

MOVING AMERICA FORWARD

FRA GradeDec.NET Crossing Evaluation Tool Overview

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FRA GradeDec.NET Crossing Evaluation Tool Overview

A cloud-based application and decision support tool for the identification and evaluation of highway-rail grade crossing (HRGC) upgrades, separations, and closures; as well as a support tool for the allocation of Federal funding.

- Calculates predicted accident risk at the crossing, corridor or regional level
- Analyzes the safety impacts of HRGC improvements
- Performs benefit-cost analyses of HRGC improvements
- Assists with multi-year HRGC improvement planning
- Supports HRGC closure or elimination planning





How to Register and Access GradeDec.NET

https://gradedec.fra.dot.gov/Login Or search "FRA GradeDec"

An official website of the United States government Here's how you know

U.S. Department of Transp	ortation			Search	Q
Federal Railroad	Administration				
About Railroad	Rail Network	Research &	Legislation &	Grants &	FRA

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Program Areas

Railroad Systems Issues	
Train Occupant Protection	>
Rolling Stock	>
HazMat Transportation	
Human Factors	
Track and Structures	>

GradeDec.NET Crossing Evaluation Tool

The Federal Railroad Administration developed <u>GradeDec.NET</u>, a highway-rail grade crossing investment analysis tool, to provide grade crossing investment decision support. **GradeDec.NET** provides a full set of standard benefit cost metrics for a rail corridor, a region, or an individual grade crossing. Model output allows a comparative analysis of grade crossing alternatives that are designed to mitigate highway-rail grade crossing accident risk and other components of user costs including highway delay and queuing, air quality, and vehicle operating costs.

GradeDec.NET is intended to assist state and local transportation planners in identifying the most efficient grade crossing investment strategies. The **GradeDec.NET** modeling process can encourage public support for grade crossing strategies, including closure and separation, where project success often depends on getting the community involved in the early planning stages. GradeDec.NET computes model output using a range of values for many of the model inputs. This process allows individual stakeholders to influence how different investment options are weighed and evaluated.



Predicted Risk

- GradeDec calculates predicted accident risk at the crossing, corridor, or regional level
 - Provides the choice of three predictive risk and severity models:
 - The New APS, APS, and HSR models
- The New APS model was developed using two sources of FRA HRGC data:
 - <u>Grade Crossing Inventory System (GCIS) Data (Form 71)</u> <u>Highway-Rail Grade Crossing Accident Data (Form 57)</u>
 - The same data sources are used to calculate the predicted accident risk, namely variables:
 - Annual Average Daily Traffic (AADT) Count
 - Total Trains = Total Daily Thru Trains, Total Nighttime Thru Trains, Total Switching Trains
 - Maximum Timetable Speed
 - Crossing Surface Material
 - Location classified as Urban or Rural
 - Warning Devices: Lights or Gates



Safety impact and benefit-cost analysis of HRGC improvements

GradeDec provides users the ability to **simulate** highway-rail grade crossing upgrades, separations, and closures, which allows the user to compare results and evaluate for safety and cost benefits of various updates.

Simulated analyses can be done at the at the crossing, corridor, or regional level

- Up to 600 grade crossings can be analyzed simultaneously
- Crossing results can be viewed at the individual level, or across a corridor or region

Corridor vs Region Schema



Features:

- All HRGCs on single rail alignment
- Rail traffic uniform in corridor
- □ Closing or grade separation → reassignment of highway traffic in corridor (optional)



□ Features:

□ HRGCs within region on multiple alignments

Rail traffic varies by HRGC

□ No traffic reallocation with closure or grade separation



Use Case	Purpose(s)	GradeDec Pages	GradeDec Results
Safety Analysis	Calculate accident risk and impacts of improvements	Data Management, Crossings, Import, Parameters	 Annual predicted accidents by HRGC by severity category Cumulative risk in corridor or region
Benefit-Cost Analysis	Calculate benefit-cost and risk analysis of improvement programs; analyze safety, delay, and user cost impacts; support resource allocation and investment decisions; support planning processes	Data Management, Crossings, Import, Parameters, Scenarios, Simulation, Results	 NPV, BCR, ROR Cumulative benefit by benefit category PV\$ by benefit category by crossing Above metrics as MC simulation outputs (i.e., probability distributions)



Manage Data



Navigation Menu, Status Bar, Data Container, Edit Data



Workflow	GradeDec Page
Create and/or select a dataset	Manage Data
Create and/or select a new corridor or region	Manage Data
Import or Quick Import HRCG data	Import, Crossings
Set values for corridor or region	Manage Data
Verify default values and modify as needed	Parameters
Verify and refine data, assumptions and choice of alternative case	Crossings
Select safety analysis model (New APS, APS, HSR) and calculate predicted risk	Crossings
Review data results and risk charts	Crossings



Manage Data

Selecting or creating a new dataset

GradeDec	U.S. Department of Transportation Federal Railroad Administration				Heilo, Janine McFadden@dot.gov Profile Log.out
Anage Data	Dataset: newest	Schema: Corridor	Corridor: South Empire	Scenario: Strong rail growth	Results: Placeholder - Comidor Model
			Data Management		
			Initial dataset	Select Dataset	Create New Dataset D ete Dataset
			Corridor Schema Regional Schema		
			Corridor Scenario Results Set		
	More Options +		South Empire	Select Corridor	Create New Corridor Delete Corridor
	Settings for the selected corridor	Create Dataset		×	Edit
		Create New DataSet			
		Create new dataset hour sample Create new dataset by copying at DataSet to copy: Initial dataset Name of the new DataSet: Submit Cancel	vala n existing dataset		
			Last Modified 6/3/2014 11:29:00 AM		



Import

Dataset: Initial dataset	Sohema: Corridor	Corridor: South Empire	Scenario: Strong rail growth	Results: Placeholder - Corridor Model
		Import Grade Crossings		
Import Options and Criteria		Go		
Select county(ies): View map * Multiple selections will add wi Q MARTIN MIAMI-DADE MONROE NASSAU OKALOOSA Select subarea(s) within the selected county: MIAMI-DADE Q WHOLE COUNTY AVENTURA BROWNSVILLE	ole counties	Contraction of the second seco	Il down to state, county counties), and city (or es) Corridor Schema, ridors of HRGCs are ntified by matches of anch AND Division AND	Can set threshold criteria such as AADT, number of trains, 5-year accident history, etc. Can specify the Alternati Case warning device type for each Base Case warning device type
CORAL GABLES Selected Areas FL, MIAMI-DADE, WHOLE COUNTY Create list of corridors in selected areas Select corridor(s) in selected areas: Q FEC #NA #NA MAIN 15 crossings FEC #NA #NA MAINLINE 1 crossings FEC #NA #NA MAINLINE 1 crossings FEC #NA #NA HNA 1 crossings FEC #NA #NA HNA I Crossings FEC #NA #NA HNA HNA 1 crossings FEC #NA #NA HNA I crossings FEC #NA #NA HNA I Crossings FEC #NA #NA HNA #NA HNA I Crossings FEC #NA #NA HNA HNA I Crossings FEC #NA #NA HNA HNA I CrossingS FEC #NA #NA HNA HNA HNA I CrossingS FEC #NA #NA HNA HNA HNA I CrossingS FEC #NA #NA HNA HNA HNA HNA HNA HNA HNA HNA HNA H	clicking here, a list of corrido	rs will populate below • S	Select individual corridor Click Go Click View selected inven the crossings before import Click Import Crossing Dat	s from the list tory records to preview orting a to process the import



Manage Data

Settings for the "new" selected corridor





Time-of-Day (TOD) Distribution of Traffic = Exposure (defined as number of trains X AADT)

Crossings - Quick Import by Crossing IDs

GradeDec.NET Cros	ssing Evaluar × 📔 Gradedec	× +						- ø ×	C		
← → C == htt	tps://gradedec.fra.dot.gov/gox							۹ 🖈 🖸 🕯 :	M		
GradeDec	U.S. Department of Transportation Federal Railroad Administration						Hello, Janine M	Fadden@dot.gov Profile Log.out			
🕈 Managa Data	Dataset Initial dataset		Schema: Corridor	Corridor: South Empire	St	Scenario: rong rail growth	Placeh	Results: Ider - Comidor Model			
E Crossings				Crossings in the Corridor					~8		
15 Scenario				MP-1 03 ID 600000A TEMP OF SC	Add New Crossing Delete Crossing				×.		
15 Parameters									Ì		
#5 Import											
15 Simulation									•		
E Results	More Options *								88		
IF Help	Quick Import	.03 ID: 000000A						Edt			
	Set Default Costs (Selected Crossing)	Com APS Model HSR Model									
	Set Default Costs (All Crossings)			Value							
	Generate Corridor Report (APS86) Generate Corridor Report (New APS)			1.03							
	Generate HSR Report			000000A		Import GCX					
	Edit All Description Edit All Urban?			TEMP DESC		import dex					
	Edit All Paved?						0	uick Import			Ê
	Edit All Rank			9609		lana ad anna sin an d	`	alor import			
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					.		nto E Cro				- H
						Import U	p to 5 Cros	ssings			
						Enter below the	identification nun	nber(s) of the crossing(s)	to import	to the	
						Contone	Crossing 1				
							Crossing 2				
				GradeDec - System for Highway-Rail Grade Crossing Investment Analysis			Crossing 3		_		
				sevencere - uonsect Prov Levicipa, reserva zasmosel varmitabilitation fradewops@dot.gov 13 Joanshilly Dischesure Relay			Crossing 4				
							Crossing 5				
							crossing a				
I.S. Department o	of Transportation						l	mport Crossings			
ederal Railro	ad Administration					4	_		_	_	, T

Workflow	GradeDec Page
Create and/or select a dataset	Manage Data
Create and select a new corridor or region	Manage Data
Set values for corridor or region	Manage Data
Import or Quick Import of HRCG data	Import, Crossings
Verify default values and modify as needed	Parameters
Verify and refine data, assumptions and choice of alternative case	Crossings
Select safety analysis model (New APS, APS, HSR) and calculate	Crossings
Review data results and risk charts	Crossings



Parameters

- All parameters are set to national ۲ average default values
- All parameters can be edited ۲
- **Parameters groups include:** ٠
 - Vehicle emissions •
 - Fuel burn rates •
 - **Device effectiveness rates** ٠
 - High speed rail accident types ٠

GradeDec

Import

Results

Help

- T-O-D traffic distributions •
- Diurnal traffic direction •
- Crossing device costs ٠
- Supplementary safety • measure costs



Values in red are Federal Railroad Administration default values that indicate national average

Crossings





Crossings – Devices

Selected Crossing MP: 3.5 ID: 272717K

General C	Devices Highway Rail Cost APS Model HSR Model	\frown
	Item	Value
Edit All	Base Case Device	Gates
Edit All	Base Case Supplementary Safety Measure	None
Edit All	Alternate Case Device	New Technology 1
Edit All	Alternate Case Supplementary Safety Measure	None
4		

Edit All

Alternate Case Device

Data for all Crossings in the Corridor

				Update Cancel
Crossing ID	MilePost	Description	Alternate Case Device	
272717K	3.5	FEC - NW 27TH AVE	New Technology 1 👻	
272596P	352.86	FEC - NE 203RD ST	Passive	
272598D	353.18	FEC - NE 186TH ST	Lights	
272602R	353.6	FEC - NE 179TH ST	Closure	
272604E	354.7	FEC - NORTHEAST ONE HUNDRED SIXTY-THIRD STREET	Grade Separation	
272609N	356.12	FEC - NE 141ST ST	New Technology 1 -	
272610H	356.31	FEC - NE 135TH ST	New Technology 1	
272612W	357.42	FEC - NE 125TH ST	New Technology 1 👻	
272613D	358.35	FEC - NE 107TH ST	New Technology 1 👻	
272617F	359.43	FEC - NE 96TH ST	New Technology 1 👻	
272618M	359.75	FEC - NE 6TH AVE	New Technology 1 👻	
272620N	360.45	FEC - NE 82ND ST	New Technology 1 -	
272621V	360.61	FEC - NE 79TH ST	New Technology 1 🚽	
272627L	362.13	FEC - NE 54TH ST	New Technology 1 -	
14 ltem(s)			Prev	Next Page number 1

U.S. Department of Transportation Federal Railroad Administration

Crossings - Highway





Crossings – Rail and Cost

More Option	18 *	MP:356.31 ID:272810H FEC - NE 135TH ST		•
Selecte	ed Crossing MP: 3.5 ID: 272717K	MB-282.42 ID-272813W/EEC ME 128TU GT		Edit
General I	Devices Highway Rail Cost APS Model HSR Model			
	Item		Value	
Edit All	Number of Tracks		2	
Edit All	Minimum block time (seconds)		36	
Edit All	Maximum Timetable Train Speed (mph)		35	
Edit All	Average Passenger Train Speed (mph)		35	
Edit All	Average Freight Train Speed (mph)		28	
Edit All	Average Switch Train Speed (mph)		10.5	
Edit All	Surface		Concrete	
				4

More Option Selecte General	ed Crossing MP: 3.5 ID: 272717K Devices Highway Rat Cost PS Model HSR Model	Quick Import Download Crossings to .CSV File Set Default Costs (Selected Crossing) Set Default Costs (All Crossings)	MP:356.31 ID:272810H FEC - NE 135TH ST	▼ Edit
	ltem	Generate Corridor Report (APS86)		Value
Edit All	Principal device - Base Case Ann. Oper. & Maint. Cost (000 \$)	Generate Corridor Report (New APS) Generate HSR Report		2.5
Edit All	Principal device - Base Case Ann. Other Lifecycle. Cost (000 \$)			0
Edit All	Principal device - Alt. Case Ann. Oper. & Maint. Cost (000 \$)			5
Edit All	Principal device - Alt. Case Ann. Other Lifecycle. Cost (000 \$)			0
Edit All	Principal device - Alt. Case Capital Cost (000 \$)			280
Edit All	SSM - Base Case Ann. Oper. & Maint Cost (000 \$)			0
Edit All	SSM - Base Case Ann. Other Lifeoyole. Cost (000 \$)			0
Edit All	SSM - Alt. Case Ann. Oper. & Maint. Cost (000 \$)			0
Edit All	SSM - Alt. Case Ann. Other Lifecycle Cost (000 \$)			0
Edit All	35M - AlL Case Capital Cost (000 \$)			0
Edit All	Roadway Improvement Capital Cost (000 \$)			0



.

Crossings – Model Results



- Base represents the crossing characteristics that were imported with the crossing
- Alt represents the proposed improvements to the HRGC
- The New APS and APS model results are displayed by both the individual crossing and by the corridor (or region)
- **The HSR model** provides predicted annual accidents, injuries, and fatalities by highway and train

Steps for Benefit-Cost Analysis

Workflow	GradeDec Page
Create and/or select a dataset	Manage Data
Create and select a new corridor or region	Manage Data
Set values for corridor or region	Manage Data
Verify default values and modify as needed	Parameters
Import or Quick Import of HRCG data	Import, Crossings
Verify and refine data, assumptions and choice of alternative	Crossings
Select safety analysis model (New APS, APS, HSR) and calculate	Crossings
Review reported data and risk charts	Crossings
Create new results set and select (or select existing)	Manage Data
Create new scenario and select (or select existing)	Manage Data
Populate the scenario data with forecast assumptions	Scenario
Set cost metrics	Parameters
Set the simulation parameters and run the simulation	Simulation



Manage Data

Create or Select New Result Set

1) Select Corridor or Regional Schema, 2) Select Results Set, 3) Select a result set, or create a new result set.

Dataset: Initial dataset	Schema: Corridor	So	Corridor: outh Empire	Scenario: Strong rail growth		Results: Placeholder - Corridor Model	
More Options -		Data N Initial dataset Corridor Schen Corridor S Updated corridor model	Management	Select Dataset Select Result Set		Create New Dataset Delete Dataset	
Settings for the selected results set						Ean	
		Item	Value				
		Results ID					_
		Model ID	Placeholder - Corridor Model		Create Result		×
		GCX Collection ID	1				
		Scenario ID	0		Create New Result Name of the new Result:		
		Number of Trials	3				
		Random Seed	1		Submit Cancel		
	Sa	ampling Method of Simulation	Latin Hypercube				
	R	Run Risk Sensitivity Analysis?					
		Safety Model?		6D			
	Discount C	Carbon Dioxide at 3 Percent?		01			
	Reallocat	e Traffic if Grade Separated?					
		Run Central Values Only?					
		Date/Time of Last Run	5/15/2002 12:00:00 AM				
	Default Results Se	et for the Dataset and Model?					



Scenario



Graphical view of the distribution

Enables the evaluation of outcomes by:

- Projected annual traffic growth
- Predicted vehicle occupancy
- Average length of train
- Cost of accidents, injuries, property damages, emissions, etc.

Each scenario variable can be specified as a:

- Fixed value, or
- Probabilistic risk analysis input variable

Simulation

GradeDec U.S. Department of Federal Railroad A	Transportation Administration			Hello	, Janine.McFadden@dot.gov Profile Log out
Datas	et: Schema:	Cor	ridor:	Scenario:	Results:
A Manage Data Miami D	ade Corridor	Mian	n Dade	Strong rail growth	Placeholder - Corridor Model
∎≣ Crossings		Sim	ulation		
E Scenario		Run S	imulation		
E Parameters					Edit
IT have a		ltem	Value		
		Number of trials (3 to 9999)	3		
Simulation		Random Seed	1		
		Sampling Method	Latin Hypercube		
		Run central values only?			
∎≣ Help		Run risk sensitivity analysis?			
		Safety Model?	O New APS APS	86 HSR	
	Disc	count carbon dioxide at 3 percent?			
	Rea	allocate traffic if grade separated?			

- Can be run with or without risk analysis
 - Without risk analysis, set selected scenario to "Fixed Values" or check "Run central values only?"
- Risk Sensitivity Analysis will evaluate for the source of the result's uncertainty (will generate tornado chart)
- User has the choice of using the New APS, APS, or HSR safety models

Results

Benefits and Benefit-Cost Summary

GradeDec

Anage Manage

Crossing

Scenario

Import

E Simulatio

Results

- Select from the group drop down menu and select Go for results
- Click More Options for a selection of report types, including results in year groupings and option to export results into Excel
- Click Show Summary Chart to view the Benefits or Benefits and Costs in graphical form

Other results topics include:

- Benefits by GCX Safety, Travel Time Savings, Environmental, Vehicle operating costs, or Network
- Total Benefits by GCX, Total Costs by GCX, Net benefits by GCX
- Intermediate Safety Results, APS Model
- Etc.

U.S. Department of Transportation
Federal Railroad Administration

C U.S. Fed	Department of Trans leral Railroad Admir	portation nistration			Hello, Janine.McFa	Iden@dot.gov Profile Log out
	Dataset: Miami Dade	Schema:	Corri Miami	dor: Dade	Scenario: Strong rail growth	Results: Placsholder - Corridor Model
	Generate Generate Generate	Results Report Annual Results Report: Years 1-10 Annual Results Report: Years 11-20	Results: Placehold	er - Corridor	Model	·
More Op	tions - Generate Generate	Annual Results Report. Years 21-30 Annual Results Report. Years 31-40	Benefits and Benefit-Cost	Summary	Go	Show Summary Char
	Download	Results as CSV File	Variable	Mean Value	Standa	rd Deviation
No View	Safety benefits	s, thous \$ PV		4264.15	NaN	
No View	Travel time sav	vings, thous \$ PV		0	NaN	
No View	Environmental	benefits, thous \$ PV		0	NaN	
No View	Veh operating	cost benefit, thous \$ PV		0	NaN	
No View	Network benefi	its, thous \$ PV		0	NaN	
No View	benefits from	n induced trips, thous \$ PV		0.48389	NaN	
No View	disbenefits f	rom induced trips, thous \$ PV		-1.31158	NaN	
No View	investment s	salvage value, thous \$ PV		184.944	NaN	
No View	Total benefits,	thous \$ PV		4448.27	NaN	
No View	Total costs, the	ous \$ PV		4013.56	NaN	
No View	Net benefits, th	nous \$ PV		434.709	NaN	
No View	Benefit-cost rat	tio		1.10831	NaN	
No View	Rate of return	(constant dollars), %		5.91729	NaN	
No View	Local benefits	(not included in summary), thous \$	PV	444.827	NaN	
14 Item(s)						Prev Next Page numbe

Additional Resources

View GradeDec.NET Documentation

- GradeDec.Net 2022 User's Manual
- GradeDecNET 2022 Reference Manual
- Workbook 2003

Access GradeDec.NET Help menu:

- Reference manuals
- Training workbooks
- Webinar slideshows







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