1. Report No. FHWA/TX-11/5-5534-01-1	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle IMPLEMENTATION OF TAMSIM AND EROW RIGHT-OF-WAY ACQUISITION DECISION-SUPPORT TOOLS		5. Report Date Published: April 2011
		6. Performing Organization Code
7. Author(s) Paul E. Krugler, Carlos M. Chang-Albitres, Richard M. Feldman, Sergiy Butenko, Dong Hun Kang, and Reza Seyedshohadaie		8. Performing Organization Report No. Report 5-5534-01-1
9. Performing Organization Name and Address Texas Transportation Institute The Texas A&M University System College Station, Texas 77843-3135		10. Work Unit No. (TRAIS)
		11. Contract or Grant No. Project 5-5534-01
12. Sponsoring Agency Name and Address Texas Department of Transportation Research and Technology Implementation Office P.O. Box 5080 Austin, Texas 78763-5080		13. Type of Report and Period Covered Technical Report: September 2009–August 2010
		14. Sponsoring Agency Code

15. Supplementary Notes
Project performed in cooperation with the Texas Department of Transportation and the Federal Highway Administration.
Project Title: Implementation of ROW Acquisition Decision-Support Tools
URL: http://tti.tamu.edu/documents/5-5534-01-1.pdf

16. Abstract

An implementation project was performed to initiate use of TAMSIM and EROW tools in region offices and the Right of Way (ROW) Division. The research team worked with Texas Department of Transportation regional ROW staffs to apply both tools to a set of actual projects, one project from each region. The culminating EROW analysis provided estimates of anticipated outcomes from optimal use of potential early acquisition budgets ranging from $0.5 million to $10 million. Regional workshops utilized the data and information derived from these trial tool applications. TAMSIM and EROW were also demonstrated to ROW Division personnel, and recommendations for potential additional applications were presented. Several tool refinements were made as opportunities were identified during initial usage with district personnel. TAMSIM 2.0 and EROW 2.0 are included in the CD-ROM accompanying this report.

17. Key Words Asset Management, Simulation, Optimization, Budget Decision Support, Business Science Tools, Early Right-of-Way Acquisition		18. Distribution Statement No restrictions. This document is available to the public through NTIS: National Technical Information Service Alexandria, Virginia 22161 http://www.ntis.gov	
19. Security Classif.(of this report) Unclassified	20. Security Classif.(of this page) Unclassified	21. No. of Pages 22	22. Price

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IMPLEMENTATION OF TAMSIM AND EROW RIGHT-OF-WAY ACQUISITION DECISION-SUPPORT TOOLS

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DISCLAIMER

This research was performed in cooperation with the Texas Department of Transportation (TxDOT) and the Federal Highway Administration (FHWA). The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official view or policies of the FHWA or TxDOT. This report does not constitute a standard, specification, or regulation. This report is not intended for construction, bidding, or permitting purposes. The engineer in charge of the project was Paul E. Krugler, P.E. #43317. The United States Government and the State of Texas do not endorse products or manufacturers. Trade or manufacturers' names appear herein solely because they are considered essential to the objective of this report.

ACKNOWLEDGMENTS

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CHAPTER 1: IMPLEMENTATION ACTIVITIES

This implementation report documents activities undertaken to promote statewide use of two business science tools, TAMSIM and EROW, developed under Research Project 0-5534, "Asset Management – Texas Style." TAMSIM is a software tool named for its development at Texas A&M University with simulation as its mechanism. TAMSIM simulates the right-of-way (ROW) acquisition process utilized by TxDOT and displays anticipated impacts resulting from various ROW acquisition options the user had entered. The second tool, named EROW for Early Right-of-Way Budget Optimization, is an optimization tool for determining optimal early ROW acquisition budget allocations among a set of projects.

TOOL USE PROCEDURES

The research team developed several methodologies for using TAMSIM and EROW as decision-support tools during TxDOT ROW acquisition planning and operations. These step-by-step procedures are found in the Appendix and are appropriate for future use in the TxDOT regions and the ROW Division.

INITIAL REGIONAL TOOL APPLICATIONS

The implementation project included working closely with ROW personnel in each of the four TxDOT regions to apply TAMSIM to an actual project situation in each of them. The EROW tool was then employed to demonstrate budget allocation optimization among the four projects. Brief descriptions follow for each selected project.

Regional Projects Analyzed Using TAMSIM

North Region – SH 78 from SH 205 to FM 6 in Dallas County

This is an urban project in northeast Dallas requiring purchase of 10 parcels. The schematics for this project became available in December 2009 and information for the TAMSIM analysis was gathered in April 2010. The district believes there is some degree of probability for improvements being made by owners on three of the 10 parcels. Current district cost estimates for these 10 parcels totaled approximately $240,000.

East Region – FM 1488 East of Magnolia in Montgomery County

This is a metropolitan project planned for construction in three to five years. It has 28 parcels, a number being large tracts with potential for speculator involvement. The plans were completed in January 2005, and environmental clearance has already been obtained. The project is awaiting funding availability. Speculators are on the sidelines, waiting for assurance the project will move forward. Current district cost estimates for the 28 parcels totaled $15.8 million.

South Region – FM 973 in Travis County

This is an urban project planned for letting in the near future. It is located near Austin-Bergstrom International Airport and has 20 parcels. Several of the parcels belong to other governmental agencies or only involve acquisition of easements. District cost estimates for these 20 parcels totaled $3.1 million.

West Region – NE Parkway in El Paso County

This 10.2-mile project north of El Paso runs from 2.9 miles east of the Railroad Drive Overpass at Loop 375 to the Texas-New Mexico state line. It requires the acquisition of 19 parcels. The district's current estimate for purchasing all required parcels is $8.6 million.

Results of Regional Analyses

For each project, TAMSIM was systematically applied to individual early acquisition scenarios to determine projected cost and time duration outcomes. The results of these individual analyses provide valuable insights in themselves, but they are also needed for later input into EROW to optimize budget decision making when parcel acquisitions from numerous projects are being considered. Table 1 displays the results of TAMSIM analyses performed related to the SH 78 project in Dallas County. TAMSIM analysis results for all regional projects are included on the CD-ROM inserted into a sleeve on the back cover of this report.

An EROW analysis of input from all four projects is also included on the CD-ROM. The provided EROW analysis considers optimal funding allocations for early acquisition budgets ranging from $0.5 million to $10 million. Optimal parcels to be acquired early on each project are identified for each considered early acquisition budget. Figure 1 displays savings and rates of return anticipated to result from each considered early acquisition budget option. Highest rates of return are shown to be in the $0.5 million to $1 million budget area.

Table 1. SH 78 Parcel Cost and Project Time Projections from TAMSIM.

Dallas SH 78 TAMSIM Simulation Results

TAMSIM Scenario Number	Number of Parcels for Early Acquisition	Early Acquisition Parcel ID(s)	Mean Total ROW Cost without Early Acquisition(s), $	Difference in Mean Total ROW Cost Due to Early Acquisition(s), $	Mean Cost of Parcel(s) Acquired Early, $	Mean Time without Early Acquisition(s), months	Reduction in Mean Time with Early Acquisition(s), months	Savings/Cost Ratio of Investment in Early Acquisition(s)
	Selected Input Conditions		OUTPUT: Mean Project Cost			OUTPUT: Duration		
D01	1	78Com-1	$787,793	$9,182	$6,777	50.5	0.7	1.35
D02	1	78Com-2	$787,793	$15,768	$12,888	50.5	0.7	1.22
D03	1	BCCom-1	$787,793	$14,119	$11,999	50.5	0.3	1.18
D04	1	E-BCCom	$787,793	$56,950	$51,332	50.5	0.3	1.11
D05	1	BCCom-2	$787,793	$5,696	$4,497	50.5	0.3	1.27
D06	1	ECT	$787,793	$708	$999	50.5	0.0	0.71
D07	1	Unknown	$787,793	$39,405	$66,346	50.5	0.0	0.59
D08	1	Joint Venture	$787,793	$38,173	$64,470	50.5	0.0	0.59
D09	1	WB	$787,793	$44,653	$16,781	50.5	0.3	2.66
D10	1	MR	$787,793	$241,934	$91,813	50.5	0.3	2.64
D11	2	WB, MR	$787,793	$286,675	$108,593	50.5	0.6	2.64
D12	3	WB, MR, 78Com-1	$787,793	$296,380	$115,371	50.5	1.5	2.57
D13	4	WB, MR, 78Com-1, BCCom-2	$787,793	$302,611	$119,868	50.5	1.9	2.52
D14	5	WB, MR, 78Com-1, BCCom-2, 78Com-2	$787,793	$320,446	$132,756	50.5	3.5	2.41
D15	6	WB, MR, 78Com-1, BCCom-2, 78Com-2, BCCom-1	$787,793	$336,302	$144,756	50.5	4.4	2.32
D16	7	WB, MR, 78Com-1, BCCom-2, 78Com-2, BCCom-1, E-BCCom	$787,793	$395,963	$196,087	50.5	5.7	2.02

Parcel Early Acquisition Simulation Results Sorted by Savings/Cost Ratio

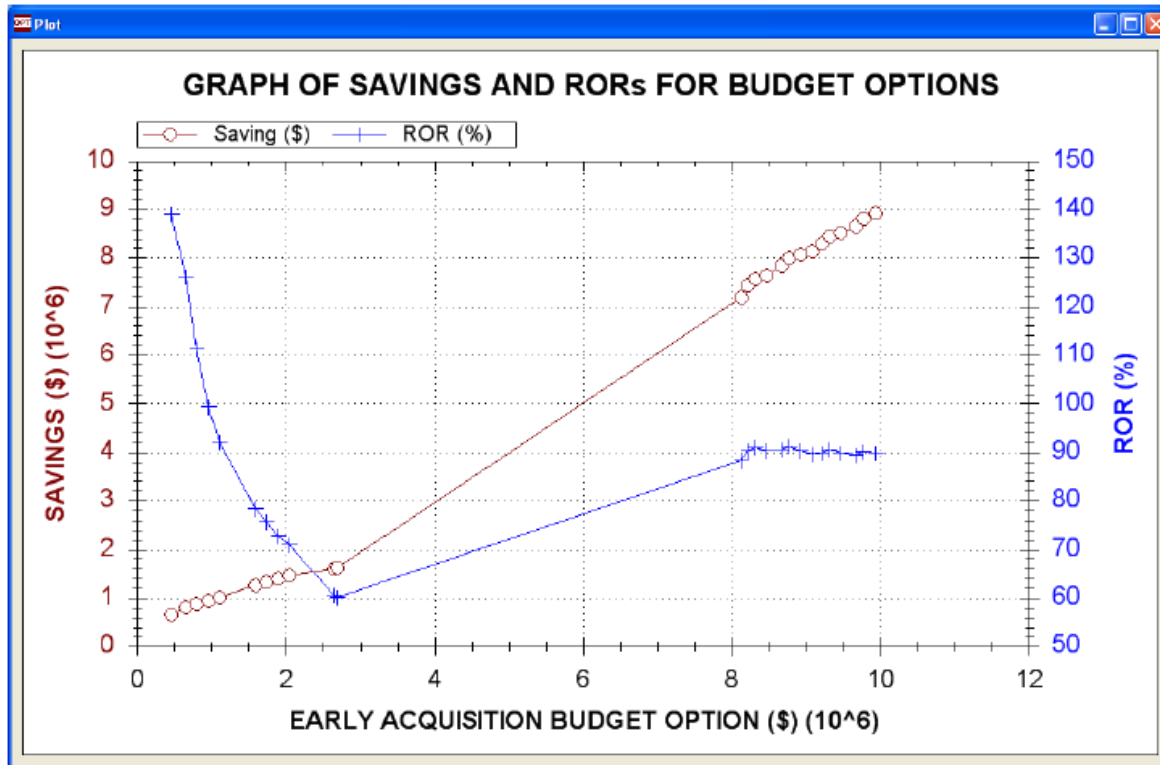| TAMSIM Scenario Number	Number of Parcels for Early Acquisition	Early Acquisition Parcel ID	Mean Total ROW Cost without Early Acquisition(s), $	Difference in Mean Total ROW Cost Due to Early Acquisition(s), $	Mean Cost of Parcel(s) Acquired Early, $	Mean Time without Early Acquisition, months	Reduction in Mean Time with early Acquisition(s), months	Savings/Cost Ratio of Investment in Early Acquisition(s)
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D08	1	Joint Venture	$787,793	$38,173	$64,470	50.5	0.0	0.59

Simulation Conditions

Nominal Local Inflation Selected for Simulation of this Project: 3.0%/Year

Speculation Modeling Was Applied to all Parcels

Speculation Modeling Was Selected to Begin when Schematics First Became Available

Additional Cost Increase Selected for Speculation Modeling: 15.0%/Year

Number of Simulation Replications: 1,000

Random Number Seed Selected: 1

3

Figure 1. EROW Graphical Results Display.

REGIONAL WORKSHOPS

Regional workshops were held in three of TxDOT's four regions. A satisfactory date and location could not be identified in the east region. Table 2 describes the regional workshops. An example workshop agenda and the presentation materials and notes are included on the CD-ROM provided with this report.

Table 2. Regional Workshop Summary.

Region	Date	Workshop Location	Number of Districts	Total Personnel
West	July 1, 2010	Odessa	2	6
North	August 2, 2010	Dallas	1	7
South	August 25, 2010	Austin	3	15

ROW DIVISION DEMONSTRATION

In addition to regional workshops, a meeting was held with the TxDOT ROW Division on August 24, 2010, to demonstrate the tools and to present the results of TAMSIM and EROW

analyses made for each region. Tool application possibilities were discussed for both region use and for use at the ROW Division.

Methods presented as potentials for gathering statewide information for possible legislative consideration included:

1. Limited Region Impact Approach.
    a. Create a generic set of projects to represent the statewide ROW scenario.
    b. Perform analyses to demonstrate potential for taxpayer savings under various expanded early acquisition scenarios.
2. Moderate Region Impact Approach.
    a. Request TAMSIM data for selected projects from each region.
    b. Perform statewide analyses on these selected projects to demonstrate potential for taxpayer savings under various expanded early acquisition scenarios.
3. Comprehensive Analyses.
    a. Request TAMSIM data for all projects at the schematics stage.
    b. Perform statewide analyses of selected or all projects to demonstrate potential for taxpayer savings under various expanded early acquisition scenarios.

Applications of the two tools presented as possibilities to assist with current ROW acquisition decision making included the following:

- Allow regions to support requests for early acquisition dollars for projects with TAMSIM output files.
- Use data from 2.a or 3.a above to select next fiscal year early acquisition budget requests to TxDOT administration.

CHAPTER 2: TOOL REFINEMENTS

Work with regional ROW personnel in the districts allowed the tool developers to observe and identify difficulties that tool users encountered. In some cases, programming bugs were identified, and then corrected, resulting in different tool versions being used during various district visits and workshops. The results of TAMSIM analyses shown in Chapter 1 and included in the CD-ROM were developed using the final tool product resulting from this project (i.e., TAMSIM version 2.0). For this reason, the results shown in this report differ in several cases from results shared with individual districts at the times of the district visits and workshops. Versions 2.0 of both TAMSIM and EROW are included on the CD- ROM with this report.

TAMSIM MODIFICATIONS

Fairly significant revisions were made to TAMSIM during the period of this implementation project. The most fundamental change was to allow the user to designate speculator involvement at the parcel level. Researchers made several significant screen design changes that gave users a more logical and efficient way to enter project and parcel information. In addition, the research team identified and corrected an error in cost calculation. Table 3 lists the more significant TAMSIM modifications.

Table 3. TAMSIM Modifications during Implementation Project.

Item	Description of TAMSIM Modification
1	User now allowed to change initial fixed seed. Default is a fixed initial seed.
2	Display of mean cost of early acquisitions was added to the Project Summary Screen. Also added project name, run date, and CPU time.
3	When Add Rows option is used on the Parcel Data screen, program was modified so that the same number of new rows is also made available on the Parcel Possession/Cost Data screen.
4	Made designation of speculator activity a parcel-level selection by user.
5	Changed default number of replications from 50 to 2500.
6	Added buttons to facilitate navigation back and forth between screens.
7	Adjusted cost distribution model to decrease likelihood of a cost occurring below the mean.
8	Added error checking on Parcel Data Screen for values entered for the duration for improvements to occur.
9	Error check added to Basic Project Data Screen for timing of Environmental Clearance and ROW release.
10	Expanded Help File provided to include additional explanation regarding speculation and inflation and description of EROW.
11	Streamlined program so that long runs do not use as much memory.
12	Created a progress bar so that users know the program has not crashed during long runs.
13	Initialized random number seed when reset.
14	Rearranged output for EROW text files. Multiple scenarios of the same project will now produce a single row of data on button click.
15	Added message indicating successful storing of EROW data.
16	Added option for abbreviated output.
17	Changed procedure for generating parcel costs and durations.
18	Re-calculated multiplier associated with condemned parcels for durations based on ROWIS data.
19	Re-calculated multiplier associated with condemned parcels for costs based on ROWIS data.
20	Re-calculated means and standard deviations for duration and costs.
21	Adjusted Help File to reflect above changes.
22	Changed version number to 2.0.

EROW MODIFICATIONS

      Changes to EROW were modest during the implementation project. Table 4 summarizes these changes.

Table 4. EROW Modifications during Implementation Project.

Item	Description of EROW Modification	Purpose
1	Input data format change	The input data format change improves data compatibility with TAMSIM. In the new input data format, each line of the cost and saving file consists of the project name followed by comma separation. The cost and saving data generated by TAMSIM can now be directly imported to EROW for budget analysis.
2	Import multiple cost and saving files	Provision was made to allow users to import multiple data sets into EROW for budget analysis. This feature allows users to combine separate data sets generated by TAMSIM, possibly even from different districts, within EROW into a single cost and saving data set for state-wide EROW budget analysis. A Reset button was added to clear the input fields in case of an error.
3	User interface enhancements	User interface is changed to enhance user experience. The revisions include the budget data format and the size and shape of the input/output screens.
4	Update version	EROW is now Version 2.0.

APPENDIX – PROCEDURES FOR USING TAMSIM AND EROW TOOLS FOR ROW-ACQUISITION PLANNING

TAMSIM Use to Determine Maximum Benefits Potentially Available from Use of Early Parcel Acquisition on a Single Project

1. Enter all information for the single project to be analyzed into TAMSIM. Revise all automatically displayed default data whenever user knowledge of the project and individual parcels allows tailoring of information to better indicate actual project and individual parcel situations. TAMSIM estimations of potential benefits are improved dramatically through diligent tailoring of default project and parcel information.
2. To determine maximum potential dollar savings on the project, go to the **Parcel Information** screen and, in the second to last column titled **Select for Early Acquisition**, check each box associated with a parcel having the possibility of speculator activity or improvements being made on it prior to acquisition. Run the simulation program. The displayed **Summary** screen indicates an estimate of maximum dollar savings possible through broad use of early acquisition for ROW parcels on this project.
3. Alternatively, should an estimation of maximum time duration benefits be desired, select all project parcels for early acquisition prior to running the TAMSIM simulation.
4. To save the TAMSIM output for later analysis in EROW, click the button titled **Output for EROW**. To save the entire TAMSIM file for possible further viewing and additional runs at a later time, click on the **File** tab at the top, select **Save**, and appropriately name the file.

TAMSIM Use to Determine Parcel Priorities for Use of Early Acquisition on a Single Project

1. Open the saved file of the maximum benefits analysis, go to the first **Parcel Information** data entry screen and modify the **Select for Early Acquisition** check box column for this simulation run, checking only the box next to the first parcel with possibility of improvements or speculator activity.
2. Perform a TAMSIM simulation. The resulting **Summary** screen indicates estimated dollar and time savings possible should this parcel be acquired early. Note the parcel name being acquired early, the **difference in mean cost** ($ Savings), the **difference in mean time** duration savings, and **mean cost of early acquisitions** ($ Costs) on a notepad or put this information into an Excel™ spreadsheet. Using this spreadsheet will facilitate later use of this information.

3. If none of the foregoing simulation data is to be saved, click the **Reset Data** button. Otherwise, make **Back Up** and **Save** copies by going to the **File** tab at the top. Also, to save the TAMSIM output for later analysis in EROW, click the button titled **Output for EROW**. This button must be clicked after each individual TAMSIM run so that the resulting output file will contain information from each TAMSIM run.
4. Repeat the above steps for each of the other individual parcels with possibility of improvements or speculator activity.
5. The created list of parcels on the notepad or in your Excel spreadsheet may now be analyzed. Calculate the Benefit/Cost Ratio for each parcel by dividing the $ Savings by the $ Cost to acquire each parcel. The list may then be sorted three times, first by Benefit/Cost Ratio, highest to lowest; second by $ Savings, highest to lowest; and finally by time duration savings, highest to lowest. Comparing these three prioritized lists allows the user to identify the parcels having greatest possible benefits available to the State of Texas if early acquisition is pursued.

TAMSIM Use to Determine Possible Dollar Benefits from Combinations of Parcels Acquired Early on a Single Project

1. Open a saved file of an earlier simulation of this project, go to the first **Parcel Information** data entry screen, and modify the **Select for Early Acquisition** check box column, this time selecting only the first and second most beneficial parcels shown on the parcel list prioritized by Benefit/Cost Ratio created as described in the section above.
2. Perform a TAMSIM simulation. The resulting **Summary** screen indicates estimated dollar and time savings possible should these two parcels be acquired early.
3. Either note the parcels being acquired early, the **difference in mean cost** ($ Savings), and the **mean cost of early acquisitions** ($ Costs) on a notepad or put this information into an Excel spreadsheet. Using this spreadsheet will facilitate later use of this information.
4. If none of the foregoing simulation data is to be saved, click the **Reset Data** button. Otherwise, make **Back Up** and **Save** copies by going to the **File** tab at the top. Also, to save the TAMSIM output for later analysis in EROW, click the button titled **Output for EROW**. This button must be clicked after each individual TAMSIM run so that the resulting output file will contain information from each TAMSIM run.
5. Repeat the above four steps, but select the first, second, and third most beneficial parcels from the Benefit/Cost Ratio prioritized parcel list.
6. Continue this process, adding the next most beneficial parcel, until the desired amount of information has been determined.

EROW Use to Determine Optimal Budget Amount to Establish for Early ROW Acquisition among Multiple Projects

1. For each project of interest, use TAMSIM as above for each scenario (combination) of parcel early acquisitions to be considered in the EROW optimization analysis to be performed.
2. Create two TXT files from TAMSIM output of simulations of different combinations of early acquisition of parcels for each project. One text file is for costs and the other for savings. Each row in the costs and savings files corresponds to different combinations of acquiring parcels within the same project.
3. Open EROW and on the left side of the **INPUT DATA** screen, enter a **Maximum Budget**, **Minimum Budget**, and budget **Increment** for the analysis to be performed. In the **RESULTS OPTIONS** box, make selections for desired information to be displayed and also enter the appropriate **MARR (Minimum Attractive Rate of Return)**. Incremental analysis using MARR guarantees that the return from the allocated budget to early ROW acquisition is at least equal to the MARR. Then click on the **Add Cost Data** button on the right of the screen to browse, locate and load the appropriate cost TXT file for the desired analysis. Then follow the same procedure for loading the savings TXT file in the area just below the cost data portion of the screen.
4. Click on **SOLVE** to perform the optimization analysis. The table at the top of the **RESULTS** screen indicates optimal scenario selections for each project for each incremental budget option being analyzed. The **Summary** information section at the bottom of the screen shows the **Best Rate of Return** and the **Maximum Savings** possible within the parameters of the analysis.
5. Click on **PLOT RESULTS** to view a graphical depiction of rate of return and maximum savings data. The peaks in the rate of return plot along with the growth in total savings assist in selecting a budget to be set aside for early ROW acquisition.
6. Click on **SAVE RESULTS** to appropriately name and save the EROW optimization analysis for later viewing.

EROW Use to Determine Optimal Utilization of a Given Early ROW Acquisition Budget among Multiple Projects

1. For each project of interest, use TAMSIM as above for each scenario (combination) of parcel early acquisitions to be considered in the EROW optimization analysis to be performed.
2. Create two TXT files from TAMSIM output of simulations of different combinations of early acquisition of parcels for each project, one for costs and the other for savings. Each row in the costs and savings files corresponds to different combinations of acquiring parcels within the same project.

3. Open EROW and on the left side of the **PROJECT INPUTS** screen, enter the available early ROW acquisition budget amount in all three entry fields in the **EARLY ACQUISITION BUDGET ($)** section. In the **RESULTS OPTIONS** selections, deselect the incremental analysis checkbox. Then click on each **Browse** button on the right of the screen to locate and load Costs and then Savings data into EROW from the files created in step 2.
4. Click on **SOLVE** to perform the optimization analysis. The table at the top of the **RESULTS** screen indicates the optimal scenario selections for each project for the given early acquisition budget amount being considered. The **Summary** information section at the bottom of the screen shows the rate of return possible from the available budget amount in the **Best Rate of Return** data field and the possible savings amount is displayed in the **Maximum Savings** data field.
5. Click on **PLOT RESULTS** to view a graphical depiction of rate of return and maximum savings data.
6. Click on **SAVE RESULTS** to appropriately name and save the EROW optimization analysis for later viewing.