Research Centre for Integrated
Transport Innovation (rCITI)

Calibration in transport planning model systems: A revisit

Taha Rashidi
Ali Najmi

Outline

- Introduction
- Calibration process in practice
- Problem definition
- Calibration solutions
- Conclusion

Introduction

The following terminologies are used in this presentation:

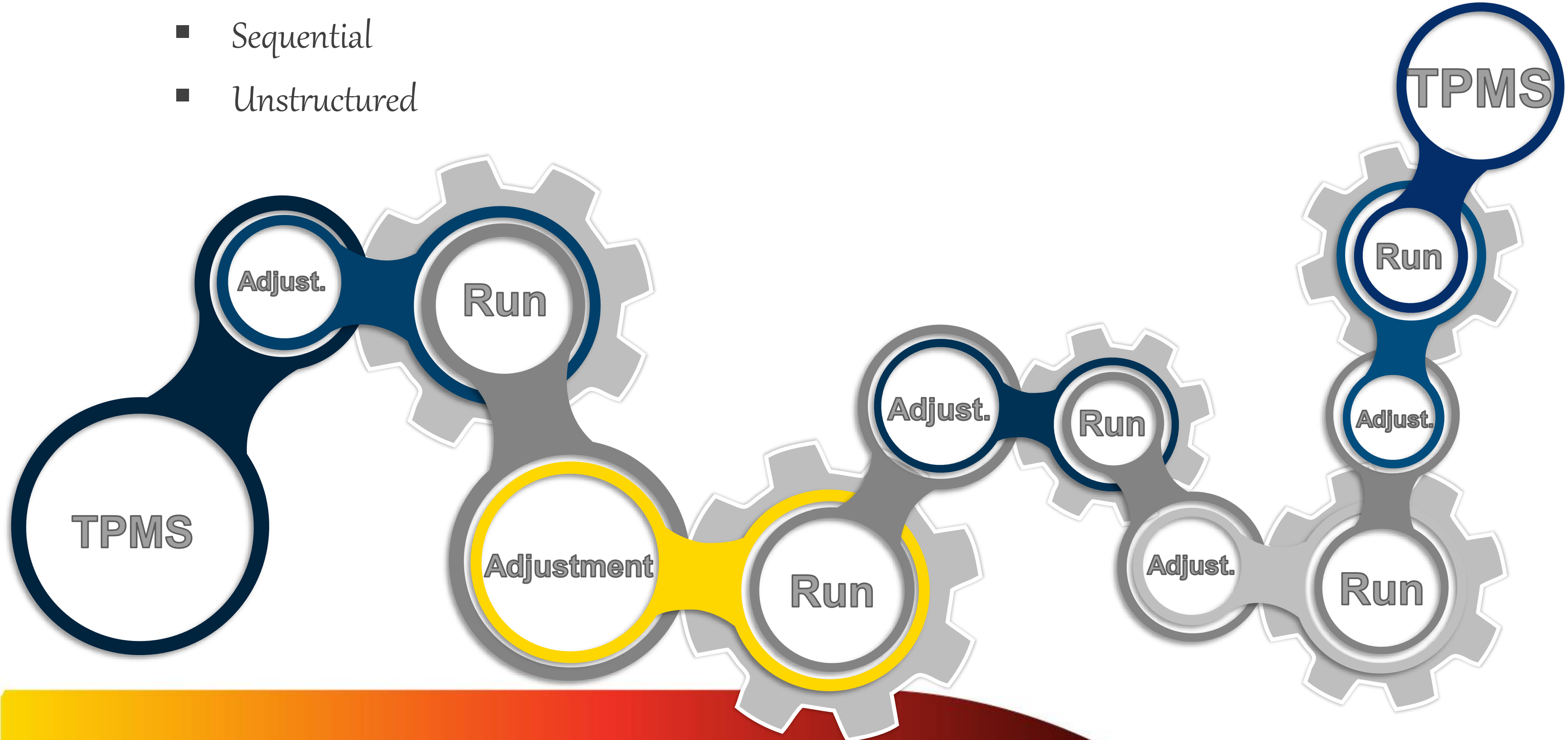
- Transport planning model system (TPMS)
- Demand-side models
- Supply-side models
- Estimation
- Calibration

Calibration techniques

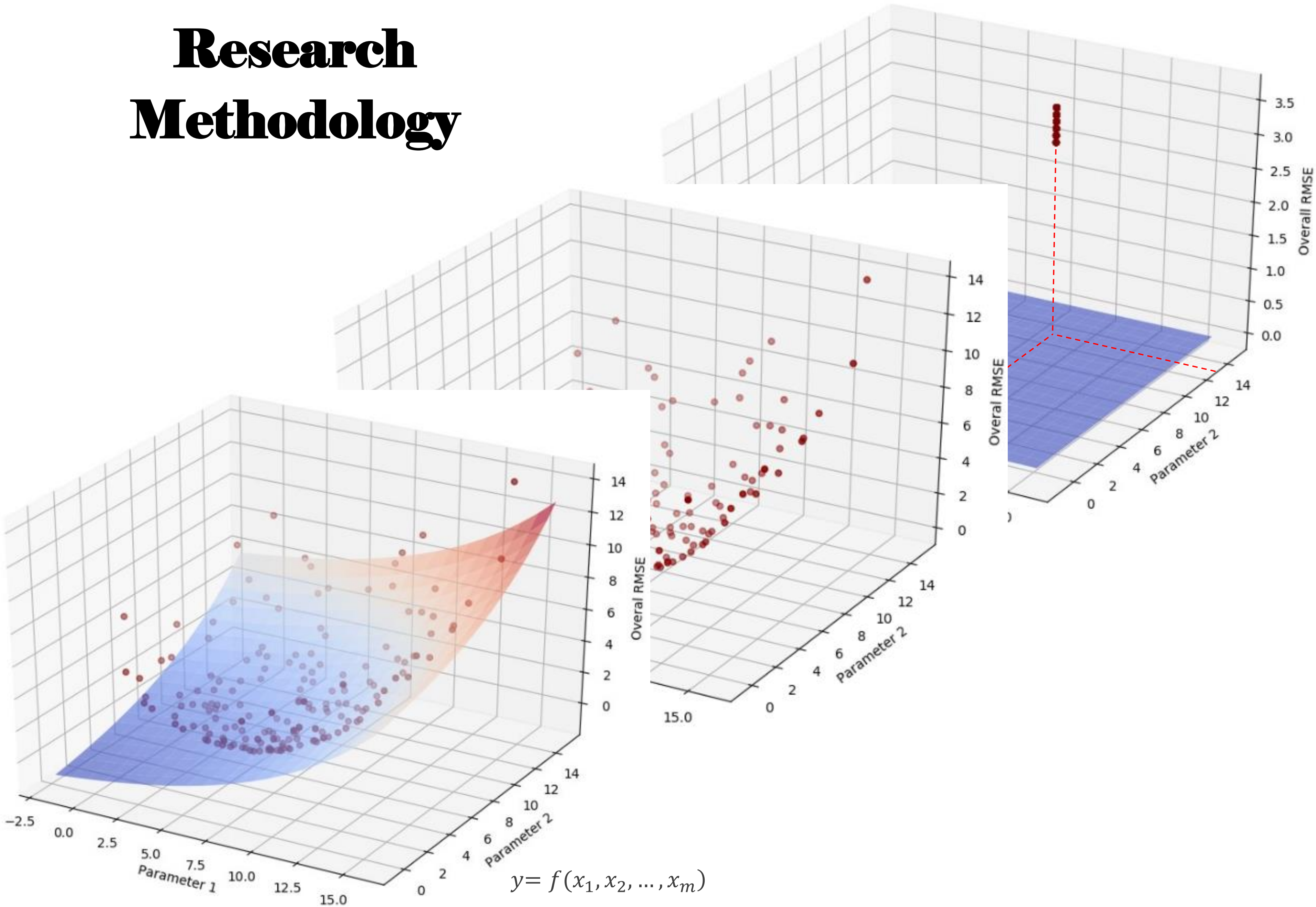
- Zone specific scaling factors
- OD K-factors
- OD matrix estimation
- Alternative-specific constants adjustments
- Data manipulation
- Weighting agents and activity patterns

Calibration process

- *Sequential*
- *Unstructured*



Research Methodology



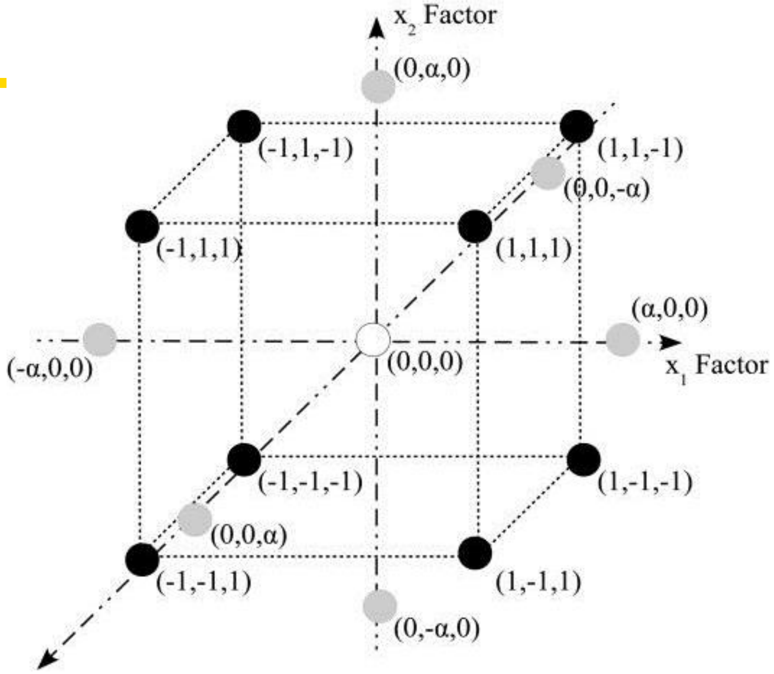
$y = f(x_1, x_2, \ldots, x_m)$

Central Composite Design

CCD uses three groups of design points:

- corners,
- centre
- axial

α is design parameter



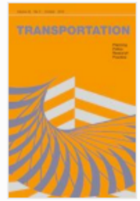
Schematic diagram of a three factor central composite design (CCD)

CCD in Calibration

Table 1 A central composite design with seven parameters								
Experiment	Parameter 1	Parameter 2	Parameter 3	Parameter 4	Parameter 5	Parameter 6	Parameter 7	Response values
1	1	1	1	-1	1	1	1	$r_1^1, r_2^1, \ldots, r_n^1$
2	1	1	-1	1	-1	1	-1	$r_1^2, r_2^2, \ldots, r_n^2$
3	1	1	-1	1	1	-1	1	$r_1^3, r_2^3, \ldots, r_n^3$
4	1	-1	1	-1	-1	-1	1	$r_1^4, r_2^4, \ldots, r_n^4$
					⋮			
34	0	0	0	0	0	$-\alpha$	0	$r_1^{34}, r_2^{34}, \ldots, r_n^{34}$
35	0	0	0	0	0	α	0	$r_1^{35}, r_2^{35}, \ldots, r_n^{35}$
36	0	0	0	0	0	0	$-\alpha$	$r_1^{36}, r_2^{36}, \ldots, r_n^{36}$
37	0	0	0	0	0	0	α	$r_1^{37}, r_2^{37}, \ldots, r_n^{37}$

$$y = f(x_1, x_2, \ldots, x_m)$$

Research Methodology



Transportation
pp 1–39 | Cite as

Calibration of large-scale transport planning models: a structured approach

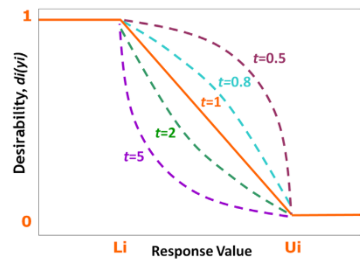
Authors Authors and affiliations

Ali Najmi, Taha H. Rashidi, James Vaughan, Eric J. Miller

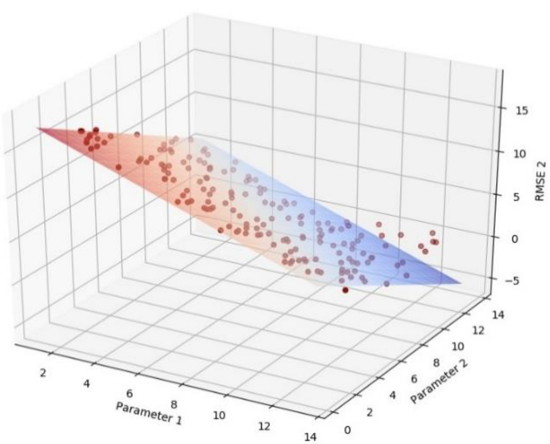
$$\max \left(\prod_{j\in\{1..n\}} d_i\,(y_i) \right)^{\frac{1}{n}}$$

Subject to:

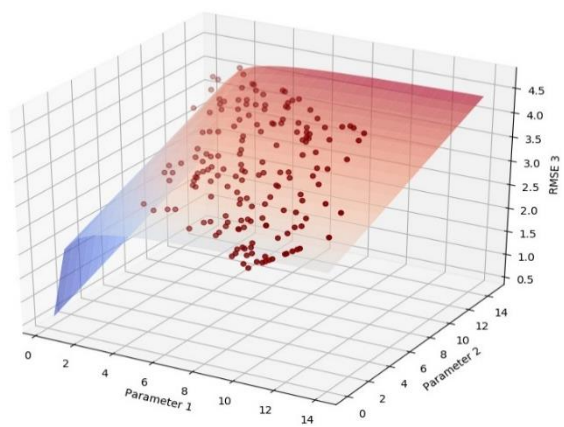
$$y_j = f_j(x_1, x_2, \dots, x_m) \qquad \forall\, j \in \{1..n\}$$



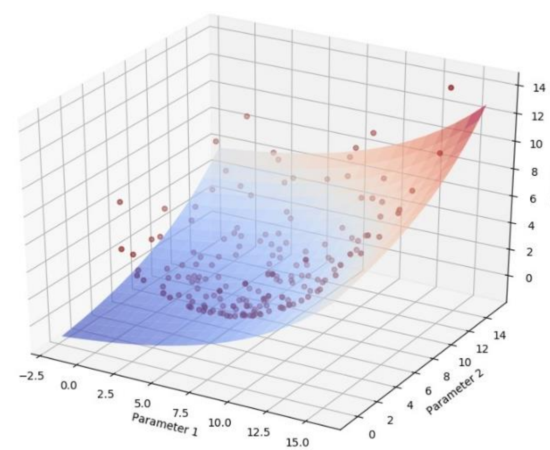
$$d_i = \begin{cases} 1 & y_i < L_i \\ \left(\dfrac{U_i - y_i}{U_i - L_i}\right)^t & L_i \le y_i \le U_i \\ 0 & y_i > U_i \end{cases}$$



$y_1 = f_1(x_1, x_2, \dots, x_m)$



$y_2 = f_2(x_1, x_2, \dots, x_m)$



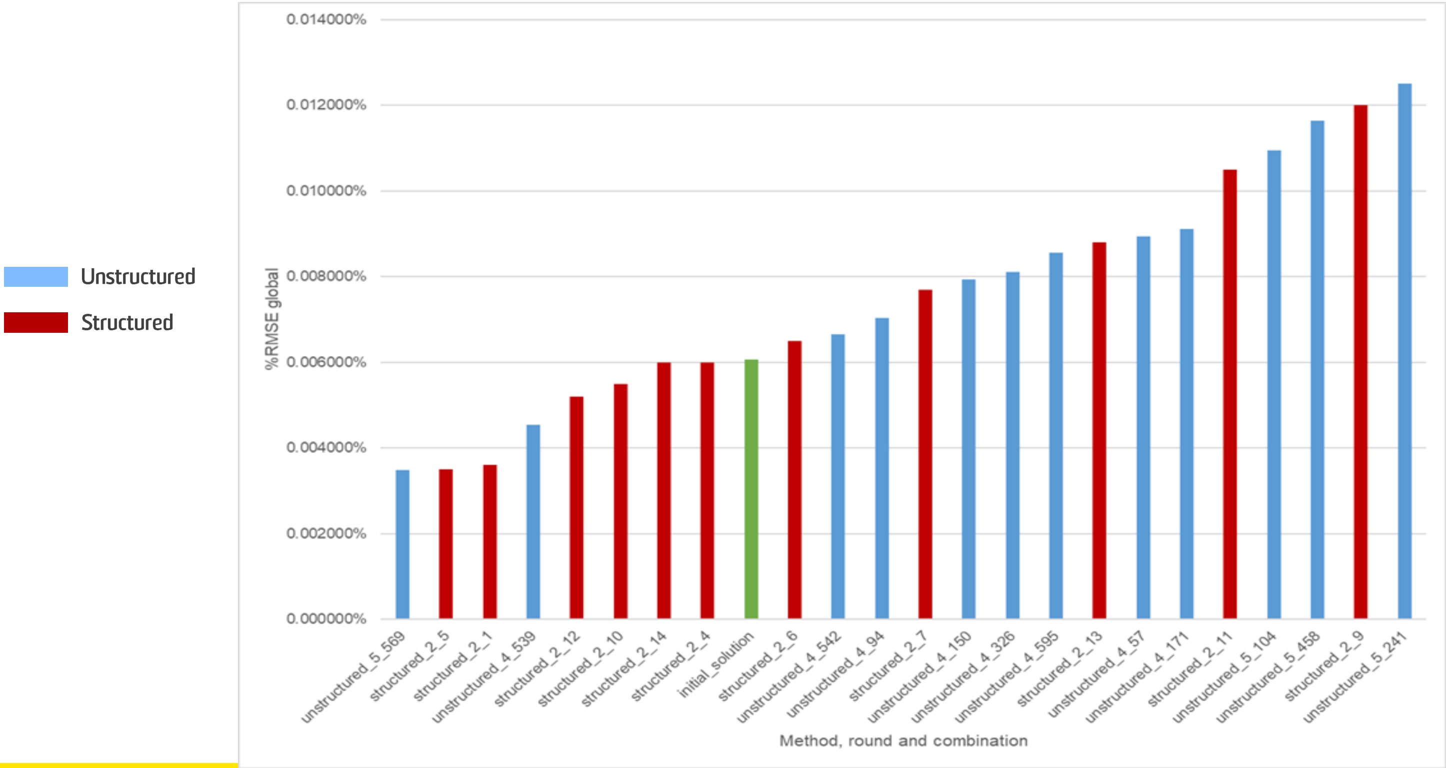
$y_3 = f_3(x_1, x_2, \dots, x_m)$

Model implementation for SILO

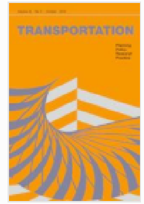
Key differences of unstructured and structured approaches

	Unstructured	Structured
Calibration nature	Sequentially	Simultaneous
Trial and error based	Yes	No
Needs knowledge (expertise) of the developed model	Yes	Not necessarily
Number of trials	7,480	1,377

Model implementation for SILO



Research Methodology

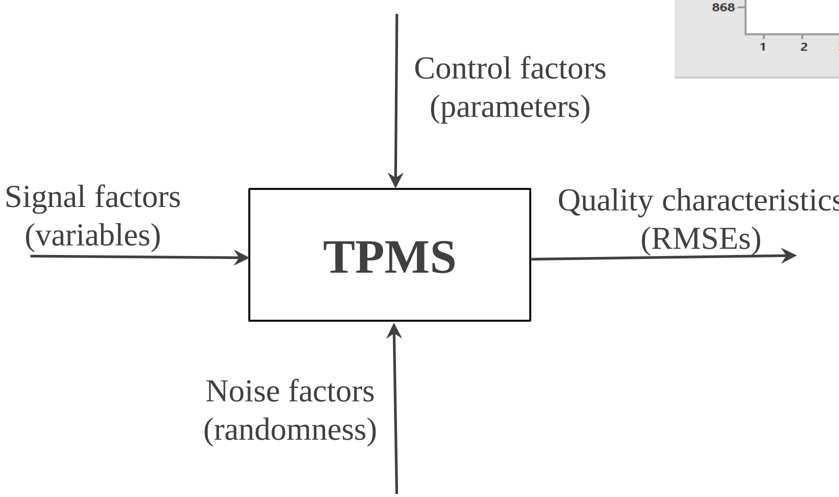


Transportation
October 2019, Volume 46, Issue 5, pp 1915–1950 | Cite as

A novel approach for systematically calibrating transport planning model systems

Authors   Authors and affiliations

Ali Najmi, Taha H. Rashidi, Eric J. Miller



$$\textbf{Max}\ \frac{Signal}{Noise}$$

Conclusion

The proposed calibration models:

- allow for using calibration techniques in a systematic structure
- Steer the modeller's decisions
- consider the interactions among the parameters
- are relatively fast
- result in a robust TPMS so that variation in the results is reduced
- may make the TPMS calibration process easier
- result in better TPMS with fewer parameter adjustments.
- require less knowledge about the structure of the estimated TMPS
- may prevent falling into over-calibration trap.

Thank you for your attention