CONGESTION AND ITS EXTENT

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Objectives

“You’re not stuck in a traffic jam, you are the jam!” – German public transport campaign

▪ How is traffic congestion in metropolitan areas defined?
▪ How is congestion measured?
▪ How reliable and accurate are such measures?
▪ How has congestion and its perception been changing over the past several decades?
ANCIENT ROME

Julius Caesar: Regulations to limit carriage travel.
Historical Framework

LONDON

17th Century: regulations to control standing coaches.

1830’s: Monetary value for congestion.
NEW YORK

1867: William P. Eno’s first traffic jam on Broadway.

1910: Word “jam” first used to describe automotive congestion, *Saturday Evening Post*
Building Capacity: Interstate Mileage
Building Capacity: U.S. Highway Miles

![Graph showing the increase in U.S. Highway System Miles from 1960 to 2005.](image)

- U.S. Highway System Miles: 3,500,000, 3,550,000, 3,600,000, 3,650,000, 3,700,000, 3,750,000, 3,800,000, 3,850,000, 3,900,000, 3,950,000, 4,000,000
PORTLAND

1962: Harbor Drive

Source: Oregon Department of Transportation
PORTLAND

1966: Morrison Bridge

Source: Oregon Department of Transportation
PORTLAND

1966: Stadium Freeway

Source: Oregon Department of Transportation
Portland 1967: Marquam Bridge

Source: Oregon Department of Transportation
PORTLAND

1972: Vista Ridge Tunnel

Source: Oregon Department of Transportation
Congestion

- Impacts people and freight
- 2002 “wasted” $63.2 billion
- Affects travel decisions
- Background 1980-2000
  - More passenger car travel (VMT +44%)
  - More vehicles (+39%)
  - Not much more lane mileage (+2%)
  - More population (+24%)
  - Real GDP (+90%)
- No absolute definition (relative)
- Measurement problems
Survey to Frame Issues

- On-line survey of transportation professionals & academics.
- 480 responses.
Definition of Congestion

How Is Congestion Defined? (n=557)

- Time: 18%
- Speed: 28%
- Vol: 19%
- LOS: 15%
- Cycle Failure: 16%
- Other: 4%
Definition of Congestion

How Is Congestion Defined? (n=557)

- **Time**
- **Point**
  - Volume
  - Time Mean Speed
- **Spatial**
  - Density
  - Travel Time
  - Space Mean Speed
Definition of Congestion

How Is Congestion Defined? (n=557)

- “Must be able to define it.”
- “ Anything below the posted speed limit.”
- “ Below a speed threshold.”
- “ A perception.”
- “ I know it when I see it.”
- “ Should be judged by commonly accepted community standards.”
Measurement of Congestion

How Is Congestion Measured (n=682)

- Travel Time: 14%
- Speed: 13%
- LOS: 20%
- Delay: 29%
- V/C: 14%
- Queue Length: 4%
- Density: 1%
- Other: 5%

Other percentages:
- LOS: 20%
- V/C: 14%
- Density: 1%
- Queue Length: 4%
- Other: 5%
- Speed: 13%
- Delay: 29%
Measurement of Congestion

How Is Congestion Measured \( (n=682) \)

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- Other: 5%
- Density: 1%

“It is never truly measured.”
How Accurate Are Congestion Measures? (n=525)

- Accurate: 18%
- Somewhat Accurate: 33%
- Inaccurate: 14%
- Unknown: 6%
- Subjective: 5%
- Relative: 4%
- Variable: 20%

Accuracy & Reliability of Measurements

PORTLAND STATE UNIVERSITY
Accuracy & Reliability of Measurements

How Accurate Are Congestion Measures?
(n=525)

- Accurate: 18%
- Somewhat Accurate: 33%
- Inaccurate: 14%
- Unknown: 6%
- Subjective: 5%
- Relative: 4%
- Variable: 20%

- “Reasonably accurate.”
- “Measure the wrong things.”
- “Based on personal experiences.”
- “A snapshot in time.”
Changes in Congestion

How Has Congestion Changed? (n=446)

- Worse: 79%
- Flat: 4%
- Better: 3%
- More Available Options: 6%
- Varies: 5%
- Unknown: 3%
Changes in Congestion

How Has Congestion Changed? (n=446)

- Worse 79%
- Flat 4%
- Better 3%
- More Available Options 6%
- Varies 5%
- Unknown 3%

- “Western cities increasing.”
- “Some rust belt cities decreasing.”
- “Drivers conditioned to tolerate more.”
- “Need to prepare for the world as it will be.”
- “Focus on accessibility.”
- “Consider options.”
Literature Review

- **FHWA**
  - Level at which transportation system performance is no longer acceptable due to traffic interference.
  - May vary by facility type, location and/or time of day.
- **Recurrent/Nonrecurrent**
- **Variability**
  - Duration
  - Extent
  - Intensity
  - Reliability
- **Speed Thresholds**
  - Minnesota: below 45 mph during peak periods
  - California: below 35 mph for 15 minutes on weekdays
  - Proposed California: below 60 mph
  - Washington: 95th percentile travel time
Point Measurements

- Top Five Bottlenecks
  (American Highway Users Alliance)
- Identified Via Survey
- Confirmed with HPMS Data
Segment Level: Point Observer

- Flow
- Capacity
- LOS
- Time Mean Speed
- Extrapolated Travel Time
- Delay
Segment Level: Spatial Observation

- Density
- Space Mean Speed
- Actual Travel Time
- Delay
Corridor Level

(a) Northbound I-5
Corridor Level: Data Fusion
Consideration of Total Trip

<table>
<thead>
<tr>
<th>Segment</th>
<th>Time (min)</th>
<th>Distance (mi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walk</td>
<td>0.2</td>
<td>0.01</td>
</tr>
<tr>
<td>Local</td>
<td>1.5</td>
<td>0.26</td>
</tr>
<tr>
<td>Collector</td>
<td>3.4</td>
<td>0.76</td>
</tr>
<tr>
<td>Arterial</td>
<td>9.4</td>
<td>2.76</td>
</tr>
<tr>
<td>Freeway</td>
<td>23.8</td>
<td>8.76</td>
</tr>
<tr>
<td>Arterial</td>
<td>28.3</td>
<td>10.26</td>
</tr>
<tr>
<td>Park</td>
<td>30.1</td>
<td>10.51</td>
</tr>
<tr>
<td>Walk</td>
<td>36.1</td>
<td>10.61</td>
</tr>
</tbody>
</table>

Segment speed:
- Walk: 1.0 mph
- Local: 2.4 mph
- Collector: 60 mph
- Freeway: 25 mph

Travel time index:
- Walk: 22%
- Local: 7%
- Collector: 22%
- Arterial: 16%
- Freeway: 6%
- Parking: 5%
- Walking: 17%
- 14%
- 22%
- 16%
- 6%
- 5%

Total time: 36.1 minutes
Total distance: 10.6 miles
Metropolitan Level Mobility Measures

HPMS Sites (Oregon)
Metropolitan Level Mobility Measures

Highway Performance Monitoring System
Portland-Vancouver (OR-WA)
Urbanized Area
495 sq. mi., 1.6 million population
Metropolitan Level Mobility Measures

Portland Area Trends 1982-2002

Proportion to 1982 Value

Year


VMT
Population
Size
Size/Population
Travel Time
Portland Area Trends 1982-2002

- VMT
- Population
- Size
- Size/Population
- Travel Time

Portland adds 23,000 transit riders 1990-2000 (#5 in U.S.)
Metropolitan Level Mobility Measures

Portland Freeway and PAS VMT and Lane Miles, 1982-2002

- Freeway DVMT (1000)
- Arterial DVMT (1000)
- Freeway Lane Miles
- Arterial Lane Miles

Year
Percent of 1982 Value
100% 120% 140% 160% 180% 200% 220% 240%
Metropolitan Level Mobility Measures

Major Road Congestion Delay, 1982-2002

Annual Hours of Delay Per Peak Period Traveler

Year

Phoenix
Portland
Sacramento
San Diego
San Jose
Seattle
Other
Average

Trends in Travel Time, 1982-2002

- Phoenix
- Portland
- Sacramento
- San Diego
- San Jose
- Seattle
- Other
- Average

Annual Hours of Travel Time Per Peak Period Traveler


Year

Phoenix
Portland
Sacramento
San Diego
San Jose
Seattle
Other

Average

Metropolitan Level Mobility Measures
Metropolitan Level Mobility Measures

Travel Time Index, 1982-2002

TTI = Actual/Free Flow

Year

Travel Time Index


Phoenix
Portland
Sacramento
San Diego
San Jose
Seattle
Other
Average
Metropolitan Level Mobility Measures

Travel Time and Population 2002

- Annual Hours of Travel Per Peak Period Traveler
- Population

Cities included: Orlando, Riverside, Indianapolis, San Jose, Nashville, Denver, Portland, Seattle, Atlanta, Kansas City, St. Louis, Baltimore, Phoenix, San Diego, Pittsburgh, Oklahoma City, Sacramento, Buffalo, Milwaukee, New Orleans, Las Vegas, Boston, Portland, and Chicago.
Travel Time and Travel Time Index 2002

Annual Hours of Travel Per Peak Period
Traveler

Travel Time Index

Metro Cities

- Portland
- Sacramento
- Orlando
- Riverside
- Atlanta
- San Jose
- Denver
- New Orleans
- Las Vegas
- Pittsburgh
- Oklahoma City
- Buffalo
- Cleveland
- Minneapolis
- Phoenix
- Baltimore
- Seattle
- San Diego
- Detroit
- Indianapolis
- Minneapolis
- St. Louis
- Tampa
- Boston
- Dallas
- Washington, DC
- Chicago
- Los Angeles
- Houston
- Salt Lake City
- Seattle
- Austin
- Miami
- Columbus
- Los Angeles
- Charlotte
- Philadelphia
- Nashville
- Houston
- Cleveland
- San Antonio
- Columbus
- Cincinnati
- Minneapolis
- Kansas City
- Oklahoma City
- Pittsburgh
- Buffalo
- Cleveland
- New Orleans
- Las Vegas
- Portland
- Sacramento
Beyond Congestion Measures

Travel Time Budget

Source: Ausubel, Marchette and Meyer
Other Viewpoints

- Congestion occurs where people pursue economic and social interactions.
- Sign of healthy economy.
- Link measures to alternative mode availability.
- Impact of non-work trips in peak.
- Define the problem.
Conclusions

- Reality and perception.
- Can no longer build our way out of congestion.
- Protect environment.
- New methods for system performance measurement.
- Consider impacts on individual users and on individual trips (passenger and freight).
- Create places where people want to be.
- Travel time and reliability.
Next Steps

- Organizations
  - Talk to one another
  - Share resources
  - Blur jurisdictions

- Options
  - Modes
  - Routes
  - Connections
  - Financing

- Operations
  - Bottlenecks
  - Management
  - Information
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Questions?

http://www.its.pdx.edu/congestion.htm