

Tapping into the Power of a Traffic Sign Inventory to Meet the New Retroreflectivity Requirements



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Sign Retroreflectivity MUTCD Requirements

- Final Rule – published Dec 21, 2007
- Effective January 22, 2008

- 4 years to establish/implement assessment management method
- 7 years to replace ground-mount signs
- 10 years to replace overhead signs

Sign Retroreflectivity – MUTCD

New “Shall” statement (Standard):

“Public agencies or officials having jurisdiction **shall use an assessment or management method** that is designed to maintain traffic sign retroreflectivity at or above the minimum levels in Table 2A-3.”

Table 2A-3. Minimum Maintained Retroreflectivity Levels (cd/lux/m²)

Sign Color	Conditions	Retroreflective Sheeting Material (ASTM D4956-01a) (legend//background)					
		I	II	III	VII	VIII	IX
White on Red	≥ 3:1	W35 // R7					
Black on Orange or Yellow	≥ 48" or Bold	X	OY50				
	< 48" or Fine	X	OY75				
Black on White		W50					
White on Green	Overhead	x // G7	x // G15	x // G25	W250 // G25		
	Shoulder	x // 7	120 // 15				

Sign Retroreflectivity – MUTCD

Guidance:

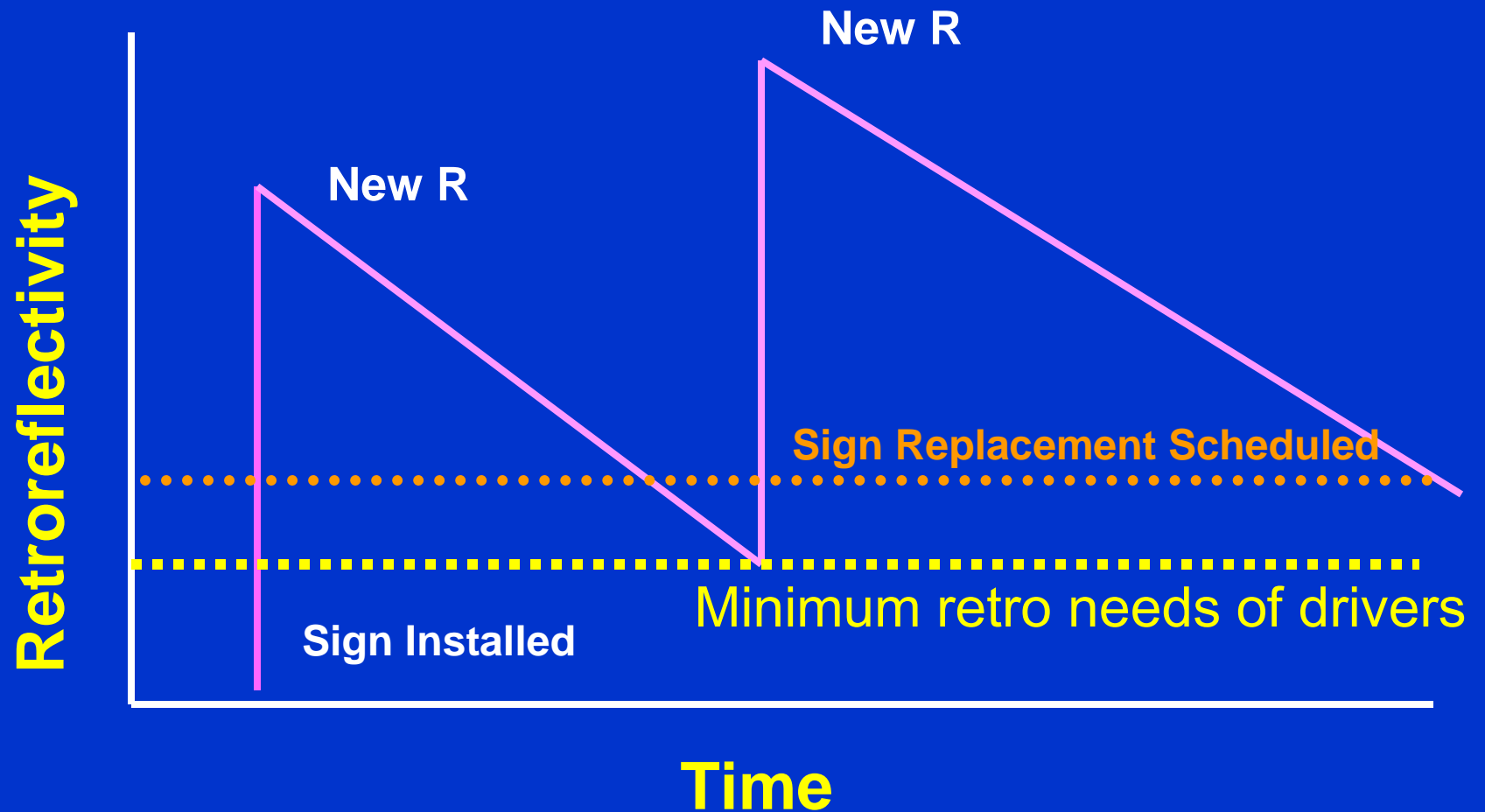
“One or more of the following assessment or management methods should be used to maintain traffic sign retroreflectivity.”

Assessment/Management Methods

- A. Visual Nighttime Inspection
- B. Measured Retroreflectivity
- C. Expected Life
- D. Blanket Replacement
- E. Control Signs
- F. Other Supported Methods



Degradation of Sign Retroreflectivity



Sign Retroreflectivity

- Which assessment or management method is best??
- What is the best way to optimize use of our labor, equipment, and materials??
- Our Sign Inventory became a powerful tool that helped guide us to the best answer.... for us.

Pierce County Sign Inventory

(~1,500 centerline miles of roads)

- 24,530 traffic signs
- 2,967 STOP & YIELD signs
- 6,761 warning (W-series) signs
- 3,117 Speed Limit signs
- 8,345 street name signs (34%)

Sign Inspection Route

Listed by Route and Position Number

Sign Finder Inspection Rt/Sign Index Input Daily Work Sheet Completed Inspections/WorkSheets

ENTER ROUTE: TA001 INCLUDE: ALL STOP & YIELD Guideposts

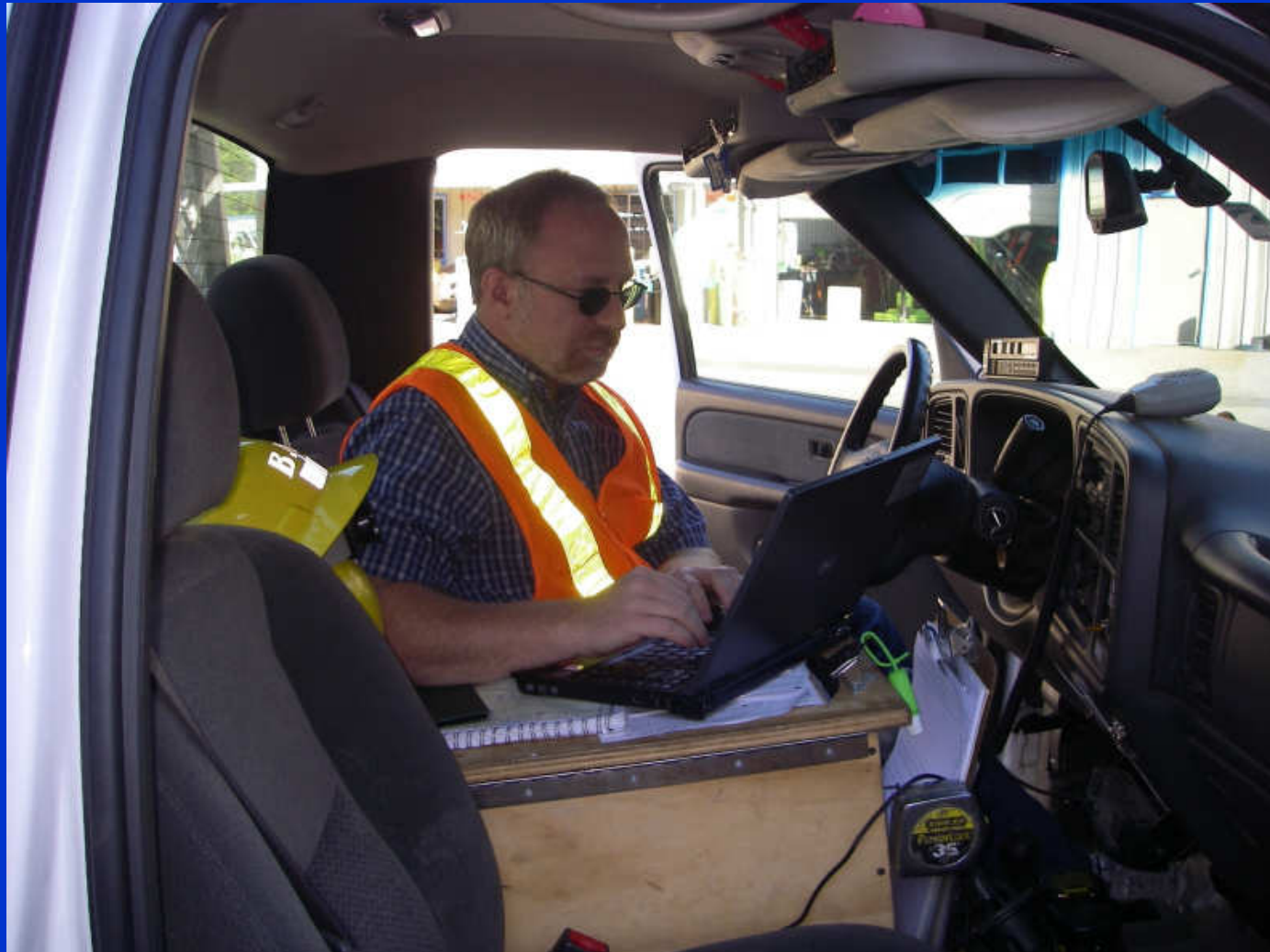
Inspection Route Save Changes Print Clear Form

Row 1 of 217

AREA 1A - Tacoma
Inspection Route TA001

Funct	On Street	Dist	DR	Reference Street	BN	Legend	Code	Var	Size	O	Serial #	Pos #	Struct
64E	STEELE ST S	280	N	102 ST S	N	SPEED LIMIT	R2-1	35	24x30	R	20071860	50	
	STEELE ST S	119	S	096 ST S	S	WELCOME TO ___	PD-61	PAF	42x30	R	20070663	75	73236
	STEELE ST S	280	S	096 ST S	S	SPEED LIMIT	R2-1	35	24x30	R	97021617	100	73237
	STEELE ST S	280	S	096 ST S	N	SIGNAL AHEAD	W3-3		36x36	R	20040082	150	73238
	096 ST S	321	E	026 AV S	E	SPEED LIMIT	R2-1	35	24x30	R	20024333	210	73239
	026 AV S	8	N	096 ST S	N	DOUBLE ARROW	W1-7		48x24	L	20042709	230	73240
	026 AV S	148	S	096 ST S	N	ONLY ONLY	PR-26		30x30	R	20071791	250	
	026 AV S	214	S	096 ST S	S	SPEED LIMIT	R2-1	35	24x30	R	20015192	270	73242
	026 AV S	308	S	096 ST S	S	CURVE	W1-2	L	30x30	R	97011448	290	73243
	SALES RD S	21	W	026 AV S	E	STOP	R1-1		30x30	R	20070164	350	73244
	026 AV S	8	S	SALES RD S	S	STREET NAME	D3-101	2	36x9	R	11111111	352	73245
	026 AV S	25	S	SALES RD S	S	D3-101 W/ARROW	PD-14A	2T	36x9	R	20051749	370	73246
	098 ST CT S	30	E	026 AV S	W	STOP	R1-1		30x30	R	20061255	390	73247
	026 AV S	25	S	098 ST CT S	N	STREET NAME	D3-101	2	36x9	R	11111111	391	73248
	026 AV S	25	S	098 ST CT S	N	D3-101 W/ARROW	PD-14A	1T	36x9	R	20051750	392	73248
	SALES RD S	278	N	102 ST S	S	ARTERIAL TURNS	PR-42	L	30x24	R	20061437	450	73249
	SALES RD S	319	N	102 ST S	N	SPEED LIMIT	R2-1	35	24x30	R	94050507	470	73250
	SALES RD S	34	S	102 ST S	S	DEAD END	W14-1		30x30	R	20013015	490	73251
	SALES RD S	304	S	102 ST S	S	ROAD ENDS ___	FPW-1	300	30x30	R	20071882	550	
	SALES RD S	651	S	102 ST S	S	END OF ROAD MA	W16-101		24x24	L	20015747	570	73253
	102 ST S	30	E	SALES RD S	W	STOP	R1-1		30x30	R	20062918	600	73254
	102 ST S	11	W	SALES RD S	W	1 SIDED STREET S	PD3-101	2	36x9	L	20051746	601	73255
	SALES RD S	9	N	102 ST S	N	STREET NAME	D3-101	2	36x9	R	11111111	602	73256
	102 ST S	31	E	SALES RD S	E	WELCOME TO ___	PD-61	PAF	42x30	R	20071888	615	
	102 ST S	440	W	STEELE ST S	W	YARD WASTE	PD-69	L	24x30	R	96022901	630	73258
	102 ST S	333	W	STEELE ST S	W	ARTERIAL TURNS	PR-42	R	30x24	R	20025572	650	73259
	102 ST S	299	E	SALES RD S	E	STOP AHEAD	W3-1A		36x36	R	20062699	670	73260
	102 ST S	53	W	STEELE ST S	E	STOP	R1-1		30x30	R	20061661	700	73261
	102 ST S	53	W	STEELE ST S	E	STREET NAME	D3-101	2	36x9	R	11111111	701	73261

Office of a Sign Technician

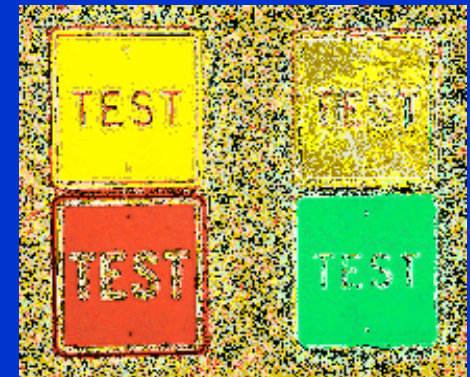


Method A: Visual Nighttime Inspection

Trained sign inspector, Moving vehicle

PROCEDURE OPTIONS:

1. Calibration Signs 
2. Consistent Parameters
3. Comparison Panels 



Older Signs Pulled From Field and Set Up in Sign Shop Yard



Retroreflectivity measurements

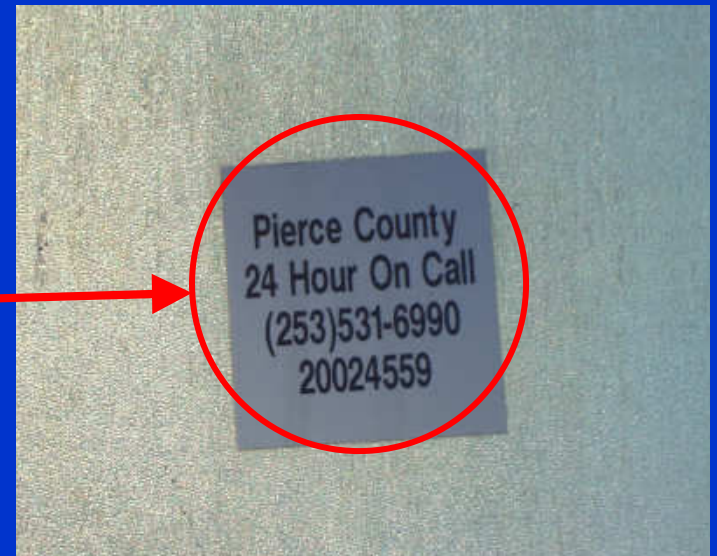
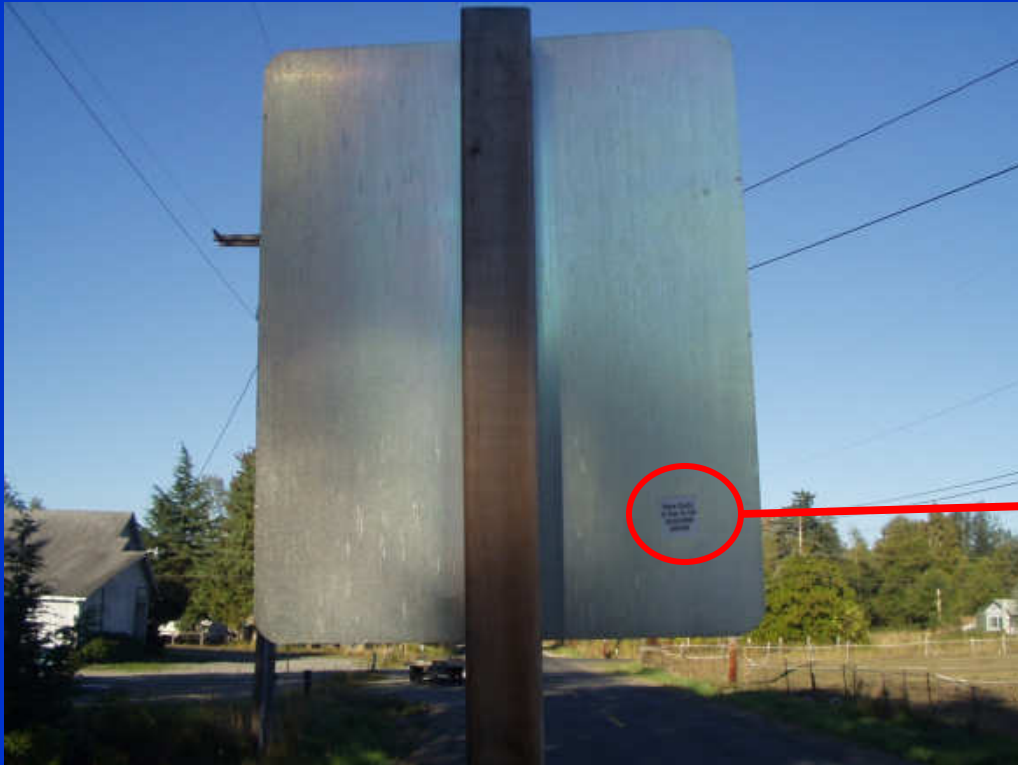


Method B: Measured Retroreflectivity

- Measure signs with retroreflectometer
- Compare measured values with minimum values
- Replace signs when measured values approach minimums



Serial number tagging



Signs left by vandals... where do they belong?



Date stamping within serial number

RT#	PDS#	STRUCT	ON STREET	DIST	DR	REF ST	BN	O	SIZE	CODE	VAR	LEGEND	SER #
SP106	702	71350	PARK AV S	93	N	133 ST S	N	R	24x10	S4-2		WHEN CHILD PRES	S2002035
SP106	4525	71459	YAKIMA AV S	175	N	138 ST S	N	R	24x30	R2-1	25	SPEED LIMIT	99100237
SP106	300	71342	PARK AV S	100	N	132 ST S	S	R	12x18	R7-1	L	NO PARKING ANYT	99100077
SP106	4925	71470	010 AV S	320	N	138 ST S	N	R	30x30	W15-1		PLAYGROUND	99060723
SP106	5000	71472	010 AV S	45	N	136 ST S	N	R	12x18	R7-1	B	NO PARKING ANYT	99050346
SP106	1951	71381	C ST S	24	S	TULE LAKE RD S	N	R	12x6	R1-3	4	X-WAY TAB	99030446
SP106	4250	71451	136 ST S	16	E	C ST S						STOP	98060145
SP106	4650	71464	137 ST S	252	W	008 AV CT S						END OF ROAD MAP	98030163
SP106	1551	71372	138 ST S	83	W	SR-7						ADVISORY SPEED	97011675
SP106	1550	71372	138 ST S	83	W	SR-7						REVERSE TURN	97011674
SP106	1451	71370	138 ST S	37	E	C ST S	E	R	18x18	W13-1	15	ADVISORY SPEED	97011673
SP106	1450	71370	138 ST S	37	E	C ST S	E	R	30x30	W1-3	L	REVERSE TURN	97011672
SP106	8100	71541	010 AV S	206	N	138 ST S	S	R	12x18	R7-1	B	NO PARKING ANYT	96082936
SP106	2050	71383	133 ST S	154	E	C ST S	E	R	24x30	R2-1	25	SPEED LIMIT	96071845
SP106	1500	71371	138 ST S	398	E	C ST S	E	L	48x24	W1-6	L	LARGE ARROW BO	95052938
SP106	3900	71444	YAKIMA AV S	17	N	134 ST S	N	L	48x24	W1-7		DOUBLE ARROW B	95050795
SP106	6850	71520	138 ST S	394	E	SPANAWAY LOOP RC E	E	R	12x36	W12-401	R	LATERAL CLEARAN	95040173
SP106	6875		138 ST S	414	E	SPANAWAY LOOP RC E	L		12x36	W12-401	L	LATERAL CLEARAN	95040154
SP106	6625	71516	138 ST S	418	E	SPANAWAY LOOP RC W	L		12x36	W12-401	L	LATERAL CLEARAN	95040153
SP106	4100	71448	135 ST S	18	E	C ST S	W	R	30x30	R1-1		STOP	9501231X
SP106	1051	71361	TULE LAKE RD S	30	W	C ST S	E	R	12x6	R1-3	4	X-WAY TAB	95011469
SP106	1401	71369	C ST S	24	N	138 ST S	S	R	12x6	R1-3	4	X-WAY TAB	95011465
SP106	4301	71452	138 ST S	21	W	C ST S	E	R	12x6	R1-3	4	X-WAY TAB	95011463
SP106	1651	71374	138 ST S	15	E	C ST S	W	R	12x6	R1-3	4	X-WAY TAB	95011461
SP106	5500	71487	134 ST CT S	18	E	010 AV S	W	R	30x30	R1-1		STOP	95011421
SP106	5400	71484	135 ST CT S	24	E	010 AV S	W	R	30x30	R1-1		STOP	95011419
SP106	4500	71457	YAKIMA AV S	24	N	138 ST S	S	R	30x30	R1-1		STOP	95011418
SP106	4450	71455	006 AV CT S	27	N	138 ST S	S	R	30x30	R1-1		STOP	95011417

99100237

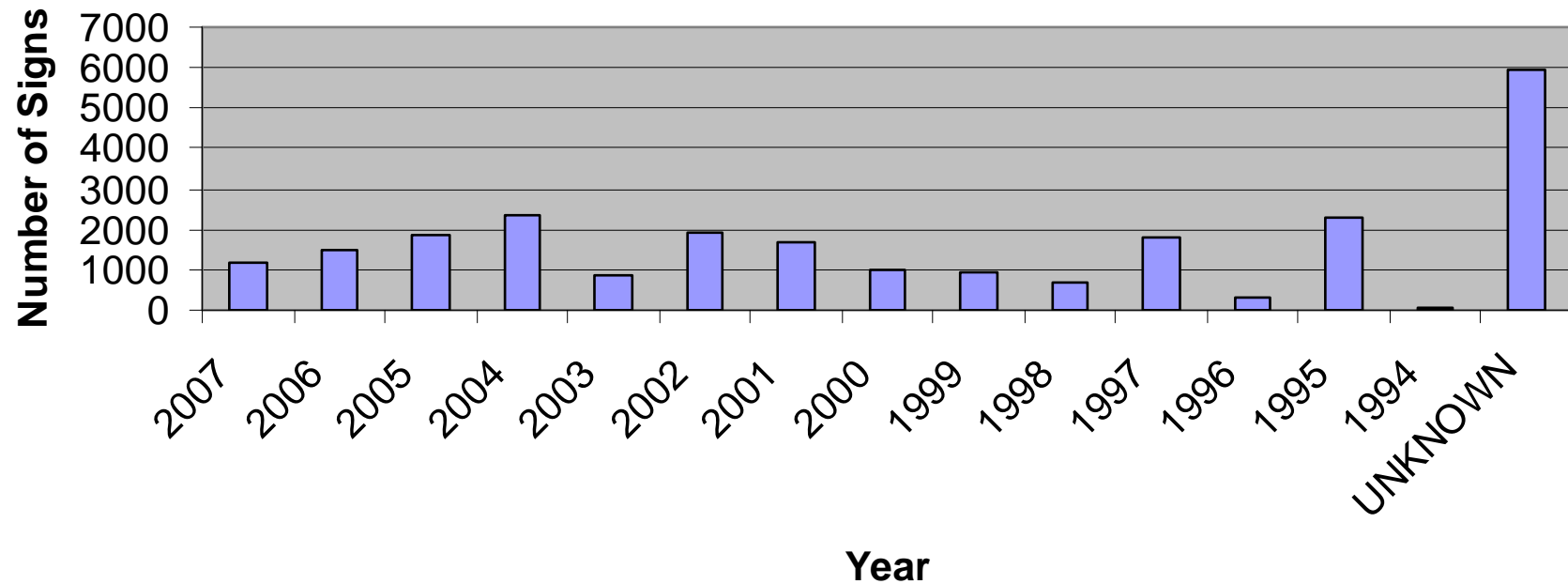
Database query for oldest signs

RT#	POS#	STRUCT	ON STREET	DIST	DR	REF ST	BN	O	SIZE	CODE	VAR	LEGEND	SER #
SP106	1500	71371	138 ST S	398	E	C ST S	E	L	48x24	W1-6	L	LARGE ARROW	95052938
SP106	3900	71444	YAKIMA AV S	17	N	134 ST S	N	L	48x24	W1-7		DOUBLE ARROW	95050795
SP106	6850	71520	138 ST S	394	E	SPANAWAY LOOP RD E	E	R	12x36	W12-401	R	LATERAL CLEARAN	95040173
SP106	6875		138 ST S	414	E	SPANAWAY LOOP RD E	L	L	12x36	W12-401	L	LATERAL CLEARAN	95040154
SP106	6625	71516	138 ST S	418	E	SPANAWAY LOOP RD W	L	L				LATERAL CLEARAN	95040153
SP106	4100	71448	135 ST S	18	E	C ST S	W	R				STOP	9501231X
SP106	1051	71361	TULE LAKE RD S	30	W	C ST S	E	R				X-WAY TAB	95011469
SP106	1401	71369	C ST S	24	N	138 ST S	S	R				X-WAY TAB	95011465
SP106	4301	71452	138 ST S	21	W	C ST S	E	R				X-WAY TAB	95011463
SP106	1651	71374	138 ST S	15	E	C ST S	W	R				X-WAY TAB	95011461
SP106	5500	71487	134 ST CT S	18	E	010 AV S	W	R				STOP	95011421
SP106	5400	71484	135 ST CT S	24	E	010 AV S	W	R				STOP	95011419
SP106	4500	71457	YAKIMA AV S	24	N	138 ST S	S	R				STOP	95011418
SP106	4450	71455	006 AV CT S	27	N	138 ST S	S	R				STOP	95011417
SP106	5025	71473	136 ST S	19	E	010 AV S	W	R				STOP	95011416
SP106	950	71358	PARK AV S	25	S	TULE LAKE RD S	N	R				STOP	95011412
SP106	1050	71361	TULE LAKE RD S	30	W	C ST S	E	R				STOP	95011409
SP106	3050	71416	130 ST S	18	W	010 AV S	E	R				STOP	95010990
SP106	6500	71513	014 AV S	21	N	138 ST S	S	R				STOP	95010889
SP106	3100	71419	130 ST S	28	E	010 AV S	W	R				STOP	95010881
SP106	2875	71409	131 ST S	15	W	010 AV S	E	R				STOP	95010880
SP106	2300	71393	132 ST S	26	W	PARK AV S	E	R				STOP	95010878
SP106	2275	71391	132 ST S	18	E	PARK AV S	W	R				STOP	95010877
SP106	2100	71384	133 ST S	10	E	C ST S	W	R				STOP	95010874
SP106	3700	71437	133 ST S	24	E	PARK AV S	W	R				STOP	95010873
SP106	600	71348	PARK AV S	25	S	134 ST S	N	R				STOP	95010869
SP106	1400	71369	C ST S	24	N	138 ST S	S	R				STOP	95010866
SP106	3600	71433	134 ST S	12	E	C ST S	W	R	30x30	R1-1		STOP	95010865

- 95052938**
- 95050795**
- 95040173**
- 95040154**
- 95040153**
- 9501231X**
- 95011469**
- 95011465**
- 95011463**
- 95011461**
- 95011421**
- 95011419**
- 95011418**
- 95011417**
- 95011416**
- 95011412**

Pierce County Signs by Age

SIGNS - AGE GRAPH



Method C: Expected Life

- Determine expected life of sheeting types used in geographical area
- End of life based on retro values in Table 2A-3
- Set up replacement program that ensures signs are replaced prior to the end of service life expectancy
- Periodic inspections or measurements to verify

Route for Control Signs in Field

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Sign Testing Results for Retroreflectivity														
2															
3	Route	POS	On Street	DIST	DR	Reference St	BN	Offset	Size	Sign Code	VAR	Serial #	#	Sequence	Result / Date
4													1		March 6, 2007
12	BR001	150	AQUEDUCT DR E (S)	23	E	GOLDEN GIVEN RD E	W	R	30x30	R1-1		95020557	White Average		310
13													Red Average		41
14													2		March 6, 2007
22	BR001	475	121 ST E	30	W	GOLDEN GIVEN RD E	E	R	36x36	R1-1		98100007	White Average		295
23													Red Average		59
24	BR001	597	GOLDEN GIVEN RD E	16	N	122 ST E		R	30x30	W2-1		97032704	3		March 6, 2007
29													Yellow Average		231
30													4		March 6, 2007
38	BR001	675	122 ST E	18	E	GOLDEN GIVEN RD E	W	R	30x30	R1-1		95020558	White Average		302
39													Red Average		40
40													5		March 6, 2007
48	BR001	1000	124 ST CT E	10	W	GOLDEN GIVEN RD E	E	R	30x30	R1-1		95020560	White Average		301
49													Red Average		38
50													6		March 6, 2007
58	BR001	1075	124 ST CT E	23	E	008 AVE	W	R	30x30	R1-1		95021181	White Average		306
59													Red Average		40
60													7		March 6, 2007
68	BR001	1200	008 AVE	20	S	121 ST E		R	30x30	R1-1		95010126	White Average		266
69													Red Average		37
70													8		March 6, 2007
78	BR001	1250	008 AVE	17	N	121 ST E	S	R	30x30	R1-1		95010125	White Average		282
79													Red Average		38
80	BR001	1275	008 AVE	105	N	121 ST E		R	24x30	R2-1	25	20061232	9		March 6, 2007
81															N/A
82													10		March 6, 2007
90	BR001	1425	125 ST CT E	17	W	GOLDEN GIVEN RD E	E	R	30x30	R1-1		95020563	White Average		318
91													Red Average		43
92													11		March 6, 2007
100	BR001	1450	126 ST CT E	15	W	GOLDEN GIVEN RD E	E	R	30x30	R1-1		95012231	White Average		322
101													Red Average		39
102													12		March 6, 2007
110	BR001	1525	126 ST CT E	16	E	008 AVE	W	R	30x30	R1-1		95012134	White Average		317
111													Red Average		41

Retroreflectivity of Control STOP Signs

Sign Testing Results for Retroreflectivity														
Route	POS	On Street	DIST	DR	Reference St	BN	Offset	Size	Sign Code	VAR	Serial #	#	Sequence	Result / Date
BR001	150	AQUEDUCT DR E (S)	23	E	GOLDEN GIVEN RD E	W	R	30x30	R1-1		95020557	1		March 6, 2007
													White Average	310
													Red Average	41
BR001	475	121 STE	30	W	GOLDEN GIVEN RD E	E	R	36x36	R1-1		98100007	2		March 6, 2007
													White Average	295
													Red Average	59
BR001	597	GOLDEN GIV										3		March 6, 2007
													Yellow Average	231
BR001	675	122 STE										4		March 6, 2007
													White Average	302
													Red Average	40
BR001	1000	124 ST CTE										5		March 6, 2007
													White Average	301
													Red Average	38
BR001	1075	124 ST CTE												March 6, 2007
													White Average	306
													Red Average	40
BR001	1200	008 AVE	20	S	121 STE	N	R	30x30	R1-1		95010126	7		March 6, 2007
													White Average	266
													Red Average	37
BR001	1250	008 AVE	17	N	121 STE	S	R	30x30	R1-1		95010125	8		March 6, 2007
													White Average	282
													Red Average	38
BR001	1275	008 AVE	105	N	121 STE	N	R	24x30	R2-1	25	20061232	9		March 6, 2007
														N/A
BR001	1425	125 ST CTE	17	W	GOLDEN GIVEN RD E	E	R	30x30	R1-1		95020563	10		March 6, 2007
													White Average	318
													Red Average	43
BR001	1450	126 ST CTE	15	W	GOLDEN GIVEN RD E	E	R	30x30	R1-1		95012231	11		March 6, 2007
													White Average	322
													Red Average	39
BR001	1525	126 ST CTE	16	E	008 AVE	W	R	30x30	R1-1		95012134	12		March 6, 2007
													White Average	317
													Red Average	41

Serial #	#	Sequence	Result / Date
95020557	1		March 6, 2007
		White Average	310
		Red Average	41

Retroreflectivity data and calculations

Sign Testing Results for Retroreflectivity														
Route	POS	On Street	DIST	DR	Reference St	BN	Offset	Size	Sign Code	VAR	Serial #	#	Sequence	Result / Date
BR001	150	AQUEDUCT DR E (S)	23	E	GOLDEN GLEN RD E	W	R	30x30	R1-1		95020557	1		March 6, 2007
											95020557		White Average	310
											95020557		Red Average	41
BR001	475	121 ST E									95020557	2		March 6, 2007
											95020557		White Average	295
											95020557		Red Average	58
BR001	597	GOLDEN									95020557	3		March 6, 2007
											95020557		Yellow Average	231
BR001	675	122 ST E									95020557	4		March 6, 2007
											95020557		White Average	302
											95020557		Red Average	40
BR001	1000	124 ST C									95020557	5		March 6, 2007
											95020557		White Average	301
											95020557		Red Average	38
BR001	1075	124 ST CT E	23	E	008 AVE	W	R	30x30	R1-1		95021181	6		March 6, 2007
											95021181		White Average	306
											95021181		Red Average	40
BR001	1					N	R	30x30	R1-1		95010126	7		March 6, 2007
											95010126		White Average	266
											95010126		Red Average	37
BR001	1					S	R	30x30	R1-1		95010125	8		March 6, 2007
											95010125		White Average	282
											95010125		Red Average	38
BR001	1					N	R	24x30	R2-1	25	20061232	9		March 6, 2007
											20061232			N/A
BR001	1				EN RD E	E	R	30x30	R1-1		95020563	10		March 6, 2007
											95020563		White Average	318
											95020563		Red Average	43
BR001	1				EN RD E	E	R	30x30	R1-1		95012231	11		March 6, 2007
											95012231		White Average	322
											95012231		Red Average	39
BR001	1					W	R	30x30	R1-1		95012134	12		March 6, 2007
											95012134		White Average	317
											95012134		Red Average	41

Serial #	#	Sequence	Result / Date	
95020557	1		March 6, 2007	
	W	000001/1	316	
	W	000001/2	300	
	W	000001/3	313	
	R	000001/4	41	
	R	000001/5	41	
		R	000001/6	40
		RATIO	7.6	
		White Average	310	
		Red Average	41	

Method E: Control Signs

- Replacement of signs based on performance of control signs
- Control signs monitored to determine end of service life for associated signs
- Field signs represented by control samples are replaced prior to reaching minimum levels

Control Signs Tested

- Red Series (R1-1, R1-2, R5-1)
 - 106 signs
- Black on Yellow (W – Series)
 - 116 signs
- Black on White
 - 39 signs
- White on Green
 - 50 signs

Control Sign Measurements

Range of Values (cd/lux/m²)

Red Series(R1-1, R1-2, R5-1)

- Red
Minimum 20 → Maximum 59
- White
Minimum 258 → Maximum 325
- Contrast Ratio
Minimum 5:1 → Maximum 9:1
- Proposed MUTCD Minimums
Red 7 White 35 Contrast Ratio > 3:1

Pierce County's Approach

A combination of.....

- Measured retroreflectivity
- Expected life
- Control signs

Method D: Blanket Replacement

- All signs in area/corridor, or signs of a specific type, are replaced at specific intervals
- No need to track individual signs
- Intervals based on the expected life of material

MUTCD Compliance Sign Retroreflectivity

“Compliance...is achieved by having a method in place and using the method to maintain the minimum levels established in Table 2A-3.... even if there are some individual signs that do not meet the minimum retroreflectivity levels at a particular point in time.”

Pilot Study Findings

- 12-year old H.I. STOP signs okay
- 10 to 12-year old H.I. Warning signs well above minimums
- 10 to 12-year old Engineer grade Speed Limit signs still above minimums

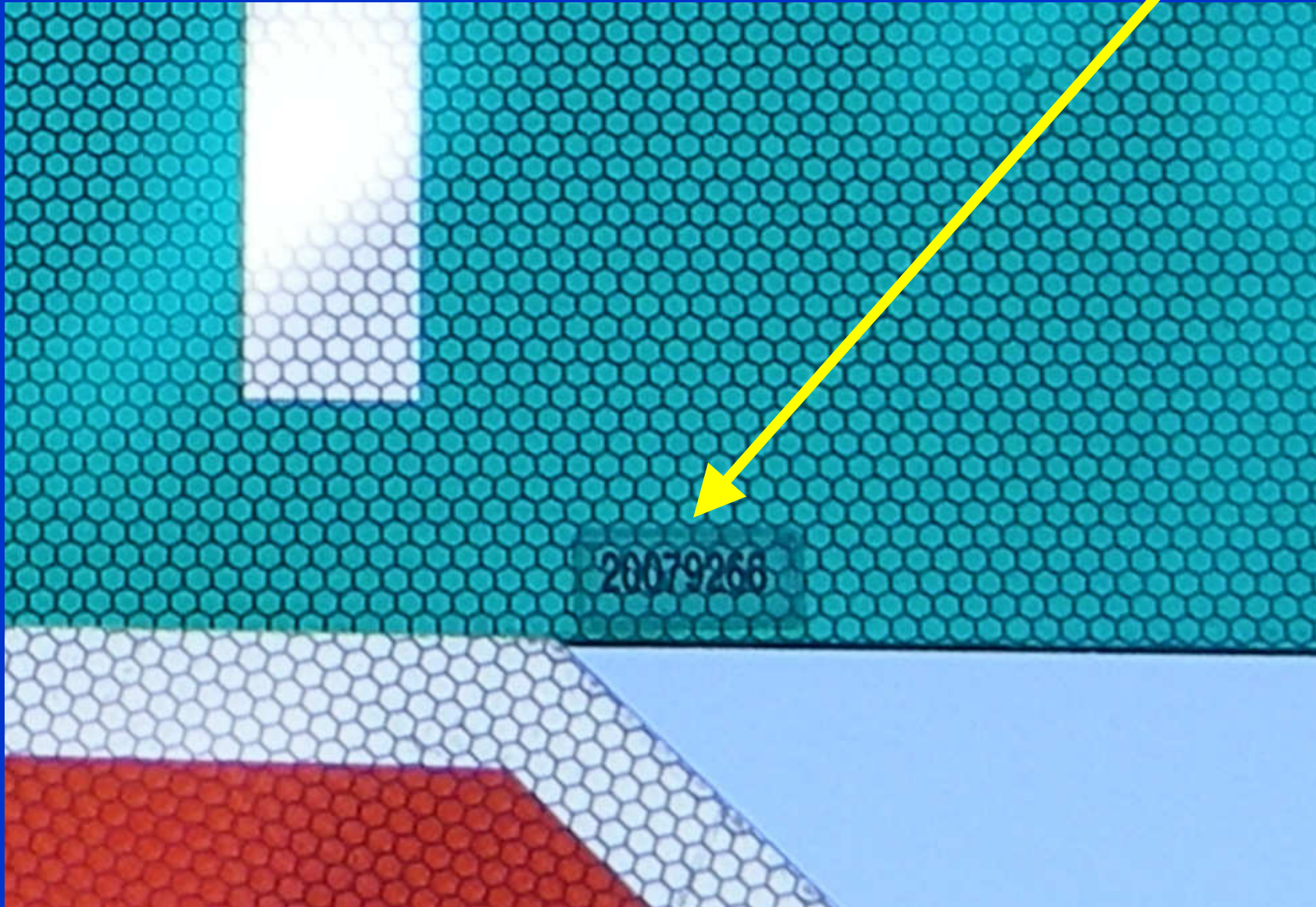
Pilot Study Findings

- Engineer grade Street Name signs need to be replaced
- High intensity Type III or IV logical selection for ground-mounted Street Name signs

Pilot Study Findings

- Control Signs (in-field) Method was not too labor-intensive
- Oldest Signs easily identified & monitored via serial numbers
- Inspection Route → Measuring Efficiencies
- First Priorities Set → Street Name signs

Serial number on street name sign



References

- FHWA, Office of Safety: Nighttime Visibility, Signs.
http://safety.fhwa.dot.gov/roadway_dept/retro
- MUTCD 2003 Edition including Revisions 1 and 2. Part 2, pages 2A-5 and 2A-6.
<http://mutcd.fhwa.dot.gov/>

A copy of this presentation can be found on
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- <http://www.ite.org/meetcon/meetingspast.asp>
 - “2008 Annual Meeting”
 - “Presentations”
 - “Session 24”