

# Bicycle Facility Types

*Some Best Practices and Innovative Solutions*

Patrick McMahon, AICP  
[patrick@mcmahon.com](mailto:patrick@mcmahon.com)  
410-599-5123

October 9, 2009



# Acknowledgements

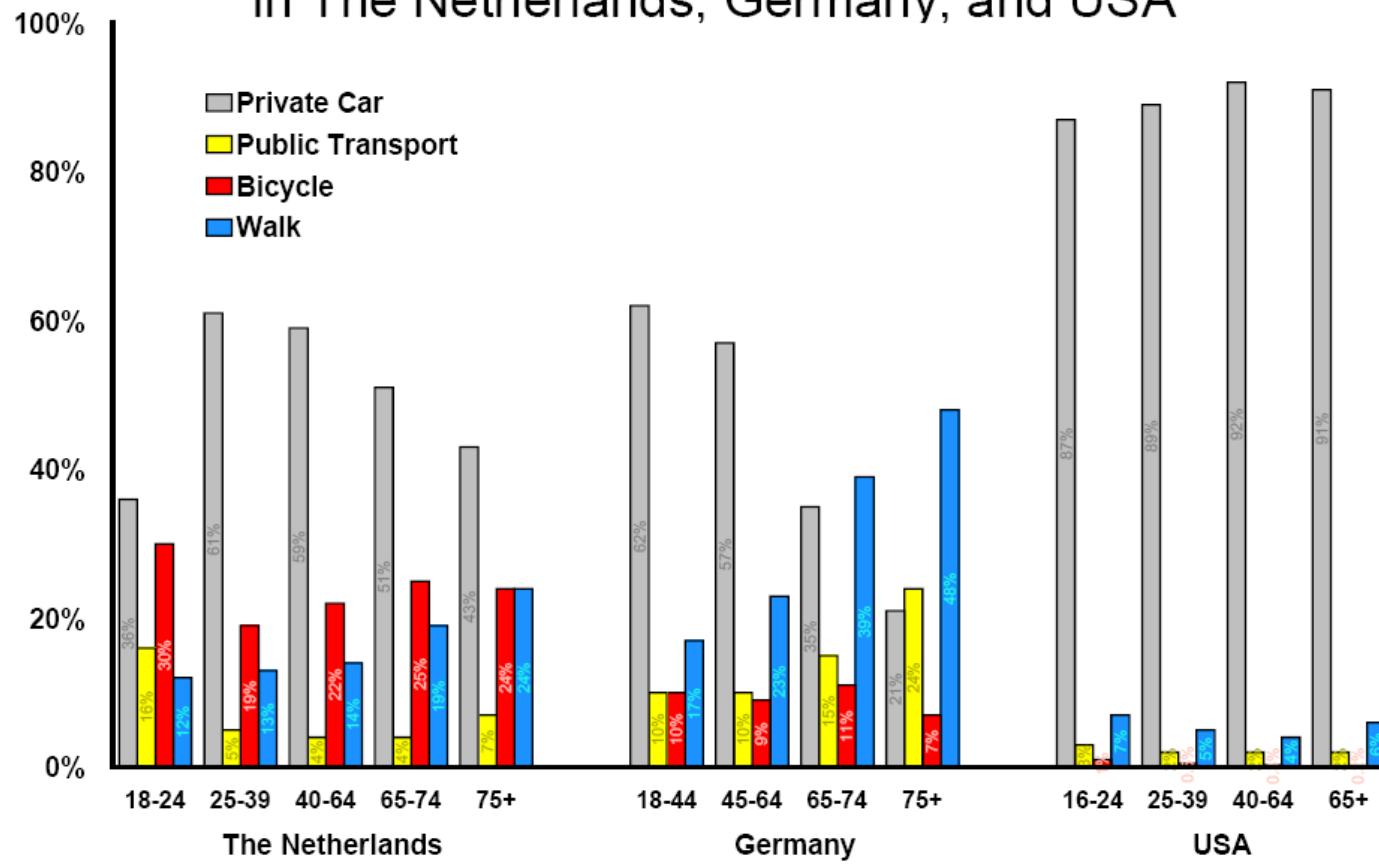
- Much of the content in this presentation was developed by Peter Koonce and Jamie Parks of Kittelson & Associates, with content added and revised by Patrick McMahon (formerly of Kittelson & Associates).



# Mode Share Comparison

## Mode Split by Age Group

In The Netherlands, Germany, and USA



Source: J. Pucher & L. Dijkstra, "Making Walking and Cycling Safer: Lessons from Europe," Transportation Quarterly, Vol. 54, No. 3, Summer 2000

# Introduction

- › Over 60% of urban and suburban trips are < 5 miles (2001 NHTS)
  - *< 30 minutes by bike*
  - *High potential for bike trips, even without shifts in travel patterns*
- › Design also matters



# Types of Cyclists

- › Research in Portland indicates that:
  - *Less than 1% will ride regardless of facilities*
  - *More than 60% are interested in biking, but don't*
- › Accommodating the 60% means more and better facilities

Strong &  
Fearless



Interested but  
Concerned

No Way, No How

Enthused &  
Confident

Source: Roger Geller, City of Portland

# Bicycle Facility Types

- › Off-street Trails
- › Shared Streets
- › Bike Lanes
- › Sidepaths
- › Cycle Tracks
- › Bicycle Boulevards
- › Sharrows
- › Floating Bike Lanes

# Bicycle Facility Types – Off-Street Trails

- › Popular for cyclists and pedestrians
- › Not possible everywhere
  - *Hard to find \$\$*
  - *Hard to find space*
- › Waterways and rail lines provide opportunities



# Off-Street Trails

- › Issues

- *ROW*
  - *Cost*
  - *Difficult to serve most destinations*



# Off-Street Trails

- Crossing major roads is a major issue
- At-grade or grade-separated
  - *Cost*
  - *Safety*
- Good design = expensive?



# On-Road Facilities

- › Whereas,
  - *Off-street paths will never go everywhere*
  - *We can't maintain the public ROW we already have*
- › Therefore,
  - *Strategies to accommodate bikes on existing public ROW are needed*

# Bicycle Facility Types – Shared Streets

- › Most streets can be shared by bikes and cars
- › < 3,000 ADT



# Bicycle Facility Types – Bike Lanes

- › Travel lane on roadway dedicated to bicycles
- › Used on higher-volume roadways where shared lanes are not possible



# Bike lane considerations

- › Width (on/off-street)
- › Interaction with right turning vehicles
- › Restriping 4- to 3-lanes
- › Transition through the intersection
  - *Skip lanes*
  - *Colored bike lanes*
- › Bike lanes for left turning traffic

# Bike Lanes

- › Some are more bike-friendly



# Bike Lanes

- › Some are shared with buses



# Bike Lanes

- › Others are less bike-friendly



- › Context is everything

# On-street left side (one-way)

- › One-way streets afford the opportunity to provide left side bicycle lanes
- › Uncommon treatment, but effective especially with bus operations on right hand side



# Contraflow lane application

- › Seldom used vehicle approach
- › Narrow lanes
- › Important bicycle connection to cross busy arterial



# Contraflow lane application



# Bicycle Facility Types - Sidepaths

- › Separated two-way facilities paralleling roadways
- › Violate driver expectancy at intersections
  - *Often have high crash rates*



# Sidepaths - Considerations

- › High-experienced crash rates at intersections
- › Key Questions:
  - *Frequency of driveways*
  - *Cyclist volumes*
  - *Traffic volumes*



# Bicycle Facility Types – Cycle Tracks

- › Best of bike lanes and sidepaths?
  - *Geometry similar to bike lanes*
  - *Separated from road by curb and/or pavement treatments*
- › Common in Northern European countries



# Cycle Tracks

- › Characteristics
  - *One-way*
  - *Separated from auto traffic*
  
- › Issues
  - *On-street parking*
  - *Pedestrians*
  - *Right-turns*



# Cycle Tracks

## › Characteristics

- *One-way*
- *Separated from auto traffic*

## › Issues

- *On-street parking*
- *Pedestrians*
- *Right-turns*



# Cycle Tracks

- › Characteristics
  - *One-way*
  - *Separated from auto traffic*
  
- › Issues
  - *On-street parking*
  - *Pedestrians*
  - *Right-turns*



# Cycle Tracks - Results

- › 2007 Copenhagen cycle track study:
  - *Lower perceived risk*
  - *Higher intersection crash rate*
  - *Lower segment crash rate*
  - *Increased bicycle volumes*

*Jensen, S., C. Rosenkilde, and N. Jensen, “Road Safety and Perceived Risk of Cycle Facilities in Copenhagen”, 2007.*

# Cycle Tracks - Issues for American context

- › Cyclist volumes
  - *Driver expectations*
- › Access management
  - *Too many driveways?*



# Bicycle Facility Types – Bike Boulevards

- › Low-volume streets with bike-friendly treatments
  - *Traffic calming*
  - *Few stop signs*
  - *Good wayfinding*
  - *Connections to major destinations*



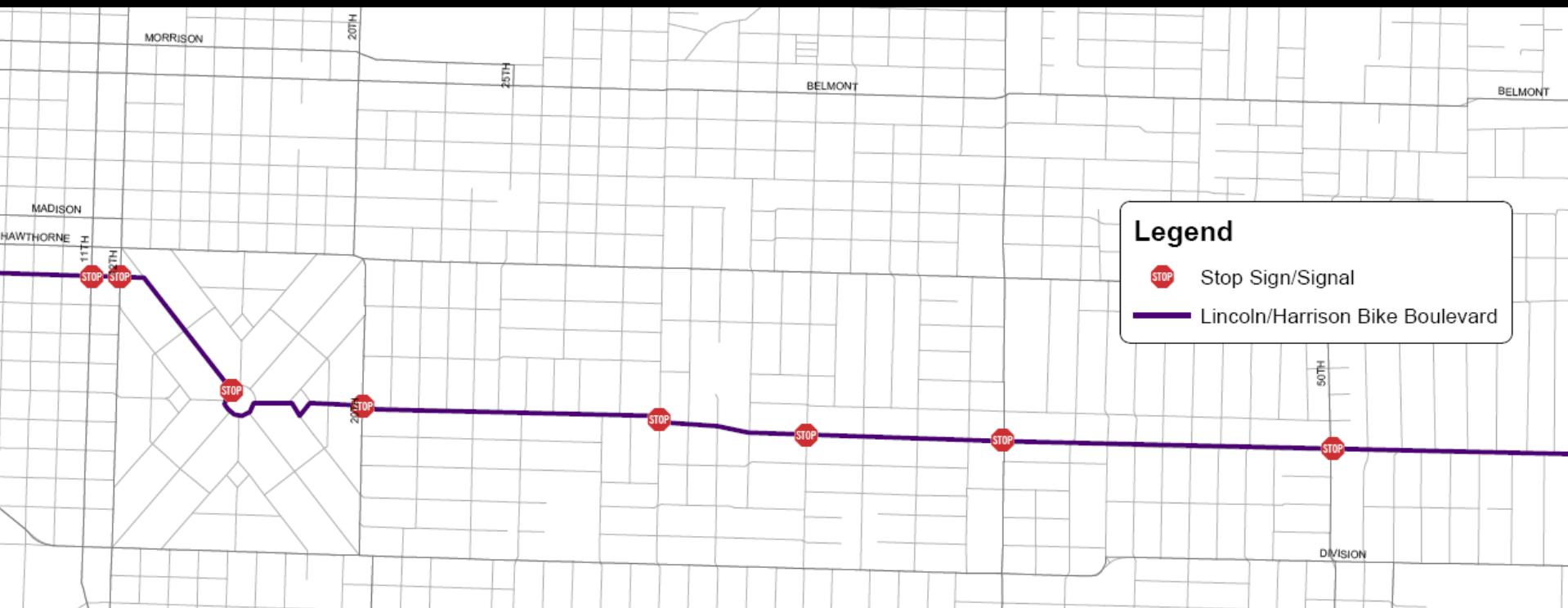
# Bike Boulevards

- › Popular among cyclists of all skill levels
- › Not a substitute for accommodating bikes on major roads



# Bicycle Boulevards – Stop Signs

- › Favor bike boulevard to extent possible
- › Minimize cyclist stops



# Bicycle Boulevards - Diverters

- › Encourage through bicycle trips
- › Reduce cut-through auto-trips



# Bicycle Boulevards - Wayfinding

- › Signing and striping needs to include bicycles
- › Especially important on local street routes that are not intuitive



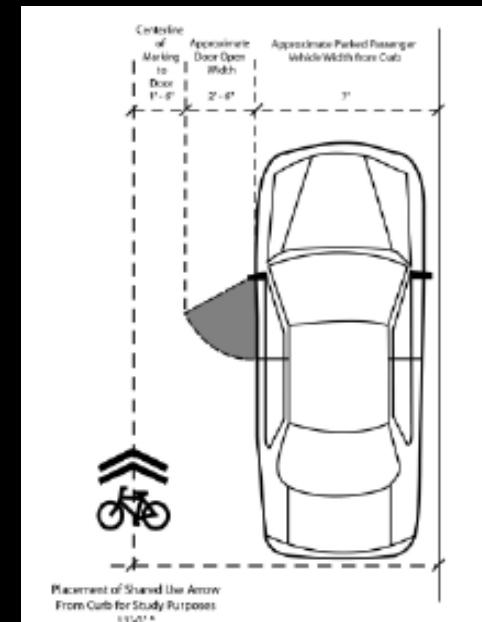
# Bicycle Design – Pavement Markings

- › Wayfinding - “Bike Dots”



# Shared-lane Markings

- › Also known as “sharrows”
- › Recommended in 2009 MUTCD
  - *Allowed on streets with and without on-street parking*
  - *Posted speed ≤ than 35mph*



# Shared-lane Markings

- Research conducted in San Francisco in 2004
- Several benefits to sharrows
  - *Motorist positioning: more separation while passing bikes*
  - *Cyclist positioning: ride outside the door zone*
  - *Better cyclist behavior: less sidewalk and wrong-way riding*
  - *Increased cyclist comfort*

Behaviors	Before	After	
	(No marking) sample size=1156	Bike-in-House sample size=570	Bike-and-Chevron sample size=794
Sidewalk riders	6.5%	4.9%	4.2%
Wrong-way riders	3.0%	3.3%	0.60%
Hostile behaviors	0.15%	0.17%	0.12%
Distance of cyclists to parked cars	3'-4"	4'-0"	4'-0"
Distance of cyclists to cars in travel lanes	2'-7" sample size=150	4'-7" sample size=50	4'-10" sample size=150
Distance of cars in travel lane to parked cars (no bike present)	4'-8"	5'-8"	5'-6"
Significant differences are indicated in <b>boldface</b> .			

San Francisco's Shared-Lane Pavement Markings: Improving Bicycle Safety, San Francisco Dept. of Parking and Traffic, 2004.

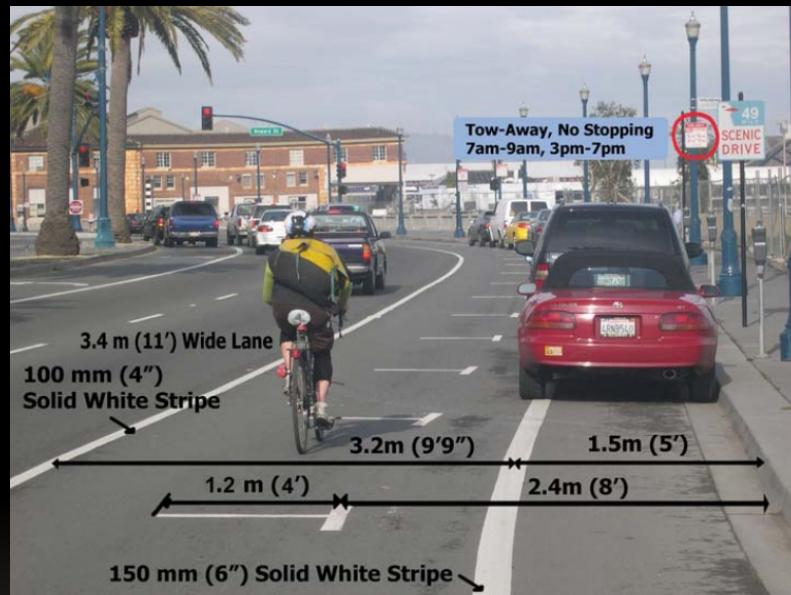
# Shared-lane Markings

- › Need to be properly installed
  - *11' from the curb when adjacent to on-street parking*



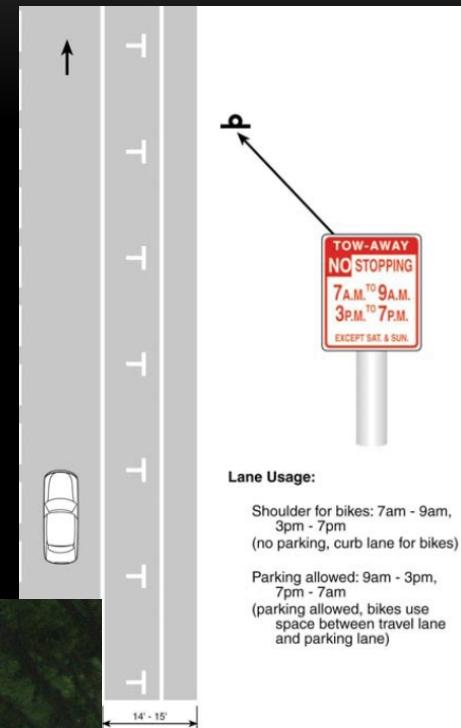
# Floating Bike Lanes

- › For streets with peak hour parking restrictions
  - *Parking restrictions are common in Baltimore*
  - *Facility type developed in San Francisco*
  - *Bike lane shifts based on time of day*
  - *Partially implemented on 33<sup>rd</sup> Street in Baltimore*

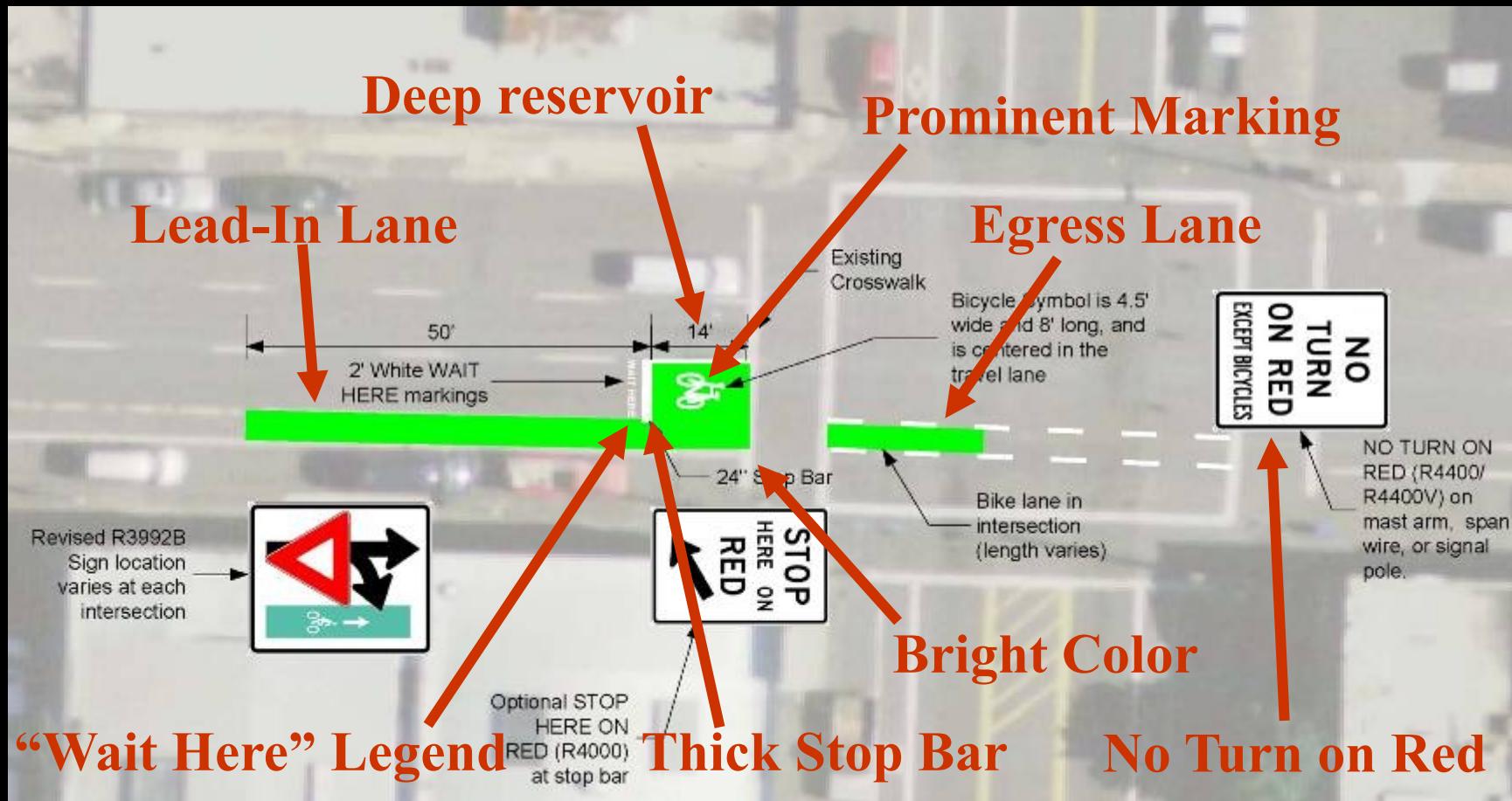


# Floating Bike Lanes

- › For streets with peak hour parking restrictions
  - *Common in Baltimore*
  - *Facility type developed in San Francisco*
  - *Partially implemented on 33<sup>rd</sup> Street*
  - *Bike lane shifts based on time of day*



# Bike Box Design Elements



Source: City of Portland

# Bike Box

- › Eliminates potential for right hook crashes
- › Provides opportunity for bicycle storage in advance of vehicles



# Exclusive right turn lane design

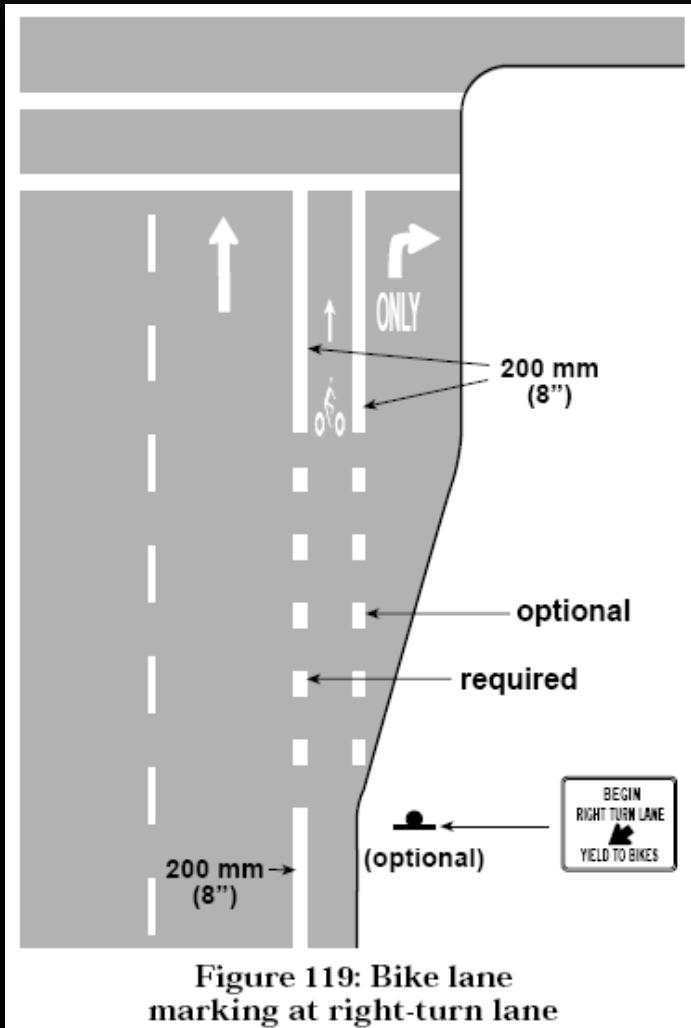


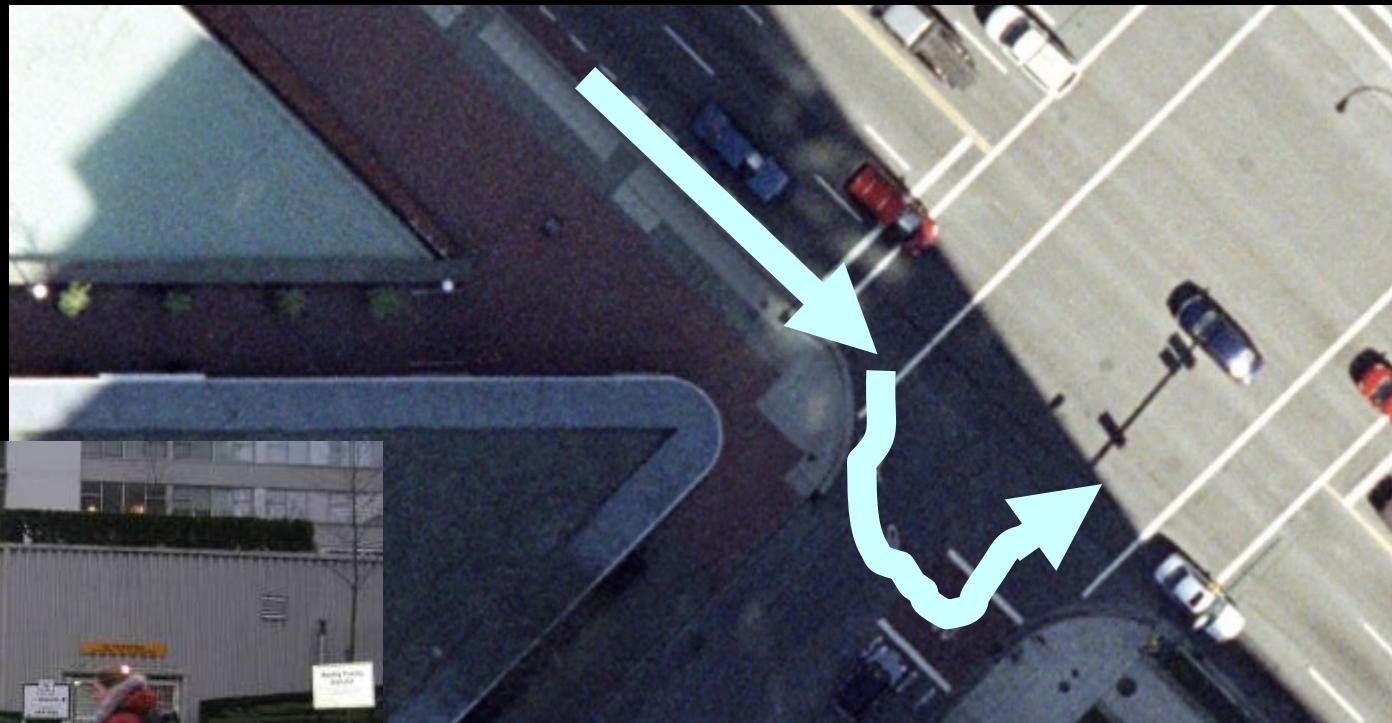
Figure 119: Bike lane marking at right-turn lane

Source: Oregon Bicycle & Pedestrian Plan, 1995

[http://www.oregon.gov/ODOT/HWY/BIKEPED/docs/or\\_bicycle\\_ped\\_plan.pdf](http://www.oregon.gov/ODOT/HWY/BIKEPED/docs/or_bicycle_ped_plan.pdf)

# Bicycle Design - Left-Turns

- » Enhanced 2-stage left-turn



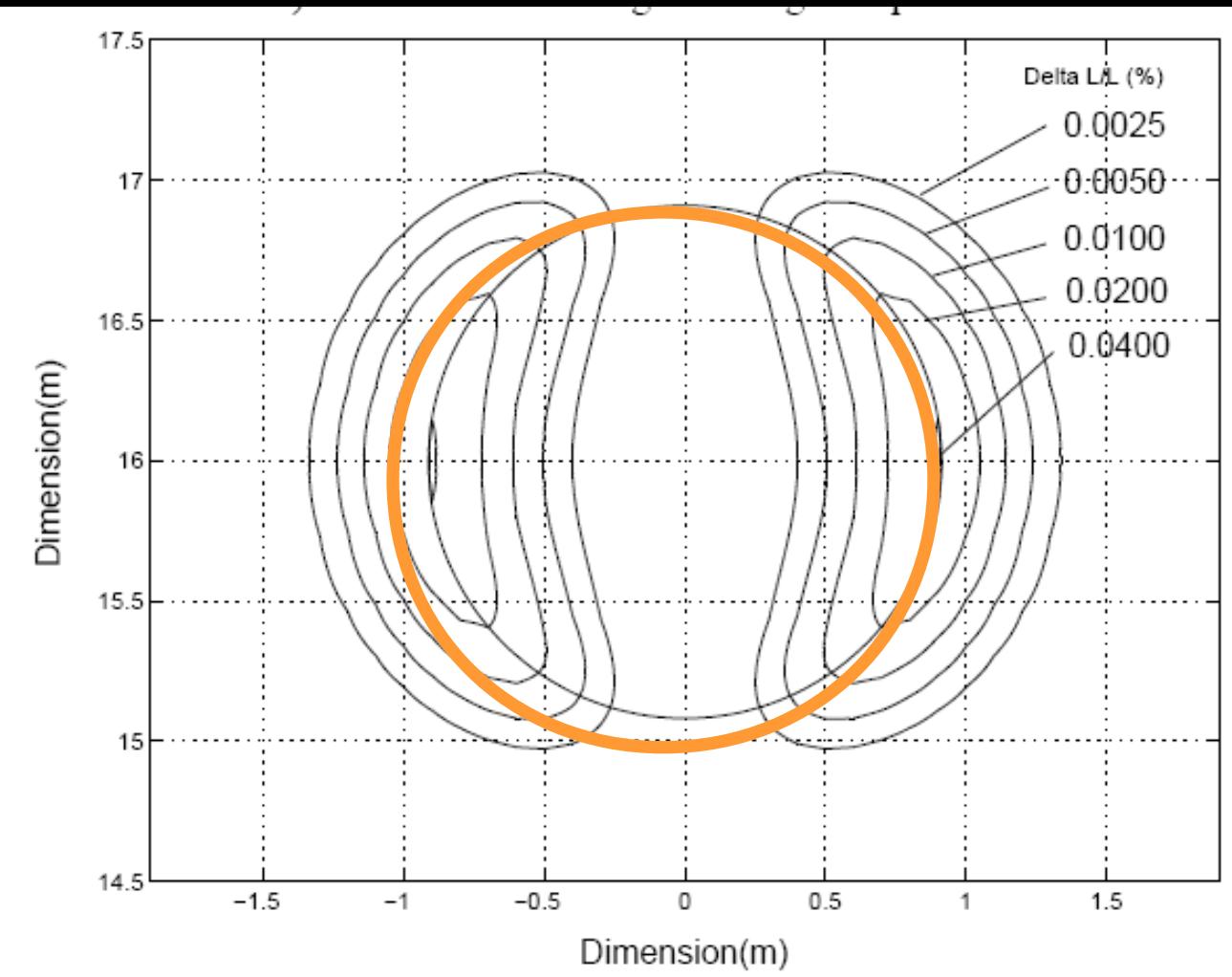
# Bicycle Detection Stencil

- Demonstrates where bicyclist should place bicycle
- Due to magnetic field symmetry, this is the most sensitive location for detection
- Detection has sensitivity settings that need to be adjusted over time



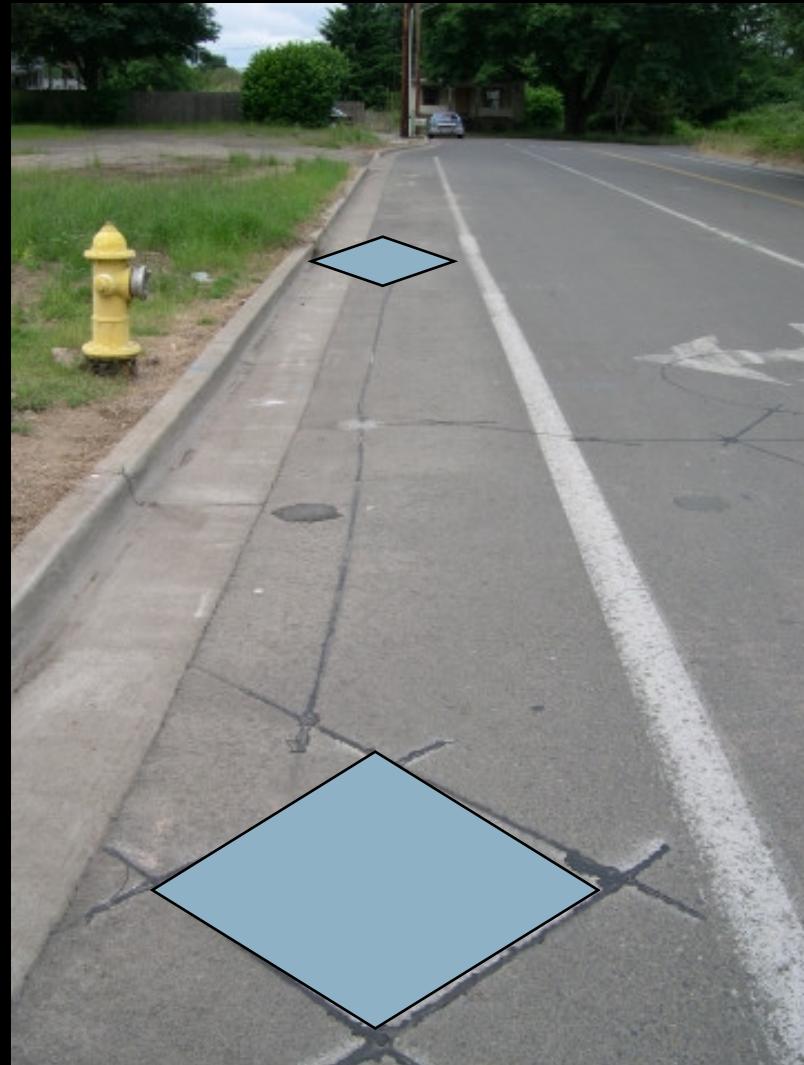
# Sensitivity of the Detector Research by Purdue University

Design Considerations for Detecting



# Bicycle Lane Detection

- › Advance detection for the cyclists consists of two inductive loops



# How to Use the New Bicycle Signal

## 1 TO GET A GREEN LIGHT

Place your bicycle on the marking on the sidewalk,  
with your wheels directly on the lines.



## 2 When the bicycle signal light is green...

bike signal

cyclists can cross the  
intersection at their own speed.



you are  
first

and then



City of Portland  
Transportation Division  
Portland Bureau of Transportation  
Portland City Council  
Portland Mayor  
Portland's bicycle master implementation  
plan

# Bicycle Only Signals

- › Exclusive movement either at an intersection or to cross at an intersection



# On-Street Bike Parking

- › Charles Village Bike Parking
  - *Only moderate usage at most times*
  - *Folks like to be able to see their bikes, still spreading parking around*
  - *Revision will probably have two smaller sites in the same block*





Nate Evans  
Bike & Pedestrian Planner  
Baltimore City Department of Transportation  
417 E. Fayette St, Room 555  
Baltimore, MD 21202  
443-984-4094  
[nate.evans@baltimorecity.gov](mailto:nate.evans@baltimorecity.gov)  
<http://www.baltimorecity.gov/bike/>

# Bike to the Future

- › 200 more racks December 2009
- › 100 miles of bike lanes January 2010
- › 2% cycle commuting 2010
- › Jones Falls Trail (Phase 2) completed 2010



# Transporting Cargo & Kids



# Cargo Bike Types – Long Tails



Rwanda Bike



Madsen



Xtracycle Radish



Yuba Mundo



PackMax Duo

# Cargo Bike Types – Box Bikes



# Cargo Bike Types – Long John or Other

