

Good morning

Washington Transportation Professionals Forum (WTPF)

Spring Westside Meeting
March 29, 2016
at Thurston County Public Works

- Optional networking time: 8-8:30 a.m.
- Meeting and webinar: 8:30 a.m.-12:30 p.m.
- Optional networking time: 12:30-1 p.m.



Photos: istockphoto.com

Hello and welcome:

Webinar attendees and In person attendees



Freephoto.com Thurston Co. Emergency Coord. Center (KMBDesign.com)

Instructions for webinar attendees

- Press the orange arrow toggle button to show and hide the GoToWebinar screen.
- You are in listen-only mode. Please ask questions and make comments by typing them in the "Questions" box. We will read your question to the presenter for a response.
 - Please take breaks when needed.
 - Have fun connecting across the state!



Photo courtesy of Pacific Technologies, Inc.

Instructions for in person attendees

- So the webinar and in-person attendees can hear better:
 - ✓ Please turn wireless devices to silent mode.
 - ✓ Move side conversations out of the room.
 - ✓ Speak loudly and clearly. We will try to repeat all questions.
- Take breaks when needed:
 - ✓ Can move around the back and sides of the room.
 - ✓ Restroom locations.
 - ✓ Food, vending machine.
- Fire exits.
- Have fun connecting across the state!



Introductions

Please tell us your:

- Name
- Agency/Business name
- Announcement? (10 seconds or less)



Blackbookdepot.com

Washington Transportation Professionals Forum

- Founded ~1978-1979 (36+ years ago) by city traffic engineers as the Urban Traffic Engineers Council (UTEC). Met to discuss common issues and develop traffic and collision analysis software.
- Group grew over time to approx. 730 current members: all cities, all counties, consultants, vendors, and other agencies.
- Meetings/forums organized by WSDOT Local Programs but the group is owned by the members. Group's focus is on local agency traffic- and transportation-related issues.
- Meetings held on both sides of the state: 315 of the current members (43%) have attended a meeting in person or by webinar in the past 5 years.



Overview/Agenda

- Pedestrian & Bicycle Program and Safe Routes to School Program Call for Projects.
- Using roundabouts to improve intersection performance.
- 10 minute break.
- Remaking traffic signals in support of walking and cycling: Policy based transportation operations.
- City of Olympia's experience with pedestrian crossing islands/medians, curb bulb-outs, and rectangular rapid flashing beacons.
- 5 minute break.
- City of Federal Way's experience with rectangular rapid flashing beacons.
- Half signals, high-intensity activated crosswalk beacons (HAWKSs), and other treatments to improve safety.

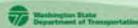


Pedestrian and Bicycle Program and Safe Routes to School

Charlotte Claybrooke

Local Programs
Washington State Department of Transportation

March, 2016



Pedestrian and Bicycle Program

- Purpose is to reduce collisions and increase walking and biking
- All public agencies are eligible
- Applications due May 6, 2016

Safe Routes to School

- Purpose is to increase the number of children walking and biking to school safely
- All public agencies and nonprofit entities are eligible
- Applications due May 13, 2016



2017/2019

- Current funding expectations
 - Pedestrian and Bicycle Program
\$18,000,000 State Funds
 - Safe Routes to School
\$11,400,000 Federal Funds
\$7,750,000 State Funds
- Award announcements expected June 2017
- No match required

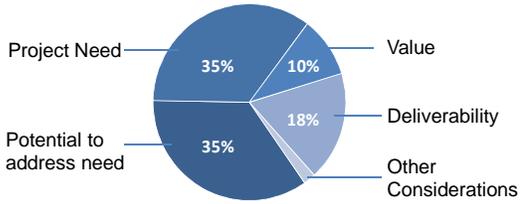


Eligible Improvements

- Both Programs
 - Pedestrian and/or Bicycle Facilities
 - Pedestrian and/or Bicycle Crossing Improvements
 - Traffic Calming
- Pedestrian and Bicycle Program Only
 - Development/Design Only Projects
- Safe Routes to School Only
 - Education and Encouragement Projects



Prioritization Criteria Based On



Criteria	Percentage
Project Need	35%
Potential to address need	35%
Deliverability	18%
Value	10%
Other Considerations	2%



Contacts

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 360-705-7302

Ed Spilker
 Pedestrian and Bicycle Program
 Active Transportation Program Specialist
 SpikeE@WSDOT.WA.GOV
 360-705-7387



Website -
<http://www.wsdot.wa.gov/LocalPrograms/SafeRoutes/CallForProjects.htm>

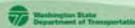


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Scalability of Roundabouts

Washington Transportation Professionals Forum

Brian Walsh, Washington State DOT
 March 29, 2016



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Why Roundabouts? - Refresher



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Why Roundabouts? Refresher



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Why Roundabouts? Refresher



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Refresher on Roundabout Use

- Safety – Low speeds benefits injury reductions and fatalities. It also allows non motorized modes to use these intersections with typically less delay and less overall risk.
- Delay – For locations under 15,000 vehicles/day (total entering), there isn't a better intersection control for efficiency (or for minimizing delay) for all hours of the day

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Myths are justification in trying to describe and demonstrate “Scalability”

- *The “All to Often” Myths heard by*
 - There are too many cars on Hwy 99
 - There is one in Massachusetts or “name a place”
 - **It won’t fit**
 - They don’t work near signals
 - They don’t work with business areas
 - They work in communities but not higher speed highways
 - **Cost more**

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Function of Scalability – To increase suitable areas for implementing roundabouts

- Predominately Traffic Signals are our higher level intersection control – by some estimates, there are over 250,000 in North America.
- This is compared to approximately 3,500 - 4,000 “roundabouts” which have only been on the system since 1990 however most coming after 2000 timeframe.

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Scalability not to be confused with “Neighborhood Traffic Calming”

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Scalability - Elements

- Smaller “Inscribed Diameters” than most design guidance will mention in writing. Many “compact roundabouts” less than 120’ for an Inscribed diameter measurement
- In many cases, a non circular shape may fit a location of existing pavement better
- Rely predominately on “engineering judgment” to balance safety, operations and geometrics

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Scalability terms to be familiar with:

- Mini Roundabout
- Compact Roundabout (gaining traction in community engagement processes)
- Conventional Roundabout
- Central Island mountable

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Planning

Reality in most areas still involve the single occupant vehicle -central cores will still build parking however walkability gaining foothold



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Intersections are unique and numerous and site specific and

- They have a unique volume of vehicle, bikes or pedestrians
- They have different mode needs
- Design Vehicle isn't always the same and sometimes Design Vehicle or Superload can take a different route
- Issue of vehicle or pedestrian/bike delay a reason to look at yield control
- Corridor type applications are possible however usually part of a long range planning process so easier to incorporate

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Context of an intersection is usually correlated with the scale of the “intersection control” that is needed to satisfy the context

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Charlottesville, VA



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Temporary Span Wire Signal to be Converted to Roundabout



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Scaled roundabout examples have:

- Expectations regarding streetscapes
- Reduced maintenance of signal hardware and landscaping
- Presence of significant non-motorized

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Dimondale, MI



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Possibilities?



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Kelso Drive Ramp (BEFORE)



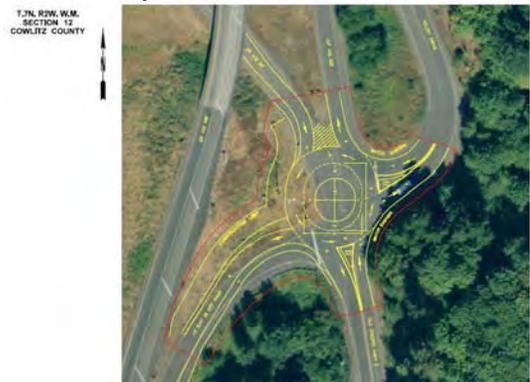
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BEFORE – looking east (2014)



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Small pavement additions OK



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Cost – Kelso Drive

- Bid came in at \$400,000
- PE Costs were higher than average as WSDOT worked to understand the Scalability required at location to get performance, particular safety.

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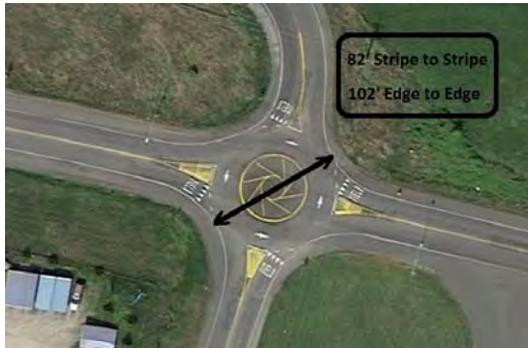
Ramp Terminal

- Ramp queue from stop sign was long in PM peak and creeping back to mainline creating obvious safety issue
- Within these vehicle volumes. intersection would see significant queue reduction due to efficiency of roundabout
- No funding for intersection in near term
- Decision to convert to roundabout was made at 3 closely spaced intersections
- Considered temporary, effect was immediate for less than \$300,000 for 3 roundabouts

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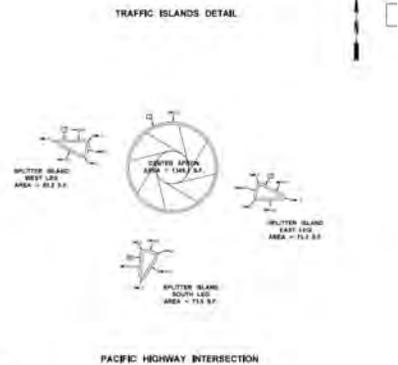


Fit within Existing Pavement



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Plan Details on Island sizes



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Small footprint – under 100K



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Volumes in this range make stop control on minor street ineffective



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Video (Optional)

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Cost

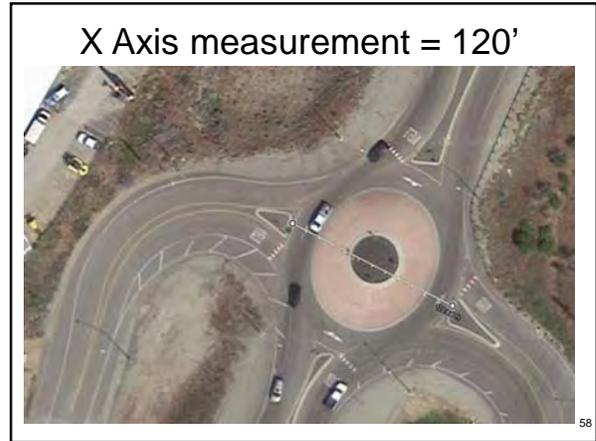
- 3 roundabouts – Bid award was \$273,000
- School bus was Design Vehicle for not touching the mountable central island
- Larger trucks, particularly with 53 foot trailers didn't all figure out the fully mountable part until well into the first month
 - Friendly curb may assist in this education on how trucks can use the mountable portion
 - Curbs were precast and locked in with slivers of new paving

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US 97A State Highway Permanent Application

- Speed Limit is hard to enforce
- Intersection where seasonal trucks were entering/exiting highway (left turns)
- County Road on opposite leg
- Gap availability limited during some portions of apple/fruit harvest
- 5 lane section of pavement

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US 97A Cost

- \$394,000
 - Price included 70K for new illumination system
 - Price did not include asphalt as this was part of a Preservation Project
 - Design PE Costs were separate

(Safe to say that Paving projects on the State system are a great way to change intersection control)

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BEFORE La Jolla (San Diego, CA)



Burlington WA



Lake Stevens, WA



Anacortes WA



BEFORE – NYC Intervale Avenue – Rainey Park





Kennewick, WA



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Blaine WA – Canada/USA border



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Bremerton WA (Manette Neighborhood)



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Previous Manette Bridge Intersection



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Important Considerations

- Pay attention to how your application is going to affect future maintenance
 - Communities still have the ability to create appealing aesthetics around smaller roundabouts hard scape is usually outcome to ensure design vehicle can make it through location
 - Curb details are undoubtedly one of the most important issues on highways and have proven to be critical in implementing a scalable roundabout in a constrained space

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Curbs – Not the idea



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More "not how to do it"



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2" curbs



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Rolled curbs helpful but not mandatory



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Photo Credit - Snohomish County Public Works, WA

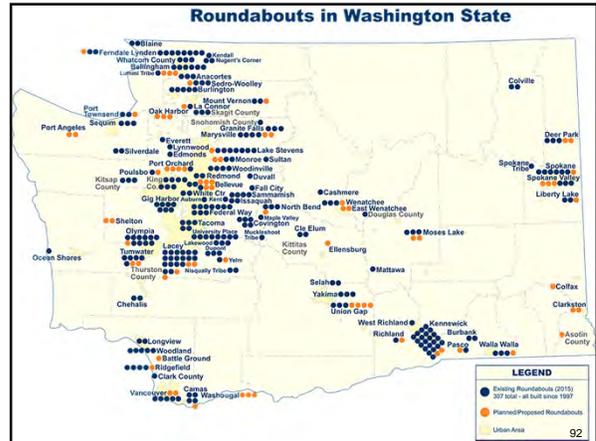
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Break Time

AlternativeIntersections.org

10 minutes

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Remaking Traffic Signals in Support of Walking and Cycling: Policy Based Transportation Operations

Presented by:

Peter Koonce, PE
Portland, OR

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Overview

- Lessons Learned from the Private Sector
- Policy Directives in Portland
- Example Applications

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Our intentions are to be as sustainable a city as possible. That means socially, that means environmentally and that means economically. The bike is great on all three of those factors. You just can't get a better transportation return on your investment than you get with promoting bicycling.

- Former Mayor Sam Adams

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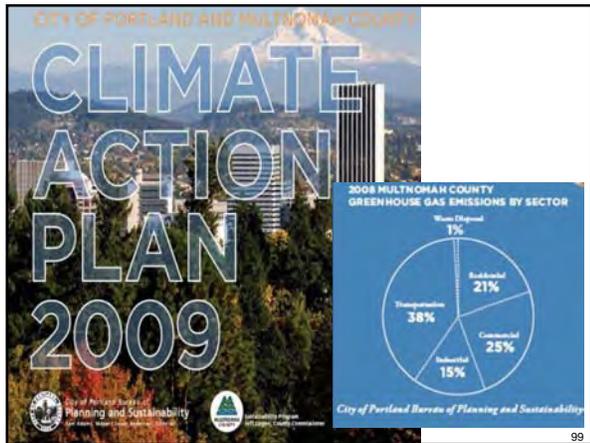
Policy Directives

- Regional Transportation Plan, Metro
- Climate Action Plan
- City Transportation System Plan
 - Bicycle Master Plan
 - Freight Master Plan
- Transit Investment Plan, TriMet



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CITY OF PORTLAND AND MULTNOMAH COUNTY CLIMATE ACTION PLAN 2009



2008 MULTNOMAH COUNTY GREENHOUSE GAS EMISSIONS BY SECTOR

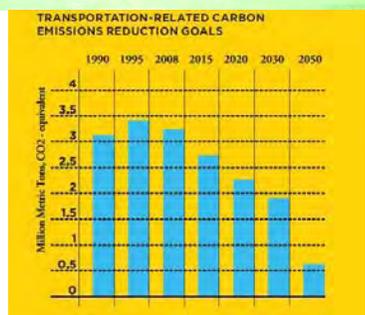
Sector	Percentage
Transportation	38%
Commercial	25%
Industrial	15%
Residential	21%
Waste Disposal	1%

City of Portland Bureau of Planning and Sustainability

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Emissions Reduction Goals

TRANSPORTATION-RELATED CARBON EMISSIONS REDUCTION GOALS

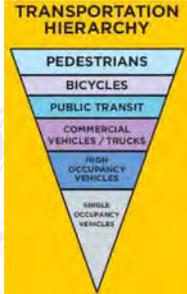


Year	Million Metric Tons CO ₂ -equivalent
1990	~3.0
1995	~3.0
2008	~3.0
2015	~2.5
2020	~2.0
2030	~1.5
2050	~1.0

Source: Climate Action Plan, City of Portland, <http://www.portlandonline.com/bps/index.cfm?c=49989&a=268612>

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Transportation Hierarchy

TRANSPORTATION HIERARCHY

- PEDESTRIANS
- BICYCLES
- PUBLIC TRANSIT
- COMMERCIAL VEHICLES / TRUCKS
- HIGH OCCUPANCY VEHICLES
- SINGLE OCCUPANCY VEHICLES

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Where are we going?

CURRENT COMMUTE MODE SHARE FOR PORTLAND

Walk	4%
Bike	8%
Carpool	8%
Transit (including park-and-ride)	15%
Drive Alone	66%

2030 TARGET COMMUTE MODE SHARE FOR PORTLAND

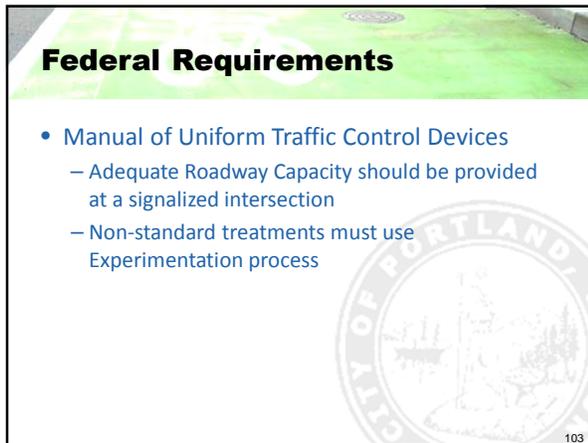
Walk	7.5%
Bike	25%
Carpool	10%
Transit (including park-and-ride)	25%
Drive Alone	30%
Additional Telecommuting	2.5%

Source: City of Portland Auditor, Service Efforts and Accomplishments: 2007-08

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Federal Requirements

- Manual of Uniform Traffic Control Devices
 - Adequate Roadway Capacity should be provided at a signalized intersection
 - Non-standard treatments must use Experimentation process



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Case in Point: City & FHWA Pedestrian Crossing Signals

- Pedestrian/Bicycle Facilities
- Traffic Control Devices focused on improving crossing opportunities for pedestrians
 - Pedestrian Hybrid Signals (HAWK)
 - Half Signals



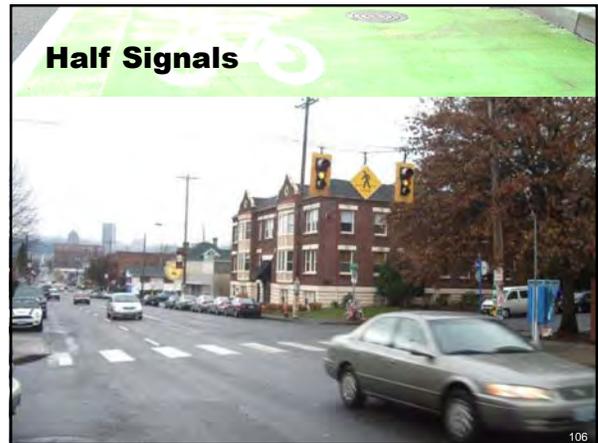
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Current USDOT Policy Directive

- Treat walking and bicycling as equals with other transportation modes
- Go beyond minimum design standards
- Improve nonmotorized facilities during maintenance projects



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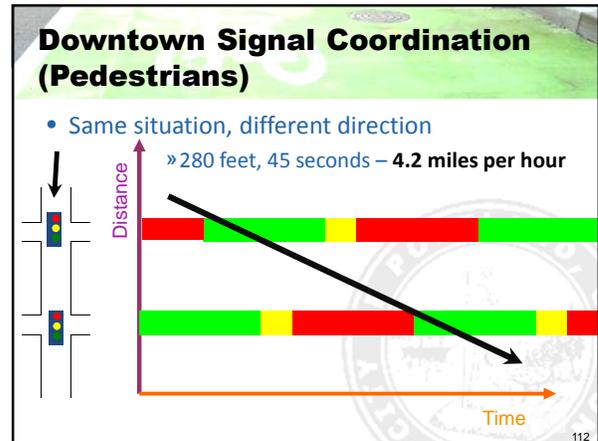
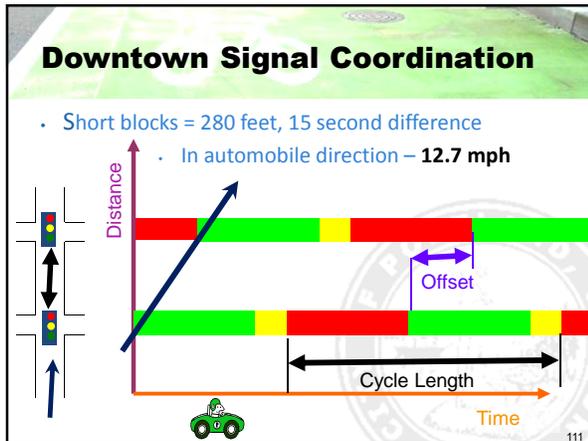




Downtown Signal Timing

- One way, regular grid street system
- Signal Cycle Lengths are as short as possible
 - Necessary with short blocks
 - Reduced delay for transit & pedestrians
- Quarter Cycle Offsets result in:
 - Progressions speeds 19-28 km/hr (vehicles/bikes)
 - Reverse progression 6.5 km/hr (pedestrians)

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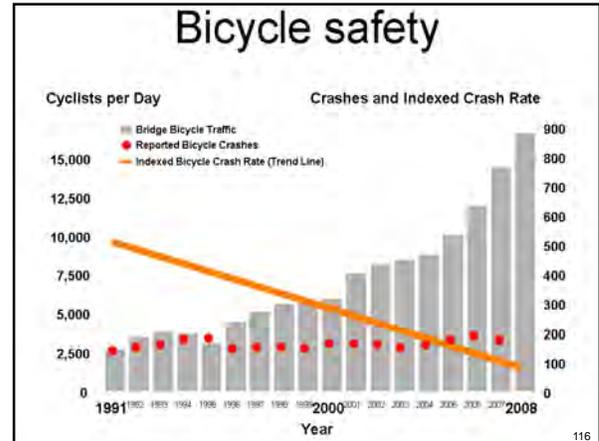
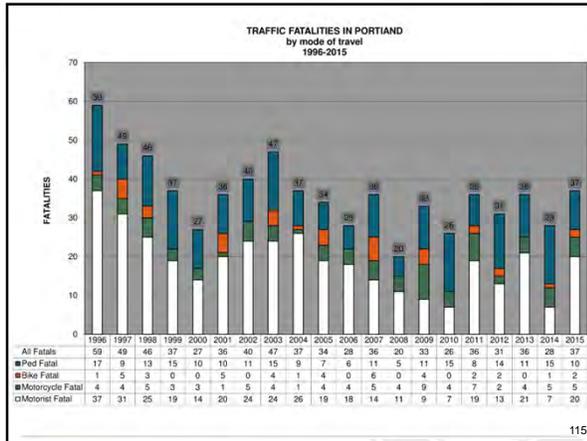


Innovations in Ped/Bike Control

- Improved information for peds at signals
- Innovative facility design

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Thoughts on Lessons...

- Transportation system analyses should *not* be treated like a typical Engineering analysis
- Vehicular traffic needs must be balanced in concert with transportation needs (transit, pedestrian, bicycle) as well as community interests
- Environmental challenges will require solutions outside the box

CITY OF OLYMPIA PEDESTRIAN CROSSING IMPROVEMENTS

March 29, 2016

Randy Wesselman
Transportation Engineering & Planning Manager
Public Works Transportation

City of Olympia | Capital of Washington State

Pedestrian Crossing Improvements

- Pedestrian Crossings
- School Crossing on Henderson Boulevard at Carlyon Avenue
- Jefferson Street at 14th Avenue Roundabout
- State Avenue Paving Project
- Harrison Avenue at Decatur Street - *RRFB*
- Capital Mall Drive at Archwood Drive – *Pedestrian Crossing Island Project*

Pedestrian Crossing Improvements

- Bicycle & Pedestrian Advisory Committee (BPAC) recommends annual funding program
- Funding: \$100,000 per year
- 37 improvements in 15 years
- Incorporated into larger projects

Pedestrian Crossing Improvements

- List of requested projects first
- FHWA study criteria
 - ✓ Speeds
 - ✓ Volumes
 - ✓ Number of lanes

The Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations



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Pedestrian Crossing Improvements

- Improvements include:
 - ✓ Bulb-outs
 - ✓ In-pavement lighting
 - ✓ Rectangular rapid flashing beacons
 - ✓ Pedestrian Crossing Islands
- New street standards require build-outs



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Henderson Boulevard and Carlyon Avenue



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Case Study: Henderson Boulevard and Carlyon Avenue Assessment

Year Installed	EXISTING IMPROVEMENT		CHANGE OR POTENTIAL IMPROVEMENT	
	Existing Improvement	Location	Improvement	Action
2005	20 MPH School Speed Limit Zone Flashing Beacons.	On Henderson Boulevard, north and southbound, approaching Carlyon Avenue. • 7:15 am - 8:30 pm • 2:30 pm - 3:15 pm Flashing beacon times are adjusted for late start and early release.	Extended flash times to AM and PM. • 7:15 am - 8:45 am • 2:10 pm - 3:15 pm Flashing beacon times were adjusted for late start and early release.	Implemented October 30, 2014.
2010	In-street School Crossing Sign sandwich board.	On Henderson Boulevard at Carlyon Avenue.		
2011	Speed Radar Sign.	On southbound Henderson Boulevard approaching Drakeville Boulevard.		
2011	Pedestrian Crossing Island/Walkway	On Henderson Boulevard at Carlyon Avenue, south leg.		
2002	Subways.	On Henderson Boulevard from McCurtick Street to Waterford Park.		
Upgraded as part of regular maintenance	High Visibility Star-Type Crosswalk Markings.	On Henderson Boulevard, south leg, at Carlyon Avenue.		
Maintained as part of regular maintenance	"School" Pavement Marking.	On Henderson Boulevard, north and southbound, adjacent to 20 MPH School Speed Limit Zone Beacons.	Remove "School" Pavement Marking.	Will remove as part of regular maintenance work in 2015.
Upgraded as part of regular maintenance	School Crosswalk Signs Fluorescent Yellow Green (FYG).	On Henderson Boulevard, south leg, at Carlyon Avenue.		
Upgraded as part of maintenance	Overhead "Crosswalk" Sign Fluorescent Yellow Green (FYG).	On Henderson Boulevard, south leg, at Carlyon Avenue.		
Upgraded	Streetlights.	On Henderson Boulevard at Carlyon Avenue, northeast and southwest corners.		
Yearly	Olympia Police Department (OPD) enforcement of school speed limit zone.	Henderson Boulevard and Carlyon Avenue.	Continued OPD enforcement of school speed limit zone.	Continued with OPD.
Yearly	School Crossing Guards.	On Henderson Boulevard at Carlyon Avenue, south leg.	Extended time of School Crossing Guards.	Implemented October 2014 by Olympia School District.
Yearly	Safe Walking Routes. Walk N Roll education program.	Passer Elementary and Washington Middle School. Administered by: • Integrity Transit (IT) • Thurston Regional Planning Council (TRPC).	Continue and expand education emphasis on safe walking, biking and driving habits.	Discuss with IT and TRPC.

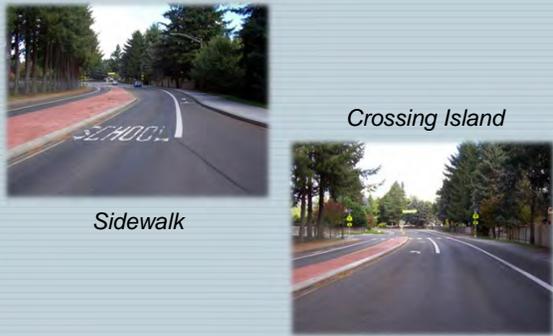
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Henderson Boulevard: Speed Radar Sign



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Henderson Boulevard



Sidewalk

Crossing Island

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Change or Improvements	
IMPROVEMENT	ACTION
Update "End of School Zone" limits/signs.	Update signing going southbound on Henderson Boulevard, south of Carlyon Avenue.
Add "School" plaque below existing advance school zone sign.	Add signing on southbound Henderson Boulevard approaching the 20 MPH School Speed Limit Zone Flashing Beacon.
Install advance School Zone Sign with "School" plaque, northbound, approaching the 20 MPH School Speed Limit Zone Flashing Beacon.	Add signing on northbound Henderson Boulevard approaching the 20 MPH School Speed Limit Zone Flashing Beacon.
Install Rectangular Rapid Flashing Beacons (RRFB) OR overhead flashing beacons OR "Embedded Light Emitting Diodes" in School Signs.	Install RRFB.
Install cross-hatching in island area on north leg of Henderson Boulevard to provide "narrowing" effect of intersection.	Install cross-hatching and buffered bike lane markings. This will include narrowing southbound vehicle travel lane to 11 feet.
"Speed Reduction" lane markings in southbound lane of Henderson Boulevard approaching Carlyon Avenue.	Testing Markings. Installed week of 11/10/14. These markings will be removed when cross-hatching in island and buffered bike lane are installed.

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Henderson Boulevard



Crossing Island



RRFB's



School Crossing Guards

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Henderson Boulevard




- Crossing Hatching
- Buffered Bike Lane
- Visual narrowing



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Jefferson Street and 14th Avenue Roundabout



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Jefferson Street and 14th Avenue Roundabout



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State Avenue Overlay and Bulb-out Improvements

Plum Street to Central Street



Downtown Olympia

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State Avenue Overlay and Bulb-out Improvements



- Curb Bulb-outs
- Colored Bike Lane
- Marked Parking Lane



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State Avenue Overlay and Bulb-out Improvements



- Curb Bulb-outs
- Stop Here for Pedestrian Signs
- Marked Parking Lane



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Harrison Avenue at Decatur Street



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Harrison Avenue at Decatur Street



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Capital Mall Drive at Archwood Drive



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Capital Mall Drive at Archwood Drive



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Questions?

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Break Time

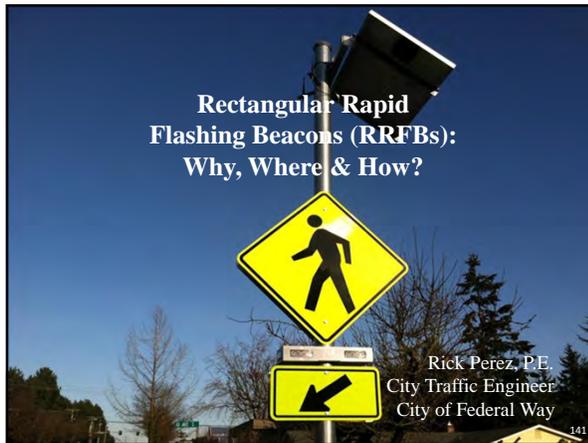


istockphoto.com

5 minutes

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Rectangular Rapid Flashing Beacons (RRFBs): Why, Where & How?



Rick Perez, P.E.
City Traffic Engineer
City of Federal Way

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Safe and Effective Pedestrian Crossing Treatments



“The Search for the Holy Grail”



“...like herding cats...”

3/31/2016 142

Development of RRFB's

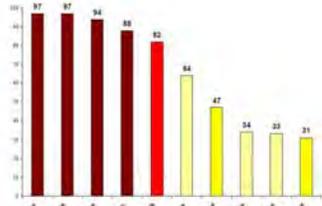
- St. Petersburg, Florida Experiment FHWA No. 4-305(E)
- Gratifying Results
- FHWA Interim Approval IA-11



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How Do They Rank?

RRFB's rank behind full signals, HAWK signals and in-roadway pedestrian stop signs in driver compliance.



Treatment	Compliance (%)
Full Signal	97
HAWK	97
RRFB	94
In-Roadway Pedestrian Stop Sign	88
Other	82
Standard Crosswalk	64
Other	47
Other	34
Other	33
Other	21

Innovative Crosswalk Treatments

Source: Michael J. Frederick, Manager Transportation, City of St. Petersburg, FL, and Dr. Bin-Yan Hsueh, Vice President - Center for Education and Research in Safety, Paper Presented to ITE, July 2008.

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CITY OF Federal Way

Site Ranking Criteria

Point Scale	Roadway & Traffic	
	Roadway Crossing Width (ft) **	Average Daily Traffic (ADT/Lane)
0	0 - 24	500 - 1,499
0.5	25 - 34	1,500 - 2,499
1	35 - 44	2,500 - 3,499
1.5	45 - 54	3,500 - 4,499
2	55 - 64	4,500 - 5,499
2.5	65 - 74	5,500 - 6,499
3	75 - 79	6,500+

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CITY OF Federal Way

Site Ranking Criteria

Point Scale	School Frontage or Safe Walking Routes
0	-
0.5	Potential High School Walking Route
1	High School Frontage
1.5	Middle School Walking Route
2	Middle School Frontage
2.5	Designated Elementary School Safe Route
3	Elementary School Frontage

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CITY OF Federal Way

Site Ranking Criteria

Point Scale	Parks, Recreation & Libraries
0	-
0.5	Private Indoor Recreational Facilities & Private Outdoor < 25 acres, or Church
1	FW Open Space < 25 acres & Private Outdoor Recreation > 25 acres
1.5	FW Open Space > 25 acres & State Parks/Lands, Mega-Church
2	Dumas Bay Center, Senior Center, KC Aquatic Center & Weyerhaeuser Trails
2.5	FW Neighborhood Parks
3	FW Community Parks, FW Designated Trails, FW Community Center & KC Libraries

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CITY OF Federal Way

Site Ranking Criteria

Point Scale	Adjoining Land Uses
0	-
0.5	Business Park & Office
1	Community Business
1.5	Single-Family Residential
2	Multi-Family Residential
2.5	Neighborhood Business
3	City Center Core & Frame, Senior Housing

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CITY OF Federal Way

Site Ranking Criteria

Point Scale	Existing Transit Ridership Data	
	Bus Stops within 400 feet (either or both sides)	Riders per Weekday Other Bus Stops Within 1/3 rd Mile
0	0 - 14	0 - 29
0.5	15 - 29	30 - 59
1	30 - 44	60 - 89
1.5	45 - 59	90 - 119
2	60 - 74	120 - 149
2.5	75 - 89	150 - 179
3	90+	180+

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CITY OF Federal Way

Site Ranking Criteria

Point Scale	Crosswalks
	Distance to Nearest Existing Marked Crosswalk (ft.)
0	0 - 299
0.5	300 - 599
1	600 - 899
1.5	900 - 1,199
2	1,200 - 1,499
2.5	1,500 - 1,799
3	1,800+

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CITY OF Federal Way

Site Ranking Criteria

Point Scale	Cost Feasibility	
	Estimated Cost (\$)	
-1.5	+ 50,001	
-1.0	50,000 - 35,001	
-0.5	35,000 - 30,001	
0	30,000 - 25,001	
0.5	25,000 - 20,001	
1.0	20,000 - 15,001	
1.5	15,000 - 0	

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CITY OF Federal Way

Site Ranking Criteria



Point Scale	Collision Rate Per Year	
	Total	Fatal
0	-	-
1	0.1	-
2	0.2	-
3	0.3	-
4	0.4	0.1
5	0.5	-
6	0.6+	0.2+

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CITY OF Federal Way

Site Ranking Criteria

1.5 points if proposal improves motorized safety



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Ranking Observations

- RRFB not considered where more than 2 lanes crossed at a time
- Led to consideration of road diet
- Not considered an option on 6-lane arterials
- A new installation affects scores of potential adjacent locations




Las Vegas, NV - Google Earth

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Ranking Observations

- Some high-ranking locations precluded by site conditions
 - High driveway density
 - Inadequate sight distance
 - No way to provide pedestrian refuge



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Impacts

- Continues to be popular with the public
- One council member cited these as one of his accomplishments in State Representative campaign
- Anecdotal concerns from Police about rear-end collision increase
- Can free up latent demand – one location went from 9 to 40 crossings with installation

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Overall Safety

- Now have 3 years after-experience at 14 locations
 - 58% reduction in collisions
 - 33% reduction in injuries
 - 31% reduction in PDO's

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Collision Types

Reductions:

- 32% Rear Ends
- 17% Fixed Objects
- 100% Approach Turn
- 31% Right Angle
- 50% Sideswipe
- 100% Others

No Change in Backing

Increases:

- 25% Pedestrian/Cyclist

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Ped Collision Increases???

- Where?
 - 5-lane 35-mph crossing from 1 to 2 collisions
 - 5-lane 40-mph crossing from 0 to 1 collisions
 - 2-lane 35-mph crossing from 0 to 1 collisions
- Increased Exposure?
- Will doing more crossing treatments train drivers to yield more?
- More will be revealed...

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Lessons Learned

- Visibility can be a concern
- Interpretation Letter 4-376 allows overhead mountings to address restricted sight distance



Cave Junction, OR - Google Earth

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Lessons Learned

- Check for Solar exposure
- Shade may cause need to frequently swap out batteries in the winter
- Can be addressed with second solar panel



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Lessons Learned

- Coordinate crossing locations with transit stops



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Lessons Learned

- Median mounts are very vulnerable
- One lasted less than 24 hours
- Out of 16 location-years, had 7 knockdowns
- Use frangible bases



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Conclusions on RRFB's

- A cost-effective pedestrian crossing improvement
- Generally improve safety
- No formal warrant analysis needed
- Can unleash latent crossing demand
- Median mountings tend to be short-lived

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Stop vs. Yield

RCW 46.61.235(1): "The operator of an approaching vehicle shall stop and remain stopped to allow a pedestrian or bicycle to cross the roadway within an unmarked or marked crosswalk..." WSDOT has interpreted this to mean that we need to use this



instead of this



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Stop vs. Yield

But:

RCW 46.61.190(1) requires "...every driver of a vehicle approaching a stop sign shall stop at a clearly marked stop line, but if none, before entering a marked crosswalk..."

And RCW 46.61.190(2) requires "The driver of a vehicle approaching a yield sign shall... slow down to a speed reasonable for the existing conditions and if required for safety to stop, shall stop at a clearly marked stop line, but if none, before entering a marked crosswalk..."

Hence, the yield sign more appropriately conveys desired driver behavior consistent with RCW 46.61.235(1).

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How Did the Pedestrian Cross the Road?

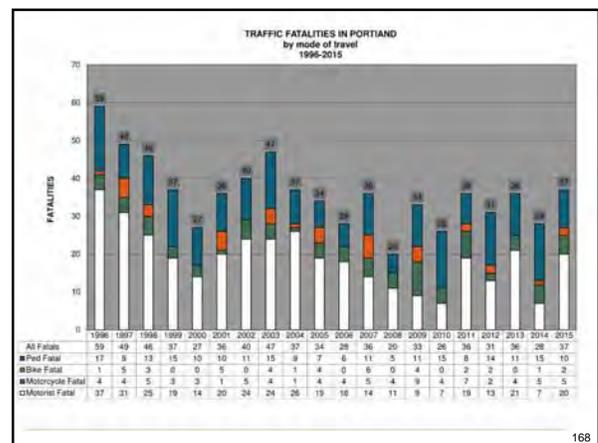
March 29, 2016

Presented by:

Peter Koonce, PE



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Transport Policy - Climate Action Plan

TRANSPORTATION HIERARCHY

- PEDESTRIANS
- BICYCLES
- PUBLIC TRANSIT
- COMMERCIAL VEHICLES / TRUCKS
- HIGH OCCUPANCY VEHICLES
- SINGLE OCCUPANCY VEHICLES

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Pedestrian Violations at Traffic Signals

- The longer the wait time the higher the probability of a violation
- People will trade effort and risk to reduce wait time.
 - Adding to the wait time for elevators increases use of stairs.
 - Adding to wait time for signals increases violations

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Risk Factors

- Speed Limit for Crossing
- Presence of Gaps
- Crosswalk Length / Number of lanes
- Directions that need to be watched - one way streets are less risky than two way

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Treatments Used to Reduce Risk

- Geometric Modifications
- Beacons
- Signals
- Grade Separation

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Geometric Modifications Curb Extensions

- Reduce crossing distance and pedestrian exposure
- Increases ability of pedestrians to see oncoming traffic
- Can introduce drainage issues if designed improperly
- Can reduce travel speeds
- Increases visibility of pedestrians waiting to cross

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Geometric Modifications Tighten Curb Radii

- Reduce crossing distance and pedestrian exposure
- Decreases speeds for right-turning traffic
- Decreases vehicular delay
- Increases visibility of pedestrians
- Challenging at intersections with large design vehicles

Wide curb radius means a longer crosswalk. Tight curb radii means a shorter crosswalk.

Portland Pedestrian Design Guide, 1999

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Geometric Modifications Raised Median Islands

- Simple solution for roadways with two-way left-turn lanes



175

Geometric Modifications Raised Median Islands

- Allows pedestrians to make 2-stage crossings
- Improve safety and comfort
- Reduced crossing delay
- Refuge area for slower pedestrians



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Geometric Modifications Raised Median Islands

- Offset crosswalks (2-stage crossings)
 - Position pedestrians to face oncoming traffic



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Signing Enhancements High-visibility Treatments

- Increase awareness of pedestrians



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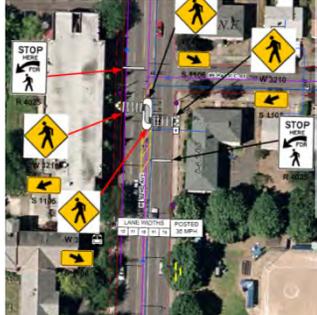
Signing Enhancements High-visibility Treatments

- After 1 month... 
- After 5-months... 

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Combining Treatments

- Raised median
- Off-set marked crossing
- Advance stop lines
- Pedestrian warning signs (black on yellow)
- Regulatory pedestrian signs (black on white)



180

Pedestrian Beacons

- Increase visibility of pedestrian crossings
- Typical applications of Warning Beacons include
 - Supplemental emphasis to warning signs
 - Emphasis for midblock crosswalks
- *Warning Beacons that are actuated by pedestrians, bicyclists, or other road users may be used as appropriate to provide additional warning to vehicles approaching a crossing or other location [2009 MUTCD, Section 4L.03]*



Photo: ITE Pedestrian/Bicycle Council

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Rectangular Rapid Flash Beacons (RRFBs)

- beacons that use an irregular flash pattern similar to emergency flashers
- installed on either two-lane or multi-lane roadways
- Active warning beacons should be used to alert drivers to yield where bicyclists have the right-of-way
- Interim approval from USDOT in July 2008
 - http://mutcd.fhwa.dot.gov/resources/interim_approval/ia11/ia11_rrfb_iapmemo.pdf

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SE 80th & Foster Road Example



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Before RRFB @ SE 80th/Foster



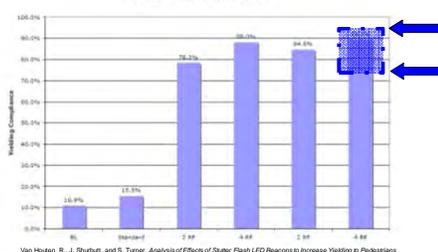
184



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Rectangular Rapid Flash Beacons (RRFB)

- High motorist yield rates
- Consistent over 1-year period



Beacon Type	Yielding Compliance (%)
None	10.8%
Standard	15.3%
2 RF	75.2%
4 RF	88.0%
2 RF	94.6%
4 RF	98.5%

Van Houten, R., J. Shurtutt, and S. Tamer. Analysis of Effects of Solar Flash LED Beacons to Increase Yielding to Pedestrians Using Multiple Crosswalks. Transportation Research Board, 2008.

http://mutcd.fhwa.dot.gov/resources/interim_approval/ia11/spetersburgpt/index.htm

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Rectangular Rapid-Flash Beacons (RRFB)

- **Advantages**
 - Lower cost option compared to other devices that produce similar vehicular yield rates
 - Research shows a higher yield rate than a regular round beacon
 - Research shows highest yielding rate of all devices that do not feature a red display
- **Disadvantages**
 - Pedestrians misinterpreting flashing lights and/or not waiting for traffic to stop prior to entering crosswalk

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RRFB in Pieces

Cabinet



Controller



Solar Power



188

RRFB in Pieces

Push Button



Stop Sign (side street)



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Traditional Pedestrian Signal

- *Midblock crosswalks shall not be signalized if they are located within 300 feet from the nearest traffic control signal, unless the proposed traffic control signal will not restrict the progressive movement of traffic. [2009 MUTCD, Section 4D.01]*

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Traditional Pedestrian Signal

- *A midblock crosswalk location should not be controlled by a traffic control signal if the crosswalk is located within 100 feet from side streets or driveways that are controlled by STOP signs or YIELD signs. [2009 MUTCD, Section 4D.01]*



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Current Status of Half Signals

- Portland has 46 half signals in operation
- PSU has completed research to compare relative safety of unsignalized and signalized locations (half, full, HAWK)
- Results match our experience which is they offer safety benefits without compromising vehicular performance

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Pedestrian Hybrid Beacons (HAWK)

- **HAWK = High-Intensity Activated CrossWalk**
 - Approximately 80 in Tucson; 6 in Portland; 1 in Klamath Falls
 - Included in 2009 MUTCD as "Pedestrian Hybrid Beacon"



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Pedestrian Hybrid Beacon (or is it a HAWK signal)



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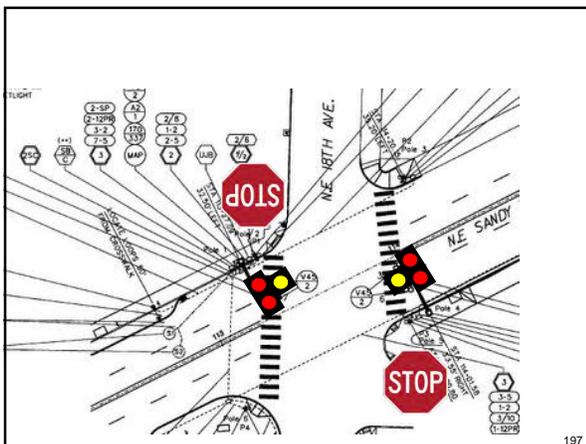
195

Exclusive bike-ped signal



NCHRP 562
FHWA Publication FHWA-HRT-10-042

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HAWK Signals on YouTube

- **Concerns about Pedestrian Hybrid Beacons**
 - Not stopping on Flashing Red – Tucson, AZ
– <http://www.youtube.com/watch?v=ReNk2T5ay1c>
 - Not going on Flashing Red – Springfield, OR
– <http://www.youtube.com/watch?v=KoX-aTe7SAo>
 - Police Officer Description - Peoria, AZ
– <http://www.youtube.com/watch?v=SEPIHLoXpTs&feature=related>

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HAWK signal sequence

Sequence for Coordinated HAWK, Bicycle and Pedestrian Signal.

Interval	Motor Vehicle	Bicyclist	Pedestrian
1	[Red light]	[Red bicycle symbol]	[Red hand symbol]
2	[Flashing red light]	[Red bicycle symbol]	[Red hand symbol]
3	[Flashing yellow light]	[Red bicycle symbol]	[Red hand symbol]
4	[Red light]	[Red bicycle symbol]	[Red hand symbol]
4	[Red light]	[Green bicycle symbol]	[White walking symbol]

5



6



7



8



1



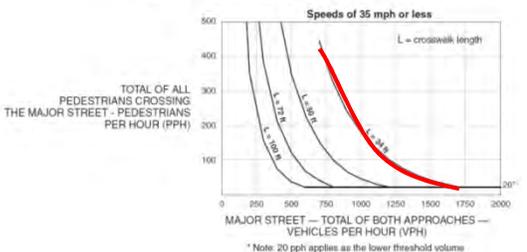
NACTO Urban Bikeway Design Guide

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Pedestrian Hybrid Beacons (HAWK)

- 2009 MUTCD includes installation guidelines

Figure 4F-1. Guidelines for the Installation of Pedestrian Hybrid Beacons on Low-Speed Roadways

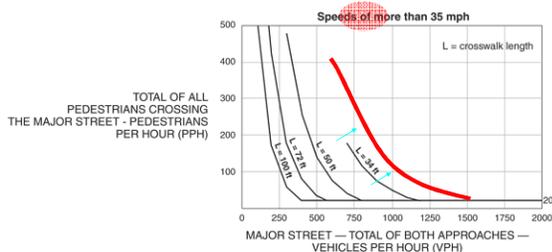


* Note: 20 pph applies as the lower threshold volume

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Pedestrian Hybrid Beacons > 35mph

Figure 4F-2. Guidelines for the Installation of Pedestrian Hybrid Beacons on High-Speed Roadways



* Note: 20 pph applies as the lower threshold volume

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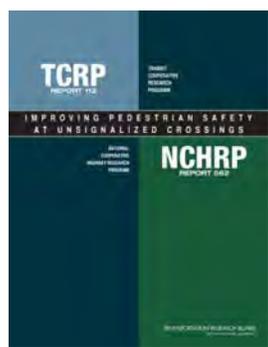
What comes after Signals? Grade Separation

- Advantages**
 - Accommodates high volume pedestrian crossings
 - Avoids vehicular/pedestrian conflicts
 - Pedestrian safety
 - Can be designed around topography
- Disadvantages**
 - Cost
 - Out-of-direction travel
 - Safety/Crime/Security (undercrossings)
 - Drainage
 - Visibility of crossing to unfamiliar users
 - Can be difficult to meet ADA requirements for grade

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Selecting Treatments - NCHRP 562

- NCHRP 562: Improving Pedestrian Safety at Unsignalized Crossings**
 - Field study of motorist yielding for multiple crossing treatments
 - Delay-based method to select appropriate crossing treatments
 - Generally consistent with FHWA marked vs. unmarked crosswalk study



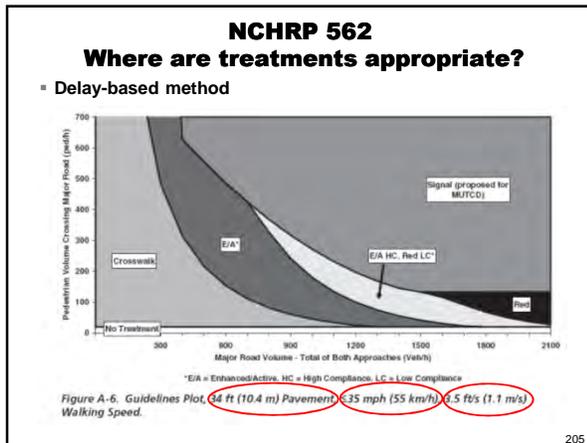
203

NCHRP 562 – Selecting Treatments

- Based on estimated pedestrian delay using HCM methodology
 - More delay = more aggressive treatment
- Delay Calculation Methodology:**

Inputs	Outputs
Walk speed, Crossing distance	Critical gap
Critical gap, Traffic volume	Delay per pedestrian
Delay/ped., Pedestrian Volume	Total pedestrian delay
- Worksheet examples in Appendix A (Guidelines for Pedestrian Crossing Treatments)

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Costs for Various Devices

- Full Signal - \$200 to 300K (includes soft costs)
- Half Signal/Ped Hybrid Beacon - \$150 to \$250K
- Rapid Flash Beacons - \$40 to \$100K

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Questions?

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Thank you and
Goodbye

Fall 2016 in Eastern WA and
December in Federal Way

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