Research Report
KTC-09-17/SPR 358-08-1F

KENTUCKY TRANSPORTATION CENTER

GUARDRAIL LOCATION RATING SYSTEM USERS MANUAL

OUR MISSION

We provide services to the transportation community through research, technology transfer and education. We create and participate in partnerships to promote safe and effective transportation systems.

OUR VALUES

Teamwork
Listening and communicating along with courtesy and respect for others.

Honesty and Ethical Behavior
Delivering the highest quality products and services.

Continuous Improvement
In all that we do.

Research Report
KTC-09-17/SPR358-08-1F

Guardrail Location Rating System Users Manual

By

Charlie Sun
Tony Beckham
Tommy Hopkins
and
Jerry G. Pigman
Eric R. Green
Kenneth R. Agent

Kentucky Transportation Center
University of Kentucky
Lexington, KY

December 2009

1. Report Number	2. Government Accession No.	3. Recipient's Catalog No.
KTC-09-17/SPR358-08-1F		

4. Title and Subtitle	5. Report Date
GUARDRAIL LOCATION RATING SYSTEM USERS MANUAL	*December 2009*
	6. Performing Organization Code

7. Author(s)	8. Performing Organization Report No.
C. Sun, T. Beckham, T. Hopkins, J. Pigman, E. Green, K. Agent	*KTC-09-17/SPR358-08-1F*

9. Performing Organization Name and Address	10. Work Unit No.
Kentucky Transportation Center College of Engineering University of Kentucky Lexington, Kentucky 40506-0281	
	11. Contract or Grant No. *KYSPR-08-358*

12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
Kentucky Transportation Cabinet 200 Mero Street Frankfort, Kentucky 40622	*Final*
	14. Sponsoring Agency Code

15. Supplementary Notes

Prepared in cooperation with the Kentucky Transportation Cabinet and the Federal Highway Administration

16. Abstract

The Kentucky Transportation Cabinet's Division of Maintenance is responsible for identifying and prioritizing locations in need of guardrail. A procedure used by the Kentucky Transportation Cabinet was originally developed by the Kentucky Transportation Center in 1989 and updated in 2002. Based on frequent usage by the Kentucky Transportation Cabinet of the guardrail location rating system database, the need was identified to update the existing database and incorporate improved reporting capabilities. The objectives of the research study, as documented herein, were to update and improve the processes for identification of roadway locations that should be considered for installation of guardrail.

Primary new features include the following:

1) Revised crash data reflecting the most recent statistics of run-off-road crashes,

2) Incorporating the Critical Rate Calculator as the mechanism for obtaining crash data, and

3) Photographs and descriptive information representative of the Subjective Hazard Rating required for each location being considered for guardrail installations.

17. Key Words	18. Distribution Statement
Guardrail Roadside Barriers Safety Hazard Rating Crashes	Unlimited, with approval of the Kentucky Transportation Cabinet

19. Security Classification (report)	20. Security Classification (this page)	21. No. of Pages	22. Price
Unclassified	*Unclassified*	51	

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Run off the road type crashes represented approximately 28 percent of all crashes in Kentucky in 2008. Collisions with fixed objects represented 19 percent of all crashes and 39 percent of fatalities. Typically when vehicles leave the roadway and encroach upon the shoulder and areas beyond, the result is impact with a variety of objects located at varying distances from the travel lane. Among these objects are trees, utility poles, rocks, embankments, and bridge walls. Decisions relative to the type of action to be taken are based on a series of criteria outlined in the *Roadside Design Guide* (1). When conditions dictate, guardrail and other types of longitudinal barriers are used to deflect and protect vehicles that impact objects near the roadway. The Kentucky Transportation Cabinet's (KYTC) Division of Maintenance is responsible for identifying and prioritizing locations in need of guardrail. A procedure used by the Kentucky Transportation Cabinet was originally developed by the Kentucky Transportation Center (KTC) and documented as part of Report KTC-89-39 titled "Warrants and Guidelines for Installation of Guardrail" (2). Additional work was performed in 2001-2002 by KTC, in conjunction with KYTC, to create a database to document sites in need of guardrail based on the *Roadside Design Guide* (1) and field data. This database and a user's guide were documented as an unpublished report in 2002 (3). The resulting Guardrail Rating System database, which is originated at the highway district level and transmitted to the KYTC Division of Maintenance, presently contains approximately 2,000 sites.

Based on frequent usage of the Guardrail Rating System database to determine locations in need of guardrail or other barrier type, the need was identified to update the existing database and incorporate improved reporting capabilities. The objectives of the research study, as documented herein, were to update and improve the processes for identification of roadway locations that should be considered for installation of guardrail. Primary new features include the following:

1) Revised crash data reflecting the most recent statistics of run-off-road crashes,

2) Incorporating the Critical Rate Calculator as the mechanism for obtaining crash data, and

3) Photographs and descriptive information representative of the Subjective Hazard Rating required for each location being considered for guardrail installations.

1.0 INTRODUCTION

Run off the road type crashes represented approximately 28 percent of all crashes in Kentucky in 2008. Collisions with fixed objects represented 19 percent of all crashes and 39 percent of fatalities. Typically when vehicles leave the roadway and encroach upon the shoulder and areas beyond, the result is impact with a variety of objects located at varying distances from the travel lane. Among these objects are trees, utility poles, rocks, embankments, and bridge walls. As outlined in the *Roadside Design Guide*, there are several options, listed below in order of preferred actions to be taken, for reducing roadside obstacles (1):

- Remove the obstacle,
- Redesign the obstacle so it can be safely traversed,
- Relocate the obstacle to a point it is less likely to be struck,
- Reduce impact severity by using an appropriate breakaway device,
- Shield the obstacle with a longitudinal traffic barrier designed for redirection or use a crash cushion, and
- Delineate the obstacle if the other alternatives are not appropriate.

Decisions relative to the type of action to be taken are based on a series of criteria outlined in the *Roadside Design Guide* (1). When conditions dictate, guardrail and other types of longitudinal barriers are used to deflect and protect vehicles that impact objects near the roadway.

The Kentucky Transportation Cabinet's (KYTC) Division of Maintenance is responsible for identifying and prioritizing locations in need of guardrail. A procedure used by the Kentucky Transportation Cabinet was originally developed by the Kentucky Transportation Center (KTC) and documented as part of Report KTC-89-39 titled "Warrants and Guidelines for Installation of Guardrail" (2). Additional work was performed in 2001-2002 by KTC, in conjunction with KYTC, to create a database to document sites in need of guardrail based on the *Roadside Design Guide* (1) and field data. This database and a user's guide were documented as an unpublished report by Beckham, Sun, and Hopkins in 2002 (3). The resulting Guardrail Rating System database, which originates at the highway district level and transmitted to the KYTC Division of Maintenance, presently contains approximately 2,000 sites.

Based on frequent usage of the Guardrail Rating System database to determine locations in need of guardrail or other barrier type, the need was identified to update the existing database and incorporate improved reporting capabilities. The objectives of the research study, as documented herein, were to update and improve the processes for identification of roadway locations that should be considered for installation of guardrail.

2.0 GUARDRAIL RATING SYSTEM OVERVIEW

The Guardrail Rating System database was developed in a client server environment. The server is maintained by the Transportation Cabinet's Office of Information Technology. Users are connected through a local Intranet system. The system is designed to enable users from each highway district to enter and update their data on a central server. At the central office level (Division of Maintenance), personnel have access to the data immediately after updating. Data can flow both ways between district and central offices. Multiple users can use the system simultaneously.

The Guardrail Rating System database was developed using Powerbuilder® 8.0 software. All data is in an Oracle 8.*i*® database. Input and output is performed with Graphical User Interface screens. Knowledge of Windows® type commands is required to use the system.

Search routines, as well as input and output formats were developed, and then modified, after initial testing by the Division of Maintenance. All records are permanently stored and can be retrieved in several formats. Cost data can be entered and stored as a part of the record.

Options are available for including digital photographs and latitude-longitude coordinates, or State Plane coordinates, which allows the data to be displayed on electronic highway maps embedded in the program.

3.0 USER'S MANUAL

Following are descriptions of the data input and update processes for the Guardrail Rating System. Primary new features include the following:

1) Revised crash data reflecting the most recent statistics of run-off-road crashes,

2) Incorporating the Critical Rate Calculator as the mechanism for obtaining crash data, and

3) Photographs and descriptive information representative of the Subjective Hazard Rating required for each location being considered for guardrail installations.

3.1 Users Manual – Log On

To enter the system a **UserID/Last Name** and a **Password** are assigned by the database administrator (contact KYTC Office of Information Technology). The **User ID** is the user's first initial and **Last Name** with no spaces. A database administrator assigns the user's Password. Security is controlled at the login level. Users may only modify data within their respective highway districts. Database administrators can view and edit all data, statewide. Some users have view-only access. The database administrators determine the level of security and access for individual users.

A user must enter their first initial and **Last Name** with no spaces and a **Password** (assigned previously by a database administrator) to log into the system. This log-on screen is shown below as Figure 1.

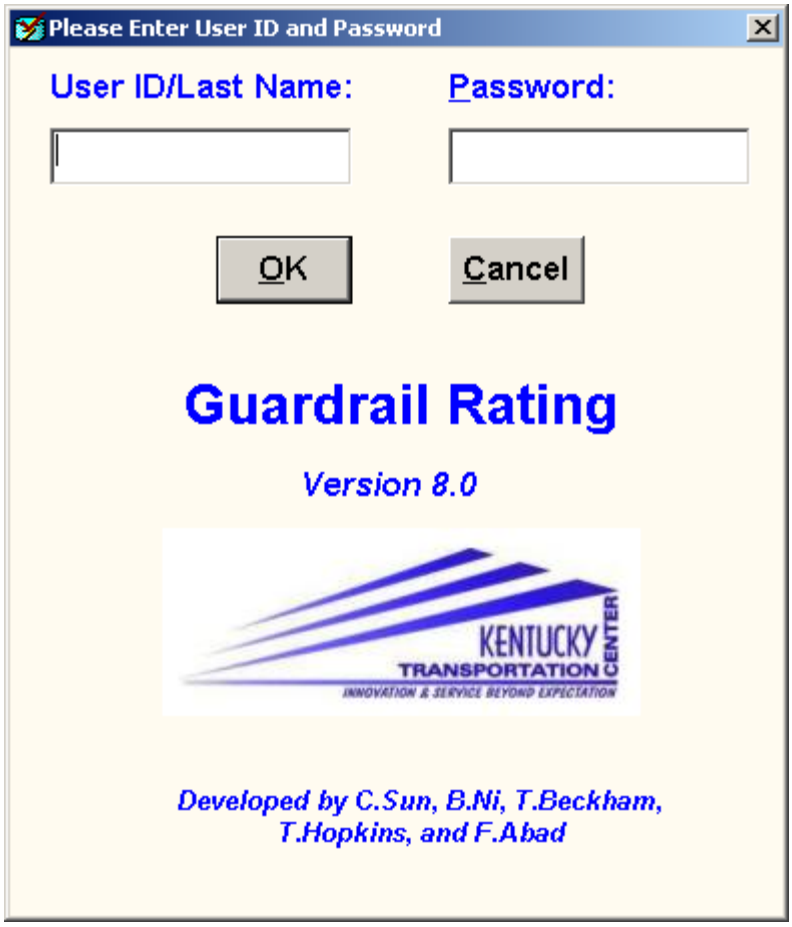


Figure 1. Log On Screen

3.2 User's Manual – Main Menu

After logging into the system the Main Menu Screen appears with options for tasks that can be accomplished beginning with the screen shown as Figure 2.

Figure 2. Main Menu Screen

The **Main Menu** screen (Figure 2) offers the following options:

Add a New Project

Retrieve Priority List

Get Reports

Retrieve Completed Project

Email Service

Exit This Database

3.3 Main Menu – Add a New Project

Activating this option returns to the screen shown in Figure 3.

The first screen displayed is the **Guardrail Survey and Condition Description**. It is based on a paper data form previously used by KYTC's Division of Maintenance. The Survey tab in the upper left-hand corner appears raised when this screen is being used. The **Highway District** box is filled when a **County** is selected from the drop down list or by typing the name in the box. For example, if Anderson County is selected from the drop down list, District 7 is placed in the box (Figure 4). Also, if the first letter of the **County** name is typed, the drop down list choices will begin at the first **County**, alphabetically, of the letter typed. For example, typing D would begin the selection at Daviess County. Typing the first letter of the selection can make choices for any drop down list.

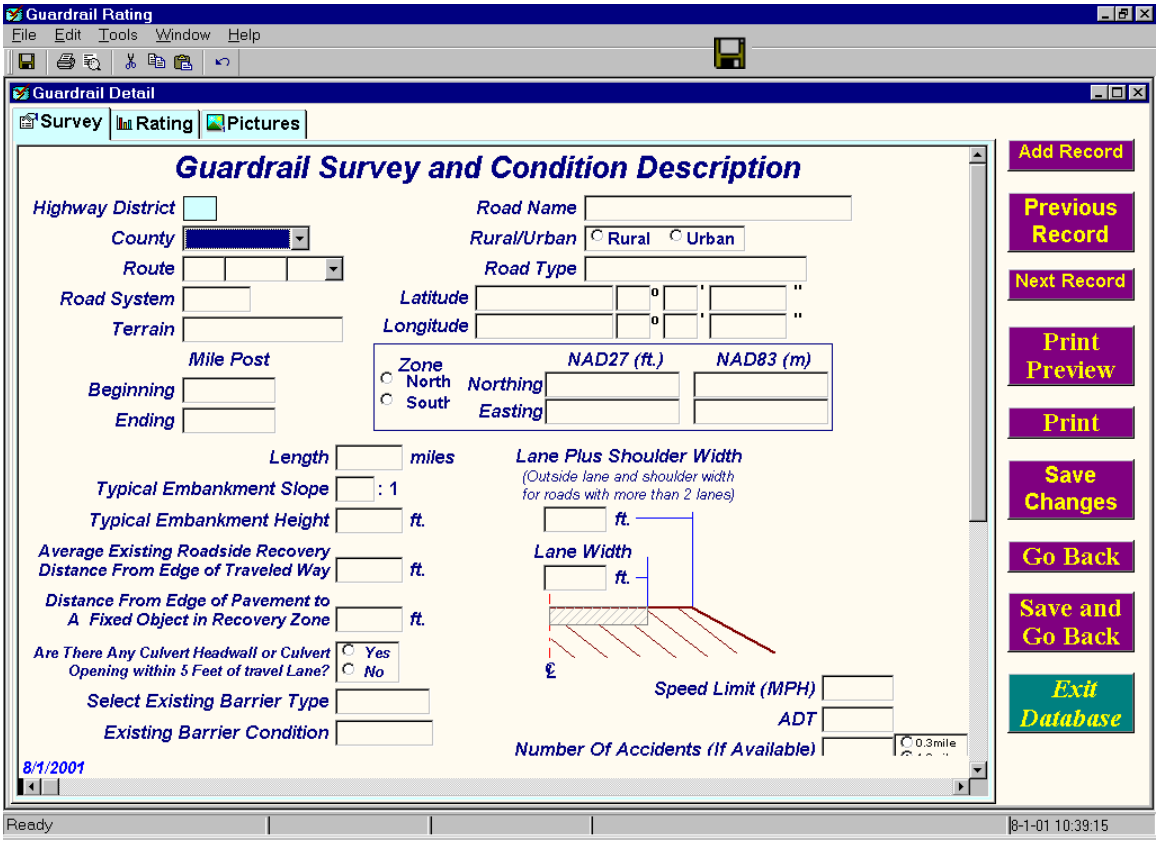


Figure 3. Add a New Project Main Screen

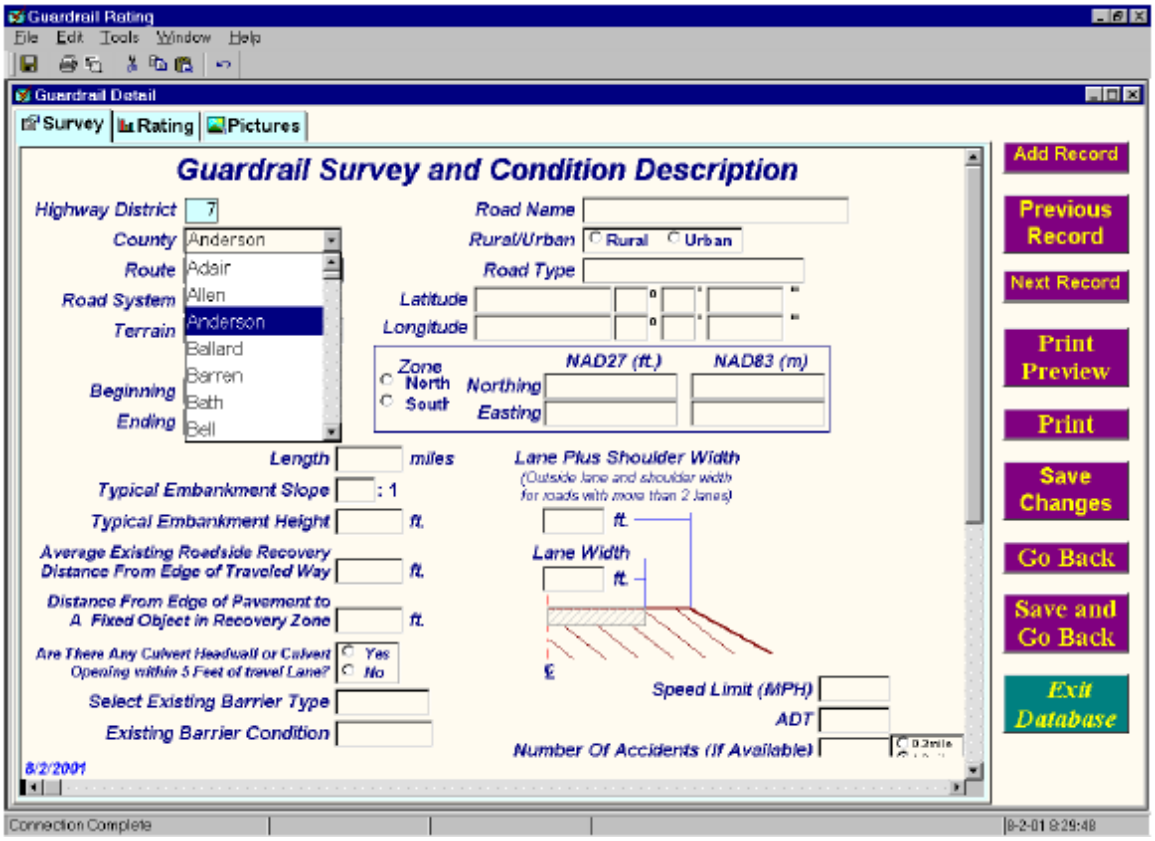


Figure 4. Example Screen Showing District and County Selection

Route prefix information can be typed in or selected from a drop down list, which is activated by placing the cursor in the blank box, as are all boxes when definite preset parameters are established. **Route Number** is typed in the second box. If the route has a suffix it can be entered from a drop down list or by typing the information. US 127 Bypass was selected in the example shown in Figure 5.

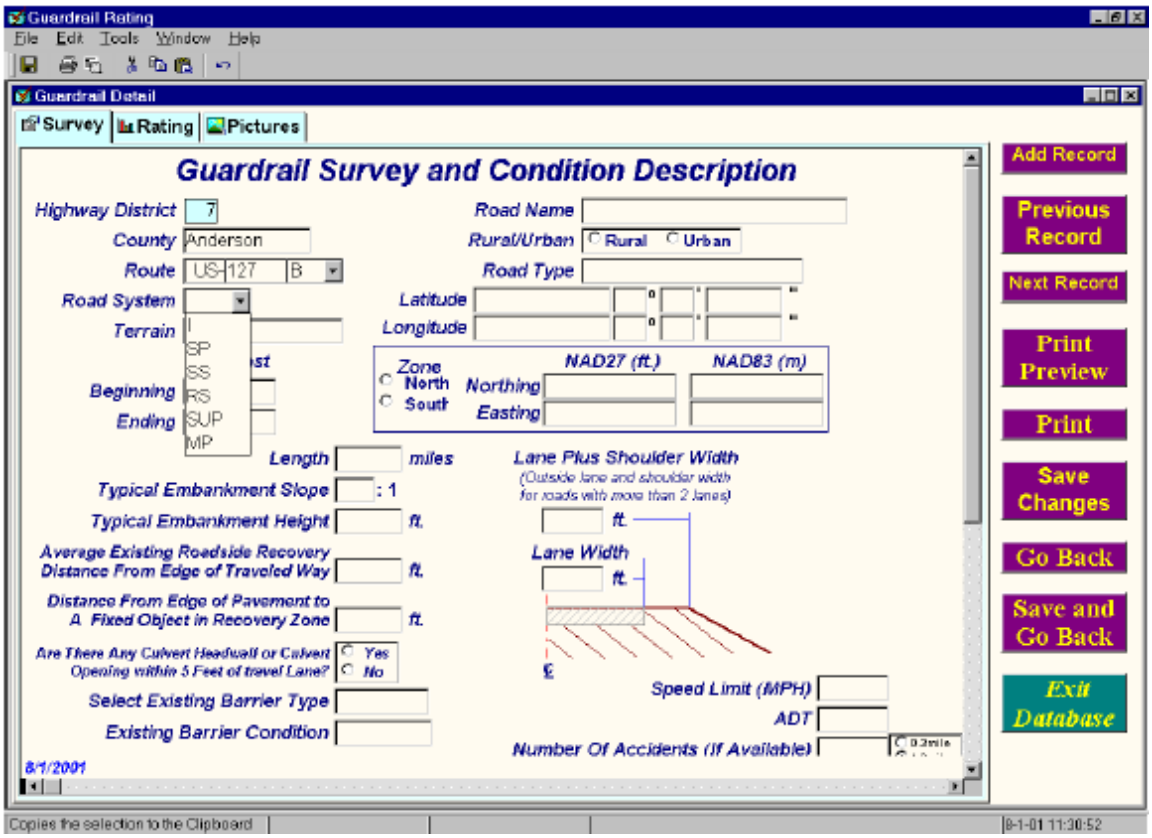


Figure 5. Example Showing Route Selection

The type of **Road System** and **Terrain** are selected from a drop down list or typed in (Figures 6 and 7).

Note: The Rating tab appears only for database administrators.

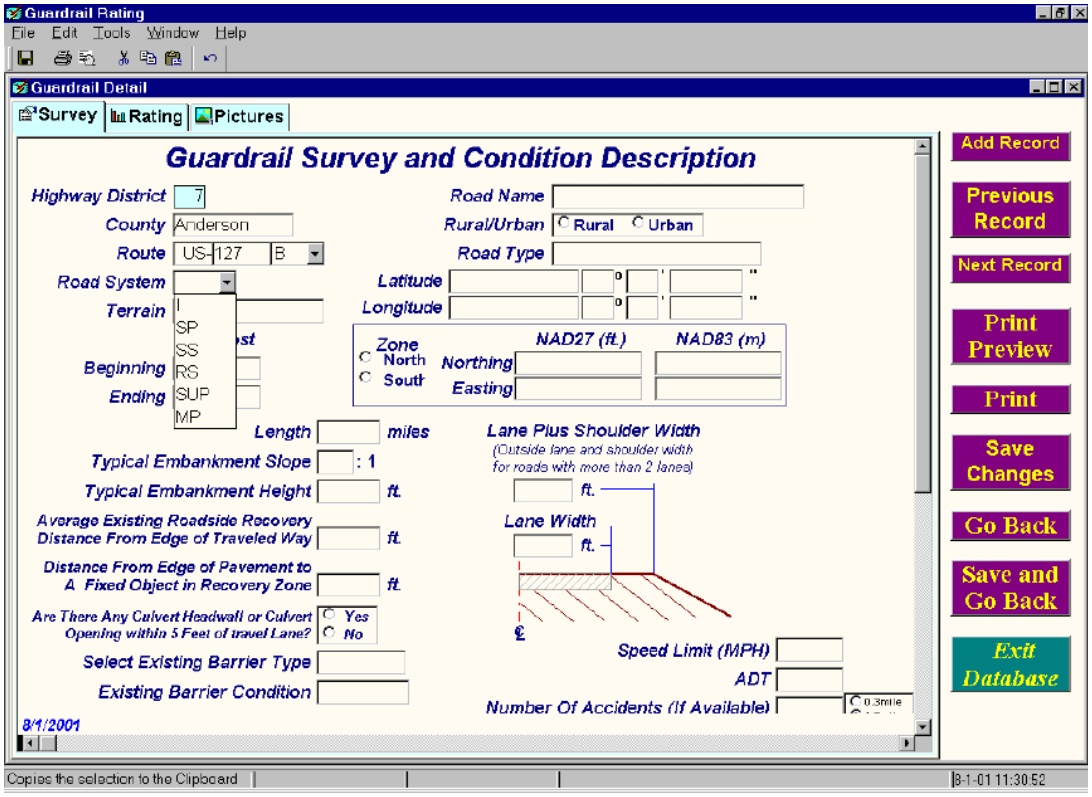


Figure 6. Example Showing Road System Selection

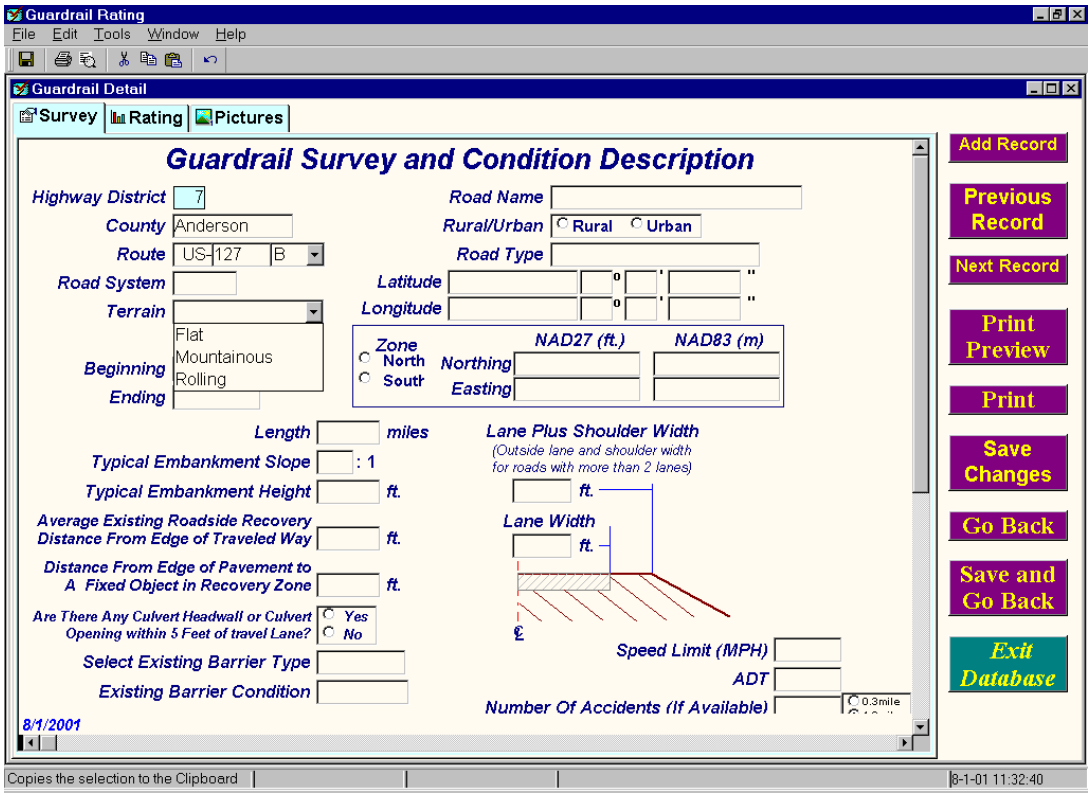


Figure 7. Example Showing Terrain Selection

Beginning and **Ending Mile Post** can be entered and the **Length** of the guardrail section is calculated (Figure 8). If **Mile Post** values are not known, the **Length**, in miles, can be entered independently.

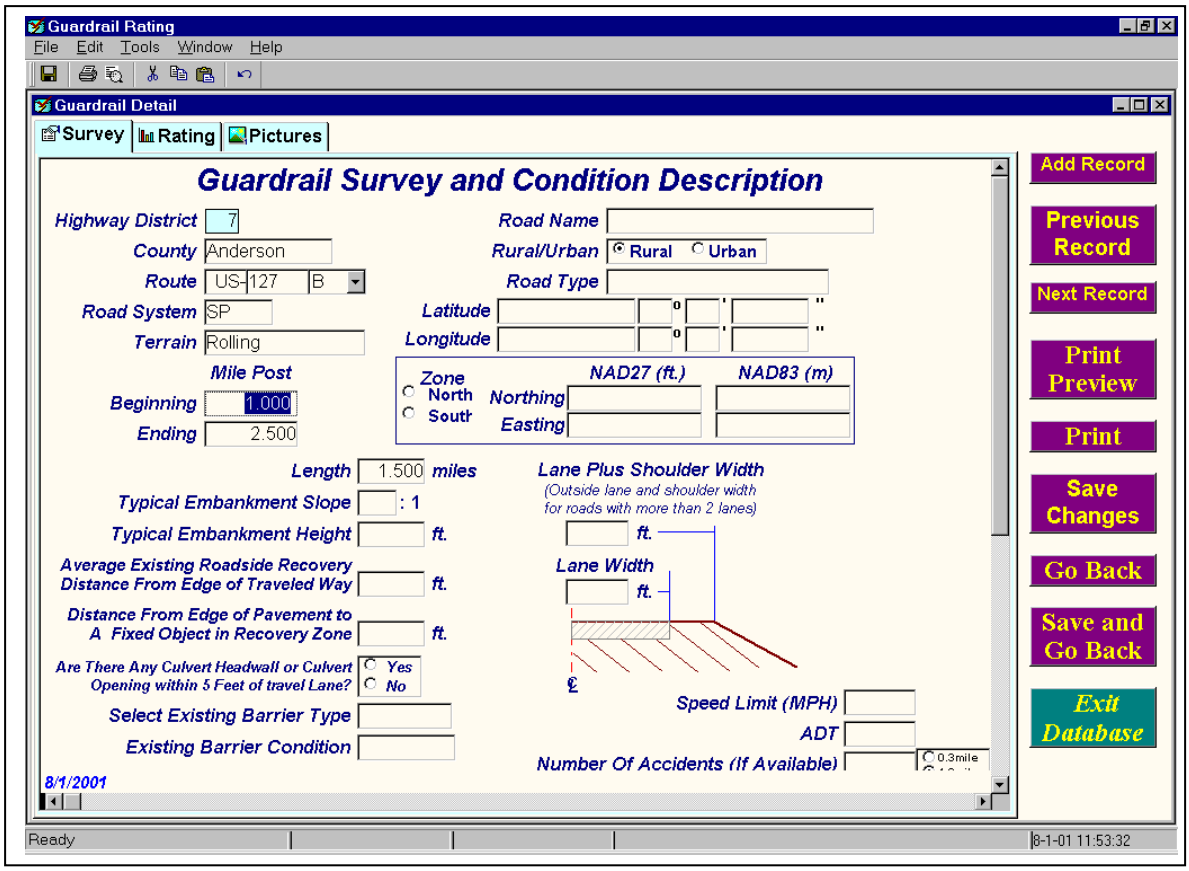


Figure 8. Example Showing Mile Post Values and Length

The horizontal to vertical ratio of the **Typical Embankment Slope** can be entered in the appropriate box or selected from the drop down list as shown if Figure 9, where a 2:1 slope is selected.

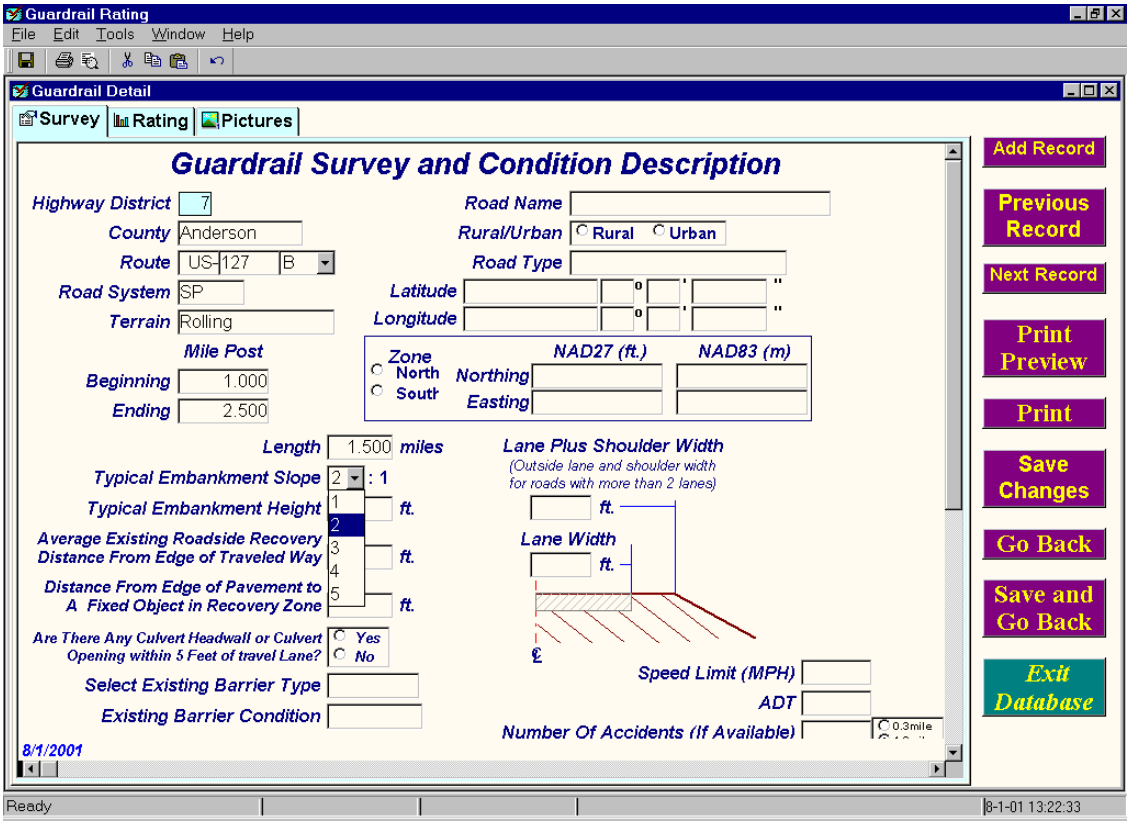


Figure 9. Example Showing Typical Embankment Slope Configuration

Typical Embankment Height, Average Existing Roadside Recovery Distance from Edge of Traveled Way, and **Distance from Edge of Pavement to a Fixed Object in Recovery Zone** values are to be typed in.

Are there any Culvert Headwall or Culvert Openings within 5 feet of Travel Lane? This is selected by clicking the **Yes** or **No** button (Figure 10).

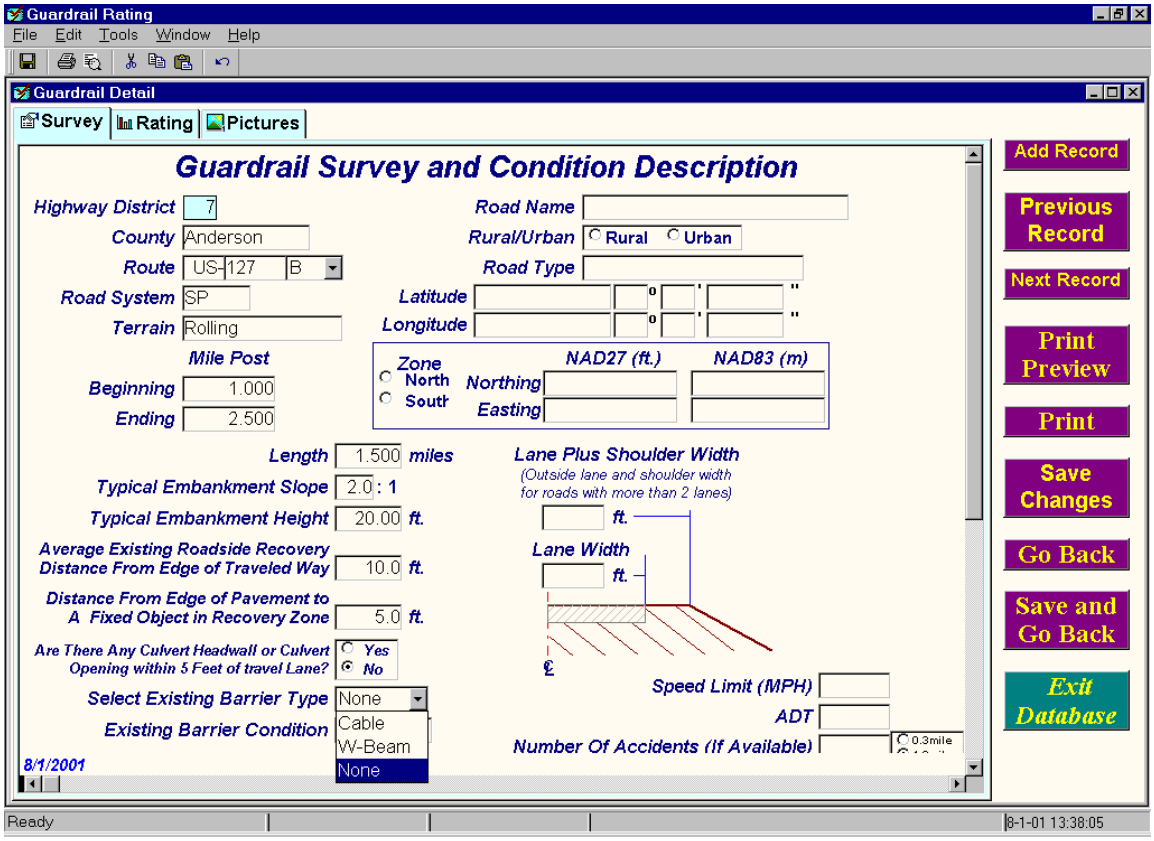


Figure 10. Example Showing Selection for Culverts and Barrier Data

Select Existing Barrier Type is addressed and accomplished by typing or selecting from a drop down list (also shown in Figure 10).

Existing Barrier Condition is selected by typing or choosing from a drop down list (Figure 11).

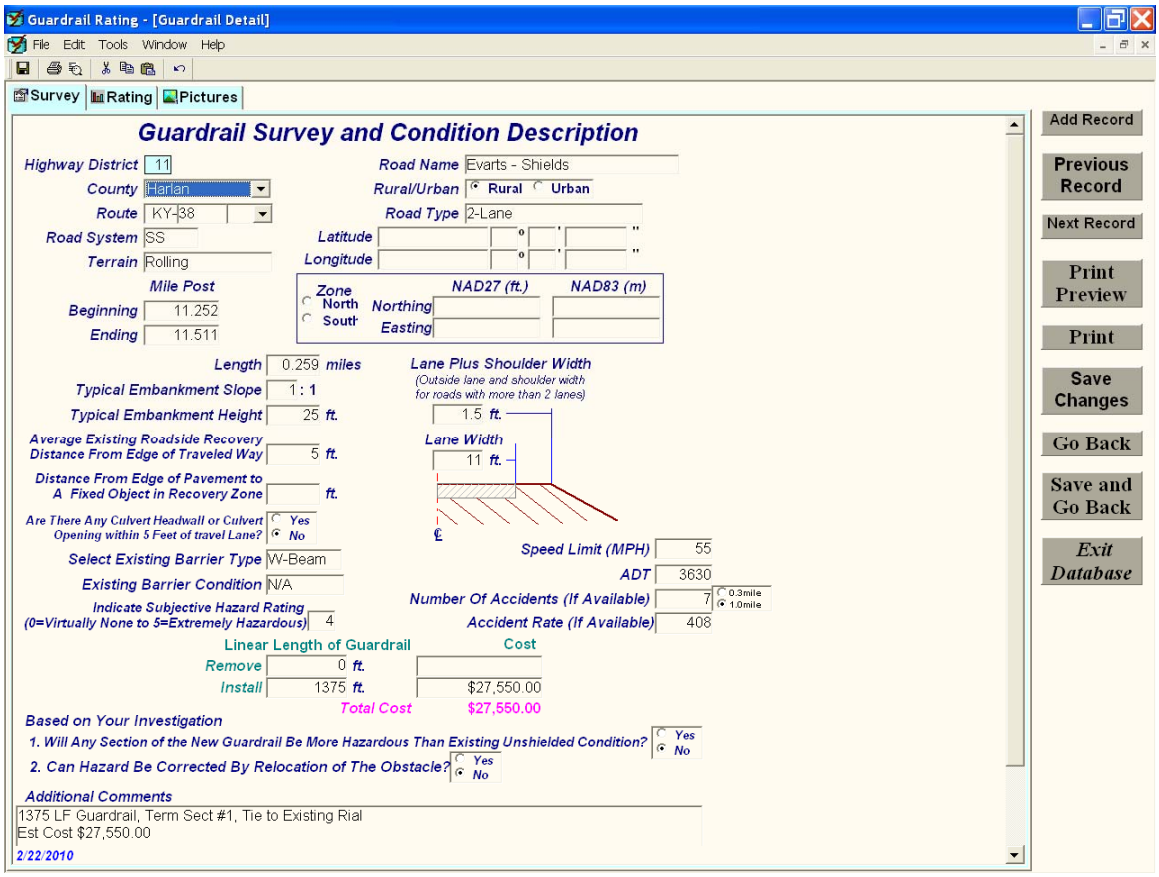


Figure 11. Example Showing Barrier Condition Selection

Lane Plus Shoulder Width and **Lane Width** values are typed entries.

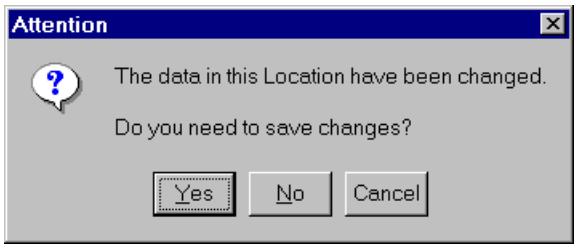
Speed Limit (MPH) is a typed entry.

Addition information for the Guardrail Survey and Condition Description screen is input by scrolling down using the button on the bottom right side, dragging the bar on the right side of the screen, or using a wheeled computer mouse.

Linear Feet of Existing Guardrail to be Removed and **Linear Feet of Existing Guardrail to be Installed** are entered values.

Add Record

A new record can be added by clicking. A prompt will appear to save the existing record.



Returns the **Next Record** selected in a search query
Returns the **Previous Record** selected in a search query

Previous Record

Next Record

Go Back

Save Changes

Exit Database

Print Preview

Print

Save and Go Back

Road Name is typed into the box and Rural or Urban classification is selected by clicking the **Rural/Urban** button 1, as shown in Figure 12.

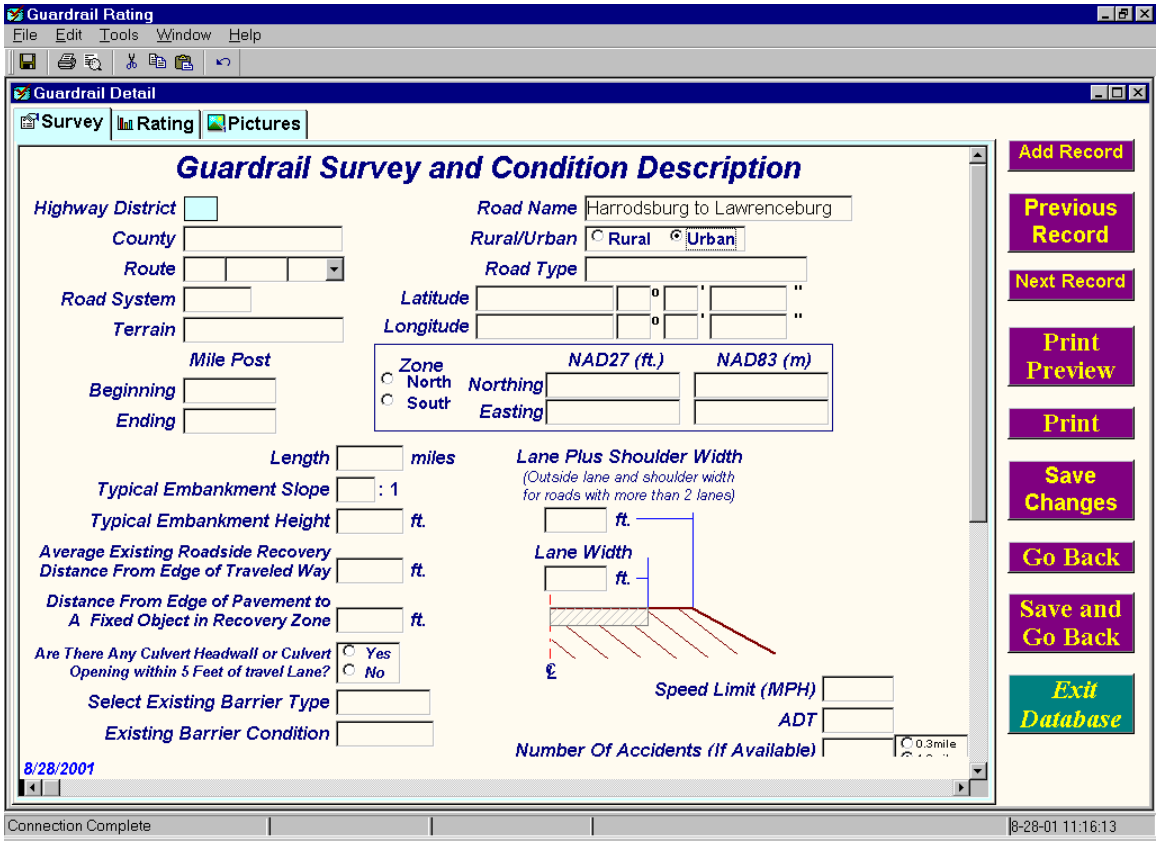


Figure 12. Road Name and Choice of Rural or Urban Entry Example

Road Type is selected by activating the drop down list as shown in Figure 13.

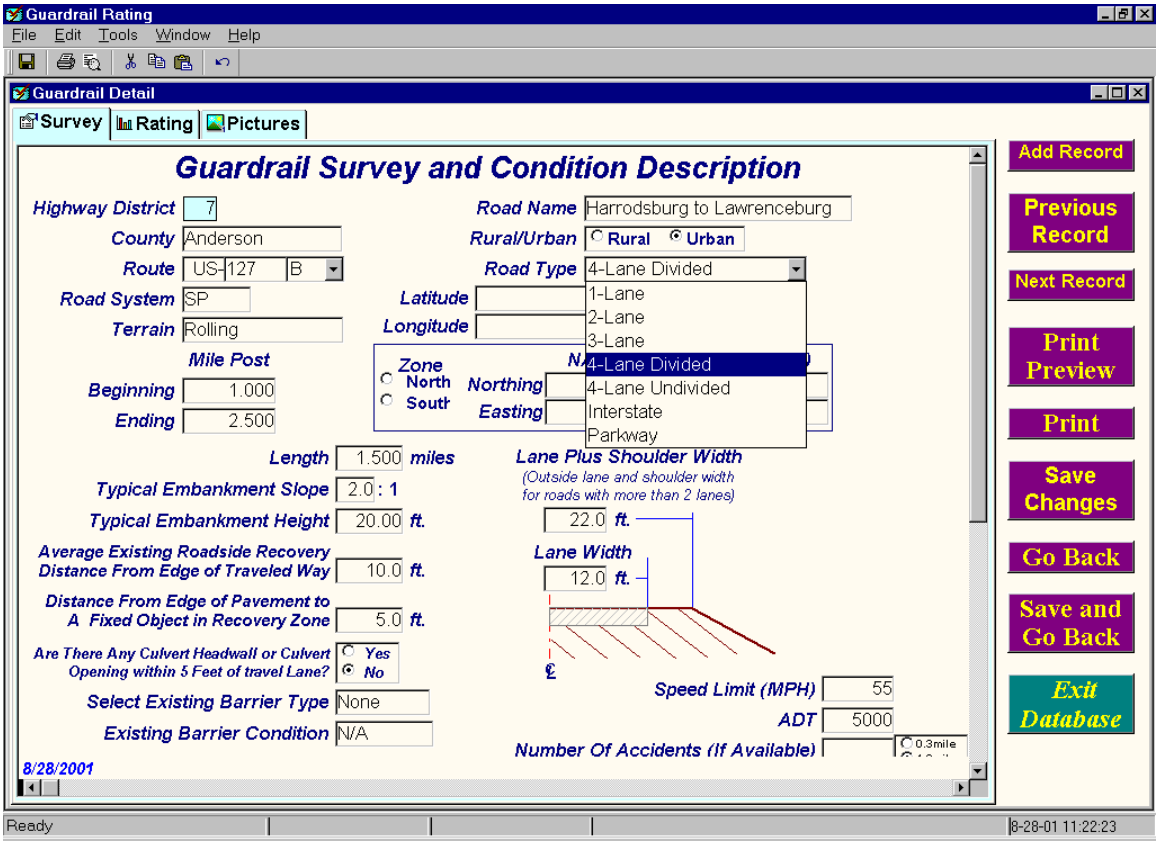


Figure 13. Example Showing Road Type Selection

Latitude and **Longitude** or **State Plane Coordinate** values can be entered if desired, as shown in Figure 14. This feature is included in order for the location data (center of the project, for example) to be geo-referenced and displayed on electronic maps or imported into Geographic Information System (GIS) software packages. Routines have been programmed in the system to convert any combination of Latitude and Longitude from Degrees, Minutes, and Seconds, Decimal Degrees, and State Plane Coordinates. If values are entered in Degrees, Minutes, and Seconds, the corresponding values in decimal degrees and State Plane Coordinates are calculated and displayed. Alternatively, values can be entered, as decimal degrees or State Plane coordinates and the equivalent values are calculated.

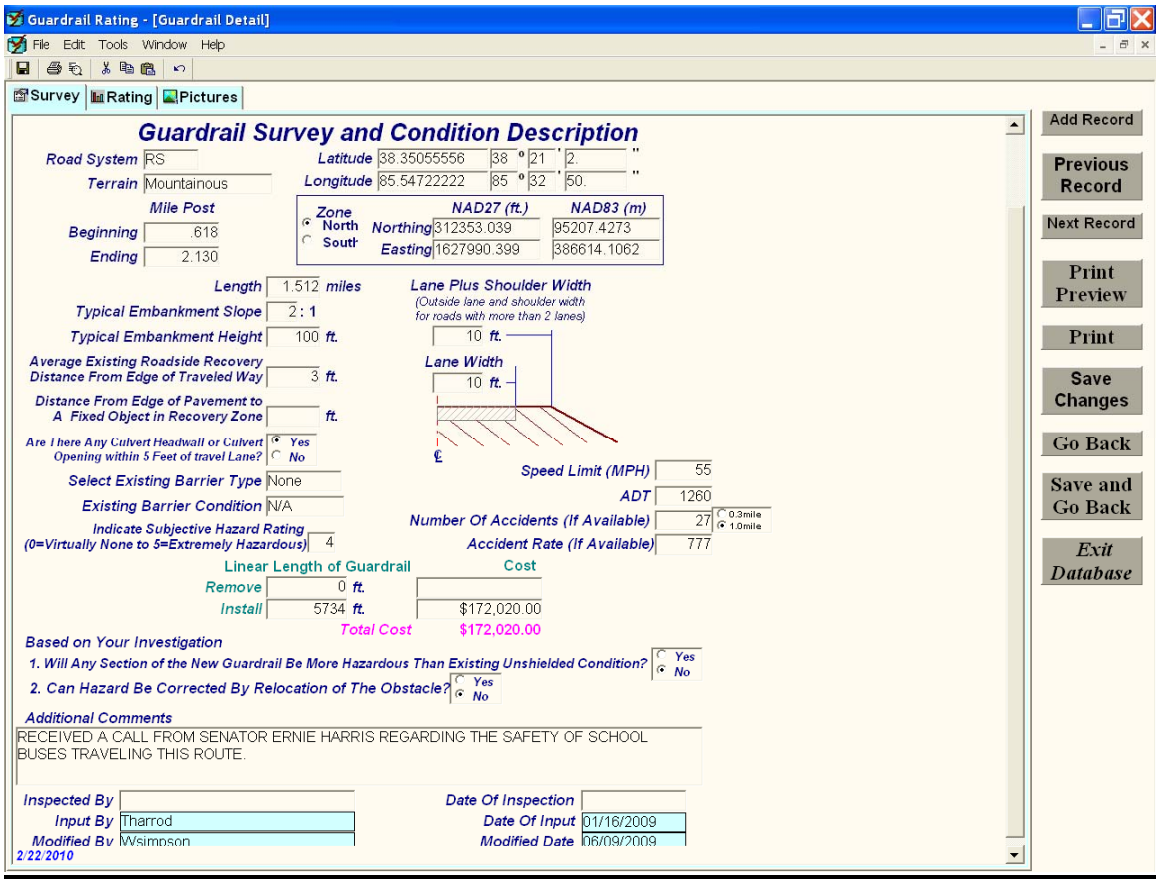


Figure 14. Latitude and Longitude Input Screen

As shown in Figure 15, the inspector or person entering data is asked the following two questions concerning hazards.

1. **Will Any Section of the New Guardrail be More Hazardous than Existing Unshielded Condition?**

2. **Can the Hazard Be Corrected By Relocation of The Obstacle?**

These are answered by clicking the **Yes** or **No** buttons.

A space is provided for any **Additional Comments.**

Inspected By and **Date of Inspection** are entered values.

Input By and **Modified By** are automatically entered. The name entered is the User ID of the person using the system

Date of Input and Modified Date are also automatically entered.

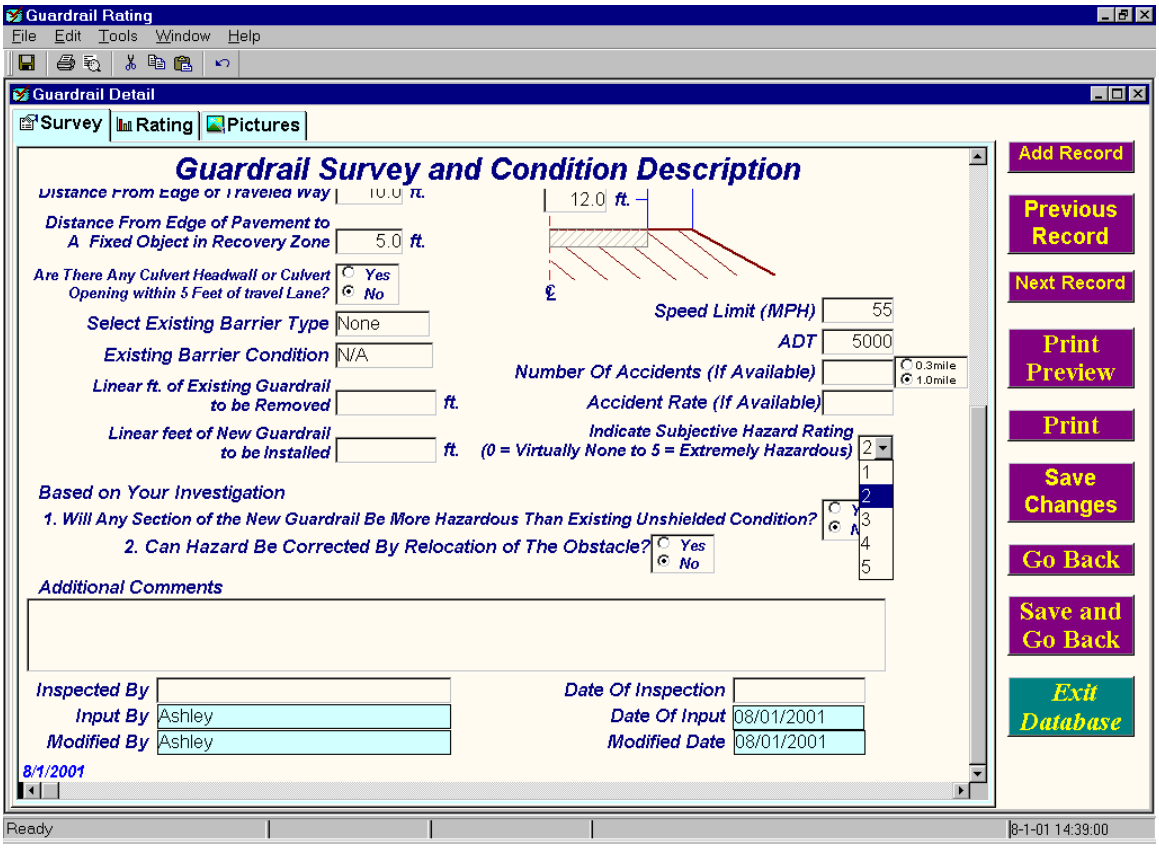


Figure 15. Example Showing Questions, Inspector and Date of Guardrail Survey

An example of a completed screen is shown in Figure 16.

After completing this screen the data can then be saved by using **File** and **Save** from the tool bar or double clicking the icon. If a user attempts to exit this page without saving a screen, Figure 17 will be displayed prompting the user to save.

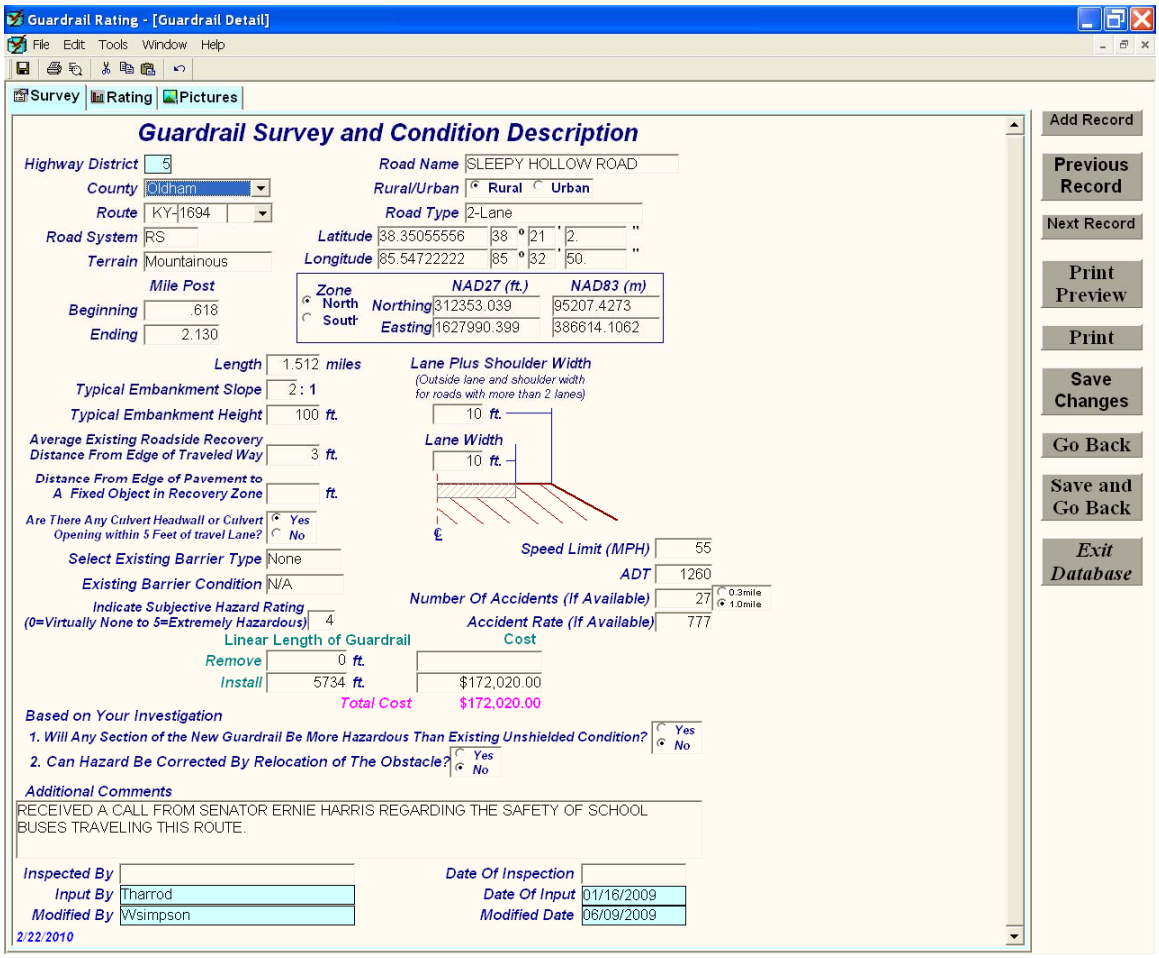


Figure 16. Completed Guardrail Survey and Description Screen

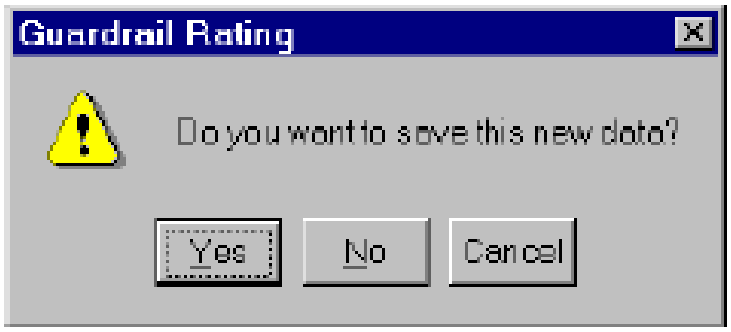


Figure 17. Save Rating Data Screen

Add Record A new record can be added by clicking this button. A prompt will then appear to save the existing record as shown in Figure 18.

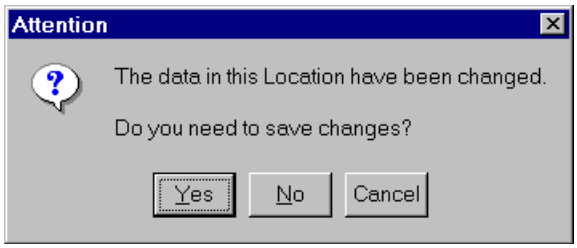


Figure 18. Save Changes Prompt

Previous Record Returns the **Previous Record** selected in a search query

Next Record Returns the **Next Record** selected in a search query

Print Preview Provides a **Print Preview**

Print **Prints** the current record

Save Changes **Saves Changes** in the current record

Go Back **Goes Back** to the previous screen

Save and Go Back **Saves** the current record and **Goes Back** to the previous screen

Exit Database **Exits the Database**

3.4 Hazard Rating Points

The **Rating** prompt at the top left of the screen activates the **Proposed Guardrail Location Summary of Hazard Rating Points** input screen. Figure 19 is an example of a blank **Rating** screen. The rating scores to be input into the database as shown in Figure 19 are described in the following sections. This screen and others displaying a summary of hazard rating points are only available for the central office database adminmistrators.

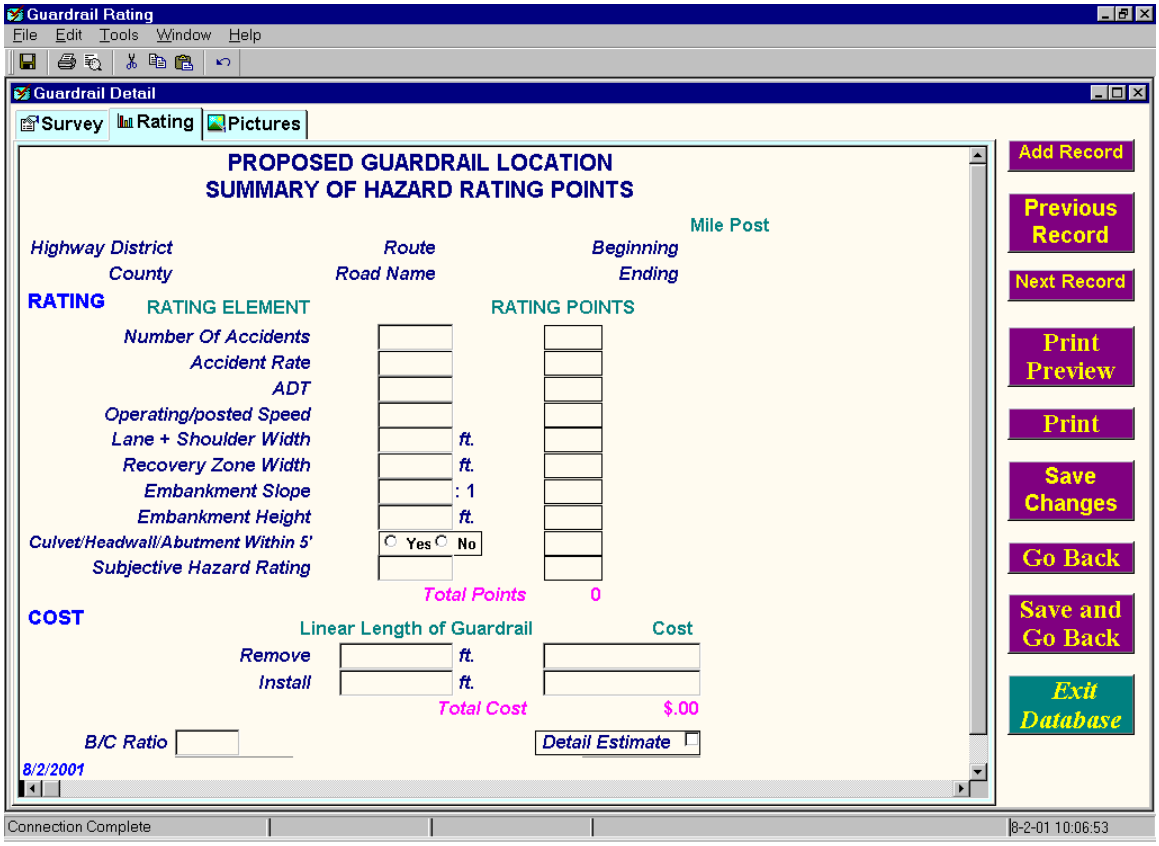


Figure 19. Guardrail Location Summary of Hazard Rating Points Input Screen

As noted in the introduction, procedures for selecting locations in need of guardrail and prioritizing them was originally developed by the Kentucky Transportation Center (KTC) and documented as part of Report KTC-89-39 titled "Warrants and Guidelines for Installation of Guardrail" (2). Hazard Index Rating points were also developed as part of that report and have continued to be used by Kentucky Transportation Cabinet employees. Improved and more automated procedures have since been developed and are being incorporated into this report and the Guardrail Rating System. A primary component of the updated procedure is the Critical Rate Calculator Program that was developed by the Kentucky Transportation Center and used in the analysis and evaluation of statewide crash rates (4). This procedure and accompanying computer programs have been customized to address run-off-the-road crashes for application to address the need for guardrail and other barriers. Following are a series of screen displays from the Critical Rate Calculator Program, with supporting detail explaining application to the Guardrail Rating System. Values for the specific roadway sections being evaluated are to be compared to the following tables to determine the number of Hazard Index Rating points. Figure 20 is an example of the main screen of the Critical Rate Calculator.

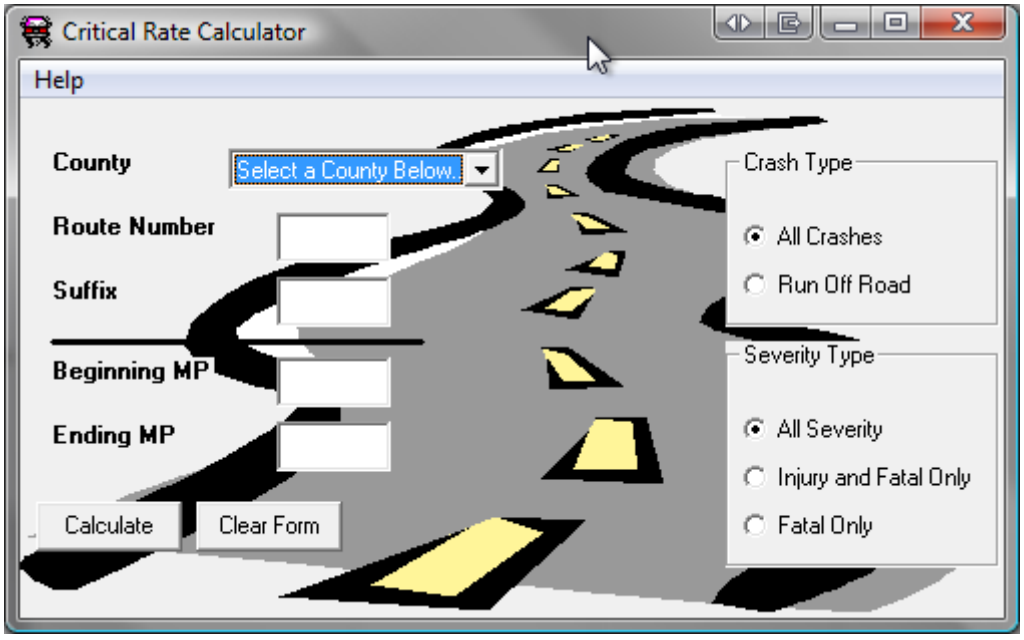


Figure 20. Main Screen Display of Critical Rate Calculator (CRC) Program

Information required for the Critical Rate Calculator program is demonstrated in the example shown in Figure 21. The user should select a **County,** enter a **Route Number** (no prefix), **Suffix** (if applicable), and milepoint range (**Beginning MP – Ending MP**). Additional information to be selected is **Crash Type** (**Run Off Road**) and **Severity Type** (**All Severity** for this example).

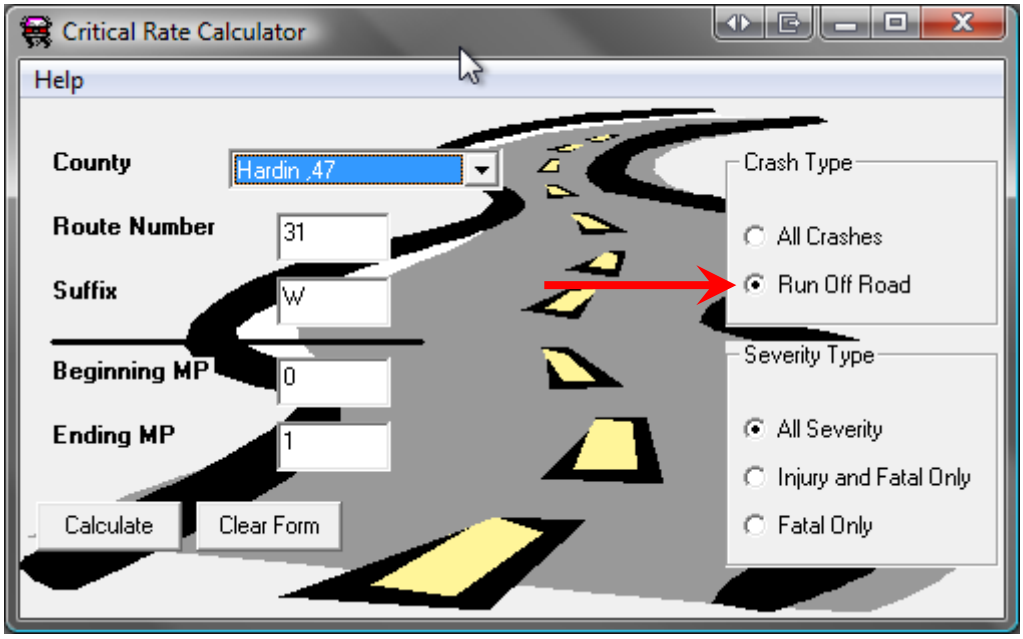
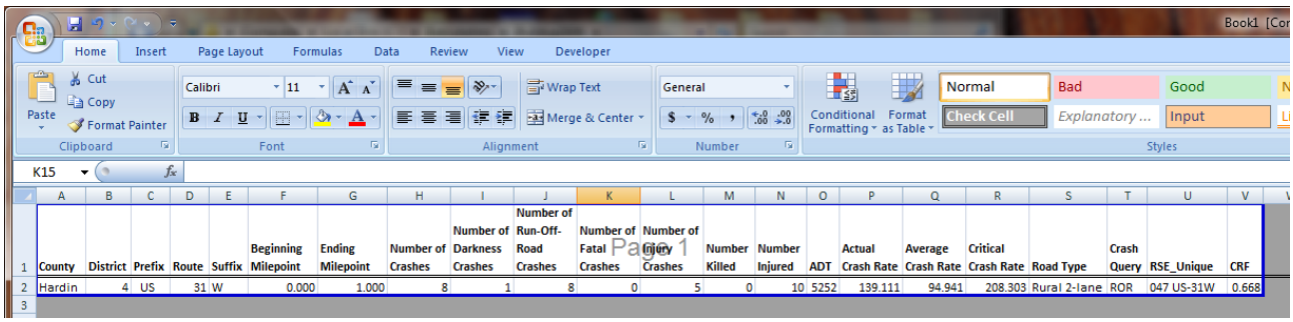


Figure 21. Example Input for Critical Rate Calculator Program

.



	County	District	Prefix	Route	Suffix	Beginning Milepoint	Ending Milepoint	Number of Crashes	Number of Darkness Crashes	Number of Run-Off-Road Crashes	Number of Fatal Crashes	Number of Injury Crashes	Number Killed	Number Injured	ADT	Actual Crash Rate	Average Crash Rate	Critical Crash Rate	Road Type	Crash Query	RSE_Unique	CRF
2	Hardin	4	US	31	W	0.000	1.000	8	1	8	0	5	0	10	5252	139.111	94.941	208.303	Rural 2-lane	ROR	047 US-31W	0.668

Figure 22. Results from Example of Critical Rate Calculator as Displayed in Excel

Results from the example using Critical Rate Calculator as shown in Figure 22 provide the following information for entering and assessing number of crashes and crash rate as part of the Hazard Index Rating:

- Number of crashes,
- **Number of run-off-road crashes**,
- Number of fatal crashes,
- Number of injury crashes,
- Number killed,
- Number injured,
- **Average daily traffic**,
- Actual crash rate (for the specific road segment being evaluated),
- Average crash rate (for all segments representative of this road type),
- **Critical crash rate**,

- Road type,
- Crash query type,
- RSE Unique (unique county and route identifier), and
- **CRF (critical rate factor which is actual divided by critical crash rate)**.

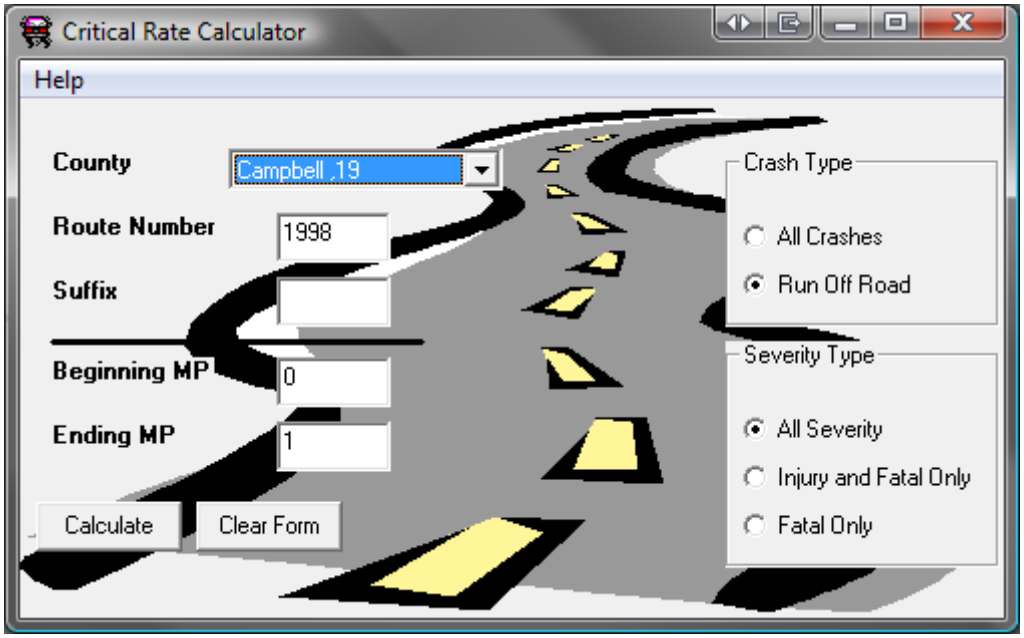


Figure 23. Return to CRC to Run Subsequent Queries

By returning to the **Critical Rate Calculator** main screen as shown in Figure 23, additional queries can be made and displayed in the Excel spreadsheet format.

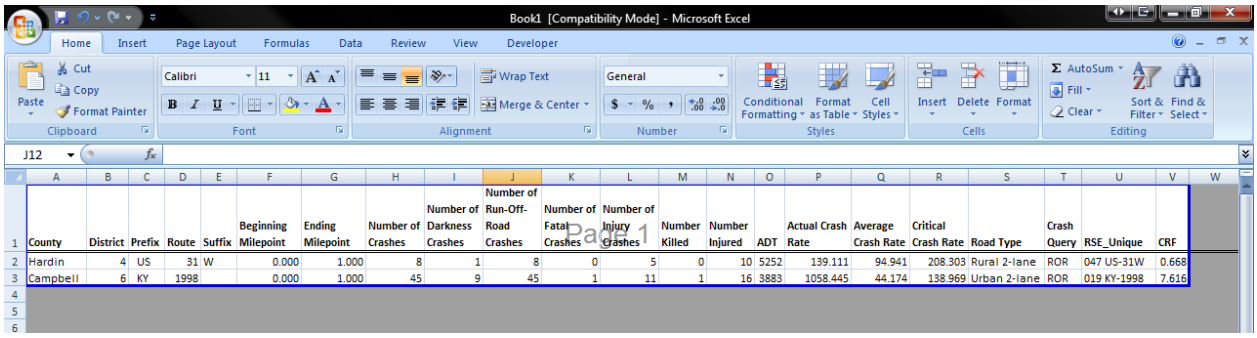


Figure 24. Excel Spreadsheet Displaying Multiple Queries

Subsequent queries are appended to the existing Excel document as shown in Figure 24. The calculations are formulas in Excel; therefore, the capability is available to edit the number of crashes if needed. This edit will change/adjust the calculated rates.

Hazard Index Rating – Critical Number of Crashes
(Run-off-road crashes)

Note: Assign 15 points if the number of crashes for a roadway section is equal to or greater than the **Critical Number of Crashes** shown for each type of road and length.

If the number of crashes for the specific road segment is less than the **Critical Number of Crashes**, assign 0 points.

Rural Sections
Critical Number of Crashes

Type of Road	0.3 Mile	1.0 Mile	Points
1-Lane	2	3	15
2-Lane	4	7	15
3-Lane	4	9	15
4-Lane Div.	5	11	15
4-Lane Und.	6	14	15
Interstate	11	15	15
Parkway	6	12	15

Urban Sections
Critical Number of Crashes

Type of Road	0.3 Mile	1.0 Mile	Points
2-Lane	5	12	15
3-Lane	7	17	15
4-Lane Div.	9	22	15
4-Lane Und.	8	19	15
Interstate	21	56	15
Parkway	9	21	15

Hazard Index Rating - Crash Rate
(Run-off-road crashes)

Note: Assign 15 points if the Critical Rate Factor (Actual Crash Rate divided by Critical Crash Rate) is greater than 1.0.

Rural Sections			Urban Sections		
Type of Road	Critical Crash Rate (Crashes/100 MVM)	Points	Type of Road	Critical Crash Rate (Crashes/100 MVM)	Points
1-Lane	114	15	2-Lane	44	15
2-Lane	95	15	3-Lane	46	15
3-Lane	28	15	4-Lane Div.	38	15
4-Lane Div.	96	15	4-Lane Undiv.	28	15
4-Lane Undiv.	30	15	Interstate	28	15
Interstate	26	15	Parkway.	43	15
Parkway.	34	15			

Hazard Index Rating - Traffic Volume

Note: Assign number of points corresponding with average annual daily traffic.

AADT	Points
0 – 100	0
101 – 500	2
501 – 1,000	4
1,001 – 2,500	6
2,501 – 5,000	8
> 5,000	10

Hazard Index Rating - Highway Speed
(Speed limit or prevailing speed if less than speed limit)

Note: Assign number of points corresponding to speed limit or prevailing speed.

Speed (mph)	Points
25 or less	0
26 – 35	3
36 – 45	5
46 – 55	7
56– 70	10

Hazard Index Rating - Roadway Cross-Section
(Average lane and shoulder width or outside lane and shoulder width for roads with more than 2 lanes)

Note: Assign number of points corresponding to lane and shoulder width cross-referenced with average annual daily traffic.

	Points by Volume (AADT) Category			
Width (feet)	0 – 500	501 – 1,000	1,001 – 2,500	> 2,500
more than 20	0	0	0	0
18 – 20	2	2	2	3
15 – 17	2	3	4	5
11 – 14	3	5	6	7
10 or less	4	6	8	10

Hazard Index Rating - Average Roadside Recovery Distance
(Including shoulder width)

Note: Assign number of points corresponding to average roadside recovery distance cross-referenced with average annual daily traffic.

	Points by Volume (AADT) Category			
Distance (feet)	0 – 500	501 – 1,000	1,001 – 2,500	> 2,500
30 or more	0	0	0	0
20 – 29	2	2	2	3
10 – 19	2	3	4	5
5 – 9	3	5	6	7
4 or less	4	6	8	10

Hazard Index Rating - Typical Embankment Slope

Note: Assign number of points corresponding to embankment slope cross-referenced with average annual daily traffic.

	Points by Volume (AADT) Category			
Slope	0 – 500	501 – 1,000	1,001 – 2,500	> 2,500
5:1 or flatter	0	0	0	0
4:1	0	1	2	3
3:1	2	3	4	5
2:1	3	5	6	7
1:1 or steeper	4	6	8	10

Hazard Index Rating - Typical Embankment Height

Note: Assign number of points corresponding to embankment height cross-referenced with average annual daily traffic.

Height	Points by Volume (AADT) Category			
(feet)	0 – 500	501 – 1,000	1,001 – 2,500	> 2,500
5 or less	0	0	0	0
6 - 10	0	1	2	3
11 – 20	2	3	4	5
21 - 30	3	5	6	7
more than 30	4	6	8	10

Hazard Index Rating - Culvert Headwall or Opening Within 5 Feet of Travel Lane

Yes - 5 Points
No - 0 Points

Note: Assign either 0 or 5 points based on whether a culvert headwall or opening was within 5 feet of the travel lane.

Hazard Index Rating – Average Roadside Character
(Based on a scale of 1 to 5 (lowest to highest hazard) representing the degree of hazard associated with a section of roadway being considered for installation of guardrail)

Note: Assign number of points corresponding to the overall character of the roadside.

Example photographs representative of the five categories of roadside hazard are shown on the following pages.

Subjective Rating	Points
1	1
2	2
3	3
4	4
5	5

Rural Roadside Hazard Rating of 1

Rural Roadside Hazard Rating of 2

Rural Roadside Hazard Rating of 3

Rural Roadside Hazard Rating of 4

Rural Roadside Hazard Rating of 5

Figure 25 shows a screen where the data is automatically displayed from values entered for each of the Hazard Index Rating Points.

3.5 Cost Data

Also shown on the screen displayed as Figure 25, is the capability of entering unit **Cost** data for removing existing guardrail and installing new guardrail. When **Cost** data is entered, a **Total Cost** is calculated.

B/C Ratio is a benefit to cost ratio feature which is not currently activated.
Detail Estimate box should be checked if appropriate.
Letting Date and **Completion Date** can be entered.

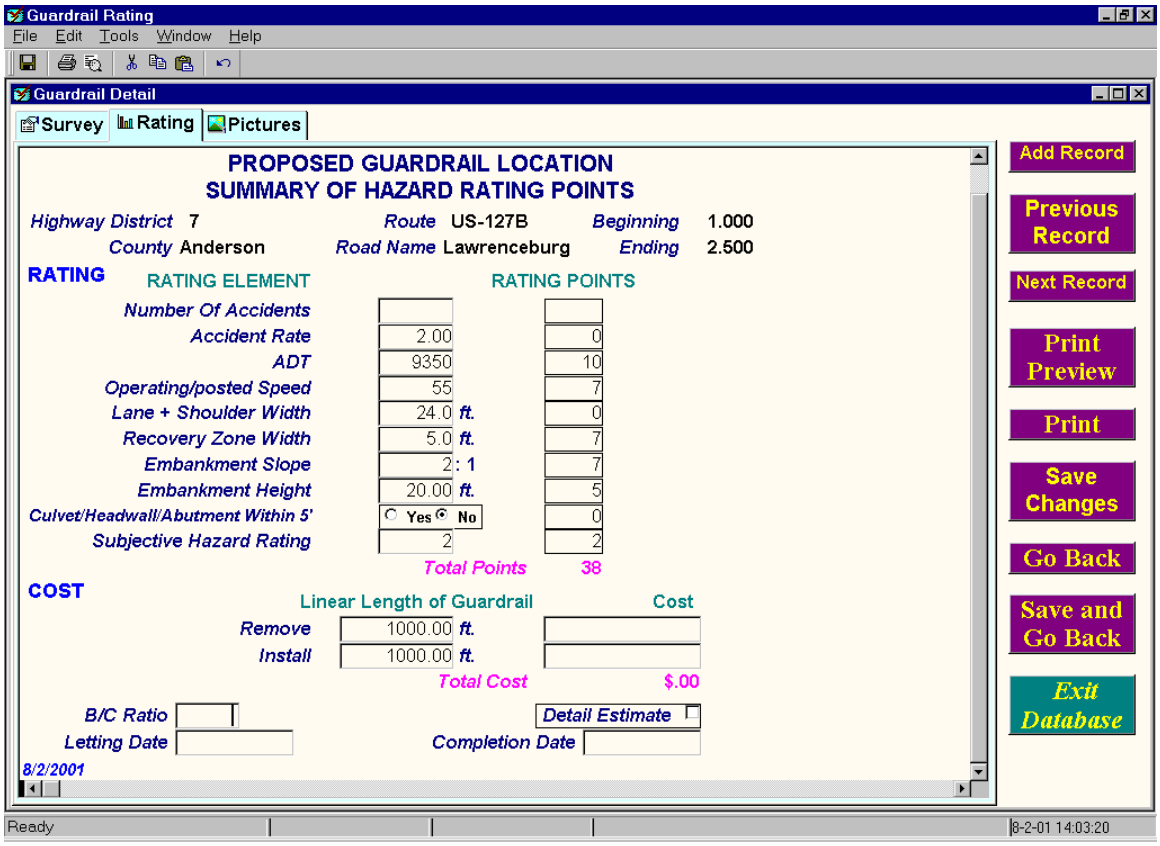


Figure 25. Example of Rating Points Calculated From the Survey Input Screen

3.6 Site Photographs

The Pictures Screen (Figure 26) allows the user to insert digital photographs.

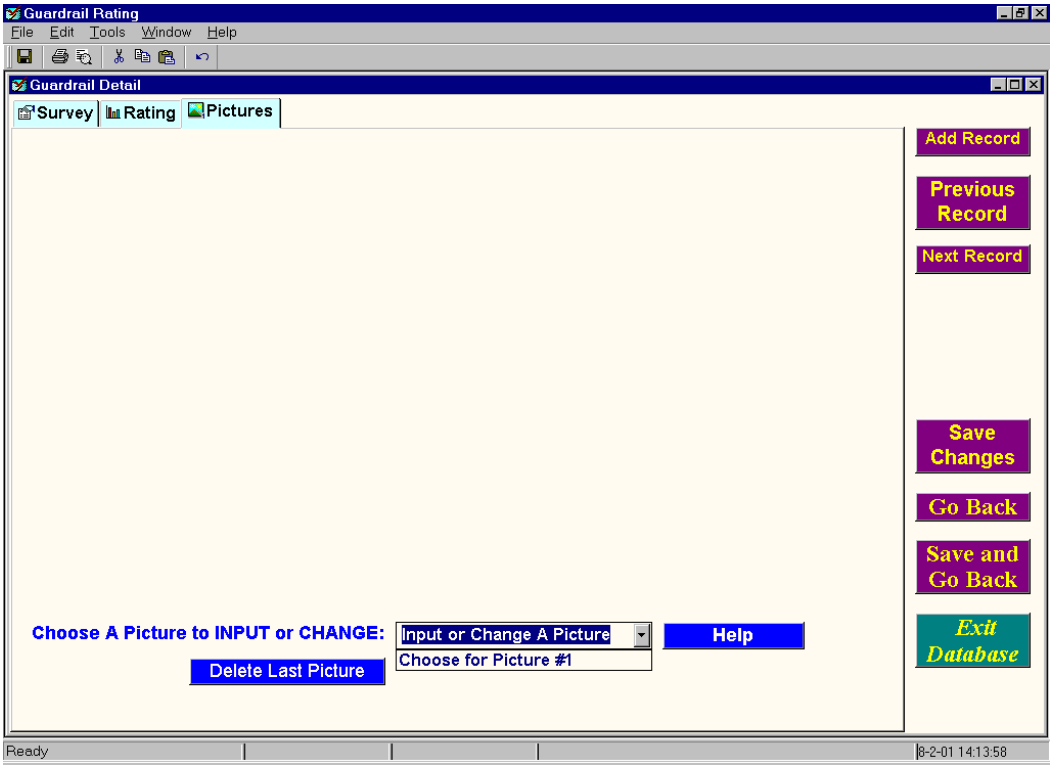


Figure 26. Blank Picture Main Screen

Photographs are entered by placing the cursor in the box were Input or Change a Picture is displayed. **When Choose for Picture #1** is selected a screen similar to Figure 27 appears prompting the user to select the photograph from a computer file: In this example the digital picture highlighted in blue, pic_6.jpg, is selected.

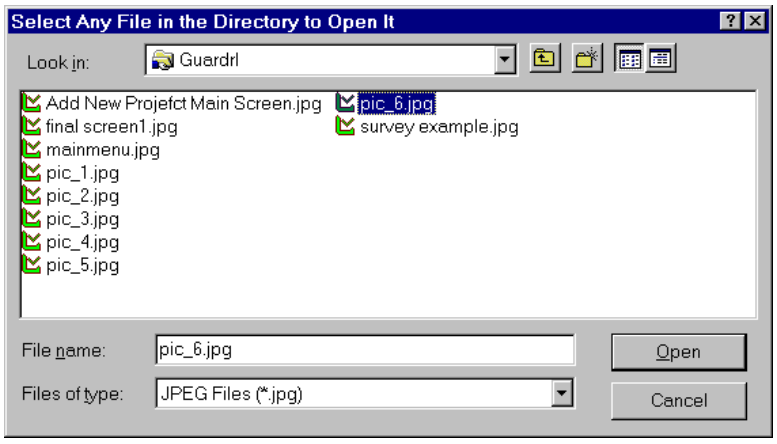


Figure 27. Screen to Select Digital Photograph

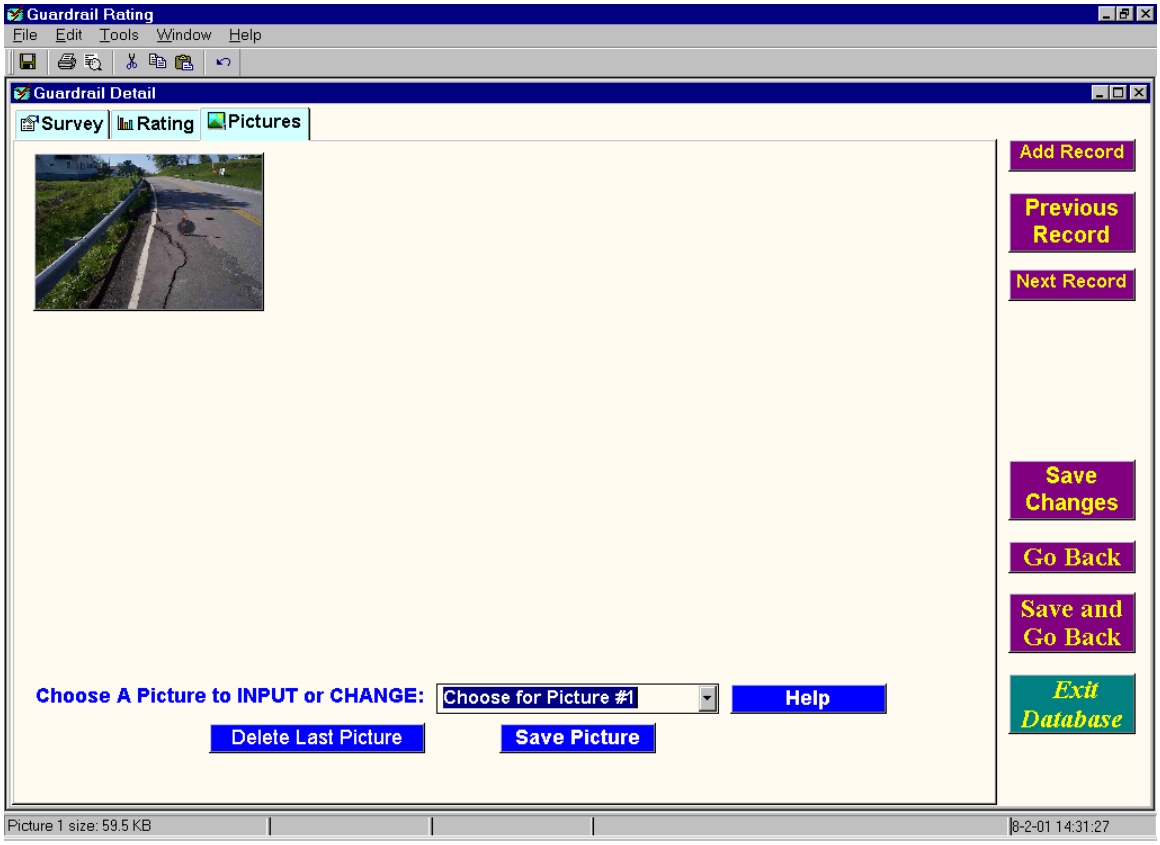


Figure 28. Digital Photograph Installed

The picture selected will be displayed on the screen (example shown in Figure 28) and will be a permanent part of the record when **Save Picture** is clicked. Repeating the procedure and selecting the picture number can enter additional photographs (up to 12).

If an incorrect photograph is entered, use the **Delete Last Picture** tab (displayed in Figure 28) to remove it. Photos must be deleted in reverse order. That is, if Picture # 3 is to be deleted and there are five pictures entered. Picture #'s 5 and 4, respectively, must be deleted first.

The **Help** button will return an on-screen menu (Figure 29) for installing photographs.

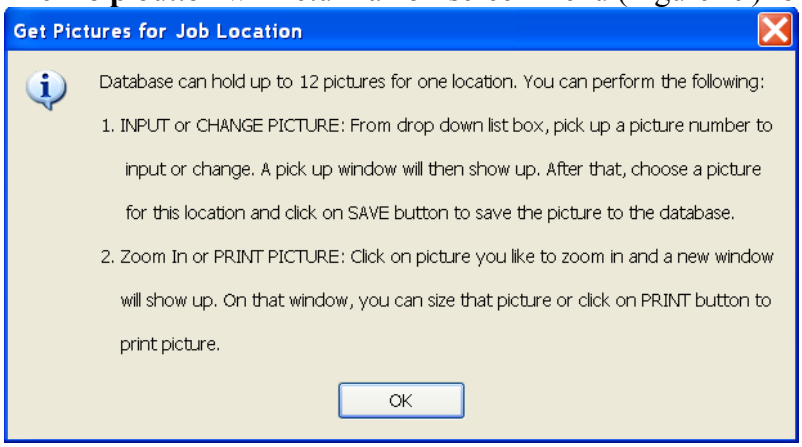


Figure 29. Picture Help Screen

After the picture is installed, double clicking on the image will enlarge the photograph and a print picture and sizing option is available (Figure 30). **Picture Size** can be changed by activating the ○ button for **Original** or **Size to Fit. Close** will close the picture screen and **Print** will print the picture.

Figure 30. Picture Size and Print Screen

3.7 Retrieve Priority List

Figure 31 is an example of a blank screen designed to retrieve data in a printable format using the ***Retrieve Priority List*** option. The data can be selected by Highway District **(HW District**), **County, Road System,** and **Route Number**. Further restrictions on searches are available by selecting information that was originally entered into the survey screen. **Min.** (Minimum) and **Max**. (Maximum) values can be used to restrict the search. These parameters include: **Total Points** (Rating Points) **Total Cost**, # **of Accidents** (Crashes)**, Accident** (Crash) **Rate**, **ADT**, and **Speed Limit**. If **HW District** is selected, only counties in that district will be displayed.

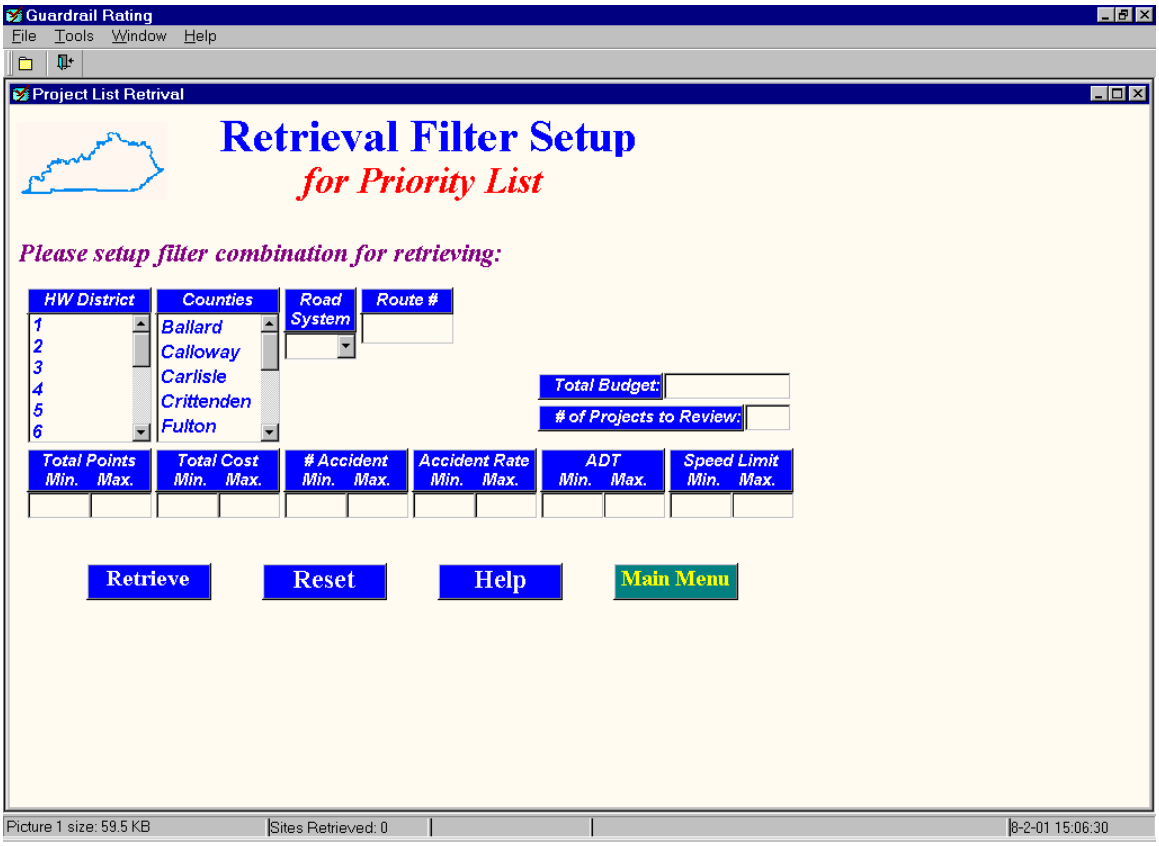


Figure 31. Blank *Retrieve Priority List* Search Screen

The # of Projects to Review option will limit the number of selections returned to the value entered. The controlling criterion for number of sites returned is the **Rating Score**, descending from the largest to smallest score.

Retrieve will return a screen with all sites in the search.

Reset will clear all entry boxes.
Help will display the following screen (Figure 32) providing instructions for searching.

Main Menu returns to the main screen.

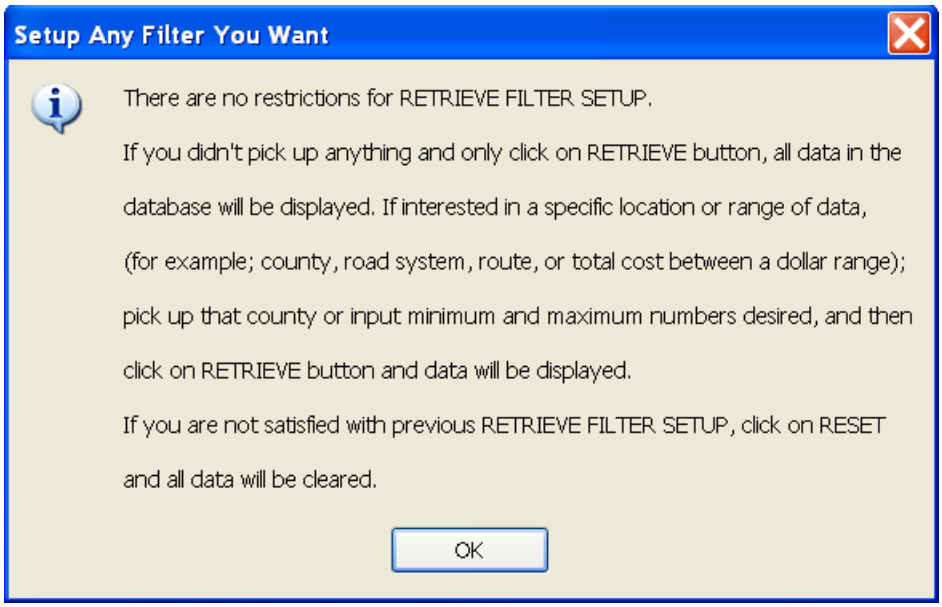


Figure 32. Help Screen for Search Restrictions

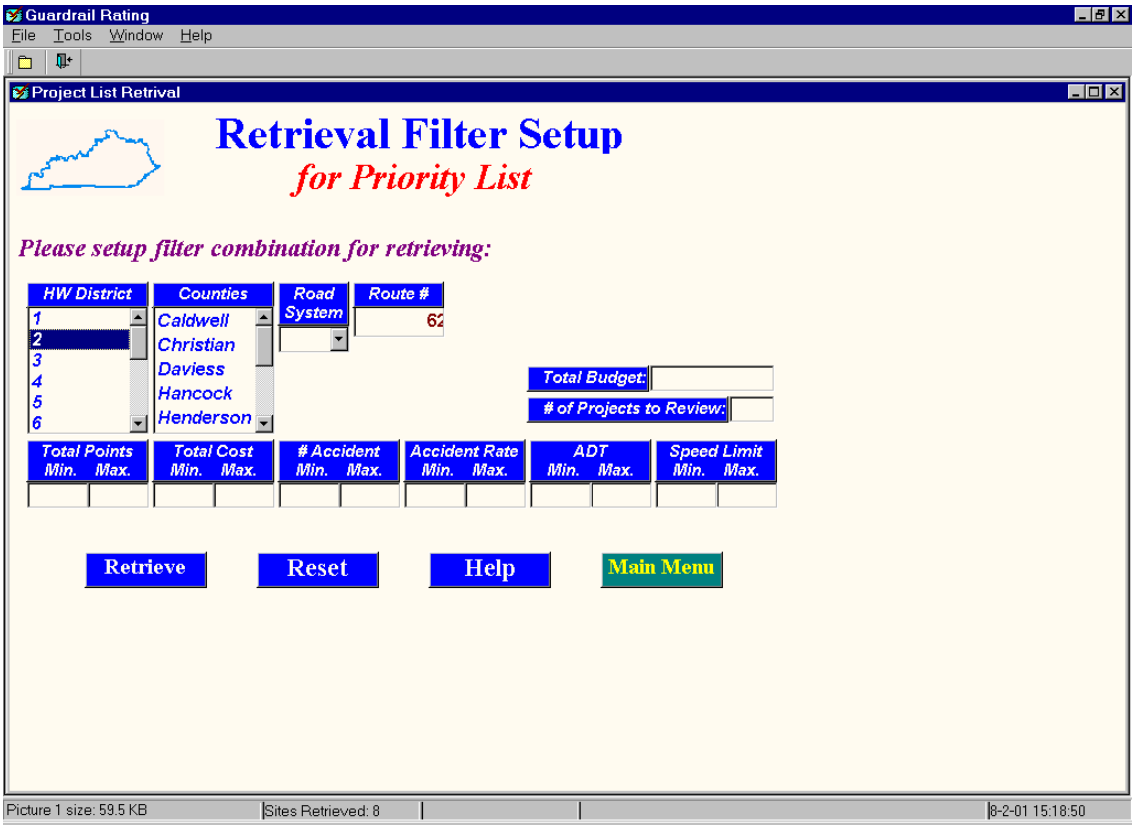


Figure 33. Example Search for Retrieve Priority List

The example as shown in Figure 33 searches for all sites entered on US 62 in Highway District 2. If any search parameters are unknown they can be left blank. The **Retrieve** tab will activate the selected search.

The following screen (Figure 34) is an example of results produced from the ***Retrieve Priority List*** search parameters (Route US 62, District 2) selection as shown in Figure 33.

The **Distribution on Map** option does not function for this example because Latitude-Longitude or State Plane Coordinates were not entered on the ratings screen. If coordinates are entered this option will display a map showing locations of the projects. The map has zoom functions, county and road identifiers, and site data retrieval options.

Double clicking on a line will return the user to the original input data and rating. Additional information can be seen by clicking on the arrow ► or moving the gray bar on the bottom of the screen with the computer mouse.

The ***Sort By*** functions allows the user two levels of sorting; ***Primary*** and ***Secondary***. **Primary** and **Secondary** can be sorted in ascending, **Ascend**, or descending order, **Descend** by activating the ○ button. Figures 35 and 36 show an example of data sorted by **County** (primary sort in ascending order) and **Route** (secondary and ascending)**.**

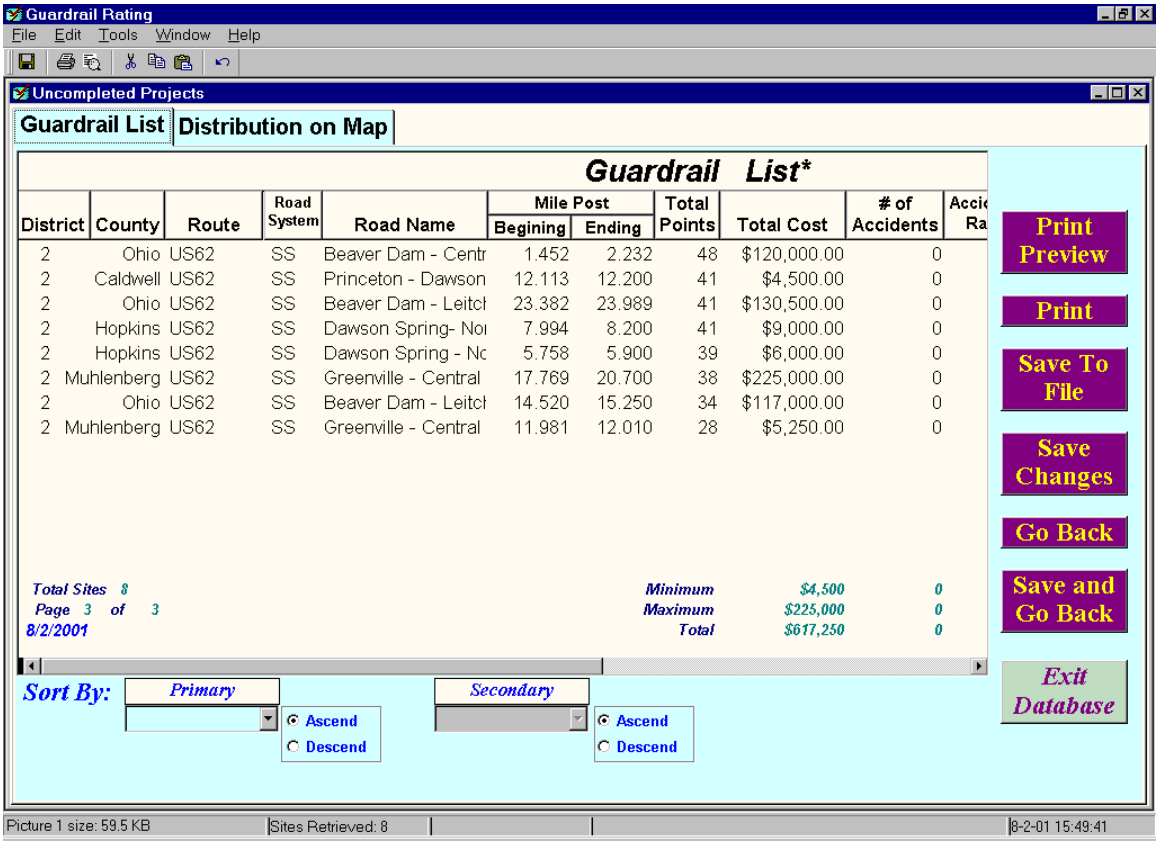


Figure 34. Example of *Retrieve Priority List* Search with Results

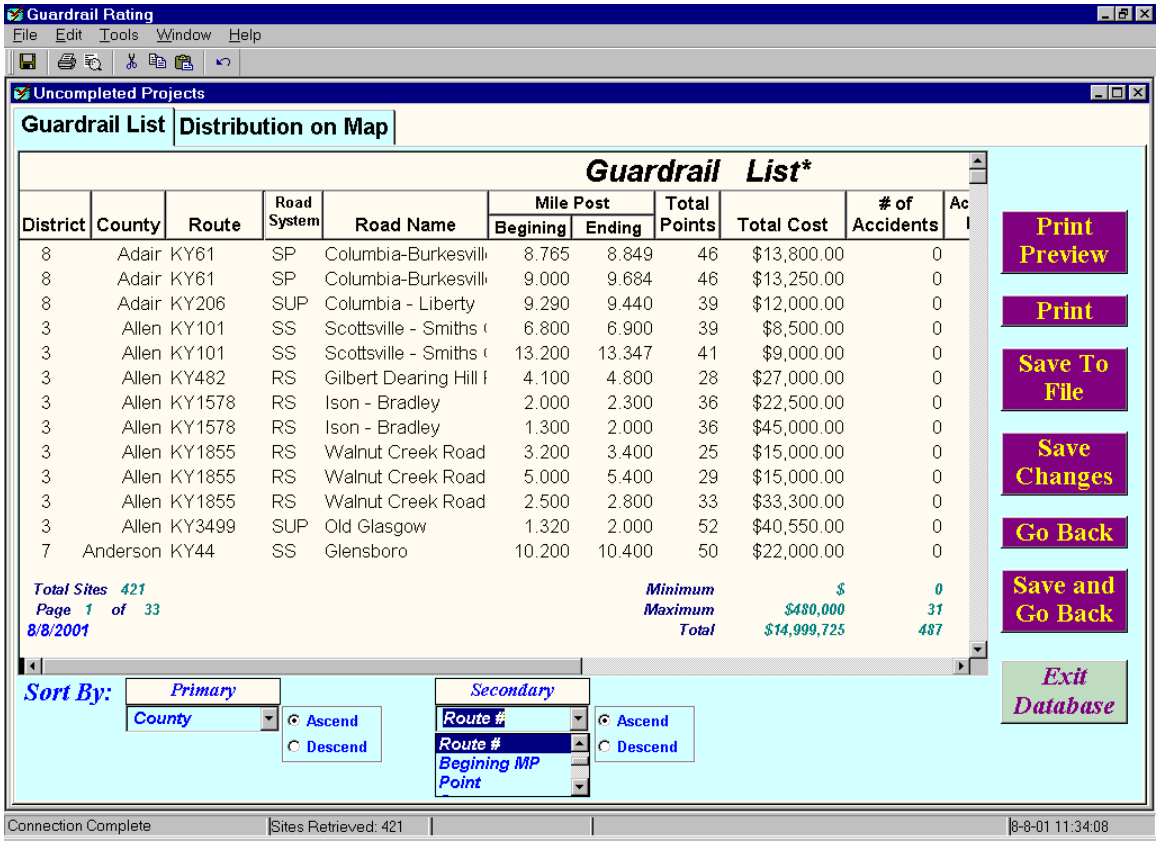


Figure 35. Example Screen using Primary and Secondary Sort Parameters

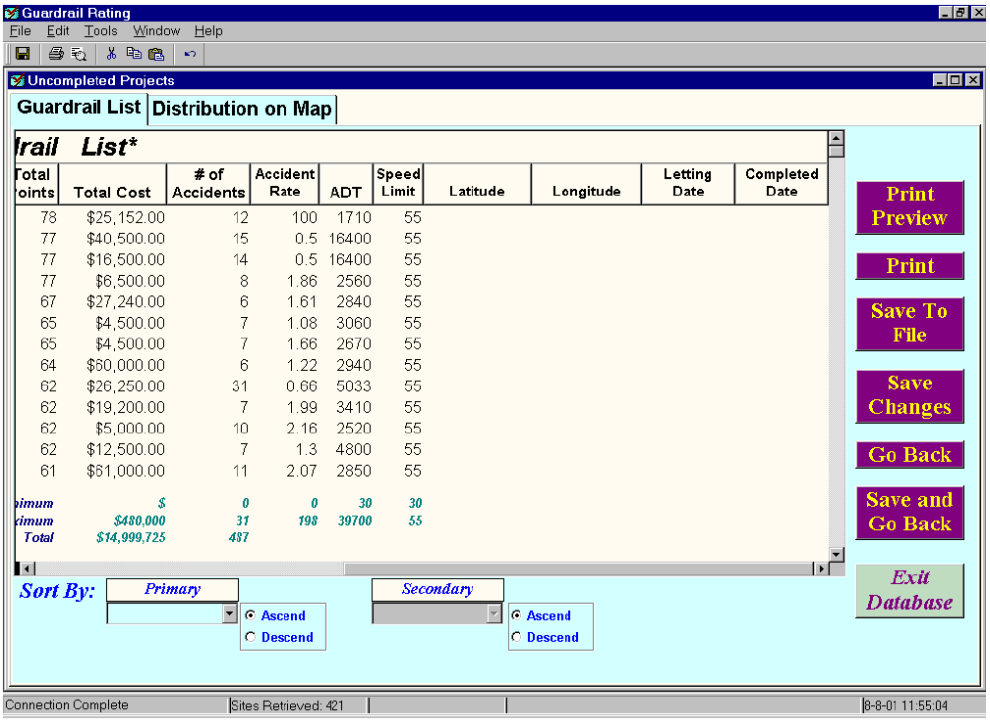


Figure 36. Right Side of Retrieve Priority List Screen

3.8 Get Reports

The ***Get Reports*** option produces the following screen (Figure 37). It is an expanded search screen. Search parameters include: Highway District or **HW District**, **County, Road System**, **Route #**, **Letting Date**, **Completed Date**, **Total Budge**t, and **Min**. (minimum) and **Max.** (maximum) values for **Total Points** (Rating Points) **Total Cost**, # **of Accidents** (Crashes)**, Accident** (Crash) **Rate**, and **ADT**. The **# of Projects to Review** option will return the number selected with the highest rating points as the search criteria.

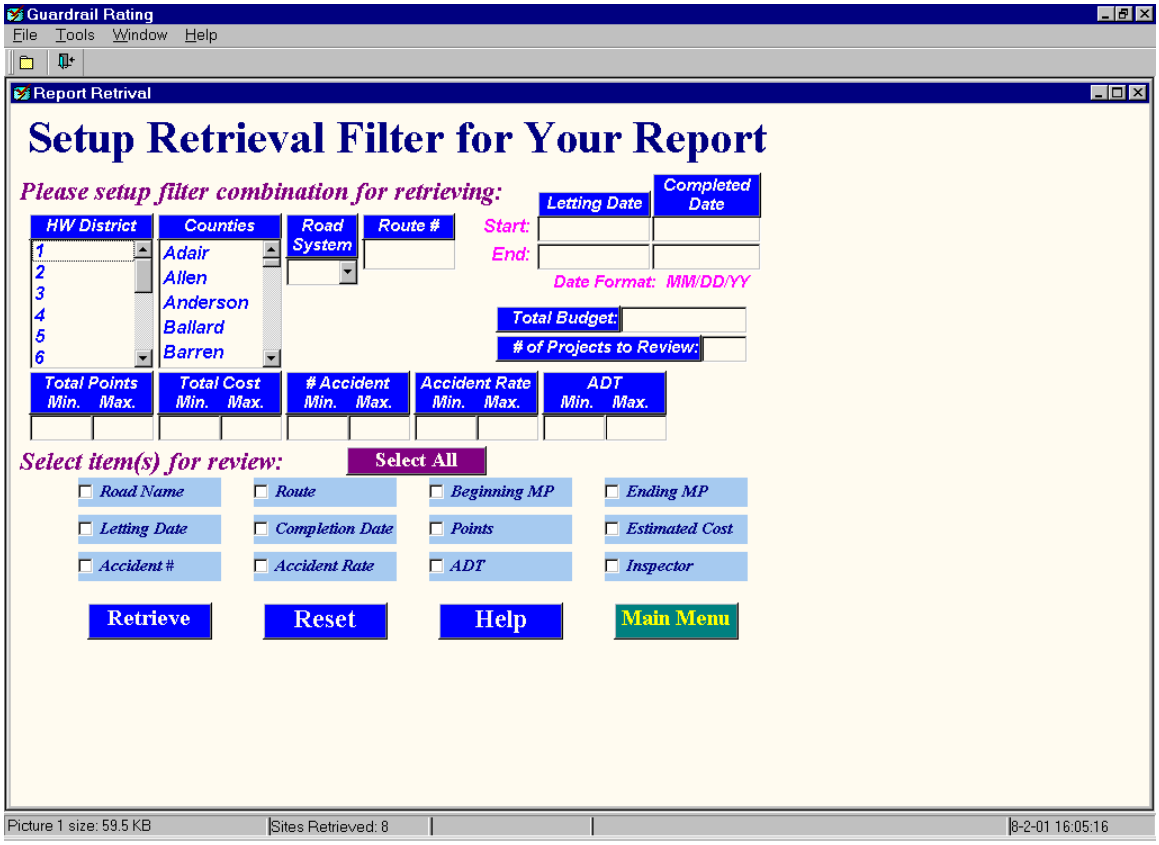


Figure 37. Blank *Get Reports* Screen Showing Options

The search can also be restricted by selecting the items on the bottom of the screen: ***Road Name, Route, Beginning MP, Ending MP, Letting Date, Completion Date, Points, Estimated Cost, Accident*** *(Crash)* ***#, Accident*** *(Crash)* ***Rate, ADT,*** *and* ***Inspector***.

Select All will choose all of the above choices displayed in the light blue boxes.

Retrieve will return a screen with all sites in the search.
Reset will clear all entry boxes.
Help will display the screen shown previously (Figure 32), providing instructions for search parameters.
Main Menu returns to the main screen (Figure 2).

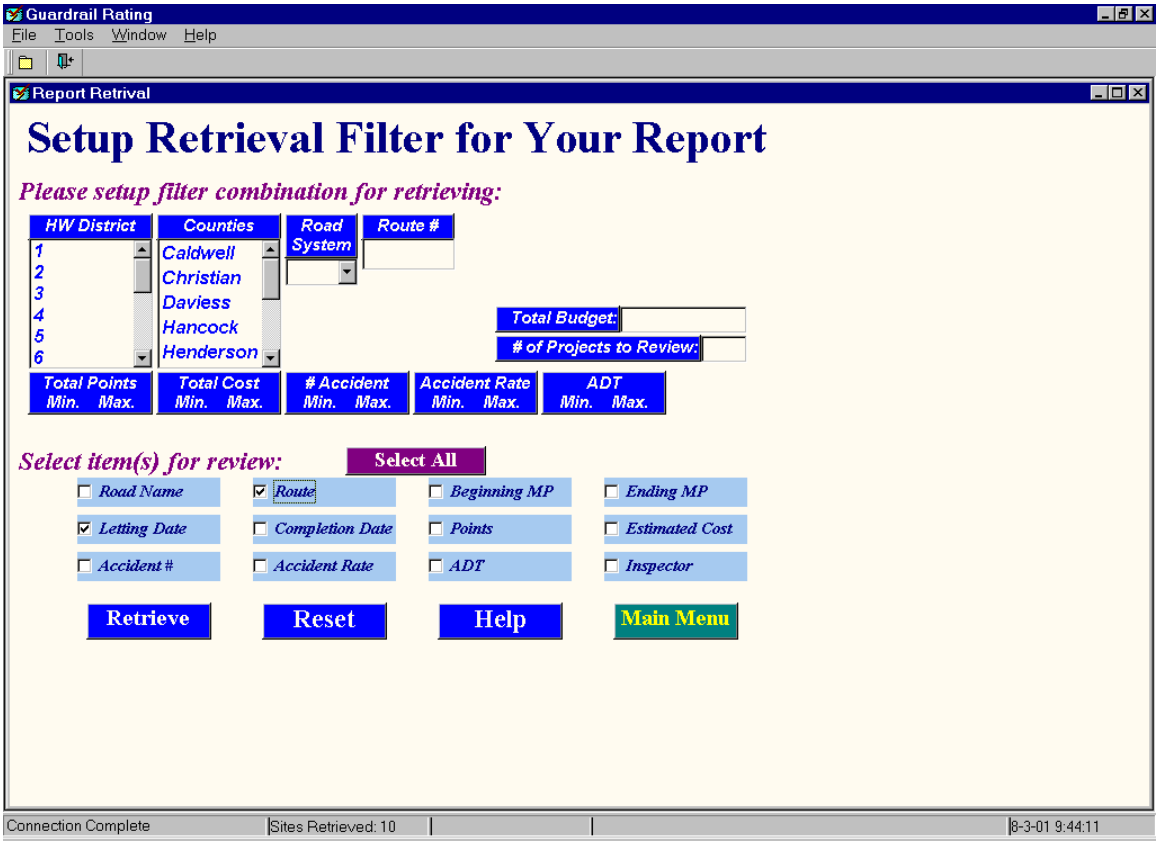


Figure 38. Blank Search Screen

Figure 38 is an example of a search routine with ***Letting Date*** and ***Route*** search parameters. The search defaults to District and County, respectively for the selected parameters. **Letting Date** and **Completion Date** in the top portion are deactivated when search routines in the lower portion are used. When **Retrieve** is activated, a screen (Figure 39) appears prompting the user for a Report Title. Figure 40 is an example with *Letting Date by Route* as the report title.

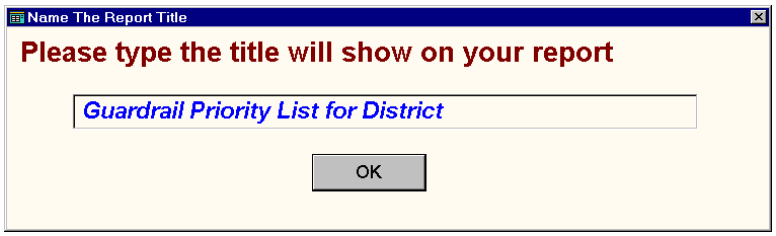


Figure 39. Screen Prompting User for a Report Title

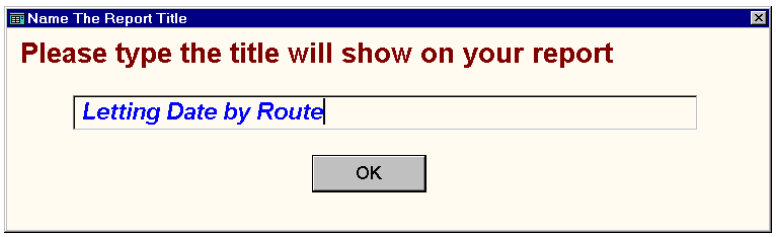


Figure 40. Example Showing Title of Report

The report screen titled *Letting Date by Route* is produced as shown in Figure 41.

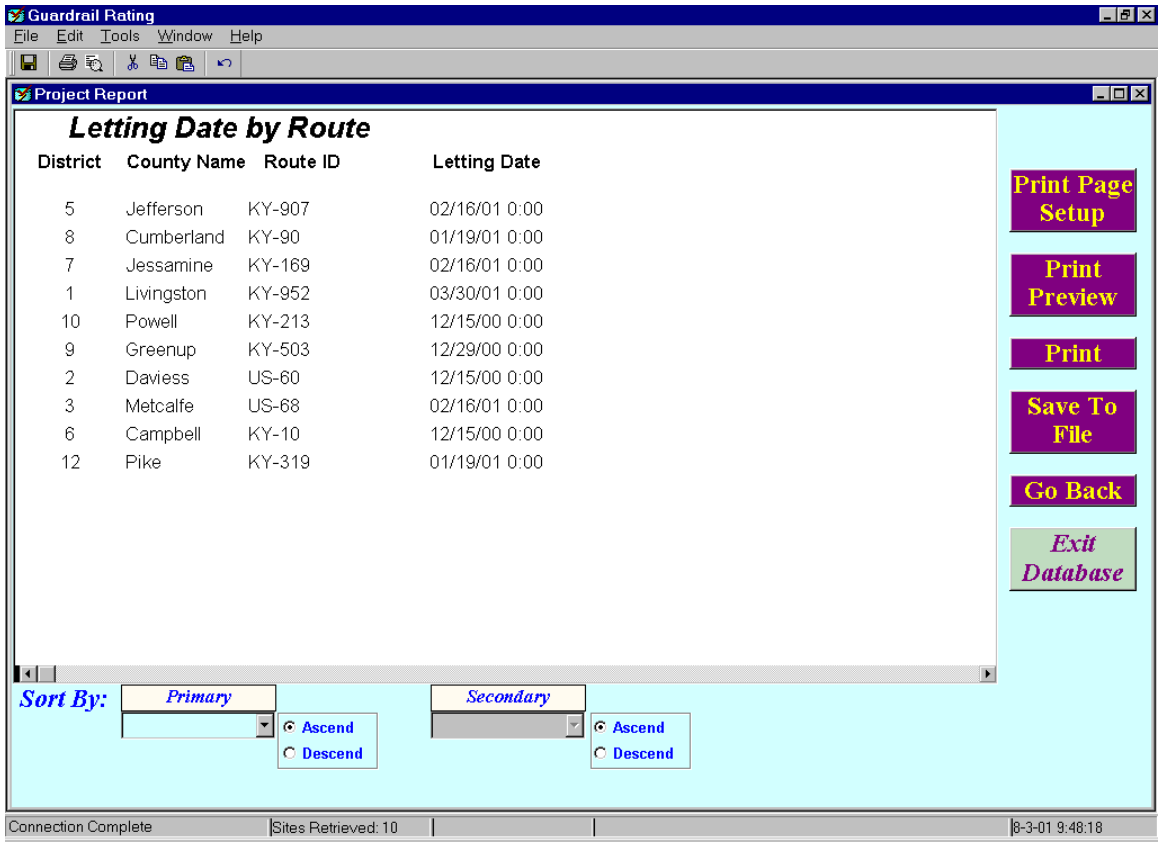


Figure 41. Example Report Titled Letting Date by Route

Double clicking on **District**, **County Name**, **Route ID**, or **Letting Date** will sort the data generated numerically or alphabetically. Figure 42 shows the same data as seen in Figure 41, with the data sorted by **District.**

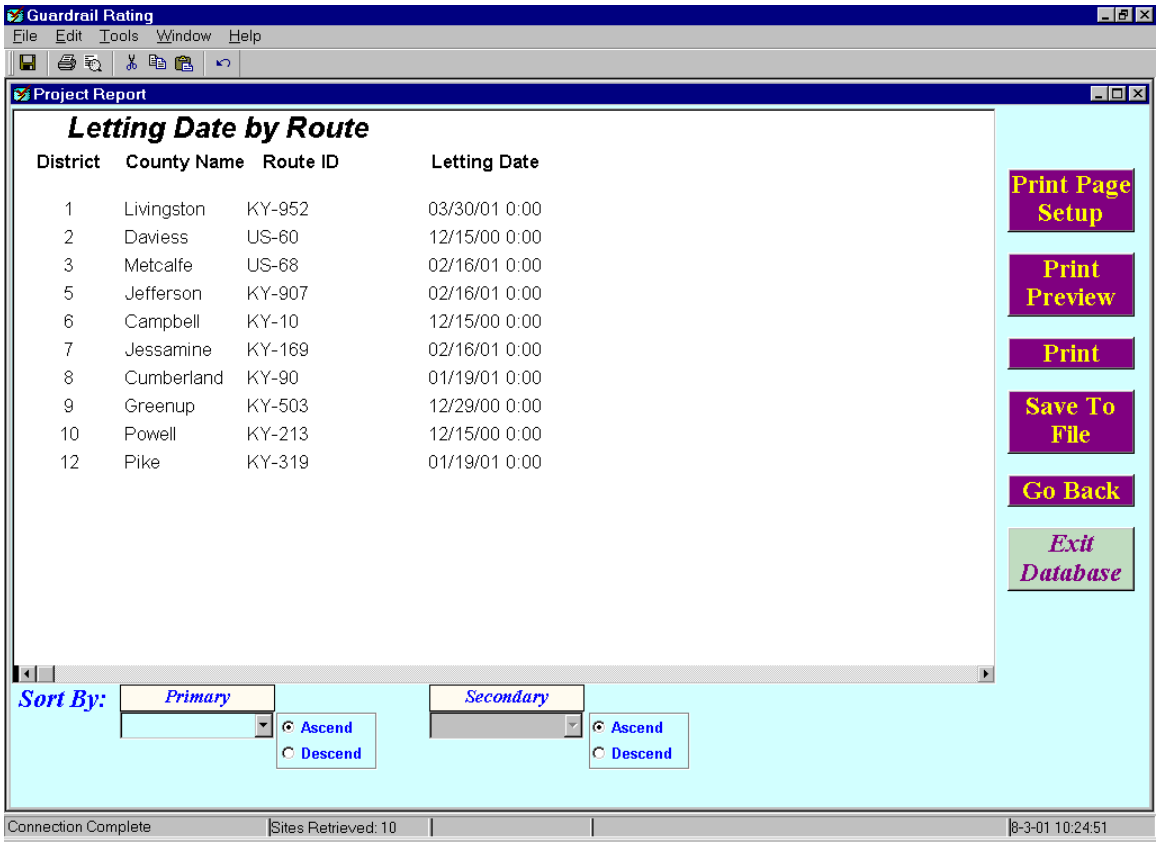


Figure 42. Letting Date by Route Example Sorted by District

3.9 Retrieve Completed Project

Retrieve Completed Project allows the user to retrieve files where the **Letting Date** field has been completed. Data does not have to be entered into the **Completed Date.** Figure 43 is an example of a screen designed to retrieve data in a printable format using the ***Retrieve Completed Project*** option. The data can be selected by Highway District **(HW District**), **County, Road System, and Route Number**. Further restrictions on searches are available by selecting information originally entered into the survey screen.

Min. (Minimum) and **Max**. (Maximum) values can be used to restrict the search. These parameters include: **Total Points** (Rating Points) **Total Cost**, # **of Accidents, Accident Rate**, **ADT**, and **Speed Limit**. **HW District** will display only counties in that district.

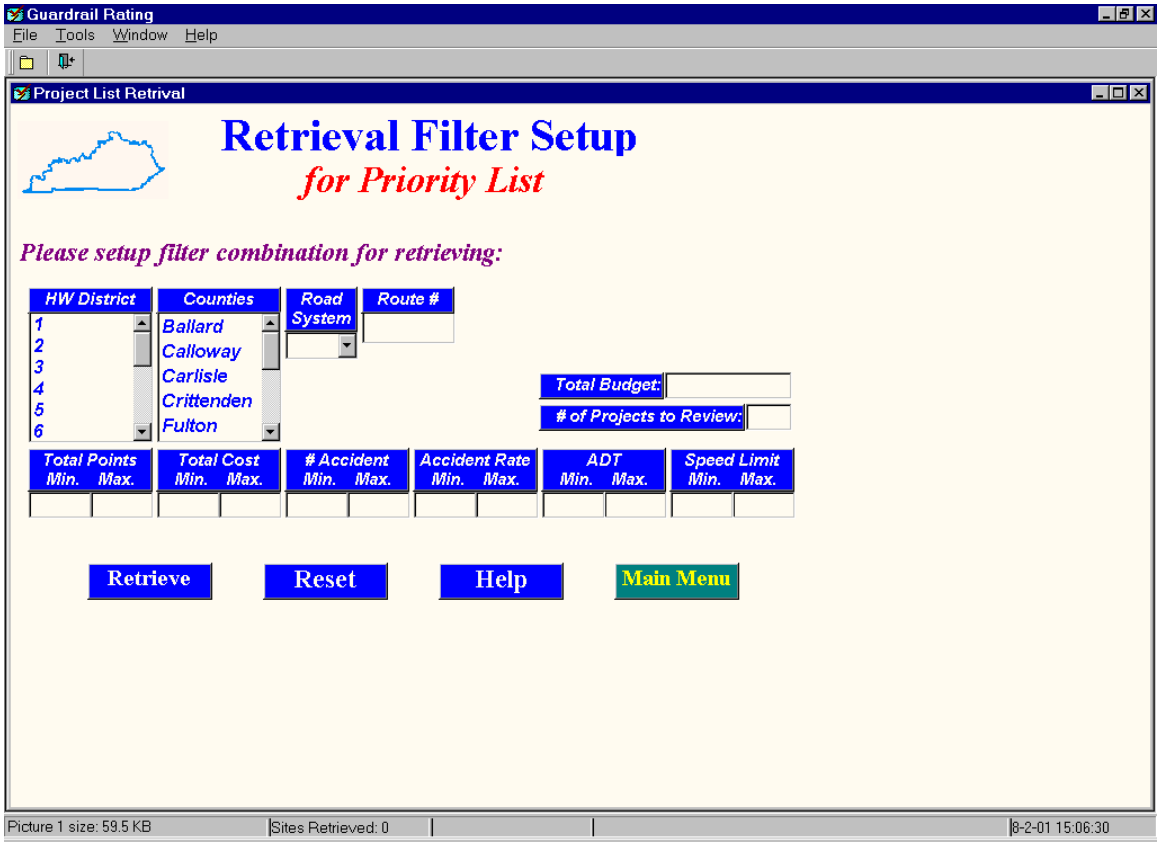


Figure 43. Retrieve Completed Project Search Screen

Retrieve will return a screen with all sites in the search.

Reset will clear all entry boxes.

Help will display the following screen (Figure 44).

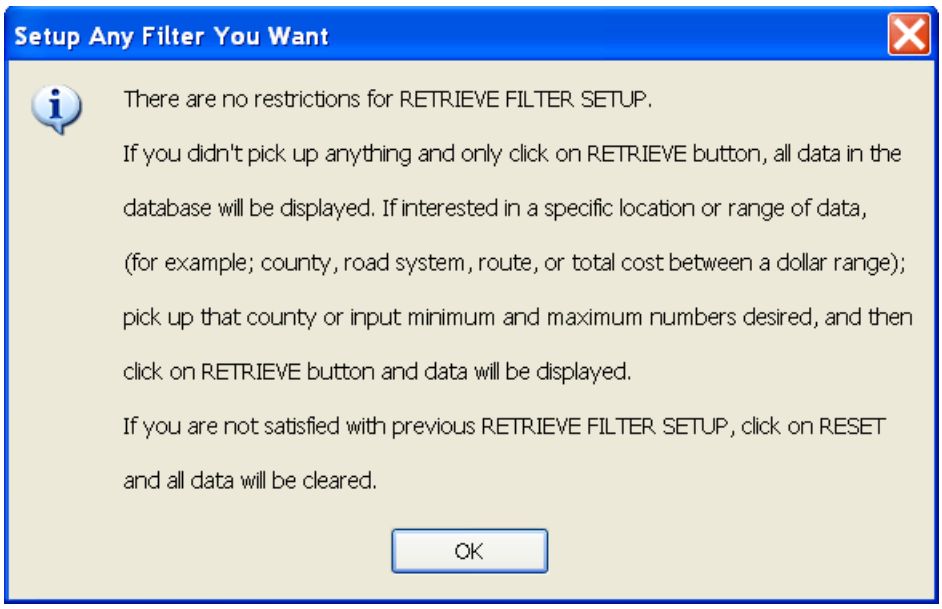


Figure 44. Help Screen for Retrieving Data

A completed project report screen in order of descending points is shown in Figure 45.

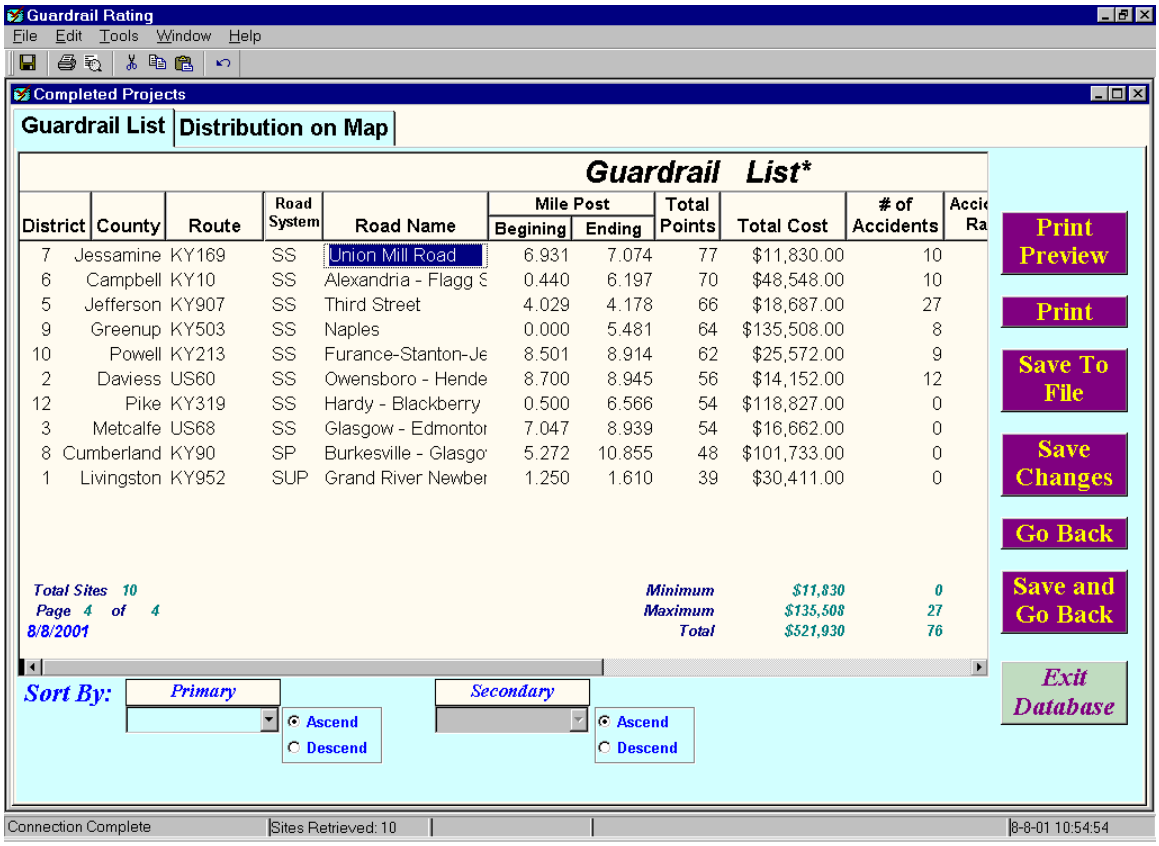


Figure 45. Completed Project Report Screen in Order of Descending Points

Main Menu returns to the main screen.

This tab will exit the database

4.0 REFERENCES

1. *Roadside Design Guide*, American Association of State Highway and Transportation Officials, 2006.

2. Pigman, J. G.; and Agent, K. R. "Warrants and Guidelines for Installation of Guardrail", Report KTC 89-39, Kentucky Transportation Center, University of Kentucky, 1989.

3. Beckham, T; Sun, Charlie; and Hopkins, T; "Guardrail Rating System User's Manual, Unpublished Document, Kentucky Transportation Center, 2003.

4. Green, E., Agent, K., and Pigman, J.; "Analysis of Traffic Crash Data in Kentucky (2004-2008)", Report KTC-09-16, Kentucky Transportation Center, University of Kentucky, 2009.

For more information or a complete publication list, contact us at:

KENTUCKY TRANSPORTATION CENTER

176 Raymond Building
University of Kentucky
Lexington, Kentucky 40506-0281

(859) 257-4513
(859) 257-1815 (FAX)
1-800-432-0719
www.ktc.uky.edu
ktc@engr.uky.edu