P3 Project Risk Assessment

P3-VALUE Webinar – September 20, 2013

Patrick DeCorla-Souza
P3 Program Manager
Office of Innovative Program Delivery

FHWA's P3 Toolkit

- FHWA's Public-Private Partnerships (P3) Toolkit provides educational tools and guidance documents to enhance the capacity of public sector decision-makers to analyze procurement options
- Will address four key phases of P3 implementation:
  1. Legislation and policy
  2. Planning and evaluation
  3. Procurement
  4. Monitoring and oversight

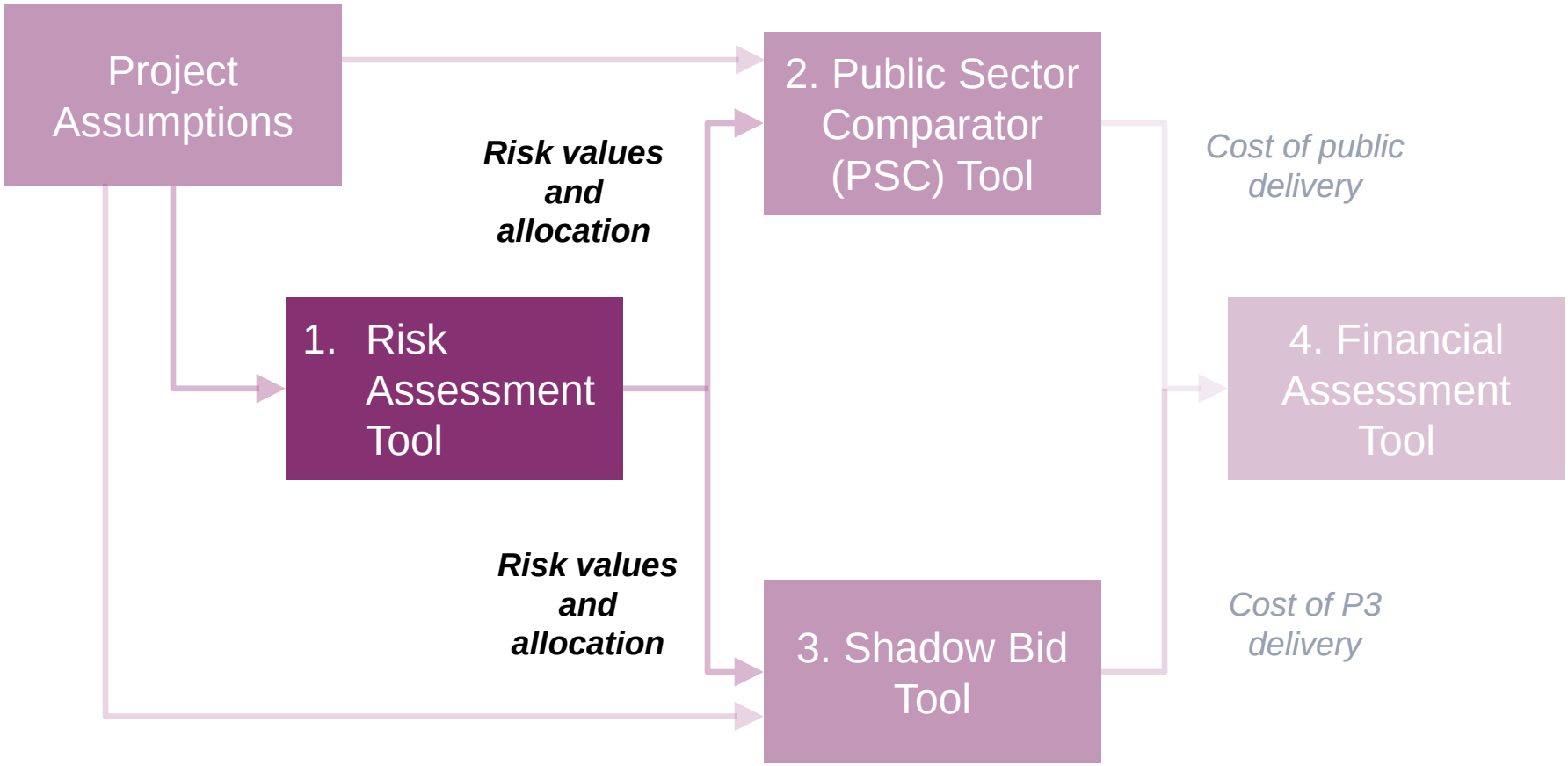
P3-VALUE Webinars

- **P3-VALUE:** Suite of four integrated analytical tools and supporting documentation to help practitioners understand processes used to quantitatively evaluate P3 options
- This is the second of four webinars on P3-VALUE
  - P3 Evaluation Overview (September 5)
    - Recording available at https://connectdot.connectsolutions.com/p483tfus83b/
  - P3 Project Risk Assessment (today)
  - Value for Money Analysis (January 23, 2014)
    - Recording from July 11 available at https://connectdot.connectsolutions.com/p4jg5w4li0n/
  - Financial Structuring and Assessment (March 13, 2014)
    - Recording from August 7 available at https://connectdot.connectsolutions.com/p1b6ku8za83/

P3-VALUE Tools

- **Risk Assessment Tool**
  - Assists in identifying risks, risk allocation, risk response strategies, potential cost and schedule impacts
- **Public Sector Comparator (PSC) Tool**
  - Estimates risk-adjusted life cycle costs of conventional procurement
- **Shadow Bid Tool**
  - Estimates costs of P3 procurement, including payments to private partner
- **Financial Assessment Tool**
  - Compares PSC and Shadow Bid costs to calculate value for money

P3-VALUE Tools



P3-VALUE Tools are accessible at:
http://www.fhwa.dot.gov/ipd/p3/toolkit/analytical_tools/index.htm

Course Outline

Course Objectives

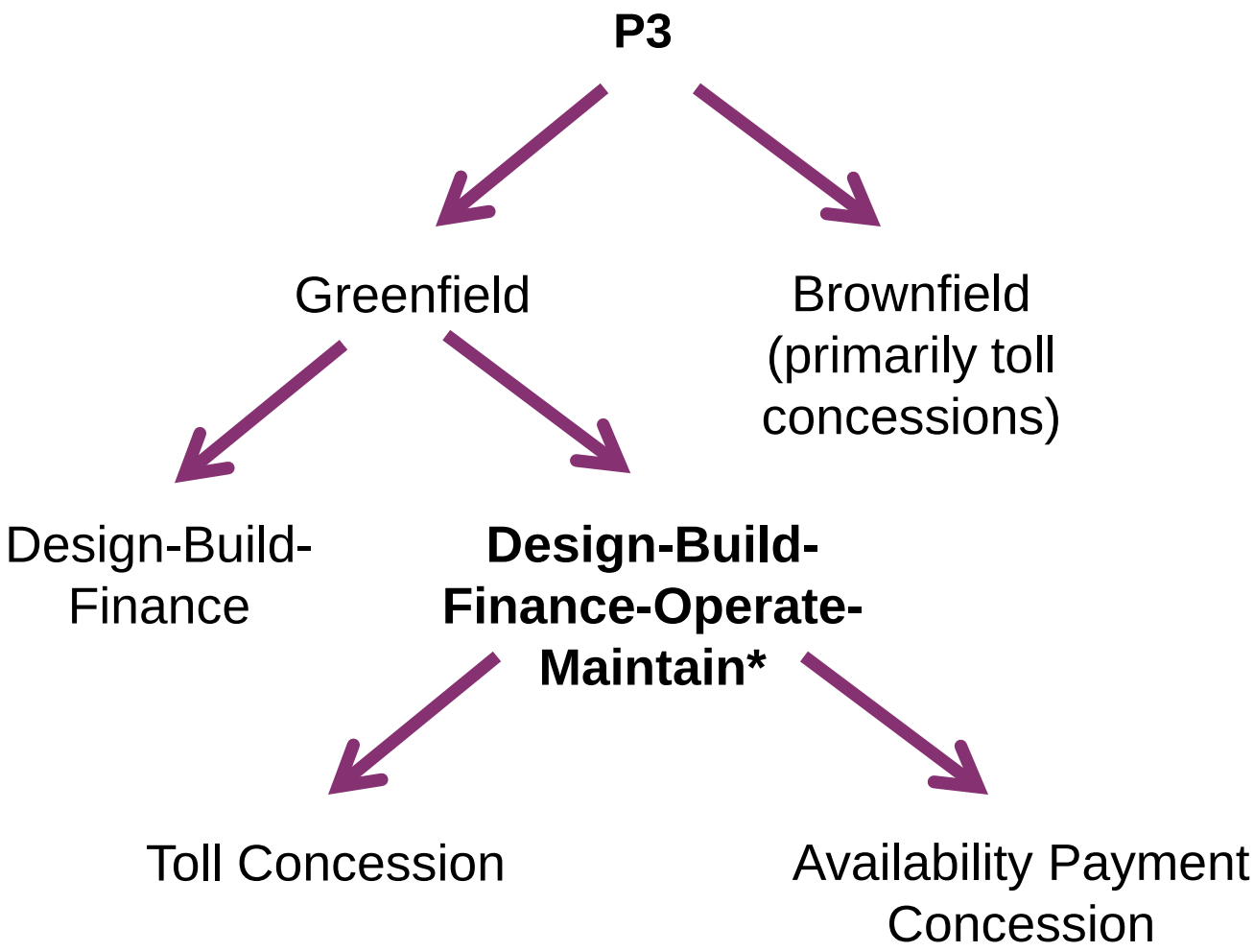
After taking this course you should be able to:

- Identify types of risks in the life cycle of a major project
- List the steps in the risk management process
- Explain the methods for quantifying and monetizing the value of individual risks
- Describe how financial impacts of risks are incorporated into Value for Money analysis
- Access the P3-VALUE tools and supporting information
- Be equipped to test-run the P3-VALUE Risk Assessment tool

Lesson 1

P3s and Risk

Common Types of P3s



*Focus of P3-VALUE tools

Potential Benefits and Drawbacks

Potential Benefits

- Additional Financial Capacity
  - Gap financing accelerates project delivery
  - Conserves public sector debt capacity
- Lifecycle Cost Efficiencies
  - Creates incentives to manage lifecycle costs
  - Integrates project phases creating efficiencies
- Risk Transfer
  - Budget and cost certainty
  - Improved risk management reduces costs

Potential Drawbacks

- Loss of flexibility of public agency
  - Changing priorities
  - Integration of facility into the wider network
- Complex procurement process
  - Higher costs for procurement
  - Need for P3 expertise to conduct negotiations
- Increased financial costs
  - Higher cost for private capital

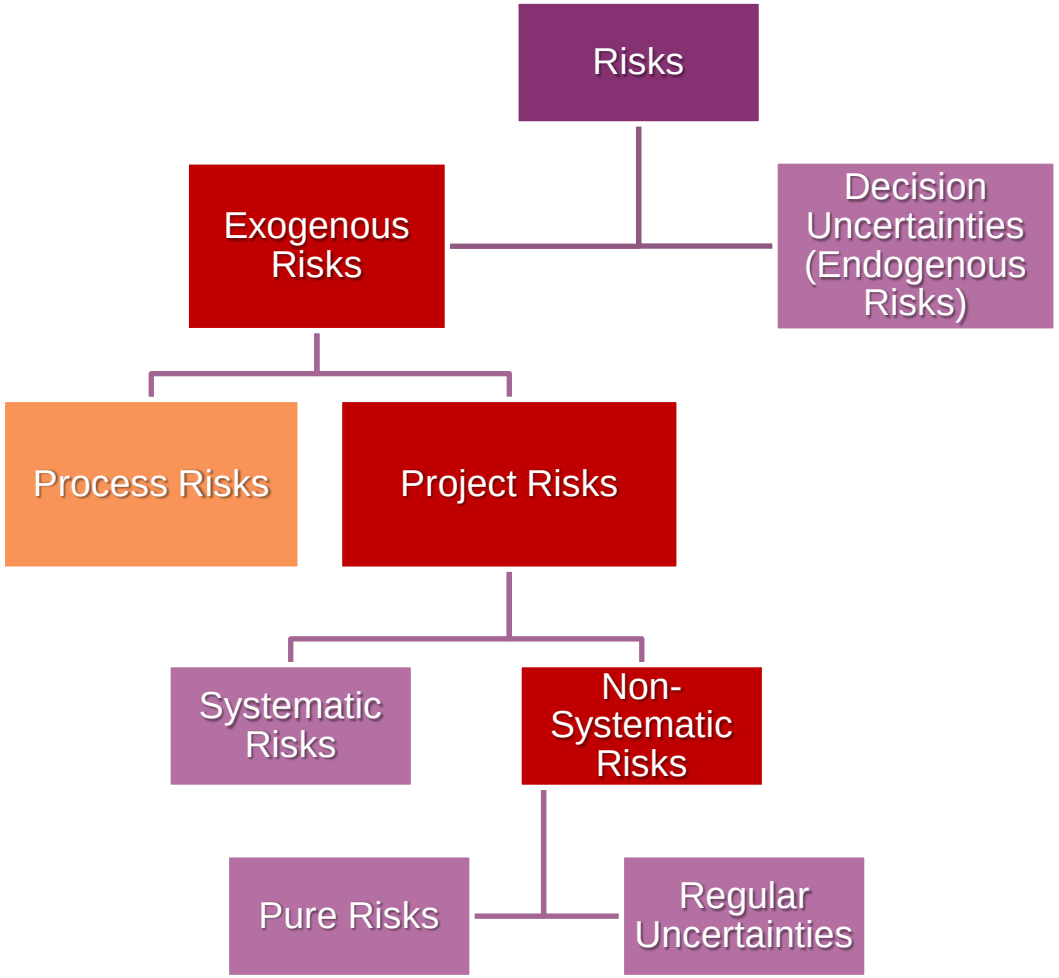
Purpose of Risk Assessment

- To evaluate ***financial viability***
- To calculate value of risks transferred to private sector and retained by public sector for ***value for money*** analysis
- To design technical requirements and commercial terms prior to developing ***draft agreement*** for RFP
- To assist in ***negotiation*** with bidders over the allocation and pricing of risk
- To develop ***risk management plans*** and reporting requirements

Financial Impacts of Project Risks

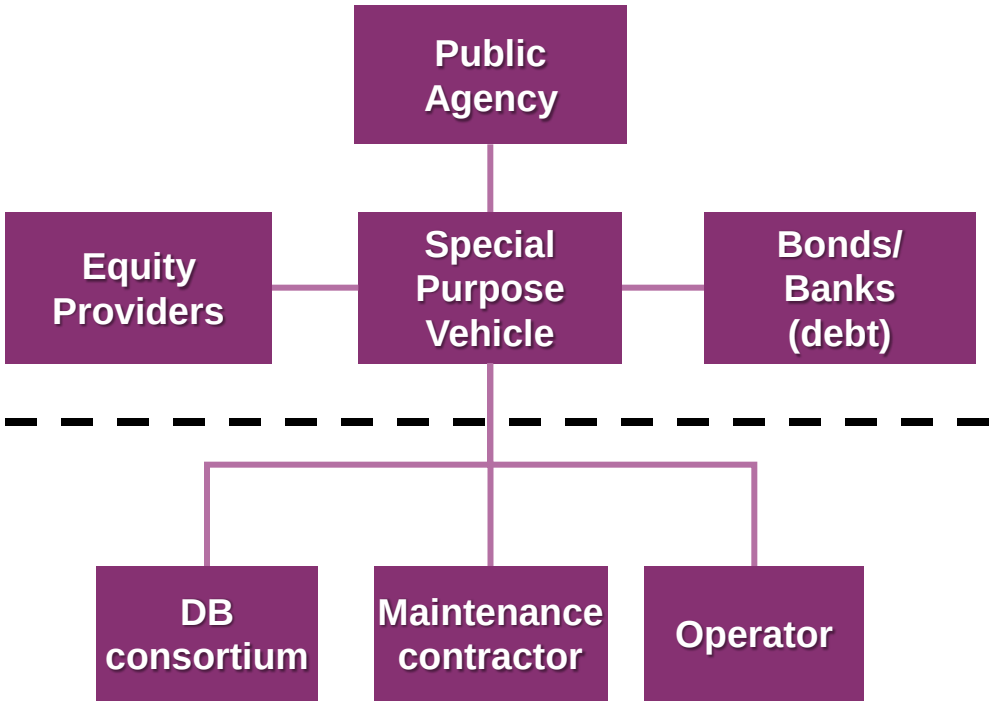
- Costs
  - Capital and O&M
- Revenue
  - Reduced toll revenue or availability payments
- Schedule
  - Delays impact costs as well as revenues

Categorization of Risks



Project Risks

- Includes both systematic and non-systematic risks



- Inflation risk
- Interest rate risk
- Performance risk
- Integration risk
- Toll risk

Subcontractors

- CAPEX risk
- OPEX risk

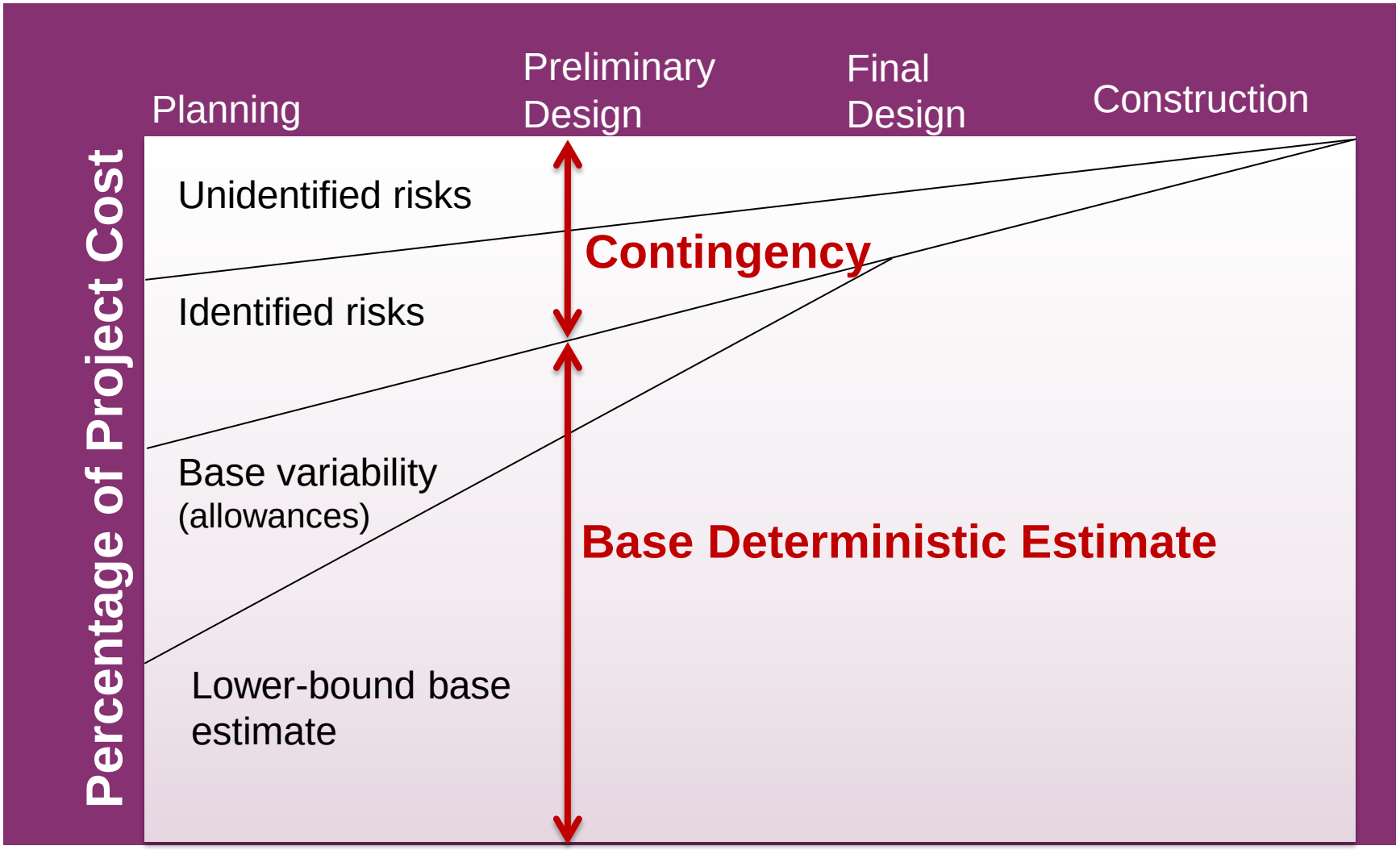
Regular Uncertainties vs. Pure Risk

- **Regular uncertainty**– inherent uncertainty not caused by risk events
  - Function of level of design & estimation process
  - We know it's going to happen, but don't have enough information to estimate the cost accurately
  - "Allowance" estimate
- **Risk**– an uncertain event or condition that, if it occurs, has a *negative or positive* effect on project's costs, schedule or revenues
  - Negative impacts: threats
  - Positive impacts: opportunities
  - "Contingency" estimate

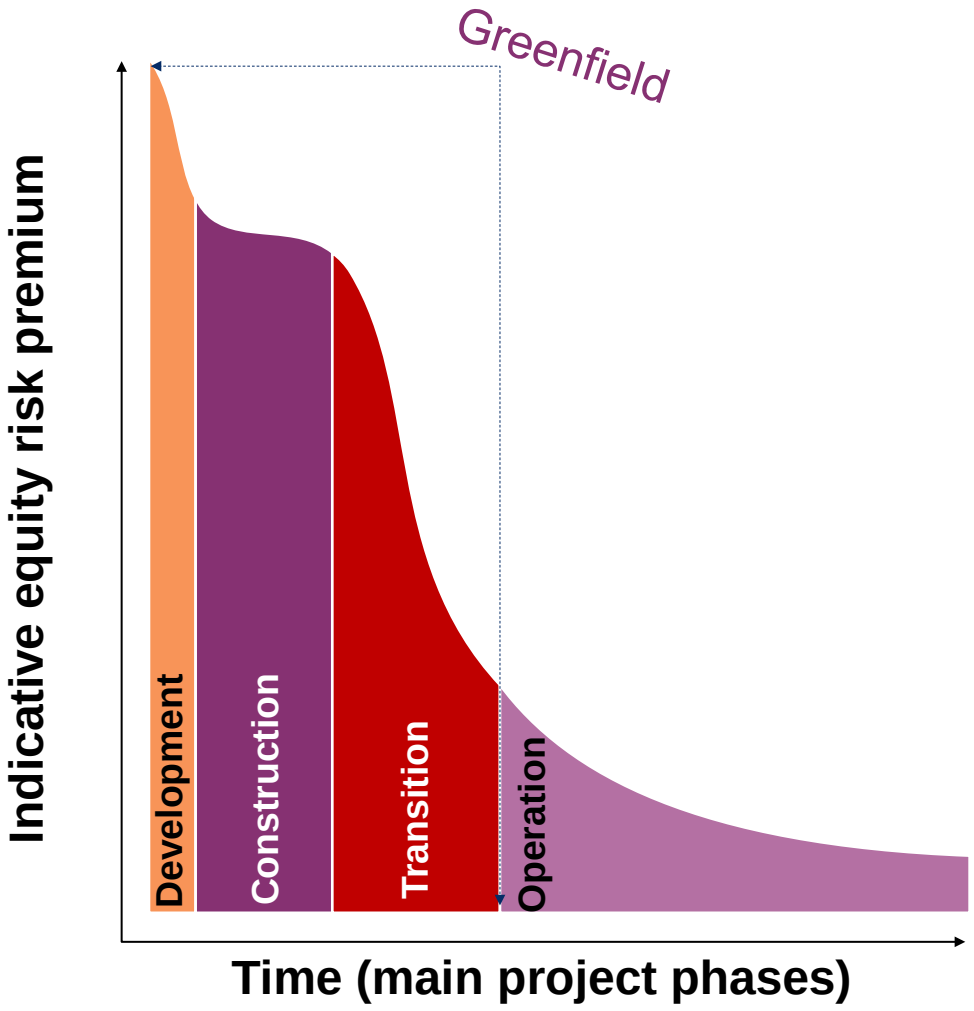
Identified vs. Unidentified Risks

- **Identified risks**
  - Known unknowns – "*It might happen, but at least we are aware of it.*"
  - Accounted for in a "risk register"
  - Can be valued and accounted for in cash flows through a "contingency" amount, or through a "risk premium" in concessionaire's financing costs
  - May be transferred to subcontractors
- **Unidentified risks**
  - Unknowns -- "*We didn't see that coming*."
  - Not accounted for in the "risk register"
  - Can be accounted for in cash flows through a contingency or through "risk premiums" in financing costs

Base Estimate vs. Risk Contingency



Risk Premium over Concession Term



Audience Feedback

On average, how much contingency does your agency include in cost estimates to account for risk in the planning phase? In the design phase?

- None
- 0 – 2 percent
- 2 – 5 percent
- 5 – 10 percent
- 10 – 15 percent
- More than 15 percent
- I don't know

Questions?

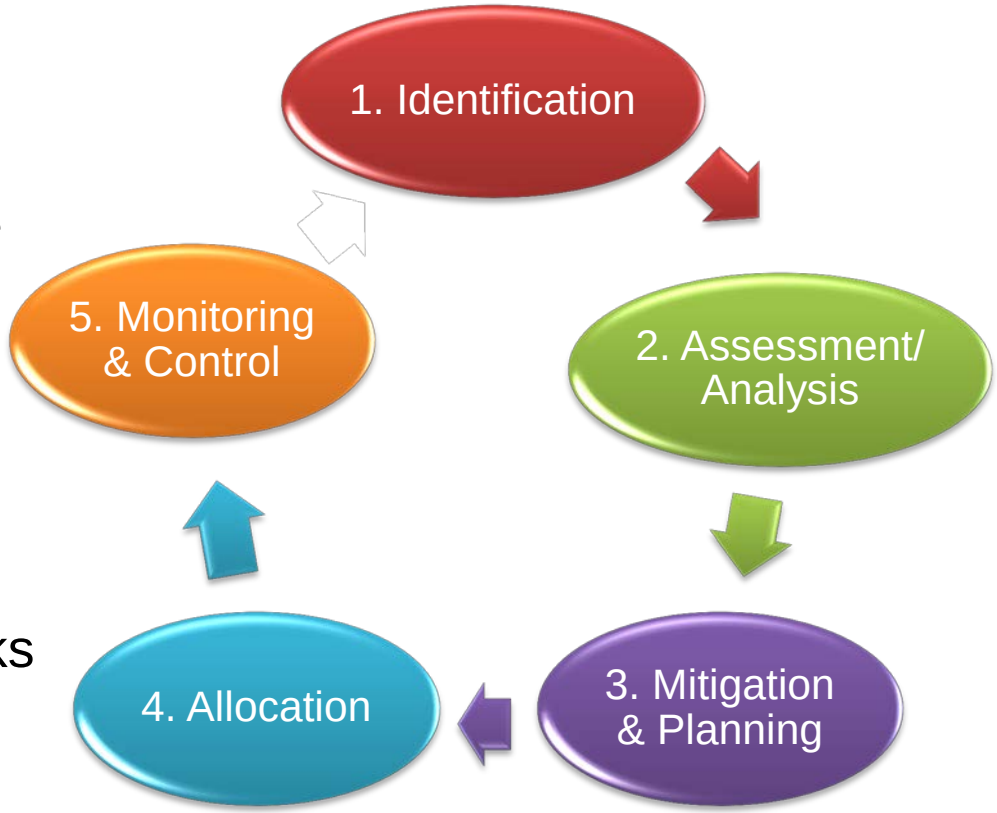
Submit a question using the chat box

Lesson 2

Risk Management Process

Risk Management Process Overview

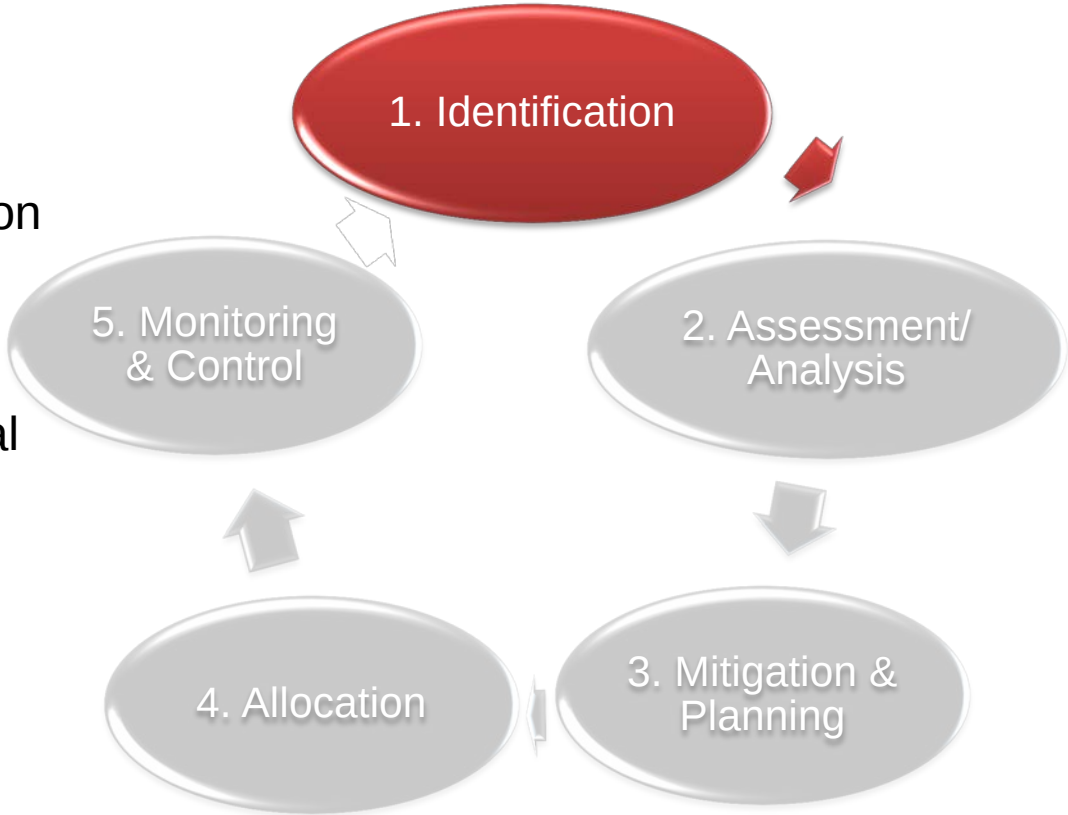
1. Identification
   - Type & timing of risk
2. Analysis and Valuation
   - Probability & consequence of risk
3. Response Planning
   - Minimization of risk impact
4. Allocation
   - Transfer of appropriate risks
5. Monitoring & Control
   - Ongoing oversight of risks



1. Risk Identification

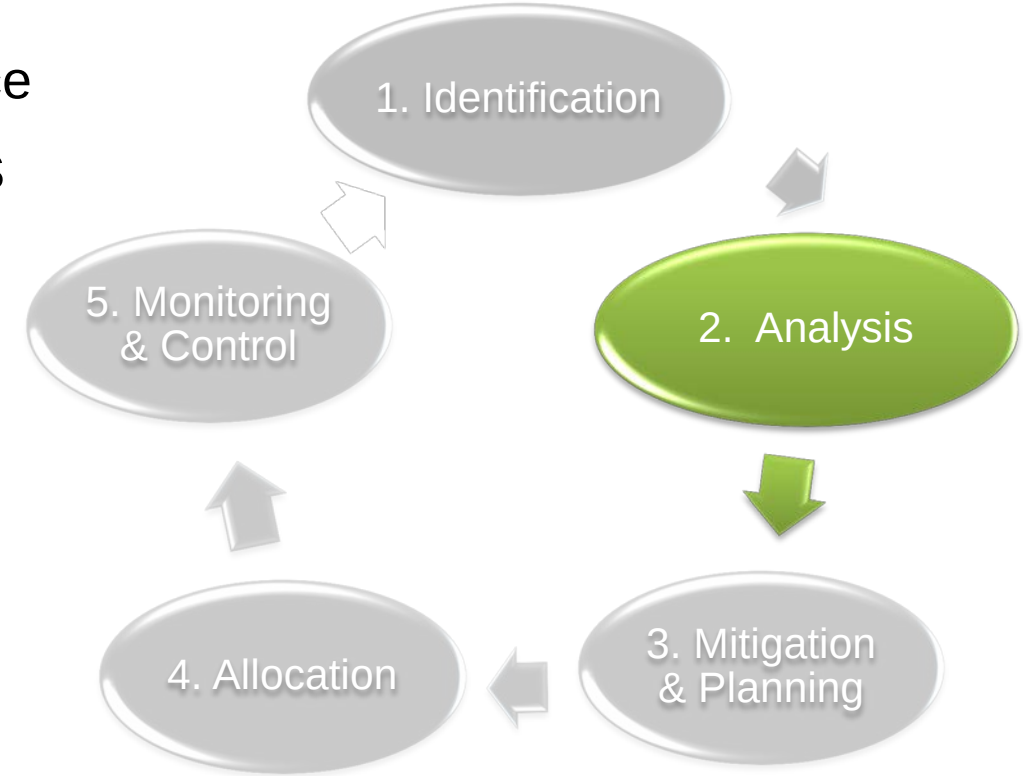
Risk Workshops

- Who?
  - Facilitator
  - Subject matter experts:
    - Design and Construction Engineering
    - Environmental
    - Geological/Hydrological
    - Financial
    - Policy/Planning
- What tools are used?
  - Risk Checklist
  - Risk Register



2. Risk Analysis and Valuation

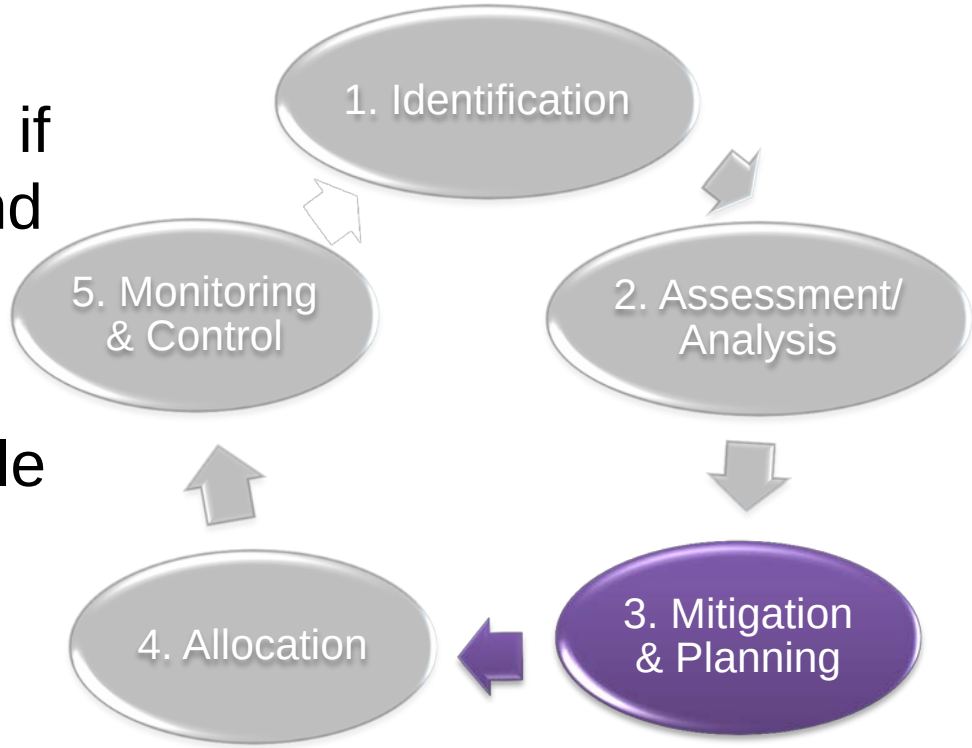
- Calculating the Value of Risk
  - Probability x Consequence
- Potential Consequences
  - Cost
  - Schedule
  - Revenue
- Types of Assessments
  - Qualitative
  - Quantitative



3. Risk Response Planning

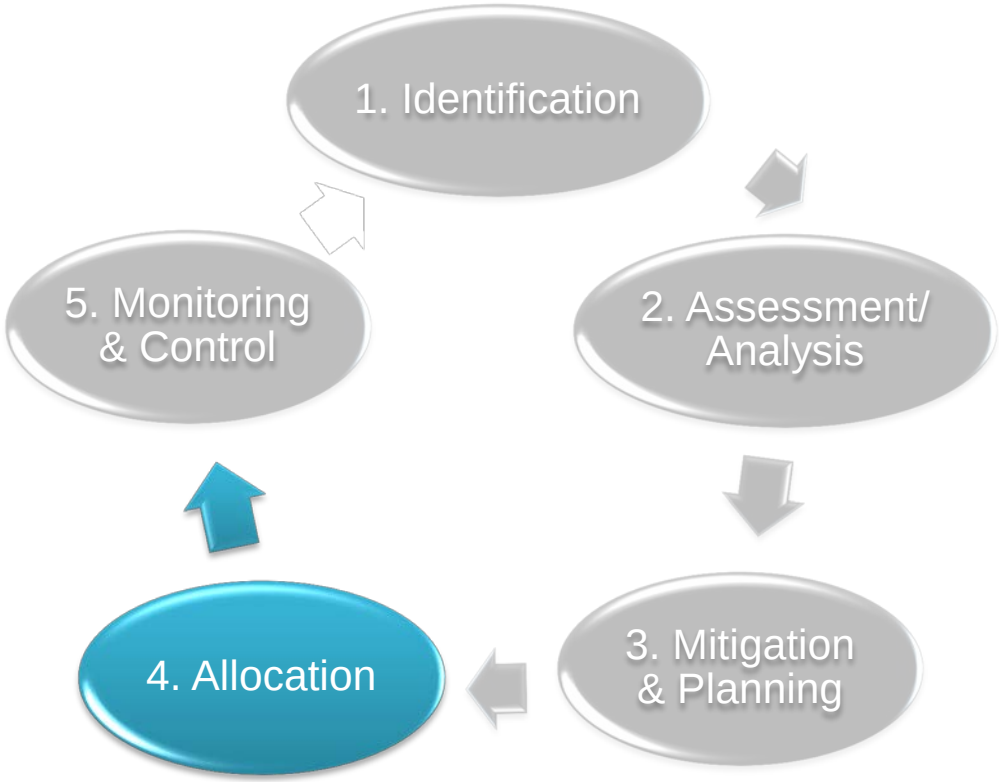
Risk Response Strategies

- **Avoid**: Reduce probability of risk event occurring
- **Mitigate**: Reduce consequence of risk event if it does occur (both cost and time)
- **Transfer/Share**: transfer risk to a party more capable of managing the risk



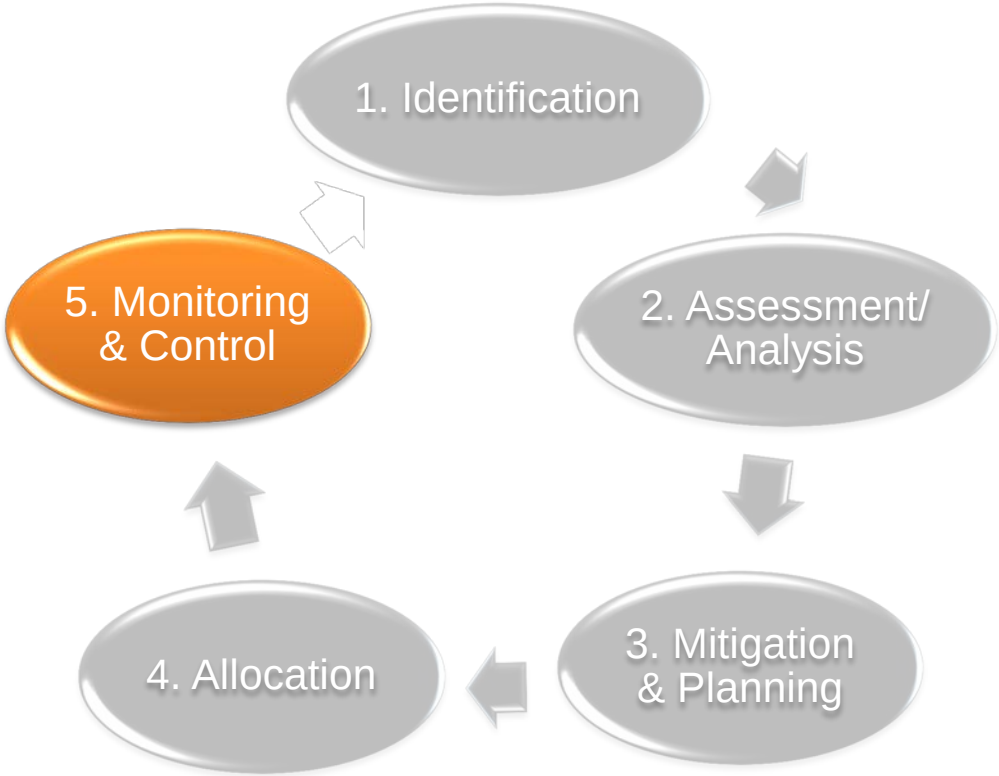
4. Risk Allocation

- Transferrable Risks
- Retained Risks
- Shared Risks



5. Risk Monitoring & Control

- Revisit risk register as risks become clearer
- Use performance metrics to monitor risk
- Understand P3 agreement and negotiated risk management provisions
- Avoid taking back transferred risks



Audience Feedback

In your view, which of the following risks may be managed at lower cost by the private sector?

- Environmental
- Land acquisition
- Utilities
- Financial
- Design/geotechnical
- Construction
- Traffic/revenue
- Operation/maintenance

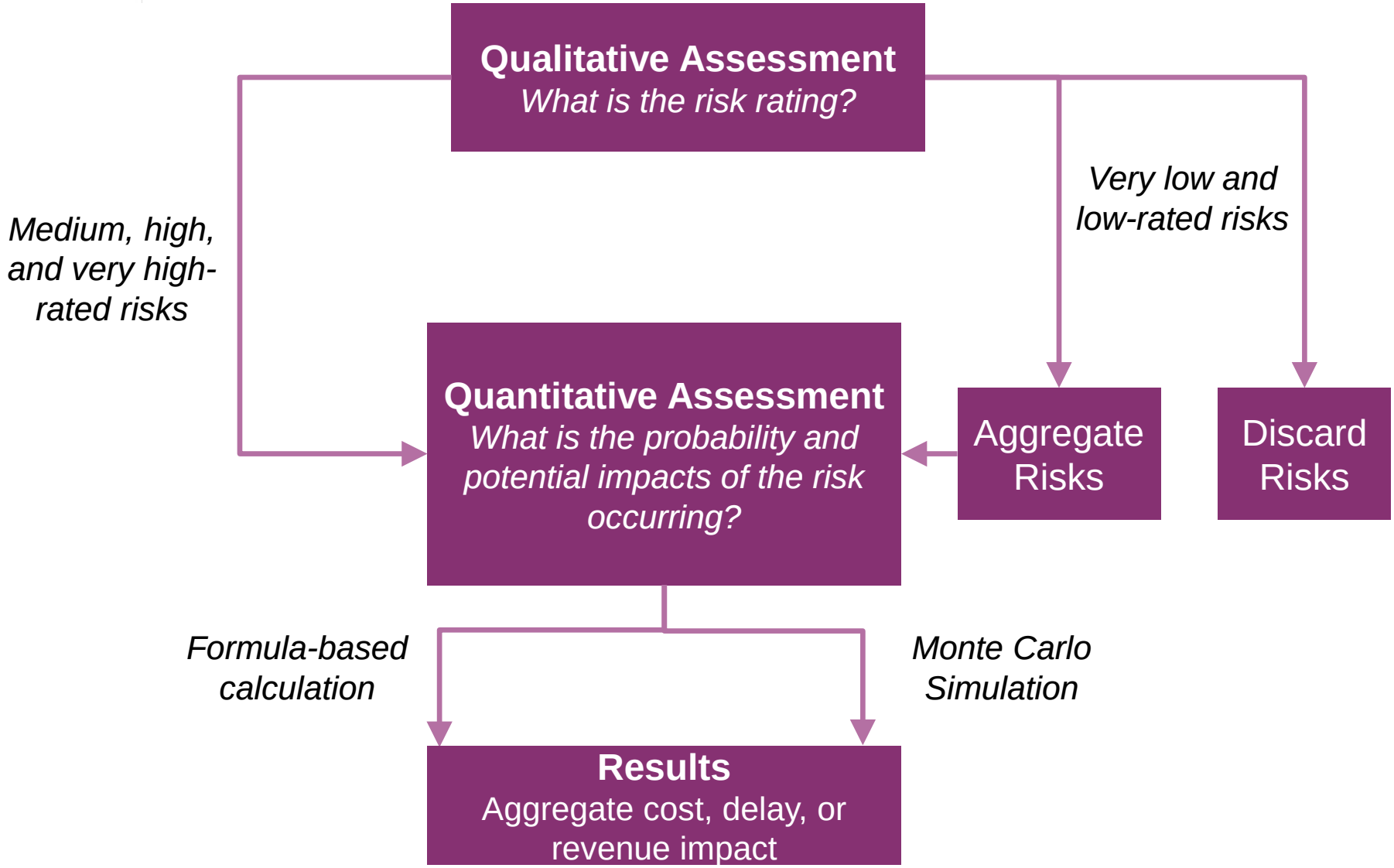
Questions?

Submit a question using the chat box

Lesson 3

Risk Analysis and Valuation

Risk Assessment Process Overview



Types of Analysis

- Qualitative
- Quantitative:
  - Deterministic – uses a formula
  - Probabilistic – uses simulation

Key Inputs

- Probability of risk occurrence
  - Qualitative – very low, low, medium, high, very high
  - Quantitative – % probability (0% - 100%)
- Scale of impact if risk occurs
  - Qualitative – very low, low, medium, high, very high
  - Quantitative – dollar amount or number of days of delay

Qualitative Risk Assessment

- Risk Matrix

Representative Cost Impact Assessment Matrix

		Cost Consequence				
		5	4	3	2	1
Probability	**Scale**	> 25%	10% - 25%	3% - 10%	1% - 3%	<1%
	5 - > 70%	High	High	High	Medium	Low
	4 - 40% - 70%	High	High	Medium	Medium	Low
	3 - 20% - 40%	High	Medium	Medium	Low	Low
	2 - 5% - 20%	Medium	Medium	Low	Low	Low
	1 - 0% - 5%	Low	Low	Low	Low	Low

Representative Schedule Impact Assessment Matrix

		Schedule Consequence				
		5	4	3	2	1
Probability	**Scale**	> 365 days	120 - 365 days	30 - 120 days	7 - 30 days	< 7 days
	5 - > 70%	High	High	High	Medium	Low
	4 - 40% - 70%	High	High	Medium	Medium	Low
	3 - 20% - 40%	High	Medium	Medium	Low	Low
	2 - 5% - 20%	Medium	Medium	Low	Low	Low
	1 - 0% - 5%	Low	Low	Low	Low	Low

Deterministic Analysis

- Formula-based Risk Assessment (VDOT example)
  - Impact = Probability X (Min.+ Max.+ 4 * Most Likely) / 6
- Example:

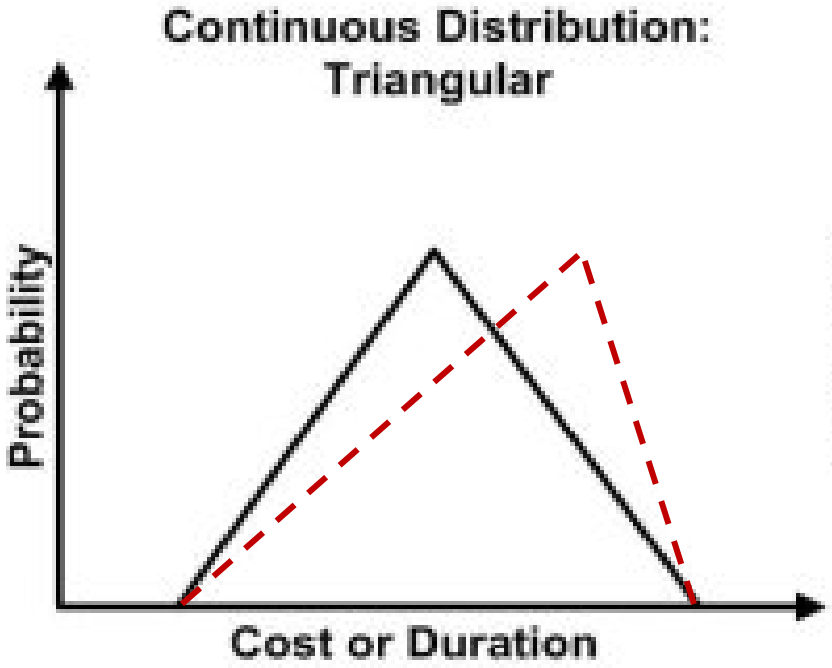
	Risk 1	Risk 2	Risk 3	Aggregate
Probability	90%	50%	20%	
Consequence (min.)	$5 M	$1 M	$2 M	
Consequence (max.)	$20 M	$10 M	$5 M	
Consequence (most likely)	$10 M	N/A	$3 M	
Expected impact of risk using VDOT formula	0.90 X $65M / 6 = $9.75 M	0.50 X $11M / 2 = $2.75 M	0.20 X $19M / 6 = 1.11 M	$9.75 M + $2.75 M + $1.11 M = $13.61 M

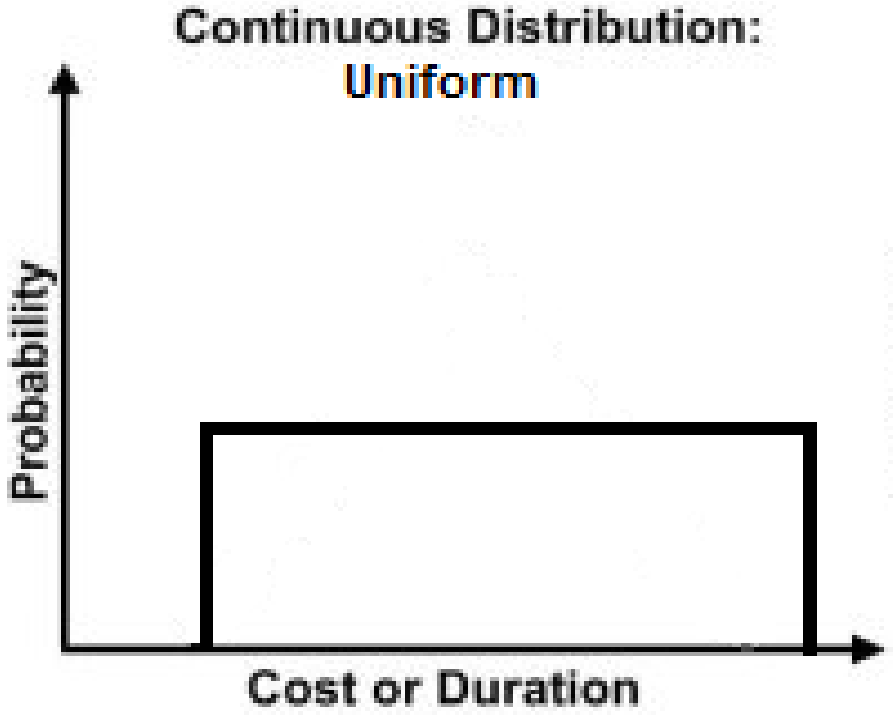
Probabilistic Analysis

- Monte Carlo simulation
  - Simulation of large number of scenarios based on probabilities of risk occurrence and probabilities of magnitude of risk impact

1. Select distribution type (normal, lognormal, triangular, flat or discrete) for each risk's impact;
2. Determine the impact levels (most likely, minimum, maximum);
3. Run simulation using risk software;
4. Determine aggregate risk valuation for desired confidence level.

1. Select Risk Impact Distribution Type





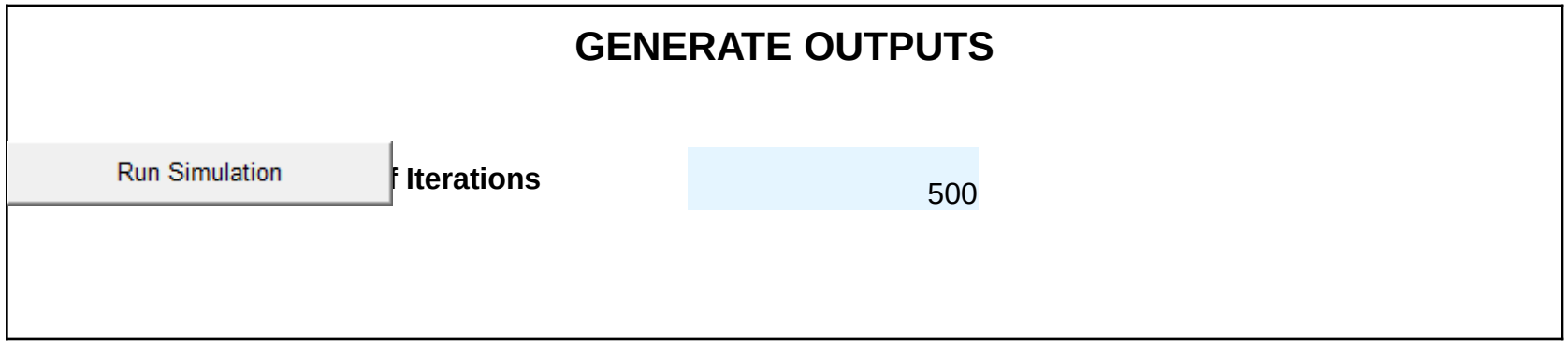
2. Determine Probability & Impact Levels

- Example:

	Risk 1	Risk 2	Risk 3
Probability	90%	50%	20%
Consequence (min.)	$5 M	$1 M	$2 M
Consequence (max.)	$20 M	$10 M	$5 M
Consequence (most likely)	$10 M	N/A	$3 M
Type of probability distribution of consequence	Triangular	Uniform	Triangular

3. Run Simulation

- P3-VALUE simulation:



4. Determine Aggregate Impact

- Impacts for various confidence levels can be estimated

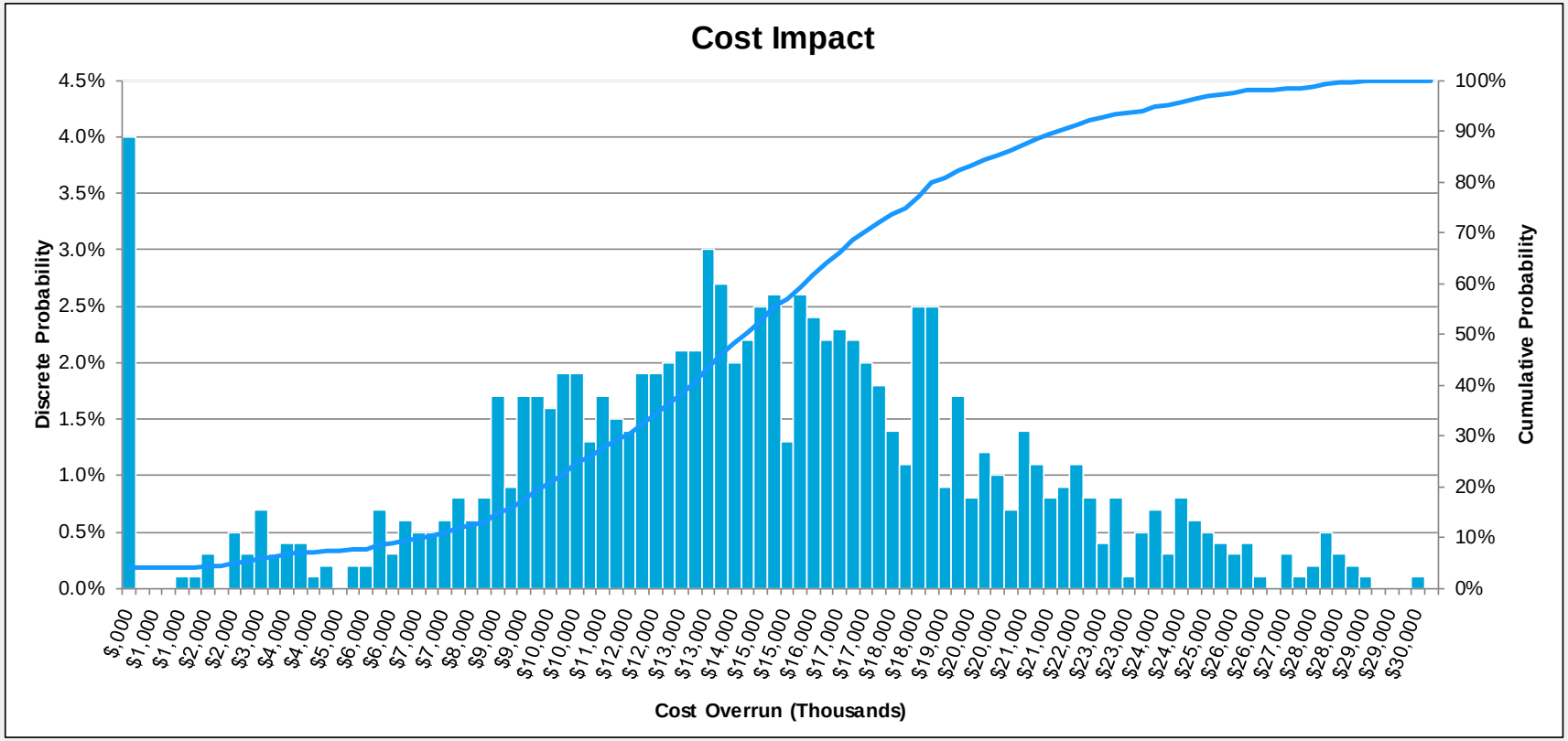
Cost Risk Results (Real Dollars)	
P10 Impact	$6,779,463
P70 Impact	$17,057,332
P90 Impact	$21,656,436

% of Cost Risk Share		
	Public	**Private**
Design Build	10%	90%
Operations	N/A	N/A

Cost Breakdown By Phase

	P10 Impact	P70 Impact	P90 Impact
Planning	$ -	$ -	$ -
Design	$ 6,184,773	$ 13,392,671	$ 17,281,398
Construction	$ 594,690	$ 3,664,661	$ 4,375,038
Commissioning	$ -	$ -	$ -
Turn-Over	$ -	$ -	$ -
Design Build Subtotal	$ 6,779,463	$ 17,057,332	$ 21,656,436
Operations	$ -	$ -	$ -
Total	**$ 6,779,463**	**$ 17,057,332**	**$ 21,656,436**

Aggregate Impact – Graphical



Risk Assessment Challenges

- Estimating risk impacts and probabilities with limited data
  - Avoiding optimism bias
  - Or overestimating PSC risks
- Accounting for correlation among risks
- Accounting for unidentified risks
- Avoiding double-counting of risks
  - Project risks in cash flows vs. “systematic” risks accounted for in financing risk premiums or discount rates
- Accounting for revenue risks
- Aggregating low probability/low consequence risks
- Accounting for procurement phase risks that are unique to P3s

Test Your Knowledge

True or False:

A deterministic (formula-based) risk valuation can provide varying estimates of aggregate risk values, from which an analyst can choose depending on the confidence level desired by decisionmakers.

Questions?

Submit a question using the chat box

Lesson 4

Risk Allocation

Risk Transfer by Procurement Type

Procurement Type	Design Risk	Construction Risk	Financial Risk	O&M Risk	Traffic & Revenue Risk
Design-Build (DB)	X	X			
Design-Build-Finance (DBF)	X	X	X		
Design-Build-Finance-Operate-Maintain (DBFOM) w/Availability Payment	**X**	**X**	**X**	**X**	
DBFOM w/Toll Concession	**X**	**X**	**X**	**X**	**X**

Typical Risk Allocation

Risk	Design - Bid - Build	Availability Payment P3	Toll Concession P3
Design errors	Public	Contractor	Contractor
Change in scope	Public	Public	Public
Delay in permits	Public	Shared	Shared
Delay in right-of-way acquisition	Public	Public	Public
Construction cost overruns	Contractor	Contractor	Contractor
Construction risks	Contractor	Contractor	Contractor
Archeological findings	Public	Public	Public
Delay in relocation of cables and pipes	Public	Contractor	Contractor
Unknown ground conditions	Public	Contractor	Contractor
Hazmat	Public	Shared	Shared
Security	Public	Contractor	Contractor
Major maintenance cost overruns	Public	Contractor	Contractor
Snow and ice removal cost overruns	Public	Contractor	Contractor
Regular maintenance	Public	Contractor	Contractor
Traffic information systems	Public	Public	Public
Incident management	Public	Contractor	Contractor
Toll revenue risk	Public	Public	Contractor
Financing risks	Public	Contractor	Contractor
Force majeure	Public	Shared	Shared

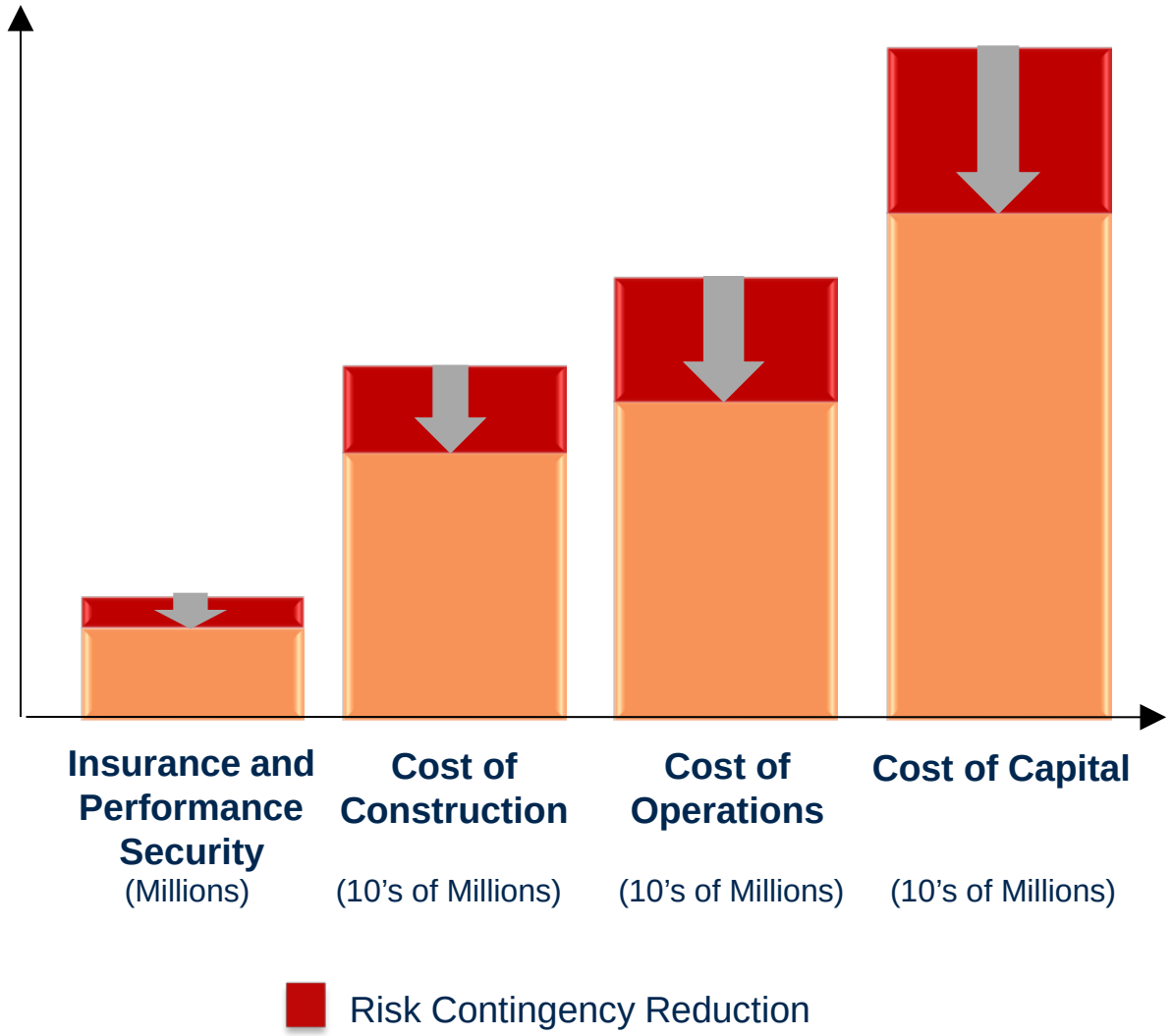
Risk Transfer Principles

- P3s do not transfer *all* project risk
- Risk is allocated to party most capable of managing the risk
  - "Managing risk" may mean insuring that risk
- Risk transfer will increase the bid price of the private sector
- Transferring risks can incentivize performance
- A risk may be shared if neither party is more capable of managing it
- Risks have a value (or cost) that varies over time

Risk Allocation Steps

Step 1: "Likelihood"	• First, risk should be allocated to the party best able to control the likelihood of the risk occurring.
Step 2: "Impact"	• Second, risk should be allocated to the party best able to control the impact of the risk on project outcomes.
Step 3: "Lowest Cost"	• Third, risk should be allocated to the party best able to absorb the risk at lowest cost if the likelihood and impact cannot be controlled.

Financial Impact of Risk Transfer



Port of Miami Tunnel
Risk Allocation Example

Risk Category	FDOT	Private	Shared
Political	X		
Financial		X	
Traffic and Revenue	X		
Right of Way	X		
Planning and Permitting			X
Utilities			X
Procurement	X		
Construction		X	
Operations and Maintenance		X	
Hand-Back		X	
Force Majeure			X
Change in Law	X		
Geotechnical			X

Test Your Knowledge

True or False:

The goal in risk allocation is to transfer all risks to the private partner in a P3.

Questions?

Submit a question using the chat box

Lesson 5

Risk and Value for Money Analysis

What is Value for Money?

- **Value for Money (VfM)**
  - The optimum combination of life cycle costs and quality of a good or service to meet the user's requirements
  - Expressed as cost difference (dollars or %) between conventional and P3 procurement
- **VfM Analysis**
  - Quantitative analysis to compare the financial impacts of procurement alternatives for a project
  - Compares *present value* of costs for P3 vs. present value of costs for conventional project delivery
  - Considers value of transferred and retained risks under different procurement options

Value for Money Analysis Steps

1. Identify potential procurement options
2. Identify, monetize and allocate project risks
    1. Risk identification
    2. Risk quantification
    3. Aggregate risk valuation
    4. Risk allocation
3. Apply risk values to expected cash flows over project lifecycle in the public sector comparator (PSC) and P3 option (“shadow bid”)
4. Discount cash flows to calculate net present costs of PSC and Shadow Bid
5. Compare public sector comparator to P3 option
6. Consider qualitative factors

Hypothetical Example

- Conventional procurement – Design-Bid-Build (DBB)
- P3 options – 23-year Design-Build-Finance-Operate-Maintain (DBFOM) concession, including 3-year design-build phase, with:
  - Availability payment (option 1)
  - Toll (option 2)
- Illustrative assumptions:
  - Risks transferred to P3 concessionaire are managed at 50 percent lower cost
  - P3 concessionaire may increase toll revenue by 5 percent for toll concession (opportunity)
  - Future cash flows discounted using public sector borrowing rate

Valuation of Transferrable Risks

Real dollar values	Conventional	P3-Avaliability	P3-Toll
Value of threats	**-$100 M**	**-$50 M**	**-$50 M**
Year 1 cash flow impact	-$20 M	-$10 M	-$10 M
Year 2 cash flow impact	-$70 M	-$ 35 M	-$ 35 M
Year 3 cash flow impact	-$10 M	-$5 M	-$5 M
Value of opportunities	**--**	**--**	**+$200***
Year 4 through 23 cash flow impact			+$10 M per year

*Note that the opportunity for additional revenue can reduce the bid price of the concessionaire, thus can represent a cash flow increase for the public agency also.

Nominal Cash Flows of Transferrable Risks

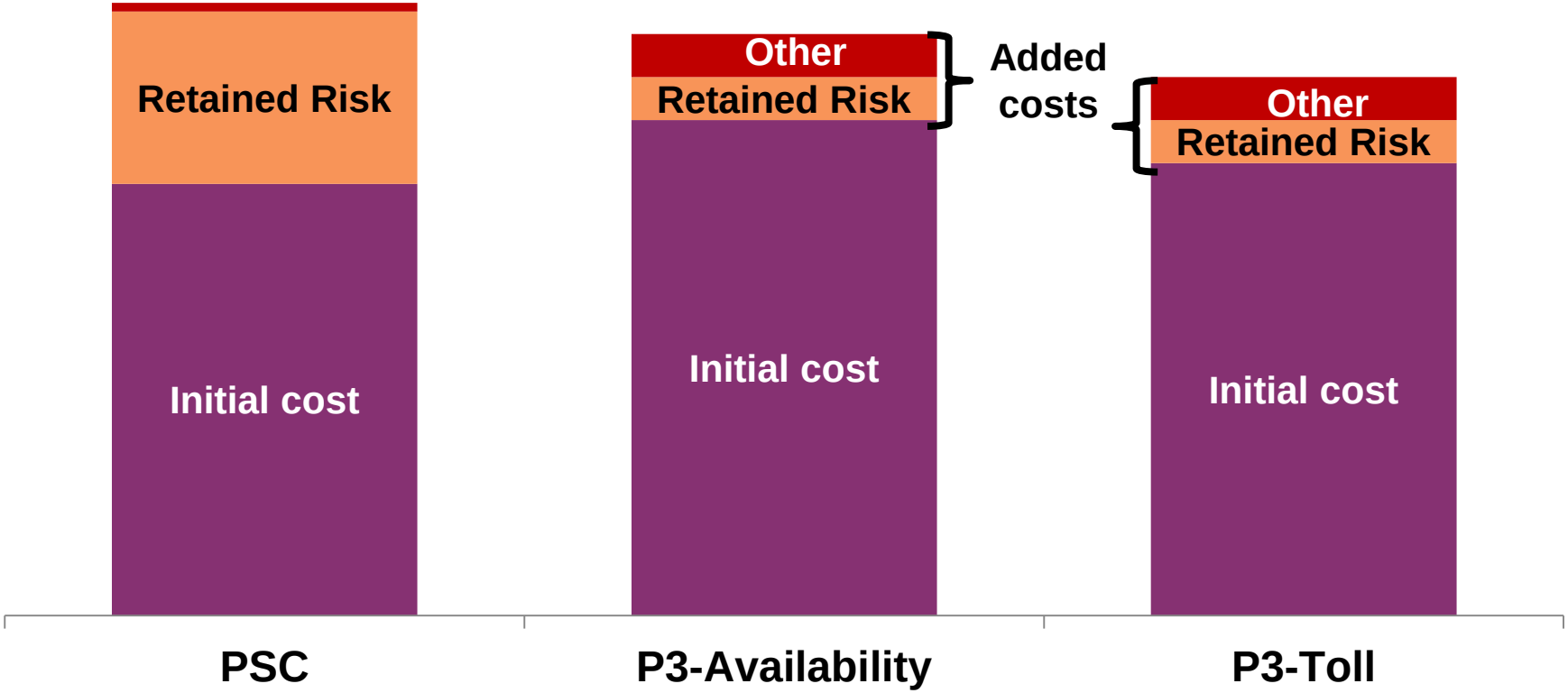
Nominal dollar values at 3% annual inflation rate	Conventional	P3-Avaliability	P3-Toll
Threats (negative risks)			
Year 1 cash flow impact	-$20.6	-$10.3	-$10.3
Year 2 cash flow impact	-$74.3	-$37.1	-$37.1
Year 3 cash flow impact	-$10.9	-$5.5	-$5.5
Opportunities (positive risks)	--	--	
Year 4 cash flow impact			+$11.3
Year 23 cash flow impact			+19.7

Present Value of Transferrable Risks

5% nominal discount rate applied to nominal cash flows	Conventional	P3-Avaliability	P3-Toll
Threats (negative risks)			
Year 1 cash flow impact	-$19.6	-$9.8	-$9.8
Year 2 cash flow impact	-$67.4	-$33.7	-$33.7
Year 3 cash flow impact	-$9.4	-$4.7	-$4.7
Subtotal	**-$96.4**	**-$48.2**	**-$48.2**
Opportunities (positive)			
Year 4 cash flow impact			+$9.3
Year 23 cash flow impact			+$6.4
Subtotal for 20 years			**+$155.2**
Present value of risks	**-$96.4**	**-$48.2**	**+$107.0**

How Does Risk Affect VfM?

- Transferred risks increase Initial Cost of P3 options, but retained risks in conventional procurement (PSC) may make it more costly than P3 options overall



NOTE: This figure is for demonstration purposes only. One should not conclude that a P3-Toll concession is less costly than a P3-Availability concession.

Audience Feedback

Has your agency conducted a value for money analysis?

- Yes
- No
- I don't know

Questions?

Submit a question using the chat box

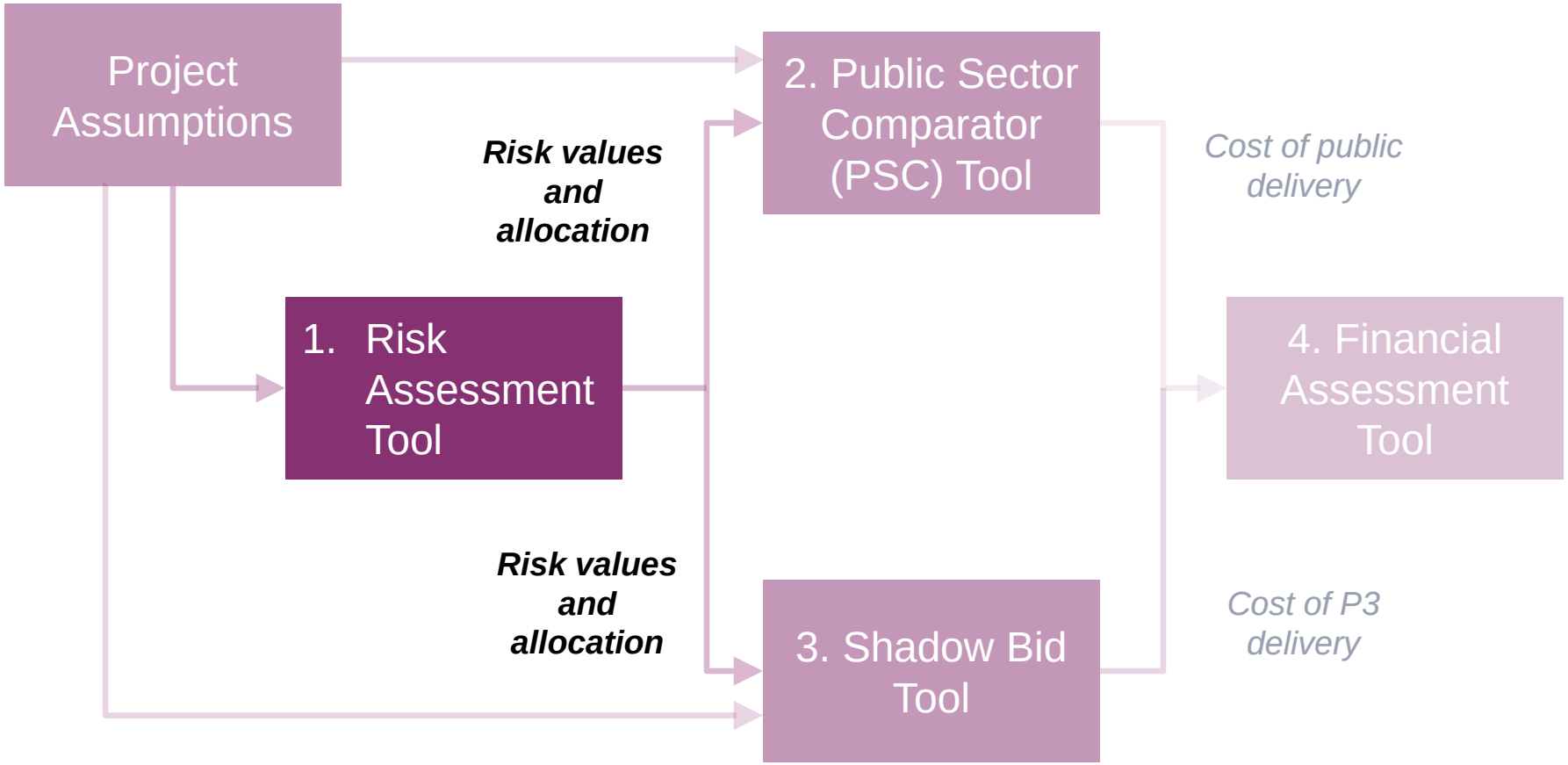
Lesson 6

Using the P3-VALUE Risk Assessment Tool

Accessing the Risk Assessment Tool

- P3-VALUE tools posted to FHWA IPD website:
  - http://www.fhwa.dot.gov/ipd/p3/toolkit/analytical_tools/index.htm
- Users should refer to the relevant supporting documentation when opening and navigating the tool
- Send questions and comments to P3-VALUE@dot.gov

P3-VALUE Tools



P3-VALUE Tools are accessible at:
http://www.fhwa.dot.gov/ipd/p3/toolkit/analytical_tools/index.htm

Supporting Documentation

- **Orientation Guide**
- **User Manual and Quick Start Guide**
  - *Risk Assessment Tool User Manual* provides technical guidance, including a two-page "quick-start guide" for exploring the tool
- **Primer**
  - *Risk Assessment for Public-Private Partnerships: A Primer* explains the basic concepts involved in risk assessment
- **FAQs and Troubleshooting Guide**
- **Guidebook (under development)**
  - *Risk Assessment & Allocation for Public-Private Partnerships Guidebook* will provide an advanced understanding of the practical applications and challenges of assessing P3 project life cycle risks

P3-VALUE Tool

- Risk Register

1.Risk Identification					
Risk Number	Risk Category	Impact Phase	Risk Type	Description	Consequence of Risk
Technical Risks					
1	Environmental	Construction	Threat	The project is in marshy ground that is prone to flooding and there have not been many boreholes. Later investigations may uncover worse ground than that assumed in preliminary engineering. Excavations at the site of major may result in foundations have to be reinforced / redesigned	Change in design during early stages will require update of cost estimate. Changes on site could result in increase in project costs and potential delay to construction. Change in design during early stages will require update of cost estimate.

P3-VALUE Tool

- Qualitative Risk Assessment

2.Qualitative Risk Assessment				
Probability Rating	Cost		Schedule	
	Consequence	Risk Rating	Consequence	Risk Rating
5	2	Medium	2	Medium

P3-VALUE Tool

- Quantitative Risk Assessment

3.Quantitative Risk Assessment								
Probability Percentage	Schedule Impact (days)				Cost Impact ($)			
	Distribution	Min	Most Likely	Max	Distribution	Min	Most Likely	Max
80%	Triangular	15	20	30	Triangular	$ 8,340,950	$ 16,681,900	$ 83,409,500

P3-VALUE Tool

- Risk Allocation & Mitigation

4.Allocation & Mitigation		
Risk Allocation (%)		Risk Mitigation
Public	Private	
20%	80%	Perform additional borings before substantially progressing the design

Risk Assessment Tool Limitations

- Risk Assessment Tool is not suitable for all types of potential scenarios
  - Monte Carlo Simulation does not accommodate revenue risks
- Risk Assessment Tool assumes all risks are independent, with no correlation between the risks
- Risk Assessment Tool does not aggregate lower-rated risks
  - Users can do an “off-sheet” calculation if the impacts of those aggregated risks represent a more significant risk

Questions?

Submit a question using the chat box

Course Summary

Course Recap

Lesson 1	P3s and Risk
Lesson 2	Risk Management Process
Lesson 3	Risk Analysis and Valuation
Lesson 4	Risk Allocation
Lesson 5	Risk and Value for Money Analysis
Lesson 6	Using the P3-VALUE Risk Assessment Tool

Resources

IPD's P3 Website:
http://www.fhwa.dot.gov/ipd/p3/

FHWA Risk Assessment Primer:
http://www.fhwa.dot.gov/ipd/pdfs/p3/p3_risk_assessment_primer_122612.pdf

FHWA Risk Valuation and Allocation Factsheet:
http://www.fhwa.dot.gov/ipd/pdfs/p3/factsheet_02_riskvalutationandallocation.pdf

P3-VALUE Website:
http://www.fhwa.dot.gov/ipd/p3/toolkit/index.htm

P3-VALUE Risk Assessment Tool:
http://www.fhwa.dot.gov/ipd/p3/toolkit/analytical_tools/index.htm

P3-VALUE Risk Assessment User Manual:
http://www.fhwa.dot.gov/ipd/pdfs/p3/p3_value_riskassessment_manual_v1.pdf

Upcoming P3-VALUE Training

- **October 4:** Office Hours: Risk Assessment Homework Review
- **October 29-30:** Advanced P3 Evaluation Pilot Training*
- **January 23:** Value for Money Analysis 201
- **February 21:** Office Hours: VfM Homework Review
- **March 13:** P3 Financial Structuring & Assessment
- **April 18:** Office Hours: Financial Assessment Homework Review

To register for the P3-VALUE webinars, please visit
http://www.nhi.fhwa.dot.gov/resources/webconference/eventcalendar.aspx

****To register for the two-day workshop, please visit***
http://152.122.41.186/IPDRegistration/regional.asp

Contact Information

Patrick DeCorla-Souza

P3 Program Manager

Office of Innovative Program Delivery

Federal Highway Administration

(202) 366-4076

Patrick.DeCorla-Souza@dot.gov

Contact Information

Jim Sinnette

Project Delivery Team Leader

Office of Innovative Program Delivery

Federal Highway Administration

(202) 366-1561

James.Sinnette@dot.gov

Contact Information

Thay N. Bishop, CPA, CTP

Senior Program Advisor/Capacity Builder

Office of Innovative Program Delivery

Federal Highway Administration

(404) 562-3695

Thay.Bishop@dot.gov