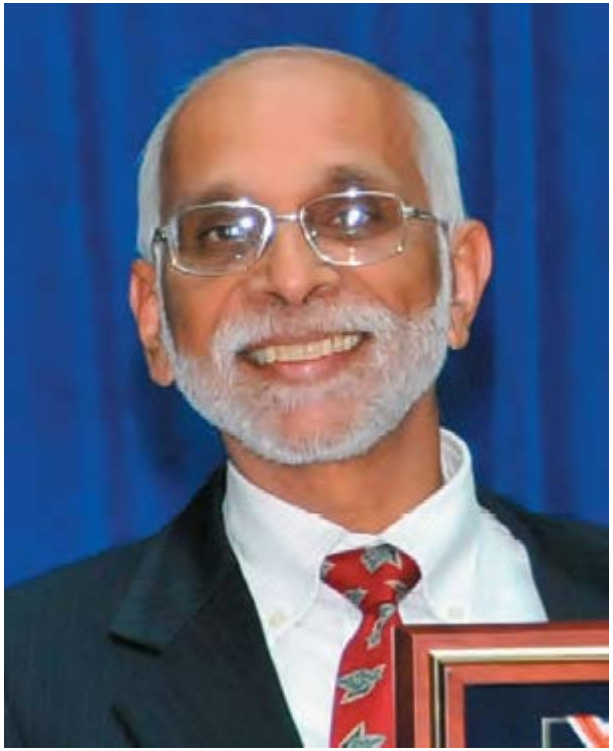
Project Delivery Benefit-Cost Analysis Exercise Review

P3-VALUE 2.0 Webinar

February 29, 2016

Instructors



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P3-VALUE 2.0 Webinars

- This is one of a series of webinars to introduce P3-VALUE
  - P3 Evaluation Overview (January 25, 2016)
  - Value for Money Analysis (February 8, 2016)
    - Value for Money Exercise Review (February 16, 2016)
  - **Project Delivery Benefit-Cost Analysis (Feb 22, 2016)**
    - **PDBCA Exercise Review (today)**
  - Risk Valuation
  - Financial Viability Assessment

Exercise Objective

- Learn how to enhance P3 Value-for-Money (VfM) analysis using benefit-cost analysis methods to include the societal perspective.
- Learn how to test the impacts of alternative travel growth projections on net benefits.
- Learn how to test the impacts of P3 quality of service assumptions on net benefits.

Webinar Outline

Intro	Project Background
Part A	Project Delivery Benefit-Cost Analysis
Part B	Impacts of Travel Growth Assumptions
Part C	Impacts of P3 Quality of Service Assumptions
Recap	Summary of Webinar

Introduction

Project Background

Homework Exercise

A study was done previously by a state DOT to estimate social benefits and costs of P3 delivery for a highway project. The various inputs required for the analysis are included in the P3-VALUE 2.0 spreadsheet model.

Project Information

- 20 miles highway expansion
- From 3 lanes to 5 lanes in each direction
  - 3 General Purpose Lanes (GPL)
  - 2 Managed Lanes (ML)
- Costs (excluding risks and financing):
  - Pre-construction & construction: $425M
  - Routine O&M: $4M per year
  - Major maintenance: $10M (every 8 years)
- Preconstruction start: 2015 (2 years)
- Construction start: 2017 (4 years)
- Operations start: 2021 (40 years)

Questions?

Submit a question using the chat box or hit *6 to ask your question by telephone

Questions from February 22 Webinar

- DAVID LUSKIN: What is the basis for the estimation of pavement roughness impacts on vehicle operating costs?

Part A

Project Delivery Benefit-Cost Analysis

PDBCA Steps

- Use the PDBCA training module to:
  1. Review the Delayed Conventional Delivery (Delayed PSC) analysis
  2. Review the Conventional Delivery (PSC) analysis
  3. Review the P3 Option analysis
  4. Compare the options to assess net benefits of:
     1. the project itself;
     2. acceleration of project delivery; and
     3. P3 delivery

PSC Inputs

Key project information for the PSC in the input sheets of the model:

- **Costs** and their timeline
  - **Build phase**:
    - Pre-construction and construction
    - Financing fees, which are the upfront costs incurred to arrange public debt
  - **Operations phase**: O&M plus periodic major maintenance
- **Risks** (to be covered in topical Webinar 4)
- **Social benefits**
  - User benefits – to existing and new users
  - Externalities -- emissions

Delayed PSC Inputs

Key project information for the Delayed PSC in the input sheets of the model:

- Same as PSC, except for timeline

P3 Option Inputs

Key P3 Option inputs are:

- **Costs:** PSC costs and timeline, but adjusted to take into consideration assumed P3 differences:
  - **Build phase**:
    - Pre-construction and construction
    - Financing fees
  - **Operations phase**: O&M plus periodic major maintenance
- **Risks:** Will be covered in Webinar 4
- **Social benefits:**
  - Difference in timing of completion of construction
  - Traffic ramp up difference
  - Pavement ride quality difference
  - Work zone practice effects
  - Incident response

Inputs for Comparisons

Key input for the comparisons is the discount rate to be applied to future cash flows:

- Real social discount rate (3%)

Review of Model Inputs

Please stand by as we open the Excel file

Review of Model Outputs

- Comparisons to No Build to estimate net benefits from the perspective of society as a whole:
  - **Project benefits** under delayed conventional delivery
  - **Project acceleration benefits**: Any incremental project benefits from an accelerated conventional project delivery
  - **P3 delivery benefits**: Any further benefits from P3 delivery

Delayed PSC - Outputs

Benefits & costs under Delayed Conventional Delivery Units >>	NPV @ 3.00% USD m	Real total USD m
Δ Travel time cost	1,252	2,930
Δ Delays due to construction	(43)	(55)
Δ Delays due to O&M	7	16
Δ Delays due to incidents	997	2,280
Δ Non-fuel costs	84	189
Δ Fuel costs	(93)	(191)
Δ Accident costs	221	496
Δ Emissions cost	(93)	(217)
O&M No Build cost savings	160	350
Real construction costs	(333)	(425)
Real operations costs	(81)	(180)
Real base variability	(63)	(88)
Real pure risks	(52)	(83)
Lifecycle performance risk	(147)	(308)
Total benefits / (costs) under Delayed Conventional Delivery	***1,817***	***4,714***
Benefit cost ratio under Delayed Conventional Delivery	***4.5211***	***N/A***

Project Benefits with Delayed PSC

Item	Delayed PSC NPV @3% ($M)
Social benefits (sum row 5-12)	2,333
No Build cost savings (row 13)	160
Construction costs (row 14)	(333)
Operations costs (row 15)	(81)
Risks (sum row 16-18)	(262)
Total Net Benefits under Delayed PSC	**1,817**

PSC Outputs

Benefits & costs under Conventional Delivery Units >>	NPV @ 3.00% USD m	Real total USD m
Δ Travel time cost	1,440	3,167
Δ Delays due to construction	(47)	(52)
Δ Delays due to O&M	9	18
Δ Delays due to incidents	1,184	2,517
Δ Non-fuel costs	102	212
Δ Fuel costs	(124)	(231)
Δ Accident costs	268	556
Δ Emissions cost	(111)	(240)
O&M No Build cost savings	199	400
Real construction costs	(386)	(425)
Real operations costs	(102)	(210)
Real base variability	(74)	(91)
Real pure risks	(62)	(88)
Lifecycle performance risk	(185)	(351)
Total benefits / (costs) under Conventional Delivery	***2,111***	***5,181***
Benefit cost ratio under Conventional Delivery	***4.4637***	***N/A***

Project Benefits with PSC

Item	A. PSC benefits and costs ($M)	B. Delayed PSC benefits and costs ($M)	PSC difference ($M) (Col A – Col B)
Social benefits (sum row 24-31)	2,720	2,333	387
No Build cost savings (row 32)	199	160	39
Construction costs (row 33)	(386)	(333)	(53)
Operations costs (row 34)	(102)	(81)	(21)
Risks (sum row 35-37)	(321)	(262)	(59)
Total Net Benefits	**2,111**	**1,817**	**294**

P3 Outputs

Benefits & costs under P3 Units >>	NPV @ 3.00% USD m	Real total USD m
Δ Travel time cost	1,477	3,210
Δ Delays due to construction	(33)	(37)
Δ Delays due to O&M	10	21
Δ Delays due to incidents	1,267	2,654
Δ Non-fuel costs	106	216
Δ Fuel costs	(131)	(238)
Δ Accident costs	278	568
Δ Emissions cost	(114)	(245)
O&M No Build cost savings	208	410
Real construction costs	(378)	(410)
Real operations costs	(96)	(193)
Real base variability	(71)	(86)
Real pure risks	(57)	(80)
Lifecycle performance risk	(171)	(318)
Total benefits / (costs) under P3	***2,295***	***5,473***
Benefit cost ratio under P3	***5.0618***	***N/A***

Project Benefits with P3 Option

Item	A. P3 benefits and costs ($M)	B. PSC benefits and costs ($M) from Step 2	P3 difference ($M) (Col A – Col B)
Social benefits (sum row 43-50)	2,860	2,720	140
No Build cost savings (row 51)	208	199	9
Construction costs (row 52)	(378)	(386)	8
Operations costs (row 53)	(96)	(102)	6
Risks (sum row 54-56)	(299)	(321)	22
Total Net Benefits	**2,295**	**2,111**	**184**

Project Delivery Net Benefits

Project acceleration benefits:

- NPV of net benefits under PSC $2,111 M
- NPV of net benefits under delayed PSC $1,817 M
- NPV of difference (acceleration benefits) **$294 M**

P3 delivery benefits:

- NPV of net benefits under P3 $2,295 M
- NPV of net benefits under PSC $2,111 M
- NPV of difference (P3 benefits) **$184 M**

Questions?

Submit a question using the chat box

Part B

Alternative Traffic Growth Scenarios

Tests of Alternative Growth Scenarios

- Use the PDBCA training module to analyze the effect of traffic assumptions on the previously estimated net benefits by changing the PDBCA traffic sensitivity factor, which is only applied to traffic above the No Build base year traffic.
  1. 20% lower growth of traffic (i.e., 80% of base growth assumption)
  2. 20% higher growth of traffic (i.e., 120% of base growth assumption)
  3. No growth of traffic (i.e., 0% of base growth assumption)

Review of Model Inputs

Please stand by as we open the Excel file

Review of Model Outputs

NPV with Alternative Growth Scenarios

	Net benefits @ Base Case ($M)	Net benefits @ 80% traffic ($M)	Net benefits @ 120% traffic ($M)	Net benefits @ 0% traffic growth ($M)
A. NPV of net benefits under Delayed PSC	1,817	1,524	2,194	785
B. NPV of net benefits under PSC	2,111	1,804	2,506	1,015
C. **Difference between A and B, i.e., NPV of project acceleration**	294	280	312	230
D. NPV of net benefits under P3 Option	2,295	1,984	2,694	1,177
E. **Difference between B and D, i.e., NPV of P3 delivery**	184	180	188	162

Questions?

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Part C

Alternative P3 Quality of Service Scenarios

Tests of Alternative P3 Assumptions

- Use the PDBCA training module to analyze the effect of alternative P3 quality of service assumptions on the previously estimated net benefits under the “No Traffic Growth” scenario, by changing the PDBCA service quality inputs:
  1. Early completion of construction
  2. Pavement ride quality
  3. Work zone practices during construction activities and during the operations phase
  4. Incident response

Model Input Changes

- Early Construction completion – Increase P3 construction duration to 4 years to match PSC
- Pavement Ride Quality – Eliminate the improvement in P3 ride quality by increasing the International Roughness Index (IRI) so that it is the same as that for the PSC
- Travel delays related to construction and O&M – Eliminate the reduction in duration of construction and O&M activities for P3
- Travel delays related to incidents – Eliminate the reduction in speed adjustment for incident delays for P3

Review of Model Inputs

Please stand by as we open the Excel file

Review of Model Outputs

NPV with Alternative P3 Assumptions

Test Scenario	A. NPV of PSC ($M)	B. NPV of P3 Option ($M)	C. Difference between P3 and PSC ($M) = Col B – Col A	Incremental difference ($M) compared to prior model run
Base Case assumptions with 0% traffic growth scenario (from Part B)	1,015	1,177	162	N.A.
1. No early completion	1,007	1,088	81	(81)
2. No ride quality improvement	1,007	1,088	81	0
3. No reduction in const. and O&M duration	1,007	1,084	77	(4)
4. No reduction in incident response time	1,007	1,053	46	(31)

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Webinar Summary

Webinar Recap

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Tool and References

P3-VALUE 2.0 Excel Spreadsheet

User Guide

Primers & Guidebooks

Upcoming P3-VALUE Training

- **March 7** Risk Valuation
- **March 21** Financial Viability Assessment

Resources

FHWA's Office of Innovative Program Delivery Website:
http://www.fhwa.dot.gov/ipd/

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

Questions?

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Contact Information

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