Project Delivery
Benefit-Cost Analysis

P3-VALUE 2.0 Webinar
February 22, 2016
Instructors

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IMG/Rebel
P3-VALUE 2.0 Webinars

- **P3**: Public Private Partnership
- **P3-VALUE 2.0**: Analytical tool to help practitioners understand processes used to quantitatively evaluate P3 options
- This is the fourth webinar on P3-VALUE
  - P3 Evaluation Overview (January 25, 2016)
  - Value for Money Analysis (February 8, 2016)
    - VfM Exercise Review (February 16, 2016)
  - **Project Delivery Benefit-Cost Analysis (today)**
  - Risk Valuation
  - Financial Viability Assessment
Webinar Outline

**Part 1**  
Introduction

**Part 2**  
Benefit-Cost Analysis (BCA) Process

**Part 3**  
P3 Delivery Economic Differences

**Part 4**  
Benefit-Cost Analysis using P3-VALUE 2.0

**Summary**
Types of Project Delivery Evaluation

Financial Evaluation*

* Cash flow analysis

Economic Efficiency Evaluation**

** Net economic benefits excludes transfers and financing cash flows

Financial Viability Assessment

Value for Money (VfM) Analysis

Project Delivery Benefit-Cost Analysis (BCA)
Financial vs. Economic Evaluation

- **Financial Evaluation**
  - Considers financial elements only, i.e., “cash flows”
  - Perspective is that of the procuring agency

- **Economic Efficiency Evaluation**
  - Considers full range of costs and benefits to society
  - Perspective is that of society as a whole
Financial Evaluation Questions

- Is the project affordable to the public agency?
- Will P3 procurement enhance the financial position of the public sponsor?
Economic Efficiency Questions

- Does the project yield benefits to society that exceed the costs to society?
  - What is the best project design alternative?
  - When should a project be undertaken?
- Will P3 delivery increase net benefits to society compared with conventional procurement?
P3-VALUE 2.0 Tool Structure

Project Assumptions (Inputs) → Risk Assessment → Financial Viability Assessment → Value for Money Analysis

Cost, timing, revenues

Subsidy, bid

Risk values & allocation

Cost, timing, benefits

Risk values & allocation

Project Delivery Benefit-Cost Analysis
# Accounting for Costs

<table>
<thead>
<tr>
<th>Project Cost</th>
<th>Benefit-Cost Analysis</th>
<th>Value for Money</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital cost</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>O&amp;M cost</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Risk</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Public transaction costs</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Private transaction costs (winning bid)</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Private transaction costs (losing bids)</td>
<td>✓</td>
<td>✗</td>
</tr>
</tbody>
</table>
# Accounting for Other Social Impacts

<table>
<thead>
<tr>
<th>Other Social Impacts</th>
<th>Benefit-Cost Analysis</th>
<th>Value for Money</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>User Benefits</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Travel time cost</td>
<td>✓</td>
<td>✗</td>
</tr>
<tr>
<td>Incident/accident cost</td>
<td>✓</td>
<td>✗</td>
</tr>
<tr>
<td>Vehicle operation cost</td>
<td>✓</td>
<td>✗</td>
</tr>
<tr>
<td>Accident cost</td>
<td>✓</td>
<td>✗</td>
</tr>
<tr>
<td><strong>Externalities</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emission costs</td>
<td>✓</td>
<td>✗</td>
</tr>
</tbody>
</table>
## Accounting for Financing

<table>
<thead>
<tr>
<th>Purely Financial Transactions, i.e., Economic Transfers</th>
<th>Benefit-Cost Analysis</th>
<th>Value for Money</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenues</td>
<td>✗</td>
<td>✓</td>
</tr>
<tr>
<td>Taxes</td>
<td>✗</td>
<td>✓</td>
</tr>
<tr>
<td>Debt and equity contributions</td>
<td>✗</td>
<td>✓</td>
</tr>
<tr>
<td>Interest and dividend payments</td>
<td>✗</td>
<td>✓</td>
</tr>
</tbody>
</table>
### Real vs. Nominal Values

<table>
<thead>
<tr>
<th></th>
<th>Benefit-Cost Analysis</th>
<th>Value for Money</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dollar values</td>
<td>Real</td>
<td>Nominal</td>
</tr>
<tr>
<td>Discount rate for NPV calculations</td>
<td>Real</td>
<td>Nominal</td>
</tr>
</tbody>
</table>
True or False

- Financial evaluation considers the full range of costs and benefits to society.
Questions?

Submit a question using the chat box
Part 2

Benefit-Cost Analysis Process
Benefit-Cost Evaluation Process

Step 1: Project BCA

Step 2: Impacts of Funding Constraints
- Timing impacts
- Cost impacts
- Quality impacts
- Scope optimization

Step 3: Impacts of P3 Delivery
Project Delivery BCA Framework

1. Evaluate Project Benefits/Costs
2. Evaluate Impacts of Funding Constraints
3. Evaluate P3 Delivery Effects

- No Build
  - Cost and benefit comparison between No Build and Delayed PSC
- Delayed PSC
  - Cost and benefit comparison between Delayed PSC and PSC
- PSC
  - Cost and benefit comparison between PSC and P3
- P3
Step 1: Project Benefits/Costs

Delayed Conventional Delivery compared to No Build

Costs
- Lifecycle Costs
- Risks
- Procurement, oversight and monitoring costs

Benefits
- User Benefits
- Externalities

Project Benefits & Costs
Step 2: Impacts of Funding Constraints

Delayed Conventional Delivery (Delayed PSC) compared to Conventional Delivery (PSC)

- Delayed Conventional Delivery
  - Costs
  - Benefits

- Conventional Delivery
  - Costs
  - Benefits

Impacts of Funding Constraints

Time impacts
- Project Acceleration
Step 3: P3 Delivery Effects

Conventional Delivery (PSC) compared to P3

Timing Impacts
- Delayed Start
- Δ Construction Period

Cost Impacts
- Δ Public transaction costs
- Δ Private transaction costs
- Δ Lifecycle costs

Quality Impacts
- Pavement quality
- Lane unavailability
- Incident response
- Outreach (ramp-up)

Scope Optimizations
- Scope optimizations
P3 Timing Impacts

P3 can delay or accelerate project:

- Complex P3 contracting may delay project start
- P3 concessionaire may be financially incentivized to shorten construction period (acceleration)

Impacts of acceleration are:

- Higher NPV of costs due to effect of discounting
- Higher NPV of benefits due to earlier opening to traffic
# P3 Quality Impacts

<table>
<thead>
<tr>
<th>Benefit Category</th>
<th>Estimation based on:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pavement quality adjustment to vehicle operating costs</td>
<td>• Difference in International Roughness Index (IRI)</td>
</tr>
<tr>
<td>Delays during construction due to lane unavailability</td>
<td>• Differences in number of days and hours of lane closures</td>
</tr>
<tr>
<td>Delays during operation due to lane unavailability</td>
<td>• Differences in number of days and hours of lane closures</td>
</tr>
<tr>
<td>Delays during operation due to incidents</td>
<td>• Differences in effect on average speed</td>
</tr>
<tr>
<td>Faster traffic ramp-up due to P3 innovations &amp; outreach activities</td>
<td>• Difference in traffic volumes during ramp-up period</td>
</tr>
</tbody>
</table>
## Economic Costs

<table>
<thead>
<tr>
<th>Cost item</th>
<th>Delayed PSC ($M)</th>
<th>PSC ($M)</th>
<th>P3 ($M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning and preparation costs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Procurement costs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Design and engineering costs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Construction costs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>O&amp;M costs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Major maintenance costs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contingencies</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Base variability</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Systematic risks and uncertainties</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Total costs for Build Alternative*

No Build cost savings

*Total economic costs*
## Economic Benefits

<table>
<thead>
<tr>
<th>Benefit item</th>
<th>Delayed PSC ($M)</th>
<th>PSC ($M)</th>
<th>P3 ($M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travel time savings</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vehicle operating cost savings</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fuel cost savings</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Environmental benefits</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safety benefits</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other benefits</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disbenefits during construction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P3 quality impacts</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Economic benefits - existing users</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consumer surplus - “new” users</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Producer surplus - “new” users</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total economic benefits</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Project Delivery BCA Output

Delivery models compared to No Build

- Delayed Conventional Delivery
- Conventional Delivery
- Public-Private Partnership

Costs vs Benefits comparison:

- Costs
- Benefits
## Perspective Considerations

<table>
<thead>
<tr>
<th>Perspective</th>
<th>Financial Analysis (VfM)</th>
<th>Economic Analysis (PDBCA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agency</td>
<td>Costs to Agency’s balance sheet</td>
<td>Agency costs plus societal benefits</td>
</tr>
<tr>
<td>State</td>
<td>Costs to State</td>
<td>State costs plus societal benefits</td>
</tr>
<tr>
<td>National</td>
<td>Societal costs</td>
<td>Societal costs and benefits (true BCA)</td>
</tr>
</tbody>
</table>
True or False

- Benefits from project acceleration may not necessarily be attributable to P3 delivery.
Questions?

Submit a question using the chat box
Part 3

P3 Delivery Economic Differences
Factors Affecting P3 Differences

Project characteristics
- Size
- Complexity

Context characteristics
- Institutional capacity
- Market

Procurement characteristics
- Agreement
- Conventional delivery efficiency
Impacts of P3 Differences

Costs
- Base costs
- Risks

Benefits
- Quality of service
- More users
Differences Relative to VfM Analysis

- **Included costs:**
  - Only financing fees
  - Lifecycle performance risk under P3
  - Uncompensated costs of losing bidders

- **Not included:**
  - Toll revenues (and uncertainty adjustment)
  - Financing – equity, debt, and repayments
Differences Relative to VfM (contd.)

- **Benefits:**
  - *User benefits* – travel time, travel cost (including vehicle operating costs), accident cost differences
    - Existing users
    - New users
  - *Externalities* – emissions cost differences
Sources of Benefits

- Improved quality of service:
  - Earlier construction completion
  - Pavement ride quality
  - Work zone practices
  - Incident response
Benefits to Users

- Earlier construction completion: Increase in years of benefits
Benefits to Users (contd.)

- **Pavement ride quality**: International Roughness Index vs. fuel and non-fuel cost

<table>
<thead>
<tr>
<th>Parameters &gt;&gt;</th>
<th>Fuel cost % adjustment</th>
<th>Non-fuel cost % adjustment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2 axle</td>
<td>4+ axle</td>
</tr>
<tr>
<td>IRI</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>0</td>
<td>97.05%</td>
<td>96.07%</td>
</tr>
<tr>
<td>25</td>
<td>97.68%</td>
<td>96.53%</td>
</tr>
<tr>
<td>50</td>
<td>98.00%</td>
<td>97.04%</td>
</tr>
<tr>
<td>75</td>
<td>98.24%</td>
<td>97.53%</td>
</tr>
<tr>
<td>100</td>
<td>98.46%</td>
<td>97.99%</td>
</tr>
<tr>
<td>150</td>
<td>99.52%</td>
<td>99.31%</td>
</tr>
<tr>
<td>200</td>
<td>100.53%</td>
<td>100.74%</td>
</tr>
<tr>
<td>250</td>
<td>101.95%</td>
<td>102.57%</td>
</tr>
<tr>
<td>300</td>
<td>103.39%</td>
<td>104.68%</td>
</tr>
<tr>
<td>350</td>
<td>105.01%</td>
<td>107.03%</td>
</tr>
<tr>
<td>400</td>
<td>107.16%</td>
<td>109.96%</td>
</tr>
<tr>
<td>450</td>
<td>109.31%</td>
<td>112.89%</td>
</tr>
</tbody>
</table>
Benefits to Users (contd.)

- **Work zone practices**: Estimated 45% speed reduction in work zones, applied:
  - To traffic in section affected
  - For duration affected, on the days affected

*based on SHRP 2 Project L08.*
Benefits to Users (contd.)

- **Incident response**: Speed reduction relative to congested speed estimated based on *Urban Mobility Report* (Texas Transportation Institute)

<table>
<thead>
<tr>
<th>Level of congestion</th>
<th>Daily traffic volume per lane</th>
<th>Speed reduction factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uncongested</td>
<td>Under 15,000</td>
<td>5%</td>
</tr>
<tr>
<td>Medium</td>
<td>15,001 - 17,500</td>
<td>5%</td>
</tr>
<tr>
<td>Heavy</td>
<td>17,501 – 20,000</td>
<td>9%</td>
</tr>
<tr>
<td>Severe</td>
<td>20,001 – 25,000</td>
<td>18%</td>
</tr>
<tr>
<td>Extreme</td>
<td>Over 25,000</td>
<td>23%</td>
</tr>
</tbody>
</table>
Benefits to “New” Users

Rule of Half

```
User cost
per trip

Demand

Supply
No Build

User cost
No Build

Social cost
No Build

Δ Travel costs

User cost
Build

Social cost
Build

Supply
Build

Consumer
surplus

Producer
surplus

T_{No Build}

T_{Build}

Volume of trips
```
Test Your Knowledge

Which of the following may be different under a P3:

- Construction completion
- Pavement ride quality
- Impacts of work zone practices on travel time
- Incident response time
- All of the above
Questions?

Submit a question using the chat box
Part 4

Project Delivery Benefit-Cost Analysis using P3-VALUE 2.0
FHWA’s P3-VALUE 2.0

Value for Money Analysis

Conventional Delivery

P3

VfM

Inputs

Costs

Risks

Revenues

Financing & Tax

Benefits

Project Delivery Benefit-Cost Analysis

Conventional Delivery

Delayed Conventional Delivery

P3

PDBCA

P3 Efficiencies

Costs/Risks

Benefits

Conventional Delivery

Delayed Conventional Delivery

P3
Training Modules

Value for Money Analysis

Risk Assessment

Project Delivery Benefit-Cost Analysis

Financial Viability Assessment

Innovative Program Delivery

U.S. Department of Transportation
Federal Highway Administration
Training Navigator User Interface

Training Module Selection:
- Module 1: Value-for-Money Analysis
- Module 2: Project Delivery Benefit-Cost Analysis
- Module 3: Risk Assessment
- Module 4: Financial Viability Assessment

Input sheet selection:
- InpTiming&Cost: Project timing and cost inputs
- InpTraffic&Toll: Traffic and toll inputs
- InpSeries: Construction, ramp-up and milestone payments time series inputs
- InpBCA: Benefit-cost analysis inputs

Output sheet selection:
- PDBCA Output Summary: PDBCA output summary tables and graphs
- PDBCA Comparison Table: Table comparing Delayed PSC, PSC and P3
- PDBCA Comparison Graph: Graph comparing Delayed PSC, PSC and P3
- PDBCA Delayed PSC Graph: Graphs with costs & benefits to society under Delayed P3
Demonstration of PDBCA Module

Please stand by as we open the Excel file
Questions?

Submit a question using the chat box
Webinar Recap

Part 1  Introduction
Part 2  Benefit-Cost Analysis (BCA) Process
Part 3  P3 Delivery Economic Differences
Part 4  Benefit-Cost Analysis using P3-VALUE 2.0
Tool and References

- P3-VALUE 2.0 Excel Spreadsheet
- User Guide
- Primers & Guidebooks
Upcoming P3-VALUE Training

- February 29 (12:30pm) BCA Exercise review
- March 7 (2:00pm) Risk Valuation (2:00pm)
- March 21 (2:00pm) Financial Viability Assessment

To access the Exercise Review webinar, please use the following link and telephone number:

Link: https://connectdot.connectsolutions.com/p3
Telephone: 1-888-363-4749, Passcode: 6139168#
Resources

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

P3 Website:
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P3 Program Manager
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Federal Highway Administration
(202) 366-4076
Patrick.DeCorla-Souza@dot.gov
Questions?

Submit a question using the chat box