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Managing CONGESTION in large urban areas

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What is Congestion?

Don't we all know?

- Absolute vs. relative phenomenon?
  - *Demand for road space exceeds supply*
  - *Difference between road users expectations and how the system actually performs*
- Users vs. Road Managers?
- Negative outcome of Agglomeration (positive)
- Something to be eradicated… or something to be managed?
- Avoiding excessive congestion….

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When is Congestion Excessive?

Two Answers:

- When people say it is – but what about the cost of delivering improved road performance?
- Congestion is excessive when the marginal costs of efforts to reduce congestion is lower than the marginal costs to society of congestion itself.

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How Should Congestion be Measured?

- Different metrics for different audiences
- Road managers interested in speed, flow queue length, etc., road users interested in predictability of travel times and trip quality.
- Indicators should be policy-neutral:
  - free-flow speeds should not be used as a direct benchmark to measure congestion policy outcomes.
- Reliability indicators are crucial for road users.

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Is Congestion Getting Worse?

- Travel times are increasing in many urban areas (alongside with urban economic activity)
- Travel time variability increasing in some urban areas.
- Peak hours are spreading.
- Trands likely to continue.

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What Should Policy-Makers Know about the Causes of Congestion?

- Congestion is *triggered* on the road but is *driven* by macro-level factors (contributing to overall travel demand)
  - While congestion takes place on the roads, it is not only, nor necessarily primarily, a traffic engineering problem.
- Recurrent vs. non-recurrent congestion.

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Conceptual Approaches to Managing Congestion

- Maximise Flows: (can lead to inherent instability and sudden phase switches into congested flow)
- Optimise flows taking into account the balance between supply and demand as arbitrated by people's willingness to pay for better performance (technical vs. economic optimisation – need new hybrid approaches)

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What Can We do Now to Better Manage Congestion?

Practical, Outcome-oriented Questions

- (Why) and when should I act?
- What should I do?
- How should I do It?

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How Can We be More Effective in Managing Congestion than We Have Been in the Past?

Practical, Outcome-oriented Questions

- (Why) and when should I act?
- What should I do?
- How should I do It?

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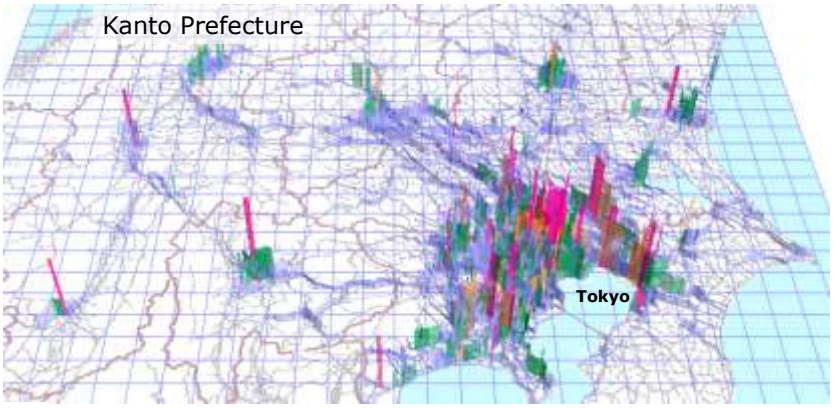
What are the Impacts of Congestion and are we Measuring them Accurately?

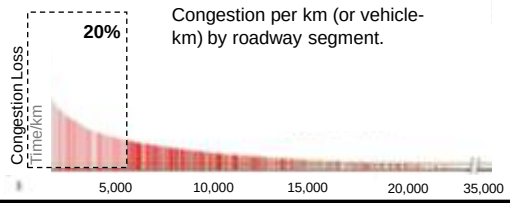
Practical, Outcome-oriented Questions

- (Why) and when should I act?
- What should I do?
- How should I do It?

Targeting the Worst Congestion (Tokyo Region)

Time "losses" by segment





Congestion per km (or vehicle-km) by roadway segment.

1/3 of Japan's Congestion impacts (measured in time "losses" occur in the Tokyo Metropolitan Area. The Government tracks congestion impacts by road segment (color-coded map above) and targets the worst 20% (see left) of congested road segments for priority action.

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Policy-makers: Key questions about Congestion

Practical, Outcome-oriented Questions

- (Why) and when should I act?
- What should I do?
- How should I do It?

Questions often not explicitly articulated

- What is congestion? (Don't we all know?!)
- What does success look like? (Policy goals)

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What is Congestion? … some considerations

Characterisation of Congestion:

- Congestion and *Agglomeration*
- Congestion and *Access*
- Absolute vs. *Relative* phenomenon
- Congestion vs. *Excessive* congestion

Policy Indicators:

- Not to be based on *free-flow* speeds
- Track system performance: Speed *and* reliability
- Use to prioritise action

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Why and When Should I Act?

When Congestion is Excessive

- Cost of congestion higher than the cost of relief

What is the Cost of Congestion?

- Relative vs. Total Costs
- Delay and Unreliability, but also…
  - Environment
  - The urban economy
  - Safety and health

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What Should I Do?

Strategic principles to guide policy

1. Manage congestion in the context of the *urban area*: integrated transport and urban planning
2. "*Lock-in*" the benefits of congestion policies
3. Deliver *reliable and predictable* travel conditions

Integrate These Principles into Congestion Management Policies

- All policies should address desired urban outcomes, manage demand & supply and take account of user expectations

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Principle #1: Align Congestion Management Policies with Land Use and Planning Processes

Land Use & Urban Form: Key Driver of Demand

- Adopt and implement sustainable land-use policies
- Integrate transport decision-making and land-use planning
- Traffic outcomes should be compatible with citizens' wishes for, and visions of, life in the urban area

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Principle #2:
"Lock-in" the Benefits of Congestion Measures

- "Traditional fixes" = More capacity (released or new),
- More capacity = More traffic (Induced traffic),
- More traffic = More congestion

Three Types of Policies Qualitatively Different re. Outcomes:

1. Access Management
2. Parking Management
3. Road Pricing

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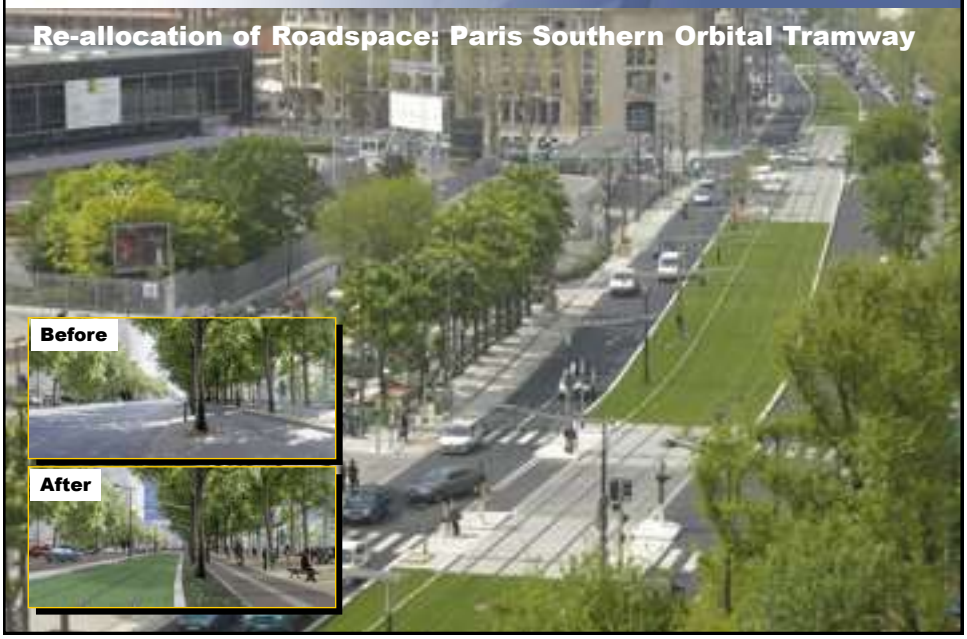

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Road Pricing

- **Long academic pedigree**
  Dupuit (Fr, 1849), Pigou (UK, 1920),
  Knight (US, 1924) Walters (UK, 1961),
  Smeed REport (UK, 1964), Vickery (USA, 1963)
- **Double consensus**
  1. Analysts and academics all for
  2. Politicians against

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New Developments

- **Concrete trials and applications**
- **Schemes different in many ways**
  1. Applications
  2. Policy objectives
  3. Economic arguments
  4. Technology used

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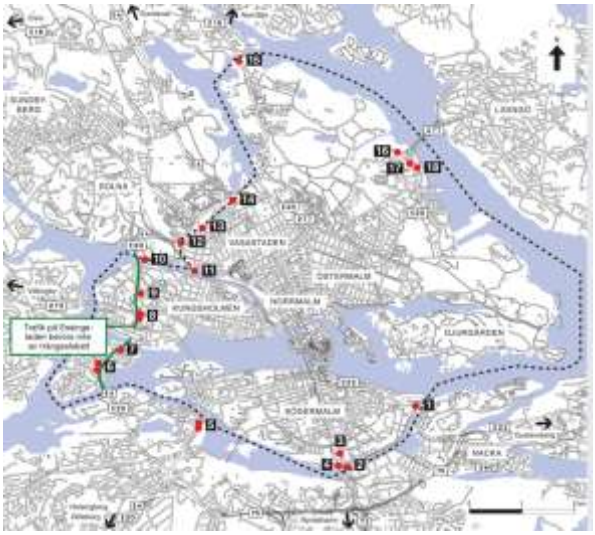
Stockholm Charging Cordon



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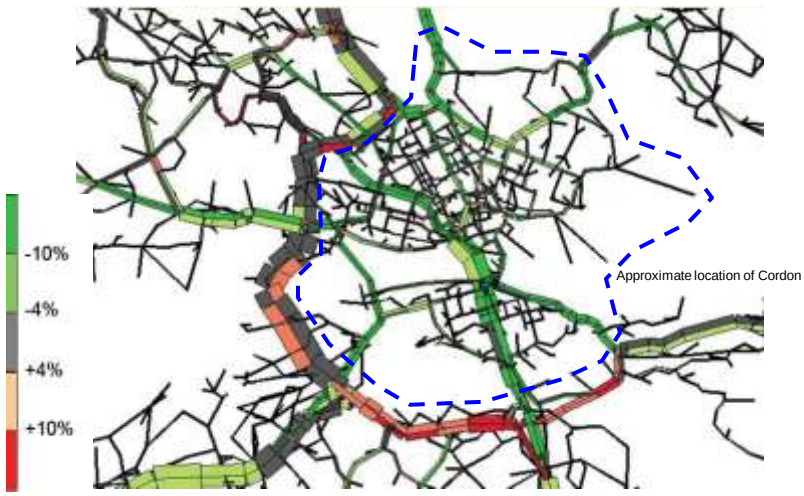
Stockholm Charging Cordon



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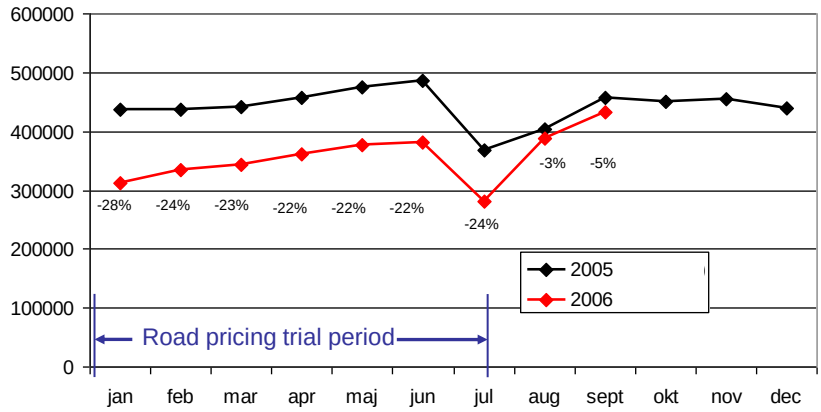
Did the Stockholm Charge Work?
Vehicles crossing cordon on weekdays:
22% drop in traffic



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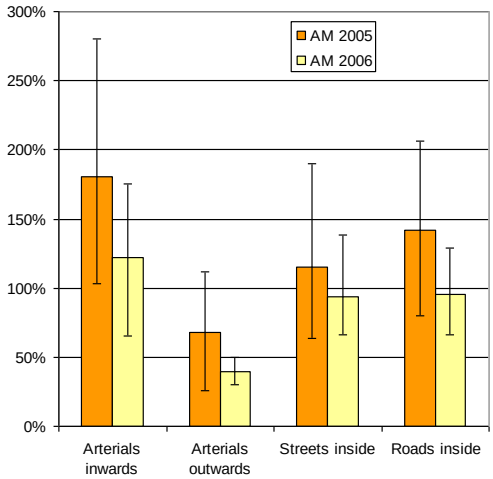
Delays Reduced, Reliability Improved

Average trip times compared to free flow

&

10% best and worst trip times



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Economic Assessment

- Positive
- Assuming emissions reductions are added to congestion relief
- Assuming bus capacity expansion is not an integral part of scheme, as there was spare capacity
- Result is very sensitive to differentiation of values of time assigned to users
- Note, technology performed better than expected and 2008 version will reduce costs by eliminating redundancies

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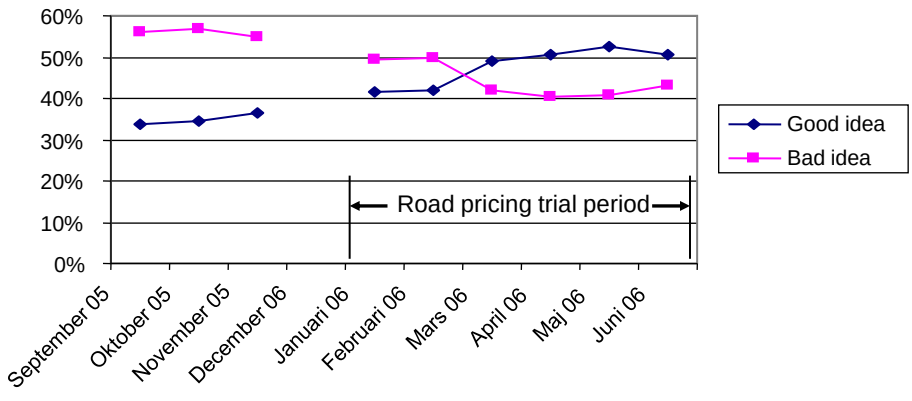
Acceptance: Seeing is believing
Public opinion in Stockholm



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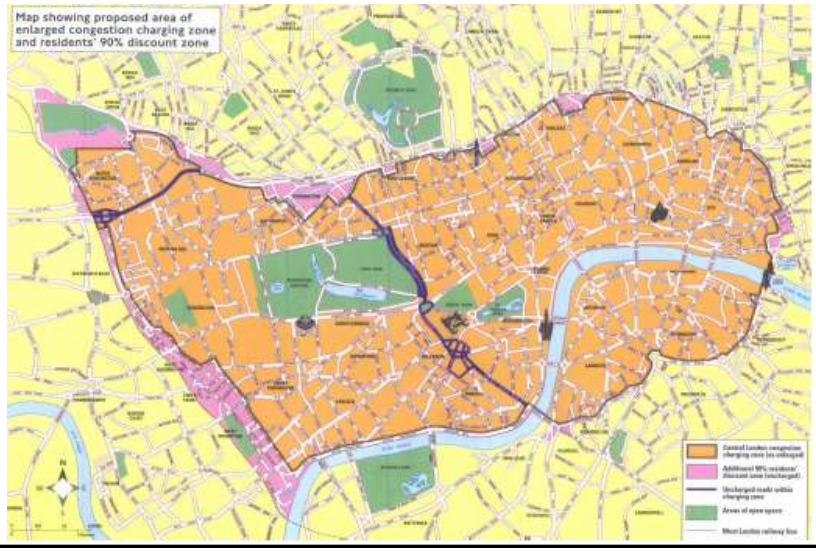
London Congestion Charge



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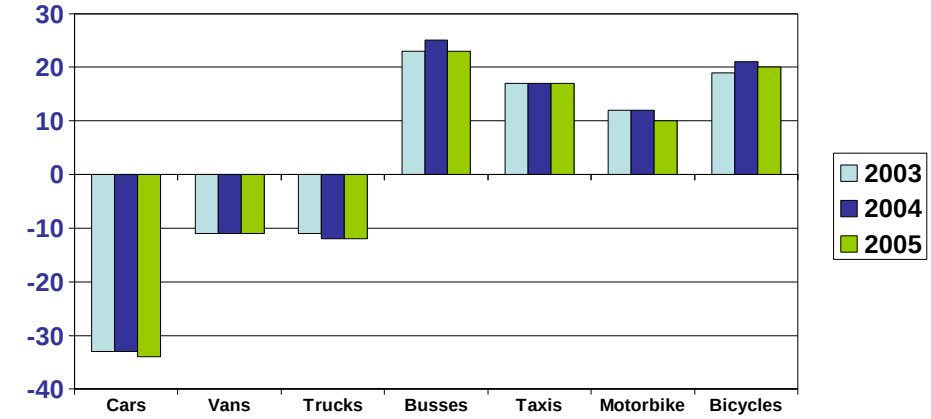
Impact on traffic in City zone: Delays down 30%

Vehicles entering the zone - % change over 2002



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Charge relative to cost of congestion

- Oxford University Transport Studies Unit, G. Santos, supportsTfL modelling that charge about right but:
- Cars over-charged
- Trucks under-charged
- Vans about right at 8 pounds – undercharged at previous 5 pounds level
- Residents “priced on to roads”

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Western Extension

- 10-14% veh-km decrease forecast by TfL
- 2/3 vehicles pay no additional charge:
  - Paid already for City zone
  - Residents
  - Buses, taxis etc.
- Congestion impact and cost effectiveness less than for City zone

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Kilometre charging

- **HDV/Freight precedents (AT, DE, CH)**
- **Dutch Target: 2010 for national km charging system**
  - To replace fixed vehicle charges
  - With "fairer" pay-as-you go charge: "Fairness" means a national scheme, that is revenue neutral and identical for all users
  - Costs must not exceed 5% of revenues
- **UK charging Proposal: Goal – national electronic km charge for all vehicles**
  - differentiated for congestion
  - to replace part of fuel excise

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US: Value Pricing

- Two examples in Southern California:
  - I-15 (near San Diego),
  - SR-91 (connects Riverside and Orange Counties).
- Offers a choice: toll and fast travel, or no toll and slow travel ("product differentiation").
- Value pricing is facility pricing (US way), different from cordon pricing (European way).
- Attractiveness of toll lanes relies on considerable congestion on free lanes.
- Assesments:
  - Value pricing is better than no pricing,
  - Gains in reliability as important as reduction of average travel time.

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Principle #3:
Improve the Reliability and Predictability of Travel Time

Reliability and Predictability: User focus

- Identify causes of irregular delays
- "Low-hanging" fruit
- Delivers tangible benefits for (relatively) small investments
- Co-ordination and management (e.g. road works, incident response) – often outside of road management authority
- Targets

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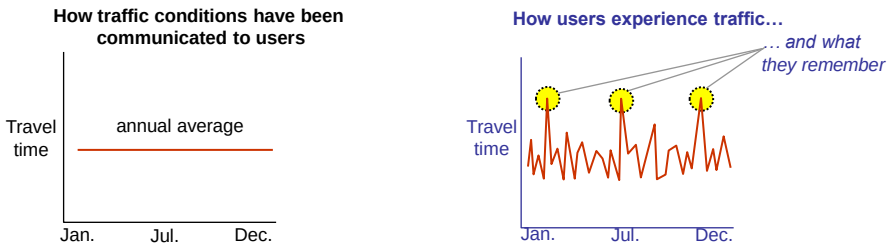
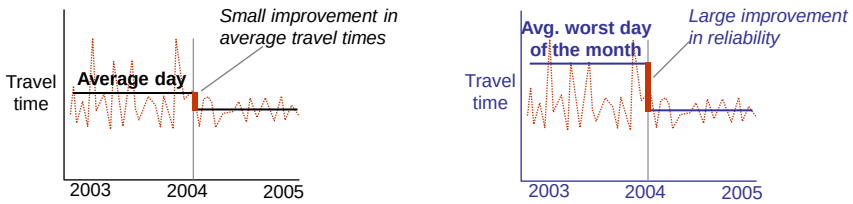
I. Average vs. real system performance



II. Road user perception of improvements: travel time vs. travel reliability



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Congestion Management Measures: Non-Road Building Measures

Four Principal Options

1. Operations and traffic management
2. Public transport
3. Mobility management
4. Infrastructure modification

Above Measures Free-up Existing Capacity

- Manage traffic to preserve capacity
- Consider alternative use/allocation of capacity
- Provide alternative modes

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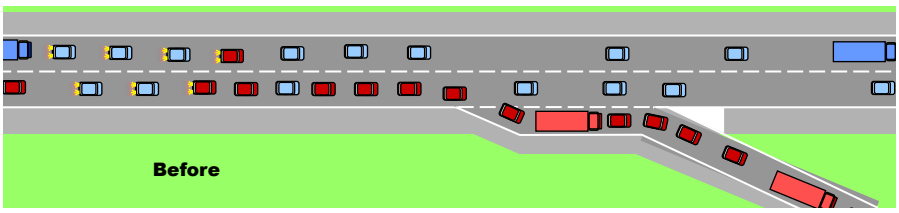

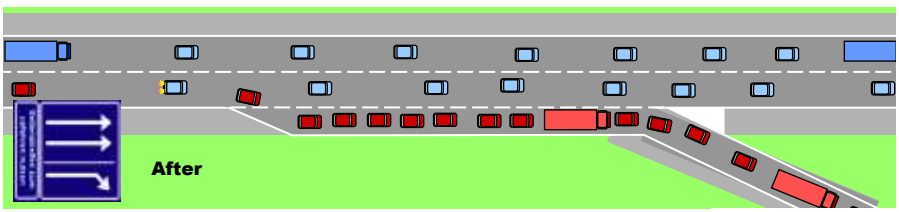

Exiting vehicles

On-ramp/Off-ramp Lengthening: Stauventil (Germany)


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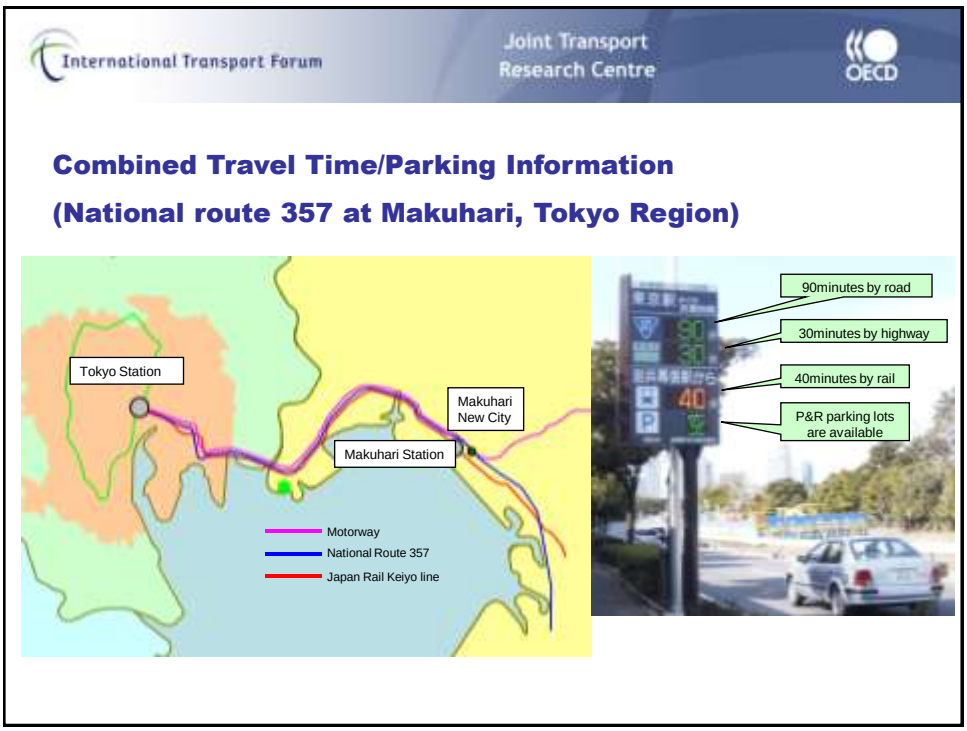
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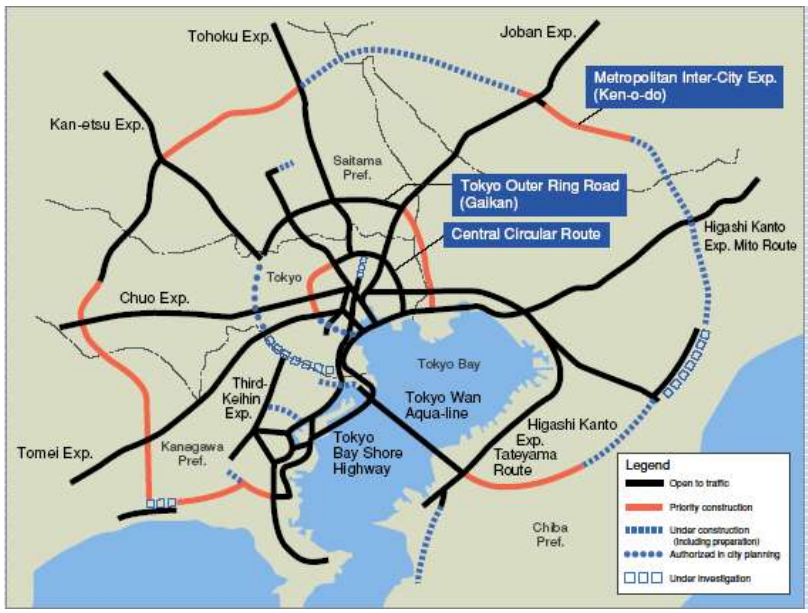
Combined Travel Time/Parking Information
(National route 357 at Makuhari, Tokyo Region)
Tokyo Station
Makuhari
New City
Makuhari Station
Motorway
National Route 357
Japan Rail Keiyo line
90minutes by road
30minutes by highway
40minutes by rail
P&R parking lots
are available

Road Construction/Expansion Often Constrained in Urban Areas – But Can be Effective

When and Where Does it make Sense?

- By-passes to remove through traffic
- Incomplete orbital networks
- Pinch points – river crossings
- Cost benefit assessment is key
- Again, consider options for use of new capacity

Incomplete Orbital Road Network (Tokyo)



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How Should I Implement My Congestion Management Policy?

Matching the Policy Response to the Problem

- Involving key actors
- Including the public (urban areas complex with many interactions)
- Aligning incentives and powers to act with agents responsible for delivery
- Aligning scope of policy response to geographic scope of congestion (travel-to-work area)
- Funding may only be available for specific (not necessarily best-suited) responses – address this

Ex-post Assessment (Improve/build on Past)

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