**P3 Risk Assessment Exercise**

**ANSWERS SHOWN IN BOLD RED FONT**

**Objectives of this exercise**

* Learn how to estimate, for use in VfM analysis, the cost impacts of base cost variability, pure risks, lifecycle performance risks, and revenue risk uncertainty adjustments; as well as the value of risks retained by the public agency and those transferred to the concessionaire under a P3.
* Learn how to estimate the value of risks for use in benefit-cost analysis.
* Be able to explain the role of financial conditions in developing a market-based estimate of the costs of lifecycle performance risks and revenue uncertainty.

**Project Background**

A study was done previously by a state DOT to estimate Value for Money and net social benefits of P3 delivery for a highway project. The various inputs required for the analysis are included in the P3-VALUE 2.0 spreadsheet model. The project information is as follows:

* 20 miles highway expansion
* Expansion from 3 lanes to 5 lanes in each direction:
	+ 3 General Purpose Lanes (GPL)
	+ 2 Managed Lanes (ML)
* Costs under PSC (excluding risks and financing):
	+ Pre-construction & construction: $25M and $400M respectively
	+ Routine O&M: $4M per year
	+ Major maintenance: $10M (every 8 years)
* Preconstruction under PSC starts in 2015; 2 years duration
* Construction duration under PSC: 4 years, starting in 2017
* Operations period under PSC: 40 years, starting in 2021

**Analysis Steps**

* Part A: Risk Valuation for use in VfM Analysis: Review the DOT’s cost estimates, for VfM analysis, for the following:
	+ Base cost variability, pure risk and lifecycle performance risk costs, and revenue risk uncertainty; and
	+ The value of risks retained by the public agency and transferred to the concessionaire under a P3
* Part B: Risk Valuation for use in Benefit-Cost Analysis: Review the DOT’s cost estimates, for benefit-cost analysis, for the following:
	+ Base variability, pure risk and lifecycle performance risk costs.
* Part C: Valuation of Lifecycle Performance Risks and Revenue Uncertainty: Test the impacts of financial conditions on market-based cost estimates of lifecycle performance risk and revenue uncertainty.

**Part A: Risk Analysis for VfM**

1. Open P3-VALUE 2.0 Excel file.
2. When opening the file, Excel may prompt you to approve the use of macros. To do so, click “Enable editing” and/or “Enable content” on the yellow bar across the top of the screen.
3. After the model opens, the following user form will appear.



1. Select the “Training Navigator” to access the training modules. The “Training Navigator” contains four training modules that provide limited access to only the most relevant inputs and outputs for a particular training session.
2. Select “Module 3: Risk Assessment” and proceed with the steps below (Note that the Training Navigator window may be closed and reopened at any point. Also, the tool has already been optimized and therefore optimizing the tool is not required unless specified).
3. Review the cost impacts of each of the following for the Conventional Delivery and P3 Options:
4. Base cost variability
5. Pure risks
6. Lifecycle performance risks
7. Revenue uncertainty (toll concessions only)

***Step 1: Conventional Delivery (PSC)***:

The PSC risks include (1) Base variability; (2) Pure risks; (3) Lifecycle performance risks; and (4) Revenue uncertainty.

Review the key PSC project information in the ***InpRisk***sheet of the model provided.

* **Pure risk** inputs: risk probabilities (row 10), most likely impact, impact distribution (uniform or triangular), minimum/maximum impact variation relative to most likely impact (rows 16-27 and rows 33-38)
* **Base variability** inputs: percentage of costs (rows 45-47)
* **Lifecycle performance risk** inputs: lifecycle performance risk cost estimate or P3 financing conditions (rows 52-53)
* **Revenue uncertainty adjustment** inputs: revenue uncertainty “haircut” or P3 financing conditions (rows 59-60)

Review the key PSC project information in the ***InpFin*** sheet of the model provided.

* **Lifecycle performance risk** inputs/financing conditions:
	+ P3 cost of equity and gearing (rows 54-55)
	+ P3 debt and equity bridge loan interest rates (rows 61-62)
	+ P3 minimum debt service coverage ratio (DSCR, row 64)
* **Revenue uncertainty adjustment** inputs:
	+ P3 - Difference between Availability Payment WACC and Toll Concession WACC (row 71)

Review and record below the Conventional Delivery risk values for VfM (see ***Risk Output for VfM*** sheet)

|  |  |
| --- | --- |
| **Item** | **Risks under Conventional Delivery** |
| **NPV risk values($M, Column G)** | **Nominal risk values($M, Column H)** |
| Total Pure risks (row 28) | **69** | **121** |
| Total Base variability (row 34) | **79** | **112** |
| Lifecycle performance risk premium (row 36) | **228** | **574** |
| Revenue uncertainty adjustment (row 38) | **130** | **377** |
| **Total risks under Conventional Delivery (row 45)** | **505** | **1,184** |

***Step 2: P3 Option***:

Differences between P3 and Conventional Delivery that could affect P3 risk values may include:

* P3 differences with regard to lifecycle costs and risk management, potentially leading to a reduction in costs and risk valuation
* Share of pure risks transferred to the concessionaire

Review the P3 differences assumed for pure risks and base variability in the ***InpRisk*** sheet.

Review and record below the retained P3 risk values for VfM (see ***Risk Output for VfM*** sheet).

|  |  |
| --- | --- |
| **Item** | **Risk Retained by Agency under P3** |
| **NPV risk values($M, Column J)** | **Nominal risk values($M, Column K)** |
| Pure risks (row 28) | **6** | **11** |
| Base variability (row 34) | **7** | **10** |
| Lifecycle performance risk premium (row 36) | **-** | **-** |
| Revenue uncertainty adjustment (row 38) | **-** | **-** |
| **Total risks retained under P3 (row 45)** | **13** | **21** |

Review and record below the transferred P3 risk values for VfM (see ***Risk Output for VfM*** sheet).

|  |  |
| --- | --- |
| **Item** | **Risk Transferred to P3 Developer** |
| **NPV risk values($M, Column M)** | **Nominal risk values($M, Column N)** |
| Pure risks (row 28) | **40** | **98** |
| Base variability (row 34) | **54** | **94** |
| Lifecycle performance risk premium (row 36) | **93** | **515** |
| Revenue uncertainty adjustment (row 38) | **51** | **382** |
| **Total risks transferred under P3 (row 45)** | **238** | **1,089** |

Below, please respond to the following questions; we will also discuss them at the webinar:

1. What is the discount rate used to calculate NPV of the P3 risks *(see top of column M)?* Why is it different from what is used for calculating NPV of risks under conventional delivery?

**The discount rate is 8.84%. This value is higher than the rate used under conventional delivery (4.0%) because the agency has a lower cost of capital (i.e., WACC) than the P3 developer, and the P3’s WACC is used as the discount rate to obtain present values of P3 risk costs (as also for other P3 cash flows) since the perspective is that of the concessionaire.**

Please fill in the blanks below (see ***Risk Output for VfM*** sheet):

* Nominal value of all risks retained by Agency under PSC $\_\_**1,184**\_\_\_\_M
* Nominal value of all retained + transferred risks under P3 $\_\_**1,110**\_\_\_\_M
* Nominal value of difference $\_\_**74**\_\_\_\_M
1. Does the difference indicate that the overall risk transfer was beneficial to the Agency?

**Yes. The total nominal value of risks retained and transferred under the P3 scenario is $74 million less than under the PSC scenario.**

1. Compare the P3 and PSC total ***nominal values*** of risks. Then compare the total ***net present values*** for P3 and PSC. Can you explain the larger differences?

**The difference between P3 and PSC total nominal values is $74 M and the difference between total net present values is $254 M. The larger difference is primarily due to the higher discount rate (or WACC) that is applied to the risks retained by the P3 developer (8.84%) compared to the rate applied to the agency (4.0%).**

1. Compare the ***nominal values*** of the revenue risk uncertainty adjustment for P3 and PSC. Can you explain why they differ?

**The nominal value for the total revenue risk uncertainty adjustment under the PSC scenario is $5 M lower than under the P3 scenario. Due to there being one less year of facility operations than under the P3 option, total revenue is lower than under the P3 option. Since the revenue risk uncertainty adjustment factor is a percentage that is applied to projected revenues, the revenue risk adjustment is also lower.**

**Part B: Risk Valuation for Benefit-Cost Analysis**

Review Project Delivery BCA (PDBCA) ***present values*** of the following risks for the Conventional Delivery and P3 Options: (1) Base cost variability; (2) Pure risks; (3) Lifecycle performance risks

Review and record below the ***present values*** of risks for Delayed Conventional Delivery and Conventional Delivery for PDBCA (see ***Risk Output for PDBCA*** sheet)

|  |  |  |
| --- | --- | --- |
| **Item** | **Delayed Conventional Delivery Risk values NPV @ 3.00% ($M) for PDBCA****(Column G)** | **Conventional Delivery Risk values NPV @ 3.00% ($M) for PDBCA****(Column J)** |
| Pure risks (row 28) | **52** | **62** |
| Base variability (row 34) | **63** | **74** |
| Lifecycle performance risk premium (row 36) | **147** | **185** |
| **Total risks (row 38)** | **262** | **321** |

Below, please respond to the following questions (we will also discuss them at the webinar):

1. Why are revenue risks not included in the table?

**Revenue risks are not included because revenues are an economic transfer, and therefore not considered in benefit-cost analysis. (However, they are considered in conducting the VfM analysis, which is a financial analysis).**

1. Why are the values higher under Conventional Delivery than under Delayed Conventional Delivery?

**Risks are higher because starting a project today increases the present values of costs and risks incurred in the design-build phase, relative to starting the same project in the future. Also, there are more years of operations, which results in a higher value of risks in the operations phase.**

Review and record below the present values of risks under Conventional Delivery and P3 for PDBCA (see ***Risk Output for PDBCA*** sheet)

|  |  |  |
| --- | --- | --- |
| **Item** | **Conventional Delivery Risk values NPV @ 3.00% ($M) for PDBCA****(Column J)** | **P3 Risk values NPV @ 3.00% ($M) for PDBCA****(Column M)** |
| Pure risks (row 28) | **62** | **57** |
| Base variability (row 34) | **74** | **71** |
| Lifecycle performance risk premium (row 36) | **185** | **171** |
| **Total risks (row 38)** | **321** | **299** |

Below, please respond to the following questions; we will also discuss them at the webinar:

1. Why are risks transferred to the P3 not shown separately, as on the ***Risk Output for VfM*** sheet?

**The risks are not shown separately because the PDBCA considers the costs and benefits to society as a whole, which includes both the agency and the P3 developer.**

1. Compare the lifecycle performance risk values. Why are they different, given that the market-based WACC was used to estimate both values?

**The NPV of the lifecycle performance risk premium under the PSC scenario is $14 M greater than under the P3 scenario. The difference is due to the procedure used to calculate the risk cost. The NPV of the lifecycle performance risk for the PSC and P3 respectively is based on the Agency’s and the concessionaire’s cost cash flows respectively. However, the developer has lower base, pure risk and base variability costs due to P3 efficiencies assumed in the inputs.**

1. Were overall risk costs reduced with the P3 option? Why do you think so?

**Yes. Overall risk costs were reduced from $321 M to $299 M, because the inputs assumed that the private sector can manage many of the risks more efficiently, and the calculation method for lifecycle performance risk costs for the P3 is based on the lower cost cash flows of the concessionaire.**

**Part C: Part C: Use of WACC to Value Risk**

Assume that, due to new information on revenue uncertainty, project financiers perceive much higher revenue risk and financing conditions will change. In ***InpFin***, increase the cost of equity (I54) and interest rates (I61 & I62) by 2% each. Optimize the model and record the revised WACC below (WACC values are listed in a pop up window after the model is optimized. The value will also be equal to the discount rate applied to the P3 Developer seen in the ***Risk Output for VfM*** tab) :

* Prior WACC (row 3, column M) = \_\_\_**8.84**\_\_\_\_\_\_%
* Revised WACC = \_\_\_**10.70**\_\_\_\_\_%
* Increase in WACC = \_\_\_**1.86**\_\_\_\_\_%

Use the model to calculate the new value of revenue uncertainty by adding the increase in WACC to the existing revenue uncertainty adjustment input in ***InpFin***:

* Difference between Availability Payment WACC and Toll Concession WACC (row 71) = 1.6% + Increase in WACC = **3.46** %

Optimize the model again

Review and record below the nominal risk values for VfM (see ***Risk Output for VfM*** sheet).

|  |  |
| --- | --- |
| **Item** | **Nominal risk values ($M)** |
| **ConventionalDelivery (Column H)** | **Retainedrisks P3(Column H)** | **Transferredrisks P3 (Column N)** |
| Pure risks (row 28) | **121** | **11** | **98** |
| Base variability (row 34) | **112** | **10** | **94** |
| Lifecycle performance risk premium (row 36) | **575** | **-** | **517** |
| Revenue uncertainty adjustment (row 38) | **579** | **-** | **586** |
| **Total risks (row 45)** | **1,387** | **21** | **1,295** |

Please fill in the blanks below (see ***Risk Output for VfM*** sheet):

* Nominal value of risks (all retained by Agency) under PSC $\_\_**1,387**\_\_\_\_M
* Nominal value of total (retained + transferred) risks under P3 $\_\_\_**1,316\_\_\_**M
* Nominal value of difference $\_\_\_**71**\_\_\_M

Below, please respond to the following questions; we will also discuss them at the webinar:

1. Did the nominal values of the PSC and P3 increase or decrease relative to the base values you calculated in Step 2 of Part A? Can you explain why?

**The nominal values increased. Before increasing the WACC and revenue uncertainty adjustment input, nominal PSC risks retained by the agency were $1,184 M, and retained and transferred by the agency under P3 were $1,110 M. After the adjustments, the nominal risks under PSC and P3 were $1,387 M and $1,316 M respectively. This increase is due to capital being more expensive or a higher WACC, which in a toll concession, reflects both lifecycle performance risk and revenue uncertainty increases.**

1. We only changed financial input values for the P3. Yet the values of risks under Conventional Delivery also changed. Can you explain why?

**Values of lifecycle performance risk and revenue uncertainty adjustment under PSC are calculated using P3 financing terms. In this particular case, the change in P3 WACC leads mainly to an increase in the revenue uncertainty adjustment input.**

1. Does the difference still indicate that the overall risk transfer would be beneficial to the Agency?

**Yes. The total nominal risks under P3 scenario are $71 M less than the total nominal risks under the PSC scenario.**

1. How do you think subsidized debt (such as TIFIA) will impact the estimated value of the lifecycle performance risk? For a fair comparison between Conventional Delivery and P3, would you need to adjust for this, assuming that the WACC is used to estimate the revenue uncertainty and lifecycle performance risks for both Conventional and P3 delivery?

**Subsidized debt such as TIFIA can result in lower interest rates and therefore a lower WACC. This will lower the estimated value of the lifecycle performance risk, which is based on the WACC. Since the risk is estimated using the same (lower) WACC for PSC as well as the P3, the NPV of both PSC and P3 lifecycle performance risks will be underestimated by equal proportions. Therefore, no adjustment for TIFIA subsidies would be needed if our only purpose is to conduct a fair comparison. However, if our purpose is to estimate the true value of the lifecycle performance risk itself, a market-based WACC (such as we have used in this example) would need to be used.**