

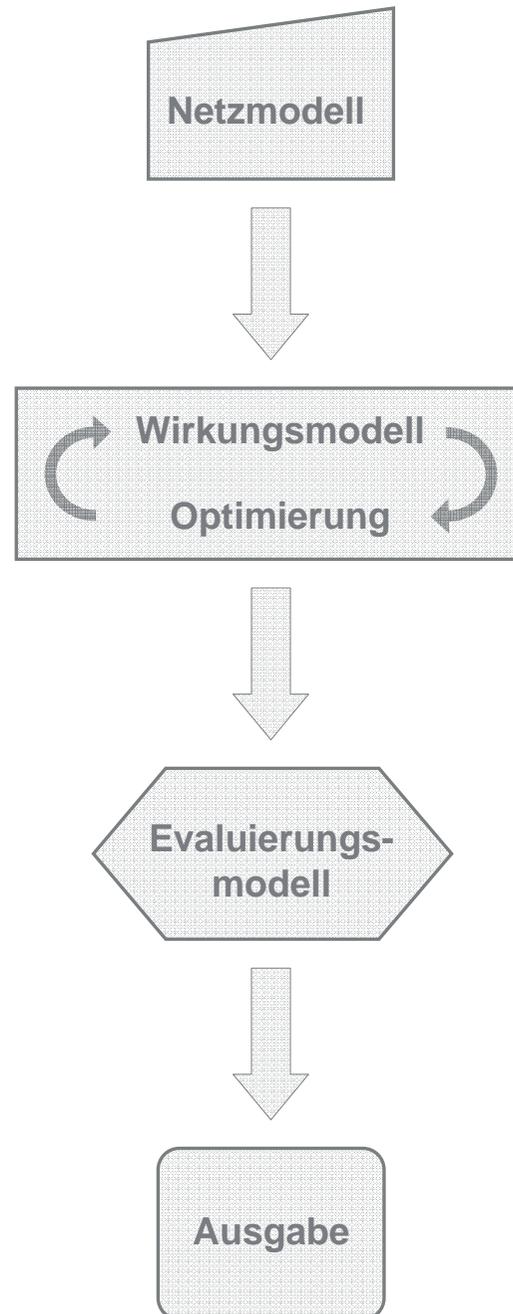
Emissions- und Kraftstoffreduzierung im Stadtverkehr durch innovative Verkehrslenkungsmaßnahmen

Werkstattbericht

Jannis Rohde

Institut für Verkehrswirtschaft, Straßenwesen und Städtebau

Gliederung



Netzmodell: Eingabe Straßennetz + LSA-Daten

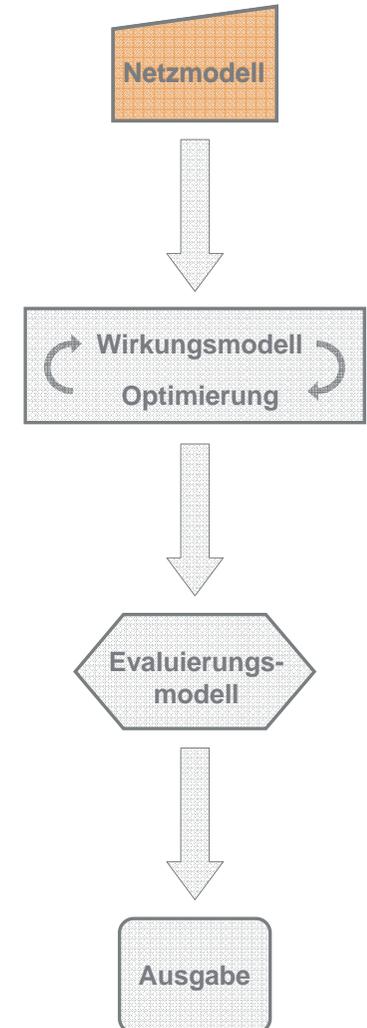
The screenshot shows the TRANSVER software interface. On the left, a tree view displays the project structure:

- SignalControllers
 - SignalController
 - SignalControllerId: 1070815103444128002
 - CycleTime: 90
 - Offset: 0
 - SignalGroups
 - SignalGroup
 - SignalGroupId: K1
 - MinGreen: 10
 - MajorDirection: 1
 - SignalGroup
 - SignalGroupId: K2
 - MinGreen: 10
 - MajorDirection: 0
 - SignalGroup
 - SignalGroupId: K3
 - MinGreen: 10
 - MajorDirection: 1
 - SignalGroup
 - SignalGroupId: K4
 - MinGreen: 10
 - MajorDirection: 0
 - Turns
 - Turn
 - TurnId:
 - From_LinkId
 - To_LinkId
 - SignalGroupId
 - Stages
 - Stage
 - StageId: 1
 - SignalGroups
 - SignalGroup
 - SignalGroupId: K1
 - BeginGreen: 0
 - EndGreen: 25
 - SignalGroup
 - SignalGroupId: K3
 - BeginGreen: 0
 - EndGreen: 25
 - Stage
 - StageId: 2
 - SignalGroups
 - SignalGroup
 - SignalGroupId: K2
 - BeginGreen: 35
 - EndGreen: 50
 - SignalGroup
 - SignalGroupId: K4K4
 - BeginGreen: 35
 - EndGreen: 50

The main window displays a network graph with nodes and edges. A 'Kante' (edge) window is open, showing the following data:

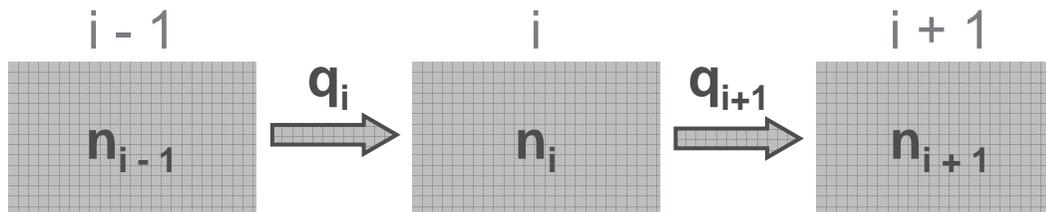
Schlüssel	
Quellknoten	Zielknoten
109 LSA 423	110 LSA 423
110 LSA 423	112 LSA 423
112 LSA 423	115 LSA 423
115 LSA 423	118 LSA 423
118 LSA 423	123 LSA 423
123 LSA 423	124

The 'Eigenschaften' (properties) section shows 'Gruppe: Kante'. The 'Attribute' section lists various parameters such as 'CTM-DivergeMergeRatioStartnode [%]: 1,000 (nie)', 'CTM-FreeFlowSpeed [m]: 50,000 (nie)', and 'CTM-Lanes [l]: 1,000 (nie)'. Buttons for 'Ok', 'Übernehmen', 'Attribute...', and 'Abbrechen' are visible at the bottom.



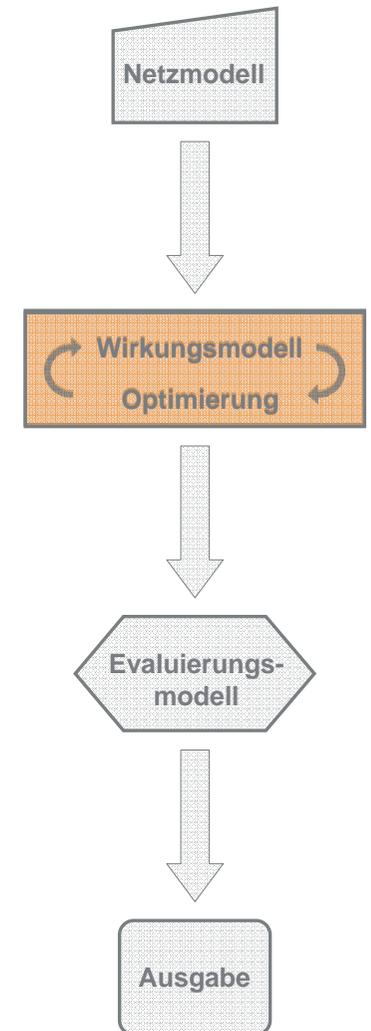
Wirkungsmodell: Cell Transmission Model

- Verkehrsfluss: Freie Strecke [DAGANZO]



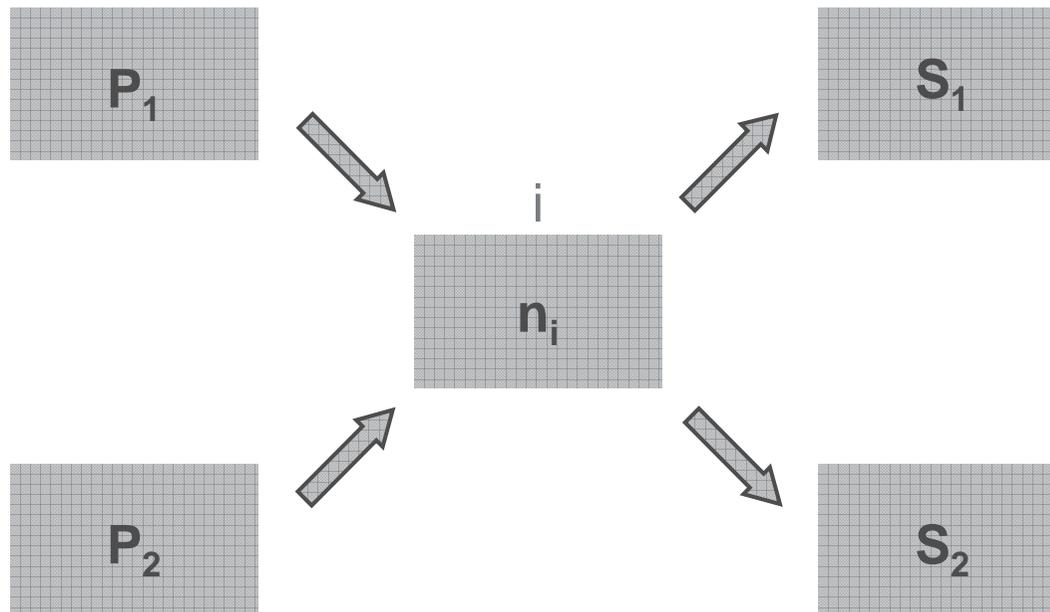
$$q_{i+1}^{(t)} = \min \left\{ n_i^{(t)} ; Q_{i+1} ; w/v_f \cdot (N_{i+1} - n_{i+1}^{(t)}) \right\}$$

$$n_i^{(t+1)} = n_i^{(t)} + q_i^{(t)} - q_{i+1}^{(t)}$$

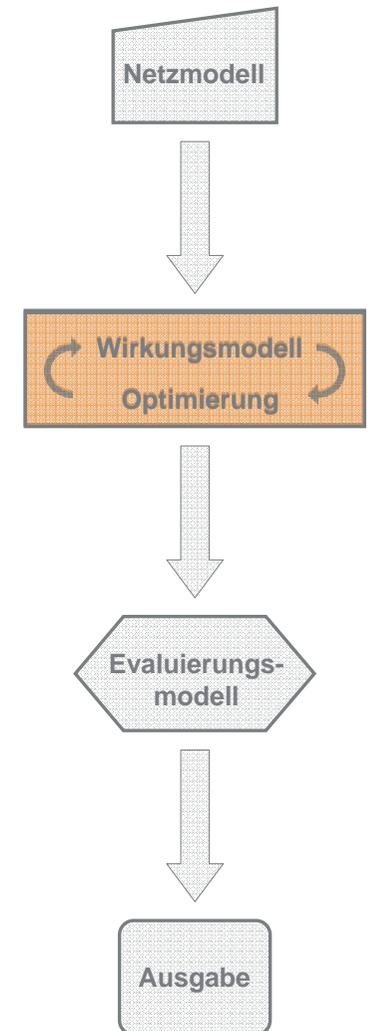


Wirkungsmodell: Cell Transmission Model

- Verkehrsfluss: Knotenpunkte [DAGANZO]

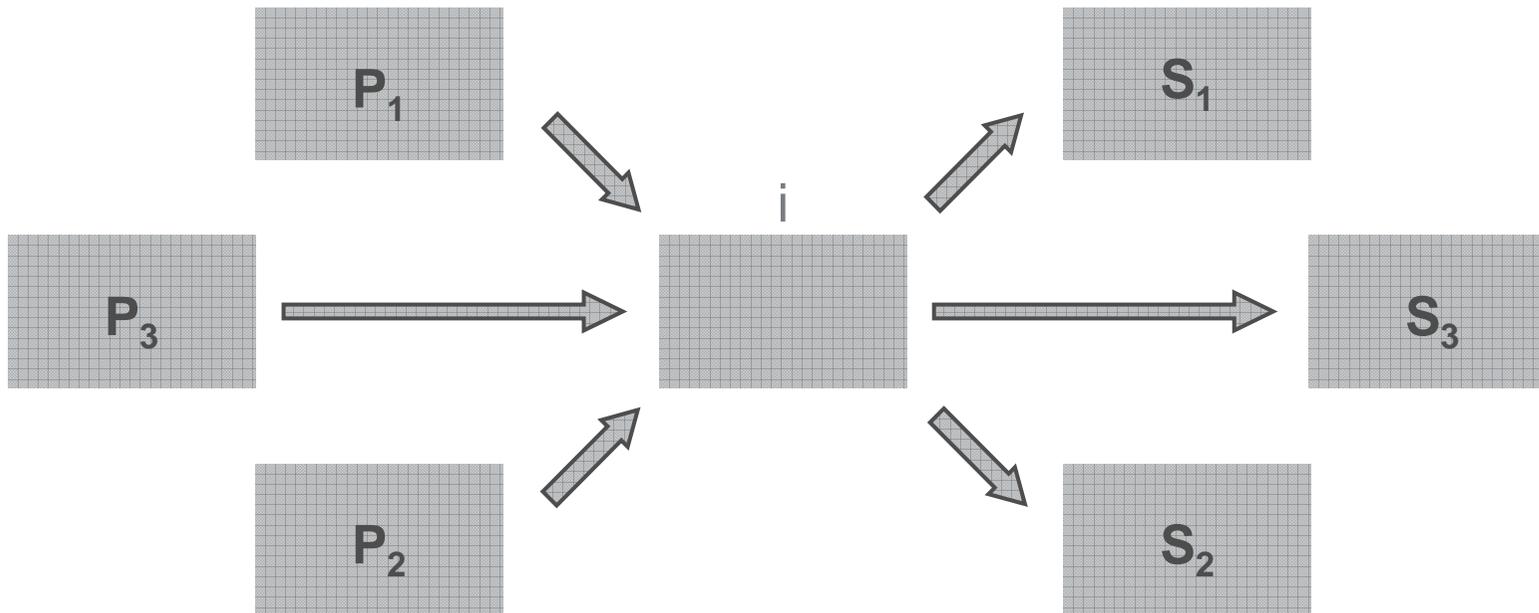


→ Zur Abbildung innerstädtischer Knotenpunkte zu unflexibel

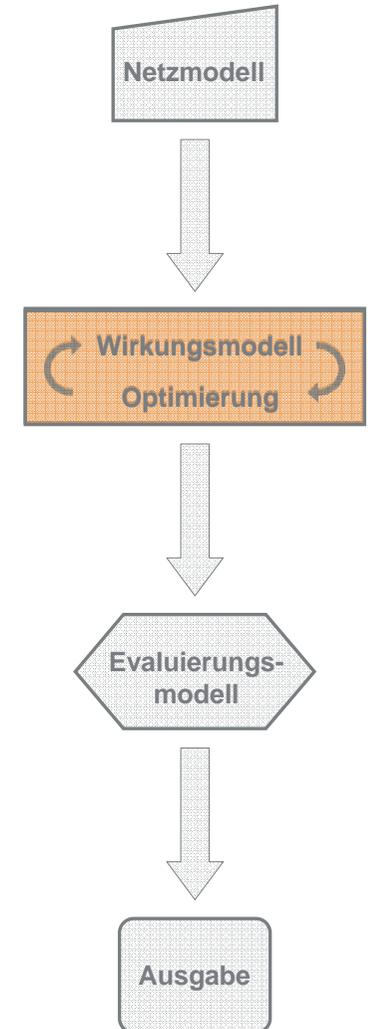


Wirkungsmodell: Cell Transmission Model

- Verkehrsfluss: Knotenpunkte [NAGEL/FLÖTTERÖD]

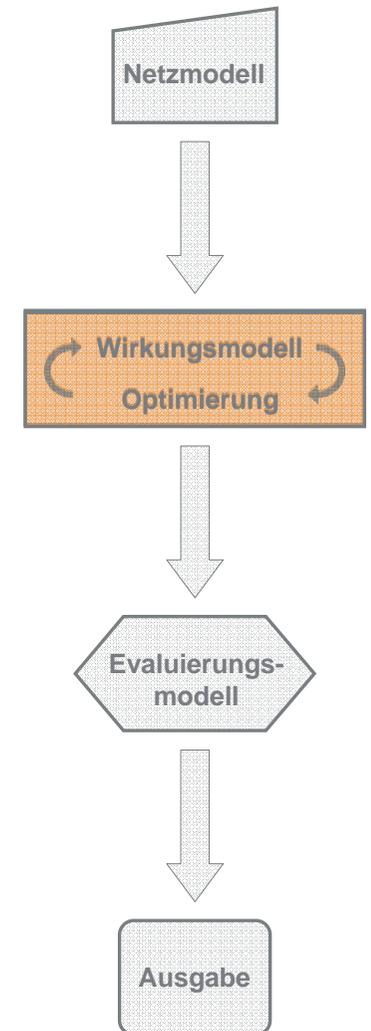
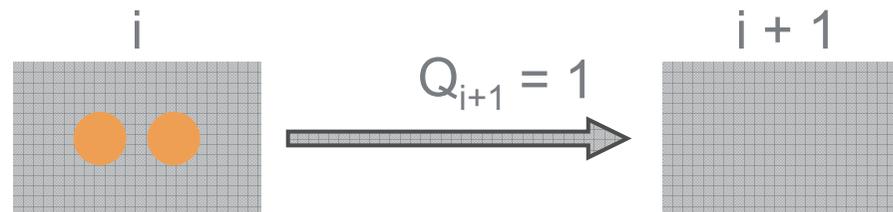


→ flexible Abbildung innerstädtischer Knotenpunkte



Optimierung: Zielfunktion

- Optimierungskriterium: Verlustzeit

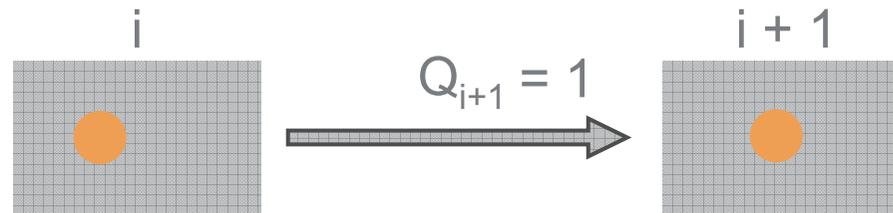


Optimierung: Zielfunktion

- Optimierungskriterium: Verlustzeit

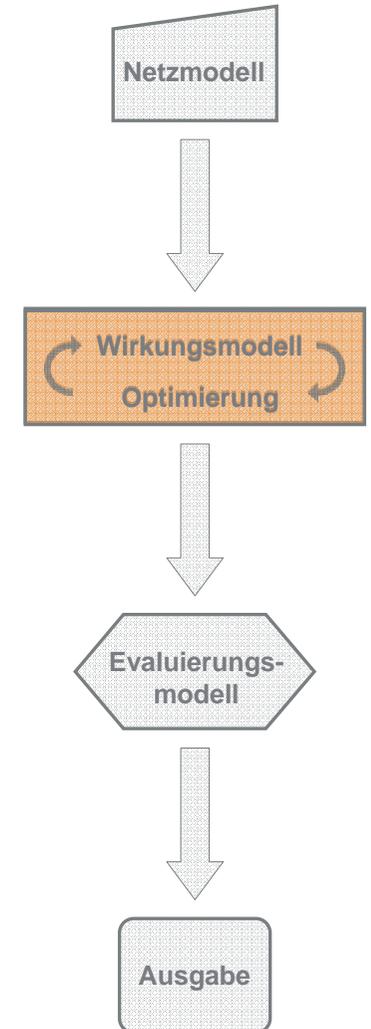
$$d_i = 1 \cdot \Delta t$$

$$d_i(t) = (n_i(t) - q_{i+1}(t)) \cdot \Delta t$$

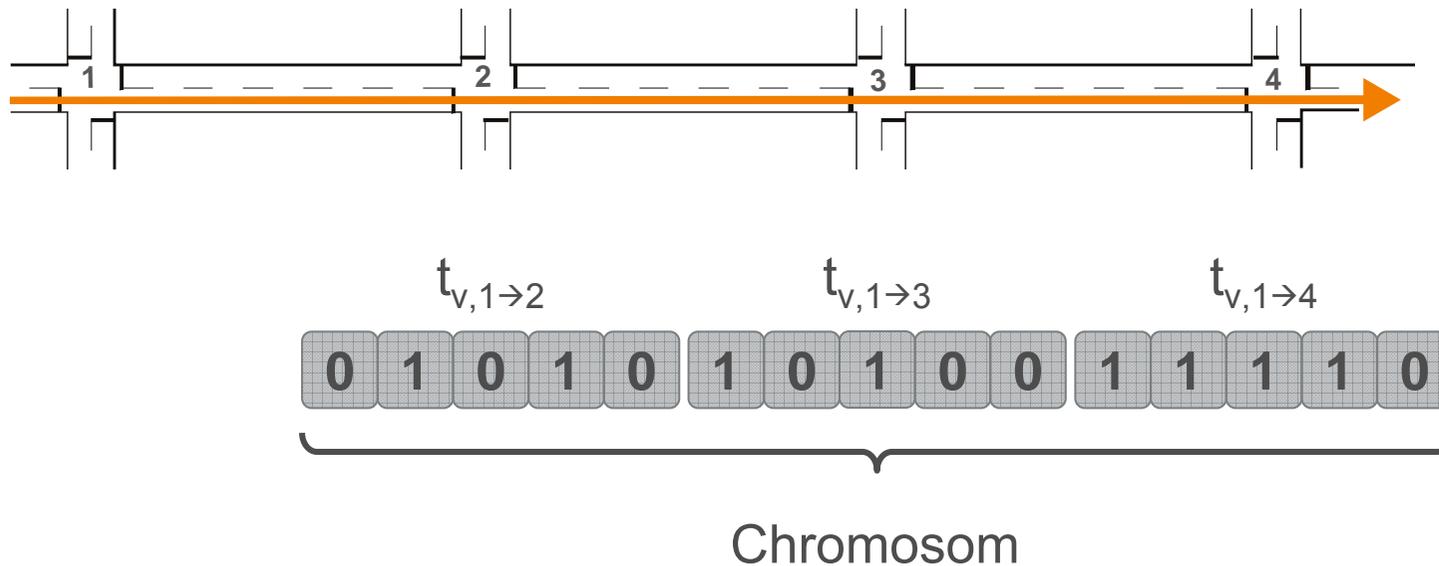


$$\rightarrow \min! f = \sum_{t=1}^{n_{\text{Zeitintervalle}}} \sum_{i=1}^{n_{\text{Zellen}}} d_i(t)$$

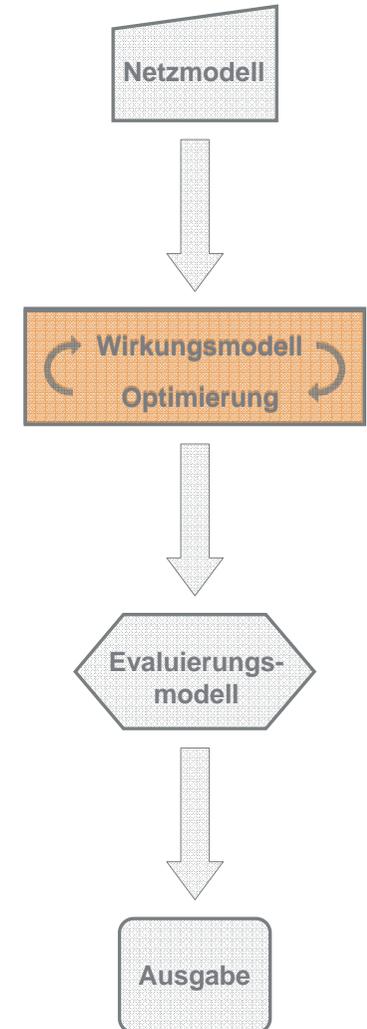
→ Entscheidungsvariable: Versatzzeit



Optimierung: Genetischer Algorithmus



- Mögliche Lösung → Chromosom → Individuum
- Zielfunktionswert → Fitness des Individuums
- Menge möglicher Lösungen → Population



Optimierung: Genetischer Algorithmus

- Optimierung durch Evolution der Population

– Rekombination:

0 1 0 1 0 1 0 1 0 0 1 1 1 1 0

0 1 0 0 1 1 0 0 1 1 1 1 1 0 1

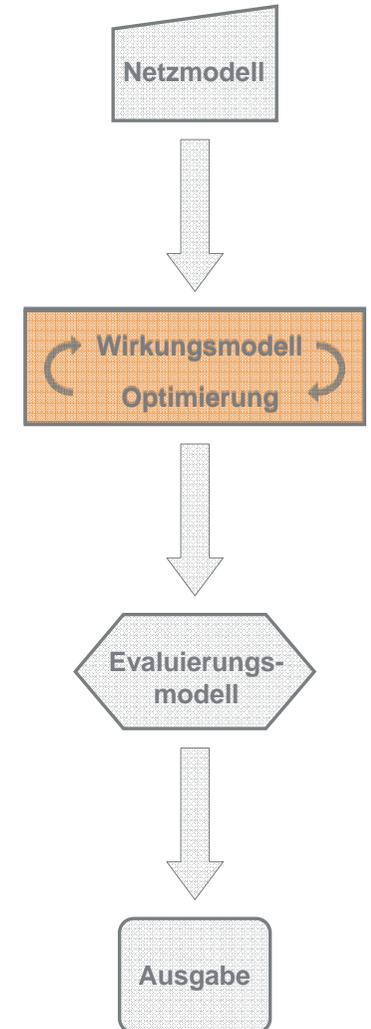
– Mutation:

0 1 1 0 0 1 0 0 1 1 1 1 1 0 1

– Selektion:

0 1 0 1 0 1 0 1 0 0 1 1 1 1 0

0 0 1 0 1 0 1 0 1 0 1 1 0 0 1



Optimierung: Genetischer Algorithmus

- Optimierung durch Evolution der Population

– Rekombination:

0 1 0 1 0 1 0 0 1 1 1 1 1 0 1

0 1 0 0 1 1 0 1 0 0 1 1 1 1 0

– Mutation:

0 1 1 0 0 1 0 0 1 0 1 1 1 0 1

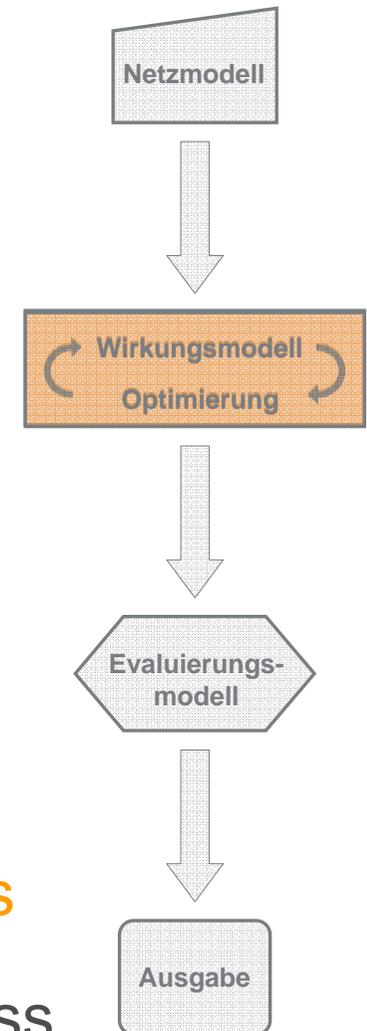
– Selektion:

0 1 0 1 0 1 0 1 0 0 1 1 1 1 0

0 0 1 0 1 0 1 0 1 0 1 1 0 0 1

→ Best Fitness

→ Worst Fitness



Optimierung: Genetischer Algorithmus

- Optimierung durch Evolution der Population

– Rekombination:

0 1 0 1 0 1 0 0 1 1 1 1 1 0 1

0 1 0 0 1 1 0 1 0 0 1 1 1 1 0

– Mutation:

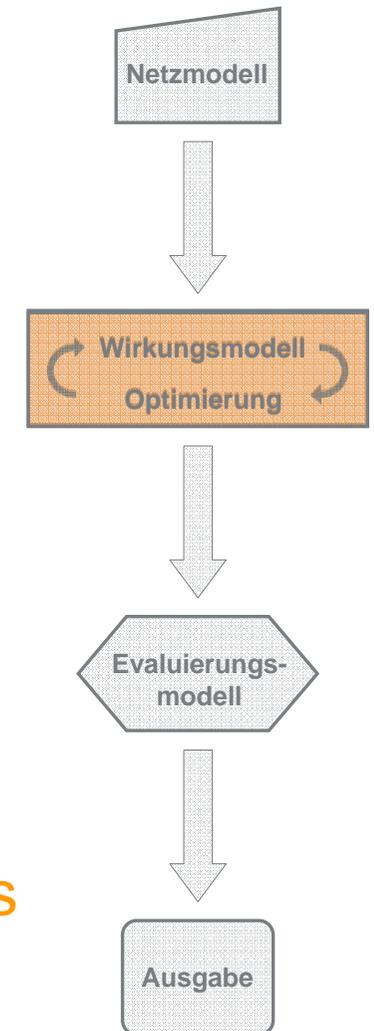
0 1 1 0 0 1 0 0 1 0 1 1 1 0 1

– Selektion:

0 1 0 1 0 1 0 1 0 0 1 1 1 1 0

0 1 0 1 0 1 0 0 1 1 1 1 1 0 1

→ Best Fitness



Ausblick: Optimierung

- Weitere Optimierungskriterien:

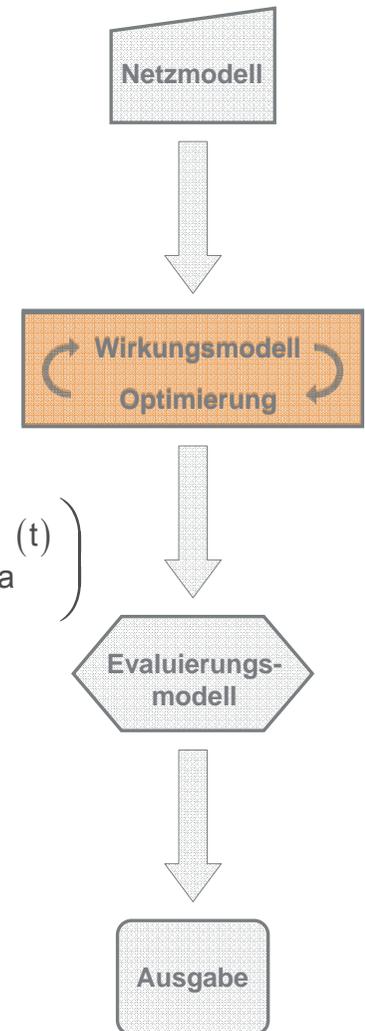
- Halte [LIN/WANG]

$$\text{Halte}_i^{(t)} = \sum_{t=1}^{n_{\text{Zeitintervalle}}} \sum_{i=1}^{n_{\text{Zellen}}} \frac{1}{2} \cdot \left(q_i^{(t)} - q_{i-1}^{(t-1)} \right)$$

- Emissionen [DELL'ORCO]

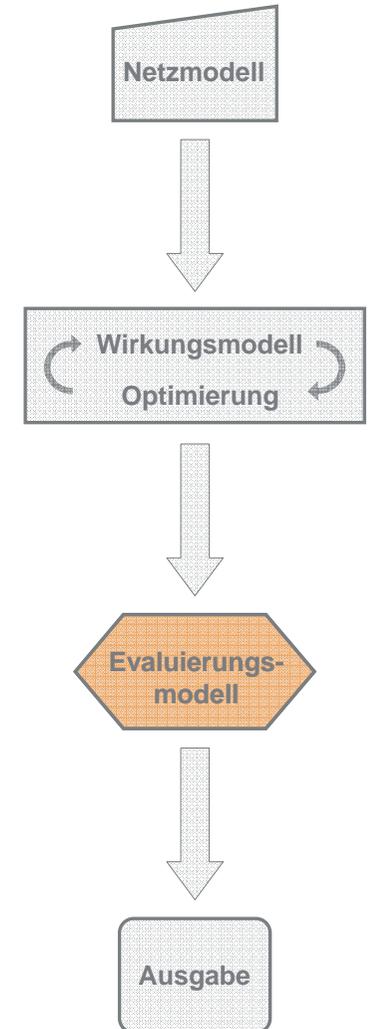
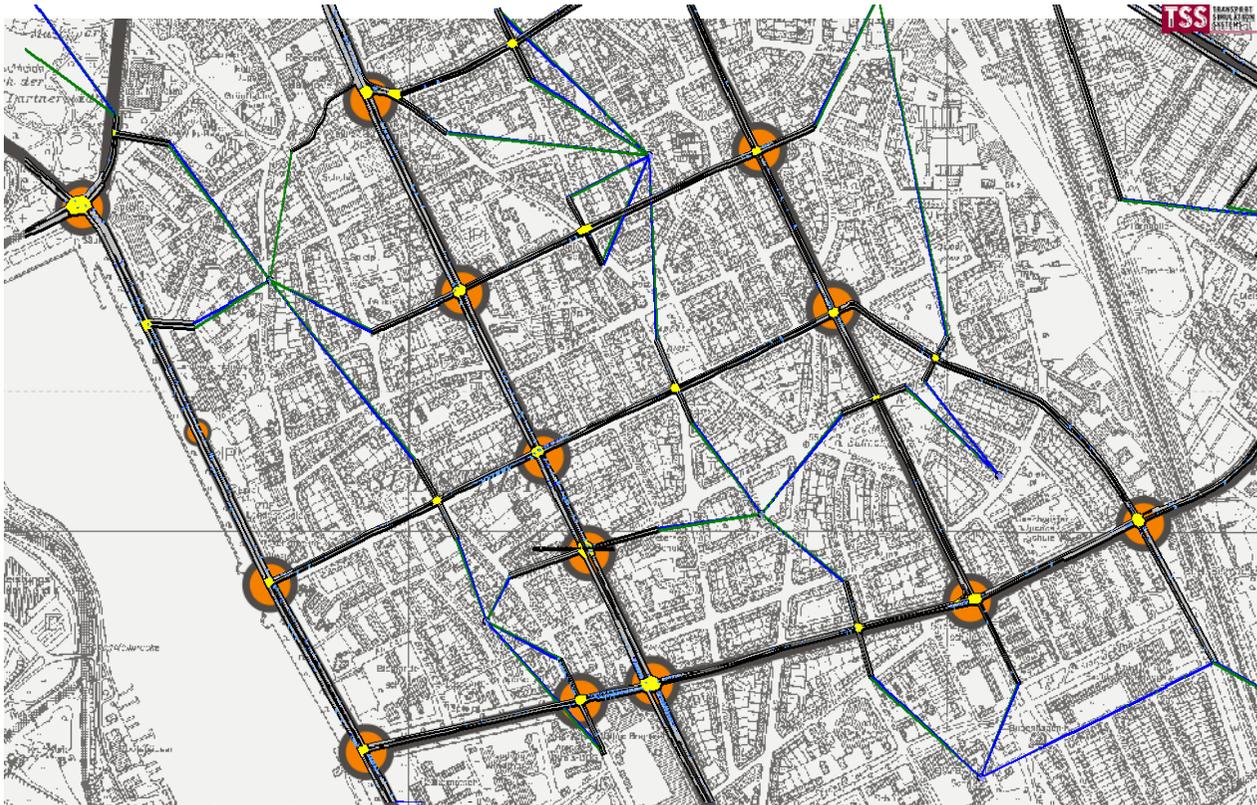
$$E_a^{(t)} = N \cdot \left(f_1 + f_2 \cdot v_a^{(t)} + f_3 \cdot \left(v_a^{(t)} \right)^2 + f_4 \cdot a_a^{(t)} + f_5 \cdot \left(a_a^{(t)} \right)^2 + f_6 \cdot v_a^{(t)} \cdot a_a^{(t)} \right)$$

- Optimierungsmethode: Tabu Search



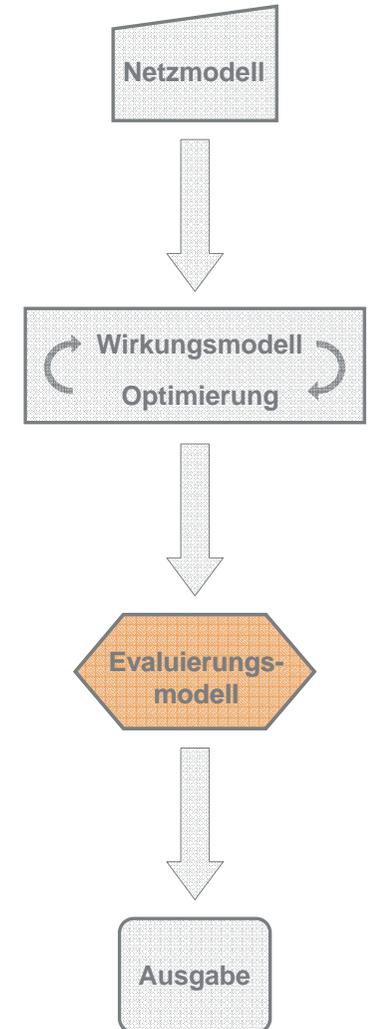
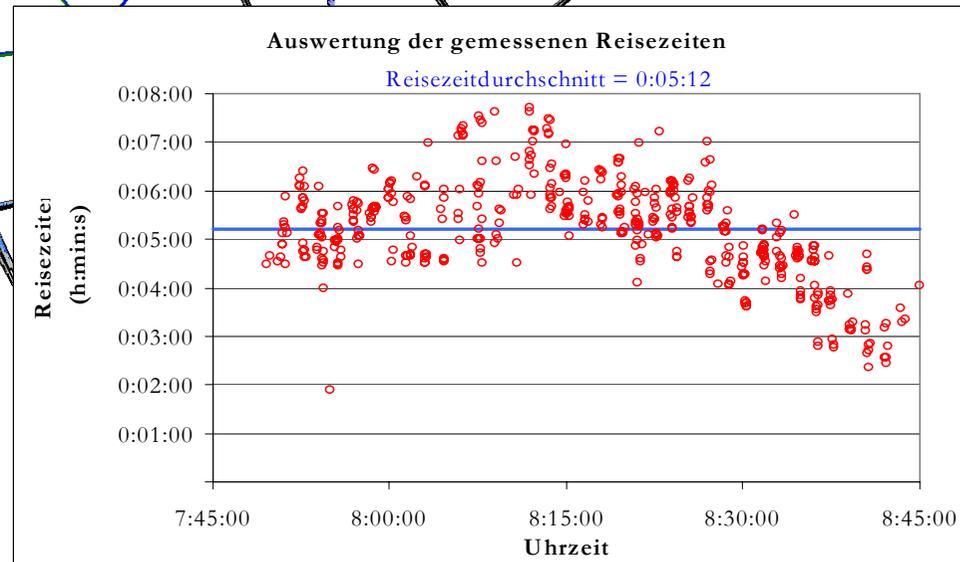
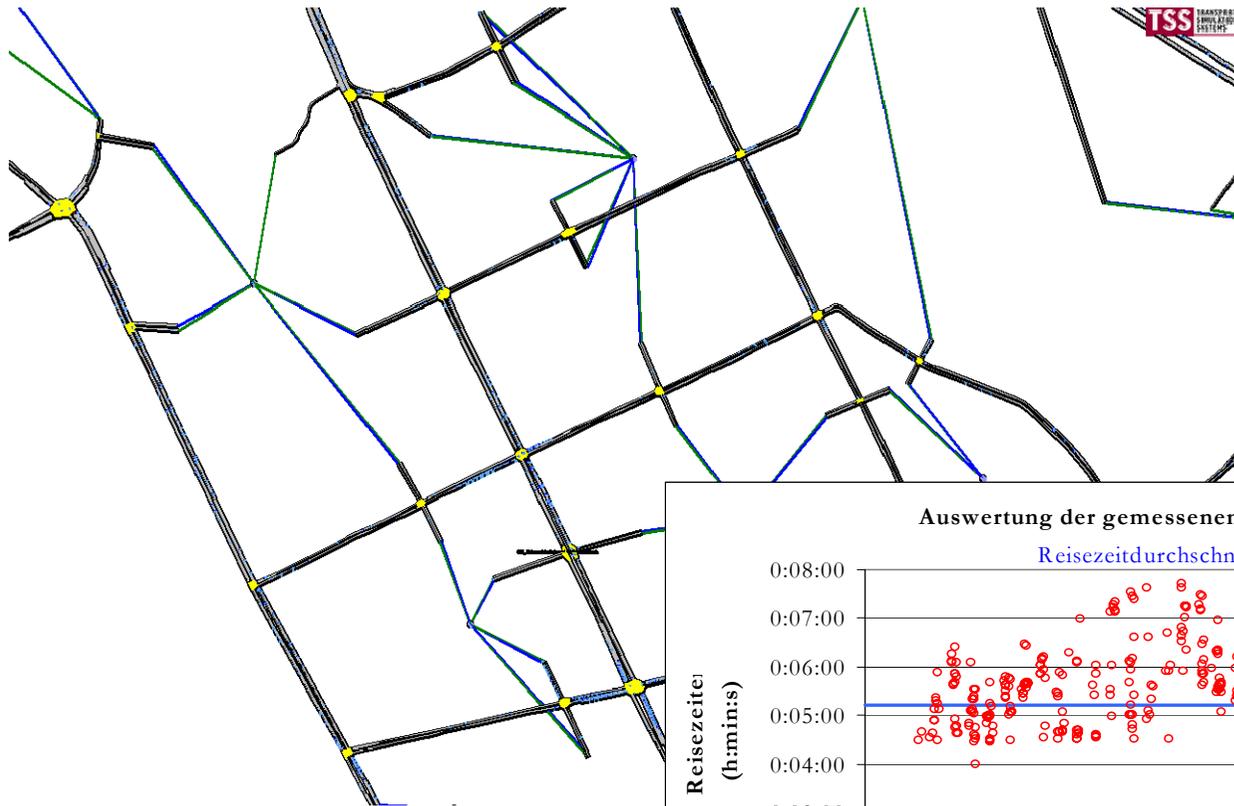
Evaluierungsmodell: Mikroskop. Simulation

- AIMSUN: Hauptstraßennetz Hannover-Südstadt

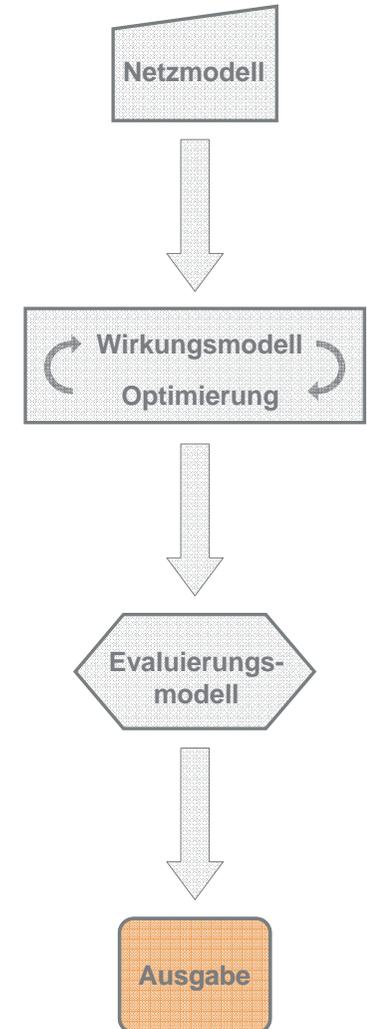
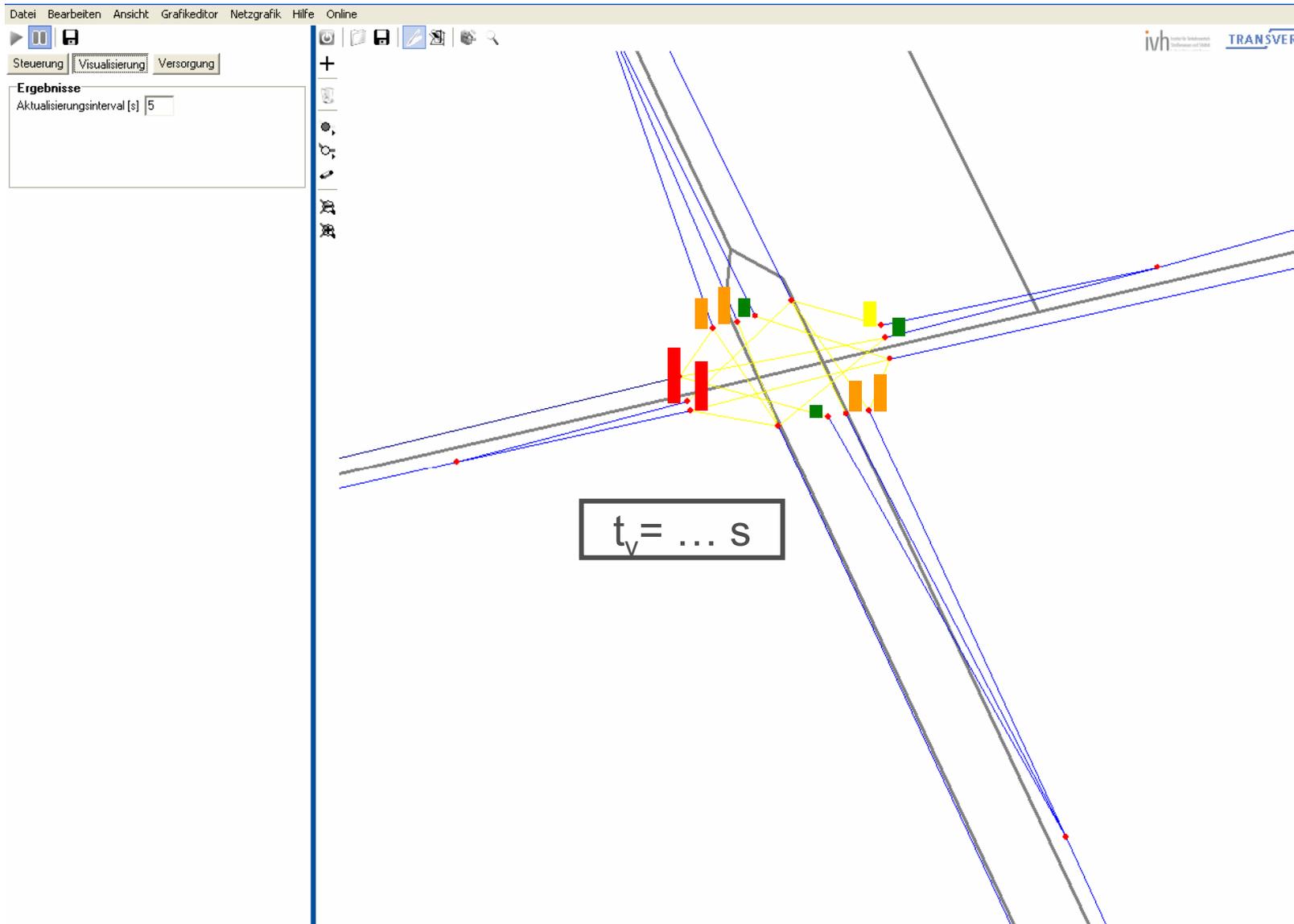


Evaluierungsmodell: Mikroskop. Simulation

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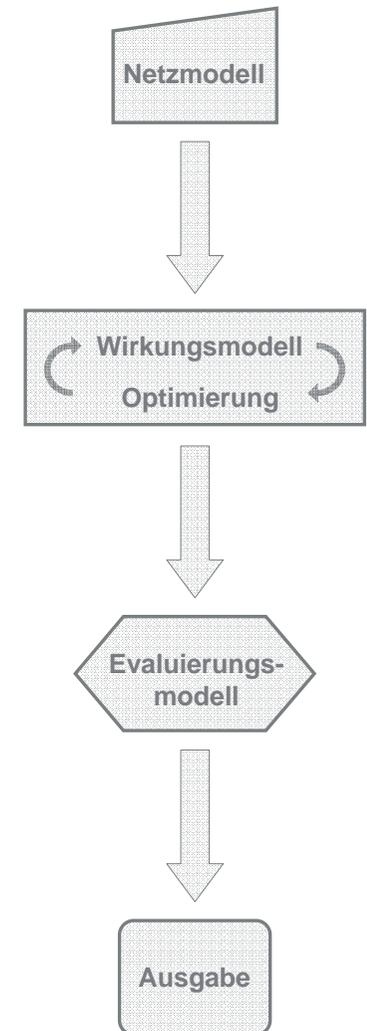


Ausgabe: Visualisierung der Kenngrößen



Literatur

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