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DEVELOPMENT OF AN INTERACTIVE PC BASED DATABASE OF CRASH PULSES

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1. General Description of Software

Occupant simulation programs such as **DYNAMAN** are used to simulate the dynamics of an occupant of a vehicle involved in a crash. One of the primary inputs to the occupant simulation program is the motion of the vehicle defined by the crash pulse. We have developed an interactive PC based software program, called **PULSER** which can be used to obtain crash pulses for a variety of crash situations from an appropriate database. It is an add on program to the **DYNAMAN** software package.

PULSER consists of three components:

* A user friendly query generation system to search the data base for a crash pulse corresponding to a crash event by specifying information such as the vehicle make, model, test closing speed, etc..

* A graphical interface to view the plots of the resulting crash pulses for the vehicle in the x, y and z directions and the geometry of the vehicles involved in the crash and their damage profiles.

* A database that consists of vehicle geometry, crash damage information and crash pulses for a large number of representative vehicle models and a variety of crash situations.

The software will run on 80286 and 80386 based personal computers under DOS 3.xx. The graphics can be viewed on EGA or VGA monitors. Figure 1. shows the main screen of **PULSER**.

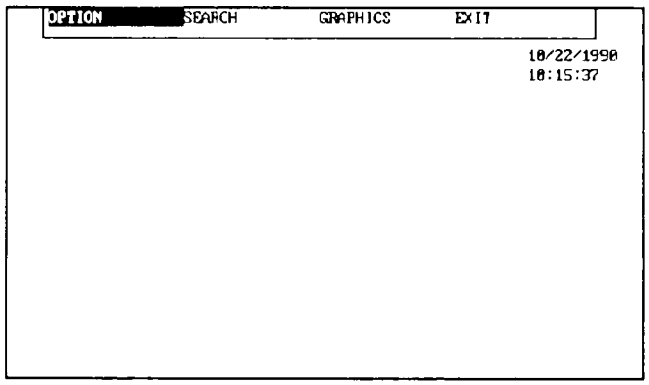

Figure 1. Main menu of PULSER.

2. PULSER Interface to the Database.

The first component of the software is an interactive interface to the database. The interface allows the user to set up a search condition and retrieve the relevant information from the database. Figure 2. shows the data entry screen for setting up a search criterion.

```
                    SET UP A SEARCH CRITERION

MAKE                MODEL                          YEAR

BODY          TSTCFN              MAX.CRUSH        CRS.RANGE

WEIGHT        WT.RANGE            CLSSPD           SPD.RANGE

IMPANG        ANG.RANGE           WHLBAS           WHL.RANGE

IMPPNT        IMP.RANGE           OFFSET           OFF.RANGE

      F1 - PROCESS      ESC - EXIT

< Enter values at the highlighted areas for up to 5 fields>
```

Figure 2. Search criterion screen.

The interface allows the user to enter the information related to the vehicle such as **Make, Model, Year, Body, Weight, and Wheelbase.** The interface also allows the user to enter information related to the crash situation such as **Closing Speed, Test configuration, Maximum Crush, Impact Angle, Impact Point and Impact Offset.**

For fields which require numerical values, e.g. Weight or Closing speed, the user can specify a range of values. For example, if a user wants to search the database for crash events which involve the vehicle weight in the range 2500 - 3500 lbs., he/she can enter 3000 in the **Weight** field and 500 in the **WT.Range** field.

Pulser allows the user to set up a search condition by entering values for up to 5 fields.

After the search condition has been entered, the program will

search the database and retrieve information on those cases which match the condition.

Figure 3. shows the screen which appears after the search is completed. The first line displays the number of cases found in the database which match the specified criteria. The screen also displays a menu. The general information on the cases retrieved from the database can be viewed by selecting **"Display Data"** from the menu.

```
NUMBER OF RECORDS FOUND =    50

PLEASE ENTER YOUR SELECTION TO DISPLAY DATA,
VIEW GRAPHICS, RESTART SEARCH, OR EXIT.

 NUMBER      FUNCTION

    1.       DISPLAY DATA

    2.       VIEW GRAPHICS

    3.       RESTART SEARCH

    4.       QUIT
```

Figure 3. Display data menu.

The general information on the retrieved cases include vehicle make, year, body, weight, closing speed, maximum crush and occupant injury parameters HIC and CSI. The user can review the information and decide on whether to restart the search by narrowing down his search criteria or view the information on the graphics screen. The main screen, shown in Figure 1, is displayed when the user selects to view the graphics.

3. PULSER Graphics Interface:

The second component of the database is the graphics interface. The graphics interface displays the plots of the crash pulses and geometry of the vehicles and their damage profiles for the cases retrieved during the database search. Figure 4. shows a sample screen of the data retrieved using **(HONDA)** as the MAKE and **(CIVIC)** as the MODEL for the search criteria.

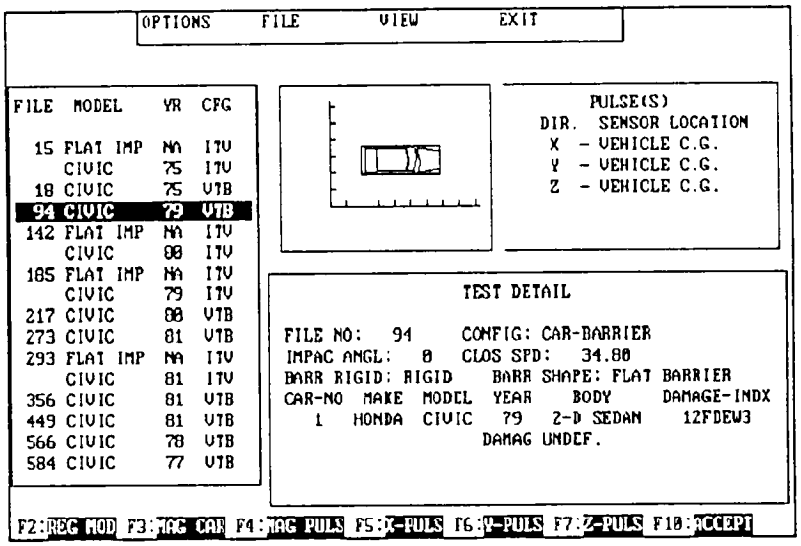

Figure 4. Graphics screen of PULSER.

The graphic information is displayed in four windows on the screen. On the left side of the screen, a window displays a table which contains a list of all the cases retrieved from the database which match the specified criteria. For each case it displays the file number, vehicle make, model, year, and test configuration.

The other three windows on the right side of the screen display information for the specific test which is highlighted in the table.

A small window at the center displays a small view of the geometry of the vehicles involved in the crash and their damage profiles. Another small window on the right displays a list of the available crash pulses, their direction and sensor location. This window will display a message "No Pulse", if no crash pulse is found in the database corresponding to the case.

The fourth window on the bottom displays descriptive information on the case which is highlighted in the table. It includes the file number for the case, test configuration, impact angle, closing speed, barrier type, and barrier shape. It also displays the make, model, year, body and a damage code (VDI) for each vehicle involved.

The user can view the information on any case by highlighting it in the table on the left side of the screen, and then pressing the [ENTER] key.

At the bottom of the screen a status line describes the function keys which can be used to display magnified views of the

vehicles with their damage profiles and crash pulse plots.

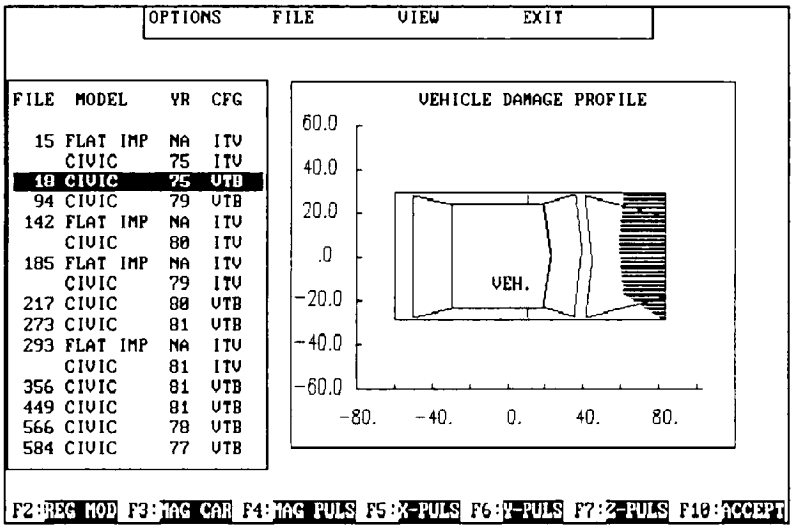

Figure 5. Magnified view of the crashed vehicle.

Figure 5 displays a magnified view of the vehicle geometry and damage profile for the **Honda Civic** crashed against a barrier at 34 MPH. The highlighted area on the vehicle geometry represents the damage sustained by the vehicle.

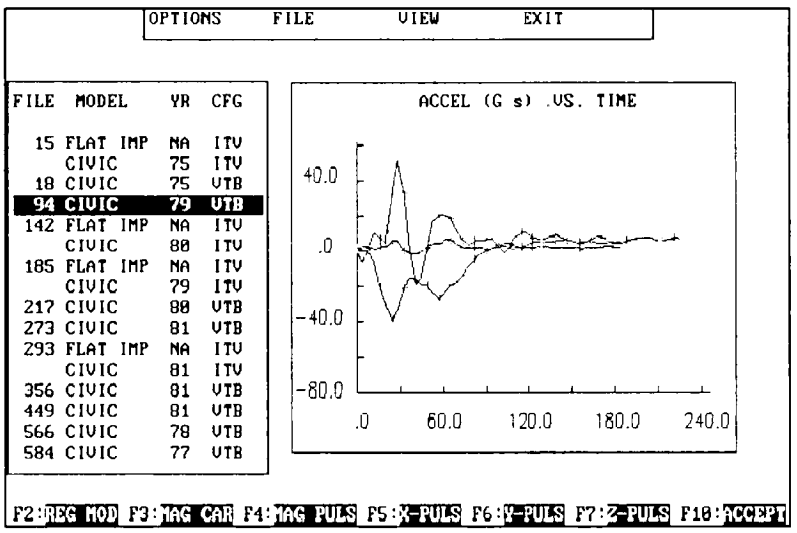

Figure 6. Overlaid plot of crash pulses.

Figure 6 shows the magnified view of the vehicle crash pulse plot in X, Y and Z directions. User can view the crash pulse plot in each direction separately by pressing appropriate keys

[Figure 7, 8, 9]. The pulse plot also displays the location of the sensor in the vehicle in abbreviated form. For example in Figure 5, "X-Direction (VECG)" means the screen displays the crash pulse in X direction measured by the accelerometer located at the Center of Gravity of the vehicle. A message "No Pulse" will appear on the screen if no pulse is available for a case.

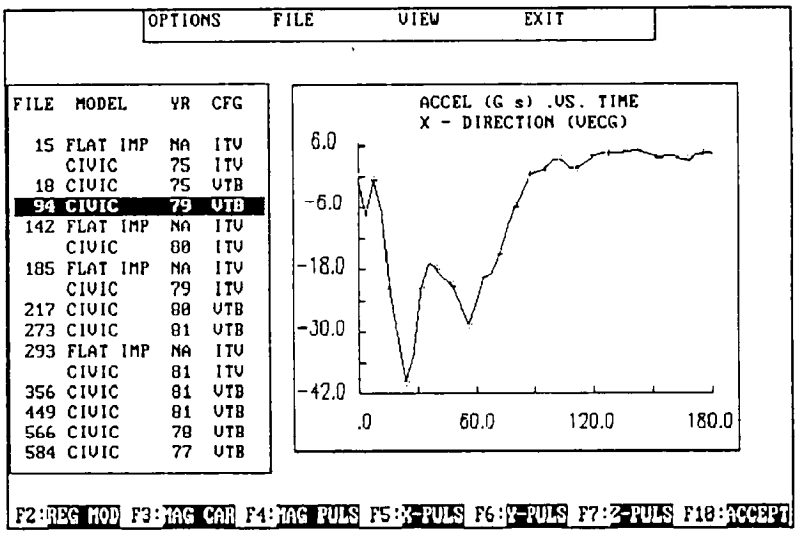

Figure 7. Crash pulse in X direction.

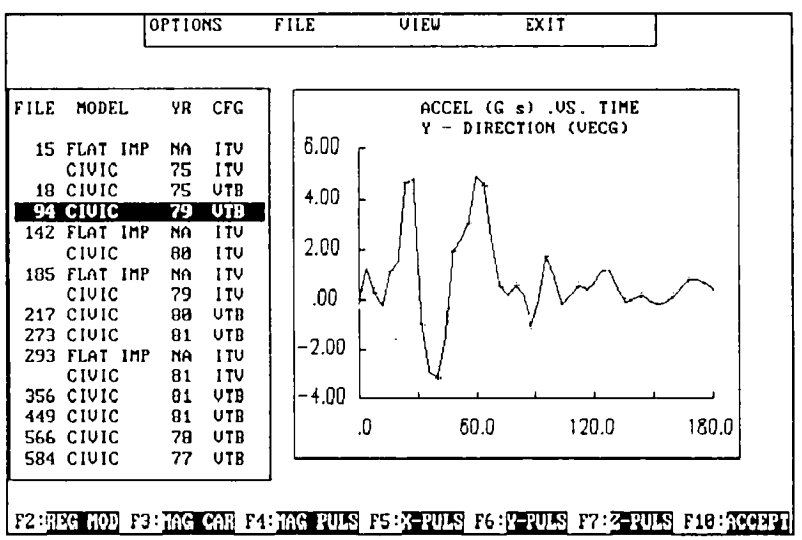

Figure 8. Crash pulse in Y direction.

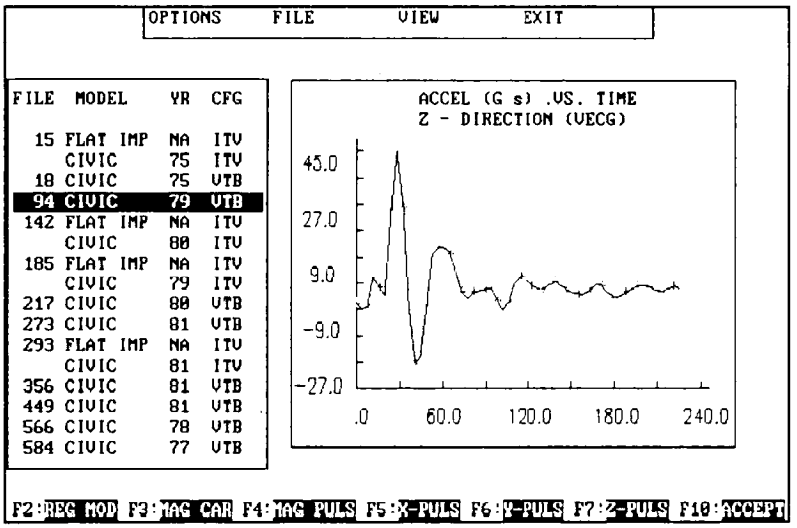

Figure 9. Crash pulse in Z direction.

4. PULSER Database

The third component of the software is the database. The database contains sample information on the vehicle geometry, crash damage, and crash pulses for a large number of representative vehicle models and for a variety of crash situations.

5. Application of PULSER

The crash data obtained by the **PULSER** program are written to a data file which can be read by the **DYNAMAN** preprocessor. **DYNAMAN** allows the user to define vehicle motion in a number of ways. One way is by defining a table of unidirectional deceleration values and a second method is by defining a table of three dimensional deceleration values. For the frontal crash situation the major component of the deceleration pulse is in the X direction. However, pulse in the Y and Z directions could be significantly large in some cases. In those cases vehicle motion should be described as a 3-D tables. **PULSER** allows the user to retrieve the deceleration data for both unidirectional motion and a 3-D motion.

PULSER can be used by the accident reconstruction analyst. The interactive interface can be used to search the database for cases which match the specified criteria corresponding to the accident. The deceleration data obtained from the **PULSER** can then be used in the simulation program to predict the gross body motion of the occupant for the specified crash event.

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No questions asked.