



TAM
TRANSPORTATION
ASSET MANAGEMENT

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Weighting Workshop

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Multi-Criteria Decision Analysis

- When we have multiple criteria, how do we decide?
- Multi-Criteria Decision Analysis (MCDA) is a type of Decision Analysis that is best suited to resources allocation questions.
- There are many different MCDA approaches, but they typically result in a weights that can be applied to each attribute to create an overall score.
- For our case, Swing Weighting was selected because it is relatively straightforward and easy to understand.

Swing Weighting

- Weights depend on context (importance AND variability)
- Consider house style and neighborhood



Great layout!
Perfect size!
Easy access to downtown!
Priced 5% below market!

Swing Weighting

- Great neighborhood?



Swing Weighting Process

1. Assess how much value would result if you could “swing” each criterion from its worst feasible outcome to its best feasible outcome
2. Rank criteria according to the swing in value that results when moving from the worst feasible outcome to the best
 - a. Consider a “worst case” project where all criteria are set to their worst feasible outcome
 - b. Which criterion would you swing first to its best feasible outcome?
 - c. Which would you swing second? and so on
 - d. OK to have ties (i.e., if two criteria are of equal importance)

Swing Weighting Process

3. Weight the criteria.
 - a. Assign a weight of 100 points to the highest ranked criterion
 - b. Assign a weight (between 0-100) to the next highest ranked criterion, and so on
 - c. The weights should be proportional to that of the highest ranked criterion (i.e., assign a weight of 50 if the swing in value is half as great as that of the highest ranked criterion)
4. Once you have weights for each criterion, review them for consistency and validity
 - a. Compare highs vs. lows to ensure the relative weightings make sense

Swing Weighting Example - Home Purchase

Weighting Form						
Prioritization and Analysis Tool Weighting Exercise						
Initials						
	Evaluation Criteria	Prioritization Performance Measure	Worst Feasible Outcome	Best Feasible Outcome	Rank ^a	Weight ^b
1.0	Bedrooms	Number of Bedrooms	2	5		
2.0	Bathrooms	Number of Bathrooms	2	4		
3.0	Yard	1-3 Scale	1	3		
4.0	School District	1-3 Scale	1	3		
5.0	Commute	1-3 Scale	1	3		
6.0	Property Taxes & HOA Fees	% of monthly payment	80%	25%		
7.0	Price	Price of home	\$300,000	\$240,000		

Swing Weighting Example - Home Purchase

Weighting Form						
Prioritization and Analysis Tool Weighting Exercise						
Initials						
	Evaluation Criteria	Prioritization Performance Measure	Worst Feasible Outcome	Best Feasible Outcome	Rank ^a	Weight ^b
1.0	Bedrooms	Number of Bedrooms	2	5		
2.0	Bathrooms	Number of Bathrooms	2	4	1	
3.0	Yard	1-3 Scale	1	3		
4.0	School District	1-3 Scale	1	3		
5.0	Commute	1-3 Scale	1	3		
6.0	Property Taxes & HOA Fees	% of monthly payment	80%	25%		
7.0	Price	Price of home	\$300,000	\$240,000		

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Prioritization and Analysis Tool Weighting Exercise						
Initials						
	Evaluation Criteria	Prioritization Performance Measure	Worst Feasible Outcome	Best Feasible Outcome	Rank ^a	Weight ^b
1.0	Bedrooms	Number of Bedrooms	2	5	2	
2.0	Bathrooms	Number of Bathrooms	2	4	1	
3.0	Yard	1-3 Scale	1	3		
4.0	School District	1-3 Scale	1	3	2	
5.0	Commute	1-3 Scale	1	3		
6.0	Property Taxes & HOA Fees	% of monthly payment	80%	25%		
7.0	Price	Price of home	\$300,000	\$240,000		

Swing Weighting Example - Home Purchase

Weighting Form						
Prioritization and Analysis Tool Weighting Exercise						
Initials						
	Evaluation Criteria	Prioritization Performance Measure	Worst Feasible Outcome	Best Feasible Outcome	Rank ^a	Weight ^b
1.0	Bedrooms	Number of Bedrooms	2	5	2	
2.0	Bathrooms	Number of Bathrooms	2	4	1	
3.0	Yard	1-3 Scale	1	3	6	
4.0	School District	1-3 Scale	1	3	2	
5.0	Commute	1-3 Scale	1	3	5	
6.0	Property Taxes & HOA Fees	% of monthly payment	80%	25%	3	
7.0	Price	Price of home	\$300,000	\$240,000	4	

Swing Weighting Example - Home Purchase

Establishing the Weights

Weighting Form						
Prioritization and Analysis Tool Weighting Exercise						
Initials						
	Evaluation Criteria	Prioritization Performance Measure	Worst Feasible Outcome	Best Feasible Outcome	Rank ^a	Weight ^b
1.0	Bedrooms	Number of Bedrooms	2	5	2	
2.0	Bathrooms	Number of Bathrooms	2	4	1	100
3.0	Yard	1-3 Scale	1	3	6	
4.0	School District	1-3 Scale	1	3	2	
5.0	Commute	1-3 Scale	1	3	5	
6.0	Property Taxes & HOA Fees	% of monthly payment	80%	25%	3	
7.0	Price	Price of home	\$300,000	\$240,000	4	

Swing Weighting Example - Home Purchase

Establishing the Weights

Weighting Form						
Prioritization and Analysis Tool Weighting Exercise						
Initials						
	Evaluation Criteria	Prioritization Performance Measure	Worst Feasible Outcome	Best Feasible Outcome	Rank ^a	Weight ^b
1.0	Bedrooms	Number of Bedrooms	2	5	2	90
2.0	Bathrooms	Number of Bathrooms	2	4	1	100
3.0	Yard	1-3 Scale	1	3	6	
4.0	School District	1-3 Scale	1	3	2	90
5.0	Commute	1-3 Scale	1	3	5	
6.0	Property Taxes & HOA Fees	% of monthly payment	80%	25%	3	
7.0	Price	Price of home	\$300,000	\$240,000	4	

Swing Weighting Example - Home Purchase

Establishing the Weights

Weighting Form						
Prioritization and Analysis Tool Weighting Exercise						
Initials						
	Evaluation Criteria	Prioritization Performance Measure	Worst Feasible Outcome	Best Feasible Outcome	Rank ^a	Weight ^b
1.0	Bedrooms	Number of Bedrooms	2	5	2	90
2.0	Bathrooms	Number of Bathrooms	2	4	1	100
3.0	Yard	1-3 Scale	1	3	6	20
4.0	School District	1-3 Scale	1	3	2	90
5.0	Commute	1-3 Scale	1	3	5	50
6.0	Property Taxes & HOA Fees	% of monthly payment	80%	25%	3	70
7.0	Price	Price of home	\$300,000	\$240,000	4	65

Swing Weighting Example - Home Purchase

Weights Scaled to Percent

Weighting Form							
Prioritization and Analysis Tool Weighting Exercise							
Initials							
	Evaluation Criteria	Prioritization Performance Measure	Worst Feasible Outcome	Best Feasible Outcome	Rank ^a	Weight ^b	Weights in Percent
1.0	Bedrooms	Number of Bedrooms	2	5	2	90	19%
2.0	Bathrooms	Number of Bathrooms	2	4	1	100	21%
3.0	Yard	1-3 Scale	1	3	6	20	4%
4.0	School District	1-3 Scale	1	3	2	90	19%
5.0	Commute	1-3 Scale	1	3	5	50	10%
6.0	Property Taxes & HOA Fees	% of monthly payment	80%	25%	3	70	14%
7.0	Price	Price of home	\$300,000	\$240,000	4	65	13%
						485	100%

Swing Weighting Example - Home Purchase

Bringing Weights Together

Criteria Weights										
ID#	Evaluation Criteria	Consensus Weights	Dad	Mom	Brother	Sister	Mean	Sdev	Max	Min
1	Bedrooms		90	100	100	80	92.5	9.574271078	100	80
2	Bathrooms		100	80	100	100	95	10	100	80
3	Yard		20	50	10	50	32.5	20.61552813	50	10
4	School District		90	100	80	80	87.5	9.574271078	100	80
5	Commute		50	30	5	60	36.25	24.28133714	60	5
6	Taxes/Fees		70	70	30	55	56.25	18.87458609	70	30
7	Price		65	90	30	90	68.75	28.39454173	90	30

Percentage Weights						
ID#	Evaluation Criteria	Consensus Weights	Dad	Mom	Brother	Sister
1	Bedrooms		19%	19%	28%	16%
2	Bathrooms		21%	15%	28%	19%
3	Yard		4%	10%	3%	10%
4	School District		19%	19%	23%	16%
5	Commute		10%	6%	1%	12%
6	Taxes/Fees		14%	13%	8%	11%
7	Price		13%	17%	8%	17%



Summary

- MODA method called “Swing Weighting” allows for the generation of weights to bring multiple factors together.
- Discussion of weights allows people to better express their own preferences as well as understand the preferences of others.

Swing Weighting Example - Home Purchase

Establishing the Weights

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1.0	Bedrooms	Number of Bedrooms	2	5	2	90
2.0	Bathrooms	Number of Bathrooms	2	4	1	100
3.0	Yard	1-3 Scale	1	3	6	20
4.0	School District	1-3 Scale	1	3	2	90
5.0	Commute	1-3 Scale	1	3	5	50
6.0	Property Taxes & HOA Fees	% of monthly payment	80%	25%	3	70
7.0	Price	Price of home	\$300,000	\$240,000	4	65