
GradeDec.Net

User's Manual

Federal Railroad Administration



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Introduction

Introduction to *GradeDec.NET*

GradeDec.NET is a web-based decision support tool that assists federal, state and local authority decision makers in evaluating the benefits and costs of highway-rail grade crossing upgrades, separations, and closures. *GradeDec.NET* employs benefit-cost methodologies that are used to evaluate highway-rail grade crossing investment alternatives at the corridor level or in a region. The modeling frameworks in *GradeDec.NET* were developed by the Federal Railroad Administration and include research findings of the Volpe National Transportation Systems Center and the National Cooperative Highway Research Program. *GradeDec.NET* analyses effectively support the planning and investment decision processes. Features of the software were designed specifically to facilitate analyses supporting Next Generation High Speed Rail and compliance with the Proposed Rule for Use of Locomotive Horns at Highway-Rail Grade Crossings 49 CFR Parts 222 and 220.

GradeDec.NET forecasts the transportation and non-transportation effects of highway-rail grade crossing investments and estimates the economic value of these effects over the useful life of the project in dollar terms. The benefit-cost of an investment is calculated by comparing the time-stream of expected economic benefits with the time-stream of investment-related and other costs, after adjusting for the opportunity costs of capital. Known as “discounting”, this adjustment enables decision makers to inspect future benefits and costs in terms of their *present-day* value. This is a standard way of giving due weight to nearer-term versus distant (thus less valued) outcomes.

GradeDec.NET's underlying methodology is consistent with the current benefit-cost methodologies employed by the United States Department of Transportation Agencies (Federal Railroad Administration, Federal Highway Administration, Federal Transit Administration, and the Federal Aviation Administration) and with Executive Order 12866, which governs the principles of federal infrastructure investment. The model is transparent in all of its assumptions and the model inputs are readily accessible to users who may want to adjust model inputs to reflect local circumstances.

GradeDec.NET is designed to minimize the data needs and technical expertise required of the user while at the same time providing reliable benefit-cost results. With information about a series of grade crossing improvements along a particular corridor, the range of anticipated accident reductions, train crossing delay improvements, and n travel demand forecasts generate preliminary benefit-cost results for a given confidence interval. Depending on the user's needs, requirements, and abilities, one can select either an extensive default database that will minimize

input requirements, or the user can customize the analysis by inputting project specific localized data. In this way, GradeDec.NET functions as both a high-level preliminary model and a micro-level localized model.

Why *GradeDec.NET*

Growing requirements for highway-rail grade crossing investments and dwindling fiscal resources point to the need for a new tool for investment analysis.

GradeDec.NET determines the effects rail corridor investments will have on safety and highway delay and queuing. Improvements will result in the following economic benefits:

- Improvement in safety and reduced accident costs;
- Reduced travel time costs;
- Improved air quality;
- Reduced vehicle operating costs;
- Network benefits.

GradeDec.NET uses risk analysis to evaluate highway-rail grade crossing investments and the results of an analysis include probability distributions for all of the model outcomes. These outcomes are viewed with *GradeDec.NET*'s user-friendly displays of charts and statistics.

For a corridor or regional analysis, *GradeDec.NET* can evaluate up to 600 grade crossings simultaneously. The user can view model results in total for the corridor or region, or by individual grade crossings. For example, the user can view the safety benefits of each grade crossing improvement along the corridor and the probability range associated with those benefits. Likewise, the user can view the highway vehicle operating costs savings or environmental benefits for each grade crossing.

GradeDec.NET conducts comprehensive statistical simulations in order to provide a probability range for the net present value, and other results, associated with each rail corridor-level investment plan. This enables the user to assess the risk associated with each plan. Additionally, *GradeDec.NET* conducts risk sensitivity analyses based upon the probability ranges and informs the user which factors will have the greatest impact on the outcomes. For each result the user can display a "tornado chart" that shows the eight most significant factors contributing to risk. This information is essential for planning contingencies and working to mitigate risks.

GradeDec.NET is deployed as a web-based decision support tool unlike its predecessor versions, which were desktop applications. Web deployment addresses the following issues:

- Users are moving to secure systems and in some cases a requirement to install dedicated software is a barrier to use. *GradeDec.NET* does not require any special software, other than an Internet connection and a web browser.
- *GradeDec.NET* does not require special hardware or even a special operating system (it will run on client computers running Windows, Linux, Unix or Mac operating systems).
- Modifications and improvements to the software are immediately deployed for all users.

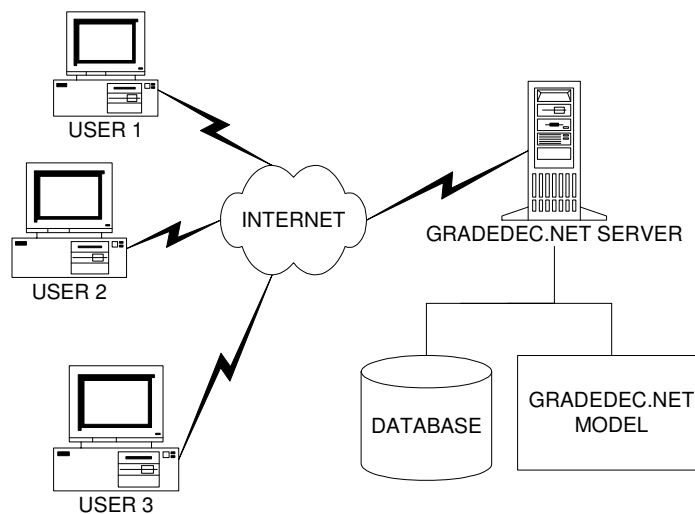
- FRA's most recent grade crossing data is always available to the application.
- User analyses and data run on a central database thus minimizing the need for users to track and maintain their data on their computer (users have the option of storing their data locally at the end of a session and restoring their data for use when beginning a new session).

Technical Description

A Web-Based Application

GradeDec.NET is a web-based application deployed over the Internet. This enables many users to access the system simultaneously, while using minimal resources from each user's computer.

Figure 1 Overview Schema of GradeDec.NET



The technical description of the system that follows is presented in the form of “FAQs” (frequently asked questions). This section concludes with the “Terms of Use” that apply to system users.

Using GradeDec.NET - FAQs

How do I access GradeDec.NET?

Check the section below on “Software and Hardware Requirements” to verify that your computer is compliant.

Open your web browser to the address (URL) <http://gradedec.net>. When the logon screen appears, enter your user name and password, and then click “Submit”. New users should click on the “New User Registration” link.

How do I use GradeDec.NET?

After logging on, you can access all the features of *GradeDec.NET*. You navigate to the different functional areas of the system, each represented by a web page, by clicking on links of the main navigation menu (left side of the page).

You develop your data and conduct your analysis by selecting options on the web pages of *GradeDec.NET*. When you make entries and click on selections in the web browser, a request is sent over the Internet to the *GradeDec.NET* server. The server performs all the calculations and data transformations and then sends back to your browser an updated page that reflects your selections.

Where do my data reside?

During a *GradeDec.NET* session, your data reside on the *GradeDec.NET* server. You may choose to leave your data on the server between sessions, or, you can store it locally on your own computer and delete it from the *GradeDec.NET* server. When you start a new session, you can restore your data to the *GradeDec.NET* server and continue your analysis.

Are my data secure?

See “Data Security” in the *GradeDec.NET* Terms of Use below.

Terms of Use

The following are the *GradeDec.NET* Terms of Use:

1. Purpose and Intended Use

GradeDec.NET, system for highway-rail grade crossing investment analysis, is an online service provided by the Federal Railroad Administration (FRA). It is available to the general public and its intended users are: U.S. Department of Transportation employees; state and local authorities for transportation planning and policy; railroads; consultants, academics and others engaged in grade crossing policies and issues. The intended use of the system is for the development of analyses that support grade crossing management and investment decisions.

2. General Disclaimer

Use of the GradeDec.NET web application, documentation, or data is without warranty of any kind by FRA. To the maximum extent permitted by applicable law, FRA further disclaims all warranties, including without limitation any implied warranties of merchantability, fitness for a particular purpose, and noninfringement. The entire risk arising out of the use or performance of the GradeDec.NET web application, documentation, or data remains with the user. To the maximum extent permitted by applicable law, in no event shall the FRA or its contractors be liable for any consequential, incidental, direct, indirect, special, punitive, or other damages whatsoever (including, without limitation, damages for loss of business profits, business interruption, loss of business information, or other pecuniary loss) arising out of the use of or inability to use the GradeDec.NET web application, documentation, or data, even if FRA has been advised of the possibility of such damages.

3. Applicability of Models, Supplied Values and Assumptions

GradeDec.NET includes modeling frameworks, sample analyses and default values for a range of model parameters and input variables. FRA does not guarantee that these are well-suited for a particular analysis or situation. It is the user's

responsibility to validate all inputs and assumptions for the analyses generated by GradeDec.NET.

4. Non-Endorsement of Results

Results that are obtained from GradeDec.NET analyses are solely the responsibility of the user and are not endorsed by FRA.

5. Availability of Service and Outages

FRA seeks to provide GradeDec.NET as an "always on" service. However, there may be service outages due to any of the following factors: disruptions in the power supply, disruptions in the data communications network, equipment failure or system maintenance. FRA is not liable for damages that might result from service outages.

6. Possible Discontinuance of Service

FRA reserves the right to discontinue this service, temporarily or permanently, and without advance notice. FRA is not liable for damages that might result from the discontinuance of service.

7. Data Security

a. Transmission

The transmission of data over the Internet between the user's computer and the GradeDec.NET server is not secure. There exists a possibility that data may be intercepted by an unauthorized third party during transmission.

b. Storage on the GradeDec.NET server

User analysis data resides on the GradeDec.NET server computer during an analysis session, and the user has the option of allowing data to remain on the server between analysis sessions. FRA will take reasonable measures to ensure the integrity and privacy of the user's data. However, FRA does not guarantee that the integrity or privacy of data will not be compromised due to either technical failure or the actions of an unauthorized third party. FRA is not liable for any damages that might result from the loss of data or their access by unauthorized parties. The user has the option of storing analysis data offline on the user's computer between sessions, deleting it from the GradeDec.NET server computer, and restoring it to the server for use in subsequent sessions.

8. Denial of Access for Misuse

FRA reserves the right to deny access to a party that seems to be misusing the system. Misuse of the system includes, but is not restricted to: hacking, deliberately circumventing system security, overloading, attempting to deny service to others, attempting to use system resources for purposes other than the system's intended use.

Software and Hardware Requirements

Computer, Operating System and Web Browser

GradeDec.NET is designed for use with any computer and operating system running a "high level" browser (i.e., browsers that were released in the second half of 1999 or later). The system has been tested on the following web browsers: Microsoft Internet Explorer 5, Internet Explore 6, Netscape Navigator 6, and Navigator 7.

The required hardware is the same as that required to run the web browser on a specific platform (type of computer and operating system).

If for instance, you were running Internet Explorer 5.5 with Service Pack 2 on an Intel-based computer and a Windows operating system, then your minimum hardware requirements would be as follows:

- A 486, 66 megahertz (MHz) processor (Pentium processor recommended)
- For Windows 95 or Windows 98: 16 megabytes (MB) of random access memory (RAM) minimum
- For Windows NT 4.0: 32 MB of RAM minimum, and you must be running Service Pack 3 or later
- For Windows 2000: 64 MB of RAM minimum
- For Windows Me: 32 MB of RAM minimum

And, of course, all browsers require a mouse (or other pointing device) and a modem or other Internet connection.

Internet Connection

GradeDec.NET requires an Internet connection. With a dial-up connection, the speed should equal or exceed 56kbps (kilobits per second). The system will operate with lower speed connections, but the user experience will be compromised.

A faster, broadband connection (either through your local area network, or from a cable or DSL connection) will enhance the user experience.

As a general guideline for what to expect, pages sent to your browser from the *GradeDec.NET* server are between 2KB (kilobytes) and 6KB (pages with graphical content are at the higher end of this range). With a 56kbps connection, the larger pages should download to your computer in less than 2 seconds. With a broadband connection, downloads should take a fraction of a second. Keep in mind that other factors, like traffic volume on the Internet, may cause slower response times in your session with *GradeDec.NET*.

Web Browser Settings

This section discusses several browser settings that you may need to adjust in order to use *GradeDec.NET*. These settings can be accessed from your browser's main menu. In Internet Explorer use the menu option Tools>Internet Options. With Netscape, select Edit>Preferences.

Cookies

GradeDec.NET uses session cookies. Your browser should allow session cookies with most privacy settings except "Block all cookies". Session cookies promote the security of your session without compromising your privacy.

Security and Other Settings

The following security settings must be enabled in your browser in order to use *GradeDec.NET* and all of its features.

In Internet Explorer, under "Security" you must enable:

- "Active scripting"
- "Downloading of files"

With Netscape, you must check under Advanced>Scripts & Plug-Ins:

- “Enable JavaScript with Navigator”

Also with Netscape, under Navigator>Downloads> you must select one of the following options:

- “Open the download manager”
- “Open a progress dialog”

File Formats

Some of the optional features of *GradeDec.NET* involve the transfer of files between the *GradeDec.NET* server and your computer. The following are the file formats used in these transfers:

- ZIP files are used when downloading data for storage between sessions. The user has no need to access these files locally.
- CSV, or comma-separated value, files are used when downloading scenario data for offline modification. These files are readable by spreadsheet programs (like Microsoft Excel), which can also write files in this format. You must save your modified files in this format in order to upload your modifications to *GradeDec.NET*.
- PDF, or portable document files are used with *GradeDec.NET* reports. In order to view and print these files, you should have Adobe Acrobat Reader or other compatible software installed on your computer in order to read and print these files.

Overview of this Manual

The remainder of this document describes how to conduct a *GradeDec.NET* analysis and use the pages that are encountered during an analysis. The manual concludes with a glossary of terms and an index.

Note that the *GradeDec.NET Model Reference Manual* is the companion piece to this *User's Manual* and may be required to fully understand some of the features and processes of *GradeDec.NET* that this manual describes.

In the text, the following conventions are used:

- Bold text is used to refer to a page in *GradeDec.NET* (e.g., **Settings** page). The same bold text will be used when referencing the links to these pages from the main navigation menu.
- Italics are used to designate drop down list options and selections in *GradeDec.NET* (e.g., *Add new crossing*)
- Choices in browser menu hierarchies are shown with the > symbol (e.g., “Edit>Paste” means “select menu option Edit then select from its submenu the option Paste”).

Using *GradeDec.NET*

Introduction

This chapter gives general guidance on working with *GradeDec.NET*. The first section describes the principal modes of use for *GradeDec.NET*. The section that follows describes the management of data in *GradeDec.NET*. The final section describes the steps taken to conduct an analysis for each of the modes of use.

The subsequent chapter, “*GradeDec.NET* Page-by-Page”, provides detailed descriptions of all the features of *GradeDec.NET*.

Modes of Use

GradeDec.NET has several modes of use, and the specific mode of use that you choose will depend upon the type of decision that your analysis should support. This section identifies and describes the two principal modes of use with *GradeDec.NET*. These are:

- Safety analysis, and
- Full investment analysis

Safety Analysis

For a safety analysis, the user examines predicted accidents at grade crossings and for the corridor (or region) as a whole. The safety analysis is, essentially, a comparison of a “before” and “after” situation, where “before” represents the *status quo* and “after” reflects the impact of crossing improvements (through device upgrade, closures, separations, traffic management measures, etc). The safety analysis is restricted to examining the safety impacts at a crossing. The safety analysis reflects a snapshot of current conditions and does not account for the forecast growth of highway traffic or rail operations.

Full Investment Analysis

A full investment analysis supports resource allocation and planning decisions. The full investment analysis accounts for safety benefits and, as well, other highway user costs. These user costs include time savings, vehicle operating costs and emissions. The full investment analysis monetizes the benefits from each benefits category and sums the benefits from the improvements over the time horizon of the investment.

This analysis includes user assumptions regarding the forecast of traffic growth, by highway and rail, and analyzes the risk associated with the forecast values.

A “safety analysis” will involve a subset of the *GradeDec.NET* features required for a “full investment analysis”. The following table shows the two modes of use, purposes associated with each, and the functional pages in *GradeDec.NET* used in each type of analysis.

Table 1 GradeDec.Net Modes of Use

Mode of Use	Purpose	Functional Pages in GradeDec.NET to Use
Safety analysis	Calculate accident risk and impacts of improvements, identify improvement programs, analyze safety regulatory impacts Support safety and regulatory compliance decisions.	Settings, Import, Crossings, Parameters
Full investment analysis	Benefit-cost and risk analysis of programs of improvements; analyze safety, delay and user cost impacts Support resource allocation and investment decisions. Support planning process.	Settings, Import, Crossings, Parameters, Scenario, Simulation, Results

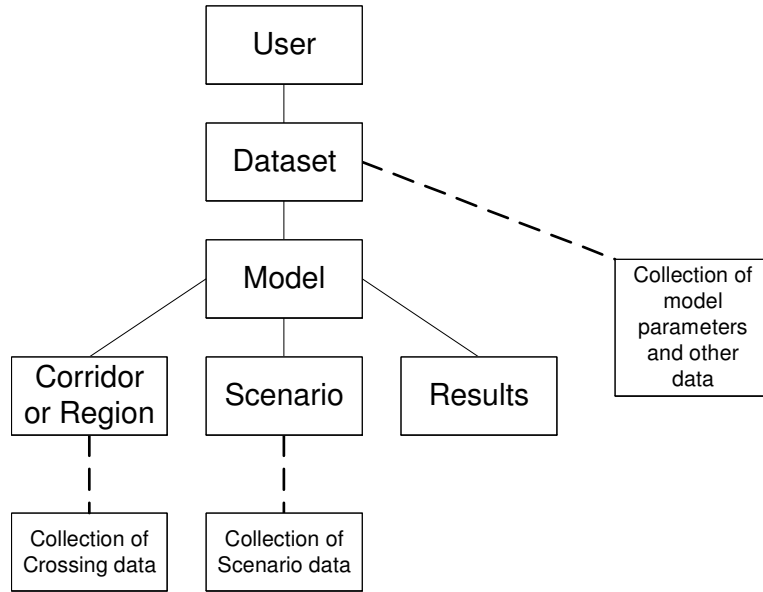
The Data Hierarchy in *GradeDec.NET*

In order to conduct analyses effectively in *GradeDec.NET* you should be familiar with its data hierarchy.

Every active session of *GradeDec.NET* has a data hierarchy that is populated with values at all times. These values correspond to the current selections of data collections that are viewable, editable and are used in *GradeDec.NET* model calculations. You navigate among different data collections by making selections on the **Settings** page, which sets the values in the data hierarchy.

The data hierarchy is shown in the figure below. A brief description of each of the nodes (boxes) in the figure follows at the end of this section.

Figure 2 Data Hierarchy in GradeDec.NET



The connecting lines in the data hierarchy figure mean that the lower node is a “child” of the parent node above it to which it is connected. When you change the value of a parent node (by making a selection in the **Settings** page) you are also re-populating the nodes in the hierarchy below the parent with values that represent data collections belonging to the newly selected parent node value.

For example, when a newly registered user logs on, the data hierarchy is populated with values like in the table below.

Table 2 Data Hierarchy at New User Logon

Data Hierarchy Node	Value
User	Your user id
Dataset	“Initial dataset”
Model	“Corridor Model”
Corridor	“South Empire”
Scenario	“Strong rail growth”
Result	“Placeholder – Corridor Model”

Suppose the user then changes the Model selection in the **Settings** page to “Regional Model”. The data hierarchy will then be populated with the following values (changed values in italics):

Table 3 Data Heirarchy After Changing Model

Data Hierarchy Node	Value
User	Your user id
Dataset	“Initial dataset”
Model	“Regional Model”
Region	“Montgomery, MD”
Scenario	“Strong highway growth”
Result	“Placeholder – Regional Model”

For every parent node value there are designated default values for its child nodes, which fill the data hierarchy when the parent node value is selected. When you first register as a *GradeDec.NET* user you are assigned an “Initial Dataset” that includes data collections with sample values, and the system designates some of these data collections as defaults. You can never delete a data collection that is a default of its parent node. You can designate another data collection to be a default, and then delete the collection that was previously designated as default. You can create and delete data collections, set their defining values and set defaults from the **Settings** page.

The following are descriptions of the nodes in the data hierarchy.

User

When you log in to *GradeDec.NET*, a value representing your user account is set in the User node. This never changes during your session and ensures that users can only access their own data and not those of others.

Dataset

User data for analyses are organized in datasets in the *GradeDec.NET* database. A user may create and maintain up to 10 datasets. A dataset is a comprehensive container of data collections used in *GradeDec.NET* analyses. Note that data from different datasets cannot be combined in a single analysis. You can use datasets to preserve a baseline analysis, and then develop new analyses from copies of the baseline. You can download a dataset to your computer and restore it to the system at a later date. You can also share data with a colleague by sending him or her your downloaded dataset, which your colleague can then upload during a session with *GradeDec.NET*.

Access the options for selecting, creating, deleting, downloading and uploading datasets from the **Settings** page.

Model Parameters and Other Data

Each dataset contains a set of model parameters (including: crossing device effectiveness rates; model coefficients for emissions and fuel consumptions calculations; high speed rail model calculations – see the *Model Reference* for a full description). “Other data” refers to traffic time-of-day distributions and cost data for grade crossing device and supplementary safety measures.

These parameter and data are specific to the selected dataset and can be viewed and modified from the **Parameters** page.

Model

GradeDec.NET has both a corridor model and a regional model. The data requirements are slightly different for each model so that data collections below the Model node are specific to the selected model.

Corridor

A corridor has a set of defining values (these can be viewed and modified in the data grid at the bottom of the **Settings** page – see Section 2.1 Settings Page below) and refers to a collection of grade crossings along a single rail alignment. A corridor is selected in the data hierarchy only if the Model node is set to the corridor model. A dataset will contain at least one corridor and may contain as many as 50.

Create and delete corridors, and modify their defining values in the **Settings** page. After selecting a corridor, view or modify its crossings data from the **Crossings** page.

Region

A region has a set of defining values (these can be viewed and modified in the data grid at the bottom of the **Settings** page – see Section 2.1 Settings Page below) and refers to a collection of grade crossings in a designated region. A region is selected in the data hierarchy only if the Model node is set to the regional model. A dataset will contain at least one region and may contain as many as 50.

Create and delete regions, and modify their defining values in the **Settings** page. After selecting a region, view or modify its crossings data from the **Crossings** page.

Scenario

A scenario has a set of defining values (a description, start year, last year of near term, and end year) and an associated collection of scenario data. A dataset will contain at least one scenario for each of the two models, and may contain as many as 30 scenarios for each model.

Create and delete scenarios, and modify their defining values from the **Settings** page. After selecting a scenario, view and modify the scenario data from the **Scenario** page.

Results

GradeDec.NET sets the defining values of a results set automatically when you run a simulation. You can set the description for a results set.

Create and delete result sets, and modify its description from the **Settings** page. After selecting a results set and running a simulation, view results from the **Results** page.

Steps in Conducting a *GradeDec.NET* Analysis

Overview

The following table shows a sample set of steps that you would undertake to conduct each of the two analyses. The sections that follow walk you through these steps in a sample analysis. Additional detailed is provided in the “*GradeDec.NET Page-by-Page*” chapter, including screen snapshots.

Table 4 *GradeDec.Net Modes and Sample*

Mode of Use	Functional Steps	Page
Safety analysis	(Optional) Create and select a new dataset	Settings
	Create and select a new corridor (or region)	Settings
	Set values for corridor (or region)	Settings
	(Optional) Set default crossing device cost data	Defaults
	Import data from Grade Crossing Inventory	Import
	Verify and refine data, assumptions and choice of alternative	Crossings
	Calculate predicted accidents, view/print reports and charts	Crossings
Full investment analysis	Conduct all of the steps in the “Safety analysis” mode of use listed above	
	Create new results set	Settings
	Create new scenario	Settings
	Populate the scenario data with forecast data and assumptions	Scenario
	Verify and modify parameters and other data values	Parameters
	Set the simulation parameters and run the simulation	Simulation
	View results table and charts, print report	Results

Safety Analysis

In this example you will set up an analysis for 10 crossings in a freight rail corridor in Lincoln County, Nebraska.

(Optional) Create and select a new dataset

If you skip this step, then in subsequent steps you will be using the default or other existing dataset.

On the **Settings** page, click on the link “New” on the row with “Selected Dataset”. This will transfer you to the **New Dataset** page. On this page you choose to either “Copy an existing dataset” – in which case you select one of your datasets from the drop down list – or choose “Use sample values”. Select the second option.

Enter a name for the new dataset (i.e., “Sample analyses”) and then click create. This will transfer you back to the **Settings** page. From the dataset drop down list, select the dataset that you just created.

Create and select a new corridor (or region)

This section will assume that the Corridor Model is suitable for your analysis.

Select the “Corridor Model” (or ensure that it is selected) from the drop down list

On the **Settings** page, click on the link “New” to the right of “Selected Corridor”. This will transfer you to the **New Corridor** page. On this page select “Use sample values and no crossings (modify values and add crossings later)”. Enter a name for the new corridor (e.g., Lincoln 1) and then click create. This will transfer you back to the **Settings** page.

Enable the “Corridor” drop down list by selecting the radio button by “Selected Corridor” (or, ensure that it is selected).

From the “Selected Corridor” drop down list, select the corridor that you just created.

Set values for corridor (or region) characteristics

In the table at the bottom of the **Settings** page you need to set the characteristics that correspond to your corridor. This includes: the number of daily trains by type, the time-of-day distribution for rail operations in the corridor, specify yes/no whether highway traffic signals in the corridor are synchronized with crossing signals.

In this example, set:

- Passenger trains to 0
- Freight trains to 108
- Switch trains to 1
- Rail TOD (time-of-day) distribution to Uniform
- Signal Synchronization to False

Set these values by clicking “Edit” in the table next to the value to modify, enter or select the suitable value, then click on “Update”.

(Optional) Modify or Add Time-of-Day Traffic Distributions

If the sample time-of-day traffic distributions provided, adequately reflect the distributions of highway traffic at crossings and for rail movements in the corridor, then skip this step. Otherwise, browse to the **Parameters** page by clicking on the link on the main navigation menu. On this page select from the toolbar at the top “Other data”.

Add new time-of-day crossings distributions as needed.

(Optional) Set default crossing device cost data

If in your analysis of safety you have no interest in the costs of improvements, then skip this step.

Browse to the **Parameters** page by clicking on the link on the main navigation menu. On this page select from the toolbar at the top “Other data”. From the drop down list select crossing device costs. Enter alternative values to the ones listed, as needed.

Import data from Grade Crossing Inventory

From the main navigation menu, select the **Import** page. From the drop down lists on the left select:

- State: *Nebraska*
- County: *Lincoln*
- Area: *Whole County*

The “Selected Areas” table will show your selection. Click on the button “Create list of corridors in selected areas”. The list of corridors will appear as options in the following drop down list. Select the corridor: *UP Nebr Eastern 4 Crossings*. This is the corridor with crossings in the selected area for the UP railroad, Nebraska division, Eastern subdivision. In this example there are four crossings.

You can view the National Grade Crossings Inventory data for the selected crossings at the table at the bottom of the page. You can modify the options and criteria that appear on the right side of the page (see the section 5.1 Import Page section for full description), or you can just click on “Import crossings data” to import your data to your Lincoln 1 corridor. After clicking import, your browser will automatically shift to the **Crossings** page.

Verify and refine data, assumptions and choice of alternatives

In the **Crossings** you can browse the imported data and make any modifications that you need. Also, in the “General” section you can view and modify the choices for the improvement alternative.

Calculate predicted accidents, view/print reports and charts

When you are satisfied with the data and the alternative selections, click on the calculator button on the toolbar in order to calculate the predicted accidents for each crossing and for the whole corridor. You can view the results in the “Accident Prediction” section of the page.

You can generate a report for viewing and printing by pressing the report icon button. You can view a chart of the predicted accidents by selecting the chart icon button.

Full Investment Analysis

For a full investment analysis, complete the steps above for the safety analysis.

Create new results set

On the main navigation menu, click on the link **Settings** to return to the **Settings** page. On the **Settings** page, click on the radio button on the next to “Selected results set” and then click the lower of the two “New” links. This will launch the **New Results** page. On this page, enter the name of the new results set “Lincoln UP, Base” and then click the “Create” button. Your browser will create the results set

and shift back to the **Settings** page. Now from the drop down list select the newly created results set.

Create new scenario

Now click on the radio button next to “Selected scenario” and then click the lower of the two “New” links. This will launch the **New Scenario** page. Select “Copy an existing scenario” and select from the drop down list the sample “Base scenario” scenario. You can leave the year settings (Start year: 2003, last year near term: 2007, end year: 2027) at their default values, or modify them if you wish. These values determine the first and last years of the analysis time horizon, and, the periods in which the respective near-term and far-term growth rates are applied. Enter a name for the scenario (e.g., Lincoln base) and click on “Create”. Your browser will create the scenario and shift back to the **Settings** page. Now from the drop down list select the newly created scenario.

Modify the scenario data with forecast values and assumptions for your analysis

Click on the **Scenario** link of the main navigation menu. Your browser will transfer to the **Scenario** page. This page will display the scenario that you selected. This scenario is pre-populated with the sample values copied from the “Base scenario”. Modify these values to suit your analysis.

The scenario data variables are organized by topic areas: rail operations, highway, social costs and prices. You select a topic area by using the drop down list on the upper left. You select a variable within a topic area by browsing to it using the up and down pointing finger icons, or by clicking on a “Select” link in the table in the lower part of the page.

The data for the scenario variables are either a fixed value, or two or three values that define a probability distribution. You select the type of probability distribution (skewed bell, normal, uniform or triangle) from the drop down list at the upper left of the page. You enter values in the designated text boxes and buttons on the toolbar allow you to commit (“save”) your modifications, undo them or refresh the chart and the tables on the page.

Verify or modify parameters and other data values

Browse to the **Parameters** page by clicking on the link on the main navigation menu. On this page select from the toolbar at the top “Model Parameters”. Select from the drop down list a table of values to view. If for your analysis you have local information that is better suited than the standard values supplied with *GradeDec.NET*, then edit the model values here (see the *Model Reference*) for documentation of the equations in the *GradeDec.NET* model.

Set the simulation parameters and run the simulation

Browse to the **Simulation** page by clicking on the link on the main navigation menu. On this page set the parameters for running a risk analysis of the benefit-cost of the program of improvements defined in **Crossings**, with the probability distributions described in **Scenario**. You can run your simulation with the default values, or modify them and take advantage of the options on this page. When ready, click on the green traffic light icon to run the simulation. When completed, your browser will shift to the **Results** page.

View results table and charts, print report

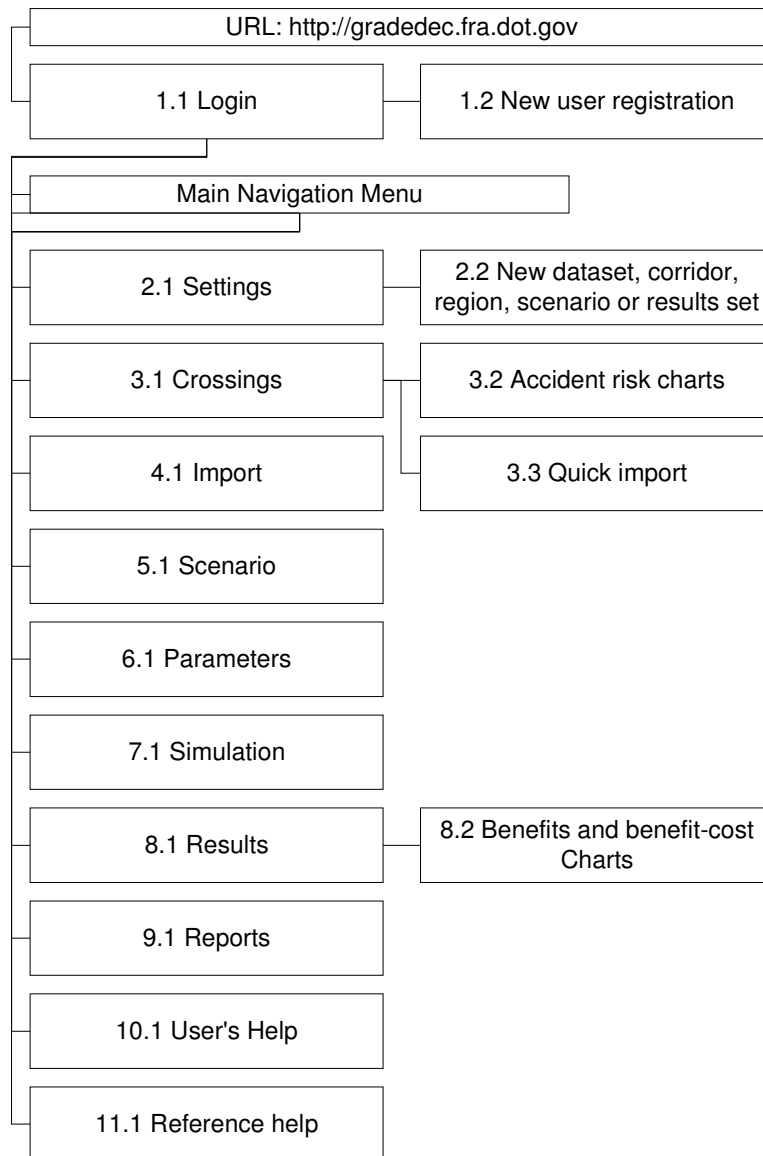
On the **Results** view your analysis results on the tables and charts that this page makes available.

***GradeDec.NET* Page-by-Page**

Introduction

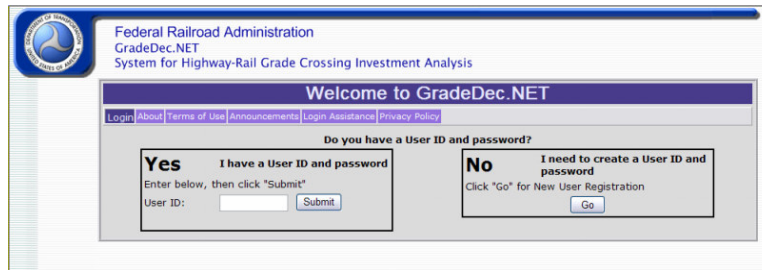
The figure below shows the pages in *GradeDec.NET* and the means for accessing each page (pages directly connected to the main navigation menu are accessed from it. Access other pages from the connecting page to its left in the figure). The following descriptions of pages each contain an Overview and a Features section.

Figure 3 Key to Pages in GradeDec.NET



1.1 Login Page

Figure 4 View of Login Page



The screenshot shows the login page for GradeDec.NET. At the top left is the Federal Railroad Administration logo. The header text reads: "Federal Railroad Administration", "GradeDec.NET", and "System for Highway-Rail Grade Crossing Investment Analysis". Below this is a navigation bar with links: "Login", "About", "Terms of Use", "Announcements", "Login Assistance", and "Privacy Policy". The main heading is "Welcome to GradeDec.NET". A question asks, "Do you have a User ID and password?". There are two options: "Yes" and "No". The "Yes" option includes a "Submit" button and a text input field for the "User ID:". The "No" option includes a "Go" button and the text "Click 'Go' for New User Registration".

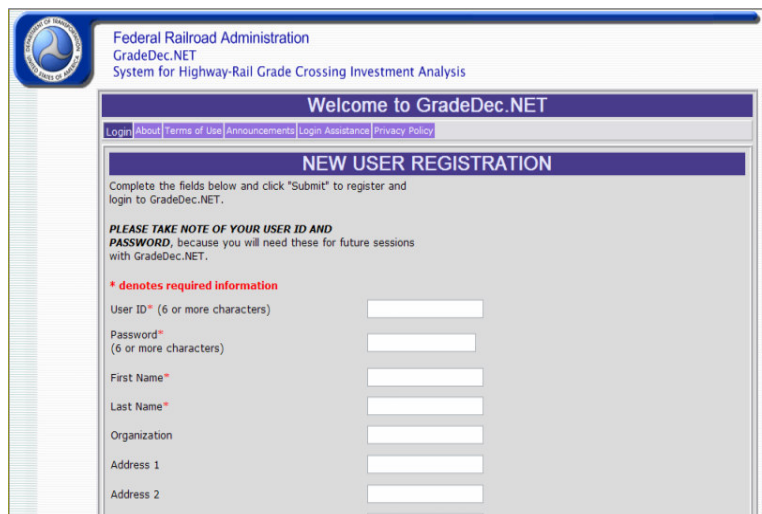
Overview

After directing your browser to the *GradeDec.NET* URL (<http://gradedec.fra.dot.gov>), the **Login** page appears. Enter your user id and password and click on "Submit" to begin a *GradeDec.NET* session.

First-time users should click the link to transfer to the **Register** page where they can set a user ID and password.

1.2 Registration Page

Figure 5 View of Registration Page



The screenshot shows the registration page for GradeDec.NET. At the top left is the Federal Railroad Administration logo. The header text reads: "Federal Railroad Administration", "GradeDec.NET", and "System for Highway-Rail Grade Crossing Investment Analysis". Below this is a navigation bar with links: "Login", "About", "Terms of Use", "Announcements", "Login Assistance", and "Privacy Policy". The main heading is "Welcome to GradeDec.NET". Below that is a section titled "NEW USER REGISTRATION". The text says: "Complete the fields below and click 'Submit' to register and login to GradeDec.NET." A note reads: "PLEASE TAKE NOTE OF YOUR USER ID AND PASSWORD, because you will need these for future sessions with GradeDec.NET." A red asterisk indicates required information. The form fields are: "User ID*" (6 or more characters), "Password*" (6 or more characters), "First Name*", "Last Name*", "Organization", "Address 1", and "Address 2".

Overview

On this page, first-time users register with *GradeDec.NET*. Required information includes the user ID, password and an email address.

2.1 Settings Page

Figure 6 View of Settings Page

Item	Value	Edit
Corridor ID*	1	Edit
Description	CSX - South Florida	Edit
Daily Pass. Trains	0	Edit
Daily Freight Trains	38	Edit
Daily Switch Trains	3	Edit
Rail TOD Distribution	AM Peak	Edit
Rail TOD Distribution - Freight	AM Peak	Edit
Rail TOD Distribution - Switch	AM Peak	Edit
Signal Synchronization?	False	Edit
Effectiveness Factor, New Technology 1	0.5	Edit
Effectiveness Factor, New Technology 2	0.5	Edit
Effectiveness Factor, New Technology 3	0.5	Edit
Last Modified*	2/1/2002 3:33:00 PM	Edit

Overview

With the **Settings** page use the controls on the page to set and manage the data collections for your analysis (see the section on “The Data Hierarchy in *GradeDec.NET*”). You can also modify the defining values for data collections, set or restore defaults, and, launch the page to create new data collections or delete existing ones.

Features

- **“Actions” drop down list** – from this list access the following:
 - Reload defaults – Some of your data collections are designated as “defaults”, which are set as “selected” when you begin your *GradeDec.NET* session. This action restores your default settings to be the current ones.
 - Save current selections as defaults – This action will replace your default settings with the ones that are current.
 - Download dataset – When you download a dataset, you create a ZIP file on your computer that contains a replica of all the data in your dataset. The downloaded dataset is for storage and sharing with another user. It is not in a suitable format for offline modification of data. After downloading your dataset you can delete it from the *GradeDec.NET* server database.
 - Upload dataset – Select this action to upload and restore a downloaded dataset to the *GradeDec.NET* server.
- **Select dataset** drop down list – if you have more than one dataset, select the one to use with this control.
- **New dataset** link - Invoke the page for creating a new dataset.

- **Delete dataset** link – Delete the selected dataset (note that you cannot delete a default dataset – if it is default, then select a different dataset and set it as default and then delete the originally selected dataset).
- **Select model** drop down list – within the selected dataset, select the model (Corridor or Regional) to use. The Corridor model examines crossings along a designated rail alignment and calculates impacts in the corridor, while the Regional model looks at all crossings in a specified region.
- Selection buttons – when you click one of these buttons you put the focus on the selected item (corridor or region, scenario, results set) and accomplish the following:
 - Enable the corresponding drop down list for data collection selection.
 - Populate the grid at the bottom of the page with the defining values of the selected data collection and enable editing of these values.
 - Enable the “New” link to navigate to the corresponding page when clicked for creating a new data collection.
- **Select corridor or region** drop down list – Select the corridor or region for your analysis.
- **Select scenario** drop down list – Select the scenario for your analysis.
- **Select results set** drop down list – Select the results set for your analysis.
- **New corridor, region, scenario or results set** link - Invoke the page for creating a new data collection (corridor/region, scenario or results set, depending upon which radio button you have selected).
- **Delete corridor, region, scenario or results** link – Delete the selected data collection (note that you cannot delete a default data collection – if it is default, then select a different data collection and set it as default and then delete the originally selected data collection).

- **View/Modify Defining Values of Selected Data Collection** data grid – After selecting a data collection with the drop down lists above, its defining values will appear in the data grid at the bottom of the page. Items marked with an asterisk are not editable (the values are determined by *GradeDec.NET* processes). Editable values can be edited by clicking on the Edit link. Click the Update link when you have completed editing.

2.2 New Data Collection (Dataset, Corridor, Region, Scenario, Results) Page

Figure 7 View of New Data Collection Page

Overview

Invoke this page from the **Settings** page and use it to create a new data collection. Each page will request that you specify a “Copy” to create, or, a “Default” collection. For a copy, you select the data collection to copy. In either case, you need to select a name for the new data collection.

In the case of a scenario data collection, you need to specify the first year, last year of the near term and the last year of the scenario data.

The two pages, “Crossings Page – Single” and “Crossings Page – Multiple”, both have the same functionality. The “Single” page facilitates the editing of the data for a single grade crossing, while the “Multiple” page makes it easy to enter and modify data for several crossings at the same time. The “Single” page is better suited for new users and the “Multiple” for experienced users.

The “Crossings” pages are similar for the Corridor and Regional models. The differences in the pages for the two models is due to each model having unique data input requirements.

3.1a Crossings Page - Single

Figure 8 View of Crossings Page (No Capital Programming)

Federal Railroad Administration
GradeDec.NET
System for Highway-Rail Grade Crossing Investment Analysis

Crossings for Corridor: CSX - South Florida

General Highway Rail Costs Accidents HSR Model

Milepost: 1018.78 Crossing ID: 628279Y Rank: Description: CSX - TAFT S Urban? Paved?

Devices and Programmed Improvements

Base Case: Principal Device Type: Gates Supplementary Safety Type: None

Alternate Case: Principal Device Type: Gates Supplementary Safety Type: 4 quad - 60' mediar

[Add new crossing](#) [Delete checked](#) [Delete all on page](#)

ID	Milepost	Crossing ID	Description	
1	1018.78	628279Y	CSX - TAFT S	<input checked="" type="checkbox"/>
2	1019.3	628280T	CSX - JOHNSON S	<input type="checkbox"/>
3	1019.83	628281A	CSX - HOLLYWOOD BLVD	<input type="checkbox"/>
4	1020.85	628282G	CSX - PEMBROKE ROAD	<input type="checkbox"/>
5	1021.1	628290Y	CSX - HALLANDALE BEACH	<input type="checkbox"/>

Figure 9 Crossings Page (With Capital Programming)

Federal Railroad Administration
GradeDec.NET
System for Highway-Rail Grade Crossing Investment Analysis

Crossings for Corridor: CSX - South Florida

General Highway Rail Costs Accidents HSR Model Year 1

Milepost: 1018.78 Crossing ID: 628279Y Rank: Description: CSX - TAFT S Urban? Paved?

Devices and Programmed Improvements

Base Case: Year (Base=0): Principal Device Type: Gates Supplementary Safety Type: None

Phase I Improvement: Year: 0 Principal Device Type: Gates Supplementary Safety Type: 4 quad - 60' mediar

Phase II Improvement: Year: 1 Principal Device Type: Gates Supplementary Safety Type: 4 quad - 60' medians

[Add new crossing](#) [Delete checked](#) [Delete all on page](#)

ID	Milepost	Crossing ID	Description	
1	1018.78	628279Y	CSX - TAFT S	<input checked="" type="checkbox"/>
2	1019.3	628280T	CSX - JOHNSON S	<input type="checkbox"/>
3	1019.83	628281A	CSX - HOLLYWOOD BLVD	<input type="checkbox"/>
4	1020.85	628282G	CSX - PEMBROKE ROAD	<input type="checkbox"/>
5	1021.1	628290Y	CSX - HALLANDALE BEACH	<input type="checkbox"/>

Overview

Use this page in safety or investment analysis to:

- View crossing data.
- Add, modify and delete crossing data.
- Calculate predicted accidents using both the Accident Prediction and Severity Model and the High Speed Rail Model
- Print the crossings reports
- View charts ranking the crossings

Features

The Crossings page is divided into two main sections: 1) the data entry form (top of the screen), and, 2) the data grid (bottom of the screen). You use the data grid to select a crossing for viewing or editing. Data entry and modifications to crossing data are entered on the data entry form. You navigate among topics on the data entry form for the selected crossing by clicking on a tab at the top of the form. Note that the Crossings page appears different depending upon whether the “Allow Capital Programming?” setting is set to true. See Figures 8 and 9 above. (You set the setting “Allow Capital Programming?” in the Settings Page by editing the data for the selected corridor).

If set to true, then in the General Information section, there will be data entry drop down lists for two alternatives (Phase I and Phase II) and their respective years for implementation. Also, on the toolbar at the top of the page the user can specify the year for comparing base and alternate accident risk, which will account for the improvements in the alternate case for the year specified.

Several buttons on the form facilitate updates, calculations and navigation among crossings and are discussed below.

Other features can be accessed from the Actions drop down list at the top of the form.

Crossing Data Entry Form

General Information

This block of the data entry form contains general information about the crossing, locational factors and its physical characteristics. The base and alternate warning device type for the crossing are the "before" and "after" improvement crossing types, respectively. Using the mouse, click on the field where you wish to enter data. For “Base Device Type” and "Alternate Device Type", use the drop down lists.

If your corridor or region allows capital programming, then you can set a Phase I and a Phase II alternate and you must specify the years of implementation for each.

Note: When analyzing a corridor, you must specify in the data the milepost location of each grade crossing.

If one of the selected crossing types is “Lights and Gates” a drop down list appears below the warning device type. Here you specify the supplementary safety measure that is implemented (in the base) or planned (in the alternate).

Highway

The highway data block includes data entry boxes for the number of lanes, AADT and percentages of trucks (and of trucks, percent truck-trailers) and buses. The data block also includes pull-down menus where the user specifies the time-of-day traffic distribution for auto, truck and bus traffic.

Rail

In the rail data block the user specifies the number of tracks and train speeds. The user specifies the maximum timetable speed at the crossing and the average speeds traveled by trains of different types at the crossing.

With the regional model there is additional detail for rail operations characteristics.

Costs

The cost data block contains the cost data for the crossing in the base and alternate cases. You can enter the data manually for each crossing, or you can use the default costs by section from the Actions drop down list "Apply default costs".

If a crossing device type is set to "Lights and Gates" and a supplementary safety measure is chosen, then the user can specify the costs for the supplementary measure in the appropriate boxes.

Predicted Accidents

This block contains one data entry box for the number of accidents at the crossing in the preceding five-year period (for the Corridor Model) and five boxes for each year (for the Regional Model). The other information on this section of the form is the predicted number of accidents for the crossing and the corridor (calculated based upon the data for the crossing and corridor). Predicted accidents are updated when the user presses the "Calculate Predicted Accidents" button. The rates and predicted accidents are calculated using the US DOT Accident Prediction and Severity Formulas and Resource Allocation Method (see the *GradeDec.NET* Model Reference and Documentation).

Predicted Accidents – HSR Model (Corridor Model Only)

This portion of the data entry form shows the predicted accidents using the High Speed Rail Model. The predicted accidents on this block of the form are updated when the user presses the "Calculate Predicted Accidents" button.

Calculate Predicted Accidents Button

After modifying data for a crossing, press the "Calculate Predicted Accidents" to update the crossing data in the database and calculate predicted accidents for each crossing in the corridor and in the corridor as a whole.

Update Data Button

After entering or modifying the data for a grade crossing, press the "Update" button to save the new data in the crossings database. If you move to another crossing in the item list or exit the Corridor Crossing Data form without pressing the "Update" button or the "Calculate Predicted Accidents" button, you will lose any information that you entered since you last pressed "Update".

Note: Pressing the "Update" button does not recalculate the predicted accidents and rates based upon new or changed crossing or corridor data. In order to recalculate the rates and save them in the crossing database you must press the "Calculate Predicted Accidents" button.

Navigation Arrows (Up and Down Pointing Finger Icons)

Clicking on these arrows moves the selection to the next crossing in the Item List. When the selected item changes, the data of the selected item are shown in the data entry form.

Crossings Data Grid

Clicking on the milepost link (Corridor Model) or the crossing ID link (Regional Model) in the row of the Crossings Data Grid selects a crossing. This will display the crossing's information on the **Crossings** page data entry section. Use the check boxes to select multiple crossings. Any Delete link will delete all checked crossings.

You delete crossings from the corridor or region by using the links above the data grid “Delete checked” and “Delete all on page”. In order to use “Delete checked”, you must check in the column of check boxes in the row of the corridor that you wish to delete. Use the “Add new crossing” link to add a new crossing to the corridor (which is initially populated with placeholder values that you must modify to reflect the data you wish to include). If you wish to add to the corridor or region a small number of crossings from the Grade Crossing Inventory, and you know the FRA grade crossing ID numbers for these crossings, use the Quick Import function from the Actions menu on this page. If the crossings that you wish to add are numerous, or, you do not know the FRA grade crossing IDs, then you need to import data to the corridor or region from the Import Page.

Actions Menu

“Add New Crossing”

This action will give a blank form for entering data for a new crossing. If you enter a milepost that already exists, the new data that you enter will overwrite the existing data for the crossing when you press “Update”.

“Apply default costs”

This action will apply the default costs (see the **Parameters** page) to all of the crossings in the corridor or region.

“Delete all crossings on the page”

This action deletes all of the crossings on the page (up to 10 crossings).

“Set default costs (this crossing)”

This action will apply the default costs (see the Parameters page) to the selected crossing in the corridor or region.

“Set default costs (all crossings)”

This action will apply the default costs (see the Parameters page) to all of the crossings in the corridor or region.

“Quick Import”

Selecting Quick Import will launch the Quick Import page (see below). Use Quick Import to import a small number of crossings to the corridor or region, whose FRA grade crossing ID numbers you already know.

“Download data (.CSV file)”

The “Download data” action sends all of the scenario data to a comma separated values file for download to your computer. This file can be imported to your spreadsheet software and modified.

The crossing data will include a single row for each crossing and will include the data for all sections.

“Upload data (.CSV file)”

In order to upload data to the Crossings page follow these steps: 1) Use a spreadsheet program to open the comma separated value (CSV) file that was generated and downloaded using the download data feature described above, 2) make your changes to the data in a spreadsheet, 3) save the file from your spreadsheet as a CSV file, 4) return to the Crossings page in *GradeDec.NET* and choose the Upload data action from the Actions menu.

When you select the “Upload data” action, you will be prompted to enter the name of the file for upload (a “browse” button is also available). After entering the file information, click the “Upload” button to import your modified data.

“Capital Programming Report”

This action generates a pdf file (readable with Adobe Acrobat Reader) that shows the year-by-year capital expenditure and the crossing device status for each year of the alternative. This feature is useful if you have selected “Allow Capital Programming”.

Reports and Charts

“Report Icon”

Prints a report of the data for the corridor including all crossings and the associated predicted accidents using the DOT model.

“Bar Char Icon”

Launches the **Accident Risk Charts** page.

3.1a Crossings Page – Multiple

Figure 10 View of Crossings Page (No Capital Programming)

The screenshot shows the 'Crossings' page in the GradeDec.NET application. The page title is 'Federal Railroad Administration GradeDec.NET System for Highway-Rail Grade Crossing Investment Analysis'. The page is for Corridor: CSX - South Florida. The table below shows the data for 8 crossings.

ID	MilePost	Crossing ID	Base Device	Base Supp. Safety Device	Alternate Device	Alt. Supp. Safety Device	Select
1	1018.78	628279Y	Gates	None	Gates	4 quad - 60' medi	<input type="checkbox"/>
2	1019.3	628280T	Gates	None	Gates	Mountable curbs	<input type="checkbox"/>
3	1019.83	628281A	Gates	None	Grade Separation	None	<input type="checkbox"/>
4	1020.85	628282G	Gates	None	Gates	Barrier curbs	<input type="checkbox"/>
5	1021.1	628290Y	Gates	None	Gates	4 quad - 60' medi	<input type="checkbox"/>
6	1021.11	000000A	Passive	None	Passive	None	<input type="checkbox"/>
7	1021.12	000000A	Passive	None	Passive	None	<input type="checkbox"/>
8	1021.13	000000A	Passive	None	Passive	None	<input type="checkbox"/>

Figure 11 View of Crossings Page (With Capital Programming)

ID	MilePost	Crossing ID	Base Device	Base Supp. Safety Device	Year of Phase I Investment	Phase I Device	Phase I Supp. Safety Device	Select
1	1018.78	628279Y	Gates	None	0	Gates	4 quad - 60' medics	<input type="checkbox"/>
2	1019.3	628280T	Gates	None	0	Gates	Mountable curbs	<input type="checkbox"/>
3	1019.83	628281A	Gates	None	0	Grade Separation	None	<input type="checkbox"/>
4	1020.85	628282G	Gates	None	0	Gates	Barrier curbs	<input type="checkbox"/>
5	1021.1	628290Y	Gates	None	0	Gates	4 quad - 60' medics	<input type="checkbox"/>
6	1021.11	000000A	Passive	None	0	Passive	None	<input type="checkbox"/>
7	1021.12	000000A	Passive	None	0	Passive	None	<input type="checkbox"/>
8	1021.13	000000A	Passive	None	0	Passive	None	<input type="checkbox"/>

Overview

See Crossings Page – Single

Features

The Crossing page differs by viewing the “Devices” section under the “General” drop down list. Note that the Crossings Devices page appears different depending upon whether the “Allow Capital Programming?” setting is set to true. Also, with Capital Programming the “Alternative Case” becomes “Phase I” and “Phase II”. See Figures 10 and 11 above. (You set the setting “Allow Capital Programming?” in the Settings Page by editing the data for the selected corridor). Depending on the drop down selected (ex. Costs, Highway, Accidents, HSR Accidents) a submenu view will become available.

If set to true, then the Device will add the data entry drop down lists for two alternatives (Phase I and Phase II) and their respective years for implementation. Also, on the toolbar at the top of the page the user can specify the year for comparing base and alternate accident risk, which will account for the improvements in the alternate case for the year specified.

Several buttons on the form facilitate updates, calculations and navigation among crossings and are discussed below.

Other features can be accessed from the Actions drop down list at the top of the form.

Crossing Data Entry Form

General Information

This block of the data entry form contains general information about the crossing, locational factors and its physical characteristics. The Phase I and Phase II device types for the crossing are the “before” and “after” improvement crossing types,

respectively. If your corridor or region under Devices allows for capital programming, then you can set a Phase I and a Phase II alternate along with the years of implementation for each.

Note: When analyzing a corridor, you must specify in the data the milepost location of each grade crossing.

Highway

The highway data block includes data entry boxes for the number of lanes, AADT and percentages of trucks (and of trucks, percent truck-trailers) and buses. The data block also includes pull-down menus where the user specifies the time-of-day traffic distribution for auto, truck and bus traffic. A submenu is available to view “Base Case and Alternative Case with” or “without traffic management”.

Rail

See Crossings Page – Single

Costs

The cost data block contains the cost data for the crossing in the base and alternate cases. You can enter the data manually for each crossing, or you can use the default costs by section from the Actions drop down list "Apply default costs".

If a crossing device type is set to “Lights and Gates” and a supplementary safety measure is chosen, then the user can specify the costs for the supplementary measure in the appropriate boxes. Also, a drop down menu is available to view “Base Case Costs”, “Phase 1 Costs”, or “Phase 2 Costs”.

Predicted Accidents

This block contains one data entry box for the number of accidents at the crossing in the preceding five-year period (for the Corridor Model) and five boxes for each year (for the Regional Model). The other information on this section of the form is the predicted number of accidents for the crossing and the corridor (calculated based upon the data for the crossing and corridor). Predicted accidents are updated when the user presses the "Calculate Predicted Accidents" button. The rates and predicted accidents are calculated using the US DOT Accident Prediction and Severity Formulas and Resource Allocation Method (see the *GradeDec.NET* Model Reference and Documentation). Also, a drop down menu is available to view “Annual Predicted Accidents either by Base” or “Alternative Case”.

Predicted Accidents – HSR Model (Corridor Model Only)

This portion of the data entry form shows the predicted accidents using the High Speed Rail Model. The predicted accidents on this block of the form are updated when the user presses the "Calculate Predicted Accidents" button. Also, a drop down menu is available to view “Base and Alternative for both Annual Predicted Occurrences”.

Calculate Predicted Accidents Button

See Crossings Page – Single

Update Data Button

See Crossings Page – Single

Navigation Arrows (Up and Down Pointing Finger Icons)

See Crossings Page – Single

Crossings Data Grid

See Crossings Page – Single

Actions Menu

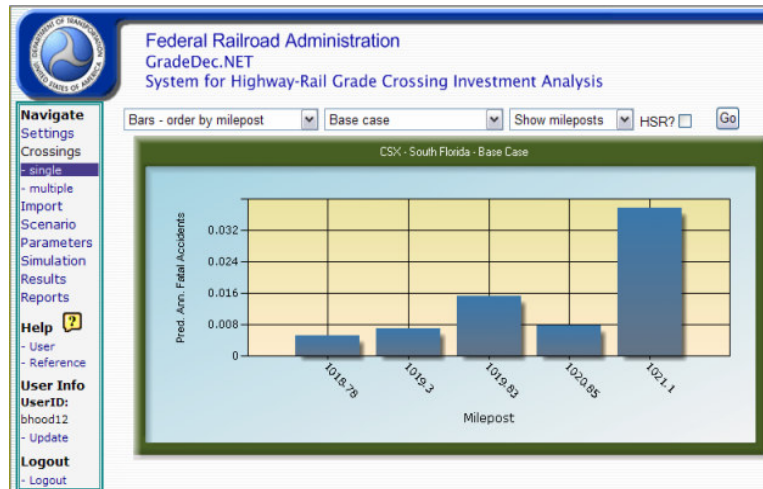
See Crossings Page – Single

Reports and Charts

See Crossings Page – Single

3.2 Accident Risk Charts Page

Figure 12 View of Accident Risk Charts Page



Overview

This page displays a series of charts that rank the crossings in a corridor based upon predicted fatal accidents (for the DOT model) or predicted fatalities (for the HSR model). You invoke this page from the **Crossings** page, using the bar chart icon in the toolbar at the top of the page.

Features

This page displays a ranking of crossings by risk for both the base and the alternate cases. The page includes two charts, namely:

- Risk ranking - bar chart
- Cumulative risk by ranked crossings

The charts display a maximum number of 30 crossings.

3.3 Quick Import Page

Overview

This page is invoked from the Actions menu on the “Crossings Page”, single or multiple versions.

“Quick Import” allows the user to import data quickly from the National Grade Crossing Inventory into your selected corridor or region. In order to use “Quick Import” you need to know the FRA IDs of the grade crossings that you seek to import. Unlike the “Import Page”, with “Quick Import” you cannot select crossings

by geographic location and you cannot screen the imported crossings according to a number of criteria.

Features

There are two methods for employing “Quick Import”, one is by entering up to five grade crossing IDs, and the other is importing based on a list that is stored in a text file. You select which of these two methods to use by:

Option 1 - Enter Up to Five IDs

Figure 13 View of Quick Import Page

Federal Railroad Administration
GradeDec.NET
System for Highway-Rail Grade Crossing Investment Analysis

Quick Import Enter up to five IDs | Import List Import crossings to corridor: CSX - South Florida

Option 1 - Import Up to 5 Crossings - Enter Crossing IDs on Page

Enter below the identification number(s) of the crossing(s) to import to the current corridor.

Crossing 1

Crossing 2

Crossing 3

Crossing 4

Crossing 5

Calculate predicted accidents after import?

Use this option to enter up to five grade crossings. Enter the FRA grade crossing IDs into the boxes. Check the box if you wish to have *GradeDec.Net* calculate predicted accidents for the imported grade crossings. Click “Import Crossings” after you have entered the information. Following the import, you will be redirected back to the “Crossings Page”.

Option 2 - Import List

Figure 14 View of Import List

Federal Railroad Administration
GradeDec.NET
System for Highway-Rail Grade Crossing Investment Analysis

Quick Import Enter up to five IDs Import List Import crossings to corridor: CSX - South Florida

Option 2 - Import Crossings Using a File with a List of IDs

Prepare a comma separated value (CSV) file that contains a list of Grade Crossing IDs to import from the National Grade Crossing Inventory of Public Highway-Rail Grade Crossings. Along with each crossing ID, the list should specify a rank value.

The file should contain column headers in the first row (Rank and ID) followed by successive rows with the rank and the ID of each crossing to import. The rank value and its column header must be followed immediately by a comma. For instance, the Sample List File on the right shows the contents of a file with five grade crossings to import.

You can create the CSV file using a text editor like Notepad, or by creating a spreadsheet with your list of crossings and saving it as a CSV file.

Enter below the full path and name of the file with crossing IDs to import:

Calculate predicted accidents after import?

Rank	ID
1,	003629K
2,	003630E
3,	003635N
4,	003637C
5,	003638J

Prepare a comma separated value (CSV) file that contains a list of Grade Crossing IDs to import from the National Grade Crossing Inventory of Public Highway-Rail Grade Crossings. Along with each crossing ID, the list should specify a rank value.

The file should contain column headers in the first row (Rank and ID) followed by successive rows with the rank and the ID of each crossing to import. The rank value and its column header must be followed immediately by a comma. For instance, the Sample List File on the right shows the contents of a file with five grade crossings to import.

You can create the CSV file using a text editor like Notepad, or by creating a spreadsheet with your list of crossings and saving it as a CSV file.

Click “Import Crossings” after you have entered the information. Following the import, you will be redirected back to the “Crossings Page”.

4.1 Import Page

Figure 15 View of Import Page

Federal Railroad Administration
GradeDec.NET
System for Highway-Rail Grade Crossing Investment Analysis

Import You are importing data from the National Grade Crossing Inventory to your selected corridor: South Empire.

Select a state

Automatically fill crossing default costs?
 Automatically select alternative type?
 Calculate predicted accidents after import?

Base type	Alternative type
No device	==> Flashing lights
Other stop	==> Flashing lights
Crossbucks	==> Flashing lights
Stop signs	==> Flashing lights
Special procedures	==> Gates
Wigwags, etc.	==> Gates
Flashing lights	==> Gates
Gates	==> New technology

View selected inventory records

* If crossings with duplicate mileposts exist in the corridor, only the last one appearing will be imported.

Overview

Use this page to import data from the Federal Railroad Administration's National Inventory of Highway-Rail Grade Crossings database.

The purpose of this page is to enable the analyst to import data from the National Inventory of Highway-Rail Grade Crossings database into *GradeDec.NET* for analysis. The page lets the user build a query based on geography, identified corridors and grade crossing characteristics. The page also enables the specification of automatic mapping to *GradeDec.NET* fields. The following sections describe the different parts of the page and their functions.

Features

Importing Data from the National Inventory of Grade Crossings

When the Import page opens in the browser use the following drop down lists to select the region under consideration:

"Select a State", "Select a County", "Select Area"

Choose the state first and then the county from the drop down lists. After selecting the county, you should select an area, which is an area within the county (i.e., "the whole county", a specific city, or "not in any city"). After selecting the area, it will appear in the "Selected Areas" data grid.

For Corridor Model

After selecting the areas for inclusion, use the drop down list to select crossings that are identified as being in a specific corridor. After making this selection, the records from the Grade Crossing Inventory to be imported will be viewable in the data grid at the bottom of the page.

For Regional Model

After selecting the areas for inclusion the records from the Grade Crossing Inventory to be imported will be viewable in the data grid at the bottom of the page.

Press the "Delete" link in the "Selected Areas" data grid to delete a selected area.

Other Criteria

The "Other Criteria" section allows the user to restrict the crossings to import to those that meet specific criteria. The criteria include: average annual daily traffic, number of trains per day and number of accidents in the previous 5 years.

Note: While *GradeDec.NET* allows you to import records that have no train or highway traffic, be aware that the absence of either at a grade crossing will cause a computational error in the model (e.g., divide by zero). To avoid this, you should either exclude crossings with no traffic, or enter data manually for these crossings (assuming that this reflects actual conditions at the crossings).

Note: With the Corridor Model, after setting "Other Criteria" you need to reselect the corridor.

Import Options

Use this section to determine the automated filling of *GradeDec.NET* fields when importing data. You can specify to use default cost data, or leave cost data blank for manual data entry. The base grade crossing type is the type specified in the National Inventory of Highway-Rail Grade Crossings database. The alternative grade crossing type can be automatically designated using the pull-down menus, or the user can specify that alternative crossing types will be manually entered.

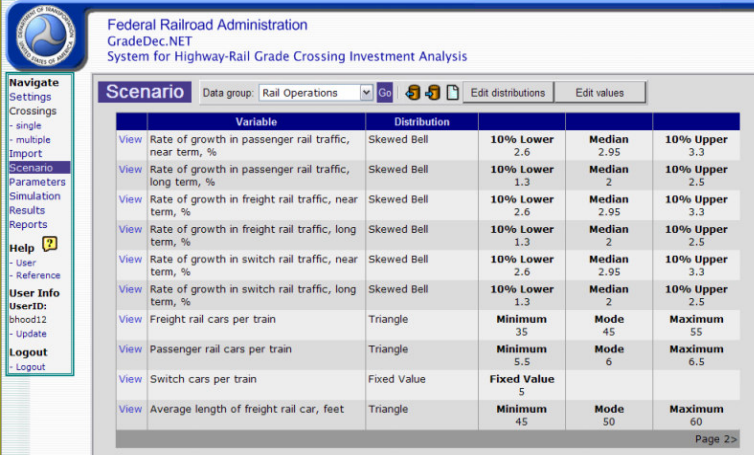
Import Data

By clicking on the button “Import Data”, the selected records are imported to the selected corridor or region, and your browser transfers to the **Crossings** page. The instructions that you specified in the **Import** page for automatic field fill are executed and the new data records are appended to the existing records in the selected region. After importing, predicted accidents are calculated for all crossings as well as a summary for the corridor or region.

If upon importing data a record already exists with the same crossing ID as a newly imported crossing, the existing record in the region is overwritten by the imported data.

5.1 Scenario Page

Figure 16 View of Scenario Page



	Variable	Distribution	10% Lower	Median	10% Upper
View	Rate of growth in passenger rail traffic, near term, %	Skewed Bell	2.6	2.95	3.3
View	Rate of growth in passenger rail traffic, long term, %	Skewed Bell	1.3	2	2.5
View	Rate of growth in freight rail traffic, near term, %	Skewed Bell	2.6	2.95	3.3
View	Rate of growth in freight rail traffic, long term, %	Skewed Bell	1.3	2	2.5
View	Rate of growth in switch rail traffic, near term, %	Skewed Bell	2.6	2.95	3.3
View	Rate of growth in switch rail traffic, long term, %	Skewed Bell	1.3	2	2.5
View	Freight rail cars per train	Triangle	Minimum 35	Mode 45	Maximum 55
View	Passenger rail cars per train	Triangle	Minimum 5.5	Mode 6	Maximum 6.5
View	Switch cars per train	Fixed Value	Fixed Value 5		
View	Average length of freight rail car, feet	Triangle	Minimum 45	Mode 50	Maximum 60

Overview

The Scenario Input Screen is where you view and edit scenario data for an analysis. Scenario data for a model input variable can be either a fixed value, or several values that describe a probability distribution.

This page possesses a number of features that let you easily visualize data and quickly develop probability distributions that best reflect available information and judgments on operations, future developments and social costs. These features include:

- Ease of navigation among variables

- Instant viewing of statistics and charts
- Instant validation and saving of ranges
- Seamless connectivity with spreadsheet software

Please note that the *GradeDec.NET* tool can store many different scenarios for analysis (e.g., passenger rail operations; social costs; baseline assumptions, etc.). Scenarios are initially defined and selected in the **Settings** page (change to the Scenario view using the **Settings>Scenario** submenu). Modifications made to scenario data in the **Scenario** page apply only to the scenario selected in the **Settings** page, and will not affect other scenarios not selected. Also, remember that the data in the selected scenario are the data that will be used by the *GradeDec.NET* model to conduct the benefit-cost analysis on the strategies and cases defined elsewhere in the model. If you wish to work with data from another scenario and use that data in the analysis, that scenario must be selected from the **Settings** page (see section above on the **Scenario** page).

Features

The **Scenario** page is shown above. The scenario input variables in *GradeDec.NET* are organized into data groups according to a functional classification. The data groups are:

- Rail Operations
- Highway
- Social Costs
- Price Growth Rates

When you link to the **Scenario** page the Rail Operations sheet is loaded and the first variable in that sheet is selected and shown in the chart and tables. You browse among the different sheets using the drop down list in the upper right-hand corner of the form.

The remainder of this section describes each component of the **Scenario** page and their functions.

Toolbar

The toolbar at the top of the page contains two drop down lists and several icon buttons that perform the following functions.

Data Group Pull Down List

Use this drop down list on the left side of the upper toolbar to select the data group to view and edit.

The data groups accessible from the **Scenario** page offer the analyst great flexibility in specifying the present and future travel, cost, and policy environment that will affect a project. The content of the major groups are summarized below. Note that each data group allows the analyst to specify a range of uncertainty around any of the values entered for that group (see the Variable Data Grid below).

- “Rail Operations” and “Highway” data on this page (see Figure 13) impact other rail data that are input on the **Settings** page with **Corridor** view, and on the **Crossings** page (multiple and single settings). Inputs on the **Scenario** page that impact rail levels include: rail level

uncertainty, average rail occupancy, annualization factor (that converts daily traffic flows into annual values), and effective price elasticity of demand (the response of traffic to changes in the cost of driving).

- “Social costs” data are entered in this **Scenario** page view. Most of the cost items (including discount rate, value of travel time, value of statistical life and injury, etc.) are self-explanatory and are set to default values taken from FRA sources. The analyst can specify, of course, alternate values for these items in accordance with his or her agency’s policies.

Please note that *GradeDec.Net* works in terms of constant dollars (i.e., dollars that have the purchasing power of a specified year. In *GradeDec.Net*, dollars are base year constant dollars). Inflation is assumed to affect all prices equally and is not tracked in *GradeDec.Net*. The only exception to this is that users can choose to set a real oil price index (i.e., the change in oil prices net of general price inflation). The change in oil prices will be reflected in the analysis in the user costs of fuel and oil consumption. As the model uses constant dollars, the discount rate for converting multi-year streams to present value equivalents must be a constant dollar discount rate (i.e., has no component for deflating future nominal dollars).

The model uses the “depreciation rate” to calculate the residual value (if any) of a project’s non-land assets at the end of the analysis period, and to adjust the construction disruption costs realized in the analysis period if an analysis period ends before the end of the useful life of an asset. *GradeDec.Net* does not depreciate the value of the land in its residual value calculations. Fuel prices are before taxes (taxes are added in the “Policies” view of the Scenario page – see below). *GradeDec.Net* does not assign default cost values to emissions. Emission costs should reflect region-specific values developed by the regional planning agency for each emission type (e.g., tons of carbon monoxide).

- The “Price Inflation” view in the **Scenario** page allows you to specify future increases in the real price of fuels and motor oil (net of general price inflation). This feature is helpful if you wish to study the effects of increases in fuel prices that exceed the rate of general inflation.

Export Scenario Data to CSV File

Export the results to a comma separated values (CSV) file. Click on this button and you will be prompted to click to download and to browse for the folder and the name of the downloaded file.

Import Scenario Data to CSV File

In order to import data follow these steps: 1) Use a spreadsheet program to open the comma separated value (CSV) file that was generated and downloaded using the export feature above, 2) make your changes to the data in a spreadsheet (refer to the above table to interpret the values in your downloaded file), 3) save the file from your spreadsheet as a CSV file, 4) return to the Scenario page in *GradeDec.NET* and choose the Import data (data-in icon) button on the toolbar of the Scenario page.

When you press the copy icon in GradeDec.NET you will be prompted to enter the name of the file for upload (a “browse” button is also available). After entering the file information, click the “Upload” button to import your modified data.

Generate Report

Opens a report in Adobe Acrobat format of the screens results from the Data Group Pull Down List.

Edit Distribution

Allows for the Distributions to be changed for each of the variables. The probability distributions can be seen in the Table 5 listed below. For each scenario input variable, you can specify a probability distribution. The input values and the choice of probability distribution type determine the probability distribution for the input variable. Once the Edit Distribution button is selected the button changes to Cancel while the Edit Values button changes to Update.

Edit Values

Allows for the values representing the distribution from the Lower 10% and Median to the Upper 10% values to be changed manually. Once the Edit Distribution button is selected the button changes to Cancel while the Edit Values button changes to Update.

Export Scenario Data (data-out icon)

The Export Scenario Data button sends all of the scenario data to a comma separated values file for download to your computer. This file can be imported to your spreadsheet software and modified.

The scenario data will include one row for each variable and the following columns: a) description, b) variable name, c) low value, d) middle value, e) high value, f) distribution type value, and g) the correlation factor (inactive future option).

After pressing the icon, a link will appear that prompts you to download the file. After clicking this link, a dialogue box will direct you to select the folder and file name for the downloaded file.

Table 5 Probability Distributions and their Displays on the Scenario Page

Probability Distribution	Type Value	Meaning of Value 1	Meaning of Value 2	Meaning of Value 3
Fixed Value	-1	Fixed value	Fixed value	Fixed value
Uniform	0	Minimum value	Median	Maximum value
Skewed Bell	1	10 th percentile	50 th percentile	90 th percentile
Normal	2	Mean - standard deviation	Mean	Mean + standard deviation
Triangle	3	Minimum value	Mode	Maximum value

After pressing the icon, the file dialogue box will appear and you will be prompted to either approve the default file path and name or enter a new path and name.

Import data (data-in icon)

In order to import data follow these steps: 1) Use a spreadsheet program to open the comma separated value (CSV) file that was generated and downloaded using the export feature above, 2) make your changes to the data in a spreadsheet (refer to the above table to interpret the values in your downloaded file), 3) save the file from your spreadsheet as a CSV file, 4) return to the **Scenario** page in *GradeDec.NET* and choose the Import data (data-in icon) button on the toolbar of the **Scenario** page.

When you press the copy icon in *GradeDec.NET* you will be prompted to enter the name of the file for upload (a “browse” button is also available). After entering the file information, click the “Upload” button to import your modified data.

Probability distribution drop down list

For each scenario input variable, you can specify a probability distribution. The input values and the choice of probability distribution type determine the probability distribution for the input variable.

The types of probability distributions from which you can choose are:

Fixed Value (single value required)

When you choose fixed value, there is no distribution and the variable assumes a unitary, fixed value in a simulation. For a fixed value, no statistics are shown and only the middle percentile box is enabled for data entry. No chart is shown for a fixed value.

Skewed Bell (three values required – 10, 50 and 90 percentiles)

The skewed bell distribution is derived from three points: the 10% lower value, the 50% value (or, median) and the 10% upper value. For non-skewed values the distribution is normal.

This distribution is useful when the exact form of the distribution is not known yet good estimates on the median and boundary values are available.

When this distribution type is selected, the 10, 50 and 90 percentile boxes in the percentiles table are enabled for data entry.

Normal (two values required – mean and standard deviation)

For this distribution, enter data in the statistical summary frame. The mean and standard deviation are available for data entry when this distribution type is selected.

Use this distribution type when you have data indicating the variable is non-skewed and normally distributed.

Uniform (two values required – maximum and minimum value)

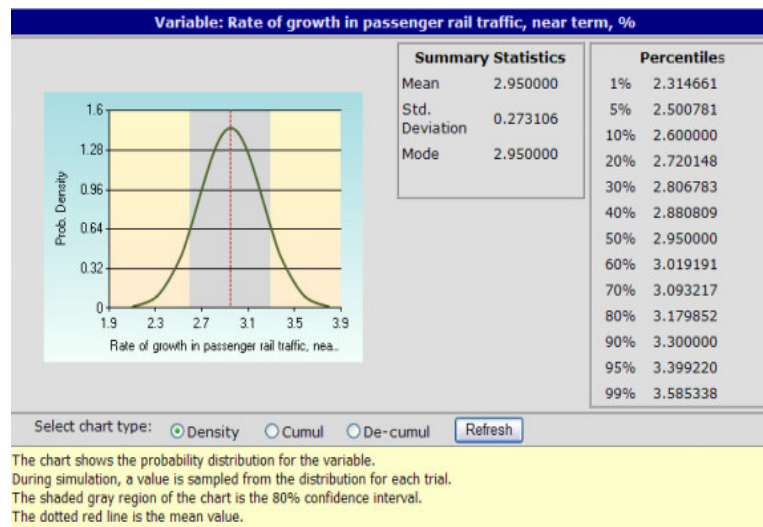
With the uniform distribution every point on an interval is equally likely. When you select this distribution type, the 0 percentile (minimum value) and 100 percentile (maximum value) are enabled for data entry.

Triangle (three values required – maximum, minimum and mode)

For the triangle distribution, you enter data for the maximum value, the minimum value and the most likely value (the mode of the distribution). All values for this distribution lie between the minimum and the maximum and its density function forms a triangle with its peak at the mode. Use this distribution when the variable and data indicate firm bounds on the maximum and minimum values and a most likely value.

6.a Scenario Input Variable Chart

Figure 17 View of Scenario Input Variable Chart



Overview

Clicking on “View” for a variable on the Scenario page will cause the scenario input variable chart to pop up, showing a chart and data for the variable. The page contains a chart, a summary statistics table, a percentiles table and option buttons for selecting alternative chart types.

For a fixed value, the chart will display the message “No Chart for Fixed Value” and the tables will reflect the information for the single, fixed value.

There are three chart types and each shows a shaded region that represents the 80% confidence interval. A dotted red line marks the mean value of the distribution.

The x-axis on all the charts ranges between the values whose probabilities are 0.1 and 99.9 percent, respectively. The different chart types are selected using the option buttons below the chart (click “Go” after making a selection).

Features

Density/Cumul/De-Cumul option buttons

The selected option determines which of the three chart formats:

- Probability density
- Cumulative probability
- De-cumulative probability

are displayed for the selected variable (see the Glossary for definitions).

Summary statistics tables

The summary statistics frame displays the mean, mode, and standard deviation of the distribution. See the glossary for the definitions.

Percentiles

The percentiles frame displays the percentiles of the input distribution. A percentile indicates the probability that the value of the input variable would fall below the given value of the x-axis. For instance, in Figure 17, the chance that the sampled input value of “the rate of growth in passenger traffic, near term, %”, would fall below 3.3 is 90 percent, given the distribution specified by the users.

6.1 Parameters Page

Figure 18 View of Parameters Page

Federal Railroad Administration
GradeDec.NET
System for Highway-Rail Grade Crossing Investment Analysis

Parameters | Model parameters | Other data | Vehicle emissions | Go | Restore Defaults

Vehicle Emissions Rates
(grams of emissions per minute of idling)

Vehicle Type	HC	CO	NOx	
Cars	0.302985 0.302985	4.85986 4.85986	0.091555 0.091555	Edit
Buses	0.6655 0.6655	11.85 11.85	0.183 0.183	Edit
Trucks	0.2559 0.2559	3.1446 3.1446	0.2754 0.2754	Edit

*Values in red are Federal Railroad Administration default values that indicate national averages.

Overview

The **Parameters** page is where you can view and modify model parameters and other data values in *GradeDec.NET*. Parameters include:

- Vehicle emission coefficients;
- Fuel and oil burn coefficients
- Effectiveness rates, and,
- High-speed rail model coefficients

Other data include:

- Traffic time-of-day distributions
- Default costs of grade crossing devices
- Default costs of supplementary safety devices

See the *GradeDec.NET Model Reference* for additional explanations.

The page enables the user to access model parameters other data values for reference and for editing, if necessary. In most applications it is unlikely that you will wish to modify the emission and fuel burn coefficients. You may wish to modify or add to the time-of-day traffic distributions if localized information is available that better characterizes these distributions. There may well be local guidance on grade crossing operating and maintenance costs and these should be modified as needed.

7.1 Simulation Page

Figure 19 View of Simulation Page

Overview

Use the **Simulation** page to set the simulation parameters and begin a simulation. You should browse to this page only when you are ready to conduct a simulation, that is, after having made all required modifications to data, and after having selected the corridor (or region), scenario and results file.

Note that the checkboxes “Re-assign traffic if grade separated” and “Use High Speed Rail Model” appear only with the corridor model and not with the regional model.

You also have the option of selecting the results that will be reported upon completion of the simulation.

Features

The **Simulation** page is used to run a simulation. Use the page to set the simulation parameters and initiate the simulation. The simulation parameters are discussed below.

About Simulation

GradeDec.NET uses simulation, or risk analysis, to generate result forecasts. By specifying probability distributions for scenario inputs, the user quantifies their variability and uncertainty. The impact of this uncertainty on the outcomes, as reflected in the *GradeDec.NET* analytic model, is quantified using simulation.

With simulation, rather than solving the model once using "best guess" values for inputs, *GradeDec.NET* solves the model for many independent trials. In each trial, a random sample is taken from the distribution of each scenario input. Each trial produces an outcome (e.g., a set of values for the result variables) that is as likely to be achieved as any other. By applying statistical analysis to a set of outcomes, *GradeDec.NET* derives descriptive statistics for each result variable. Thus, for instance, *GradeDec.NET* will tell us not only that "the answer is 50", but also that "with 90% probability the answer lies between 30 and 75". As opposed to point estimates or sensitivity analysis (where one variable is arbitrarily varied), risk analysis supports better decisions by explicitly reporting the probability distributions of the results.

Also see the section "Why *GradeDec.NET*" in the Introduction.

"Run central values only" check box

Check this box to run your model using only the central values. The reported results will be point values without probability ranges. When this box is checked, the trials box and random seed box are disabled.

Trials Box

Enter the number of trials for the simulation. The number of trials is the number of times that the program will sample from the scenario input distributions, solve the model and generate results. More trials will yield more stable results and will take more time to run. While a number of factors will determine the minimum number of trials needed to achieve stable results, 500 trials will almost always be adequate. You must use at least 3 trials to run a simulation.

Recommended Practice: To save time, when testing your data and assumptions, use a small number of trials (50 or less). After you are satisfied that you will make no more changes to the data, and then run a simulation with a large number of trials to arrive at your final result.

Expert Option: The user can select Latin Hypercube, the default, as the simulation method, or, alternately, the user can select the regular Monte Carlo method for simulation. Latin Hypercube is a stratified sampling method and will usually converge to the true result distribution with fewer trials than the Monte Carlo method. If you wish to know more on this subject, a good technical reference is "Latin Hypercube sampling (A Program Users Guide)", by R.L. Iman J.M. Davenport and D.K. Zeigler, Technical Report SAND79-1473, Sandia Laboratories, Albuquerque (1980)

Random Seed Box

The random seed determines the sequence of pseudo-random numbers that are generated by the simulation engine. Any positive integer value will generate a unique sequence of pseudo-random numbers for the simulation. Two simulations with identical data, number of trials and random seed will generate identical results.

Changing the random seed is an expert option. You may want to change the random seed to test the effects of the randomness of the sampling on the result distributions.

Risk Sensitivity Analysis Check Box

The risk sensitivity analysis, which is executed after the simulation, runs the *GradeDec.NET* model with all the input variables except one set to their mean values. The exception input variable is set to its 10 percent lower value and the model is solved. This input variable is then set to its 10 percent upper value and the model is solved again. This process is repeated for all input variables. The results of the sensitivity analysis are displayed in the tornado chart, which is invoked from the **Results** page.

By leaving this box unchecked your results file will not contain values for the tornado chart. When there are numerous grade crossings in a region or corridor, the risk sensitivity analysis can greatly increase the time required to run a simulation. You may prefer to sacrifice the risk sensitivity analysis in favor of shorter run times by not checking the box.

"Re-Assign Traffic, If Grade Separated" Check Box

This check box appears on the Simulation page only when using the corridor model. In the *GradeDec.NET* corridor model, there is an algorithm that re-assigns highway traffic from the adjacent grade crossings to an improved crossing with grade separation. This box is checked by default and by removing the check you choose to run your simulation without the re-assignment of traffic.

"Use HSR Model"

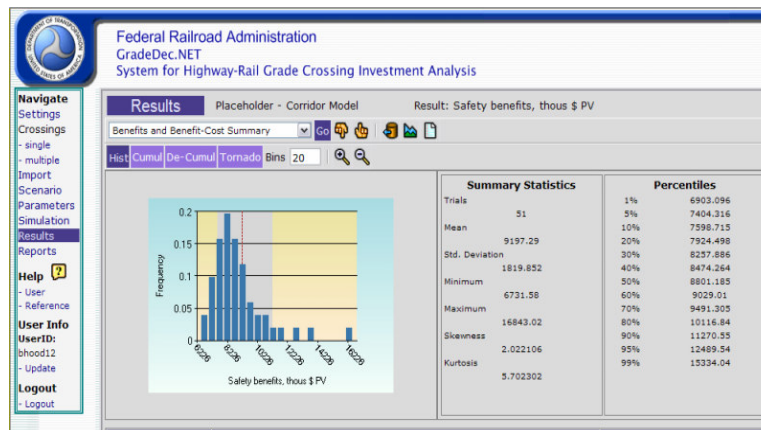
This check box appears on the Simulation page only when using the corridor model. If this box is checked, then the simulation uses the HSR model algorithms to calculate the safety improvements (i.e., risk reduction) at the crossings. By default, when this box is unchecked, the model uses the algorithms specified by the US DOT Accident Prediction and Severity Model. The *GradeDec.NET* Model Reference and Documentation presents a fuller description of the models and their modes of usage.

Include in Results

You can reduce the amount of results that your simulation will generate by unchecking some of the results details. If you are conducting a risk sensitivity analysis with your simulation, this will reduce the length of time that it will take for your simulation to complete.

8.1 Results Page

Figure 20 View of Results Page



Overview

The results of a simulation are viewed in the **Results** page. When you browse to the page it displays the first results group and the first variable in that group

When a simulation completes, the browser automatically redirects to this page.

The purpose of this page is to navigate, view and print results and their associated tables and graphics. Results can be exported from this page to a comma separated values (CSV) file that can be read into spreadsheet software.

Features

Navigating the Results

You navigate among the results by selecting the result variable group with the drop down list in the upper left-hand corner of the screen. After selecting the result variable group, use the up and down buttons in the toolbar to find the variable of interest. Alternatively, you can scroll or point-and-click to the variable of interest in the results data grid at the bottom of the page.

When a result is selected its statistics are shown in the tables on the page as well as a chart of the table values. Using the option buttons you can choose to display the summary chart as a cumulative, de-cumulative or histogram. If in your simulation you selected to run a risk sensitivity analysis, then you can also view the tornado chart.

The Toolbar

Result Group Pull Down List

Use this drop down list on the left side of the upper toolbar to select the result group to view. The groups include the corridor or region summary and breakouts by crossings for each benefit and intermediate result category.

Next Variable (down-pointing finger icon)

Pressing the button with the down-pointing finger icon selects the next result variable in the result group.

Previous Variable (up-pointing finger icon)

Pressing the button with the up-pointing finger icon selects the previous result variable in the result group.

Export results (data-out icon)

Export the results to a comma separated values (CSV) file. Click on this button and you will be prompted to click to download and to browse for the folder and the name of the downloaded file.

Benefit-Cost Charts (chart icon)

Clicking on the chart icon launches the **Benefit-Cost Charts** page. See section below.

Results Report (report icon)

The report icon will generate a report of the results for printing.

Histogram/Cumul/De-Cumul/Tornado option buttons

The selected option determines which of the three chart formats:

- Histogram;
- Cumulative probability;
- De-cumulative probability; or,
- Tornado (option available only if the risk sensitivity option was selected when you ran the simulation)

is displayed for the selected result variable (see the Glossary for definitions).

Histogram, Cumulative probability chart and De-cumulative probability chart

When you browse to this page a histogram chart of the first result variable is displayed with its values distributed into 20 probability bins. You can modify the granularity of the histogram by changing the number of bins using the “Bins” box in the toolbar.

Choose the “De-cumul” option button to view the de-cumulative probability chart. This chart shows the full range of values for the selected result and the probability of exceeding each value in its range.

The cumulative probability chart is displayed when you press the "Cumulative" option button on the form.

Tornado chart

An input variable contributes to risk by means of: a) its own variance, and, b) its structural role in the *GradeDec.NET* model. For instance, an input variable with

large variance may not be a significant contributor to the risk of a result while an input variable with small variance may cause the result to be very uncertain and risky. Without the analysis of risk sensitivity it is not easy to determine which factors are the significant contributors to the riskiness of a particular result.

The tornado chart shows the impact of each random variable input factor when all the other input factors are set to their mean values and the single input factor is allowed to vary within its 80% confidence interval. The tornado chart displays in order the ten input variables that are the major contributors to the risk of a result.

This analysis of sensitivity can guide the analyst to focus on refining the estimates on the range of input variables that truly matter, and help decisions makers plan for mitigating risks.

Number of Bins

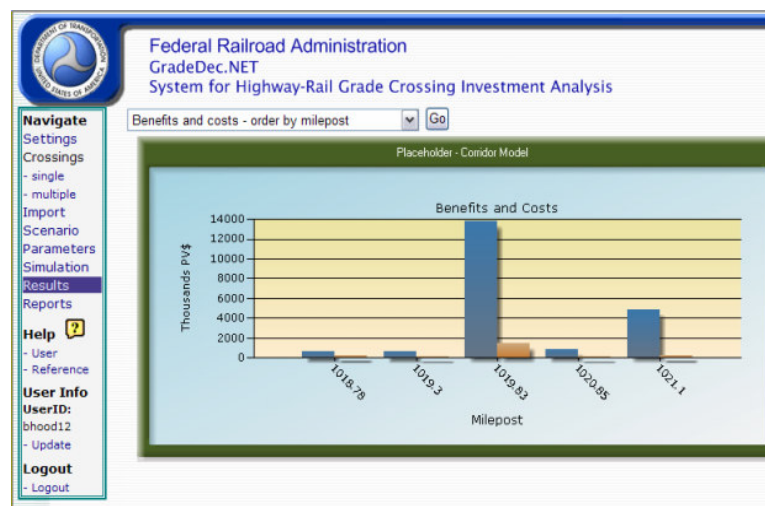
Select the number of bins for the histogram chart. You may choose a value between 10 and 100.

Zoom-in/Zoom-out (magnifying glass icons)

If the smaller chart format is displayed, the zoom-in icon is enabled. When you click it, the page posts back with a larger version of the chart. When the larger format is displayed, the zoom-out icon is displayed. When you click it, the page posts back with the smaller version of the chart.

8.2 Benefit-Cost Charts Page

Figure 21 View of Benefits and Costs



Overview

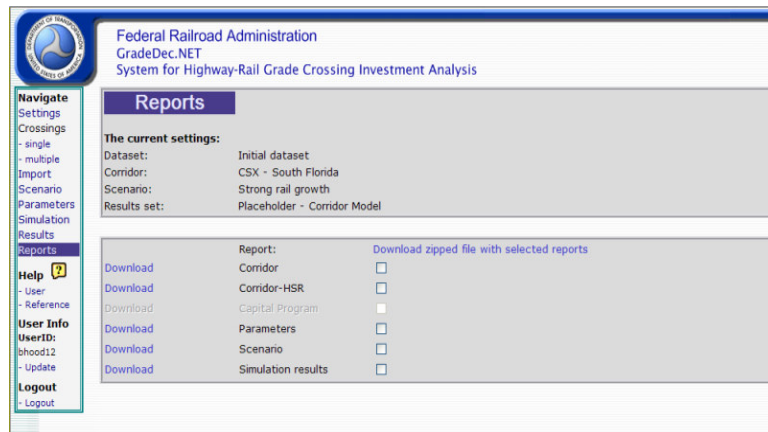
This page contains several charts that illustrate the benefits, costs and the rankings of the crossings by benefits. The user can choose to rank crossings either by safety benefits only or total benefits.

The charts on this page are designed to support resource allocation decisions. The charts illustrate the relative magnitude of benefits, how the ranked crossings compare with one another and the cumulative benefits from crossing improvements.

One chart also compares the ranked benefits by crossing with the costs by crossing. This view of the benefits and costs assists users to quickly identify high yield improvements and to develop improvement programs accordingly.

9.1 Reports Page

Figure 22 View of Reports Page



Overview

With the reports page you can either: 1) Generate each report one at a time by clicking on the link to the left of the requested report, or, 2) Check all the reports you wish to generate and download them as a zipped file, which you can unzip, and then view and print the charts using a program that reads the PDF format files.

Glossary of Terms

Bins

The range for a simulation result variable, that is, the values bounded by its minimum and maximum values, is divided into equal portions called bins. The result value from each trial "falls" into one of these bins. Charting the result value's range on the horizontal axis and the probability of a result value falling in the bins yields the histogram chart.

Cumulative Probability Distribution

A cumulative probability distribution is constructed by cumulating the frequency of the probability density function. A cumulative probability distribution is an "upwardly sloping" curve, where each point on the curve gives the probability that the variable will be equal to or less than the value on the x-axis. The y-axis of the cumulative probability distribution ranges between 0 and 1. The cumulative probability distribution equals zero for a variable's minimum value and rises to 1 at a variable's maximum value.

De-Cumulative Probability Distribution

A de-cumulative probability distribution is constructed by subtracting (or de-cumulating) a variable's probability frequency starting with a probability of 1. A de-cumulative probability distribution is a "downward sloping" curve, where the curve gives the probability of the variable exceeding the value along the X-axis. The de-cumulative probability is 1 for a variable's minimum value and is 0 for its maximum value (i.e., the y-axis ranges between 1 and 0).

Deterministic

The term deterministic indicates that there is no uncertainty associated with a given value, variable or model. Models that include random variables are called stochastic.

Histogram

A histogram shows the frequency of a discrete random variable and is used to display the frequency distribution of Monte Carlo simulation result variables. In a histogram, the result values are gathered in bins and the height of the bars correspond to the frequency with which values fall in the respective bins.

Kurtosis

Kurtosis is a statistical measure of a distribution's peakedness. Flatter distributions (with thin tails) are called platykurtic and peaked distributions (with fat tails) are called leptokurtic. The formula for kurtosis is:

$$\left(\frac{n(n+1)}{(n-1)(n-2)(n-3)} \frac{\sum_i (x_i - \bar{x})^4}{s^4} \right) - \frac{3(n-1)^2}{(n-2)(n-3)}$$

where \bar{x} is the mean of the observations, s is the standard deviation and n is the number of observations.

Latin Hypercube

Latin Hypercube is an alternative statistical sampling method to the Monte Carlo method. This is a stratified sampling method, which means that the range for each input variable is divided into strata and one random sample is taken from each stratum. This method ensures faster convergence to the result distribution than with the Monte Carlo sampling method.

Lower 10% Value

The lower 10% value is the 10th percentile value and is the lower limit of an 80% confidence interval as input by the user.

Mean Value

The mean value for a collection of observations of a random variable is its expected value and equals the sum of the observations divided by the number of observations. For skewed distributions, the mean value is off the median value and is located in the direction of the distribution's skew.

Median Value

The median value is the 50th percentile: there is equal probability that the value for a random variable will lie above or below the median.

Mode

The mode of a probability distribution is the value for which the probability density function is at a maximum. The value has the highest probability (and is sometimes called "the most likely value", not to be confused with the mean or expected value).

Monte Carlo

Monte Carlo is the method of sampling from random variables by taking a random number on the 0-1 interval, call it a , and finding the value of the random variable whose cumulative probability equals a . Repeated Monte Carlo sampling on a number of random variables that are inputs to a model and repeatedly solving the model to arrive at probability distributions for the result variables is called Monte Carlo simulation.

Probability

Probability is the likelihood of the occurrence of a value or event.

Probability Density Function

Same as probability distribution.

Probability Distribution

A probability distribution or probability density function shows a continuous random variable's frequency of occurrence over its range.

Random seed

The random seed is a number that initializes the generation of random numbers used in a Monte Carlo simulation. For the same random seed and the same number of trials given no change in the model or inputs, the results of two Monte Carlo simulations will be identical.

Risk

The term refers to uncertainty in a forecast outcome. Colloquially, risk is often associated with undesirable or downside outcomes (as in "hedging against risk"). In a risk analysis, risk is reflected in the probability distributions of result variables.

Risk Analysis

Risk analysis is a term applied to several methods for quantifying uncertainty in forecasts. The risk analysis method used in GradeDec 2000 is called Monte Carlo simulation.

Simulation

Simulation is a numeric method for finding solutions to analytically complex problems by "simulating" repeated, real world occurrences.

Skewness

Skewness is a measure of the asymmetry of a distribution. The probability density function of a skewed distribution has a longer tail on its skewed side. A right skewed distribution has skewness greater than 0 and a left skewed distribution has skewness less than 0. The formula for skewness is:

$$\frac{n}{(n-1)(n-2)} \frac{\sum_i (x_i - \bar{x})^3}{s^3}$$

where \bar{x} is the mean of the observations, s is the standard deviation and n is the number of observations.

Standard deviation

The standard deviation, which is the square root of the variance, is the principal descriptive statistic after the mean value. Knowing only a distribution's mean value and standard deviation, an upper bound can be found on the probability of any value in a variable's range. The standard deviation reported for the results is the sample standard deviation, given by the formula:

$$\sqrt{\frac{n \sum x^2 - (\sum x)^2}{n(n-1)}}$$

where n is the number of trials.

Trial

A trial is one solution of a model in a simulation. A simulation consists of many trials. In each trial, every input variable is populated with a data value sampled from the variable's probability distribution.

Upper 10% Value

The upper 10% value is the 90th percentile of a probability distribution and the upper limit of an 80% confidence interval.

Variable

A variable is a model element that can assume more than one value. A fixed-value input variable can assume only one value. A random variable can assume a range of values according to its probability distribution.

Variance

The variance is a measure of the dispersion of values in a probability distribution, and is a measure of risk. The variance is the average of the squared deviations about the mean. The variance gives disproportionate weight to "outliers," values that are far away from the mean. The variance is the square of the standard deviation.

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