MOTOR VEHICLE ATTRIBUTES

STATUS REPORT

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Approved by: 

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Motor Vehicle Attributes Status Report

ADDENDUM

TSC is continuing the refinement of the vehicle attributes data bases, which were described in the October 1983 "Motor Vehicle Attributes Status Report". The first step of this process has been completed, by inserting a common code into each of the data bases.

This common code designates the manufacturer and model names for each vehicle, using the same numbering system that was developed in the "Engineering Model of Future Motor Vehicles - Final Report". The report was the result of a study conducted by Volkswagen for NHTSA under contract DOT HS-5-01273.

The common code consists of a numerical manufacturer code (MCODE) from 1 to 56, representing 56 domestic and foreign vehicle manufacturers, and a model code (MODCODE) from 1 to N for each vehicle model within that manufacturer's product line. For example, an American Motors Ambassador is identified in each data base as MCODE=1 and MODCODE=6. The Toyota Corolla 1200 is consistantly labeled MCODE=56 and MODCODE=6.

The Volkswagen contract was completed in 1976. Therefore, TSC has identified all vehicles introduced by the various manufacturers since the publication of the final VW report and assigned vehicle model codes to each consistant with the pre-1976 vehicle designations.

The common code will facilitate user mobility between the data bases. A complete list of the common codes can be obtained from the NIH file DSNAME = NEWCODES on FILE35.

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APPENDICES

1.0 Summary

The Transportation Systems Center (TSC) was requested by the National Highway Traffic Safety Administration's (NHTSA) Office of Vehicle Research to compile and computerize a data base of vehicle safety attributes for automobiles, trucks and motorcycles. The data base was developed as a source of vehicle specifications and dimensions for research in the areas of Crash Avoidance and Crashworthiness.

As a result of this effort, a series of data bases has been developed by TSC. The data bases include information from manufacturers and other sources on automobiles, trucks and their respective engines. TSC also developed a data base of automobile interior and exterior dimensions collected through a program of direct measurement of several automobiles.

Three existing data bases were obtained from within the industry during the course of this study, which were developed and computerized by General Motors, Volkswagen and the Society of Automotive Engineers. TSC transferred these three along with the above mentioned TSC data bases onto the National Institutes of Health's (NIH) computer system in Statistical Analysis Systems (SAS) data sets for NHTSA/TSC research use. NHTSA collected vehicle attribute information for two additional data bases, which TSC also stored on the NIH computer.

TSC's current emphasis has been placed on consolidating redundant information across the data sets to create a concise data base of vehicle attributes. Concurrent with this effort, TSC is determining future vehicle data requirements and identifying characteristics that will be obtained to supplement the existing data.

The information within the data base will aid NHTSA and TSC researchers in relating vehicle characteristics to injuries and fatalities by providing data input for computer modeling and the formulation of accident-avoidance concepts. The vehicle safety attributes data base must be up-dated and fine-tuned on a continuing basis to reflect changing trends in the vehicle population.

2.0 Introduction

2.1 Background

TSC was requested by NHTSA to assemble a computerized data base of vehicle safety attributes. These attributes include relevant dimensions and specifications for automobiles, trucks and motorcycles. The sources for these attributes include published technical literature, manufacturers data, trade journals and, when required, direct measurement of selected vehicles. The information from these sources may exist in either hard-copy or computer files. The data base for automobiles was started late in FY'82 and is continuing. Sources of information were identified, data has been collected and computer entry is underway. Truck data sources and required attributes have been defined and data collection has started. Some sources for motorcycle data have been identified and relevant attributes from these sources examined for possible inclusion in the data base if NHTSA requires such action.

2.2 Objectives

The vehicle attributes data base will provide to researchers in NHTSA's Office of Vehicle Research's Crash Avoidance and Crashworthiness Divisions a source of information on vehicle specifications and dimensions. Such information is needed to relate vehicle characteristics to injuries and fatalities, as input data to computer models, and to formulate accident-avoidance concepts.

The following pages will document the existing data bases that have been developed and those that are in the process of being developed, as well as the development of future requirements for this effort. The documentation

includes a descriptive explanation of the data bases and lists their contents. The vehicle model years covered by each data base are given in Table 1. The specific contents of each data base and the information required by a user to access the data are found in the Appendices.

An important aspect of this report is to delineate the future requirements in this effort. We recognize that the users of these data bases are diverse in their needs and requirements. With this in mind, a data survey is being undertaken to determine future requirements.

2.3 Approach

The approach that was adapted for this effort was evolutionary. After an initial list of automobile safety attributes (see Appendix H) was established as a basic foundation, the list was supplemented by other related data as it became available or as the needs of other researchers became evident. The results of this effort to date have been a series of separate data bases (Appendix C through Appendix L), some of which contain redundant information and where recognized data gaps exist. The on-going effort is focused on consolidating the redundant information and making the data bases more useful through merging the data. Data gaps are also being identified and eliminated. Simultaneous with this effort, we are determining future requirements of vehicle safety information and defining characteristics that will be added to the data base (Section 4).

Table 1

PRESENTLY AVAILABLE AUTOMOTIVE DATA BASES

Data Base	DSNAME	VOL	Years Covered	Number of Vehicles	Contents
Make/Model Codes	NEWCODES	FILE35		All vehicles listed in data bases	Common identifying make/model codes
General Motors	GMSPCS	FILE09	75-83 84*	All GM Cars	150 interior and exterior dimensions
NHTSA Interior Restraint	INTERIOR	FILE09	78	U.S. passenger cars (foreign and domestic)	156 interior and restraint system dimensions
Volkswagen			65-75	U.S passenger cars (foreign and domestic)	
	VWATTS	FILE09		4000	104 descriptive vehicle and dimensional data points
	VWWGT	FILE09		32	63 weight break-down variables
	GEOMETRY	FILE09		48	93 interior geometry measurements
NHTSA Crash Pulse			75-84	Representative Automobiles	Dynamic crash test results
	SEG1	FILE09			
	SEG2	FILE09			
	SEG3	FILE09			
	SEG4	FILE09			
	SEG5	FILE09			
TSC Safety				150 per year domestic/foreign	72 interior and exterior dimensions
	VEH75	FILE09	75		
	VEH79	FILE09	79		
	VEH80	FILE09	80		
TSC Measurement	HH	FILE09	75-83	150 domestic and foreign	49 interior and equipment dimensions

*Machine-readable data, not presently in a SAS data set.

3.0 Data Base Development

3.1 Automobile Data Sources

A number of sources have been utilized in the process of constructing the automobile vehicle data base. Data from the following sources have been included: manufacturer-supplied information on their vehicles' dimensions and capacities; NHTSA crash test results and passsenger restraint information; measurement data gathered by TSC; MVMA Specifications; and a historical data base of vehicular information for makes and models of all manufacturers that was compiled by Volkswagen. In addition, the R.L. Polk National Vehicle Population Profile has been utilized to obtain counts of vehicle registrations.

3.1.1 Polk National Vehicle Population Profile

The Polk National Vehicle Population Profile (NVPP) is a census of official state vehicle registration records. The NVPP is prepared from two primary elements: Vehicle Identification Number (VIN) and the registrant's address. The vehicle is identified in separate Polk data bases as a passenger car or truck, by: make, model year, series, body style and engine size. Vehicle manufacturer's specifications are used to decipher the items contained within the VIN.

Each year, the R.L. Polk Company obtains calendar year totals of registrations by vehicle make and model from all states, except Oklahoma. The Polk data is grouped into four modules: domestic automobiles, imported automobiles, light trucks, and medium/heavy trucks. The data is available at the national, state and county levels. TSC examined data on the national level only.

The Polk automobile data files contain the following characteristics: registered vehicle counts, manufacturer, series, body style, number of cylinders, displacement (inches for domestics, centimeters for imports), engine code, carburetion, fuel type, curb weight, wheelbase, and standard tire size. The Polk information also indicates whether the vehicle has front wheel drive or a transversely mounted engine.

3.1.2 MVMA Forms

The automobile data contained in the Motor Vehicle Manufacturers Association (MVMA) Specifications Forms is probably the most thorough and up-to-date automobile data source available. MVMA oversees the development, collection, and compilation of the passenger car specification forms which are completed by both domestic and foreign automobile manufacturers.

MVMA data forms contain engine, vehicle emission, electrical, drive unit, brake, steering, suspension, convenience equipment, weight, and car and body information. This or similiar data has been collected from as early as 1950; however, complete and readily accessible data is only available from 1975 to the present.

For imported cars, the Automobile Importers of America collects the MVMA specifications. For 1975 to 1980, the data compiled on foreign cars was not complete. More recent years (1980, 1981, 1982 and 1983) represent more dependable data in terms of the number of vehicles and the MVMA attributes.

In general, the MVMA data is broken down by year, manufacturer, and car line. A sample specification form is provided in Appendix A for a 1980 Chrysler Plymouth Horizon. This and similar MVMA specification forms were used as the major source of data for the TSC data base, which is described in Section 3.1.7.

3.1.2.1 SAE and MVMA References

References for most of the specifications in the MVMA forms can be found in the Society of Automotive Engineer's (SAE) Handbook. The MVMA Specifications Forms also contain their own Key Sheets and definitions describing the exterior car and body dimensions given in their data. The SAE Handbook contains a collection of SAE standards, recommended practices, and information reports. For instance, detailed definitions and descriptions of the car and body data in MVMA are given in the "Motor Vehicle Dimensions (SAE Recommended Practice J1100)". SAE J1100 is provided in Appendix B. SAE also publishes other automotive reports of interest such as "Motor Vehicle Seating Systems (SAE Recommended Practice J879b)".

3.1.3 Manufacturer Sources

Some manufacturers produce supplements to the MVMA specifications. In all cases, these supplements are a detailed extension of the MVMA specifications. The attributes in these detailed specifications are clearly defined in SAE J1100.

3.1.3.1 General Motors

General Motors (GM) has produced the most complete set of detailed supplements. GM supplements range from 1975 through the present including all of their model year cars within this period. Each contains 151 interior and exterior dimensions. GM has transformed this data into a computerized data base. TSC has entered this data base at the National Institutue of Health (NIH) computer in a Statistical Analysis System (SAS) data set. In this form it can be manipulated and used in statistical analysis. The car attribute contents of this SAS data set are in Appendix C.

3.1.3.2 Other Sources

No other manufacturer has developed annual detailed supplements as complete as GM's. Ford has produced MVMA supplements of car and body dimensions for 1975 through 1980 model passenger cars. In addition, Ford has developed a data base of 42 attributes and specifications for 1978 through 1984 vehicles. The interior and exterior dimensions and other specifications of the Ford data base are listed in Appendix D. The data exists in machine-readible form on a magnetic tape.

Chrysler has MVMA supplements for 1979 to 1983 model year cars. This data is in machine-readable form, and TSC has requested a copy of the data base from the manufacturer.

American Motors Corporation (AMC) developed an MVMA Specification Form Supplement for its 1981 model year cars. This

data exists only in hardcopy form.

3.1.4 NHTSA Enforcement Data

In 1977, the National Highway Traffic Safety Administration (NHTSA) requested that all domestic and foreign automobile manufacturers provide certain dimensional data from the front occupant compartment of their 1978 passenger cars. The resulting response was extensive. GM, Ford, Chrysler and AMC provided at least a representative sampling of their 1978 models. Most major foreign manufacturers also responded with significant data.

The interior data is also entered on the NIH computer in a SAS data base. Interior attributes in this data are listed in Appendix E, along with a geometrical reference for the data.

3.1.5 Volkswagen Data

Another automobile data source is the Engineering Model of Future Motor Vehicles performed by Volkswagen (VW) Research Division under contract to NHTSA. The data base was completed in 1976 and contains information on most domestic passenger cars dating back to 1965. The data consists of design, performance, and other pertinent variables affecting safety. These attributes are divided up into five separate categories: descriptive vehicle data, dimensional (geometric) data, weight break-down data, safety attributes, and miscellaneous data.

Three of the five categories: descriptive vehicle data, dimensional data and weight data; exist as separate computer files in a SAS data set.

The descriptive vehicle data makes up the majority of the VW data base, with 104 attributes for approximately 4000 vehicle models. The geometric data set consists of 93 variables for 48 models, and the weight break-down data was collected for 63 aspects of 32 vehicles. Documentation and definitions do exist in VW's Final Report for all five categories. Appendix F contains the variable contents of the three files of the VW data base. This information has also been entered by TSC into the NIH computer in a SAS format.

3.1.6. Crash Data

Crashworthiness data exists as a result of dynamic crash testing performed by the Automated Sciences Group for NHTSA. For each test crash, the following test specification data was collected: general test information, vehicle information, barrier or rollover information, occupant information, and instrumentation information. The data exists for representative vehicles from model years 1975 to 1984 in a SAS data base on the NIH computer. Appendix G provides a list of the data's variables. Complete documentation and reference material can be found in the "Dynamic Crash Test Information Guide" and "Collision Deformation Classification (SAE Recommended Practice J224a)."

3.1.7 TSC Data

3.1.7.1 TSC Computer Program Development

The TSC effort initially focused on development of a vehicle attributes data base for those 1980, 1975, and 1979 model year vehicles which were most heavily represented in the traffic stream. Specifically, all makes and models with more than 10,000

total registrations were included in the data base. This resulted in approximately 200 models for each model year.

MVMA vehicle specification data was transcribed by hand from hard copy documents onto coding forms for keypunching and computer entry. The R.L. Polk data was loaded into a separate data base, accessed to obtain the specific vehicles with more registrations than 10,000, and a sequential file created. A series of Fortran programs were written on the TSC DEC System-10 to merge the two files and create a resultant file, which has the MVMA attributes appended to the Polk data records. Sample listings for the data were designed and used to correct data entry errors. Ultimately, the data was transferred to NIH for SAS retrieval. The data elements on the final file are listed in Appendix H.

3.1.7.2. TSC Measurement Program

TSC has developed a data base of interior dimensions and vehicle equipment through direct measurement of 120 automobiles. The data already collected has been stored in SAS (see Appendix I). Similar data on additional vehicles will be gathered in the future.

3.1.7.3. TSC Automobile Engine Data

In order to establish an automotive engine data base, TSC has performed an initial investigation into automotive engine data. TSC has selected 22 available attributes which could have safety

implications. These attributes will serve as a basis for the engine data base. These attributes are shown in Appendix J. The data will cover foreign and domestic engines from 1975 to present.

3.1.8. Trade Journals and Reference Books

Several other automobile data sources exist in hardcopy form. There are several trade journals that contain passenger car information. The April issue of Automotive Industries is annually the "Engineering Specifications and Statistical Issue". It contains engine and selected body data for domestic and foreign cars. Automotive News publishes selected MVMA specifications. Automotive Fleet gives data on certain car specifications (like MVMA) and Environmental Protection Agency (EPA) ratings. Also, Commercial Car Journal contains selected body dimensions and EPA ratings. Finally, World Cars is a reference book that provides annual general specifications for all domestic and foreign cars available in a given year.

3.2 Truck Data Sources

The development of a data base of truck safety attributes began with a literature search, which provided potential sources of data such as: the Polk National Vehicle Population Profile (NVPP), the Gasoline and Diesel Truck Index digests, several manufacturers' data manuals and annual specification issues of Pickup, Van & 4WD, Commercial Car Journal, Fleet Owner, and International Automotive Industries.

These four trade journals contain specifications for truck models equipped with standard features. The data listed in each magazine was found to be

included in both the Truck Index digests and manufacturer's data books.

The literature search also indicated several SAE and MVMA reports on anthropometric studies of truck and bus drivers as sources of data on cab interior layout and design.

A separate data base is being developed for truck engines. The data will be extracted from the Truck Index digests and the Polk NVPP.

3.2.1. Polk National Vehicle Population Profile

As described in Section 3.1.1, the Polk National Vehicle Population Profile is a census of official state vehicle registration records. The Polk data is divided into four volumes: domestic cars, imported cars, light trucks and medium/heavy trucks.

Within the Polk modules, medium/heavy trucks are further identified by gross vehicle weight, wheels by wheels driving, cab configuration and diesel engine manufacturer. The light truck volume more closely resembles the Polk automobile modules. For all trucks, the address of the registrant is used for geographic coding by state and county. The number of vehicles in operation as of the most current (1981) edition of Polk is given for each truck model.

The Polk data will play a major role in the development of the truck safety attributes data base. The Polk data for light and medium/heavy trucks is being sorted and listed by decreasing vehicle registration count and cumulative percentage of the vehicle population. This will

serve as a guide in the determination of a cut-off point that will include the majority of the current fleet.

Each of the truck characteristics listed above will be transferred directly from the Polk computer tapes to serve as the first 20 attributes of the data base.

The Polk data is also being sorted by truck engine, which will provide engine information and cut-off points for the Truck Engine data base, as described in Section 3.2.5.

3.2.2 Truck Index

Truck Index, Inc. of Anaheim, CA publishes a yearly digest of current model highway-rated trucks and tractors. The digest is divided into two publications, one each dedicated to gasoline and diesel engine-driven vehicles. Each year Truck Index covers the leading manufacturers for gasoline and diesel trucks, providing specifications for each model in a manufacturer's production line. Specifications include: gross vehicle and gross curb weight ratings; engines; chassis diagrams and dimensions; chassis weights and weight distributions; frames; transmissions; clutches; axles and capacities; suspensions; steering, electrical, and cooling systems; drive lines; wheels, rims, and tires; body materials; and window glass areas. Component information is listed for standard and optional equipment. The complete list of truck attributes from Polk and the Truck Index that will be entered into a data base is shown in Appendix K.

The Truck Index digests will be used in extracting the bulk of the information for the data base. An extensive search has located the Gasoline Truck Index for 1975 through 1983, and Diesel Truck Index for 1977 through 1983. A wide range of manufacturers, government offices and industry members have been contacted to secure the 1975 and 1976 Diesel books, but neither have been located. Additional contacts are being made to obtain these remaining books.

The Truck Index exists only in hard copy and must be transferred to machine readable form. Several options are being considered for this transformation, including an optical character reader, coding and keypunching, word processing, and direct input onto a personal computer. Each method is being weighed as to costs incurred and the time frame to completion. An example from the Truck Index for one truck model is shown in Appendix L.

3.2.3. Manufacturers' Data Manuals

Manufacturers' Data Manuals are compiled as an aid to dealership sales representatives in their analysis of proper truck specification and selection. The manuals list capacities, dimensions, and standard and optional equipment for each model. There is also detailed information on axles, suspensions, steering systems, brakes, cab bodies, electrical systems, engines, cooling systems, frames, transmissions, drivelines, wheels and tires. Some manuals provide a chapter on truck selection and performance criteria.

Several data manuals have been found in the libraries of TSC, NHTSA,

SAE and others. However, manuals for each of the major manufacturers could not be compiled for the time period of 1975 to present.

3.2.4. Interior Dimensions and Anthropometric Data

Four sources of data on interior dimensions were found through the literature search. The first three are reports published by the Federal Highway Administration's Bureau of Motor Carrier Safety (FHWA/BMCS) and the Society of Automotive Engineers (SAE). The last source located was developed through an SAE study and is recorded in machine readable form.

The first report, "A Nationwide Survey of Truck and Bus Drivers," was published in two volumes by the FHWA in March 1977. Volume I describes the results of a survey of nearly 4000 truck and bus drivers, which collected biographical data, vehicle data, and information on the nature of their employment and their hours of service. Volume II details a program in which a mobile lab was constructed to collect data on static and dynamic anthropometry, reach envelope, sleep envelope and force production to steering wheel and brake/clutch pedals on truck and bus drivers.

The second FHWA report, published in February 1980, is entitled "Interior Cab Dimensions of Heavy Duty Motor Vehicles." The report describes a survey of truck manufacturers' cab design practices. This survey responded to complaints that restrictions in overall vehicle length have decreased interior cab dimensions to a point where drivers

cannot properly manipulate the controls and safely operate the vehicle, or that the lack of space induces fatigue. The study indicated that available data on anthropometric dimensions is outdated, and the variation in such data now covers a wider range with the increase of female drivers in the trucking population.

A report published in January 1983 by SAE, "U.S. Truck Driver Anthropometric and Truck Work Space Data Survey" reported anthropometric, demographic and interior cab design data on a nationwide sample of male and female heavy-duty truck drivers. In addition to standard anthropometric measurement apparatus, a specially designed cab buck was constructed for the project, with a seat and steering wheel that could be uniquely adjusted to accomodate the driver population.

In developing the cab buck, ten truck manufacturers were asked to provide ranges of interior dimensions for their model lines (see Appendix M). This data was digitized by SAE, and a copy of the tape secured by TSC. TSC has suggested that the interior dimension ranges either be added to the list of Truck Safety Attributes, or entered into the NIH computer in a separate file.

3.2.5. Truck Engine Data

A separate data base containing 15 identifying attributes is being established for truck engines, as shown in Appendix N. The engine models to be included in the data base will be determined from the Polk National Vehicle Population Profile (NVPP), which is being sorted as per

engine, engine population count, percent of the total fleet population and cumulative percent to determine data input cut-off points.

Engine data will be obtained from the 1981 Polk data, and the Gasoline and Diesel Truck Index digests. The Polk NVPP contains six of the 15 attributes that are being collected on truck engines. The remainder, which include physical properties such as dimensions and weight, will be extracted from the Truck Index. If there are gaps in the information, the data base will be supplemented from trade journals, manufacturers' data books, and additional sources as required. Data has been extracted for a sample truck engine, a Detroit Diesel Model 4-53N, as listed in Appendix L.

3.3 Motorcycle Data Sources

Data sources for motorcycles and the attributes associated with these sources have been identified. The sources include Polk registrations, trade journals, and motorcycle magazines. Establishment of a motorcycle data base utilizing these attributes is being delayed until NHTSA's needs are clarified. However, the sources and their related characteristics are included here for completeness. Polk registration data at the state level on motorcycles is available only by special order at a cost of approximately $30,000. As summaries of this data are available from other sources (see below) and the needs of NHTSA were not fully established in regard to motorcycles, it was determined that Polk data would not be acquired at this time.

Data on motorcycles is available from the manufacturers. An example of

this data is included in Appendix O, from U.S. Suzuki's Press Kit. It includes specifications and photographs of each model.

The Motorcycle Industry Council, Inc. (MIC) each year publishes Motorcycle Statistical Annual. This publication includes information on the motorcycle market, manufacturers and distributors, usage, and the owner. Polk registration data on a state-by-state basis is summarized in the MIC publication. An example of the registration data taken from the 1981 Motorcycle Statistical Annual, which uses FHWA information, is also given in the Appendix.

Another source of data are the motorcycle enthusiast's magazines such as Cycle World. These magazines publish both technical and performance specifications. An example of these specifications is given in Appendix 0, along with a list of attributes that would be available for motorcycles from the various identified data sources that were described above.

4.0 Future Requirements

The vehicle attributes data base was created to provide NHTSA and TSC with a source of vehicle specifications and dimensional data. To ensure that the outcome of this effort reflects the requirements of ongoing and planned NHTSA/TSC research, a survey will be conducted of potential users of the automotive, truck and engine data bases. The survey will be distributed to NHTSA and TSC personnel technically involved in programs addressing crash avoidance and crashworthiness. Their input will be solicited on research requirements for various categories of data. The survey form is contained in Appendix P.

Simultaneous with the survey, the files that comprise each of the data bases described in Section 3 will be merged to eliminate any repetitive attributes between the data bases. Gaps that may exist in the data will also be identified and eliminated. This will make the data base more concise and will facilitate user access.

The data base should be continually maintained and expanded as new vehicle models are introduced into the marketplace. This will ensure that the data base will provide a consistant and up to date source of vehicle dimensions and specifications for current and future vehicle crash avoidance and crashworthiness research.