RISK MANAGEMENT

Course title: International Project Management

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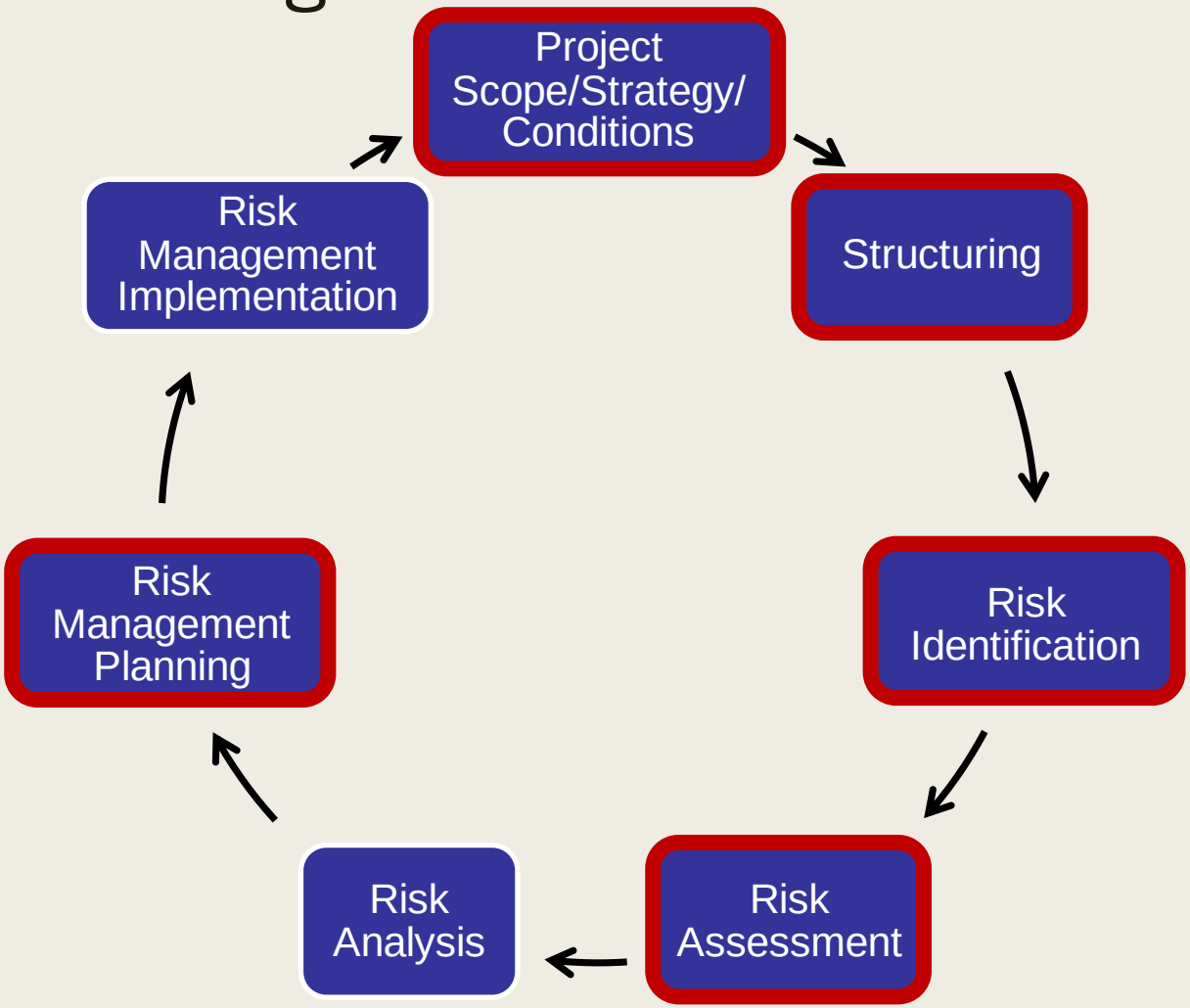
Risk Management

- Historically, many projects, especially if complex, experience poor "performance"
  - *exceed cost and schedule estimates*
  - *more disruption and less longevity than planned*
- Often due to unanticipated problems (invalid assumptions), which possibly could have been anticipated and then planned for

➔Formal *risk management*

Risk Management Process



Ref. *Guide for the Process of Managing Risk on Rapid Renewal Projects*

Objectives

- Identify, assess, evaluate, and rank all significant project performance risks and opportunities ("risks")
- Identify, evaluate, and plan potential risk-reduction actions to cost-effectively reduce key risks (and exploit key opportunities) ➔ improve performance
- "Risk" definition
  - *relative to project "base" ➔ total = base + risk*
  - *possible "event"*
    - performance impacts <u>if</u> occurs
    - probability of occurrence

Notes on Objectives

- Establish risk management scope (performance measures, project alternatives, exclusions/scenarios).
- Per <DOT>, not evaluating uncertainty in project performance, so that risk assessment:
  - *focuses on risk severity and ranking only*
  - *is expressed in terms of "ratings" or mean values*
  - *uses previously developed forms/template*
  - *can be basis for subsequent analysis of project cost and schedule uncertainty (budget/contingency/milestones)*
- First evaluate <primary project case>, and then quickly evaluate <secondary project case(s)>, in terms of key differences from primary case

Agenda of 2-day Workshop

- <Day 1> morning – for <primary case>
  - ✓ *Risk management planning overview/scope*
  - – *Project overview (scope, strategy, conditions)*
  - – *Structuring for risk management*
  - – *Risk identification ("brainstorming", risk register)*
- <Day 1> afternoon – for <primary case>
  - – *Risk assessment (e.g., in two concurrent groups)*
    - Funding/policy, planning/scoping, environmental, right-of-way/utilities/railroad, contracting
    - Design (prelim/final), construction, O&M, replacement

Agenda of 2-day Workshop

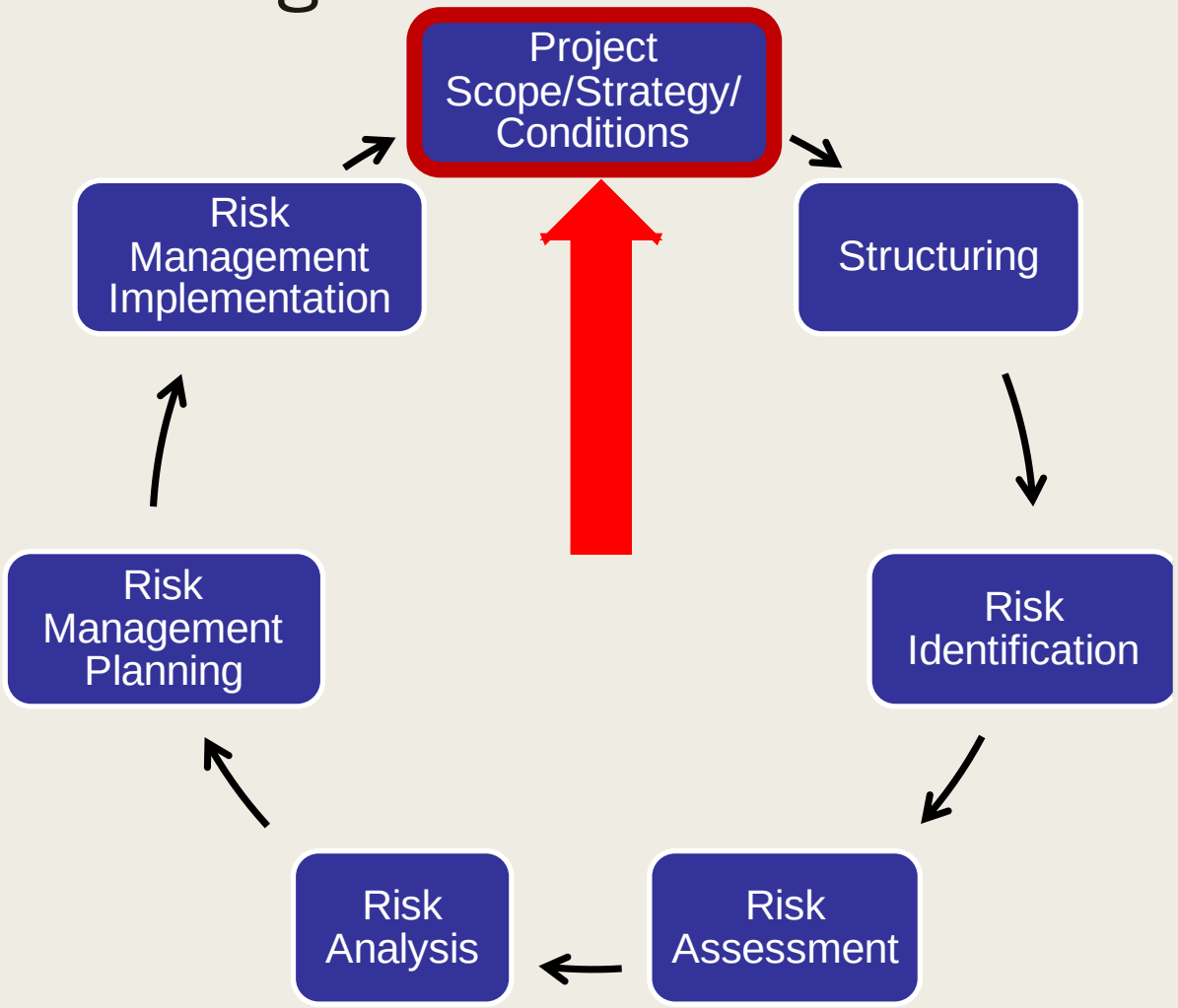
<Day 2> morning – for <primary case>

- *Present and confirm ranked risk register*
- *Risk management planning (e.g., in same two concurrent groups)*

<Day 2> afternoon – for <secondary case(s)>

- *Identify and assess differences in risks (e.g., in same two concurrent groups)*
- *Identify, evaluate and plan changes in risk management (e.g., in same two concurrent groups)*

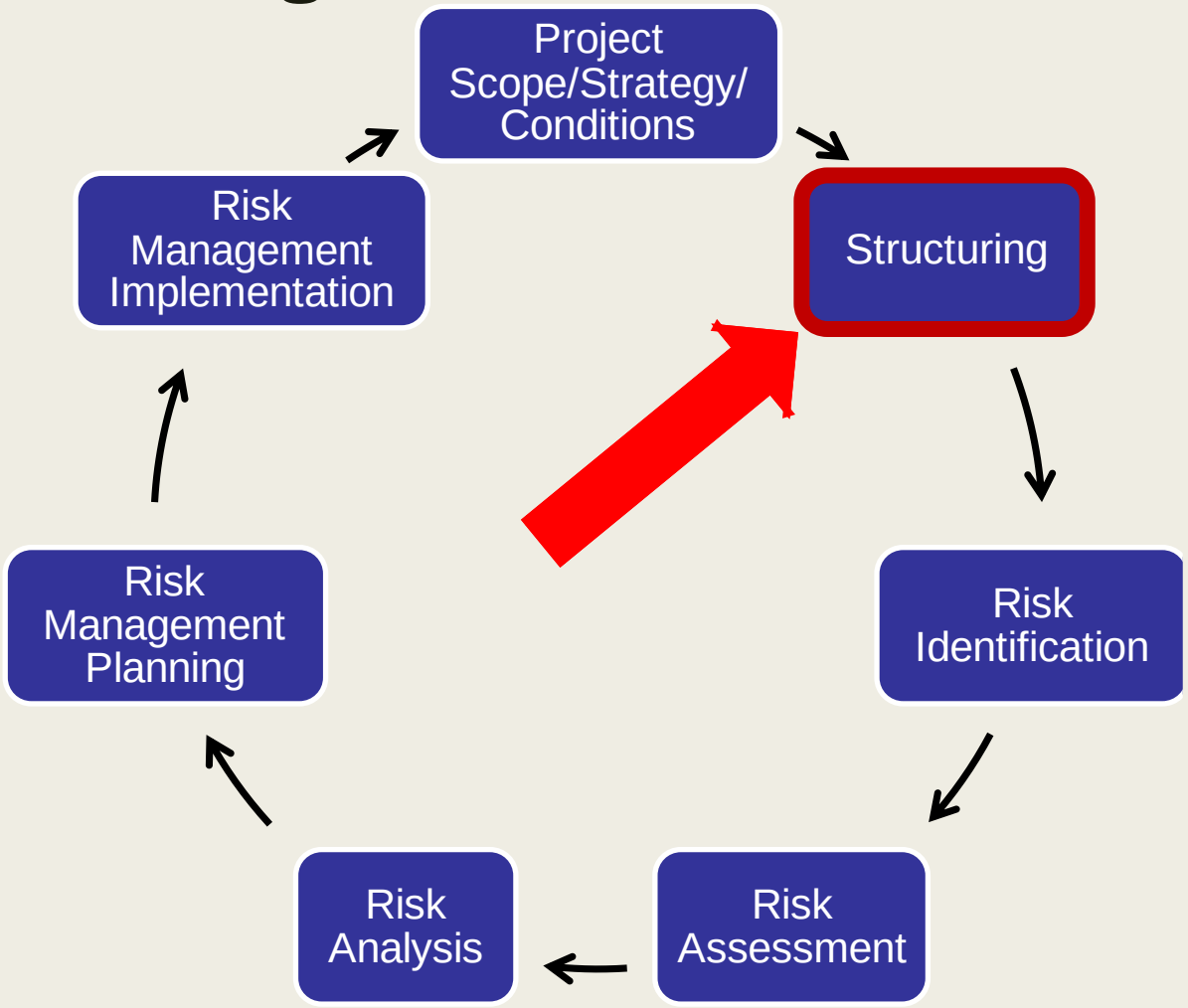
Risk Management Process



Project Scope, Strategy, Conditions

- Project team presents overview of project
- Understand key project elements (use established form):
  - *Planned scope and alternatives*
  - *Planned/current status delivery and funding strategies*
  - *Conditions significantly affecting project*
  - *Major assumptions used in performance estimates*
  - *Latest performance estimates*

Risk Management Process

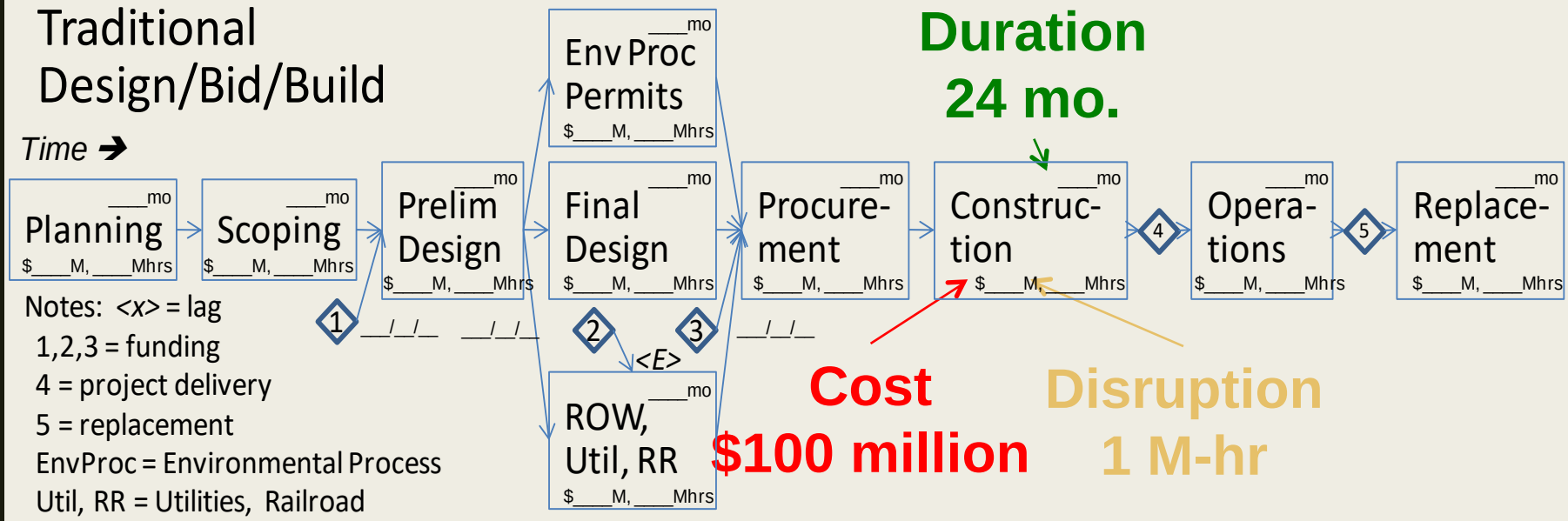


Structuring

- Identify “base” project (without risk)
- Base project defined by (use established forms/template):
  - *Simplified project “flow chart”*
  - *By activities in project flowchart*
    - Base schedule
    - Base cost
    - Base disruption
  - *Tradeoffs*
- Template does base performance analysis

Structuring

Standard simplified "flow chart" (on form) for risk identification and assessment for D/B/B or D/B

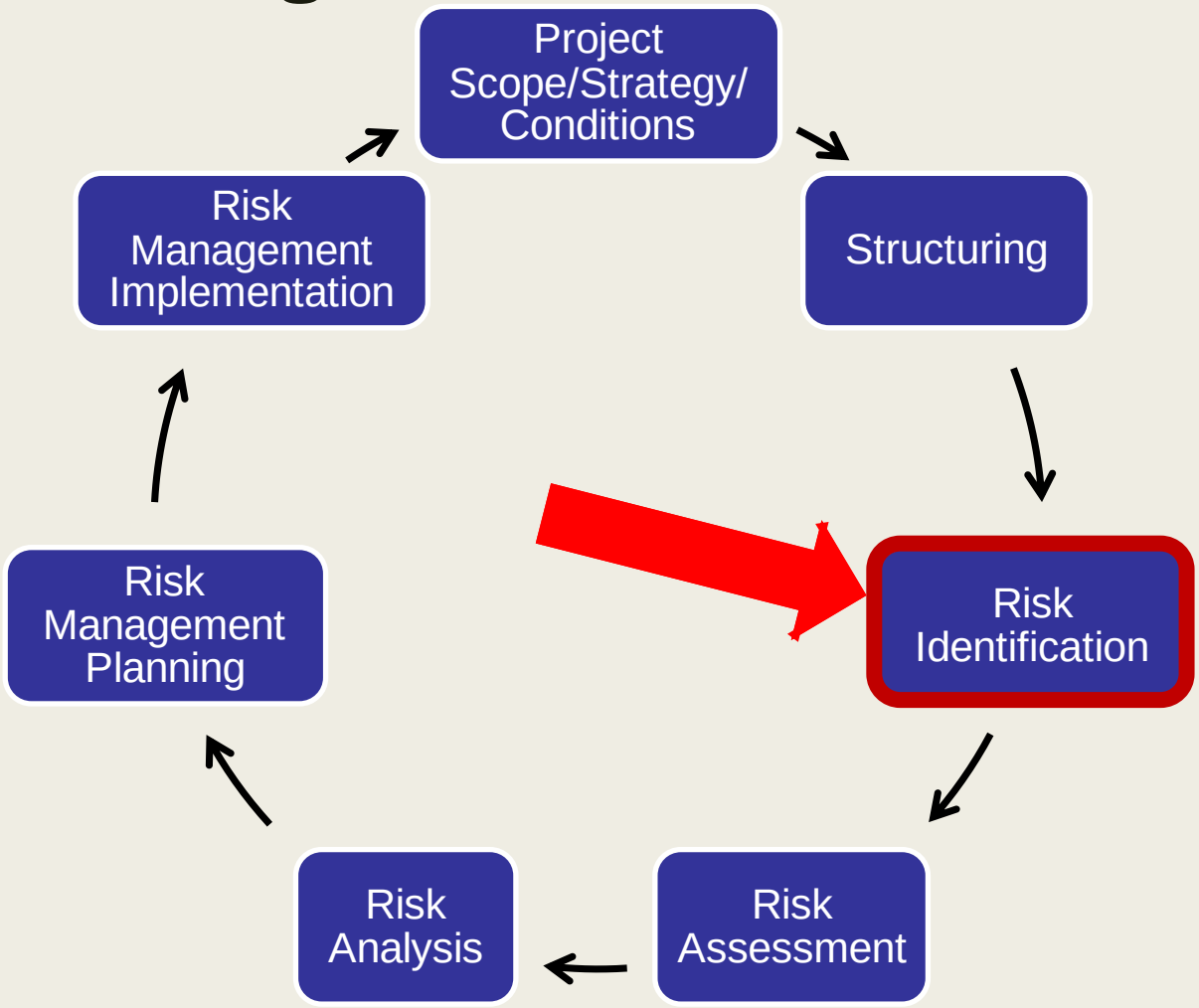


Assumes one contract package

Similar flowchart for D/B.

If quantifying performance uncertainty, would need more-detailed flow chart.

Risk Management Process



Risk Identification

Identify, document, and categorize comprehensive and non-overlapping set of risks (including opportunities) to project's performance
e.g., delay in ROW

Risk Identification

- Document risks in “risk register”
- *Categorize* risks to help ensure comprehensive and non-overlapping set of risks
- Categorize by project phase (from standard simplified flowchart) when most likely to occur
  - *Planning*
  - *Scoping*
  - *Preliminary Design*
  - *Environmental and permitting*
  - *Right-of-way, utilities, railroad*
  - *Final Design*
  - Procurement
  - Construction
  - Operations
  - Replacement
  - Funding (design, ROW, construction)

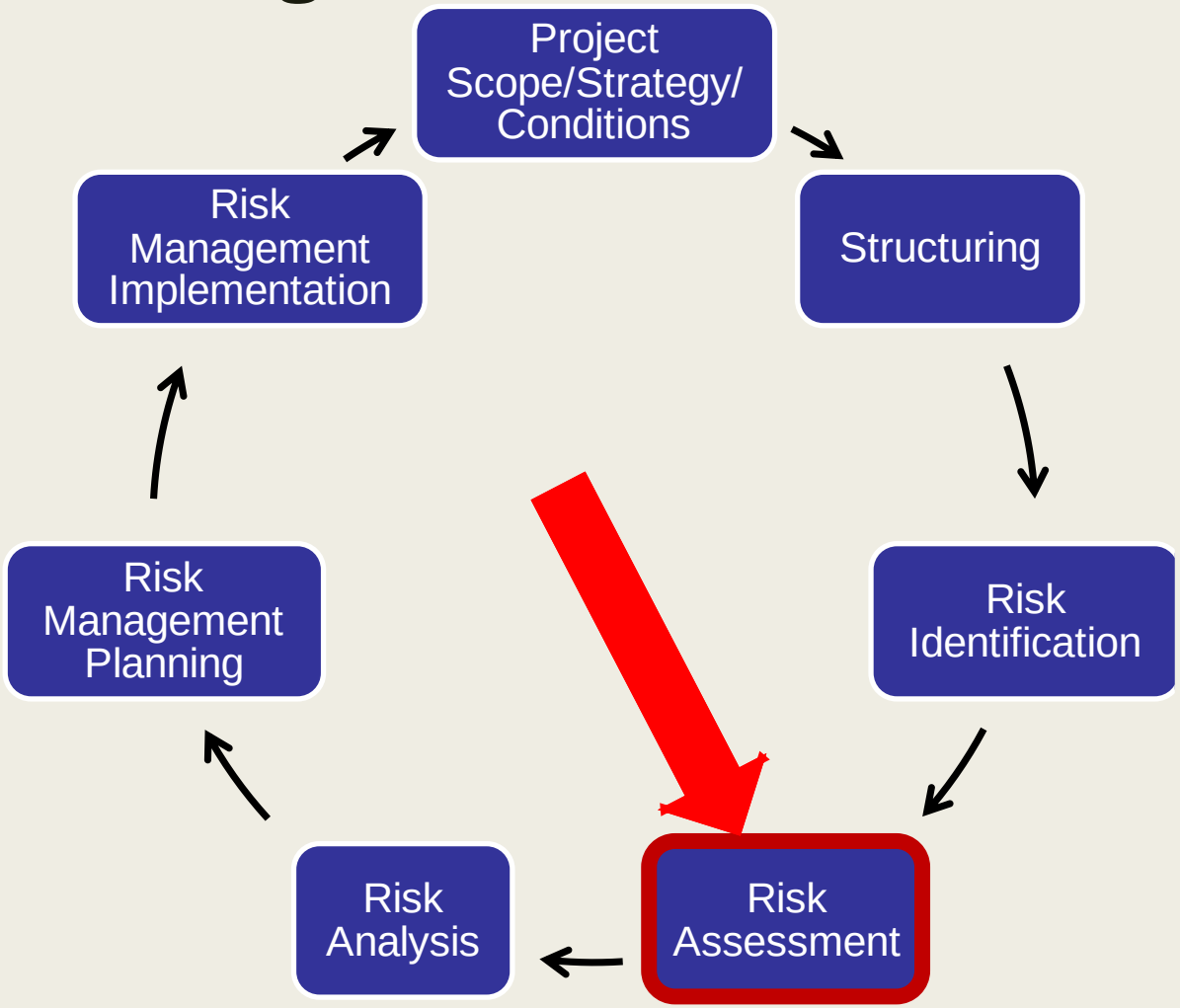
Risk Identification

Guidance for risk identification:

- *Identify and document <u>all</u> credible issues – think broadly and at appropriate level of detail*
  1. *Brainstorm (use forms/template)*
  2. *Categorize and edit (use forms/template)*
  3. *Refer to checklist (Appendix D in Guide)*
- *Don't debate severity of issues (yet) or prematurely "screen" issues out*
- *Avoid excluding issues, but document if you do*

Goal is to identify everything that eventually happens (as well as many things that don't)

Risk Management Process



Risk Assessment

Adequately but efficiently describe and assess the severity (likelihood and impact magnitude) of each risk (and opportunity) in the risk register

Per <DOT>, not evaluating uncertainty in project performance, only risk severity/ranking. Hence:

- *don't need to fully quantify uncertainties*
- *for efficiency, only assess mean ratings or mean values for risks (use established form/template) (can refine significant assessments later)*

Risk Assessment

Mean-value methods characterize each risk in terms of either:

- *Pre-defined risk "**ratings**" (e.g., L, M, H)*

  For example, Low probability of a Medium cost impact to ROW and a Low schedule impact to ROW

***Or**, directly in terms of*

- ***Mean values** (probability-weighted averages)*

  For example, 25% probability of a $1 million mean cost increase to ROW and a 3-month mean delay to ROW

Risk Assessment - Ratings

f use ratings (which are quicker, but less accurate):

1. *Define risk factor rating scales in terms of ranges of values (probabilities, cost dollars, schedule time, disruption time)*

Rating	Impacts if Event Occurs						Probability of Event Occurring (0=impossible to 1=guaranteed)		Severity (equivalent inflated $ million)	
	Change to Affected Activity Direct Cost $ (uninflated $ million)		Change to Affected Activity Duration T (months)		Change to Affected Activity Disruption D (million person-hours lost)					
	Low end of range	High end of range	Low end of range	High end of range	Low end of range	High end of range	Low end of range	High end of range	Low end of range	High end of range
VH	+25%	>+25%	+12	>+12	+25%	>+25%	0.7 (2:3)	1.0 (1:1)	+25%	>+25%
H	+10%	↖	+4	↖	+10%	↖	0.4 (2:5)	↖	+10%	↖
M	+3%	↖	+1	↖	+3%	↖	0.2 (1:5)	↖	+3%	↖
L	+1%	↖	+0.2	↖	+1%	↖	0.05 (1:20)	↖	+1%	↖
VL	0	↖	0	↖	0	↖	0.0 (0:1)	↖	0	↖
-VL	-1%	↖	-0.2	↖	-1%	↖			-1%	↖
-L	-3%	↖	-1	↖	-3%	↖			-3%	↖
-M	-10%	↖	-4	↖	-10%	↖			-10%	↖
-H	-25%	↖	-12	↖	-25%	↖			-25%	↖
-VH	<-25%	↖	<-12	↖	<-25%	↖			<-25%	↖
Base	$_____				_____Mhrs				$_____	

Risk Assessment - Ratings

If use ratings, cont'd:

2. *Assess (by consensus) ratings (e.g., L, M, H) for each risk factor and activity affected by each impact; e.g.:*
   - Cost change if risk occurs (e.g., M to ROW)
   - Probability of risk (as defined by impacts) occurring (e.g., M)

Risk #	Risk	Impact Rating			Probability Rating
		Cost	Schedule	Disruption	
C1	D/B Design & Construction Risk Contingency, Escalation & Profit	H to CN	L to Proc	VL to CN	VH
C2	Bidding Climate for NATM Tunnel	M to CN	VL to Proc	VL to CN	H
C3	Construction Materials Escalation	M to CN	VL to CN	VL to CN	L
R1	ROW Acquisition	M to ROW	M to ROW	VL to ROW	M

Risk Assessment - Ratings

If use ratings, cont'd:

3. *Template determines the mean severity (i.e., change in combined project performance) rating for each risk in terms of equivalent cost in inflated dollars, by combining (via tradeoffs) risk factors*

Risk #	Risk	Impact Rating			Probability Rating	Mean Severity Rating (equivalent cost in inflated $M)
		Cost	Schedule	Disruption		
C1	D/B Design & Construction Risk Contingency, Escalation & Profit	H to CN	L to Proc	VL to CN	VH	H
C2	Bidding Climate for NATM Tunnel	M to CN	VL to Proc	VL to CN	H	M
C3	Construction Materials Escalation	M to CN	VL to CN	VL to CN	L	VL
R1	ROW Acquisition	M to ROW	M to ROW	VL to ROW	M	L

4. *Prioritize risks per their mean severity rating*

Risk Assessment – Mean Values

If use mean values directly (i.e., skip the ratings):

1. *Assess (by consensus) the mean <u>value</u> for each risk factor and activity affected by each impact; e.g.:*
   - Cost change if risk occurs (e.g., $15 million to ROW)
   - Probability of risk (as defined by impacts) occurring (e.g., 25%)
2. *Template determines the mean severity <u>value</u> for each risk by combining risk factors (in same way as for ratings)*

Risk Assessment – Mean Values

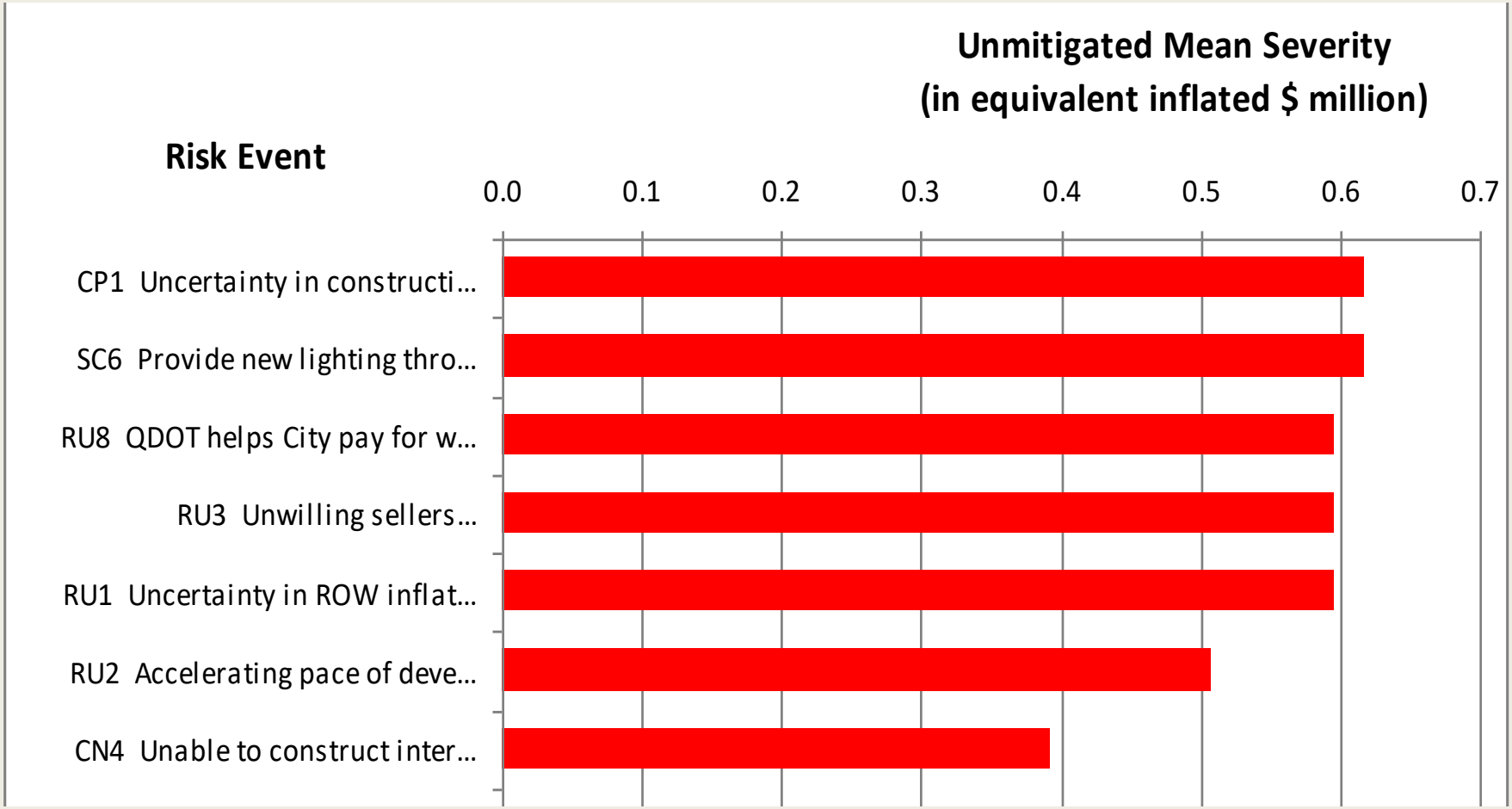
If use mean values directly, cont'd:

Risk #	Risk	Mean Consequences If Risk Occurs			Probability of Occurrence	Mean Severity (in Equivalent cost, Inflated $M) (escalation=10%, 1mo delay=$6M)
		Mean Cost (uninflated $M)	Mean Delay to Overall Schedule (months)	Mean Disruption (user lost-hours)		
C1	D/B Design & Construction Risk Contingency, Escalation & Profit	+75 to CN	+1.0 to Proc	0	80%	70.8
C2	Bidding Climate for NATM Tunnel	+20 to CN	+0.5 to Proc	0	50%	12.5
C3	Construction Materials Escalation	+12 to CN	+0.5 to CN	0	10%	1.6
R1	ROW Acquisition	+15 to ROW	+3.0 to ROW	0	25%	9.6

3. *Prioritize the risks per their mean severity values (in equivalent cost in inflated dollars)*
4. *Template also determines sums of mean risks, by category and for project – however, use with caution!*

Risk Assessment - Prioritization

Risk prioritization based on mean severity values:

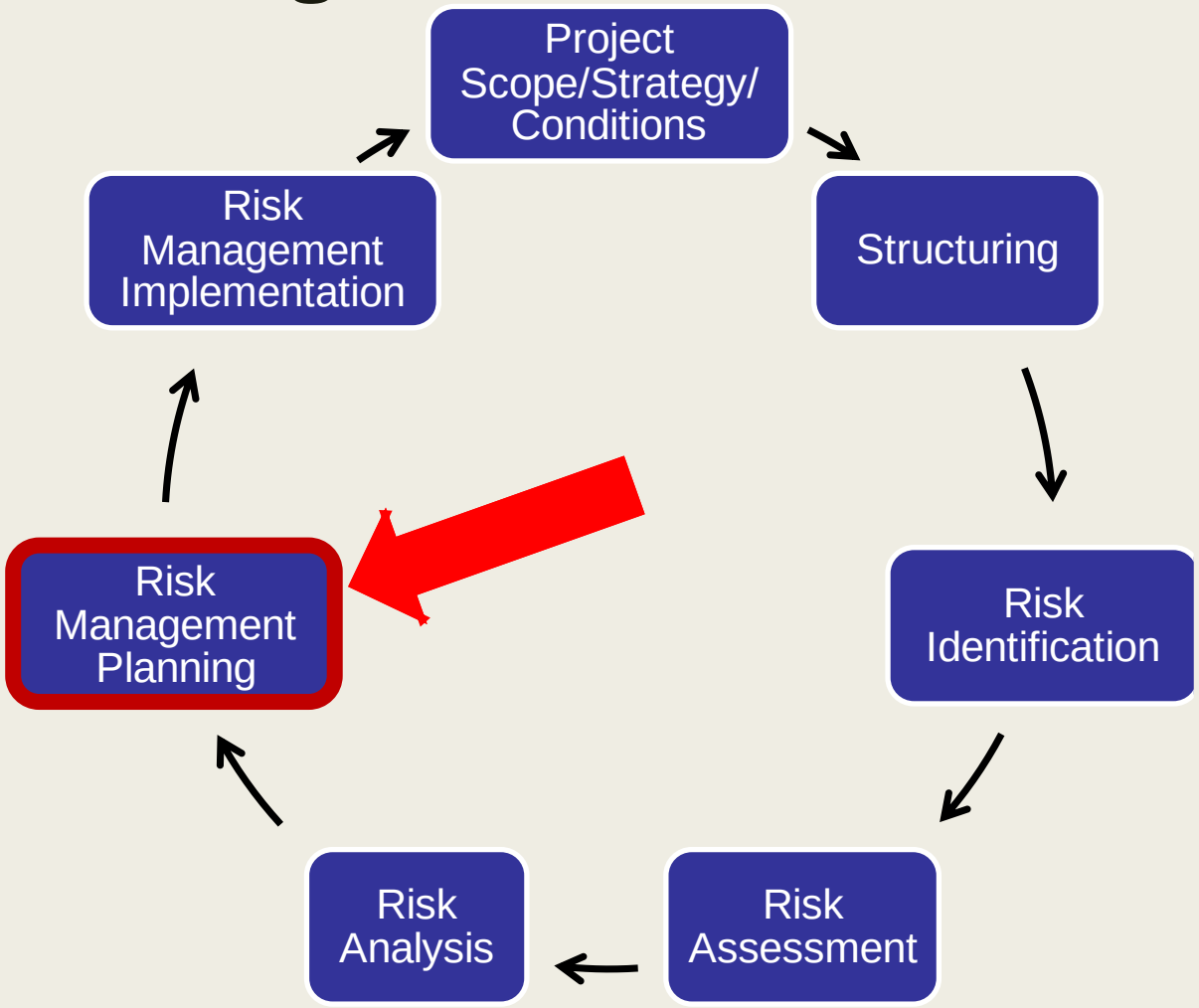


Risk Assessment

For efficiency, assess risks by category / project phase in two concurrent groups, e.g.:

- *Group 1*
  - Funding and policy
  - Planning and scoping
  - Environmental and permitting
  - Right-of-way, utilities, railroad
  - Contract procurement
- *Group 2*
  - Design (preliminary and final)
  - Construction
  - O&M
  - Replacement

Risk Management Process



Risk Management Planning

Identify, evaluate, and plan potential actions to cost-effectively, proactively reduce key risks (and exploit key opportunities)

Also, but out of current risk management scope:

- *Establish and manage contingency (allowance and recovery plans, to reactively cover collective residual risks)*

- Establish organizational structure and resources to implement plan (include monitor and update)

Risk Management Planning

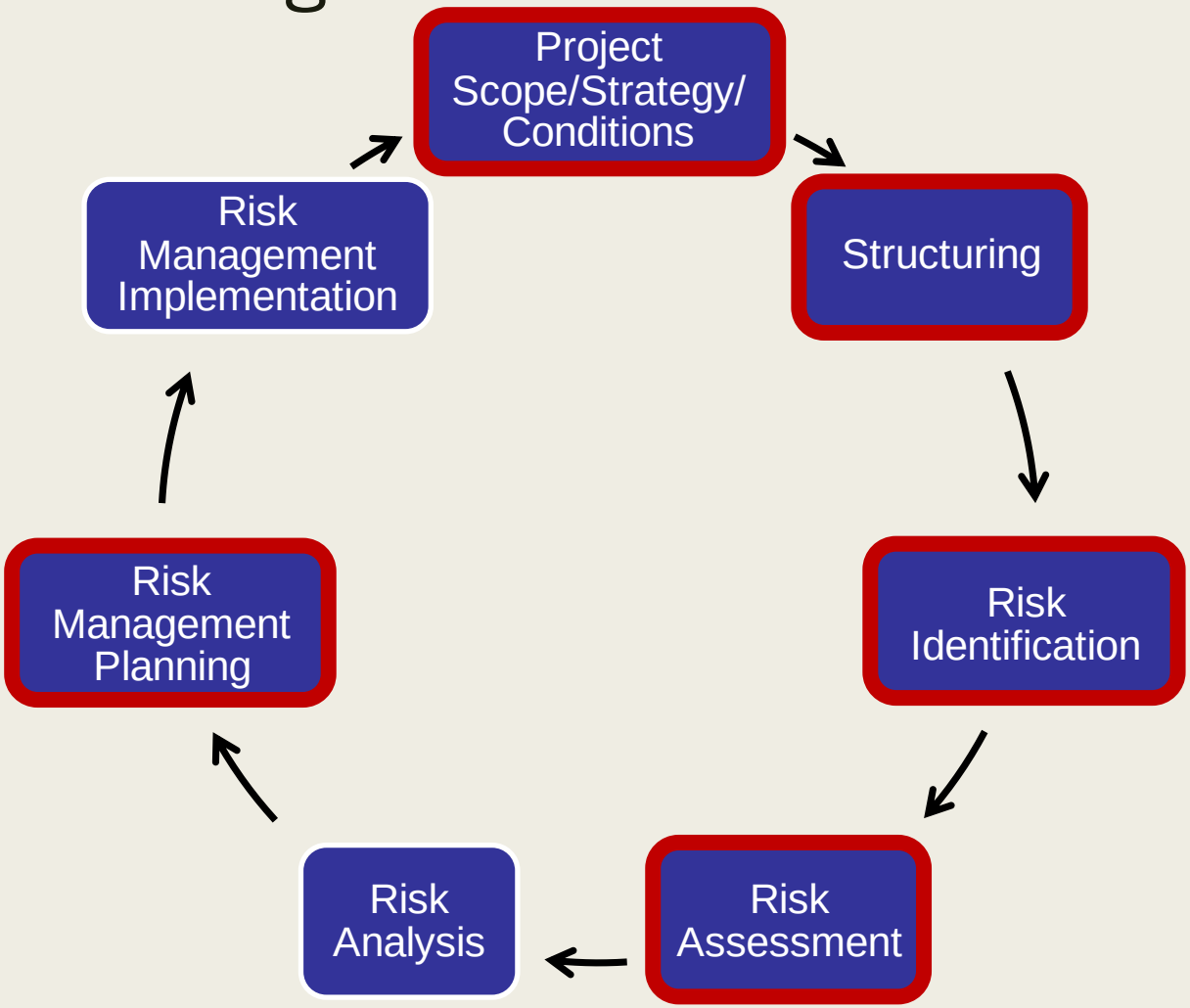
- Start with high-priority risks (and opportunities)
  e.g., ROW delay
- Identify potential, *specific* actions to reduce (exploit)
  e.g., advance ROW acquisition
- Assess implementation impacts for each action
  e.g., additional $1.0M to ROW
- Assess effectiveness of each action, in terms of its mean *changes to* one or more risk factors:
  - *Schedule, cost and/or disruption impact if risk occurs*
    e.g., reduce schedule impact to ROW in ½, from +3 to +1.5 months
  - *Probability of occurrence*
    e.g., reduce in ½, from 50% to 25%

Risk Management Planning

- Template determines cost-effectiveness of each action
- Select and subsequently plan cost-effective actions
- Template also determines sums of mean mitigated risks, by category and for project – *however, again, use with caution!*

– *For efficiency, identify and evaluate potential actions by category / project phase in same two concurrent groups as for risk assessment*

Risk Management Process



Questions?

Reference and source

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