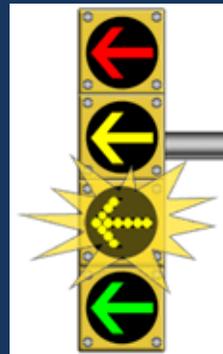
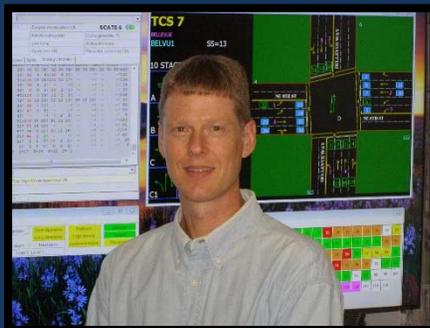


PED MINUS LEFT

Mark Poch, PE, PTOE
Darcy Akers, EIT

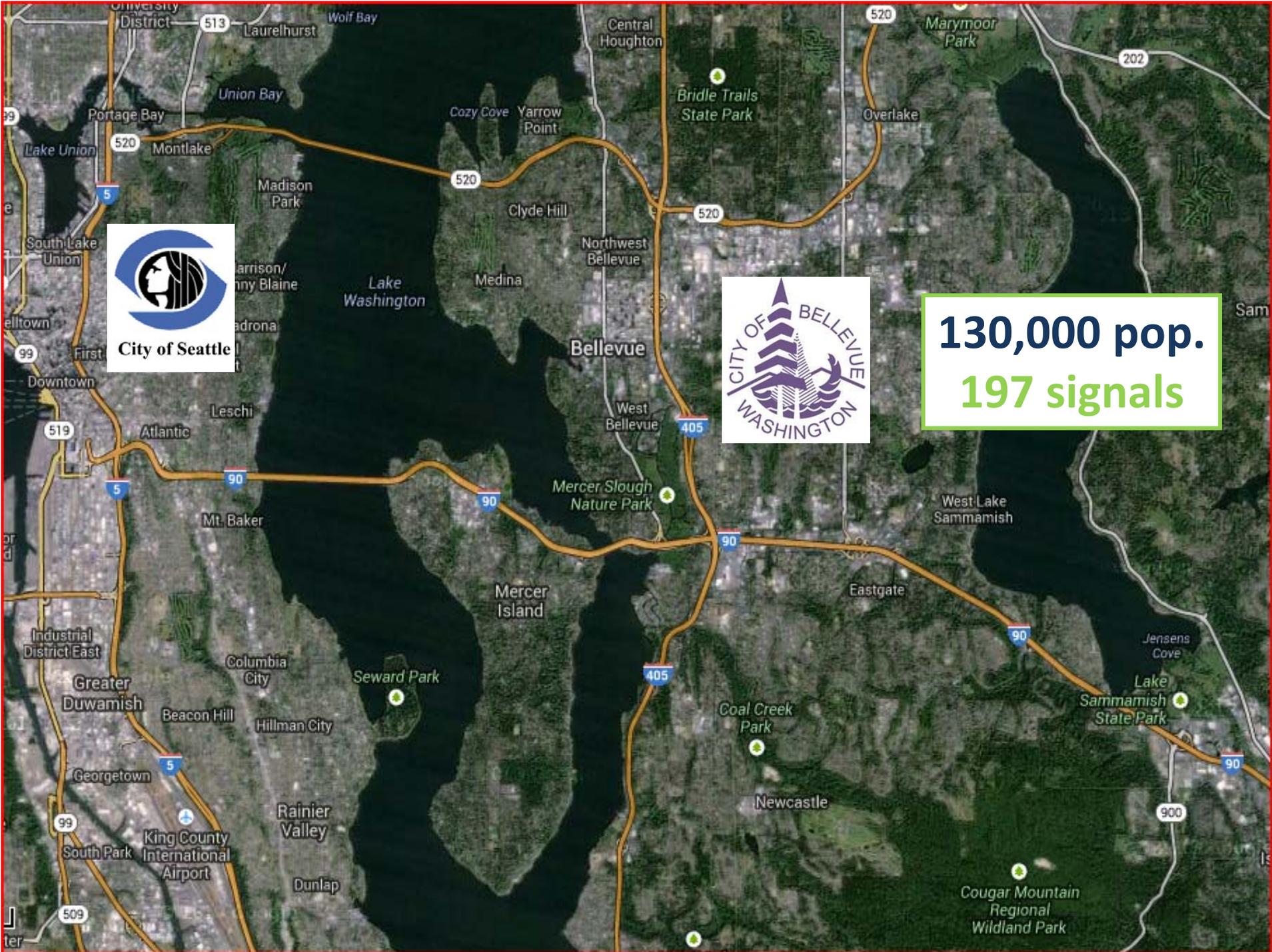
City of Bellevue, WA



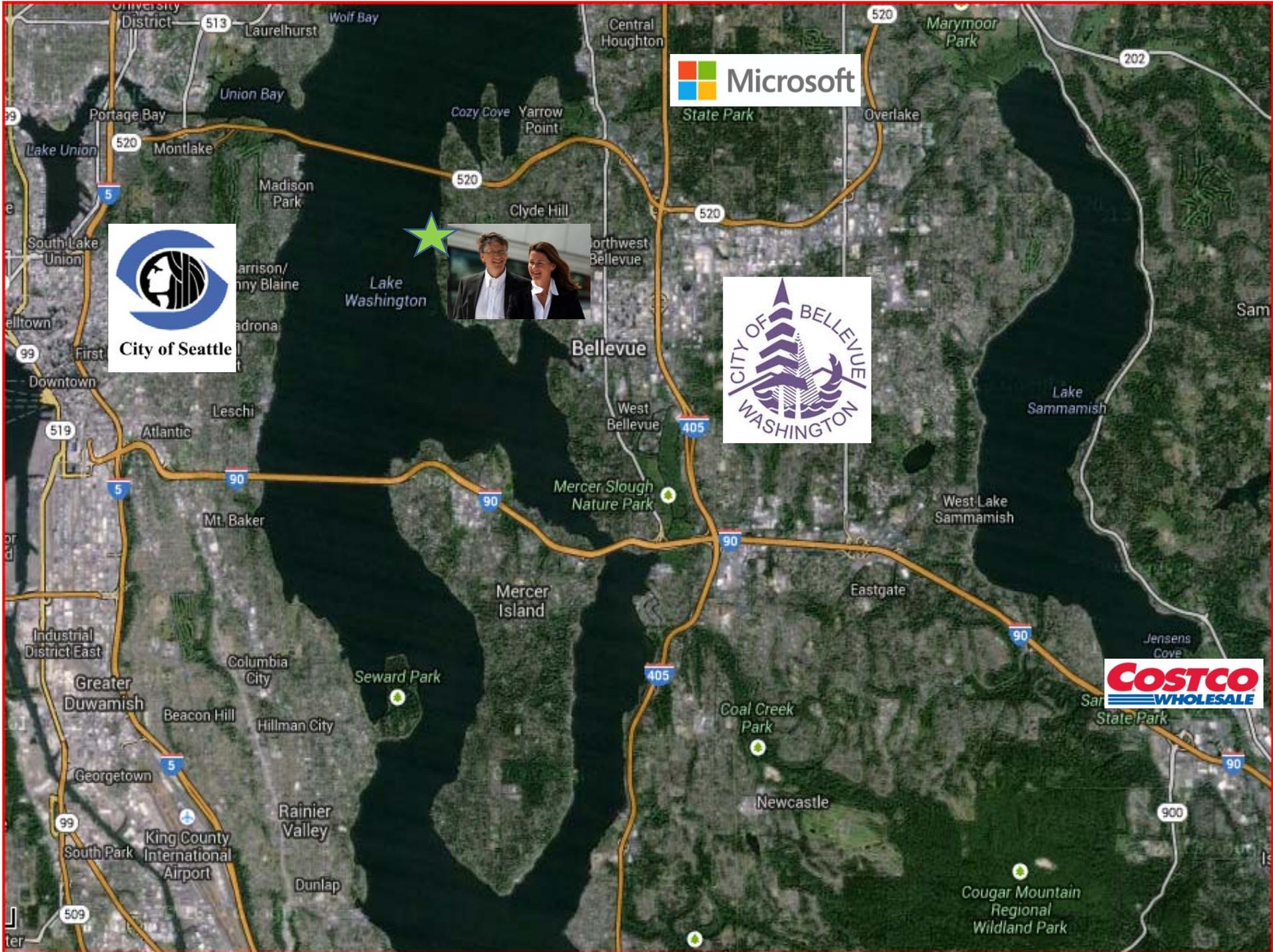
T3 Webinar

December 2, 2015



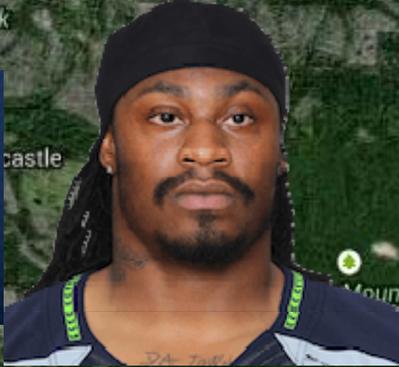


130,000 pop.
197 signals





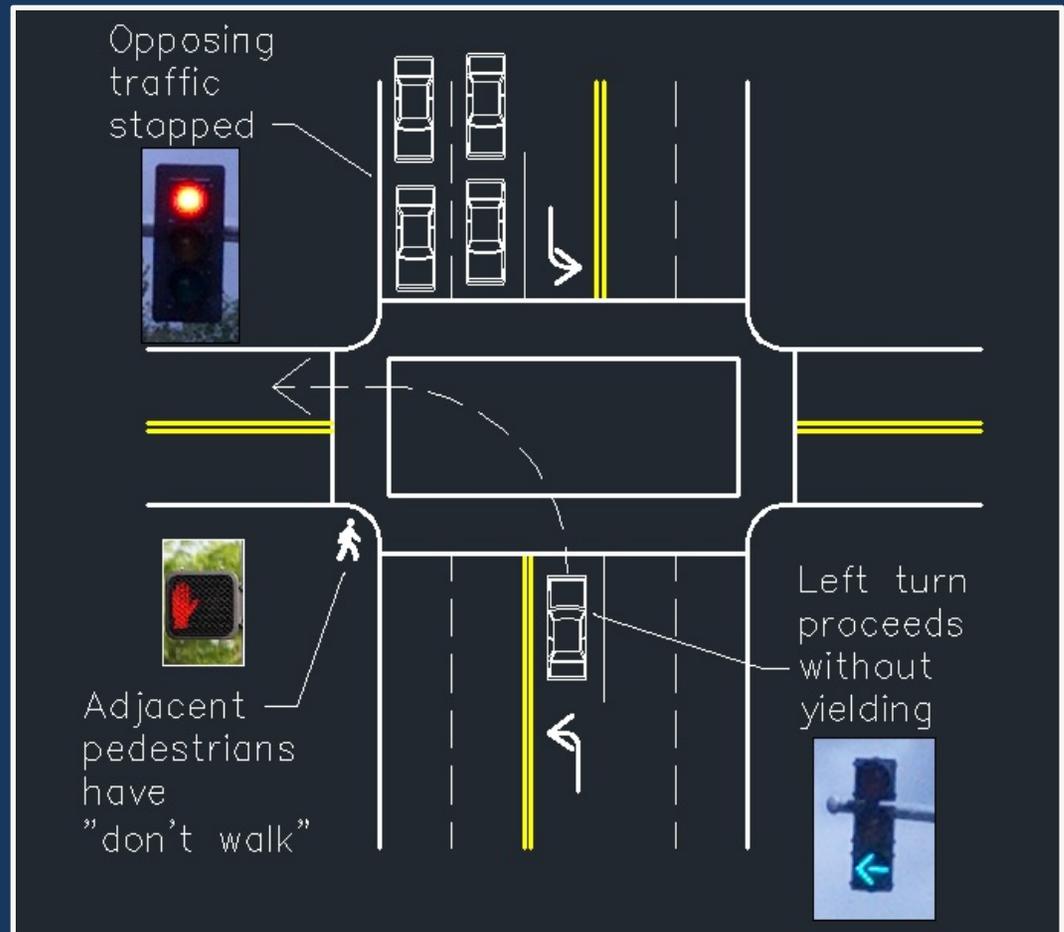
City of Seattle





The Challenge

Protected Only Turns

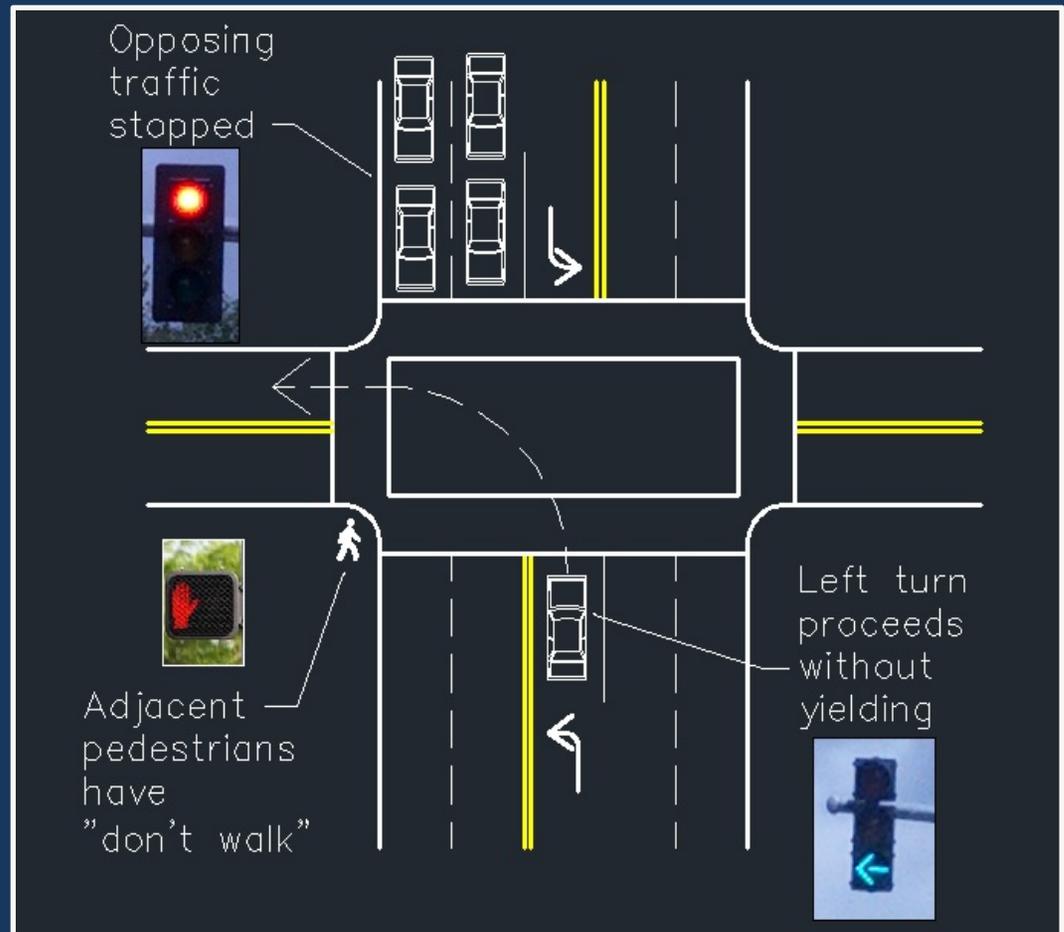




The Challenge

Protected Only Turns

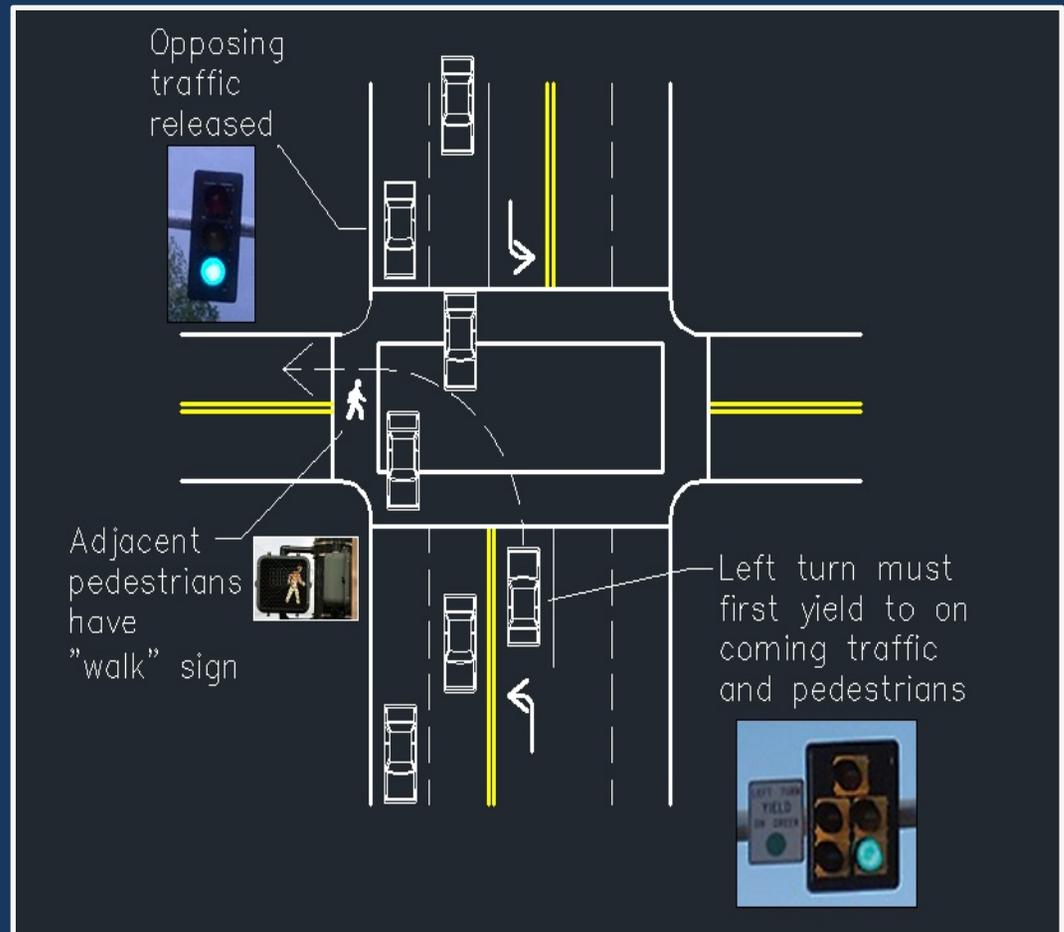
- Set up to run 24/7/365
- No permissive turns during less heavy traffic conditions





The Challenge

Protected/Permissive Turns

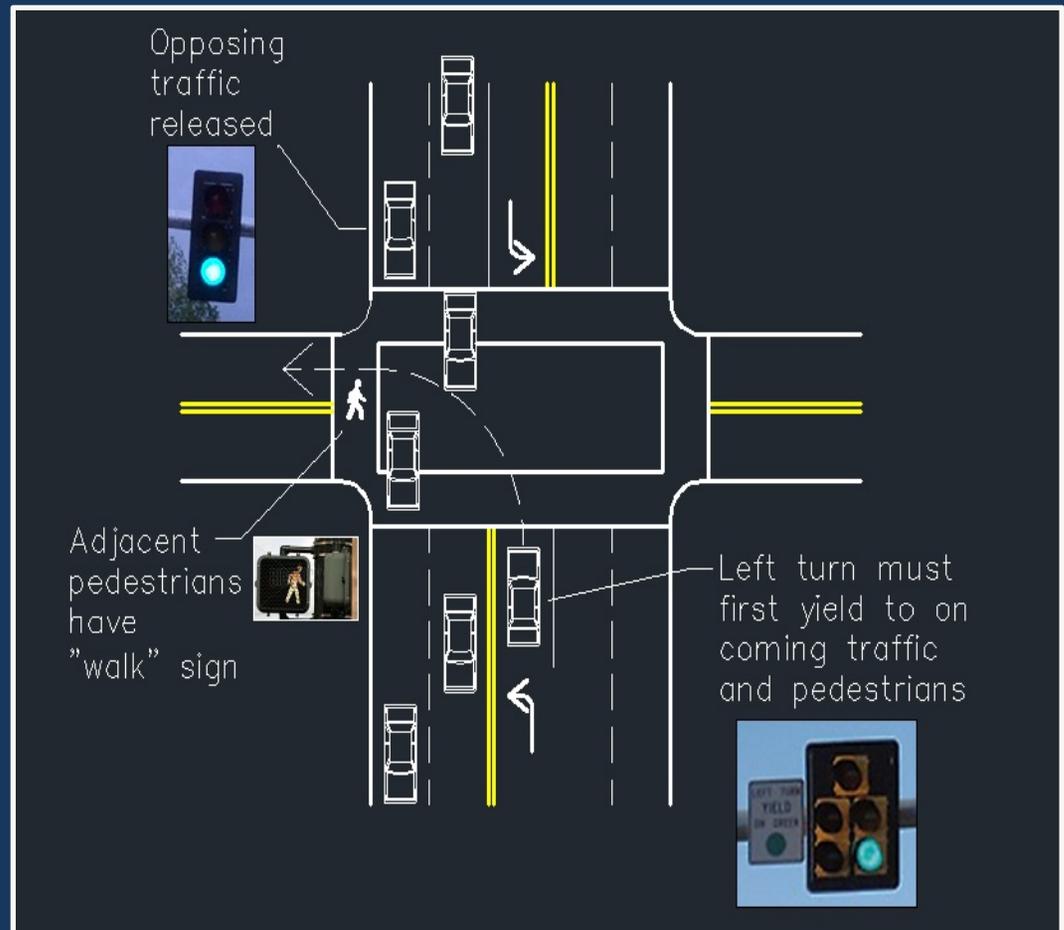




The Challenge

Protected/Permissive Turns

- **Conflicts with Pedestrians**
- **No Protected ONLY turns during heavier traffic conditions**

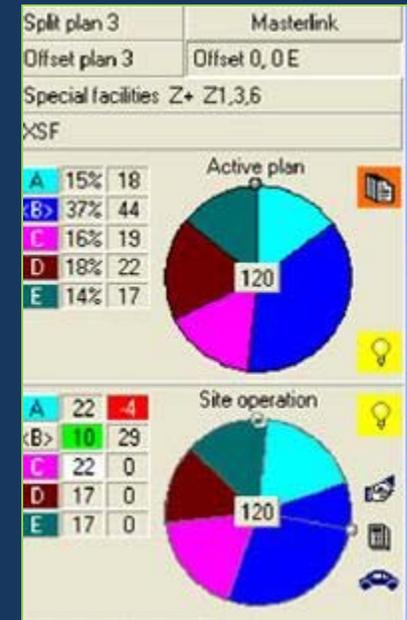
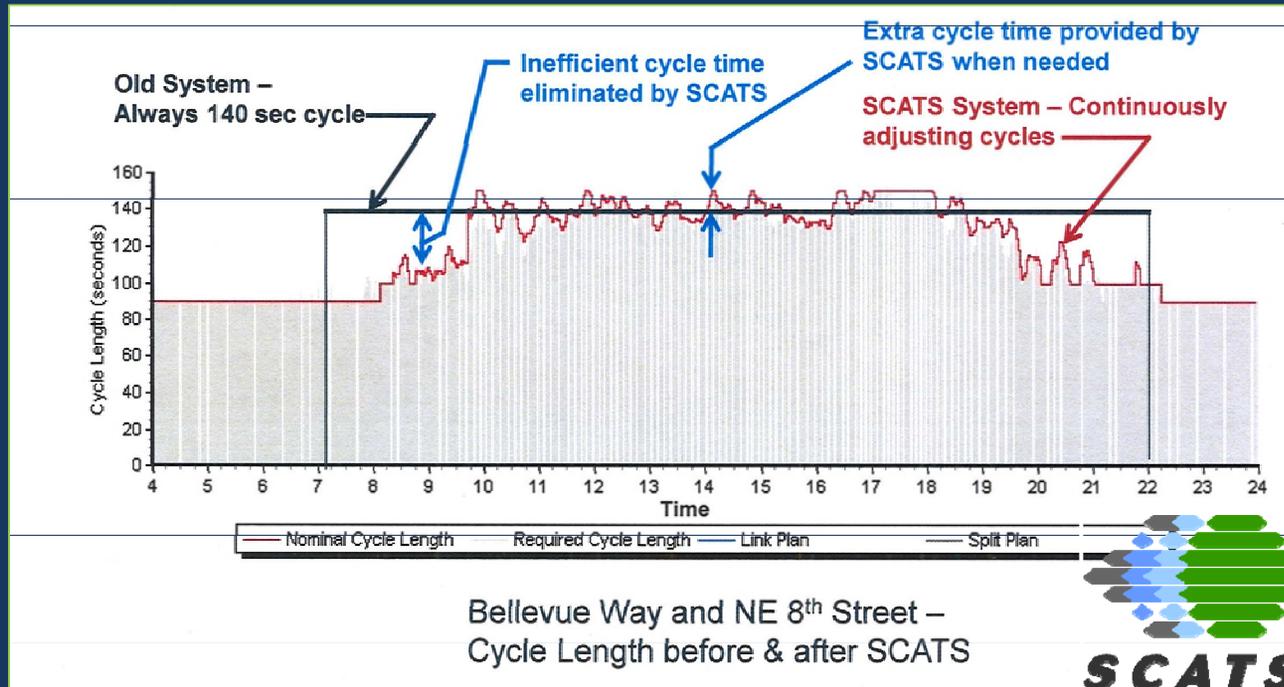


The Challenge



How to provide the **right** LT phasing at the **right** time?

The Response

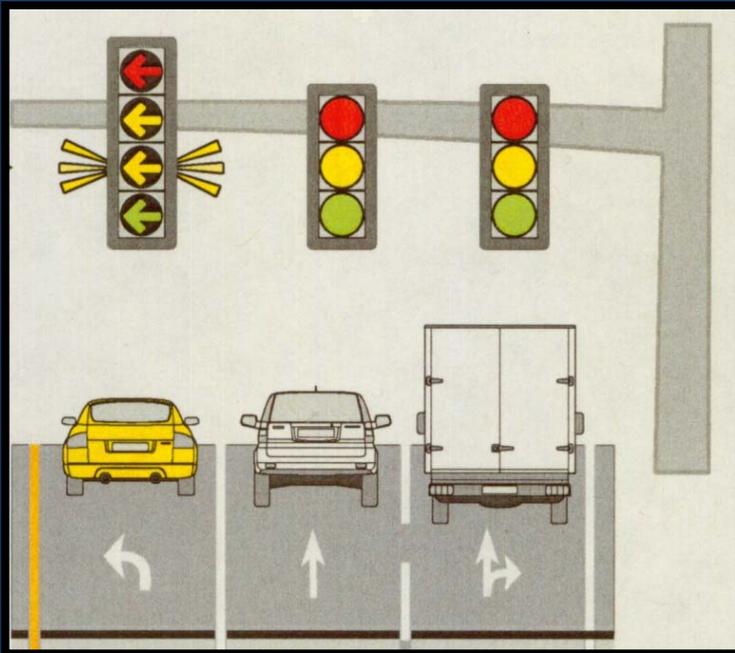


Example of Cycle Split Plan

Develop new tools

- Sydney Coordinated Adaptive Traffic System (SCATS)
- Utilize Flashing Yellow Arrow (FYA) display
- Pro Only vs. Pro/Per by Time of Day or adaptively

Flashing Yellow Arrow (FYA)



Flashing Yellow Arrow Display

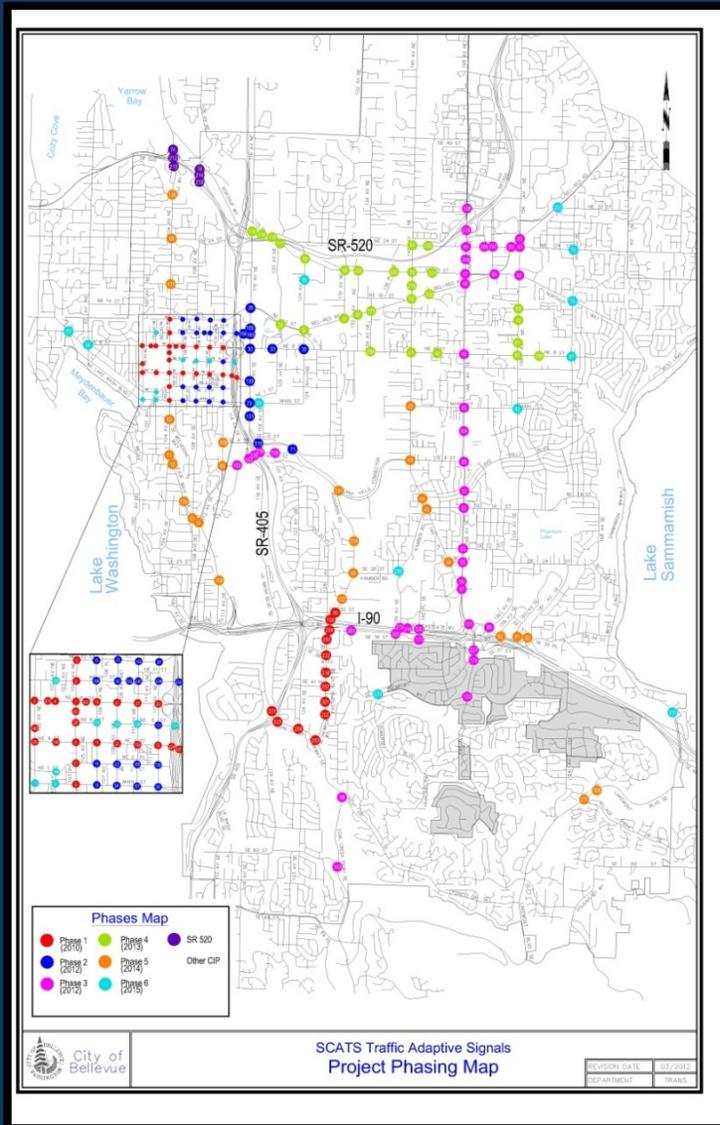


*Protected Permissive Operation
Before Flashing Yellow Arrow*

Protected Left Turn to Protected/Permissive by

- Time of Day (TOD)
- Adaptively

Systematically evaluate all Protected left turn locations citywide



SCATS Phasing Map



City of Bellevue Left Turn Phasing Implementation

Protected/Permissive LT Phase

Location: 140th Ave NE and NE 24th St (#64)

Direction: NBLT

Proposed: Flashing Yellow Arrow

Evaluated by: Fred Liang

Date: 3/5/2013

Existing: Protected/Permissive

Data:	Speed Limit (mph)	30	AM vol	LT 2013	66	Opp Thru	432	X-prod	28512	Opp LT	120
	# opposing thru lane	1	Noon vol	LT 2013	66	Opp Thru	297	X-prod	19602	Opp LT	61
			PM vol	LT 2013	157	Opp Thru	401	X-prod	62957	Opp LT	79
	Accident	one direction	1 year	NA	2 years	NA	3 years	NA			
		two directions	1 year	NA	2 years	NA	3 years	NA			

Satisfy

Consideration

Yes **Speed Limit**

<= 45 mph

Sample Calculation Spreadsheet

Yes **Phasing**

No lead-lag unless using "flashing arrow" operation

NA **Accident**

5/yr; 9/2-yr; 13/3-yr (one direction); >=9/yr; 16/2-yr; 20/3-yr (two directions)

Yes **Sight distance**

Posted Speed Limit (mph)

		25	30	35	40
Number	1	202	242	282	323
of	2	220	264	308	352
Lanes	3	238	286	334	381

Yes **# of opposing lanes**

Less than or equal to 3 opposing lanes (including right turn only lane)

No **Ped Minus Left**

Use during higher traffic periods if previous phasing was protected only

Yes (PM) **Volume & X product**

LT >= two vehicles/cycle during peak

AND

One opposing thru lane	>50,000 if opposing LT >=50 (vph)
One opposing thru lane	>75,000 if opposing LT <50 (vph)
Two or more opposing thru lanes	>100,000 if opposing LT >=50 (vph)
Two or more opposing thru lanes	>125,000 if opposing LT <50 (vph)

Recommendation: All day FYALT

Protected/Permissive

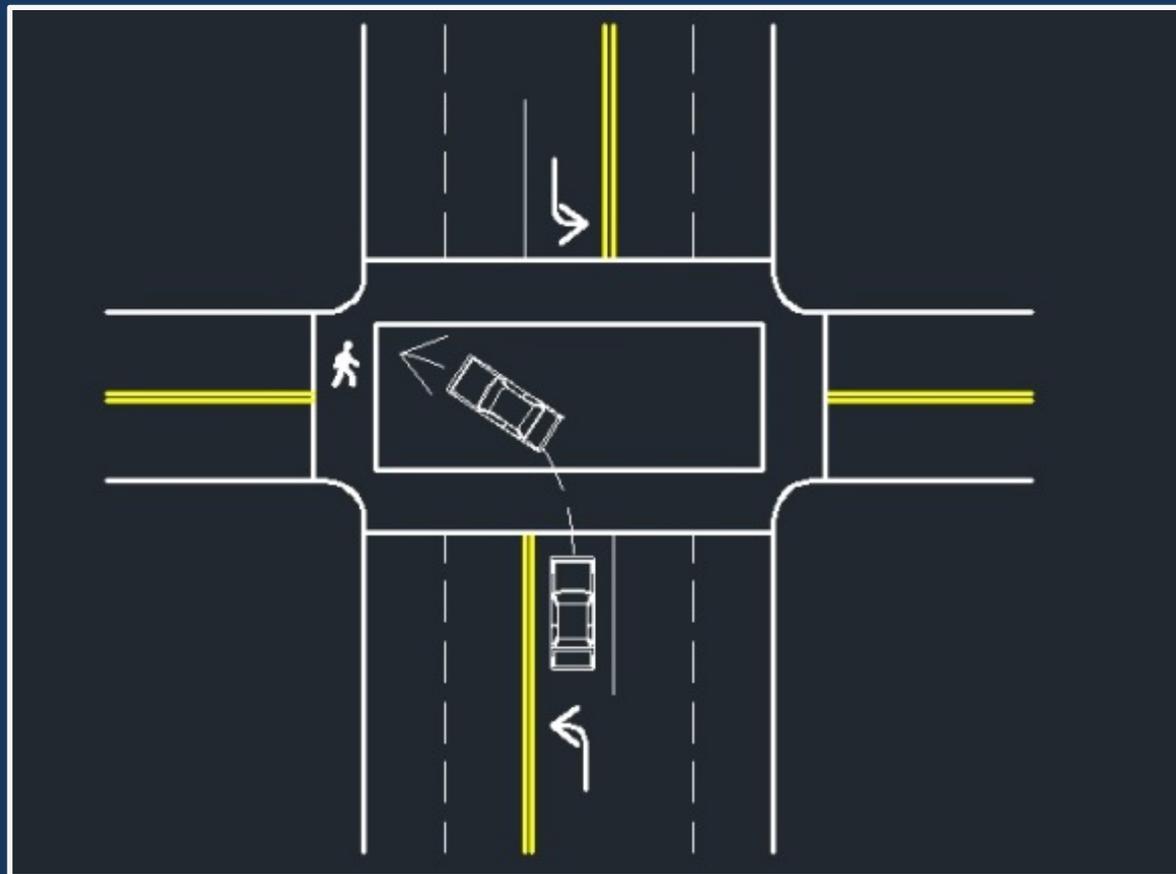
107 protected only left turns converted to pro/per with FYA by TOD or adaptively



Installation of new heads in preparation for SCATS implementation

Protected/Permissive

Resolve Pedestrian conflict with permissive left



Resolve Pedestrian conflict with permissive left turn



A recent controversial study by Oregon State University examined driver behavior in permissive left turns has identified about 4-9 % of the time, drivers don't even bother to look and see if there are people in the way.



Resolve Pedestrian conflict with permissive left turn



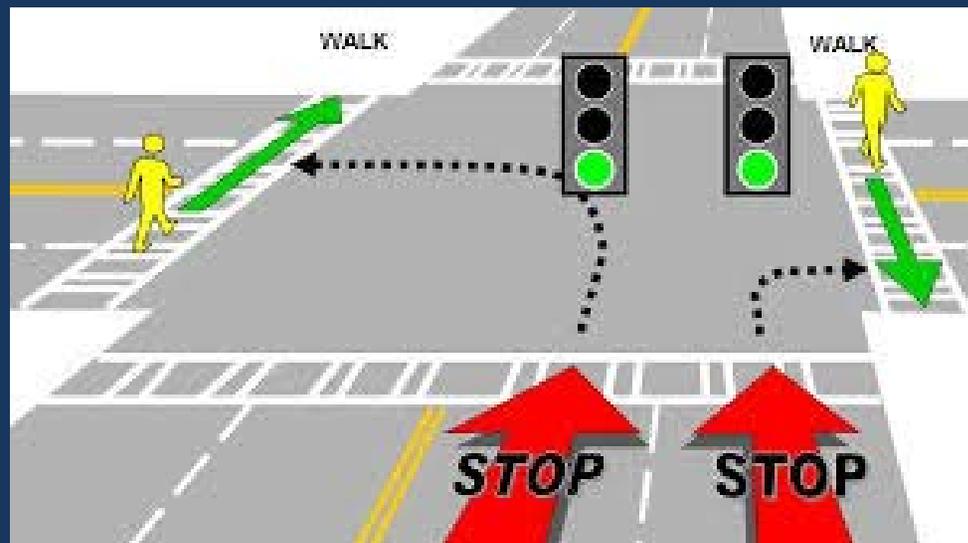
A recent controversial study by Oregon State University examined driver behavior in permissive left turns has identified about 4-9 % of the time, drivers don't even bother to look and see if there are people in the way.



Resolve Pedestrian conflict with permissive left turn



How? *SCATS "Ped Minus Left" Feature*



Ped Minus Left = Pedestrian crosses without the left turn conflict

Resolve Pedestrian conflict with permissive left turn



How? *SCATS "Ped Minus Left" Feature*

Allows engineers to protect pedestrians by omitting the permissive left turn when the crosswalk has a walk or flashing don't walk indication

Used at all previously protected only locations



Ped Minus Left

Example



Ped Minus Left



No Ped – FYA
(Don't Walk)



Ped Minus Left



Ped Waiting – Red
(Don't Walk)



Ped Minus Left



Ped Crossing – Red
(Walk and FDW)



Ped Minus Left



After FDW – FYA
(Don't Walk)



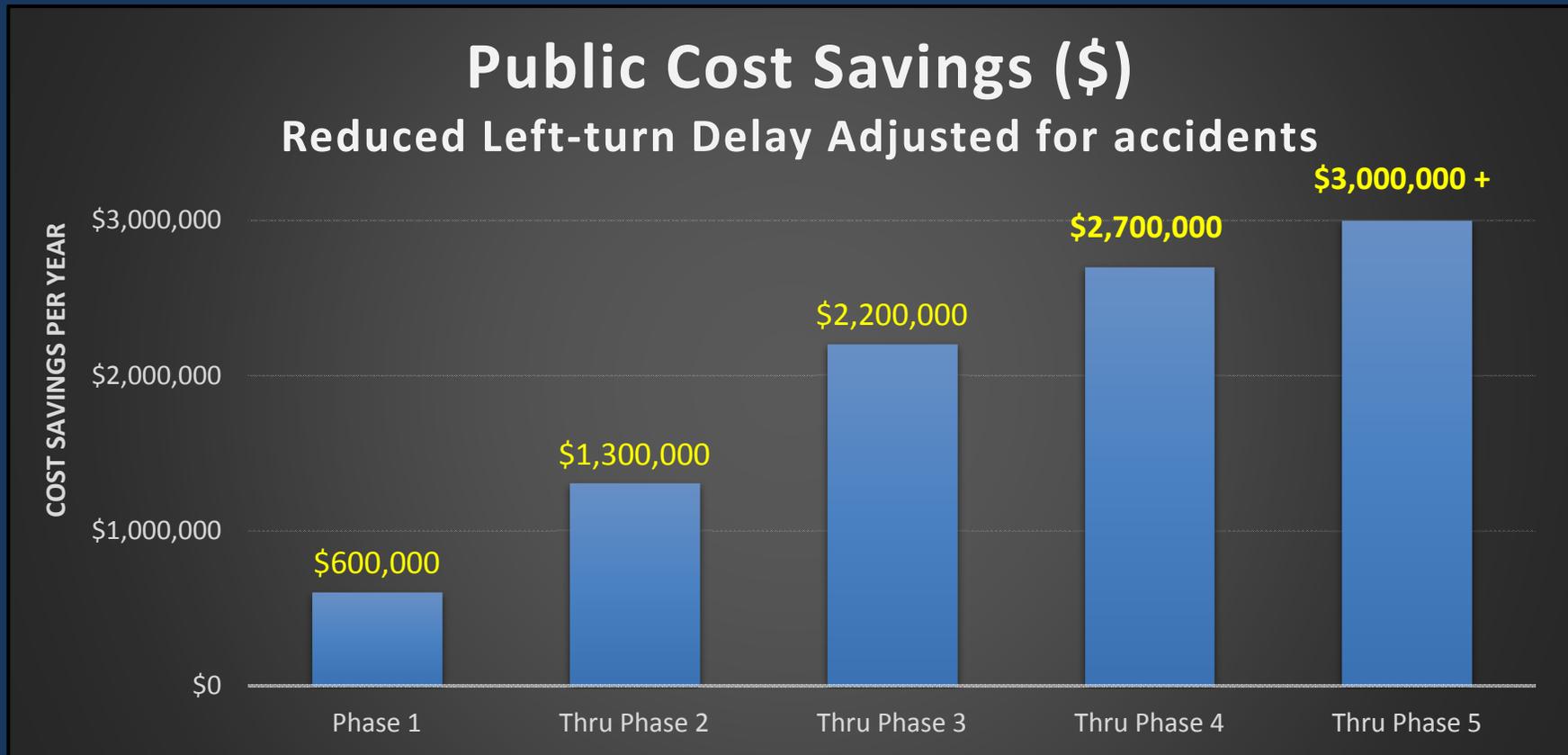
Ped Minus Left

Video Example

Pro/Per with Ped Minus Left

Cost Savings from Reduced Delay

- Simulation models
- Value of time = \$15/hr



Pro/Per with Ped Minus Left

No Left Turn vs. Pedestrian Accidents when Ped Minus has been activated



Final Thoughts

WHY??



- Net Left Turn Improvement Benefit = \$3 million/yr
- Decreased Vehicle and Pedestrian Delays
- SCATS Project Cost = \$5.5 million (one time)
- Not possible without Ped Minus Left
- Potential for standard application