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Archival Database Specifications for the SHRP Asphalt Research Program

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Abstract

This report contains information about the development of text and data files for the SHRP Asphalt Research Program database. All files developed by the Asphalt Research Program Contractors must follow the format set forth in this document.

Executive Summary

The Archival Database was developed for the SHRP Asphalt Research Program to serve as a historical record of data developed by the Asphalt Research Program Contractors. It contains two types of files: text files and data files. Text files contain details of each experiment, its objective and scope. Data files include the data generated for each experiment.

This document provides detailed instructions for developing the text and data files. Information regarding the components of each file, width, allowable characters, and the order in which the information should be organized are detailed in this report. This document describes the file format for both text and data files, and outlines the information that must be included in the header of each file. Instructions to generate file numbers and keyword lists for each experiment are also included in this report.

Chapter 1 Overview Of The Archival Database

Introduction

The Archival Database has been designed to serve as the historical record of data that are being generated as part of the SHRP Asphalt Research Program. The Archival Database will contain individual test results, data sufficient to describe the individual test results, and the conditions under which the results were obtained. The raw, unreduced data will be retained by the researchers as part of their laboratory notebook, computer data acquisition files, or plotter output.

The primary purpose of the Archival Database is to provide SHRP researchers with an orderly and well-documented record of the results obtained in the SHRP Asphalt Research Program. When the project is completed, the Archival Database will provide future researchers with a valuable database that can be used for future studies and as a basis for continuing the current Asphalt Research Program.

The Archival Database is organized as a series of ASCII flat files, each of which contains the individual test results from a single experiment.

Overall Data Flow In a typical Asphalt Research Program contract, laboratory or other data will be generated under the control of the individual task managers and researchers in accordance with specified experiment plans. The data will be stored in laboratory notebooks, computer files, plotter output, and other media as appropriate. These records will then be reduced to produce the experimental results (reduced data) that will be entered into the Archival Database files. The archival data files must be developed in accordance with the guidelines outlined in this and other SHRP reports.[2] It is essential that the guidelines are followed carefully and that the data are entered accurately and in accordance with the prescribed format. The assistance of the project statistician or database manager should be sought in developing the archival data files. When additional technical assistance is needed, the Technical Assistance Contractor (TAC) (A-001) statistician assigned to the project should be consulted.

Whenever appropriate, average test results and appropriate measures of uncertainty--computed by statisticians employed by the individual project--will be stored in the Database.[2] Again, if needed, the TAC statistician assigned to the project in question should be consulted for technical direction in the development of the data elements.

Archival Data Defined Data generated as part of the Asphalt Research Program will be used for several purposes:

i. drawing inferences regarding the fundamental behavior of asphalt cement and

hot-mix asphalt

ii. relating the physical and chemical properties of asphalt cement to the properties of hot-mix asphalt concrete

iii. relating the properties of asphalt cement and hot-mix asphalt concrete to field performance

iv. developing a database for use by future researchers

It is important that the data used for these purposes are well documented, readily accessible to others, and sufficient to complete statistical or other analyses of the data. This was a primary consideration in the development of the Archival Database. Because the data will be generated within experiments conducted by a number of different researchers at different institutions, the TAC has decided to organize the archival data into a series of files that are referenced to the individual experiments.

Reduced data in the Archival Database should be sufficient to allow future researchers to use the data in other studies and to expand upon the research conducted in the current Asphalt Research Program. Therefore, it is imperative that the archival data files contain information that adequately identifies the material being tested, the conditions under which the testing was done, and the individual results. The test results

must be reduced in as concise a manner as possible but yet be sufficiently comprehensive so that they can be used reliably by other researchers. In this way the findings of the researchers can be verified by others and can serve as the basis for future analyses and for expanded research studies.

Laboratory results are not the only source of data that will be entered into the Archival Database. When used to generate models or to draw substantive conclusions affecting the direction of the program, historical data selected from the literature, performance data obtained from the field, and hypothetical data used in the development of performance models and specifications (for example, those generated as part of the A-005 contract) must also be entered into the Archival Database. Consequently, when the Asphalt Research Program is completed, the Archival Database will contain all the data used by the researchers to develop and validate the theories and models resulting from the Asphalt Research Program. In this sense, historical and field data used for performance modeling will be treated in the same manner as laboratory data. A text file that describes the study objective and companion data file(s) that contain the data used in the study are mandatory elements for historical and modeling studies contained in the Archival Database.

Data Appropriate For The Archival Database

Researchers are expected to use accepted experimental techniques in recording,

documenting, and maintaining their laboratory data. Quality control for these efforts is the responsibility of the project managers for each project. Laboratory notebooks, computer data acquisition files, or plotter output are the more common means of storing raw laboratory data. In general, raw data contained in such media should not be transcribed verbatim into the Archival Database files.

The definition of raw data that should be excluded from the Archival Database varies from one experiment to another, and what should be included or excluded from the Archival Database files is difficult to specify. Raw data that are inappropriate for the Archival Database may include unreduced data that are not essential to the definition of the material being tested or to the conditions under which the data were obtained. Generally, repeated measures on the same specimen, as well as replicated measurements on new independent samples, should be entered individually. The data should be identified so that repeat measurements on the same specimen can be clearly distinguished from measurements from new, independent samples.

Raw data may also include test results that are used to calculate reduced data. For example, in a creep experiment, load and deflection measurements would probably be considered raw data and would be excluded from the data files; calculated values of stress and strain would be considered reduced data and would be included in the data files. Similarly, the weight of asphalt dissolved in a solvent would be considered raw data and would be excluded; the weight concentration of the asphalt would be

considered reduced data and would be included. There are, however, cases where raw laboratory data, such as temperature measurements, should be entered into the Archival Database files.

In general, and as described above, it will not be necessary or desirable to include in the data files all the raw data that support the calculation of reduced data. However, when the calculation of a data element is controversial, or when others may use raw data to calculate different parameters, consideration should be given to including raw data in the Archival Database files. Examples include the stress level at which a resilient modulus was obtained or the concentration of a solution in which asphaltenes are precipitated. The stress level and the solvent concentration should be recorded because they may affect the results and because they are operating conditions that others using the data should have available. Decisions regarding what should and should not be included in the Archival Database must be addressed by individual researchers, statisticians, and project managers. Constraints such as the person hours available for data entry, storage requirements, and the anticipated needs of other researchers will dictate the extent of the data that are archived.

Features Of Archival Database

The Archival Database is organized around data files that reflect individual experiments

or studies, and the summary statistics that may be readily retrieved. Asphalt source, aggregate source, and modifier type are the three attributes for retrieving the appropriate files in the Archival Database. After the user of the Database selects the asphalt, or the aggregate source, a list of basic properties for the selected asphalt, or aggregate, will be displayed. Also, by selecting an asphalt aggregate, or modifier, or any combination thereof, a list of experiments in which those materials were used will be displayed, and the user will have the opportunity to view each file individually.

The Archival Database will be useful to researchers and others who desire complete data sets regarding specific experiments. The typical user of the Archival Database will be a researcher who will download the data for further analysis at the researcher's facility.

A user will either browse the Database for specific data elements, which will be typically physical or chemical properties, and may simply be viewed while the user is logged onto the University of Texas (UT) mainframe or download the file to the user's facility.

Chapter 2 Structure Of The Archival Database

The structure of the Archival Database is very simple and is built upon the following elements:

i. an index of the experiments and studies that are contained in the database

ii. a series of text files, one for each experiment or study, that describe each experiment plan

iii. one or more data files that are associated with each experiment or study and that contain the data obtained from the respective experiment

iv. a list of the keywords used in the database

The experiment plans, developed and executed by the individual researchers, are the basis for developing the Archival Database. All experimental data, historical data, and field performance data must be generated under the direction of a written experiment

plan. These experiment plans will be incorporated directly into the database as a series of text files, one for each experiment or study. Specific details regarding the development of experiment plans are contained in another document that should be reviewed by all SHRP researchers, database managers, or statisticians before they develop an experiment plan.[2]

One or more data files will be generated for each experiment, and these files will be imported into the database by the TAC database manager as a series of data files. As described later, the experiment numbers and file numbers are synonymous and are the basis for creating the index and for linking the data and text files from a given experiment.

The Archival Database Program will contain a list of completed or planned experiments by the researchers. The Archival Database will also contain a file that lists selected keywords and their abbreviations in the database. The list of experiments may be viewed on the screen and downloaded by the user.

Development Of Text Files

The text file is developed jointly by the researcher and statistician when the experiment plan is written; the text file is synonymous with the experiment plan. A sample text file

(experiment plan) is shown in Exhibit 1. Exhibit 1 has been reproduced from an earlier publication[2] with several modifications: the addition of an abbreviated experiment name, the date of last revision, a list of keywords, and a data description section.

Exhibit 1. Example of experiment plan.

File Number: A0100001.TXT

Performing Agency: University of Texas

Project: A-001 Technical Assistance Contractor

Task 0.0: Use of Metal Fibers in Hot-Mix Asphalt

Subtask 0.0.0: Evaluation of Titanium Fibers

Experiment Name: Sample Experiment

Date First Entered into Database: 31 Jun 1989
Date Last Revision Entered into Database: 23 Jan 1990
Task Manager: J. Fiber
Researchers: S. Bitumen
Experiment Statistician: H. Variance

1. Objective

Task: The object of this task is to determine the effect of the addition of metal fibers on the physical properties of hot-mix asphalt concrete.

Subtask: The objective of this subtask is to study the effect of titanium fibers on the physical properties of hot-mix asphalt concrete.

Experiment: The objective of this experiment is to establish whether or not titanium fibers sufficiently enhance the properties of hot-mix asphalt to warrant further study. This experiment will also be used to determine the experimental error variance for the response variables. (Note: One cannot assume that the experimental error variance will be the same for the control (no fibers) and modified mixes.) If the results from this experiment are positive, a second experiment will be designed to optimize the mixture design variables and the length-diameter of the fibers.

Keywords: diametral resilient modulus, diametral tensile strength, diametral failure strain, metal fibers

2. Scope

In this experiment, a single mix (aggregate and gradation) and asphalt cement will be used to quantify the effect of adding titanium fibers to hot-mix asphalt concrete. Diametral resilient modulus and diametral tensile strength will be measured at one temperature to characterize the physical properties of the mixes. Two different fiber lengths and diameters will be studied at two levels of fiber addition.

Exhibit 1. Example of experiment plan (cont).

3. Experimental Protocol

Specimen Preparation The specimens will be prepared in the customary manner (Asphalt Institute MS-1) except that the fibers will be added by hand to the hot mix immediately after mixing. The fibers will be heated to the mix temperature in a separate oven. Compaction of the 2 1/2-in by 4-in diameter specimens will be accomplished with a Fox Model 41-A gyratory compactor and 7% target in air void content.

Specimens will be tested after curing in air for 3 days at 77 F, +/-5 F. The resilient modulus and tension testing will be conducted at 77 F, +/-1 F with a Model 61 STM electrodynamic testing machine. Testing conditions are as follows:

- resilient modulus: Haversine load, 0.1 sec load time, 0.9 sec dwell between load applications

- indirect tension: Conducted immediately after resilient modulus testing, 10 mm/m crosshead speed

4. Experiment Design

Controlled Factors The following controlled variables and levels will be included in the experiment design:

- fiber length, 2 levels (0.5 cm, 1.0 cm)

- fiber diameter, 2 levels (0.005 mm, 0.01 mm)

- fiber content, 3 levels (0%, 0.05%, 0.1% by weight of total mix)

Response Variables Response variables measured for each specimen will include the following:

- resilient modulus at 77 F, 0.1 s haversine load, 0.9 s dwell time, calculated as peak to peak stress divided by the recoverable strain

- indirect tensile strength and strain at failure (at maximum tensile stress)

5. Statistical Design

A full factorial design with three replicates will be used for this experiment. For each replicate all specimens will be prepared on a single day according to the experiment plan.

Exhibit 1. Example of experiment plan (cont).

The run order of preparation of the specimens will be randomized, independently for each day (replicate). After the three day curing period, the specimens will be measured in a random order. Note: After preparation the specimens will be labeled with a randomly assigned code number. This will provide the random order for the measurements, and blinds the technician to the identity of the specimens.

Analysis of variance will be used to identify the magnitude of the effects of the controlled variables on the response variables and to determine the experimental error variance for the control and modified mixes. In addition regression models will be used as appropriate to quantify the effects of the controlled variables on the responses.

6. Anticipated Results

The results of this experiment will be used to determine the effect of adding titanium fibers on the resilient modulus and strength properties of a hot-mix asphalt concrete mixture. The results of this experiment will be used to determine if titanium fibers merit further study as a reinforcement for hot-mix asphalt.

7. Conclusions

To be added when data analysis is completed.

8. Data Description

001.D01 Asphalt number
002.D01 Aggregate number
003.D01 Laboratory sample identification number
004.D01 Replicate specimen number
005.D01 Length of fiber, cm
006.D01 Diameter of fiber, mm
007.D01 Percent of fiber added to mix based on weight of total mix
008.D01 Date when mix was made
009.D01 Mixing temperature, F
010.D01 Bulk specific gravity, ASTM D 2726
011.D01 Maximum theoretical specific gravity, Rice Method, ASTM D 2041
012.D01 Percent air voids in compacted mixture, [100]*[(11)-(10)]/(10)
013.D01 Peak to peak stress in Resilient Modulus Test, psi, MARK IV Schmidt apparatus, ASTM D 3497
014.D01 Recoverable strain - measured 0.1 second after release of load
015.D01 Resilient modulus, [13]/[14], ksi
***The above data are contained in data file with extension .D01
016.D02 Tensile strength, tensile stress at peak load, psi, SHRP APTM 00
017.D02 Failure strain defined as the diametral strain at peak load, in/in, using SHRP ATPM 00
***The above data are contained in data file with extension .D02

File Format Definition of a file format for the text files and the data files is a difficult task given the variety of computers, software, and file transfer protocols that the SHRP contractors can be expected to use. The requirement that all SHRP Asphalt Program contractors use a common database program has been rejected and instead a file format that should be acceptable to the users of a variety of computers and software has been adopted.

All text files are to be prepared using what is commonly referred to as ASCII text format. The width of text files is limited to 78 characters so that the files may be easily viewed on a monitor. Only the characters found on a standard IBM PC keyboard, Exhibit 2, are allowed. No word processor commands, such as subscripts, superscripts, underline, center, and bold, are allowed. When the file is listed, it should consist only of the characters in Exhibit 2 and the standard carriage return line feed and end of file commands. Most word processors as well as most spreadsheet and database packages can produce and import ASCII text files.

Data files are limited to 120 characters in width but may be of unlimited length. Again, only the characters in Exhibit 2, and as described in the previous paragraph, may be included in a data file. Data files must be space delimited. Thus, the data files must be organized with rows of data, each row indicated by a line feed-carriage return. Within each row, data elements will be separated by a space. With this format all data elements must be identified by a nonblank entry. For uniformity, an asterisk has been selected to

indicate a blank or missing value. Under no circumstances should a data element be left blank or contain a zero. The asterisk character must be used for all blanks or missing values.

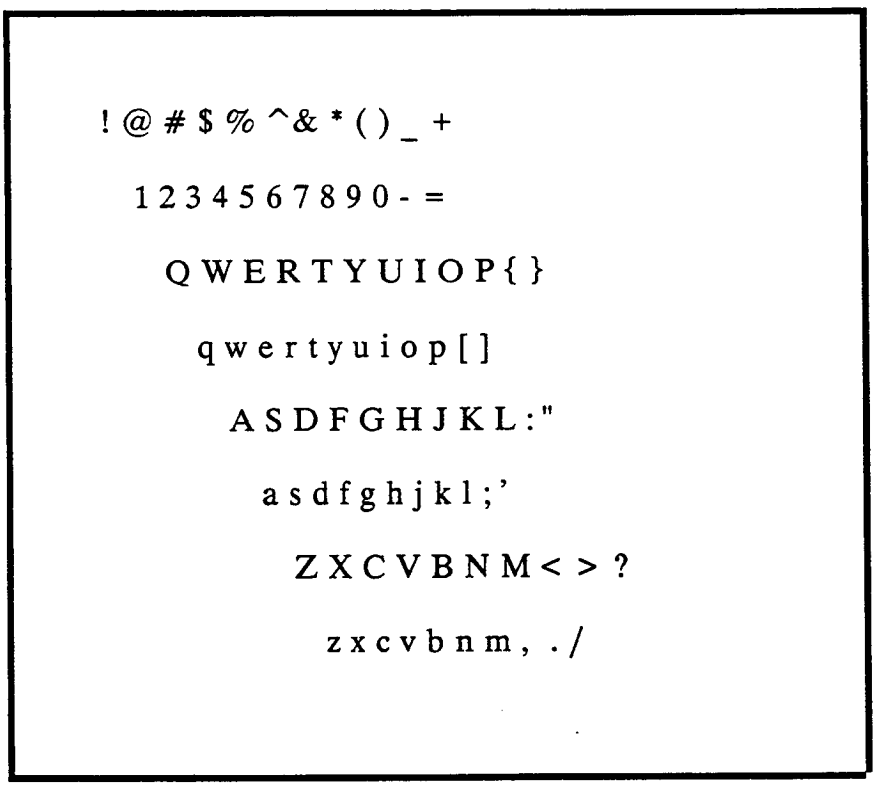
If blanks are left between words in text entries, such as in "ft lbs," the ft and lbs will be placed in separate columns. Instead, write ft-lbs with a dash and no spaces to force both ft and lbs into the same column.

Header Each text file must contain a 17-line header that identifies the experiment. Directions for constructing this header are given in Exhibit 3. Care must be used to be certain that the information appears on the lines as requested. Entries should be allowed to scroll to the next line only as specified in Exhibit 3. Note that two lines are allowed for some of the items.

File Numbers The format for developing the file number (note that the experiment number and file number are synonymous) is given in Exhibit 4. The file number must contain 11 characters--8 for the file name and 3 for the file extension. The first three characters are reserved for the project identification and the last five are reserved for identifying the particular experiment. It is suggested that the fourth and fifth characters be used to identify the task and the sixth, seventh, and eighth characters be used to identify the individual experiment (see Exhibit 4). The file extension for all text files must be the three alpha characters TXT.

Keywords Keywords may consist of a single word or a string of words. Only the ASCII characters in Exhibit 2 should be used to construct keywords--do not use Greek letters or other special characters.

Exhibit 2. Characters allowed in text or data files.



Note that the backslash (\) and the vertical line (|) are <u>not</u> included in the list of allowed characters.

Exhibit 3. Directions for Constructing Header.

Line 1:	File Number (Experiment Number) with extension as per instructions in Exhibit 5.
Line 2:	Blank.
Line 3:	Name of agency where research is being conducted, not necessarily the name of the prime contractor.
Line 4:	Blank.
Lines 5, 6:	Project title.
Lines 7, 8:	Task number and title.
Lines 9, 10:	Subtask number and title. Leave these lines blank if there is no identified subtask.
Lines 11, 12:	Name of Experiment.
Line 13:	Date First Entered into Database: The current date will be automatically entered on this line by UT when the file is first entered into the Archival Database. When files are submitted to UT this line should be blank.
Line 14:	Date Last Revision Entered into Database: The current date will be automatically entered on this line by UT whenever the file is updated (overwritten). When files are submitted to UT this line should be blank.
Line 15:	Name of the task manager.
Line 16:	Name(s) of the researcher(s) in charge of the work.
Line 17:	Name of the statistician assigned by the contractor to the experiment.

Exhibit 4. Format for developing file (experiment) numbers.

A2A12XXX.TXT
A2A12XXX.D01
A2A12XXX.D02
A2B1OXXX.TXT
A3B15XXX.TXT
A0416XXX.TXT
A0416XXX.D01
A0416XXX.TXT
A0416XXX.D01

I0110XXX.TXT
I0110XXX.D01
I0210XXX.D01

Numbers in the extension, e.g., D01, D02, D03, etc., indicate additional files when more than one file is needed per experiment. If only one file is needed, indicate with D01

Indicates data or text file

Indicates experiment number in any format desired by researcher

Indicates task number within project

Indicates project Name A-002A, A-003A,...(last 2 characters in project number), 01, 2A, 2B, 2C, 3A, 3B, 04, 05, 06

A indicates A-type project, I indicates an A-IIR Project, e.g., I01, I02, I12

Keywords may consist of the names of test properties, test equipment if the equipment is unique, and test methods. Asphalt and aggregate source codes as keywords may be used, and, if appropriate, the words aggregate, mixes, or modifier may also be used. The following is an example of a set of keywords:

> resilient modulus, creep compliance, diametral tensile strength,
> time-temperature superposition, Rheometrics RMS-800, ASTM D 2170,
> SHRP TM45, Peskins-Elton 409 Spectrophotometer, IR spectra, SEC, NMR,
> bulk specific gravity, nitrogen, sulfur, elemental analysis,
> TFAAT, POV

Separate entries by commas and use acronyms whenever possible--SEC for Size Exclusion Chromatography, ASTM for American Society for Testing and Materials, SHRP for Strategic Highway Research Plan, etc. The field containing keywords should be no more than 78 characters wide and no more than 20 single-spaced lines long.

When sorting or querying, the NOMAD II database does not differentiate between upper- and lowercase letters; thus for searching purposes, "A" and "a" are treated as the same symbol. However, the user may use upper- or lowercase letters in the text files, and they will appear as such when the text file is viewed on the screen.

When using keywords for searching purposes, do not break a keyword on a line. For example, "modulus" will be considered as two keywords if the letters "Mod" appear on one line and "ulus" appears on the second line.

Data Description A data description section must be included in the experiment

plan. The purpose of this section is to describe the data in each column of the data files. Including the data description in the text file will allow the database user to review the data elements without exiting to the data files. Information contained in the data description section includes the column number from the data file, the name of the data element, and, when appropriate, units and test method.

The format for the data description section is shown as item 8 in Exhibit 1. Column numbers are used in order to tie the data description to a specific column in the data file. The first three characters in each data description are used for the column number. Column numbers start with 001 and are continuous from one data file to the next across the entire set of data files for a single experiment (item 8, Exhibit 1). Use as many lines as needed to describe each data element. There is no limit on the number of lines used to describe each data element or the total length of the data description section.

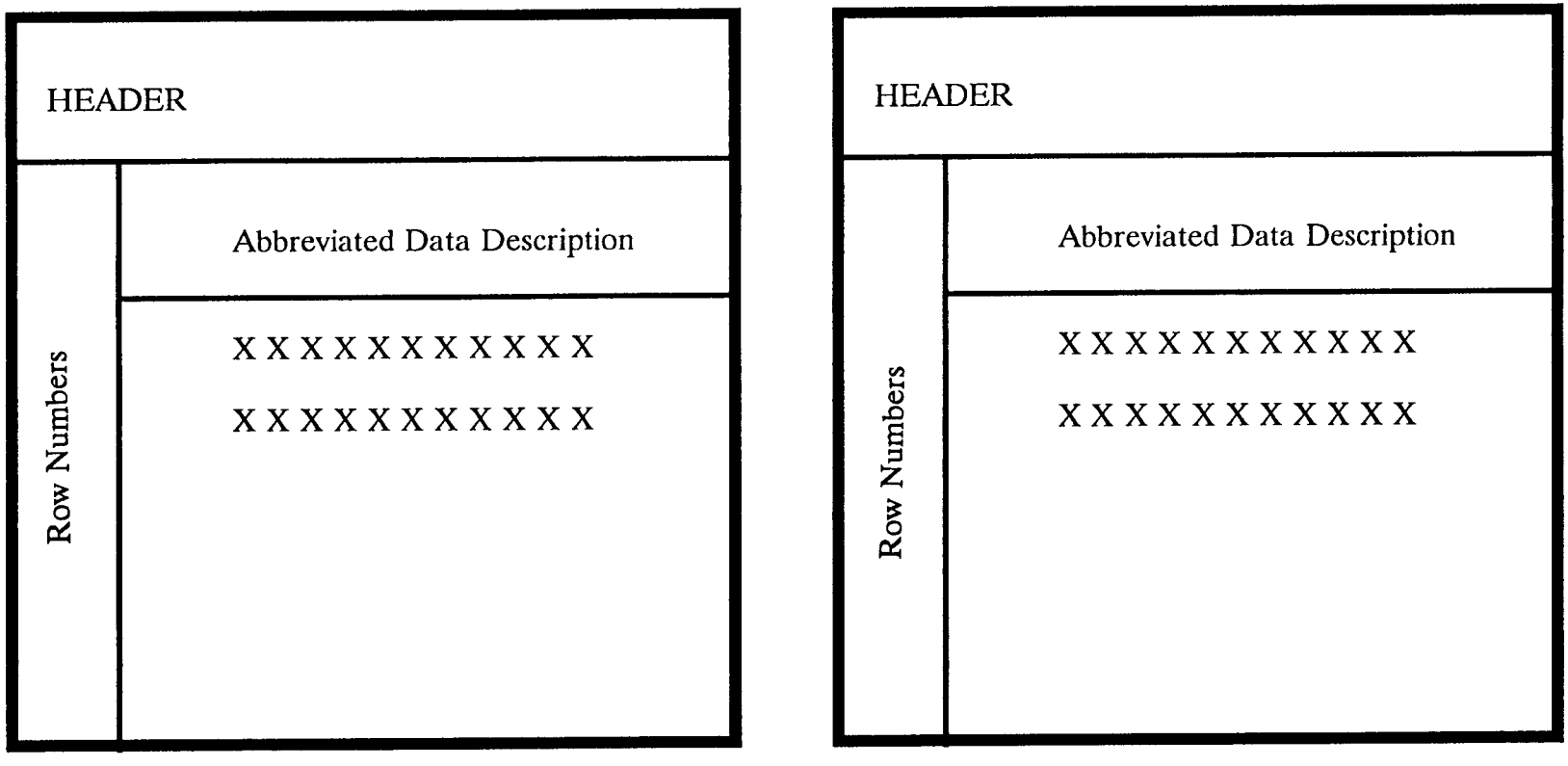
Some means for identifying which data file (from within the set of data files) contains specific columns of data is needed. This may be done with a simple comment line--"***The above data are contained in data file with extension .D01." Alternatively, the column numbers may be followed by the relevant data file extension, such as 003.D01. Although both of these schemes are illustrated in item 8, Exhibit 1, either or both may be adopted by the user.

Development Of Data Files

File Format Different researchers and research organizations will organize their data in a variety of ways, varying from hand entry on tabular sheets to entry into sophisticated database programs. SHRP does not intend to specify the format in which the data are stored by the individual researchers within their own organizations. But, SHRP, by virtue of this document, does specify the format used to transfer data to the Archival Database. All data will be transferred to the A-001 contractor in the form of an ASCII file. This format is simply a compilation of rows and columns as illustrated in Exhibit 6.

An outline of a typical data file is shown in Exhibit 5, in which four important elements are shown: an eight-line header, abbreviated column descriptors that include column numbers, row numbers, and the data elements. An example of a partially completed data file is given in Exhibit 6. As illustrated in Exhibit 6, data files that are more than 120 characters wide must be divided into 2 or more files; individual files within the set must be no more than 120 characters wide. With the 120-character limitation, individual files may be printed on 8 1/2-in-wide paper without the need to print sideways. (Compressed mode, or 16.6 characters per inch, must be used in this case.) The most compelling reason for the 120-character width limitation is the inability of several network protocols to transmit files that are wider than 120 characters.

Exhibit 5. Schematic illustration of data file structure.



A01SAMPL.D01

Date First Entered into Database: 31 Jun 1991
Date Last Revision Entered into Database: 23 Jan 1992
R.Stone
Closed

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Asph ID No.	Agg ID No.	Specimen ID No.	* Repl No.	Fib Len (cm)	Fib Diam (mm)	Fib Level (%)	Date Specimen Mixed	Mix Temp (F)	Bulk Sp Gr	Theo Sp Gr	Mix Voids (%)	Diam Stress (psi)	Diam Strain (in/in)	Diam Mr (ksi)
AAA1	RA	12000891	1	.00	.000	.00	12/20/89	325	2.382	2.457	3.1	104	.000231	450
AAA1	MM	12000892	2	.00	.000	.00	12/20/89	325	2.379	2.439	2.5	99	.000248	399
AAA1	MM	12000893	3	.00	.000	.00	12/20/89	325	2.374	2.458	3.5	101	.000271	373
AAA1	MM	12AAA891	1	.50	.005	.05	12/20/89	*	*	*	*	*	*	*
AAA1	MM	12AAA892	2	.50	.005	.05	12/20/89	*	*	*	*	*	*	*
AAA1	MM	12AAA893	3	.50	.005	.05	12/20/89	*	*	*	*	*	*	*
AAA1	MM	12AAB891	1	.50	.005	.10	12/21/89	*	*	*	*	*	*	*
AAA1	MM	12AAB892	2	.50	.005	.10	12/21/89	*	*	*	*	*	*	*
AAA1	MM	12AAB893	3	.50	.005	.10	12/21/89	*	*	*	*	*	*	*
AAA1	MM	12ABA891	1	.50	.010	.05	12/21/89	*	*	*	*	*	*	*
AAA1	MM	12ABA892	2	.50	.010	.05	12/21/89	*	*	*	*	*	*	*
AAA1	MM	12ABA893	3	.50	.010	.05	12/21/89	*	*	*	*	*	*	*
AAA1	MM	12ABB891	1	.50	.010	.10	12/19/89	*	*	*	*	*	*	*
AAA1	MM	12ABB892	2	.50	.010	.10	12/19/89	*	*	*	*	*	*	*
AAA1	MM	12ABB893	3	.50	.010	.10	12/19/89	*	*	*	*	*	*	*
AAA1	MM	12BAA891	1	1.00	.005	.05	12/19/89	*	*	*	*	*	*	*
AAA1	MM	12BAA892	2	1.00	.005	.05	12/19/89	*	*	*	*	*	*	*
AAA1	MM	12BAA893	3	1.00	.005	.05	12/19/89	*	*	*	*	*	*	*
AAA1	MM	12BAB891	1	1.00	.005	.10	12/18/89	*	*	*	*	*	*	*
AAA1	MM	12BAB892	2	1.00	.005	.10	12/18/89	*	*	*	*	*	*	*
AAA1	MM	12BAB893	3	1.00	.005	.10	12/18/89	*	*	*	*	*	*	*
AAA1	MM	12BBA891	1	1.00	.010	.05	12/18/89	*	*	*	*	*	*	*
AAA1	MM	12BBA892	2	1.00	.010	.05	12/18/89	*	*	*	*	*	*	*
AAA1	MM	12BBA893	3	1.00	.010	.05	12/18/89	*	*	*	*	*	*	*
AAA1	MM	12BBB891	1	1.00	.010	.10	12/20/89	*	*	*	*	*	*	*
AAA1	MM	12BBB892	2	1.00	.010	.10	12/20/89	*	*	*	*	*	*	*
AAA1	MM	12BBB893	3	1.00	.010	.10	12/20/89	*	*	*	*	*	*	*

A01SAMPL.D02

Date First Entered in
Date Last Revision En
R.Stone
Closed

16	17
Ten Stren (psi)	Fail Strain (%)
367	1.45
357	1.39
345	1.68
*	*
*	*
*	*
*	*
*	*
*	*
*	*
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*	*
*	*

Exhibit 6. Example of an Experiment Data File.

To facilitate viewing a file that is 120 characters wide, the Archival Database contains an editor with a simple horizontal scroll feature. When logged onto the UT mainframe, the user may use predefined keys[3] to move sideways or up and down within a file. The 120-character limit should not pose any problem when a file is downloaded to another mainframe or PC; most word processing, database, or spreadsheet programs will accept files that are up to 120 characters wide. To ensure that the files are compatible with the mainframe and with other software packages, only the keyboard characters presented in Exhibit 2 will be allowed in data files. As with the text files, do not use superscripts or subscripts or Greek and other special symbols that cannot be recognized by the mainframe.

Numbering the Data Files Each data file is numbered with an experiment number in the same fashion as described above for the text files except that a somewhat different scheme is used for the file extension. Because the data from many of the experiments will generate files that are much wider than 120 characters, it will be necessary to divide the data from these files into two or more individual files as shown in Exhibit 6. The extension for a data file is always of the form Dxx, where xx is a number, starting with 01, such that the individual files have successive extensions D01, D02, D03, up to D99, as necessary.

Header Each of the data files must contain an eight-line header that identifies the file. This eight-line header contains the file name and describes the status of the

data in the file as illustrated in Exhibit 7.

Abbreviated Data Description Lines 9 through 14 are used to provide an abbreviated description of the data elements. Line 10 contains the column numbers that identify the variables. These numbers correspond to the column numbers in the data description section in the text file. Dashes are used to outline the data description (entered on lines 9 and 14). Lines 11 to 13 are used for data names and units. Make the headings as brief as possible; a full description is given in the text file and is cross-referenced to the data file by means of the column numbers. Note that spaces should not appear in the abbreviated data descriptions. Use ft-lbs or Mix-temp; otherwise, ft and lbs and mix and temp may appear in separate columns when downloaded to certain software programs.

Exhibit 7. Structure of header in data file.

Line 1: File Number (Experiment Number) with extension.

Line 2: Blank.

Line 3: The date that the file is first entered into the University of Texas data base will be entered automatically in this line. This line should be blank when the file is transmitted to the University of Texas.

Line 4: The date on this line will represent the date of the most current revision to the data file. This line should be blank when the file is transmitted to the University of Texas.

Line 5: Enter the name of the individual responsible for verifying the data file.

Line 6: This line is used to indicate the status of the data. The researcher must enter one of the following on this line:

Closed--to indicate that the data have not yet been analyzed and are not ready for release. This will prompt the UT mainframe to automatically enter a statement regarding the confidentiality of the data and that the data are not to be published or cited.

Open--to indicate that the data are available for use by anyone who has access to the Archival Database and that the data are in the public domain. This will prompt the UT mainframe to automatically enter a statement indicating that the data are in public domain.

Line 7: Blank (for future use).

Line 8: Blank (for future use).

Line 9 - 14: Used for abbreviated data description.

Line 15 - end: Data.

Row Numbers Starting with line 9, the first column of numbers is reserved for row numbers. Row numbers should appear in all data files, regardless of whether the file is the first or a subsequent panel in the file (Exhibit 6). These numbers provide the basis for merging two or more data files and retaining the correspondence between observations.

Data Elements The data elements (rows) start on line 15. Each line (row) is reserved for an individual observation, and the data should be clearly identified to indicate if successive lines represent replicate measurements on a single specimen or measurements on replicate specimens. The following guidelines are applicable:

i. Each row will contain the data for an independent observation.

ii. Columns should be arranged so that the first columns present the identifier information on asphalt, aggregate, and modifier and descriptor information such as the date, specimen number, replicate number, and operator code.

iii. The next set of columns should contain levels of factors specified or controlled by the experiment, such as temperature, time in oven, and any other conditions specified.

iv. Finally, the last set of columns should contain the response data and any calculated data obtained from the experiment.

An example of a set of data files is presented in Exhibit 6. The data for this experiment exceed the 120-character width requirement and therefore two files have been used for the data, A0100001.D01 and A0100001.D02. In this example, identifier and descriptor information is given in columns 1 to 4; specified or controlled factors in columns 5 to 9 and 13; and measured or reduced data in columns 10 to 12 and 14 to 17.

Data Specification Missing data should be indicated with an asterisk (Exhibit 6).

Under no circumstances should a blank or a zero be used to indicate missing data. A zero entered into a data field will be interpreted as a data entry with a value of zero. Try to avoid characters such as slashes or backslashes, dashes, or others that have special meaning or that do not lend themselves to sorting procedures. When the same value is repeated in successive lines in a column, as, for example, the temperature for a series of repeat measurements, be certain to enter the value in each line--do not leave repeated values blank. The data portion of a data file should consist of an n-by-m matrix of entries, where n is the number of rows and m is the number of columns. Each element in the matrix should have a nonblank entry. Data files that are incomplete should have asterisks inserted for the blank or missing data entries even though the blank or missing data will be supplied in subsequent revisions of the file. Being certain that all elements of the matrix are filled will allow the files to be read in an unformatted mode, which greatly simplifies the process of importing the files into different software packages.

Identifier codes, such as material, sample, or test identification numbers, should contain only alphanumeric characters, i.e., numbers and alphabetic characters. Spaces, dashes, periods, or backslashes are not allowed in identifier codes. For example, the following identification codes are acceptable: AAK1 for asphalt AAK-1; UAC for Unaged - Conditioned; and AAK1UA for asphalt AAK-1, Unaged. The following identification codes are unacceptable: AAK-1 as an asphalt source number; A.2.3.1 as a specimen number; UA-C for Unaged, Conditioned; or AAK-1 UA for asphalt AAK-1, Unaged.

It is especially important that there are no blanks within a data entry. A blank is a signal to the computer to read a new data element. Thus, entering "239 BAC" will result in 239 in one column and BAC in the next column. The entry "239BAC" will result in 239BAC in one column.

Scientific notation is acceptable using the format given in Exhibit 8. Alternatively, prefixes may be used as presented in Exhibit 9. As an example, if values of force are being reported in the range of 0.001 to 0.0001 grams, report the data in units of

micrograms, ug, with numerical entries ranging from 1 to 10. Use asterices to indicate a number raised to a power. For example, express lb/in^2 as lb/in**2. Do not use the carrot, ^, to express a power. For example do not use lb/in^2 to express lb/in^2.

Normal convention should be used in selecting the number of significant digits for individual data elements. Report only the number of digits that are appropriate for the data element; do not use 15 digits simply because that number was generated by your computer. The number of digits should reflect the precision of the measurements; a modulus value calculated on the basis of data measured to three significant digits should be reported with no more than four digits. The use of an excessive number of significant digits implies a false sense of accuracy and precision in the data.

Exhibit 8. Exponential Notation (E)

Exponential, or scientific, notation is a short-hand system used to express large and small numbers. The number

-0.000231

is expressed in exponential notation as:

-2.31E-04

Negative sign
(if number is negative)

Single digit to
left of decimal

Decimal point

0 to 11 digits to the right
of the decimal point

Exponent as a two or
three digit number

Negative sign (if number
is less than 1)

The symbol, E,
indicating a power of 10

EXHIBIT 9

PREFIXES FOR POWERS OF 10

10^{18}	exa	E
10^{15}	peta	P
10^{12}	tera	T
10^{9}	giga	G
10^{6}	mega	M
10^{3}	kilo	k
10^{-3}	milli	m
10^{-6}	micro	u
10^{-9}	nano	n
10^{-12}	pico	p
10^{-15}	femto	f

Chapter 3 Using The Archival Database

Access To The Archival Database

The database will reside on the mainframe at the University of Texas. Access to the database will be through a PC modem or through a mainframe communication network such as INTERNET. Specific instructions for accessing the Archival Database are presented elsewhere.[3] These instructions are subject to change and the user should verify that the latest version of the instructions are being used. The user will need a user identification number (ID) and a password in order to log onto the UT computer. These will be assigned to the user by the TAC and will control access allocated to the database. Only those users with authorized passwords will be able to access the data; passwords are not transferrable to other users. Persons other than the SHRP staff or researchers may have access to the data, especially after the data have been cleared for general use.

Input To The Archival Database

All input to the Archival Database will be conducted by the A-001 contractor. When text or data files are at the point where they can be entered into the database, they will be sent via electronic mail or floppy disk to the TAC. The individual files will then be loaded into the database by TAC personnel, who will verify that the files are properly loaded, i.e., copy verified. It is the responsibility of the individual researcher to verify that the files have been correctly entered (as opposed to correctly copied). This may be

done by logging onto the UT computer and reviewing the files or by requesting a hard copy output from the TAC.

Corrections or data updates will be accomplished by submitting an updated version of the file(s) to the TAC. Only those files that require corrections or updating need to be re-submitted to the TAC. The updated files will then be loaded into the database by UT so that the files that are to be corrected or updated are overwritten.

Downloading Of Archival Database Files

Downloading may be accomplished interactively when the user is logged onto the database. Data should be transferred to the user electronically to a PC or to another mainframe using BITNET, FTP, or other communication software. Only in special cases will the downloaded data be available in floppy or hard copy format. All files will be uploaded, downloaded, and stored in ASCII format.

References

1. M. Gonzalez, et. al., "Materials Database User's Manual," draft prepared by SHRP Contract A-001, Center for Transportation Research, The University of Texas at Austin, November 1989.

2. C. E. Antle, et. al., "Experiment Guidelines for Asphalt Research Contractors," SHRP-A/WP-89-001, August 1989 (revised October 1990).

3. M. Blibeche, et. al., "User's Guide for Interim Archival (Level B) Database," SHRP-A/UWP-90-20, October 1990.

   or

   "User's Guide for Archival (Level B) Database," prepared by SHRP Contract A-001, Center for Transportation Research, The University of Texas at Austin, to be published when permanent database is operational.

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