

## [Technologies for Safe and Sustainable Road Traffic Society]

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Traffic Management and Control

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# Scientific Approach for Traffic Flow

Our missions are to research road traffic from various aspects and develop traffic management methods, which are expected to realize sustainable road traffic with less traffic accident, congestion, and negative impact on environment.

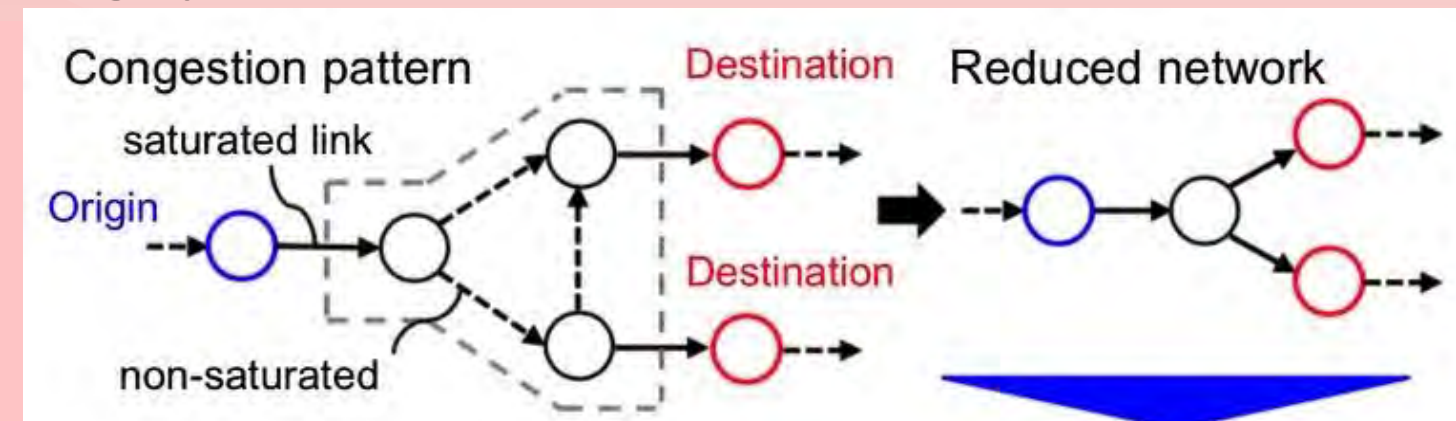
## Innovative policy

How to manage road traffic?

Studies on road management (incl. planning, design, operation) policies for more safe and efficient urban traffic flow:

- Network control based on spatial congestion patterns
- Impact of AV sharing on parking allocation strategy
- Scenarios for automated driving systems
- Comparison of crosswalk design and operation
- Planning method for functionally hierarchical road network
- Promotion of open public transit data

Proposal of analytical formula of network throughput based on reduced network structure



**[Analytical Formula of Network Throughput (one-to-many)]**

$$\bar{t}_d = \mathbf{T}^{-1} \mathbf{V}_{dd} \bar{t}_d - \mathbf{T}^{-1} [\mathbf{V}_{di} (\mathbf{V}_{ii})^{-1} (\mathbf{V}_{id} \bar{t}_d - \delta_i) + \delta_d]$$

$$\mathbf{V}_{ab} \equiv \mathbf{A}_i \mathbf{M} \mathbf{A}_b, \mathbf{T} \equiv \text{diag}[\dots, \bar{t}_d, \dots], \mathbf{M} \equiv \text{diag}[\dots, \mu_l, \dots]$$

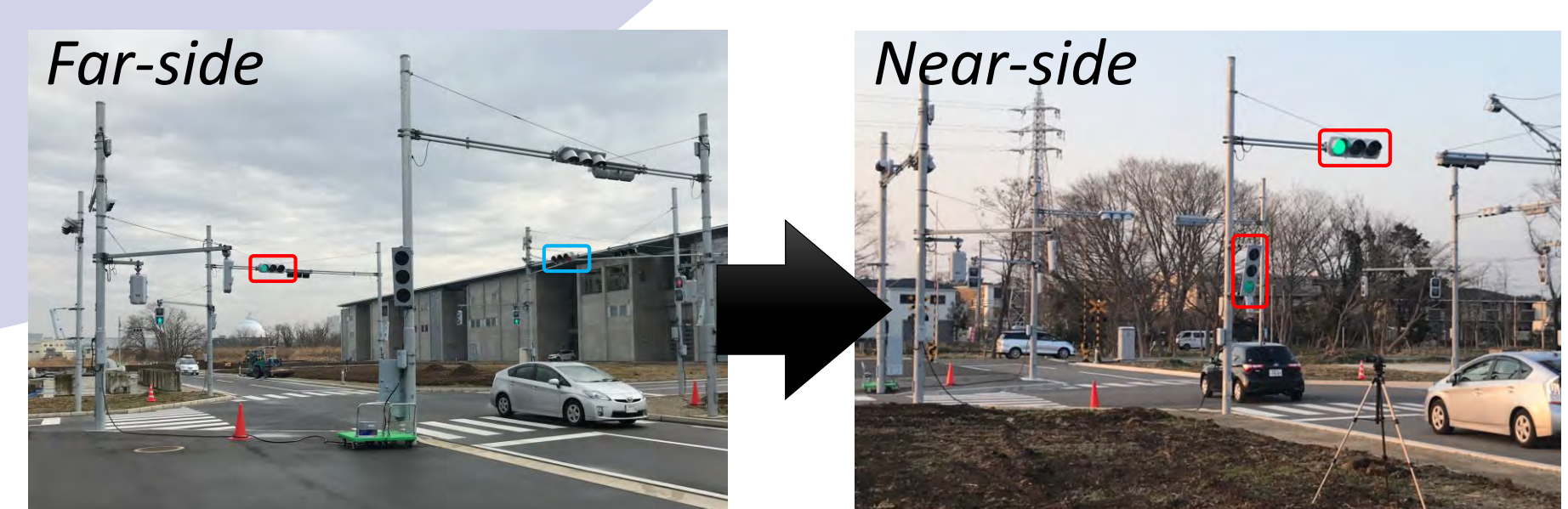
$\mathbf{A}_a$  : Node-link incident matrix (reduced network)  $\mu_l$  : capacity of link /  $i, d$  (subscript) : corresponding to transient and destination nodes

## Science

What's happening in road traffic?

Development of basic theories of traffic flow and analysis of various kinds of observed data to understand road traffic:

- Theory of capacity drop of sag and tunnel bottlenecks
- Left-turn trajectory estimation using jerk minimization principle
- Analysis of spatial distributions of throughputs in a congested network
- Macroscopic and dynamic model of urban rail transit
- Analysis of taxi time of aircraft at international airports
- Impact of location of traffic lights on drivers' behavior



Near-side traffic lights in the experiment field



**ITS**  
Intelligent  
Transport  
Systems

Development of traffic simulation models and data complementing methods to assess road management policies:

- AVENUE (Street-level traffic simulator)
- SOUND (Regionwide-level traffic simulator)
- Operational evaluation system for three-ring expressways in Tokyo metro area
- Traffic data imputation using matrix completion

## Technology

How to assess road management policies?