Urban gridlock: Macroscopic modeling and mitigation approaches

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KEY ISSUES

• MOBILITY IMPROVEMENT APPROACH
  PROPOSE→ EVALUATE→ IMPLEMENT

• FRAGILE EVALUATION MODELS
  – Inputs unreliable
  – Outputs unpredictable

• WHAT TO DO?

• ROBUST APPROACH
  PROPOSE→ MONITOR→ MODIFY

• BUT IS IT POSSIBLE?
DEFINITIONS

Accumulation: \( n_i \) (vehs)

Travel Production: \( P_i = n_i \cdot u_i \) (veh-km/hr)

Output: \( E_i = n_i \cdot u_i \cdot \alpha_i \) (vh/hr)
AGGREGATION HYPOTHESIS

\[ P = \sum P_i = \sum Q_i(n_i) \approx Q\left(\sum n_i\right) \]

\[ E = \sum E_{ij} = \sum G_i(n_i) \approx G\left(\sum n_i\right) \]
AGGREGATE DYNAMICS

Given: \( Q, G \)
Control: \( O(t) \)
Monitor: \( n(t) \)
Maximize: \( \int E(t) dt \)

\[
\frac{dn(t)}{dt} = O(t) - G(n(t))
\]

POLICY: \( n^*(t) \approx n_{crit} \)
PROPERTIES OF POLICY

- Observable (monitor)
- Robust (no forecasts)
- Pareto Efficient
ADDITIONAL INSIGHTS AND CONCLUSIONS

• INVARIANCE PRINCIPLE 2: TRAFFIC vs. DESTINATION DENSITY
  • Multi-Reservoir Systems
  • Multimodal principles
  • Tests and deployment
QUESTIONS

http://www.its.berkeley.edu/volvocenter/