

Investigation of Multiple Data Sources To Provide Truck Performance Monitoring

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A FHWA
sponsored test
using ITS devices
in the Western
Washington



Project Goals

- How do you use ITS devices to develop regional travel time data to determine exactly when, how, and where congestion affects freight mobility?



Project Approach

- Obtain data from the region's ITS devices
- Determine how to integrate data from different ITS sources
- Develop regional and corridor travel times and patterns
- Document process
- Make recommendations

Sources of ITS Data in Region

- Truck transponders used for CVISN system and Custom's pre-arrival at Canadian border
- Container door seal transponders (E-seals)
- WSDOT's freeway management system data
- GPS data from fleet management system
- Other:
 - Transit fleet tracking data
 - Safeway distribution trucks



Use of the Data

- CVISN Truck Tags
 - Regional facility performance
 - Travel times
 - Long Segments – Major Facilities
 - Portland – Olympia
 - Olympia – Seattle
 - Seattle – Canadian Border

Use of Truck Tags

- Use time of arrival at two locations

Border Crossing

- Performance =

$$T_{12} = T_{\text{Border}} - T_{\text{Weighstation}}$$

- Speed = D_{12} / T_{12}

Weigh Station



Use of Freeway Operations Data

- Facility Volume
 - Total volume
 - In some locations, simple truck volumes (3 or 4 length classes)
- Segment performance
 - Average vehicle speed

Use of Vehicle Location Data

- Fleet tracking systems
 - GPS (or other)
 - For transit bus, or commercial vehicle
- Point and vehicle specific speed / location information
 - Point estimates of facility speed or
 - Facility travel time

Are These Data Useful?

Are These Data Useful?

It Depends

Are The Data Useful?

- Are there enough data points?
 - Enough tag reads?
 - Are the “segments” useful?
 - Are the data “accurate?”
 - Can you place the GPS read on the correct road?
 - Do trucks = cars? = the facility?
 - Do trucks stop between readers?
 - Do buses = cars * 1.5?

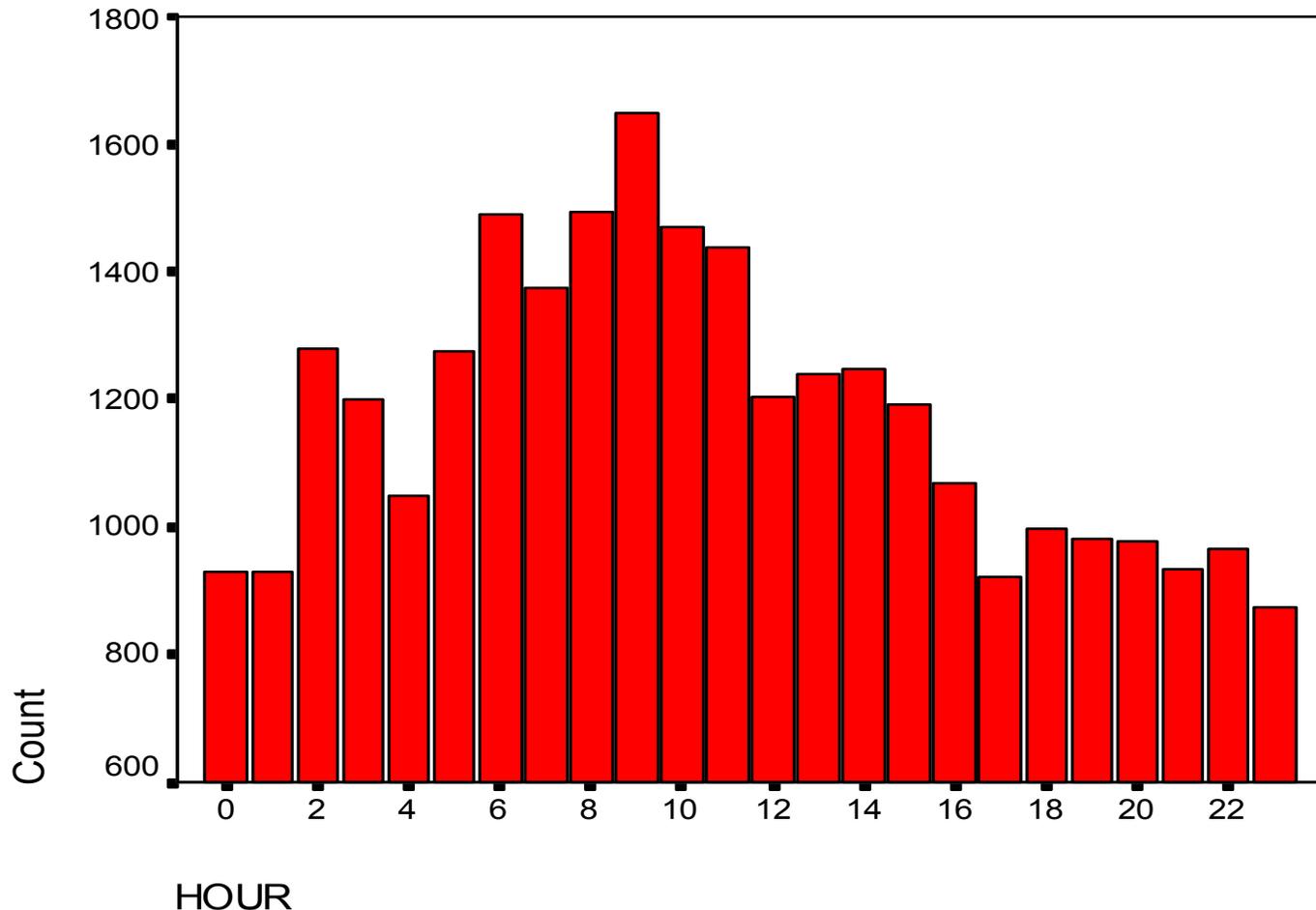
Are the Data Useful?

- What are you trying to measure?
 - Real time performance?
 - Historical patterns?
 - Average performance?
 - Average performance by time of day?
 - Frequency of congestion by day of year and time of day?

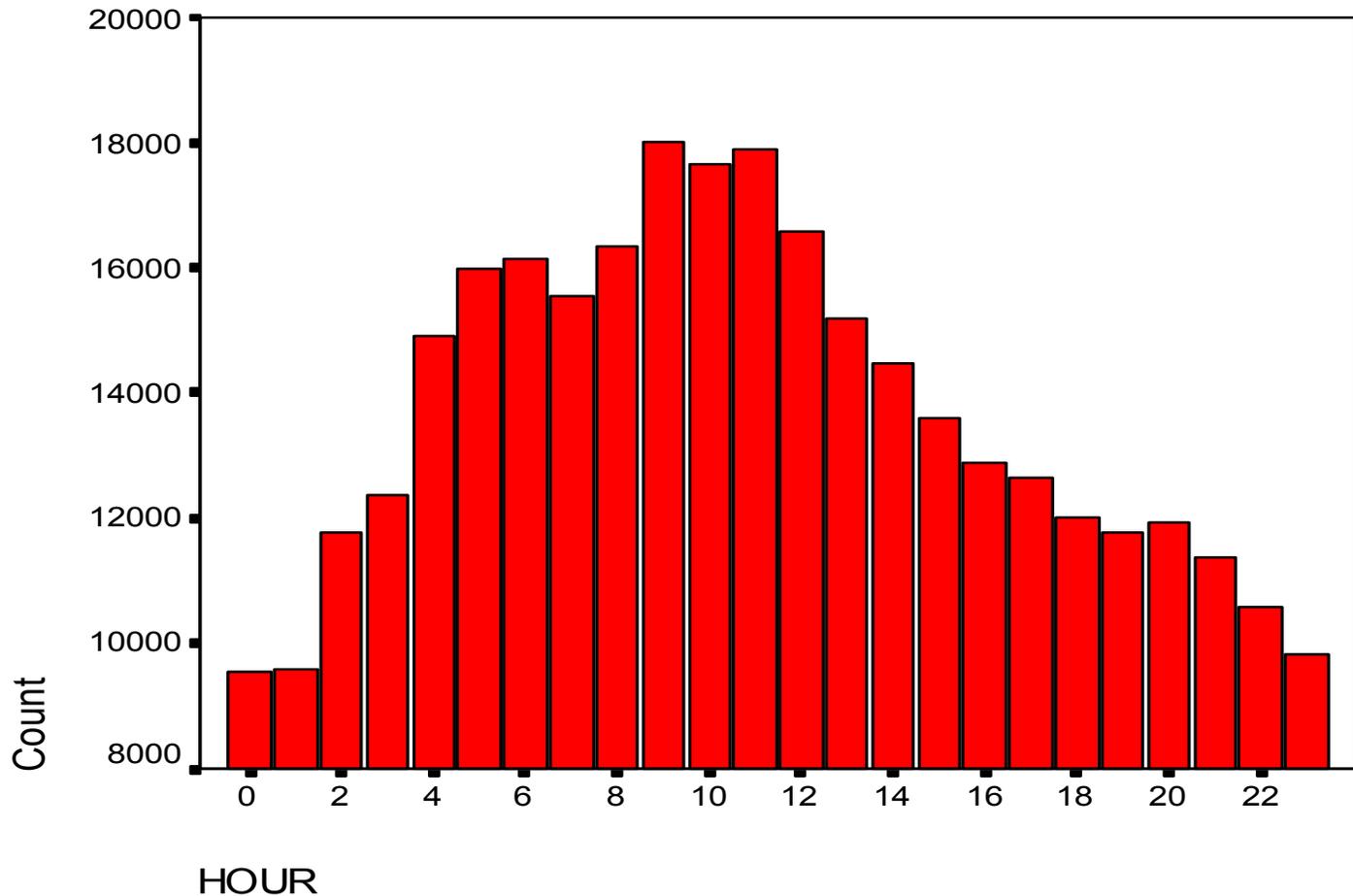
CVISN Truck Tags

- Are there enough data points?
 - By day?
 - By time of day?
 - For “special days”
 - (Memorial day weekend)

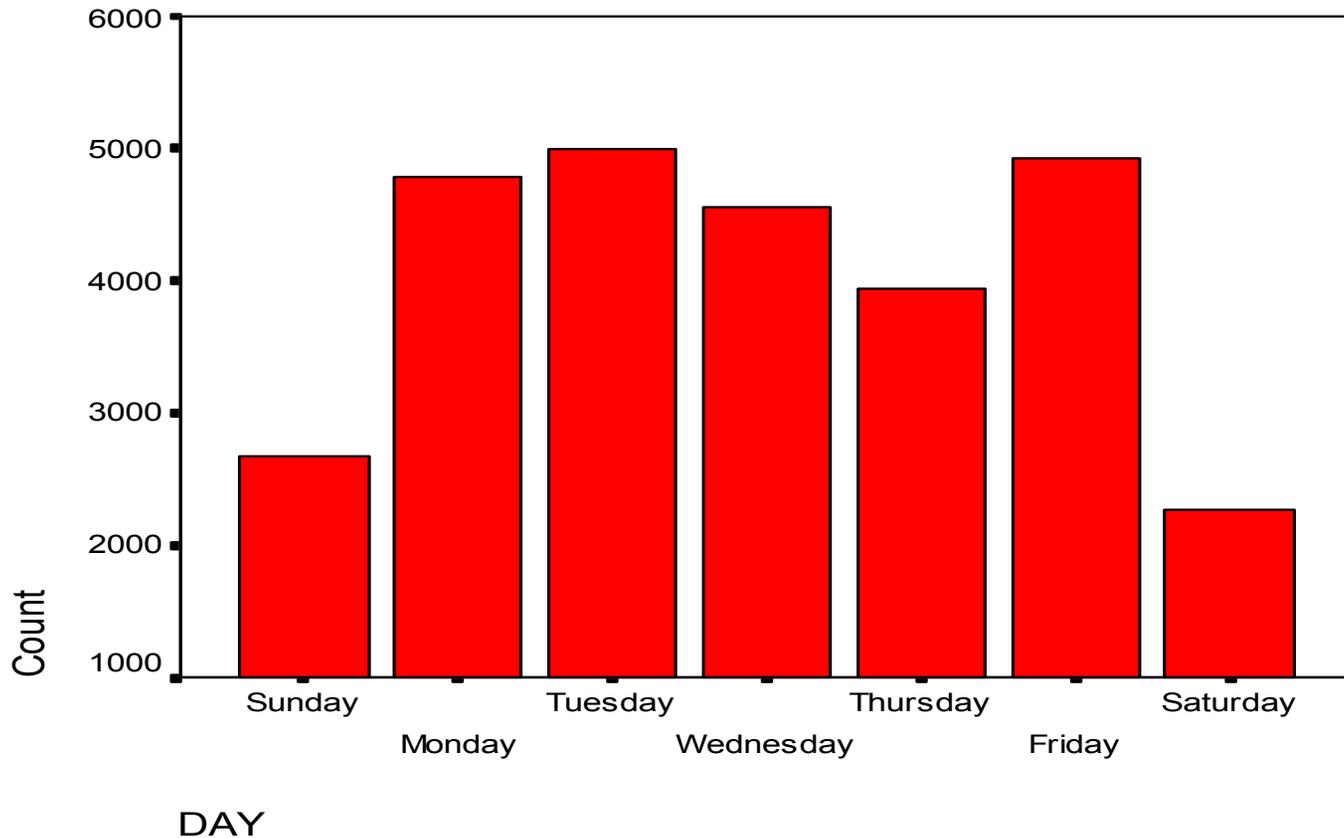
Hourly Reads at Ridgefield (March 2002)



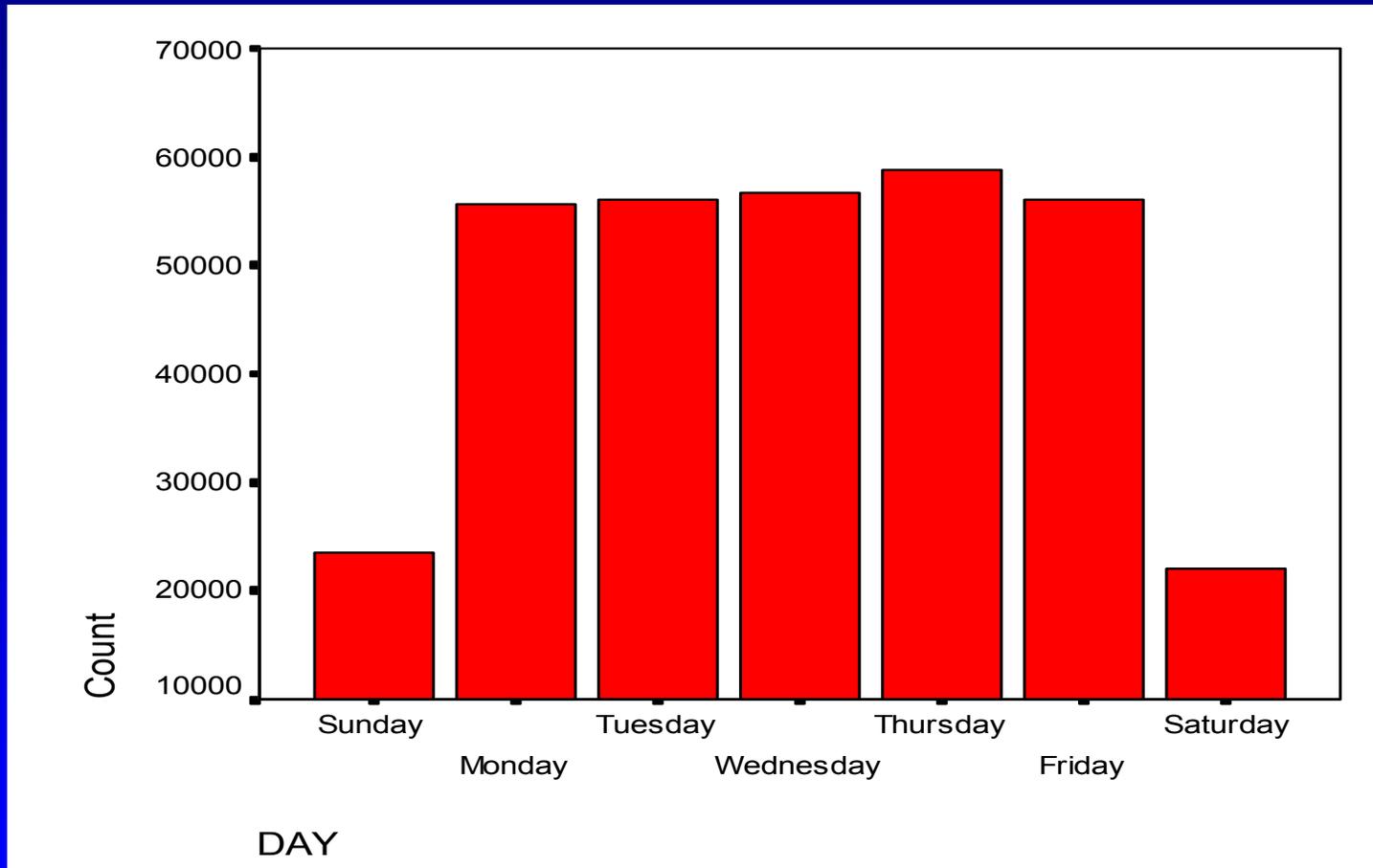
Tag read by hour (five sites for one Year)



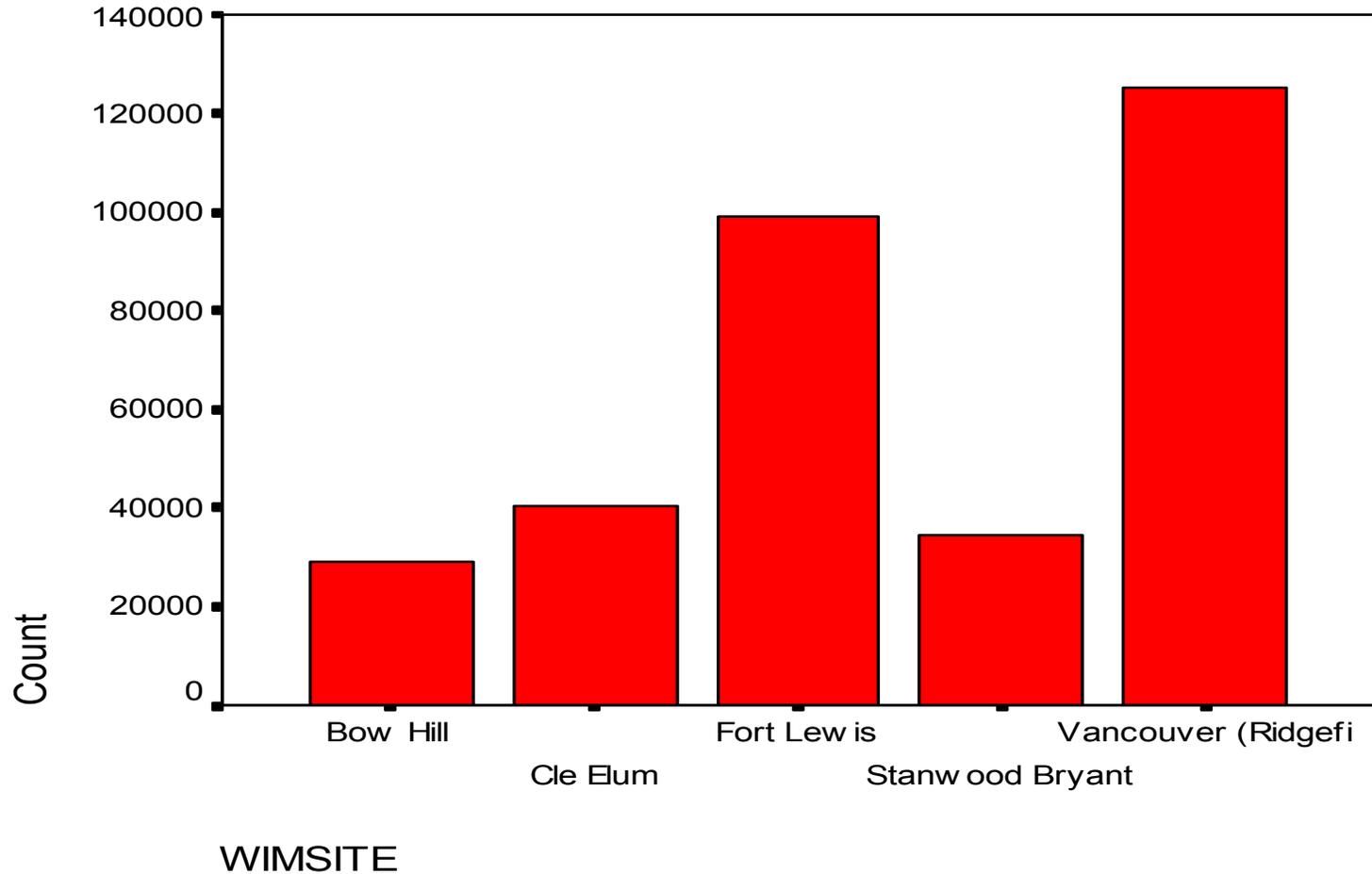
Reads by Day of Week at Ridgefield (March 2002)

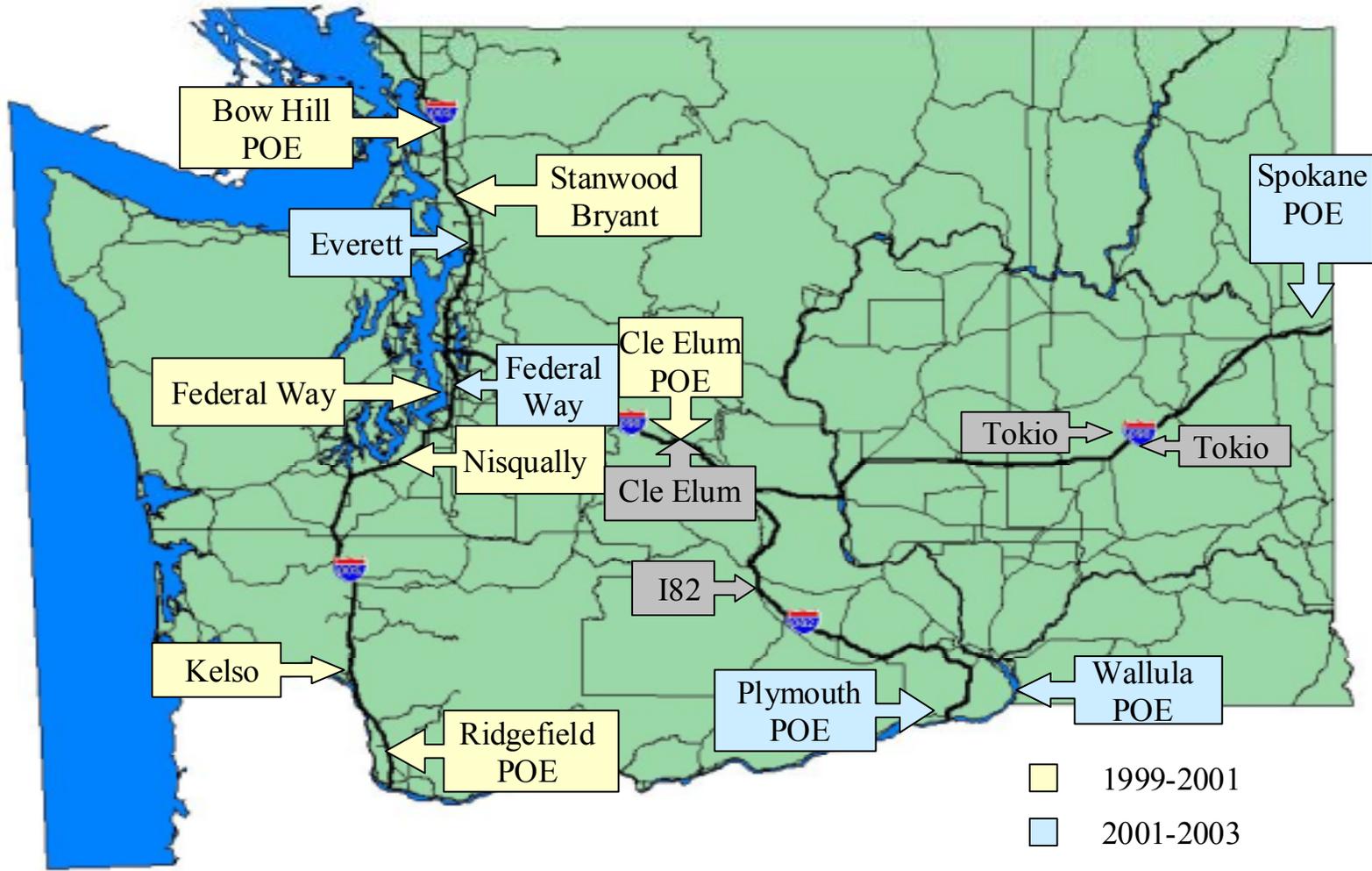


Tag Reads by Day of the week (One Year – 5 sites)



Reads by Site for One Year





- 1999-2001
- 2001-2003
- 2003-2005

Translation?

- Weekdays during the middle of the day
 - 40 to 80 trucks per hour
- Weekends during the middle of the day
 - 25 to 40 trucks per hour
- Weekends during the middle of the night
 - 5 to 10 trucks per hour

Is that “Good Enough?”

- For planning purposes – Yes*
 - Frequency of Congestion
 - Average travel times
 - Basic travel time distribution

* If enough trucks are observed at consecutive locations

Is that “Good Enough?”

- For real time travel ATIS reporting? – Maybe*
 - During mid-day weekdays? Probably
 - During holiday travel? (Probably not)
 - During late night? ?????
 - (are there concerns late at night?)

* If enough trucks are observed at consecutive locations

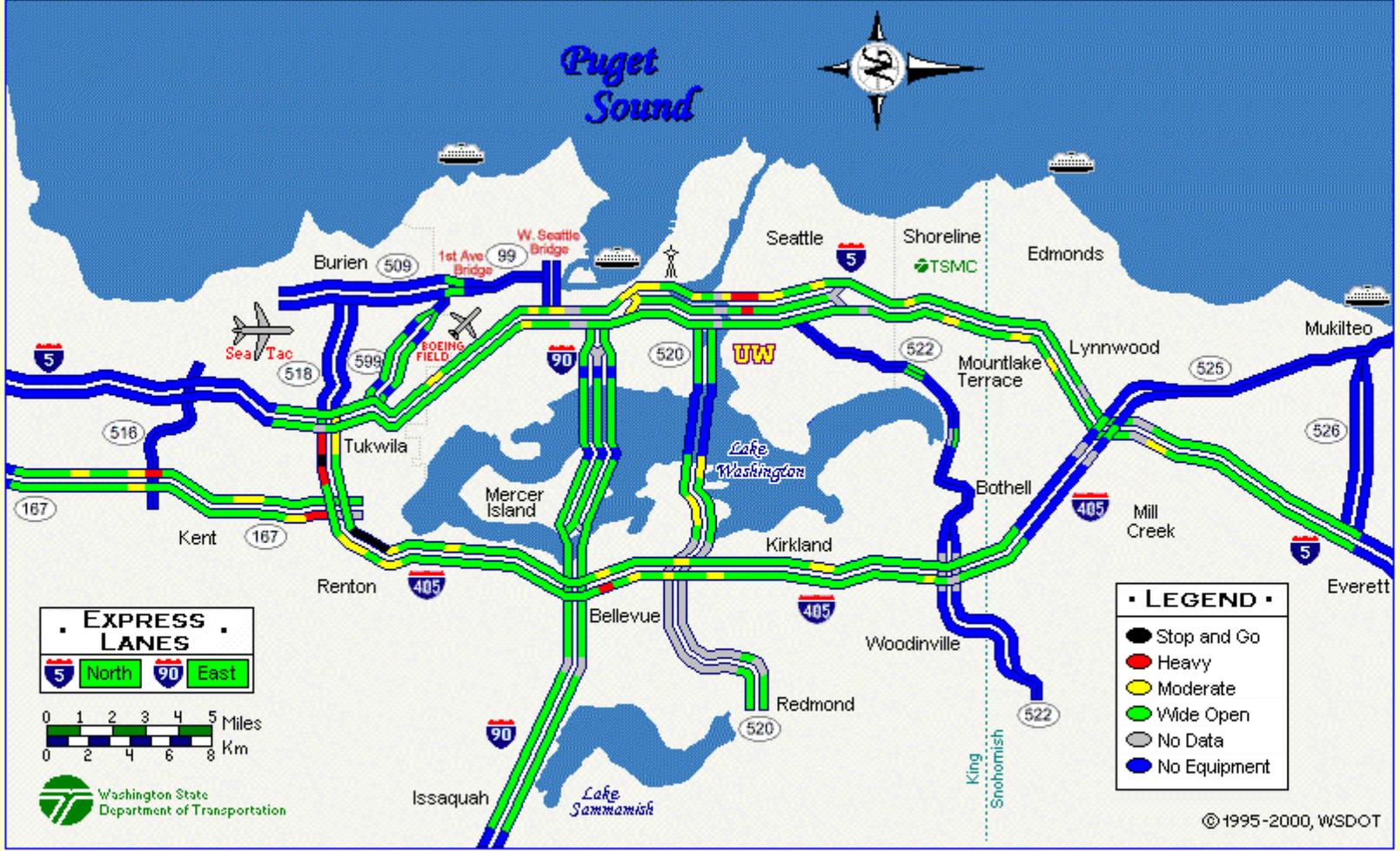
Can We Get More Data?

- Additional readers (Customs?)
 - More travel time matches
 - \$18,000 per reader, + installation & communications
- Additional tags
 - Growth in CVISN participation (30% from 2000 – 2001)
 - E-Seal container tags
 - Other vehicles
 - Greyhound buses
 - Government cars
 - Others?

Traffic Management System Data

- Covers a much smaller geographic area
- Tends to have much more dense sensor network
 - Needed for traffic management
 - But also matches data needs
 - Rural segment versus urban segment

Traffic Conditions as of: Aug 21, 2000 2:19:19 PM



WebFLOW

If you use these maps frequently to help plan your commute, download [WebFLOW](#) for quicker and easier access.

- Sept 30, 1999: New Maps are now available.
- Jul 12, 2000: [New Palm version added!](#)

Telephone Traffic Reports

Current traffic reports are also available over the phone!

206-DOT-HIWY
 (206-368-4499).

Traffic Management System Data

- Can be used to describe the “center” of a longer segment travel time relationship
- Use combination of
 - Bigger segments (rural, tag reader based)
 - Smaller segments (urban, ATMS based)
- To define smaller rural/urban segments

CVISN Tag Reads



Oregon

Olympia

Seattle

Everett

Canada

Seattle ATMS



Combined Data Sets Yield Information On New Segments



Integration of Data Sets

- Need geographically compatible referencing systems
 - GIS (common segment ends)
 - Route and milepost (common sensor locations)
- Need compatible time periods

Other Data Available

- Fleet Monitoring Systems
 - Vehicles cover more roads
 - Not restricted to specific sensor locations
 - Multiple fleets are available
 - Transit buses
 - Commercial buses
 - Freight vehicles
 - Taxis
 - Business / government fleet vehicles

Fleet Monitoring Data

- Data are usually
 - Location (X/Y) and time, or
 - Location, time, speed
- Can we convert these to segment speed and/or travel time? (geographically compatible referencing systems)
 - It Depends ☺

Fleet GPS Data

- Can we assign data points to the right roadway segment?
 - Accuracy of base GIS file
 - Accuracy of location (GPS) system
- Do the data points represent accurate measures of speed / travel time?

Fleet GPS Data

- Do the data points represent accurate measures of speed / travel time?
 - Type of vehicle being monitored?
 - Bus
 - Truck
 - Car
 - Taxi
 - What data are reported? Location? Speed?

Fleet Data Conversion

- How frequently do you “see” a vehicle?
 - Once a minute?
 - Once an hour?
- How many vehicles do you see per road segment per reporting period?

Fleet Data Conversion

- Do you know the vehicle path?
 - I-80 versus urban arterials in the CBD

Fleet Data Conversion

- Can you obtain the data?
- At what frequency?
 - Density of data points
 - Frequency of reporting (real time / planning)
- At what cost?
 - Commercial system
 - Special purpose system
 - Government / private

Our Real-time Acquisition Costs

- Wirelessly Connected GPS
 - \$100 per month per vehicle
 - For relatively frequent data collection
 - (Every 1 to 3 minutes)
 - Reporting time required, a function of segment length
 - Distance / speed
 - 1 mile segment length @ 30 mph = every 2 minutes

Data Acquisition Issues

- Convincing agencies to archive data
- Privacy concerns
 - Encryption/conversion of tag IDs prior to data storage
 - Formal terms of use and privacy statements

Data Manipulation/Cleaning Issues

- Need to develop a common data format
- Assigning tag and GPS data to roadway network (is it on a arterial or a freeway?)
- Need accurate GIS / roadway locations
- Tests of data quality

Development of Data Storage Platform

- Maintaining “up-to-date” roadway network is critical
- GIS used to organize, manipulate, and integrate data
- Need to define within GIS relationships between different data collection systems
 - i.e., how to aggregate segments in one system

Develop Supplemental Data

- On each roadway segment
 - Vehicle volumes
 - Vehicle classifications
 - Vehicle occupancy
 - Commodity information

Output Reports

- Timing of vehicle (truck) flows
- Origin / destination information
- Facility reliability
 - Specific “bad” times or days
 - Average travel times
 - Distribution of travel times
- Time, location, duration of congestion