NCHRP Project SP20-59 (17)

CAPTA

*C*osting *A*sset *P*rotection:
An All Hazards Guide for *T*ransportation *A*gencies

Physical Security and Hazard Mitigation Committee

Federal Facilities Council

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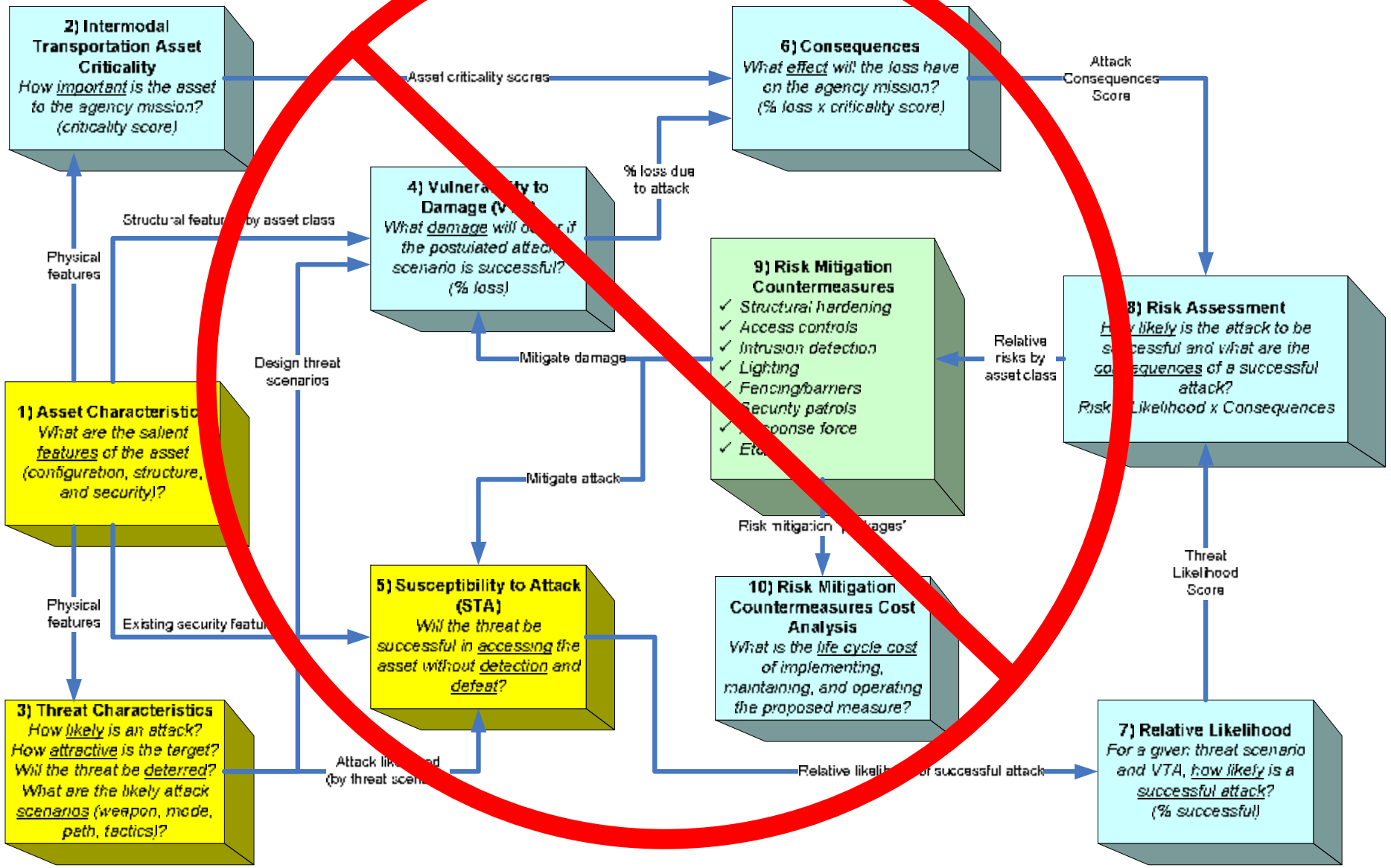
Briefing Overview

- **Objectives Evolution**
- Model Overview
- Discussion

Evolution: Initial NCHRP SP2-59(17) Project Objective

To develop a *Guide to Risk Management of Multimodal Transportation Infrastructure* that will provide state DOTs and other transportation entities with a risk management methodology that can be used to conduct threat, vulnerability, and criticality assessments of their facilities and to determine cost-effective countermeasures to prevent, detect, and reduce threats to assets on a multimodal basis.

Evolution: Initial Approach to Multimodal Transportation Risk Management Methodology



Evolution: Focus on Realistic View of Utility Context

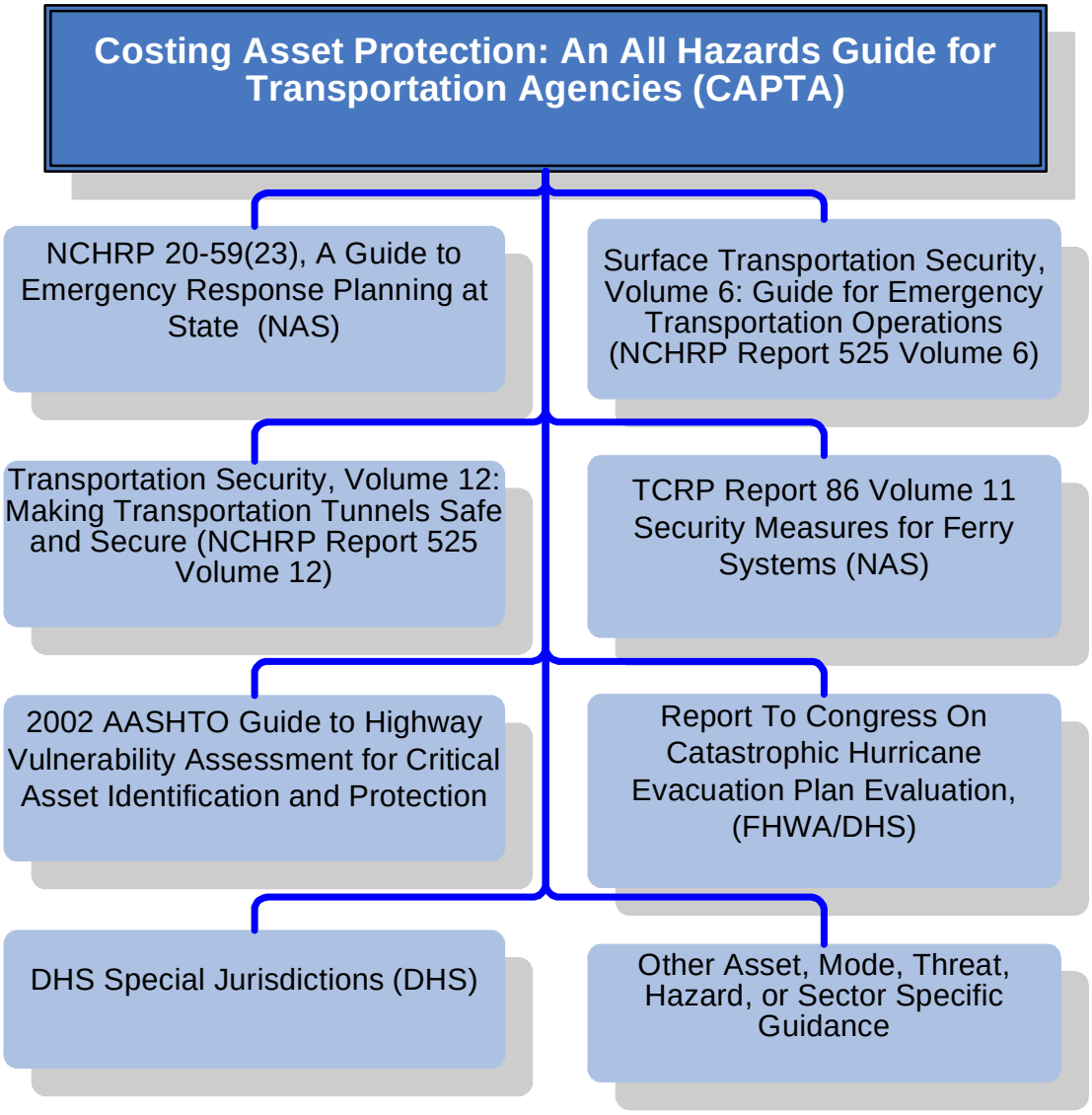
- Current available risk management strategies are asset, mode, threat/hazard specific. These *tactical* approaches do not accommodate *strategic*, high-level, multimodal, all-hazard considerations needed for overall agency-level planning, budgeting and allocating.

- The full range of risks faced by a transportation owner/operator forms a continuum. This range of risk requires a systematic, cohesive, risk management approach that encompasses all modes.

- Many Transportation agencies have already internalized (1) natural hazards, (2) unintentional events and (3) *some* intentional threats (crime) in established design standards and operational planning. Adding terrorism as a separate matter

- Agency threat management expertise is minimal, but risk awareness in terms of consequence understanding is keen. CAPTA uses this knowledge as input to the assessment process with minimal resort to "black box" methods (multiple F XWXR schemes)
- Refocused on management of consequences and cost implications – an objective framework

Evolution: Capstone Role in SDOT Methodology Portfolio



Evolution: Revised NCHRP SP2-59(17) Project Focus

To support *mainstreaming* an integrated, high level, all-hazard, NIMS-responsive, multimodal consequence-driven, risk management process into transportation agency programs and activities by providing a convenient and robust planning tool for top-down estimation of both capital and operating budget implications of measures intended to reduce risks to locally acceptable levels.

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Model: Key Features

- Program level perspective at high level of aggregation- top down
- User-specified consequence/threshold-driven (resident experts)
- Countermeasures based on common consequences
- Order-of-magnitude estimate for a user-chosen assembly of risk mitigation strategies (i.e., countermeasures)
- Cost & relative effectiveness of various countermeasure choices combinations -- capital and operations. Effectiveness (relative) rather than "benefits" are considered
- Budgetary implications of risk mitigation levels indicated by the consequence threshold acceptance
- Indicates assets for detailed risk management analysis
- Guidance in an objective, transparent, manner.
- Iterative, learning feature

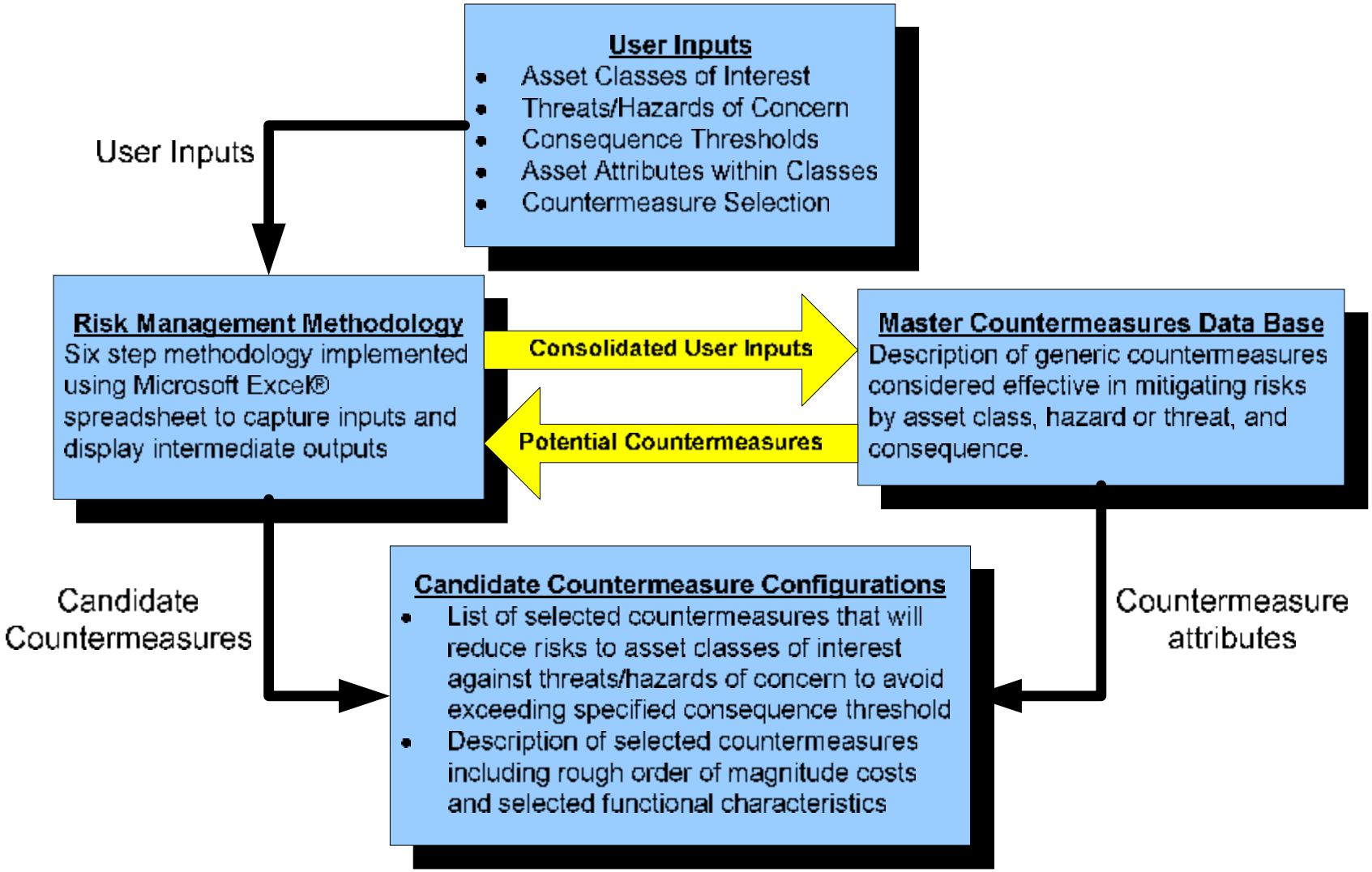
Model: Ease of Use

- Uses language familiar to owner/operator community
- Choices offered – "basic" or "enhanced" versions
- Integrated data base and user interface
- No special hardware/software (Uses MSExcel®)
- Simple identification of inputs and thresholds
- Iterative analysis (simple enough assess multiple options)
- Default values provided for "quick look" analysis (threats and hazards/asset data/countermeasure selection and analysis)
- Ends with summary report re committed resources across assets

Model: Products

- Project report that documents research activity and methodology development
- User Guide that explains and illustrates the CAPTA methodology and its implementation and application
- Computer-based tool that implements the methodology
- Embedded data model (updatable)

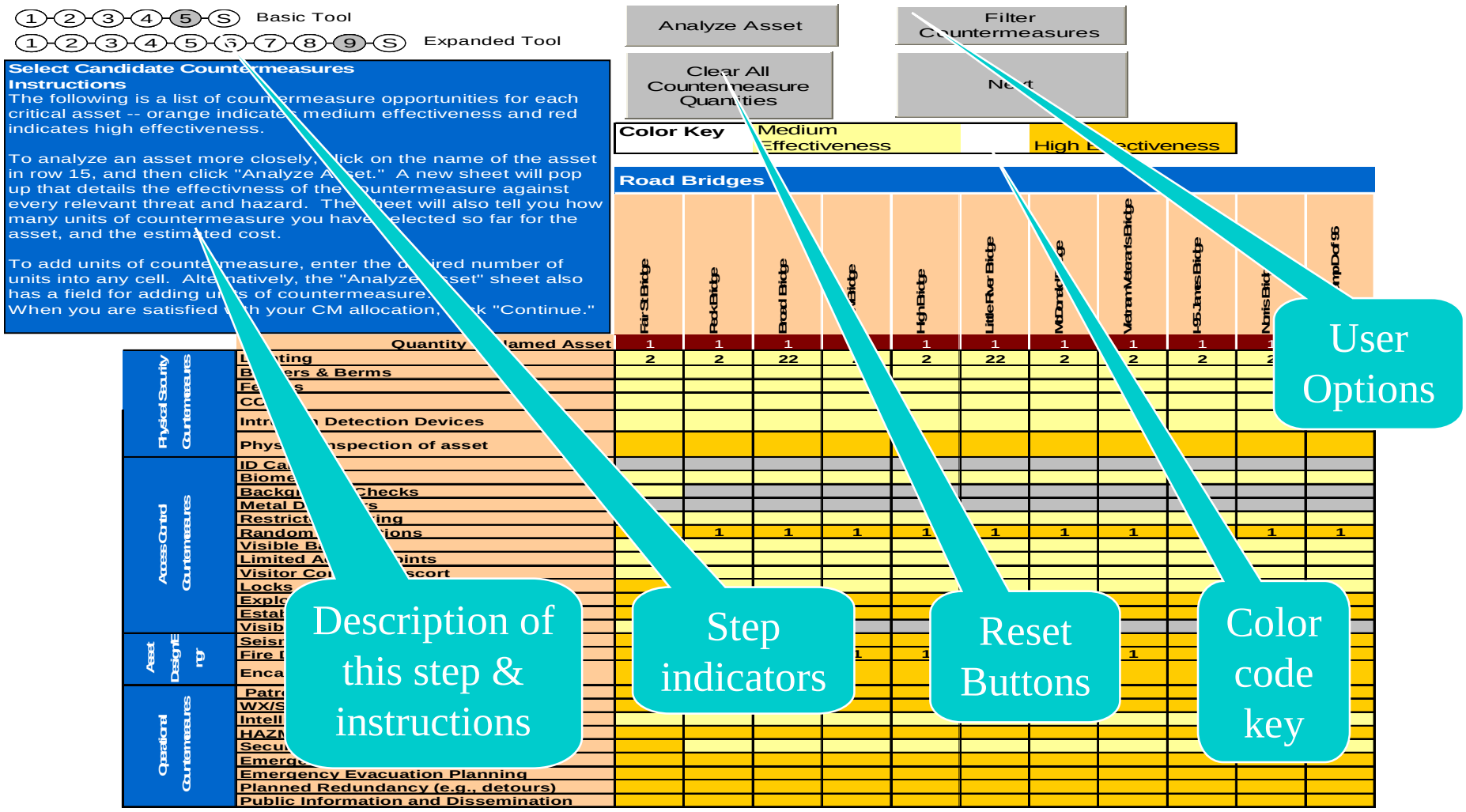
Model Demonstration: Interactions



Model Demonstration:
Overview of CAPTA Implementation

Basic CAPTA	Steps in Methodology	Expanded CAPTA
1	Identify Relevant Risks and Asset Classes	**1**
	Verify High Consequence Threats and Hazards	**1a**
2	Establish Consequence Thresholds	**2**
3	Describe Infrastructure Assets	**3**
4	Identify Critical Assets Across Modes	**4**
	Review Countermeasure Unit Costs	**5a**
	Identify and Describe Additional Countermeasures	**5b**
	Set Countermeasure Filters based on User Preference	**5c**
5	Select Candidate Countermeasures	**5**
6	Summary Report	**6**

Look and Feel



Step 1: Relevant Risk and Asset Classes

	Road Bridges	Road Tunnels	Transit/Rail Station	Transit/Rail Bridges	Transit/Rail Tunnels	Admin & Support Facilities	Ferry	Fleet
THREATS								
Small Explosives	Y	Y	Y	Y	Y	Y	Y	Y
Large Explosives	Y	Y	Y	Y	Y	Y	Y	Y
Chemical/Biological/Radiological	N	N	N	N	N	N	N	N
Criminal Acts	N	N	N	N	N	N	N	N
UNINTENTIONAL HAZARDS								
Fire	Y	Y	Y	Y	Y	Y	Y	N
Struct. Failure	N	N	N	N	N	N	N	N
HAZMAT	Y	Y	Y	Y	Y	N	N	N
NATURAL HAZARDS								
Flood	N	N	N	N	N	N	N	N
Earthquake	N	N	N	N	N	N	N	N
Extreme Weather	N	N	N	N	N	N	N	N
Mud/Landslide	N	N	N	N	N	N	N	N

Step 2: Establish Consequence Thresholds

	Category	Critical Threshold		Explanation
ROAD BRIDGE	Potentially Exposed Population	200		Potentially exposed population threshold
	Property Loss	$101,685,981		Replacement cost
	Mission Importance	Demand Percentile II		Demand percentile for ADT * Detour Length
	Level I	29000	Restore Defaults	The default threshold values for ADT * detour length are taken from the 75th, 85th, and 95th percentiles for the U.S. If these are inappropriate for your state, enter different values in the appropriate fields to the left.
	Level II	68000		
	Level III	790000		
ROAD TUNNEL	Potentially Exposed Population	99		Potentially exposed population threshold
	Property Loss	$101,699,661		Replacement cost
	Mission Importance	No		Do you consider all road tunnels to be mission critical?
TRANSIT/RAIL STATION	Potentially Exposed Population	103		Potentially exposed population threshold
	Property Loss	Yes		Do you consider below-ground stations to be property critical?
	Mission Importance	Yes		Do you consider all transfer stations to be mission critical?
TRANSIT/RAIL BRIDGE	Potentially Exposed Population	200		Potentially exposed population threshold
	Property Loss	$100,004,750		Replacement cost
	Mission Importance	20		What % of ridership does a bridge need to serve in order to be mission critical?
TRANSIT/RAIL TUNNEL	Potentially Exposed Population	200		Potentially exposed population threshold
	Property Loss	$100,004,750		Replacement cost
	Mission Importance	20		What % of ridership does a tunnel need to serve in order to be mission critical?
ADMIN & SUPPORT FACILITIES	Potentially Exposed Population	100		Potentially exposed population threshold
	Property Loss	$101,699,661		Replacement cost
	Mission Importance	No		Do you consider all administrative and support facilities to be mission critical?
FERRY BOATS	Potentially Exposed Population	305		Potentially exposed population threshold
	Property Loss	$101,699,661		Replacement cost
	Mission Importance	No		Do you consider all ferry boats to be mission critical?
TRANSIT FLEETS	Potentially Exposed Population	43		Potentially exposed population threshold
	Property Loss	$100,004,750		Replacement cost
	Mission Importance	No		Do you consider all transit fleets to be mission critical?

Step 3: Describe Infrastructure Assets

(Separate list for each mode/asset type)

ROAD BRIDGES						
Asset ID	Quantity	ADT	Length (ft)	Lanes	Detour (mi)	Replacement Cost Per Asset (Optional)
George's Island	1	2600	732	2	100	
High Rise		71000	4825	4	10	
Blue River Bridge		30000	23200	4	19	
State Line Bridge		37000	4680	6	18	$50,000,000
Veteran's Bridge		15000	4767	8	16	
Interstate Bridge		109000	4185	6	10	
Morris Bridge		7600	9989	2	80	
Route 500 River Bridge		13000	1483	2	74	
Metropolitan Bridge		14000	3545	4	52	
Point Park Bridge		34000	2187	4	10	
Rt 17 Bridge		31000	2035	4	10	
Military Highway Bridge		32000	882	4	10	
Rt 71 Bridge		19000	4102	2	20	
Boulavard Bridge		35000	1755	6	10	
Business Route Bridge		30000	132	2	10	
Kings Point Bridge		6700	2050	2	10	
Memorial Bridge		20000	1000	2	129	
New River Bridge		26550	1800	4	186	
Old River Bridge		41826	1658	4	12	
Lazy River Bridge		117600	1298	6	10	
Muddy River Bridge		43100	1416	4	10	
Crooked River Bridge		78800	678	4	10	
Beltway Interstate Bridge		207290	185	12	10	
Big River InterstateBridge		139800	1000	12	10	
Big River InterstateBridge		139800	1000	12	10	
Interstate Highway Ramp		210000	1000	4	10	

Step 4: Identify Critical Assets Across Modes

Asset Type	# of critical assets	# of assets considered
Road bridges	3	26
Road tunnels	11	11
Stations	13	13
Rail bridges	6	6
Rail tunnels	4	4
Facilities	5	12
Ferry	0	2
Fleet	5	8
Other	0	0
Total	47	82

X

		Road Bridges			Road Tunnels					
		Blue River Bridge	State Line Bridge	Veteran's Bridge	Big Mountain Tunnel	Bay Tunnel	Shoals Tunnel	Downtown Tunnel	East Mountain Tunnel	Uptown Tunnel
CRITICALITY	Potentially Exposed Population	Y	Y	Y				Y		Y
	Property Loss									Y
	Mission Importance				Y	Y	Y	Y	Y	Y
	Manual Override									
RELEVANT THREATS/ HAZARDS	Small Explosives	X	X	X				X		X
	Large Explosives	X	X	X	X	X	X	X	X	X
	Fire	X	X	X	X	X	X	X	X	X
	HAZMAT				X	X	X	X	X	X

(Partial list of critical assets)

Step 5: Select Candidate Countermeasures

		Road Bridges			Road Tunnels										
	Quantity of Named Asset	Blue River Bridge	State Line Bridge	Veteran's Bridge	Big Mountain Tunnel	Bay Tunnel	Shoals Tunnel	Downtown Tunnel	East Mountain Tunnel	Uptown Tunnel	Midtown Tunnel	Memorial Tunnel	Harbor Tunnel	Airport Runway Tunnel	Parkland Tunnel
		1	1	1	1	1	1	1	1	1	1	1	1	1	1
Physical Security Countermeasures	Lighting														
	Barriers & Berms	10													
	Fences	2													
	CCTV														
	Intrusion Detection Devices														
	Physical Inspection of asset														
Access Control Countermeasures	ID Cards														
	Biometrics														
	Background Checks														
	Metal Detectors														
	Restricted Parking														
	Random Inspections														
	Visible Badges														
	Limited Access Points		1	1	1										
	Visitor Control & Escort														
	Locks														
	Explosive Detection				1	1	1	1	1	1	1	1	1		
	Establish Clear Zones	1												1	1
	Visible Signs														
Asset Design/Engr	Seismic Retrofitting														
	Fire Detection & Supression					1		1		1					
	Encasement, Wrapping, Jacketing														
Operational Countermeasures	Patrols														
	WX/Seismic Information														
	Intelligence Networking														
	HAZMAT Mitigation														
	Security Awareness Training														
	Emergency Response Training														
	Emergency Evacuation Planning														
	Planned Redundancy (e.g., detours)														
	Public Information and Dissemination														

Step 5: Select Candidate Countermeasures

		Road Bridges			Road Tunnels										
	Quantity of Named Asset	Blue River Bridge	State Line Bridge	Veteran's Bridge	Big Mountain Tunnel	Bay Tunnel	Shoals Tunnel	Downtown Tunnel	East Mountain Tunnel	Uptown Tunnel	Midtown Tunnel	Memorial Tunnel	Harbor Tunnel	Airport Runway Tunnel	Parkland Tunnel
		1	1	1	1	1	1	1	1	1	1	1	1	1	1
Physical Security Countermeasures	Lighting														
	Barriers & Berms	10													
	Fences	2													
	CCTV														
	Intrusion Detection Devices														
	Physical Inspection of asset														
Access Control Countermeasures	ID Cards														
	Biometrics														
	Background Checks														
	Metal Detectors														
	Restricted Parking														
	Random Inspections														
	Visible Badges														
	Limited Access Points		1	1	1										
	Visitor Control & Escort														
	Locks														
	Explosive Detection				1	1	1	1	1	1	1	1	1		
	Establish Clear Zones	1												1	1
	Visible Signs														
Asset Design/Engr	Seismic Retrofitting														
	Fire Detection & Supression					1		1		1					
	Encasement, Wrapping, Jacketing														
Operational Countermeasures	Patrols														
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	Planned Redundancy (e.g., detours)														
	Public Information and Dissemination														

Some Expansion Options

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	PREDICT	DETER	DETECT	INTERDICT	RESPONSE PREP.	DESIGN/ENGINEERING	Area-Wide	Asset Specific	Temporary/Redeployable	Multipurpose Potential	Basic	Enhanced	Threat Responsive	Blue River Bridge	State Line Bridge	Veteran's Bridge	TOTAL COST (x1000)
Barriers & Berms	0	X	X	0	0	0	0	X	0	X	X	0	0	10			$33.0
Fences	0	X	X	0	0	0	0	X	0	X	X	0	0	2			$42.0
Limited Access Points	0	0	X	0	0	0	0	X	X	0	0	0	X		1	1	$60.0
Establish Clear Zones	0	0	X	0	0	0	0	X	0	0	X	0	0	1			$0.1
													TOTAL COST (x1000)	$75.10	$30.00	$30.00	$135.1

			Road Bridges	Road Tunnels	Transit/Rail Station	Transit/Rail Bridges	Transit/Rail Tunnels	Admin & Support Facilities	Ferry	Fleet	Other
Functions	PREDICT	Is prediction a desirable countermeasure function?	N	N	N	N	N	N	N	N	N
	DETER	Is deterrence a desirable countermeasure function?	Y	Y	Y	Y	Y	Y	Y	Y	Y
	DETECT	Is detection a desirable countermeasure function?	Y	Y	Y	Y	Y	Y	Y	Y	Y
	INTERDICT	Is interdiction a desirable countermeasure function?	Y	Y	Y	Y	Y	Y	Y	Y	Y
	RESPONSE PREP.	Is response preparedness a desirable countermeasure function?	Y	Y	Y	Y	Y	Y	Y	Y	Y
	DESIGN/ENGINEERING	Are countermeasures related to design/engineering desirable?	Y	Y	Y	Y	Y	Y	Y	Y	Y
Implementation	Area -Wide and Asset-Specific	Do you wish to consider only area-wide countermeasures, only asset-specific countermeasures, or both?	Asset-Specific	Asset-Specific	Asset-Specific	Asset-Specific	Asset-Specific	Area-Wide	Area-Wide	Area-Wide	Both
	Temporary/Redeployable	Do you wish to consider temp/redeployable countermeasures?	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Multipurpose Potential	Are you willing to consider CMs that are NOT multipurpose?	Y	Y	Y	Y	Y	Y	Y	Y	Y
Package	Basic and Enhanced	Do you wish to consider only basic countermeasures, only enhanced countermeasures, or both?	Basic	Enhanced	Basic	Basic	Enhanced	Basic	Basic	Basic	Both
	Threat Responsive	Do you wish to consider threat responsive countermeasures? (Answer "N" if only want permanent countermeasures.)	Y	Y	Y	Y	Y	Y	Y	Y	Y
Cost	Max Unit Cost (x1000)	What is the maximum per unit countermeasure cost you are willing to pay?	$999,999.0	$999,999.0	$999,999.0	$999,999.0	$999,999.0	$999,999.0	$999,999.0	$999,999.0	$999,999.0

		Physical Security Countermeasures					
		1	2	3	4	5	6
	Countermeasure	Lighting	Barriers & Berms	Fences	CCTV	Intrusion Detection Devices	Physical Inspection of asset
Functions	PREDICT						X
	DETER	X	X	X	X	X	
	DETECT	X	X	X	X	X	
	INTERDICT						
	RESPONSE PREP.						
	DESIGN/ENGINEERING						
Cost	Investment $ (x1000)	$11.3	$3.3	$21.0	$17.5	$0.9	$30.0
Implementation	Area-Wide						
	Asset Specific	X	X	X	X	X	X
	Temporary/Redeployable						X
	Multipurpose Potential	X	X	X	X	X	X
Package	Basic	X	X	X	X	X	X
	Enhanced						
	Threat Responsive						X

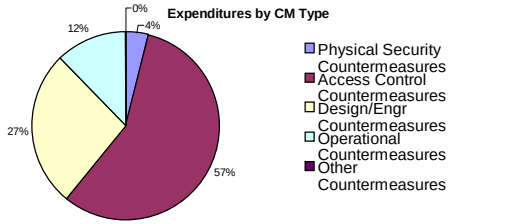
and attrib

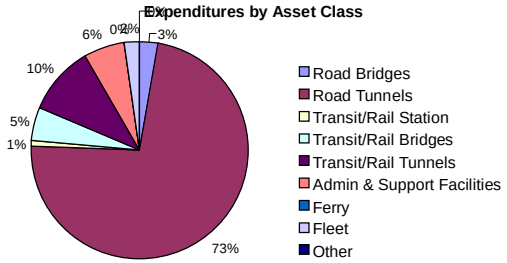
		Physical Security Countermeasures					
		1	2	3	4	5	6
	Countermeasure	Lighting	Barriers & Berms	Fences	CCTV	Intrusion Detection Devices	Physical Inspection of asset
Road Bridges	Small Explosives	L	H	H	M	M	H
	Large Explosives	M	M	M	M	M	M
	Chemical/Biological/Radiological	M	L	L	L	M	H
	Criminal Acts	M	M	M	M	M	M
	Fire	M	M	L	M	L	L
	Struct. Failure	L	L	L	L	L	H
	HAZMAT	L	L	L	L	L	H
	Flood	L	M	L	L	L	H
	Earthquake	L	L	L	L	L	L
	Extreme Weather	L	M	L	L	L	H
	Mud/Landslide	L	M	L	L	L	H
Road Tunnels	Small Explosives	L	H	H	M	M	H
	Large Explosives	M	M	M	M	M	M
	Chemical/Biological/Radiological	M	L	L	L	M	H
	Criminal Acts	M	M	M	M	M	M
	Fire	M	M	L	M	L	L
	Struct. Failure	L	L	L	L	L	H
	HAZMAT	L	L	L	L	L	H
	Flood	L	M	L	L	L	H
	Earthquake	L	L	L	L	L	L
	Extreme Weather	L	M	L	L	L	H
	Mud/Landslide	L	M	L	L	L	H

Step 6: Summary Report

		Road Bridges	Road Tunnels	Transit/Rail Stations	Transit/Rail Bridges	Transit/Rail Tunnels	Admin & Support Facilities	Ferries	Fleets	Other
Relevant Risks	Small Explosives	X	X	X	X	X	X	X	X	
	Large Explosives	X	X	X	X	X	X	X	X	
	Fire	X	X	X	X	X	X	X		
	HAZMAT	X	X	X	X	X				
Thresholds	Potentially Exposed Population	Persons	Persons	Persons	Persons	Persons	Persons	Persons	Persons	--
		300	305	300	308	300	305	305	300	--
	Property Loss	Damage	Damage	Below Ground Stations Critical?	Damage	Damage	Damage	Damage	Damage	--
		$1,000,002,500	$1,033,900,720	Yes	$1,033,335,750	$1,016,669,125	$1,000,002,500	$1,033,900,720	$1,000,002,500	--
	Mission Importance	ADT * Detour Length	Road tunnels critical?	Transfer Stations Critical?	% of ridership that causes mission criticality	% of ridership that causes mission	Facilities critical?	Ferries critical?	Fleets critical?	--
		Demand Percentile	II Yes	Yes	50	50	No	No	No	--
Counts	# of Unique Critical Assets	3	11	13	6	4	5	0	5	0
	# of Unique Countermeasures	4	4	2	2	6	2	0	2	0
	Total # of Countermeasures	15	15	15	10	9	10	0	4	0
Expenditures	Physical Security Countermeasures (x1000)	$75.0	$0.0	$42.0	$84.0	$0.0	$0.0	$0.0	$0.0	$0.0
	Access Control Countermeasures (x1000)	$60.1	$2,343.2	$1.3	$180.0	$120.0	$150.0	$0.0	$60.0	$0.0
	Asset Design/Engr Countermeasures (x1000)	$0.0	$1,380.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
	Operational Countermeasures (x1000)	$0.0	$0.0	$0.0	$0.0	$410.0	$150.0	$0.0	$60.0	$0.0
	Other Countermeasures (x1000)	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
	Total Countermeasure Expenditures (x1000)	**$135.1**	**$3,723.2**	**$43.3**	**$264.0**	**$530.0**	**$300.0**	**$0.0**	**$120.0**	**$0.0**

Totals	
Physical Security Countermeasures	$201,000
Access Control Countermeasures	$2,914,600
Design/Engr Countermeasures	$1,379,976
Operational Countermeasures	$620,000
Other Countermeasures	$0
Overall Total	**$5,115,573**





- Shows how available funds could be allocated across all asset types
- Shows funding required to implement selected countermeasures
- Shows distribution of resources among modes
- Shows distribution of funds among countermeasure types
- Provides a record of analysis results for comparison to future iterations

Next Steps

- CAPTool version 1.0 – updates and enhancements
- Roll-out – how to get to states and other owner/operators
- Access – CDROM, Server, etc.
- Possible AASHTOWare®