Analysis of NPMRDS Data for Estimating Freight Transportation Performance Measures

Saravanya S. Edward McCormack Mark Hallenbeck Anne Goodchild
Why Freight Performance Measures?

> MAP-21: Improving the efficiency of the freight movement - one of the important goals is performance-based programs.

> Performance Measures “allows planners and engineers to monitor and evaluate transportation facilities or projects and to justify the allocation of funds among alternative transportation improvement options”.

> NPMRDS is a national level GPS dataset released by FHWA using data from probe trucks and passenger vehicles.
NPMRDS Characteristics

- Historical archive of average travel times in 5-minute increments
- Aggregated over space and time using the GPS readings from probe vehicles
- Truck travel times are obtained from ATRI’s (American Transportation Research Institute) class 7 and 8 trucks
- Passenger travel times are from HERE probe data
- It covers the entire national highway system and some arterials
- Available for each direction in a roadway, classified into unique TMC (traffic message channel) segments of varying lengths
- Available to all DOTs and MPO
Objective

> To develop performance measures using NPMRDS
  – Truck Speeds on Highways
  – Travel Time Delay
  – Travel Time on Arterial Streets
Case Study

TMC segment
Truck speeds slower than Car speeds (> 15mph)
Travel time delay (TTD) estimation

> NPMRDS travel time data (in seconds) for one month is considered
> Compute Speed (in mph) from travel time values observed
> Subsets of Weekdays and Weekends
> Each weekday/weekend classified into different time periods
  – Weekdays: AM peak, Midday, PM peak & Night
  – Weekends: Day, Night
Travel Time Delay estimation

• **Thresholds for estimating delay**
  - Type 1: At the Speed Limit (SL)
  - Type 2: Speed Limit - 10 MPH (SL-10)
  - Type 3: At 70% of Speed Limit (0.7*SL)

• **Delay per vehicle in each time period based on the threshold level is:**

  \[
  \text{Delay per vehicle} = \text{Travel time at the threshold level} - \text{Actual Travel Time observed}
  \]

• **Total delay is given by:**

  \[
  \text{Total Delay} = \text{Delay per vehicle} \times \text{Volume}
  \]
TTD for AM Peak (weekday)

- Average delay (mins)
- EB I-90 TMC segments
- Urban area
- Rural area
- At SL
- SL-10
- 0.7*SL

ttd for Mid-day (weekday)

- Average delay (mins)
- Urban area
- Rural area
- At SL
- SL-10
- 0.7*SL

King County
EB I-90 TMC segments
Kittitas County
Minor Arterial Analysis

License Plate Reader locations on 4th Ave S, Seattle, WA
NPMRDS vs. License Plate Reader
Weekday only from 10/01 to 10/17/2014, Minor Arterial

Pearson Correlation Coefficient = 0.77
Major Arterial Analysis

Bluetooth readers on SR 522, Seattle, WA
NPMRDS vs. Bluetooth
Weekday only from 10/01 to 10/17/2014, Major Arterial

Pearson Correlation Coefficient = 0.71
Summary

- NPMRDS is useful in understanding the system performance of freight corridors such as I-90.
- Helps in identifying the interstate roadway segments where truck speeds are slower.
- The use of different delay threshold changes results and locations
- Comparing NPMRDS with other travel systems (Bluetooth and LPR) shows there is useful NMPRDS information on arterial streets.
- Further research plans includes
  - Analysis of variable time-of-day based on thresholds for delay estimation
Thank You

Questions?
Truck speeds slower than Car speeds (> 15mph)

WB I-90 TMC segments in King County, WA

EB I-90 TMC segments in King County, WA

I-5 interchange, Seattle
I 405 Interchange
WA 18 interchange

%percentage

North Bend

I 405 Interchange

?-?

?-?

%-percentage

I-90 TMC segments in King County, WA

North Bend

I 405 Interchange

%-percentage

%-percentage