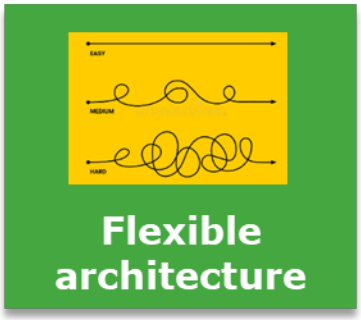


Rijkswaterstaat
Ministry of Infrastructure and Water Management

Major transitions require renewal of strategic transport models

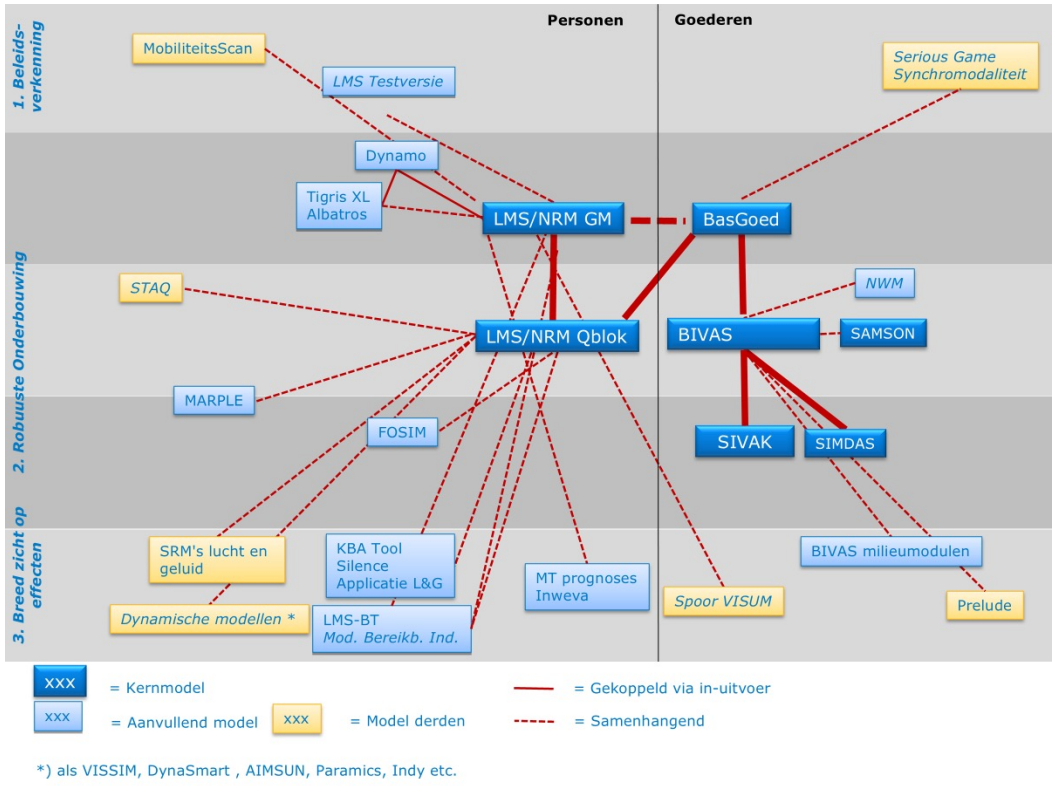
Challenges and questions for the Dutch innovation Program on nationwide transport modelling

Modelling Mobility Conference 2025

Erik Verroen (Ministry of Transport)

Nationwide transport modelling in the Netherlands

- **Portfolio** of model systems for passenger and freight transport
- Key models **owned** by the Ministry of Transport
- Demand modelling based on nested **logit** model (discrete choice theory and random utility maximization)
- **Sample Enumeration** for population synthesis and tour generation
- Multi user class equilibrium **assignment**



The Bermuda triangle of modelling

Uncertain

Incomprehensible

Undemocratic

Brought up challenges

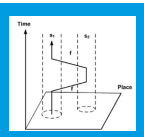
Methodological	**Societal**
➢ Data	➢ Sustainability
➢ Behaviour	➢ New and Smart Mobility
➢ Complexity	➢ Digitalisation
➢ Spatial dynamics	➢ Diversification
	➢ Shifting values
	➢ *System limits to grow*
	➢ *Participation*
	➢ *Inherent uncertainties*

Why renewal is necessary

1. Major **transitions**: climate, energy, housing, digitalisation.
2. Challenges at the Ministry of Transport and the Road Authority: **maintenance** and renewal of infrastructure.
3. Modelling **gap** between demand and supply: current models cannot always handle new policy questions and information needs.
4. System **upgrade**: modelling toolkit difficult to manage and maintain in a coherent and up-to-date state.

=> Towards a new flexible, modular, comprehensive and shared modelling system (acronym to be decided)

Thematic challenges

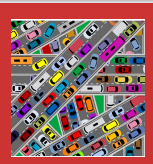


Changing behaviour in space & time

We will travel differently across and within days, choose different destinations, spend more time at home, and adopt new forms of mobility.

Individual differences in preferences and attitudes are important explanatory variables in travel choice behaviour. There is a growing need and ambition to take these differences into account and to provide insight into distributional effects.

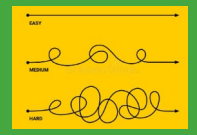
More diversity in behaviour



More crowded networks

Increasing network loads make traffic flows harder to predict because of the complex dynamics between traffic demand and bottlenecks. This complexity is also reflected in demand modelling.

While there is a tendency to make models increasingly complex and extensive, there is also a growing need for models that are transparent, traceable, and can be used in a flexible way.



Flexible architecture

Programmatic approach

Functional architecture

Modules

Calculating sequences

Level of detail

Technical architecture

Platform

Data model

Configurator

Software

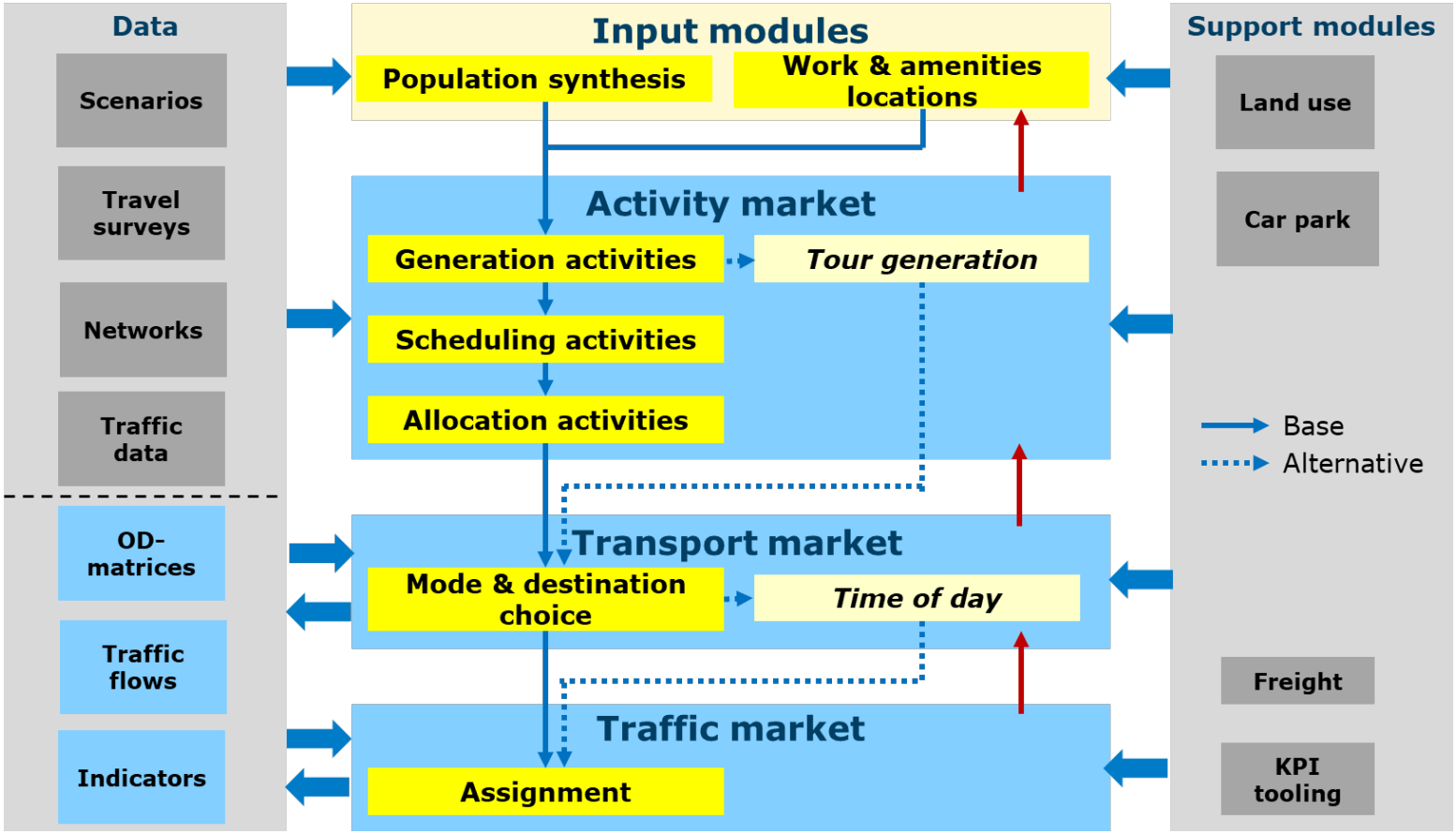
2024

Fundamental choices

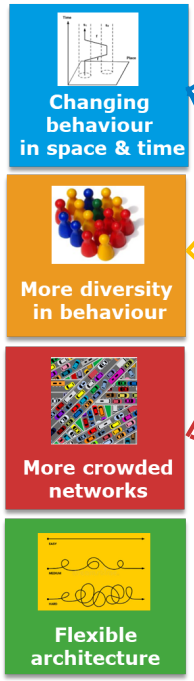
2028

Collaboration with market & knowledge institutions

Functional architecture at a glance



Fundamental design choices



1. Activities, tours or hybrid model
2. (Full) Population synthesis vs. prototype sampling
3. Average day peak - off peak vs. multi-day and part of day modelling
4. New or more behavioral variables in choice functions
5. Average static representation vs. dynamic variation in congestion lengths and travel times
6. Which flexible platform-based model architecture to adapt different modules, data sources and levels of detail?

Summary

- **Strategic renewal is essential**: Our transport models must evolve to meet societal transitions in climate, housing, energy, and technology.
- **Behavioural realism matters**: Weekday patterns, teleworking, and individual heterogeneity all demand a more dynamic, flexible model structure.
- **Modular thinking is the future**: Standalone models are no longer sufficient. A coherent, interoperable system enables adaptability and collaboration.
- **There are still open questions**: Key methodological decisions (attitudes, population synthesis, travel time realism) need empirical study and stakeholder alignment.
- **We need to move together**: Collaboration with academia, policy, and market is crucial to design a modelling toolkit fit for the future.

Discussion points (1)

1. **Activity based, tours+ or hybride:**
   - Diversity in behavior
   - Spatial constraints
   - Budget constraints (time & money)
   - Household dependencies
   - *(Full) population synthesis vs. prototype sampling?*
   - *Data demands?*
2. **The future of MN Logit:**
   - Behavioral options (modelling mode and destination choices)
   - Budget constraints – variable cost and time parameters
   - Spatial equilibrium
   - Constant behavior
   - Spatial self selection

Discussion points (2)

3. Next steps in assignment:

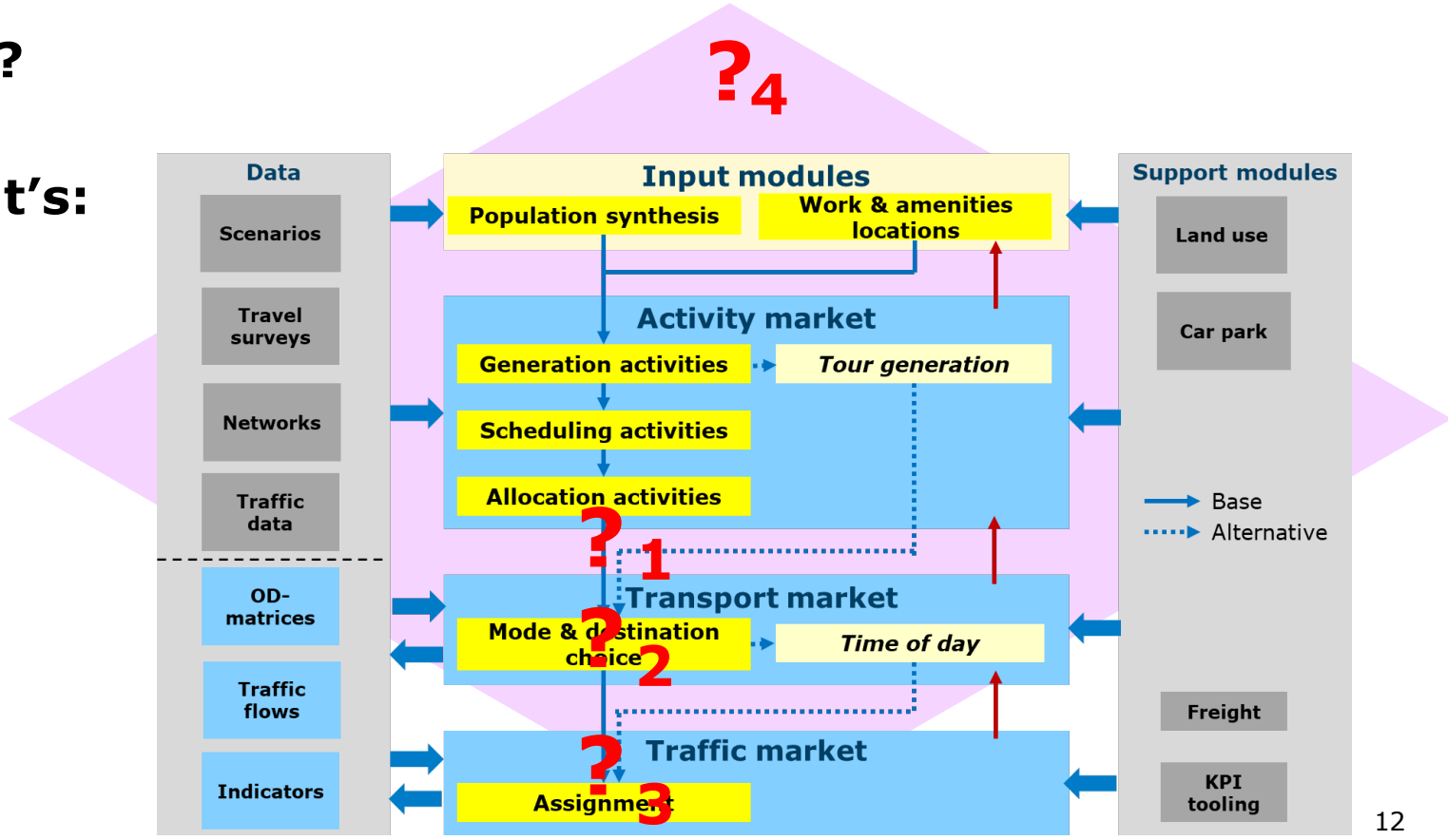
- Equilibrium vs dynamic – simulation
- Ensembles
- Hypernetworks
- Behavior of cars

4. Flexible model architecture:

- Modular structure
- Platform techniques
- Automation of calibration
- Communication and organization

Please give us your reflections

a. Recognizable?

b. Does and dont's:

1. Activity based?
2. Logit?
3. MUC Assignment?
4. Modular platform?