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Leveraging Signal Infrastructure for Non-Motorized Counts in a Statewide Program: A Pilot Study

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Oregon Department of Transportation

Maseeh College of Engineering and Computer Science
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Paper #15-5168

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Presentation Outline

- Research project goals
- Pilot study
  - Pedestrian results
  - Bicycle results
  - Overall Performance of 2070 controllers and inductive loops
  - Lessons learned and recommendations

Research Project Goals

- **SPR # 754: Design and Implementation of Pedestrian and Bicycle Specific Data Collection Methods in Oregon**
- Review best practices regarding statewide non-motorized data collection programs and data collection technologies
- Provide guidelines regarding location and data collection procedures
- Perform a pilot study

Pilot Study

- Evaluate **2070 traffic signal controllers** and **inductive loops** as methods for pedestrian and bicycle counting on a typical ODOT facility
- Apply factors to estimate bicycle and pedestrian Average Annual Daily Traffic (AADT)

Site Selection Criteria

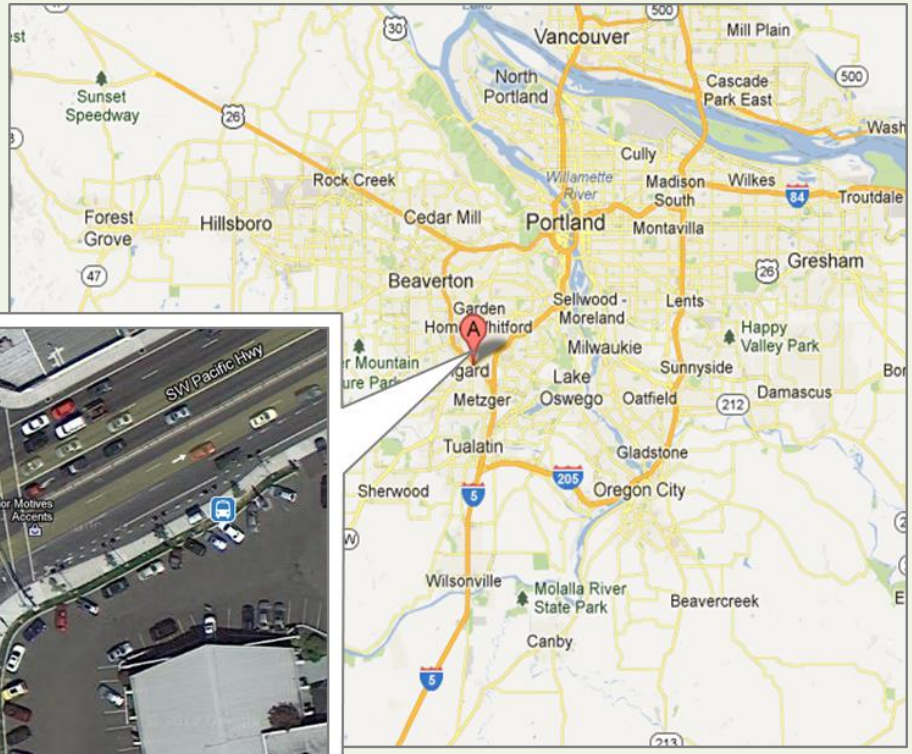
- Adequate volume of pedestrians and bicyclists
- On ODOT facilities
- 2070 signal controller
- Pedestrian push-button to request a pedestrian phase **(for counting pedestrians)**
- Bicycle lane inductive loops **(for counting bicycles)**
- Staff support/recommendation

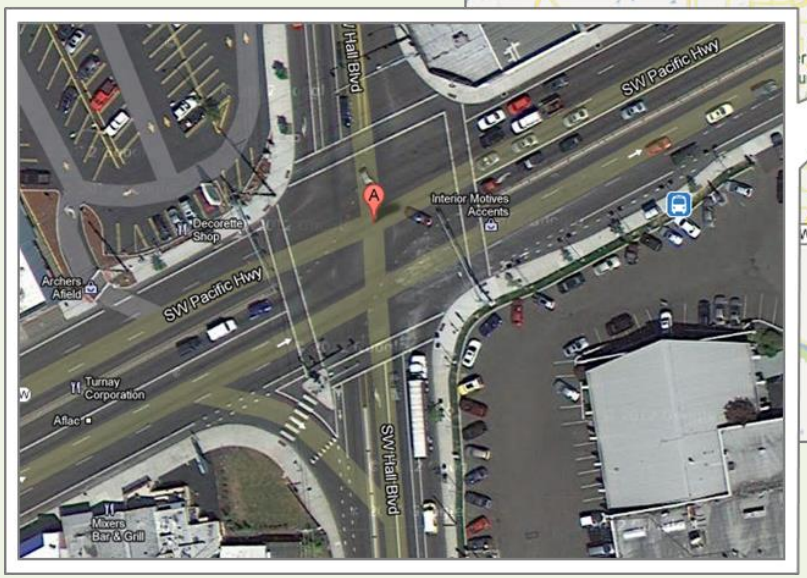
Pilot Study Site

OR-99W & Hall Boulevard, Tigard

99W AADT ≈ 41,000

Hall AADT ≈ 16,000





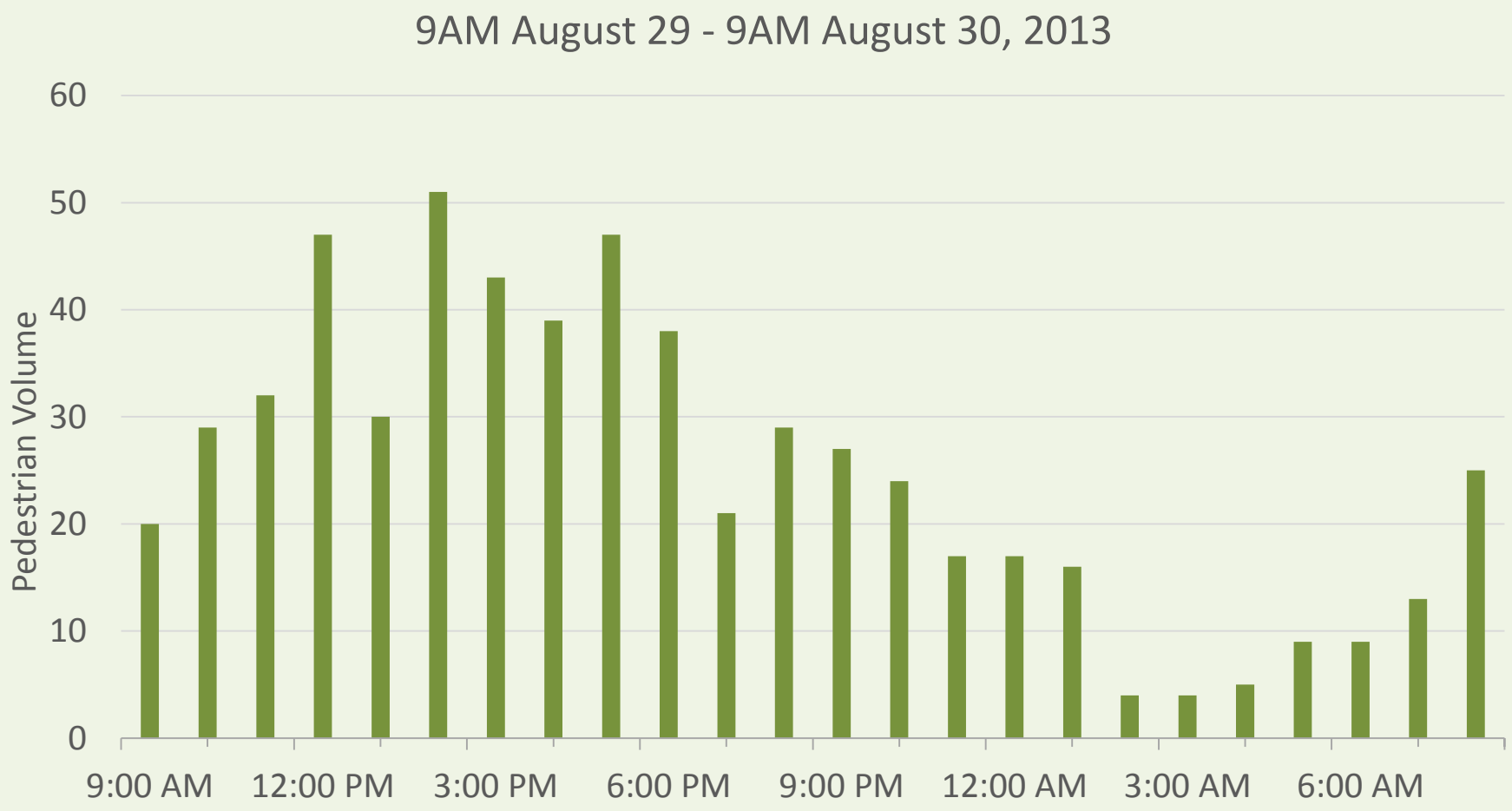
Pedestrian Data

Preliminary Site Prep

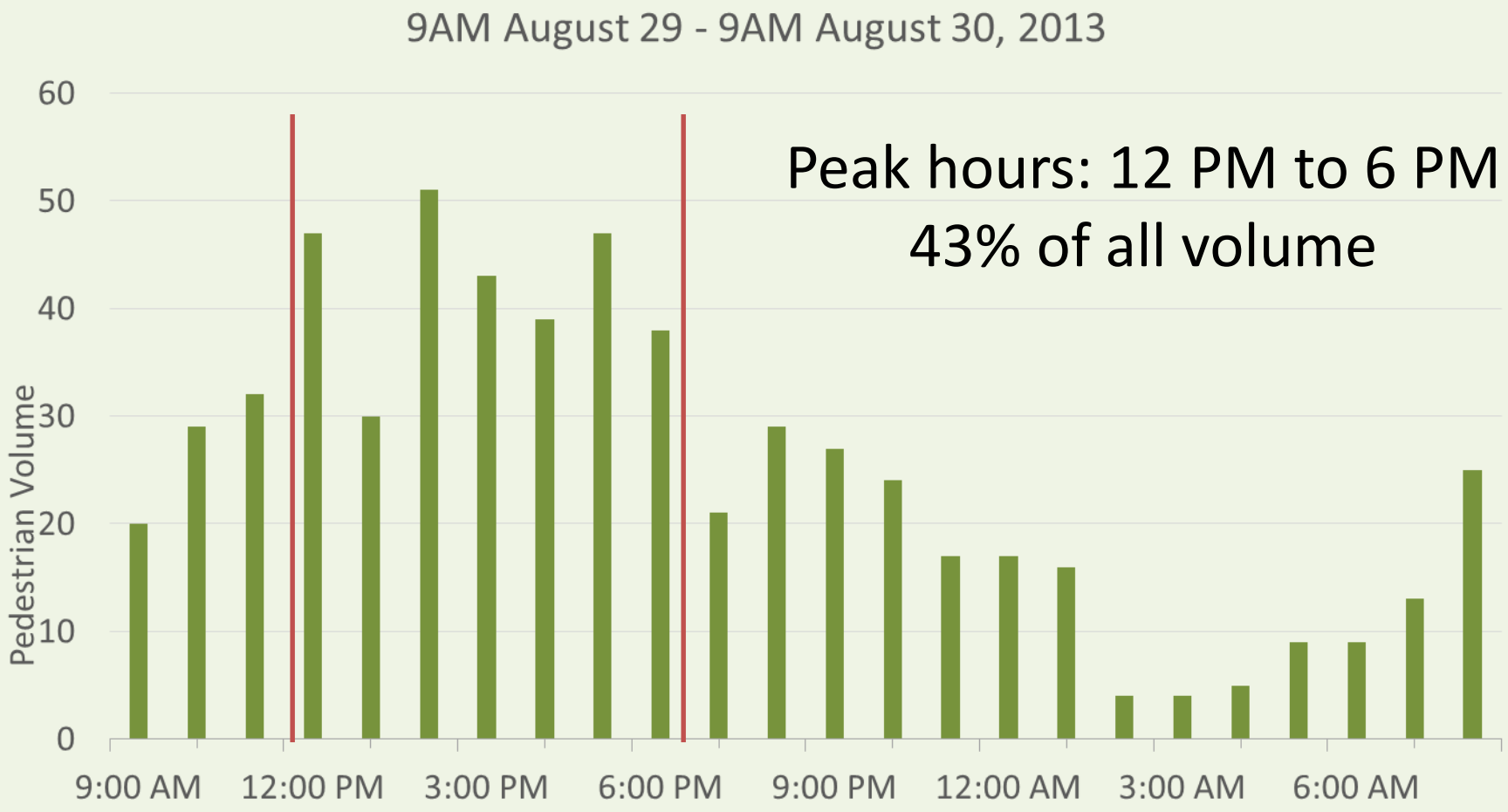
- PSU Data Collection

- Counting Cars Video Recorder
- 3 cameras
- 24 hours
- 8/29 9 AM – 8/30 9 AM, 2013

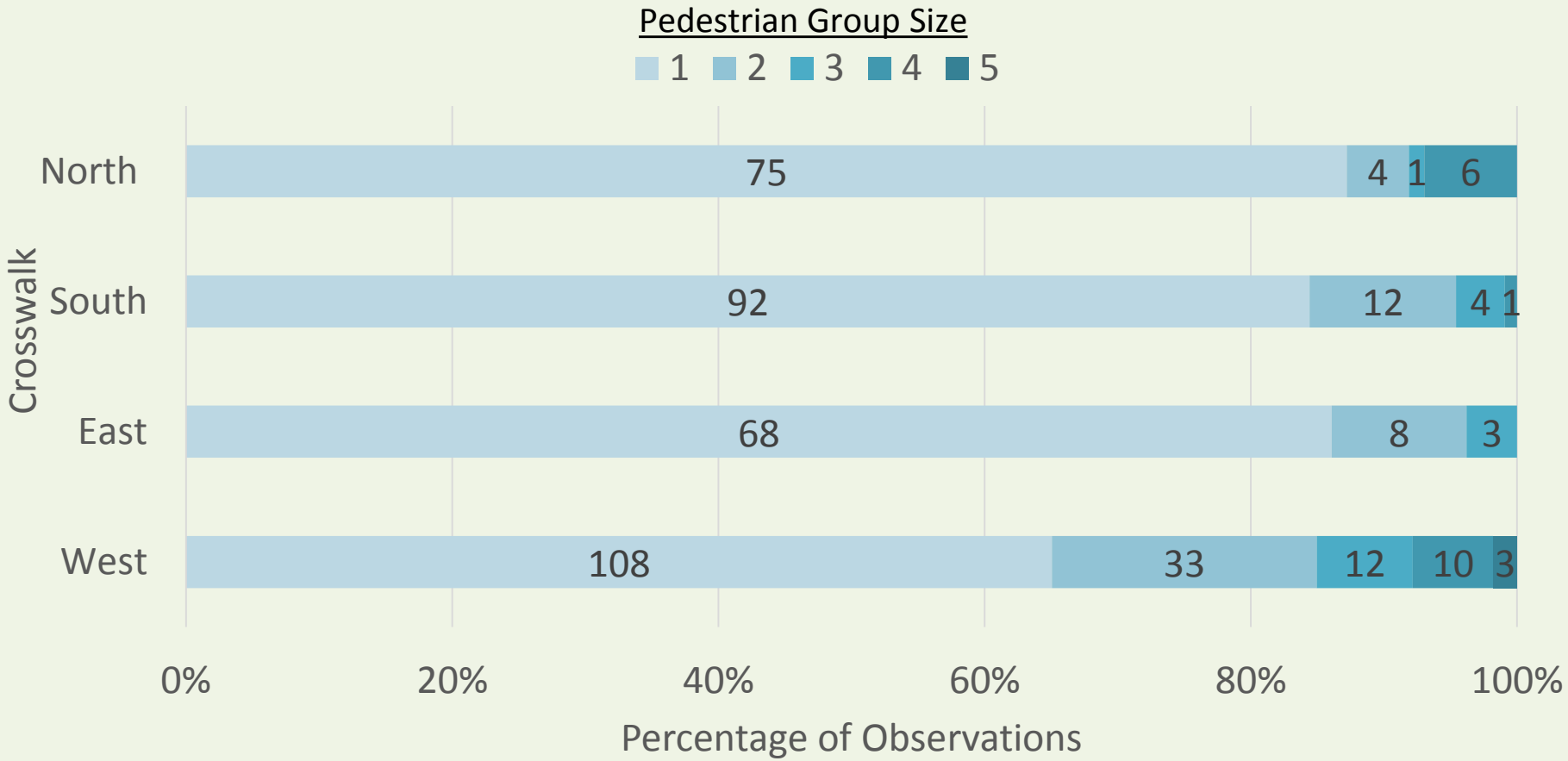
Pedestrian volumes – video counts



Pedestrian volumes – video counts



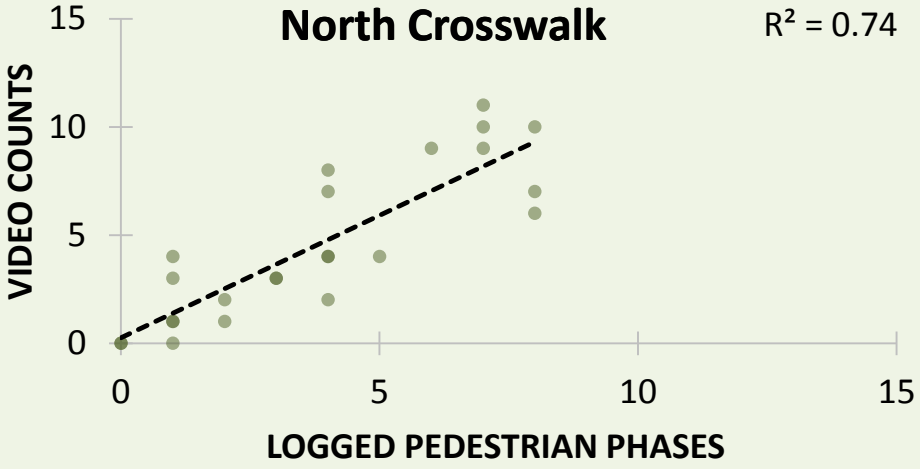
Pedestrian Activity by Crosswalk and Group Size

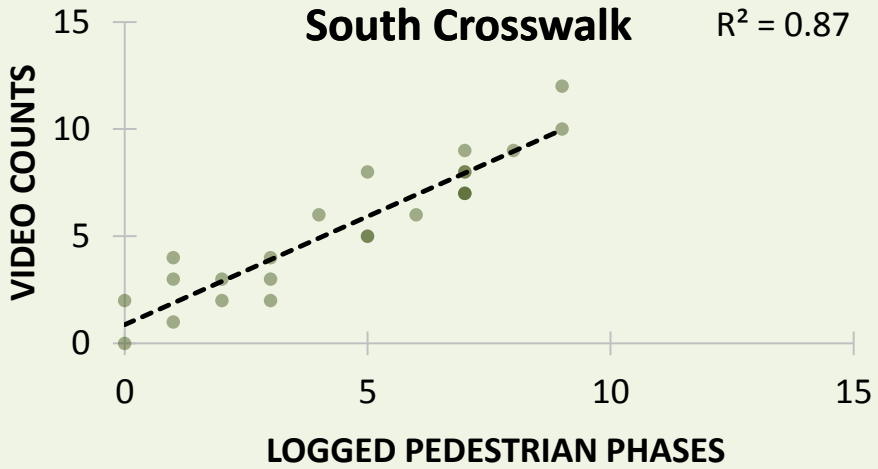


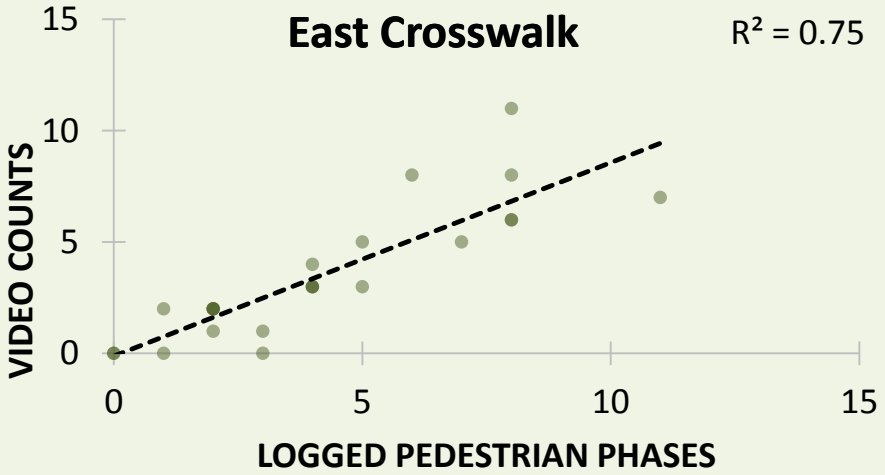
Total observations: 440 groups (1 or more per group)

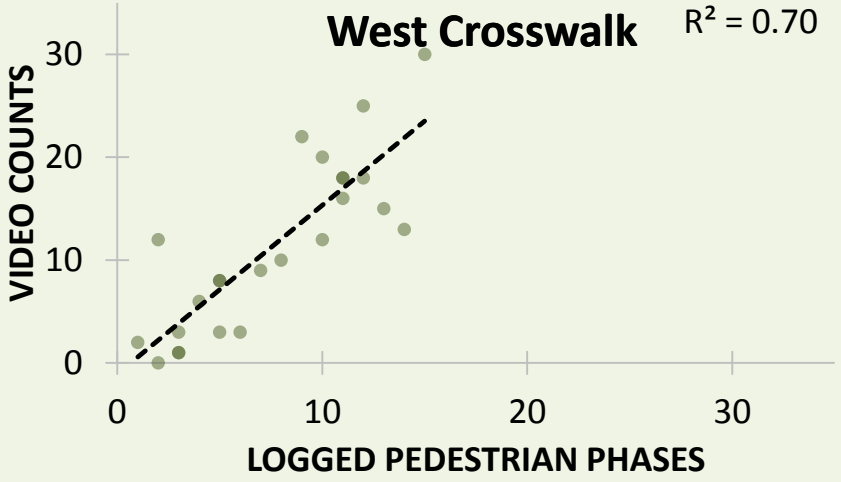
Total: 596 pedestrians

Actual vs. Logged Volumes by Crosswalk









Potential sources of error

- Pedestrian groups: phases vs. actual number of pedestrians
- Some pedestrians push buttons in both directions
  - Confusion/error
  - Pedestrians have a long wait time

Potential sources of error

- Some pedestrian phases are called by bicyclists (6%)
  - Bicycles on the sidewalk
  - Perceived safety
  - Confusion or lack of understanding
  - Long wait time

Overall Accuracy

- 482 pedestrian phases vs. 440 groups
  - 91% accuracy (for groups of pedestrians)
- 482 Pedestrian phases vs. 596 people using the intersection
  - 81% accuracy (for pedestrians)
  - Factor: 1.24 people per pedestrian phase
- Strong correlations (R^2>0.70) when broken down by crosswalk and hour

Overall Analysis: Pedestrians

- Importance of video analysis
  - Demographic info and bike/pedestrian behavior
- Counting pedestrian phases is a promising and cost-effective method for AADT estimation!
- …but it is necessary to increase the number of sites/analyses before generalizing results
  - Different sites, land use, traffic impacts, etc.

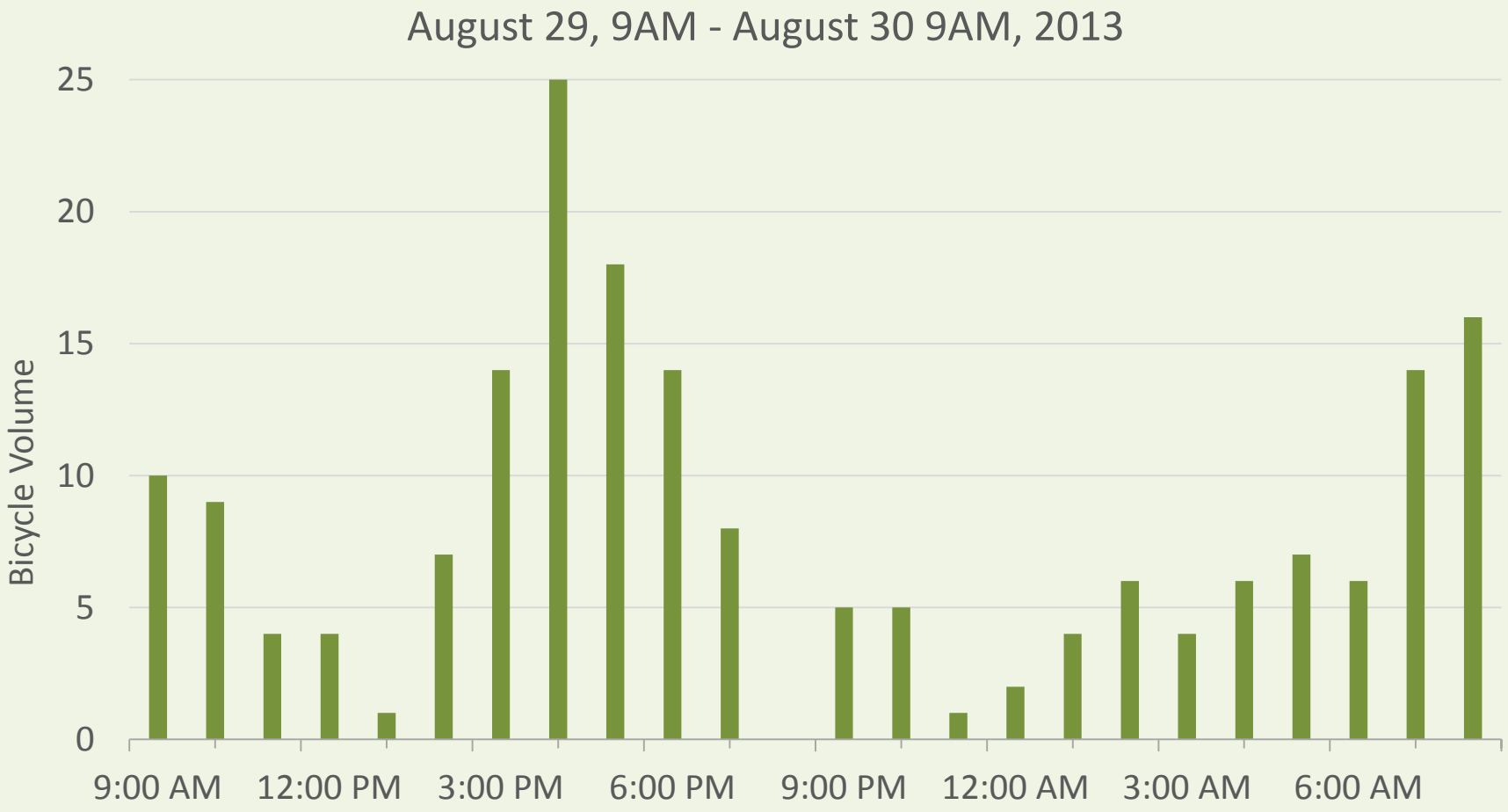
Bicycle Data

Preliminary Site Prep

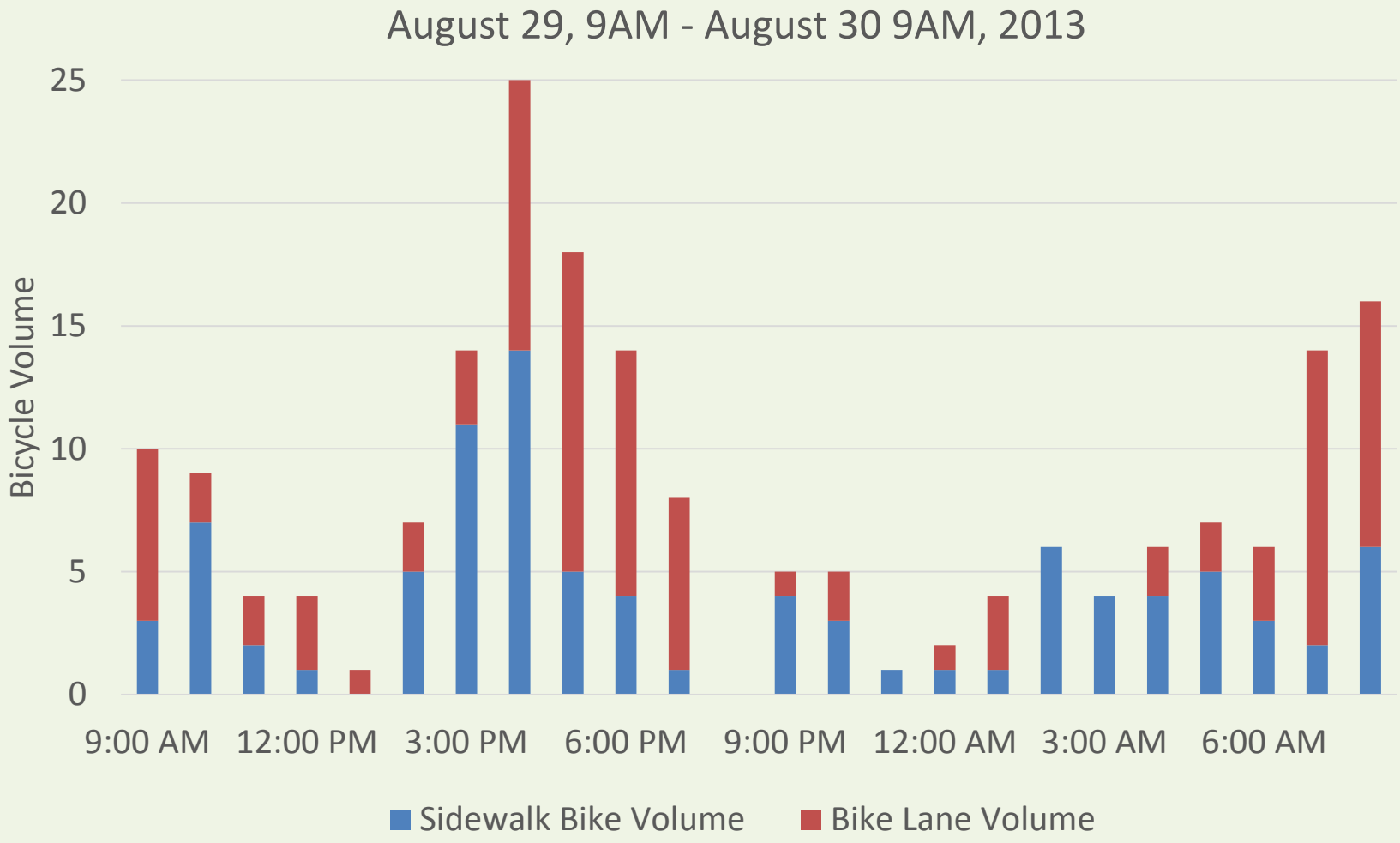
- PSU Data Collection

- Counting Cars Video Recorder
- 3 cameras
- 24 hours
- 8/29 9 AM – 8/30 9 AM, 2013

Bicycle Volumes: video data



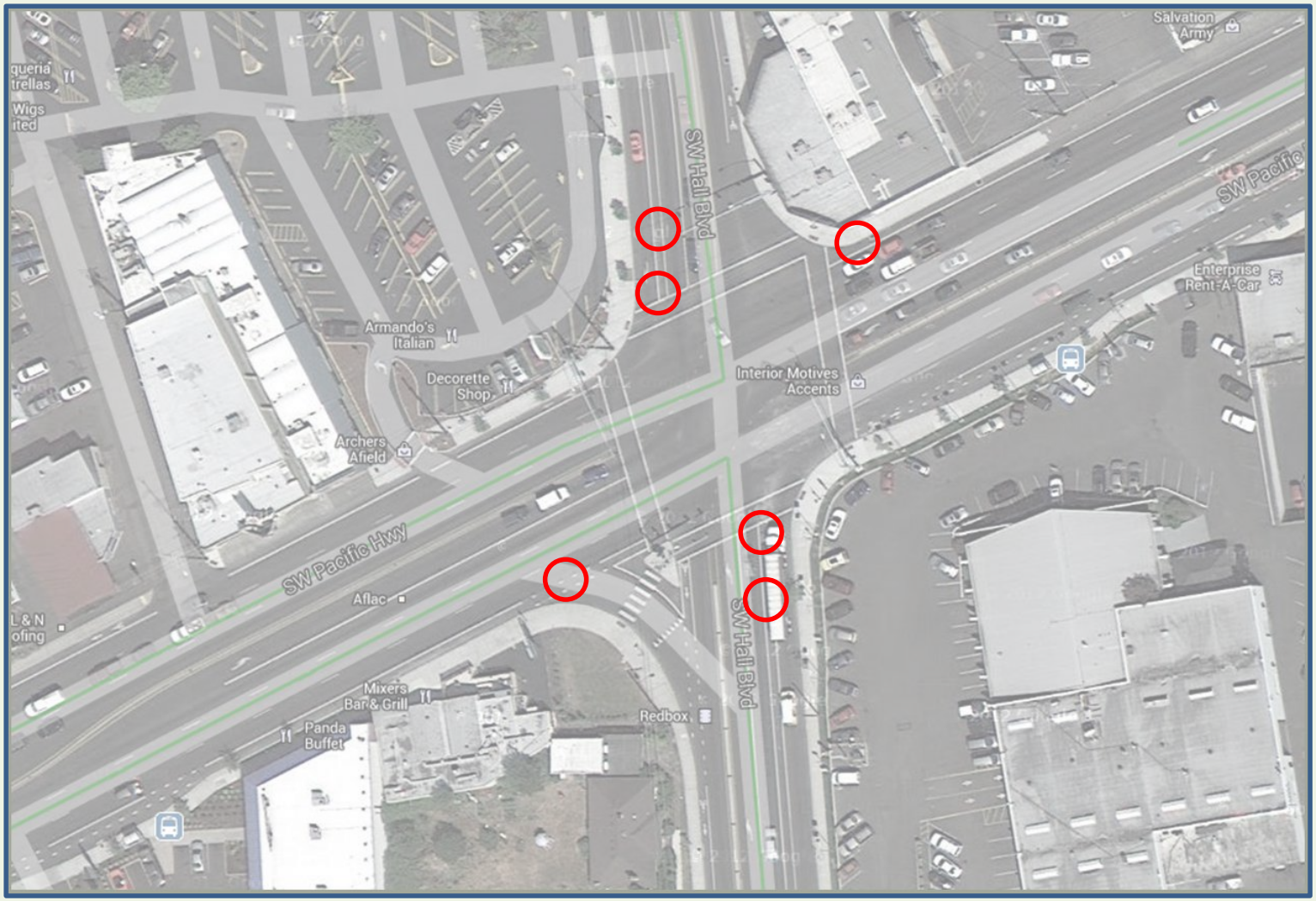
Bicycle Volumes: 51% in bike line



Video Data Summary

- Total bicycle volume: 190
- Bicycles in bike lane: 97 (51%)
- Bicyclists using pedestrian push buttons: 30 (16%)

Bike Loop Locations



Pilot Study

Southbound Hall Boulevard to Tigard Library

- Loop at stop bar
- Second loop approximately 50 feet from stop bar
- Loops in series, counted twice in 2070 data
- *Note worn bike lane stripe !!!*

Pilot Study

Eastbound- 99W to Portland

- Right turn pocket
- Single Loop before turn pocket

Loop Accuracy: Overcounting

$$\% \text{ Error} = \frac{\#loop - \#video}{\#video}$$

NB to Beaverton :	1474 %
SB to Tigard:	1169 %
EB to Portland:	5413 %
WB to Sherwood:	2180 %

Eastbound- 99W to Portland

Analysis- Bicycle Loops

- Getting the right inductive loop sensitivity is important to obtain accurate counts
- Sensitivity was subsequently lowered: only switches 2 and 8 set to ON (1 and 4 off)
- We recorded another 24 hour video session from 9 AM 10/24 to 9 AM 10/25

Loop Accuracy

$$\% \text{ Error} = \frac{\#loop - \#video}{\#video}$$

Sensitivity Change:	Before	After
NB to Beaverton :	1474 %	7 % *
SB to Tigard:	1169 %	89% *
EB to Portland:	5413 %	2430 %
WB to Sherwood:	2180 %	61 %

Accuracy did improve, but there may be a **high correlation between vehicle traffic and bicycle detections** – especially with high right turning volumes

* Based on 32 and 66 detections (see previous slide, the sum of two loops), the actual number of vehicles or bicycles that were detected at each bicycle loop on Hall is not known

Summary: Bicycle Loops

- Optimizing sensitivity is important to obtain accurate counts. Testing is **necessary.**
- The location of loops in relation to right turn movements is very important (EB to Portland very inaccurate)
- Right turn volume higher for Hall NB approach (less accuracy in counting bikes than Hall SB approach)
- Loops wired in series added difficulties in determining whether a bicycle was detected

Overall Analysis: Bicycles

- Importance of **video analysis**
  - Demographic/purpose info and bicycle behavior
- Overall **low accuracy** in this study
  - Test other loop configurations
  - Analyze other intersections with better loop location

Overall Conclusions

- Promising results: pedestrian counts utilizing pedestrian phases and simple factors
- Not so good: counting bicycles utilizing inductive loops (many problems as explained)
- Many more pedestrians than expected!
- More research is needed to generalize the results
  - Another ODOT sponsored project is underway

Acknowledgements

- Technical Advisory Committee
- Tiffany Slauter, ODOT Region 1 Signal Manager
- ODOT TMS
  - Don Crownover
  - Steve Chance, ODOT Traffic Data Analyst
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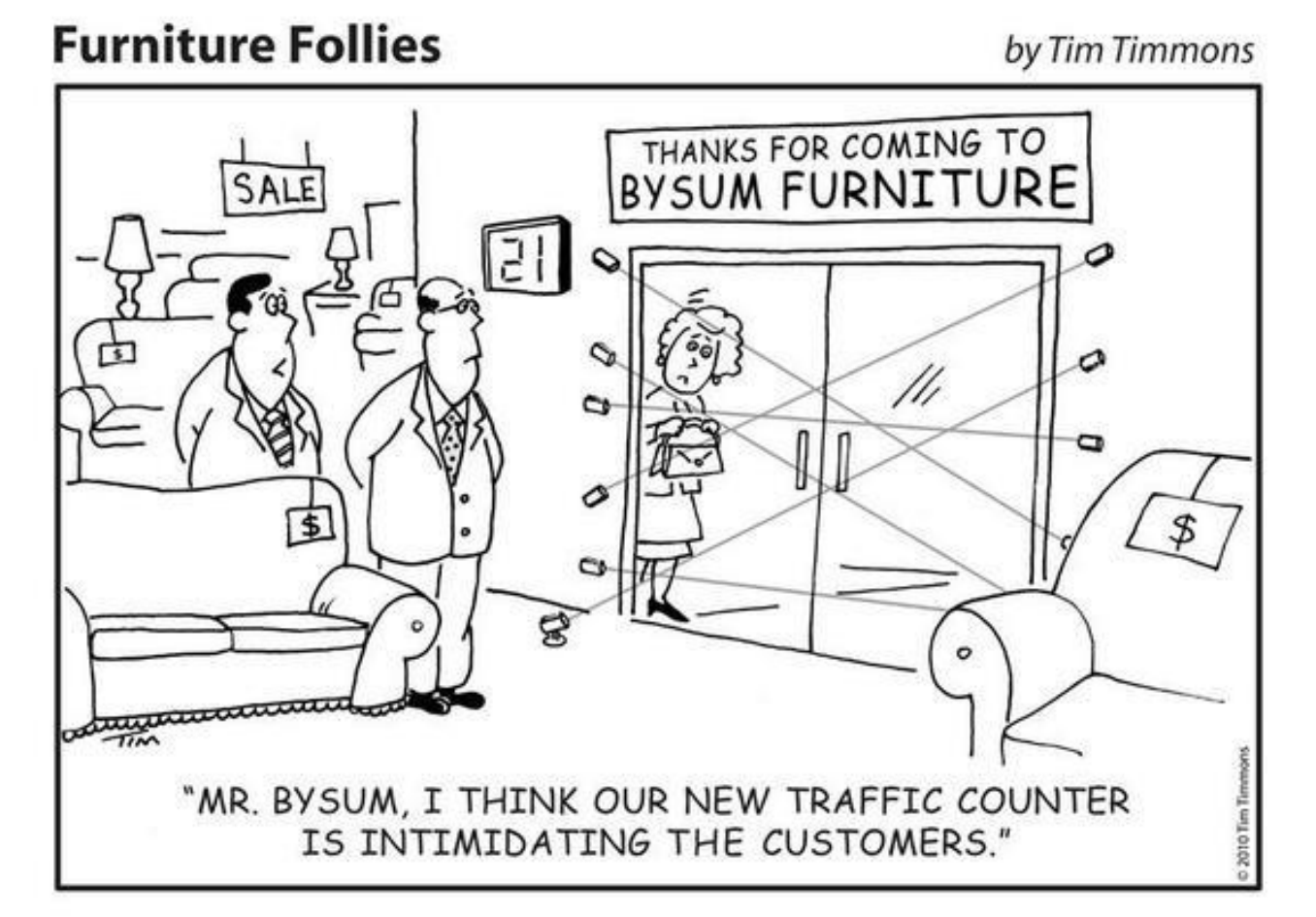
  - Sam Thompson
  - Adam Moore
- Bruce Moody : video documenting and interviewing

Questions?



https://pbs.twimg.com/media/BVGwDQLCEAAASMl.jpg

Pilot Study Land Use

Pilot Study

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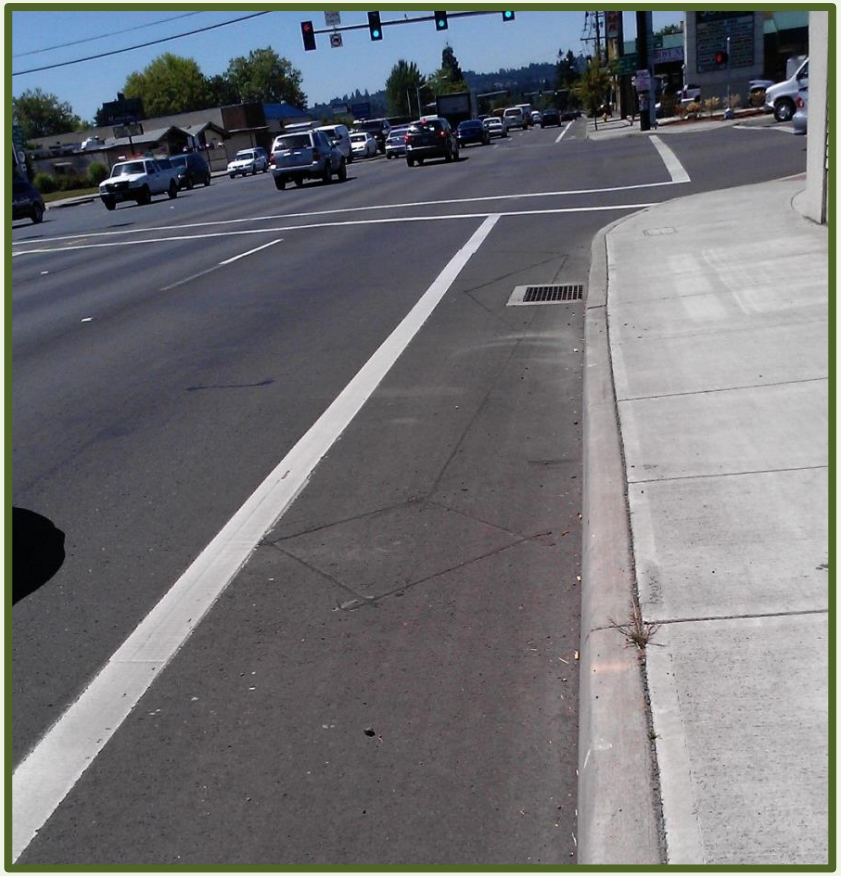
Pilot Study

Westbound - 99W to Sherwood



- Single Bicycle Loop

Loop Accuracy

10 hours with highest volumes:
6 AM to 11 AM and 2 PM to 7 PM

	Video Counts	Loop Detections
NB to Beaverton :	30	32*
SB to Tigard:	35	66*
EB to Portland:	10	253
WB to Sherwood:	28	45

*32 and 66 are the sum of two loops; the actual number of vehicles or bicycles that were detected at each loop on Hall is not known

Acknowledgements

Technical Advisory Committee

- Lyn Cornell, ODOT Research Coordinator
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