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V2X Bicycle and Pedestrian Detection

ITS Wisconsin Annual Conference
October 23, 2018



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Denver, CO



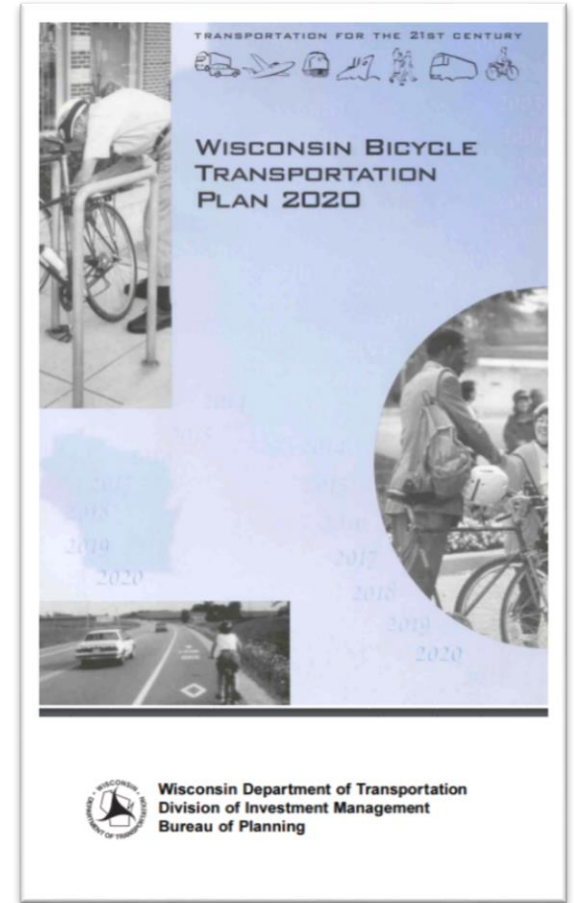
Wisconsin is focused on improving safety for bikes and pedestrians!

WisDOT Funded
Bike/Ped Projects
1993 – 2014
~700 projects
\$283M

WisDOT
2018 – 2022
TAP Awards
29 Projects
\$15.7M

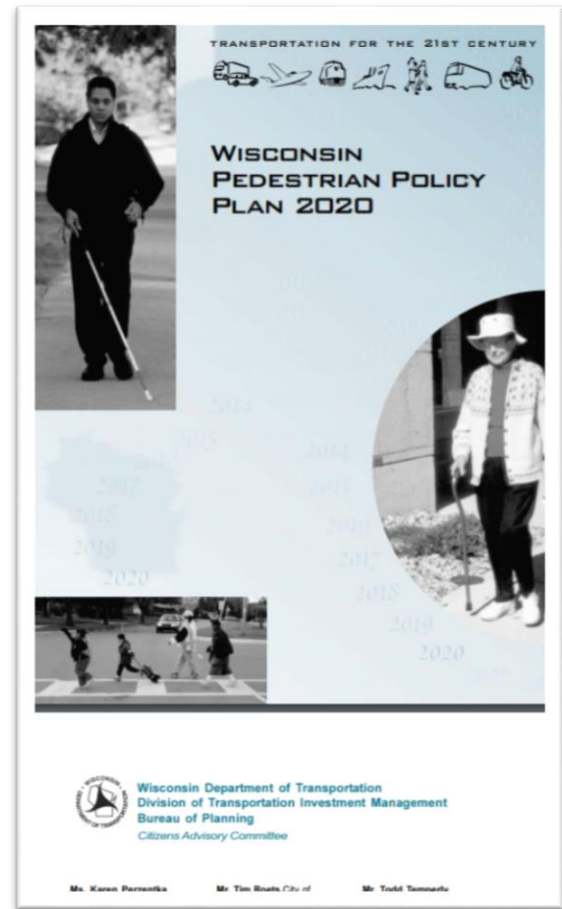
1998 WI Bicycle Transportation Plan

- **Increase levels of bicycling throughout Wisconsin**, doubling the number of trips made by bicycles by the year 2010 (with additional increases achieved by 2020)
- **Reduce crashes involving bicyclists** and motor vehicles by at least 10% by the year 2010 (with additional increases achieved by 2020).



1999 Wisconsin Pedestrian Policy Plan

- **Increase the number** and improve the quality of walking in Wisconsin.
- **Reduce the number of pedestrian crashes and fatalities.**
- **Increase the availability of pedestrian planning and design guidance** and other general information for state and local officials and citizens.



The trends are going in the right direction!

Figure 1. Wisconsin Fatal & Severe Pedestrian Crash Rates, 2004 to 2013

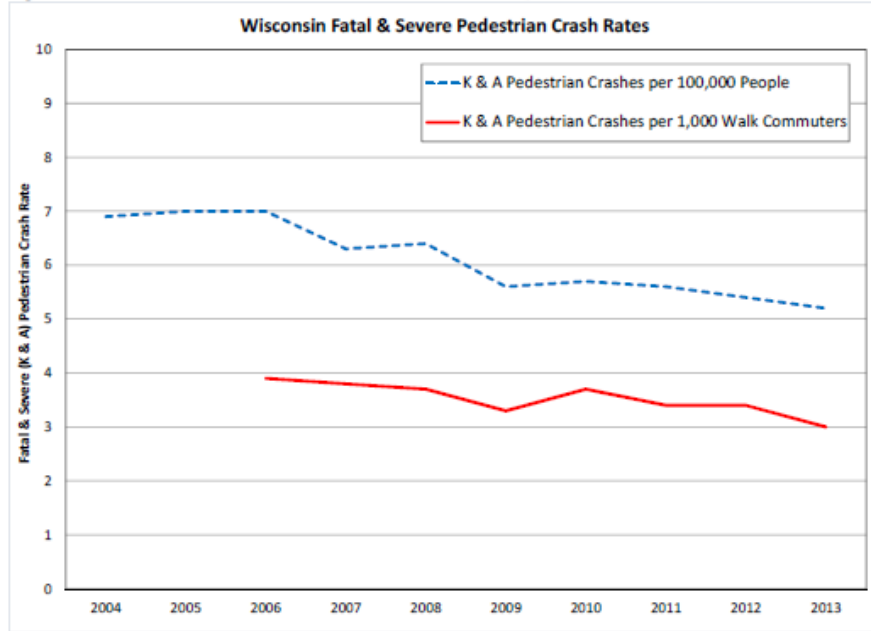
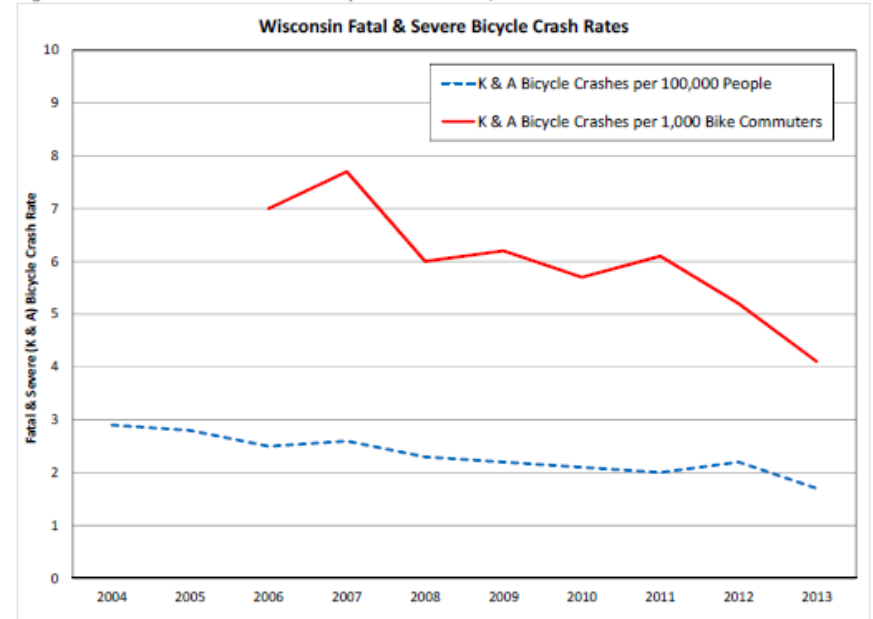


Figure 2. Wisconsin Fatal & Severe Bicycle Crash Rates, 2004 to 2013





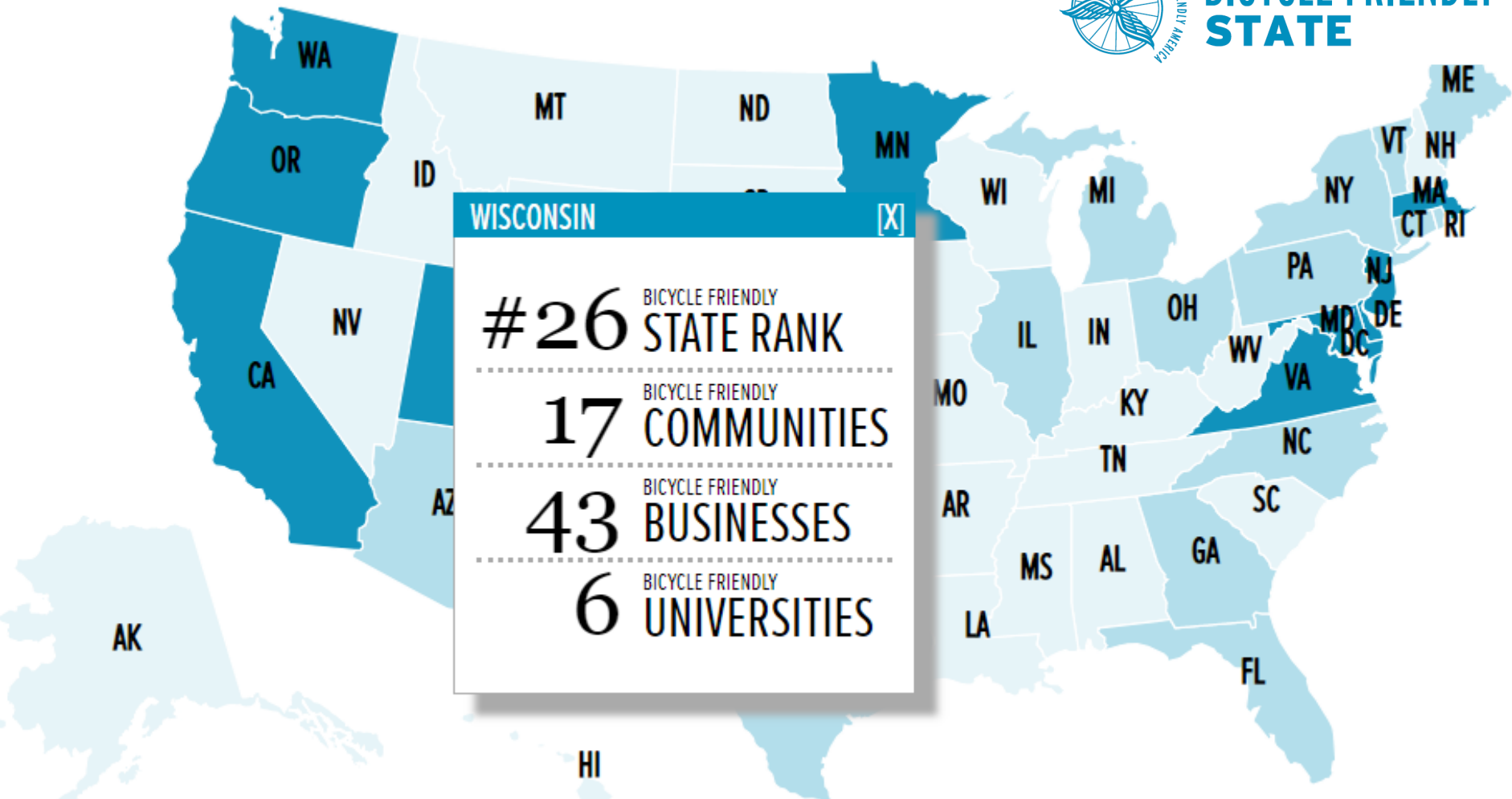
BUILDING A BICYCLE FRIENDLY AMERICASM

*A roadmap to
transforming states,
communities,
businesses and
universities*

THE LEAGUE
OF AMERICAN BICYCLISTS
since 1880



BICYCLE FRIENDLY STATE



WISCONSIN [X]

#26 BICYCLE FRIENDLY STATE RANK

17 BICYCLE FRIENDLY COMMUNITIES

43 BICYCLE FRIENDLY BUSINESSES

6 BICYCLE FRIENDLY UNIVERSITIES



BICYCLE FRIENDLY STATE

2017 Ranking

Key: Category rank among all 50 states



Categories

STATE	2017 Rank	# of Bicycle Friendly Actions*	Infrastructure & Funding	Education & Encouragement	Legislation & Enforcement	Policies & Programs	Evaluation & Planning
Rhode Island	22	🚲 🚲 🚲	🟡	🟡	🟡	🟡	🟠
New York	23	🚲 🚲 🚲	🟢	🟢	🟠	🟢	🟢
Connecticut	24	🚲 🚲 🚲 🚲 🚲	🟡	🔴	🟢	🟢	🟢
Texas	25	🚲 🚲	🟠	🟢	🟡	🟡	🟢
Wisconsin	26	🚲 🚲	🟠	🟢	🟢	🟠	🟠
Tennessee	27	🚲 🚲 🚲 🚲	🟢	🟠	🟢	🟠	🟡
Idaho	28	🚲 🚲	🔴	🟠	🔴	🟠	🟡
Louisiana	29	🚲 🚲 🚲	🟠	🟠	🟢	🟢	🟡



Madison is one of 5
 platinum level cities
 today.



MADISON, WI

TOTAL POPULATION
 237,395
 TOTAL AREA (sq. miles)
 94.9

POPULATION DENSITY
 3055

OF LOCAL BICYCLE FRIENDLY BUSINESSES 13
 # OF LOCAL BICYCLE FRIENDLY UNIVERSITIES 1

10 BUILDING BLOCKS OF A BICYCLE FRIENDLY COMMUNITY

	Average Diamond	Madison
Arterial and Major Collector Streets with Bike Lanes	90%	34%
Total Bicycle Network Mileage to Total Road Network Mileage	70%	21%
Public Education Outreach	EXCELLENT	GOOD
Share of Transportation Budget Spent on Bicycling	INSUFFICIENT DATA	5%
Bike Month and Bike to Work Events	EXCELLENT	VERY GOOD
Active Bicycle Advocacy Group	YES	YES
Active Bicycle Advisory Committee	YES	MEETS MONTHLY OR MORE
Bicycle-Friendly Laws & Ordinances	EXCELLENT	FEW
Bike Plan is Current and is Being Implemented	YES	YES
Bike Program Staff to Population	PER 10K	PER 23.7K

CATEGORY SCORES

ENGINEERING <i>Bicycle network and connectivity</i>	5 / 10
EDUCATION <i>Minimize awareness and bicycling skills</i>	4 / 10
ENCOURAGEMENT <i>Maximizing bicycling culture</i>	6 / 10
ENFORCEMENT <i>Promoting safety and protecting bicyclist's rights</i>	4 / 10
EVALUATION & PLANNING <i>Setting targets and having a plan</i>	4 / 10

KEY OUTCOMES

	Avg. Diamond	Madison
RIDERSHIP <i>Percentage of daily bicyclists</i>	20%	5.3%
SAFETY MEASURES CRASHES <i>Crashes per 100 daily bicyclists</i>	50	181
SAFETY MEASURES FATALITIES <i>Fatalities per 100 daily bicyclists</i>	0.2	0.8



- » Continue work to update your 2000 bicycle plan to ensure that state-of-the-art bicycle facilities are included, and that infrastructure planning is complimented with encouragement, education, and enforcement programs to increase bicycling for transportation and recreation. Set bold goals and establish policies that will help ensure their accomplishment. For example, pre/post evaluation may be a valuable part of community outreach efforts for new infrastructure designs or other changes to the built environment whose trade-offs might not be immediately apparent without a substantive evaluation.
- » Ensure that there are bicycle education opportunities specifically for people of color, low-income populations, and other specific demographic groups. By targeting education opportunities to certain groups those groups can be better

- reached and their concerns addressed by the curriculum.
- » Ensure good connectivity of your street network by adopting connectivity policies or standards. A well connected street network is associated with more walking, biking, and transit use due to greater directness of travel and more route choice options.
- » Promote National Bike Month, Bike to Work Day or Bike to School Day by engaging the mayor and/or City Council in a bicycle ride that highlights how people can get around Madison by bike and the resources available to them that enable biking.
- » As you update your bicycle plan, and other transportation plans, consider how the planning process can be inclusive and engage demographics that currently do not bike or have not participated in past planning efforts.

MILWAUKEE COMPLETE STREETS



STREETS THAT MEET
THE NEEDS
OF ALL!

Together we can help pass a Complete Streets policy that allows all people, regardless of their age or physical ability, to walk, bike, take public transportation or drive safely.



Riding bikes is not something of the past. **It is the future.**



The Growing Popularity of Bicycling

Between 2012 and 2017, the number of bike riders increased from 51 million to more than 66 million riders.

Prior to 2012, the number of cyclists only slightly increased each year.*

| *Source: www.statista.com/statistics/227415/number-of-cyclists-and-bike-riders-usa/

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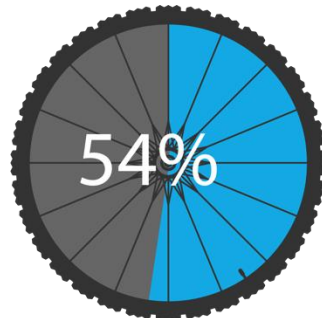
41%

OF AMERICANS
RIDE BICYCLES

48% of Americans live in

**BICYCLE FRIENDLY
COMMUNITIES**

59% wish it was easier to use a bicycles as a source of transportation where they live.



believe that
IN THE FUTURE
more people will
ride bicycles

**“ More bikes equal
more fatalities and
injuries. ”**













The Importance of **Bicycle Safety**

FACT:



40% of bicyclist fatalities in crashes occur at intersections.*

NEED:



Reduce intersection conflicts by optimizing traffic signals.

ACTION:



Use enhanced detection system to extend green phases for slow moving bicyclists.

Some Intersection Treatments



Historical Signal Timings

- Traffic Engineers want to:
 - Maximize arterial green time
 - Minimize minor movement green time
 - Eliminate motorist delay
 - Coordination
- Designed for vehicles not bicycles
 - Short Initial green times
 - “Snappy” gap-out times



Why Not Bicycles?

- Historically no Differentiation from Motor Vehicles
- Slower than Vehicles – Faster than Peds

No special accommodation means:

Bicyclists cannot safely get through a large intersection with too short initial or extension times



What can we do as traffic professionals to improve safety at signalized intersections for vulnerable road users?

Bicycle
Differentiation

Pedestrian
Detection

V2X
Applications

Detection versus Differentiation



BI

PR

PR

PR

BI

PR

BI

PR

BI

PR
BI

BI

Optimize Intersections For Effectiveness & Safety



Use Bicycle
Differentiation

Design signal system to
operate differently when
system detects a bicycle
is present

Allow special timing only
when necessary to
improve efficiency

Provide the ability to
collect data

Other Detection Technologies for Bikes



Thermal

- Can Differentiate



Inductive Loops

- Requires special loop in specific location

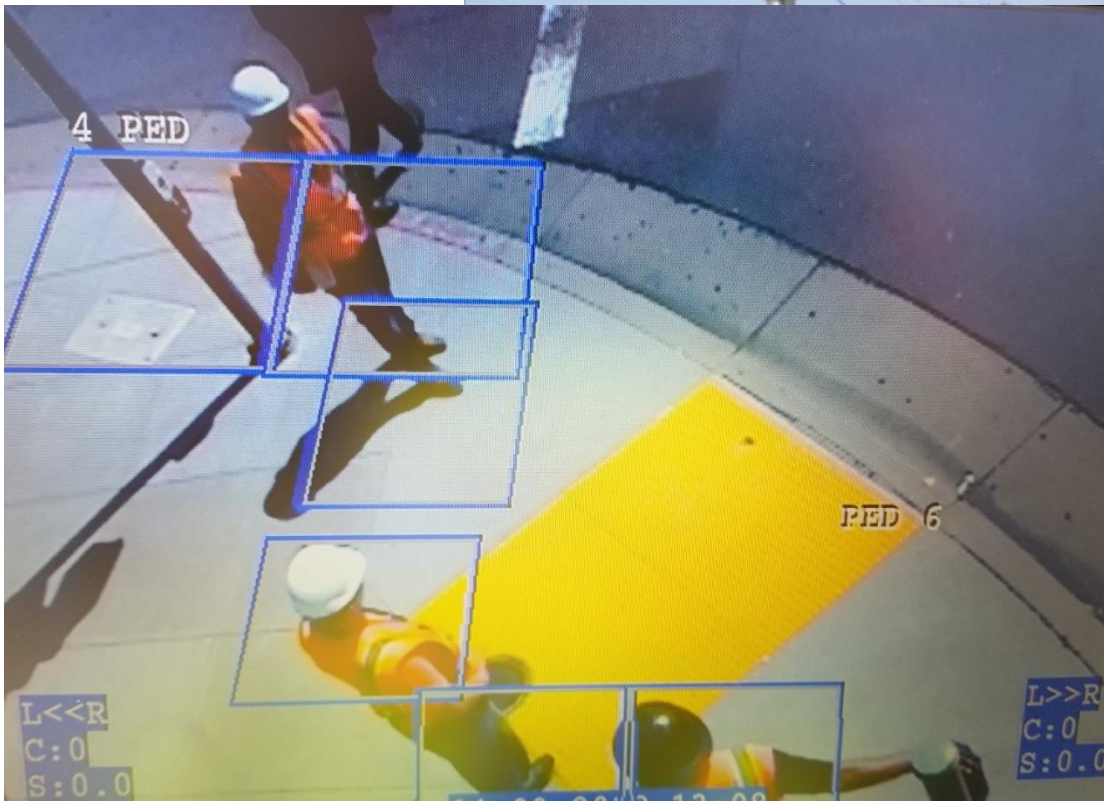


Radar

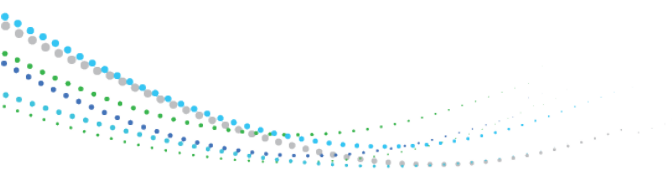
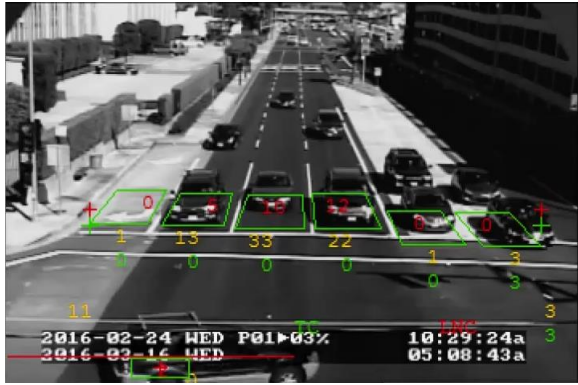
- Harder to differentiate



Passive Ped Detection



Pedestrian Detection and Data Collection

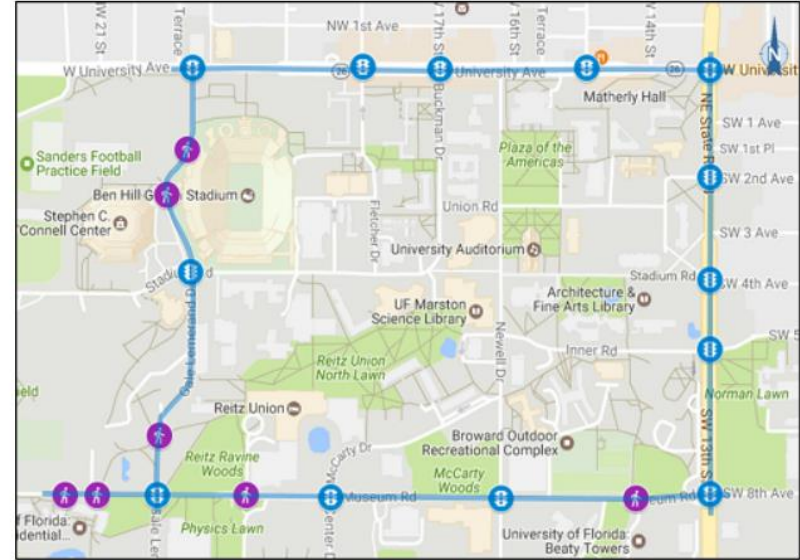


What are other agencies doing in this space?

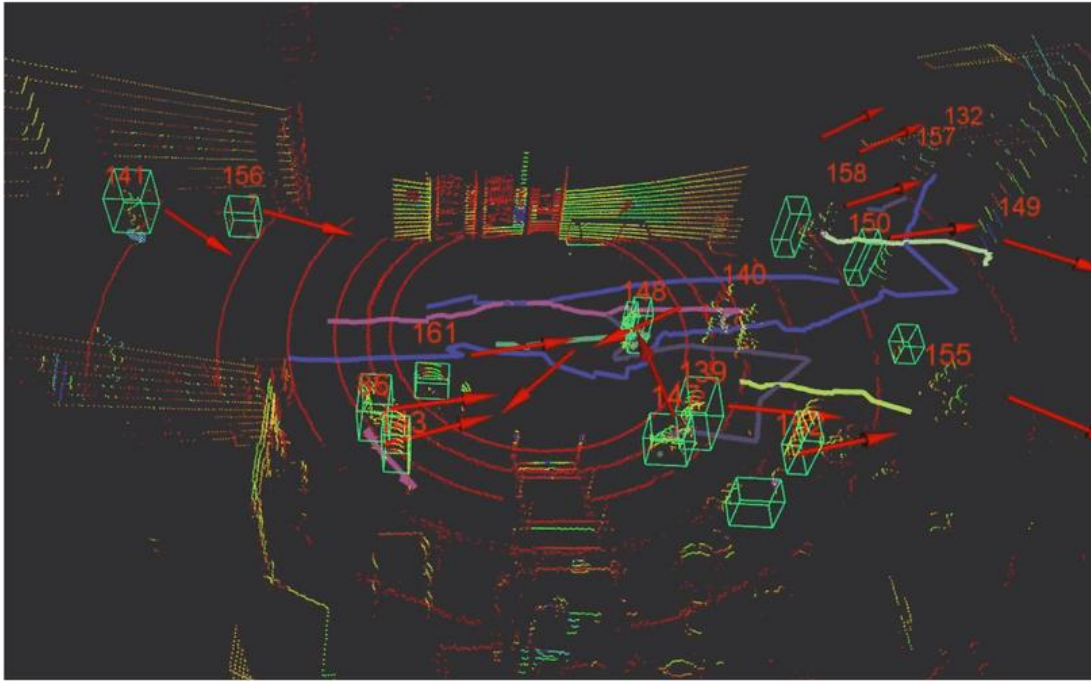


I-STREET University of Florida Smart Test Bed

- FDOT, City of Gainesville, and UF
- 13 intersections, 7 mid-block
- Testing passive pedestrian and bicyclist detection
- Providing real-time notification to transit, vehicles, and peds/bikes
- DSRC broadcasting via RSUs with various technologies



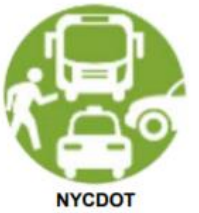




- Using LIDAR sensors to map crosswalk and transmit pedestrian detections to vehicle OBUs



USDOT New York City CV PILOT



Pedestrian in Signalized Crosswalk

- Peds (and bikes) in crosswalk with mobile app sending location data

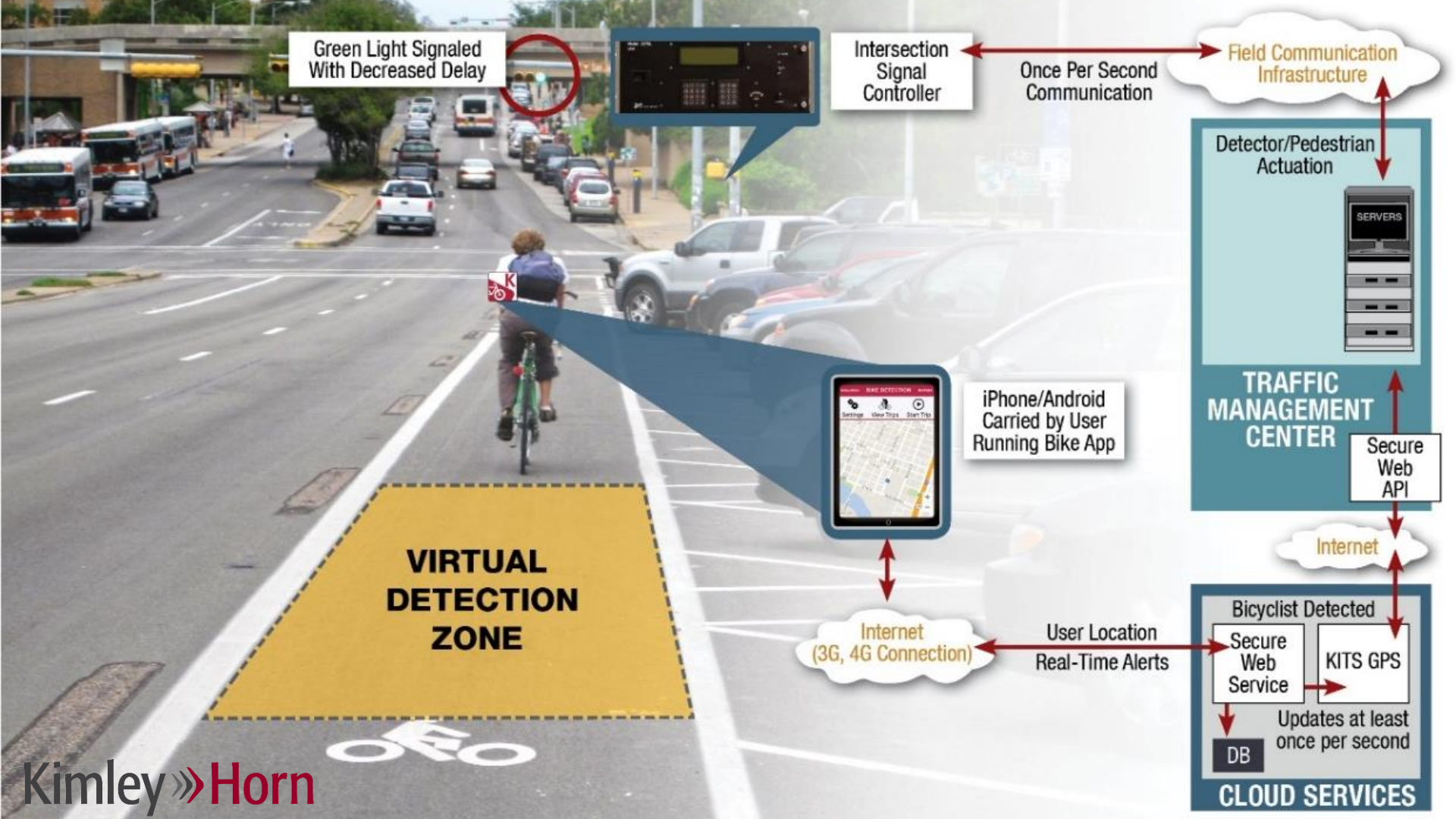
Mobile Accessible Pedestrian Signal System (PED-SIG)

- Pedestrian Information Device (PID)
- For the visually impaired
- Custom app/interface



C-V2X





1

Video cameras detect pedestrians moving in crosswalk

2

Pedestrian detection output is sent to road side unit (RSU)

3

RSU sends information to vehicle on-board unit (OBU)

4

Audible alarm and on-tablet alert inside vehicle:
"Pedestrian in Crosswalk Ahead"

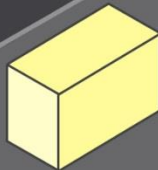


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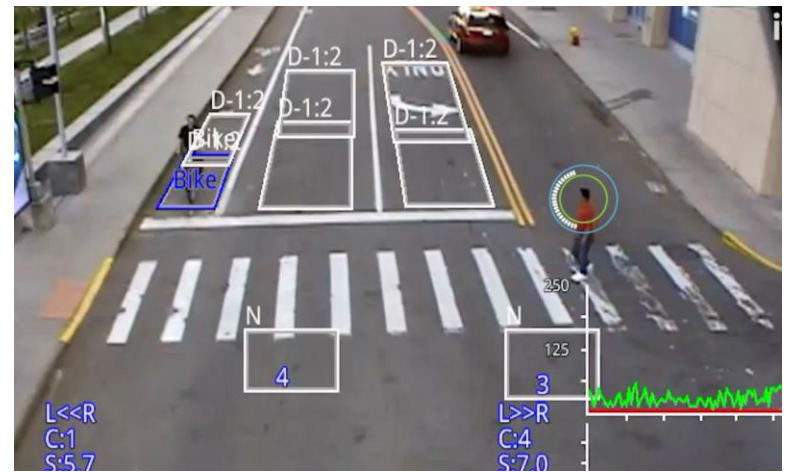
1

3



2

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Summary



Existing detection sensors today can provide additional value by also detecting vulnerable road users



New sensors & technology are being tested and evaluated



Mobile apps for VRUs can support increased safety



V2X is new, but has great potential for increasing ped and bike safety at intersections





ARROW

7

epov
YOGA
ONE WEEK
FREE

CROOKED PINT ALE HOUSE

WE NOW SERVE TRUCKS
IN BEERS ON TAP

BICYCLE
DETECTED
WHEN
ILLUMINATED

Thank you!

Adam Lyons

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