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# TXDOT PUBLIC-PRIVATE FEASIBILITY ANALYSIS MODEL User Manual





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## Getting Started

### Overview

This document describes the usage and operation of the TxDOT Public-Private Feasibility Analysis Model, a spreadsheet application developed using *Microsoft Excel*<sup>®</sup>. The Economic Model has been developed to provide stakeholders with a transparent assessment of transportation infrastructure projects that will be funded jointly by public and private entities.

The Economic Model has been formatted as a generic analysis tool capable of determining the feasibility of any ground transportation project (e.g., rail relocations, passenger rail service, toll roads, or intermodal service). Since the Economic Model has been developed using *Excel*<sup>®</sup>, project analyses can be tailored to specific public-private scenarios by copying one or more of the basic worksheets to accommodate multiple stakeholders. For example, the relocation of freight rail operations from an urban area to a new bypass may be followed by the operation of passenger rail service over the original tracks. Private interests in this scenario might be represented by both a commuter rail corporation and a freight railroad company, in which case the basic “public” worksheet can be copied in order for the interests of each private stakeholder to be represented.

Flexibility in the application of the Economic Model is based on a shared feature of all public-private transportation projects – each case involves the interchange of a specific transport volume (i.e., vehicles, passengers, trains, etc.) from one mode, corridor, or ownership entity to another. Essentially, the only constraint in modeling these cases is a requirement for consistency in the origin and destination of these transport volumes from, say, point A to point B.

This User Guide assumes that the user possesses general knowledge and familiarity with the *Windows*<sup>®</sup> operating system and *Excel*<sup>®</sup>, and makes no attempt to explain these applications. The Economic Model was developed with *Microsoft Excel*<sup>®</sup> 2003 and, therefore, should only be installed on systems with either *Microsoft Office*<sup>®</sup> 2003 or *Microsoft Excel*<sup>®</sup> 2003.

### Installation Instructions

The Economic Model is a spreadsheet application developed using *Microsoft Excel*<sup>®</sup> 2003 as a single spreadsheet and can be launched from any *Windows*<sup>®</sup>-based PC with either *Microsoft Office*<sup>®</sup> 2003 or *Microsoft Excel*<sup>®</sup> 2003 installed. The Economic Model can be launched from a network drive or a local drive, with the general installation requirements being:

## PREREQUISITES

- *Windows*®-based PC
- Microsoft Excel® 2003 installed

## INSTALLATION INSTRUCTION

- Copy the Economic Model application to a local or network drive that the user has permission to use (i.e., which allow read and write capabilities).

**Tip** *This application is a single user spreadsheet; only one user can make changes to it at a time.*

## REMOVING THE ECONOMIC MODEL

The Economic Model is a single spreadsheet application based on *Microsoft Excel*® that can be removed by simply deleting it from local and network drives.

### *Using the Economic Model*

To begin using the Economic Model, simply double-click the file or open it from *Excel*®. If the enable macros window appears, simply click the “Enable Macros” button to continue (see Figure 1).

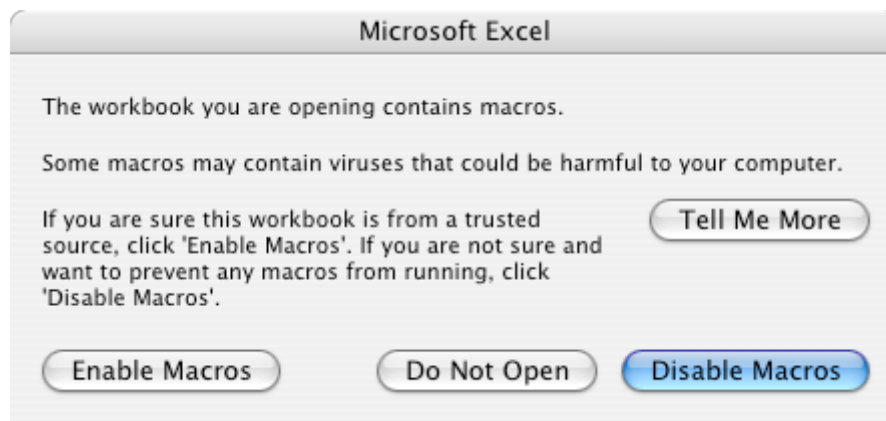


Figure 1: Enable Macros Window

# ECONOMIC MODEL TOUR

Figure 2 is displayed upon opening the information screen. The information screen contains important information such as the TxDOT designation, version number, and qualifying statements. Simply click the window close button to continue opening the Economic Model.

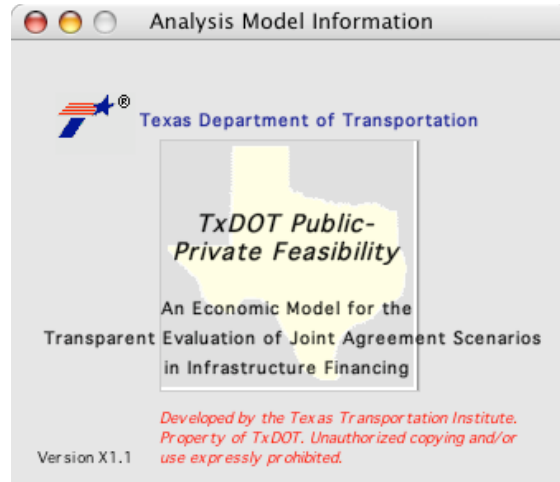


Figure 2: Model Information Screen

Once the Economic Model has been fully loaded, the Public worksheet will open (see Figure 3).

HELP MENU																	
New Toll Road			Toll Existing Road			Rail Relocation			New Passenger Rail			Passenger/Rail Relocation			Intermodal Service		
PART A - DEFINE COSTS & BENEFITS OF MODAL SERVICE																	
I. Vehicle Unit Costs & Benefits																	
Vehicle Cost/Benefit Parameters						Agency Cash Flows (\$/Vehicle-Mile)											
ClassificationType	Initial Vehicle Traffic (Veh/Day)	Vehicle Trip Length (Miles)	Trip Frequency (Days/Week)	Vehicle Growth Rate (%/Year)	Base Annual Volume (Veh-Mi)	Reduced Pavement Damage	B	C	D	Agency Totals (\$/Veh-Mi)	R	P					
8 Auto, San Marcos-Austin					0					0							
9 Auto, New Braunfels-SA					0					0							
10 Auto, Austin-SA					0					0							
11 Auto, Georgetown-Austin					0					0							
12 Auto, Round Rock-Austin					0					0							
13 Classification 6					0					0							
14 Classification 7					0					0							
15 Classification 8					0					0							
16 Classification 9					0					0							
17 Classification 10					0					0							
18					0					0							

Figure 3: Example of Model Upon Opening

## Cell Input Features

Cells are color coded for easy recognition of non-input (calculated) cells, default-value cells, and case-specific cells. As can be seen below in Figure 4, the cells in blue font are non-input cells; cells in green font contain data that rarely requires changing; and cells in black font are for input values that will change with each project. The blue non-input cells and their labels are locked to protect the integrity of the application, however all other input cells remain unlocked to allow for full control by the user.

59	<b>III. Total Vehicle Impedance Costs</b>	
60	<b>Traffic Mix</b>	
61	Percent Automobiles (%)	60
62	Percent Trucks (%)	30
63	Percent Buses (%)	10
64	<b>Operator Time Costs</b>	
65	Automobile (\$/Vehicle-Hour)	10.40
66	Truck (\$/Vehicle-Hour)	18.06
67	Bus (\$/Vehicle-Hour)	0.00
68	<b>\$/Vehicle Mile Cost</b>	
69	Total Cost (\$/Vehicle-Hour)	13.40

Figure 4: Color-coded Cells

Checkboxes in the Public worksheet are a feature that allows for the easy selection of a dichotomous input, typically non-numerical choices such as “yes” or “no.” By checking a checkbox, the criteria defined by the label has been selected. For example, in Figure 5, the checked box indicates that the response to “Will a Freight Rail Corridor be Relocated” is “yes”, which happens to initiate the calculation of benefits associated with a reduction in the impedance of vehicles at grade crossings.

88	<b>IV. Multimodal Service Options</b>	
89	<b>Conflicting Roadway Traffic</b>	
90	Annual Vehicle Growth Rate at Grade Crossings (%/Year)	1
91	<b>Commuter Rail Service</b>	
92	Will Passenger Rail Service be Implemented? (Yes/No)	<input type="checkbox"/> Yes
93	Increased Grade Crossing Impedance (Vehicle*Hours/Year)	0
94	<b>Freight Rail Relocation</b>	
95	Will a Freight Rail Corridor be Relocated (Yes/No)	<input checked="" type="checkbox"/> Yes
96	Reduced Grade Crossing Impedance (Vehicle*Hours/Year)	605798

Figure 5: Checkbox Example

**Tip** Checkboxes can be selected/deselected by clicking the box with the mouse.

## Help Features

The Public worksheet has a built-in help feature in the form of pop-up windows that can be accessed by clicking a button that matches the type of project being modeled. Figure 6 shows the menu of project help buttons available in this worksheet.



Figure 6: Help Buttons

## PROTECTED CELLS

In order to protect the integrity of the application, all cells are locked except those allowing user input. The following lists identify the spreadsheet areas as locked or unlocked:

### Locked Cells – User Input Not Allowed

- Calculated cells are **Blue** color-coded cells
- Labels
- Headers
- Colored area of worksheet

### Unlocked Cells – User Input Allowed

- User input cells – White background numeric cells (non-labels), **green** or black text
- Checkboxes

## APPLICATION WORKSHEETS

The Economic Model is comprised of seven worksheets, four of which are used to show results plotted graphically. Any of these can be accessed by clicking on one of the worksheet tabs at the bottom of the screen, as they appear in Figure 7.



Figure 7: Eight Available Worksheets

The available worksheets are:

**Public** – this worksheet models the agency’s project economics.

**Private** – this worksheet models the corporation’s project economics, and can be copied in order to include a third party (e.g., a commuter rail corporation, an intermodal trucking company, etc.).

**GC Data** – this worksheet allows for changes in vehicular impedance at grade crossings (GC), due to conflicts with freight and passenger railroad operations, to be modeled using project scenarios involving changes in railroad operations and the construction of grade separations.

**Public Plot** – this worksheet displays the project economics for the public sector.

**Joint Plot** – this worksheet displays a comparison of project economics between the public and private sectors.

**Public CF Plot** – this worksheet displays the annual cash flows (CF) for the public agency.

**Traffic Plot** – this worksheet displays the vehicular and passenger rail traffic volumes assumed by the project scenario being modeled.



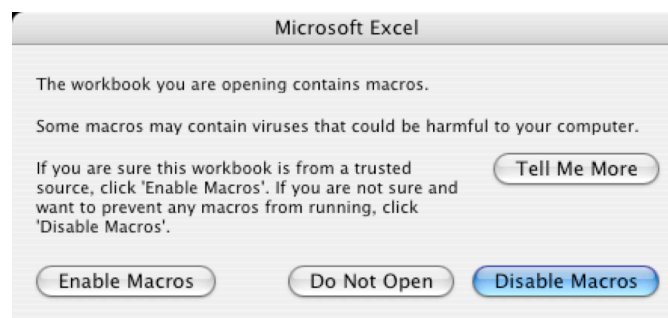
## How To Use the Economic Model

### *Simple Instructions On How To Use The Built-In Features Of The System*

This User Manual assumes that the user possesses general knowledge and familiarity with the *Microsoft Windows*® operating system and has experience using *Excel*® spreadsheets. Therefore, the manual provides no guidance on these subjects and, instead, highlights the built-in features of the Economic Model application.

### *Opening The Economic Model*

To begin using the Economic Model, simply double-click the file or open it from *Excel*®. If the Enable Macros window appears simply click the “Enable Macros” button to continue (see Figure 8). Macros are used in the application, therefore if you are not allowed to “Enable Macros” contact your computer support team.



**Figure 8: Enable Macros Window**

Upon opening the file the information screen is displayed (see Figure 9). The information screen contains important information such as the Economic Model version number, TxDOT implementation project number, etc. Simply click on the window close button to proceed with using the Economic Model.



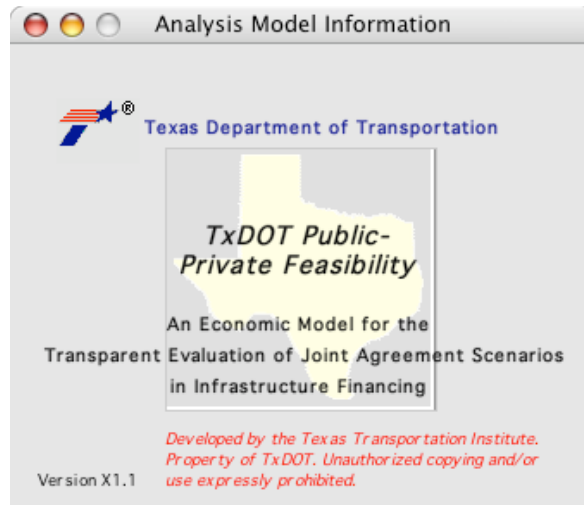


Figure 9: Model Information Screen

## DATA INPUT FEATURES

Several data entry and plot generating worksheets are included in the Economic Model. Upon opening the Economic Model for the first time, a worksheet formatted for the entry of public sector data (titled “PUBLIC”) will appear (see Figure 10). Thereafter, the Economic Model will open to the last saved location/worksheet.

**Tip** *The Economic Model will open to the last saved location/worksheet.*

HELP MENU											
New Toll Road		Toll Existing Road		Rail Relocation		New Passenger Rail		Passenger/Rail Relocation		Intermodal Service	
PART A - DEFINE COSTS & BENEFITS OF MODAL SERVICE											
I. Vehicle Unit Costs & Benefits											
Vehicle Cost/Benefit Parameters						Agency Cash Flows (\$/Vehicle-Mile)					
ClassificationType	Initial Vehicle Traffic (Veh/Day)	Vehicle Trip Length (Miles)	Trip Frequency (Days/Week)	Vehicle Growth Rate (%/Year)	Base Annual Volume (Veh-Mi)	Reduced Pavement Damage	B	C	D	Agency Totals (\$/Veh-Mi)	R P.
Auto, San Marcos-Austin					0					0	
Auto, New Braunfels-SA					0					0	
Auto, Austin-SA					0					0	
Auto, Georgetown-Austin					0					0	
Auto, Round Rock-Austin					0					0	
Classification 6					0					0	
Classification 7					0					0	
Classification 8					0					0	
Classification 9					0					0	
Classification10					0					0	

Figure 10: Example of Model Upon Opening

## INPUT FIELD FORMAT

The worksheet cell input format is denoted by the units defined in parentheses following the title of the data field. Pay close attention to each label since all spreadsheet calculations assume these specific units. For example, when inputting a parameter such as percent (%), calculations are based on a zero-to-one hundred scale (e.g., 50%) rather than on a decimal scale (e.g., 0.50). The following lists the general guidelines for field input:

**%** – Percent (zero-to-one hundred scale)

**\$M** – Dollars in millions

**Veh** – Number of vehicles

**Pass** – Number of passengers

**Mi** – Distance in miles

**Min** – Time in minutes

**Qt** – Volume in quarts

**Gal** – Volume in gallons

**ADT** – Average daily vehicular traffic

## WORKSHEET CELL DEFINITIONS

Different types of input methods and color-coding of cells have been used to simplify the user's experience and, therefore, increase the user's efficiency with the application. The following describes two distinct input methods employed in this application.

### Color-Coded Cells

Worksheet parameters are color coded to denote the frequency with which the contents of cells are expected to be updated. As illustrated in Figure 11, **blue** font is reserved for parameters that require no input and are the result of internal calculations., **Green** font is reserved for parameters containing default values (i.e., values that are expected to rarely change). All other cells are in **black** font, which is intended for the analysis of data that is project-specific

59	<b>III. Total Vehicle Impedance Costs</b>	
60	<b>Traffic Mix</b>	
61	Percent Automobiles (%)	60
62	Percent Trucks (%)	30
63	Percent Buses (%)	10
64	<b>Operator Time Costs</b>	
65	Automobile (\$/Vehicle-Hour)	10.40
66	Truck (\$/Vehicle-Hour)	18.06
67	Bus (\$/Vehicle-Hour)	0.00
68	<b>\$/Vehicle Mile Cost</b>	
69	Total Cost (\$/Vehicle-Hour)	13.40

Figure 11: Color-coded Cells

## Checkboxes

Another input method is the checkbox. Checkboxes allow for dichotomous input to be easily selected. When these features are checked, the criteria defined by the label is accepted. For example, the question “Will a Freight Rail Corridor be Relocated” in Figure 12, requires a response of either Yes or No. If this particular checkbox is **checked**, calculations are performed that account for the economic benefits associated with separating train/vehicle conflicts; by leaving the checkbox **unchecked**, no such benefits are recognized.

88	<b>IV. Multimodal Service Options</b>	
89	<b>Conflicting Roadway Traffic</b>	
90	Annual Vehicle Growth Rate at Grade Crossings (%/Year)	1
91	<b>Commuter Rail Service</b>	
92	Will Passenger Rail Service be Implemented? (Yes/No)	<input type="checkbox"/> Yes
93	Increased Grade Crossing Impedance (Vehicle*Hours/Year)	0
94	<b>Freight Rail Relocation</b>	
95	Will a Freight Rail Corridor be Relocated (Yes/No)	<input checked="" type="checkbox"/> Yes
96	Reduced Grade Crossing Impedance (Vehicle*Hours/Year)	605798

Figure 12: Checkbox Example

**TIP** *Checkboxes can be selected/deselected by clicking the box with your mouse.*

## PROTECTED CELLS

In order to protect the integrity of the application, all cells are locked except for those intended for user input. The following differentiates between the locked and unlocked features of the spreadsheet:

### Locked Cells – User Input Not Allowed

- Calculated cells (cells with **blue** font)
- Labels
- Headers
- Border area of worksheets

### Unlocked Cells – User Input Allowed

- User input cells (cells with **black** or **green** font)
- Checkboxes

## APPLICATION WORKSHEETS

The Economic Model is comprised of seven worksheets: Three input worksheets and four graph output worksheets. The worksheets can be accessed by clicking on the appropriate worksheet tab. See Figure 13 for the selection of worksheets.



Figure 13: Application Worksheets

### Public

The Public worksheet is comprised of four parts that together are used to calculate the public costs and benefits of the project. The four sections and the corresponding tables are:

**Part A – Define Costs & Benefits of Modal Service** – This part is used to assign costs and benefits to the different aspects of project operation both on a unit basis (i.e., \$/vehicle or \$/passenger) and on an annual basis.

- I. **Vehicle Unit Costs & Benefits** – This table accommodates costs and benefits that accrue on a vehicle-mile basis, and allows for these costs and benefits to be assigned to agency, societal, or user segments of the public sector. Up to four cost/benefit values can be entered in the agency, societal, and user sections. Enough rows are provided so that up to ten classification types (i.e., vehicle classifications, origin-destination pairs, etc.) can be listed in this section.
- II. **Passenger Unit Costs & Benefits** – This table accommodates costs and benefits that accrue on a passenger-mile basis, and allows for these costs and benefits to be assigned to agency, societal, or user segments of the public sector. Up to four cost/benefit values can be entered in the agency, societal, and user sections. Enough rows are provided so that up to six classification types (i.e., passenger rail routes, origin-destination pairs, etc.) can be listed in this section.
- III. **Annual Costs & Benefits** – This table accommodates costs and benefits that accrue on an annual basis, and allows these costs and benefits to be assigned to agency, societal or user segments of the public sector. Two rows are provided so that major classification types (i.e., administrative costs, real estate revenues, etc.) can be listed separately.

**Part B – Define Grade Crossing Costs** – This part is used to define the costs associated with vehicles idling a grade crossings so that changes in vehicle impedance can be assigned to the project.

- I. **Vehicle Emissions Costs** – This table is used to quantify the automobile, truck, and bus emissions associated with vehicles idling at grade crossings. Three pollutants are treated as societal costs in these calculations: hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NO<sub>x</sub>).
- II. **Vehicle Operating Costs** – This table is used to quantify the cost of consuming volatile organic compounds (VOCs), such as motor oil and gasoline, by automobiles, trucks, and buses idling at grade crossings.

III. **Total Vehicle Impedance Costs** – This table is used to characterize the mix of traffic at grade crossings as percentages of automobiles, trucks, and buses.

**Part C – Define Financing, Construction & Operating Strategy** – This part is used to define the financial conditions under which the project will operate, such as financing strategies, cost and operating schedules, and economic advantages associated with the elimination of grade crossing conflicts.

- I. **Project Economic Parameters** – This table allows input of capital financing information, bond terms, and bond retirement.
- II. **Cost Allocation Schedule** – This table allows for percentages of the total capital cost to be distributed over years 0 through 8.
- III. **Operation Schedule** – This table allows for the start year of a vehicle toll facility, passenger rail service, and/or a freight rail relocation project to be defined.
- IV. **Grade Crossing Impedance Options** – This table provides a convenient means of including or excluding the net benefits associated with information listed in the grade crossing data worksheet.

**Part D – Tabulation of Economic Results** – This part tabulates annual cash or cash-equivalent flows over a 40-year project life. It should be noted that only the Selection of Discount Rates section requires input.

- I. **Pro Forma Statement** – This table contains the calculated results for base projections of corridor traffic and cash or cash-equivalent flows to the agency, society, and users of the facility.
- II. **Selection of Discount Rates** – This table allows the user to define four distinct discount rates that are used to plot the public sector's net present value (NPV) in the Public Plot worksheet.
- III. **Summary of Economic Analysis Results** – This table contains the NPV summaries for the agency, society, and users, by discounting cash and cash-equivalent flows in the Pro Forma Statement using the discount rates defined in the Selection of Discount Rates table.
- IV. **Record of Concession Fees** – This table summarizes the cash inflows to the agency from concession fees paid by the private sector, as defined in Part B, Table IV of the Private worksheet. These fees are reported as present values by discounting the cash flows according to the year in which payments are received from the private sector.

**Tip** *Each field and formula used for these sections is defined in Chapter 4.*

## Private

The Private worksheet is comprised of three parts for defining the corporate or private sector costs and benefits of the project. The three sections and the corresponding tables are:

### Part A – Define Costs and Benefits of Modal Service

- I. **Vehicle Unit Costs & Benefits** – This table references the vehicle unit cost and benefit categories defined in Part A, Table I of the Public worksheet for

assignment of corresponding costs and revenues to the private sector. Up to four user-defined corporate cost/revenue items are supported for each category.

- II. **Passenger Unit Costs & Benefits** – This table references the passenger rail unit cost and benefit categories defined in Part A, Table II of the Public worksheet for assignment of corresponding costs and revenues to the private sector. Up to four user-defined corporate cost/revenue items are supported for each category.
- III. **Freight Rail Annual Operating Costs** – This table allows input of freight rail parameters for route description, train characteristics, and train operating costs such as route mileage, crew requirements, and crew cost. This table accommodates up to four categories (i.e., train routes, origin-destination pairs, etc.).
- IV. **Passenger Rail Annual Operating Costs** – This table allows input of passenger rail parameters for route description, train characteristics, and train operating costs such as trains in service, railcars per train, and railcar maintenance. This table accommodates up to four categories (i.e., train routes, origin-destination pairs, etc.).
- V. **Other Annual Costs & Revenues** – This table accommodates cost and revenue parameters that accrue on an annual basis, such as cash flows from administrative or real estate-related activities.

#### **Part B – Define Financing, Construction & Operating Strategy**

- I. **Project Economic Parameters** – This table allows input of the capital financing information, bond terms, and bond retirement.
- II. **Cost Allocation Schedule** – This table allows for percentages of the total capital cost to be distributed over years 0 through 8.
- III. **Operation Schedule** – This table allows for the start year of a vehicle toll facility, passenger rail service, and/or a freight rail relocation project to be defined.
- IV. **Schedule of Concession Payments** – This table accounts for cash outflows from the private sector to the public sector in the form of concession payments or similar periodic financial obligations.

#### **Part C – Tabulation of Economic Results**

- I. **Pro Forma Statement** – This table contains the calculated results for projections of corporate finances due to construction costs, debt financing, toll or passenger revenues, and annual costs and revenues.
- II. **Selection of Interest Rates** – This table allows the user to define four distinct interest rates that are used to plot the private sector's net present value in the Joint Plot worksheet.
- III. **Summary of Economic Analysis Results** – This table contains the NPV summaries for the private sector by discounting cash and cash-equivalent flows in the Pro Forma Statement using the interest rates defined in the Selection of Interest Rates table.

**Tip** *Each field and formula used for these sections is defined in Chapter 4.*

## GC Data

The GC Data worksheet is comprised of four parts for defining grade crossing information associated with the project. This worksheet only provides information regarding grade crossings. Any costs or benefits associated with grade crossings are input on either the Public or Private worksheets. The four sections and the corresponding tables are:

### Part A – Define Freight Rail Operations

- I. **Freight Rail Operating Conditions** – This table is used to document typical freight rail operating conditions, including average train speed, average train length, and the impact of train movements on vehicles at grade crossings.
- II. **Freight Rail Train Schedule** – This table is used to document train schedules over a typical 24-hour period before and after a freight rail project has been implemented.

### Part B – Define Passenger Rail Operations

- I. **Passenger Rail Operating Conditions** – This table is used to document typical passenger rail operating conditions, including average train speed, average train length, and the impact of train movements on vehicles at grade crossings.
- II. **Passenger Rail Train Schedule** – This table is used to document train schedules over a typical 24-hour period before and after a passenger rail project has been implemented.

### Part C – Record of Grade Crossing Vehicular Traffic

- I. **Define Roadway Traffic Pattern** – This table is used to describe vehicular traffic at grade crossings over a 24-hour period as a percentage of average daily traffic.
- II. **In-Place Grade Crossings** – This table is used to identify grade crossings and average daily traffic (ADT) along a corridor that will remain in place following the implementation of a proposed rail project
- III. **Proposed Grade Separations** – This table is used to identify grade crossings and ADTs that will be eliminated with the construction of grade separations in a rail project.

**Part D – Summary of Impedance Conditions** – This table summarizes the net annual grade crossing impedance (in vehicle-hours/year) created by the train-vehicle conflicts prescribed by information listed in Parts A-C.

**Tip** *Each field and formula used for these sections is defined in Chapter 4.*



## Public Plot

The Public Plot shows the project economics for the public-sector (i.e., agency, society, and user) by plotting NPV versus discount rate, as shown below in Figure 14. This type of plot allows for public-sector project feasibility to be determined at any discount rate deemed appropriate by a public entity (e.g., as prescribed by the Office of Management and Budget in Federal projects).

**Tip** See Chapter 4 for the exact formulas used by the data fields.

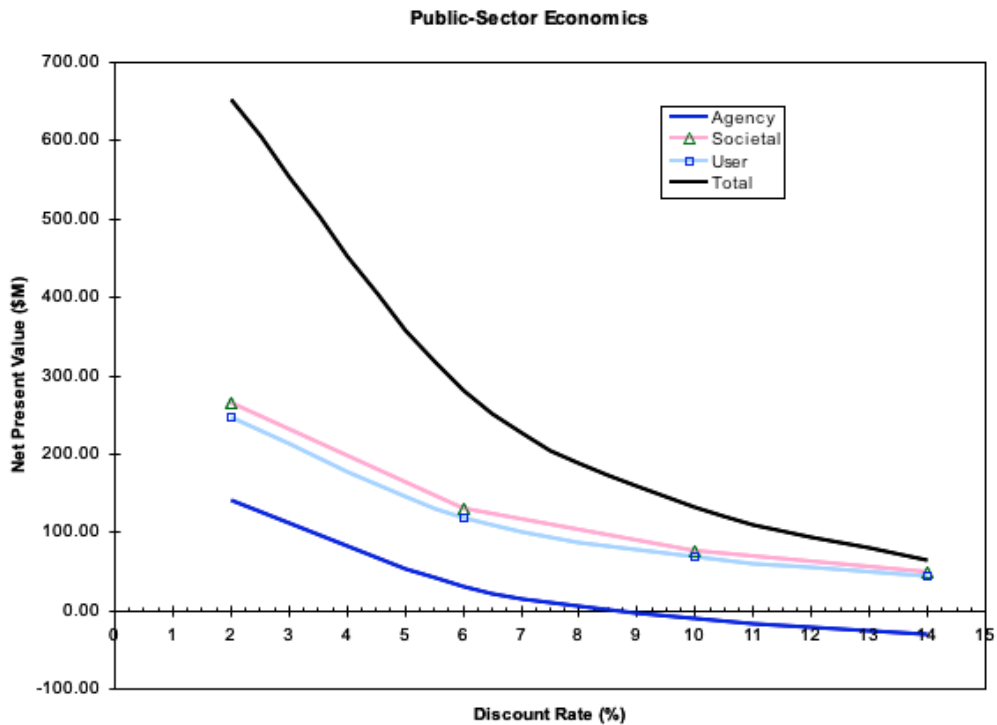


Figure 14: Sample of Public Plot

## Joint Plot

The Joint Plot shows the comparison of project economics among the public and private sectors by plotting NPV versus discount rate, as shown below in Figure 15. Public-sector project feasibility is determined as described in the previous section (Public Plot). Private-sector feasibility is assessed by determining the discount rate at which NPV equals zero – this is the internal rate of return to the private sector.

**Tip** See Chapter 4 for the exact formulas used by the data fields.

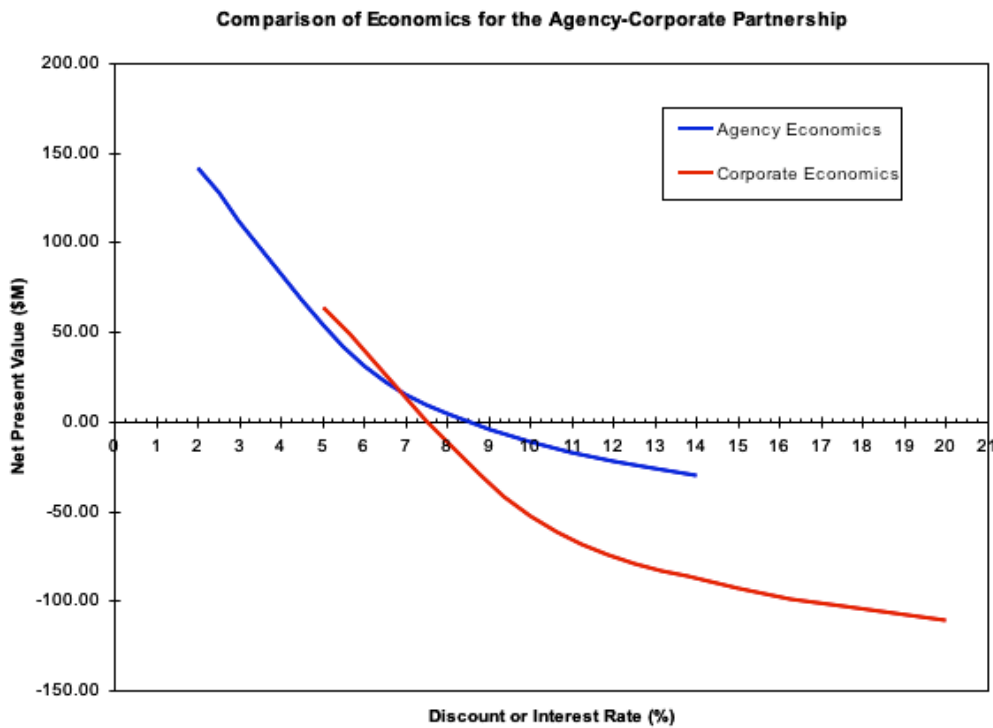


Figure 15: Sample of Joint Plot

## Public CF Plot

The Public CF Plot displays the annual cash flows for the agency in current year dollars, as shown below in Figure 16.

**Tip** See Chapter 4 for the exact formulas used by the data fields.

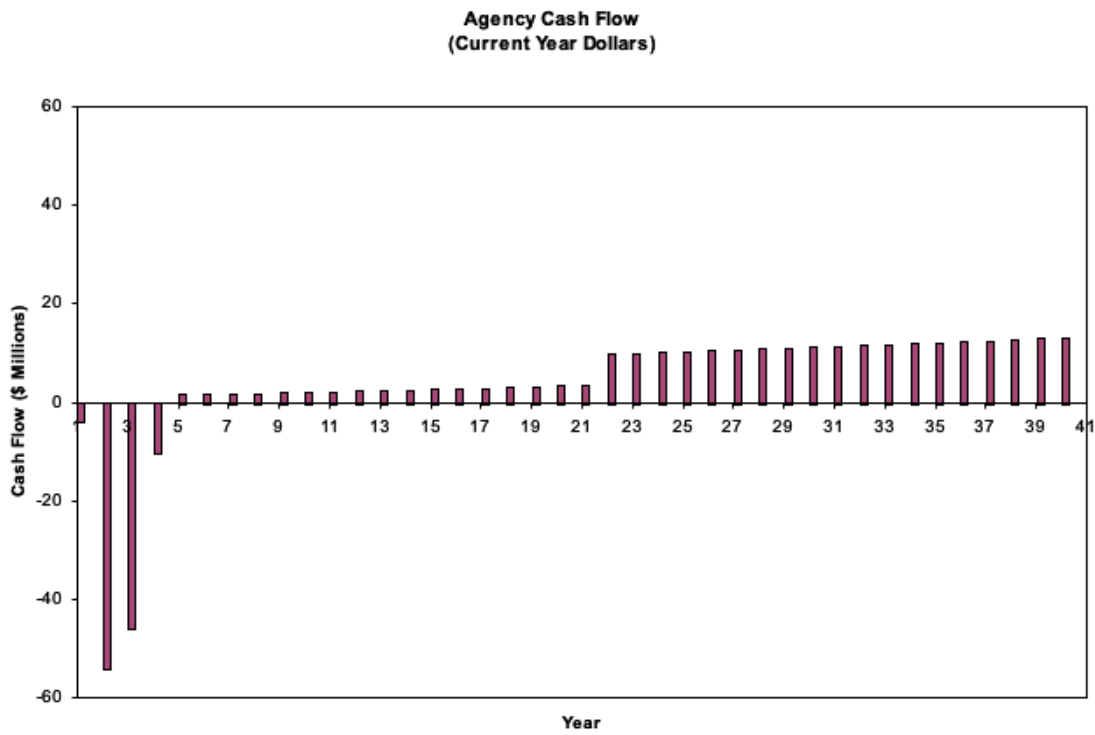


Figure 16: Sample of Public CF Plot

## Traffic Plot

The Traffic Plot displays vehicular and passenger rail traffic volume projections over time, as defined by data entries in the Public worksheet (Part A, I and II) and shown below in Figure 17.

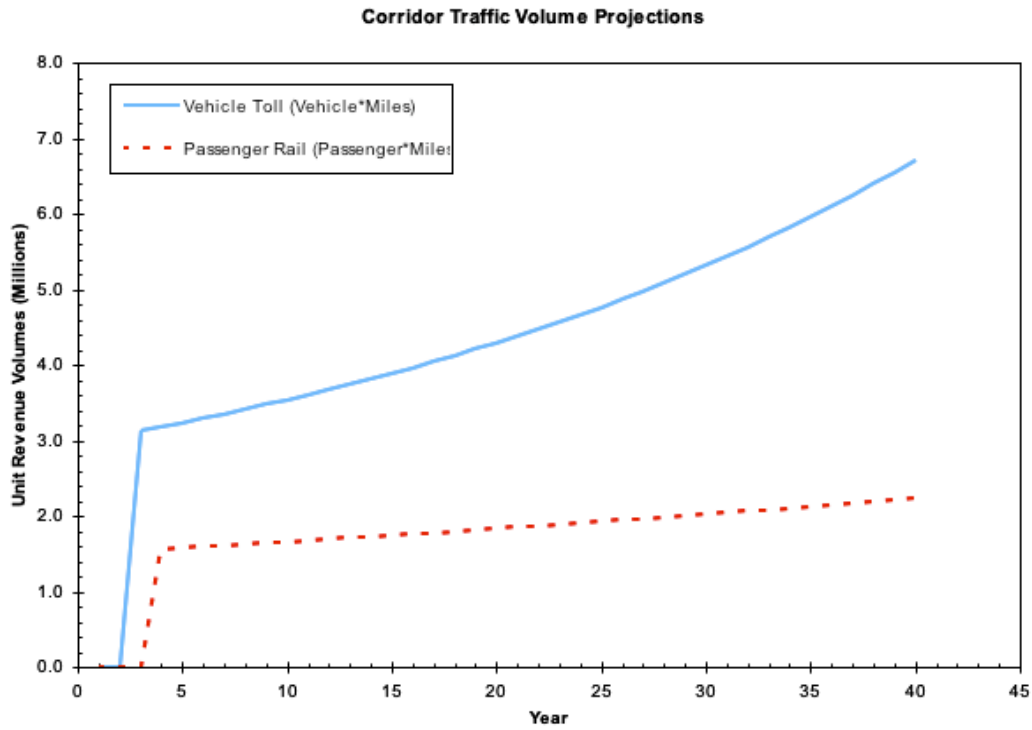


Figure 17: Sample of Traffic Plot

## PRINTING AND CUSTOM VIEWS

Printing can be cumbersome with large, complex *Excel*® worksheets. To simplify the process and ensure concise printouts, Custom Views of logical specific portions of the worksheets have been created and print areas assigned to the Custom View.

Custom Views can be accessed from the View menu. Once selected, a pop-up window appears with the available views similar to Figure 18. The views are denoted in the format **<Worksheet Name: View Identification>**. To display, select a view then click Show; the view will displayed as the active worksheet.

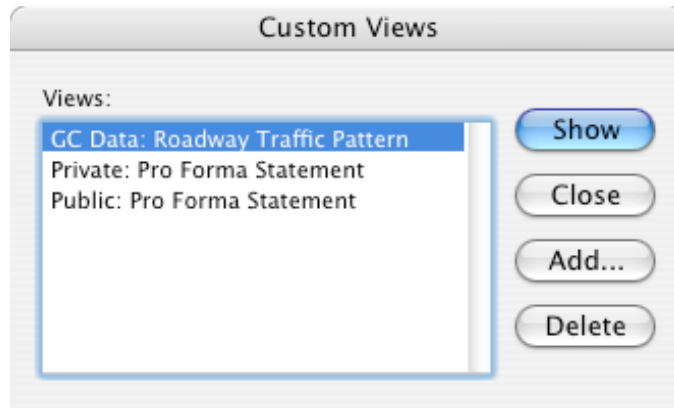


Figure 18: Custom Views

### Printing

Printing is simple once the Custom View has been selected. Simply choose Print from the File menu. Paper size and orientation have been pre-selected to ensure optimal printing. For example, for the Public: Pro Forma Statement view, the print out is positioned in landscape orientation on one sheet of legal size paper.

**Tip** Use *Print Preview* from the *File* menu to view the actual layout of the Custom View printout prior to printing.



## Help Menu

### Overview

This section introduces the built-in help menu buttons provided at the top of the Public worksheet, as shown in Figure 19. The Economic Model is designed with the recognition that each type of transportation project involves the redistribution of traffic (i.e., automobiles, trucks, passengers, etc.) moving in one corridor between points A and B to another corridor that extends between the same two points. This second corridor may be a new travel option (e.g., intermodal freight rail service, a new toll road, start-up commuter rail service, etc.), or it may simply be the conversion of an existing facility into a toll-financed enterprise (e.g., collecting tolls on a previously open road). The following sections describe how the help menu can be used to identify applicable sections of the Economic Model when performing a feasibility analysis for any type of ground transportation project.



Figure 19: Help Menu

### New Toll Road

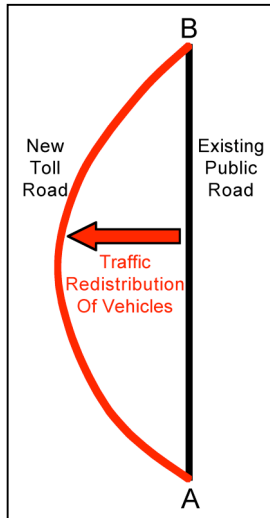
Construction of a new toll road will shift some traffic from the existing public road to the toll facility. Figure 20 illustrates this shift in traffic between points A and B to the new toll road (in red). Feasibility of the new toll road will require the assessment of cost and benefit reallocations with respect to new cash flows from toll revenues. Specific data entries should focus on:

#### Redistribution of Traffic

##### Part A, Section I (Public); Part A, Section I (Private)

- Vehicle class or origin-destination pairs
- Base annual volume = initial traffic  $\times$  trip length  $\times$  trip frequency
- Annual growth in base annual traffic volumes





**Figure 20: New Toll Road**

- Unit costs & benefits of traffic (\$/vehicle-mile) such as:
  - ✓ Agency – reduced pavement damage
  - ✓ Society – reduced environmental damage (idling, stop-start, etc.)
  - ✓ User – improved driving conditions (time, safety, etc.), toll fee
  - ✓ Corporate – toll revenue, pavement maintenance costs

### Administration and Finance

#### Part A, Section III (Public); Part A, Section V (Private)

- Franchise administration and public oversight costs
- Economic benefits of associated real estate revenues
- Facility operational costs

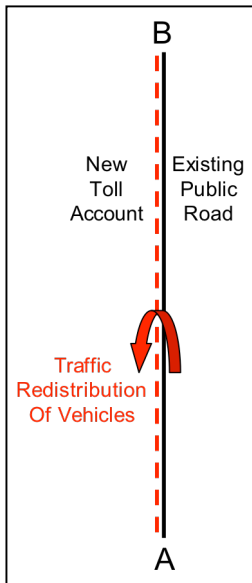
### Operating Schedule

#### Part C, Section III (Public); Part B, Section III (Private)

- Define the start-up year of vehicle toll service
- These projects involve *No* passenger rail or freight rail operations

**NOTE:** Part C, Section IV (Public): Make sure grade crossing impedance options for passenger rail and freight rail are entered as “No”.

## Toll Existing Road



**Figure 21: Toll Existing Road Illustration**

Tolling an existing road will reorganize costs and benefits of formerly free-access traffic to an account that includes toll revenue cash flows. Figure 21 represents this shift in traffic between points A and B strictly as a transfer between operating accounts (i.e., between non-revenue and revenue accounts). Feasibility of the new toll road will require the reallocation of costs and benefits with respect to new cash flows from toll revenues. Specific data entries should focus on:

### Redistribution of Traffic

#### Part A, Section I (Public); Part A, Section I (Private)

- Vehicle class or origin-destination pairs
- Base annual volume = initial traffic  $\times$  trip length  $\times$  trip frequency
- Annual growth in base annual traffic volumes
- Unit costs & benefits of traffic (\$/vehicle-mile) such as
  - ✓ Agency – reduced pavement damage
  - ✓ Society – modified driving behavior (carpooling, etc.)
  - ✓ User – improved driving conditions (reduced congestion, etc.), toll fee
  - ✓ Corporate – toll revenue, pavement maintenance costs

### Administration and Finance

#### Part A, Section III (Public); Part A, Section V (Private)

- Franchise administration and public oversight costs
- Facility operational costs

### Operating Schedule

#### Part C, Section III (Public); Part B, Section III (Private)

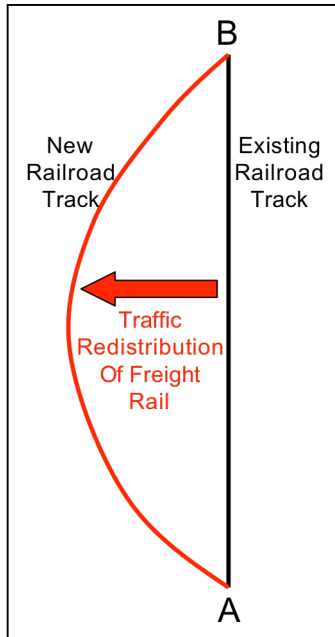
- Define start-up year of vehicle toll service
- These projects involve *No* passenger rail or freight rail operations

**NOTE:** Part C, Section IV (Public): Make sure grade crossing impedance options for passenger rail and freight rail are entered as “No”.

## Rail Relocation

The main purpose of relocating an existing railroad may be to eliminate conflicts with vehicles at existing grade crossings by shifting rail traffic to a new rail corridor, as illustrated in Figure 22. Although, freight rail service to customers along the original rail corridor may remain, the evaluation of these projects must account for changes in train operating schedules along the

original corridor and how these changes affect the interaction with vehicle ADT volumes at grade crossings. Specific data entries should focus on:



**Figure 22: Rail Relocation Illustration**

## Freight Rail Operating Requirement

### Part A, Section III (Private)

- Change in route miles (+ for increase, - for decrease) × trains in service × train schedule × operating frequency = total train miles
- Train miles @ train characteristics and train costs = annual cost or benefit

### Grade Crossing Conflicts

- Blockage time at grade crossings [Part A, Section I (Grade Crossings)]
- Train schedule changes [Part A, Section II (Grade Crossings)]
- Vehicle traffic time distribution [Part C, Section I (Grade Crossings)]
- ADT at grade crossings [Part C, Section II (Grade Crossings)]
- Proposed grade separations [Part C, Section III (Grade Crossings)]

## Administration and Finance

### Part A, Section III (Public); Part A, Section V (Private)

- New expenses
- Economic benefits of associated real estate revenues
- Changes in ongoing facility operating costs

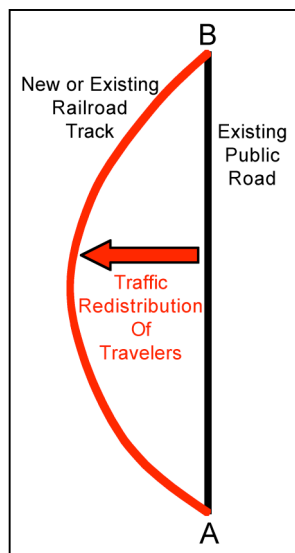
## Operating Schedule

### Part C, Section III (Public); Part B, Section III (Private)

- Define start-up year of new freight rail service (relocation of thru freight)
- These projects involve *No* vehicle toll service or passenger rail operations

**NOTE:** Part C, Section IV (Public): Make sure the grade crossing impedance option for passenger rail is entered as “No” and the grade crossing impedance option for freight rail is entered as “Yes”.

## New Passenger Rail



**Figure 23: New Passenger Rail Illustration**

The implementation of passenger rail service will reduce the number of vehicles or growth of vehicles on public roads, as illustrated in Figure 23, but will also increase the number of train conflicts with vehicles at existing grade crossings. Therefore, the evaluation of these projects must account for the operating schedules of new passenger trains along the rail corridor and how these changes affect the interaction with vehicle ADT volumes at grade crossings. Specific data entries should focus on:

### Redistribution of Traffic

#### Vehicles [Part A, Section I (Public)]

- Vehicle class or origin-destination pairs displaced from public road
- Base annual volume = initial traffic  $\times$  trip length  $\times$  trip frequency
- Annual growth in base annual traffic volumes
- Unit costs & benefits of traffic (\$/vehicle-mile) such as:
  - ✓ Agency – reduced pavement damage
  - ✓ Society – reduced environmental damage (vehicle emissions)
  - ✓ User – elimination of driving costs (i.e., collision, congestion, etc.)

#### Passenger rail [Part A, Section II (Public); Part A, Section II (Private)]

- Origin-destination pairs
- Base annual volume = initial ridership  $\times$  trip length  $\times$  trip frequency
- Unit costs & benefits of traffic (\$/passenger-mile)
  - ✓ Agency – percentage of train fare revenues (if any)
  - ✓ Society – Subsidy cost (in any)
  - ✓ User – train fare
  - ✓ Corporate – train fare revenue, public subsidy (if any)

### Passenger Rail Operating Requirements

#### Part A, Section IV (Private)

- Route miles  $\times$  trains in service  $\times$  train schedule  $\times$  operating frequency = total train miles
- Train miles @ train characteristics and train costs = annual costs

## Grade Crossing Conflicts

- Blockage time at grade crossings [Part B, Section I (Grade Crossings)]
- Train schedules [Part B, Section II (Grade Crossings)]
- Vehicle traffic time distribution [Part C, Section I (Grade Crossings)]
- ADT at grade crossings [Part C, Section II (Grade Crossings)]
- Proposed grade separations [Part C, Section III (Grade Crossings)]

## Administration and Finance

### **Part A, Section III (Public); Part A, Section V (Private)**

- Railroad administration costs (overhead)
- Track maintenance costs
- Economic benefits associated with real estate revenues
- Facility operational costs

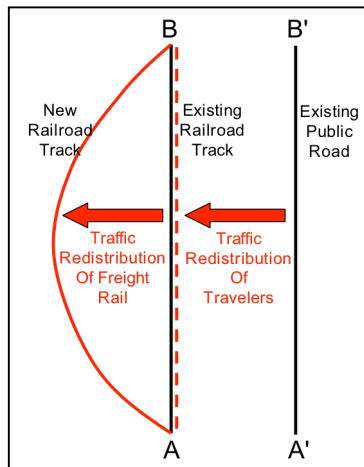
## Operating Schedule

### **Part C, Section III (Public); Part B, Section III (Private)**

- Define start-up year of new passenger rail service
- These projects involve *No* vehicle toll service or freight rail operations

**NOTE:** Part C, Section IV (Public): Make sure the grade crossing impedance option for passenger rail is entered as “Yes” and the grade crossing impedance option for freight rail is entered as “No”.

## Passenger/Rail Relocation



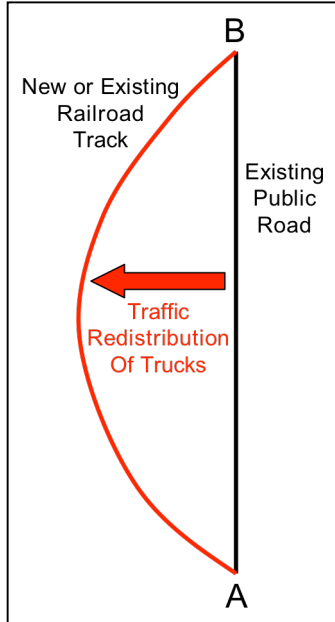
**Figure 24: Passenger Rail Relocation Illustration**

A passenger/rail relocation project involves adding passenger rail service to a freight rail line that has either been partially or completely abandoned. This type of project involves the transfer of freight rail traffic between points A and B in Figure 24 to a new rail corridor, accompanied by the transfer of travelers from a public road (corridor A'-B' in Figure 24) to the original rail corridor. Consequently, the analysis can be accomplished by treating the project as two separate scenarios modeled in one spreadsheet, that is:

- Follow the procedure described for rail relocation projects to model the events associated with the transfer of freight rail from rail corridor A-B to a new facility.
- Follow the procedure described for passenger rail projects to model the events associated with the transfer of travelers from public road corridor A'-B' to rail corridor A-B.

**NOTE:** Part C, Section IV (Public): Make sure the grade crossing impedance option for passenger rail is entered as “yes” and the grade crossing impedance option for freight rail is entered as “yes”.

## Intermodal Service



**Figure 25: Intermodal Service Illustration**

An intermodal rail project will transfer some truck traffic from existing public roads to a new or existing rail corridor, as shown in Figure 25. The evaluation of these projects must account for the transfer of costs and benefits between the public and private sectors. Specific data entries should focus on:

### Redistribution of Traffic

#### Part A, Section I (Public); Part A, Section I (Private)

- Vehicle class or origin-destination pairs
- Base annual volume = initial traffic × trip length × trip frequency
- Annual growth in base annual traffic volumes
- Unit costs and benefits of truck reduction (\$/vehicle-mile) such as:
  - ✓ Agency – reduced pavement damage
  - ✓ Society – reduced environmental damage
  - ✓ User – accident reduction, changes in shipping costs
  - ✓ Corporate – revenue from shipping charges

### Freight Rail Operating Requirement

#### Part A, Section III (Private)

- Route miles × trains in service × train schedule = train miles
- Train miles @ train characteristics and train costs = annual cost

### Grade Crossing Conflicts

- Blockage time at grade crossings [Part A, Section I (Grade Crossings)]
- Train schedule changes [Part A, Section II (Grade Crossings)]
- Vehicle traffic time distribution [Part C, Section I (Grade Crossings)]
- ADT at grade crossings [Part C, Section II (Grade Crossings)]
- Proposed grade separations [Part C, Section III (Grade Crossings)]

### Administration and Finance

#### Part A, Section III (Public); Part A, Section V (Private)

- Railroad administration (overhead)
- Track maintenance
- Postponement of right-of-way acquisitions
- Facility operational costs



## Operating Schedule

### **Part C, Section III (Public); Part B, Section III (Private)**

- Simultaneous start-up of vehicle toll (intermodal) service and freight rail operations
- These projects involve *No* passenger rail operations

**NOTE:** Part C, Section IV (Public): If the effects of additional rail traffic at grade crossings are to be measured, make sure the grade crossing impedance option for passenger rail is entered as “No” and the grade crossing impedance option for freight rail is entered as “Yes”.



## Parameter Definitions and Formulas

### *PUBLIC Worksheet*

## **PART A - DEFINE COSTS & BENEFITS OF MODAL SERVICE**

### **I. Vehicle Unit Costs & Benefits**

**Classification Type** – distinct vehicle grouping that characterizes a particular mode or route, such as vehicle class (e.g., 80-kip trucks, passenger cars, etc.) or origin-destination pairs (e.g., Dallas to Austin, northbound Mile Posts 10-12, etc.).

#### **Vehicle Cost/Benefit Parameters**

**Initial Vehicle Traffic (Veh/Day)** – traffic count of vehicles by classification type in the first year in which costs and benefits occur

**Vehicle Trip Length (Miles)** – distance traveled by each vehicle per classification type

**Trip Frequency (Days/Week)** – average number of days per week traveled by each vehicle per classification type

**Vehicle Growth Rate (%/Year)** – average expected annual growth in vehicular traffic per classification type.

**Base Annual Volume (Veh/Mi)** – Initial Vehicle Traffic  $\times$  Vehicle Trip Length  $\times$  Trip Frequency  $\times$  52

#### **Agency Cash Flows (\$/Vehicle-Mile)**

**A, B, C, or D** – initial placeholders for user-defined labels of agency unit costs and benefits.

**Agency Totals (\$/Veh-Mi)** – sum of parameters A through D per classification type

### **Societal Costs & Benefits (\$/Vehicle-Mile)**

E, F, G, or H – initial placeholders for user-defined labels of societal unit costs and benefits

**Societal Totals (\$/Veh-Mi)** – sum of parameters E through H per classification type

### **User Costs & Benefits (\$/Vehicle-Mile)**

I, J, K, or L – initial placeholders for user-defined labels of user unit costs and benefits

**User Totals (\$/Veh-Mi)** – sum of parameters I through L per classification type

## **II. Passenger Unit Costs & Benefits**

**Classification Type** – distinct grouping of travelers that characterizes a particular revenue base or route, such as fare (e.g., variable ticket pricing strategies) or origin-destination pairs (e.g., San Marcos to Austin, Segment A of the Red Line, etc.).

### **Passenger Rail Cost/Benefit Parameters**

**Initial Passenger Traffic (Pass/Day)** – passengers count by classification type in the first year in which costs and benefits occur

**Passenger Trip Length (Miles)** – distance traveled by each passenger per classification type

**Trip Frequency (Days/Week)** – average number of days per week traveled by each passenger per classification type

**Passenger Growth Rate (%/Year)** – expected annual growth in passenger travel per classification type.

**Base Annual Volume (Pass/Mi)** – Initial Passenger Traffic × Passenger Trip Length × Trip Frequency × 52

### **Agency Cash Flows (\$/Passenger-Mile)**

A, B, C, or D – initial placeholders for user-defined labels of agency unit costs and benefits

**Agency Totals (\$/Pass-Mi)** – sum of parameters A through D per classification type

### **Societal Costs & Benefits (\$/Passenger-Mile)**

E, F, G, or H – initial placeholders for user-defined labels of societal unit costs and benefits

**Societal Totals (\$/Pass-Mi)** – sum of parameters E through H per classification type

### **User Costs & Benefits (\$/Passenger-Mile)**

I, J, K, or L – initial placeholders for user-defined labels of user unit costs and benefits

**User Totals (\$/Pass-Mi)** – sum of parameters I through L per classification type

### III. Annual Costs & Benefits

**Classification Type** – distinct grouping of annual cash flows that characterize a particular revenue base (e.g., earnings from real estate leases) or general expense (e.g., administrative costs)

#### **Agency Cash Flows (\$Million)**

**Annual Sum (\$M)** – initial annual agency revenue or expense per classification type

**Start Year** – year in which the agency first realizes annual cash flows

**Growth Rate (%)** – percent annual growth in agency cash flow beginning in start year

#### **Societal Costs & Benefits (\$Million)**

**Annual Sum (\$M)** – initial annual cost or benefit to society per classification type

**Start Year** – year in which society first realizes annual costs or benefits

**Growth Rate (%)** – percent annual growth in costs or benefits to society beginning in start year

#### **User Costs & Benefits (\$Million)**

**Annual Sum (\$M)** – initial annual user cost or benefit per classification type

**Start Year** – year in which users first realize annual costs or benefits

**Growth Rate (%)** – percent annual growth in user costs or benefits beginning in start year

## PART B – DEFINE GRADE CROSSING COSTS

### I. Vehicle Emissions Costs

Cost associated with the generation of harmful emissions by vehicles while idling at grade crossings

**Emission Burn Rate (Grams/Veh-Min)** – average rate at which HC, CO, and NO<sub>x</sub> are emitted from an idling engine per vehicle type

**HC** – hydrocarbons

**CO** – carbon monoxide

**NO<sub>x</sub>** – oxides of nitrogen

**Environmental Cost (\$/Ton)** – cost of environmental damage per ton of HC, CO, and NO<sub>x</sub> emitted per vehicle

**Idling Cost (\$/Vehicle-Hour)** –  $\text{Emission Burn Rate} \times \text{Environmental Cost} \times 60 \text{ min/hour} \div 907185 \text{ grams/ton}$

**Total Cost** – sum of idling costs per vehicle type

## II. Vehicle Operating Costs

Cost associated with the consumption of volatile organic compounds (VOCs) by vehicles while idling at grade crossings

**Idle Burn Rate (Gal/Veh-Min and Qt/Veh-Min)** – average rate at which fuel and oil are consumed during engine idling per vehicle type.

**Fuel** – burn rate of gasoline or diesel, depending on vehicle type (i.e., automobiles, trucks, or buses) in Gal/Veh-Min

**Oil** – burn rate of engine motor oil in Qt/Veh-Min

**Fuel & Oil Costs (\$/Gal and \$/Qt)** – market price of gasoline (or diesel) and motor oil

**Fuel** – market price of gasoline or diesel in \$/gallon

**Oil** – market price of motor oil in \$/quart

**Idling Cost (\$/Vehicle-Hour)** – Idle Burn Rate  $\times$  Fuel or Oil Cost  $\times$  60 min/hour

**Total Cost** – Fuel Idling Cost + Oil Idling Cost

## III. Total Vehicle Impedance Costs

### Traffic Mix

Composition of typical traffic at grade crossings by vehicle type

**NOTE:** *The sum of the three fields should equal 100%.*

**Percent Automobiles (%)** – percentage of automobiles in the typical traffic mix

**Percent Trucks (%)** – percentage of trucks in the typical traffic mix

**Percent Buses (%)** – percentage of buses in the typical traffic mix

### Operator Time Costs

Average hourly value of driver time per vehicle type

**Automobile (\$/Vehicle-Hour)** – estimated hourly value of time for automobile drives

**Truck (\$/Vehicle-Hour)** – estimated hourly value of time for truck operators

**Bus (\$/Vehicle-Hour)** – estimated hourly value of time for bus fleet operators

**\$/Vehicle Mile Cost** – quantifies the economic cost of vehicle-hour measurements. Emissions, operating, and time costs for automobiles, trucks, and buses are tabulated in proportion to the defined traffic mix

**Total Cost (\$/Vehicle-Mile)** – [(Automobile Emissions Cost + Automobile VOC Cost + Automobile Operator Time Costs)  $\times$  % Automobiles/100] + [(Truck Emissions Cost + Truck VOC Cost + Truck Operator Time Costs)  $\times$  % Trucks/100] + [(Bus Emissions Cost + Bus VOC Cost + Bus Operator Time Costs)  $\times$  % Buses/100]

# **PART C – DEFINE FINANCING, CONSTRUCTION & OPERATING STRATEGY**

## **I. Project Economic Parameters**

### **Capital Financing Strategy**

**Public Share of Capital Cost (\$Million)** – agency capital cost

**Percent Financed with Equity (% of Cost)** – percent of agency capital cost financed with internal funds

**Equity Expended on Project (\$Million)** – dollar amount of agency’s equity commitment.

**Debt to be Financed (\$Million)** – dollar amount to be raised through the issue of public bonds

### **Bonding Conditions**

**Bond Issuance Cost (% of Bond)** – Fee charged by the financial institution for issuing public bonds, calculated as a percentage of the bond package

**Bond Term (Years)** – number of years to bond maturity

**Nominal (Annual) Interest Paid on Bond (%)** – percentage of the bond’s face (par) value paid annually to bondholders

**Annual Interest Payment on Bonds (\$M)** –  $\text{Par Value} \times \text{Interest Percent}$

**Sinking Fund Investment Rate (%)** – rate at which interest can be earned by the sinking fund, in which deposits are made to retire bond obligations

**Annual Payment to Sinking Fund (\$Million)** –  $\text{Bond Face Value} \times \text{Sinking Fund Factor}$  (at the sinking fund investment rate)

**Annual Debt Obligation (\$Million)** –  $\text{Annual Interest Payment on Bonds} + \text{Annual Payment to Sinking Fund}$

### **Assumed Interest Rates**

**Interest Rate Earned on Unused Funds (%)** – rate at which the bonds account can earn interest

## **II. Cost Allocation Schedule**

**Year** – time at which a portion of the agency’s capital cost is incurred

**% Expended** – percentage of the agency’s capital cost that is incurred in any one year

**Total** – confirms that 100 percent of the agency’s capital cost is used in the analysis

## **III. Operation Schedule**

### **Type of Service**

**Vehicle Toll Service** – involves an increase, reduction, or transfer of vehicles on a roadway (e.g., new toll road, tolling of an existing road, intermodal service, or the transfer of travelers from vehicles to passenger rail)

**Passenger Rail Service** – involves an increase in travelers on passenger rail facilities

**Freight Rail Relocation** – involves a redistribution of some or all freight rail operations from an existing rail corridor to a new corridor

### **Start Year**

**Start Year** – first year that a vehicle toll, passenger rail, or freight rail relocation project is in service

## **IV. Multimodal Service Options**

### **Conflicting Roadway Traffic**

**Annual Vehicle Growth Rate at Grade Crossings (%/Year)** – allows the first year ADT at grade crossings (listed in the GC Data worksheet) to increase at an annual rate

### **Passenger Rail Service**

**Will Passenger Rail Service be Implemented? (Yes/No)** – allows the change in grade crossing impedance due to the implementation of passenger rail (calculated in the GC Data worksheet) to be easily included in or excluded from the analysis

**Increased Grade Crossing Impedance (Vehicle\*Hours/Year)** – imports the total addition of grade crossing impedance in the GC Data worksheet when “Will Passenger Rail Service be Implemented?” is answered “Yes”

### **Freight Rail Relocation**

**Will a Freight Rail Corridor be Relocated? (Yes/No)** – allows the change in grade crossing impedance due to the relocation of a freight rail corridor (calculated in the GC Data worksheet) to be easily included in or excluded from the analysis

**Reduced Grade Crossing Impedance (Vehicle\*Hours/Year)** – imports the total reduction in grade crossing impedance in the GC Data worksheet when “Will a Freight Rail Corridor be Relocated?” is answered “Yes”

## **PART D - TABULATION OF ECONOMIC RESULTS**

### **I. Pro Forma Statement**

Contains the annual cash flow and cash flow-equivalent projections over the project life. Financial projections are based on current year (year zero) dollars, assuming end-of-year receipt of annual cash flows. Cash flows and cash flow-equivalents in future years are discounted at user-defined discount rates in the subsequent economic analyses.

*Note: This table requires data from the Selection of Discount Rates table.*

#### **Base Projections for Facility Operation**

**Vehicle Toll Traffic [Millions] (Veh\*Mt)** – annual vehicle traffic volume calculated from the Vehicle Unit Costs & Benefits table

**Passenger Rail Traffic [Millions] (Veh\*Mt)** – annual passenger rail traffic volume calculated from the Passenger Unit Costs & Benefits table.



**Freight Rail Impedance (Veh\*Mi)** – equals Reduced Grade Crossing Impedance escalated at Annual Vehicle Growth Rate at Grade Crossings when “Will a Freight Rail Corridor be Relocated?” is answered “Yes”

**Passenger Rail Impedance (Veh\*Mi)** – equals Increased Grade Crossing Impedance escalated at Annual Vehicle Growth Rate at Grade Crossings when “Will Passenger Rail Service be Implemented?” is answered “Yes”

### **Agency Financial Projections**

**Bond Retirement Cost (\$M)** – Total Annual Cost of Bond Retirement in each applicable year

**Construction Cost (\$M)** – assigns annual percentages of the agency’s capital cost to the appropriate year

**Vehicle Toll Cash Inflows (\$M)** – beginning in the first year of vehicle toll service, net annual agency revenues from Vehicle Unit Costs & Benefits assigned to the appropriate year

**Passenger Rail Cash Inflows (\$M)** – beginning in the first year of passenger rail service, net annual agency revenues from Passenger Unit Costs & Benefits assigned to the appropriate year

**Annual Cost & Benefit Cash Inflows (\$M)** – beginning in the start year, net annual agency revenues from Annual Costs & Benefits assigned to the appropriate year

**Balance of Bond Capital (\$M)** – sum of beginning-of-period unused bond capital and end-of-period net cash inflow

**Interest on Bond Capital (\$M)** – end-of-period interest earned on beginning-of-period balance of bond at the rate specified in Interest Rate Earned on Unused Funds

**Net Income (\$M)** – sum of cash inflows and cash outflows for the year

### **Agency Economics Analysis**

**Present Values at “A” Disc. Rate (\$M)** – value of Net Income discounted at rate “A” as specified in Selection of Discount Rates

**Present Values at “B” Disc. Rate (\$M)** – value of Net Income discounted at rate “B” as specified in Selection of Discount Rates

**Present Values at “C” Disc. Rate (\$M)** – value of Net Income discounted at rate “C” as specified in Selection of Discount Rates

**Present Values at “D” Disc. Rate (\$M)** – value of Net Income discounted at rate “D” as specified in Selection of Discount Rates

### **Societal Economic Projections & Analysis**

**Vehicle Toll Benefits (\$M)** – beginning in the first year of vehicle toll service, net annual societal benefits from Vehicle Unit Costs & Benefits are assigned to the appropriate year

**Passenger Rail Net Benefits (\$M)** – beginning in the first year of passenger rail service, net annual societal benefits from Passenger Unit Costs & Benefits are assigned to the appropriate year

**Annual Costs & Benefits (\$M)** – beginning in the start year, net annual societal benefits from Annual Costs & Benefits are assigned to the appropriate year

**Gr. Cross. Impedance Benefits (\$M)** – beginning in the first year that rail is relocation, net annual societal benefits from reduced grade crossing impedance is assigned to the appropriate year

**Net Societal Benefits (\$M)** – sum of cash-equivalent inflows and outflows to society

**Present Values at “A” Disc. Rate (\$M)** – value of Net Societal Benefits discounted at rate “A” as specified in Selection of Discount Rates

**Present Values at “B” Disc. Rate (\$M)** – value of Net Societal Benefits discounted at rate “B” as specified in Selection of Discount Rates

**Present Values at “C” Disc. Rate (\$M)** – value of Net Societal Benefits discounted at rate “C” as specified in Selection of Discount Rates

**Present Values at “D” Disc. Rate (\$M)** – value of Net Societal Benefits discounted at rate “D” as specified in Selection of Discount Rates

### **User Economic Projections & Analysis**

**Vehicle Toll Benefits (\$M)** – beginning in the first year of vehicle toll service, net annual user benefits from Vehicle Unit Costs & Benefits assigned to the appropriate year

**Passenger Rail Net Benefits (\$M)** – in the first year of passenger rail service, net annual user benefits from Passenger Unit Costs & Benefits assigned to the appropriate year

**Annual Costs & Benefits (\$M)** – beginning in the start year, net annual user benefits from Annual Costs & Benefits assigned to the appropriate year

**Net User Benefits (\$M)** – sum of user cash and cash-equivalent inflows and outflows

**Present Values at “A” Disc. Rate (\$M)** – value of Net User Benefits discounted at rate “A” as specified in Selection of Discount Rates

**Present Values at “B” Disc. Rate (\$M)** – value of Net User Benefits discounted at rate “B” as specified in Selection of Discount Rates

**Present Values at “C” Disc. Rate (\$M)** – value of Net User Benefits discounted at rate “C” as specified in Selection of Discount Rates

**Present Values at “D” Disc. Rate (\$M)** – value of Net User Benefits discounted at rate “D” as specified in Selection of Discount Rates

## II. Selection of Discount Rates

Selected as deemed appropriate for the economic analysis. Discount rates A through D are used to plot NPV versus discount rate for all public-sector entities (i.e., agency, society, and users) in the Public Plot and Joint Plot worksheets

**Rate ID** – discount rates A, B, C, and D correspond to the discount rates used to calculate present values in the pro forma statement

**Discount Rate (%)** – rate at which future year cash and cash equivalent-flows are discounted to represent their present value

## III. Summary of Economic Analysis Results

Tabulates net present values of the project for all segments of the public sector (agency, society, and user) at discount rates A through D. Each of these results are plotted as NPV versus discount rate in the Public Plot worksheet; agency values of NPV are also used in the Joint Plot worksheet.

**Disc. Rate (%)** – references the discount rates in Selection of Discount Rates

**Agency (\$M)** – sum of the agency’s annual present values at discount rates A through D, plus the NPV of concession fees paid by the private sector in Record of Concession Fees

**Societal (\$M)** – sum of society’s annual present values at discount rates A through D

**User (\$M)** – sum of users’ annual present values at discount rates A through D

**Total (\$M)** – sum of all public sector NPV’s

## IV. Record of Concession Fees

Imports concession fees listed under Schedule of Concession Payments in Private worksheet for inclusion as cash inflows to the agency.

**Disc. Rate (%)** – references the discount rates in Selection of Discount Rates

**NPV (\$M)** – discounts private-sector concession fees by the years and payments listed in Record of Concession Fees (Private worksheet) at rates A through D; the NPV equals the sum of these discounted values

## *PRIVATE Worksheet*

### **PART A – DEFINE COSTS & BENEFITS OF MODAL SERVICE**

#### **I. Vehicle Unit Costs & Benefits**

**Classification Type** – distinct vehicle grouping that characterizes a particular mode or route, such as vehicle class (e.g., 80-kip trucks, passenger cars, etc.) or origin-destination pairs (e.g., Dallas to Austin, northbound Mile Posts 10-12, etc.), as defined in the Public worksheet

### **Vehicle Cost/Benefit Parameters**

**Initial Vehicle Traffic (Veh/Day)** – count of vehicles by classification type in the first year in which costs and benefits occur, as defined in the Public worksheet

**Vehicle Trip Length (Miles)** – distance traveled by each passenger per classification type, as defined in the Public worksheet

**Trip Frequency (Days/Week)** – average number of days per week traveled by each vehicle per classification type, as defined in the Public worksheet

**Vehicle Growth Rate (%/Year)** – average expected annual growth in vehicular traffic per classification type, as defined in the Public worksheet

**Base Annual Volume (Veh/Mi)** – Initial Vehicle Traffic  $\times$  Vehicle Trip Length  $\times$  Trip Frequency  $\times$  52, as calculated in the Public worksheet

### **Corporate Costs & Revenues (\$/Vehicle-Mile)**

**A, B, C, or D** – initial placeholders for user-defined labels of corporate unit costs and benefits

**Corporate Totals (\$/Veh-Mi)** – sum of parameters A through D per classification type

## **II. Passenger Unit Costs & Benefits**

**Classification Type** – distinct grouping of travelers that characterizes a particular revenue base or route, such as fare (e.g., variable ticket pricing strategies) or origin-destination pairs (e.g., San Marcos to Austin, Segment A of the Red Line, etc.), as defined in the Public worksheet

### **Passenger Rail Cost/Benefit Parameters**

**Initial Passenger Traffic (Pass/Day)** – count of passengers by classification type in the first year in which costs and benefits occur, as defined in the Public worksheet

**Passenger Trip Length (Miles)** – distance traveled by each passenger per classification type, as defined in the Public worksheet

**Trip Frequency (Days/Week)** – average number of days per week traveled by each passenger per classification type, as defined in the Public worksheet

**Passenger Growth Rate (%/Year)** – expected annual growth in passenger travel per classification type, as defined in the Public worksheet

**Base Annual Volume (Pass/Mi)** – Initial Passenger Traffic  $\times$  Passenger Trip Length  $\times$  Trip Frequency  $\times$  52

### **Corporate Costs & Revenues (\$/Passenger-Mile)**

**A, B, C, or D** – initial placeholders for user-defined labels of corporate unit costs and benefits

**Corporate Totals (\$/Pass-Mi)** – sum of parameters A through D per classification type

### III. Freight Rail Annual Operating Costs

**Train Route** – distinct travel pattern characterized by origin-destination pairs (e.g., Austin-San Antonio bypass, Laredo-Fort Worth intermodal service, etc.) and/or train composition (e.g., 5,000-ft intermodal trains, local 30-car trains, etc.)

#### Route Description

**Route Mileage (Miles/Route)** – length of train route in miles

**Trains in Service (Trains/Route)** – number of trains required by each freight rail service defined in Train Route

**Train Schedule (Trains/Day)** – number of train trips conducted each day per freight rail service defined in Train Route

**Operating Frequency (Days/Week)** – average number of operational days each week per freight rail service defined in Train Route

#### Train Characteristics

**Crew Requirement (Crew/Train)** – number of railroad crew required to operate each train per freight rail service defined in Train Route

**Railcars per Train** – number of cars per train, excluding locomotives

**Railcar Weight (Tons)** – average weight of freight railcars

**Cargo Weight (Tons/Railcar)** – average weight of cargo transported by railcars

**Locomotives per Train** – number of locomotives required to haul the railcars and cargo prescribed for each train route

**Locomotive Weight (Tons)** – weight of an individual locomotive used to build a complete train per freight rail service defined in Train Route

**Gross Train Tonnage (Tons/Train)** – Railcars per Train × (Railcar Weight + Cargo Weight) + Locomotives per Train × Locomotive Weight

#### Train Operating Costs

**Crew Cost (\$/Crew-Day)** – average wage rate for train crew.

**Railcar Maintenance (\$/Car-Mile)** – estimated maintenance cost for each railcar per mile traveled

**Locomotive Maintenance (\$/Loc-Mile)** – estimated maintenance cost for each locomotive per mile traveled

**Fuel Cost (\$/Ton-Mile)** – estimated cost of fuel required to move the unit weight of a train (i.e., one ton) over a distance of one mile

**Total Annual Cost (\$M/Year)** –  $[\text{Crew Cost} \times \text{Crew Requirement} \times \text{Trains in Service} \times \text{Operating Frequency} + (\text{Railcar Maintenance} \times \text{Railcars per Train} + \text{Locomotive Maintenance} \times \text{Locomotives per Train}) \times \text{Train Schedule} \times \text{Operating Frequency} \times \text{Route Mileage} + \text{Fuel Cost} \times \text{Gross Train Tonnage} \times \text{Train Schedule} \times \text{Operating Frequency} \times \text{Route Mileage}] / 1,000,000$

## IV. Passenger Rail Annual Operating Costs

**Train Route** – distinct travel pattern characterized by origin-destination pairs (e.g., Austin-San Antonio, the Red Line, etc.)

### Route Description

**Route Mileage (Miles/Route)** – length of train route in miles

**Trains in Service (Trains/Route)** – number of trains required by each passenger rail service defined in Train Route

**Train Schedule (Trains/Day)** – number of train trips conducted each day per passenger rail service defined in Train Route

**Operating Frequency (Days/Week)** – average number of operational days each week per passenger rail service defined in Train Route

### Train Characteristics

**Crew Requirement (Crew/Train)** – number of railroad crew required to operate each train per passenger rail service defined in Train Route

**Railcars per Train** – number of passenger cars per train

**Railcar Weight (Tons)** – average weight of passenger cars

**Cargo Weight (Tons/Railcar)** – average weight of passengers plus cargo transported in the passenger cars (usually minimal)

**Locomotives per Train** – number of locomotives required to haul the passenger cars prescribed for each train route

**Locomotive Weight (Tons)** – weight of an individual locomotive used to build a complete train per passenger rail service defined in Train Route

**Gross Train Tonnage (Tons/Train)** – Railcars per Train  $\times$  (Railcar Weight + Cargo Weight) + Locomotives per Train  $\times$  Locomotive Weight

### Train Operating Costs

**Crew Cost (\$/Crew-Day)** – average wage rate for train crew

**Railcar Maintenance (\$/Car-Mile)** – estimated maintenance cost for each railcar per mile traveled

**Locomotive Maintenance (\$/Loc-Mile)** – estimated maintenance cost for each locomotive per mile traveled

**Fuel Cost (\$/Ton-Mile)** – estimated cost of fuel required to move the unit weight of a train (i.e., one ton) over a distance of one mile

**Total Annual Cost (\$M/Year)** –  $[\text{Crew Cost} \times \text{Crew Requirement} \times \text{Trains in Service} \times \text{Operating Frequency} + (\text{Railcar Maintenance} \times \text{Railcars per Train} + \text{Locomotive Maintenance} \times \text{Locomotives per Train}) \times \text{Train Schedule} \times \text{Operating Frequency} \times \text{Route Mileage} + \text{Fuel Cost} \times \text{Gross Train Tonnage} \times \text{Train Schedule} \times \text{Operating Frequency} \times \text{Route Mileage}] / 1,000,000$

## V. Other Annual Costs & Revenues

**Type of Service** – distinct grouping of annual cash flows that characterize a particular revenue base (e.g., earnings from real estate leases) or general expense (e.g., administrative costs)

### Corporate Cash Flows (\$Million)

**Annual Sum (\$M)** – initial annual corporate revenue or expense per classification type

**Start Year** – year in which the corporation first realizes annual cash flows

**Growth Rate (%)** – percent annual growth in corporate cash flow beginning in start year

## PART B - DEFINE FINANCING, CONSTRUCTION & OPERATING STRATEGY

### I. Project Economic Parameters

#### Capital Financing Strategy

**Corporate Share of Project Cost (\$Million)** – corporate capital cost

**Percent Financed with Equity (% of Cost)** – percent of corporate capital cost financed with internal funds

**Equity Expended on Project (\$Million)** – dollar amount of the corporation's equity commitment

**Debt to be Financed (\$Million)** – dollar amount to be raised through the issue of corporate or revenue bonds

#### Bonding Conditions

**Bond Issuance Cost (% of Bond)** – Fee charged by the financial institution for issuing corporate bonds, calculated as a percentage of the bond package

**Bond Term (Years)** – number of years to bond maturity

**Nominal (Annual) Interest Paid on Bond (%)** – percentage of the bond's face (par) value paid annually to bondholders

**Annual Interest Payment on Bonds (\$M)** –  $\text{Par Value} \times \text{Interest Percent}$

**Sinking Fund Investment Rate (%)** – rate at which interest can be earned by the sinking fund, in which deposits are made to retire bond obligations

**Annual Payment to Sinking Fund (\$Million)** –  $\text{Face Value} \times \text{Sinking Fund Factor}$  (at the sinking fund investment rate)

**Annual Debt Obligation (\$Million)** –  $\text{Annual Interest Payment on Bonds} + \text{Annual Payment to Sinking Fund}$

### **Assumed Interest Rates**

**Interest Rate Earned on Unused Funds (%)** – rate at which the bonds account can earn interest

**Average Investment Opportunity Rate (%)** – rate at which interest can be earned from typical corporate investments

## **II. Cost Allocation Schedule**

**Year** – time at which a portion of the corporation’s capital cost is incurred

**% Expended** – percentage of the corporation’s capital cost that is incurred in any one year

**Total** – confirms that 100 percent of the corporation’s capital cost is used in the analysis

## **III. Operation Schedule**

### **Type of Service**

**Vehicle Toll Service** – involves an increase, reduction, or transfer of vehicles on a roadway (e.g., new toll road, tolling of an existing road, intermodal service, or the transfer of travelers from vehicles to passenger rail), as defined in the Public worksheet

**Passenger Rail Service** – involves an increase in travelers on passenger rail facilities, as defined in the Public worksheet

**New Freight Rail Service** – involves the start-up of freight rail revenue service

### **Start Year**

First year that a vehicle toll, passenger rail, or a new freight rail project is in service

## **IV. Schedule of Concession Payments**

Allows for a schedule of concession payments stipulated by the terms of a franchise agreement to be counted as cash outflows for the corporation

**Year** – defines the year in which a concession fee is paid by the corporation

**Payment (\$M)** – defines the dollar amount of a concession fee payment by the corporation

**Total** – calculates the sum value of concession payments

# **PART C – TABULATION OF ECONOMIC RESULTS**

## **I. Pro Forma Statement**

Contains the annual cash flow projections over the project life. Financial projections are based on current year (year zero) dollars, assuming end-of-year receipt of annual cash flows. Cash flows in future years are discounted at user-defined interest rates in the subsequent economic analyses.

*Note: This table requires data from the Selection of Interest Rates table.*



## **Corporate Finances**

**Bond Retirement Cost (\$M)** – Total Annual Cost of Bond Retirement in each applicable year

**Construction Cost (\$M)** – annual percentages of the corporation’s capital cost to the appropriate year

**Concession Payment Costs (\$M)** – lists of annual cost of concession payments to the public sector

**Vehicle Toll Cash Inflows (\$M)** – beginning in the first year of vehicle toll service, net annual corporate revenues from Vehicle Unit Costs & Benefits assigned to the appropriate year

**Passenger Rail Cash Inflows (\$M)** – beginning in the first year of passenger rail service, net annual corporate revenues from Passenger Unit Costs & Benefits assigned to the appropriate year

**Annual Cost & Benefit Cash Inflows (\$M)** – beginning in the start year, net annual corporate revenues from Annual Costs & Benefits assigned to the appropriate year

**Balance of Bond Capital (\$M)** – sum of beginning-of-period unused bond capital and end-of-period net cash inflow

**Interest on Bond Capital (\$M)** – end-of-period interest earned on beginning-of-period balance of bond at the rate specified in Interest Rate Earned on Unused Funds

**Capital Investment Expenses (\$M)** – sum of construction costs and concession costs for the year

**Net Operating Income (\$M)** – sum of cash inflows and cash outflows for the year

## **Corporate Economics Analysis**

**Present Values at “A” Disc. Rate (\$M)** – value of Net Operating Income discounted at rate “A” as specified in Selection of Discount Rates, plus value of Capital Investment Expenses discounted at Average Investment Opportunity Rate

**Present Values at “B” Disc. Rate (\$M)** – value of Net Operating Income discounted at rate “B” as specified in Selection of Discount Rates, plus value of Capital Investment Expenses discounted at Average Investment Opportunity Rate

**Present Values at “C” Disc. Rate (\$M)** – value of Net Operating Income discounted at rate “C” as specified in Selection of Discount Rates, plus value of Capital Investment Expenses discounted at Average Investment Opportunity Rate

**Present Values at “D” Disc. Rate (\$M)** – value of Net Operating Income discounted at rate “D” as specified in Selection of Discount Rates, plus value of Capital Investment Expenses discounted at Average Investment Opportunity Rate

## II. Selection of Interest Rates

Selected as deemed appropriate for the economic analysis. Interest rates A through D are used to plot NPV versus interest rate for the corporation.

**Rate ID** – interest rates A, B, C, and D correspond to the interest rates used to calculate present values in the pro forma statement.

**Interest Rate (%)** – rate at which future year cash flows are discounted to represent their present value

## III. Summary of Economic Analysis Results

Tabulates net present value of the project for the corporation at discount rates A through D. Each of these results are plotted as NPV versus discount rate in the Joint Plot worksheet.

**Interest Rate (%)** – each row references the Interest Rate from II. Selection of Interest Rates A – D

**NPV (\$M)** – sum of the corporation’s annual present values at discount rates A through D

## *GC DATA Worksheet*

### **PART A – DEFINE FREIGHT RAIL OPERATIONS**

#### **I. Freight Rail Operating Conditions**

##### **Train Characteristics**

**Average Train Speed (MPH)** – speed at which trains typically pass grade crossings listed in the GC worksheet

**Average Train Length (Feet)** – train length used to determine the time each grade crossing is blocked

**Freight Rail Operating Frequency (Days/Week)** – average number of operational days each week for freight rail service

##### **Impedance Conditions**

**Gate Advanced Closure Time (Seconds)** – time that grade crossings are blocked by warning gates prior to the arrival of a train

**Fraction of Train that Blocks Vehicles (%)** – average amount of train (or train blockage time) that actually impedes vehicles at grade crossings

**Total Train Blockage Time (Hours)** –  $\text{Average Train Length} / (\text{Average Train Speed} \times 5280) + \text{Gate Advanced Closure Time} / 3600$

**Vehicle Impedance Time (Hours)** –  $\text{Total Train Blockage Time} \times \text{Fraction of Train that Blocks Vehicles} / 100$

## II. Freight Rail Train Schedule

### Freight Rail Operations

**Current Number of Freight Trains** – current number of freight trains that operate in each of 24 hourly intervals

**Proposed Number of Freight Trains** – anticipated number of freight trains that will operate in each of 24 hourly intervals as a result of the proposed project

**Total Freight Rail Reduction** –  $\text{Current Number of Freight Trains} - \text{Proposed Number of Freight Trains}$

### Daily Timetable of Freight Rail Operations

**Hour 1 thru Hour 24** – schedule of daily time increments

**Total Trains** – total number of trains per day

## PART B – DEFINE PASSENGER RAIL OPERATIONS

### I. Passenger Rail Operating Conditions

#### Train Characteristics

**Average Train Speed (MPH)** – speed at which trains typically pass grade crossings listed in the GC worksheet

**Average Train Length (Feet)** – train length used to determine the time each grade crossing is blocked

**Passenger Rail Operating Frequency (Days/Week)** – average number of operational days each week for passenger rail service

#### Impedance Conditions

**Gate Advanced Closure Time (Seconds)** – time that grade crossings are blocked by warning gates prior to the arrival of a train

**Fraction of Train that Blocks Vehicles (%)** – average amount of train (or train blockage time) that actually impedes vehicles at grade crossings

**Total Train Blockage Time (Hours)** –  $\text{Average Train Length} / (\text{Average Train Speed} \times 5280) + \text{Gate Advanced Closure Time} / 3600$

**Vehicle Impedance Time (Hours)** –  $\text{Total Train Blockage Time} \times \text{Fraction of Train that Blocks Vehicles} / 100$

### II. Passenger Rail Train Schedule

#### Corridor Segment

**Current Number of Passenger Trains** – current number of freight trains that operate in each of 24 hourly intervals

**Proposed Number of Passenger Trains** – anticipated number of freight trains that will operate in each of 24 hourly intervals as a result of the proposed project

**Total Passenger Rail Addition** – Proposed Number of Passenger Trains – Current Number of Passenger Trains

### **Daily Timetable of Commuter Rail Operations**

Hour 1 thru Hour 24 – schedule of daily time increments

**Total Trains** – total number of trains per day

## **PART C – RECORD OF GRADE CROSSING VEHICULAR TRAFFIC**

### **I. Define Roadway Traffic Pattern**

#### **Type of Traffic Distribution**

**Highway Distribution (% of ADT)** – hourly percentage of average daily traffic that is expected to exist at the grade crossings

#### **Time of Day**

Hour 1 thru Hour 24 – schedule of daily time increments

**Total**– confirms that the sum of hourly percentages of ADT over 24 hours equals 100 percent

### **II. In-Place Grade Crossings**

**Grade Crossing Identification** – allows for the grade crossing to be listed by street name or railroad industry identification number

#### **Current Daily Grade Crossing Vehicular Traffic**

**ADT** – average daily traffic for each distinct grade crossing

**Hour 1 thru Hour 24** –  $ADT \times \text{Highway Distribution (at each hour)} / 100$

**Totals** – sum of hourly ADT increments, confirms that the sum of calculated hourly ADT equals ADT input

#### **Totals for Grade Crossing Vehicular Traffic**

**Freight Delay Reduction Subtotals (Vehicle\*Hours)** –  $[\text{sum of hourly ADT}] \times \text{Total Freight Rail Reduction} \times \text{Vehicle Impedance Time (for freight rail)}$

**Passenger Rail Delay Addition Subtotals (Vehicle\*Hours)** –  $[\text{sum of hourly ADT}] \times \text{Total Passenger Rail Addition} \times \text{Vehicle Impedance Time (for passenger rail)}$

### **III. Proposed Grade Separations**

**Grade Separation Identification** – allows for the grade crossing separation to be listed by street name or railroad industry identification number.

#### **Current Daily Grade Crossing Vehicular Traffic**

**ADT** – average daily traffic for each distinct grade crossing.

**Hour 1 thru Hour 24** –  $ADT \times \text{Highway Distribution (at each hour)} / 100$

**Totals** – sum of hourly ADT increments, confirms that the sum of calculated hourly ADT equals ADT input

**Totals for Grade Crossing Vehicular Traffic**

**Freight Delay Reduction Subtotals (Vehicle\*Hours)** – [sum of hourly ADT] × Proposed Number of Freight Trains × Vehicle Impedance Time (for freight rail)

**Passenger Rail Delay Addition Subtotals (Vehicle\*Hours)** – [sum of hourly ADT] × Proposed Number of Passenger Trains × Vehicle Impedance Time (for passenger rail)

**PART D – SUMMARY OF IMPEDANCE CONDITIONS**

**Total Annual Grade Crossing Impedance**

**Total Freight Rail Delay Reduction (Vehicle\*Hours/Year)** – [sum of hourly Freight Rail Delay Reduction (for grade crossings and grade separations)] × Freight Rail Operating Frequency × 52

**Total Passenger Rail Delay Addition (Vehicle\*Hours/Year)** – [sum of hourly Passenger Rail Delay Addition (for grade crossings and grade separations)] × Passenger Rail Operating Frequency × 52





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