EAM Model Demonstration

13 August 2015

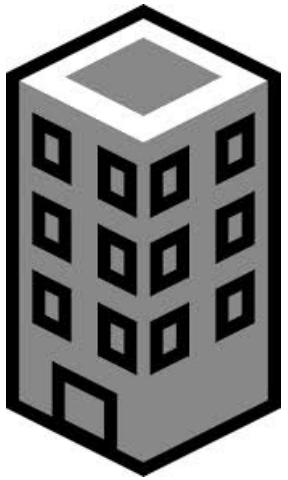
Christy.M.Foran@usace.army.mil

Simple Example?

- Developed a simple example to demonstrate the approach, and identify all the pieces.
- The example is fictional, and develops a models for something you might do “in your head”
- However, it might provide some clarity… So here goes.

Morning Commute

- It is something we will do repeatedly, in succession and would like to learn to make more effective.
- We have different opinion about what is important
  - »Predictability
  - »Time
  - »“Movement”



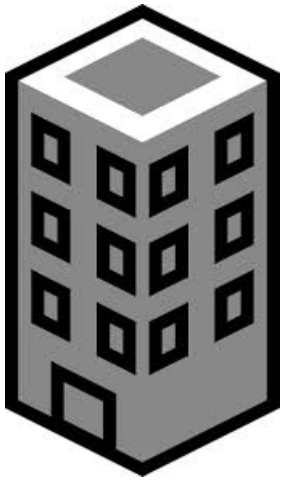
Objective Statement

- We would like to select the way to work that allows us to arrive comfortably on time, regularly, without spending a fortune or substantial amount of time waiting.

- Decided to use AM because learning about the system, being able to predict and understand the outcome is important.

Commute EAM

Identify criteria for successful commute from objectives (predictable, short, inexpensive, little waiting) – and metric(s) that inform each.

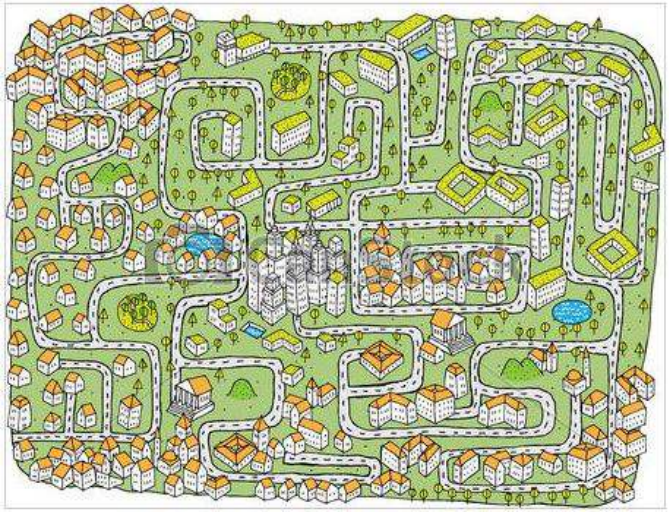


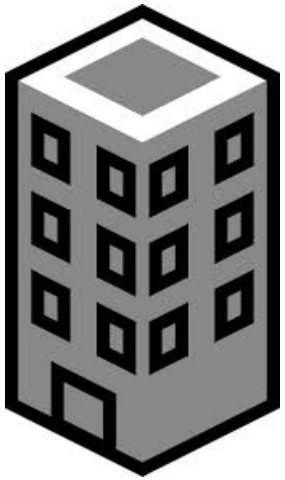
Criteria:	**Metric:**	**Utility Scale (min – max):**
Duration	Average time	30min – 2hrs
Cost	$/month	$50-$250
Wait time	Time sitting still (daily)	20min - max
Variability	Max- Min time/month, freq	15min – max, 1/week

Select initial set of alternatives that you want to compare.

highway

urban maze





commuter rail

Construct best understanding of the effects of each alternative to predict their performance (scores).

highway

urban maze

commuter rail

Criteria:

45 – 120 min depending on departure time, weather

Duration

$70/month – based on tolls, fuel, parking fees

Cost

30-50% of commute, dependent on departure time

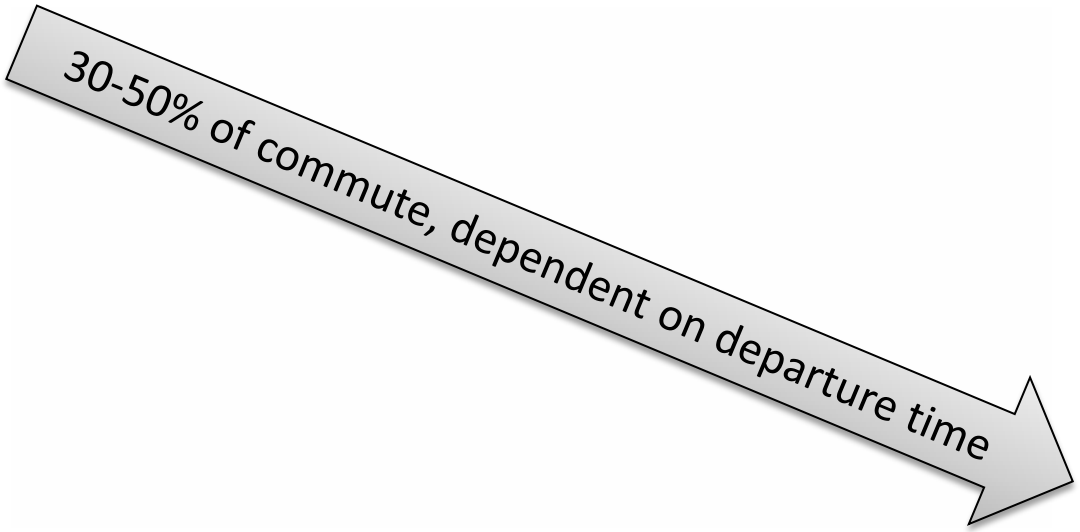
Waiting time

150% of min time; routinely (other variables consistent)

Variability

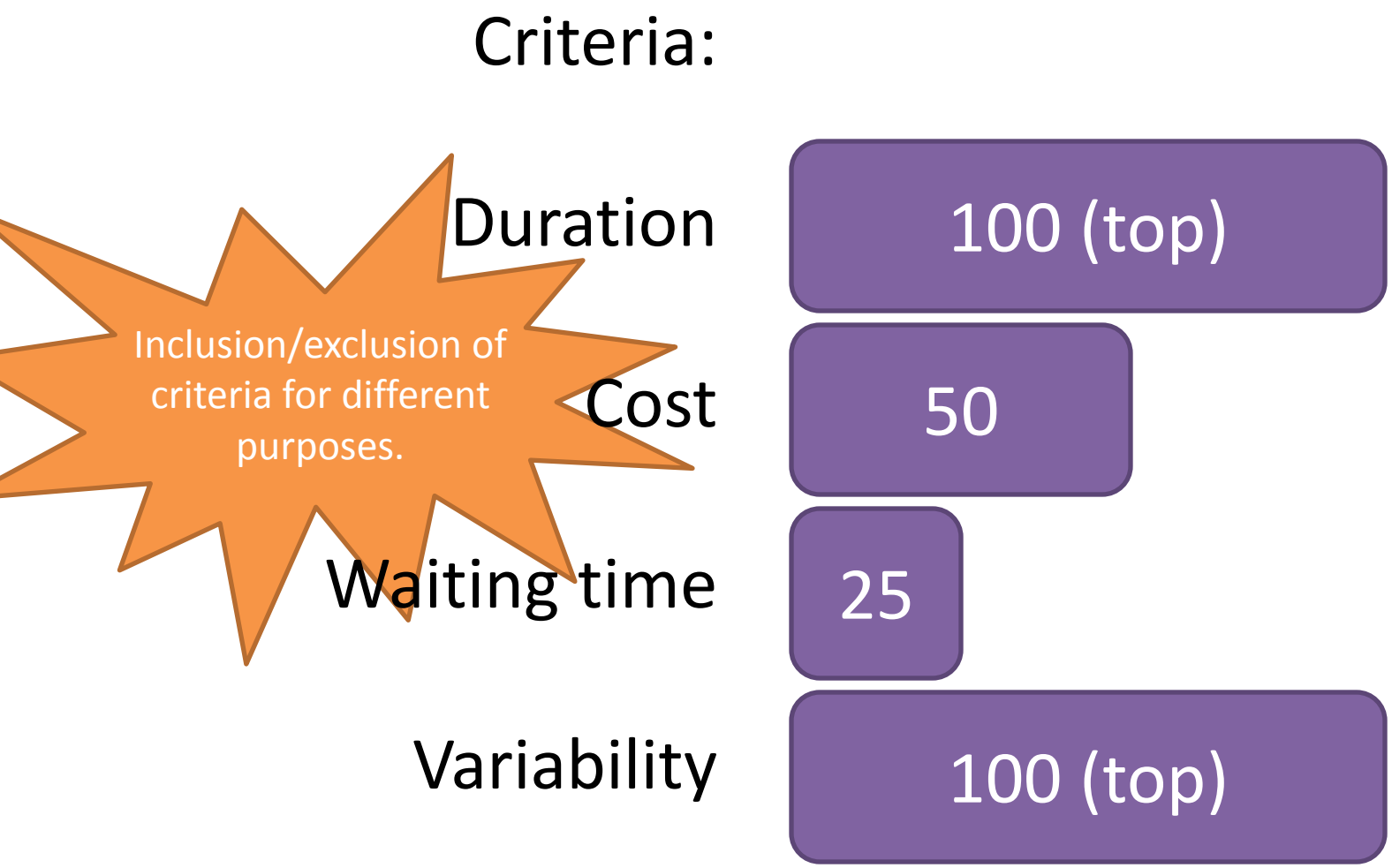
Use mechanistic and conceptual models, empirical relationships, experience, etc. to predict*:

- the anticipated outcome
- the external or intermediate factors that the outcome is dependent on (monitoring plan)
- predicted relationship between the factors

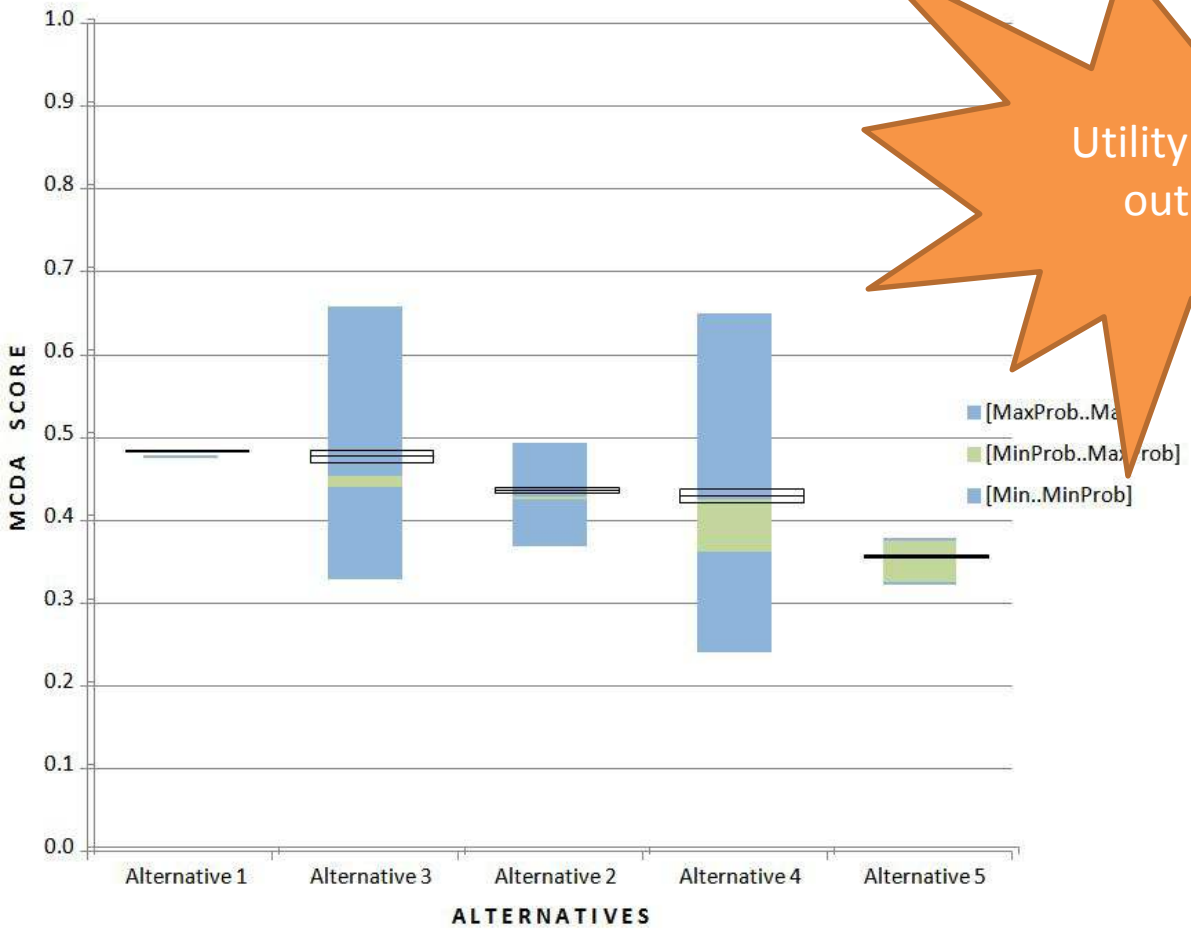


*basis of “learning” and reduction in

In order to compare the alternatives, we also need to characterize the preferences or trade-offs between criteria(weights).



Normalized weighted sum (value) allows you to visualize the relative performance of the choices.



Utility of this output.

Updating the “effects” (monitoring) allows you to see the change in performance with additional information.

Putting the pieces together:

Weights

Alternatives **Criteria**

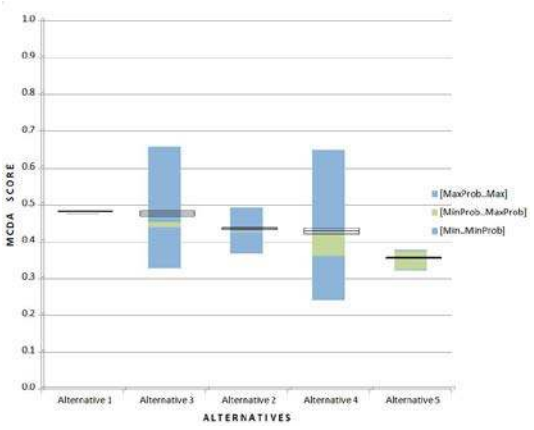
	Duration	Cost	Waiting time	Variability
highway 	$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$
urban maze 	$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$
commuter rail 	$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$

Scores

Utility Scale 0 – 1 $X_2 - y_2$ min–max etc.

Value

visualization(s)



South River EAM

- Two functions:
  - Archive the predictions and uncertainty expected from each remedial alternative
  - Provide a way to visualize how different alternatives perform for different objectives and when trade-offs between objective add value
- Two levels of use:
  - Creating and scoring different alternatives
  - Changing weights, or utility scales, corresponding to different preferences

Creating and scoring alternatives:

Criteria

Alternatives

Effectiveness	Habitat Value	Human Use	Implementation	Cost
$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$
$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$
$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$

Scores

Utility Scale 0 – 1 $X_2 - y_2$ min–max etc.

Creating and scoring alternatives

1) Consider the criteria (set)
2) Choose number of alternatives
3) Name and describe
4) Score each in data tabs
5) Consider utility scale

Altering weights and scales:

Weights

Criteria

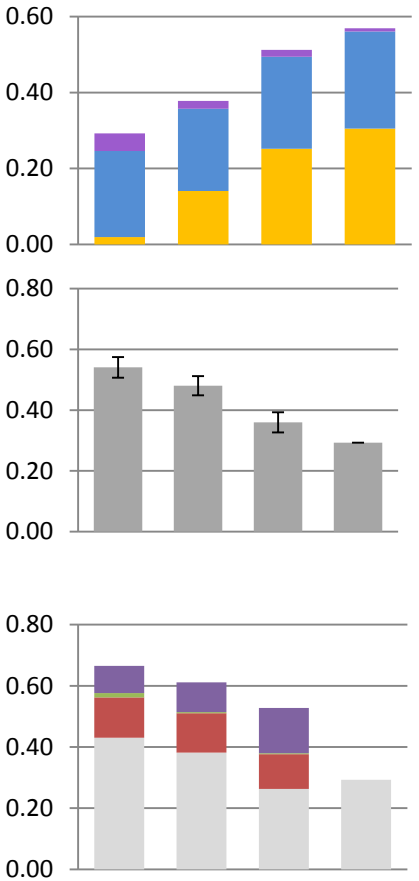
Alternatives

Effectiveness	Habitat Value	Human Use	Implementation	Cost
$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$
$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$
$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$	$X_1 - y_1$

Scores

Utility Scale 0 – 1 $X_2 - y_2$ min–max etc.

Value
visualization(s)



Altering weights and scales

1) Consider trade-off between criteria and sub-criteria
2) Review relative weights
3) Check utility scales
4) Run
5) Save output
6) Repeat as needed…