Extracting Freight Corridor Performance from Weigh-in-Motion Data

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Objectives

• Retrospectively study truck transponder data in key corridors to determine the feasibility of producing freight corridor performance measures.
• Demonstrate other freight performance measures.
Motivation

Using Federal Highway Administration (FHWA) / American Transportation Research Institute (ATRI) proprietary truck satellite data.
Data Almanac

• 22 reporting WIM sites in Oregon
  – All upstream of fixed weigh stations
  – All are CVISN sites

• PSU WIM Data Archive
  – Part of our PORTAL project
  – April 2005 – May 2010
    • 44,000,000 + trucks
  – Data quality
    • Intermittent data outages and problems
    • Focus of other research project
Oregon Weigh-in-Motion

- Axle weights
- Gross vehicle weight
- Axle spacing
- Vehicle class
- Bumper-to-bumper length
- Speed (point)
- Unique transponder numbers

J. Lane, Briefing to American Association of State Highway and Transportation Officials (AASHTO), 22 February 2008
freight.transportation.org/doc/hwy/dc08/scoht_cvisn.ppt
Estimating Corridor Performance

- 2007-2008 WIM data
- Matching transponders
- Filtering through trucks

All trucks 21.5M
Trucks with tags 8.4M
Trucks between stations 2.4M
Through Trucks 1.3M
I-84 WB, FWB to EMH

Free flow travel time = Distance / 55 mph = 126.4 mi / 55 mph = 2.3 hrs

Search window = 2.3 * .75 = 1.7 hrs (74 mph)
2.3 * 2 = 4.6 hrs (27 mph)

Pendleton NOAA El 1493 ft

Ladd Summit RWIS El 3619 ft
All Matched Trucks in Time Window
Filter Algorithm

• For each truck $j$ traveling on link $i$ determine the estimated travel time, $t_{j,i}$.
  – If the travel time $t_{j,i}$ is less than the free-flow time $ff_{j,i}$ denote this truck as a through truck.
  – If the travel time $t_{j,i}$ is less than the upper travel time $ut_{j,i}$ (defined as an average travel time of 50 mph).
  – Find the median travel time $mt_{j,i}$ in the sample of $X$ previous truck observations and compare that to $t_{j,i}$. If $t_{j,i}$ does not exceed $mt_{j,i}$ by a threshold of $Y$, truck $j$ is assumed to be a through vehicle.

• If none of the above criteria are met, the $t_{j,i}$ is excluded (i.e., $j$ is not a through truck).
Filtered Trucks (Green)
Through Trucks Only
I-84 WB, FWB to EMH, August 07
I-84 WB, FWB to EMH, Aug 07
I-84WB, Average Link Speed, by Day

Average Speed, mph

2007 2008 2009
Average Link Speed, by month
US-97 NB, KFP to LWL
US-97 NB, KFP to LWL

Average Speed, mph

2007 2008 2009

40 50 60
Comparison to Probes (Vehicles)

Passenger Car Travel Time, hrs = 0.30519 + 0.64441(Truck Travel Time, hrs)
Other Freight Performance Measures

• Using the matched trucks
  – Estimated Freight Activity on Corridor
  – Freight Patterns
  – Ton Miles
  – Emissions

• Assume trucks with transponders are the same as those without
About 1600 more truckloads consumed
Freight Activity

217: WDN to CSL
Five-Axle Trucks, 2007 Reported Data

- Trucks Increasing Wt
- Trucks Decreasing Wt
- Difference

Cumulative Weight (kips, thousands)

Month

Number of observations = 19494

Production

About 3200 more truckloads produced

Consumption
Conclusions and Next Steps

• Average speed measures useful
  – More tag reading stations would be helpful
  – Integration with probe-based samples?
• Developing automated method to load data and quantify data quality
• Ongoing - Weight-spacing signature matching
• Ongoing - Estimate O-D flows
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Questions?

Thank You!
www.its.pdx.edu