Research Report
KTC-90-14

PAVEMENT DEFLECTION TEST DATABASE

by

Bobby W. Meade
Research Investigator

David L. Allen
Chief Research Engineer

Kentucky Transportation Center
College of Engineering
University of Kentucky

in cooperation with
Transportation Cabinet
Commonwealth of Kentucky

and

Federal Highway Administration
U. S. Department of Transportation

July 1990

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
KTC-90-14		

4. Title and Subtitle	5. Report Date
Pavement Deflection Test Database	July 1990
	6. Performing Organization Code

7. Author(s)	8. Performing Organization Report No.6
B. W. Meade and David L. Allen	KTC-90-14

9. Performing Organization Name and Address	10. Work Unit No. (TRAIS)
Kentucky Transportation Center College of Engineering University of Kentucky Lexington, KY 40506-0043	11. Contract or Grant No. KYHPR 86-109
	13. Type of Report and Period Covered Interim
12. Sponsoring Agency Name and Address Kentucky Transportation Cabinet State Office Building Frankfort, KY 40622	14. Sponsoring Agency Code

15. Supplementary Notes

Publication of this report was sponsored by the Kentucky Transportation Cabinet in cooperation with the U.S. Department of Transportation, Federal Highway Administration

16. Abstract

Pavement deflection measurements have been collected on various pavement types by both research and the Pavement Management Branch of the Transportation Cabinet for several years. This report outlines the establishment of a data base of deflection measurements which have been collected. A index program has been developed to search the available data base for pavement sections which meet given criteria. This data base will provide up-to-date information which may be used for both research and pavement management activities. The presence of historical data will assist in evaluating the structural performance of various pavement types. It will also provide additional information for life-cycle-cost analysis of pavements.

17. Key Words	18. Distribution Statement
Pavement Deflection Database Software Catalog	Unlimited with permission of the Kentucky Transportation Cabinet

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	29	

EXECUTIVE SUMMARY

A study titled "Pavement Deflection Evaluations" was initiated in 1986. The purpose of the study was to collect and evaluate pavement deflection data. One of the stated objectives was to establish and maintain a statewide deflection database for research and pavement management purposes. This report addresses that objective and serves as a users manual for the software used for data storage.

Pavement deflection data collected by the Kentucky Department of Highways and the Transportation Center since 1982 are compiled into one database. Project identification data and other pertinent data associated with each set of deflection data were used to create a catalog from which specific data may be selected for analysis. This catalog also includes the file name where each set of deflection data is stored.

The catalog, named Pavall.dbf, was created in the dBASE III Plus system. This system permits convenient updating of the database as additional deflection data are acquired. The dBASE III Plus system includes search, organization, and report options.

A search and retrieval program, DEF, was produced by the Transportation Center. This program permits more rapid location of data in the catalog than the dBASE III Plus system.

Table of Contents

INTRODUCTION

The technology for collection, evaluation, and interpretation of pavement deflection measurements has been evolving at a rapid pace for the past decade. Procedures have been developed in Kentucky suitable for the use of deflection measurements from a Road Rater to estimate the effective condition of flexible pavement structures. Progress is being made toward implementation of a testing program for routine collection of deflection measurements on flexible pavements for pavement management activities. Refinement and verification of procedures for interpretation of deflection measurements (Research Study KYHPR 86-115) also are being made.

Deflection measurements have been collected for research purposes for many years. There is no standardized procedure or mechanism for development and maintenance of a statewide database for pavement deflection measurements. A considerable amount of data is being amassed with the routine collection of deflection measurements on flexible pavements for pavement management/overlay design combined with research evaluation of special design and/or construction considerations. There is a need for development of a standardized method for data management and maintenance of the statewide database.

Routine collection of pavement deflection data began in the 1960's in Kentucky. Dynamic deflection measurement collection began in the early 1970's with use of the Road Rater. The Road Rater is still in use at the present time. A FWD, falling weight deflectometer, was acquired in 1988 and data have been collected with that instrument since that time.

This study was initiated in 1986 to collect and evaluate pavement deflection data. The objective of that study which is addressed here is to establish and maintain a statewide deflection database for research and pavement management purposes.

ORIGIN OF DATA

Data included in this data base are obtained from three types of equipment. They are a Road Rater 400B, a Road Rater 2000, and a falling weight deflectometer (FWD). The RR 400B and FWD devices are used by the Transportation Center. The RR 2000 is used by the Kentucky Department of Highways. The FWD employs more sensors (7 sensors) than the Road Raters (4 sensors); however, the data are basically the same and may be used for the same analyses.

Data collected by Transportation Center staff includes approximately 1,030 records involving 70 counties and 65 routes. The oldest data included in the database were collected in 1982. Most of the data were for flexible pavements (AC). Considerable data are available on subgrade, DGA, AC base courses, and rigid pavements (PCC). Subgrades involved various treatments such as cement, lime, kiln dust and untreated soils. Data collected on the subgrade, DGA and base courses were obtained to address objective G. of the study. Objective G. was to identify and

demonstrate potential applications for the use of deflections for construction quality control.

Sites tested by Transportation Center investigators were usually on Interstates, Parkways, US routes, or major KY routes. Nominal data are available for local streets.

Data collected by Kentucky Department of Highways (DOH) personnel include approximately 360 records involving 41 counties and 30 routes. Data collection by the DOH began in 1986. DOH data were collected on flexible pavements with the primary purpose being for determination of overlay thickness requirements. Practically all DOH data obtained were on Interstate, Parkway, and US or KY routes having high ADT's.

The data base will be kept and maintained by the Pavement Management Branch of the Department of Highways. The Transportation Center will provide data collected by Center personnel to the Pavement Management Branch on a semi-annual basis.

RECOMMENDATIONS AND IMPLEMENTATION OF THE DATABASE

The combined database will provide extensive historical and current deflection data. These data will permit evaluation of the historical performance of pavements which will be used by pavement design and pavement management personnel. Relationships describing the structural deterioration of pavement structures combined with construction and maintenance costs will provide data for remaining-life models and life-cycle cost studies.

The detailed and extensive data on the structural components and their behavior may provide the means for development of theoretical models for the behavior of various pavement structures. The database may also be used for structural adequacy analyses. It is recommended that the database be updated continuously as new deflection data are obtained.

Appendix A

USER'S GUIDE TO DATABASE

INTRODUCTION

All existing deflection data (DOH and Transportation Center) were combined into one file to more fully utilize existing and future deflection data. Each unique set of data has been assigned a file name. This permits access to each set of data for analysis. The large amount of data requires a data management system.

The identifying characteristics and file name of each set of data were cataloged in a data management file. That file is named PAVALL.dbf and was constructed in the dBASE III PLUS database management system. The dBASE III PLUS system has a wide variety of commands and functions which allow easy manipulation of the database. The indexing, sorting, and reporting capabilities of the dBASE III PLUS are sophisticated and require a certain amount of knowledge of the system. A menu driven search and retrieval program has been developed to use in conjunction with the database to make the data management system more user friendly.

Thirteen identifying or pertinent pieces of data were included for each set of deflection data. County, route, district, lane, wheel path, and beginning and ending milepoints or stations were included to physically locate the test site. Type was used to identify the material being tested (pavement, DGA, etc.). Three layer thickness fields were included. The layer thickness is not entered in the catalog because the information was not available in most cases but will be added later. Test date and the name of the data file where the actual deflection test data are stored are included.

DESCRIPTION OF DATA FIELDS

The thirteen fields and a brief description of each are as follows;

DISTRICT

The Department of Highways District (1 through 12) in which the test site was located.

COUNTY

The county in which the data were obtained.

ROUTE

The name of the highway on which the data were obtained. The route identification is usually abbreviated, for example: I-64, rather than Interstate 64.

TYPE

Type refers to the material on which the deflection data were acquired. Most tests were conducted on pavements (AC, PCC, or AC/PCC) but many tests were conducted on variously treated subgrades or on DGA.

BEGIN

Deflection tests were normally conducted at intervals of 250 or 500 feet with a single data file containing several consecutive tests. This field identifies where the deflection test began either in milepoint or station.

END

Same as Begin except that the end of the test section is identified.

TEST DATE

Identifies the month, day, and year that the deflection test was conducted.

DATAFILE

This field identifies the file where the deflection data are stored.

LANE

Most entries in this field identify the direction of travel where the deflection test was performed, such as EB (east bound), WB, NB, or SB. In some instances the test vehicle was traveling in the opposite direction (for example: SNBL would indicate south in the north bound lane). Some tests were conducted on the centerline. Direction of travel was therefore irrelevant.

WHEEL PATH

Wheel Path data are not often available, but where it is, it attempts to more precisely locate the test site as to right wheel path, left wheel path, centerline, or distance from centerline.

THICK #1

This field is used to describe the thickness of the top layer of the material being tested. This will be the depth of the asphaltic concrete course in most cases.

Depth of treated subgrade or DGA depth might be entered in this field.

THICK #2 through THICK #7

Same as THICK #1 except the layers are described in descending order from the top.

Appendix B includes a list of the abbreviations used in the catalog and an explanation of each abbreviation.

USE OF THE DATABASE CATALOG

New deflection test data will be added to the database regularly. These data will likely be added by a variety of personnel, some of whom may not have had previous experience with dBASE III PLUS. Anyone having nominal information may update and maintain the database catalog file.

dBASE III PLUS may be used in three different modes. Commands may be entered at the dot prompt, the Assist menu mode, and a program control mode. In this case, the dot prompt command or Assist mode will be used. One of the most attractive features of dBASE III PLUS is the wide variety of commands included in the Assist menu. Database updates and maintenance may be accomplished in the Assist mode.

The system is accessed by typing DBASE at the > prompt. Once the system is accessed, the database file may be opened by typing ASSIST on the command line or depressing the F2 key. The assist menu will be displayed with eight options (Figure 1). The functions available in the option on which the cursor is located will be displayed on the screen. With the cursor on the SET UP option, depress the return key and choose the appropriate drive and file. The screen will revert to the assist menu and the cursor may be moved to select the UPDATE option. If at any time you wish to return to the command line, depressing the Escape key, possibly more than once, will return the cursor to the command line.

Operations available in UPDATE include adding new records, editing existing records, or deleting existing records (Figure 2). The most efficient method of adding new records is to use the APPEND option. This option displays the last record in the file with the field identification and template. After the new record is entered, the PAGE DOWN key will save that record and display a new template.

Two features that are helpful are the CARRY command and the HELP menu. To use the CARRY command, return to the command line and type SET CARRY ON. This will cause the last entered record to be copied into the new record template when in the APPEND option. If several consecutive records have similar field

information, this feature permits you to make changes where needed rather than enter each new record completely.

Depressing the F1 key will display or remove the HELP menu (Figures 3 and 4) from the screen when in the APPEND option. If a complete screen is required to display the record, the HELP menu may need to be removed.

Other options in APPEND that are useful are EDIT and BROWSE. EDIT allows the database file to be edited one record at a time and BROWSE (Figure 5) allows editing of the file several records at a time. When appending the file, new records are saved by any of several operations. Those operations include the use of the PAGE DOWN, ESCAPE, CTRL W, or CTRL END keys.

Other options which will be used regularly are SORT, INDEX, and REPORT. SORT and INDEX are similar. SORT physically rearranges the database file. INDEX leaves the database file intact and creates a new file with an .ndx extension. Both options permit rearrangement of the records by any or all of the fields. Indexing by county is required for use of the search and retrieval program previously mentioned. When data are added to the file, the index or indices should be in use or the file should be reindexed afterward. Reindexing, for all indices in use is accomplished by typing REINDEX on the command line.

Indices may be created in the ORGANIZE option (Figure 6) in ASSIST menu or from the command line. In the ASSIST menu, the field names (separated by +) and the index file name are entered. Indices are created from the command line by typing INDEX ON <field name> TO <filename>. As in the ASSIST menu, field names are separated by +. SORT is also found in the ASSIST menu under the ORGANIZE option.

The ASSIST menu also includes a REPORT option that may be used to view or print any or all of the fields in the catalog. The search and retrieval program replaces this function of the dBASE system. If the REPORT function is needed, it is created in the CREATE option (Figure 7) of ASSIST. The field order and report file name are identified there. The report is accessed from the RETRIEVE option (Figure 8) of ASSIST. A typical report (in this case all fields were not included) is shown in Figure 9.

USE OF THE DEF SEARCH AND RETRIEVAL PROGRAM

The primary function of the catalog is to permit a user to view the identification of all the data files and choose the files to be analyzed. This is possible in the dBASE III PLUS system but is more complicated than necessary. A search and retrieval program was created to be used with the catalog. This program (DEF) is menu driven and locates desired information quickly. DEF requires that the catalog be indexed by county with the index file named COUNTY. After any updates or editing, the database catalog should be reindexed by county.

The program is executed by typing DEF at the dos prompt, D:\DBASE\subdirectory>DEF, and pressing the RETURN key. The opening screen will be the UK logo (Figure 10) and the message to press any key to continue. The user interface screen (menu) is the second screen. All thirteen fields are included in the search menu and any or all of them may be included in the search (Figure 11).

Characters entered in the search menu may be upper case or lower case. Characters should always be left justified in the menu entry field. The search menu fields contain sufficient character space so that any identification entered in the catalog will fit in the search menu field. It should be noted that when BEGINNING MILE POINT or ENDING MILE POINT are used in the search, whole numbers are entered in the search menu field. Any entry in the catalog which coincides with any part of the search parameters will provide a match. Most search menu fields require exact spelling. The TEST DATE field permits you to enter a complete date (month/day/year) or just the year. If, for example, 89 is entered in TEST DATE, all catalog entries which have 89 in the testdate field will provide a match.

The RETURN key moves the cursor through the menu to allow selection of the fields to be searched. The DOWN arrow moves the cursor forward through the menu. The UP arrow moves the cursor backward through the menu. The UP and DOWN arrows are easier to use than the ENTER key when selecting fields to be searched. The ENTER key only moves the cursor forward and, when at the end of the menu, will exit the program.

Typical use of the DEF program is to search for particular fields, such as county and route, and then determine from the output which data files are needed for analysis. For this type of use, some fields will seldom, if ever, be used in the search. Some examples of fields which will seldom be used in the search are; THICKNESS, since data are not often available, WHEEL PATH, and DATAFILE, because the name of the data file is the information being sought.

OUTPUT

After the appropriate fields have been entered, the PAGE DOWN key will initiate the search. The time required to find a match, if one exists, for the search parameters will never be more than a few seconds. The less restrictive the parameters are and the smaller number of fields included, the more quickly a match will be found. Once the desired data files have been located, the PRT (Print Screen) key will provide a copy of the output so the data file names may be used to access the deflection data. The output includes seven fields. The fields are COUNTY, DISTRICT, ROUTE, BEGMPT, ENDMPT, TESTDATE, and DATAFILE. A typical output is shown in Figure 12.

DEFLECTION DATA

Deflection data from the three sources, FWD and both Road Raters, are brought together and stored on the mainframe computer. Each set of data is found in the file identified in the catalog. Examples of the three types of data are included in appendices C (Road Rater 400B), D (Road Rater 2000), and E (FWD).

Appendix B

List of Terms

AAHWY	-Ashland to Alexandria Highway
AUDAPKWY	-Audubon Parkway
BGPKWY	-Bluegrass Parkway
BLIECHRD	-KY 3074
CUMPKWY	-Cumberland Parkway
DBPKWY	-Daniel Boone Parkway
EDEN DR	-Eden Drive; Lexington, KY
EMPIRE D	-Empire Drive; Florence, KY
GRPKWY	-Green River Parkway
HAZBYPAS	-Hazard Bypass; KY 15
I-24	-Interstate 24
I-264	-Interstate 264
I-265	-Interstate 265
I-64	-Interstate 64
I-65	-Interstate 65
I-71	-Interstate 71
I-75	-Interstate 75
KY 15	-
KY 1017	-
KY 11	-
KY 114	-
KY 205	-
KY 293	-
KY 3005	-
KY 32	-
KY 33	-
KY 342	-
KY 4	-
KY 461	-
KY 494	-
KY 519	-
KY 55	-
KY 555	-
KY 61	-
KY 627	-
KY 641	-
KY 645	-
KY 676	-
KY 80	-
KY 85	-
KY 90	-
KY 922	-
KY 94	-
LAKESHOR	-Lakeshore Drive, Lexington, KY
LBPUS23	-Louisa Bypass, US 23
MANOWAR	-Man O' War Boulevard; Lexington, KY
MNTPKWY	-Mountain Parkway

NATLTP	-National Turnpike
PURCPKWY	-Purchase Parkway
PALUMBO	-Palumbo Drive; Lexington, KY
PENNPKWY	-Pennyrile Parkway
PURCHPKW	-Purchase Parkway
RAMBLER	-Rambler Road; Lexington, KY
RICHMOND	-Richmond Road; Lexington, KY
RUNNYMEA	-Runnymeade
SEBREEBP	-Seebree Bypass
TVA ROAD	-Test Road; Location-Shawnee Power Plant, Paducah, KY
U.K. STAD	-Univ. of Kentucky Football Stadium Parking; Lexington, KY
US119	-
US127	-
US150	-
US23	-
US25E	-
US25US42	-
US27	-
US31E	-
US31W	-
US460	-
US60	-
US60BYPS	-
US62	-
US641	-
US68	-
WKPKWY	-Western Kentucky Parkway
WHTSBGBP	-Whitesburg Bypass
WOODH DR	-Woodhill Drive; Lexington, KY
AC	-Asphaltic Concrete
AC/AFBC	-Asphaltic Concrete Over AFBC Treated Subgrade
AC/BASH	-Asphaltic Concrete Over Bottom Ash Treated Subgrade
AC/CS	-Asphaltic Concrete/Control Section
AC/LIME	-Asphaltic Concrete Over Lime Treated Subgrade
AC/PCC	-Asphaltic Concrete Over Portland Cement Concrete
AC/POZZ	-Asphaltic Concrete
AC/SS	-Asphaltic Concrete
ACLIFT1	-Asphalt Concrete Lift 1
ACLIFT2	-Asphalt Concrete Lift 2
ACLIFT3	-Asphalt Concrete Lift 3
AFBC	-Atmospheric Fluidized Bed Combustion By Product
BOTTASH	-Bottom Ash

CRETE	-ENVIROCRETE Treated Subgrade
CS AC	-Control Section Asphaltic Concrete
DGA	-Dense Grade Aggregate
LIMSUBG	-Lime Treated Subgrade
MKD	-Multicone Kiln Dust
PCC	-Portland Cement Concrete
POZZ	-Pozzalonic Material
SHOULDR	-Shoulder
TREBASE	-Treated Base
UNTRBAS	-Untreated Base
CL	-Centerline
DOH	-Department Of Highways
EB	-Eastbound
LL	-Left Lane
NB	-Northbound
RL	-Right Lane
RT NB	-Right Lane, Northbound
RT/EB	-Right Lane, Eastbound
RT/SB	-Right Lane, Southbound
SB	-Southbound
WB	-Westbound
15C	-15 Feet from Centerline
15L	-15 Feet Left
21C	-21 Feet from Centerline
21L	-21 Feet Left
3CL	-3 Feet from Centerline
9CL	-9 Feet from Centerline
ALT	-Alternating Wheelpath
CBR	-Site Where In Place CBR Test Was Conducted
CL	-Centerline
IN	-Inner (Median) Wheelpath
LWP	-Left Wheelpath
OUT	-Outer (Shoulder) Wheelpath
RWP	-Right Wheelpath
SHD	-Shoulder

Appendix C

Road Rater 400B Deflection Data

TEMPERATURE: 83 F
TIME: 10:0
ROUTE: US 119 SB 1
TEST DATE: 7-20-89
TEST DEVICE KTRP ROAD RATER MODEL 400

No	Load (kips)	Freq (hz)	Sensors No 1 (mils)	No 2 (mils)	No 3 (mils)	No 4 (mils)	Load/No 1
1	1.19	25.0	0.49	0.36	0.20	0.12	2.43
2	1.19	25.0	0.51	0.37	0.21	0.16	2.33
3	1.20	25.0	0.48	0.36	0.21	0.12	2.50
4	1.20	25.0	0.50	0.36	0.22	0.12	2.40
5	1.19	25.0	0.50	0.36	0.22	0.12	2.37
6	1.20	25.0	0.51	0.36	0.22	0.11	2.34
7	1.22	25.0	0.51	0.37	0.23	0.12	2.39
8	1.22	25.0	0.51	0.36	0.22	0.11	2.39
9	1.22	25.0	0.50	0.36	0.22	0.11	2.44
10	1.21	25.0	0.51	0.36	0.22	0.11	2.36

NOTE: This is a sample deflection data obtained with the Model 400 Road Rater. Column 1 is the test number, column 2 is load in thousand pound units, column 3 is frequency in hertz, columns 4 through 7 are deflection in .001 inch units, and column 8 is the dynamic stiffness (column 2 divided by column 4).

Appendix D

Road Rater 2000 Deflection Data

```
US239.89
US   23 FLOYD COUNTY    S   3  12.596 13.555 10/11/89
6.5   2.00 54.4  0.6 11.0  6.0 60.0    3    15967000.
0033 13.5  80.0 1455 0005
0038 13.0  83.0 1507 0004
0042 12.6  83.0 1515
33  13.50     0.23 0.11 0.19 0.07     25.3  0.59 0.60
33  13.50     0.49 0.29 0.29 0.13     25.3  1.23 1.20
33  13.50     1.15 0.69 0.59 0.29     25.1  2.37 2.40
34  13.40     0.33 0.17 0.15 0.11     25.1  0.61 0.60
34  13.40     0.71 0.43 0.33 0.21     25.3  1.23 1.20
34  13.40     1.69 1.07 0.73 0.43     25.3  2.35 2.40
35  13.30     0.37 0.19 0.21 0.13     25.1  0.65 0.60
35  13.30     0.77 0.43 0.39 0.27     25.1  1.25 1.20
35  13.30     1.63 0.97 0.77 0.51     25.3  2.39 2.40
36  13.20     0.29 0.13 0.11 0.09     25.1  0.61 0.60
36  13.20     0.65 0.35 0.23 0.13     25.1  1.17 1.20
36  13.20     1.69 0.95 0.55 0.27     25.1  2.37 2.40
37  13.10     0.29 0.11 0.13 0.09     25.1  0.57 0.60
37  13.10     0.65 0.35 0.29 0.17     25.1  1.21 1.20
37  13.10     1.51 0.85 0.63 0.39     25.1  2.41 2.40
38  13.00     0.35 0.21 0.19 0.13     25.1  0.63 0.60
38  13.00     0.71 0.45 0.39 0.25     25.1  1.17 1.20
38  13.00     1.79 1.19 0.89 0.57     25.3  2.43 2.40
39  12.90     0.17 0.07 0.13 0.05     25.3  0.61 0.60
39  12.90     0.37 0.17 0.23 0.09     25.1  1.21 1.20
39  12.90     0.81 0.47 0.41 0.21     25.1  2.37 2.40
40  12.80     0.19 0.09 0.11 0.09     25.3  0.61 0.60
40  12.80     0.41 0.25 0.23 0.15     25.1  1.21 1.20
40  12.80     0.89 0.59 0.47 0.29     25.1  2.41 2.40
41  12.70     0.21 0.11 0.13 0.09     25.1  0.63 0.60
41  12.70     0.45 0.27 0.25 0.17     25.1  1.17 1.20
41  12.70     0.99 0.61 0.51 0.35     25.3  2.39 2.40
42  12.60     0.19 0.09 0.11 0.07     25.1  0.59 0.60
42  12.60     0.41 0.23 0.21 0.15     25.1  1.17 1.20
42  12.60     0.91 0.57 0.39 0.33     25.1  2.39 2.40
```

Note: Columns 1 and 2 are Test No. and Milepoint, respectively. Columns 3 through 6 are sensor deflections (.001-inch units). Columns 7 through 9 are frequency (hz), actual load (kips.), and target load (kips), respectively.

Appendix E

FWD Deflection Data

```
Date-Time: 06-27-1989 09:18:12
Sensors: CHOP1    CHOP2    CHOP3    CHOP4    CHOP5    CHOP6    CHOP7
Weight/spring:  3
Location: I-71 JEFFERSON M.P. 8 RIGHT WHEEL PATH
Temp: 92
Operator: GRAVES
Comments: COMPARISON WITH LAY/PCS
Force:  6.00  6.00  6.00  6.00
Sensors: CHOP     CHOP     CHOP     CHOP     CHOP     CHOP     CHOP
Weight/spring:  3
Force:  9.00  9.00  9.00
Location: I-71 NB JEFFERSON M.P 8 RWP
Note: POINTS ARE 25 FEET APART
2 1  8.31  3.44  2.56  2.18  1.73  1.35  1.10  0.81
2 1  8.48  3.43  2.55  2.17  1.71  1.36  1.07  0.81
2 1  8.48  3.44  2.56  2.21  1.72  1.37  1.05  0.78
3 1  8.40  3.29  2.35  1.95  1.49  1.15  0.88  0.64
3 1  8.58  3.31  2.40  1.98  1.50  1.16  0.88  0.63
3 1  8.42  3.26  2.36  1.95  1.47  1.14  0.86  0.67
4 1  8.42  3.01  2.18  1.80  1.39  1.09  0.85  0.66
4 1  8.47  3.01  2.22  1.81  1.37  1.09  0.84  0.63
4 1  8.33  2.97  2.16  1.77  1.36  1.06  0.83  0.70
5 1  8.26  3.03  2.37  1.91  1.46  1.14  0.87  0.68
5 1  8.76  3.15  2.48  1.97  1.50  1.19  0.91  0.71
5 1  8.65  3.08  2.39  1.93  1.49  1.20  0.89  0.70
6 1  8.41  3.04  2.50  2.05  1.57  1.21  0.92  0.70
6 1  8.30  3.05  2.47  2.02  1.53  1.22  0.91  0.68
6 1  8.35  3.05  2.43  2.06  1.52  1.19  0.90  0.65
7 1  8.40  3.59  2.64  2.17  1.69  1.32  0.97  0.77
7 1  8.48  3.52  2.62  2.16  1.65  1.31  0.96  0.74
7 1  8.50  3.53  2.61  2.18  1.65  1.29  0.97  0.71
8 1  8.26  2.61  2.11  1.81  1.47  1.20  0.96  0.75
8 1  8.31  2.73  2.17  1.88  1.51  1.24  0.97  0.76
8 1  8.17  2.66  2.12  1.78  1.46  1.18  0.90  0.80
9 1  8.24  2.98  2.22  1.88  1.50  1.19  0.94  0.78
9 1  8.41  3.05  2.24  1.92  1.54  1.25  0.93  0.69
9 1  8.41  2.99  2.21  1.87  1.50  1.22  0.92  0.72
10 1  8.02  2.56  1.93  1.62  1.27  1.00  0.77  0.61
10 1  8.44  2.64  1.99  1.65  1.31  1.05  0.86  0.60
10 1  8.44  2.66  1.99  1.66  1.33  1.05  0.80  0.66
Note: TEMPERATURE 97
11 1  8.18  1.98  1.54  1.34  1.04  0.86  0.67  0.50
11 1  8.37  2.97  2.18  1.82  1.38  1.09  0.82  0.71
11 1  8.42  2.99  2.20  1.82  1.41  1.11  0.82  0.62
12 1  8.19  2.52  1.83  1.57  1.25  1.03  0.78  0.63
```

NOTE: Columns 1, 2, and 3 are Test No., Lane, and Load (Kips.), respectively. The remaining columns are sensor deflections (.001 inch units).

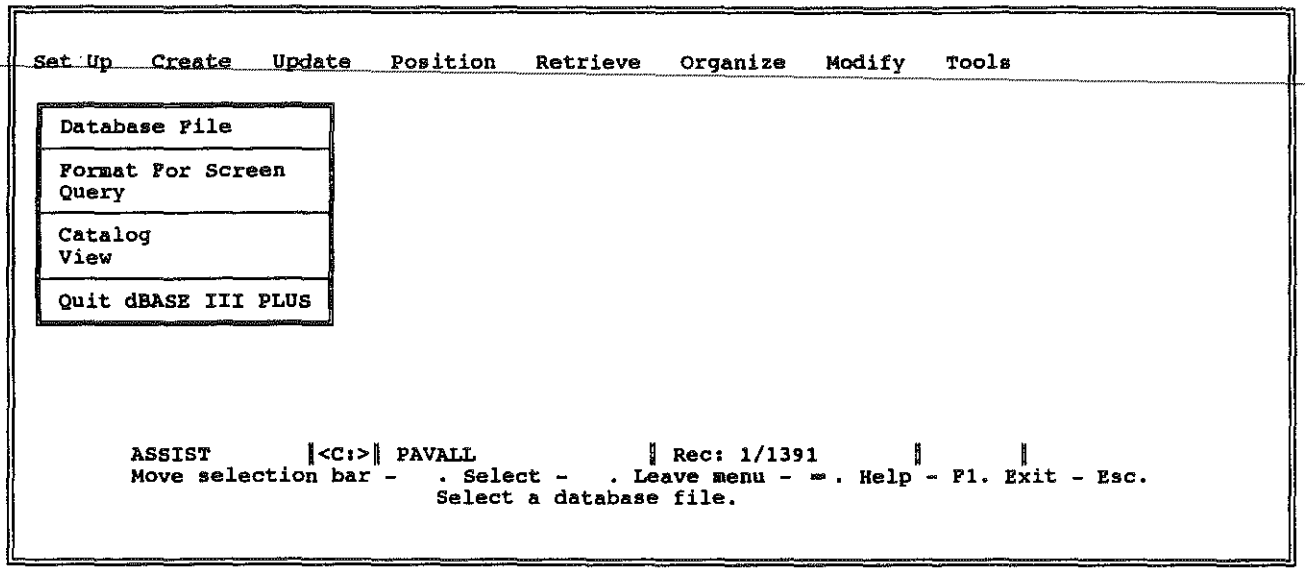

Figure 1. The SETUP Option in ASSIST.

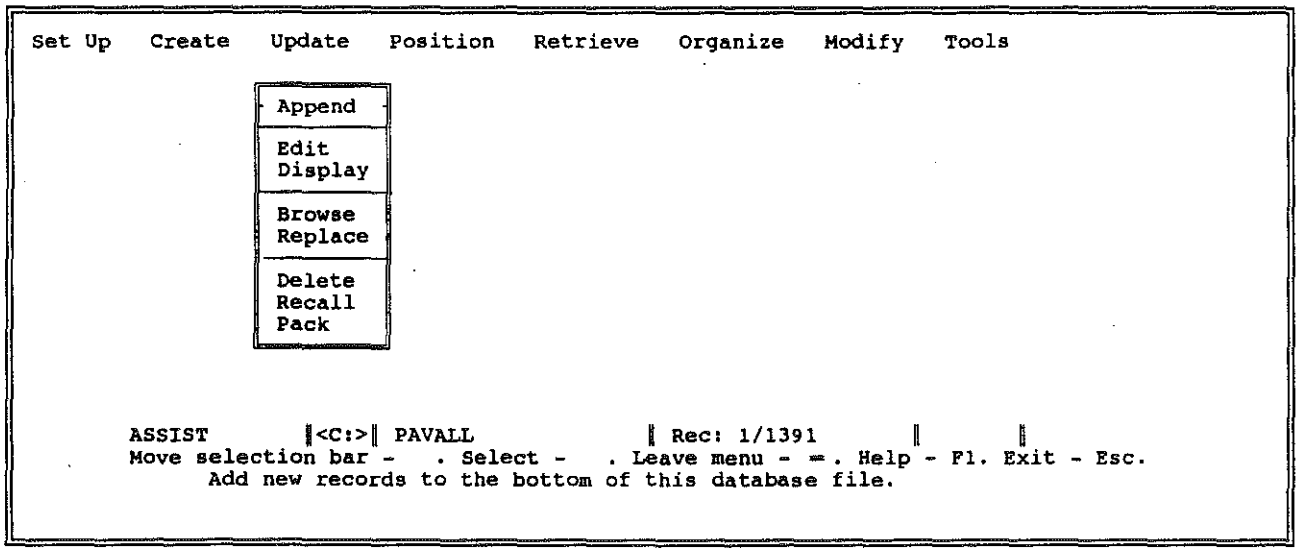

Figure 2. The UPDATE Option in ASSIST.

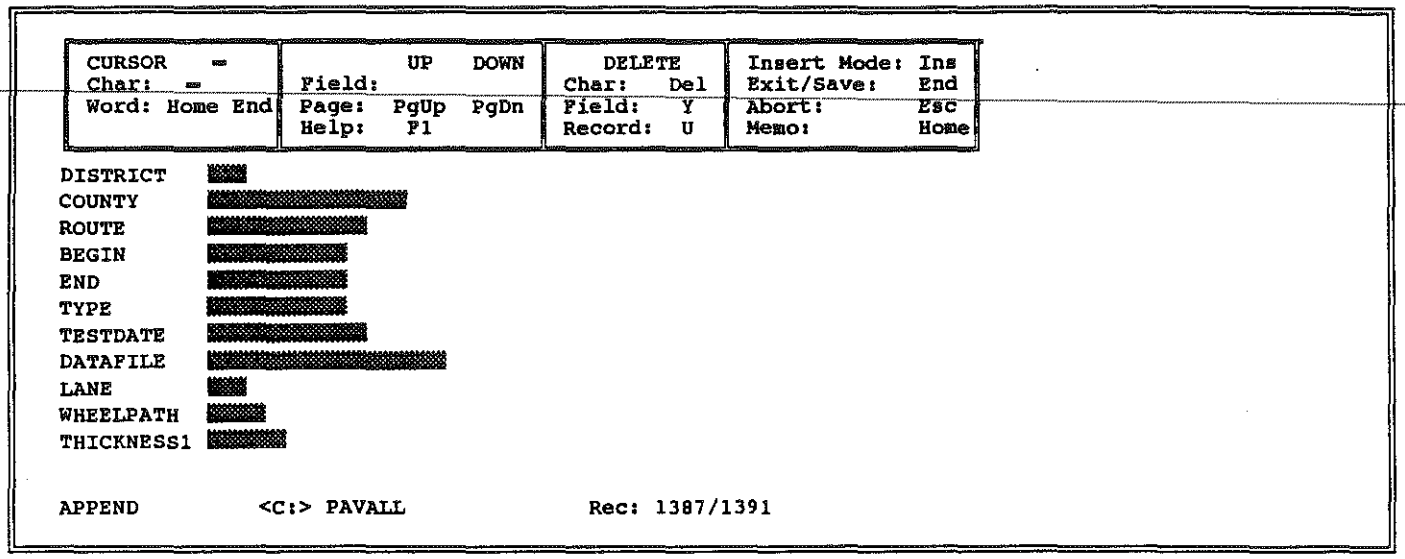

Figure 3. The APPEND Option with The HELP Menu.

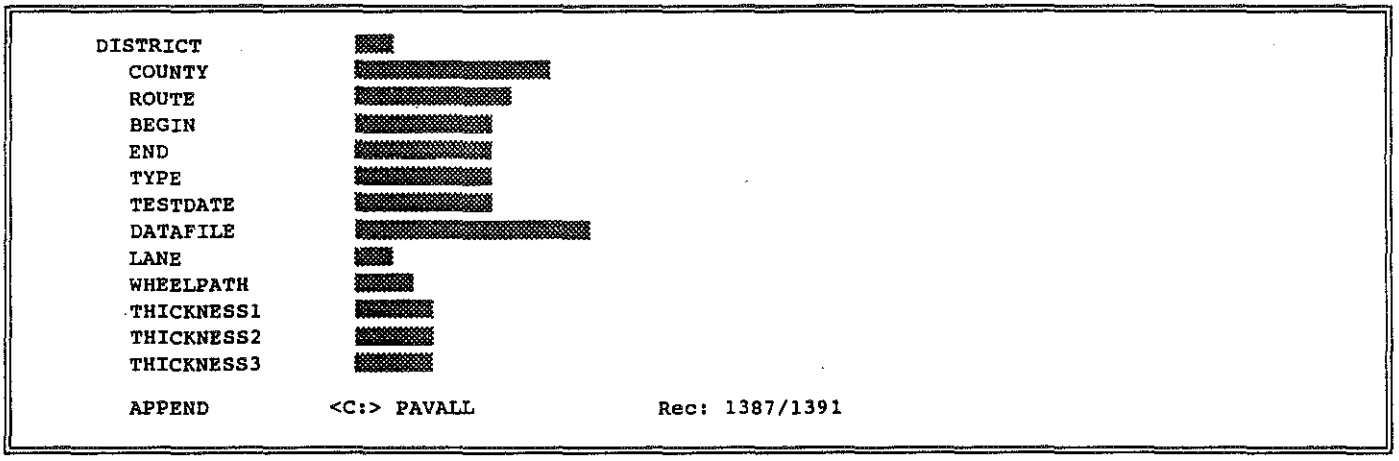

Figure 4. APPEND Option with The HELP Menu Removed.

```
DISTRICT COUNTY--- ROUTE--- BEGIN-- END---- TYPE--- TESTDATE DATAFILE----
4        HARDIN    WKPKWY   130.95  136.25  AC      09/30/86 WK900120.86
4        HARDIN    WKPKWY   130.95  136.25  AC      09/26/86 WK900121.86
4        HARDIN    WKPKWY   119.65  136.25          09/30/86 WK900122.86
4        HARDIN    WKPKWY   120.95  136.25          09/29/86 WK900123.86
4        HARDIN    WKPKWY   119.55  136.25          09/15/86 WK900124.86
4        HARDIN    WKPKWY   123.95  136.25          09/23/86 WK900125.86
4        HARDIN    WKPKWY   130.95  136.25          09/17/86 WK900126.86
4        HARDIN    WKPKWY   130.95  136.25          09/29/86 WK900127.86
4        HARDIN    WKPKWY   123.95  136.25          10/29/86 WK900128.86
2        HOPKINS   WKPKWY   21.80   136.25          01/30/87 WKp-A   .87
2        HOPKINS   WKPKWY   21.80   136.25          10/30/87 WK900120.87
1        LYON      WKPKWY   000.00  136.25  AC      06/30/87 WK900121.87
1        LYON      WKPKWY   000.00  136.25  AC      06/30/87 WK900122.87
1        LYON      WKPKWY   3.7     136.25  AC      05/30/87 WK900123.87
1        LYON      WKPKWY   3.7     136.25  AC      05/30/89 WK900124.89
1        LYON      WKPKWY   3.7     136.25  AC      09/30/89 WK900125.89



BROWSE        <C:>   PAVALL                  Rec: 27/1391
                        View and edit fields.
```

Figure 5. The BROWSE Option in APPEND.

```
        Set Up   Create   Update   Position   Retrieve   Organize  Modify  Tools

                                                          ┌──────────┐
                                                          │ Index    │
                                                          │ Sort     │
                                                          ├──────────┤
                                                          │ Copy     │
                                                          └──────────┘




ASSIST       ‖<C:>‖ PAVALL             ‖ Rec: 1/1391       ‖        ‖
Move selection bar -    . Select -    . Leave menu - ↵. Help - F1. Exit - Esc.
       Create an index file to access records in a specified order.
```

Figure 6. The ORGANIZE Option in ASSIST Where Indices Are Created.

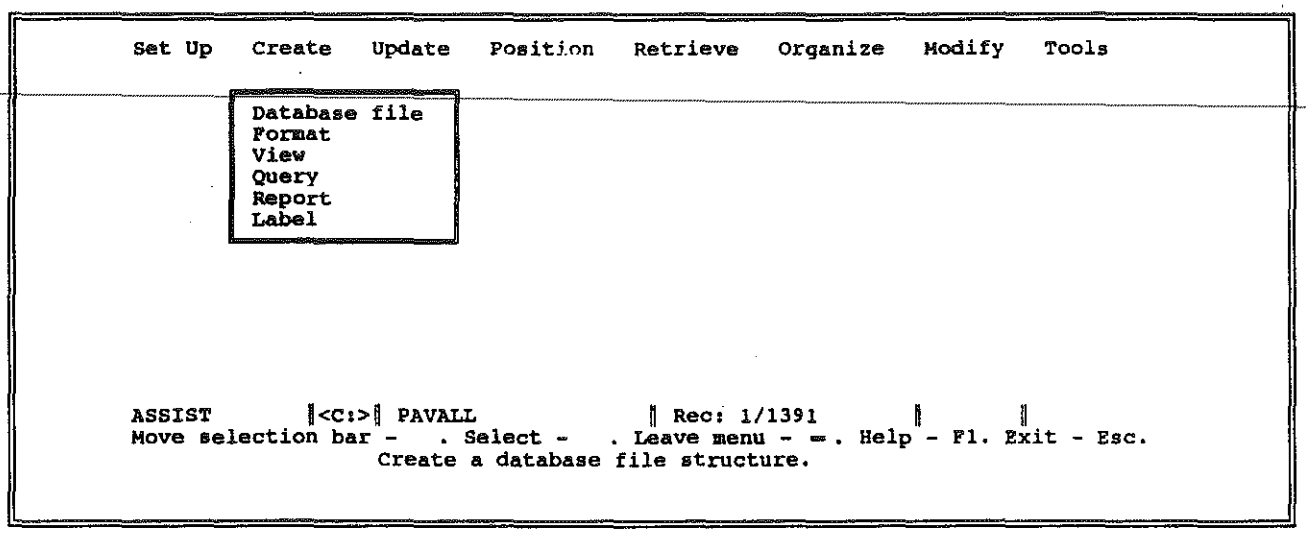

Figure 7. The CREATE Option of ASSIST Where Reports Are Created.

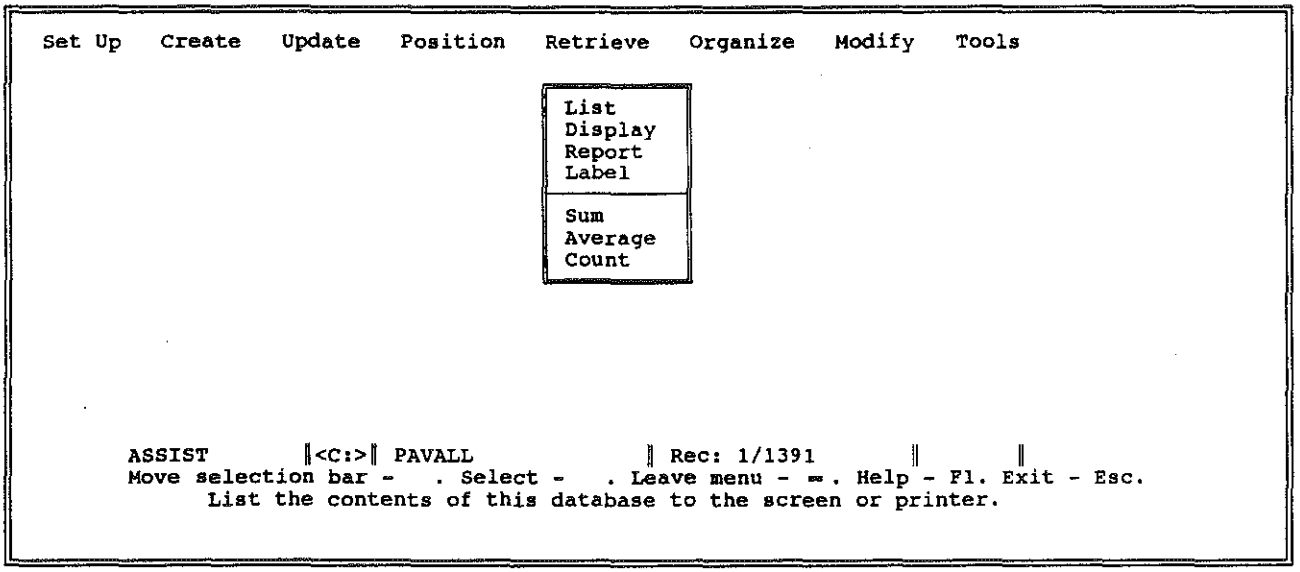

Figure 8. The RETRIEVE Option of ASSIST from Which Reports Are Accessed.

```
Page No.      1
05/25/90

dist county     route     begin     testdate  lane  datafile     type
rict

6    BOONE      25+42     13+75     07/13/88  EB    US25         AC
6    BOONE      25+42     14+25     07/14/88  WB    US25         AC
6    BOONE      25+42     15+00     08/11/88  EB    US25         AC
6    BOONE      25+42     11+75     09/17/88  EB    US25         AC
9    LEWIS      AAHWY     1495+00   04/15/87  EB    AA-TR.BAS    LIMSUBG
9    LEWIS      AAHWY     1515+00   04/15/87  WB    AA-TR.BAS    LIMSUBG
9    LEWIS      AAHWY     1555+00   04/15/87  EB    AA-TR.BAS    LIMSUBG
9    LEWIS      AAHWY     1675+00   04/15/87  WB    AA-TR.BAS    LIMSUBG
```

Figure 9. Typical dBASE Report.

```
                Kentucky Transportation Center
                    University of Kentucky
                  Deflection Catalog Program


               UUUUUUU   UUUUUUUUKKKKKKK   KKKKKKK
                UUUUU     UUUUU  KKKKK      KK
                 UUU       UUU    KKK     KK
                 UUU       UU      KK   KKKKK
                 UUU       UU      KKKK  KKKK
                 UUU       UU      KKK    KKKK
                 UUU       UU      KK      KKKK
                  UUUUUUUUUU       KKKK    KKKKKKK

      Press any key to continue...
```

Figure 10. Opening Screen in The DEF Search And Retrieval Program.

```
                Deflection Catalog Program
                      Main Menu

 DISTRICT       COUNTY        ROUTE NUMBER         TYPE

 BEGINNING MILE POINT     ENDING MILE POINT      TEST DATE

 LANE           WHEEL PATH                       DATAFILE

 THICKNESS 1        THICKNESS 2                  THICKNESS 3

ESC = Quit    Up Arrow = Up    Down Arrow = Down    Enter = Select
```

Figure 11. The Search Menu of The DEF Program.

```
 COUNTY     DISTRICT    ROUTE     BEGMPT     ENDMPT    TESTDATE   DATAFILE
  LEE         10        KY11                            09/28/88  KY11G.TXT
  LEE         10        KY11      430+00     429+00     09/29/88  KY11H.TXT
  LEE         10        KY11      317+00     328+00     11/09/88  KY11F.TXT
  LEE         10        KY11      430+00     429+00     09/29/88  KY11H.TXT
  LEE         10        KY11      317+00     328+00     11/09/88  KY11F.TXT
  LEE         10        KY11      430+00     429+00     09/29/88  KY11H.TXT
  LEE         10        KY11      317+00     328+00     11/09/88  KY11F.TXT
  LEE         10        KY11      430+00     429+00     09/29/88  KY11H.TXT
  LEE         10        KY11      317+00     328+00     11/09/88  KY11F.TXT
PRESS ANY KEY TO CONTINUE

                Print
                Screen = Print      ESC = Quit       Enter = Continue
```

Figure 12. Output of The DEF Program.