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….
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.

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.
**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.
- Trends likely to continue.

**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.
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)

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?
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?

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

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.

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)
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

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
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

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
**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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**Re-allocation of Roadspace: Paris Southern Orbital Tramway**

*Before*

*After*
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

New Developments

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

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

Delays Reduced, Reliability Improved
Average trip times compared to free flow & 10% best and worst trip times
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

Acceptance: Seeing is believing
Public opinion in Stockholm

![Graph showing public opinion over time]

- Road pricing trial period

$I_{Good} idea$ vs $I_{Bad} idea$
London Congestion Charge

Impact on traffic in City zone: Delays down 30%

Vehicles entering the zone - % change over 2002

-40 -30 -20 -10 0 10 20 30
Cars Vans Trucks Busses Taxis Motorbike Bicycles

2003 2004 2005

% change over 2002
**Charge relative to cost of congestion**

- Oxford University Transport Studies Unit, G. Santos, supports TfL 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”

**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
### 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

### 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.
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

I. Average vs. real system performance

How traffic conditions have been communicated to users

Travel time


annual average

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

On-ramp/Off-ramp Lengthening: Stauventil (Germany)
Combined Travel Time/Parking Information
(National route 357 at Makuhari, Tokyo Region)

- 90 minutes by road
- 30 minutes by highway
- 40 minutes 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)
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)

www.internationaltransportforum.org
www.cemt.org

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