver simulator consisting of steering wheel, brake pedal, and accelerator, together with preplanned events. Output is CRT picture of planned event, road, and responses of driver's vehicle.

Computational Language Analog

Operational Status Use has been discontinued. Kept as a source of techniques for a future similar problem.

Past and Potential Applications Used as the hardware-software basis of an Engineering Psychology Lab experiment.

Documentation No published reports. See C. MacAdam, HSRI, 764-2148.

Program Title PC 210 Data Set Listing (DSLIST)

Program Function The program lists a SR data set, and, optionally, its corresponding dictionary. Input is a standard SR dictionary and data file. Output is a printed listing. Restriction: When listing a subset of the variables (one of the options), a maximum of 400 variables may be listed.

Source of Program The Statistical Research System (SRS) based on OSIRIS II which was developed at the Institute for Social Research at the University of Michigan. Further revision and extension was carried out by HSRI.

Input and Output Features and Requirements Input is either batch or inter-active mode for data set information.

Computational Language Fortran IV.

Operational Status Written for operation under MTS on the IBM 360/67. Extensive revision would be required to operate under 360 or 370 OS.

Past and Potential Applications Used in SR System to obtain data set listing.

Documentation Wood, D. E., Hafner, C. D.,"The Statistical Research System," July 1, 1971, Highway Safety Research Institute.

Program Title HSRI Effective Displacement Index (EDI)

Program Function Computes effective displacement index for head injury developed by Brinn at Chrysler Corporation.

Source of Program Developed under the direction of Alem using previous work by Brinn at Chrysler. Sponsored by MVMA.

Input and Output Features and Requirements Input is head acceleration in tabular form. Output is printout of EDI values.

Computational Language Fortran IV.

Operational Status Written for IBM 360/67. Easily convertible to any other Fortran system. Available from N. Alem.

Past and Potential Applications Used in the study of head injury.

Documentation Brinn, J. and Staffeld, S. E.,"Evaluation of Impact Test Accelerations: A Damage Index for the Head and Torso," 14th Stapp Car Crash and Field Demonstration Conference Proceedings, Paper 700902, pp. 188-202, 1970.

   McElhaney, J. H., Stalnaker, R. L., Roberts, V. L., "Biomechanical Aspects of Head Injury," Human Impact Response, Measurement, and Simulation (GM Symposium), 1973, Plenum Press.

Program Title PH720 Linear Regression (ESSO)

Program Function The linear regression program performs standard linear regressions or stepwise linear regressions. Input to the program is a standard SR data set or a correlation matrix. Output is a printout. Restriction: If the dataset has missing data, correlation input must be used.

Source of Program The Statistical Research System (SRS) based on OSIRIS II which was developed at the Institute for Social Research at the University of Michigan. Further revision and extension was carried out by HSRI.

Input and Output Features and Requirements Input is either batch or interactive mode for control information and SR standard data sets for data set information.

Computational Language Fortran IV.

Operational Status Written for operation under MTS on the IBM 360/67. Extensive revision would be required to operate under 360 or 370 OS.

Past and Potential Applications Used in SR system to obtain linear regressions.

Documentation Wood, D. E., Hafner, C. D., "The Statistical Research System," July 1, 1971, Highway Safety Research Institute.

Program Title PH780 Factor Analysis (FACTAN)

Program Function Factor analysis provides analytic techniques to reduce and
rearrange data represented by correlations among variables into some smaller
number of variables, called factors, which are linear combinations of the
original variables. Options include iterative communality estimation,
orthogonal (varimax) rotation, and oblique (biquartimin, covarmin, or
any solution using a gamma value between zero and one) rotation, as well as
plotting of the factor scores. Input can be in the form of raw data,
excluding missing data, or a correlation matrix.

Source of Program The Statistical Research System (SRS) based on OSIRIS II
which was developed at the Institute for Social Research at the University
of Michigan. Further revision and extension was carried out by HSRI.

Input and Output Features and Requirements Input is either batch or inter-
active mode for control information and SR standard data sets for data set
information.

Computational Language Fortran IV.

Operational Status   Written for operation under MTS on the IBM 360/67. Ex-
tensive revision would be required to operate under 360 or 370 OS.

Past and Potential Applications Used in SR System to obtain factor analysis.

Documentation Wood, D. E., Hafner, C. D., "The Statistical Research System,"
July 1, 1971, Highway Safety Research Institute.

Program Title Flat Bed Tire Tester Data Presentation (FLATPRES)

Program Function Computes forces and moments on a tire and presents them together with load, slip angle, and camber angle.

Source of Program Developed under direction of Fancher and Grote.

Input and Output Features and Requirements Input is digitized data from flat bed tire tester at low speeds. Output is printout of measured and computed parameters.

Computational Language Fortran IV.

Operational Status Written for the IBM 1130 and converted to IBM 1800 and PDP 11/45. Easily compatible with other Fortran systems. Can be obtained from G. Hu.

Past and Potential Applications Used for presentation of tire measurements.

Documentation Tielking, J.T., Fancher, P.S., Wild, R.E.,"Mechanical Properties of Truck Tires,"Jan., 1973, SAE Paper No. 730183.

Data File Title   Florida Data Files (FLORIDA)

Data File Function   SR Data Files for Accidents.

Data File Summary   The Metropolitan Dade County Public Safety Department has
furnished accident data for the metropolitan Miami and entire Dade County,
Florida area. The data have been built into Level I accident files.

While each accident case is not documented to the extent of the
Washtenaw County or Oakland County, Michigan files, the Dade county file is
useful for analyses of a metropolitan area. The user should take the file
size into consideration of the analysis costs involved.

Operational Status   Operational only in conjunction with the SR system,
SPAD, or ADAAS.

Past and Potential Applications   Used in statistical research into accident
causation and related topics.

Documentation   SPAD newsletters publish current additions and corrections
to maintained data files. Contact James O'Day, HSRI, 764-0248.

Program Title PG 640 One-Way Analysis of Variance (FMEANS1)

Program Function A program to generate one way analysis of variance tables. It is possible to select a further subset, for each table independent of all other tables, by two table filter variables. Restriction: The control variables may have codes ranging from 0 to 11.

Source of Program The Statistical Research System (SRS) based on OSIRIS II which was developed at the Institute for Social Research at the University of Michigan. Further revision and extension was carried out by HSRI.

Input and Output Features and Requirements Input is either batch or interactive mode for control information and SR standard data sets for data set information.

Computational Language Fortran IV.

Operational Status Written for operation under MTS on the IBM 360/67. Extensive revision would be required to operate under 360 or 370 OS.

Past and Potential Applications Used in the SR system to obtain analysis of variance.

Documentation Wood, D. E., Hafner, C. D., "The Statistical Research System," July 1, 1971, Highway Safety Research Institute.

Program Title Vehicle Closing Monte Carlo Simulation Model (FOLLOW)

Program Function This model predicts whether or not a following driver
can react to a defined situation in a manner which will avoid a crash.

Source of Program Developed under the direction of Carlson and Mortimer.
Sponsored by the MVMA.

Input and Output Features and Requirements Input is the characteristics of
the lead and following vehicle specified by deterministic and probabilistic
parameters. Output provides a detailed description of the entire closing
maneuver and also the closing behavior for a platoon of vehicles in which
each vehicle reacts to the vehicle immediately in front of it.

Computational Language Fortran IV.

Operational Status Developed for the IBM 1800. Easily convertible to
any other Fortran system. Available from R. Mortimer.

Past and Potential Applications This model is used to study the behavior
of a following vehicle on a roadway system. This model is also used to
study a platoon of vehicles and the manner in which variations are reflected
back down the line.

Documentation Carlson, W.L., Mortimer, R.G.,"Development of a Computer
Simulation to Evaluate the Effectiveness of Vehicle Rear Marking and Signaling
Systems,"July 20, 1973, Report No. UM-HSRI-HF-73-20, HSRI.

Program Title PG620 Bivariate Frequencies (FTAU)

Program Function The program provides bivariate frequency tables.
The user may request percentages in three dimensions and several nonpara-
metric statistics. Each frequency table requested is independent of all
other tables. FTAU differs from TAU99 (HSRI) only in restrictions.

Source of Program The Statistical Research System (SRS) based on OSIRIS II
which was developed at the Institute for Social Research at the University
of Michigan. Further revision and extension was carried out by HSRI.

Input and Output Features and Requirements Input is either batch or interactive
mode for control information and SR standard data sets for data set information.
Output is printed bivariate frequency tables.
Restrictions: Maximum number of variables which may be used is 100.
The range of codes must be from 0 to 11.

Computational Language Fortran IV.

Operational Status Written for operation under MTS on the IBM 360/67.
Extensive revision would be required to operate under 360 or 370 OS.

Past and Potential Applications Used in the SR System to obtain bivariate
frequency tables.

Documentation Wood, D.E., Hafner, C.D., "The Statistical Research System,"
July 1, 1971, Highway Safety Research Institute.

Program Title   Generator of Occupant Data (GOOD)

Program Function   Aids in data preparation for the Calspan 3-D model (CAL3D)
or MODROS.

Source of Program   Developed under direction of Bartz and Gianotti at
Calspan. Sponsored by MVMA.

Input and Output Features and Requirements   Input is body percentile, or
mean and standard deviation, and some body measurements. Output is generated
data sets for MODROS or CAL3D.

Computational Language   Fortran IV.

Operational Status   Written in IBM 370 OS. Easily adaptable to any Fortran
system. Available from Calspan or MVMA.

Past and Potential Applications   Used to ease the generation of data for
standard-proportioned crash victims.

Documentation   Bartz, J. A., and Gianotti, C. R., "A Computer Program to
Generate Input Data Sets for Crash Victim Simulations, (GOOD -- Generator
Of Occupant Data),"January 1973, Report No. Calspan No. ZQ-5167-V-1.

Program Title Discrete Parameter Head Injury Model (HEAD)

Program Function Simulates brain, skull, and neck response to impact.

Source of Program Developed as part of the research project for Ph.D. Thesis by Alem.

Input and Output Features and Requirements Input is model parameters and impact conditions. Output is printout and optional plots of computed head component responses.

Computational Language Fortran IV.

Operational Status Written for IBM 360/67. Easily convertible into any Fortran system with the exception of the plotting sections. Available from N. Alem.

Past and Potential Applications Used to simulate blunt impact and whiplash. Can be used to develop multiple head injury criteria.

Documentation Alem, N. M., "A Discrete-Parameter Head Injury Model," 1973, Ph.D. Thesis, University of Michigan.

Program Title   Engin Head Model   (HEADENG)

Program Function   Head impact is modeled using an elastic shell filled with an ideal fluid.

Source of Program   Developed as part of the research project for Ph.D. Thesis by A. Engin.

Input and Output Features and Requirements   Input is properties of a fluid-filled spherical shell and of radial impulsive load. Output is the pressure propagation as a function of time together with other quantities.

Computational Language   Fortran IV.

Operational Status   Developed for the IBM 360/67. Easily adaptable to any other Fortran system.

Past and Potential Applications   Has been used as a model of the human head subjected to impulsive external loads.

Documentation   Engin, A. E., "The Axisymmetric Response of a Fluid-Filled Spherical Shell," 1968, Ph.D. Thesis, University of Michigan.

Program Title Visibility Distance Provided by Headlamp Beams (HEADLAMP)

Program Function Prediction of the distance at which a specified target can
be seen in opposed and unopposed night driving situations.

Source of Program Developed under the direction of Mortimer and Becker.
Sponsored by the MVMA.

Input and Output Features and Requirements Input covers observer, target,
lamp, and vehicle parameters and tables. Output is tabulation of visibility
distance versus separation distance and optional plots.

Computational Language Fortran IV.

Operational Status Written for the IBM 1800 but easily adaptable to
any other computer except perhaps for the plotting section. Contact the
authors or MVMA for copies.

Past and Potential Applications The simulation should have useful application
to evaluate current and proposed headlight beams and other variables such as
lamp aim.

Documentation Mortimer, R. G., Becker, J. M., "Development of a Computer
Simulation to Predict the Visibility Distance Provided by Headlamp Beams,"
July 25, 1973, Report No. UM-HSRI-HF-73-15, HSRI.

Program Title Wang Head Model (HEADWAG)

Program Function Head impact is modeled using a rigid shell with a visco-elastic interior subject to a prescribed motion from a probe.

Source of Program Developed as part of the research project for Ph.D. Thesis by Wang.

Input and Output Features and Requirements Input is shell, interior, and probe quantities. Output is mechanical properties of the interior.

Computational Language Written for the IBM 360/67. Easily adaptable to any other Fortran system.

Past and Potential Applications Designed to be a theoretical aid to determining shear modulus of brain tissue.

Documentation Wang, H. C., "The Response of Viscoelastic Solid Sphere to a Local Excitation -- A Theoretical Model to Determine Mechanical Properties of In Vivo Primate Brain," 1971, Ph.D. Thesis, University of Michigan.

Program Title Head-Helmet Model (HEDMET)

Program Function This is a three mass representation of skull-brain impact where the head is protected by a helmet.

Source of Program Developed under the direction of McElhaney and Alem. Sponsored by MVMA.

Input and Output Features and Requirements Input is various parameters describing the model together with impact force. Output is printout of computed kinematics of the three model components.

Computational Language CSMP 360

Operational Status Written for the IBM 360/67. Easily convertible to any other CSMP 360 system. Available from N. Alem.

Past and Potential Applications Used in the study of head injury and helmet design.

Documentation McElhaney, J. H., et. al., "A Brain Injury Model for Crash Helmet Design," Environmental Progress in Science and Education. Proceedings of the Institute of Environmental Sciences 18th Annual technical meeting, 1972, I.E.S., pp. 112-116.

Program Title Hand Force Capability Model (HFCM)

Program Function This program is a three-dimensional isometric biomechanical strength model in standing or sitting position.

Source of Program Modified from previous work as part of the research project for a Ph.D. thesis by Garg. Sponsored by Research Institute, U of Dayton, Air Force Medical Research Lab, Manned Space Craft Center, Western Electric.

Input and Output Features and Requirements   Input is body parameters, range of motion data, some body capability information, and load information. Output is body and component positions, forces, and torques.

Computational Language Fortran IV.

Operational Status Written for the Air Force Medical Research Computer. Easily adaptable to other Fortran systems.

Past and Potential Applications Used to predict the hand force capability in the basis of an individual's muscle group strengths and body position. Applications to human performance engineering, physical medicine and understanding of muscle function.

Documentation Garg, A., "The Development and Validation of a 3-Dimensional Hand Force Capability Model," University of Michigan.

Program Title Head Injury Criteria (HIC)

Program Function Processes digitized head accelerometer data and computes the
Head Injury Criterion number specified in MVSS 208.

Source of Program Developed under the direction of McElhaney, Bowman, and
Alem. Sponsored by MVMA.

Input and Output Features and Requirements Input is digitized head acceleration.
Output is printout of HIC values together with information descriptive of the
input and also the performance of the program.

Computational Language Fortran IV.

Operational Status Written for IBM 360/67. Easily convertible to any other
Fortran system. Available from N. Alem.

Past and Potential Applications Used in the assessment of the severity of
head acceleration.

Documentation McElhaney, J. H., Stalnaker, R. L., Roberts, V. L., "Biomechanical
Aspects of Head Injury," Human Impact Response , Measurements, and Simulations,
G.M. Symposium, 1973 , Plenum Press.

Program Title PG680 Histogram (HISTOGRAM)

Program Function The histogram program produces a graph representing
the relative frequencies of values of a variable. The variable may either
be categorical or continuous.

Source of Program: The Statistical Research System (SRS) based on OSIRIS II
which was developed at the Institute for Social Research at the University
of Michigan. Further revision and extension was carried out by HSRI.

Input and Output Features and Requirements Input is either batch or inter-
active mode for control information and SR standard data sets for data set
information. Output is printout of histogram.
Restrictions: The variables must be of integer mode. Maximum number of
intervals produced is 33. The maximum number of histograms pre run is 15.

Computational Language Fortran IV.

Operational Status Written for operation under MTS on the IBM 360/67.
Extensive revision would be required to operate under 360 or 370 OS.

Past and Potential Applications Used under SR System to produce histograms.

Documentation Wood, D.E., Hafner, C.D.,"The Statistical Research System,"
July 1, 1971, Highway Safety Research Institute.

Program Title HSRI two-dimensional crash victim simulator (HSRI2D)

Program Function Analysis of the dynamics of a human or dummy in an impact environment. The person is described by 8 lumped masses moving in two dimensions and the vehicle is represented by a series of contact surfaces.

Source of Program Developed under the direction of Robbins, Bennett, and Becker. Sponsored by NHTSA.

Input and Output Features and Requirements Input is a variety of parameters describing the crash victim, the vehicle structure, and the crash event. Output is victim kinematics together with forces and other quantities. Auxiliary output, print plotted graphs; and print plotted stick figures are optional.

Computational Languages Fortran IV-G and 360 Assembler F.

Operational Status Operational in IBM 360/67 MTS and IBM 360/65 OS. Easily adaptable to other Fortran systems with the exception of the print plot routines. Can be obtained from H. Robbins or R. Bennett or NHTSA.

Past and Potential Applications Used in studies of motor vehicle occupant dynamics in a crash, design of vehicle interiors, and accident reconstruction.

Documentation Robbins, D. H., Bennett, R. O., Roberts, V. L., "HSRI Two-Dimensional Crash Victim Simulator: Analysis, Verification, and User's Manual," Final Report, Dec. 31, 1970, Report No. DOT HS-800 527 (PB202537). Robbins, D. H., Bennett, R. O., Roberts, V. L.,"HSRI Two-Dimensional Crash Victim Simulator: Analysis, Verification, and User's Manual, Revision No. 1., Final Report, May 1973, Report No. DOT HS-800 849 (PB222-394).

Program Title   HSRI 3-Mass, 3-D Crash Victim Simulator (HSRI3D)

Program Function   Analysis of the dynamics of a 3 mass, 3 dimensional person in an impact environment.

Source of Program   Developed under the direction of Robbins, Bennett, Becker, and Bowman.   Sponsored by NHTSA.

Input and Output Features and Requirements   Input is a variety of parameters describing the crash victim, vehicle structure, and crash event.   Output is kinematics of the crash victim, forces, and other quantities.   Auxiliary output, plotted stick figure views, and movies of stick figure views are optional.

Computational Languages   Fortran IV-G and 360 Assembler F

Operational Status   Operational in 360/67 MTS and 360/65 OS.   Easily adaptable to other Fortran systems except for the plotting sections. Available from H. Robbins, R. Bennett, or NHTSA.

Past and Potential Applications   Used in studies of crash victim dynamics, design of vehicle interiors, and accident reconstruction.

Documentation   Robbins, D. H., Bennett, R. O., Roberts, V. L., "HSRI Three Dimensional Crash Victim Simulator: Analysis, Verification,   User's Manual, and Pictorial Section," Final Report, June 20, 1971. Report No. DOT HS-800 551 (PB208242).

Program Title WSU Revision of HSRI3D (HSRI3DA)

Program Function A predictive airbag model has been added to HSRI 3D
by Wayne State University.

Source of Program A version of HSRI3D modified by King and Chou to include
are predictive airbag mode. Sponsored by NHTSA.

Input and Output Features and Requirements Input is a variety of parameters
describing the crash victim, vehicle structure, airbag, and crash event.
Output is kinematics of crash victim, forces, and related quantities.
Optional auxillary output is available.

Computational Language Fortran IV-G and Assembler F.

Operational Status Written for IBM 360/67 MTS. Easily adaptable for
other Fortran systems.

Past and Potential Applications Used in studies of crash victim dynamics,
design of vehicle interiors, and reconstruction of accidents.

Documentation King, A.D., Chou, C.C., Mockinder, G.A., "A Mathematical
Model of an Airbag for a Three-Dimensional Occupant Simulation," Jan., 1972,
SAE Paper No. 720036.

Program Title HSRI Six-Mass, Three Dimensional Crash Victim Simulator (HSRI3DE)

Program Function Computation of the motion, velocities, accelerations, and forces acting on a pedestrian or motor vehicle occupant in a crash situation.

Source of Program Developed by D. H. Robbins, R. O. Bennett, and B. M. Bowman of the HSRI Biosciences Division during 1972-1973. The project was sponsored by the Motor Vehicle Manufacturers Association.

Input and Output Features and Requirements A variety of physical parameters describing mass, size, and deformability of the crash victim, the geometry and physical properties of the vehicle structure which may contact the crash victim, and the description of the crash event are required in order to operate this model. This data must be supplied to the program on formatted input cards. The output from this program is in the form of dynamically titled tables of motions, velocities, accelerations, and forces acting on the crash victim. A multitude of auxiliary output is available on option to examine additional physical quantities and the function of the program in detail.

Computational Languages Fortran IV-G and 360 Assembler F.

Operational Status Operational in IBM 360/67 MTS and in IBM 360/65 OS. Prepared for ease of conversion to CDC 6600 operation also. Available from HSRI in the form of a tape which includes the source, a sample data set, and the corresponding output. Can also be obtained from the Motor Vehicle Manufacturers Association.

<u>Past and Potential Applications</u>   Studies of motor vehicle occupant and
pedestrian dynamics in a crash; development of occupant restraint systems;
development of crashworthy vehicle structures; reconstruction of occupant
motions in accidents for injury assessment.

<u>Documentation</u> 1. Robbins, D. H., Bennett, R. O., and Bowman, B. M., "HSRI
Six-Mass, Three Dimensional Crash Victim Simulator," Final Report Prepared
for Motor Vehicle Manufacturers Association, Feb. 1973, 302 pages.

   2. Robbins, D. H., Bennett, R. O. and Bowman, B. M., "User-Oriented
Mathematical Crash Victim Simulator," Proceedings of the Sixteenth Stapp
Car Crash Conference and SAE Paper No. 720962, November 1972, 21 pages.

Program Title Vehicle Handling (VHOSM)

Program Function Computes accelerations for vehicle handling on or near road surface.

Source of Program Developed at CALSPAN and modified under direction of D. Dunlap to include soft soil, new tire model, and barrier contact.

Input and Output Features and Requirements Input is various parameters describing the vehicle, the barrier or curb, the soft earth, and tabular steering and braking information or path following feedback parameters. Output is printout of vehicle kinematics.

Computational Language Fortran IV

Operational Status Written for IBM 360/67 MTS. Easily convertible to any other Fortran system. Available from D. Dunlap.

Past and Potential Applications Used in studies of vehicle steering and braking. Used in studies of barrier, guard rail, or curb impacts. Used in studies of road geometrics related to skidding.

Documentation McHenry, R.R., DeLeys, N.J., "Automobile Dynamics - A Computer Simulation of Three-Dimensional Motions for Use In Studies of Braking Systems and of the Driving Task," August 1970, CAL Report No. VJ-2251-V-7.

Program Title PF510 Index Construction and Recoding (ICØN)

Program Function A general purpose index construction and recoding program. It can be used to calculate functional values, to count code types, bracket continuous variables, and recode according to tables which are indexed in three dimensions.

Source of Program The Statistical Research System (SRS) based on OSIRIS II which was developed at the Institute for Social Research at the University of Michigan. Further revision and extension was carried out by HSRI.

Input and Output Features and Requirements Input is either batch or interactive mode for control information and SR standard data sets for data set information. Output is either a standard SR data set or a non-standard file. Punched card output and a printed listing are both optional. Restrictions: The maximum number of input variables to be used is 1000. Maximum number of output variables is 1000. Maximum field width of a numeric variable is 7 digits.

Computational Language Fortran IV.

Operational Status Written for operation under MTS on the IBM 360/67. Extensive revision would be required to operate under 360 or 370 OS.

Past and Potential Applications Used in SR System to construct indicies and change codes.

Documentation Wood, D.E., Hafner, C.D., "The Statistical Research System," July 1, 1971, Highway Safety Research Institute.

Program Title   J-Tolerance Index (JTI)

Program Function   Computes J-Tolerance Index for head injury developed by
Slattenschek at Vienna Institute of Technology.

Source of Program   Developed under the direction of Alem using previous
work by Brinn at Chrysler. Sponsored by MVMA.

Input and Output Features and Requirements   Input is head acceleration in
tabular form. Output is printout of J-Tolerance Index.

Computational Language   Fortran IV.

Operational Status   Written for IBM 360/67. Easily convertible to any other
Fortran system. Available from N. Alem.

Past and Potential Applications   Used in the study of head injury.

Documentation   McElhaney, J. H., Stalnaker, R. L., Roberts, V. L., "Biomechanical
Aspects of Head Injury," Human Impact Response,   Measurements, and Simulations."
(GM Symposium) 1973, Plenum Press.

Slattenschek, A., et. al., "The Quantification of Internal Head Injury by
Means of the Phantom Head and the Impact Assessment Methods," SAE Paper
710879.

Program Title   PH740 Multivariate Analysis of Variance (MANØVA)

Program Function   The program performs a multivariate analysis of variance.
It also routinely performs univariate analyses of variance and/or covariance.
If more than one dependent variable is specified, univariate and multivariate
analyses are performed; if only one dependent variable is specified, a
univariate analysis is performed.   Input is a standard SR data set.   Output
is a printout.   Restrictions: Maximum number of cells is 90.   Maximum
number of dependent variables is 25.   Maximum number of covariables is 8.
Cell n's do not have to be equal.   If the code for any dependent variable
is a missing data code the entire case will be eliminated from the analysis.

Source of Program   The Statistical Research System (SRS) based on OSIRIS II
which was developed at the Institute for Social Research at the University
of Michigan.   Further revision and extension was carried out by HSRI.

Input and Output Features and Requirements   Input is either batch or
interactive mode for control information and SR standard data sets for data
set information.

Computational Language   Fortran IV.

Operational Status   Written for operation under MTS on the IBM 360/67.
Extensive revision would be required to operate under 360 or 370 OS.

Past and Potential Applications   Used in the SR System for obtaining
multivariate analysis of variance.

Documentation   Wood, D.E., Hafner, C.D., "The Statistical Research System,"
July 1, 1971, Highway Safety Research Institute.

Program Title PH770 Multiple Classification Analysis (MCA)

Program Function Multiple Classification Analysis provides a technique
for examining the interrelationships between several independent variables
and a dependent variable within the context of an additive model.

Source of Program The Statistical Research System (SRS)
which was developed at the Institute for Social Research at the University
of Michigan. Further revision and extension was carried out by HSRI.

Input and Output Features and Requirements Input is either batch or interactive
mode for control information and SR standard data sets for data set information.
Output is printout of correlation coefficient and sum of squares.

Computational Language Fortran IV.

Operational Status Written for operation under MTS on the IBM 360/67.
Extensive revision would be required to operate under 360 or 370 OS.

Past and Potential Applications Used in SR System to obtain comparative
correlation information.

Documentation Wood, D.E., Hafner, C.D., "The Statistical Research System,"
July 1, 1971, Highway Safety Research Institute.

Program Title Revised McKenzie neck model. (MCKENZIE)

Program Function Computes two-dimensional head kinematics including response to visoelastic neck bending given acceleration input of the bottom of the neck.

Sources of Program Developed under the direction of Wang. Sponsored by MVMA.

Input and Output Features and Requirements Input is neck parameters and properties together with the tabular acceleration of the bottom of the neck. Output is printout of head and neck kinematics.

Computational Language Fortran IV

Operational Status Written for the IBM 360/67. Easily convertible to any other Fortran system. Available from H. Wang.

Past and Potential Applications Used in Studies of neck injury. Used in crash dummy design work.

Documentation Melvin, J.W., "Improved neck Simulations for Use with Anthropomorphic Dummies," 1972, Quarterly Reports, for MVMA, University of Michigan.

Program Title PG660 Missing Data Correlations (MDC)

Program Function The missing data correlation program computes the

correlation coefficients between all pairs of variables. For each pair of

variables X, Y in the list, the program computes r on the basis of the

subsample of observations for which X and Y are valid data (non-missing

data).

Source of Program The Statistical Research System (SRS) based on OSIRIS II

which was developed at the Institute for Social Research at the University

of Michigan. Further revision and extension was carried out by HSRI.

Input and Output Features and Requirements Input is either batch or interactive

mode for control information and SR standard data sets for data set information.

Output is a printout and, optionally, the correlation matrix punched

or written in a file. Restriction: Maximum number of variables which can

be used is 80.

Computational Language Fortran IV.

Operational Status Written for operation under MTS on the IBM 360/67.

Extensive revision would be required to operate under 360 or 370 OS.

Past and Potential Applications Used in SR System to obtain missing data

correlations.

Documentation Wood, D.E., Hafner, C.D.,"The Statistical Research System,"

July 1, 1971, Highway Safety Research Institute.

Program Title   PG610   Means and Marginals (MEAN)

Program Function   The means and marginals program provides case counts,
sum of weights, number of missing data codes, ranges, means, standard
deviations, skewness and kurtois measures for a specified set of variables
in a standard SR data set. Optionally, marginal distributions may be
accumulated and percentages on the marginals computed.

Source of Program   The Statistical Research System (SRS) based on OSIRIS II
which was developed at the Institute for Social Research at the University
of Michigan. Further revision and extension was carried out by HSRI.

Input and Output Features and Requirements   Input is either batch or inter-
active mode for control information and SR standard data sets for data set
information. Output is a printout. Restrictions: Maximum number of
variables which may be used is 200. Maximum field width is 5. The absolute
difference between the maximum and minimum code value cannot exceed 24,400.

Computational Language   Fortran IV.

Operational Status   Written for operation under MTS on the IBM 360/67.
Extensive revision would be required to operate under 360 or 370 OS.

Past and Potential Applications   Used in SR system to obtain means and marginals.

Documentation   Wood, D.E., Hafner, C.D.,"The Statistical Research System,"
July 1, 1971, Highway Safety Research Institute.

Program Title PG611 Means and Marginals II (MEAN2)

Program Function This program is the same as MEAN except for the option
to store the marginals on a permanent file to be used as input to MIP.

Source of Program The Statistical Research System (SRS) based on OSIRIS II
which was developed at the Institute for Social Research at the University
of Michigan. Further revision and extension was carried out by HSRI.

Input and Output Features and Requirements Input is either batch or
interactive mode for control information and SR standard data sets for data
set information.

Computational Language Fortran IV

Operational Status Written for operation under MTS on the IBM 360/67.
Extensive revision would be required to operate under 360 or 370 OS.

Past and Potential Applications Used in SR system to obtain input marginals
for MIP.

Documentation Wood, D.E., Hafner, C.D.,"The Statistical Research System,"
July 1, 1971, Highway Safety Research Institute.

Program Title Processing Vehicle Performance Data (MEASUP)

Program Function Prepares analog vehicle performance data for use by
MEASUR. A number of derived calculations based on measurements are
computed as well as the A/D step.

Source of Program Developed under direction of Fancher and MacAdam.
Sponsored by NHTSA.

Input and Output Features and Requirements Input is analog tape of vehicle
performance data. Output is digital tape of converted vehicle performance
data together with certain derived quantities.

Computational Language Analog and Hybrid

Operational Status Written for IBM 1800, AD/FOUR, and interface.
Adaptable to other similar equipment. Available from C. McAdam.

Past and Potential Applications Used for A/D step and calibrations.

Documentation Fancher, P.S., Ervin, R.D., Grote, P., MacAdam, C.C.,
Segal, L.,"Limit Handling Performance as Influenced by Degradation of
Steering and Suspension Systems,"November 1972, Final Report UM-HSRI-PF-
72-301.
Ervin, R.D., Grote, P., Fancher, P.S., MacAdam, C.C., Segel, L.,"Vehicle
Handling Performance,"November, 1972, Final Report No. DOT-HS-031-1-159.

Program Title   Data Processing for Digital Tapes (MEASUR)

Program Function   Computes response measures from digital tapes out of digitized vehicle response tests.

Source of Program   Developed under direction of Fancher and MacAdam. Sponsored by DOT.

Input and Output Features and Requirements   Input is digital output tape of MEASUP. Output is printout of computed response measure.

Computational Language   Fortran IV.

Operational Status   Written for the IBM 1800. Easily adaptable to any Fortran system. Available from C. MacAdam.

Past and Potential Applications   Used to obtain printout from vehicle performance tests.

Documentation   Fancher, P.S., Ervin, R.D., Grote, P., MacAdam, C.C., Segal, L.,"Limit Handling Performance as Influenced by Degradation of Steering and Suspension Systems," November 1972, Final Report UM-HSRI-PF-72-3-1.
Ervin, R.D., Grote, P., Fancher, P.S., MacAdams, C.C., Segel, L., November, 1972, Final Report No. DOT-HS-031-1-159.

Program Title PA015 Check Match (MERCHECK)

Program Function The program checks merged and sorted data for missing
and/or extraneous cards, deletes invalid cards and/or cases, and inserts
"dummy" cards for missing ones.

Source of Program The Statistical Research System (SRS) based on OSIRIS II
which was developed at the Institute for Social Research at the University
of Michigan. Further revision and extension was carried out by HSRI.

Input and Output Features and Requirements Input to the program may be
cards, card image tape or a card image line file. The program creates
a data file which is suitable as input to the SR BUILD program. Restrictions:
Logical record length of input records must be 80. The input must be
merged and sorted. Control information is read in either batch or inter-
active mode.

Computational Language Fortran IV

Operational Status Written for operation under MTS on the IBM 360/67.
Extensive revision would be required to operate under 360 or 370 OS.

Past and Potential Applications Used as an integral part of SRS to carry
out   checking of a data deck before it is put in SR format.

Documentation Wood, D.E., Hafner, C.D.,"The Statistical Research System,"
July 1, 1971, Highway Safety Research Institute.

Program Title PD330 Marginal Insertion Program (MIP)

Program Function This program inserts frequency counts into the legal code values of each specified variable. The marginal frequencies are obtained by running MEAN2.

Source of Program The Statistical Research System (SRS) based on OSIRIS II which was developed at the Institute for Social Research at the University of Michigan. Further revision and extension was carried out by HSRI.

Input and Output Features and Requirements Input is either batch or interactive mode for control information and SR standard data sets for data set information. Output is an updated codebook.

Computational Language Fortran IV

Operational Status Written for operation under MTS on the IBM 360/67. Extensive revision would be required to operate under 360 or 370 OS.

Past and Potential Applications Used in the SR system to obtain an updated codebook from a new set of marginals.

Documentation Wood, D.E., Hafner, C.D.,"The Statistical Research System," July 1, 1971, Highway Safety Research Institute.

Program Title   PE440 File Merging (MMP)

Program Function   A match merge program which builds a standard SR output

data set from two standard SR input data sets. The user specifies the

variables on which the input files are to be matched and he specifies which

variables from the input files are to be transferred to each output record.

Source of Program   The Statistical Research System (SRS) based on OSIRIS II

which was developed at the Institute for Social Research at the University

of Michigan. Further revision and extension was carried out by HSRI.

Input and Output Features and Requirements   Input is either batch or interactive

mode for control information and SR standard data sets for data set information.

Output is new SR standard data set. Restrictions: Both input data sets

must be in ascending order by the matching variables used in any given

run. Maximum number of variables which may be created in an output file

is 1000. Files may be matched on up to 20 variables.

Computational Language   Fortran IV.

Operational Status   Written for operation under MTS on the IBM 360/67.

Extensive revision would be required to operate under 360 or 370 OS.

Past and Potential Applications   Used in SR system to selectively merge

two data sets.

Documentation   Wood, D.E., Hafner, C.D.,"The Statistical Research System,"

July 1, 1971, Highway Safety Research Institute.

Program Title Digitizing Mobile Tire Tester Analog Data (MOBILAD)

Program Function Digitizes analog data from Mobile Tire tester and provides input to MOBILPROC.

Source of Program Developed under the direction of Fancher and MacAdam.

Input and Output Features and Requirements General program with variable scanning rates and selection of input channels.

Computational Language Analog and Hybrid

Operational Status Written for the IBM 1130, AD/FOUR and interface. Available from C. MacAdams.

Past adn Potential Applications Used for conversion of mobile tire test data for use by MOBILPROC.

Documentation No published reports.

Program Title Processing Mobile Tire Tester Data(MOBILPROC)

Program Function Produces longitudinal and lateral forces and moments
as a function of tire slip and slip angle.

Source of Program Developed under the direction of Fancher, and MacAdam.

Input and Output Features and Requirements Input is tape from MOBILAD.
Output is printout of computed and measured quantities.

Computational Language Fortran IV

Operational Status Written for IBM 1800 and IBM 360/67 which incorporates
some plot routines. Stored for future applications. See C. MacAdam.
and T. Tielking.

Past and Potential Applications Used to obtain printout and plots of mobile
tire tester data.

Documentation No published reports.

Program Title Modified Revised Occupant Simulator (MODROS)

Program Function A 2-D model similar to HSRI2D developed by Calspan and
modified by General Motors. An airbag is included.

Source of Program Developed under direction of McHenry and Segel and modified
under direction of Danforth and Randall.

Input and Output Features and Requirements Input is a variety of parameters
describing the crash victim, vehicle structure, and crash event. Output
is crash victim kinematics, forces, and other quantities.

Computational Language Fortran IV-G, PL/I-F, and 360 Assembler F.

Operational Status Written for IBM 360/65 OS. Not easily adaptible
to MTS in some of the PL/I sections. Available from Danforth, G.M. Research,
and also from MVMA.

Past and Potential Applications Used for studies of crash victim dynamics,
design of vehicle interiors, and accident reconstruction.

Documentation Segel, L.,"Revised Computer Simulation of the Automobile
Crash Victim,"Final Report, 1971, VJ-2759-V-1.
Danforth, G.P., Randall, C.D.,"Modified ROS Occupant Dynamics Simulation,"
Oct. 26, 1972, Report No. GMR-1254, General Motors Corporation.

Program Title HSRI Maximum Strain Criterion (MSC)

Program Function Generates head injury tolerance curves according to
Maximum Strain Criterion Model.

Source of Program Developed under the direction of Stalnaker and Alem.
Sponsored by NHTSA.

Input and Output Features and Requirements Input is model parameters and
tabular head acceleration. Output is printout of tolerance curves.

Computational Language Fortran IV.

Operational Status Written for IBM 360/67. Easily convertible to any other
Fortran system. Available from N. Alem.

Past and Potential Applications Used for generating tolerance curves for
human cadaver heads and primate heads.

Documentation Stalnaker, et. al., "A Mechanical Impedance Model for Head
Injury Due to Linear Impact," Symposium on Biodynamic Models and Their
Applications, 1970.

Stalnaker, et. al., "Side Impact Tolerance to Blunt Trauma," 17th
Stapp Car Crash Conference, SAE Paper No. 730979.

Program Title   MVMA 2-D Model (MVMA2D)

Program Function   A completely overhauled version of MODROS, this model includes a real line representation of a vehicle for use in conjunction with vehicle plan drawings. Airbag, energy-absorbing steering column, and slipping three-point harness sub-models are included.

Source of Program   A continuation of the work of which MODROS was the last previous step. This latest step developed under the direction of Robbins, Bennett, and Bowman. Sponsored by MVMA.

Input and Output Features and Requirements   Input is a variety of parameters describing the crash victim, vehicle structure, and crash event. Output is crash victim kinematics, forces, and other quantities. Auxiliary output is optional.

Computational Languages   Fortran IV-G and 360 Assembler F.

Operational Status   Operational in IBM 360/67 MTS. Easily adaptable to other Fortran systems of very large size. Available from H. Robbins, R. Bennett, and MVMA.

Past and Potential Applications   Used for studies of crash victim dynamics, design of vehicle interior and restraint systems, and accident reconstruction.

Documentation   Robbins, D. J., Bennett, R. O., Bowman, B. M., "MVMA Two-Dimensional Crash Victim Simulation, Version 1, "Final Report, October 16, 1973, Report No. UM-HSRI-BI-73-5.

Program Title Design of Manual Work Stations (MWS)

Program Function Two models used in conjunction consisting of Task-Time Prediction Model (TTP) and Biokinematic Model for estimating operator configuration.

Source of Program Developed as part of the research project for a Ph.D. Thesis by Kilpatrick. Sponsored by Methods-Time Measurement Association and Western Electric Co.

Input and Output Features and Requirements Input is object descriptions, location descriptions, and method sequence for TTP. Desired anthropometry data added for Biokinematic Model. Output is tabulated predicted joint center coordinates and whole body drawings and stick figures.

Computational Language Fortran IV

Operational Status Easily convertible except for plotting sections.

Past and Potential Applications Used in the computer-aided design of industrial work places. Used in research of a range of man-machine systems.

Documentation Kilpatrick, K. E., "A Model for the Design of Manual Work Stations."

Program Title   Bowman Neck Model   (NOM)

Program Function   This program is a 3-dimensional model of neck and spinal
dynamic motion.   The neck is modeled as an extensible link and the spine as
a series of "n" lumped masses.

Source of Program   Developed as part of the research project for Ph.D.
Thesis by Bowman.

Input and Output Features and Requirements   Input is crash victim parameters
together with excitation tables.   Output is computed kinematics together with
other values.

Computational Language   Fortran IV.

Operational Status   Written for the IBM 360/67 MTS system.   Easily converted
to other Fortran systems.   Available from B. Bowman.

Past and Potential Applications   Used for free motion studies of occupants,
some limited crashes, and the effect of muscle tension in crash dynamics.

Documentation   Bowman, B. M., "An Analytical Model of a Vehicle Occupant
for Use in Crash Simulations," 1971, Ph.D. Thesis, University of Michigan.

Program Title   Numerical Computation for Automobile Ideal Stopping Distance
(NUMISD)

Program Function   Computes the ideal stopping distance for an automobile.

Source of Program   Developed under the direction of Moncarz. Sponsored
by NHTSA.

Input and Output Features and Requirements   Input is geometric description
of automobile and tire force parameters. Output is printout of ideal
stopping distance together with the dynamic load transfer.

Computational Language   Fortran IV

Operational Status   Written for IBM 360/67MTS. Easily convertible to any
other Fortran system. Available from H. Moncarz.

Past and Potential Applications   Used to determine automobile braking
efficiently measured as ideal braking distance over actual braking distance.

Documentation   Report to be issued July 1974.

Data Set Title   Oakland Data Files (OAKLAND)

Data Set Function   SRS data files for accidents.

Data File Summary   Accident information furnished by the Michigan State
Police and Traffic Improvement Association of Oakland County has been built
into Level I accident files. Each data entry represents a single accident
situation, and the file allows analysis of a combined urban and rural
locality.

Operational Status   Usable only in conjunction with SR System, SPAD
or ADAAS.

Past and Potential Applications   Used in statistical research into accident
causation and related topics.

Documentation   SPAD newsletters publish current additions and corrections to
maintained data files. Contact James O'Day, HSRI, 764-0248.

Program Title Crash Victim Data Preparation (OVERLORD)

Program Function This interactive, user-oriented program allows the user to prepare data decks for use with the HSRI 3-D, 6-mass model (HSRI3DE)

Source of Program Developed under the direction of Robbins, Bennett, and Bowman. Sponsored by MVMA.

Input and Output Features and Requirements Interactive questions and answers are used in producing data sets for HSRI3DE. Output is file containing the data set and an updated master data set.

Computational Language Fortran IV-G.

Operational Status Operational on IBM 360/67 MTS. Easily adaptable to any other terminal system and most batch systems.

Past and Potential Applications Used to aid the casual user in producing a certain class of standard data sets.

Documentation Robbins, D. H., Bennett, R. O., and Bowman, B. M.,"HSRI Six-Mass, Three Dimensional Crash Victim Simulator", February 1973, Final Report for MVMA.

Robbins, D. H., Bennett, R. O., and Bowman, B. M., "User-Oriented Mathematical Crash Victim Simulator," Proceedings of the Sixteenth Stapp Car Crash Conference and SAE Paper No. 720962, November 1972.

79

Program Title   PH710 Partial Correlation (PARTIAL)

Program Function   The nth order partial correlation and standardized

partial regression coefficients are computed for each pair of variables

in a correlation matrix, while holding the rest of the variables constant.

The multiple correlation coefficients are also computed for each variable

using all the others as predictors.

Source of Program   The Statistical Research System (SRS) based on OSIRIS II

which was developed at the Institute for Social Research at the University

of Michigan.   Further revision and extension was carried out by HSRI.

Input and Output Features and Requirements   Input is either batch or inter-

active mode for control information and SR standard data sets for data set

information.   Input is a correlation matrix, upper-right triangle, with no

diagonal present (it may be on cards or in a line file) and cards which specify

which variables from the input matrix are to be used to make a submatrix.

Calculations are done on the submatrix.   The user may specify as many

submatrices as he chooses.   Restrictions: The input matrix may not be

larger than 80 by 80.   Any given submatrix may not be larger than 30 by 30.

Computational Language   Fortran IV.

Operational Status   Written for operation under MTS on the IBM 360/67.

Extensive revision would be required to operate under 360 or 370 OS.

Past and Potential Applications   Used in the SR system to obtain partial

and multiple correlations.

Documentation   Wood, D.E., Hafner, C.D.,"The Statistical Research System,"

July,1, 1971, Highway Safety Research Institute.

Program Title   Three-Dimensional Position Analysis from Photometric Data
(PHOTO3D)

Program Function   Processes photometric position data from two high speed
cameras and locates a three-dimensional rigid body in space.

Source of Program   Developed under the direction of Robbins and Alem.
Sponsored by NHTSA.

Input and Output Features and Requirements   Input is digitized target loca-
tions as seen from the side and the top. Output is printout of computed six
coordinates of the rigid body in the inertial frame.

Computational Language   Fortran IV.

Operational Status   Written for IBM 360/67. Easily convertible to any other
Fortran system. Available from N. Alem.

Past and Potential Applications   Used in measuring kinematics in heads of
crash dummies.

Documentation   Robbins, D. H., et. al., "Predictions of Mathematical Models
Compared with Impact Sled Test Results Using Anthropometric Dummies," 14th
Stapp Car Crash Conference, 1970, SAE, 700907.

Program Title Horizontal Plane Simulation (PLANEH)

Program Function Computes dynamics of a vehicle in the horizontal plane due to steering and braking.

Source of Program Developed under direction of Fancher

Input and Output Features and Requirements Input is various parameters describing the vehicle, tire traction, and steering and braking maneuvers. Output is vehicle trajectory, tire normal loads, and suspension kinematics.

Computational Language Analog and Hybrid

Operational Status No longer in use. Kept as a source of techniques for similar future problems.

Past and Potential Applications Used in studies of the influence of tire traction on steady state turning, braking from a turn, response to an increase in steer angle at high lateral accelerations, and combined lane change and braking maneuver.

Documentation Fancher, P. and Grote, P., "Development of a Hybrid Simulation for Extreme Automobile Maneuvers."

Program Title Pitch Plane Simulation (PLANEP)

Program Function A dynamic simulation based upon a mathematical model
that represents a truck or tractor-trailer combination. Motions are
constrained to the vertical plane but wheels can bound and spin, the chassis
can heave and pitch, and the vehicle can accelerate in a straight line.

Source of Program Developed under the direction of Murphy and Bernard.
Sponsored by MVMA.

Input and Output Features and Requirements Interactive input
requests vehicle parameters, distances, and velocities.

Computational Language Analog and Hybrid

Operational Status No longer in use. Kept as a source of techniques for
similar future problems.

Past and Potential Applications Used to compute acceleration, loads, and
kinematics.

Documentation Murphy, R.W., Limpert, R., Segel, L.,"Bus, Truck, Tractor-
Trailer Braking System Performance,"March, 1971, Report No. HSRI-PF-
70-101.

Program Title PD320 Dictionary Processor (PRDICT)

Program Function The dictionary processor may be used to list a dictionary
with or without the codebook or to list any selected portions of a dictionary.
It may also be used to build a new dictionary, filtering out all codebook
information from an old dictionary.

Source of Program The Statistical Research System (SRS) based on OSIRIS II
which was developed at the Institute for Social Research at the University
of Michigan. Further revision and extension was carried out by HSRI.

Input and Output Features and Requirements Input is either batch or inter-
active mode for control information and SR standard data sets for data set
information.

Computational Language Fortran IV

Operational Status Written for operation under MTS on the IBM 360/67.
Extensive revision would be required to operate under 360 or 370 OS.

Past and Potential Applications Used in SR system to obtain dictionary
and codebook information from a data set.

Documentation Wood, D.E., Hafner, C.D.,"The Statistical Research System,"
July 1, 1971, Highway Safety Research Institute.

Program Title PA030 Print Columns (PRNCOL)

Program Function The program lists selected columns of a line file.
It is intended for listing the "printout" from another program when that
"printout" has been stored in a line file. The program is primarily for
terminal use.

Source of Program The Statistical Research System (SRS) based on OSIRIS II
which was developed at the Institute for Social Research at the University
of Michigan. Further revision and extension was carried out by HSRI.

Input and Output Features and Requirements Input is either batch or inter-
active mode for control information and SR standard data sets for data set
information.

Computational Language Fortran IV.

Operational Status Written for operation under MTS on the IBM 360/67.
Extensive revision would be required to operate under 360 or 370 OS.

Past and Potential Applications Used in the SR system to obtain printout
of a line file.

Documentation Wood, D.E., Hafner, C.D.,"The Statistical Research System,"
July 1, 1971, Highway Safety Research Institute.

Program Title   Revised Brain Model (RBM)

Program Function   Computes revised brain model index developed by Fan
at Ford Motor Company.

Source of Program   Developed under the direction of Alem using previous
work by Brinn at Chrysler.   Sponsored by MVMA.

Input and Output Features and Requirements   Input is head acceleration in
tabular form.   Output is printout of RBM Index.

Computational Language   Fortran IV.

Operational Status   Written for IBM 360/67.   Easily convertible to any other
Fortran system.   Available from N. Alem.

Past and Potential Applications   Used in the study of head injury.

Documentation   McElhaney, J. H., Stalnaker, R. L., Roberts, V. L.,
"Biomechanical Aspects of Head Injury," Human Impact Response,   Measurement
and Simulations, (GM Symposium) 1973, Plenum Press.

Program Title   Tape Reformatting Program (REFMT)

Program Function   This program reads a blocked tape in SRS format and
writes the data on a new tape in user specified blocking format.

Source of Program   Developed as part of the SR System, a modified and expanded
version of OSIRIS II which was developed at the Institute for Social Research.

Input and Output Features and Requirements   Input is a block tape in SRS
format and control parameters. Output is a new, reblocked magnetic tape.
Input and output record lengths must be identical.

Computational Language   Fortran IV

Operational Status   Written for IBM 360/67 MTS. Convertible only with
difficulty to other systems. Available from J. Green.

Past and Potential Applications   This program is useful in modifying magnetic
tapes to a new, more desirable blocking format.

Documentation   Documentation is available from J.A. Green, Rm. 232, HSRI
764-0248.

Data Set Title Seattle Data Files (SEATTLE)

Data Set Function SR Data files for accidents.

Data File Summary The state of Washington has furnished data that have been built into a Level I accident file. The file represents the greater Seattle area, and is especially useful for vehicle model size and type analysis, because of the extent of make/model category variables.

Operational Status Usable only in conjunction with the SR system, SPAD or ADAAS.

Past and Potential Applications Used in statistical research in accident causation and related topics.

Documentation SPAD Newsletters publish current additions and corrections to maintained files. Contact James O'Day, HSRI, 764-0248.

Program Title   Shock Absorber Model (SHOCKAB)

Program Function   Simulates a shock absorber system.

Source of Program   Developed as part of the research project for Ph.D. Thesis by Lang.

Input and Output Features and Requirements   Input is model parameters. Output is shock absorber force.

Computational Language   Analog and Hybrid

Operational Status   No longer in use. Kept as a source of techniques for similar future problems.

Past and Potential Applications   Used in the design and evaluation of shock absorber systems.

Documentation   Ph.D. Thesis is yet to be published.

Program Title Somatotype Calculation Program (SOMAT)

Program Function This program utilizes ten specific anthropometric measurements and calculates the somatotype (physique assessment) according to the Heath-Carter method.

Source of Program The program has been developed by D. Foust of the HSRI Biomedical Department during 1973-1974. The work was sponsored by the Insurance Institute for Highway Safety.

Input and Output Features and Requirements Input Required: Ten anthropometric measurements and a subject identification number. Output produced:
Subject identification number, body stature, weight, three-number somatotype.
This output may be produced either by a line printer or on punched cards.

Computational Language Fortran IV

Operational Status The program is installed on the University of Michigan IBM 360/67 and may be converted easily for other Fortran systems.

Past and Potential Applications 1. Physique assessment for seating studies. 2. Work space biomechanics.

Documentation Available as a program listing and a two page description through the Biomedical Department, HSRI.

Program Title PA010 Sort Data Set (SORT)

Program Function The SORT program sorts a standard SR data file into an ascending order based on user specified control fields.

Source of Program The Statistical Research System (SRS) based on OSIRIS II which was developed at the Institute for Social Research at the University of Michigan. Further revision and extension was carried out by HSRI.

Input and Output Features and Requirements This program requires the input files to be in standard SR format and accepts sort field and output device type information in either batch or interactive mode.

Computational Language Fortran IV

Operational Status Written for operation under MTS on the IBM 360/67. Extensive revision would be required to operate under 360 or 370 OS.

Past and Potential Applications Used as an integral part of SRS to carry out the sorting function. Not for independent use.

Documentation Wood, D.E., Hafner, C.D.,"The Statistical Research System," July 1, 1971, Highway Safety Research Institute.

Program Title Simplified Procedures to Access Data (SPAD)

Program Function A file of MTS commands to utilize various parts of the
SR system on various of the collections of SR data files.

Source of Program Developed under the direction of Green and Brown.

Input and Output Features and Requirements Interactive or batch usage in MTS.

Computational Language MTS

Operational Status Operational only in MTS.

Past and Potential Applications To simplify the use of the data files
and the SR system by providing the detailed calling sequences for frequent
combinations.

Documentation A Manual for SPAD, May, 1972, HSRI.

Program Title   Filebuild Program Subroutine Library (SYSSUBS)

Program Function   This library contains a number of FORTRAN callable
subroutines that are useful in data file construction programs. Included
are such functions as conversion routine between binary and EBCDIC in both
directions, character manipulation, recoding routines, and character search
routines.

Source of Program   Developed under the direction of J. Creswell. Sponsored
by MVMA.

Input and Output Features and Requirements   NA-depends upon the subroutine.

Computational Language   Fortran IV, 360 Assembler

Operational Status   Written for IBM 360/67 MTS. Convertible only with difficulty
to other systems. Available from J. Green.

Past and Potential Applications   Very useful in the coding of FORTRAN
programs to build new data files from new data or to reformat existing files.
Subroutines are designed for speed of operation.

Documentation   Documentation is available from J.A. Green, Rm. 232,
HSRI, 764-0248.

Program Title Magnetic Tape File Control Data (TAPEDATA)

Program Function TAPEDATA will read a specified number of files from a magnetic tape and report the following data 1) number of blocks, 2) total number of bytes, 3) number of bytes in the longest block, 4) number of bytes in the smallest block, 5) appropriate length in feet, and 6) the cumulative length in feet.

Source of Program Developed under the direction of J. Green. Sponsored by MVMA.

Input and Output Features and Requirements Input is control information together with a magnetic tape. Output is a printout of obtained tape file control data.

Computational Language Fortran IV

Operational Status Written for IBM 360/67 MTS. Convertible only with difficulty to other systems. Available from J. Green.

Past and Potential Applications Used to obtain information on the current contents of a magnetic tape.

Documentation Documentation is available from J.A. Green, Rm. 232, HSRI, 764-0248.

Program Title   PG630 Bivariate Frequencies with Two-Digit Codes (TAU99)

Program Function   The program provides bivariate frequency tables. The user may request percentages in three dimensions and several nonparametric statistics. Each frequency table requested is independent of all other tables. TAU99 differs from FTAU (HSRI) only in restrictions. Restrictions: Maximum number of variables which may be used is 50. Row variables may have values from 0 to 99. Column variables may have values from 0 to 11.

Source of Program   The Statistical Research System (SRS) based on OSIRIS II which was developed at the Institute for Social Research at the University of Michigan. Further revision and extension was carried out by HSRI.

Input and Output Features and Requirements   Input is either batch or interactive mode for control information and SR standard data sets for data set information. Output is a printout of frequency tables.

Computational Language   Fortran IV

Operational Status   Written for operation under MTS on the IBM 360/67. Extensive revision would be required to operate under 360 or 370 OS.

Past and Potential Applications   Used in the SR system to obtain bivariate frequency tables.

Documentation   Wood, D.E., Hafner, C.D.,"The Statistical Research System," July 1, 1971, Highway Safety Research Institute.

Program Title   PG650 Bivariate Frequencies with Two-Digit Codes (TAU99F)

Program Function   This program is the TAU99 program, expanded to handle
four local filters per table.

Source of Program   The Statistical Research System (SRS) based on OSIRIS II
which was developed at the Institute for Social Research at the University
of Michigan.   Further revision and extension was carried out by HSRI.

Input and Output Features and Requirements   Input is either batch or inter-
active mode for control information and SR standard data sets for data set
information.

Computational Language   Fortran IV

Operational Status   Written for operation under MTS on the IBM 360/67.
Extensive revision would be required to operate under 360 or 370 OS.

Past and Potential Application   Used in SR system to obtain bivariate
frequency table.

Documentation   Wood, D.E., Hafner, C.D.,"The Statistical Research System,"
July 1, 1971, Highway Safety Research Institute.

Program Title PE410 File Correction (TCOR)

Program Function A tape correction program which provides for correction, deletion, or listing of a data case.

Source of Program The Statistical Research System (SRS) based on OSIRIS II which was developed at the Institute for Social Research at the University of Michigan. Further revision and extension was carried out by HSRI.

Input and Output Features and Requirements Input is either batch or interactive mode for control information and SR standard data sets for data set information. Output is corrected standard SR data set. Data cases that were specified to be printed are listed, optionally corrected, and deleted cases are printed.

Computational Language Fortran IV

Operational Status Written for operation under MTS on the IBM 360/67. Extensive revision would be required to operate under 360 or 370 OS.

Past and Potential Applications Used in SR System to correct cases in data sets existing on tape.

Documentation Wood, D.E., Hafner, C.D.,"The Statistical Research System," July 1, 1971, Highway Safety Research Institute.

Program Title   PC220 Tape to Cards or Tape (TCOT)

Program Function   The program produces an ordinary data deck or card image
file on tape from a standard SR dictionary and data file.

Source of Program   The Statistical Research System (SRS) based on OSIRIS II
which was developed at the Institute for Social Research at the University
of Michigan.   Further revision and extension was carried out by HSRI.

Input and Output Features and Requirements   Input is either batch or inter-
active mode for control information and SR standard data sets for data set
information.   The output is a card deck or a card image line file or
a card image tape.   Restrictions: The total number of output variables may
not exceed 2000.   The maximum number of output card images/case is 45.

Computational Language   Fortran IV.

Operational Status   Written for operation under MTS on the IBM 360/67.
Extensive revision would be required to operate under 360 or 370 OS.

Past and Potential Applications   Used in the SR System to convert
a data set on tape into card images.

Documentation   Wood, D.E., Hafner, C.D.,"The Statistical Research System,"
July 1, 1971, Highway Safety Research Institute.

Data Set Title Texas Data Files (TEXAS)

Data Set Function SR Data Files for Accidents and Vehicles

Data File Summary Data for the San Antonio and entire Bexar County, Texas
area have been built into Level I accident and vehicle files. The data were
obtained from the Texas Department of Public Safety. Since Bexar County
parallels Oakland County, Michigan in size and composition, the file offers
comparative analysis opportunities.

Operational Status Usable only in conjunction with the SR System, SPAD,
and ADAAS.

Past and Potential Applications Used in statistical research into accident
causation and related topics.

Documentation SPAD newsletters publish current additions and corrections
to maintained data sets. Contact James O'Day, HSRI, 764-0248.

Program Title Tire Shear Force Models (TIRESHEAR)

Program Function A collection of several tire shear force model programs produced for purpose of studying the merits of the individual models.

Source of Program Developed under the direction of T. Tielking. Sponsored by MVMA.

Input and Output Features and Requirements Input is model parameters and tire operating conditions. Output is printout of tire traction forces and moments.

Computational Language Fortran IV, Analog and Hybrid

Operational Status Written for the PDP11/45, AD/FØUR, and interface. Easily convertible to similar systems. Available from T. Tielking.

Past and Potential Applications Used in evaluating several models of tire shear force. Used in computing tire shear forces.

Documentation Pacejka, H.B., Mital, N.K.,"A Hybrid Computer Model of Tire Shear Force Generation,"August, 1972, Interim Document 3, Tire Traction Characteristics Affecting Vehicle Performance, HSRI.
Tielking, J.T., Mital, N.K., June 1973, Interim Document 6, Tire Traction Characteristics Affecting Vehicle Performance, HSRI.

Program Title   PA000 Label Magnetic Tape (TLAB)

Program Function   This program puts a standard IBM 80-character volume
label on a magnetic tape.

Source of Program   The Statistical Research System (SRS) based on CSIRIS II
which was developed at the Institute for Social Research at the University
of Michigan. Further revision and extension was carried out by HSRI.

Input and Output Features and Requirements   This program requires the magnetic
tape to be previously mounted and accepts label information in either batch
or interactive mode.

Computational Language   Fortran IV.

Operational Status   Written for operation under MTS on the IBM 360/67.
Extensive revision would be required to operate under 360 or 370 OS.

Past and Potent·al Applications   Prepares a tape for standard label handling.

Documentation   Wood, D.E., Hafner, C.D.,"The Statistical Research System,"
July 1, 1971, Highway Safety Research Institute.

Program Title Torso Mobility Prediction Model (TORMOB)

Program Function A set of programs developed to aid in determining the link system of the human torso from photometric, x-ray, and measured data.

Source of Program Developed under the direction of Snyder, Chaffin, and Schutz. Sponsored by Aerospace Medical Research Laboratory.

Input and Output Features and Requirements Input is digitized measurements from photometric, x-ray, and direct measurements. Output is tabulated and plotted surface marker locations and nasion positions.

Computational Language Fortran IV.

Operational Status Developed for the IBM1800. Available from Chaffin.

Past and Potential Applications Used to determine quantities not directly measureable.

Documentation Snyder, R.G., Chaffin, D.B., Schutz, R.K.,"Link System of the Human Torso," August 1972, Report No. AMRL-TR-71-88, Aerospace Medical Research Laboratory
Chaffin, D.B., Schutz, R.K., Snyder, R.G.,"A Prediction Model of Human Volitional Mobility," January, 1972, SAE Paper No. 720002.

Program Title Tracking Task Display (TRACKDIS)

Program Function A set of programs to generate tracking task displays
of various difficulties and make certain measurements on subject performance.

Source of Program Developed under direction of Fancher and MacAdam.

Input and Output Features And Requirements Input is tracking control
signals from steering wheel together with prescribed tracking design and
movement. Output is track task display together with responses of subject
signals and subject performance measurements.

Computational Language Analog

Operational Status Use has been discontinued. Kept as a source of techniques
for a future similar problem.

Past and Potential Applications Used as the hardware and software basis
of an Engineering Radiology Lab experiment.

Documentation No published reports.

Program Title   Tractor-Trailer Model (TRACTLER)

Program Function   Computes the directional dynamics of a tractor-semitrailer vehicle including longitudinal, lateral, and yawing motions of a three-axle tractor-semitrailer on a flat road surface.

Source of Program   Developed as a part of the research project for Ph.D. thesis by Leucht.   Sponsored by MVMA.

Input and Output Features and Requirements   Interactive input for truck parameters, etc.   Output is controlled printout of selected topics.

Computational Language   Fortran IV.

Operational Status   Written for analog and hybrid system consisting of IBM 1130, AD/FOUR, and interface.   Rewritten in Fortran IV for the IBM 360/67.   Compatible with other systems.   Available from J. Bernard.

Past and Potential Applications   A simple model used to demonstrate the influence of design parameters, operating conditions, and environment on the directional behavior of a vehicle.

Documentation   Leucht, P. M., "Directional Dynamics of the Tractor-Semitrailer Vehicle," 1970, Ph.D. Thesis, University of Michigan.

"Tractor -Trailer Braking and Handling Performance Program," HSRI Internal Report.

Program Title Braking Performance for Trucks (TRUCKBRAKE)

Program Function Simulation of dynamic performance of articulated vehicles moving straight ahead with careful analyses of tandem axle dynamics, tire shear force, and brake system operation.

Source of Program Developed under the direction of Fancher, Winkler, and Bernard. Sponsored by MVMA.

Input and Output Features and Requirements Input is truck description, brake tables and initial conditions. Output is computed truck kinematics.

Computational Language Fortran IV.

Operational Status Written for the IBM 360/67. Easily adaptable to other Fortran systems.

Past and Potential Applications Applied to vehicle design studies for safer trucks and articulated vehicles.

Documentation 1. Fancher, P.S., Winkler, C. B., Bernard, J. E., "Braking Performance for trucks and articulated vehicles," in Hit Lab Reports, Vol. 3, number 5, January, 1973, HSRI.
　　　2. Murphy, R. W., Bernard, J. E., Winkler, C. B., "A Computer Based Mathematical Method for Predicting the Braking Performance of Trucks and Tractor-Trailers," Sept. 15, 1972, HSRI Report.

Program Title   Modified Braking Performance for Trucks (TRUCKBRAK2)

Program Function   Major revision of TRUCKBRAKE including straight line acceleration and braking, anti-locking, and new suspensions.

Source of Program   Developed under the direction of Fancher, Winkler, and Bernard.   Sponsored by MVMA.

Input and Output Features and Requirements   Input is truck description, brake tables, and initial conditions.   Output is computed truck kinematics.

Computational Language   Fortran IV.

Operational Status   Written for the IBM 360/67.   Easily adaptable to other Fortran systems.

Past and Potential Applications   Applied to vehicle design studies for safer trucks and articulated vehicles.

Documentation   Report will be issued in June, 1974.

Program Title   Prediction of Center of Gravity Location and Moments of Inertia for Trucks and Trailers (TRUCKCG)

Program Function   Computes location of center of gravity and moments of inertia from basic frames plus one or more add-ons.

Source of Program   Produced under direction of Fancher, Winkler, and Bernard. Sponsored by MVMA.

Input and Output Features and Requirements   Input is interactive and covers descriptions and masses of frame and add-ons.

Computational Language   Fortran IV.

Operational Status   Written for IBM 360/67. Easily adaptable to other Fortran systems.

Past and Potential Applications   Used to generate input data for computer truck models.

Documentation   Bernard, J., Starr, D., Gupta, R., "Programs for Estimating Inertial Properties of Trucks and Trailers," August 9, 1973, HSRI Report.

Program Title Directional Response of Trucks (TRUCKDIRT)

Program Function TRUCKBRAKE for turning trucks and articulated vehicles.

Source of Program Produced under the direction of Fancher, Winkler, and
Bernard. Sponsored by MVMA.

Input and Output Features and Requirements Input is truck description,
brake tables, and initial conditions. Output is computed truck kinematics.

Computational Language Fortran IV.

Operational Status Written for the IBM 360/67. Easily converted to other
Fortran systems.

Past and Potential Applications Applied to vehicle design studies for safer
trucks and articulated vehicles.

Documentation Bernard, J. E., Winkler, C. B., Fancher, P. S., "A Computer
Based Mathematical Method for Predicting the Directional Response of Trucks
and Tractor-Trailers," June 1, 1973, Report No. UM-HSRI-PF-73-1.

Program Title Braking Performance of the Four Axle Unit Truck (TRUCK4)

Program Function Similar to TRUCKBRAKE but adapted to the four axle unit truck.

Source of Program Developed under direction of Fancher and Bernard. Sponsored by Caterpillar.

Input and Output Features and Requirements Input is truck description, truck properties, and brake properties. Output is computed kinematics.

Computational Language Fortran IV

Operational Status Written for the IBM 360/67. Easily convertible to other Fortran systems. Available from J. Bernard.

Past and Potential Applications Used to study braking characteristics of earth-moving equipment.

Documentation Nc published reports.

<u>Program Title</u> PE420 File Updating (UDAT)

<u>Program Function</u> A data management program with which complete data records can be added to and/or deleted from a standard SR data set.

<u>Source of Program</u> The Statistical Research System (SRS) based on OSIRIS II which was developed at the Institute for Social Research at the University of Michigan. Further revision and extension was carried out by HSRI.

<u>Input and Output Features and Requirements</u> Input is either batch or interactive mode for control information and SR standard data sets for data set information. Output is an updated standard SR data file and, if records were deleted, a standard SR file containing all the deleted records. Restrictions: The dictionary of the "add file" must be identical to that on the input file and the data records of the "add file" must be in the same sort order as the input data file.

<u>Computational Language</u> Fortran IV.

<u>Operational Status</u> Written for operation under MTS on the IBM 360/67. Extensive revision would be required to operate under 360 or 370 OS.

<u>Past and Potential Applications</u> Used in SR System for updating whole records in a standard SR file.

<u>Documentation</u> Wood, D.E., Hafner, C.D., "The Statistical Research System," July 1, 1971, Highway Safety Research Institute

Data Set Title   Washtenaw Data Files (WASHTENAW)

Data Set Function   SRS data files for accidents and drivers.

Data File Summary   Data obtained from the Ann Arbor City Police Department,
Washtenaw County Sheriff's Office, and the Michigan State Police has been
built into a Level I accident file.   The file is especially useful for file
interrogations of a broad area representing urban, rural, academic, and
industrial populations.

The Michigan Secretary of State authorities have furnished driver
record data for Washtenaw County, which have been built into a driver file.

Operational Status   Usable only in conjunction with the SR system, SPAD,
and ADAAS.

Past and Potential Applications   Used for statistical research into accident
causation and related topics.

Documentation   SPAD newsletters publish current additions and corrections to
maintained files.   Contact James O'Day, HSRI, 764-0248.

Program Title   PD310 Wild Code Check (WCC)

Program Function   A wild code check program which checks variables in a standard SR data set to see that they have valid codes. The user specifies which variables are to be checked. For each variable he may specify the valid or the invalid codes.

Source of Program   The Statistical Research System (SRS) based on OSIRIS II which was developed at the Institute for Social Research at the University of Michigan. Further revision and extension was carried out by HSRI.

Input and Output Features and Requirements   Input is either batch or interactive mode for control information and SR standard data sets for data set information. Input is a standard SR data set, output is a printout documenting errors found. Restrictions: The maximum number of variables which may be checked on one pass of the data is 1000.

Computational Language   Fortran IV.

Operational Status   Written for operation under MTS in the IBM 360/67. Extensive revision would be required to operate under 360 or 370 OS.

Past and Potential Applications   Used in SR system to find illegal code values.

Documentation   Wood, D.E., Hafner, C.D., "The Statistical Research System," July 1, 1971, Highway Safety Research Institute.

Program Title   Impedance Reduction of a Mechanical Network   (ZMECH)

Program Function   Computes equivalent impedance of a general mechanical
network.

Source of Program   Developed as part of the research project for Ph.D.
Thesis by Alem.

Input and Output Features and Requirements   Input is a description of the
network. Output is printout of mechanical impedance versus frequencies and
optional plots.

Computational Language   Fortran IV.

Operational Status   Written for the IBM 360/67. Easily convertible into
any Fortran system with the exception of the plotting section. Available from
N. Alem.

Past and Potential Applications   Used to compare experimental impedance
to that of a simple mechanical model. Used to reduce the impedance of a
complex network.

Documentation   Alem, N. M., "A Discrete-Parameter Head Injury Model," 1973,
Ph.D. Thesis, University of Michigan.

Program Title Three-Dimensional Matrix Data Plotter. (3DPLOTTER)

Program Function The 3D Plotter program produces a Cal-Comp generated graph showing a 3-D representation of n x m dimensioned matrix data.

Source of Program Developed under the direction of Green. Sponsored by MVMA.

Input and Output Features and Requirements The program is conversational in nature and all input and output is specified by the user during program operation. The Cal-Comp plots are produced by the MTS Cal-Comp plotter located at the Computing Center.

Computational Language Fortran IV.

Operational Status Written for IBM 360/67 MTS. Convertible to other systems only with much difficulty. Available from J. Green.

Past and Potential Applications Used to plot a wide variety of input data in an appealing format.

Documentation Documentation is available from J.A. Green, Rm. 232, HSRI, 764-0248.