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# North Region ROW Tool Implementation Workshop

August 2, 2010

Dallas District Office

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# Welcome and Introductions

# Workshop Objectives

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- Introduce two new ROW acquisition software tools (TAMSIM and EROW) to additional district ROW personnel in region
- Share analysis of parcel acquisition possibilities for a Dallas District project
- Obtain feedback on tools from district ROW personnel

# Tool Capabilities

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- **TAMSIM**

- *Determine Maximum Benefits on a Single Project*
- *Determine Parcel Priorities within a Project*
- *Determine Comparative Benefits from Various Parcel Selection Scenarios (Input Data Files for EROW)*

- **EROW**

- *Determine Optimal Early Acquisition Budget Amount for Multiple Projects*
- *Determine Optimal Use of a Given Early Acquisition Budget*

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# Introduction to Simulation

# Simulation

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- **Simulation is a statistical experiment where a computer model is designed to reproduce probabilistic events that are inherent in the system under consideration.**

# An Example

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- ROW project involving four parcels
- Purchase time for parcels is random
- Goal is to estimate average time at which construction can begin, i.e., when all parcels have been purchased

# Probability Law for the Duration of a Parcel Purchase

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- Twenty-five percent of the time parcel purchase takes five months
- Fifty percent of the time parcel purchase takes ten months
- Twenty-five percent of the time parcel purchase takes twenty months



# Mathematical Description

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- Let  $T$  be a random variable denoting the time duration for parcel acquisition
  - $Pr\{T=5 \text{ mo}\} = 25\%$
  - $Pr\{T=10 \text{ mo}\} = 50\%$
  - $Pr\{T=20 \text{ mo}\} = 25\%$

# Mathematical Description

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- Let  $T$  be a random variable denoting the time duration for parcel acquisition
  - $Pr\{T=5 \text{ mo}\} = 25\%$
  - $Pr\{T=10 \text{ mo}\} = 50\%$
  - $Pr\{T=20 \text{ mo}\} = 25\%$
- Average duration is 11.25 months
- Not equally likely, and not symmetric

# Preparation for Simulation

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- Let  $T$  be a random variable denoting the time duration for parcel acquisition
- Let two coin flips determine simulated time durations that occur
  - $Pr\{T=5 \text{ mo}\} = \text{Tail-Tail}$
  - $Pr\{T=10 \text{ mo}\} = \text{Head-Tail or Tail-Head}$
  - $Pr\{T=20 \text{ mo}\} = \text{Head-Head}$

# A Word about Statistics

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- **Data**
  - \$9,000, \$12,000, \$12,200, \$12,500, \$50,000
- **Mean \$19,140**
- **Median \$12,200**

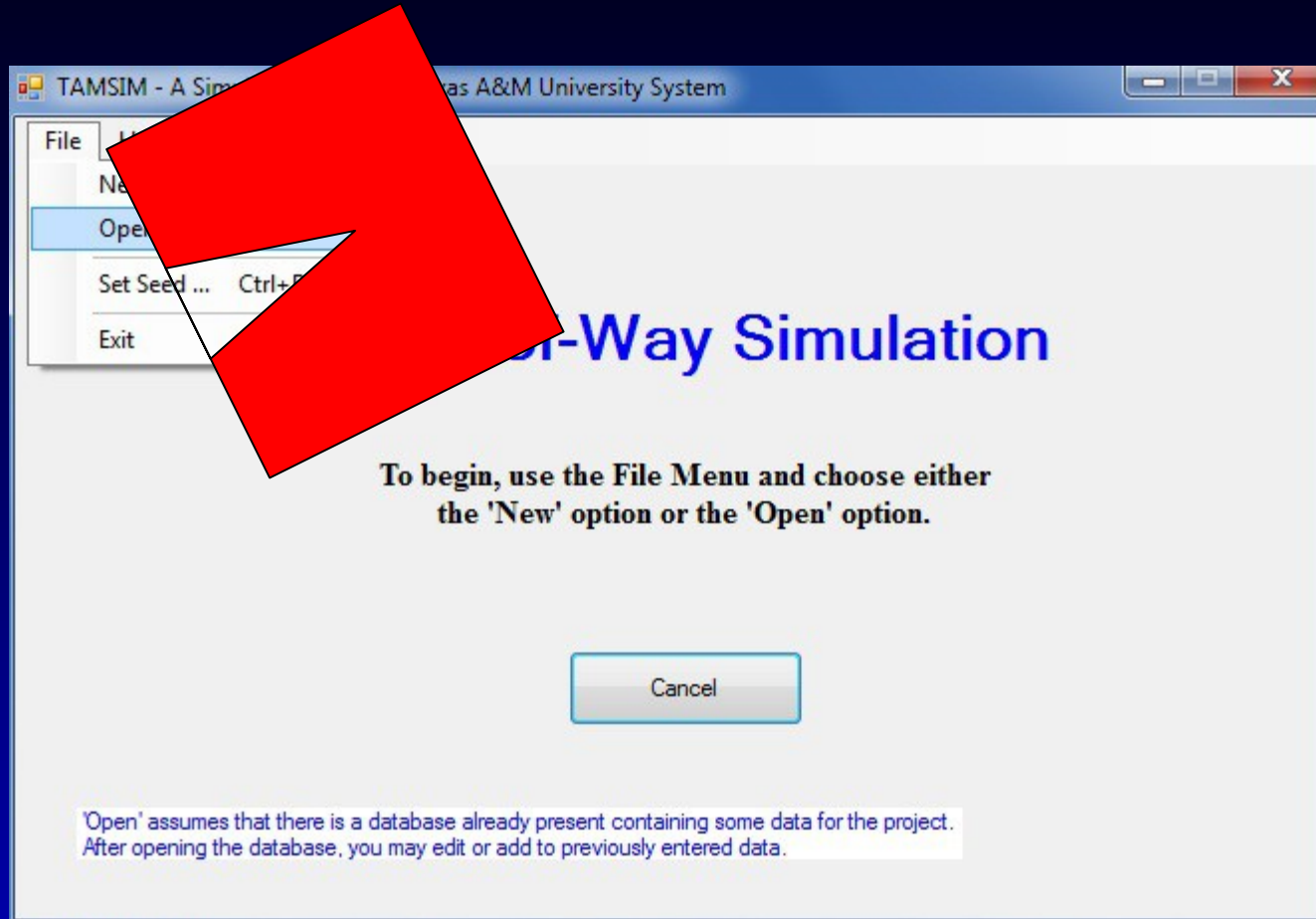
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# TAMSIM Simulation Tool Walkthrough

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# Dallas County SH 78 Practical Exercise Using TAMSIM

# TAMSIM Exercise



# TAMSIM Exercise

TAMSIM - Input of Project Information (F:\455340 ROW AM\Meetings and Reports\North Region Workshop\TAMSIM Exer...)

File View Action Help

## Project Information

**Project Description** SH78 by Dallas District

Total Number of Parcels for the Project 7 Number of Alignments 1

**Project Time Estimates from Schematics Available Until Environmental Clearance, in months**

Estimate of minimum	Estimate of most likely	Estimate of maximum
12	18	36

**Project Time Estimates from Environmental Clearance to ROW Release, in months**

Estimate of minimum	Estimate of most likely	Estimate of maximum
2	4	12

**Project Target for Time from Schematics Available Until all Parcels Purchased, in months**

Target completion date	Penalty cost per day late (\$/day)	Cost reduction per day early (\$/day)
	100	100

Benefit of early finish is sometimes estimated to be 30% of total project costs divided by 365 days.

Run Simulation Quit



# TAMSIM Exercise

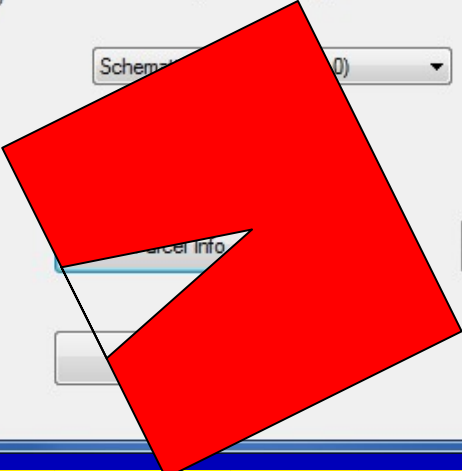
TAMSIM - Input of Simulation Settings (F:\455340 ROW AM\Meetings and Reports\North Region Workshop\TAM...

File View Action Help

## Simulation Settings

Number of replications

Nominal inflation (%/yr)  Additional cost increase due to speculation (%/yr)  Speculation begins  Offset for Speculation



# TAMSIM Exercise

TAMSIM - Input of Parcel Data (F:\455340 ROW AM\Meetings and Reports\North Region Workshop\TAMSIM Exercise\DallasDistrictExercise1.mdb)

File View Action Help

## Parcel Information

(For Urban)

	Num	ID	Associated Alignment	Likelihood of Condemnation	Likelihood of Improvements Beginning after Feasibility Study	Begin Time (months) for Improvement	Min Duration (months) for Improvement	Mode Duration (months) for Improvement	Max Duration (months) for Improvement	Cost Multiplier for Improvements	Select for Early Acquisition	Speculation Modeling Applies
▶	1	78Commercial-1	1	0.5	0.7	4	12	24	60	2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	2	78Commercial-2	1	0.5	0.7	4	12	24	60	2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	3	BearCreekCommercial-1	1	0.2	0.7	4	12	24	60	2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	4	Easement-BearCreekComm	1	0.2	0.7	4	12	24	60	2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	5	BearCreekCommercial-2	1	0.2	0.7	4	12	24	60	2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	6	Edward Cappy Trotter	1	0.2	0	0	0	0	0	1	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	7	Unknown	1	0.5	0	0	0	0	0	1	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Back to Settings Second Parcel Data Screen Simulate Quit

# TAMSIM Exercise

TAMSIM - Input of Parcel Data (F:\455340 ROW AM\Meetings and Reports\North Region Workshop\TAMSIM Exercise\DallasDistrictExercise1.mdb)

File View Action Help

## Parcel Information

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▶	1	78Commercial-1	1	0.5	0.7	4	12	24	60	2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	2	78Commercial-2	1	0.5	0.7	4	12	24	60	2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	3	BearCreekCommercial-1	1	0.2	0.7	4	12	24	60	2	<input checked="" type="checkbox"/>	
	4	Easement-BearCreekComm	1	0.2	0.7	4	12	24	60	2	<input checked="" type="checkbox"/>	
	5	BearCreekCommercial-2	1	0.2	0.7	4	12	24	60	2		
	6	Edward Cappy Trotter	1	0.2	0	0	0	0	0	1		
	7	Unknown	1	0.5	0	0	0	0	0	1		
	8	New Parcel-8	1	0	0	0	0	0	0	1		

Back to Simulation Settings
To Second Parcel Data Screen
Simulate

Add a Parcel
Quit

# TAMSIM Exercise

TAMSIM - Input of Parcel Data (F:\455340 ROW AM\Meetings and Reports\North Region Workshop\TAMSIM Exercise\DallasDistrictExercise1.mdb)

File View Action Help

## Parcel Information

(For Urban)

Num	ID	Associated Alignment	Likelihood of Condemnation	Likelihood of Improvements Beginning after Feasibility Study	Begin Time (months) for Improvement	Min Duration (months) for Improvement	Mode Duration (months) for Improvement	Max Duration (months) for Improvement	Cost Multiplier for Improvements	Select for Early Acquisition	Speculation Modeling Applies
1	78Commercial-1	1	0.5	0.7	4	12	24	60	2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
2	78Commercial-2	1	0.5	0.7	4	12	24	60	2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
3	BearCreekCommercial-1	1	0.2	0.7	4	12	24	60	2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
4	Easement-BearCreekComm	1	0.2	0.7	4	12	24	60	2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
5	BearCreekCommercial-2	1	0.2	0.7	4	12	24	60	2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
6	Edward Cappy Trotter	1	0.2	0	0	0	0	0	1	<input type="checkbox"/>	<input checked="" type="checkbox"/>
7	Unknown	1	0.5	0	0	0	0	0	1	<input type="checkbox"/>	<input checked="" type="checkbox"/>
8	Joint Venture	1	0.5	0	0	0	0	0	1	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Back to Screen Second Parcel Data Screen Simulate Quit

# TAMSIM Exercise

TAMSIM - Input of Parcel Data (F:\455340 ROW AM\Meetings and Reports\North Region Workshop\TAMSIM Exercise\DallasDistrictExercise1.mdb)

File View Action Help

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	1	78Commercial-1	1	0.5	0.7	4	12	24	60	2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	2	78Commercial-2	1	0.5	0.7	4	12	24	60	2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	3	BearCreekCommercial-1	1	0.2	0.7	4	12	24	60	2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	4	Easement-BearCreekComm	1	0.2	0.7	4	12	24	60	2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	5	BearCreekCommercial-2	1	0.2	0.7	4	12	24	60	2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	6	Edward Cappy Trotter	1	0.2	0	0	0	0	0	1	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	7	Unknown	1	0.5	0	0	0	0	0	1	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	8	Joint Venture	1	0.5	0	0	0	0	0	1	<input type="checkbox"/>	<input checked="" type="checkbox"/>
▶	9	New Parcel-9	1	0	0	0	0	0	0	1	<input type="checkbox"/>	<input type="checkbox"/>

Back to Simulation Settings      To Second Parcel Data Screen      Simulate

Add a Parcel      Quit

# TAMSIM Exercise

TAMSIM - Input of Parcel Data (F:\455340 ROW AM\Meetings and Reports\North Region Workshop\TAMSIM Exercise\DallasDistrictExercise1.mdb)

File View Action Help

## Parcel Information

(For Urban)

Num	ID	Associated Alignment	Likelihood of Condemnation	Likelihood of Improvements Beginning after Feasibility Study	Begin Time (months) for Improvement	Min Duration (months) for Improvement	Mode Duration (months) for Improvement	Max Duration (months) for Improvement	Cost Multiplier for Improvements	Select for Early Acquisition	Speculation Modeling Applies
1	78Commercial-1	1	0.5	0.7	4	12	24	60	2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
2	78Commercial-2	1	0.5	0.7	4	12	24	60	2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
3	BearCreekCommercial-1	1	0.2	0.7	4	12	24	60	2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
4	Easement-BearCreekComm	1	0.2	0.7	4	12	24	60	2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
5	BearCreekCommercial-2	1	0.2	0.7	4	12	24	60	2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
6	Edward Cappy Trotter	1	0.2	0	0	0	0	0	1	<input type="checkbox"/>	<input checked="" type="checkbox"/>
7	Unknown	1	0.5	0	0	0	0	0	1	<input type="checkbox"/>	<input checked="" type="checkbox"/>
8	Joint Venture	1	0.5	0	0	0	0	0	1	<input type="checkbox"/>	<input checked="" type="checkbox"/>
9	William Boyd	1	0.2	0.7	4	12	24	60	6	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Back to Selection Screen Second Parcel Data Screen Simulate Quit

# TAMSIM Exercise

TAMSIM - Input of Parcel Data (F:\455340 ROW AM\Meetings and Reports\North Region Workshop\TAMSIM Exercise\DallasDistrictExercise1.mdb)

File View Action Help

## Parcel Information

(For Urban)

	Num	ID	Associated Alignment	Likelihood of Condemnation	Likelihood of Improvements Beginning after Feasibility Study	Begin Time (months) for Improvement	Min Duration (months) for Improvement	Mode Duration (months) for Improvement	Max Duration (months) for Improvement	Cost Multiplier for Improvements	Select for Early Acquisition	Speculation Modeling Applies
	1	78Commercial-1	1	0.5	0.7	4	12	24	60	2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	2	78Commercial-2	1	0.5	0.7	4	12	24	60	2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	3	BearCreekCommercial-1	1	0.2	0.7	4	12	24	60	2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	4	Easement-BearCreekComm	1	0.2	0.7	4	12	24	60	2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	5	BearCreekCommercial-2	1	0.2	0.7	4	12	24	60	2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	6	Edward Cappy Trotter	1	0.2	0	0	0	0	0	1	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	7	Unknown	1	0.5	0	0	0	0	0	1	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	8	Joint Venture	1	0.5	0	0	0	0	0	1	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	9	William Boyd	1	0.2	0.7	4	12	24	60	6	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
▶	10	New Parcel-10	1	0	0	0	0	0	0	1	<input type="checkbox"/>	<input type="checkbox"/>

Back to Simulation Settings

To Second Parcel Data Screen

Simulate

Add a Parcel

Quit

# TAMSIM Exercise

TAMSIM - Input of Parcel Data (F:\455340 ROW AM\Meetings and Reports\North Region Workshop\TAMSIM Exercise\DallasDistrictExercise1.mdb)

File View Action Help

## Parcel Information

(For Urban)

	Num	ID	Associated Alignment	Likelihood of Condemnation	Likelihood of Improvements Beginning after Feasibility Study	Begin Time (months) for Improvement	Min Duration (months) for Improvement	Mode Duration (months) for Improvement	Max Duration (months) for Improvement	Cost Multiplier for Improvements	Select for Early Acquisition	Speculation Modeling Applies
	1	78Commercial-1	1	0.5	0.7	4	12	24	60	2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	2	78Commercial-2	1	0.5	0.7	4	12	24	60	2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	3	BearCreekCommercial-1	1	0.2	0.7	4	12	24	60	2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	4	Easement-BearCreekComm	1	0.2	0.7	4	12	24	60	2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	5	BearCreekCommercial-2	1	0.2	0.7	4	12	24	60	2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	6	Edward Cappy Trotter	1	0.2	0	0	0	0	0	1	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	7	Unknown	1	0.5	0	0	0	0	0	1	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	8	Joint Venture	1	0.5	0	0	0	0	0	1	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	9	William Boyd	1	0.2	0.7	4		24	60	6	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
▶	10	Meredith Roark	1	0.2	0.7	4		24	60	6	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Back to Simulation Settings

Add a Parcel

Simulate



# TAMSIM Exercise

TAMSIM - Continuation of Parcel Data (F:\455340 ROW AM\Meetings and Reports\North Region Workshop\TAMSIM Exercise\DallasDistrictExercise1.mdb)

File View Action Help

## Parcel Information - Continued

(For Urban)

Parcel Num	Name	Min-5% Duration from ROW Release to Possession in months	Median Duration from ROW Release to Possession in months	Mean Duration from ROW Release to Possession in months	StDev Duration from ROW Release to Possession in months	Max-95% Duration from ROW Release to Possession in months	Multiplier for Duration for condemn	MinCost (land, improve, damage x\$1000)	MedCost (land, improve, damage x\$1000)	MeanCost (land, improve, damage x\$1000)	StDevCost (land, improve, damage x\$1000)
0	Standard Project Parcel	8.4	11.7	12.0	2.5	16.5	1.000	82.1	97.1	97.6	10.0
1	78Commercial-1	8.4	11.7	12.0	2.5	16.5	1.500	0.3	2.2	5.0	10.0
2	78Commercial-2	8.4	11.7	12.0	2.5	16.5	1.500	1.3	5.8	8.8	10.0
3	BearCreekCommercial-1	8.4	11.7	12.0	2.5	16.5	1.500	1.6	6.5	9.5	10.0
4	Easement-BearCreekComm	8.4	11.7	12.0	2.5	16.5	1.500	26.4	39.3	40.5	10.0
5	BearCreekCommercial-2	8.4	11.7	12.0	2.5	16.5	1.500	0.1	1.3	3.8	10.0
6	Edward Cappy Trotter	8.4	11.7	12.0	2.5	16.5	1.000	0.0	0.1	1.0	10.0
7	Unknown	8.4	11.7	12.0	2.5	16.5	1.000	23.5	36.2	37.5	10.0
8	Joint Venture	8.4	11.7	12.0	2.5	16.5	1.000	23.5	36.2	37.5	10.0
9	William Boyd	8.4	11.7	12.0	2.5	16.5	1.000	23.5	36.2	37.5	10.0
10	Meredith Roark	8.4	11.7	12.0	2.5	16.5	1.000	23.5	36.2	37.5	10.0

Back to First Parcel Data Screen SIMULATE

# TAMSIM Exercise

TAMSIM - Continuation of Parcel Data (F:\455340 ROW AM\Meetings and Reports\North Region Workshop\TAMSIM Exercise\DallasDistrictExercise1.mdb)

File View Action Help

## Parcel Information - Continued

(For Urban)

Parcel Num	Name	StDev Duration from ROW Release to Possession in months	Max-95% Duration from ROW Release to Possession in months	Multiplier for Duration for condemn	MinCost (land, improve, damage x\$1000)	MedCost (land, improve, damage x\$1000)	MeanCost (land, improve, damage x\$1000)	StDevCost (land, improve, damage x\$1000)	Max-95% Cost (land, improve, damage x\$1000)	Multiplier of Cost for condemn
0	Standard Project Parcel	2.5	16.5	1.000	82.1	97.1	97.6	10.0	114.9	1.500
1	78Commercial-1	2.5	16.5	1.500	0.3	2.2	5.0	10.0	18.0	1.500
2	78Commercial-2	2.5	16.5	1.500	1.3	5.8	8.8	10.0	25.9	1.500
3	BearCreekCommercial-1	2.5	16.5	1.500	1.6	6.5	9.5	10.0	27.1	1.500
4	Easement-BearCreekComm	2.5	16.5	1.500	26.4	39.3	40.5	10.0	58.7	1.500
5	BearCreekCommercial-2	2.5	16.5	1.500	0.1	1.3	3.8	10.0	14.2	1.500
6	Edward Cappy Trotter	2.5	16.5	1.000	0.0	0.1	1.0	10.0	3.4	1.500
7	Unknown	2.5	16.5	1.000	23.5	36.2	37.5	10.0	55.8	1.500
8	Joint Venture	2.5	16.5	1.000	33.5	47.0	48.0	10.0	66.0	1.500
9	William Boyd	2.5	16.5	1.500		8.5	11.3	10.0	29.6	1.500
10	Meredith Roark	2.5	16.5	1.500		60.0	60.8	10.0	78.5	1.500

Back to First Parcel Data Screen Quit

# TAMSIM Exercise

TAMSIM - Summarized Output (F:\455340 ROW AM\Meetings and Reports\North Region Workshop\TAMSIM Exercise\DallasDistrictExercise1.mdb)

File View Help

## Summary for "SH78"

Time refers to the span of time from the availability of the schematics to when all parcels have been purchased.

**No Early Acquisition**  
10 total parcels purchased

mean time (months):	51.2	95% confidence interval +/- 0.3	mean cost	\$635,974	95% confidence interval +/- \$9,766
median time (months)	51.0	+ 0.5 or -0.5	median cost	\$646,856	+\$472,176 or \$444,188
min-10% time (months)	43		min-10% cost	\$372,711	
max-90% time (months)	60		max-90% cost	\$858,247	

## Impact of Early Acquisition

7 parcels purchased early

difference in mean time	-5.9	95% confidence interval +/- 0.2	difference in mean cost	-\$332,844	95% confidence interval +/- \$7,942
difference in median	-5.7		difference in median	-\$361,089	
min-10% time	-11.1		min-10% cost	-\$506,931	
max-90% time	-0.5		max-90% cost	-\$106,443	

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mean cost of early acquisitions

\$183,803	95% confidence interval +/- \$2,655
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Note: a negative difference in cost reduction.

Run Date: 7/29/2010 3:09:30 AM CPU Time: 0.61 sec. by Dallas District

# TAMSIM Exercise

TAMSIM - Summarized Output (F:\455340 ROW AM\Meetings and Reports\North Region Workshop\TAMSIM Exercise\DallasDistrictExercise1.mdb)

File View Help

## Summary for "SH78"

Time refers to the span of time from the availability of the schematics to when all parcels have been purchased.

### No Early Acquisition

10 total parcels purchased

mean time (months):	51.2	95% confidence interval	+/- 0.3	mean cost	\$635,974	95% confidence interval	+/- \$9,766
median time (months)	51.0		+ 0.5 or -0.5	median cost	\$646,856		+\$472,176 or \$444,188
min-10% time (months)	43	max-90% time (months)	60	min-10% cost	\$372,711	max-90% cost	\$858,247
difference in mean time	-5.9	95% confidence interval	+/- 0.2	confidence interval			+/- \$7,942
difference in median	-5.7						
min-10% time	-11.1	max-90% time	-0.5	min-10% cost		max-90% cost	-\$106,443
mean cost of early acquisitions	\$183,803	95% confidence interval	+/- \$2,655				

Run Date: 7/29/2010 3:09:30 AM CPU Time: 0.61 sec. by Dallas District

**TAMSIM Data Saved**

The following data has been saved for EROW use:

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# ***BREAK***

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# Introduction to Optimization

# Introduction to Optimization

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- Optimization is derived from the Latin word “optimus,” meaning the best.
- Organizations are striving to streamline their business processes to maximize utility of resources.



- What is the best (optimal) way of using resources (e.g., workforce, machinery,

# Example

- We have 5 projects to choose from.

Project	1	2	3	4	5
Cost, \$	10	24	14	5	7
Net profit, \$	20	60	25	9	15

- The total budget available is \$40.  
Which ones would you choose?



# Analysis of Possibilities

Projects Selected	Total Cost of Projects Selected	Total Profits from Projects Selected	Benefit/Cost Ratio
2,3			
1,2,4			
1,3,4,5			
2,4,5			

# Analysis of Possibilities

Projects Selected	Total Cost of Projects Selected	Total Profits from Projects Selected	Benefit/Cost Ratio
2,3	\$38	\$85	2.24
1,2,4			
1,3,4,5			
2,4,5			

# Analysis of Possibilities

Projects Selected	Total Cost of Projects Selected	Total Profits from Projects Selected	Benefit/Cost Ratio
2,3	\$38	\$85	2.24
1,2,4	\$39	\$89	2.28
1,3,4,5			
2,4,5			

# Analysis of Possibilities

Projects Selected	Total Cost of Projects Selected	Total Profits from Projects Selected	Benefit/Cost Ratio
2,3	\$38	\$85	2.24
1,2,4	\$39	\$89	2.28
1,3,4,5	\$36	\$69	1.92
2,4,5			

# Analysis of Possibilities

Projects Selected	Total Cost of Projects Selected	Total Profits from Projects Selected	Benefit/Cost Ratio
2,3	\$38	\$85	2.24
1,2,4	\$39	\$89	2.28
1,3,4,5	\$36	\$69	1.92
2,4,5	\$36	\$84	2.33

# Optimization

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- Optimization falls in the category of decision support tools.
- Involves building a mathematical model of business processes and solve the model to find the best (optimal) input mix to achieve the stated objective.
- The solution is obtained by systematically choosing values of decision variables within their allowable range.

# Optimization

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- There are different optimization methods/algorithms:
  - nonlinear programming,
  - linear programming,
  - mixed integer programming,
  - dynamic programming, etc.

# Dynamic Programming

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- A method of solving optimization problems that exhibit a special structure.
- The problem is divided into a sequence of overlapping sub problems and the solution from one is used to solve the next one.
- When compared with total enumeration of all solutions, dynamic



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# EROW Optimization Tool Walkthrough

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# EROW Practical Exercise

# TAMSIM Output for EROW

TAMSIM - Summarized Output (C:\Documents and Settings\p-krugler\Desktop\TAMSIM 1.1 (07142010)\TAMSIM\_folder\DallasDistrict\_v2Original.mdb)

File View Help

## Summary for "SH78 from SH205 to FM6"

Time refers to the span of time from the availability of the schematics to when all parcels have been purchased.

### No Early Acquisition

10 total parcels purchased

mean time (months):	51.2	95% confidence interval +/- 0.3	mean cost	\$580,593	95% confidence interval +/- \$9,743
median time (months)	51.0	+ 0.5 or -0.5	median cost	\$591,033	+\$417,940 or \$389,082
min-10% time (months)	43		min-10% cost	\$312,048	
max-90% time (months)	60		max-90% cost	\$810,173	

### Impact of Early Acquisition

7 parcels purchased early

difference in mean time	-5.9	95% confidence interval +/- 0.2	difference in mean cost	-\$332,489	+/- \$7,336
difference in median	-5.7		difference in median	-\$360,842	
min-10% time	-11.1		min-10% cost	-\$506,416	
max-90% time	-0.5		max-90% cost	-\$106,168	

Note: a negative difference is a cost reduction.

mean cost of early acquisitions

\$183,659

95% confidence interval  
+/- \$2,654

Run Date: 7/30/2010 11:52:52 AM CPU Time: 0.70 sec. by Dallas District

Reset Data Quit

Output for EROW

# Standard TAMSIM Runs for EROW Optimization

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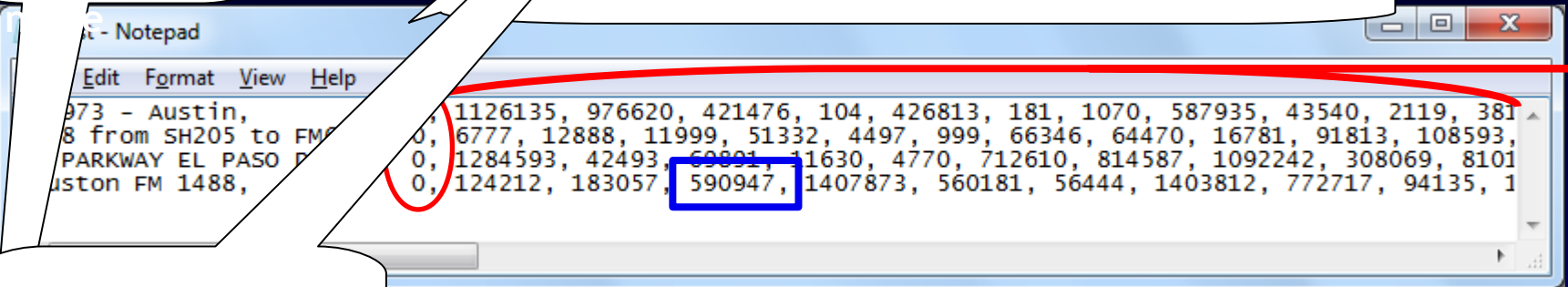
- A series of TAMSIM runs to determine individual parcel costs and savings should each parcel alone be purchased early.
- A series of TAMSIM runs to determine costs and savings of groupings of parcels. Parcel groupings are created based on individual parcel rates of return, from highest to lowest.

# TAMSIM Runs and Output for SH78

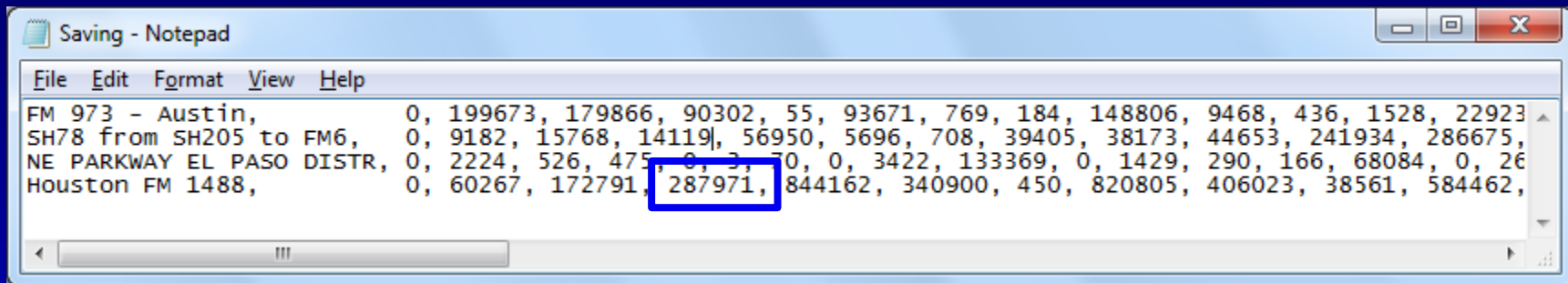
Speculation Begins: Schematics Available (Time 0)									
Additional Cost Increase Due to Speculation (%/yr): 15.00%									
Project Identification Number (ROW CSJ Number)	Scenario No.	Selected Input Conditions		OUTPUT: Mean Project Cost			OUTPUT: Duration		Saving/Cost Ratio
		Number of Parcels for Early Acquisition	Early Acquisition Parcel ID	Mean Cost without early acquisition	Difference in Mean Cost due to early acquisition	Mean Cost of Early Acquisition	Mean Time w/o early acquisition	Difference in Mean Time	
Dallas SH78 from SH205 to FM6	D01	1	1	\$787,793	\$9,182	\$6,777	50.5	0.7	1.35
	D02	1	2	\$787,793	\$15,768	\$12,888	50.5	0.7	1.22
	D03	1	3	\$787,793	\$14,119	\$11,999	50.5	0.3	1.18
	D04	1	4	\$787,793	\$56,950	\$51,332	50.5	0.3	1.11
	D05	1	5	\$787,793	\$5,696	\$4,497	50.5	0.3	1.27
	D06	1	6	\$787,793	\$708	\$999	50.5	0.0	0.71
	D07	1	7	\$787,793	\$39,405	\$66,346	50.5	0.0	0.59
	D08	1	8	\$787,793	\$38,173	\$64,470	50.5	0.0	0.59
	D09	1	9	\$787,793	\$44,653	\$16,781	50.5	0.3	2.66
	D10	1	10	\$787,793	\$241,934	\$91,813	50.5	0.3	2.64
	D11	2	9, 10	\$787,793	\$286,675	\$108,593	50.5	0.6	2.64
	D12	3	9, 10, 1	\$787,793	\$296,380	\$115,371	50.5	1.5	2.57
	D13	4	9, 10, 1, 5	\$787,793	\$302,611	\$119,868	50.5	1.9	2.52
	D14	5	9, 10, 1, 5, 2	\$787,793	\$320,446	\$132,756	50.5	3.5	2.41
	D15	6	9, 10, 1, 5, 2, 3	\$787,793	\$336,302	\$144,756	50.5	4.4	2.32
	D16	7	9, 10, 1, 5, 2, 3, 4	\$787,793	\$395,963	\$196,087	50.5	5.7	2.02

# EROW Input Files

Scenario 1. Scenario 2. Scenario 3. Scenario



```
File Edit Format View Help
973 - Austin, 0, 1126135, 976620, 421476, 104, 426813, 181, 1070, 587935, 43540, 2119, 381
8 from SH205 to FM6, 0, 6777, 12888, 11999, 51332, 4497, 999, 66346, 64470, 16781, 91813, 108593,
PARKWAY EL PASO DISTR, 0, 1284593, 42493, 59891, 11630, 4770, 712610, 814587, 1092242, 308069, 8101
Houston FM 1488, 0, 124212, 183057, 590947, 1407873, 560181, 56444, 1403812, 772717, 94135, 1
```



```
File Edit Format View Help
FM 973 - Austin, 0, 199673, 179866, 90302, 55, 93671, 769, 184, 148806, 9468, 436, 1528, 22923
SH78 from SH205 to FM6, 0, 9182, 15768, 14119, 56950, 5696, 708, 39405, 38173, 44653, 241934, 286675,
NE PARKWAY EL PASO DISTR, 0, 2224, 526, 475, 0, 3, 70, 0, 3422, 133369, 0, 1429, 290, 166, 68084, 0, 26
Houston FM 1488, 0, 60267, 172791, 287971, 844162, 340900, 450, 820805, 406023, 38561, 584462,
```

# EROW Input Screen

EROW Optimization

INPUT DATA RESULTS Help About

EARLY ACQUISITION BUDGET (\$)

Maximum Budget

Minimum Budget

Increment

RESULTS OPTIONS

☒ Display Selected Project Scenarios

☒ Apply Incremental Analysis with MARR

MARR  %

(Minimum Attractive Rate of Return)

STATUS

-- No costs or savings data is read --

DATA (\$)

Costs

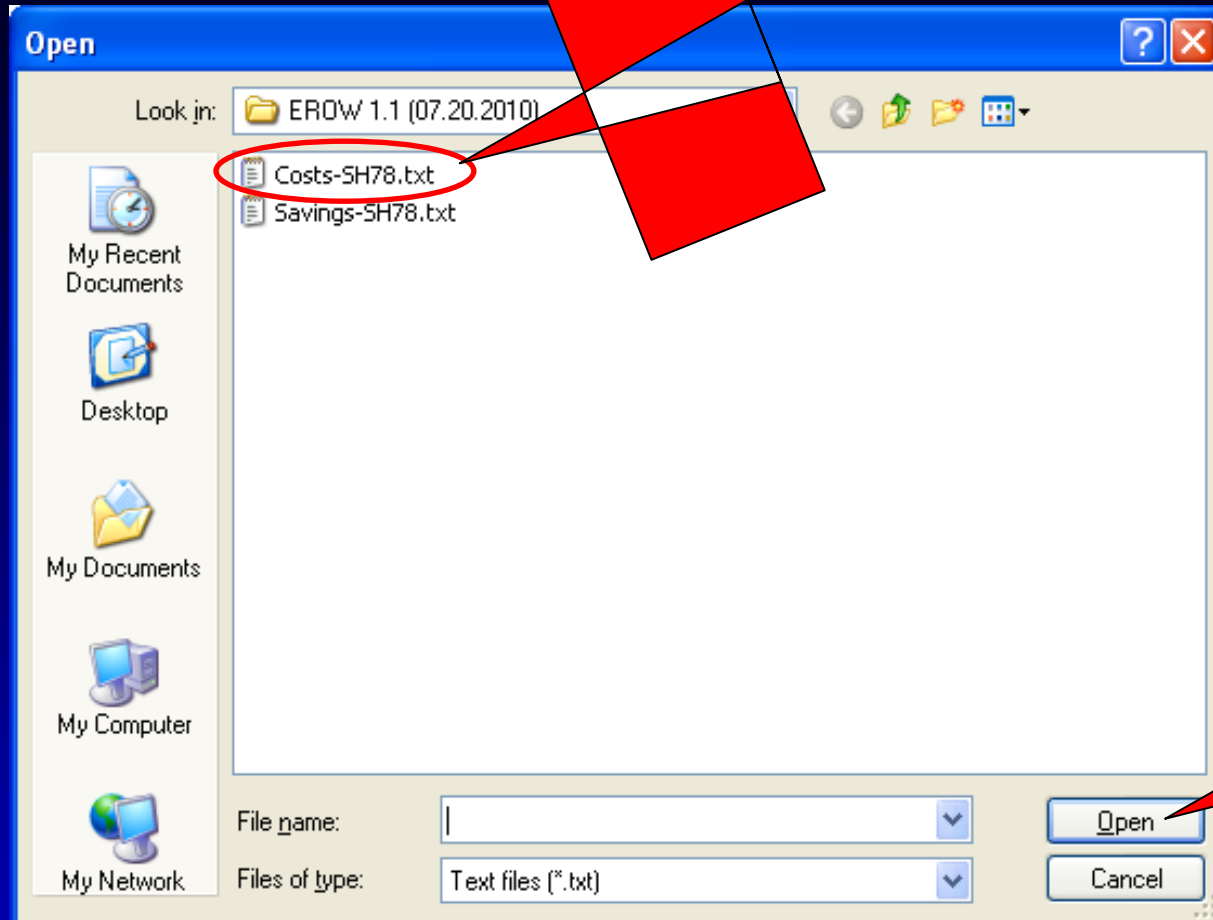
Add Cost Data Reset

Savings

Add Saving Data Reset

SOLVE

# EROW Input Screen





# EROW Input Screen

OPT EROW Optimization

INPUT DATA

RESULTS

Help

About

EARLY ACQUISITION BUDGET (\$)

Maximum Budget

Minimum Budget

Increment

RESULTS OPTIONS

☒ Display Selected Project Scenarios

☒ Apply Incremental Analysis with MARR

MARR 25 %

(Minimum Attractive Rate of Return)

STATUS

Costs data for 4 projects is read.

DATA (\$)

Costs

Add Cost Data

Reset

	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
▶ FM 973 - Austin	0	1126135	976620	421476	104
SH78 from SH205 to FM6	0	6777	12888	11999	51332
NE PARKWAY EL PASO DISTR	0	1284593	42493	69891	116
Houston FM 1488	0	124212	183057	590947	1407
*					

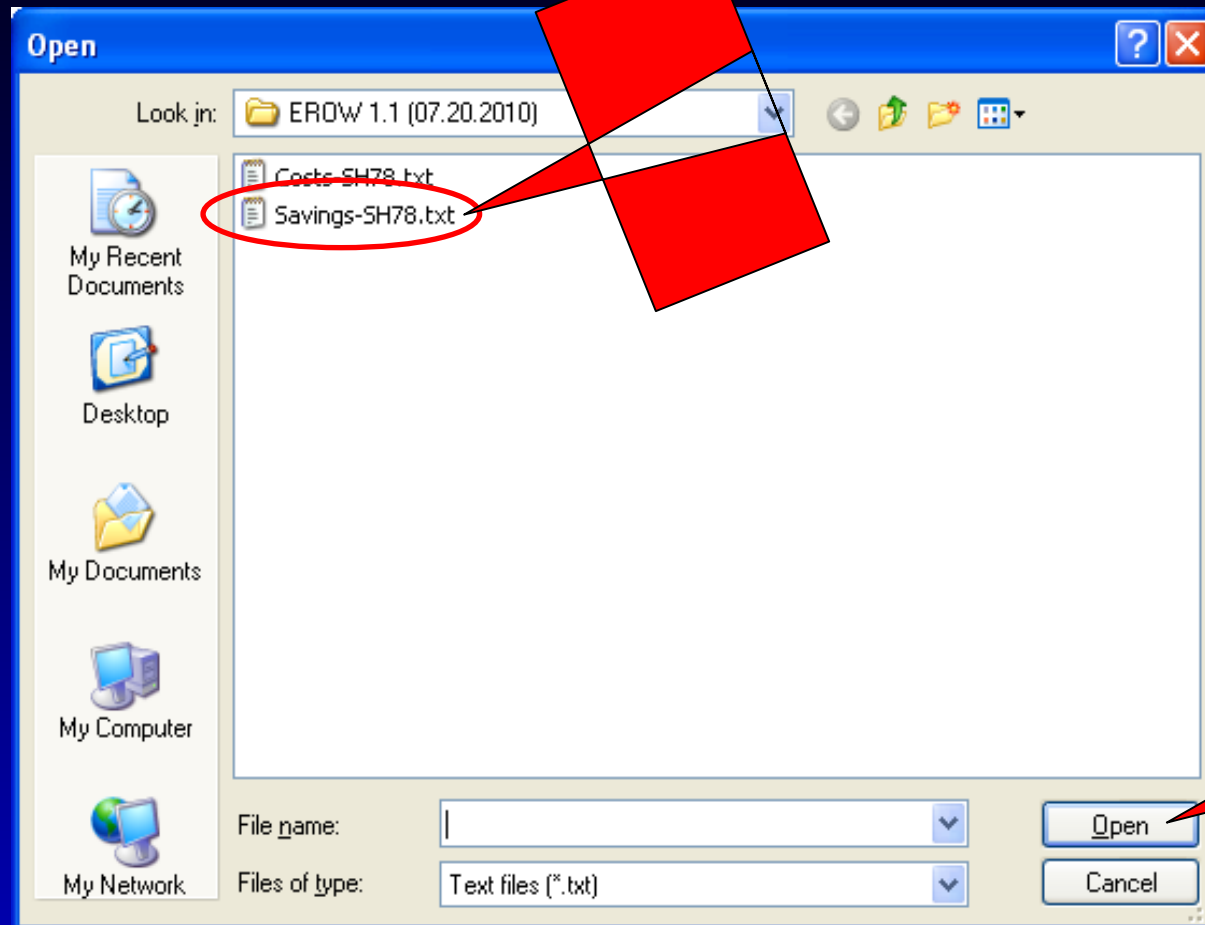
Savings

Add Saving Data

Reset

SOLVE

# EROW Input Screen



# EROW Input Screen

### INPUT DATA

#### EARLY ACQUISITION BUDGET (\$)

Maximum Budget

Minimum Budget

Increment

#### RESULTS OPTIONS

☒ Display Selected Project Scenarios

☒ Apply Incremental Analysis with MARR

MARR  %  
(Minimum Attractive Rate of Return)

#### STATUS

Savings data for 4 projects is read.

### RESULTS

[Help](#)
[About](#)

#### DATA (\$)

[Add Cost Data](#)
[Reset](#)

	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
▶ FM 973 - Austin	0	1126135	976620	421476	104
SH78 from SH205 to FM6	0	6777	12888	11999	51332
NE PARKWAY EL PASO DISTR	0	1284593	42493	69891	11630
Houston FM 1488	0	124212	183057	590947	140787
*					

#### Savings

[Add Saving Data](#)
[Reset](#)

	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
▶ FM 973 - Austin	0	199673	179866	90302	55
SH78 from SH205 to FM6	0	9182	15768	14119	56950
NE PARKWAY EL PASO DISTR	0	2224	526	475	0
Houston FM 1488	0	60267	172791	287971	844162
*					

SOLVE

**EROW Optimization**

INPUT DATA
RESULTS
Help About

---

### EARLY ACQUISITION BUDGET (\$)

Maximum Budget:

Minimum Budget:

Increment:

(Enter a number > .49 and =< 9990000 )

### DATA (\$)

	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
▶ FM 973 - Austin	0	1126135	976620	421476	104
SH78 from SH205 to FM6	0	6777	12888	11999	51332
NE PARKWAY EL PASO DISTR	0	1284593	42493	69891	11630
Houston FM 1488	0	124212	183057	590947	140787
*					

---

### RESULTS OPTIONS

☒ Display Selected Project Scenarios

☒ Apply Incremental Analysis with MARR

MARR:  %  
(Minimum Attractive Rate of Return)

### Savings

	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
▶ FM 973 - Austin	0	199673	179866	90302	55
SH78 from SH205 to FM6	0	9182	15768	14119	56950
NE PARKWAY EL PASO DISTR	0	2224	526	475	0
Houston FM 1488	0	60267	172791	287971	844162
*					

Status: Data Processed.

OPT

EROW Optimization

INPUT DATA

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EARLY ACQUISITION BUDGET (\$)

Maximum Budget

\$15,000,000

Minimum Budget

\$1,000

Increment

\$1,000

(Enter number > 49 and =< \$100,000)

RESULTS OPTIONS

☒ Display Selected Project Scenarios

☒ Apply Incremental Analysis with MARR

MARR 

25

 %  
(Minimum Attractive Rate of Return)

STATUS

Data Processed.

DATA (\$)

Costs

Add Cost Data

Reset

	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
▶ FM 973 - Austin	0	1126135	976620	421476	104
SH78 from SH205 to FM6	0	6777	12888	11999	51332
NE PARKWAY EL PASO DISTR	0	1284593	42493	69891	11630
Houston FM 1488	0	124212	183057	590947	140787
*					

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Savings

Add Saving Data

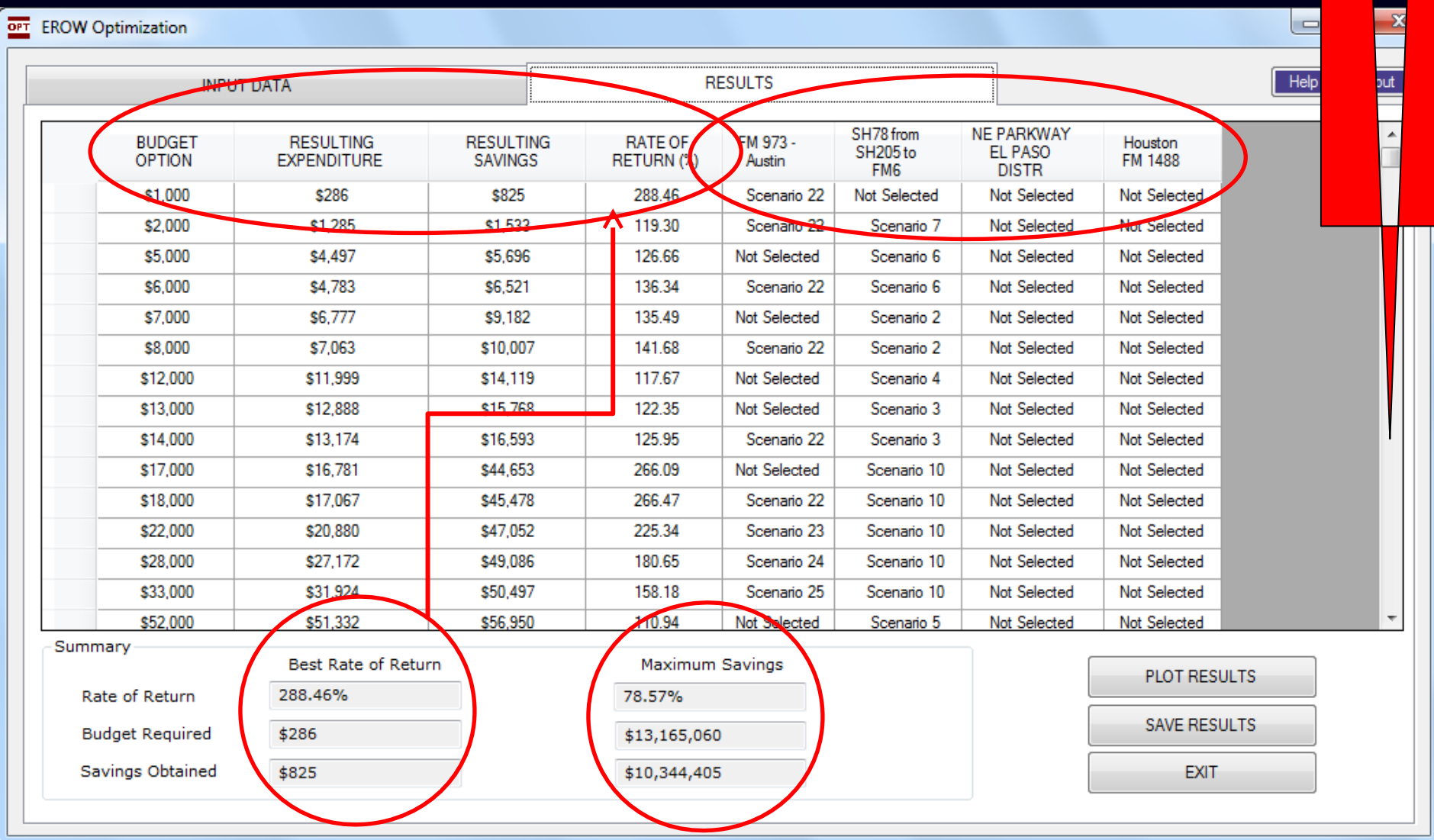
Reset

	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
▶ FM 973 - Austin	0	199673	179866	90302	55
SH78 from SH205 to FM6	0	9182	15768	14119	56950
NE PARKWAY EL PASO DISTR	0	2224	526	4755	0
Houston FM 1488	0	60267	172791		44162
*					

< ||| >

SOLVE

# EROW Output Screen



# EROW Output Screen

OPT EROW Optimization

INPUT DATA RESULTS Help About

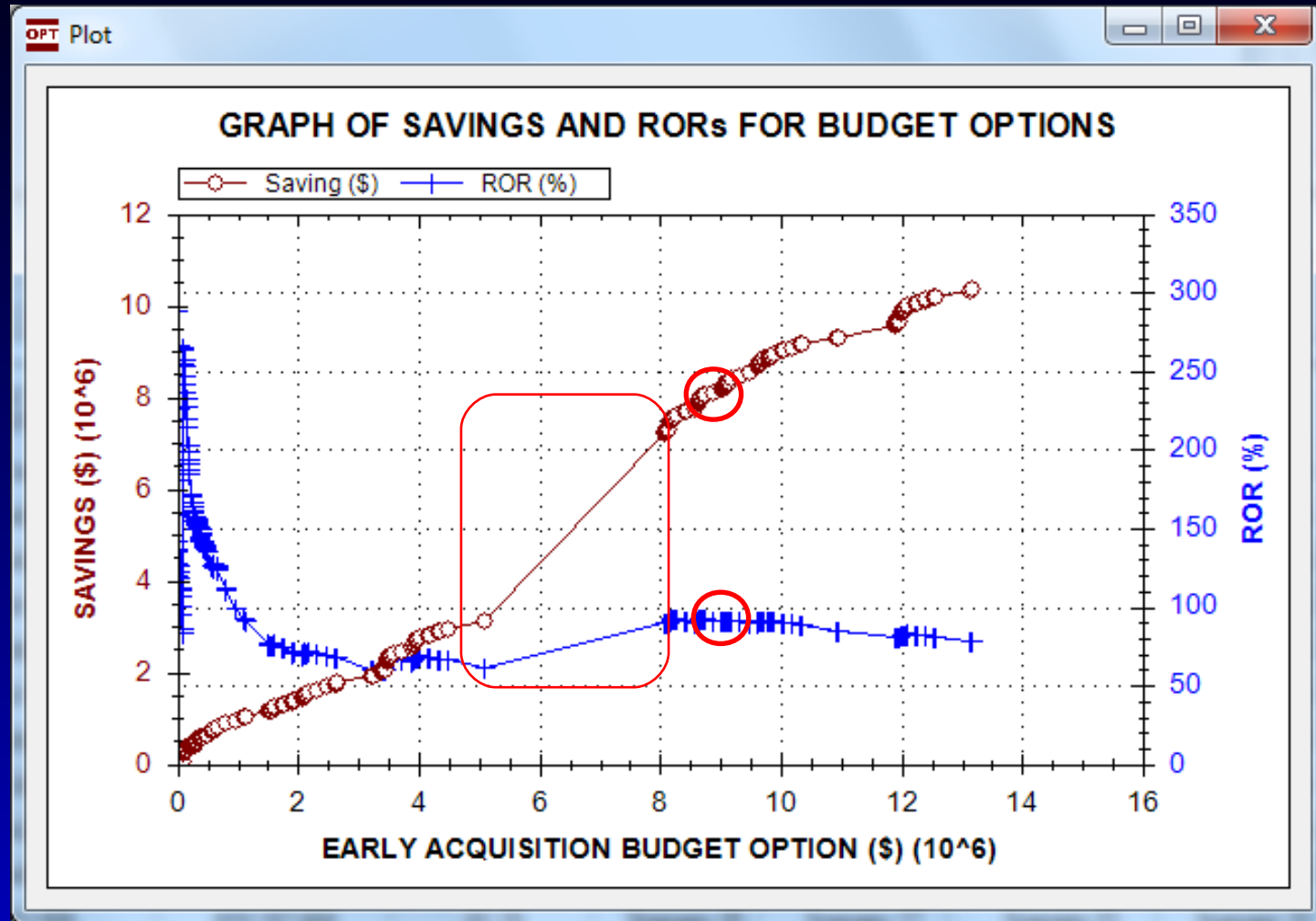
BUDGET OPTION	RESULTING EXPENDITURE	RESULTING SAVINGS	RATE OF RETURN (%)	FM 973 - Austin	SH78 from SH205 to FM6	NE PARKWAY EL PASO DISTR	Houston FM 1488
\$12,236,000	\$12,234,693	\$10,050,854	82.15	Scenario 23	Scenario 17	Scenario 15	Scenario 33
\$12,242,000	\$12,240,985	\$10,052,888	82.12	Scenario 24	Scenario 17	Scenario 15	Scenario 33
\$12,247,000	\$12,245,737	\$10,054,299	82.10	Scenario 25	Scenario 17	Scenario 15	Scenario 33
\$12,394,000	\$12,391,476	\$10,114,565	81.63	Scenario 22	Scenario 17	Scenario 10	Scenario 33
\$12,397,000	\$12,395,289	\$10,116,139	81.61	Scenario 23	Scenario 17	Scenario 10	Scenario 33
\$12,403,000	\$12,401,581	\$10,118,173	81.59	Scenario 24	Scenario 17	Scenario 10	Scenario 33
\$12,408,000	\$12,406,333	\$10,119,584	81.57	Scenario 25	Scenario 17	Scenario 10	Scenario 33
\$12,541,000	\$12,538,949	\$10,182,649	81.21	Scenario 22	Scenario 17	Scenario 21	Scenario 33
\$12,544,000	\$12,542,762	\$10,184,223	81.20	Scenario 23	Scenario 17	Scenario 21	Scenario 33
\$12,550,000	\$12,549,054	\$10,186,257	81.17	Scenario 24	Scenario 17	Scenario 21	Scenario 33
\$12,555,000	\$12,553,806	\$10,187,668	81.15	Scenario 25	Scenario 17	Scenario 21	Scenario 33
\$13,143,000	\$13,141,740	\$10,337,943	78.66	Scenario 26	Scenario 17	Scenario 21	Scenario 33
\$13,166,000	\$13,165,060	\$10,344,405	78.57	Scenario 27	Scenario 17	Scenario 21	Scenario 33

Summary

	Best Rate of Return	Maximum Savings
Rate of Return	288.46%	78.57%
Budget Required	\$286	\$13,165,060
Savings Obtained	\$825	\$10,344,405

PLOT RESULTS  
SAVE RESULTS  
EXIT

# EROW Output Screen





# EROW Output Screen

OPT

EROW Optimization

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BUDGET OPTION	RESULTING EXPENDITURE	RESULTING SAVINGS	RATE OF RETURN (%)	FM 973 - Austin	SH78 from SH205 to FM6	NE PARKWAY EL PASO DISTR	Houston FM 1488
\$4,001,000	\$3,978,986	\$2,703,279	67.94	Scenario 25	Scenario 16	Not Selected	Scenario 32
\$4,021,000	\$4,015,174	\$2,757,096	68.67	Not Selected	Scenario 17	Not Selected	Scenario 32
\$4,041,000	\$4,030,317	\$2,762,940	68.55	Scenario 25	Scenario 17	Not Selected	Scenario 32
\$4,181,000	\$4,162,647	\$2,825,180	67.87	Not Selected	Scenario 17	Scenario 15	Scenario 32
\$4,201,000	\$4,177,790	\$2,831,024	67.76	Scenario 25	Scenario 17	Scenario 15	Scenario 32
\$4,341,000	\$4,323,243	\$2,890,465	66.86	Not Selected	Scenario 17	Scenario 10	Scenario 32
\$4,361,000	\$4,338,386	\$2,896,309	66.76	Scenario 25	Scenario 17	Scenario 10	Scenario 32
\$4,481,000	\$4,470,716	\$2,958,549	66.18	Not Selected	Scenario 17	Scenario 21	Scenario 32
\$4,501,000	\$4,485,859	\$2,964,393	66.08	Scenario 25	Scenario 17	Scenario 21	Scenario 32
\$5,101,000	\$5,073,793	\$3,114,668	61.39	Scenario 26	Scenario 17	Scenario 21	Scenario 32
\$5,121,000	\$5,097,113	\$3,121,130	61.23	Scenario 27	Scenario 17	Scenario 21	Scenario 32
\$8,081,000	\$8,067,948	\$7,223,204	89.53	Not Selected	Not Selected	Not Selected	Scenario 20
\$8,101,000	\$8,084,729	\$7,267,857	89.90	Not Selected	Scenario 10	Not Selected	Scenario 20
\$8,121,000	\$8,099,872	\$7,273,701	89.80	Scenario 25	Scenario 10	Not Selected	Scenario 20
\$8,141,000	\$8,134,423	\$7,285,998	89.57	Scenario 25	Scenario 5	Not Selected	Scenario 20

Summary

Best Rate of Return

Maximum Savings

Rate of Return

266.09%

78.57%

Budget Required

\$16,781

\$13,165,060

Savings Obtained

\$44,653

\$10,344,405

PLOT RESULTS

SAVE RESULTS

EXIT

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# Review of Data Analysis

# Comparison of TAMSIM Input from the Four Districts - Project Information

Project Description	County Type	Total Number of Parcels	Months from Schematics to ENV Clearance			Months from ENV Clearance to ROW Release			Target Completion Date	Nominal Inflation Rate %	Additional Cost Increase Due to Speculation %/year
			Min. Time	Most Likely Time	Max. Time	Min. Time	Likely Time	Max. Time			
Austin: FM 973	Urban	20	12	18	36	4	4	12	36	6	5
Dallas: SH78	Urban	10	12	18	36	2	4	12	50	3	15
El Paso: NE Parkway	Rural	19	48	60	108	1	1	4	120	3	0
Houston: FM1488	Metro	28	18	24	36	48	60	72	108	9	150/15

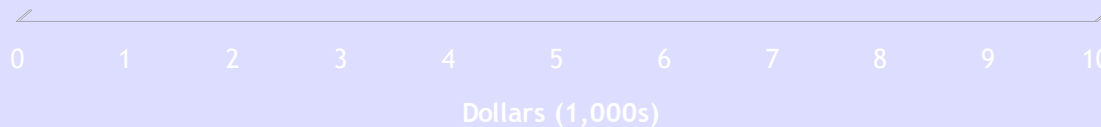
# Comparison of TAMSIM Input from the Four Districts - Parcel Information

Project Description	Total Number of Parcels	Number of Parcels with Likelihood of Improvement	Cost Multiplier for Improvements	Number of Parcels with Possible Condemnations	Multiplier for Duration of Condemnation	Multiplier of Cost for Condemnation	Mean Duration to Possession from ROW Release	Average Parcel Cost, \$1000s	Median Parcel Cost, \$1000s	Max Parcel Cost, \$1000s
Austin: FM 973	20	0	1	16	1.485	1.869	14 ~ 29	157	28	1,087
Dallas: SH78	10	6	2 ~ 6	10	1.5	1.5	12	24	10	61
El Paso: NE Parkway	19	2	2.5	11	1.661	1.3	4 ~ 18	455	115	2,756
Houston: FM1488	28	26	2 ~ 2.5	28	1.25	1.3	15 ~ 18	565	154	6,750

# Summary

District	Number of Parcels	Mean Cost Without Early Acquisition (1,000s)	Avg Cost per Parcel (1000s)
Austin	20	\$5,098	\$254.88
Dallas	10	\$788	\$78.78
El Paso	19	\$9,110	\$479.49
Houston	28	\$32,177	\$1,149.18

Average Cost per Parcel



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# Discussion on Tool Applications and Potential Benefits to Users in Districts

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# Final Questions?

## Adjourn