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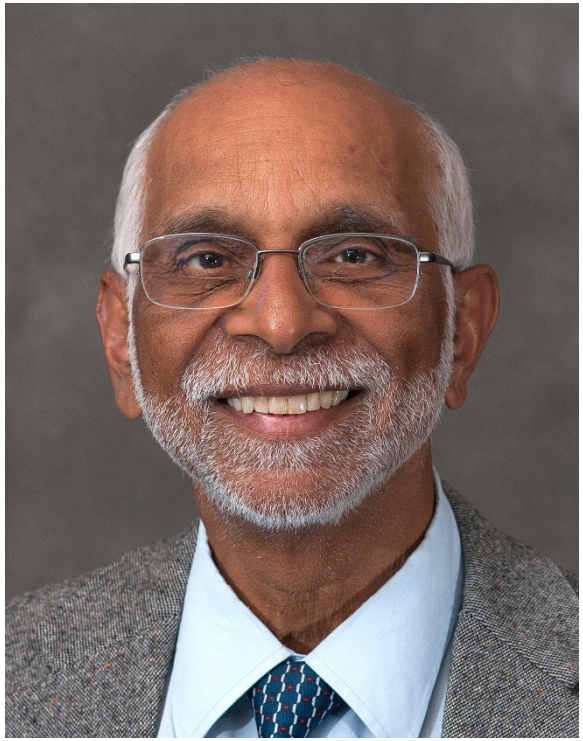
Introduction to Enhancements in P3-VALUE 2.1: Benefit-Cost Analysis

P3 Webinar
April 26, 2018

Prior Webinars

- **Basics of P3-VALUE**: Webinar on ***Project Delivery Benefit-Cost Analysis***, February 22, 2016
- **P3-VALUE 2.1 Enhancements**:
  - Simplified input sheet, reviewed in webinar on February 22, 2018
  - Transparent output for value for money analysis, Reviewed in in webinar on March 22, 2018
- *All prior webinar presentations, recordings and transcripts are available on FHWA's web site at*:
  - https://www.fhwa.dot.gov/ipd/p3/p3_training/webinars.aspx

Instructors



Patrick DeCorla-Souza

P3 Program Manager
USDOT Build America Bureau and
FHWA Office of Innovative Program Delivery

Wim Verdouw

Financial Modeler
IMG/Rebel

Webinar Outline

Part 1	Overview of Benefit-Cost Analysis (BCA)
Part 2	P3-VALUE 2.1 BCA Enhancements
Part 3	Illustrative Application of Benefit-Cost Analysis

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Part 1: Overview of P3 Benefit-Cost Analysis

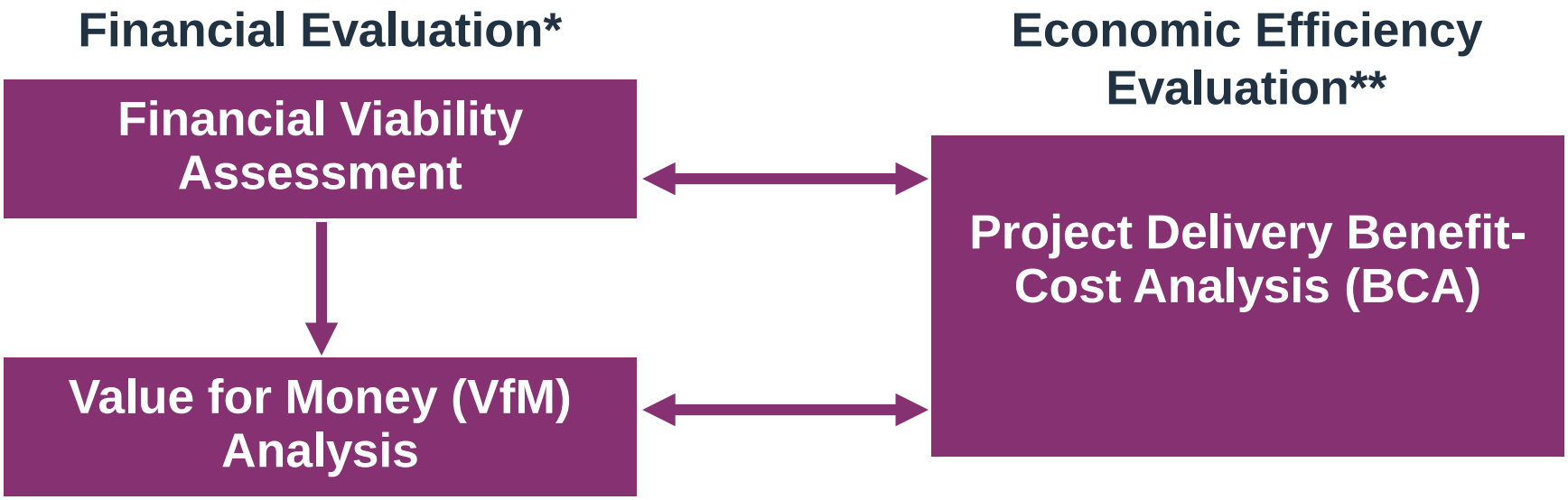
P3-VALUE 2.1 Webinar

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

Types of Project Delivery Evaluation



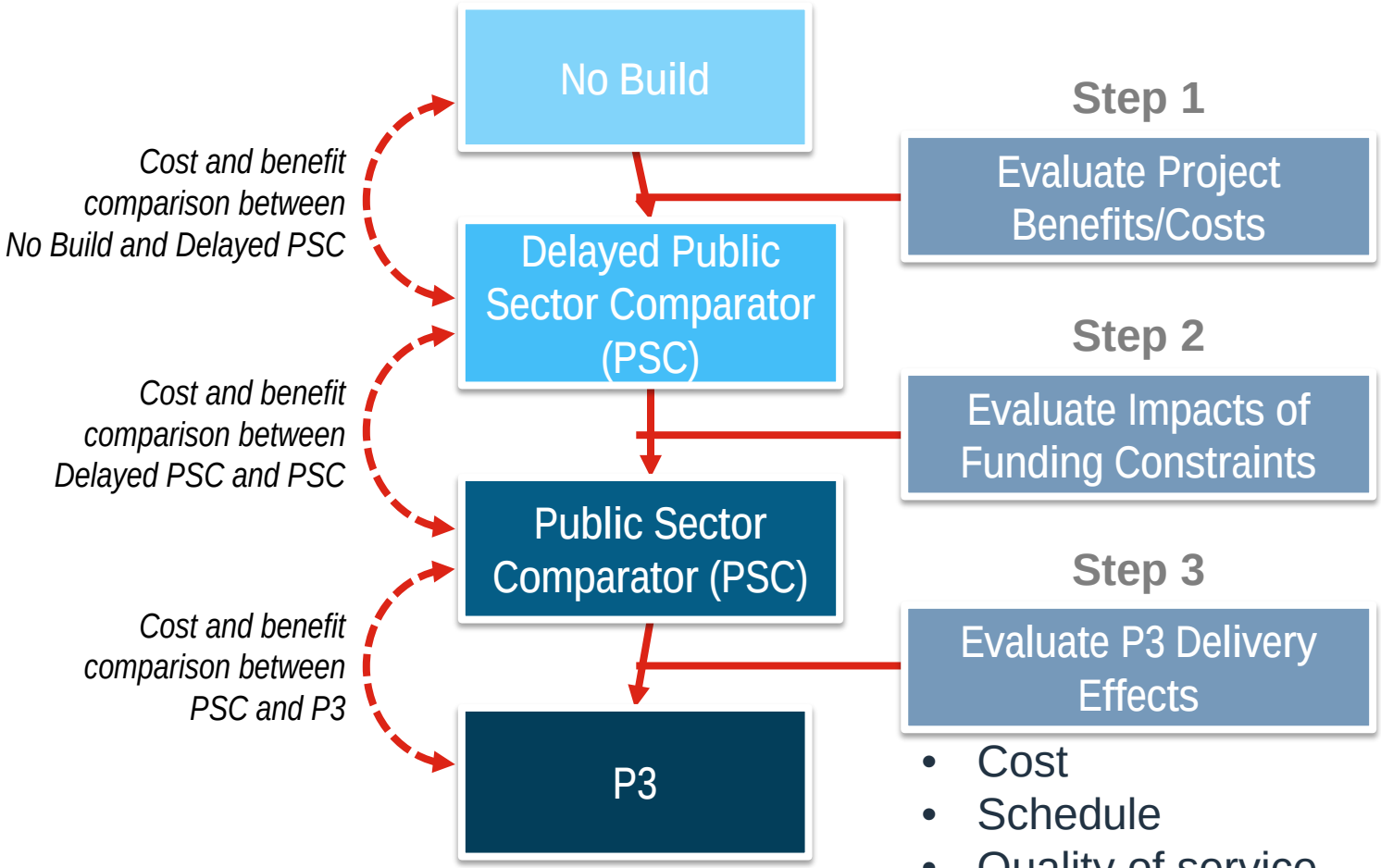
* Cash flow analysis

** Net economic benefits excludes transfers and financing cash flows

Benefit-Cost Analysis (BCA) Process

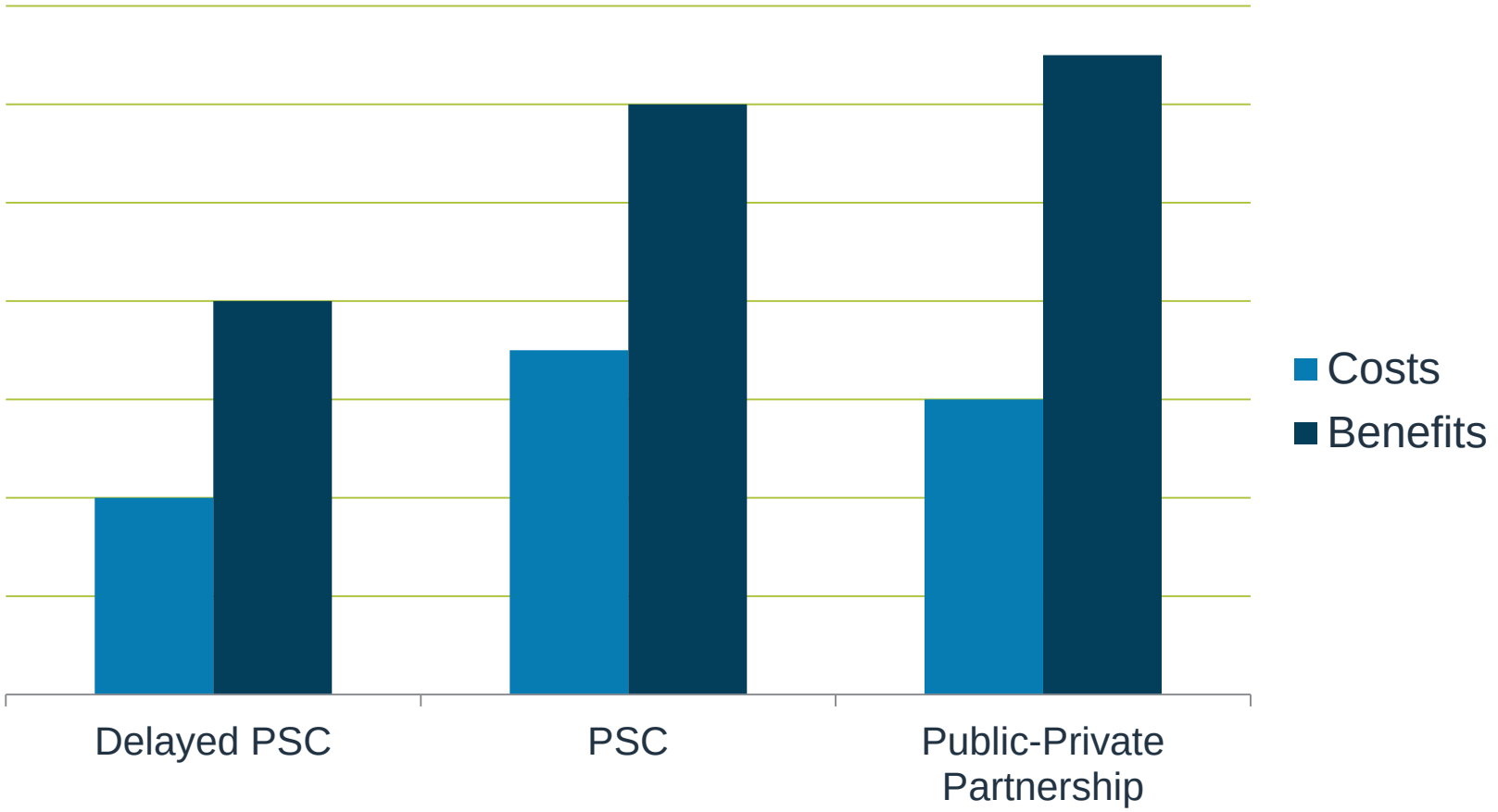
- Timing impacts
- Cost impacts
- Quality impacts
- Scope optimization

Project Delivery BCA Framework



Project Delivery BCA Output

In P3-VALUE, all three options are compared to No Build



Perspective Considerations

Perspective	Financial Analysis (VfM Analysis)	Economic Analysis (BCA)
Agency	Costs to Agency's balance sheet	Agency costs plus societal benefits
State	Costs to State	State costs plus societal benefits
National	Societal costs	Societal costs and benefits (true BCA)

For More Information

FHWA's ***Benefit-Cost Analysis for P3 Project Delivery: A Framework***

- https://www.fhwa.dot.gov/ipd/p3/toolkit/publications/guidebooks/bca/

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Part 2: Introduction to P3-VALUE 2.1 Enhancements

P3-VALUE 2.1 Webinar

What is P3-VALUE 2.1?

- An analytical tool
- Educational
- Quantitative screening

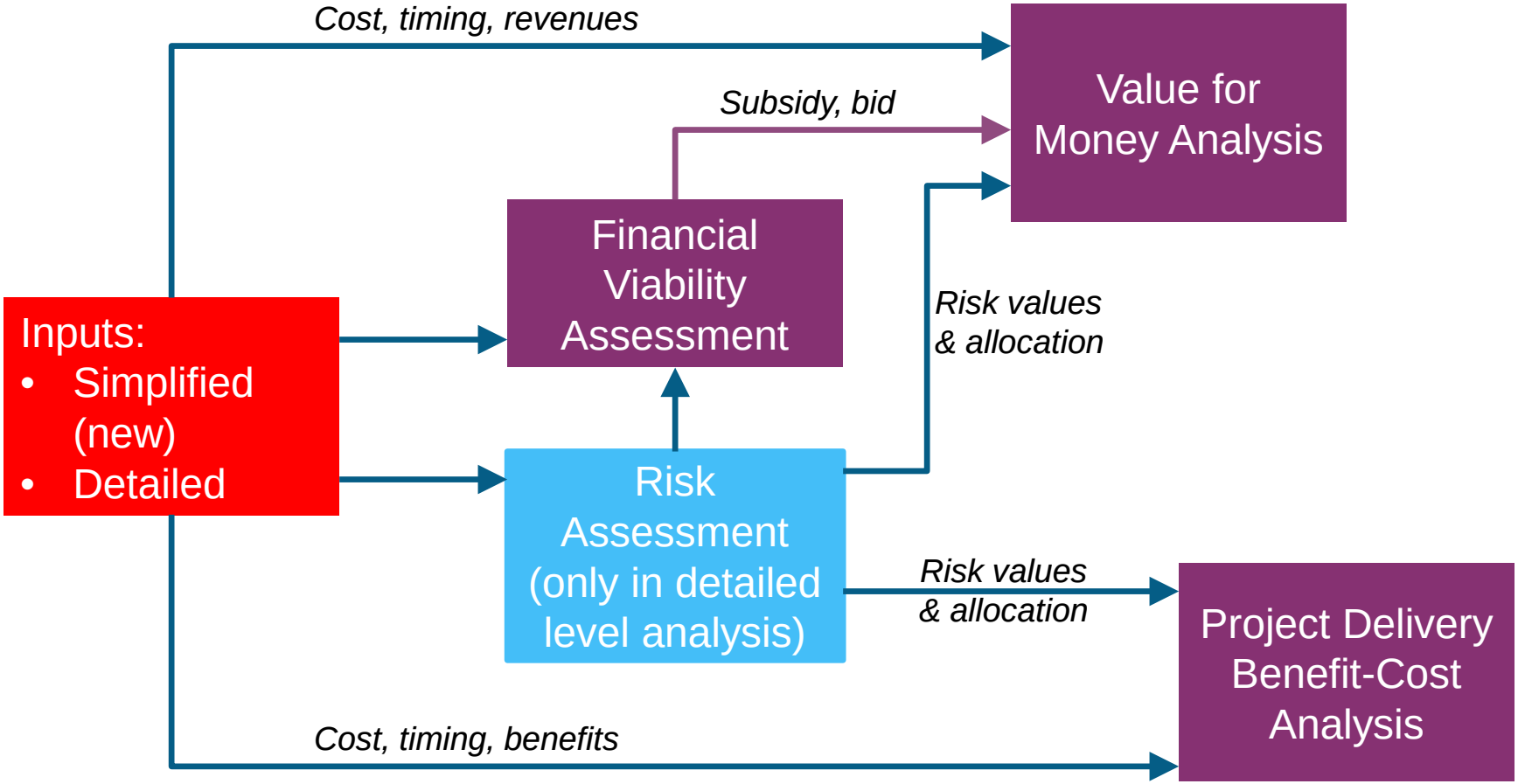
Tool and References

P3-VALUE 2.1 Excel Spreadsheet

User Guide, Quick Start Guide, FAQs

Primers & Guidebooks

P3-VALUE 2.1 Tool Structure



P3-VALUE 2.1 Enhancements

- Simplified input sheet
  - Reviewed in webinar on February 22, 2018
- Transparent output for value for money analysis
  - Reviewed in in webinar on March 22, 2018
- Benefits from ridesharing (carpools and transit) included in benefit-cost analysis
  - To be reviewed in today‘s webinar

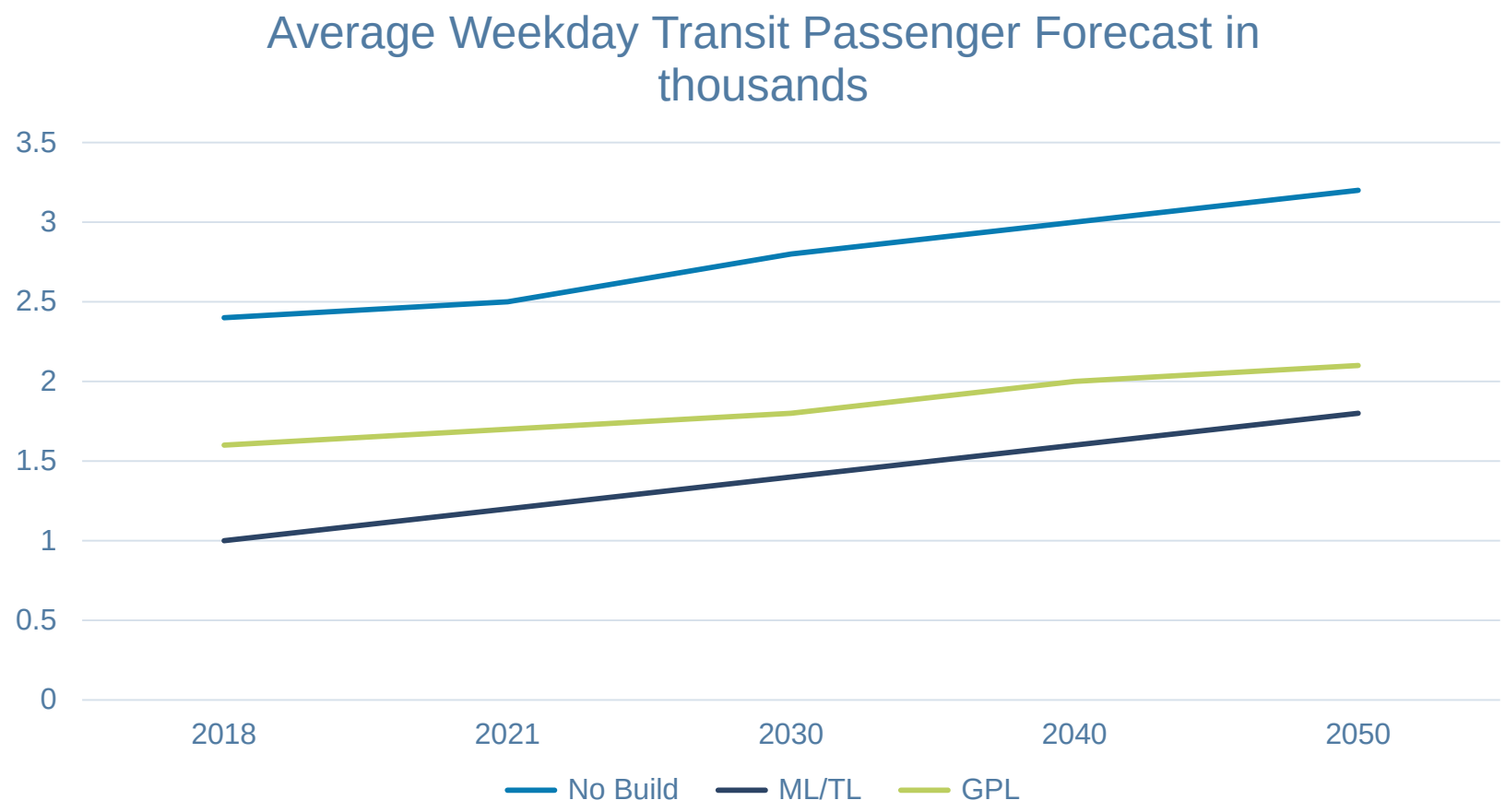
Transit and Carpool Inputs in Simplified Input Sheet

Benefit Cost Inputs (Transit & Carpool)	No Build	ML/TL	GPL
Additional passengers carried by transit (% of vehicles)	2.00%	4.00%	1.50%
Additional passengers carried by carpools (% of vehicles)	2.00%	4.00%	1.50%

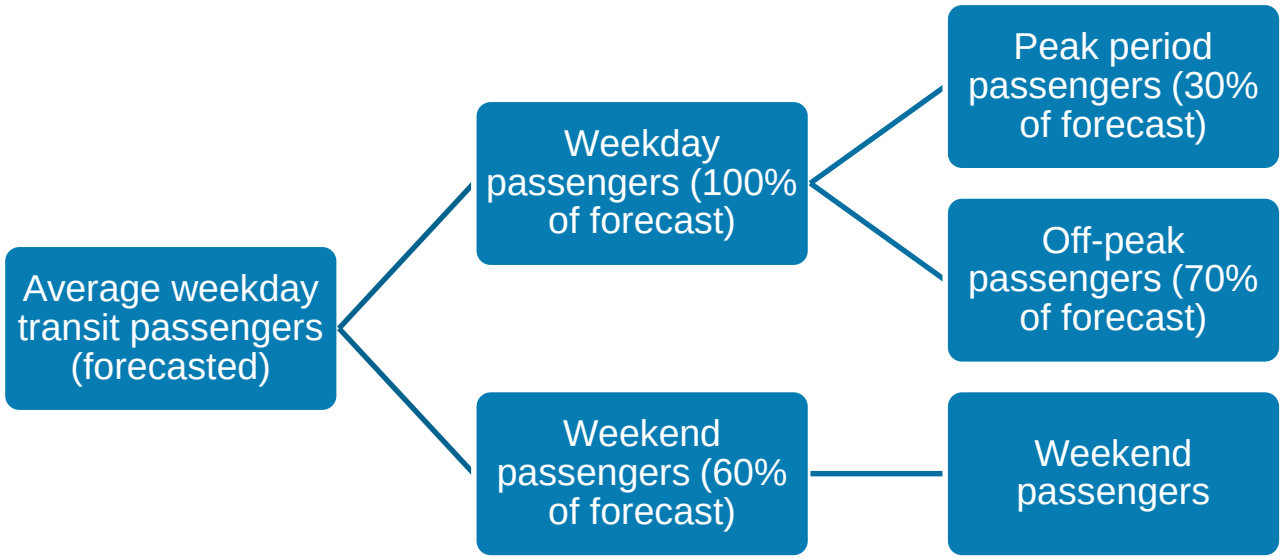
Detailed Inputs for Transit and Carpools

- Approach is similar to the approach for vehicular traffic (covered in webinar on February 22)

Transit Passenger Forecast



Breakdown of Transit Travel Forecast into Time Periods

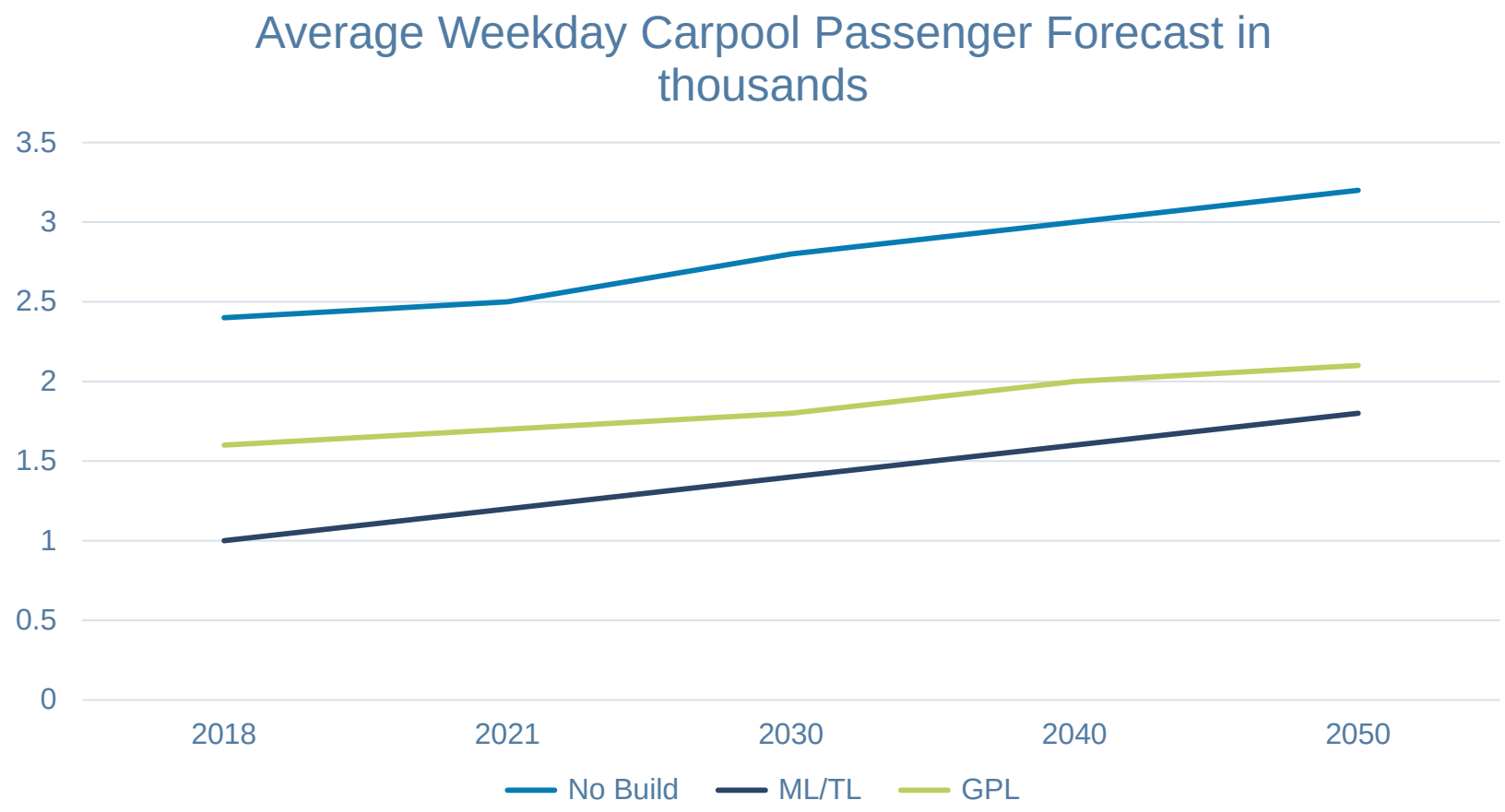


DETAILED INPUT FOR TRANSIT

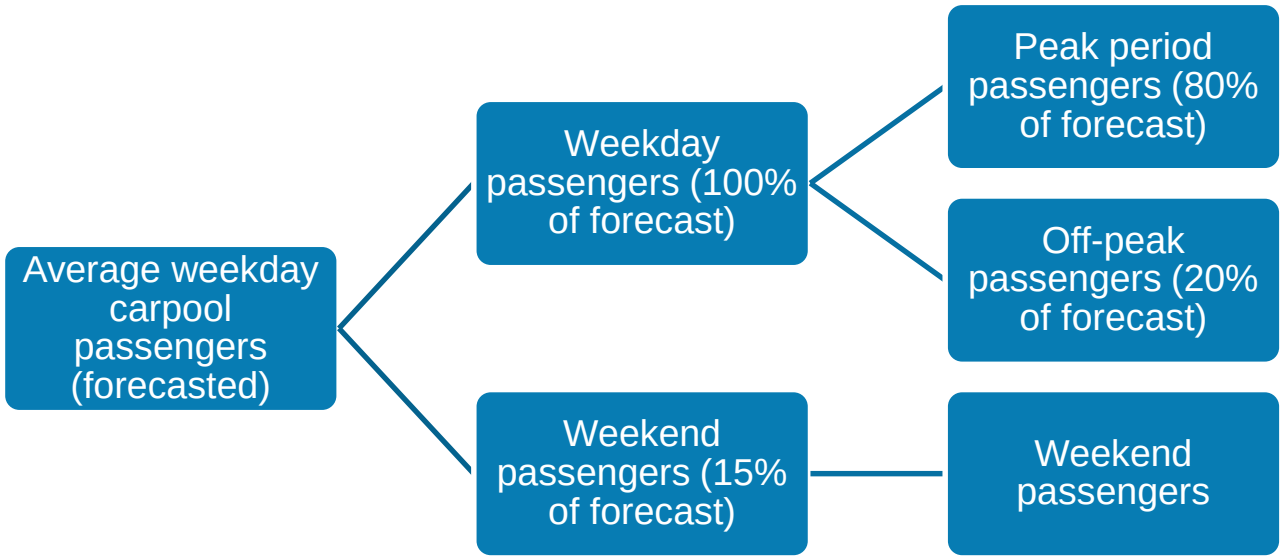
Transit Passenger Forecast	Year	No Build	ML/TL	GPL
Weekday daily transit passengers in model start year (in thousands)	2018	2.4k	1.0k	1.6k
Weekday daily transit passengers in input year 2 (in thousands)	2020	2.5k	1.2k	1.7k
Weekday daily transit passengers in input year 3 (in thousands)	2030	2.8k	1.4k	1.8k
Weekday daily transit passengers in input year 4 (in thousands)	2040	3.0k	1.6k	2.0k
Weekday daily transit passengers in input year 5 (in thousands)	2050	3.2k	1.8k	2.1k
Annual transit passengers growth after last input year (in percent)	> 2050	0.50%	1.00%	0.50%

Transit Passengers Shares	No Build	ML/TL	GPL
Peak transit percentage (of total transit passengers)	30.00%	30.00%	30.00%
Off-peak transit percentage (of total transit passengers)	70.00%	70.00%	70.00%
Weekend transit percentage (of total transit passengers)	60.00%	60.00%	60.00%

Carpool Passenger Forecast



Breakdown of Carpool Travel Forecast into Time Periods



DETAILED INPUT FOR CARPOOL

Carpooling Passenger Forecast	Year	No Build	ML/TL	GPL
Weekday daily carpooling passengers in model start year (in thousands)	2018	2.4k	1.0k	1.6k
Weekday daily carpooling passengers in input year 2 (in thousands)	2020	2.5k	1.2k	1.7k
Weekday daily carpooling passengers in input year 3 (in thousands)	2030	2.8k	1.4k	1.8k
Weekday daily carpooling passengers in input year 4 (in thousands)	2040	3.0k	1.6k	2.0k
Weekday daily carpooling passengers in input year 5 (in thousands)	2050	3.2k	1.8k	2.1k
Annual transit passengers carpooling after last input year (in percent)	> 2050	0.50%	1.00%	0.50%

Carpooling Passengers Shares	No Build	ML/TL	GPL
Peak carpooling percentage (of total carpooling passengers)	80.00%	80.00%	80.00%
Off-peak carpooling percentage (of total carpooling passengers)	20.00%	20.00%	20.00%
Weekend carpooling percentage (of total carpooling passengers)	15.00%	15.00%	15.00%

- Please stand by while we open the P3-VALUE 2.1 tool to show the enhanced features

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Part 3: Illustrative Application of P3-VALUE 2.1 for Project Delivery Benefit-Cost Analysis

P3-VALUE 2.1 Webinar

Example hypothetical project

- Managed lanes added to existing facility
- Delayed construction completion under PSC

Project Information

- 20 miles highway expansion, from 3 lanes to 5 lanes in each direction
  - 3 General Purpose Lanes (GPL); 2 new Managed Lanes (ML)
- Costs under PSC (including contingencies for risks):
  - Pre-construction $25M
  - Construction: $400M
  - Routine O&M: $4M per year
  - Major maintenance: $10M every 8 years
- Timing:
  - Preconstruction start: 2018 (2 years duration)
  - Construction duration: 4 years for PSC, 3 years for P3
  - Concession term: 46 years
  - Delay in start under PSC 5 years

Assumptions

- No difference in traffic volumes, carpooling and transit for conventional delivery vs. P3
- P3 option provides better service quality through:
  - Reduced construction-related traffic delays due to better work zone practices
  - Reduced incident-related traffic delays due to better incident response
  - Reduced vehicle operating costs due to better pavement quality

Benefit-Cost

Benefit Cost Inputs (Delays & Pavement Quality)	No Build	PSC	P3
Average duration of construction activity (in hours)	0.00 hours	8.00 hours	7.50 hours
Average duration of O&M activity (in hours)	4.00 hours	3.00 hours	2.75 hours
Speed adjustment factor for incident delays (in percent)	18.00%	9.00%	8.50%
Pavement quality (IRI, in inch/mile)	150 inch/mile	140 inch/mile	130 inch/mile

Benefit Cost Inputs (Transit & Carpool)	No Build	PSC	P3
Additional passengers carried by transit (% of vehicles)	2.00%	4.00%	1.50%
Additional passengers carried by carpools (% of vehicles)	2.00%	4.00%	1.50%

Risk Inputs

Lifecycle Performance Risk & Revenue Uncertainty Adjustment Inputs	
Lifecycle performance risk calculation method (see options below)	Option 1
Lifecycle performance risk aggregate premium (in million $, option 2 only)	**$400.0M**
Revenue uncertainty adjustment calculation method (see options below)	Option 1
Delta between availability payment & toll concession WACC (in percent, option 1 only)	**1.60%**
Revenue uncertainty adjustment (% of toll revenue collection, option 2 only)	28.00%

Guidance for Valuation Options

Option 1: WACC-based risk premium is calculated to determine the value of lifecycle performance risks/revenue uncertainty adjustment

Option 2: User to provide a risk premium for the value of lifecycle performance risks/revenue uncertainty adjustment

Option 3: Lifecycle performance risks/revenue uncertainty adjustment are ignored in the analysis

Review of Model Outputs

1. Delayed PSC (Delayed Conventional Delivery)
2. PSC (Conventional Delivery)
3. P3 Delivery

Delayed PSC (Delayed Conventional Delivery

Benefits & costs under Delayed Conventional Delivery	NPV @ 2.00%	Real total
Δ Travel time cost	$1,828M	$3,251M
Δ Delays due to construction	($48M)	($57M)
Δ Delays due to O&M	$10M	$17M
Δ Delays due to incidents	$1,360M	$2,388M
Δ Non-fuel costs	$111M	$193M
Δ Fuel costs	($109M)	($176M)
Δ Accident costs	$292M	$507M
Δ Emissions cost	($127M)	($226M)
Highway benefits subtotal	***$3,318M***	***$5,898M***
Δ Transit passenger benefits	$22M	$40M
Δ Carpooling passenger benefits	$20M	$36M
Transit and carpool passenger benefits subtotal	***$43M***	***$76M***
Total benefits	**$3,360M**	**$5,974M**
O&M No Build cost savings	$205M	$350M
Real construction costs	($370M)	($435M)
Real operations costs	($104M)	($180M)
Real base variability	-	-
Real pure risks	-	-
Lifecycle performance risk	($86M)	($140M)
Total costs	**($354M)**	**($516M)**
Total net benefits / (costs) under Delayed Conventional Delivery	***$3,006M***	***$5,458M***
Benefit cost ratio under Delayed Conventional Delivery	***9.48***	***N/A***

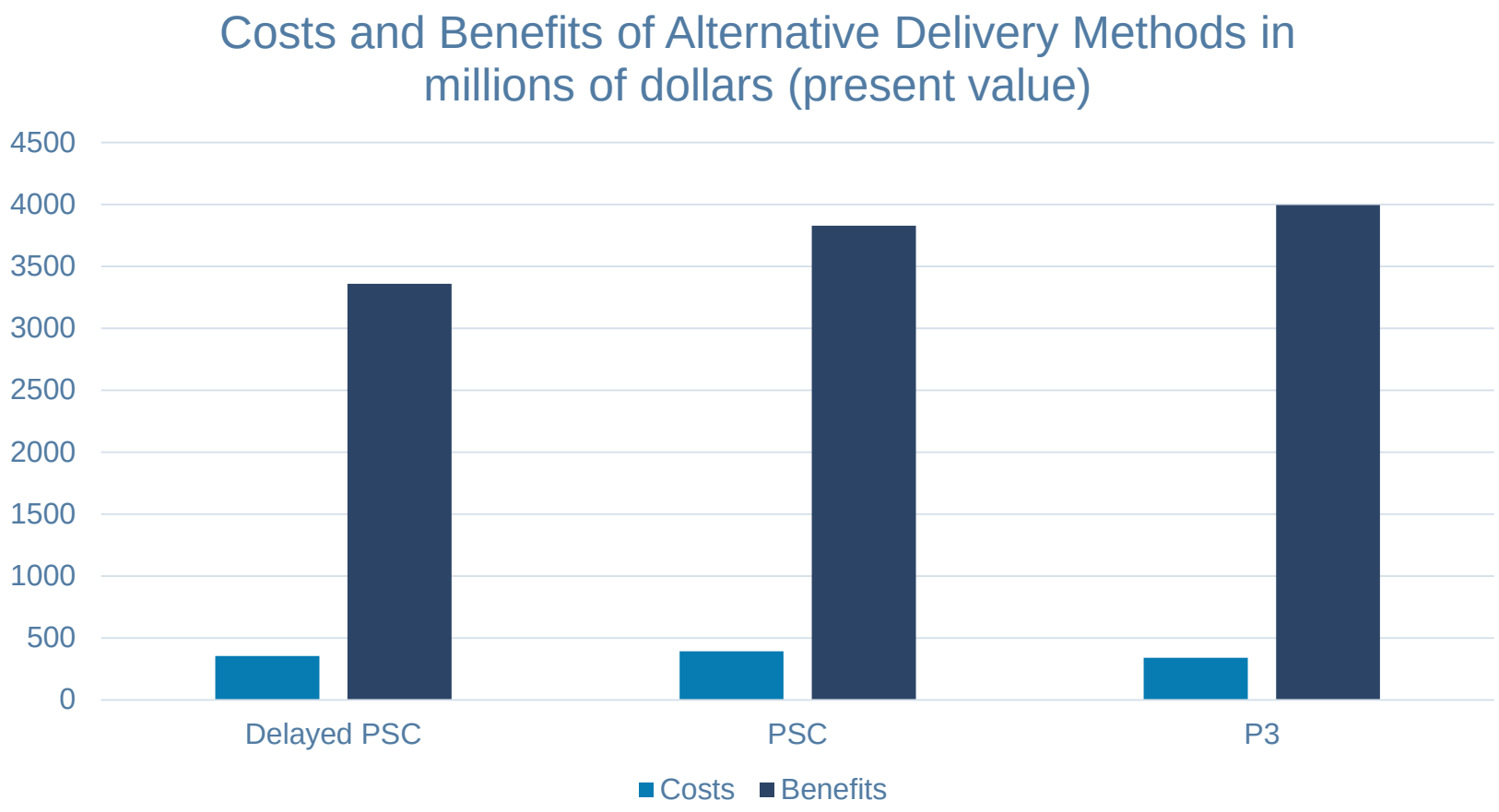
PSC (Conventional Delivery)

Benefits & costs under Conventional Delivery	NPV @ 2.00%	Real total
Δ Travel time cost	$2,058M	$3,521M
Δ Delays due to construction	($50M)	($54M)
Δ Delays due to O&M	$11M	$19M
Δ Delays due to incidents	$1,573M	$2,639M
Δ Non-fuel costs	$132M	$217M
Δ Fuel costs	($140M)	($213M)
Δ Accident costs	$345M	$568M
Δ Emissions cost	($147M)	($250M)
Highway benefits subtotal	***$3,781M***	***$6,446M***
Δ Transit passenger benefits	$25M	$43M
Δ Carpooling passenger benefits	$23M	$39M
Transit and carpool passenger benefits subtotal	***$48M***	***$82M***
Total benefits	**$3,829M**	**$6,528M**
O&M No Build cost savings	$248M	$400M
Real construction costs	($408M)	($435M)
Real operations costs	($128M)	($210M)
Real base variability	-	-
Real pure risks	-	-
Lifecycle performance risk	($104M)	($160M)
Total costs	**($392M)**	**($516M)**
Total net benefits / (costs) under Conventional Delivery	***$3,437M***	***$6,012M***
Benefit cost ratio under Conventional Delivery	***9.76***	***N/A***

P3 Delivery

Benefits & costs under P3 Delivery	NPV @ 2.00%	Real total
Δ Travel time cost	$2,103M	$3,569M
Δ Delays due to construction	($36M)	($38M)
Δ Delays due to O&M	$14M	$22M
Δ Delays due to incidents	$1,673M	$2,780M
Δ Non-fuel costs	$136M	$221M
Δ Fuel costs	($148M)	($221M)
Δ Accident costs	$356M	$580M
Δ Emissions cost	($151M)	($255M)
Highway benefits subtotal	***$3,946M***	***$6,660M***
Δ Transit passenger benefits	$26M	$44M
Δ Carpooling passenger benefits	$23M	$40M
Transit and carpool passenger benefits subtotal	***$49M***	***$83M***
Total benefits	**$3,995M**	**$6,743M**
O&M No Build cost savings	$257M	$410M
Real construction costs	($388M)	($410M)
Real operations costs	($119M)	($193M)
Real base variability	-	-
Real pure risks	-	-
Lifecycle performance risk	($90M)	($136M)
Total costs	**($340M)**	**($516M)**
Total net benefits / (costs) under P3 Delivery	***$3,655M***	***$6,227M***
Benefit cost ratio under P3 Delivery	***11.73***	***N/A***

Summary of Costs and Benefits



Patrick DeCorla-Souza

P3 Program Manager

USDOT Build America Bureau

& FHWA Center for Innovative Finance Support

(202) 366-4076

Patrick.DeCorla-Souza@dot.gov