

# Statistical Analysis Of Commercial Vehicle Border Crossing Times and Volumes: Case Study Of The Pacific Highway Port-of-Entry Free And Secure Trade Lane

Thesis Presentation By  
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8:00 am

More 119

# Pacific Highway Port-of-Entry

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# Findings (1 of 2)

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1. Relationships between crossing times and arrival volume
  - a) Strong correlation at aggregate level
  - b) Not strong at a disaggregate level
2. Non-primary crossing times contribute to very long crossing times

# Findings (2 of 2)

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3. FAST lane utilized by vehicles who transport:
  - a) Bulk
  - b) Empty
4. Complex sampling can
  - a) reduce resources
  - b) same results with higher precision

# Very Long Crossing Times Methods

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- 1) Temporal Trends of arrival volumes and crossing times
  - 2) Correlation between arrival volumes and crossing times
  - 3) Primary and Non-Primary Concepts
  - 4) Lane Utilization by Commodity
- 
- ▣ Complex Sample Survey Techniques

# Crossing Time Data Set

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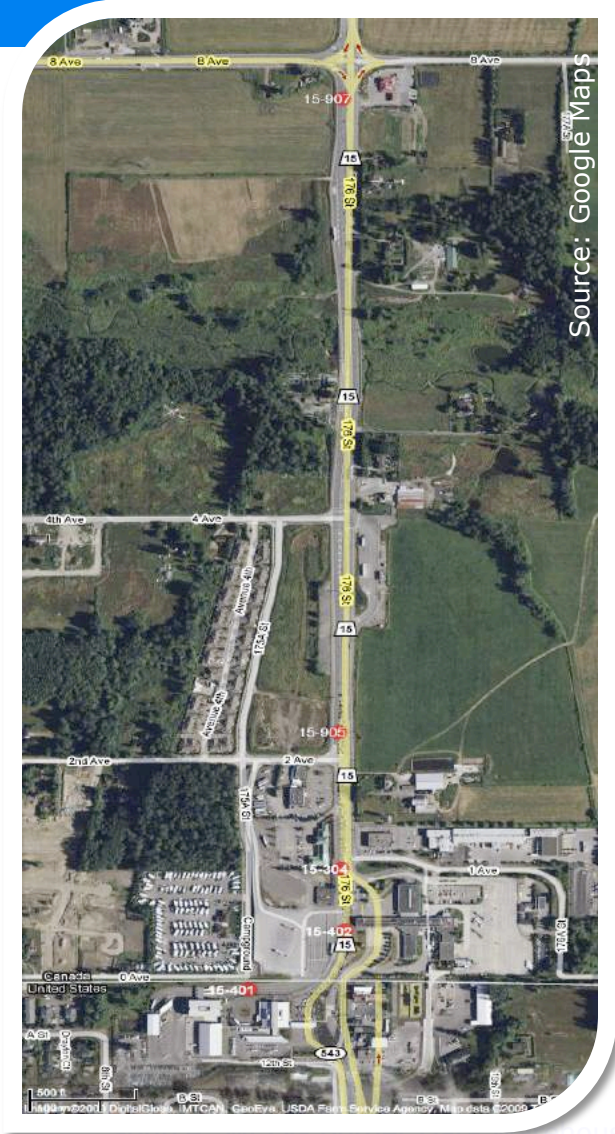
- Jet Star GPS Data Set
- Southbound
- July 10, 2005 through May 19, 2009
- FAST Hours: 8AM-8PM  
Mondays through Fridays

#Obs	Mean	Standard Deviation	Median	Min	Max
13,680	00:17:03	00:19:18	00:11:44	00:00:14	04:42:51

# Arrival Volume Data Set

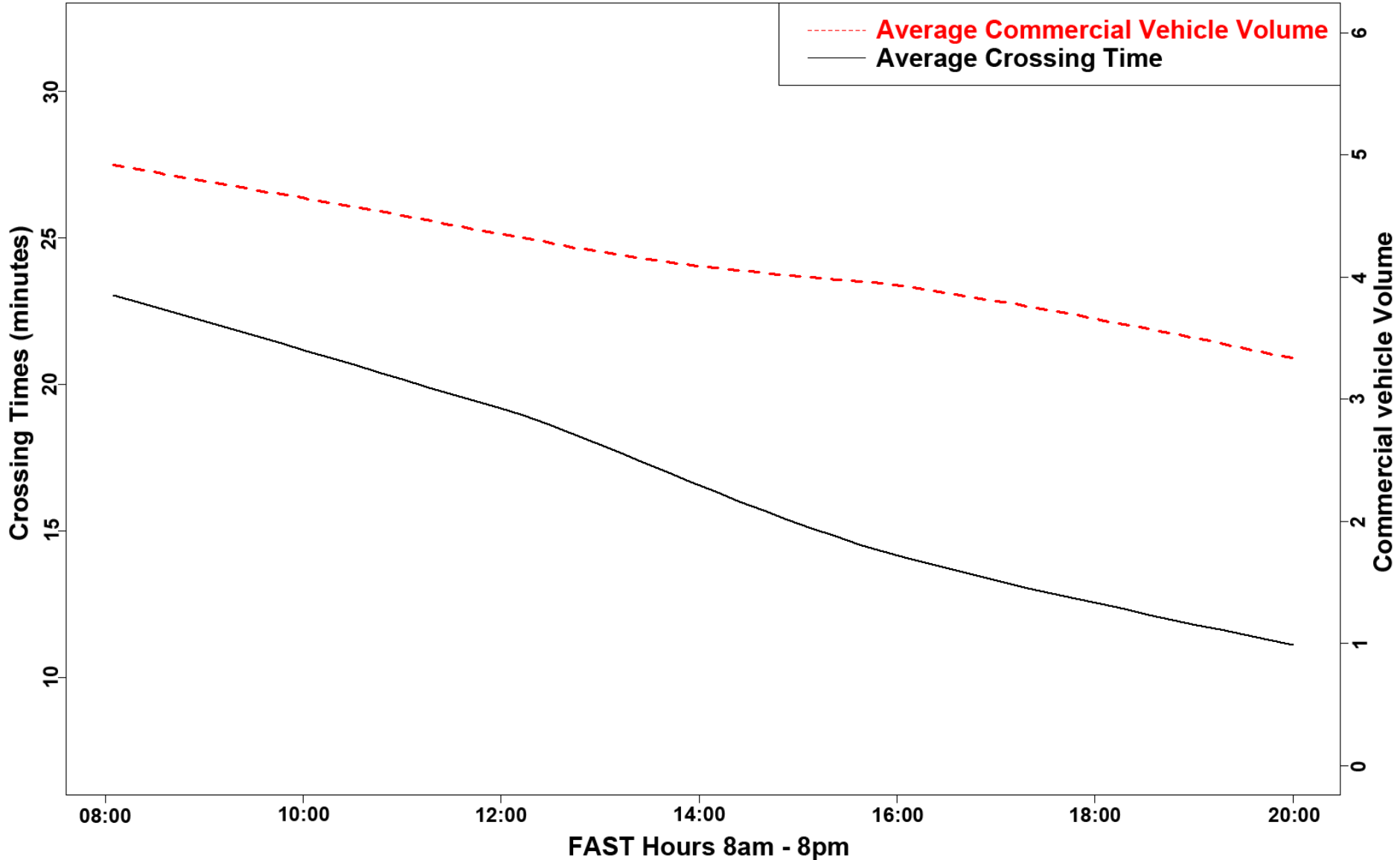
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- BC MoT Data Set
- 5 minute average intervals
- 5 paired loop detectors
- November 13, 2006 through May 5, 2008
- FAST Hours
- 388,500 observations



Source: Google Maps

# Trends between Arrival Volume and Crossing Times in 2007





# Temporal Correlations (R)

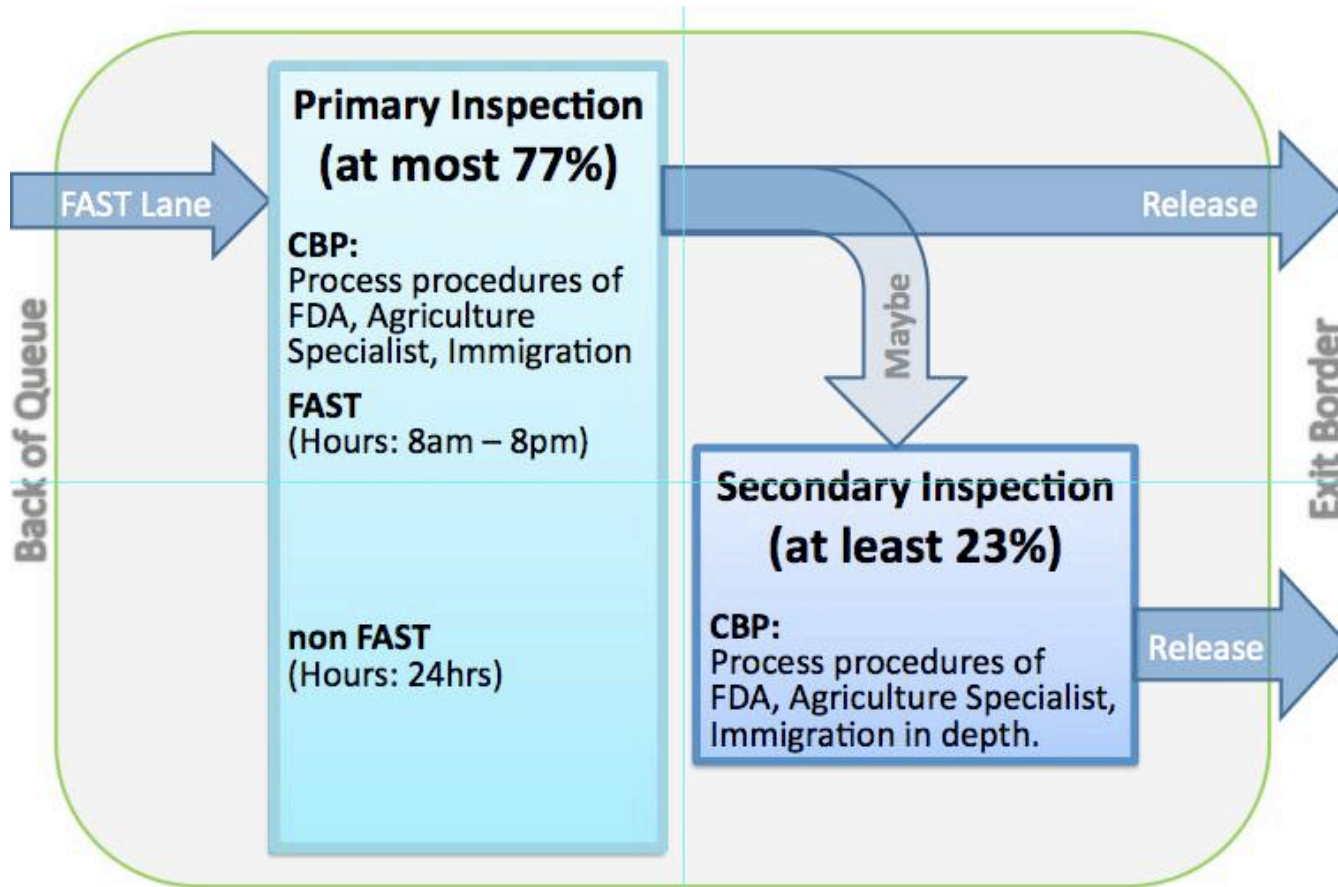
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Seasons	R	Average crossing time
Spring	0.43	19 minutes, 25 seconds
Summer	0.46	17 minutes, 38 seconds
Fall	0.22	16 minutes, 30 seconds
Winter	0.32	21 minutes, 38 seconds

Weekdays	R	Average crossing time
Monday	0.37	20 minutes, 35 seconds
Tuesday	0.30	18 minutes, 25 seconds
Wednesday	0.40	19 minutes, 38 seconds
Thursday	0.44	15 minutes, 9 seconds
Friday	0.46	22 minutes, 24 seconds

# Primary and Non-Primary

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# Lane Choice Analysis

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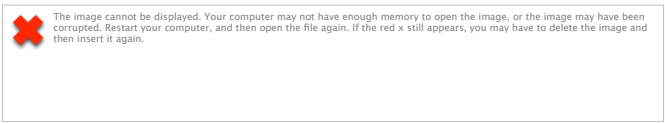
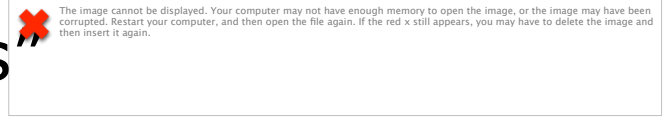
- WCOG Manifest data
  - High resolution for microscopic time period data
- June 5-8, 2006
- 1,200 observations



# Hypothesis Testing

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- Test the differences between average lane choice by commodity
- **Null Hypothesis:**
  - “Is there a difference between a commodity’s lane choice and the lane choice for all commodities”
- **Alternative Hypothesis:**
  - There is no difference
- Significance level of 5%



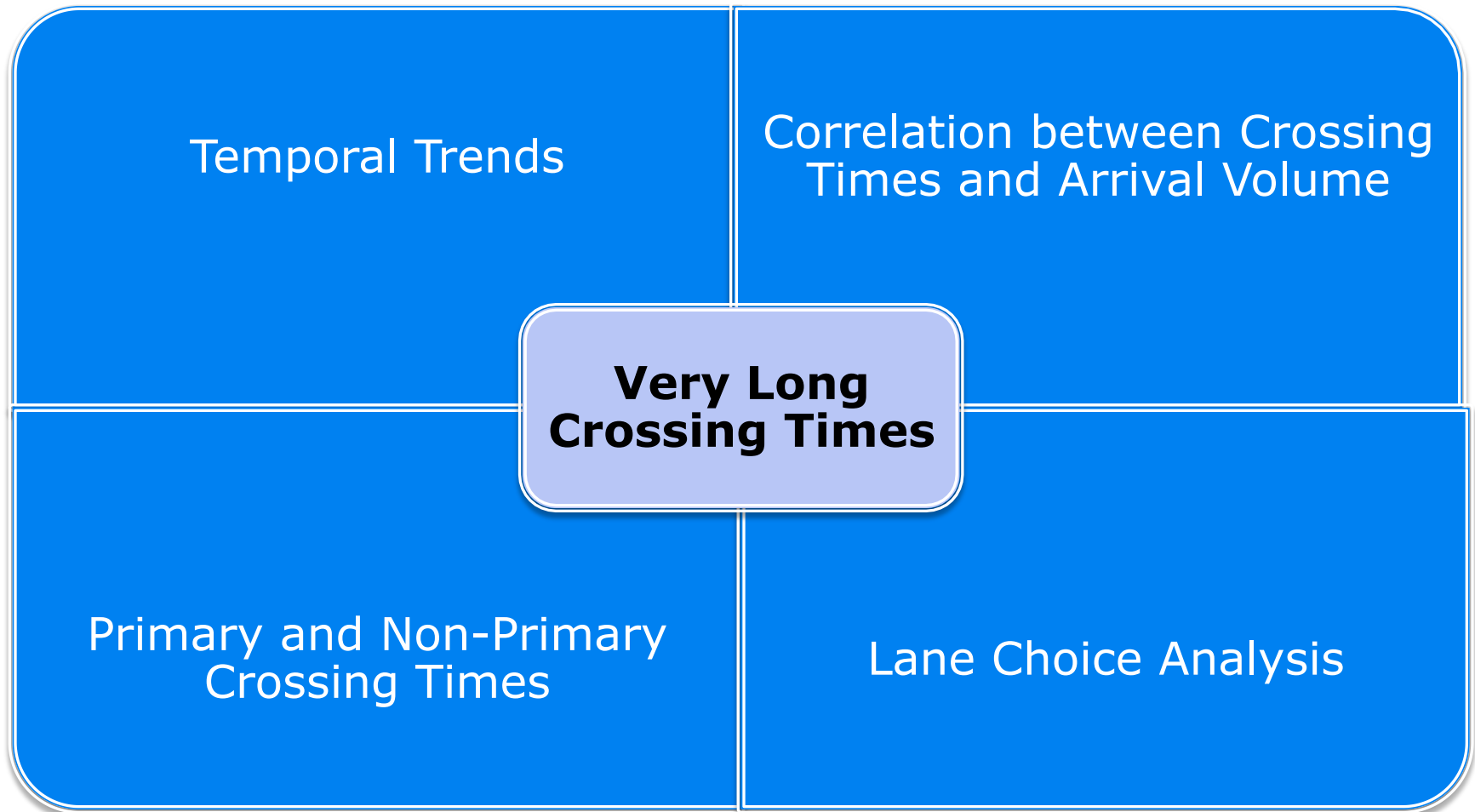
# Two-Sample T-Test Results

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Commodity Type	Significance	Lane Choice
Manufacturing	✓	Middle
Unknown	x	
Food	✓	Middle
Wood	x	
Bulk	✓	FAST
Farm	x	
Printed Matters	x	
Empty Truck Container/Pallet	✓	FAST

# Methodologies

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# Complex Sampling Analysis

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- “A simple random sample is almost always better than a non-random sample. A more complex random sample is often even better than a simple random sample: lower cost for the same precision”  
*(Lumley, 2009)*

# Parameter Estimation of 2007

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## Mean Estimates

Sampling Type	Mean	Standard Error
Empirical	00:18:58	00:20:19
Simple Random Sampling	00:19:00	00:21:47
Simulated	00:19:02	00:01:26

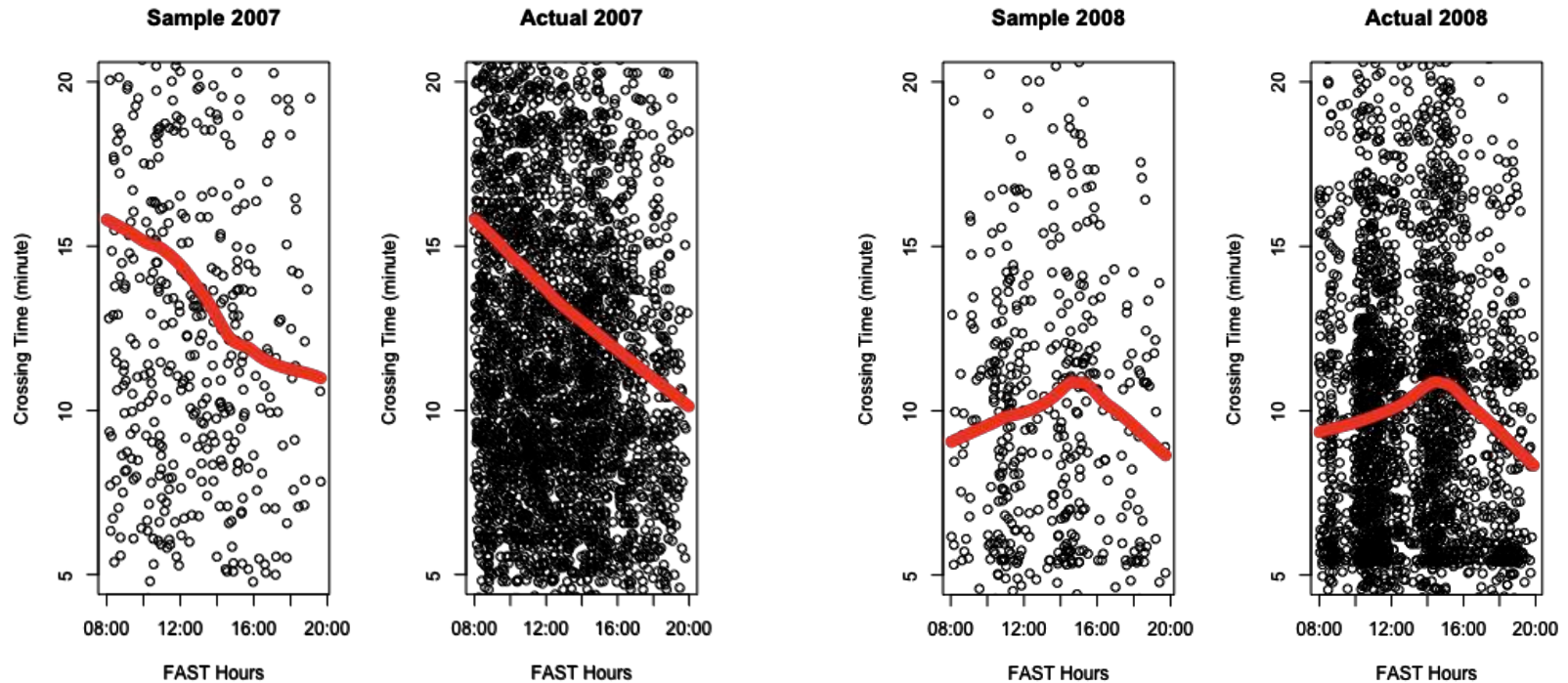
## Standard Deviation Estimates

Empirical Mean of the Standard Deviation	Simulated Mean of the Standard Deviation	Standard Error of the Standard Deviation
00:20:19	00:19:51	00:03:38



# Complex Sampling

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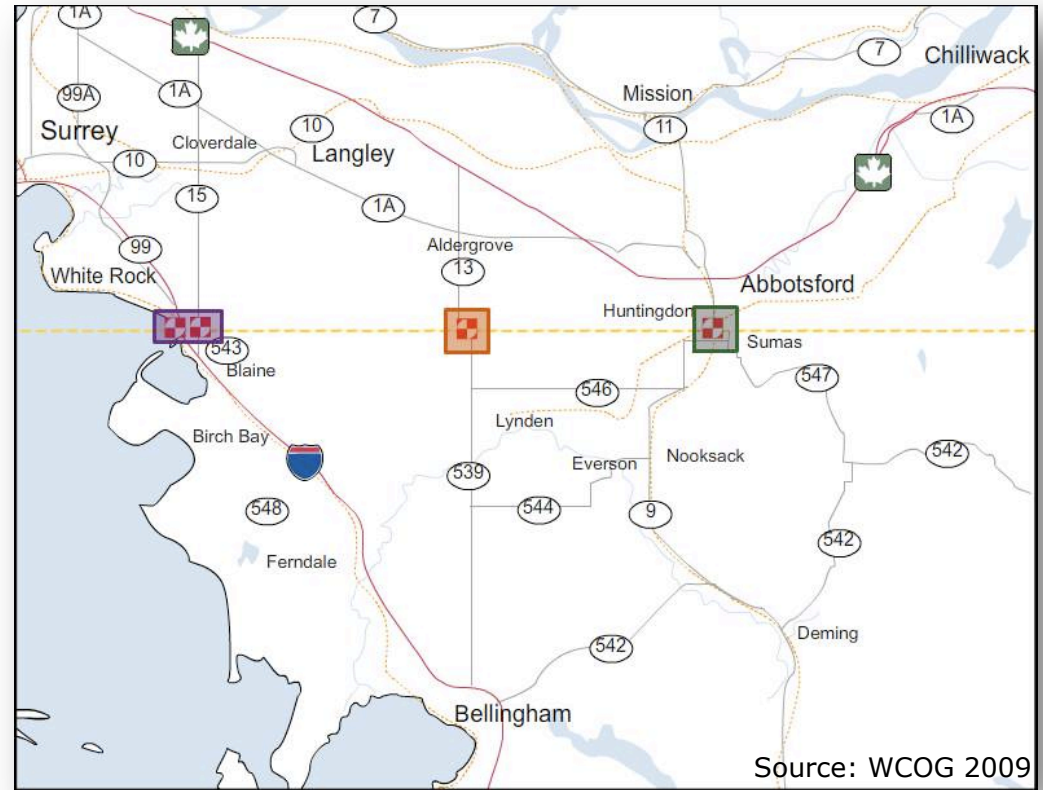


Year	Bootstrap		Simple Random Sample		Empirical Data	
	Mean	Standard error	Mean	Standard error	Mean	Standard error
2007	00:17:37	00:00:48	00:19:16	00:20:42	00:18:58	00:20:19
2008	00:17:36	00:02:02	00:15:31	00:22:37	00:14:47	00:19:32

# Recommendations

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- Sample survey
  - ▣ Infer the same estimates with less costs
  - ▣ High resolution for macroscopic time period data
- Applied to future studies
  - ▣ Sumas
  - ▣ Lynden
  - ▣ Blaine



# Thank you

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