IMPROVING THE TPB TRAVEL DEMAND FORECASTING MODEL

Status report

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Overview

- TPB's production-use travel demand model (Generation-2/Ver. 2.3)

- Strategic plan for improving the TPB travel model

- TPB's developmental travel models

  - Gen2/Ver. 2.5

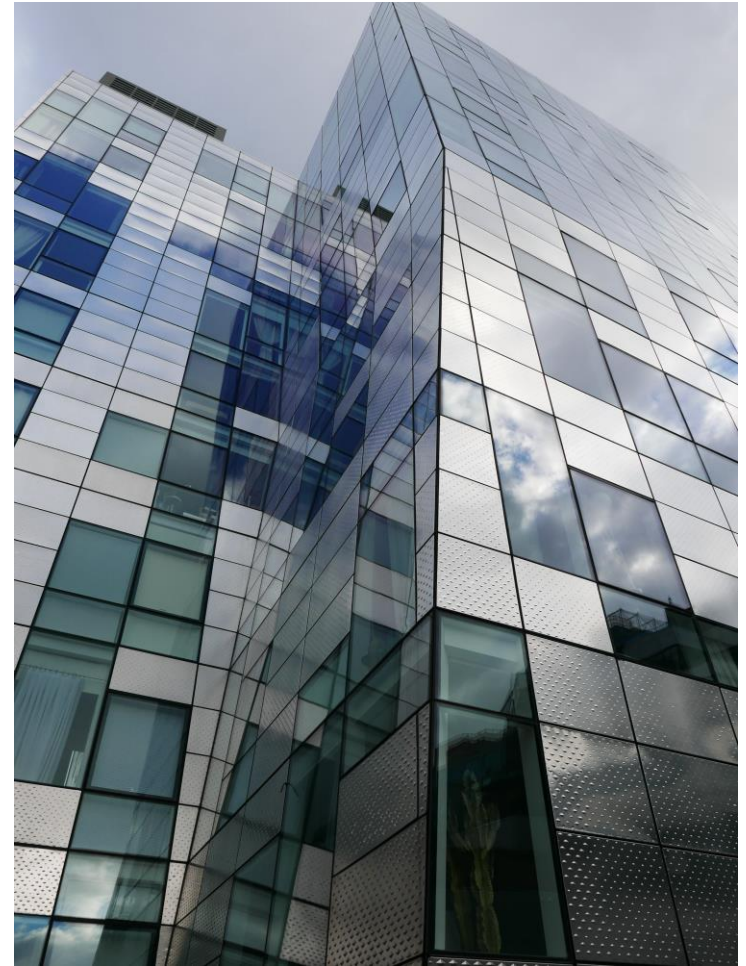 - Gen3

- Last presented to Technical Committee: 7/6/18

Image credit: Mark Moran, 2018

Background:
TPB Travel Demand Forecasting Models

- COG/TPB staff maintains at least two regional travel demand models

  - An adopted, production-use model

  - One or more developmental models

- Production-use travel

  - Updated on a regular (annual) basis

  - Used extensively by TPB member agencies

  - Becomes the adopted, production-use model implicitly by action of the TPB, e.g., approval of the air quality conformity (AQC) analysis

- Developmental models

  - Guided by the strategic plan for model improvement, developed in 2015 with consultant assistance

TPB's production-use travel model

- Current production-use model: Gen2/Ver. 2.3.75 (adopted 10/17/18)

- Travel model user's guide is updated on a regular (annual) basis

  - To be finalized by early December

- Model transmittal package for the production travel model

  - To be finalized by early December

  - Includes Ver. 2.3.75 model and its input files

    - Networks: 2019, 2021, 2025, 2030, 2040, and 2045

    - Land use: Round 9.1, TAZ-level, with CTPP-based employment adjustment

  - We have received three requests for model/inputs thus far

Strategic Plan for Model Improvement

- Three phases over 9 years (as of Nov. 2018)

Phase	Description	Duration (Years)	Fiscal Years
1	Updates to the existing four-step model (Gen2, Ver. 2.3 => Ver. 2.5)	4	2016-2019
2	Development of a next-generation (Gen3) model with existing data*	4	2019-2022
3	Development of a Gen4 model with new data*	2	2023-2024

* Data collection for the 2017/2018 Regional Travel Survey is scheduled to finish in Dec. 2018. Based on the experience of the previous survey (2007/2008), data cleaning and factoring could take one to two years, which means that the survey data would likely be ready for use in 2020 (FY 2020 or 2021).

TPB's developmental travel models

Gen2/Ver. 2.5 model

Gen2/Ver. 2.5 model timeline

- Gen2/Ver. 2.5 model was the outcome of Phase 1 of strategic plan

- Consultant delivered Ver. 2.5 model at end of FY 2017 (Ver. 2.5 base)

- FY 2018

  - TPB staff conducted validation and sensitivity tests

  - Current revised model Ver. 2.5.9

- FY 2019

  - Validation and sensitivity tests continue, though progress has slowed due to competing priorities and staffing changes

Gen2/Ver. 2.5 Travel Model: Enhancements sought versus achieved

Enhancement Sought	Major Change Made to Model	Enhancement Achieved?
Update transit network/path-building software to a newer version with more capabilities	Moved from Cube TRNBUILD to Cube Public Transport (PT)	Yes
Improved representation of non-motorized (bike and walk) travel	Added explanatory variables, e.g., intersection density (see Milone, 2018 slide 9)	Possibly
Improved ability to differentiate transit submodes (e.g., bus, LRT, BRT, rail)	Moved transit submode choice from mode choice to both mode choice and path-building/assignment	Uncertain
Improved ability to model changes in road pricing and other managed-lane facilities	Highway assignment is now stratified by three value-of-time (VOT) segments	Uncertain

Sensitivity tests were documented in two presentations:

- **Ver. 2.5 model: Milone, 2018**: "Ver. 2.5 Travel Model Development and Evaluation." presented at the July 20, 2018 meeting of the COG/TPB Travel Forecasting Subcommittee. July 20, 2018.
- **Ver. 2.3 model: Milone & Moran, 2011**: "TPB Version 2.3 Travel Model on the 3,722-TAZ Area System: Status Report and Sensitivity Tests." presented at the July 22, 2011 meeting of the COG/TPB Travel Forecasting Subcommittee, July 22, 2011.

Gen2/Ver. 2.5 Travel Model:
Model performance in validation tests

Metric	Ver. 2.5_base	Ver. 2.5.9
Daily VMT by juris. (est./obs.)	Worse than Ver. 2.3	Comparable to Ver. 2.3
Daily VMT by facility type (est./obs.)	Worse than Ver. 2.3	Comparable to Ver. 2.3
Daily volumes by facility type (%RMSE)	Worse than Ver. 2.3	Still worse than Ver. 2.3
Daily vehicle trips by screenline	Worse than Ver. 2.3	Comparable to Ver. 2.3
Transit ridership by submode	Worse than Ver. 2.3	Still worse than Ver. 2.3

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Gen2/Ver. 2.5 Travel Model: Current issues/concerns

- Ver. 2.5 model is more complex than Ver. 2.3 and run times are twice as long

- Despite months of testing, we have not proven that all four of the sought-after enhancements have been achieved

- May require further significant work, including possibly model re-calibration/re-validation to ensure that Ver. 2.5 is equal to or better than Ver. 2.3

- Zero-sum game: Time spent working on Ver. 2.5 is time not spent working on Gen3 model. Have to determine the right balance.

Gen2/Ver. 2.5 Travel Model: Status

- The development/review process has taken much longer than anticipated

- Moving ahead with Version 2.5.9 (includes streamlined application features and our updated external trip distribution process)

- Still working on QC/QA production procedures supporting PT-compliant transit networks

Gen2/Ver. 2.5 Travel Model: Lessons learned

- To be applied to Gen3 model development

  - Specify model specs, such as maximum allowable run time

  - As part of the contract, have consultant perform a series of sensitivity tests, including possible re-calibration, if needed

  - Initial Gen3 model should be delivered to TPB staff before end of contract, so that consultant has time to make updates in areas identified during testing

TPB's developmental travel models

Gen3 model

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Types of travel models

- Trip-based models

- Tour-based models

- Activity-based models

- Hybrid models

Gen3 model could be any one of these

Gen3 model: Approach for developing

- Approach for soliciting consultant assistance

  - First: Request for Information (RFI)

  - Followed by: Request for Proposals (RFP)

- We do not know of others who have taken this approach

- More common: Simply conduct an RFP

- Advantage: RFI allows staff to learn about the latest techniques that are being used and that should be part of the RFP

Current status of RFI phase

- Request for information (RFI)

  - Advertisement ended July 12

  - Excellent response!

    - 7 formal responses;
      2 informal responses

  - Formal responses

    - Two from software vendors

    - Five from consulting firms

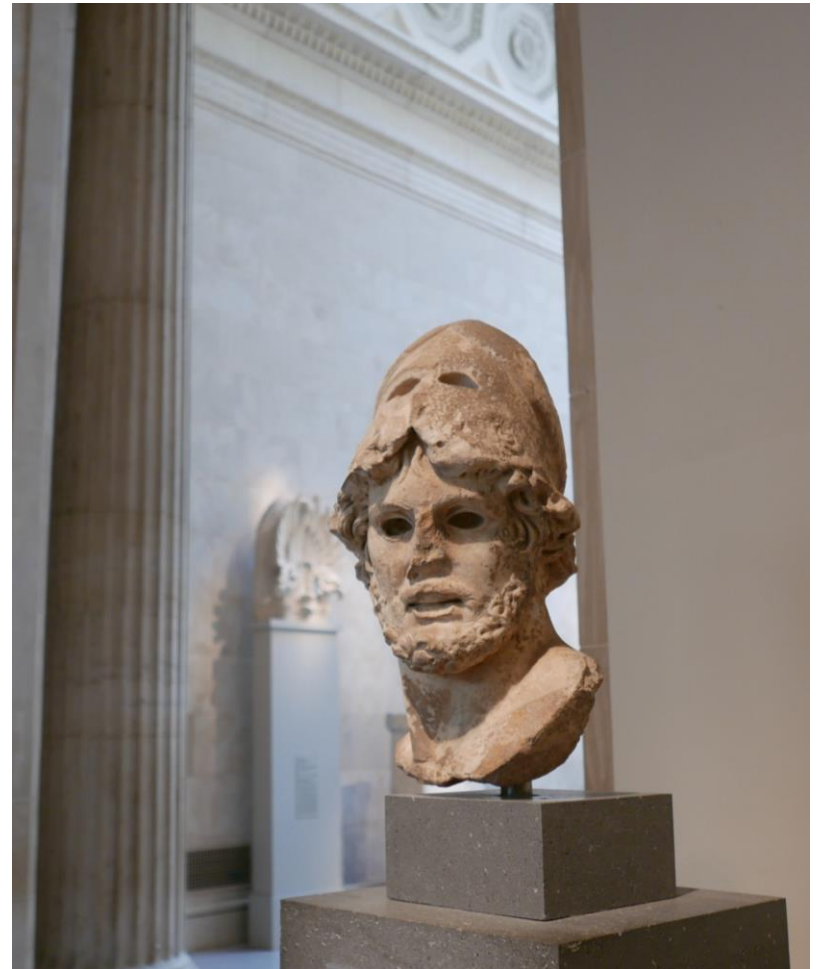 - In cases where we had questions, we followed up with those respondents
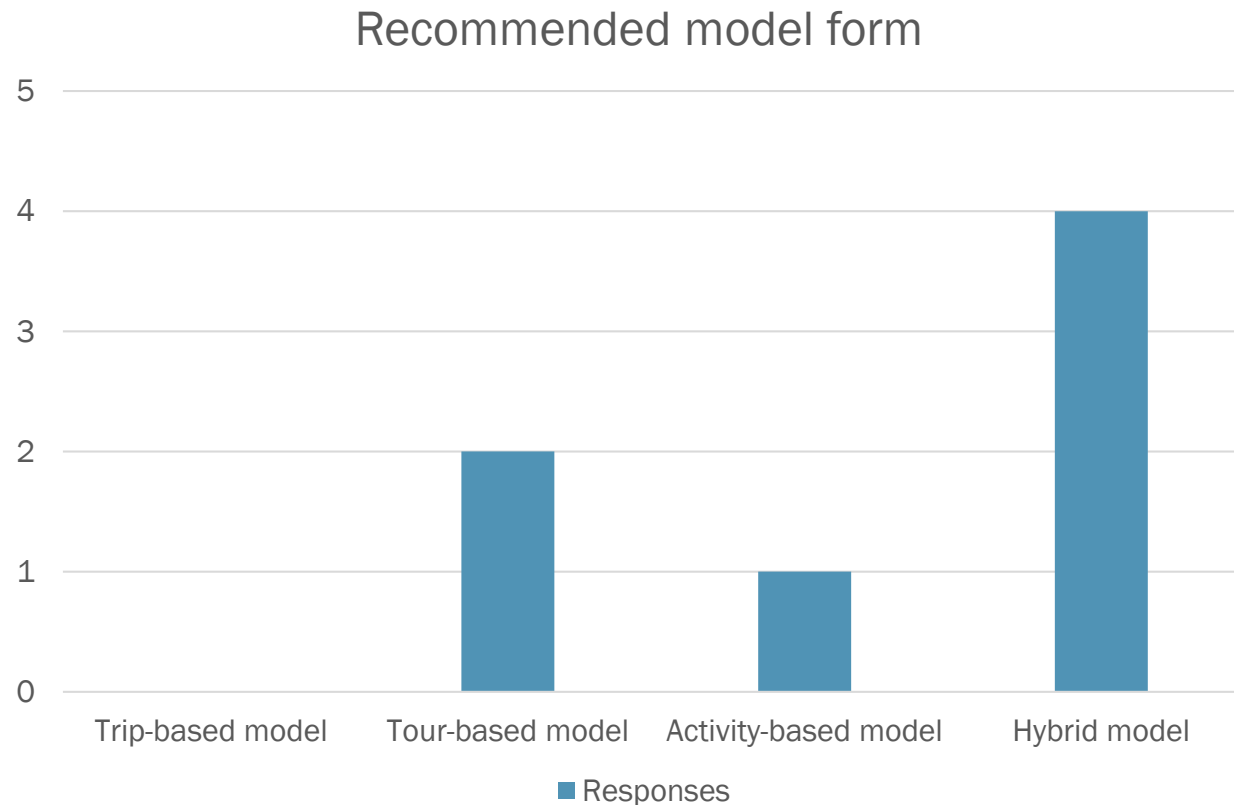

Image credit: Mark Moran, 2018
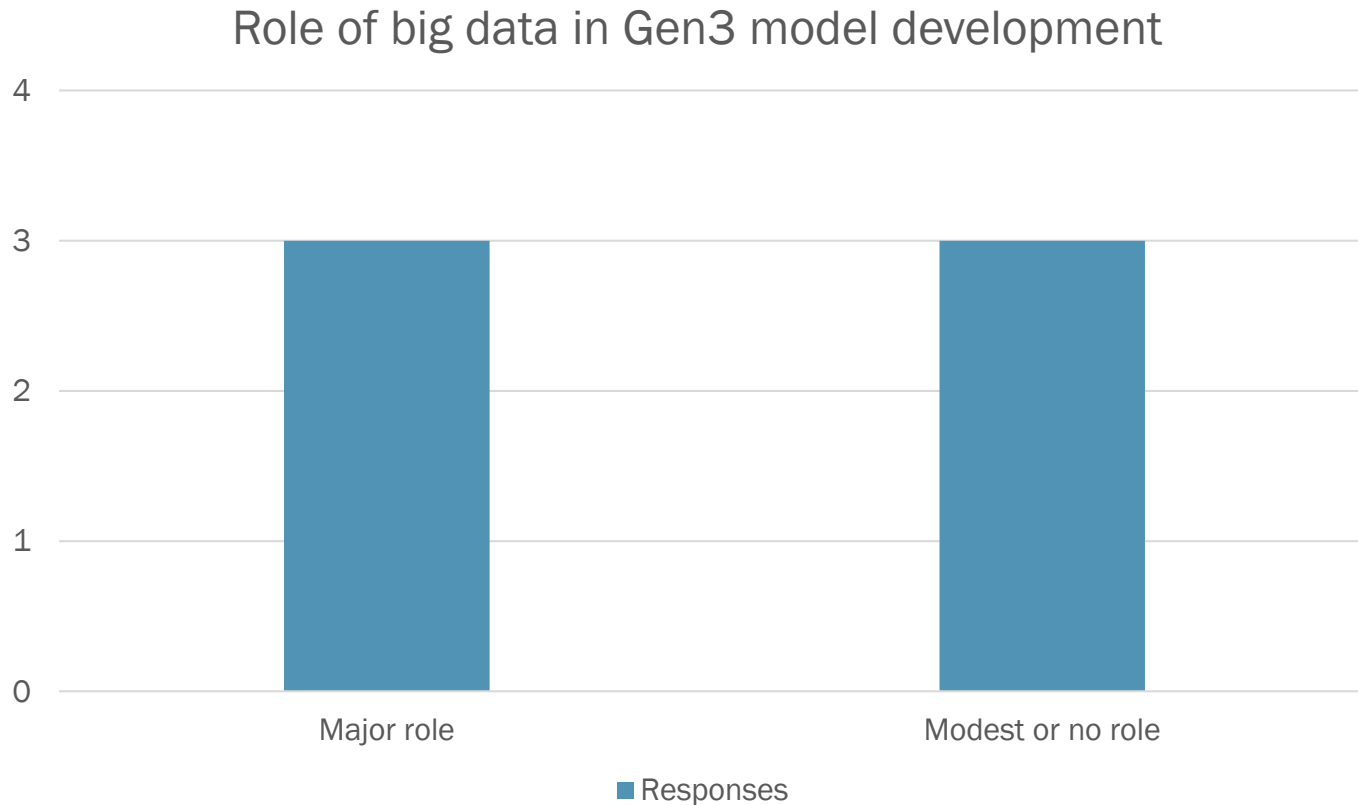
Notes about the RFI phase

- Intended to be an information-gathering phase, to aid in the writing of the scope of work for the RFP

- Vendors were told that we would not share details of their RFI response reports with others

- Nonetheless, we can provide the TFS some **aggregate, anonymized** summaries

- Caveat: This is not an election, i.e., a majority of responses for a particular model characteristic does not necessarily imply that we will choose to move in that direction with the RFP.

  - It simply indicates the opinions of the 7 responding firms

- We are presenting only a subset of the aggregate summaries

A few aggregate findings from RFI phase

Recommended model form

Bar chart showing Responses for recommended model form: Trip-based model (0), Tour-based model (2), Activity-based model (1), Hybrid model (4).

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A few aggregate findings from RFI phase

Role of big data in Gen3 model development

Bar chart comparing "Major role" (value 3) and "Modest or no role" (value 3). Legend: Responses.

A few aggregate findings from RFI phase

Recommendations for highway assignment in Gen3 model

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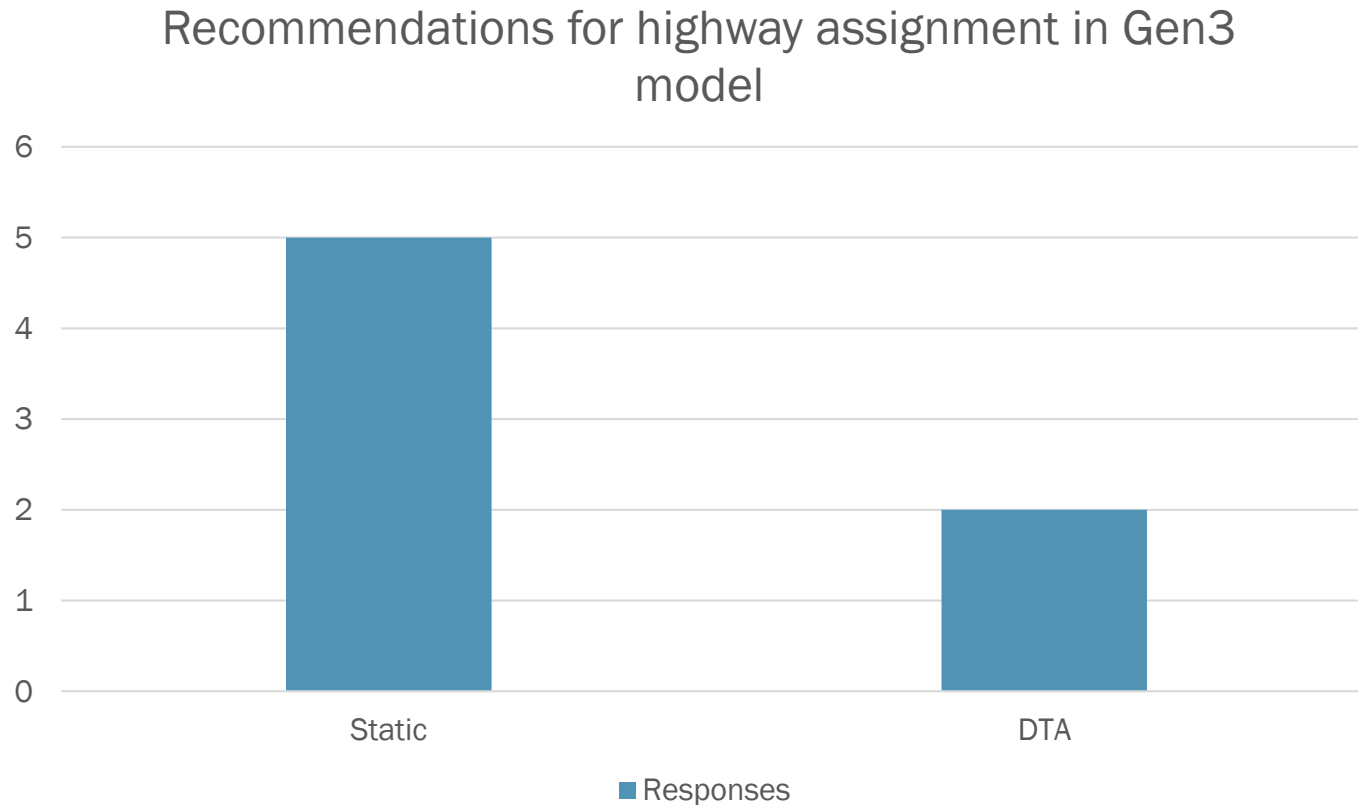
A few aggregate findings from RFI phase

Transit assignment format for Gen3 model

Responses by format type (y-axis 0 to 8):
- Production-Attraction (current approach): 0
- Origin-Destination: 7

■ Responses
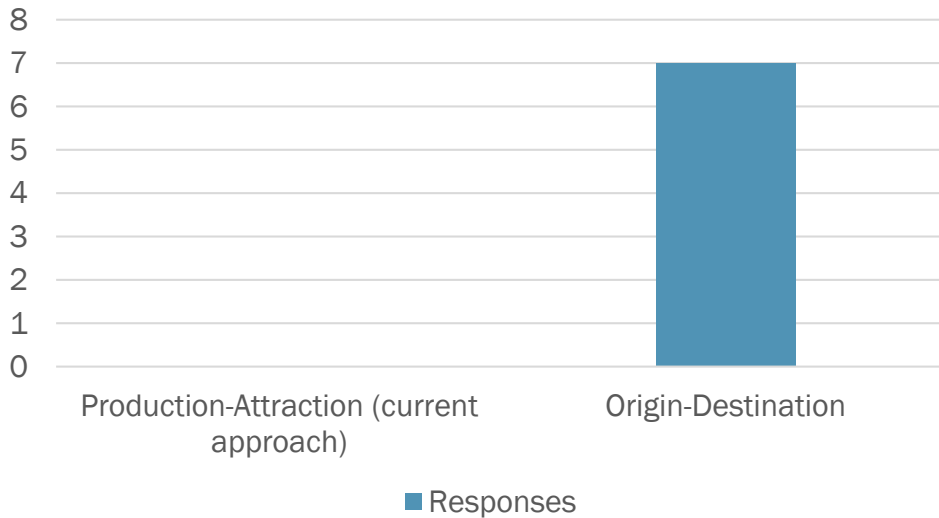
Transit assignment approach for Gen3 model

Responses by approach type (y-axis 0 to 7):
- All or nothing (current approach): 1
- Capacity-constrained: 6

■ Responses

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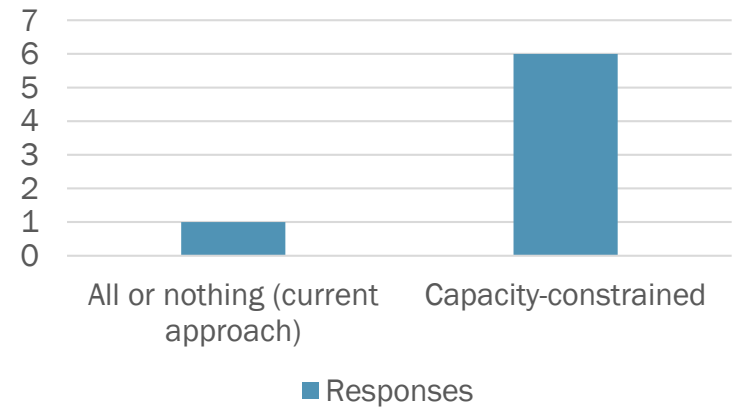
Current timeline, Gen3 model devel.

Step	Approx. Duration	Approx. Dates	Fiscal Year				
			18	19	20	21	22
Request for Information (RFI) advertisement	1.5 months	5/31/18 to 7/12/18	X	X			
Request for Proposals (RFP) advertisement	1 month	Jan. to Feb. 2019		X			
Vendor selection	1 month	Feb. to Mar. 2019		X			
Start of contract		Apr. 2019		X			
Investigations (consultant)	4 months	Apr. to Aug. 2019		X	X		
Decisions (TPB staff)	3 weeks	Aug. to Sep. 2019			X		
Development and implementation of Gen3 model	15 months	Sep. 2019 to Dec. 2020			X	X	
Data collection for Gen3 or Gen4 model?	6 to 15 months	Sep. 2019 to Dec. 2020			X	X	
Testing, sensitivity analyses, and updates	15 months	Dec. 2020 to Apr. 2022				X	X
Final decision: Is Gen3 model ready for use?		Apr. 2022					X
End of contract		Apr. 2022					X

Next steps

- RFP phase about to begin. Planned dates as of November 2018

    - Advertisement period: January to February 2019

    - Vendor selection: February to March 2019

    - Start of contract: April 2019

Image credit: Mark Moran, 2018

Acknowledgements

- We would like to acknowledge the efforts of the seven vendors and two non-vendors who prepared responses to the RFI

- Also, Ray Ngo, Dusan Vuksan, and Ron Milone

Image credit: Mark Moran, Marseille, 2017

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