Wet-Reflective Pavement Marking Demonstration Project

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Center for Transportation
Research and Education

Final Report
November 2011

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16. Abstract

One of the leading complaints from drivers is the inability to see pavement markings under wet night conditions. This issue is a major source of dissatisfaction in state department of transportation (DOT) customer satisfaction surveys.

Driving under wet night conditions is stressful and fatiguing for all drivers, but particularly so for the more vulnerable young and older driver age groups.

This project focused on the development of a two-year, long-line test deck to allow for the evaluation and demonstration of a variety of wet-reflective pavement marking materials and treatments under wet night conditions.

Having the opportunity to document the performance of these various products and treatments will assist the Iowa DOT and local agencies in determining when and where the use of these products might be most effective.

Performance parameters included durability, presence, retroreflectivity, and wet night visibility. The test sections were located within Story County so that Iowa DOT management and staff, as well as local agencies, could drive these areas and provide input on the products and treatments.

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WET-REFLECTIVE PAVEMENT MARKING DEMONSTRATION PROJECT

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Principal Investigator
Neal Hawkins
Director, Center for Transportation Research and Education
Iowa State University

Co-Principal Investigator
Omar Smadi
Co-Director, Road and Infrastructure Management and Operations Systems
Iowa State University

Post-Doc Researcher
Basak Aldemir-Bektas

Authors
Neal Hawkins, Omar Smadi, and Basak Aldemir-Bektas

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A report from
Institute for Transportation
Iowa State University
2711 South Loop Drive, Suite 4700
Ames, IA 50010-8664
Phone: 515-294-8103
Fax: 515-294-0467
www.intrans.iastate.edu

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ACKNOWLEDGMENTS

The authors want to acknowledge the Iowa Highway Research Board (IHRB) and the Iowa Department of Transportation (DOT) for sponsoring this demonstration project. The authors also want to thank the Iowa DOT Pavement Marking Management Task Force and the Iowa DOT District 1 Paint Crew for their help on this project.

EXECUTIVE SUMMARY

Problem Statement

Water significantly decreases pavement marking retroreflectivity, which can make it difficult for drivers to stay in their lanes and/or on the road when traveling under wet night and low visibility conditions.

Pavement markings provide critical guidance to motorists. However, seeing pavement markings under wet night conditions is problematic given that the presence of water can significantly decrease a marking's retroreflectivity. Driving under these conditions can cause both stress and fatigue to motorists, which can have an impact on operations and safety.

Objectives

Many new pavement marking products are being introduced to address wet night visibility. This evaluation provides the Iowa Department of Transportation (DOT) with information to consider on how 16 different products performed in Iowa over a two-year evaluation period.

The test deck layout provided an opportunity to analyze the 16 products under a variety of conditions, which included installation technique (grooved or surface-applied), line type (left yellow edge line, white center skip, and white edge line), retroreflectivity (dry and wet), and cost.

Research Description and Methods

Working with the Iowa DOT Pavement Marking Task Force, the research team developed an evaluation methodology, installed wet-reflective pavement markings, and evaluated the performance of the materials and treatments over a two year period.

Performance parameters included durability, presence, and retroreflectivity (both dry and wet). Locating the test sections within Story County allowed Iowa DOT management and staff, as well as local agencies, to drive the area and provide input on products and treatments.

Retroreflectivity was sampled using a handheld LTL-X retroreflectometer under dry conditions. For rain conditions, a rain box was built according to the specifications from ASTM WK19806 (New Test Method for Measuring the Coefficient of Retroreflected Luminance of Pavement Markings in a Standard Condition of Continuous Wetting).

Pavement marking presence was monitored for each test section through visual observation and digital photos.

Summary of Key Findings

The primary source of pavement marking damage in Iowa is due to winter maintenance operations. Accordingly, the pavement marking retroreflectivity performance is presented in the report in terms of initial values and then after one and two winters.

The white skip lines for some sections did not perform beyond the first winter. Grooved markings performed better than surface-applied markings overall through Iowa winters and snow-plowing operations. All of the paint test sections showed material loss after one and especially after two winters. After one winter, 13 of the 16 total test sections had higher values for the grooved versus surfaced-applied treatments and this was still true after the second winter.

Initial measurements of dry retroreflectivity varied considerably from a maximum value of 1,289 millicandelas (mcd) to a minimum 268 mcd. After two winters, these averages were reduced to a maximum of 512 mcd and a minimum of 131 mcd.

Wet retroreflectivity performance among the products varied considerably.

Yellow Edge Line

Initial measurements of wet retroreflectivity showed that only seven of the 16 sections measured above 100 mcd. Two sections measured roughly three to four times the average of the group. After one winter, only three sections measured above 100 mcd. After two winters only two sections measured above 100 mcd.

White Skip Line

Initial measurements of wet retroreflectivity show that 13 of the 16 sections measured above 100 mcd. Three sections measured well above the group average. After one winter, six sections measured above 100 mcd (and all of these were grooved). After two winters only one section measured above 100 mcd.

Because each agency has their own performance criteria for pavement marking materials, no other summary product conclusions were developed for this project.

Implementation Benefits and Readiness

This evaluation serves as a resource for the Iowa DOT Pavement Marking Task Force in assessing the utility of these types of markings in improving visibility and overall safety for the motoring public. The documented performance of the various products and treatments will assist the Iowa DOT and local agencies in determining when and where use of these products might be most effective.

INTRODUCTION

One of the leading complaints from drivers is the inability to see pavement markings under wet night conditions. This is a major source of dissatisfaction in state department of transportation (DOT) customer satisfaction surveys. Driving under wet night conditions is stressful and fatiguing for all drivers, but particularly so for the more vulnerable young and older driver age groups.

This project provided the opportunity to demonstrate the performance of wet-reflective pavement marking materials and treatments within Iowa. The evaluation serves as a resource for the Iowa DOT Pavement Marking Task Force in assessing the utility of these types of markings in improving visibility and overall safety for the motoring public.

Objectives

This project developed a two-year long-line test deck that enabled an evaluation and demonstration of a variety of wet-reflective pavement marking materials and treatments under Iowa roadway conditions. Having the opportunity to document the performance of various products and treatments will assist the Iowa DOT and local agencies in determining when and where use of these products might be most effective. Because each agency has their own performance criteria for pavement marking materials, no summary product conclusions were developed for this project.

Project Tasks

Working with the Iowa DOT Pavement Marking Task Force (which served as the project steering committee), the research team developed an evaluation methodology, installed wet-reflective pavement markings, and evaluated the performance of the materials and treatments over a two year period. A breakdown of the project tasks follows.

Task 1 – Steering Committee: The research team worked with the Iowa DOT Pavement Marking Task Force to coordinate project activities and provide work plan information and findings throughout the duration of the project.

Task 2 – Survey: The team worked with industry and staff from adjacent state DOTs to develop a list of potential wet-reflective pavement marking products and installation practices for the test deck. The survey included the following questions:

- Material types
- Installation requirements (desired groove depth or special surface prep)
- Surface preference (asphalt or concrete)
- Anticipated one-week window for installation (desired)
- Estimated material cost (white edge line, white lane line, yellow edge line)
- Estimated installation cost
- Vendors' contribution (toward material and installation costs)

Task 3 – Material Selection: Based on the results of the survey, a list of reasonably-feasible wet-reflective marking materials and treatments was compiled and arrangements with contractors and industry were made. The final list of products and treatments are listed in Table 1.

Table 1. Product evaluation summary

US 30 Wet Reflective Pavement Marking Test Deck (Ames, Iowa)

Center for Transportation Research and Education at Iowa State University

Roadway Surface	Material	Types	Bead Packages	Placement Depth (mils)	Line Types
ACC	MMA	HSP 6	mini cluster	surface, 60, 120	YEL, WCL
ACC	MMA	HSP 4	Visimax	surface, 60	WEL
ACC	MMA	HSP 7	1.9 RI+M247	surface, 60, 120	YEL, WCL
ACC	MMA	HPS 4	double-drop	surface, 60	WEL
ACC	Tape	AW Tape		surface, 120	YEL, WCL
ACC	Thermoplastic	AW Thermoplastic	Elements+M247	surface, 120	YEL, WCL
ACC	Epoxy	LS65, LS90	Visimax, double drop	surface, 80	YEL, WCL
ACC	Waterborne Paint	High Build	Visimax	surface, 120	YEL, WCL
ACC	Hybridized Epoxy	Mark 55.5 Fast Set	+9spots+Swarco Type 1&4	surface, 50	YEL, WCL
PCC	Multi-Polymer	Mark 55.4	+9spots+Swarco Type 1&4	surface, 50	YEL, WCL
PCC	Hybridized Epoxy	Mark 55.6	+9spots+Swarco Type 1&4	surface, 50	YEL, WCL
PCC	Urethane Epoxy	Mark 65.5	+9spots+Swarco Type 1&4	surface, 50	YEL, WCL
PCC	Waterborne Paint	HB+Visilok	double drop	surface, 120	YEL, WCL
PCC	Waterborne Paint	AW paint	Elements+M247	surface, 50	YEL, WCL
PCC	Polyurea	LPM	Elements+M247	surface, 50	YEL, WCL
PCC	Epoxy	LS65, LS90	Visimax, double drop	surface, 80	YEL, WCL

MMA = Methyl Methacrylate AW = All Weather HB = High Build Waterborne YEL = Yellow Edge Line WCL = White Skip Line WEL = White Edge Line

Task 4 – Test Deck Installation and Evaluation: The research team worked with the Iowa DOT, contractors, and industry to install the materials and pavement marking treatments identified in Table 1. The team coordinated DOT maintenance work to ensure that follow-up maintenance activities did not hinder the evaluation.

Each test deck was laid out to be approximately one-quarter mile long. The decks were evaluated at regular intervals over the 24 month period. Performance was measured using both dry and wet retroreflectivity. Retroreflectivity was sampled using a handheld LTL-X retroreflectometer under dry conditions. For rain conditions, a rain box was built according to the specifications from ASTM WK19806 (New Test Method for Measuring the Coefficient of Retroreflected Luminance of Pavement Markings in a Standard Condition of Continuous Wetting).

Task 5 – Final Report: This report and the associated tech transfer summary serve as the final project documentation.

RESEARCH METHODOLOGY

Test Deck Layout

Figure 1 illustrates the test deck location on US Highway 30 just east of Ames, Iowa.

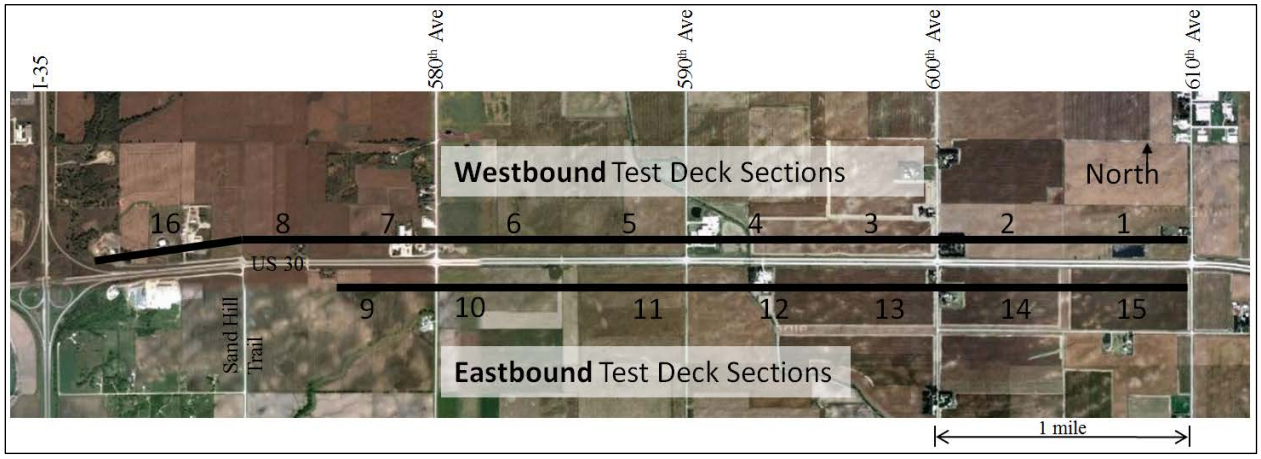


Figure 1. Test deck location and test section layout

The eastbound section of US 30 has an asphalt cement concrete (ACC) roadway surface and the westbound section is portland cement concrete (PCC) with one exception: test sections 1 through 8 are on a PCC surface and sections 9 through 16 are on an ACC surface.

The research team worked with the vendors to assign test sections for each product. As shown in Figure 2, each test section is 2,500 ft long, which includes 2,000 ft of grooved surface and 500 ft of surface preparation (surface prep). Two sections (9 and 10) were further divided into two 1,000 ft segments for the grooved area to evaluate different grooved depths. These two sections also included an evaluation of a white edge-line marking.

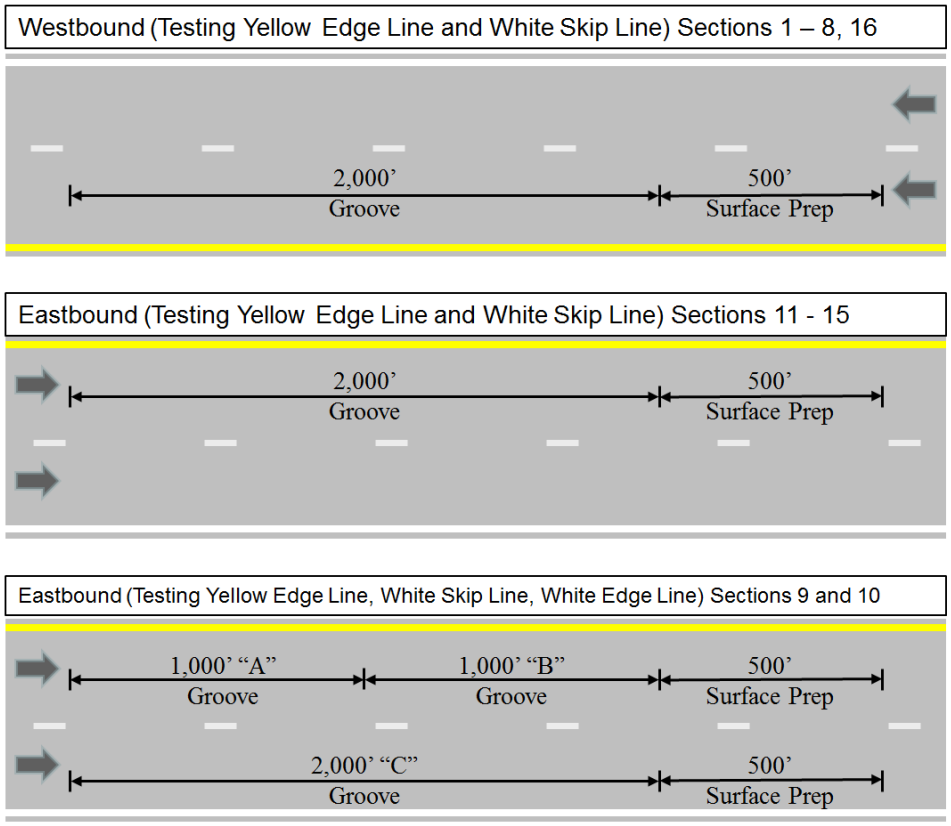


Figure 2. Test deck section lengths and surface treatments

Figure 3 shows a typical section of US 30 for each travel direction. This section of US 30 carries approximately 13,800 vehicles per day and consists of two through lanes in each direction with left turn lanes at each major intersection. All lanes are 12 ft wide with a 4 ft asphalt shoulder, which has a rumble strip.

Figure 3. US 30 test deck

Material

The project included a range of wet-reflective and wet-recoverable products. Table 2 shows each product by test section along with the installation characteristics for each. As shown, this evaluation includes the following marking materials:

- Methyl Methacrylate (MMA)
- Tape
- Thermoplastic
- Epoxy
- Waterborne
- High Build Waterborne
- Hybridized Epoxy
- Multipolymer
- Urethane Epoxy
- Visilock Waterborne
- Polyurea

Bead packages included the following:

- Mini-cluster
- Visimax
- 1.9 refractive index
- +9 spots
- Wet-reflective elements
- M247 (in combination with other beads)

Figures 4 through 11 show photographs of each product after one winter.

Table 2. Test section details

WESTBOUND Section Number:	16	8	7	6	5	4	3	2	1
Vendor	Poly Carb	Epoplex	Epoplex	3M	3M	Potters	Polycarb	Polycarb	Polycarb
Product	55.5 Hybridized Epoxy Fast-Set	LS 65 Epoxy	LS 90 Polyurea	LPM Polyurea	AW Paint	High Build WB Visilok	65.5 Urethane Epoxy	55.6 Hybridized Epoxy	55.4 Multi-Polymer
Bead	Plus9Spots, SWARCO 1&4	VisiMax	Double Drop	Elements and M247	Elements and M247	Double Drop	Plus9Spots, SWARCO 1&4	Plus9Spots, SWARCO 1&4	Plus9Spots, SWARCO 1&4
Groove Depth (Yellow Edge Line and White Skip Line)	50	80	80	50	50	120	50	50	50
Length: Surface Applied (ft)	500	500	500	500	500	500	500	500	500
Length: Grooved (ft)	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
Typical Layout See Figure:	A	A	A	A	A	A	A	A	A
Roadway Surface:	Asphalt	Concrete	Concrete	Concrete	Concrete	Concrete	Concrete	Concrete	Concrete
US 30 Travel Direction:	Westbound	Westbound	Westbound	Westbound	Westbound	Westbound	Westbound	Westbound	Westbound
Cost ($/ft for 4-inch line)	$0.90	$0.22	$0.33	$0.68	$0.10	$0.20	$0.96	$0.94	$0.97

EASTBOUND Section Number:	9A	9B	9C	10A	10B	10C	11	12	13	14	15
Vendor	Ennis	Ennis	Ennis	Ennis	Ennis	Ennis	3M	3M	Epoplex	Epoplex	Potters
Product	HPS 6 MMA	HPS 6 MMA	HPS 4	HPS 7 MMA	HPS7MMA	HPS 4	380 AW Tape	AW Thermo	LS 65 Epoxy	LS 90 Polyurea	High Build
Bead	Ennis MiniCluster	Ennis MiniCluster	VisiMax	Potters 1.9 RI & M247	Potters 1.9 RI and M248	Double Drop	Tape	Elements and M247	Double Drop	VisiMax	VisiMax
Groove Depth (Yellow Edge Line and White Skip Line)	120	60		60	120		120	120	80	80	120
Groove Depth (White Edge Line)			60			60	-	-	-	-	-
Length: Surface Applied (ft)	500		500	500		500	500	500	500	500	500
Length: Grooved (ft)	1,000	1,000	2,000	1,000	1,000	2,000	2,000	2,000	2,000	2,000	2,000
Typical Layout See Figure:	C	C	C	C	C	C	B	B	B	B	B
Roadway Surface:	Asphalt	Asphalt	Asphalt	Asphalt	Asphalt	Asphalt	Asphalt	Asphalt	Asphalt	Asphalt	Asphalt
US 30 Travel Direction:	Eastbound	Eastbound	Eastbound	Eastbound	Eastbound	Eastbound	Eastbound	Eastbound	Eastbound	Eastbound	Eastbound
Cost ($/ft for 4-inch line)	$0.88	$0.88	$0.36	$0.93	$0.93	$0.33	$1.57	$0.45	$0.19	$0.40	$0.20

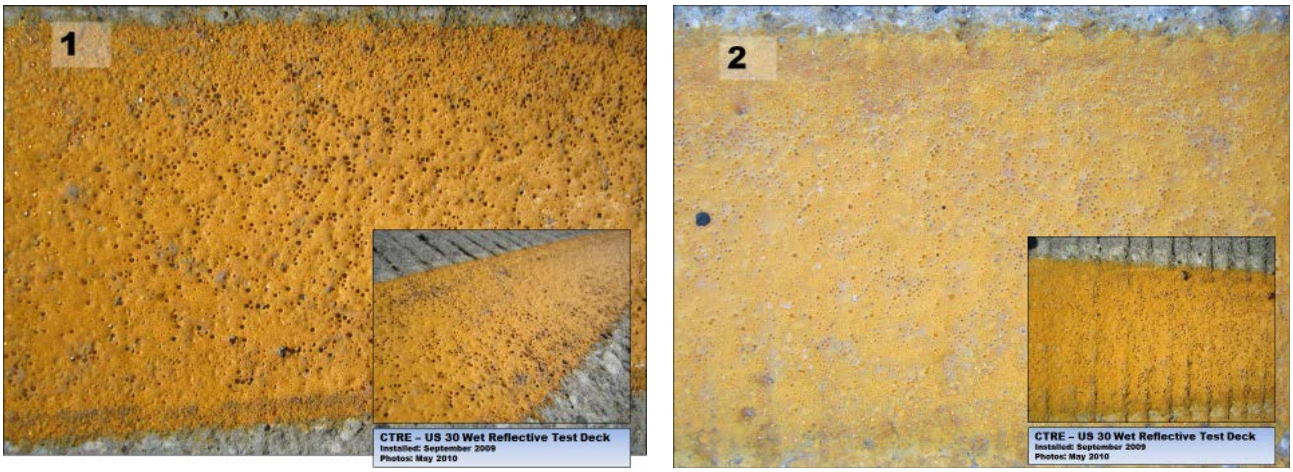


Figure 4. Poly carb test sections 1 and 2 after one winter

Figure 5. Poly carb test sections 3 and 16 after one winter

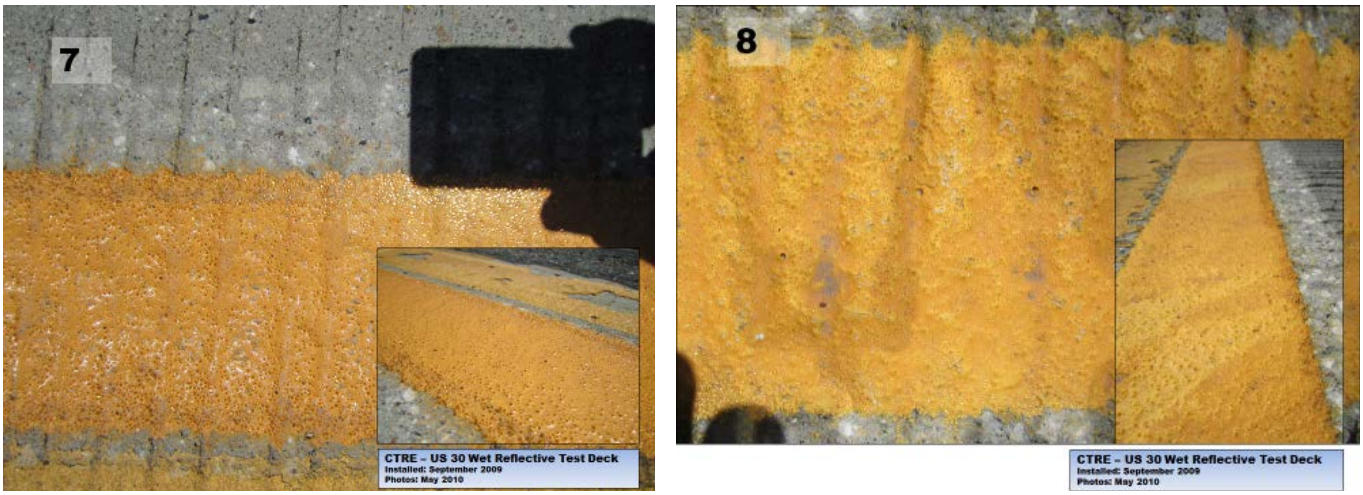


Figure 6. Epoplex test sections 7 and 8 after one winter

Figure 7. Epoplex test sections 13 and 14 after one winter

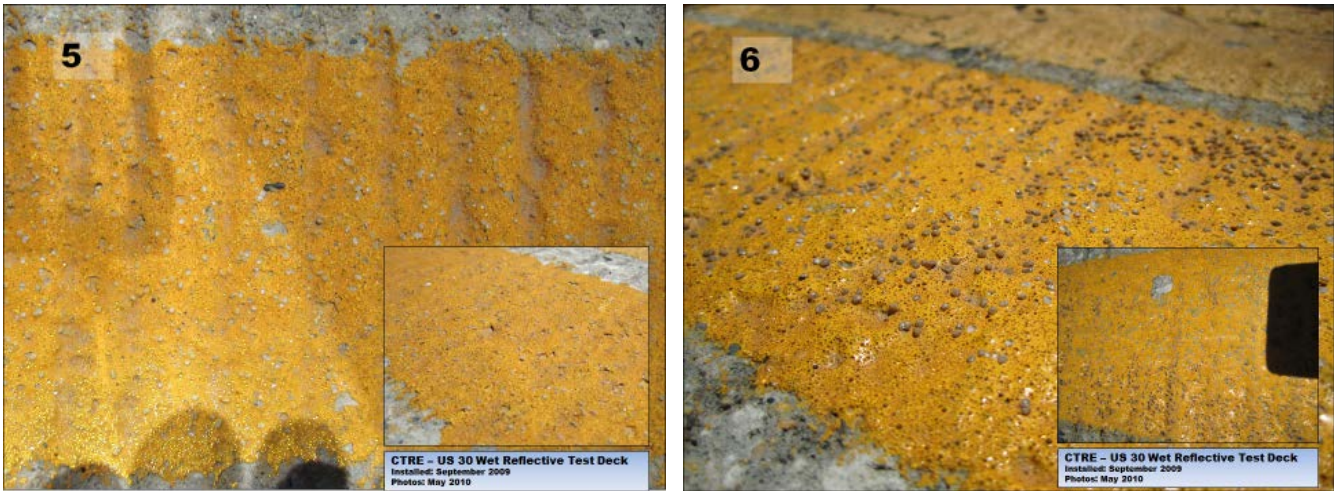


Figure 8. 3M test sections 5 and 6 after one winter

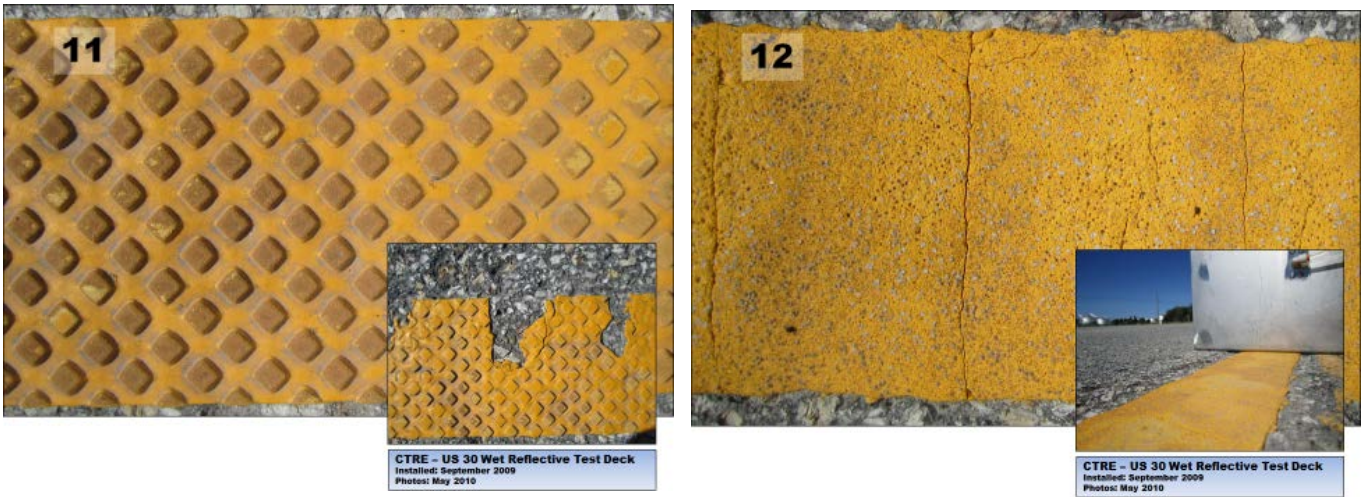


Figure 9. 3M test sections 11 and 12 after one winter

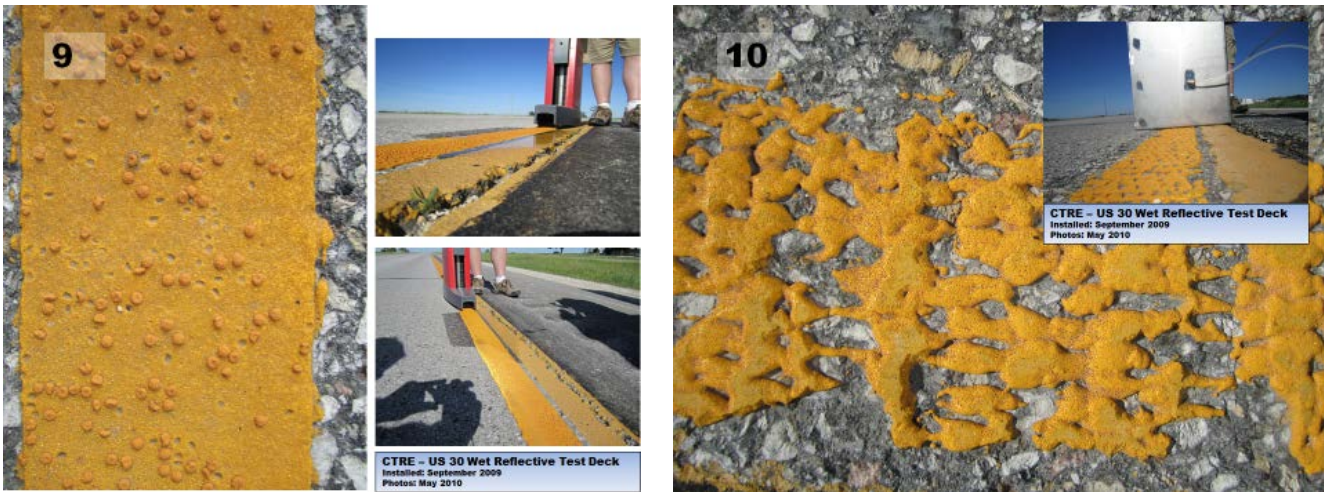


Figure 10. Ennis test sections 9 and 10 after one winter

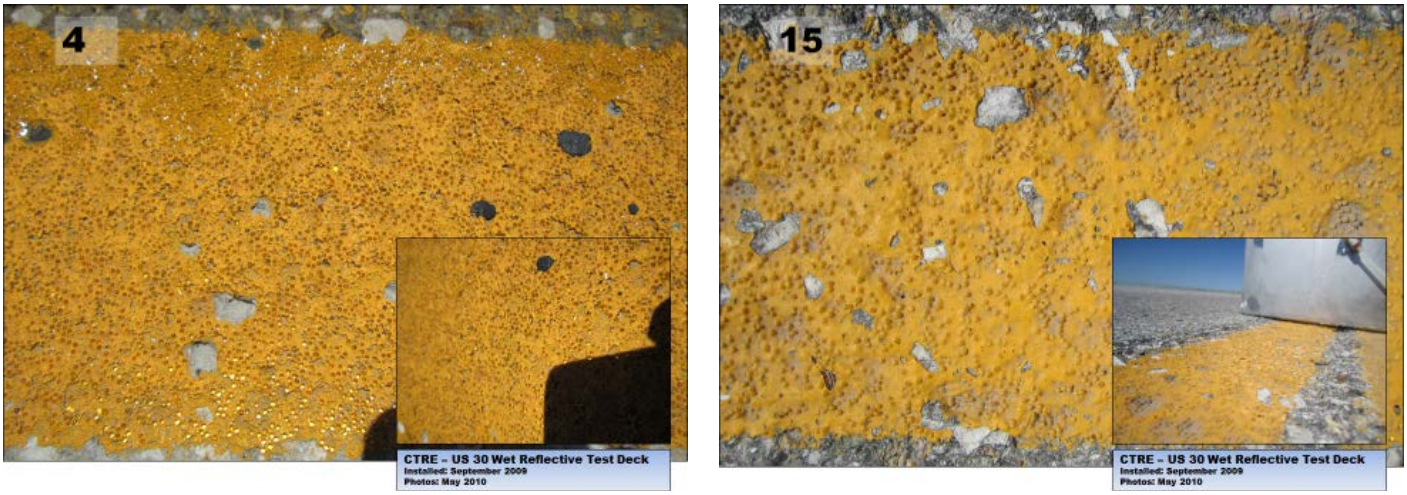


Figure 11. Potters test sections 4 and 15 after one winter

Measurement Methodology

Performance was measured using both dry and wet retroreflectivity. Retroreflectivity was sampled using a handheld LTL-X retroreflectometer under dry conditions. For rain conditions, a rain box was built according to the specifications from ASTM WK19806 (New Test Method for Measuring the Coefficient of Retroreflected Luminance of Pavement Markings in a Standard Condition of Continuous Wetting). Figure 12 shows the equipment used to obtain both dry and wet retroreflectivity measurements.

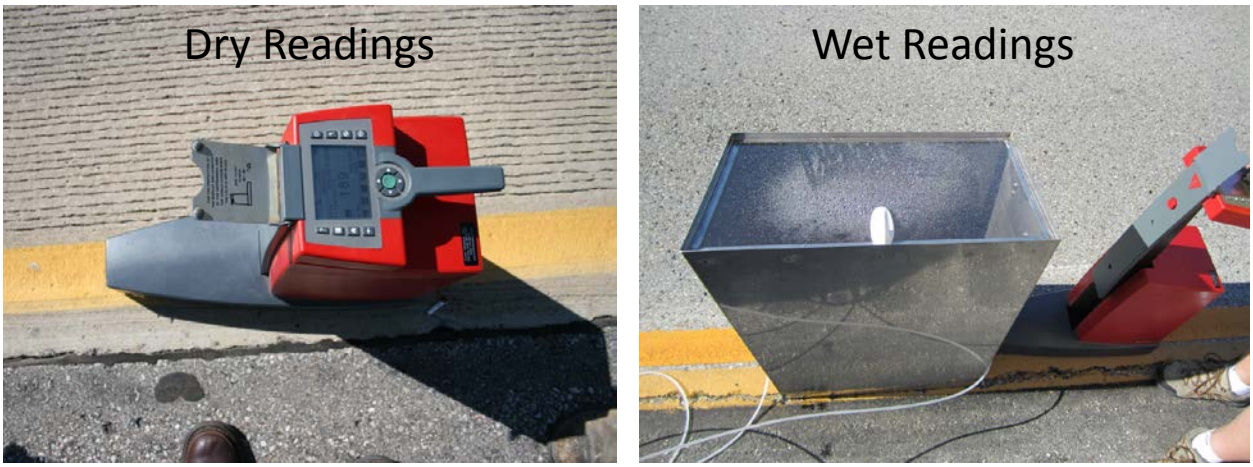


Figure 12. Retroreflectivity measurement equipment

Dry retroreflectivity readings were taken continuously along each test section (readings approximately every 4 to 5 ft). Wet retroreflectivity readings were taken at individual representative points within each grooved and surface-applied segment of each test section.

The wet retroreflectivity data exhibits some variation due to the variability of pavement marking quality and the location where each measurement was taken over time. As with most large-scale multi-year field evaluations, some sections have missing data.

The test deck was installed in September 2009 with the first retroreflectivity readings taken that fall. The research team continued taking both spring and fall readings for each test section through May 2011.

Wet retroreflectivity testing procedures included the following:

- Calibrate rain box to deliver water at a rate of 2 in. per hr
- Calibrate and place the wet measurement “feet” on the LTL-X
- Select the location to evaluate within the section
- Take two dry readings; then, place the rain box and turn on the pump
- Take continuous readings to capture wet degradation
- After 1 minute, turn the pump off and remove the rain box
- Continue taking readings to capture wet-recovery measurements
- Total testing time between 2.5 and 3 minutes

The above procedure allowed the research team to graph the retroreflectivity performance of each product over time. Figure 13 shows an example of the data as plotted with the initial dry readings (two) on the y axis and a green line which represents the end of one minute (wetting period), followed by continued readings to capture recovery. The red line identifies the wet retroreflectivity at one minute.

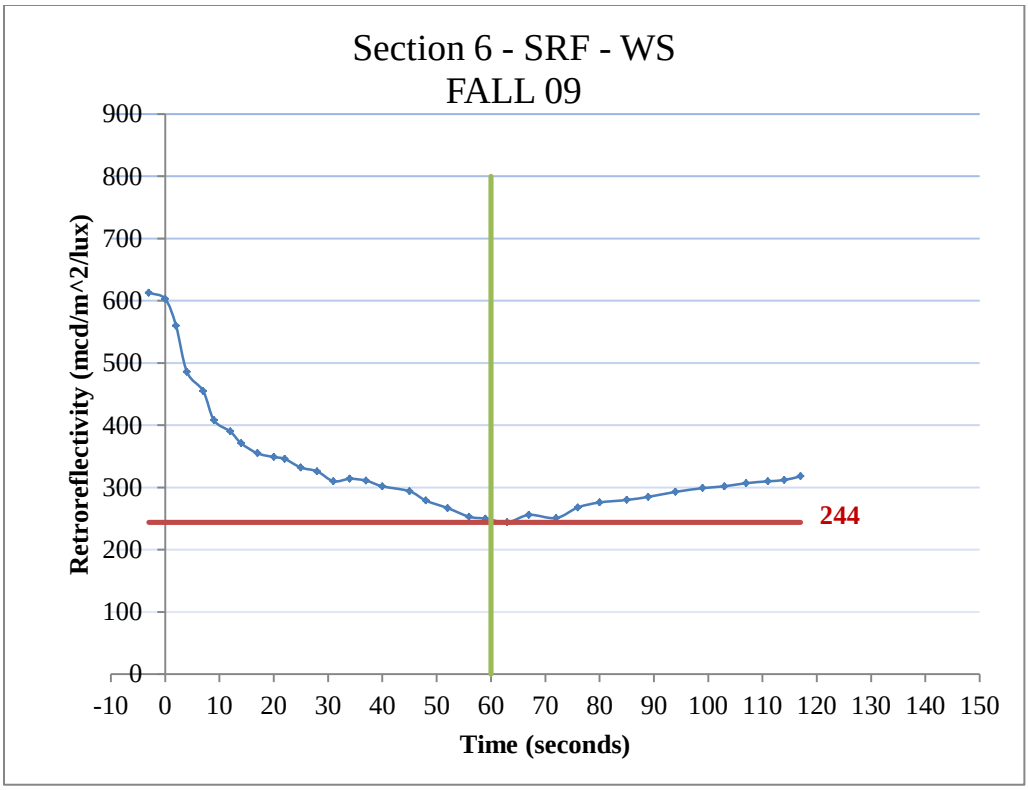


Figure 13. Sample wet retroreflectivity readings (from test section 6)

DATA BY PRODUCT

The wet and wet-recovery retroreflectivity readings, by test section and measurement period, are included in the Appendix. The information is formatted in the same manner as shown in Figure 13 (above). This includes readings for surface and grooved sections as follows:

- Yellow edge line: Fall 2009, Spring 2010, and Spring 2011
- White edge line: Fall 2009, Fall 2010, and Spring 2011
- White skip line: Fall 2009, Fall 2010, and Spring 2011 for sections 3 through 7, 9 through 11, and 13, given these were the only sections still performing after the Fall 2010 readings

Presence

Pavement marking presence was monitored for each test section through visual observation and digital photos. The presence on the majority of products after two years was 100 percent. A few products experienced a significant loss of material as described below.

Section 11 - 3M Tape - After one winter there were a significant number of white skips missing in both the grooved and surface-applied areas. The loss of white skips, see Figure 14, was significant enough to warrant painting, for the majority of the test section, by the DOT crews. The yellow edge line showed some specific areas of severe snow plow damage.

Figure 14. 3M section 11 material loss

Section 12 - 3M All Weather Thermoplastic on PCC – All of the material was missing from the small section of PCC bridge deck after the first winter. This is a known issue of thermoplastic on concrete.

Sections 4, 5, and 15 - Waterborne paint products – All of the paint test sections showed material loss after one and especially after two winters. Figure 15 shows sample material loss after two winters.

Figure 15. Material loss on paint products after two winters

ANALYSIS

The test deck layout provides an opportunity to analyze the 16 different products under a variety of conditions, which includes installation technique (grooved versus surface-applied), line type (left yellow edge line, white center skip, and white edge line for two sections), retroreflectivity (dry and wet), and cost.

This section provides a summary of findings by test section (product) for retroreflectivity, installation technique, and cost. The analysis denotes section numbers instead of product names. Table 3 provides a list of products by section number.

Table 3. Products tested by section number

Section	Manufacturer	Pavement Marking Material	Beads
1	Polycarb	55.4 Multi-Polymer	Plus9Spots, SWARCO 1&4
2	Polycarb	55.6 Hybridized Epoxy	Plus9Spots, SWARCO 1&4
3	Polycarb	65.5 Urethane Epoxy	Plus9Spots, SWARCO 1&4
4	Potters	High Build WB Visilok	Double Drop (Visibead)
5	3M	AW Paint	Elements and M247
6	3M	LPM Polyurea	Elements and M247
7	Epoplex	LS 90 Polyurea	Double Drop (Visibead)
8	Epoplex	LS 65 Epoxy	VisiMax
9	Ennis	HPS 6 MMA	Ennis MiniCluster
10	Ennis	HPS 7 MMA	Potters 1.9 RI & M247
11	3M	380 AW Tape	Tape
12	3M	AW Thermo	Elements and M247
13	Epoplex	LS 65 Epoxy	Double Drop (Visibead)
14	Epoplex	LS 90 Polyurea	VisiMax
15	Potters	High Build	VisiMax
16	Poly Carb	55.5 Hybridized Epoxy Fast-Set	Plus9Spots, SWARCO 1&4

Performance

The primary source of pavement marking damage in Iowa is due to winter maintenance practices. Accordingly, the pavement marking retroreflectivity performance is presented in terms of initial values and then after one and two winters.

The researchers found the white skip lines for some sections did not perform beyond the first winter.

Dry Retroreflectivity

Yellow Edge Line

Table 4 shows the dry retroreflectivity readings for the yellow edge-line markings by section, measurement period, and installation technique.

Table 4. Yellow edge-line dry retroreflectivity

	Yellow Edge Line Dry Retroreflectivity (mcd)					
	Initial		After 1 Winter		After 2 Winters	
Section	Surface	Grooved	Surface	Grooved	Surface	Grooved
1	413	363	165	271	175	254
2	319	365	206	257	211	221
3	441	518	202	340	152	193
4	388	441	207	384	161	211
5	361	399	237	328	185	245
6	618	619	402	458	232	337
7	270	268	188	177	116	194
8	309	320	196	178	170	142
9	847	810	530	530	372	365
10	1087	1289	282	361	145	142
11	620	584	424	632	244	512
12	459	379	136	186	168	180
13	308	284	232	251	176	227
14	797	776	191	215	124	159
15	291	482	81	109	93	131
16			147	260	129	161
Average:	502	526	239	309	178	230
Max:	1087	1289	530	632	372	512
Min:	270	268	81	109	93	131

Initial measurements of dry retroreflectivity varied considerably from a maximum value of 1,289 millicandelas (mcd) to a minimum 268 mcd. After two winters, these averages were reduced to a maximum of 512 mcd and a minimum of 131 mcd. After one winter, 13 of the 16 sections had higher values for the grooved versus surfaced-applied treatments and this was still true after the second winter.

Table 5 thematically presents the yellow edge-line marking percent change in dry retroreflectivity readings by time period and installation technique.

Table 5. Yellow edge-line change in dry retroreflectivity

	Yellow Edge Line Change in Dry Retroreflectivity (mcd)			
	Surface		Grooved	
Section	After 1 Winter	After 2 Winters	After 1 Winter	After 2 Winters
1	-60%	-58%	-25%	-30%
2	-35%	-34%	-30%	-39%
3	-54%	-66%	-34%	-63%
4	-47%	-59%	-13%	-52%
5	-34%	-49%	-18%	-39%
6	-35%	-62%	-26%	-46%
7	-30%	-57%	-34%	-28%
8	-37%	-45%	-44%	-56%
9	-37%	-56%	-35%	-55%
10	-74%	-87%	-72%	-89%
11	-32%	-61%	8%	-12%
12	-70%	-63%	-51%	-53%
13	-25%	-43%	-12%	-20%
14	-76%	-84%	-72%	-80%
15	-72%	-68%	-77%	-73%
16				
Average:	-48%	-59%	-36%	-49%

After the first winter, the grooved sections performed marginally better (36 percent average loss) over the surface-applied section (48 percent average loss) and this difference held roughly the same after the second winter (49 percent grooved versus 59 percent surface-applied). Two test sections showed minimal loss after two winters (section 11 at 12 percent and section 13 at 20 percent reduction in dry retroreflectivity). In contrast, these same products where surface-applied experienced much higher degradation (section 11 at 61 percent and section 13 at 43 percent).

White Skip Line

Table 6 shows the dry retroreflectivity readings for the white skip-line markings by section, measurement period, and installation technique.

Initial measurements of dry retroreflectivity varied from a maximum value of 900 mcd to a minimum 261 mcd. After one winter, these averages were reduced to a maximum of 726 mcd and a minimum of 89 mcd. After one winter, 12 of the 16 sections had higher values for the grooved versus surfaced-applied treatments. After the second winter, only the grooved portion of sections 3 through 7, 11, and 13 were measured given the wet reflective values after the first winter.

Table 6. White skip-line dry retroreflectivity

	White Skip Line Dry Retroreflectivity (mcd)				
	Initial		After 1 Winter		2 Winters*
Section	Surface	Grooved	Surface	Grooved	Grooved
1	664	641	279	451	
2	655	711	344	518	
3	741	794	500	444	470
4	658	668	424	504	333
5	440	460	329	343	313
6	603	750	390	432	475
7	526	540	318	427	345
8	510	530	284	198	
9	900	860	341	683	
10	792	865		349	
11	890	841	418	726	610
12	507	440	244	375	
13	555	631	400	400	337
14	361	371	231	259	
15	321	251	175	89	
16	769	710	173	302	
Average:	618	629	323	406	412
Max:	900	865	500	726	610
Min:	321	251	173	89	313

*Note: Only sections 3-7, 11, and 13 were measured given that the wet retroreflectivity values were low after the first winter.

Table 7 thematically presents the white skip-line marking percent change in dry retroreflectivity readings by time period and installation technique.

After the first winter, the grooved sections performed marginally better (35 percent average loss) over the surface-applied sections (48 percent average loss). For the grooved sections measured after the second winter, the average loss in dry retroreflectivity from initial conditions was 35 percent.

Table 7. White skip-line change in dry retroreflectivity

	White Skip Line Change in Dry Retroreflectivity (mcd)		
	Surface	**Grooved**	
Section	After 1 Winter	After 1 Winter	After 2 Winters
1	-58%	-30%	
2	-47%	-27%	
3	-33%	-44%	-41%
4	-36%	-25%	-50%
5	-25%	-25%	-32%
6	-35%	-42%	-37%
7	-40%	-21%	-36%
8	-44%	-63%	
9	-62%	-21%	
10		-60%	
11	-53%	-14%	-27%
12	-52%	-15%	
13	-28%	-37%	-47%
14	-36%	-30%	
15	-45%	-65%	
16	-78%	-57%	
Average:	-48%	-35%	-35%

White Edge Line

White edge lines were not part of the original evaluation scenario but were installed for two sections (9 and 10) at the request of the product manufacturer. Table 8 shows the dry retroreflectivity readings for the white edge-line markings by section, measurement period, and installation technique.

Table 8. White edge-line dry retroreflectivity

	White Edge Line Dry Retroreflectivity (mcd)					
	Initial		After 1 Winter		After 2 Winters	
Section	Surface	Grooved	Surface	Grooved	Surface	Grooved
9C	645	752	261	255	124	172
10C	868	1366	476	464	341	331

Table 9 thematically presents the white skip-line marking percent change in dry retroreflectivity readings by time period and installation technique.

Table 9. White edge-line change in dry retroreflectivity

	White Edge Line Change in Dry Retroreflectivity (mcd)			
	Surface		Grooved	
Section	After 1 Winter	After 2 Winters	After 1 Winter	After 2 Winters
9C	-60%	-81%	-66%	-77%
10C	-45%	-61%	-66%	-76%
Average:	-52%	-71%	-66%	-76%

Wet Retroreflectivity

Yellow Edge Line

Table 10 shows the wet and wet-recovery retroreflectivity readings for the yellow edge-line markings by section, measurement period, and installation technique.

Table 10. Yellow edge-line wet retroreflectivity

	Yellow Edge Line Wet Retroreflectivity (mcd)											
	Initial				After 1 Winter				After 2 Winters			
	Wet		Wet Recovery		Wet		Wet Recovery		Wet		Wet Recovery	
Section	Surface	Grooved	Surface	Grooved	Surface	Grooved	Surface	Grooved	Surface	Grooved	Surface	Grooved
1	72	85	111	117	46	45	82	79	7	12	22	29
2	103	58	152	104	81	63	114	113	20	28	40	50
3	64	74	104	110	37	50	76	132	20	16	37	28
4	85	81	114	99	37	49	81	112	12	29	19	51
5	213	188	235	244	76	105	146	192	37	78	81	89
6	449	437	486	505	308	219	430	396	101	49	158	206
7	70	23	84	36	59	39	121	74	25	10	45	16
8	55	33	66	33	47	26	83	66	29	36	42	42
9	127	107	151	114	63	20	92	50	41	15	81	47
10	121	142	123	158	50	47	61	56	25	27	34	38
11	506	430	528	497	101	330	168	408	56	344	115	450
12	109	111	172	389	11	25	78	48	41	24	108	64
13	89	58	98	66	45	37	59	42	12	16	38	34
14	41	34	42	34	8	12	9	19	5	38	16	60
15	31	25	33	34	5	15	9	20	20	27	42	32
16	43	54	47	62	11	51	36	114	10	15	15	31
Average:	136	121	159	163	62	71	103	120	29	48	56	79
Max:	506	437	528	505	308	330	430	408	101	344	158	450
Min:	31	23	33	33	5	12	9	19	5	10	15	16

Wet - Initial measurements of wet retroreflectivity show that only seven of the 16 sections measured above 100 mcd. Sections 6 and 11 measured roughly three to four times the average of the group. After one winter, only three sections measured above 100 mcd. After two winters only two sections were above 100 mcd.

Wet Recovery - Initial measurements of wet-recovery retroreflectivity showed that 10 of the 16 sections measured above 100 mcd. Sections 5, 6, 11, and 12 measured well above the group average. After one winter, seven sections measured above 100 mcd. After two winters only three sections were above 100 mcd. Sections 6 and 11 had the highest measurements.

Table 11 thematically presents the yellow edge-line marking percent change in wet and wet-recovery retroreflectivity readings by time period and installation technique.

Table 11. Yellow edge-line change in wet retroreflectivity

	Yellow Edge Line Wet Retroreflectivity (mcd)							
	After 1 Winter				After 2 Winters			
	Wet		Wet Recovery		Wet		Wet Recovery	
Section	Surface	Grooved	Surface	Grooved	Surface	Grooved	Surface	Grooved
1	-36%	-47%	-26%	-32%	-90%	-86%	-80%	-75%
2	-21%	9%	-25%	9%	-81%	-52%	-74%	-52%
3	-42%	-32%	-27%	20%	-69%	-78%	-64%	-75%
4	-56%	-40%	-29%	13%	-86%	-64%	-83%	-48%
5	-64%	-44%	-38%	-21%	-83%	-59%	-66%	-64%
6	-31%	-50%	-12%	-22%	-78%	-89%	-67%	-59%
7	-16%	70%	44%	106%	-64%	-57%	-46%	-56%
8	-15%	-21%	26%	100%	-47%	9%	-36%	27%
9	-50%	-81%	-39%	-56%	-68%	-86%	-46%	-59%
10	-59%	-67%	-50%	-65%	-79%	-81%	-72%	-76%
11	-80%	-23%	-68%	-18%	-89%	-20%	-78%	-9%
12	-90%	-77%	-55%	-88%	-62%	-78%	-37%	-84%
13	-49%	-36%	-40%	-36%	-87%	-72%	-61%	-48%
14	-80%	-65%	-79%	-44%	-88%	12%	-62%	76%
15	-84%	-40%	-73%	-41%	-35%	8%	27%	-6%
16	-74%	-6%	-23%	84%	-77%	-72%	-68%	-50%
Average:	-53%	-34%	-32%	-6%	-74%	-54%	-57%	-41%

Wet Reflectivity - After the first winter, 10 surface-applied sections measured 50 percent or more loss from initial values in contrast to five grooved sections. On average, the surface-applied sections lost 20 percent more than grooved sections. After the second winter, 14 surface-applied sections measured 50 percent or more loss from initial values in contrast to 12 grooved sections. On average, the surface-applied sections lost 20 percent more than the grooved sections.

Wet Recovery - After the first winter, five surface-applied sections measured 50 percent or more loss from initial values in contrast to three grooved sections. On average, the surface-applied sections lost 26 percent more than the grooved sections. After the second winter, 11 surface-applied sections measured 50 percent or more loss from initial values in contrast to 10 grooved

sections. On average, the surface-applied sections lost 16 percent more than the grooved sections.

White Skip Line

Table 12 shows the wet and wet-recovery retroreflectivity readings for the white skip-line markings by section, measurement period, and installation technique.

Table 12. White skip-line wet retroreflectivity

	White Skip Line Wet Retroreflectivity (mcd)									
	Initial				After 1 Winter				After 2 Winters	
	Wet		Wet Recovery		Wet		Wet Recovery		Wet	Recovery
Section	Surface	Grooved	Surface	Grooved	Surface	Grooved	Surface	Grooved	Grooved	Grooved
1	186	222	193	225	32	55	68	108		
2	203	228	243	242	26	41	80	113		
3	164	186	174	193	41	78	59	142	59	142
4	274	270	284	279	76	132	38	75	38	75
5	218	216	252	237	46	118	28	77	28	77
6	244	201	318	259	29	92	21	118	21	118
7	172	131	183	145	53	116	21	42	21	49
8	70	64	90	95	66	76	18	43		
9	165	118	174	135	13	48	47	102		
10		198		198		24		40		
11	608	601	609	605	98	167	191	224	191	224
12	601	211	605	331	7	100	32	187		
13	190	212	214	229	96	101	42	78	42	78
14	138	212	152	229	32	50	52	82		
15	96	57	100	59	23	33	27	29		
16										
Average:	238	208	257	231	46	82	52	97	57	109
Max:	608	601	609	605	98	167	191	224	191	224
Min:	70	57	90	59	7	24	18	29	21	49

Wet - Initial measurements of wet retroreflectivity showed that 13 of the 16 sections measured above 100 mcd. Sections 4, 11, and 12 measured well above the group average. After one winter, six sections measured above 100 mcd (all of these were grooved). After two winters only one section measured above 100 mcd.

Wet Recovery - Initial measurements of wet-recovery retroreflectivity showed that 15 of the 16 sections measured above 100 mcd. Sections 4, 6, 11, and 12 measured well above the group average. After one winter, seven sections measured above 100 mcd. After two winters only three sections were above 100 mcd. Section 11 had the highest measurements.

Table 13 thematically presents the white skip-line marking percent change in wet and wet-recovery retroreflectivity readings by time period and installation technique.

Table 13. White skip-line change in wet retroreflectivity

	White Skip Line Wet Retroreflectivity (mcd)					
	After 1 Winter				After 2 Winters	
	Wet		Wet Recovery		Wet	Recovery
Section	Surface	Grooved	Surface	Grooved	Grooved	Grooved
1	-83%	-75%	-65%	-52%		
2	-87%	-82%	-67%	-53%		
3	-75%	-58%	-66%	-26%	-68%	-26%
4	-72%	-51%	-87%	-73%	-86%	-73%
5	-79%	-45%	-89%	-68%	-87%	-68%
6	-88%	-54%	-93%	-54%	-90%	-54%
7	-69%	-11%	-89%	-71%	-84%	-66%
8	-6%	19%	-80%	-55%		
9	-92%	-59%	-73%	-24%		
10		-88%		-80%		
11	-84%	-72%	-69%	-63%	-68%	-63%
12	-99%	-53%	-95%	-44%		
13	-49%	-52%	-80%	-66%	-80%	-66%
14	-77%	-76%	-66%	-64%		
15	-76%	-42%	-73%	-51%		
16						
Average:	-74%	-53%	-78%	-56%	-80%	-60%

Wet Reflectivity - After the first winter, 12 of 14 surface-applied sections measured 50 percent or more loss from initial values in contrast to 10 of 14 grooved sections. On average, the surface-applied sections lost 20 percent more than the grooved sections. After the second winter, all of the sections measured 50 percent or more loss from initial values.

Wet Recovery - After the first winter, all of the surface-applied sections measured 50 percent or more loss from initial values in contrast to 11 grooved sections. On average, the surface-applied sections lost 22 percent more than the grooved sections. After the second winter, all but one of the sections measured 50 percent or more loss from initial values.

White Edge Line

White edge lines were not part of the original evaluation scenario but were installed for two sections (9 and 10) at the request of the product manufacturer. Table 14 shows the wet and wet-recovery retroreflectivity readings for the white edge-line markings by section, measurement period, and installation technique.

Table 14. White edge-line wet retroreflectivity

	White Edge Line Wet Retroreflectivity (mcd)											
	Initial				After 1 Winter				After 2 Winters			
	Wet		Wet Recovery		Wet		Wet Recovery		Wet		Wet Recovery	
Section	Surface	Grooved	Surface	Grooved	Surface	Grooved	Surface	Grooved	Surface	Grooved	Surface	Grooved
9C	93	119	98	131	25	34	42	56	31	7	42	25
10C	114		258		79	80	100	117	39	36	67	80

Table 15 thematically presents the white skip-line marking percent change in wet and wet-recovery retroreflectivity readings by time period and installation technique.

Table 15. White edge-line change in wet retroreflectivity

	White Edge Line Wet Retroreflectivity (mcd)							
	After 1 Winter				After 2 Winters			
	Wet		Wet Recovery		Wet		Wet Recovery	
Section	Surface	Grooved	Surface	Grooved	Surface	Grooved	Surface	Grooved
9C	-73%	-71%	-57%	-57%	-67%	-94%	-57%	-81%
10C	-31%		-61%		-66%		-74%	

Cost

Cost information was provided by each manufacturer. The costs in Table 16 only represent material costs (not installation or surface preparation/grooving). It is not the intention of the research team to identify the most cost-effective product; rather, this information is provided along with performance data to allow the Iowa DOT to consider their next steps toward the use of wet retroreflective pavement marking products.

Table 16. Cost by section number

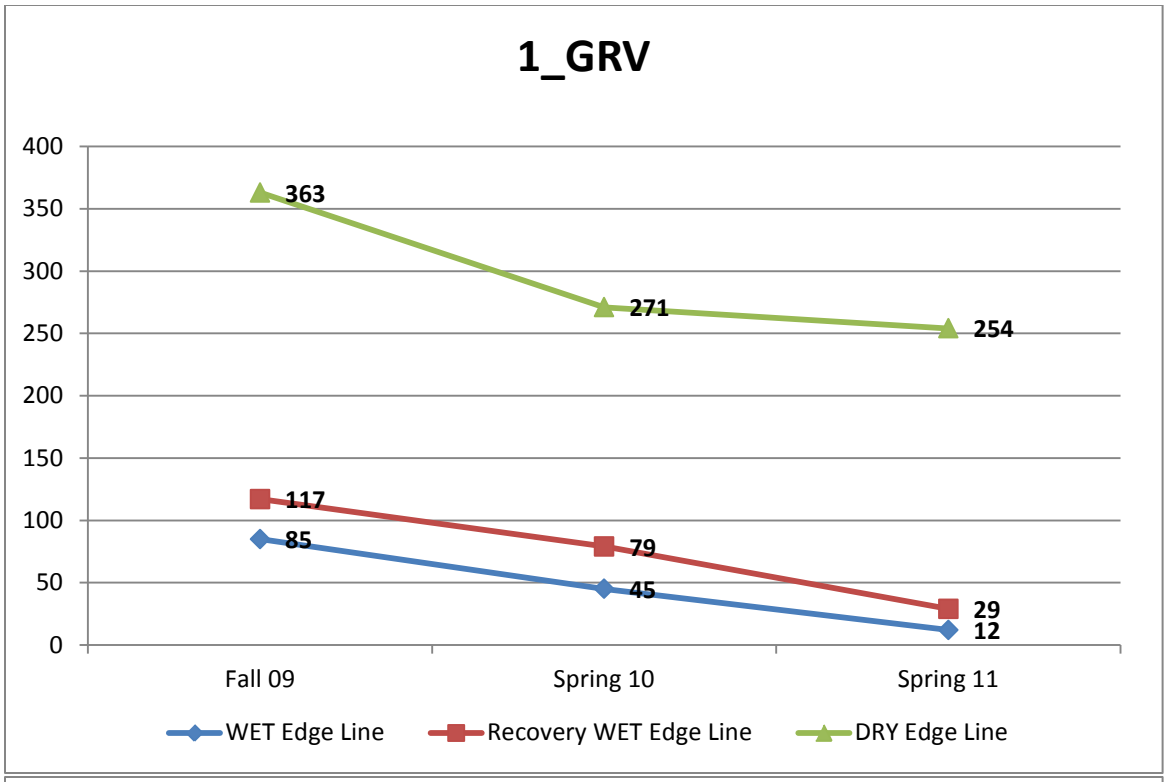
Section	Cost ($/ft for 4-inch line)
1	$0.97
2	$0.94
3	$0.96
4	$0.10
5	$0.10
6	$0.68
7	$0.33
8	$0.22
9	$0.88
10	$0.93
11	$1.57
12	$0.45
13	$0.19
14	$0.40
15	$0.20
16	$0.90

PERFORMANCE GRAPHS

This section provides pavement-marking performance graphs for each test section and installation technique (for each time period within each graph). Each graph presents the section performance over two winters. (Some skips were not measured beyond the first winter.)

Each installation technique is presented in a separate graph and labeled GRV for grooved or SRF for surface-applied. The measurements are in millicandelas (mcd).

Yellow Edge-Line Retroreflectivity Measurements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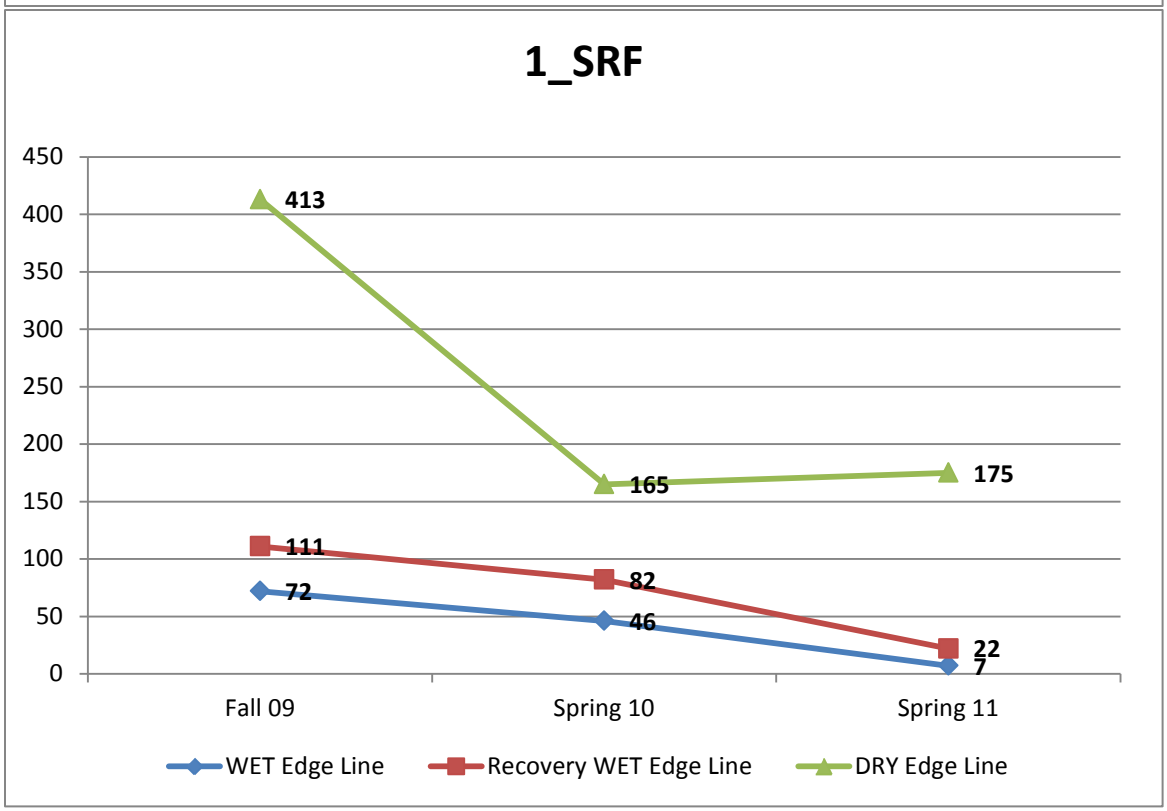
Fall 09
Spring 10
Spring 11
WET Edge Line
Recovery WET Edge Line
DRY Edge Line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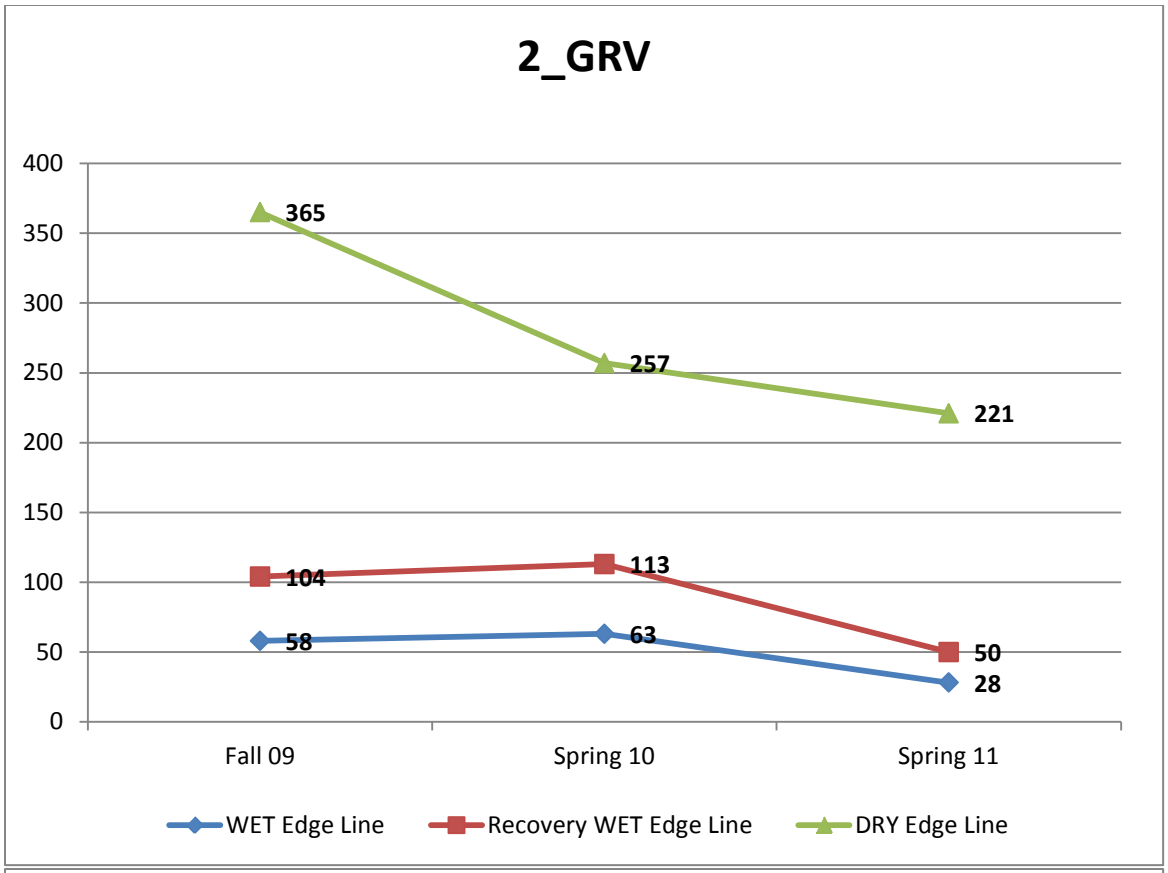
7
Fall 09
Spring 10
Spring 11
WET Edge Line
Recovery WET Edge Line
DRY Edge Line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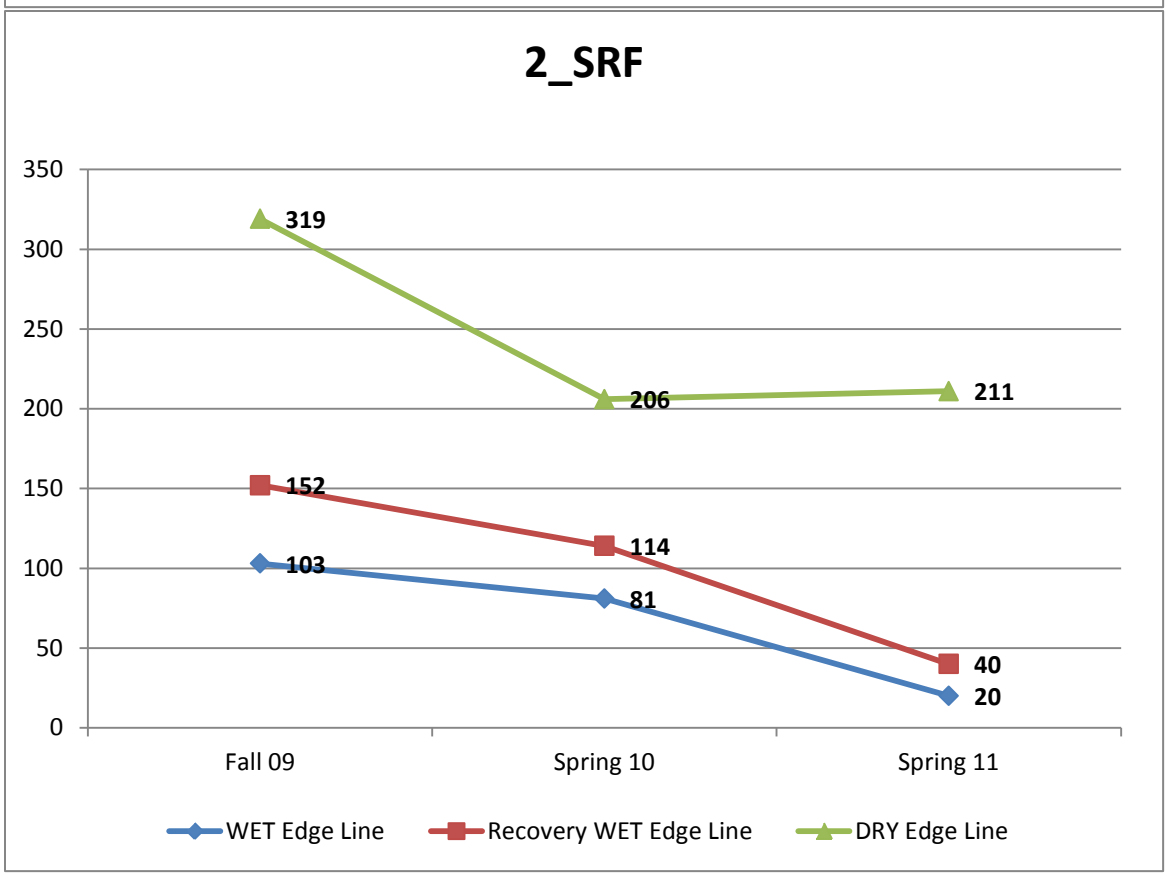
63
28
Fall 09
Spring 10
Spring 11
WET Edge Line
Recovery WET Edge Line
DRY Edge Line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152
114
40
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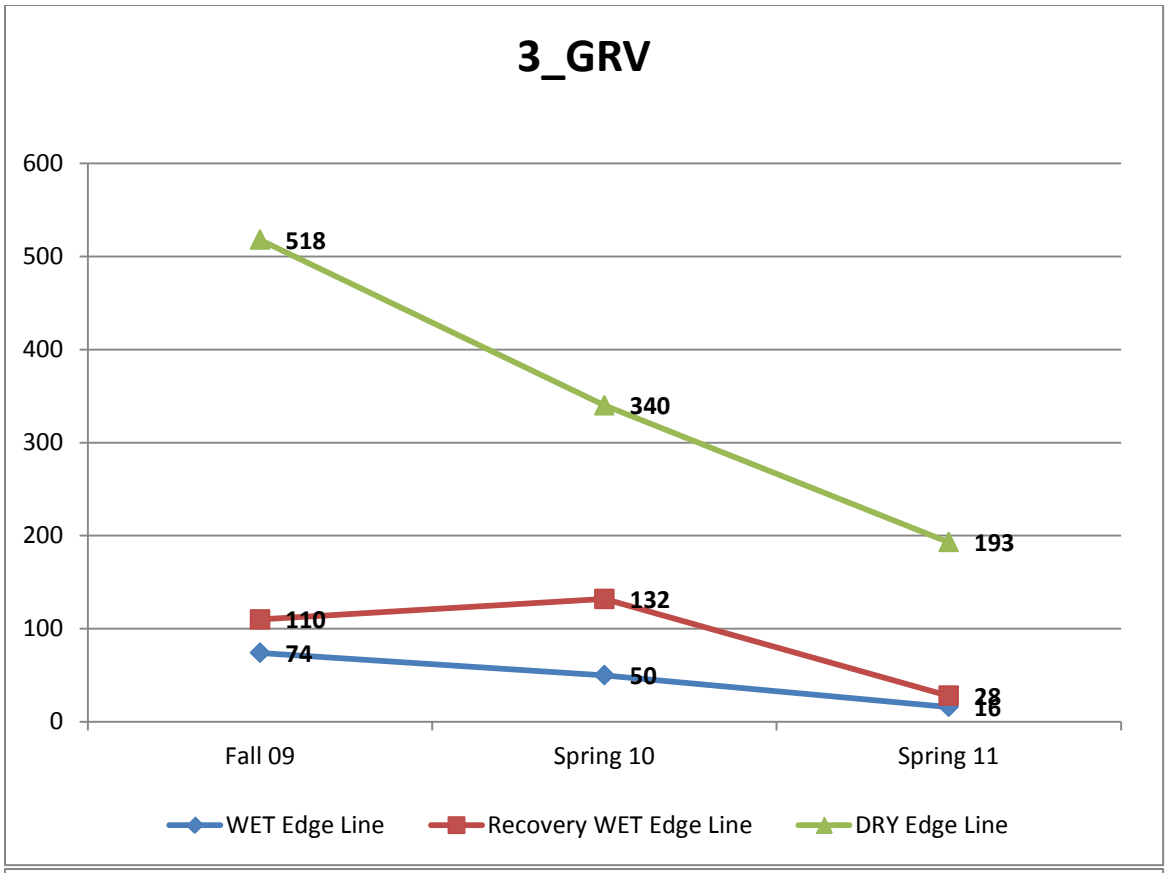
81
20
Fall 09
Spring 10
Spring 11
WET Edge Line
Recovery WET Edge Line
DRY Edge Line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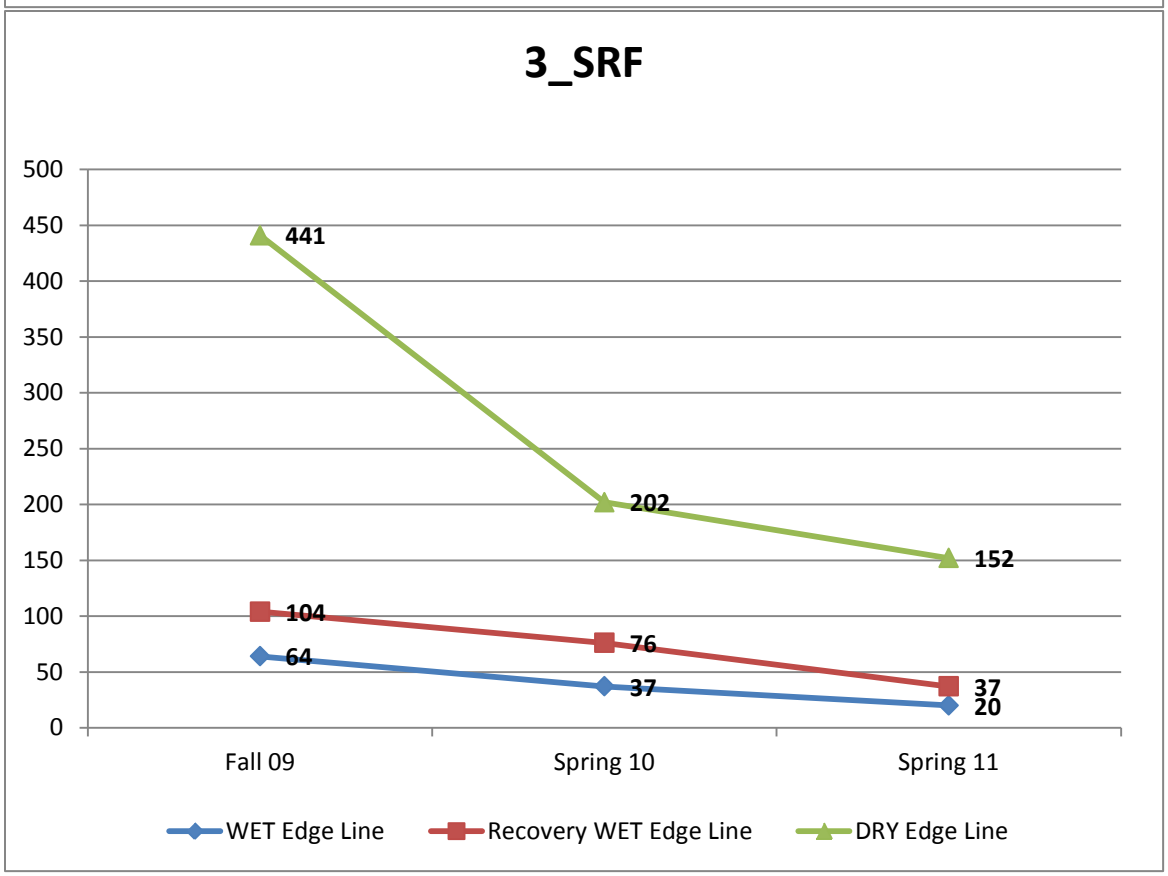
16
Fall 09
Spring 10
Spring 11
WET Edge Line
Recovery WET Edge Line
DRY Edge Line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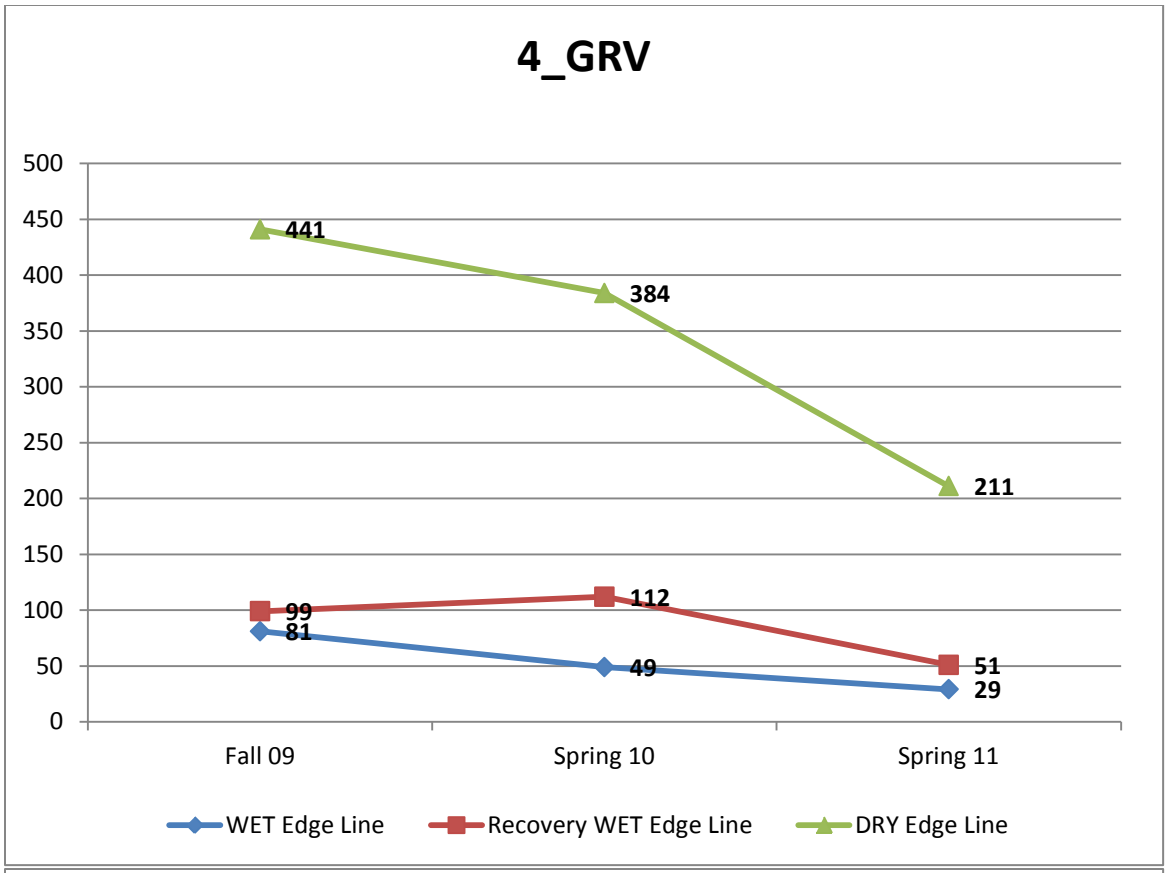
Fall 09
Spring 10
Spring 11
WET Edge Line
Recovery WET Edge Line
DRY Edge Line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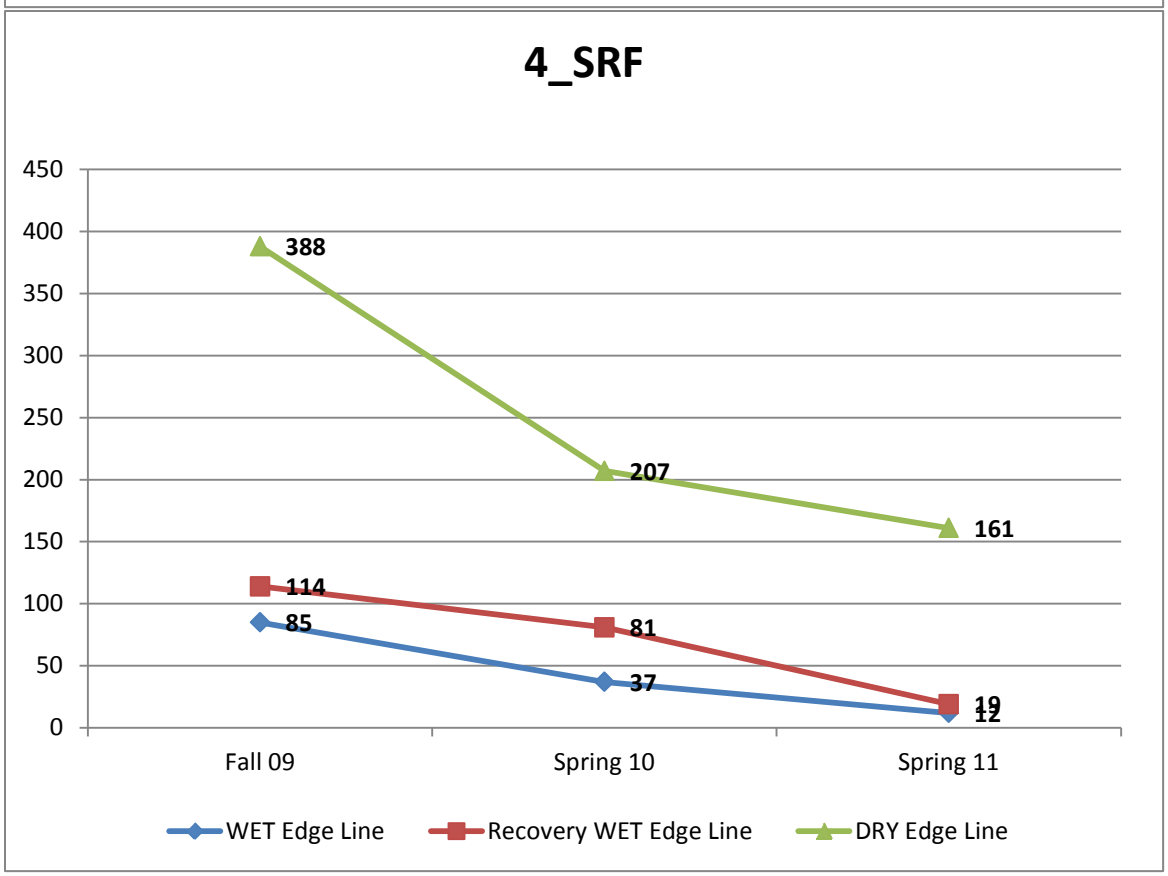
29
Fall 09
Spring 10
Spring 11
WET Edge Line
Recovery WET Edge Line
DRY Edge Line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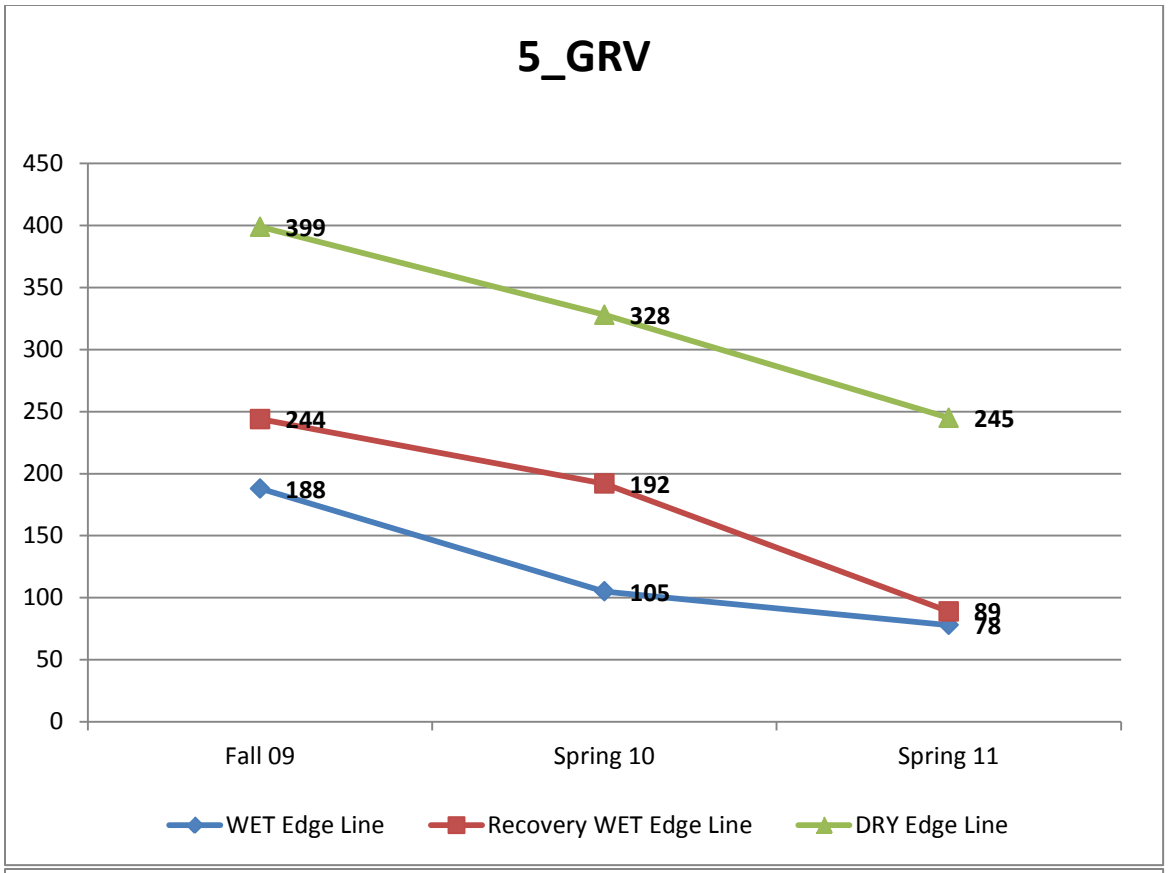
19
12
Fall 09
Spring 10
Spring 11
WET Edge Line
Recovery WET Edge Line
DRY Edge Line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200
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100
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244
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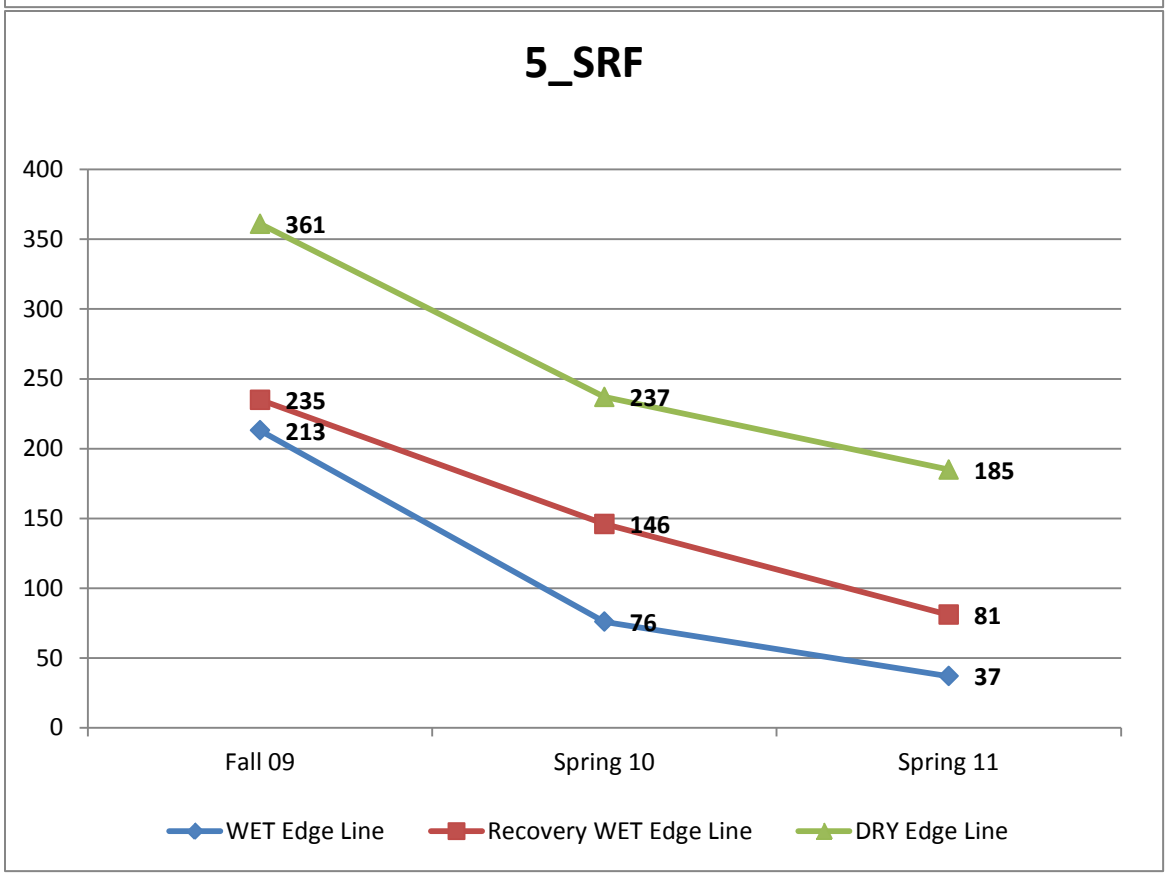
105
78
Fall 09
Spring 10
Spring 11
WET Edge Line
Recovery WET Edge Line
DRY Edge Line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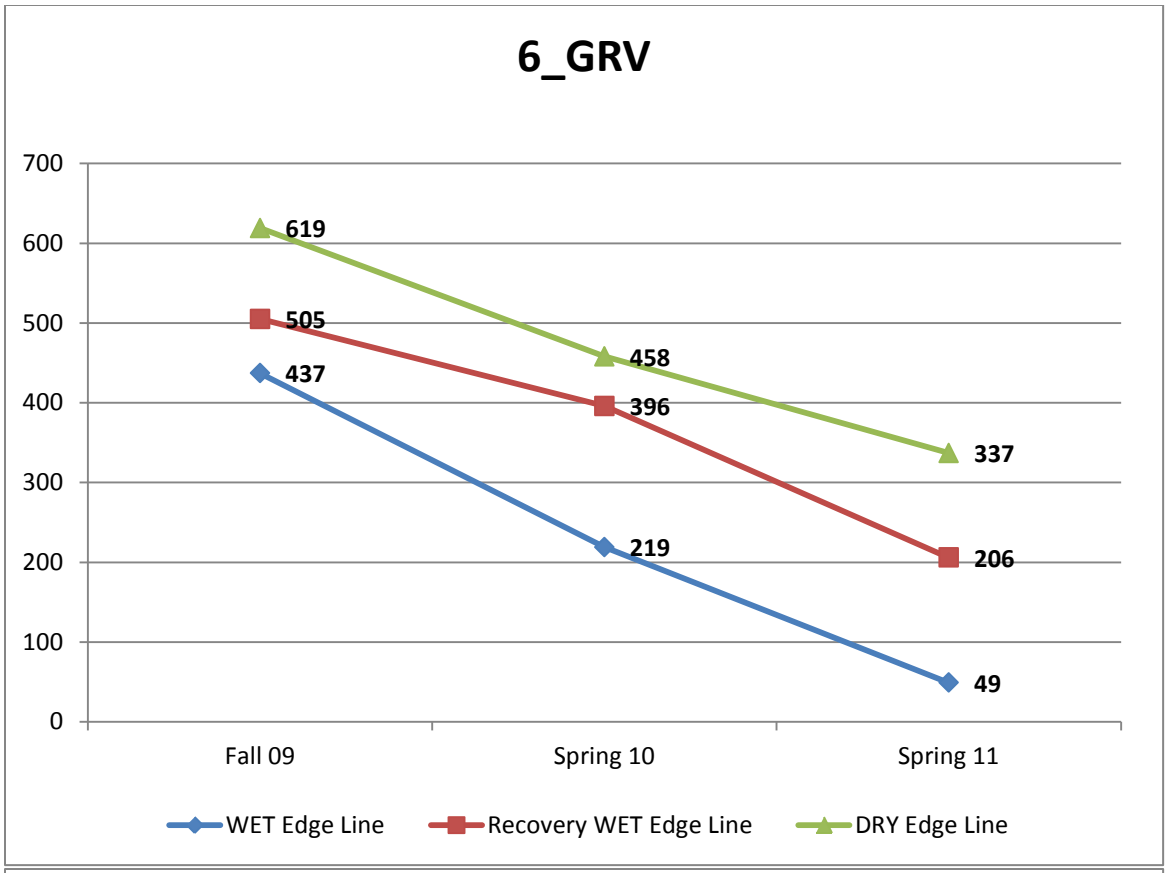
37
Fall 09
Spring 10
Spring 11
WET Edge Line
Recovery WET Edge Line
DRY Edge Line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300
200
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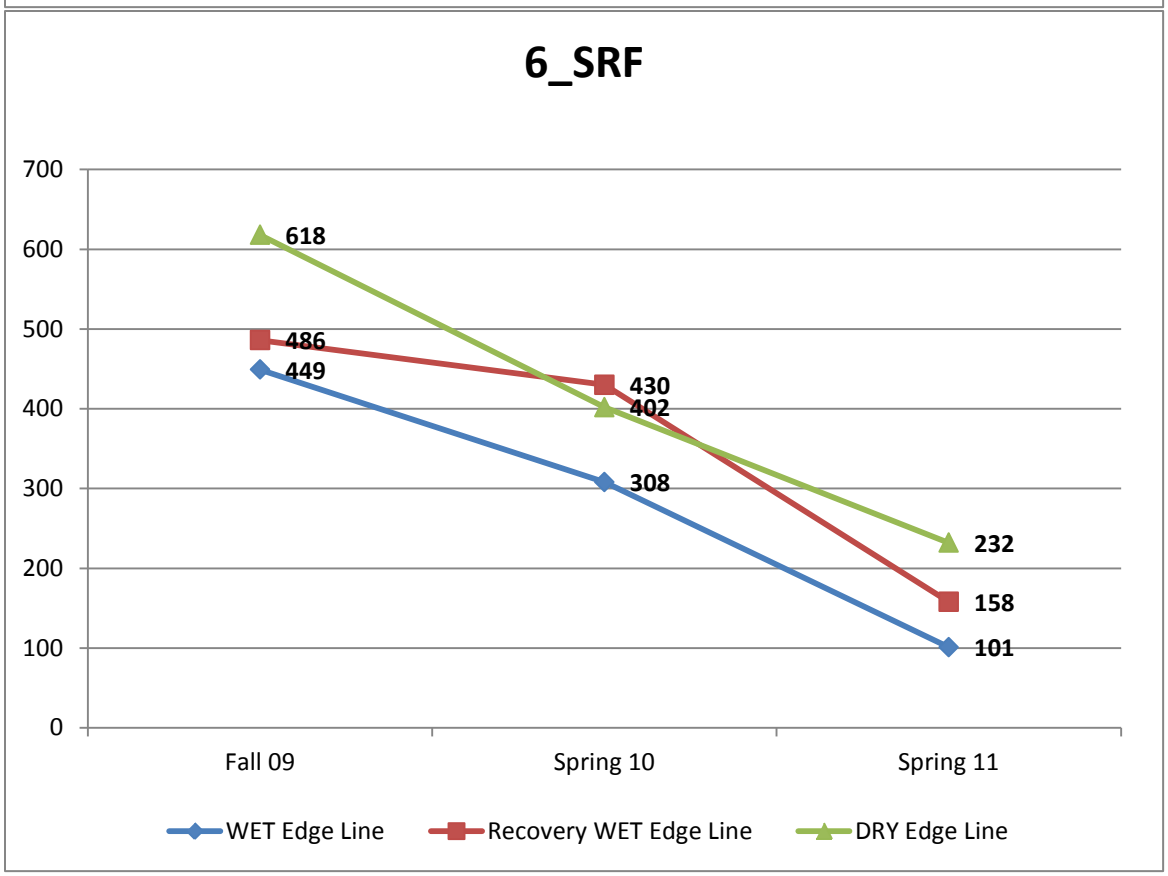
505
437
458
396
219
337
206
49
Fall 09
Spring 10
Spring 11
WET Edge Line
Recovery WET Edge Line
DRY Edge Line


6_SRF
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500
400
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200
100
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486
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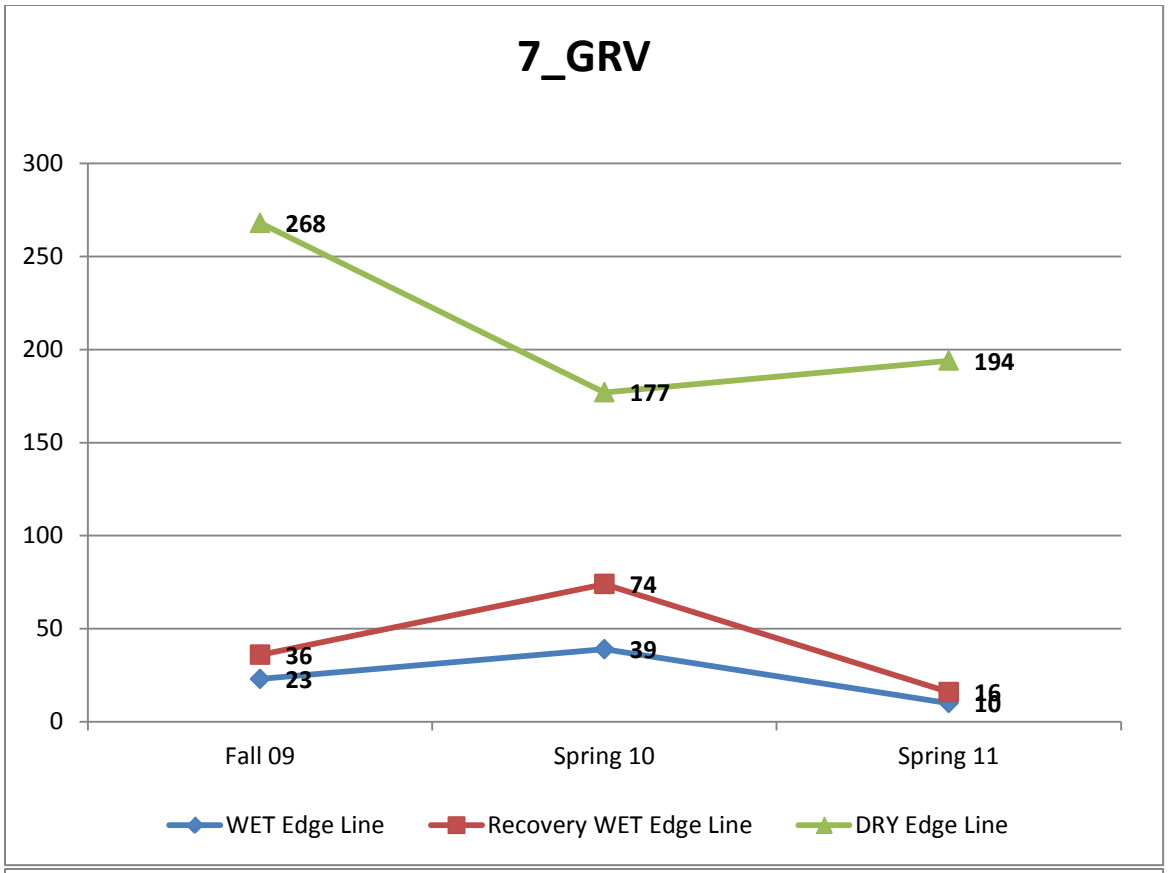
430
402
308
232
158
101
Fall 09
Spring 10
Spring 11
WET Edge Line
Recovery WET Edge Line
DRY Edge Line


7_GRV
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100
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16
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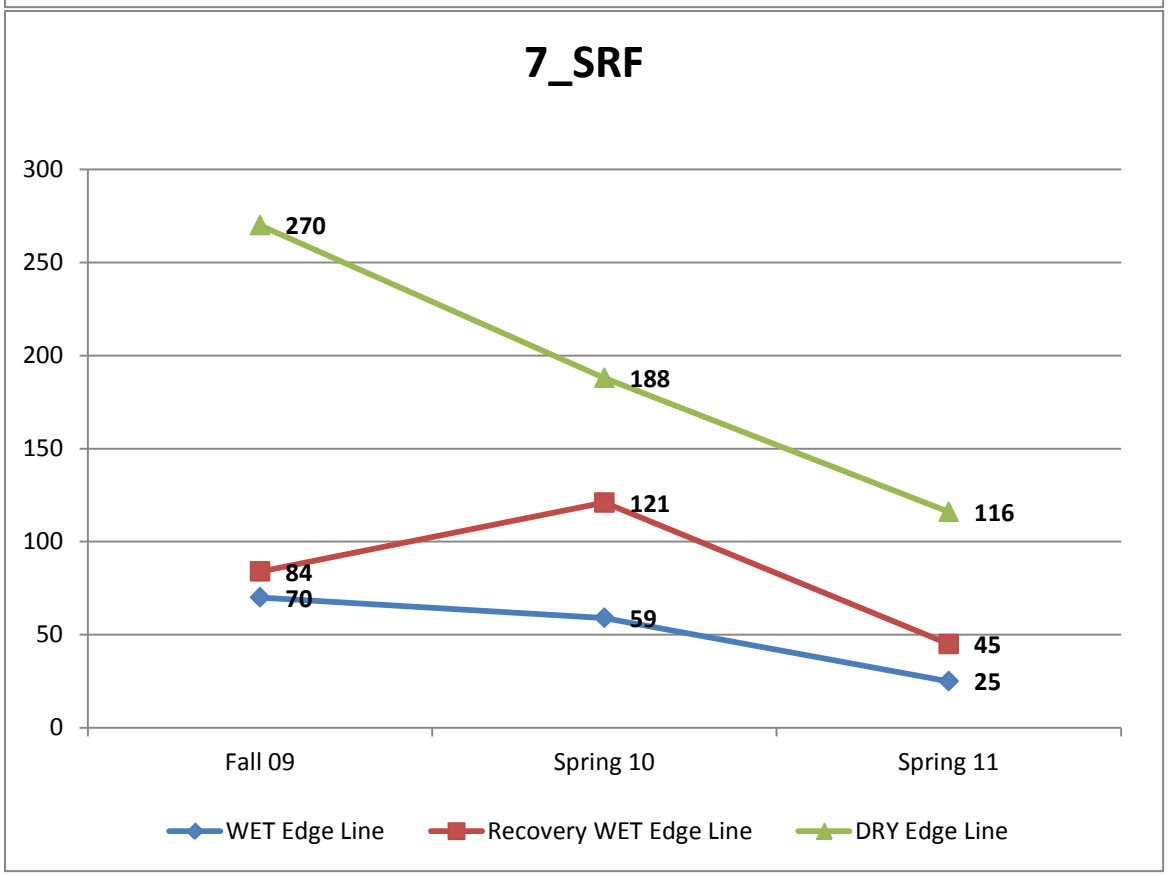
Fall 09
Spring 10
Spring 11
WET Edge Line
Recovery WET Edge Line
DRY Edge Line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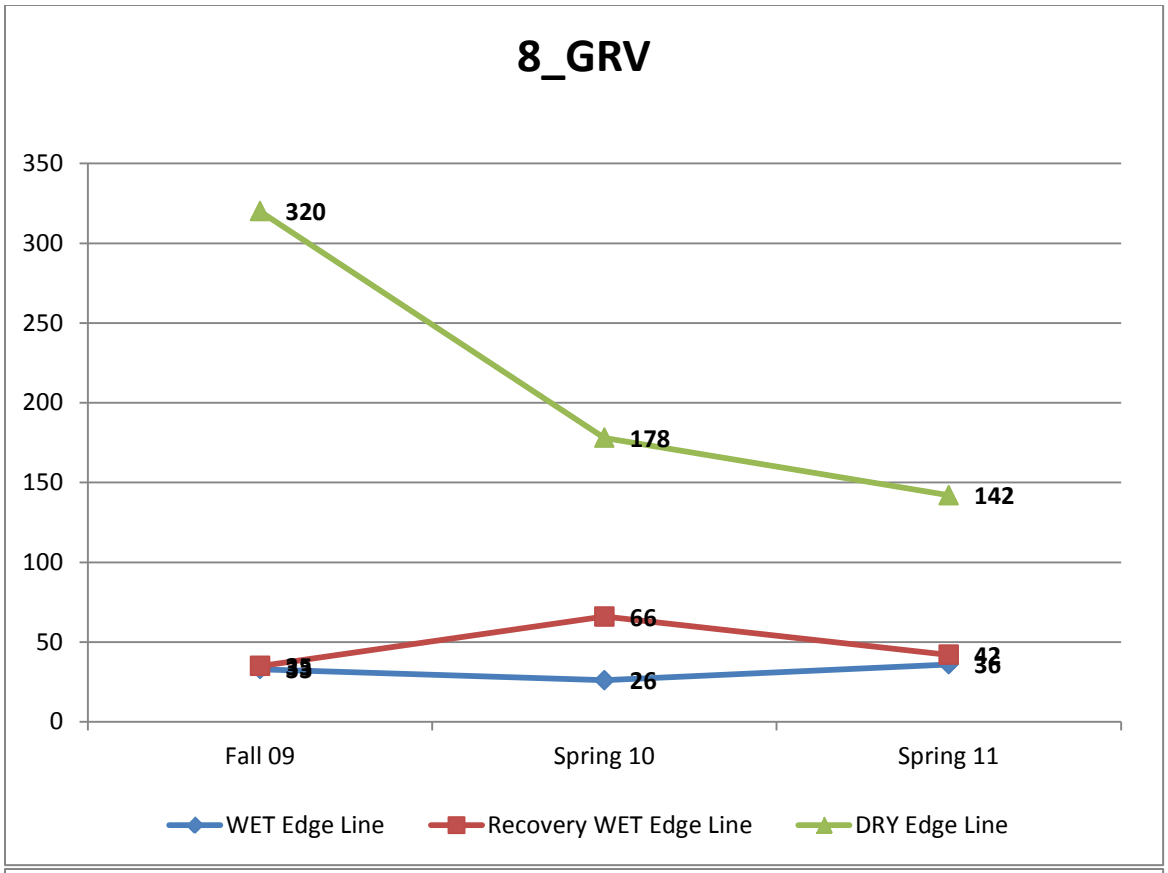
Fall 09
Spring 10
Spring 11
WET Edge Line
Recovery WET Edge Line
DRY Edge Line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Fall 09
Spring 10
Spring 11
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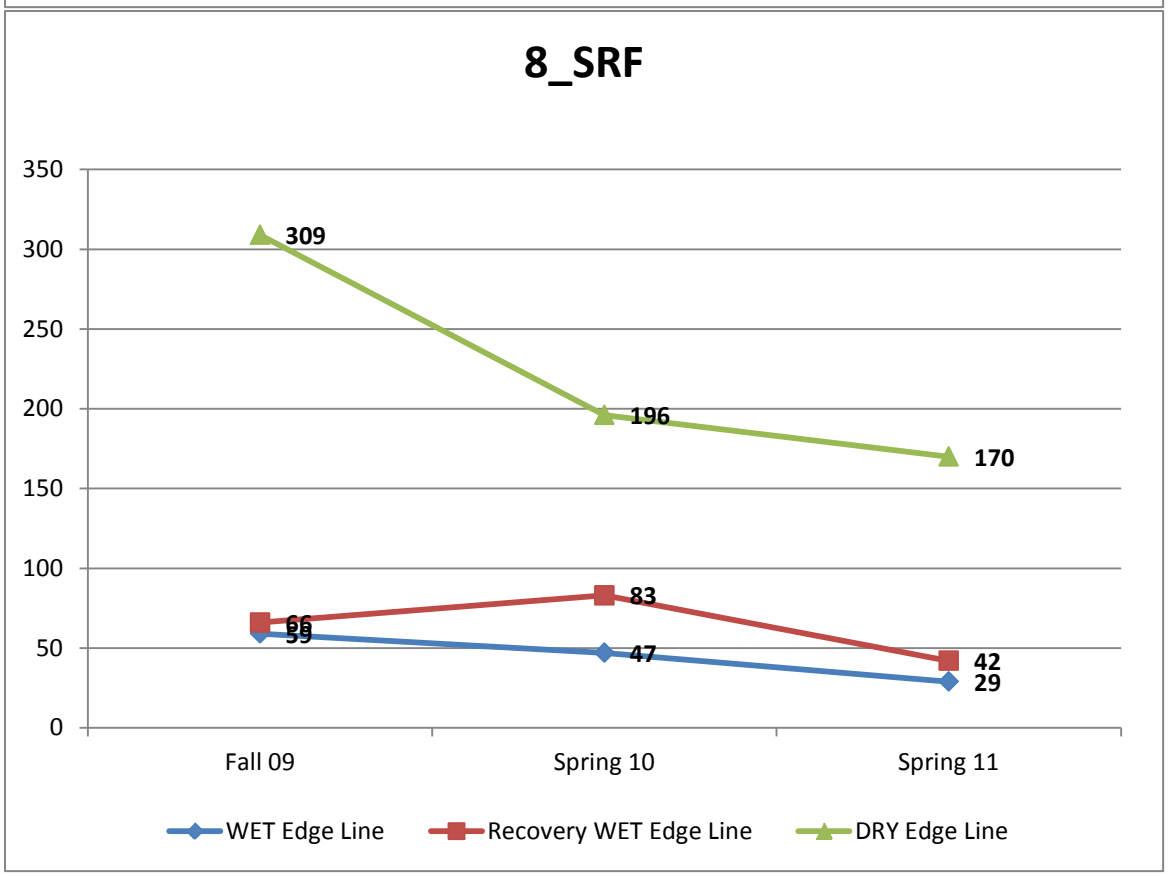
Recovery WET Edge Line
DRY Edge Line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Fall 09
Spring 10
Spring 11
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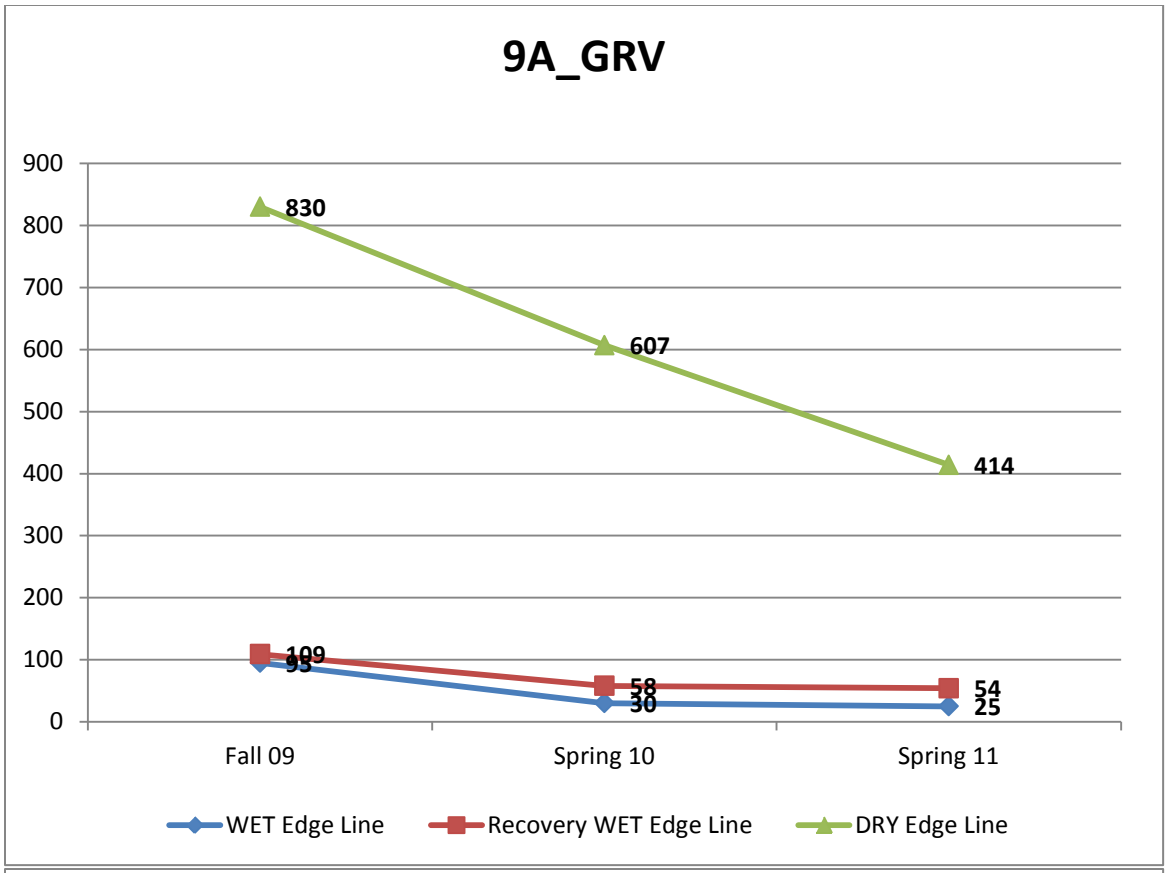
Recovery WET Edge Line
DRY Edge Line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400
300
200
100
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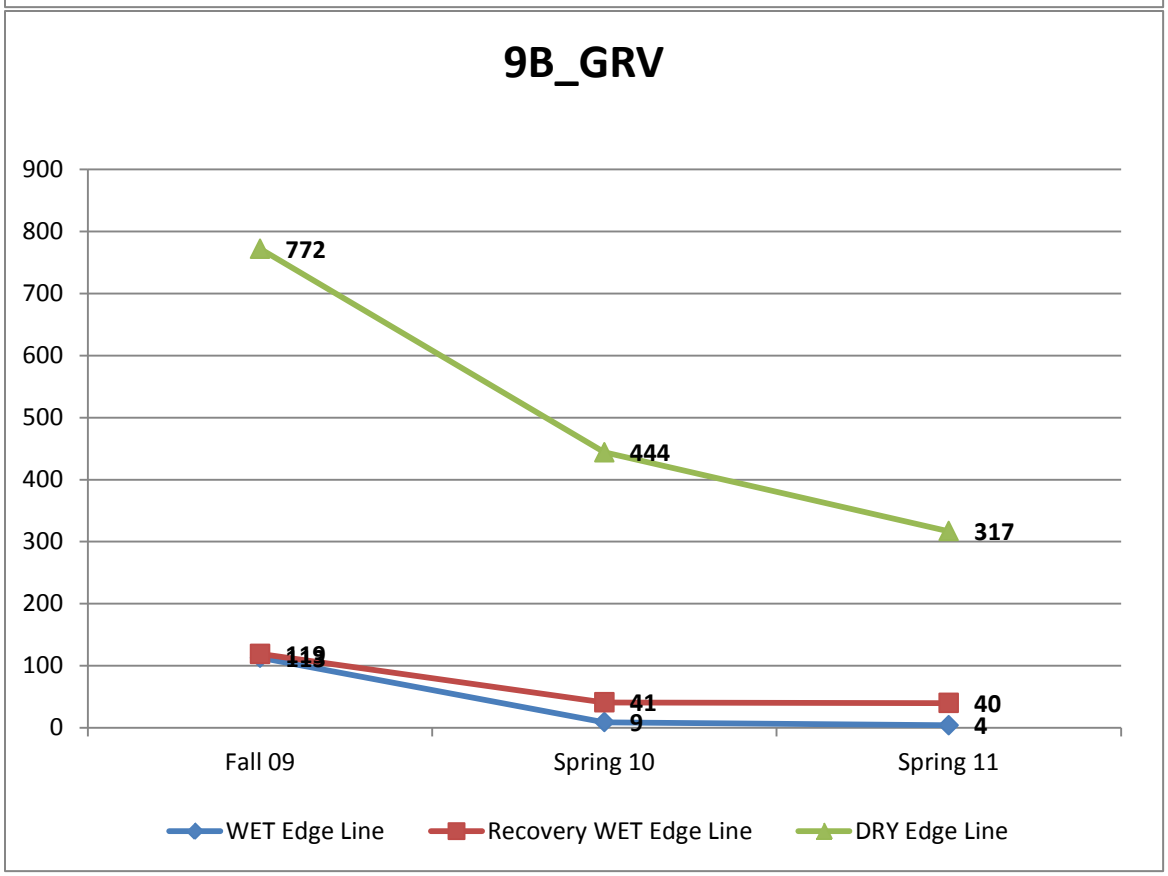
25
Fall 09
Spring 10
Spring 11
WET Edge Line
Recovery WET Edge Line
DRY Edge Line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Spring 10
Spring 11
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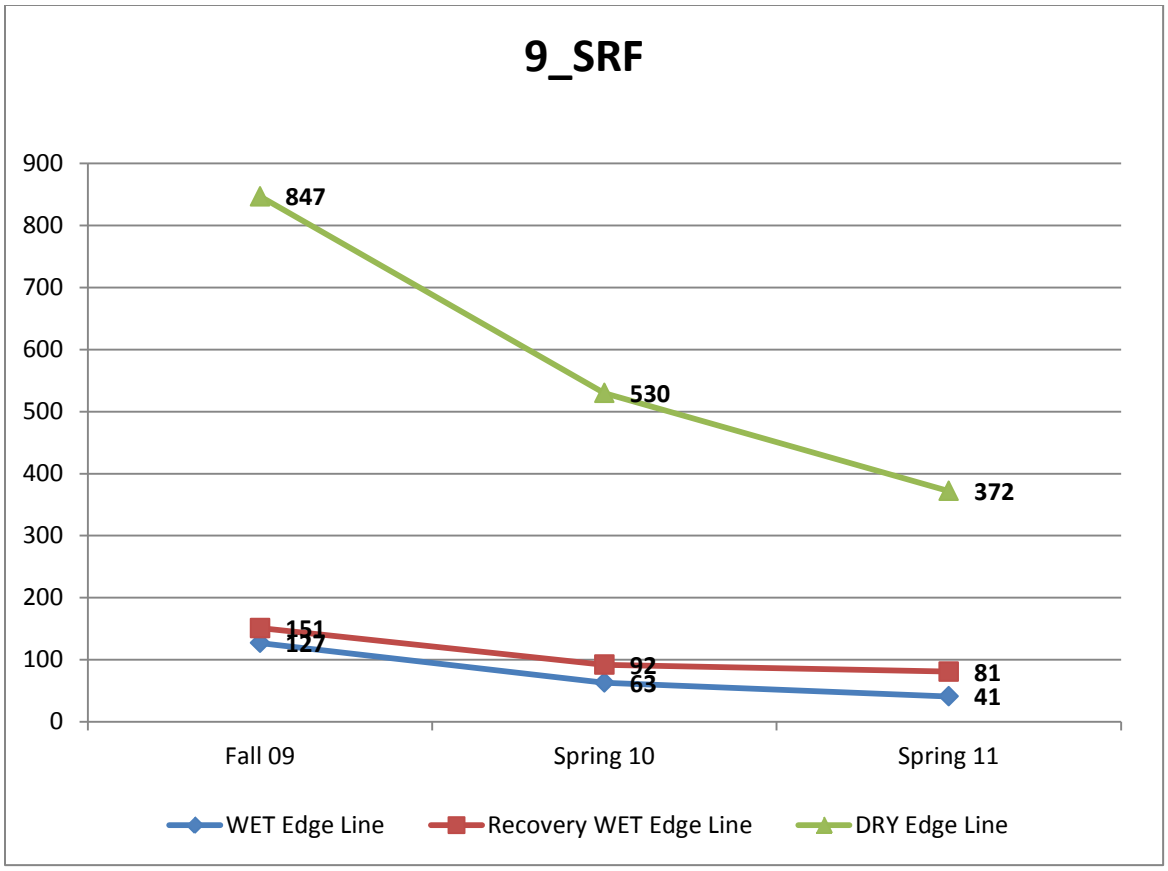
Recovery WET Edge Line
DRY Edge Line


9_SRF
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300
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100
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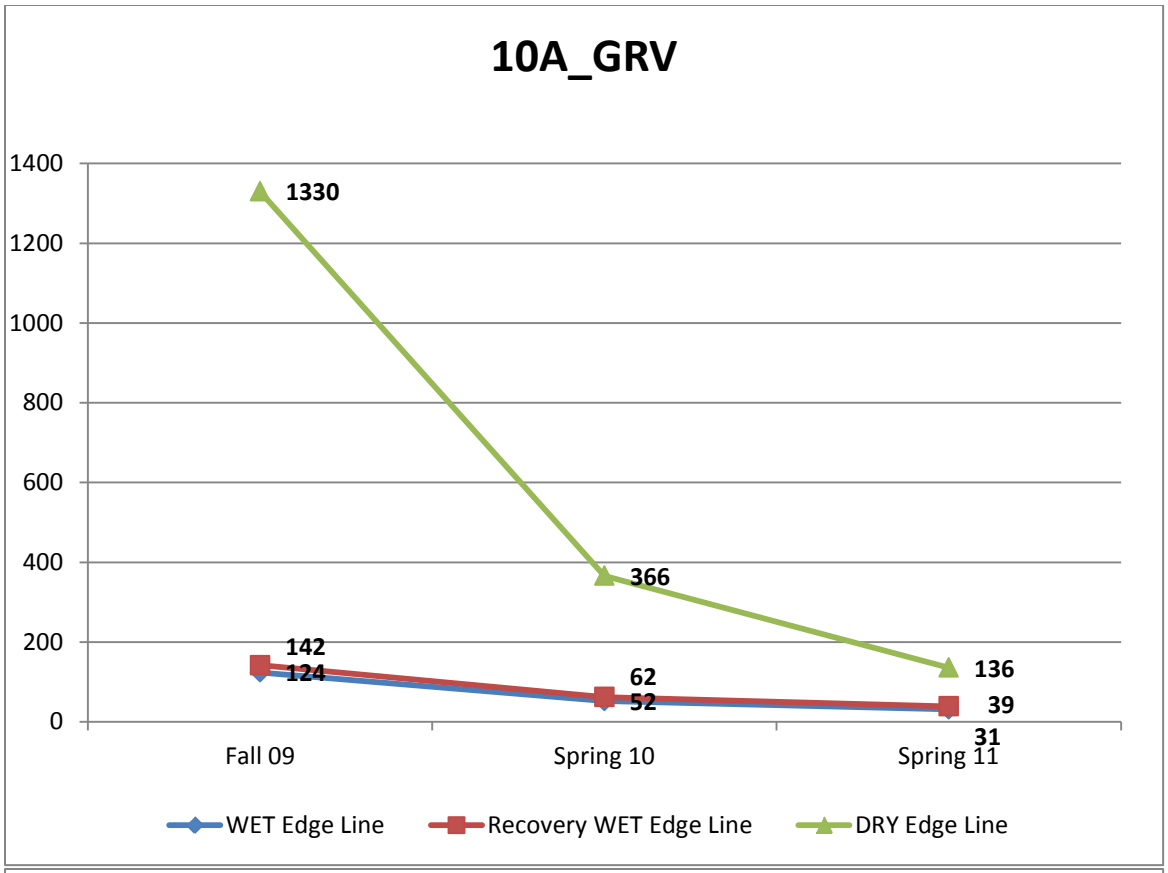
Spring 10
Spring 11
WET Edge Line
Recovery WET Edge Line
DRY Edge Line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400
200
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124
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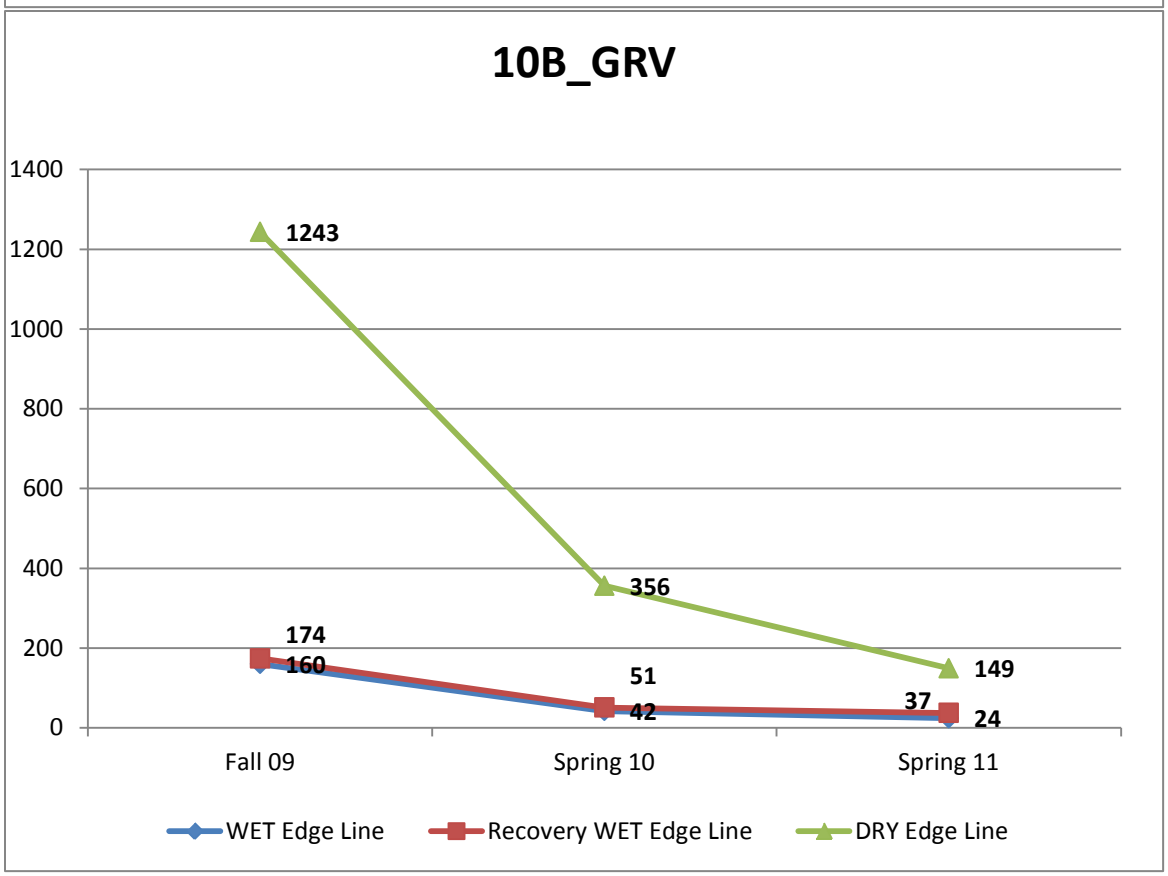
31
Fall 09
Spring 10
Spring 11
WET Edge Line
Recovery WET Edge Line
DRY Edge Line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Fall 09
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Spring 11
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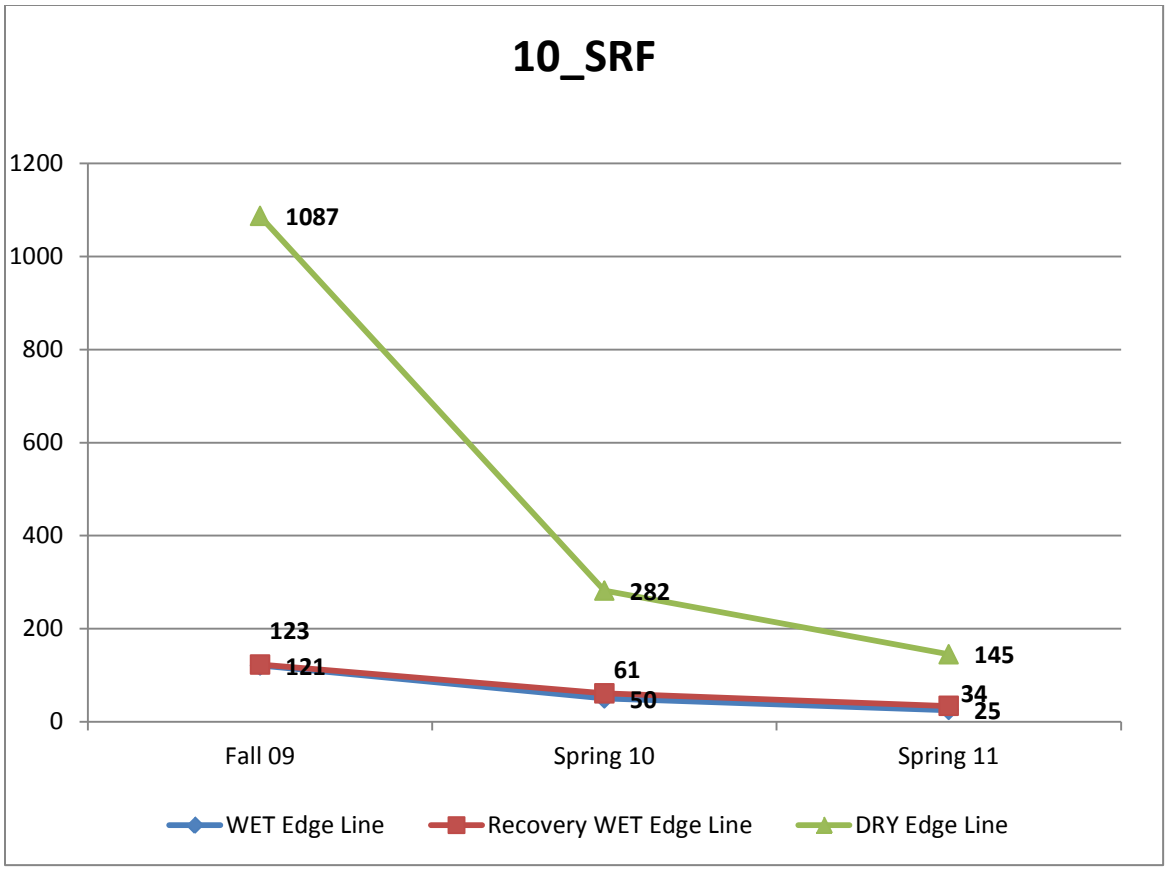
Recovery WET Edge Line
DRY Edge Line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800
600
400
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282
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34
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Fall 09
Spring 10
Spring 11
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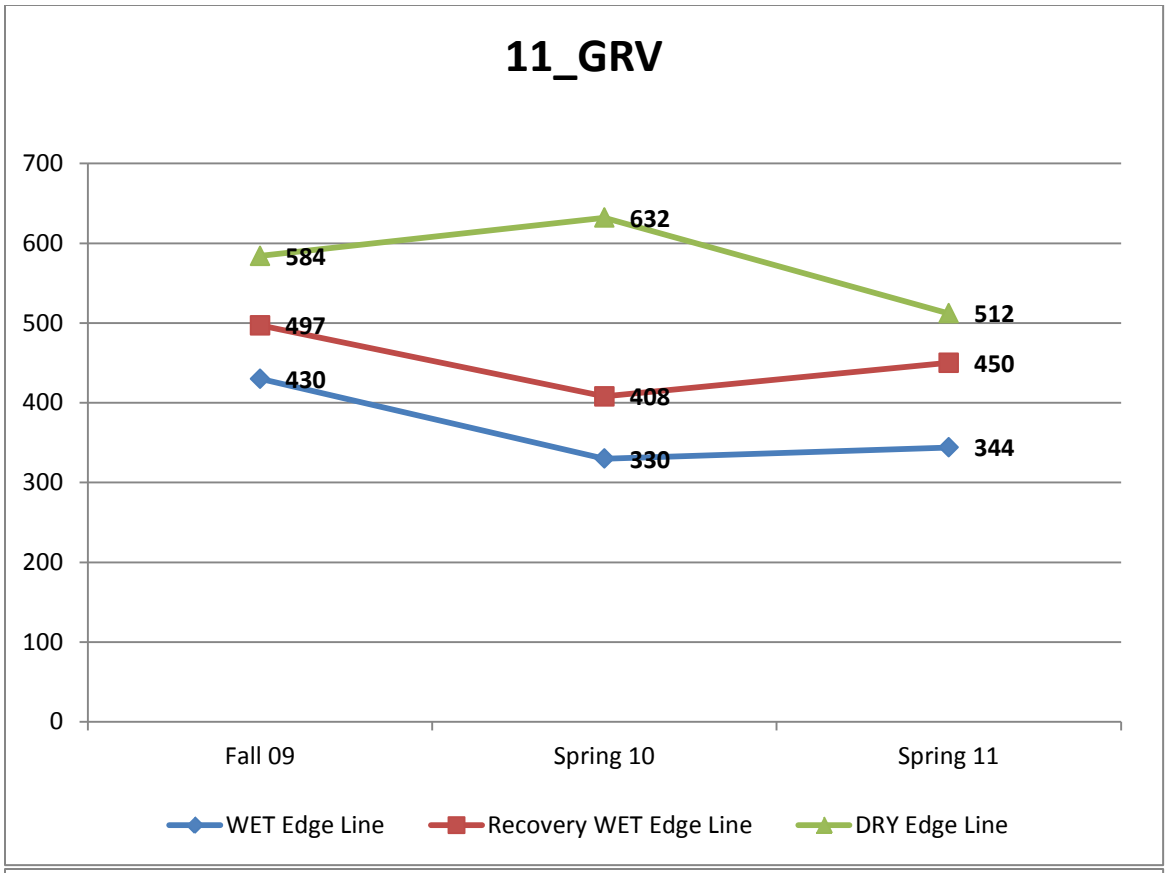
Recovery WET Edge Line
DRY Edge Line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500
400
300
200
100
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632
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408
450
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Fall 09
Spring 10
Spring 11
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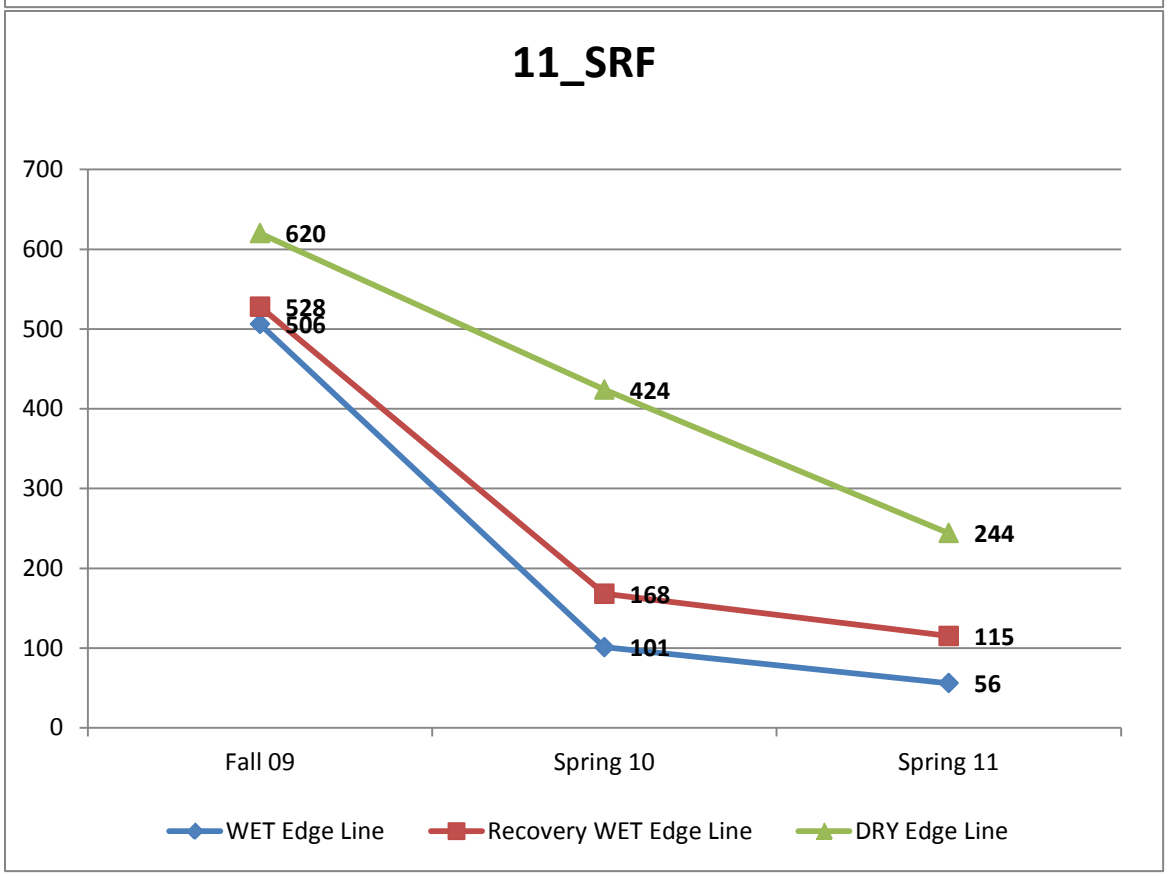
Recovery WET Edge Line
DRY Edge Line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300
200
100
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244
168
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101
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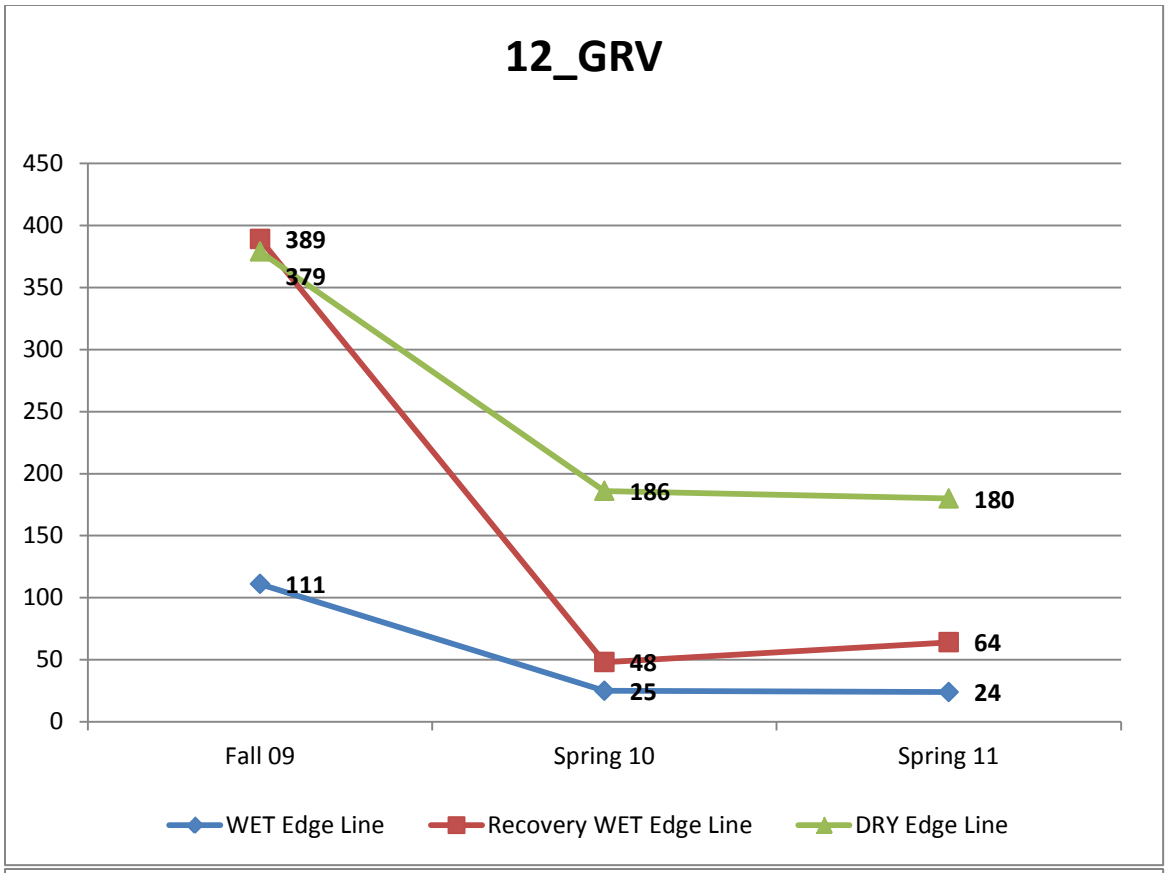
Fall 09
Spring 10
Spring 11
WET Edge Line
Recovery WET Edge Line
DRY Edge Line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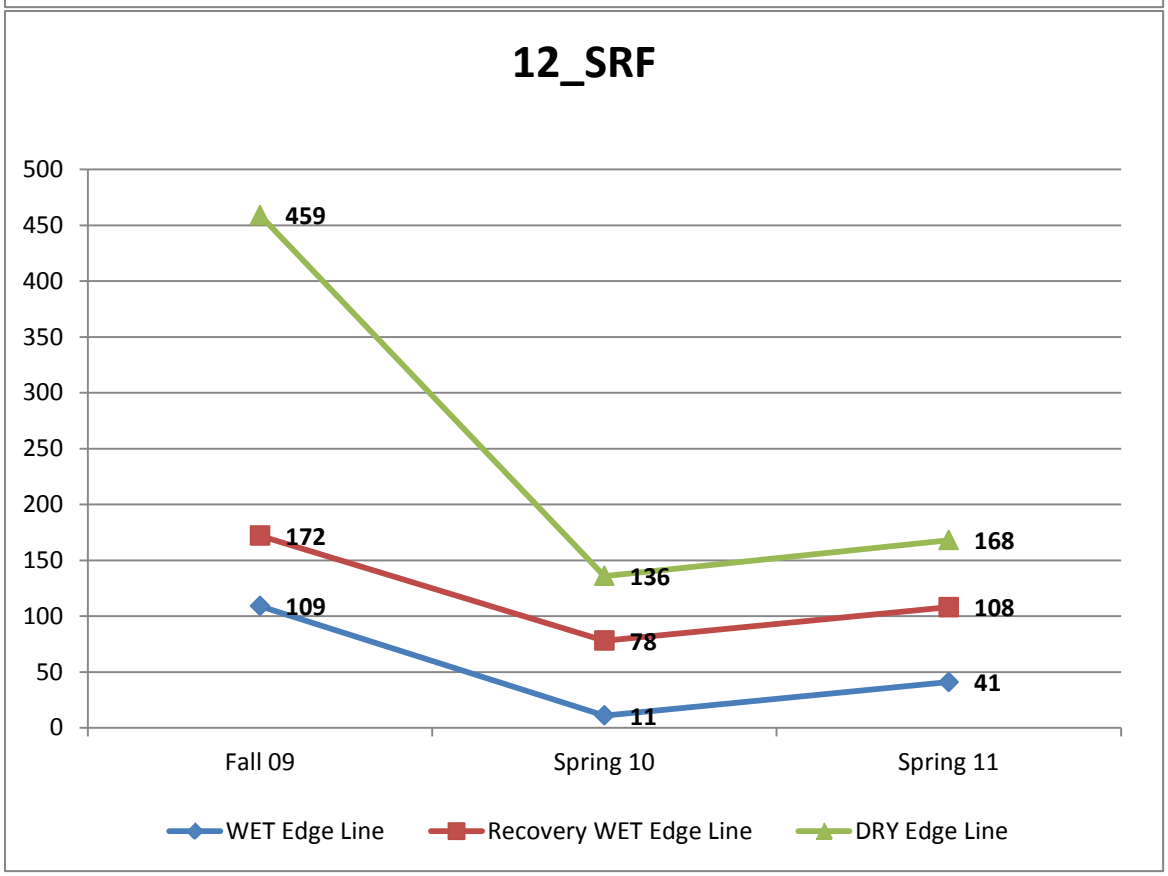
Fall 09
Spring 10
Spring 11
WET Edge Line
Recovery WET Edge Line
DRY Edge Line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100
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108
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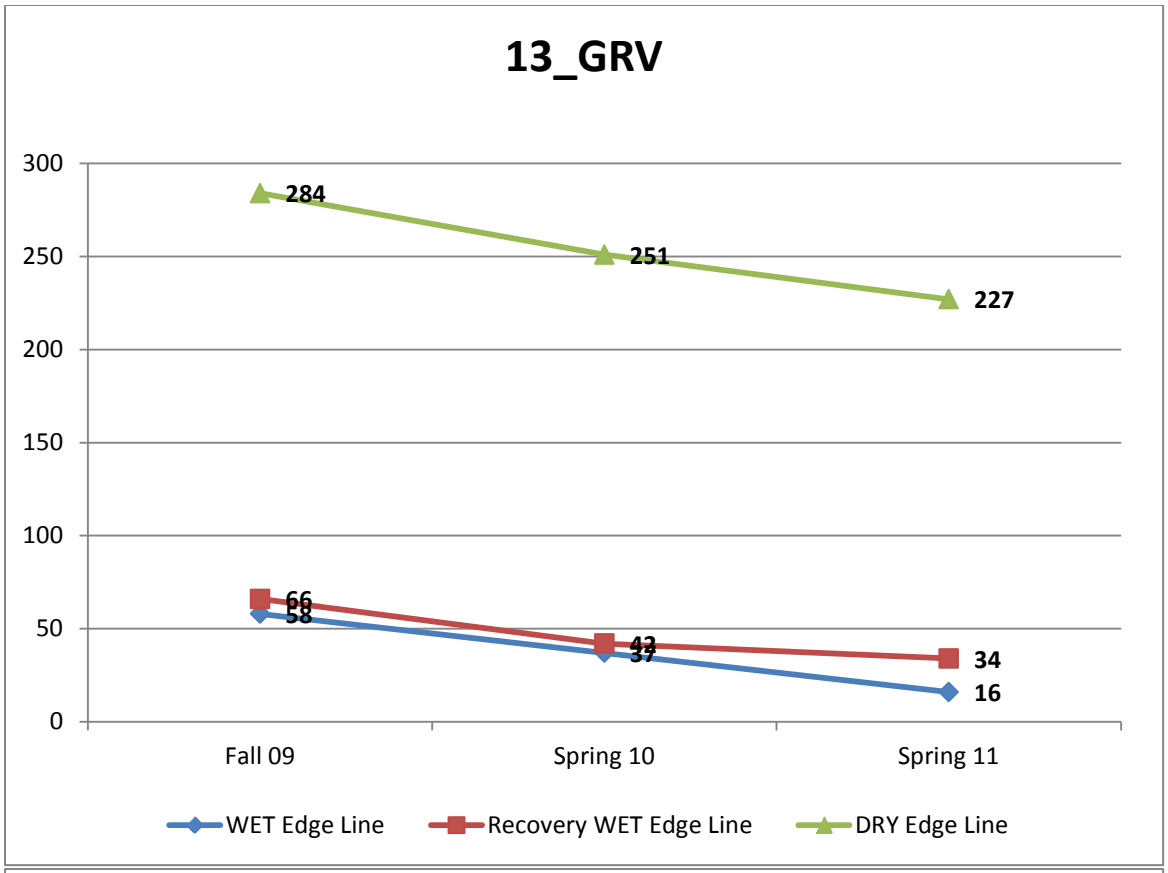
Fall 09
Spring 10
Spring 11
WET Edge Line
Recovery WET Edge Line
DRY Edge Line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200
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100
50
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251
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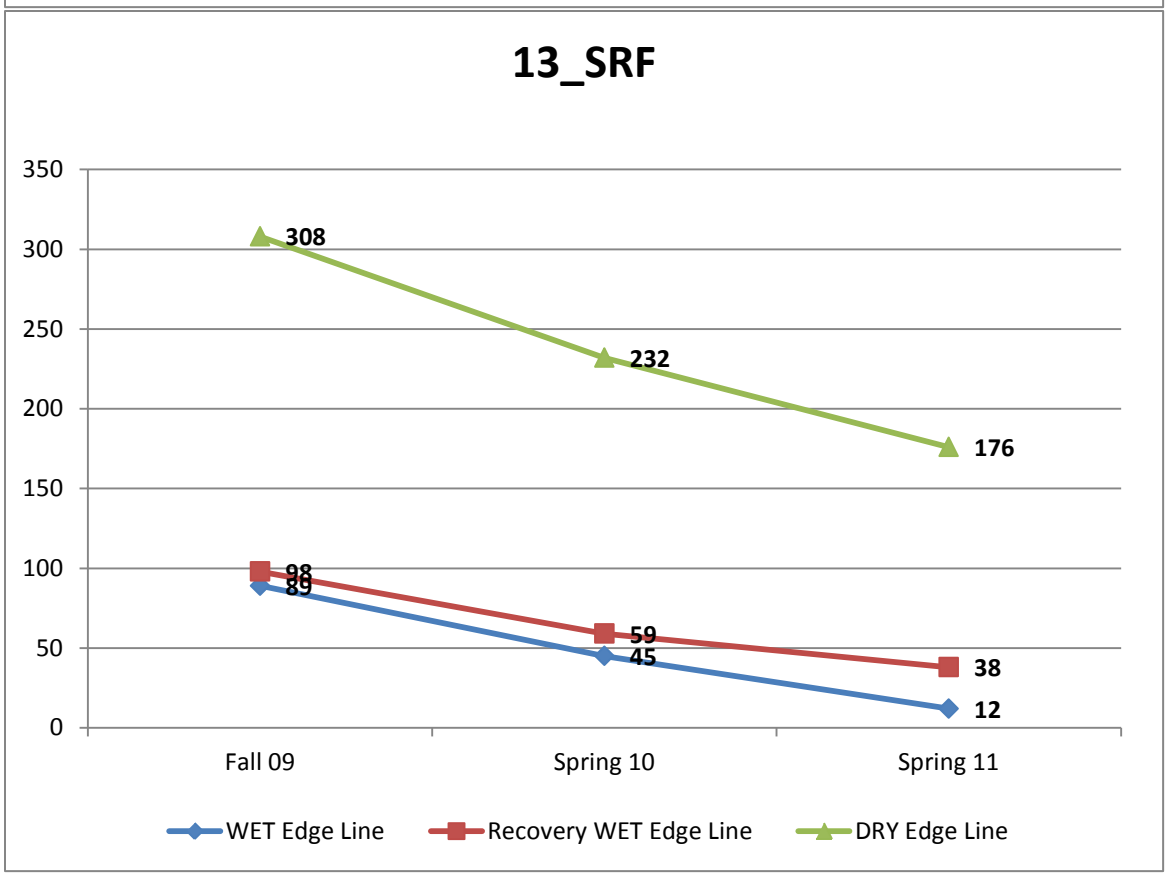
66
58
43
37
34
16
Fall 09
Spring 10
Spring 11
WET Edge Line
Recovery WET Edge Line
DRY Edge Line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200
150
100
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232
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59
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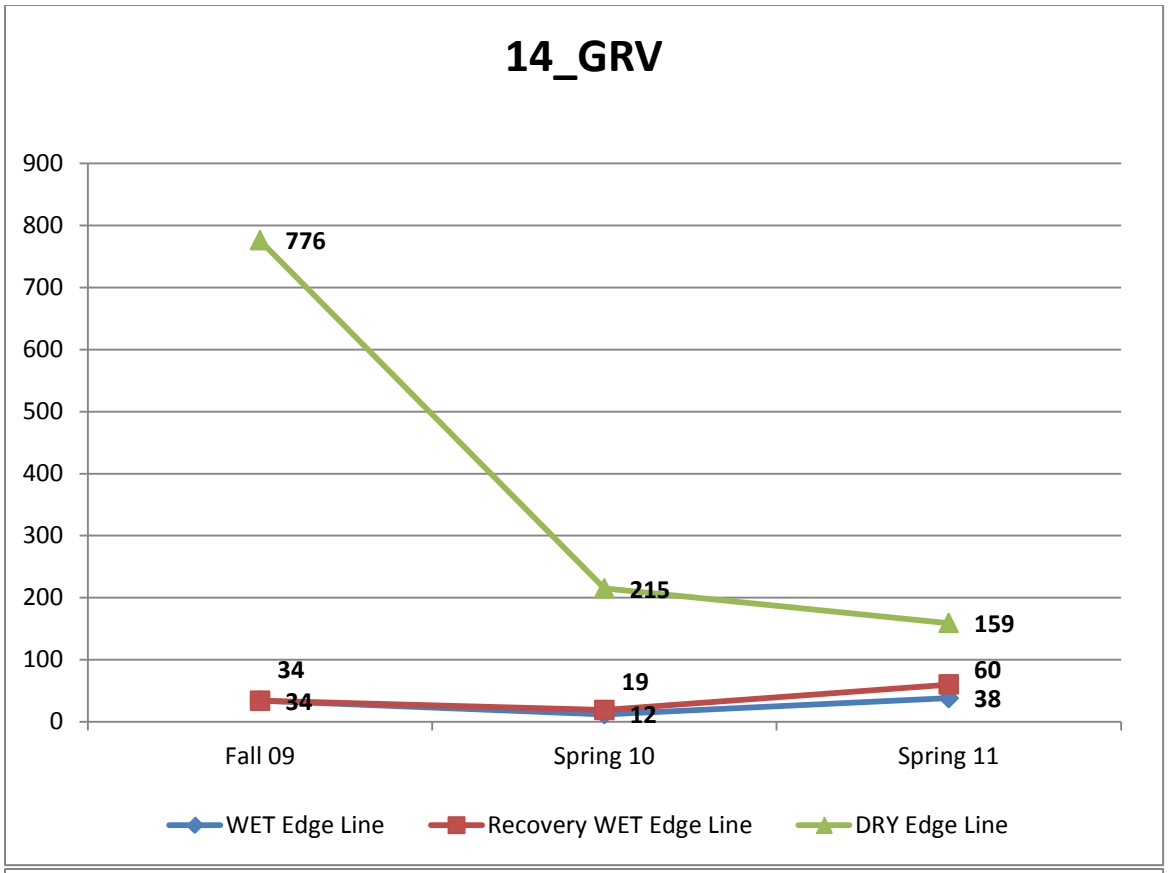
38
12
Fall 09
Spring 10
Spring 11
WET Edge Line
Recovery WET Edge Line
DRY Edge Line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500
400
300
200
100
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34
19
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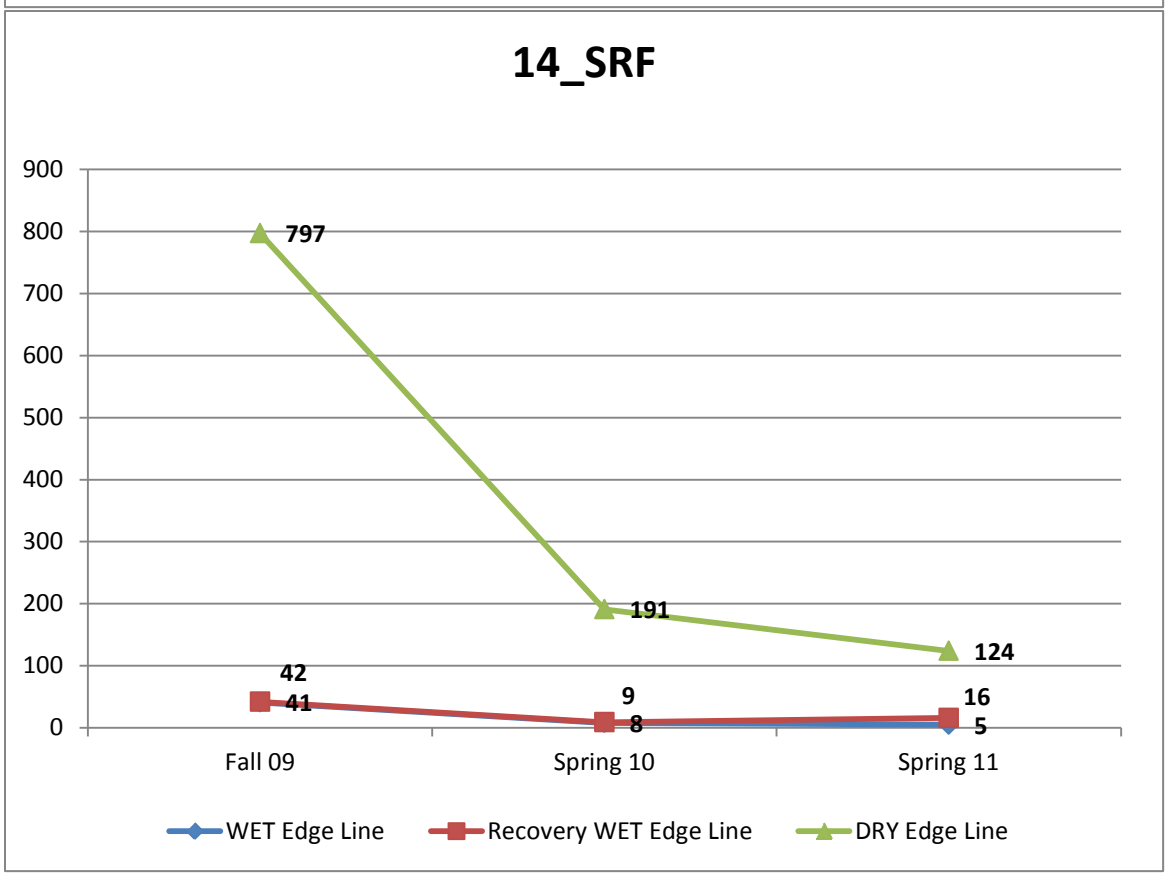
60
38
Fall 09
Spring 10
Spring 11
WET Edge Line
Recovery WET Edge Line
DRY Edge Line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600
500
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200
100
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191
124
42
41
9
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16
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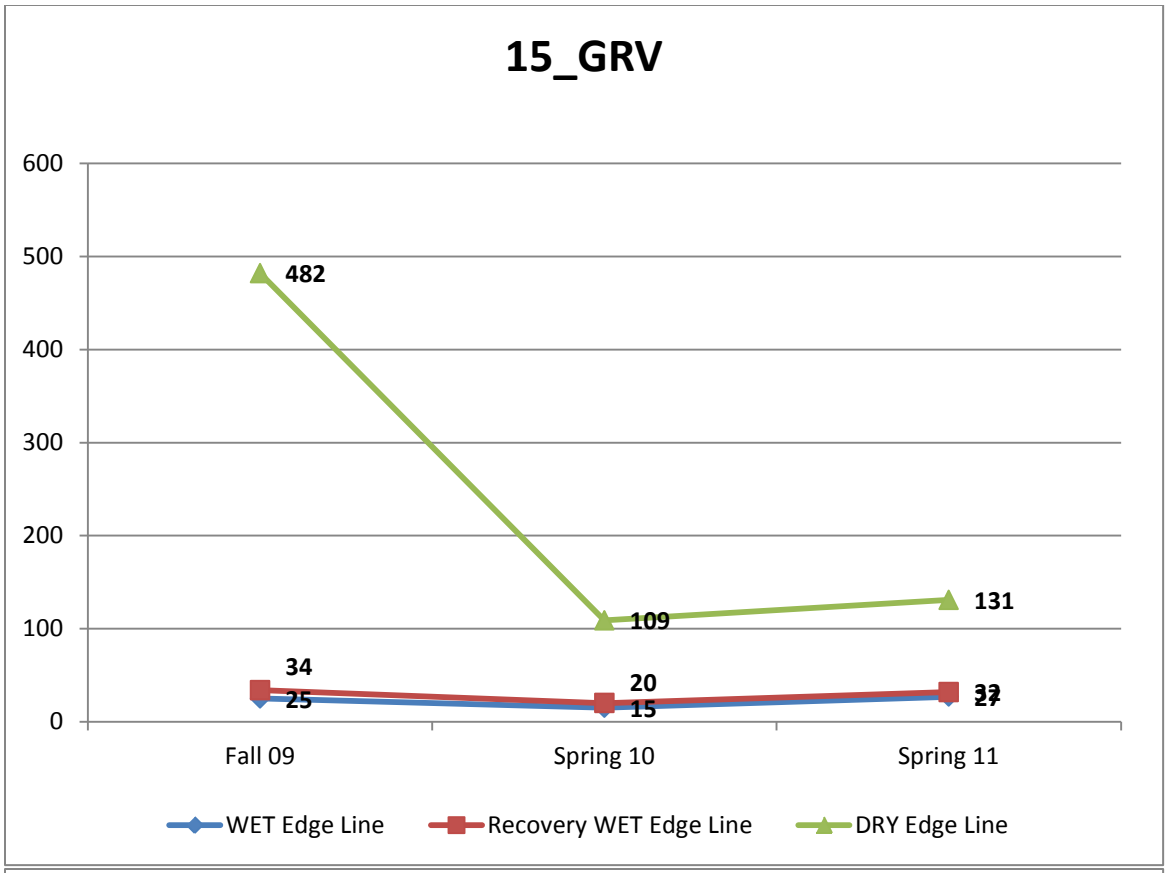
Fall 09
Spring 10
Spring 11
WET Edge Line
Recovery WET Edge Line
DRY Edge Line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400
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131
34
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Spring 11
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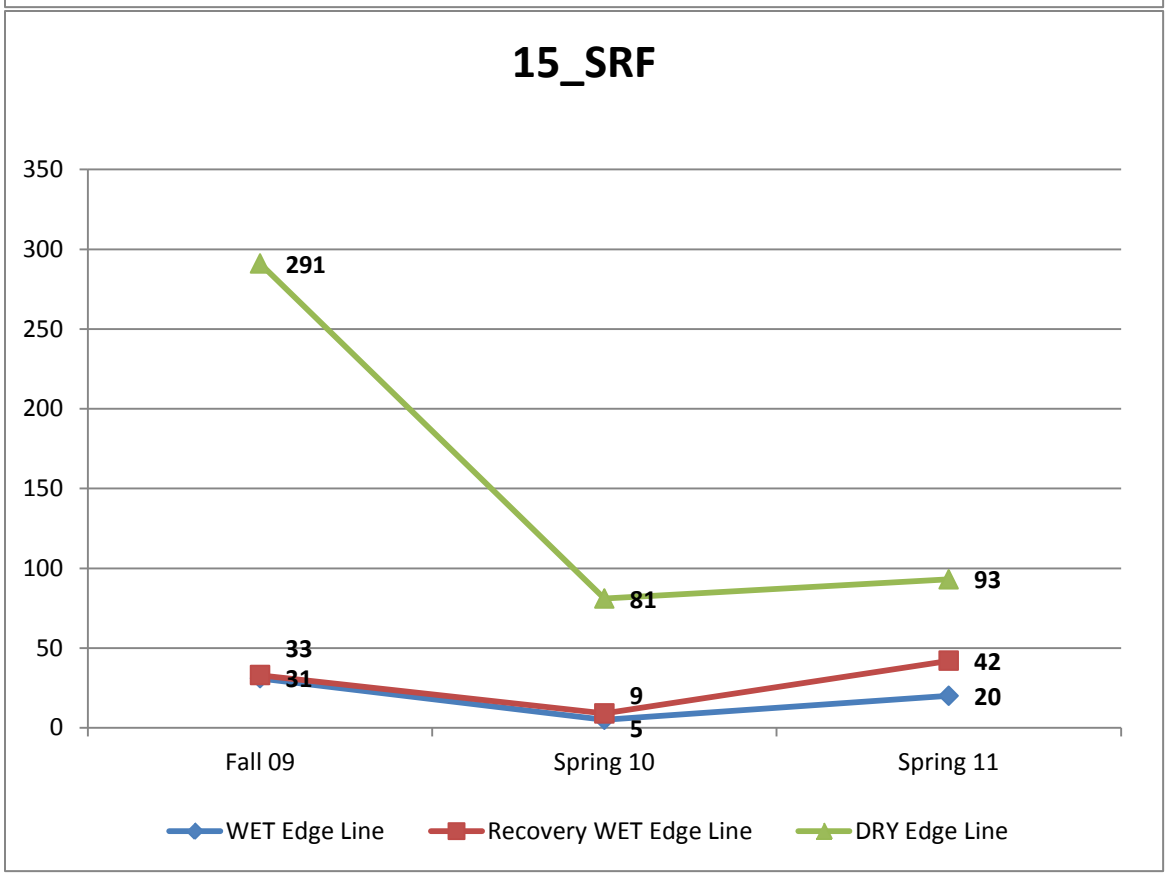
Recovery WET Edge Line
DRY Edge Line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200
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100
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9
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42
20
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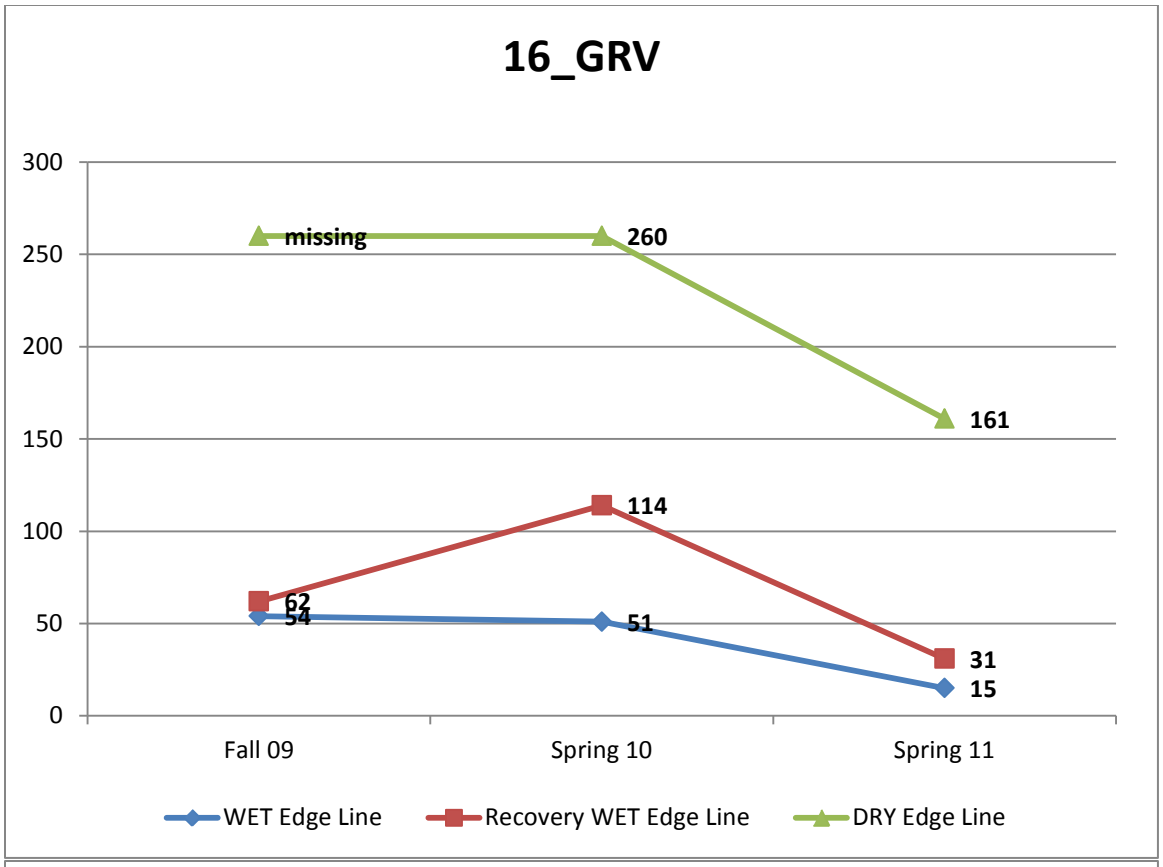
Spring 10
Spring 11
WET Edge Line
Recovery WET Edge Line
DRY Edge Line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200
150
100
50
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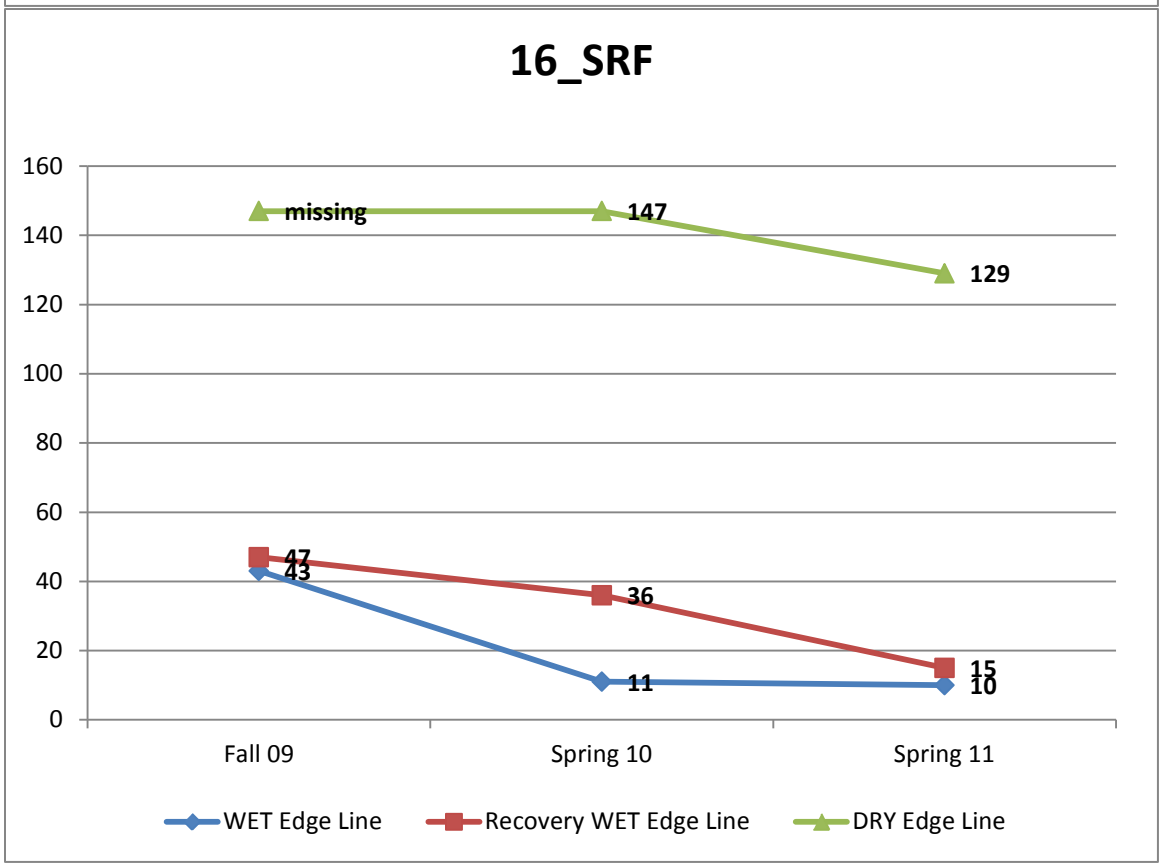
260
161
114
62
54
51
31
15
Fall 09
Spring 10
Spring 11
WET Edge Line
Recovery WET Edge Line
DRY Edge Line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20
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missing
147
129
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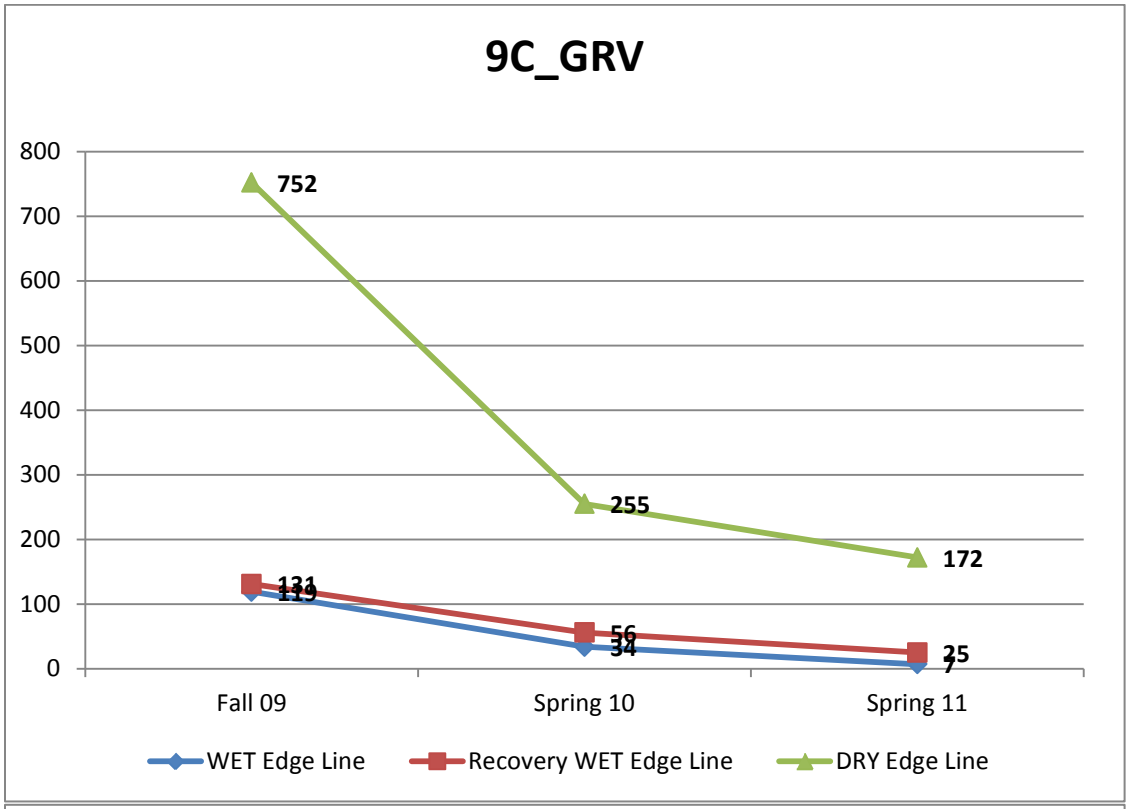
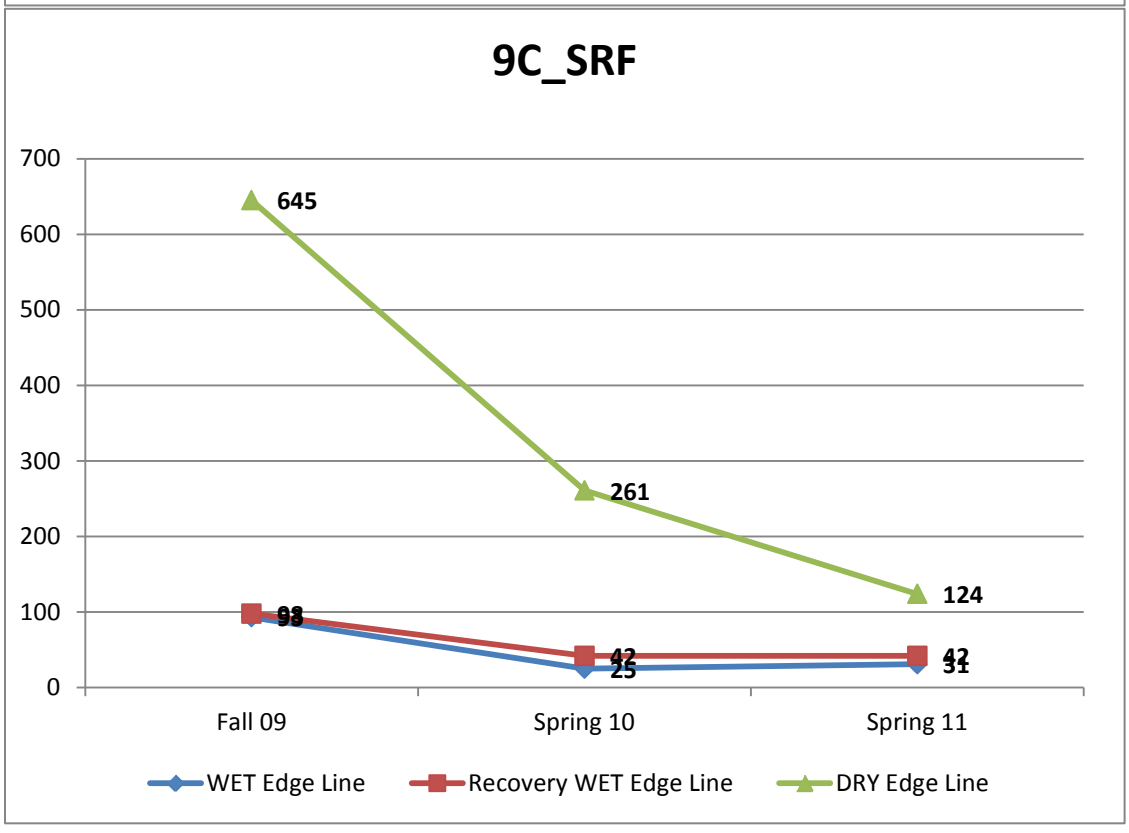
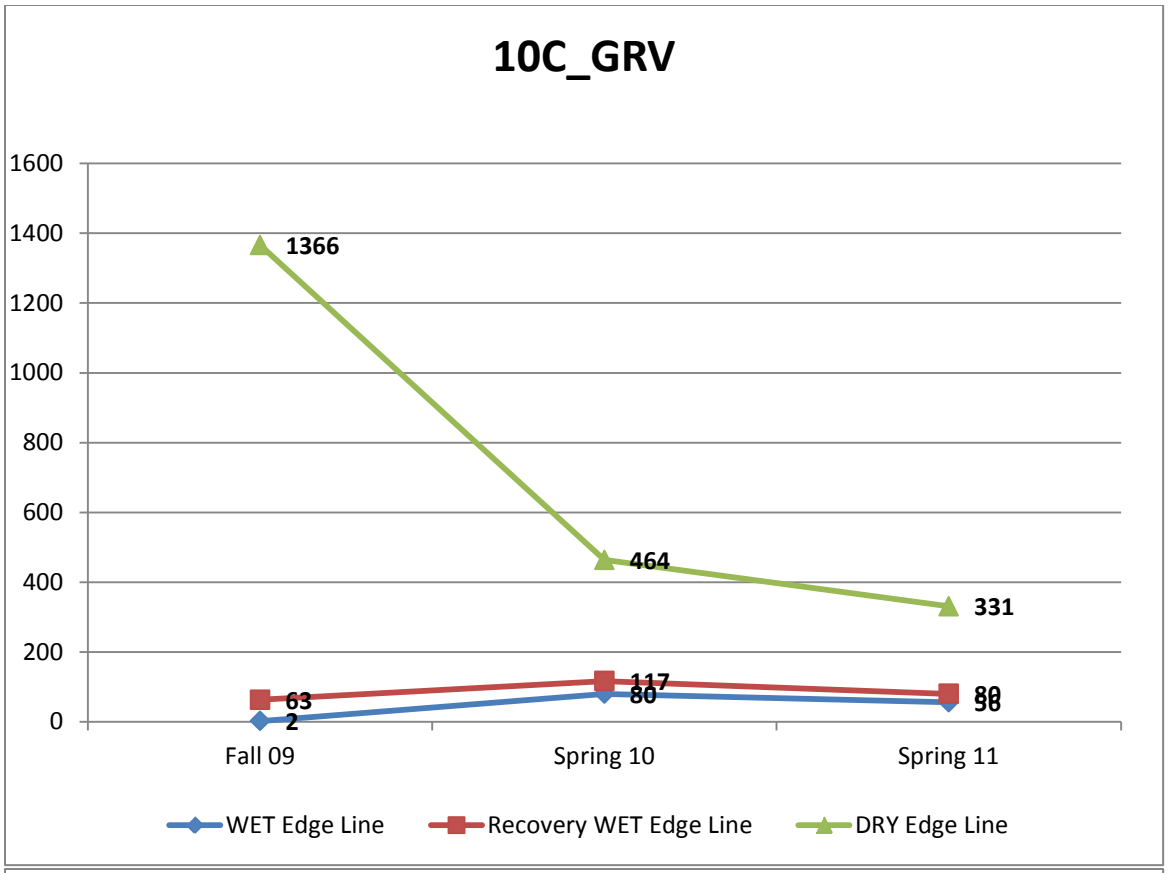
11
10
Fall 09
Spring 10
Spring 11
WET Edge Line
Recovery WET Edge Line
DRY Edge Line

White Edge-Line Retroreflectivity Measurements



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464
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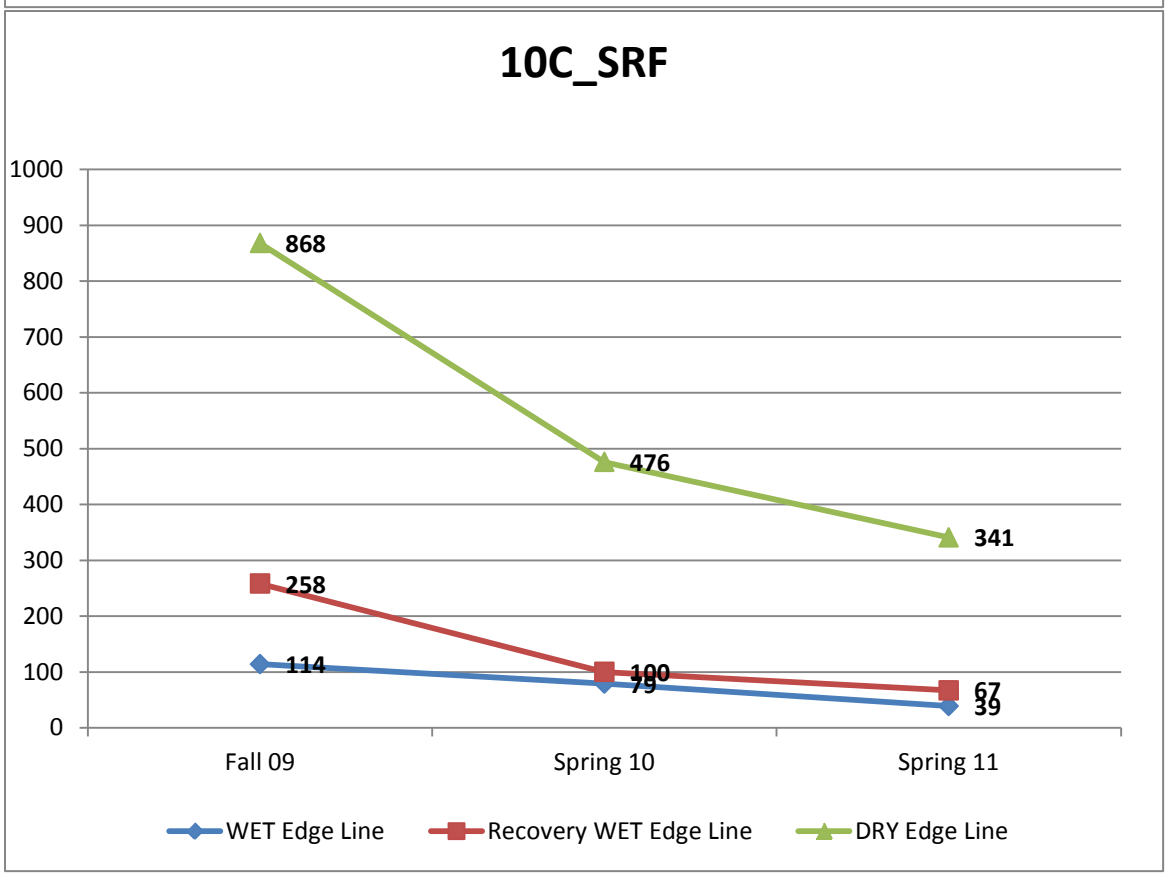
63
117
80
2
80
58
Fall 09
Spring 10
Spring 11
WET Edge Line
Recovery WET Edge Line
DRY Edge Line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500
400
300
200
100
0
868
476
341
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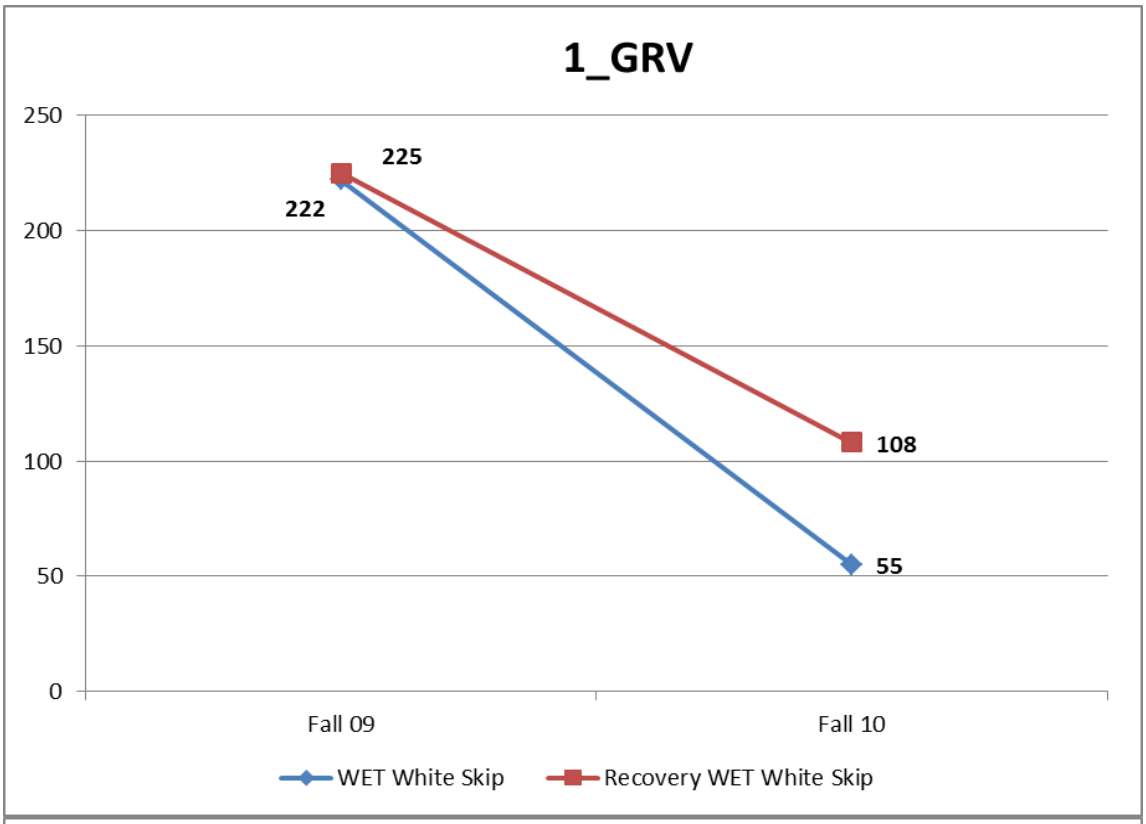
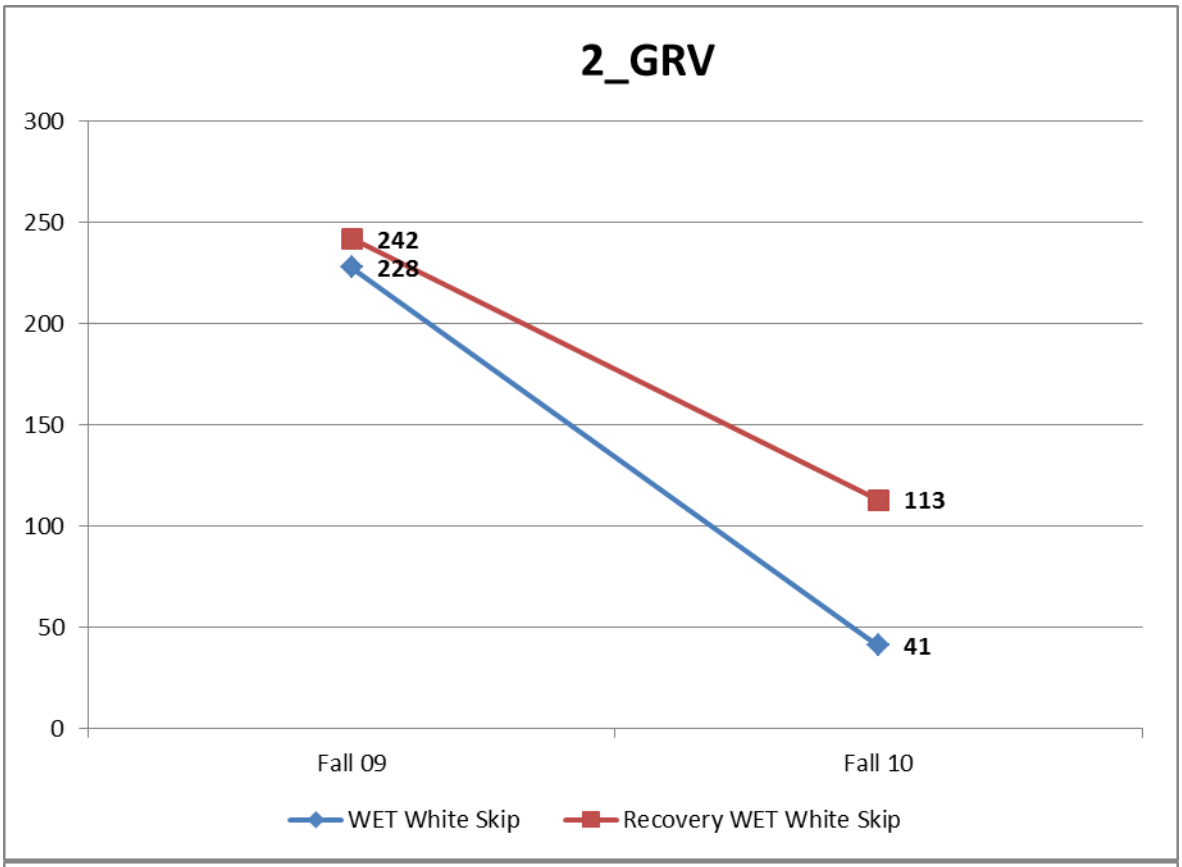
67
39
Fall 09
Spring 10
Spring 11
WET Edge Line
Recovery WET Edge Line
DRY Edge Line

White Skip-Line Retroreflectivity Measurements

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200
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100
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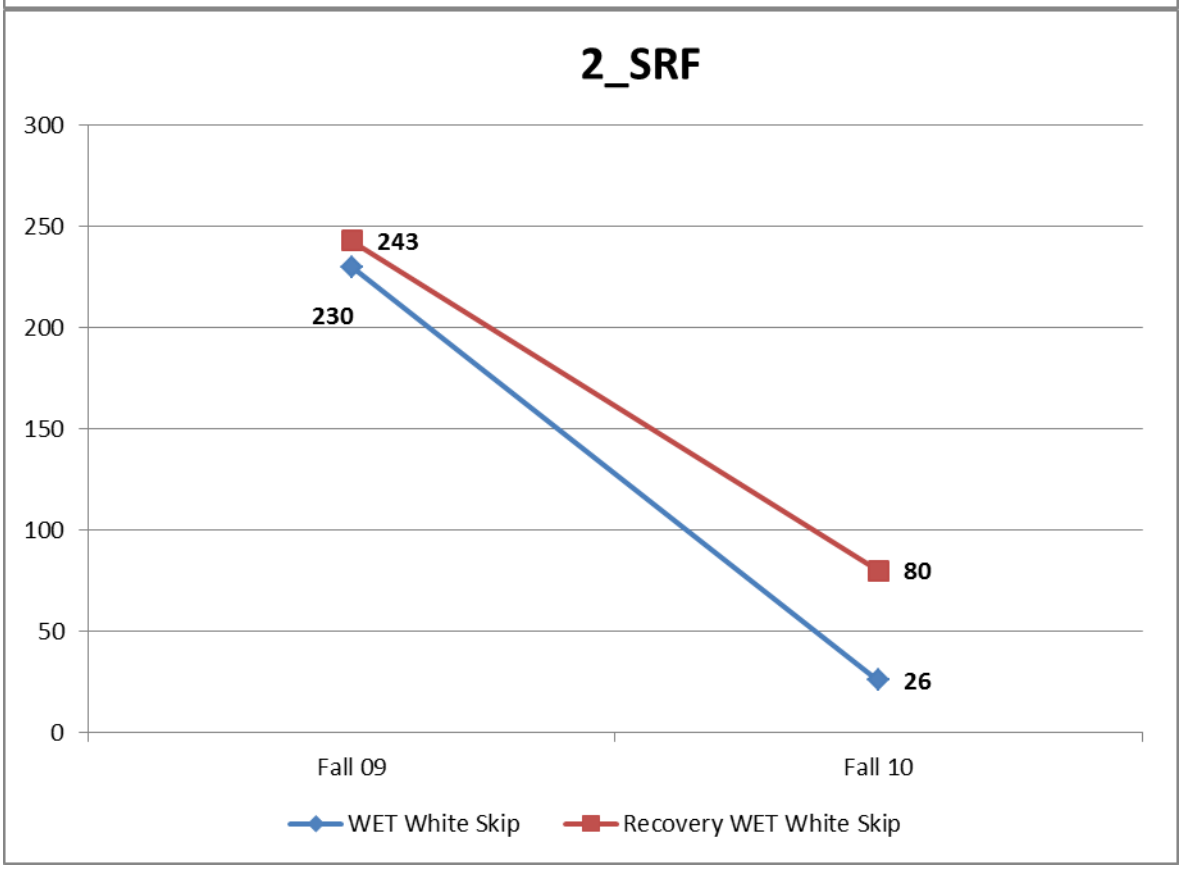
0
242
228
113
41
Fall 09
Fall 10
WET White Skip
Recovery WET White Skip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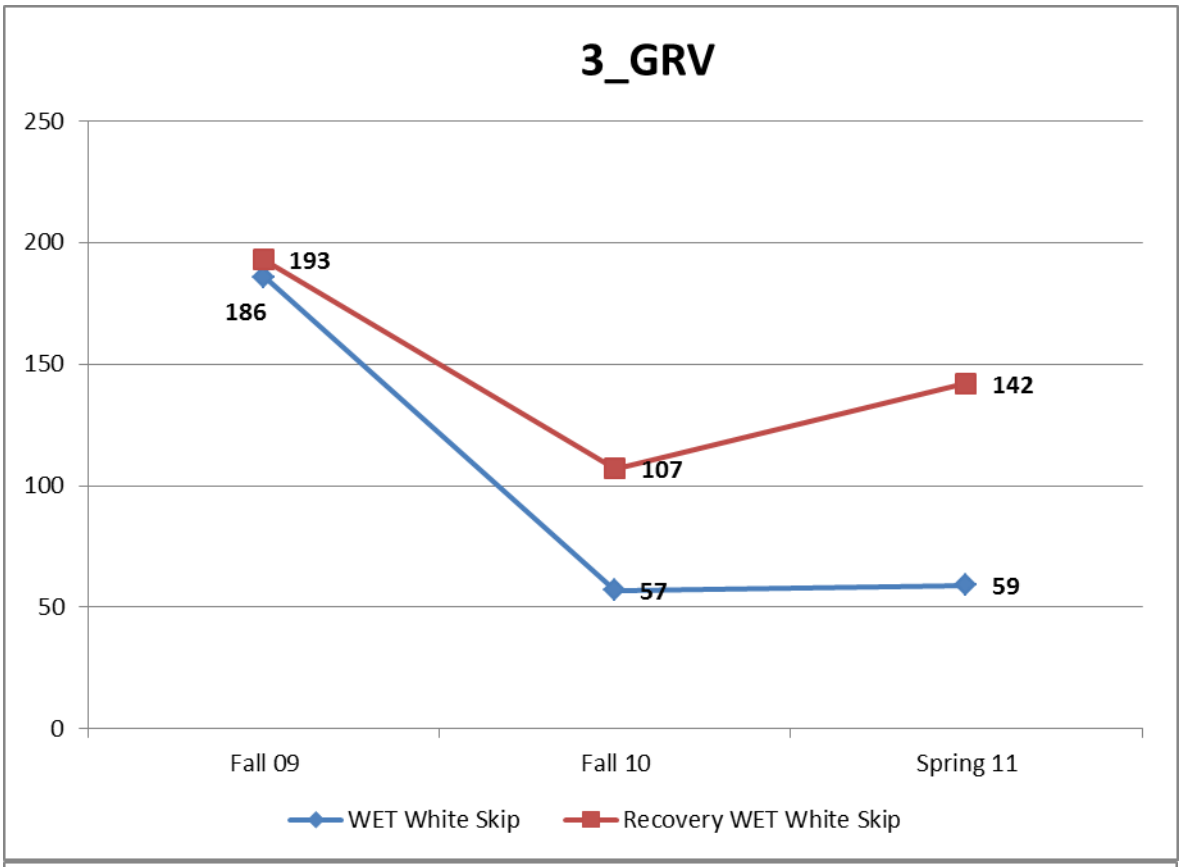
243
230
80
26
Fall 09
Fall 10
WET White Skip
Recovery WET White Skip


3_GRV
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150
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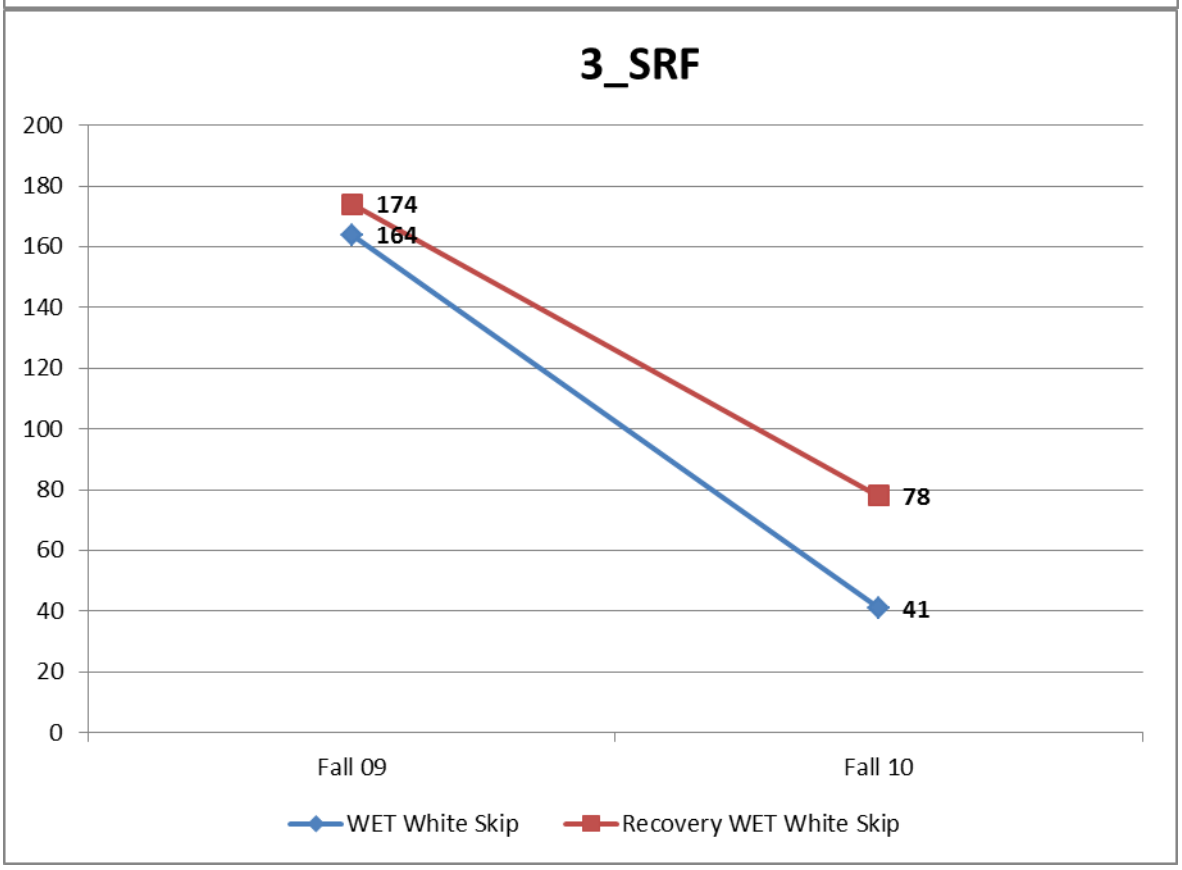
50
0
193
186
107
142
57
59
Fall 09
Fall 10
Spring 11
WET White Skip
Recovery WET White Skip


3_SRF
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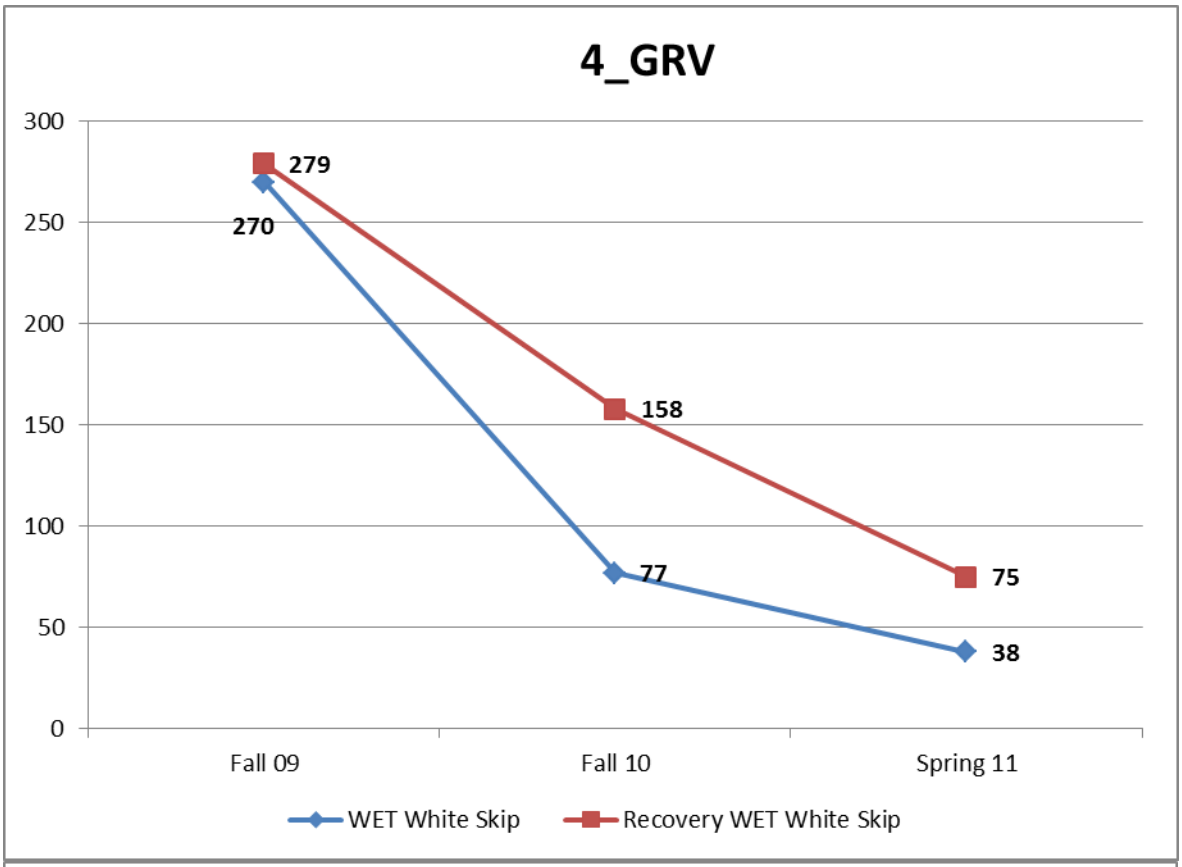
174
164
78
41
Fall 09
Fall 10
WET White Skip
Recovery WET White Skip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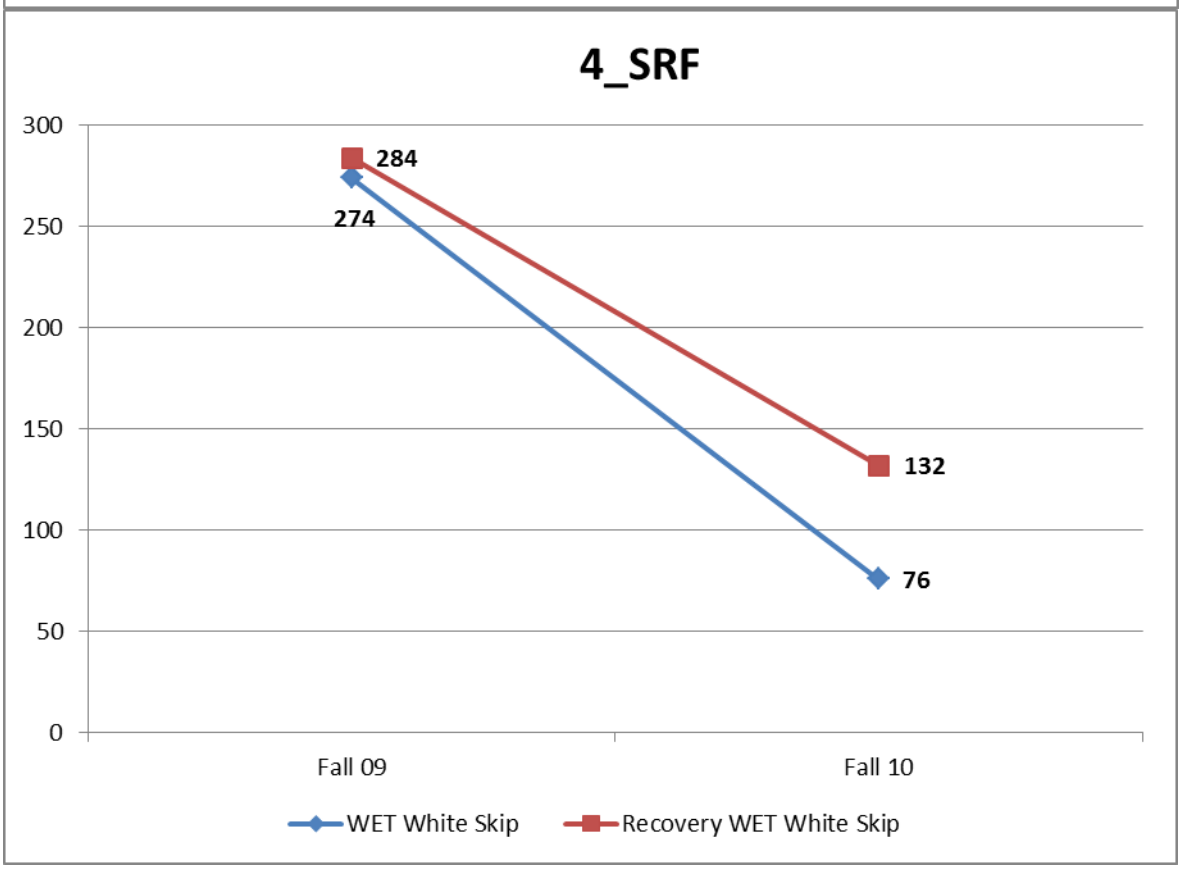
158
77
75
38
Fall 09
Fall 10
Spring 11
WET White Skip
Recovery WET White Skip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150
100
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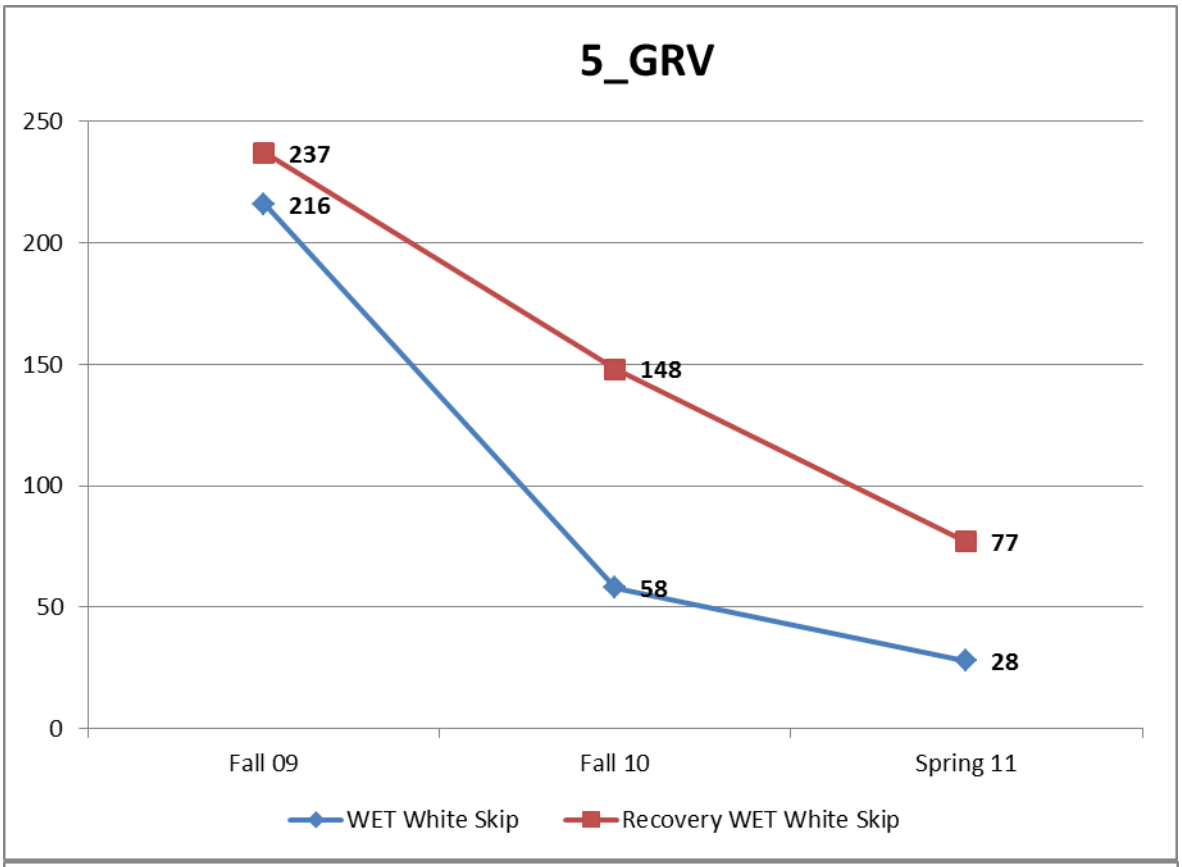
284
274
132
76
Fall 09
Fall 10
WET White Skip
Recovery WET White Skip


5_GRV
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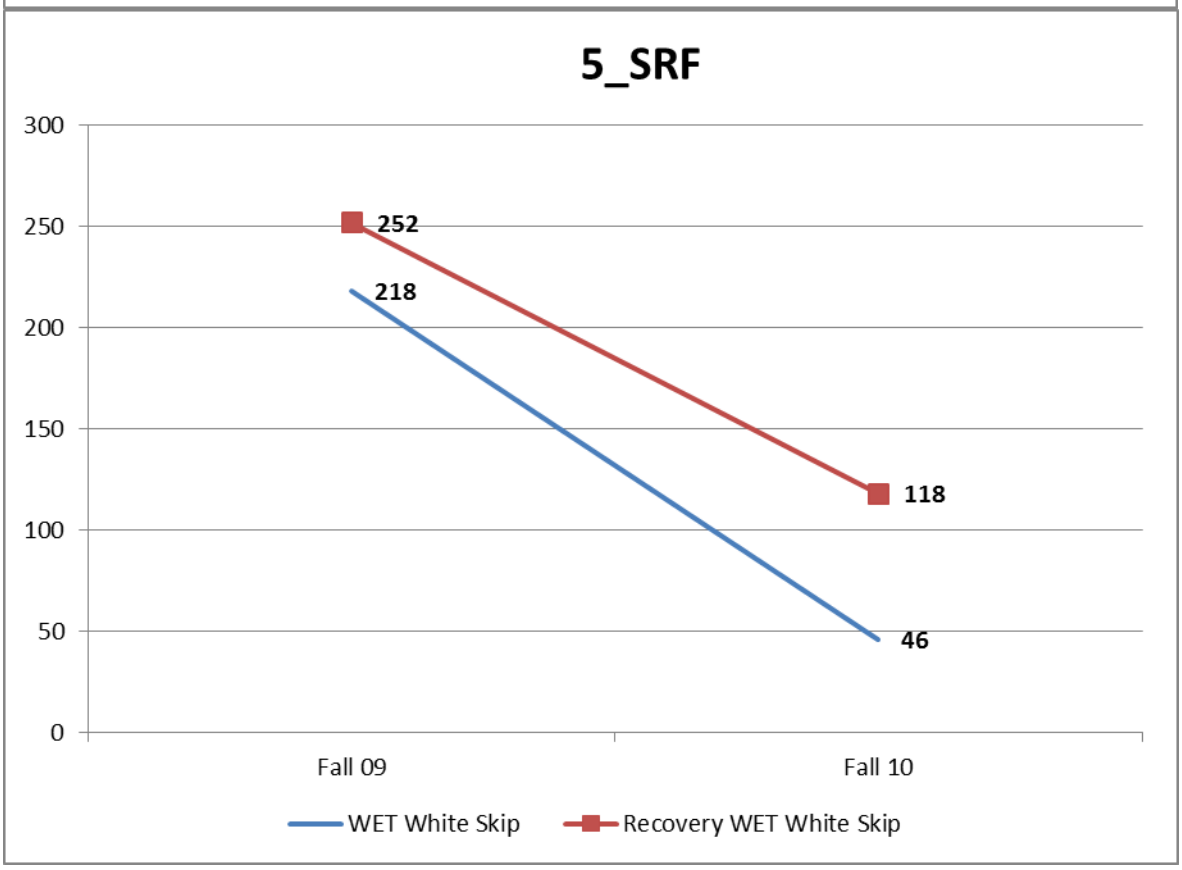
237
216
148
77
58
28
Fall 09
Fall 10
Spring 11
WET White Skip
Recovery WET White Skip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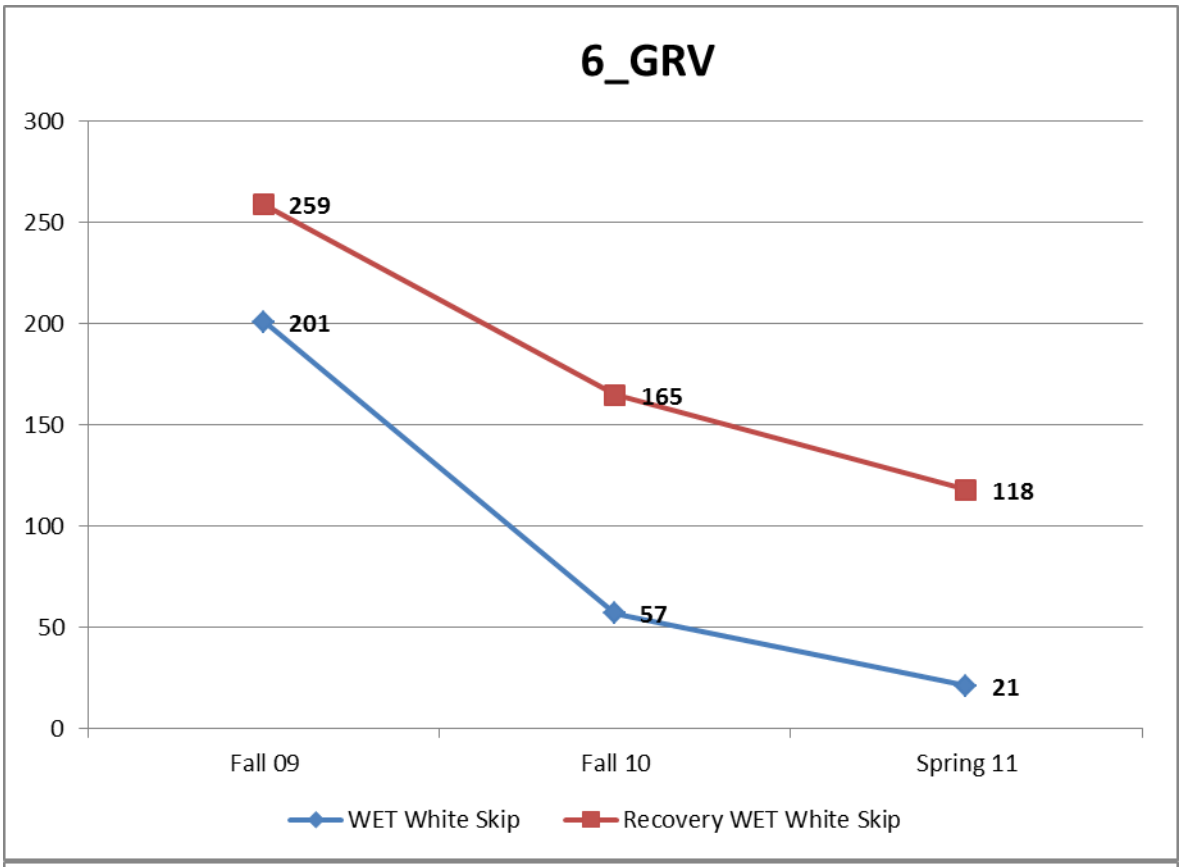
252
218
118
46
Fall 09
Fall 10
WET White Skip
Recovery WET White Skip


6_GRV
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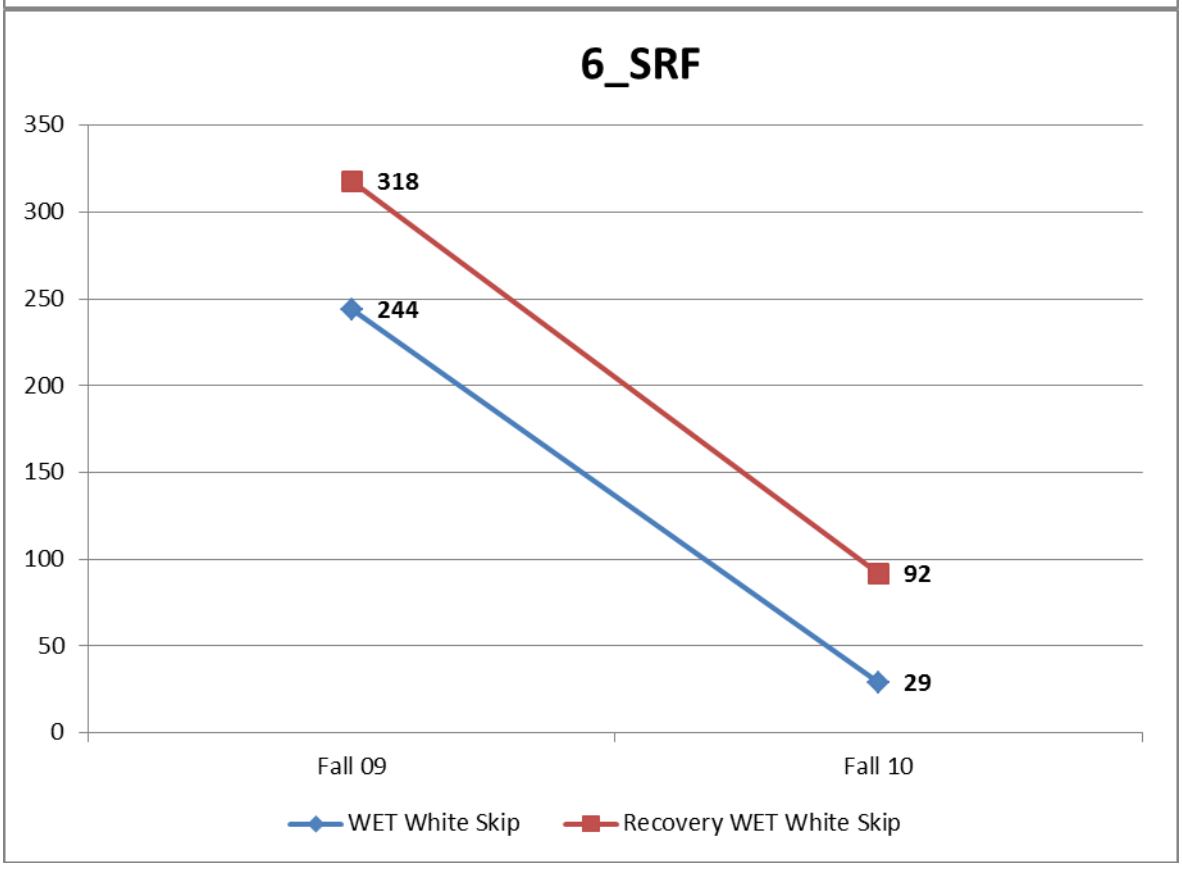
259
201
165
118
57
21
Fall 09
Fall 10
Spring 11
WET White Skip
Recovery WET White Skip


6_SRF
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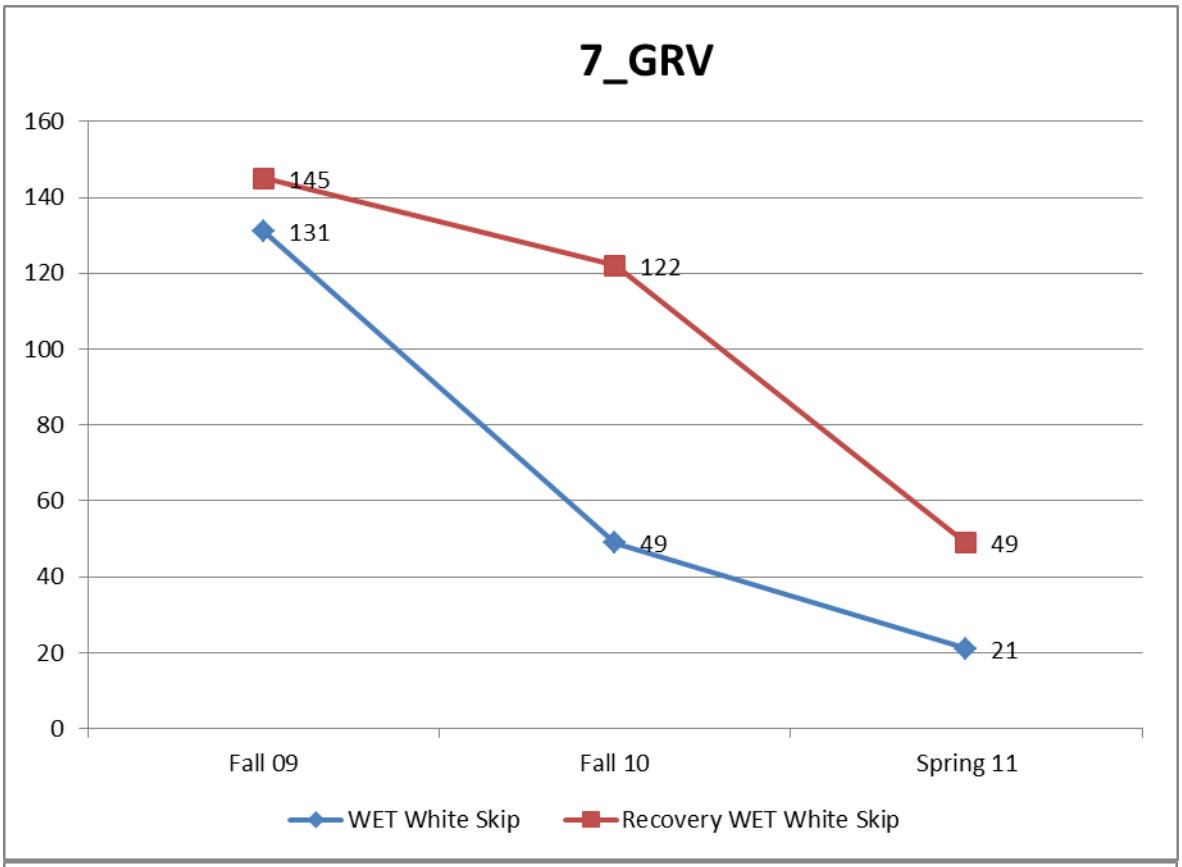
318
244
92
29
Fall 09
Fall 10
WET White Skip
Recovery WET White Skip


7_GRV
160
140
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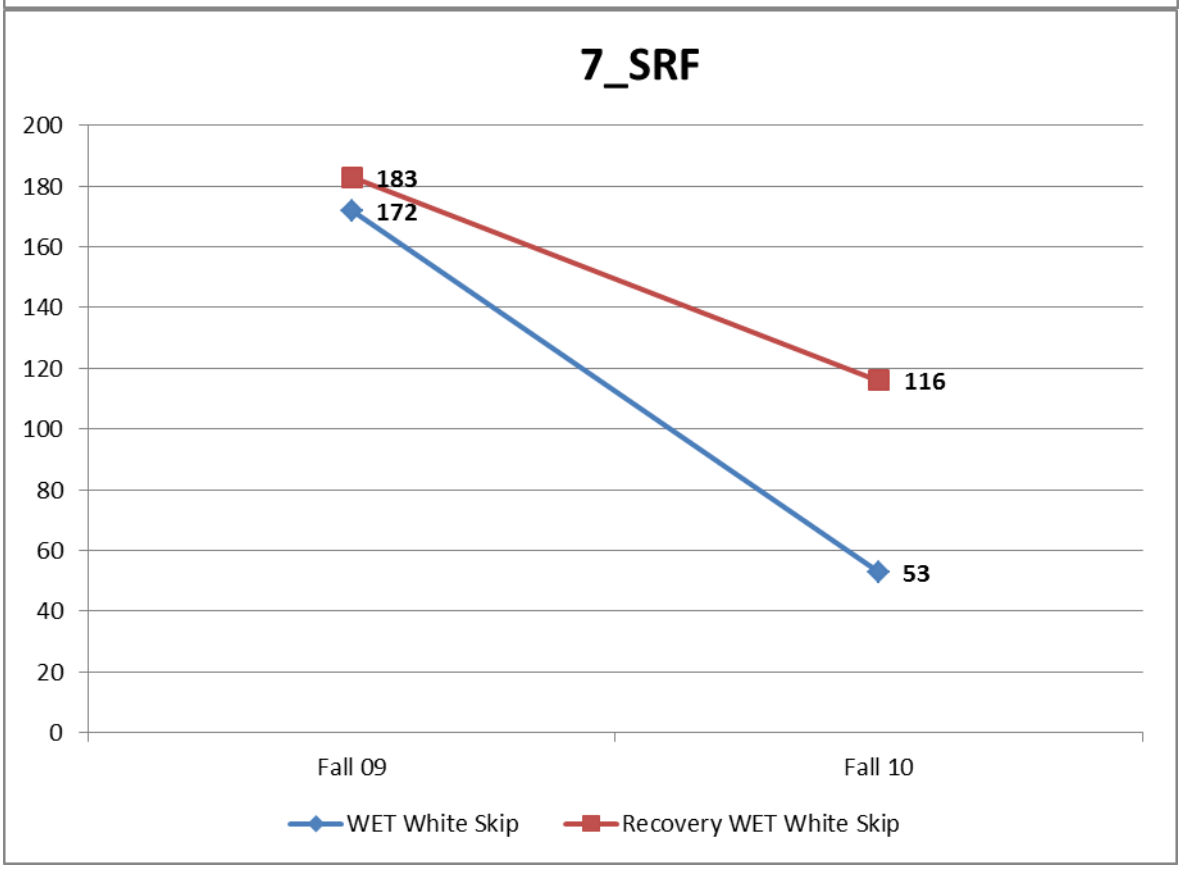
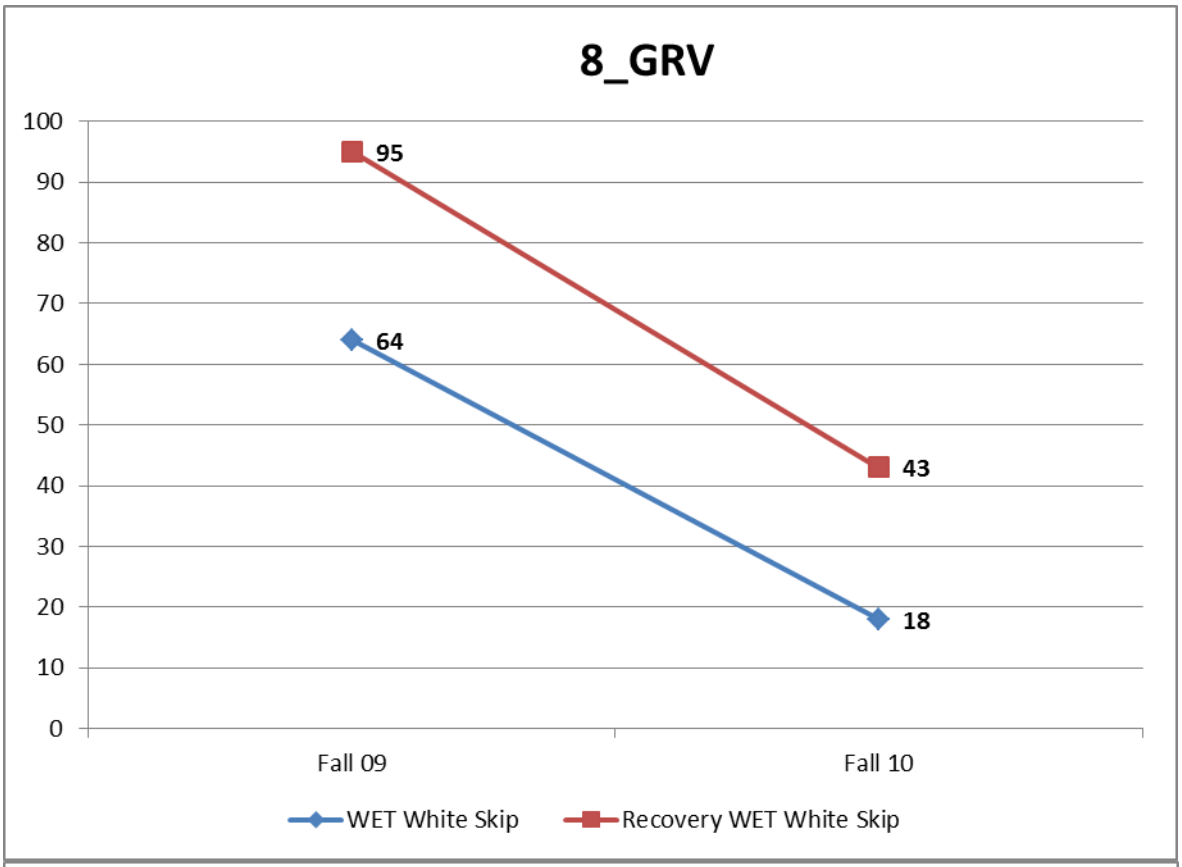
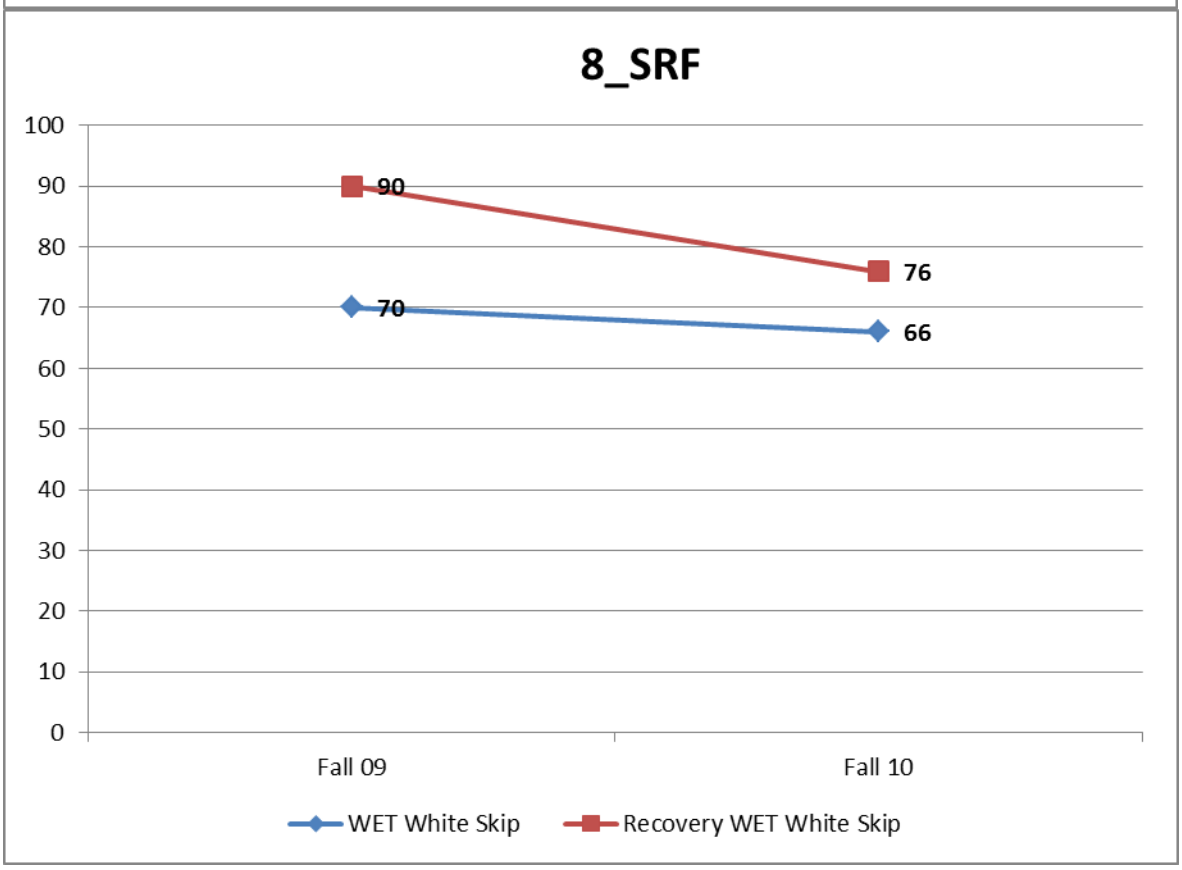
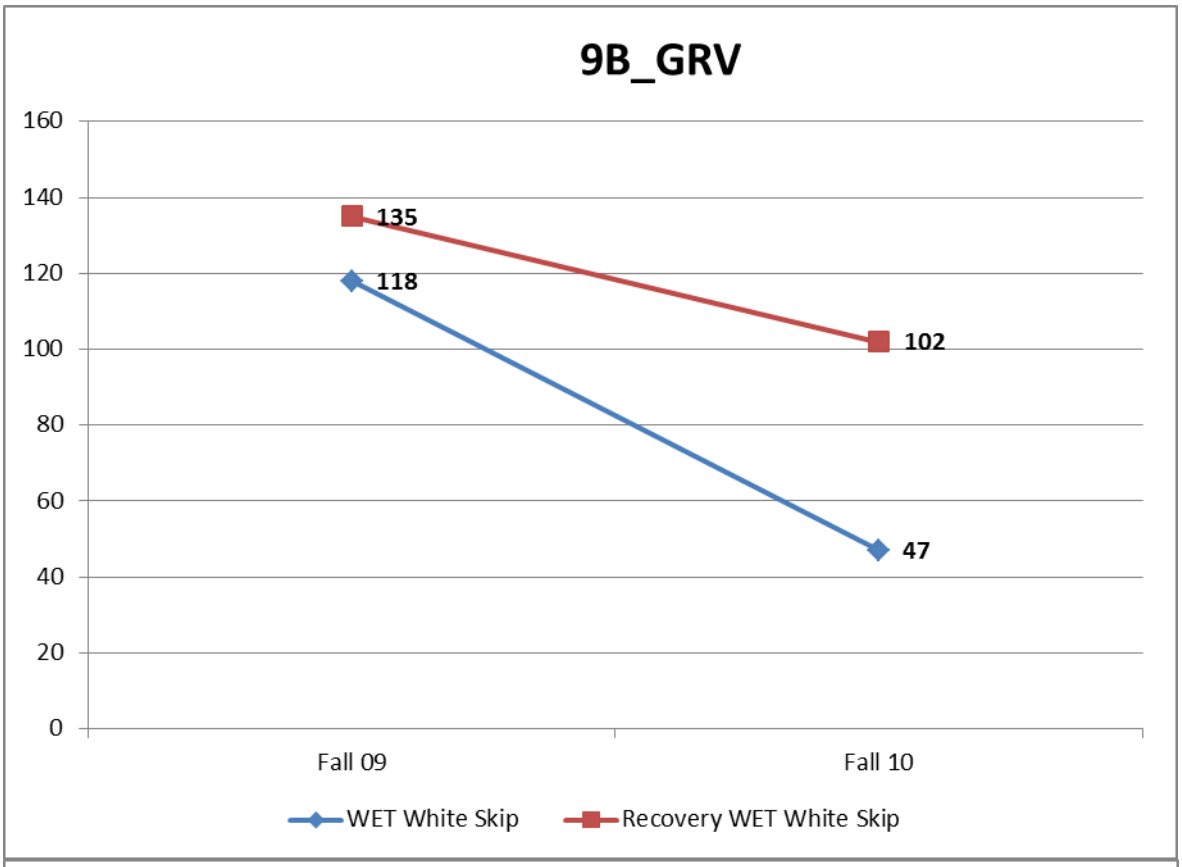
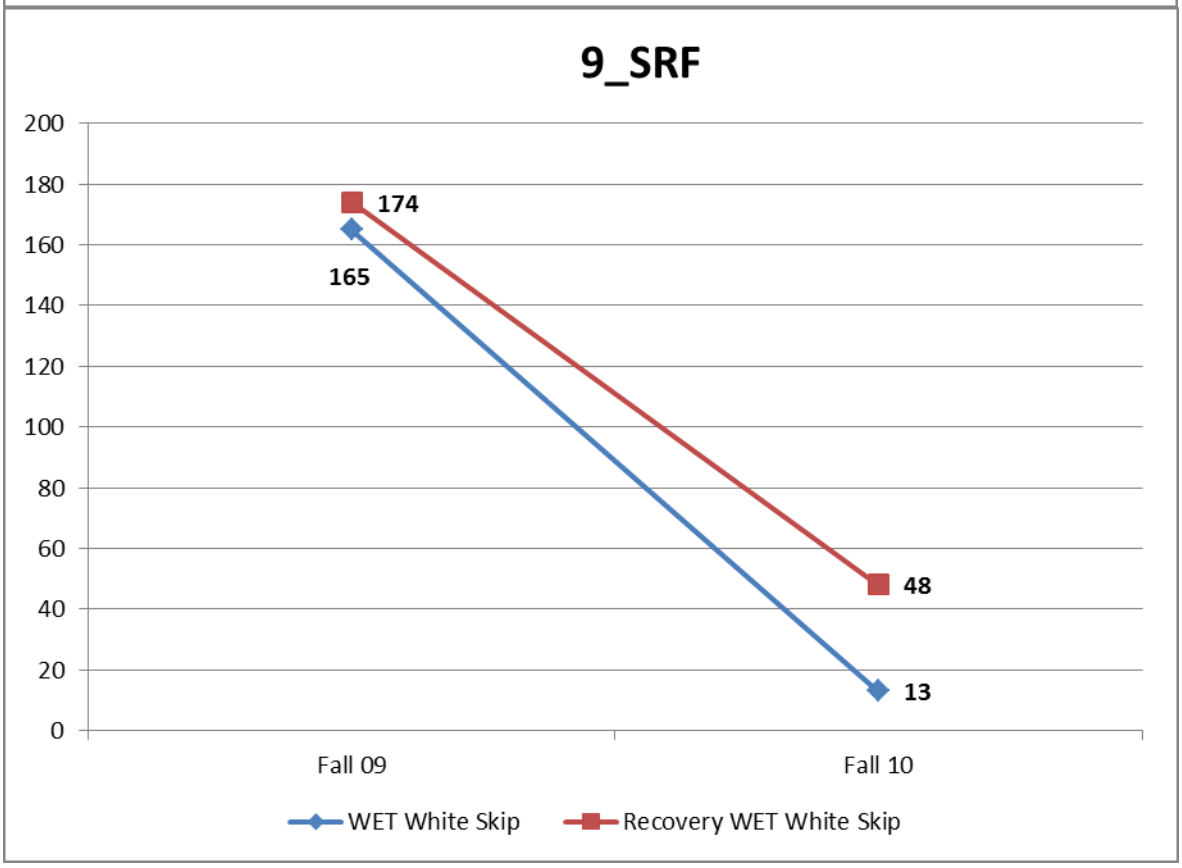
131
122
49
49
21
Fall 09
Fall 10
Spring 11
WET White Skip
Recovery WET White Skip

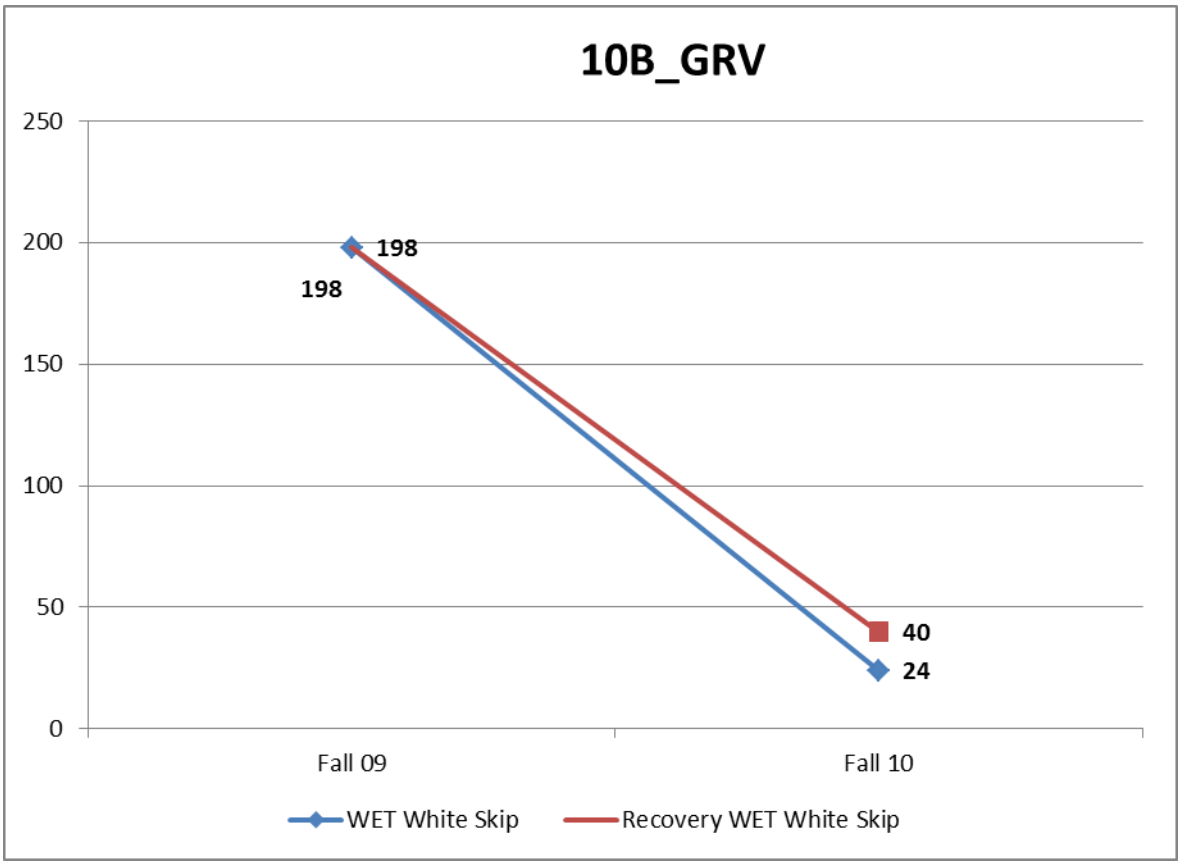

7_SRF
200
180
160
140
120
100
80
60
40
20
0
183
172
116
53
Fall 09
Fall 10
WET White Skip
Recovery WET White Skip

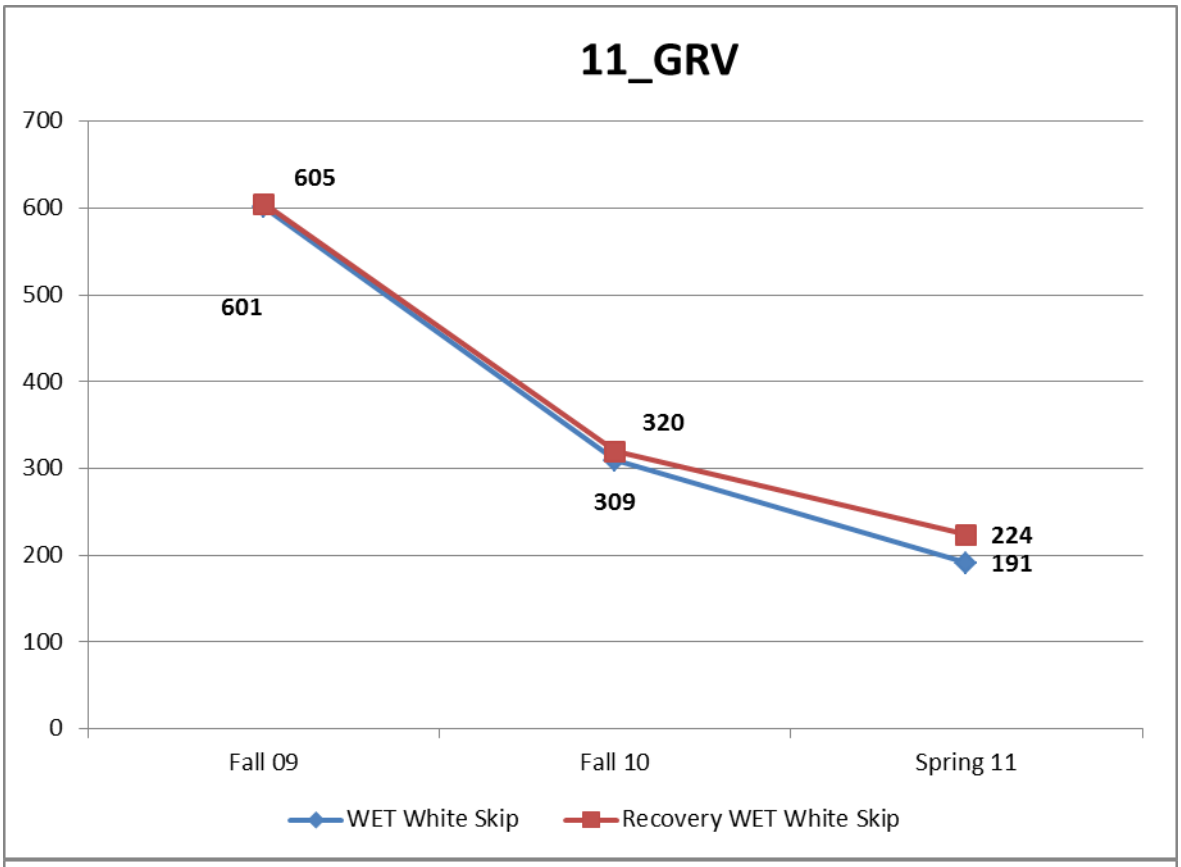

8_GRV
100
90
80
70
60
50
40
30
20
10
0
95
64
43
18
Fall 09
Fall 10
WET White Skip
Recovery WET White Skip

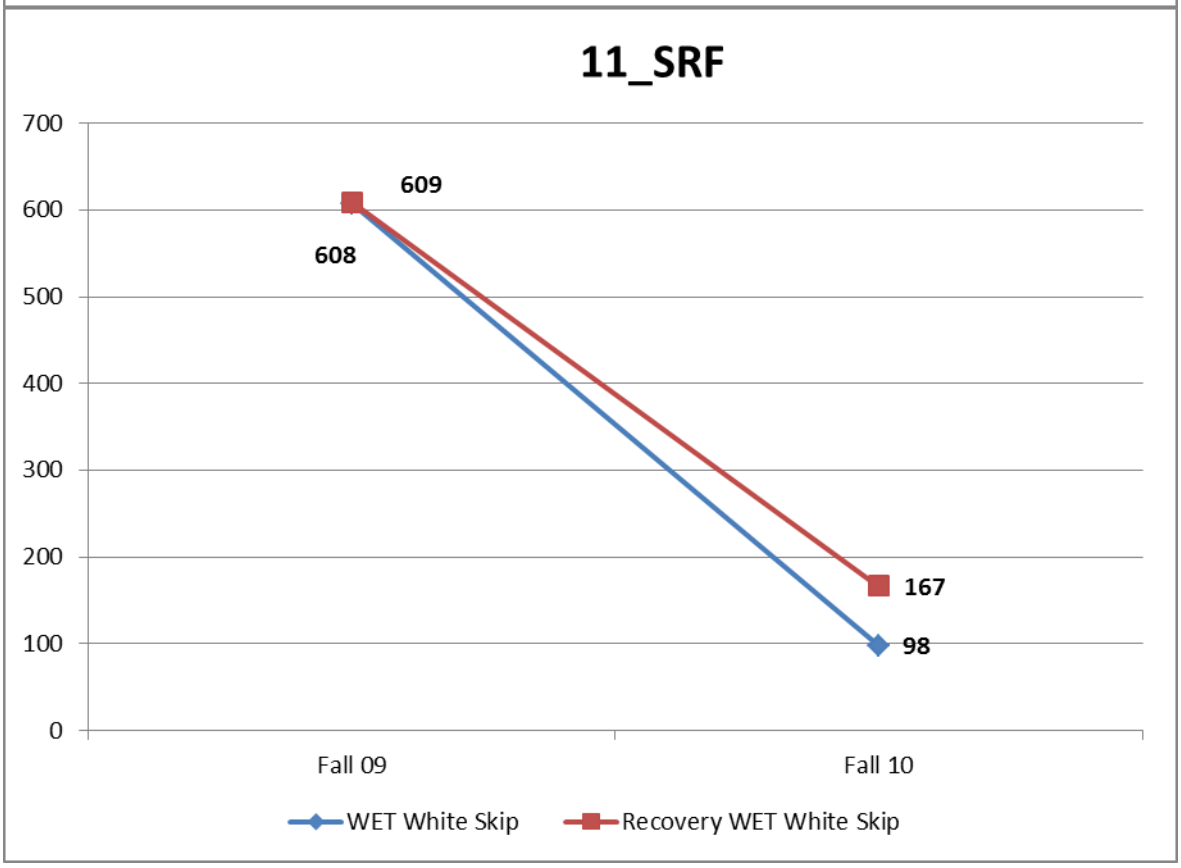

8_SRF
100
90
80
70
60
50
40
30
20
10
0
90
70
76
66
Fall 09
Fall 10
WET White Skip
Recovery WET White Skip

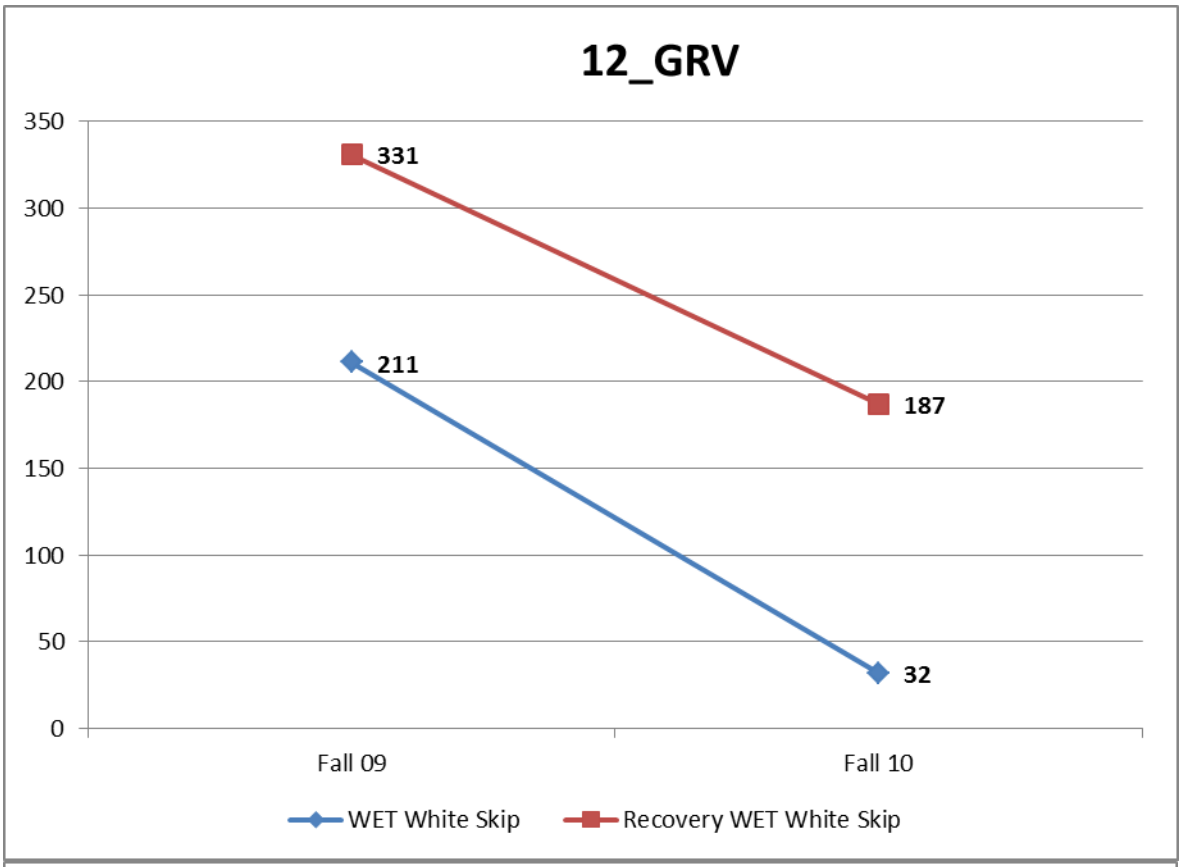

9B_GRV
160
140
120
100
80
60
40
20
0
135
118
102
47
Fall 09
Fall 10
WET White Skip
Recovery WET White Skip

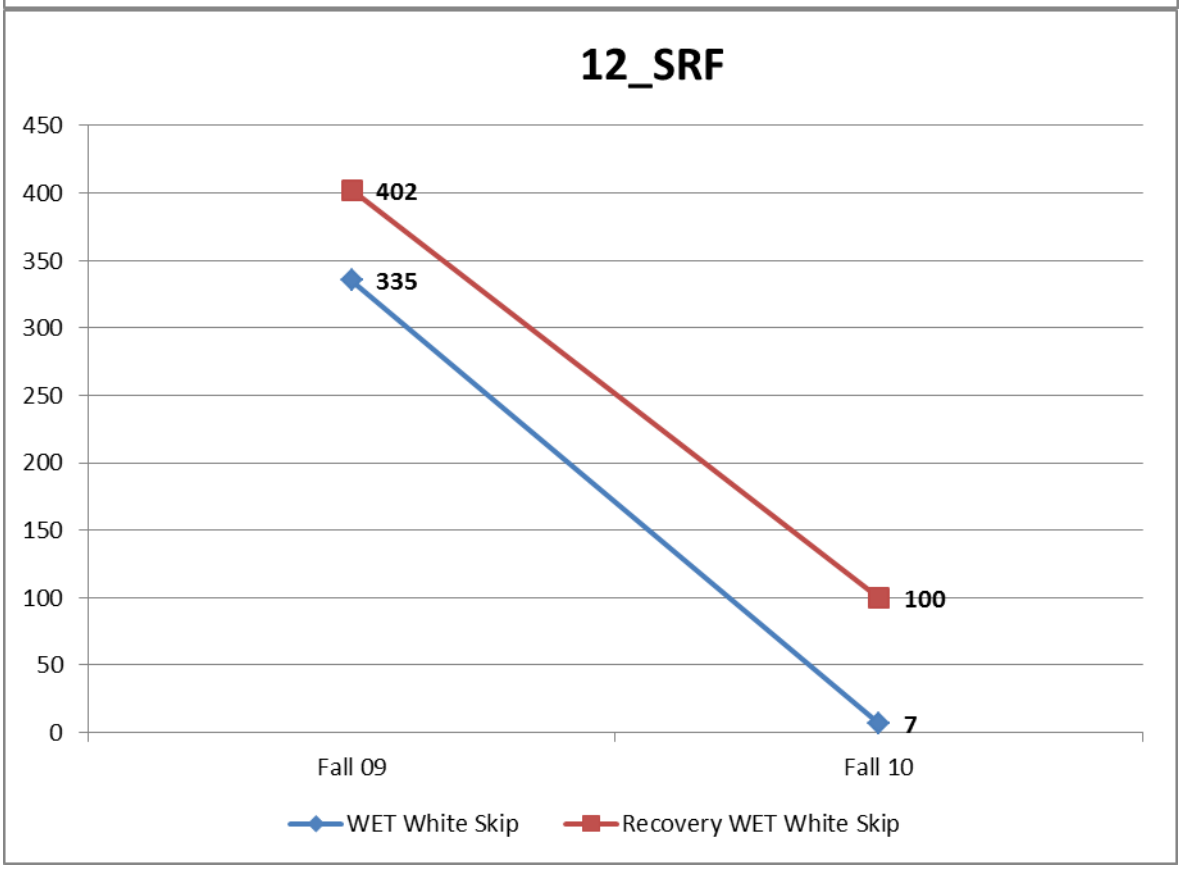

9_SRF
200
180
160
140
120
100
80
60
40
20
0
174
165
48
13
Fall 09
Fall 10
WET White Skip
Recovery WET White Skip

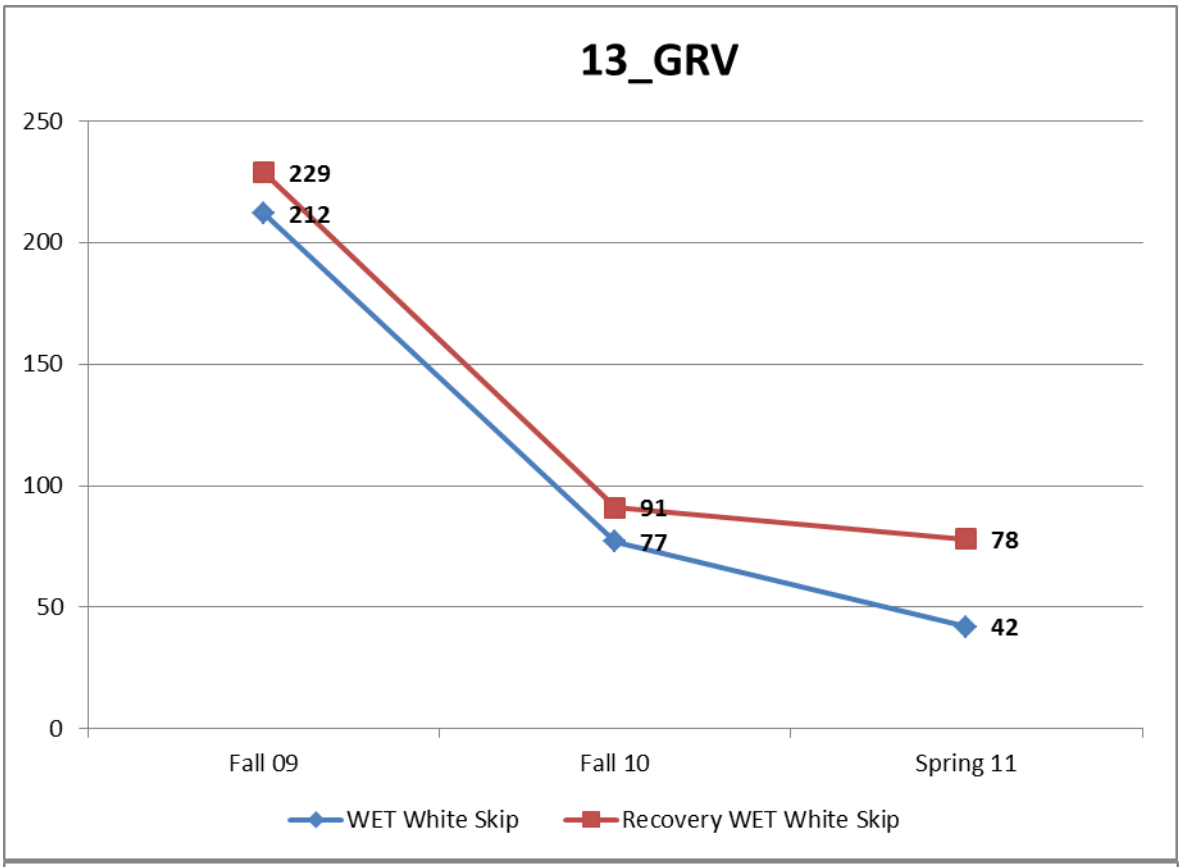

10B_GRV
250
200
150
100
50
0
198
198
40
24
Fall 09
Fall 10
WET White Skip
Recovery WET White Skip

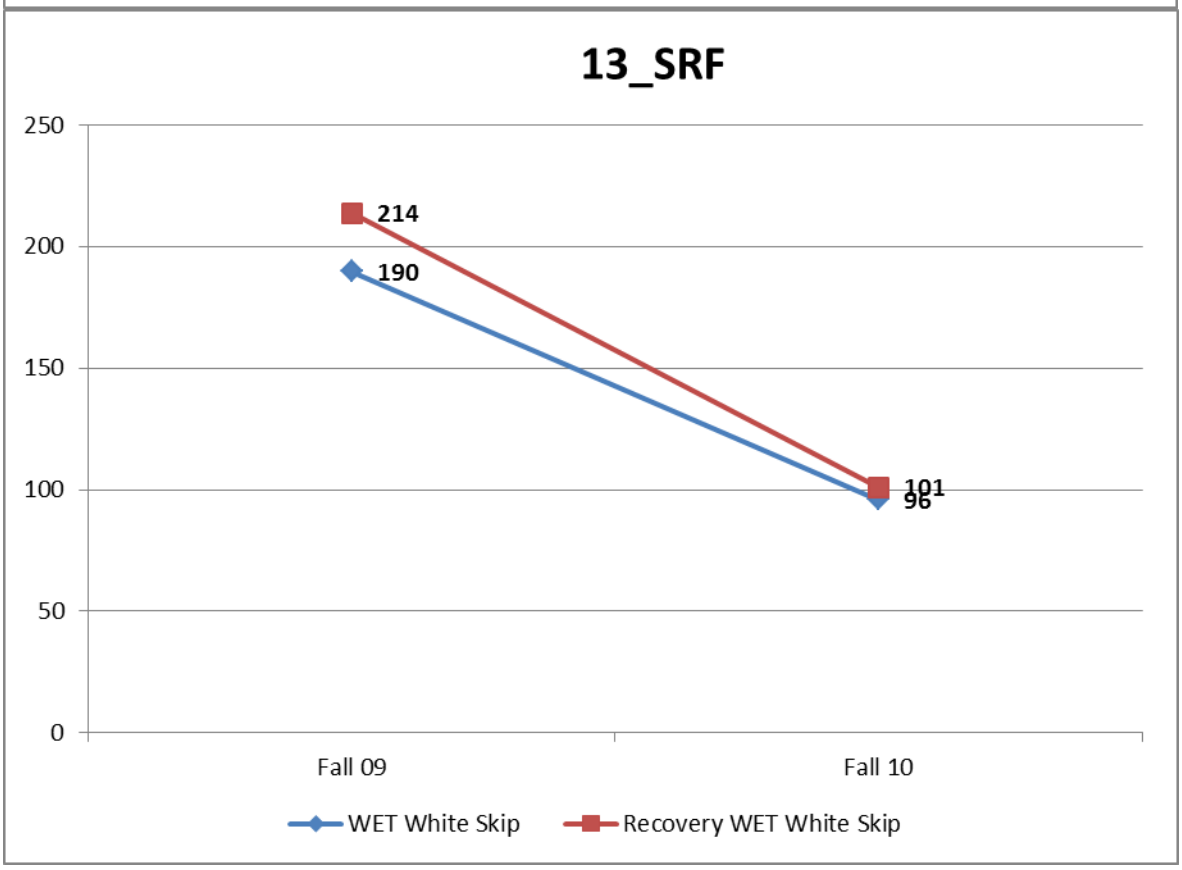

11_GRV
700
600
500
400
300
200
100
0
605
601
320
309
224
191
Fall 09
Fall 10
Spring 11
WET White Skip
Recovery WET White Skip

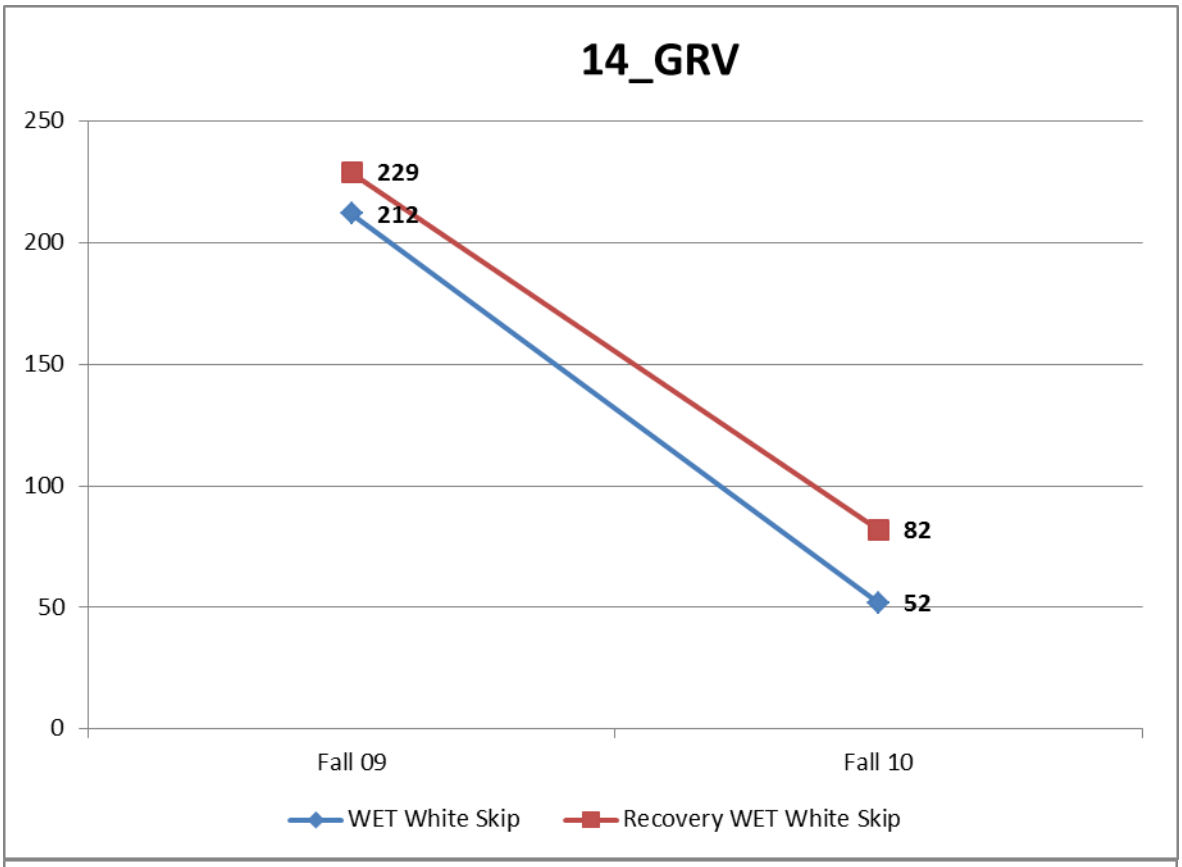

11_SRF
700
600
500
400
300
200
100
0
609
608
167
98
Fall 09
Fall 10
WET White Skip
Recovery WET White Skip

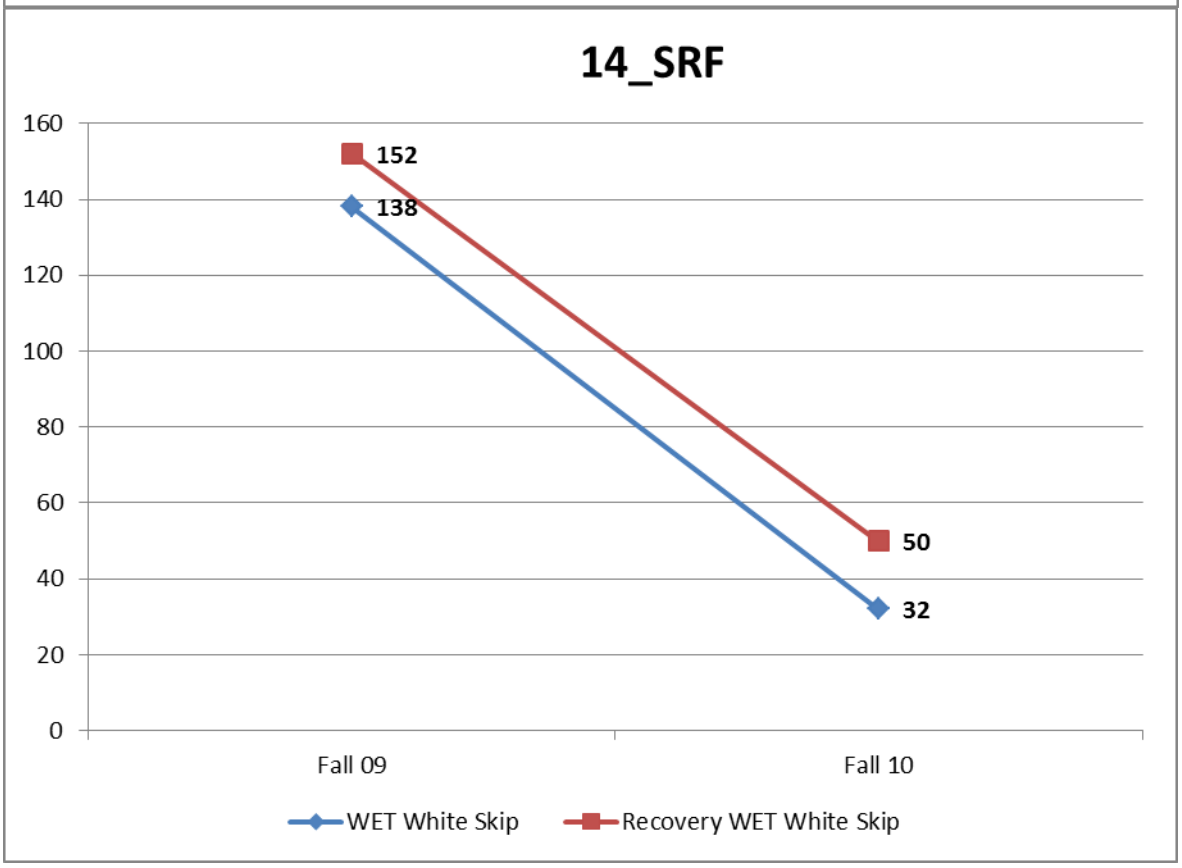

12_GRV
350
300
250
200
150
100
50
0
331
211
187
32
Fall 09
Fall 10
WET White Skip
Recovery WET White Skip

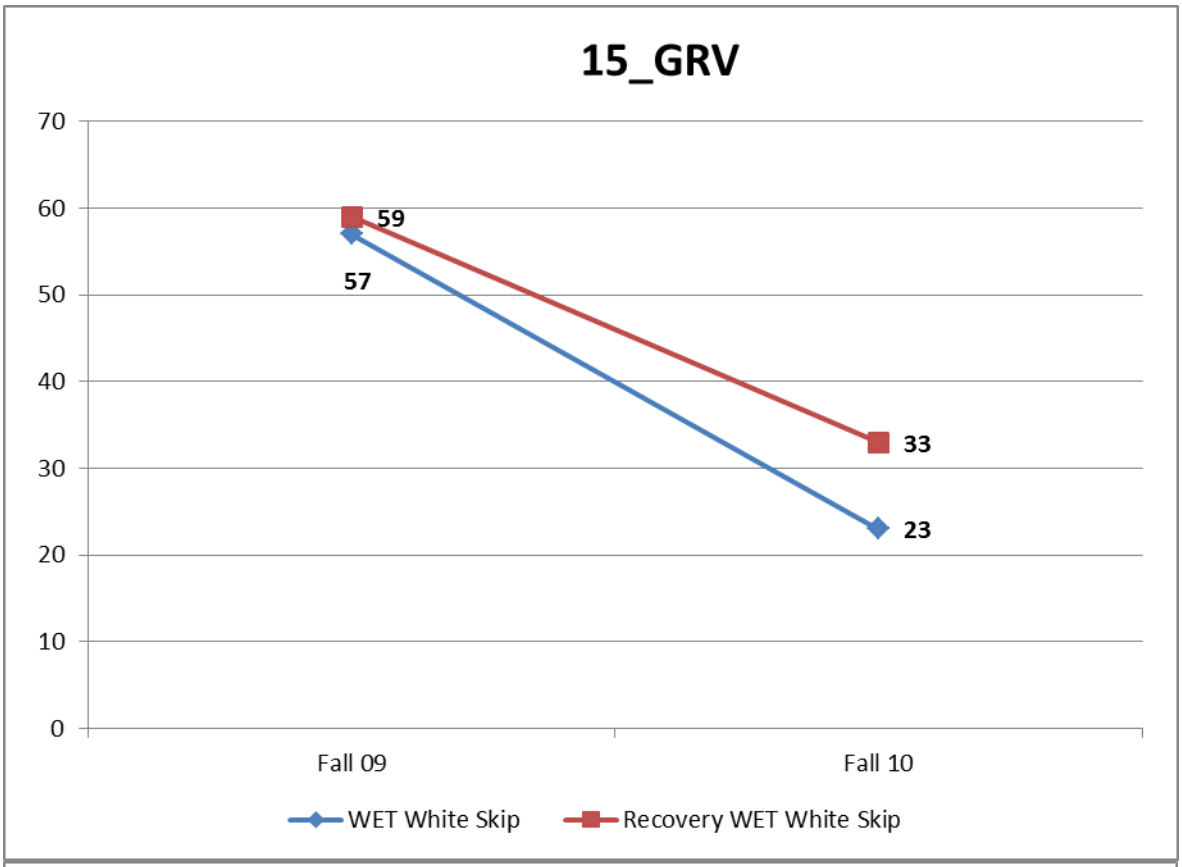

12_SRF
450
400
350
300
250
200
150
100
50
0
402
335
100
7
Fall 09
Fall 10
WET White Skip
Recovery WET White Skip

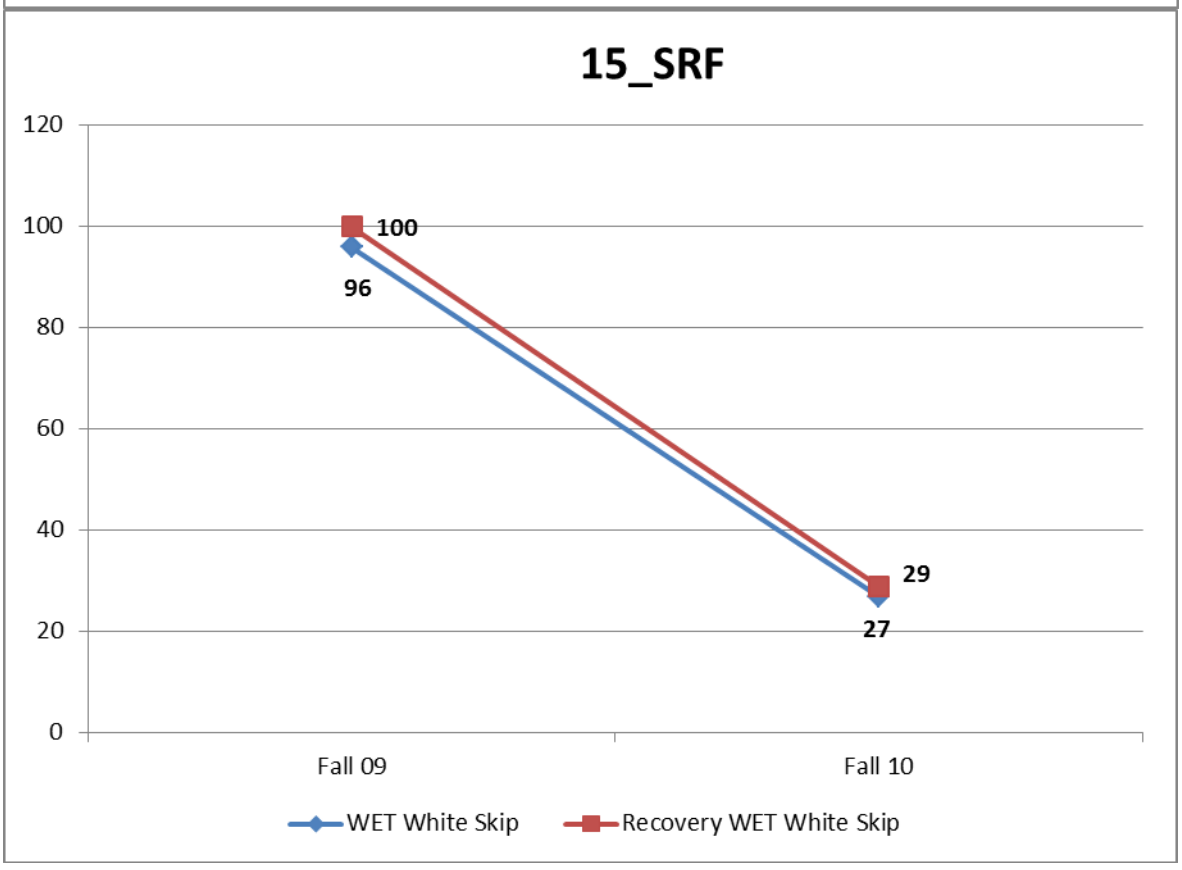

13_GRV
250
200
150
100
50
0
229
212
91
77
78
42
Fall 09
Fall 10
Spring 11
WET White Skip
Recovery WET White Skip


13_SRF
250
200
150
100
50
0
214
190
101
96
Fall 09
Fall 10
WET White Skip
Recovery WET White Skip


14_GRV
250
200
150
100
50
0
229
212
82
52
Fall 09
Fall 10
WET White Skip
Recovery WET White Skip


14_SRF
160
140
120
100
80
60
40
20
0
152
138
50
32
Fall 09
Fall 10
WET White Skip
Recovery WET White Skip


15_GRV
70
60
50
40
30
20
10
0
59
57
33
23
Fall 09
Fall 10
WET White Skip
Recovery WET White Skip

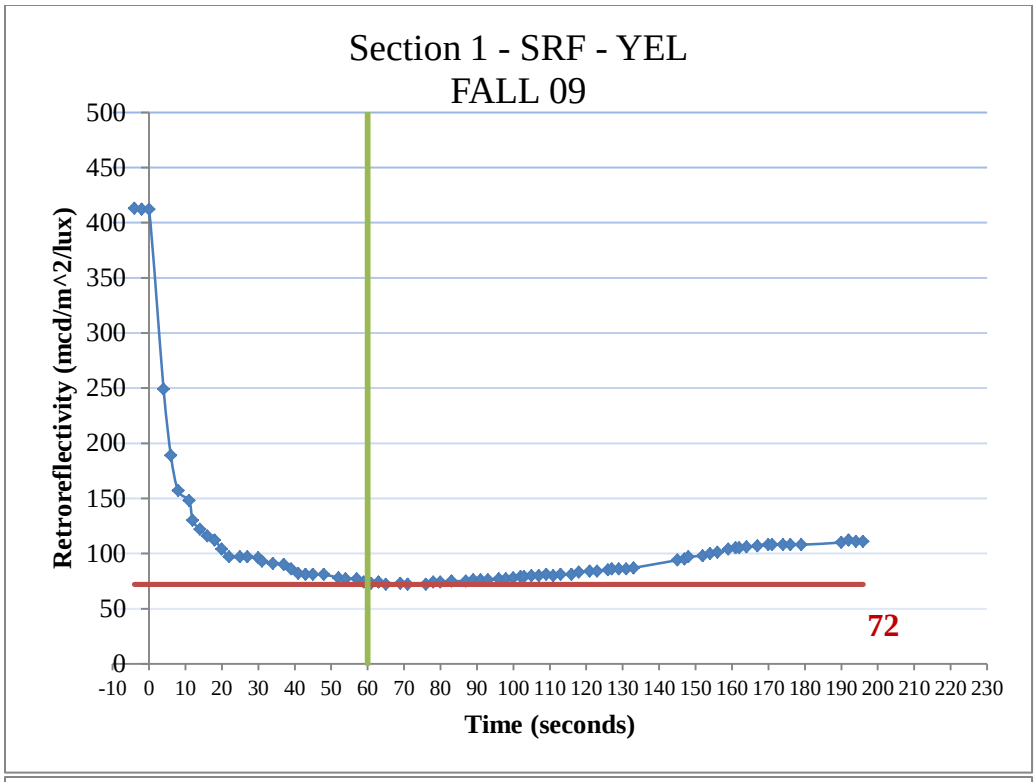

15_SRF
120
100
80
60
40
20
0
100
96
29
27
Fall 09
Fall 10
WET White Skip
Recovery WET White Skip

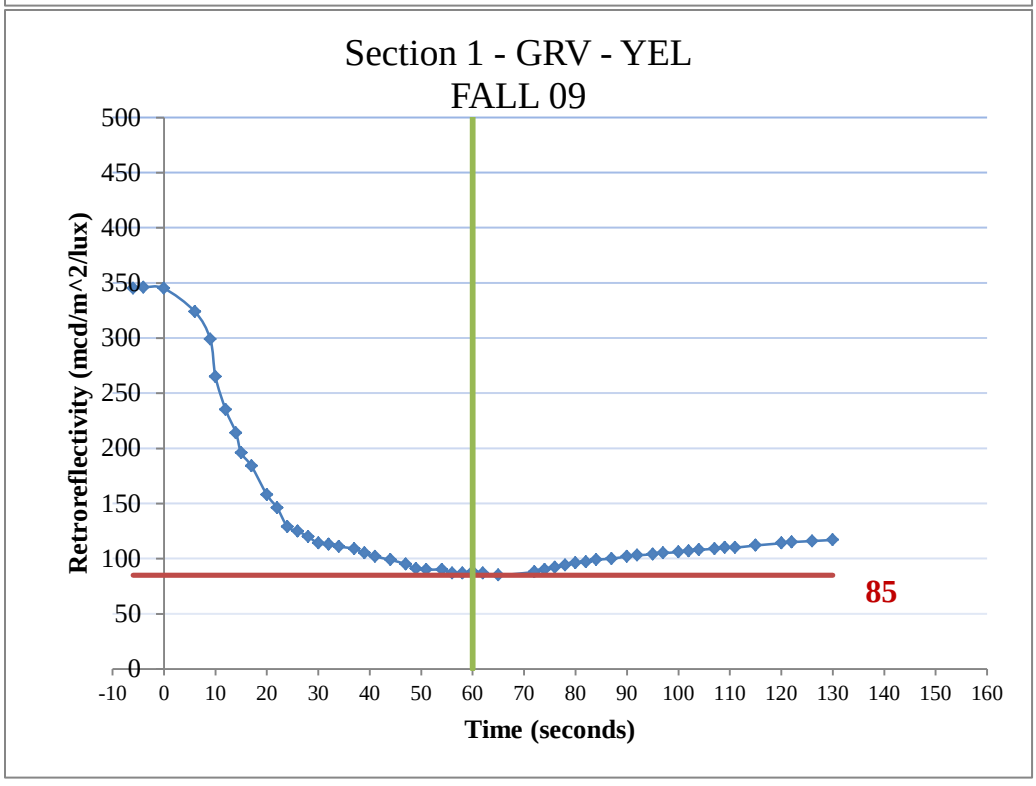
APPENDIX: WET AND WET-RECOVERY READINGS

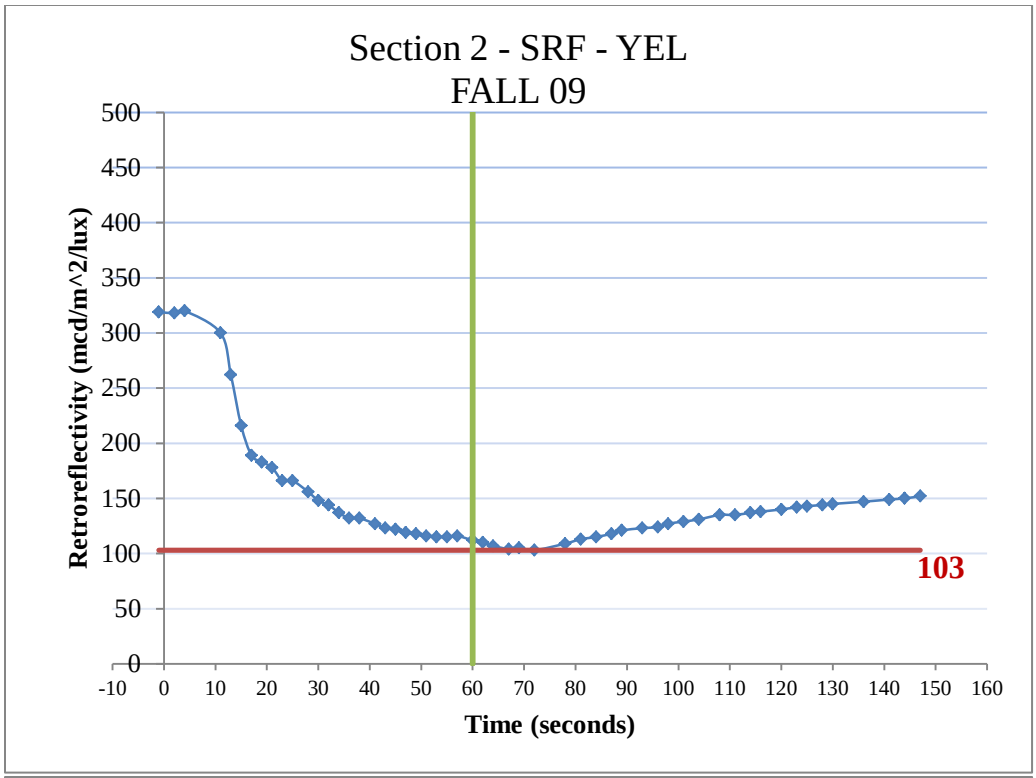
The wet and wet-recovery retroreflectivity readings, by test section and measurement period, are included in this appendix. This information is formatted in the same manner as shown in Figure 13 (in the Introduction to this report). This appendix includes readings for surface and grooved sections as follows:

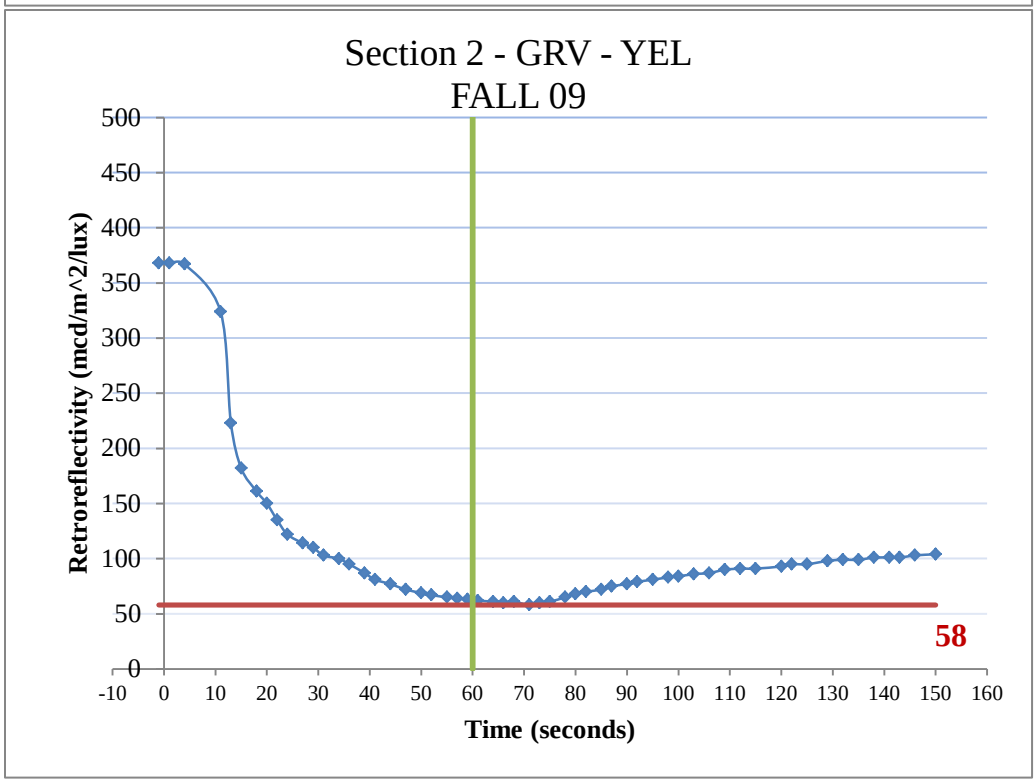
- Yellow edge line: Fall 2009, Spring 2010, and Spring 2011
- White edge line: Fall 2009, Fall 2010, and Spring 2011
- White skip line: Fall 2009, Fall 2010, and Spring 2011 only for sections 3, 4, 5, 6, 7, 9, 10, 11, and 13, given that these were the only sections still performing after the Fall 2010 readings

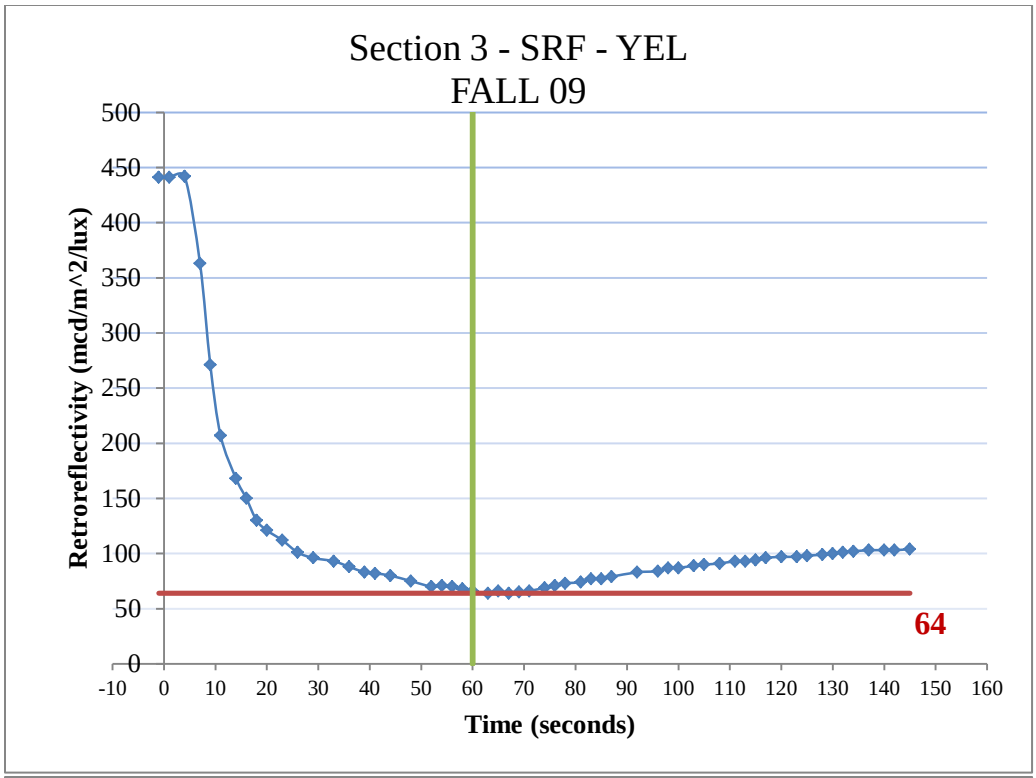
Yellow Edge Line

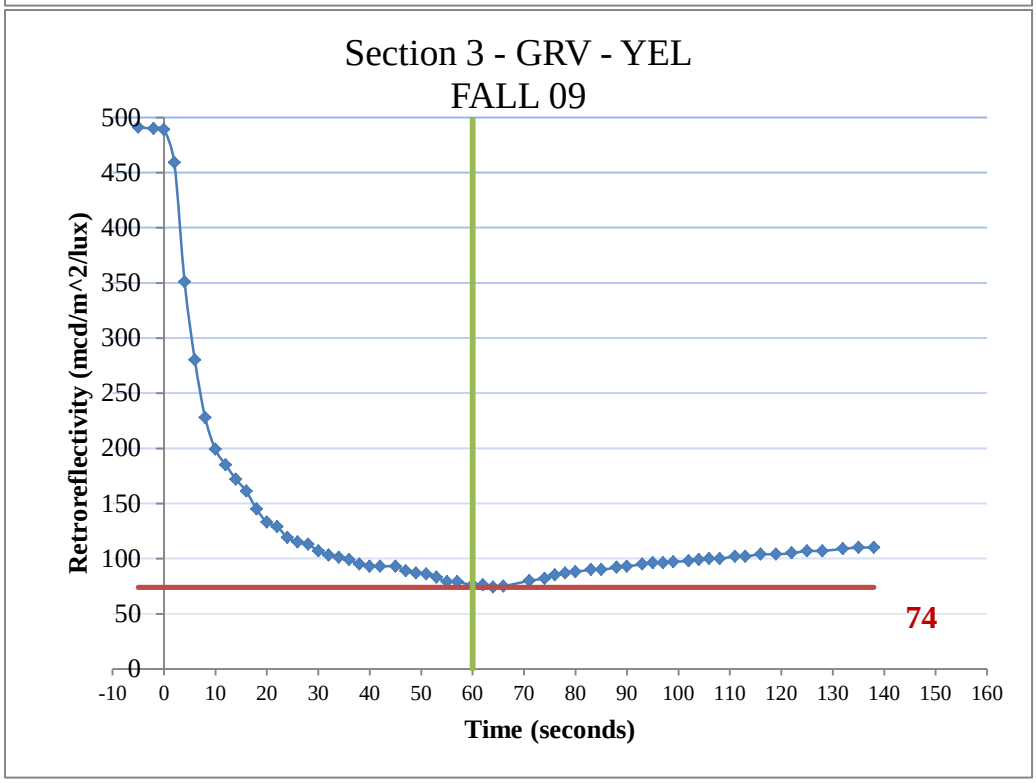

Section 1 - SRF - YEL
FALL 09
Retroreflectivity (mcd/m^2/lux)
500
450
400
350
300
250
200
150
100
50
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
Time (seconds)
72

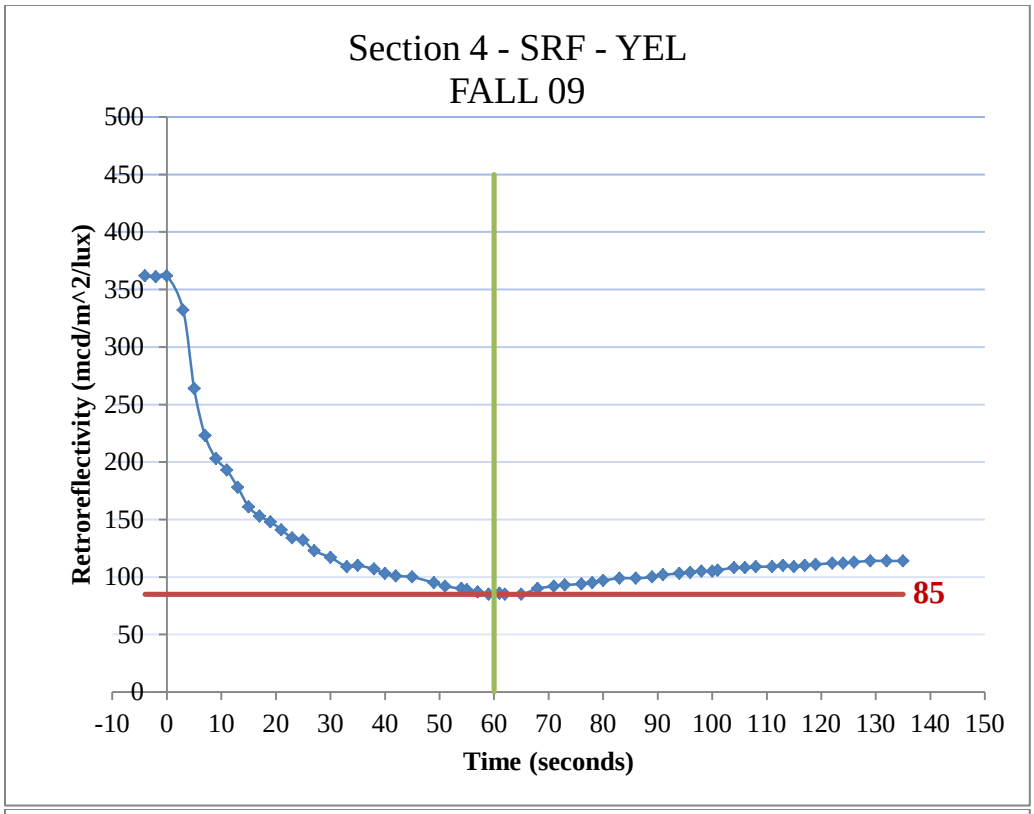

Section 1 - GRV - YEL
FALL 09
Retroreflectivity (mcd/m^2/lux)
500
450
400
350
300
250
200
150
100
50
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Time (seconds)
85

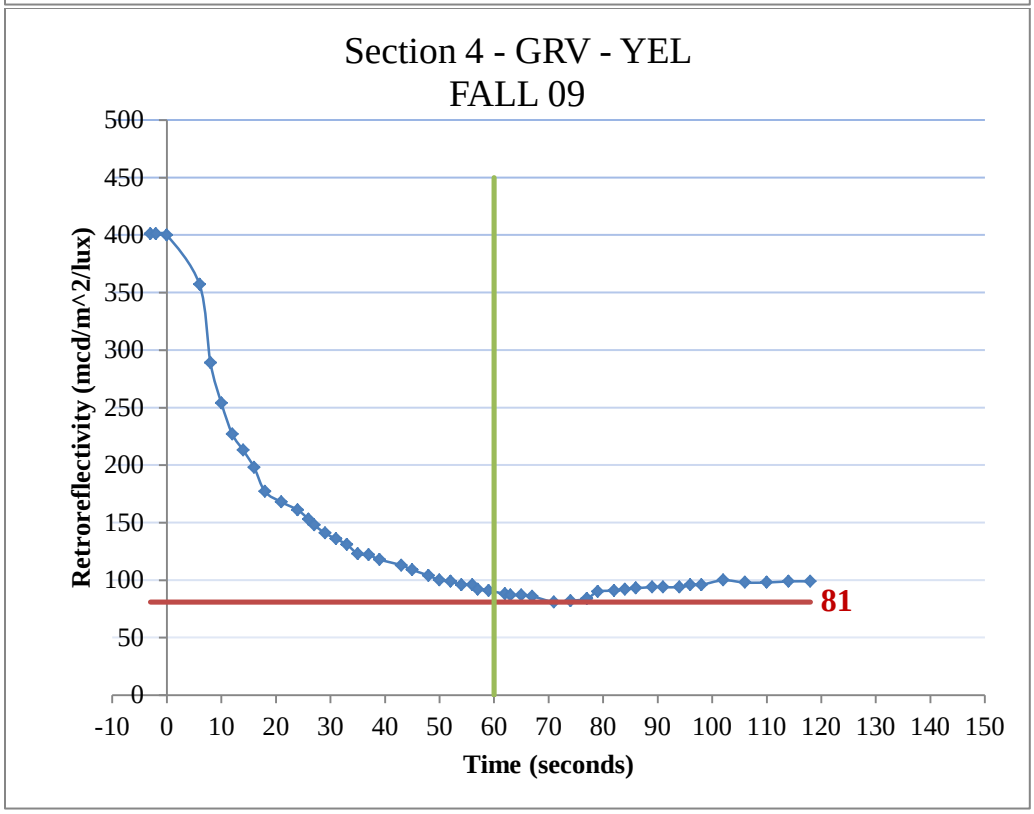

Section 2 - SRF - YEL
FALL 09
Retroreflectivity (mcd/m^2/lux)
500
450
400
350
300
250
200
150
100
50
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Time (seconds)
103

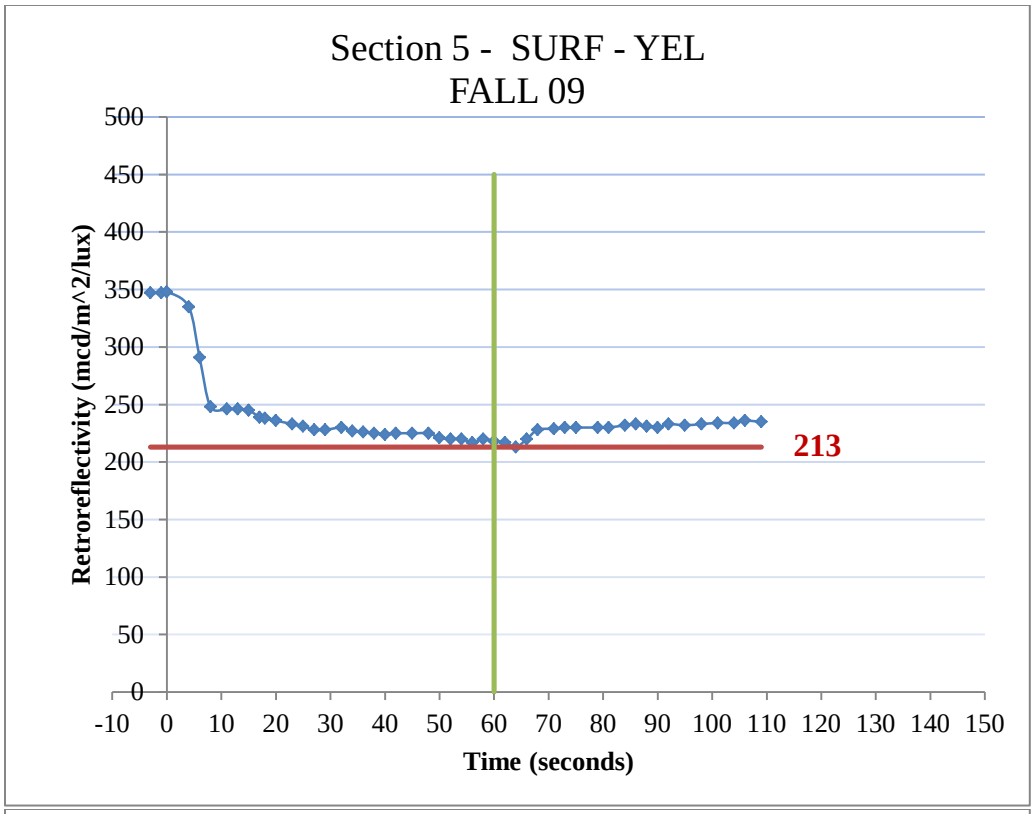

Section 2 - GRV - YEL
FALL 09
Retroreflectivity (mcd/m^2/lux)
500
450
400
350
300
250
200
150
100
50
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Time (seconds)
58

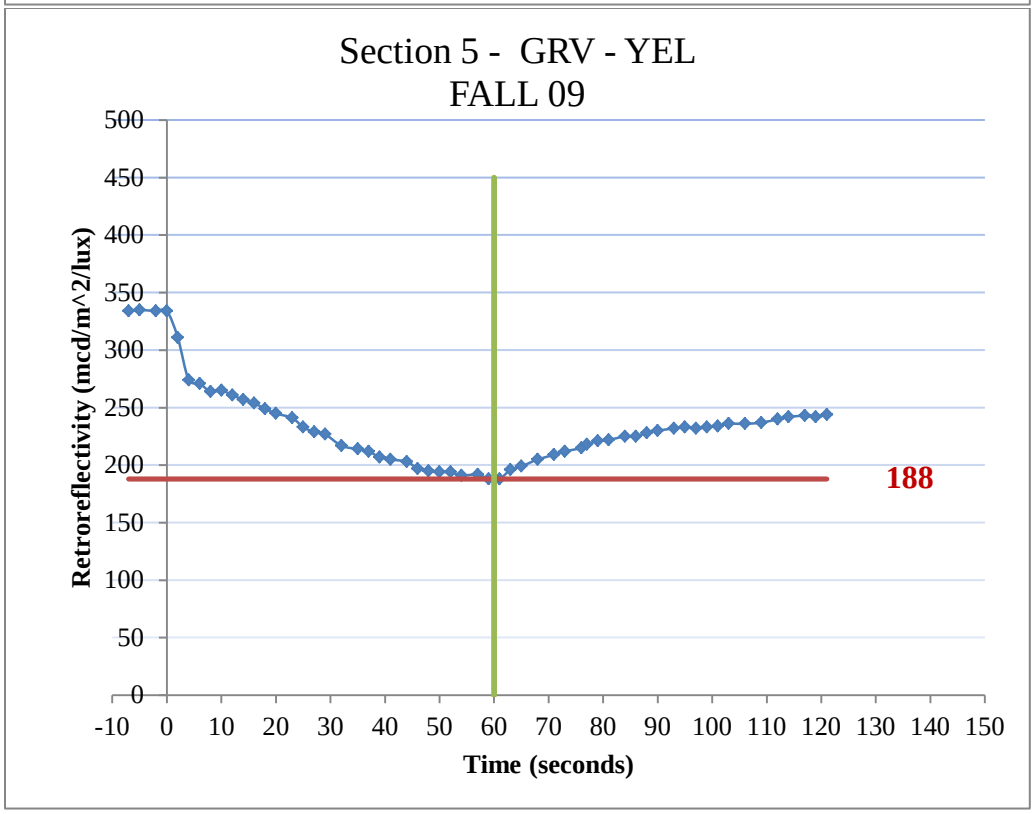

Section 3 - SRF - YEL
FALL 09
Retroreflectivity (mcd/m^2/lux)
500
450
400
350
300
250
200
150
100
50
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Time (seconds)
64

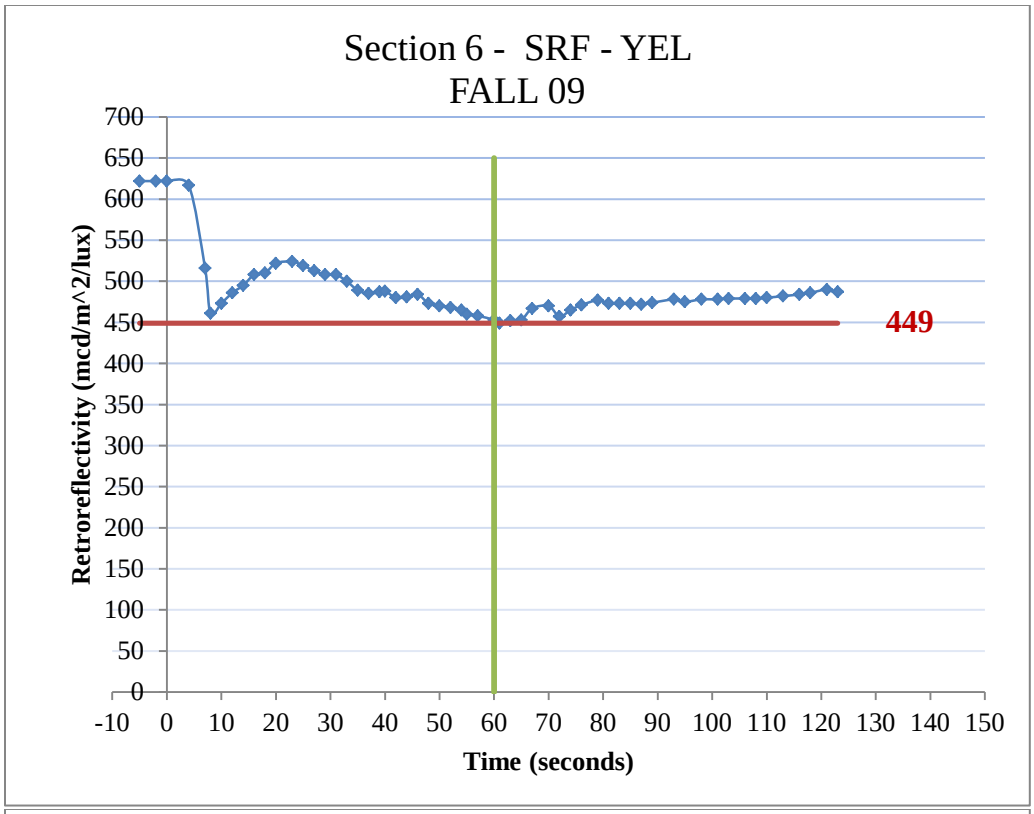

Section 3 - GRV - YEL
FALL 09
Retroreflectivity (mcd/m^2/lux)
500
450
400
350
300
250
200
150
100
50
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Time (seconds)
74

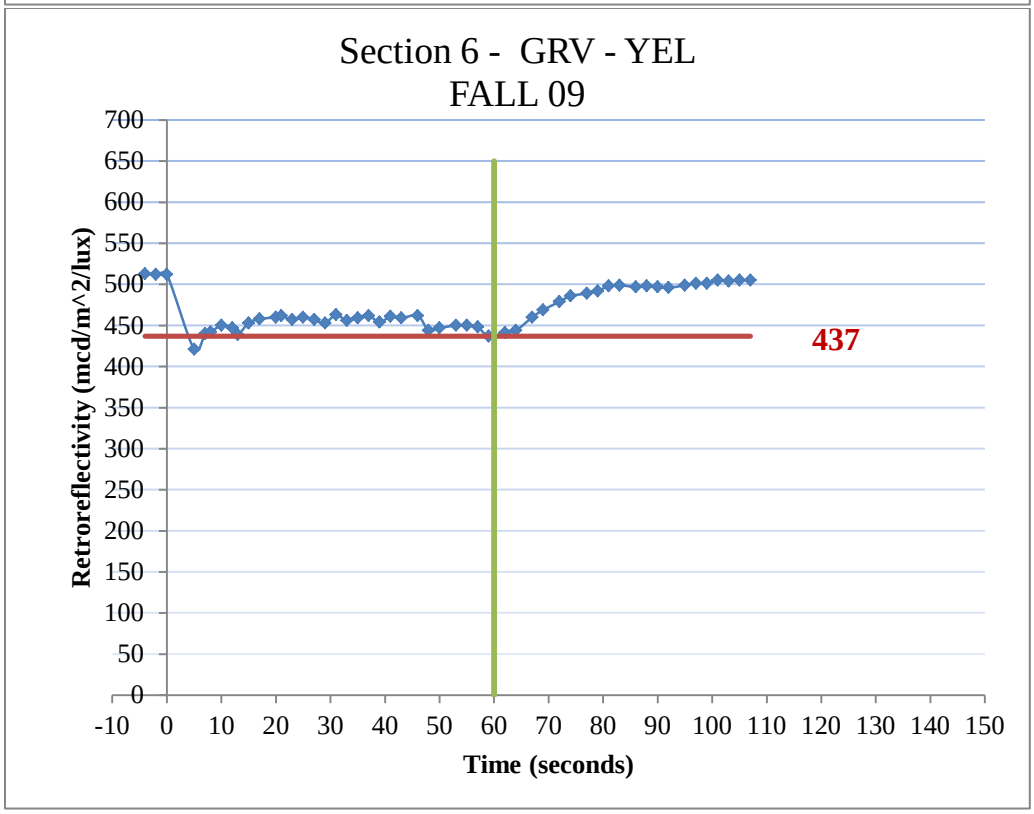

Section 4 - SRF - YEL
FALL 09
Retroreflectivity (mcd/m^2/lux)
500
450
400
350
300
250
200
150
100
50
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Time (seconds)
85

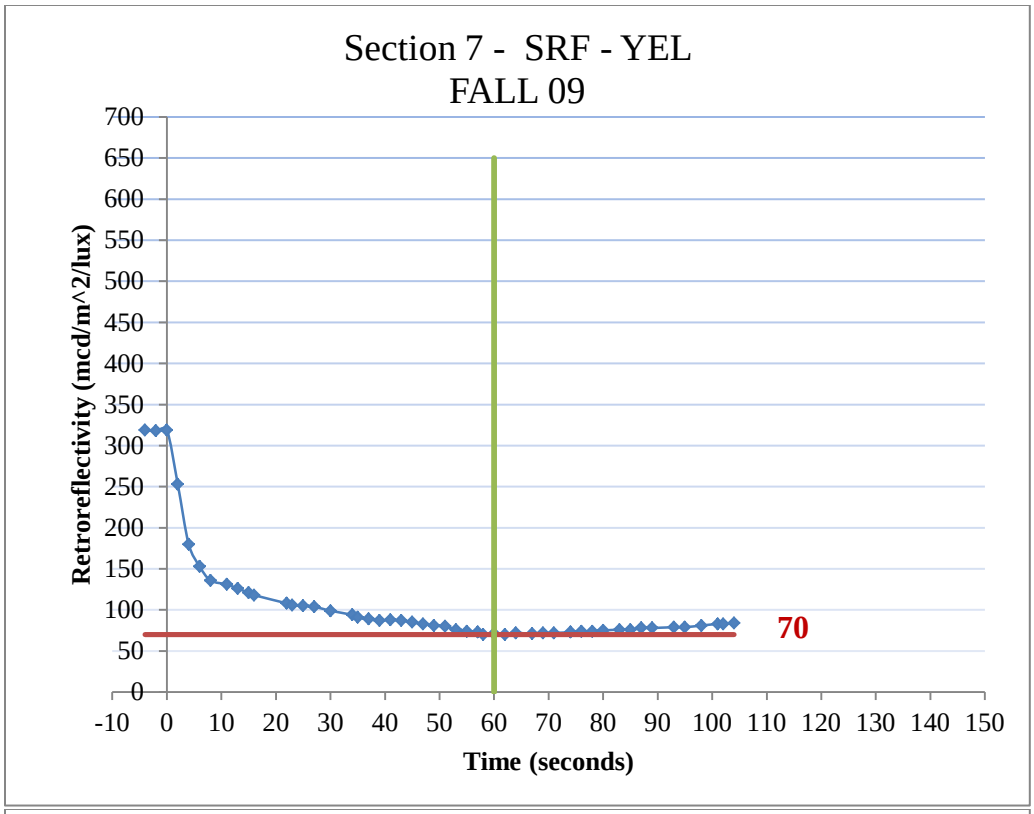

Section 4 - GRV - YEL
FALL 09
Retroreflectivity (mcd/m^2/lux)
500
450
400
350
300
250
200
150
100
50
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Time (seconds)
81

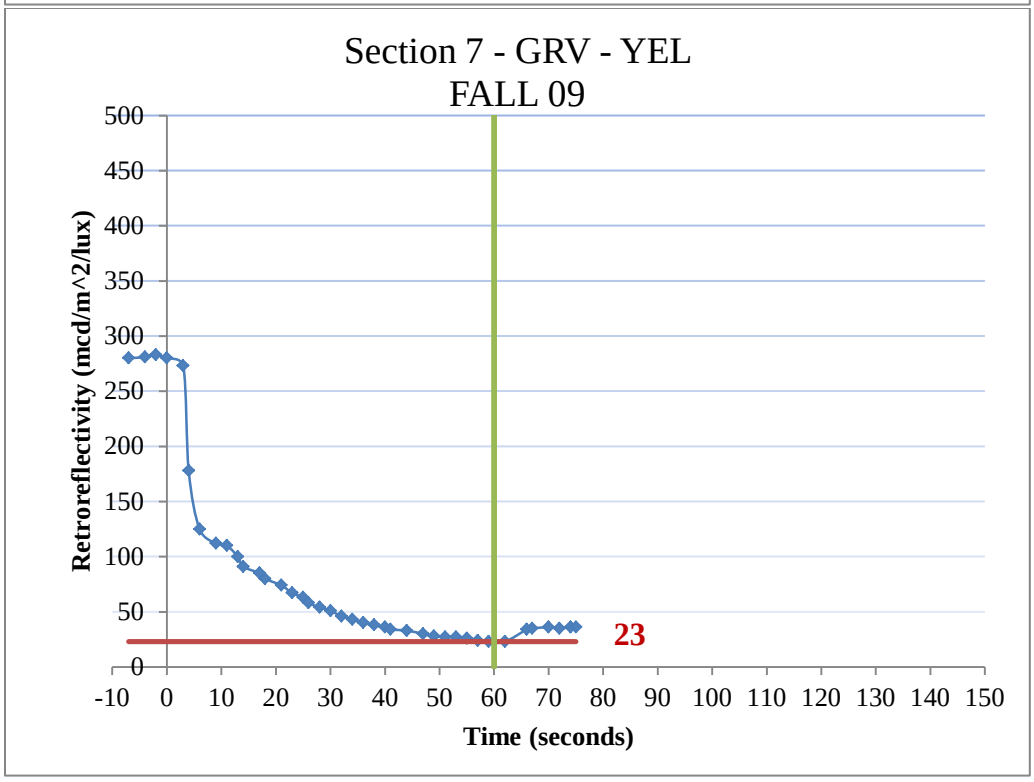

Section 5 - SURF - YEL
FALL 09
Retroreflectivity (mcd/m^2/lux)
500
450
400
350
300
250
200
150
100
50
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Time (seconds)
213

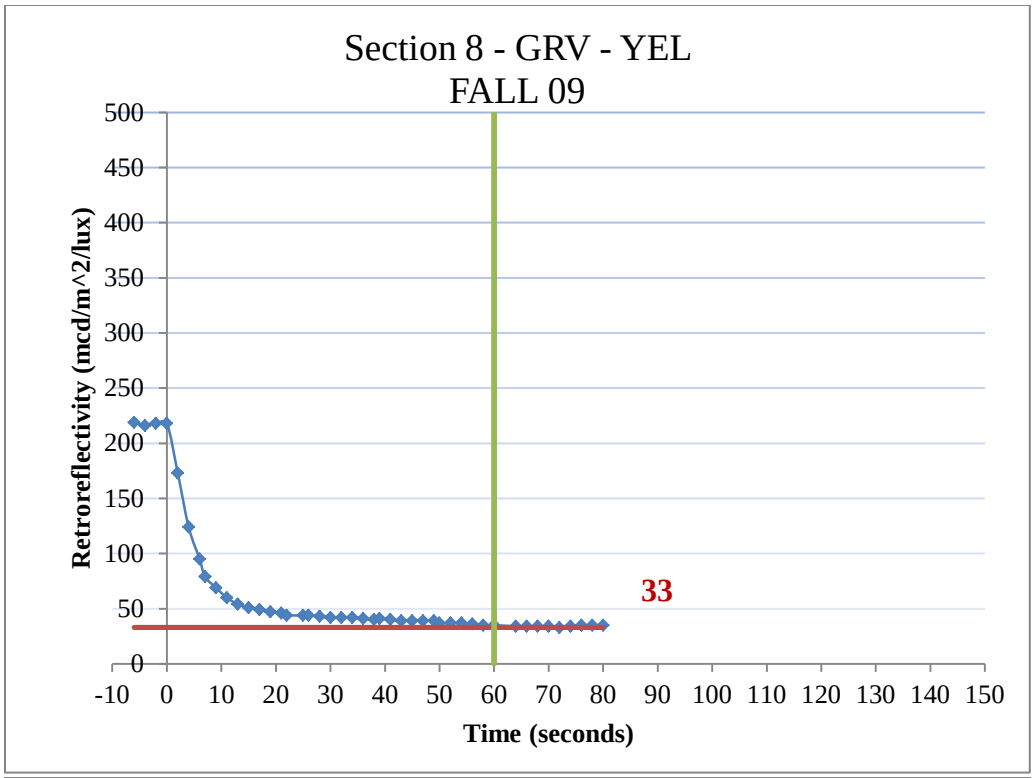

Section 5 - GRV - YEL
FALL 09
Retroreflectivity (mcd/m^2/lux)
500
450
400
350
300
250
200
150
100
50
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Time (seconds)
188

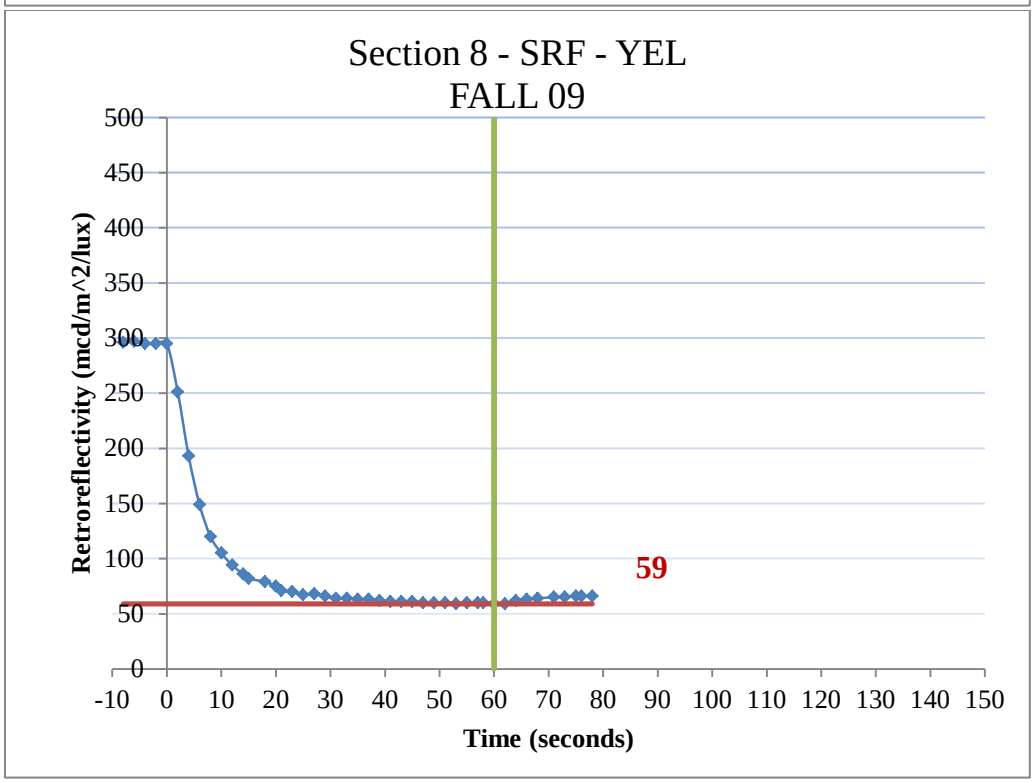

Section 6 - SRF - YEL
FALL 09
Retroreflectivity (mcd/m^2/lux)
Time (seconds)
449

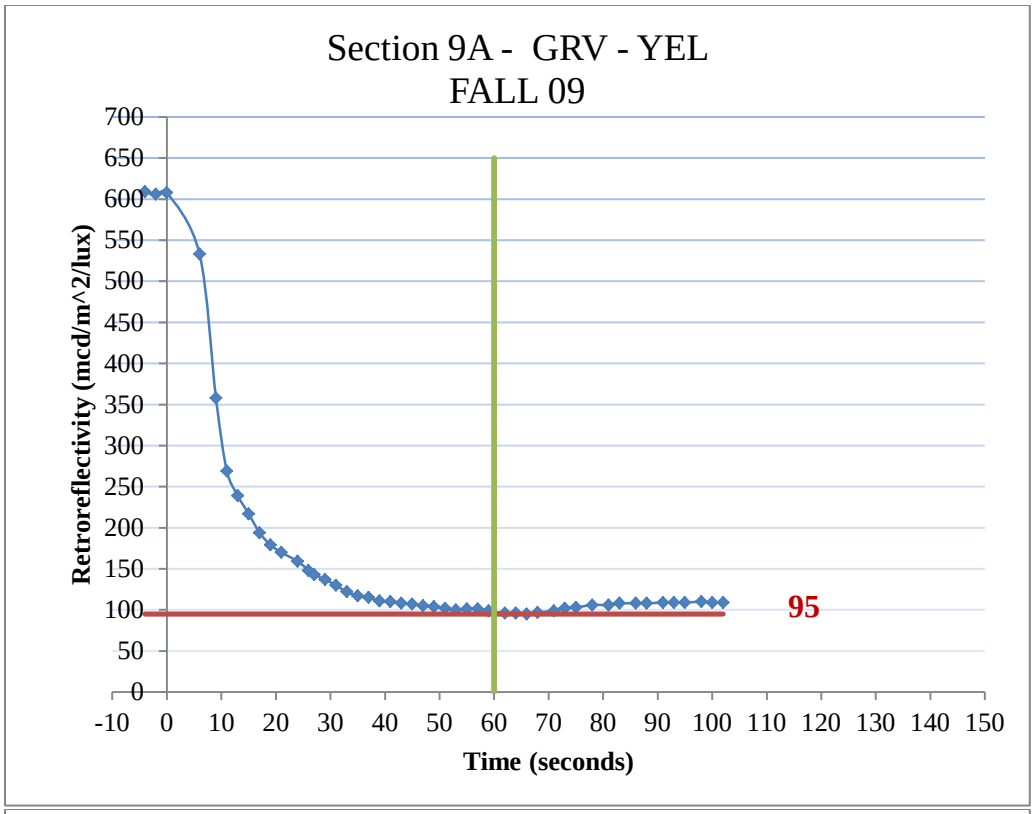

Section 6 - GRV - YEL
FALL 09
Retroreflectivity (mcd/m^2/lux)
Time (seconds)
437

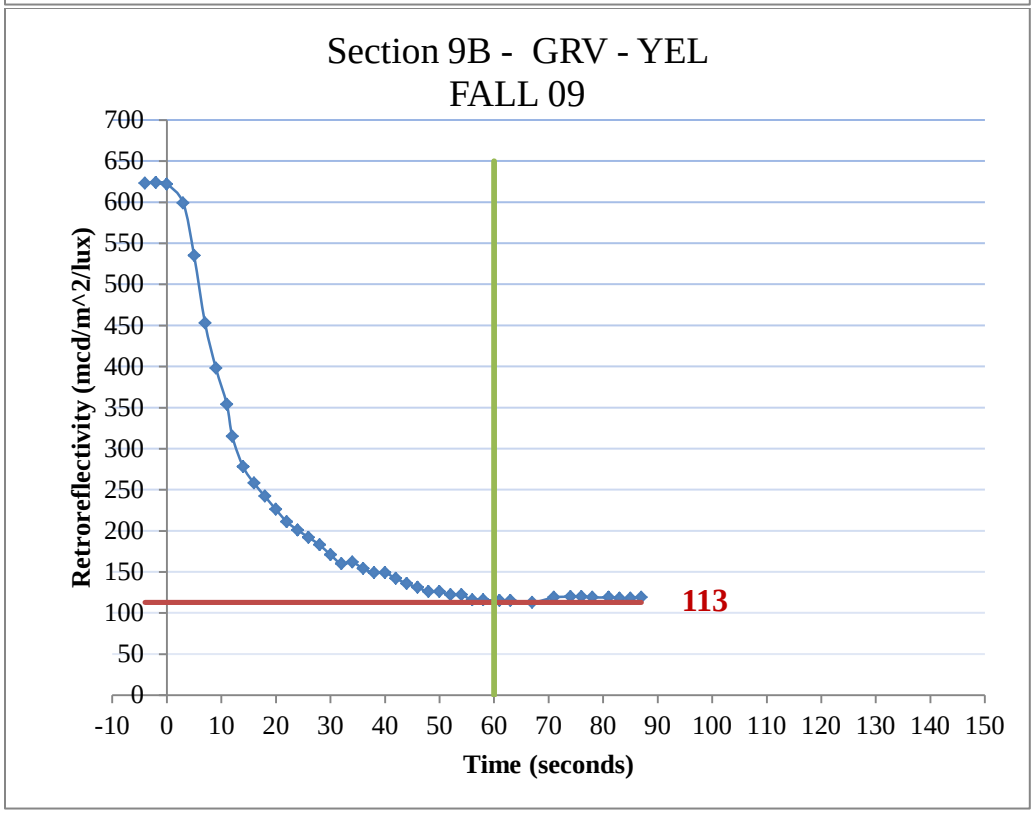

Section 7 - SRF - YEL
FALL 09
Retroreflectivity (mcd/m^2/lux)
Time (seconds)
70

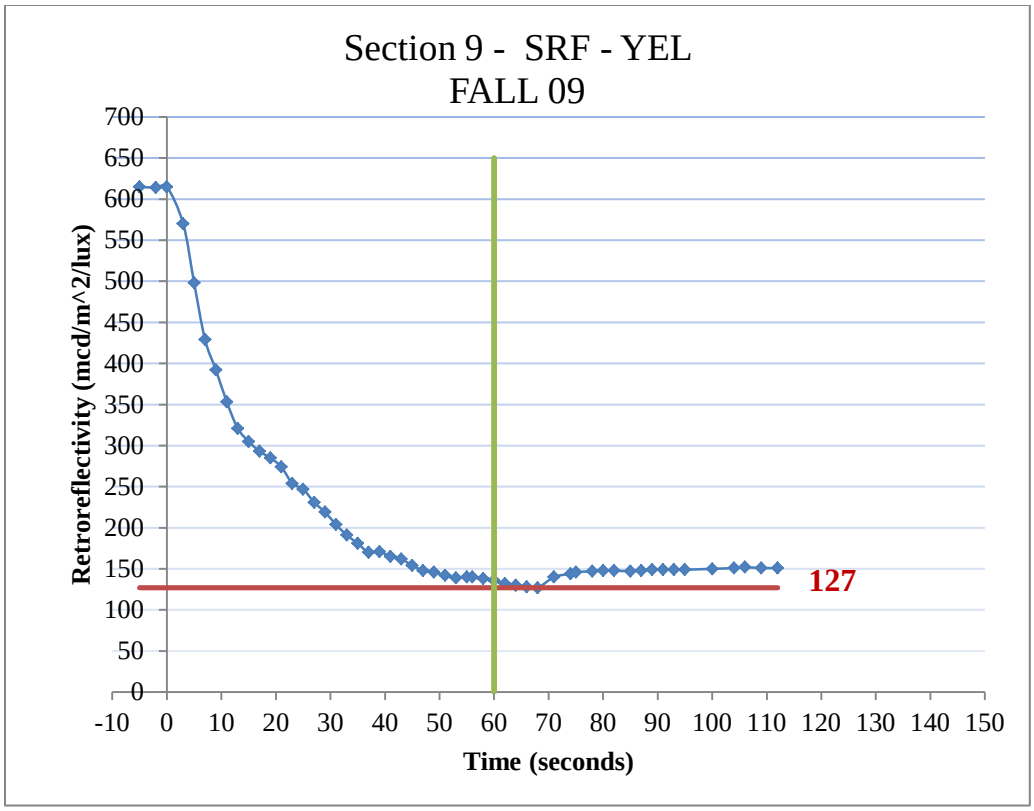

Section 7 - GRV - YEL
FALL 09
Retroreflectivity (mcd/m^2/lux)
Time (seconds)
23

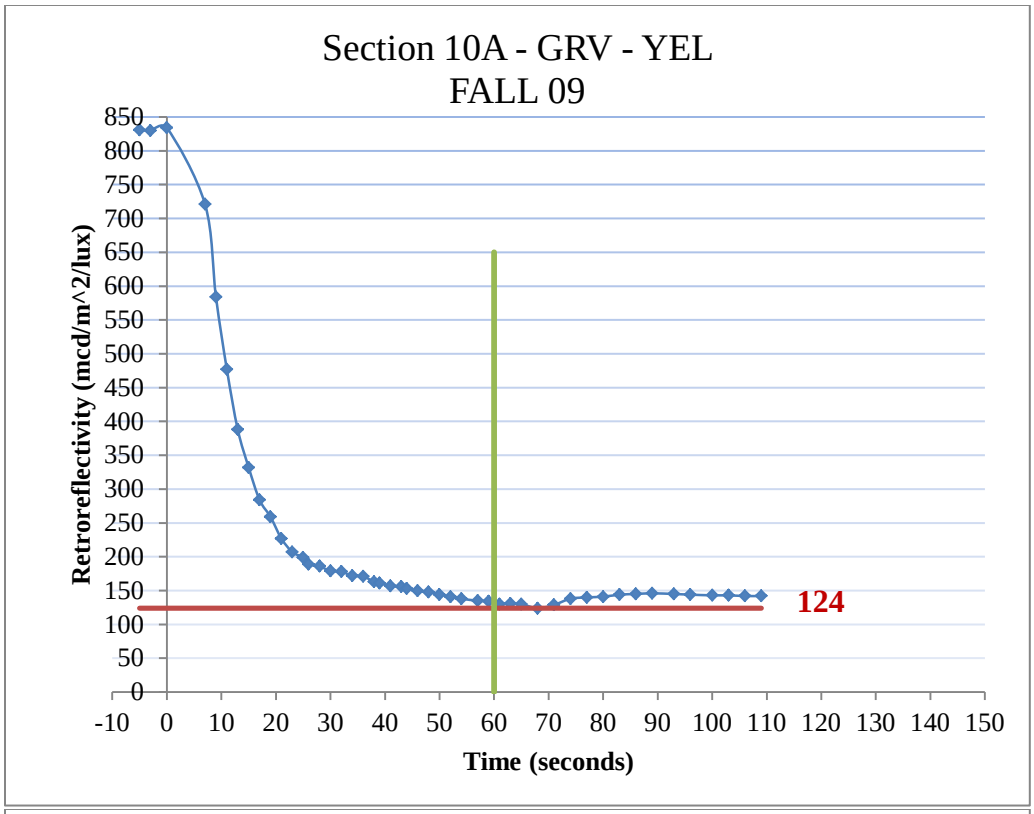

Section 8 - GRV - YEL
FALL 09
Retroreflectivity (mcd/m^2/lux)
500
450
400
350
300
250
200
150
100
50
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Time (seconds)
33

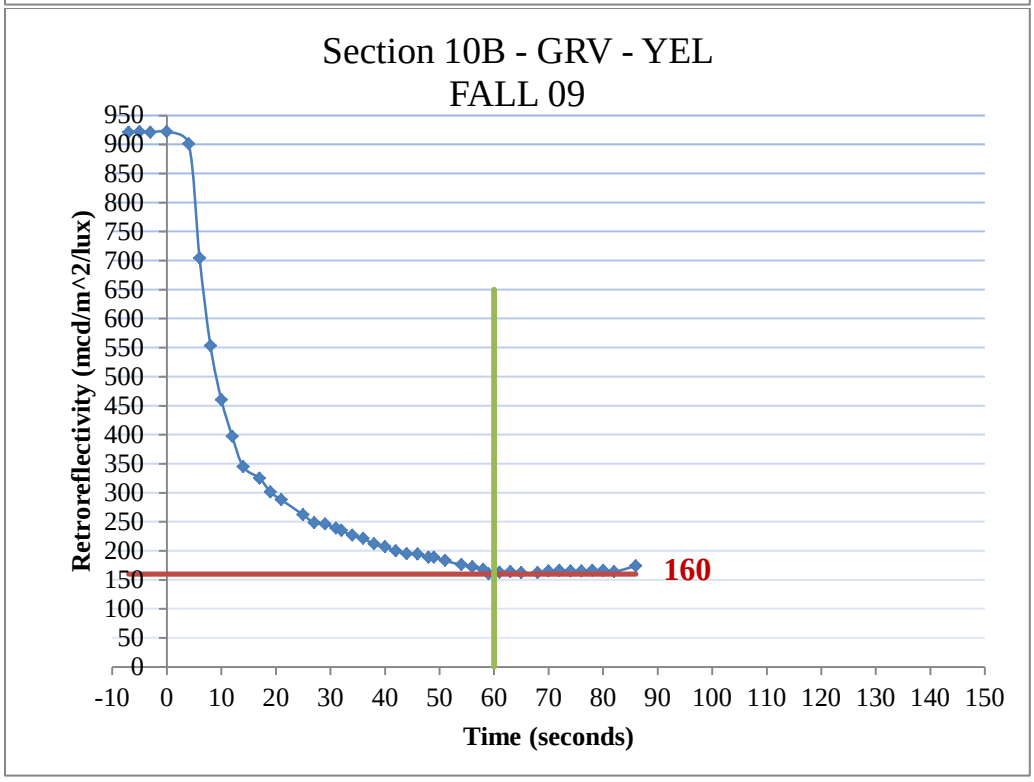

Section 8 - SRF - YEL
FALL 09
Retroreflectivity (mcd/m^2/lux)
500
450
400
350
300
250
200
150
100
50
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Time (seconds)
59

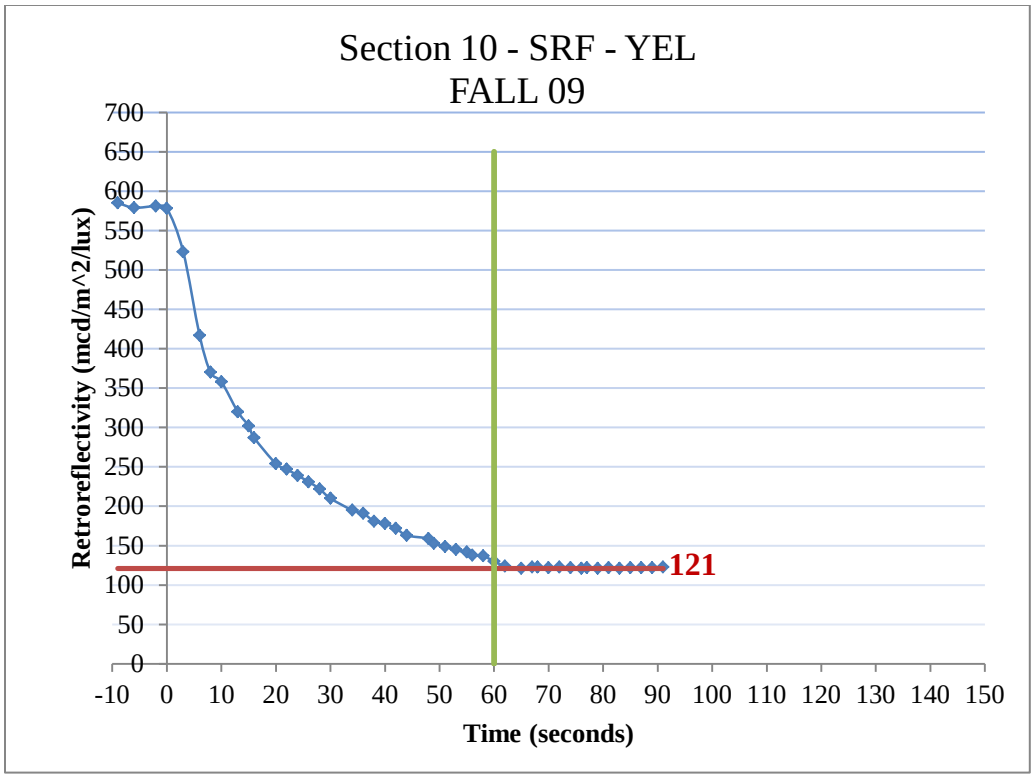

Section 9A - GRV - YEL
FALL 09
Retroreflectivity (mcd/m^2/lux)
Time (seconds)
95

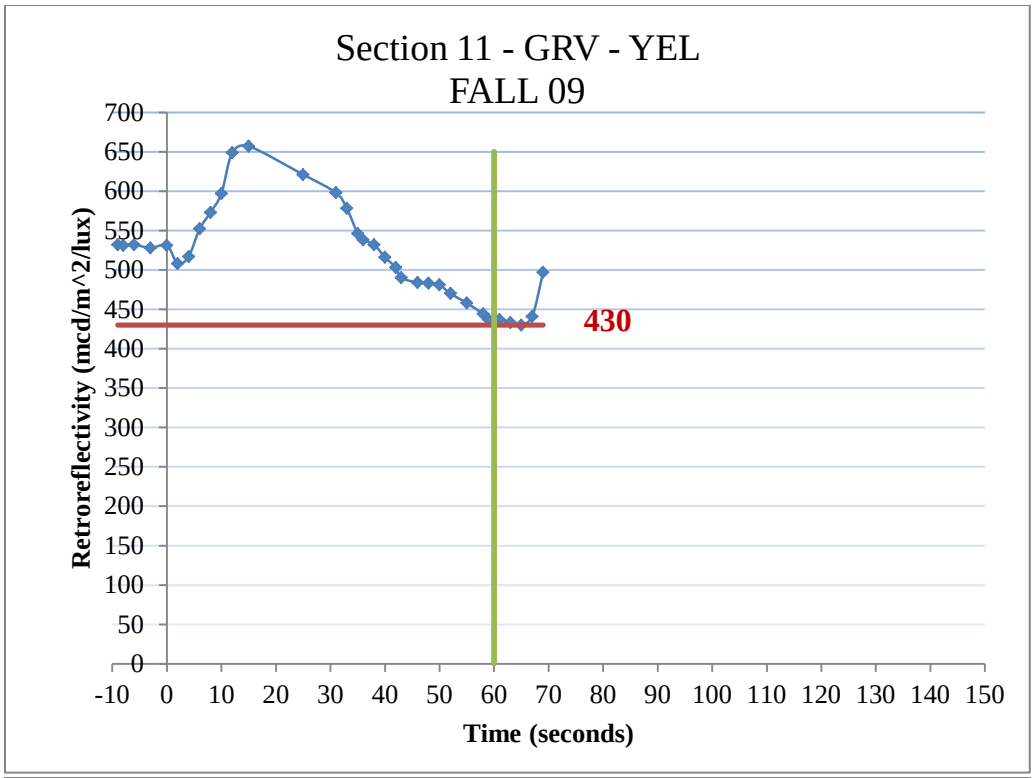

Section 9B - GRV - YEL
FALL 09
Retroreflectivity (mcd/m^2/lux)
Time (seconds)
113

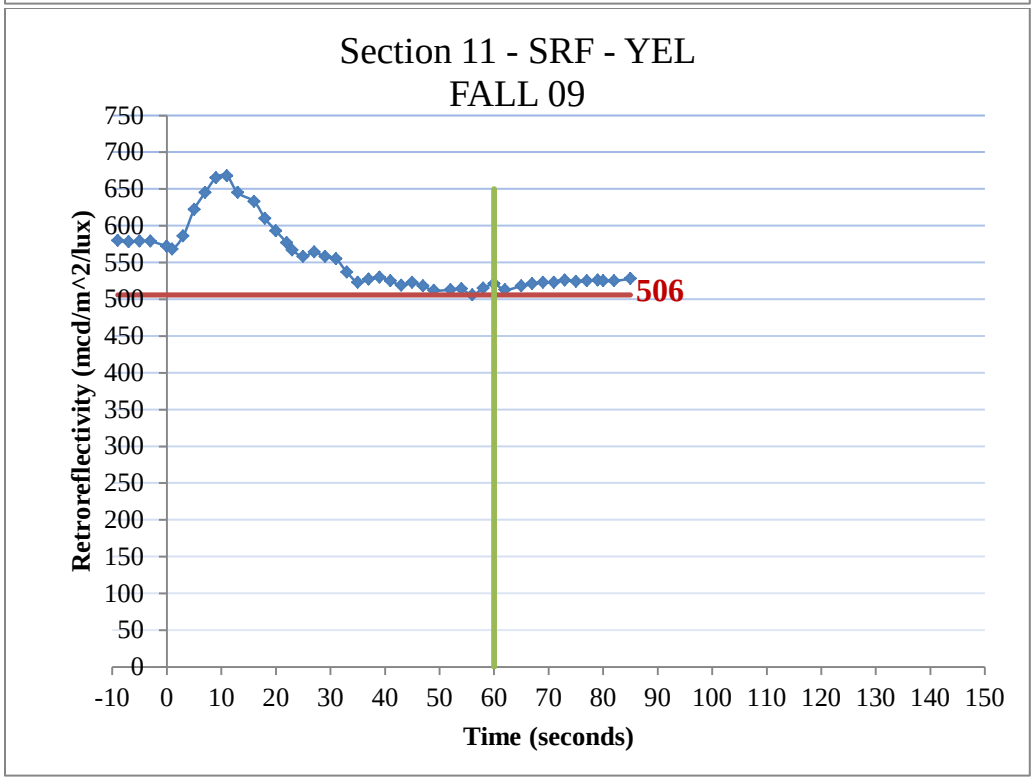

Section 9 - SRF - YEL
FALL 09
Retroreflectivity (mcd/m^2/lux)
Time (seconds)
127
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

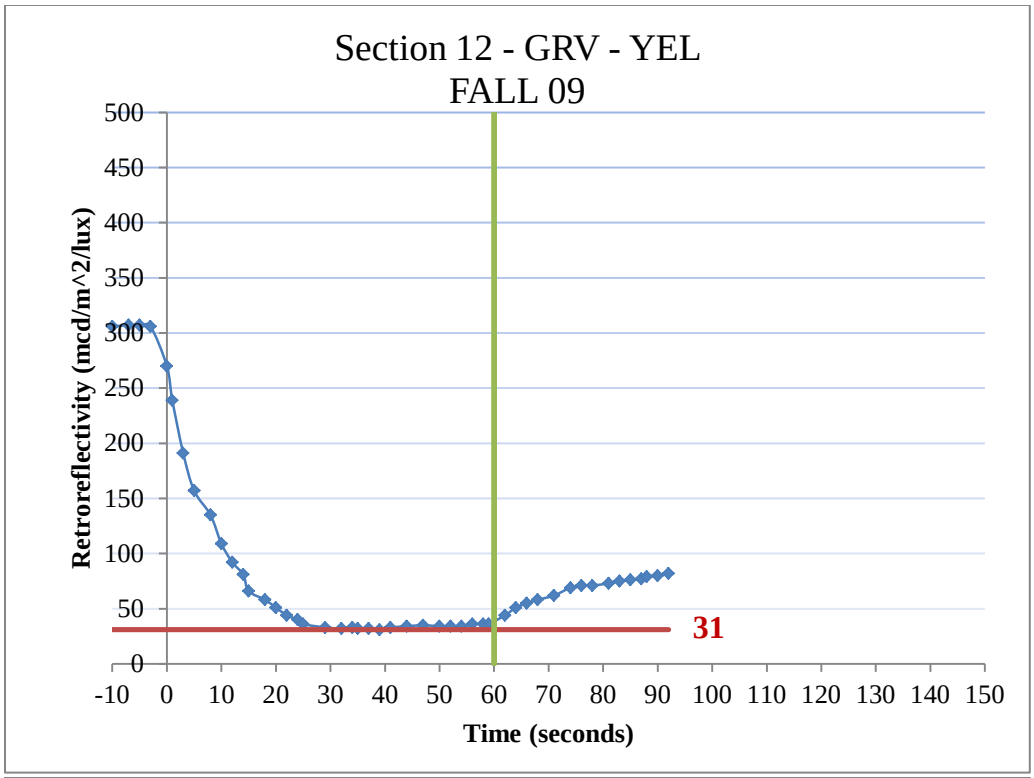

Section 10A - GRV - YEL
FALL 09
Retroreflectivity (mcd/m^2/lux)
Time (seconds)
124

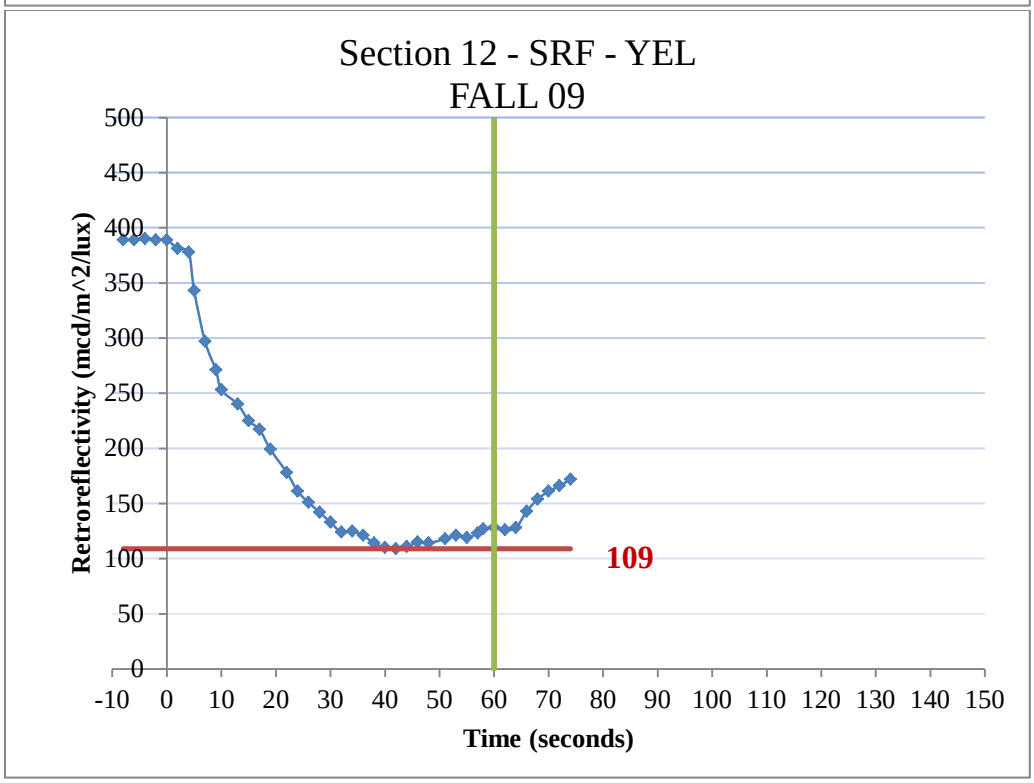

Section 10B - GRV - YEL
FALL 09
Retroreflectivity (mcd/m^2/lux)
Time (seconds)
160

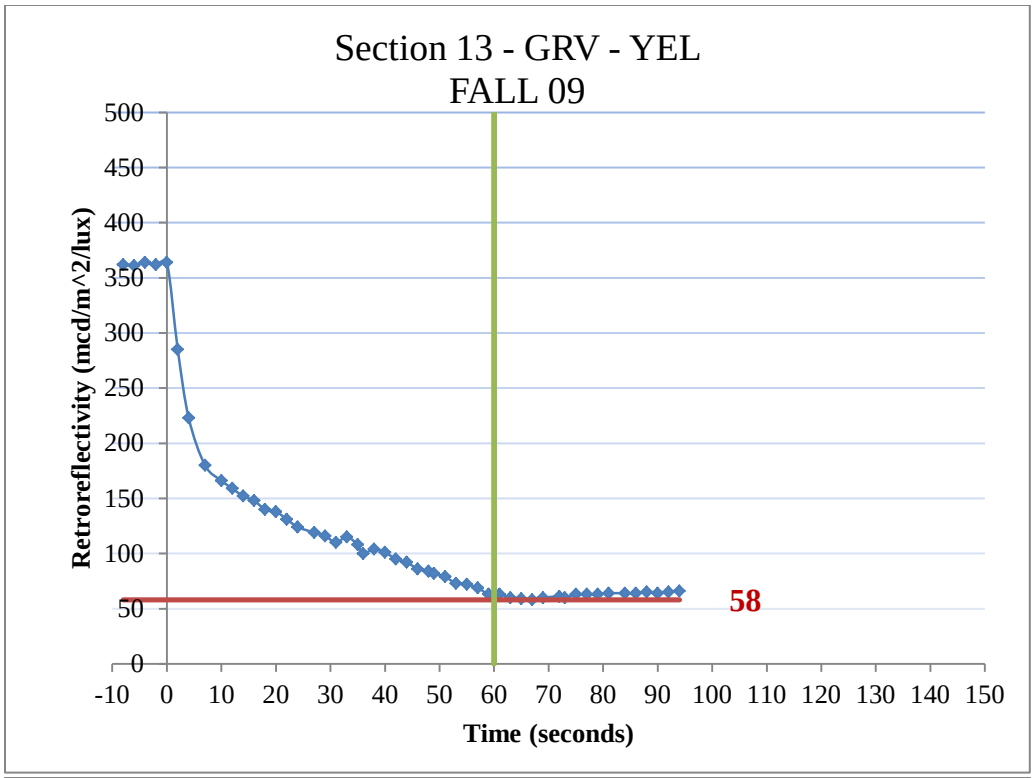

Section 10 - SRF - YEL
FALL 09
Retroreflectivity (mcd/m^2/lux)
Time (seconds)
121
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

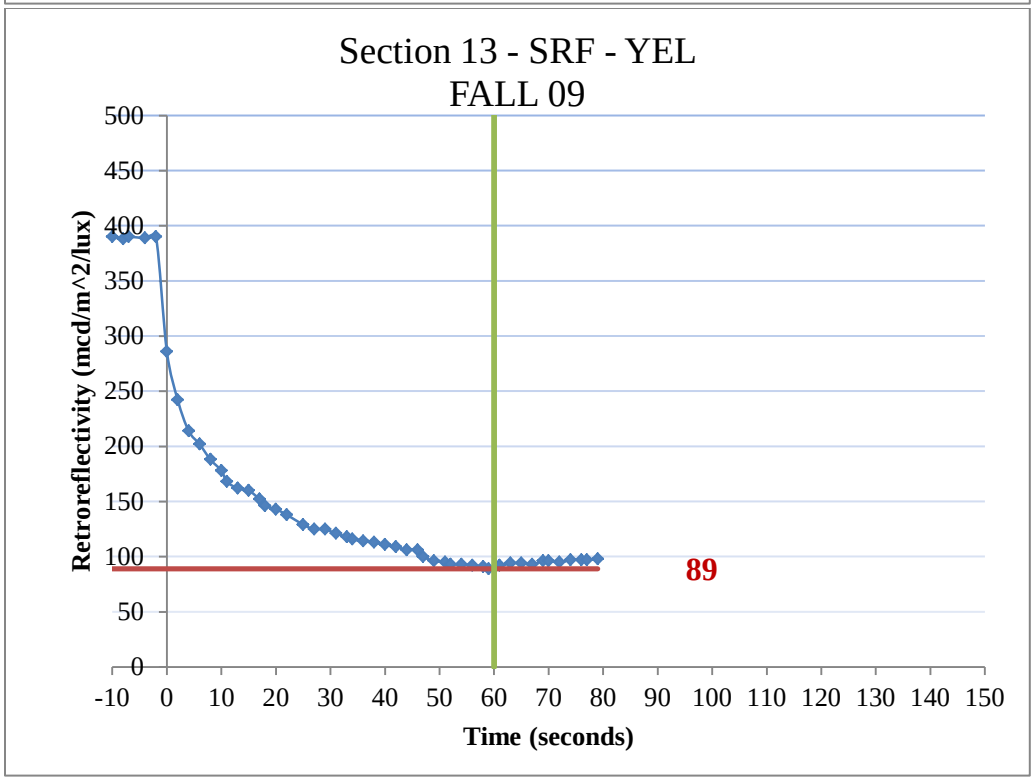

Section 11 - GRV - YEL
FALL 09
Retroreflectivity (mcd/m^2/lux)
Time (seconds)
430

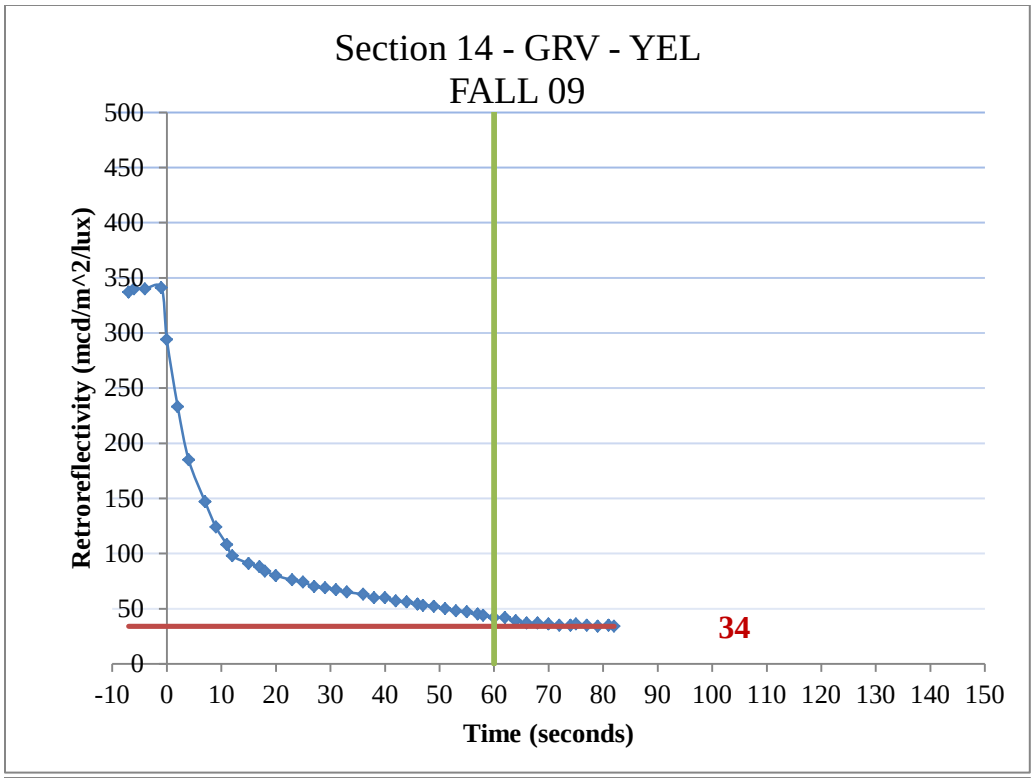

Section 11 - SRF - YEL
FALL 09
Retroreflectivity (mcd/m^2/lux)
Time (seconds)
506

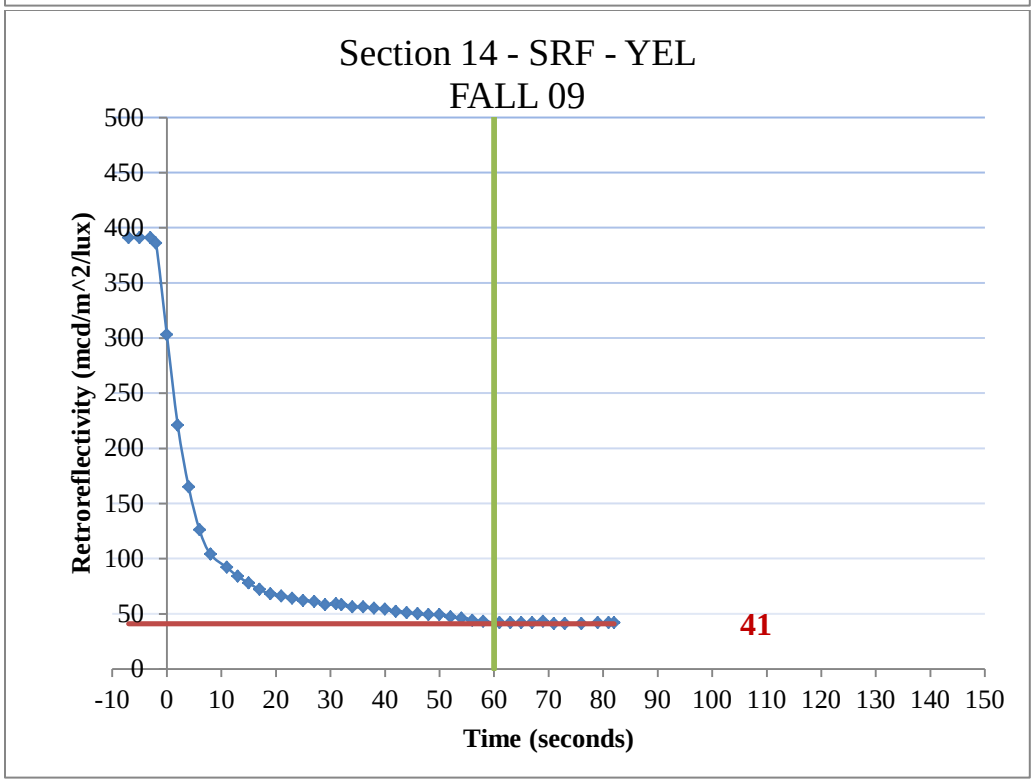

Section 12 - GRV - YEL
FALL 09
Retroreflectivity (mcd/m^2/lux)
500
450
400
350
300
250
200
150
100
50
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Time (seconds)
31

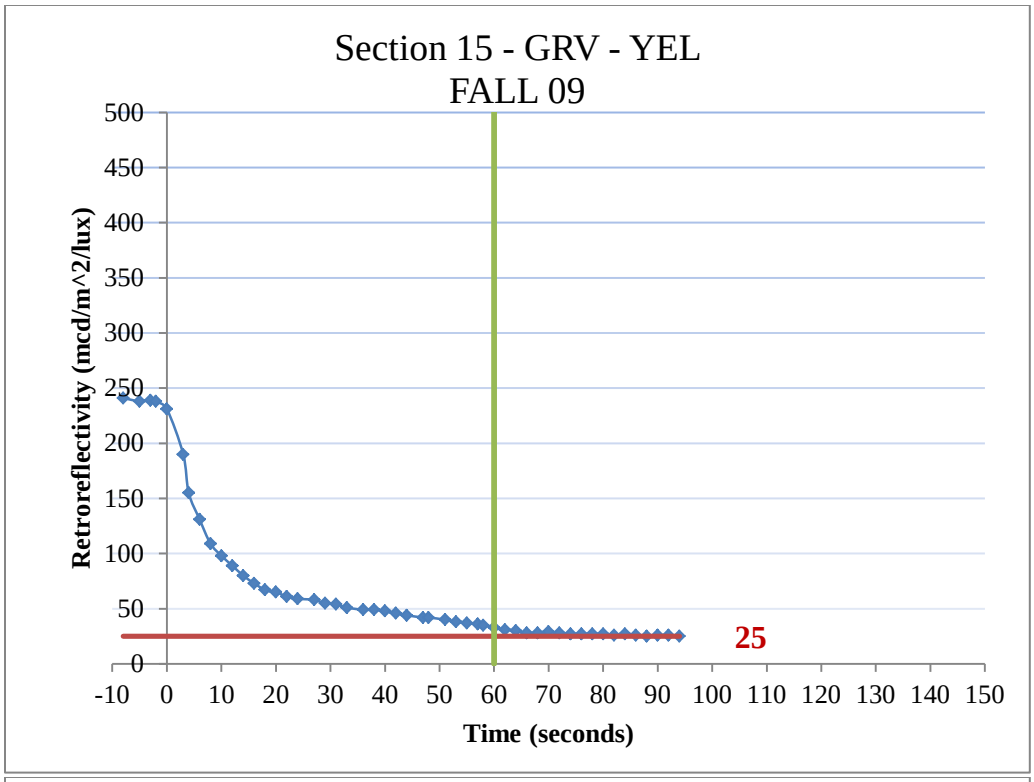

Section 12 - SRF - YEL
FALL 09
Retroreflectivity (mcd/m^2/lux)
500
450
400
350
300
250
200
150
100
50
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Time (seconds)
109

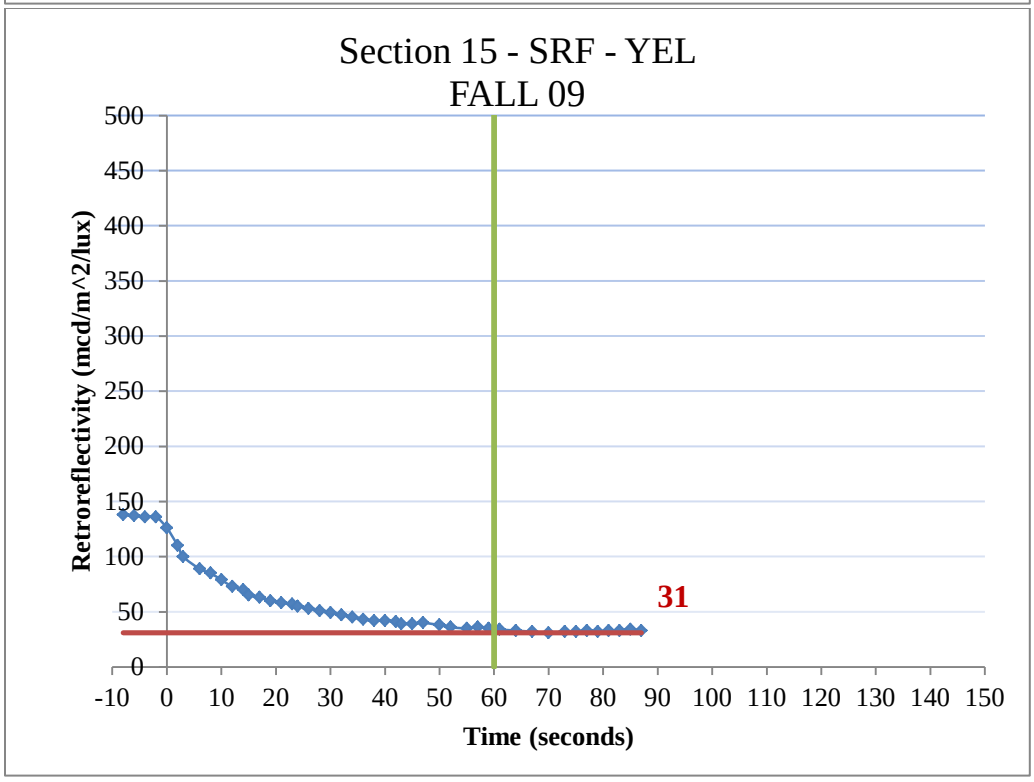

Section 13 - GRV - YEL
FALL 09
Retroreflectivity (mcd/m^2/lux)
500
450
400
350
300
250
200
150
100
50
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Time (seconds)
58

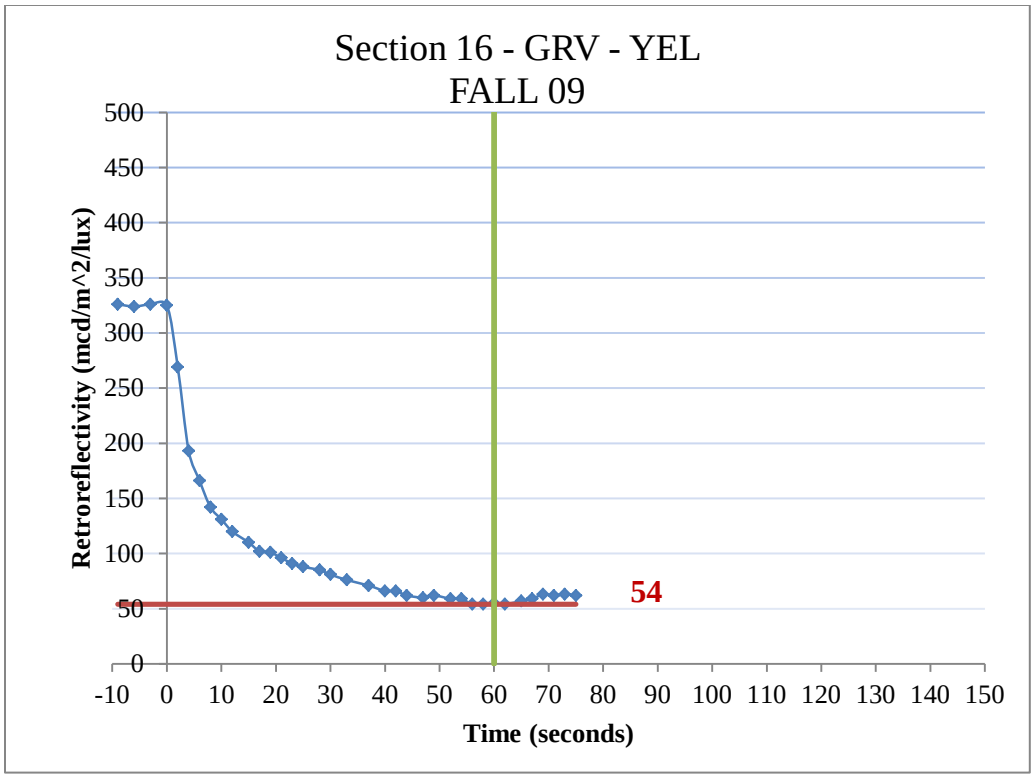

Section 13 - SRF - YEL
FALL 09
Retroreflectivity (mcd/m^2/lux)
500
450
400
350
300
250
200
150
100
50
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Time (seconds)
89

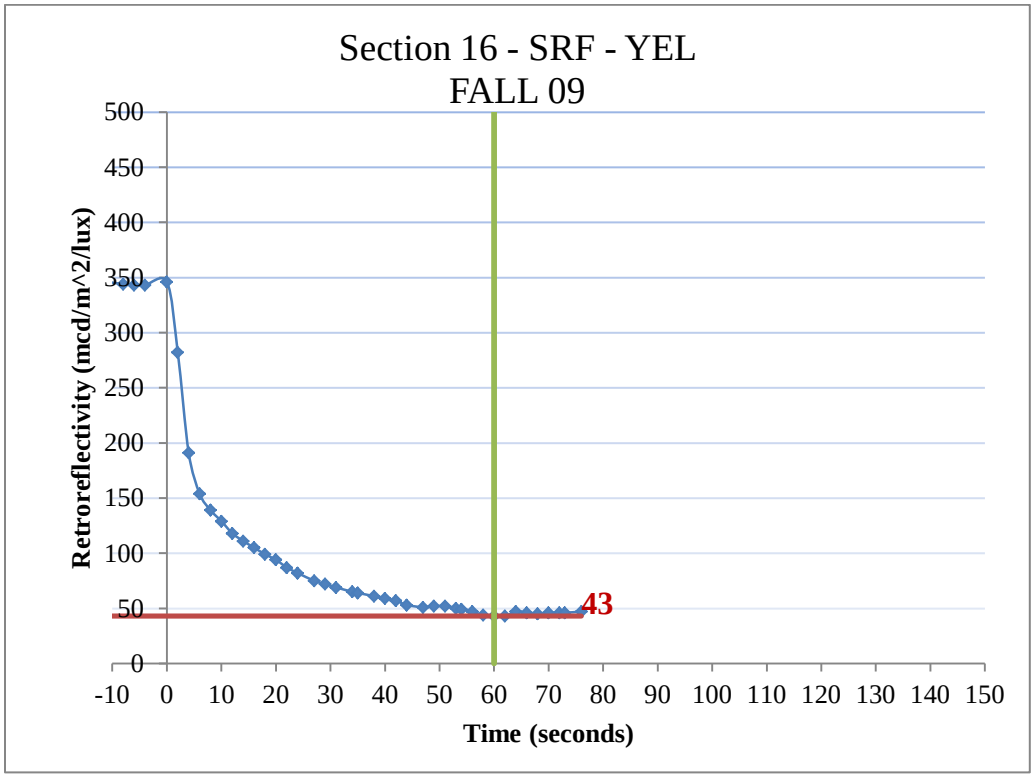

Section 14 - GRV - YEL
FALL 09
Retroreflectivity (mcd/m^2/lux)
500
450
400
350
300
250
200
150
100
50
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Time (seconds)
34


Section 14 - SRF - YEL
FALL 09
Retroreflectivity (mcd/m^2/lux)
500
450
400
350
300
250
200
150
100
50
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Time (seconds)
41

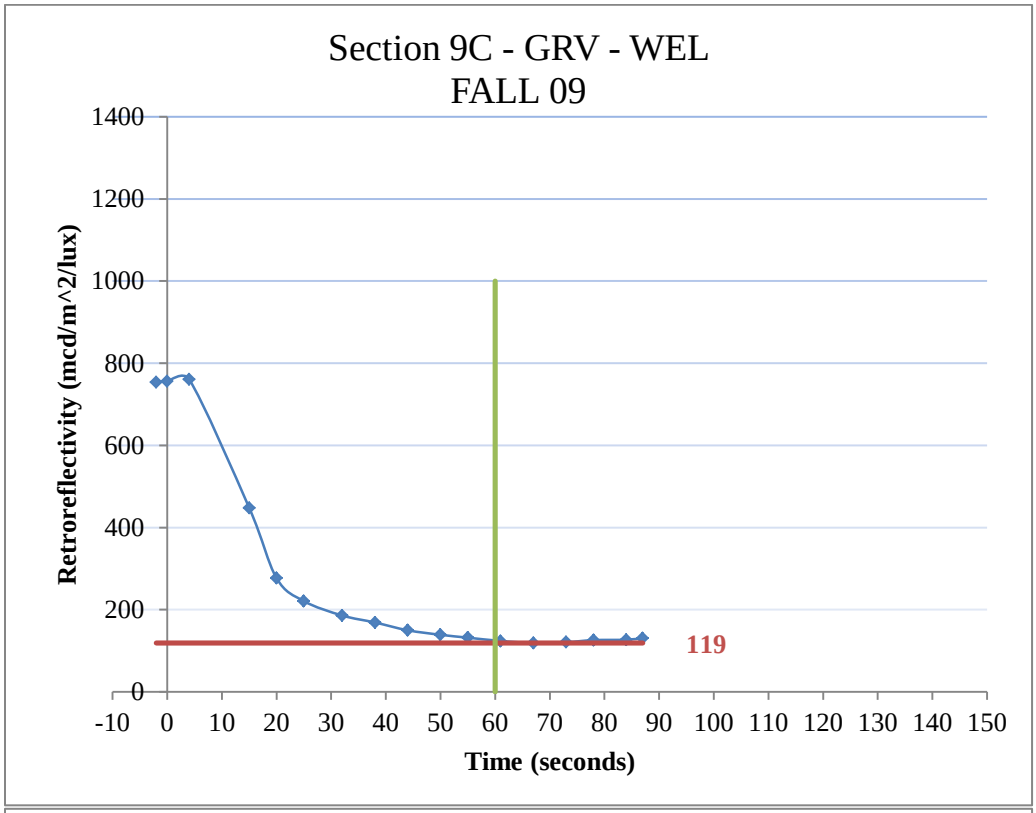

Section 15 - GRV - YEL
FALL 09
Retroreflectivity (mcd/m^2/lux)
500
450
400
350
300
250
200
150
100
50
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Time (seconds)
25

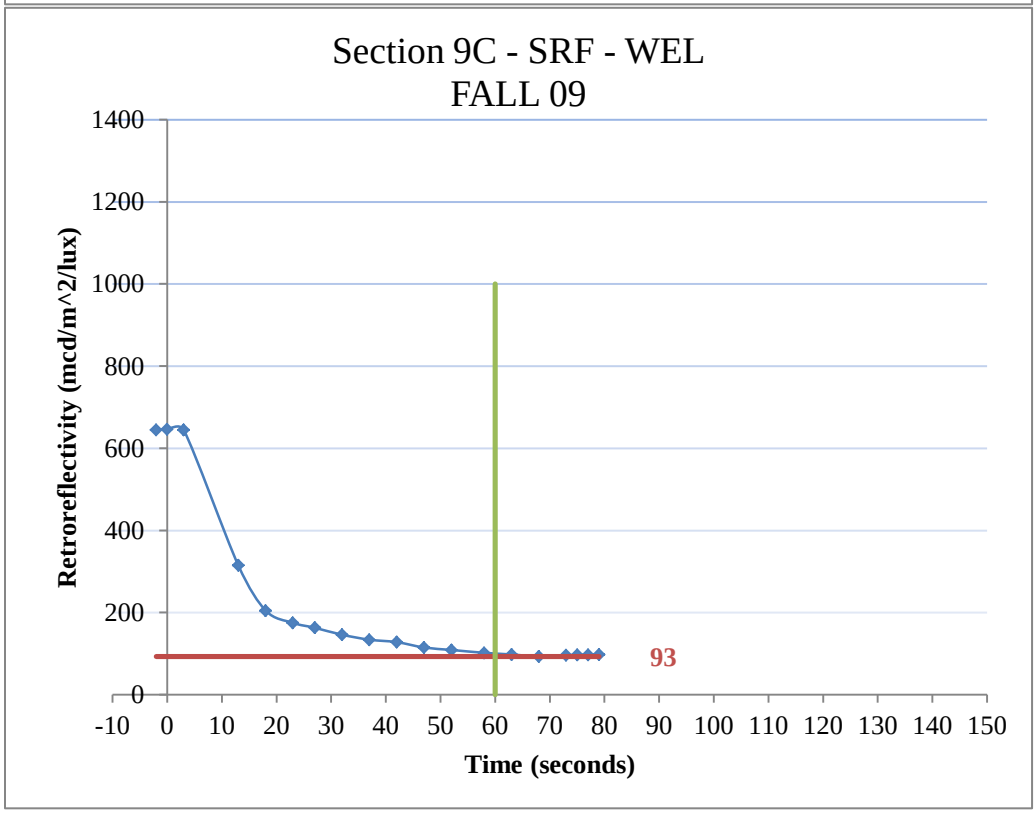

Section 15 - SRF - YEL
FALL 09
Retroreflectivity (mcd/m^2/lux)
500
450
400
350
300
250
200
150
100
50
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Time (seconds)
31

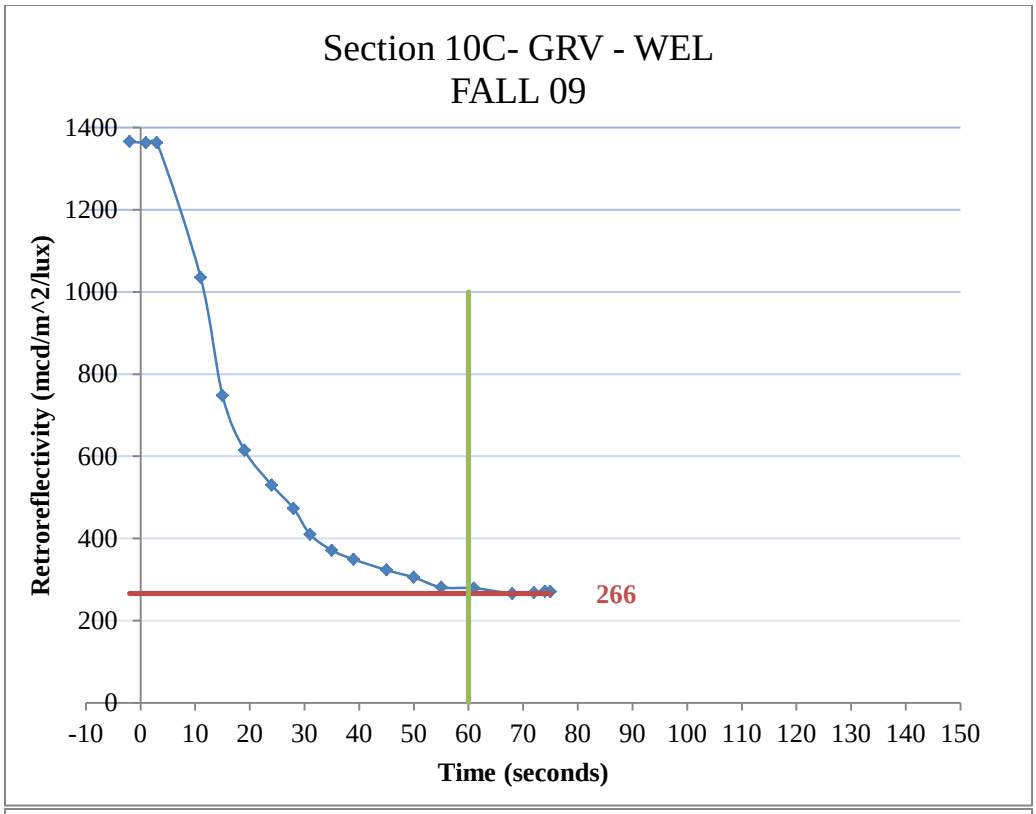

Section 16 - GRV - YEL
FALL 09
Retroreflectivity (mcd/m^2/lux)
500
450
400
350
300
250
200
150
100
50
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Time (seconds)
54

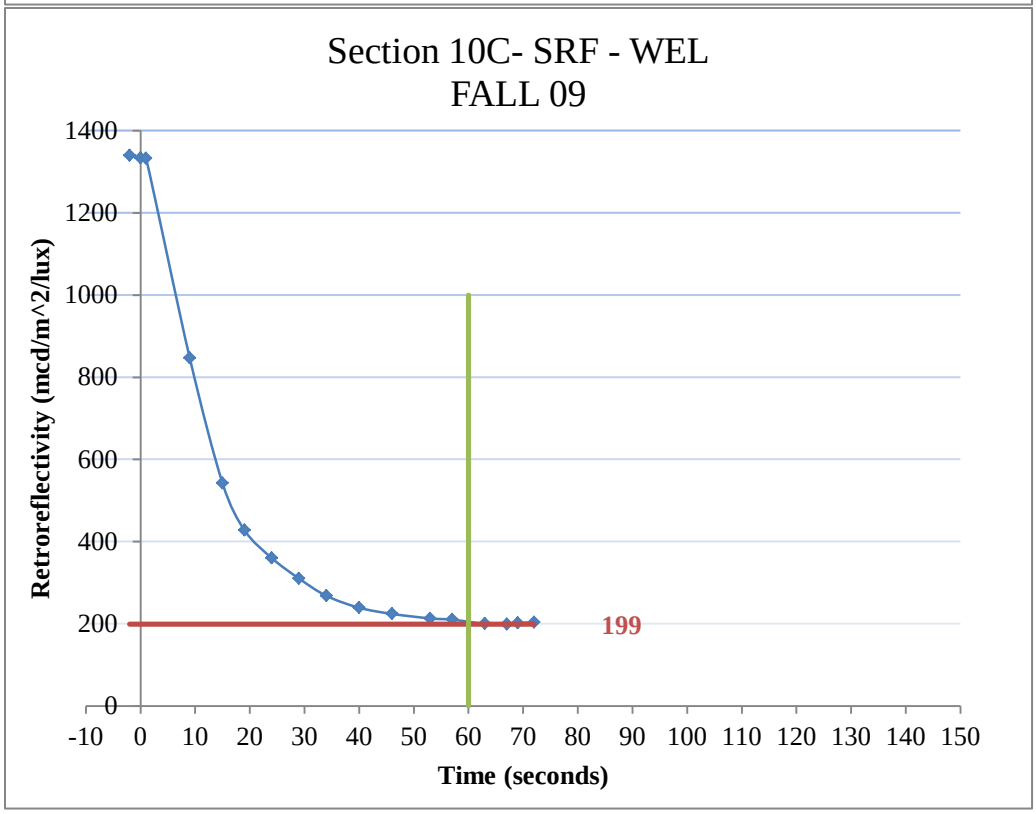

Section 16 - SRF - YEL
FALL 09
Retroreflectivity (mcd/m^2/lux)
500
450
400
350
300
250
200
150
100
50
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Time (seconds)
43

White Edge Line

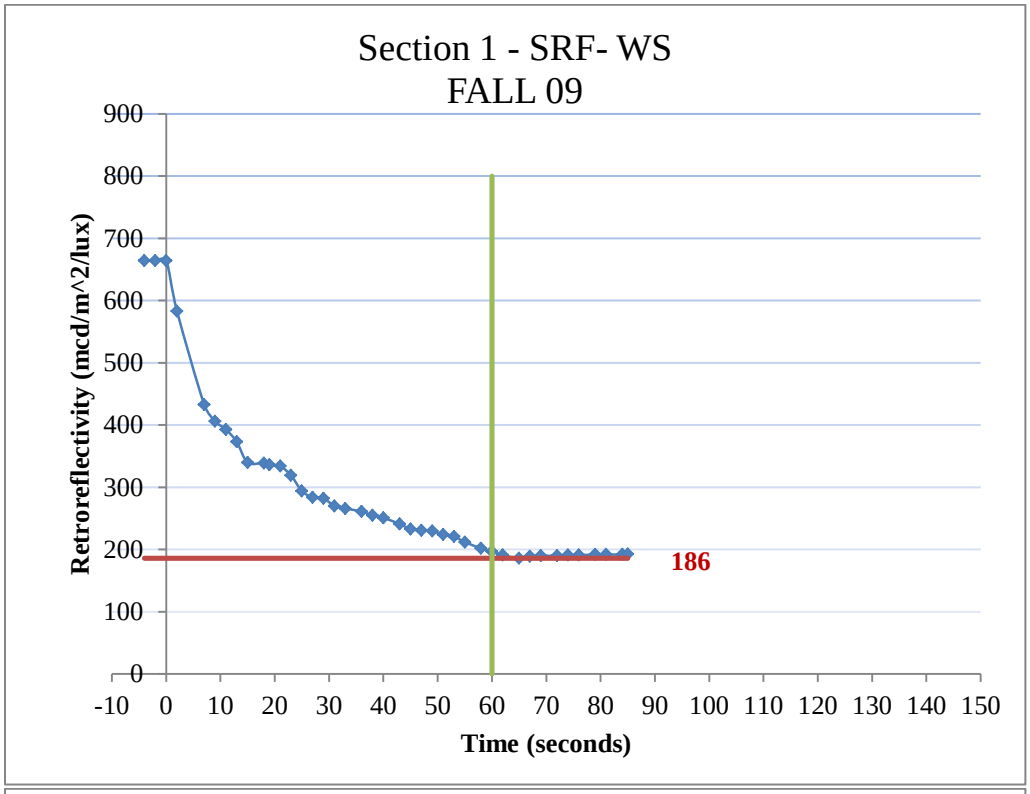


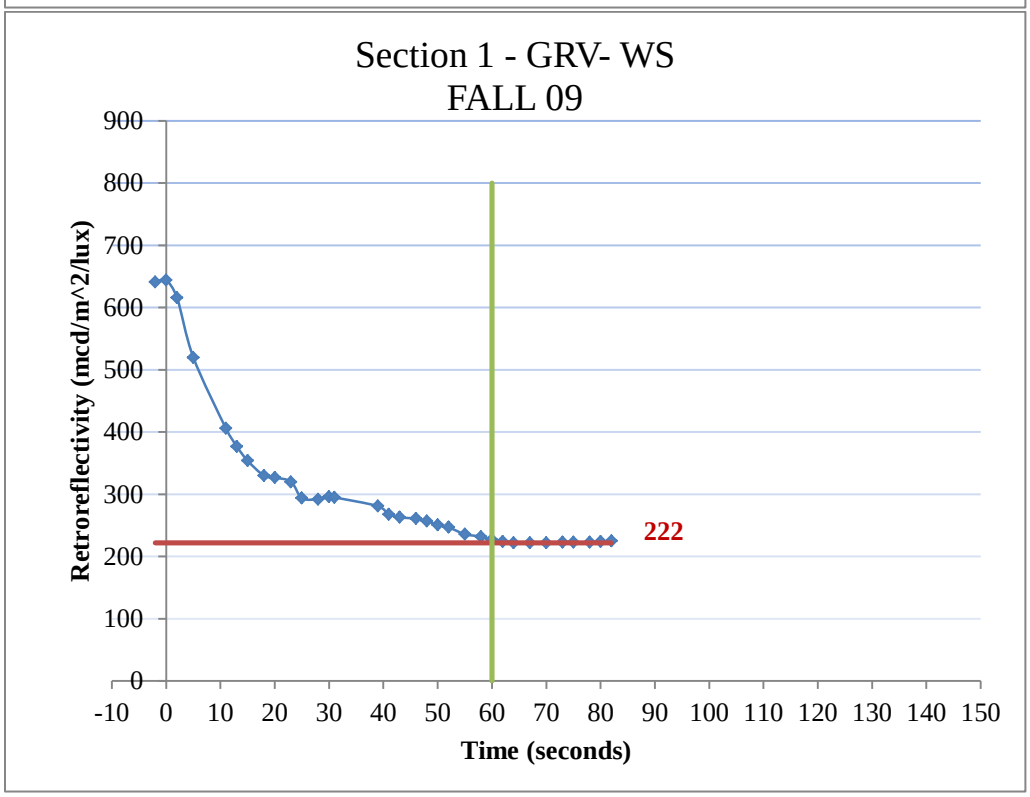


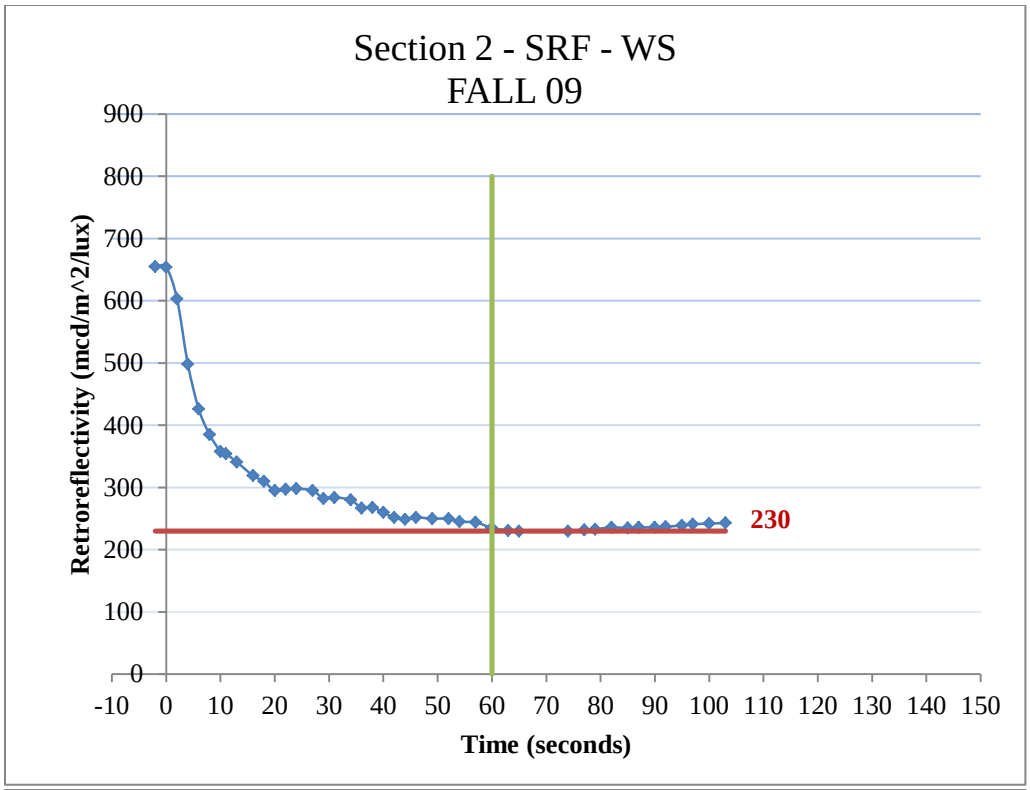

Section 10C- GRV - WEL
FALL 09
Retroreflectivity (mcd/m^2/lux)
1400
1200
1000
800
600
400
200
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Time (seconds)
266

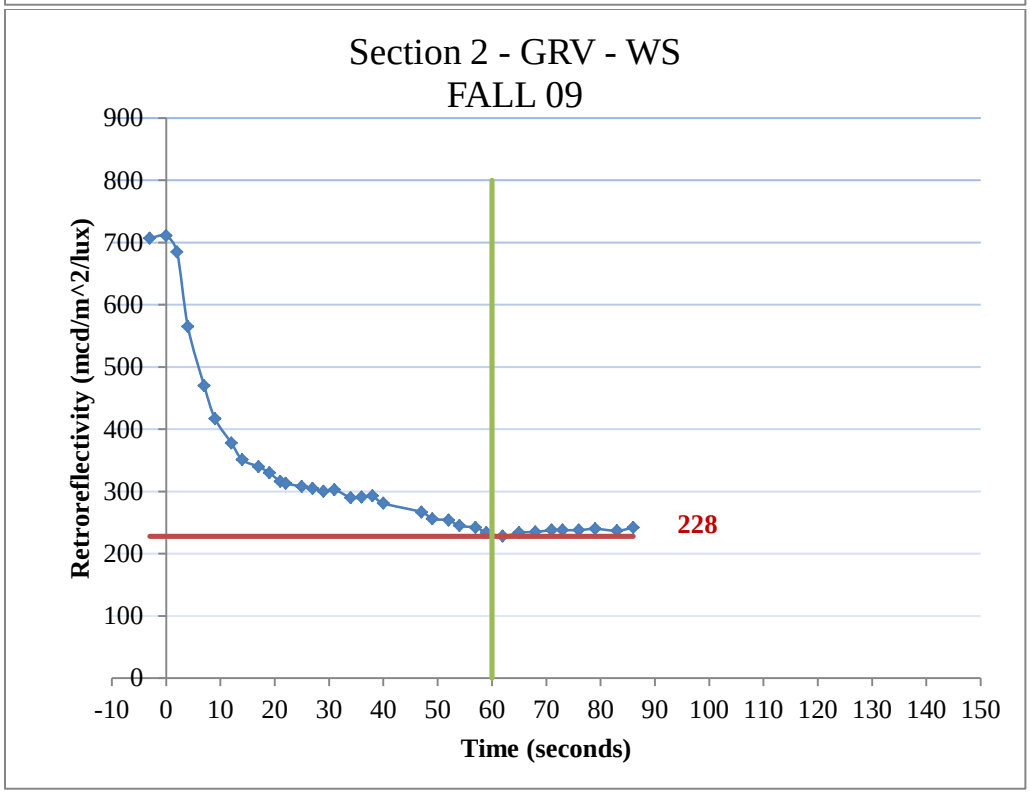

Section 10C- SRF - WEL
FALL 09
Retroreflectivity (mcd/m^2/lux)
1400
1200
1000
800
600
400
200
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Time (seconds)
199

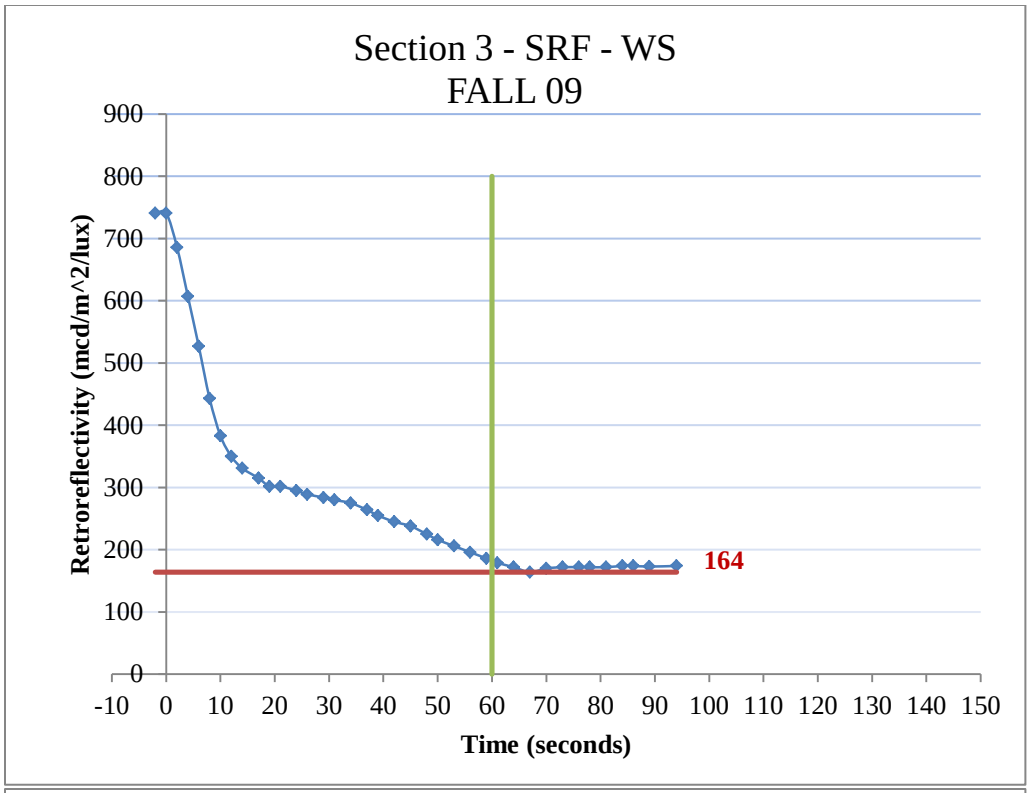
White Skip Line

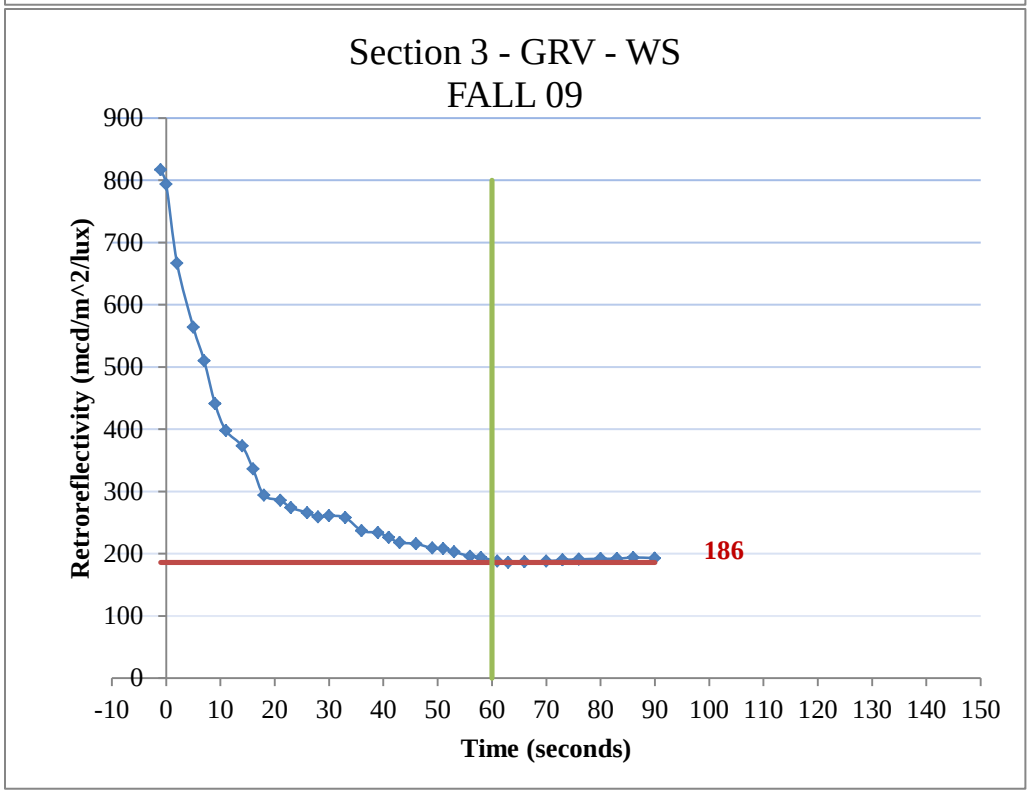


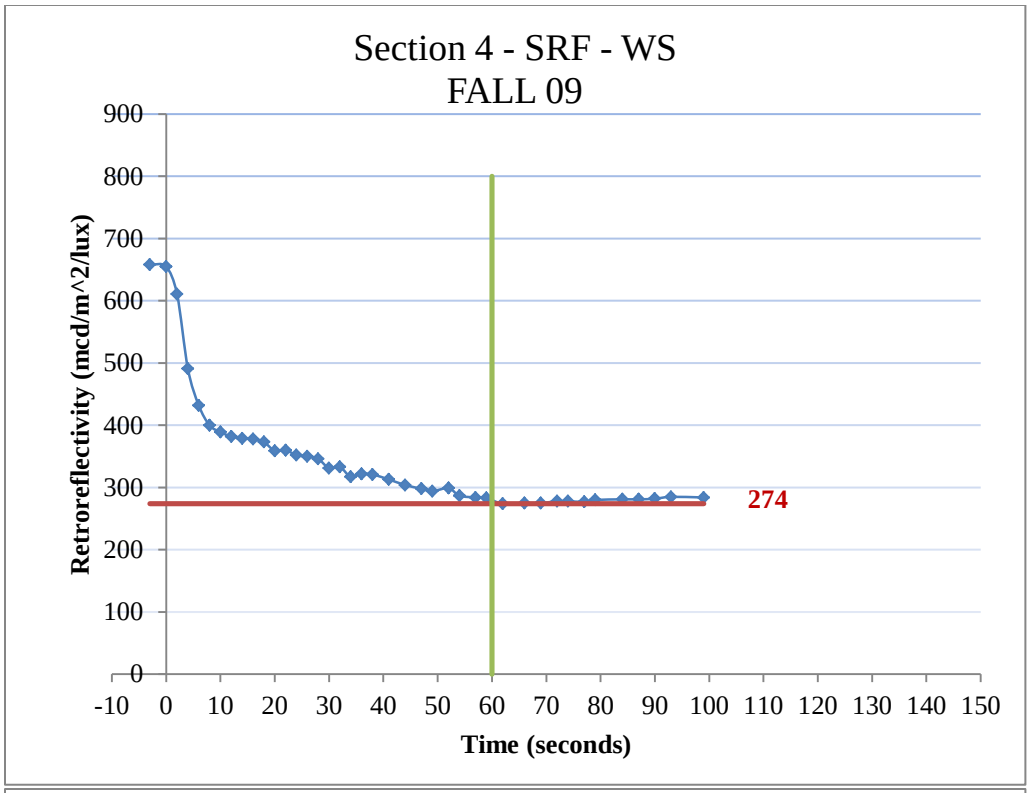


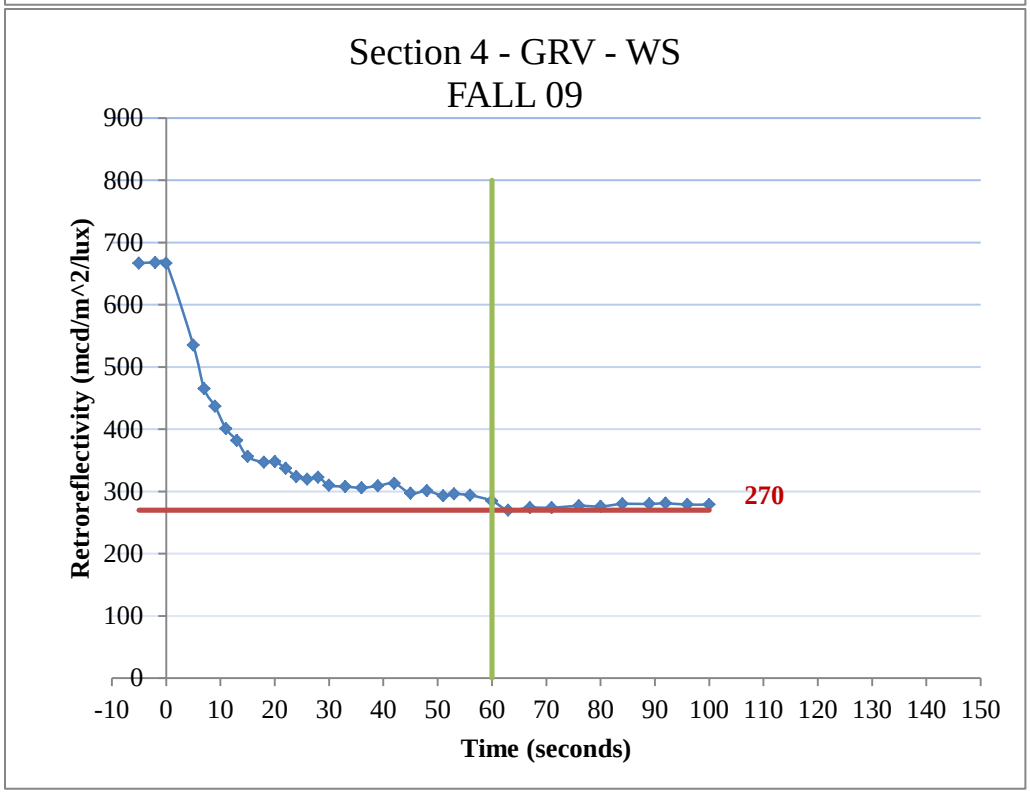

Section 2 - SRF - WS
FALL 09
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Time (seconds)
230

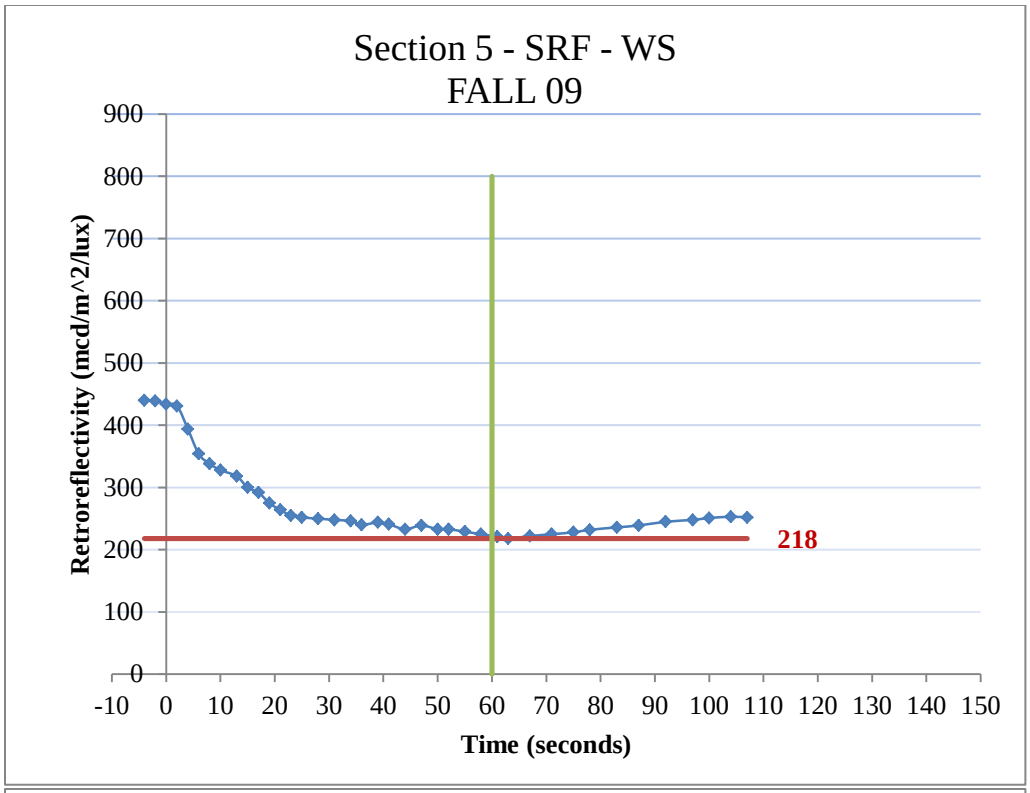

Section 2 - GRV - WS
FALL 09
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Time (seconds)
228

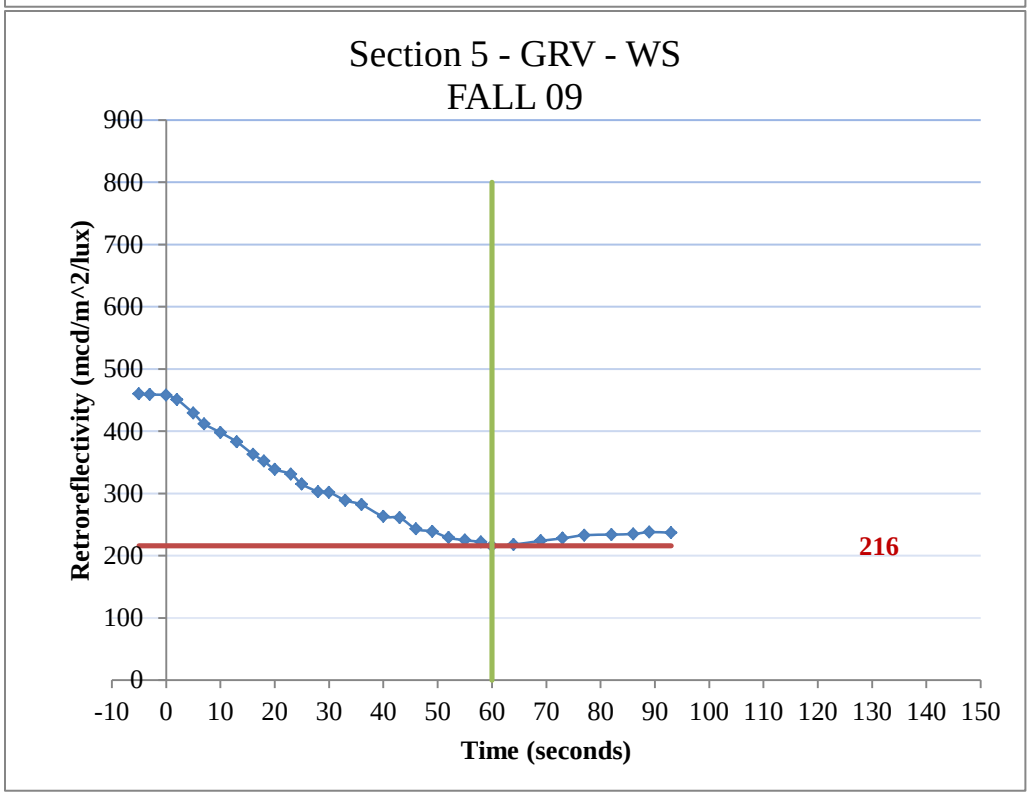

Section 3 - SRF - WS
FALL 09
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Time (seconds)
164

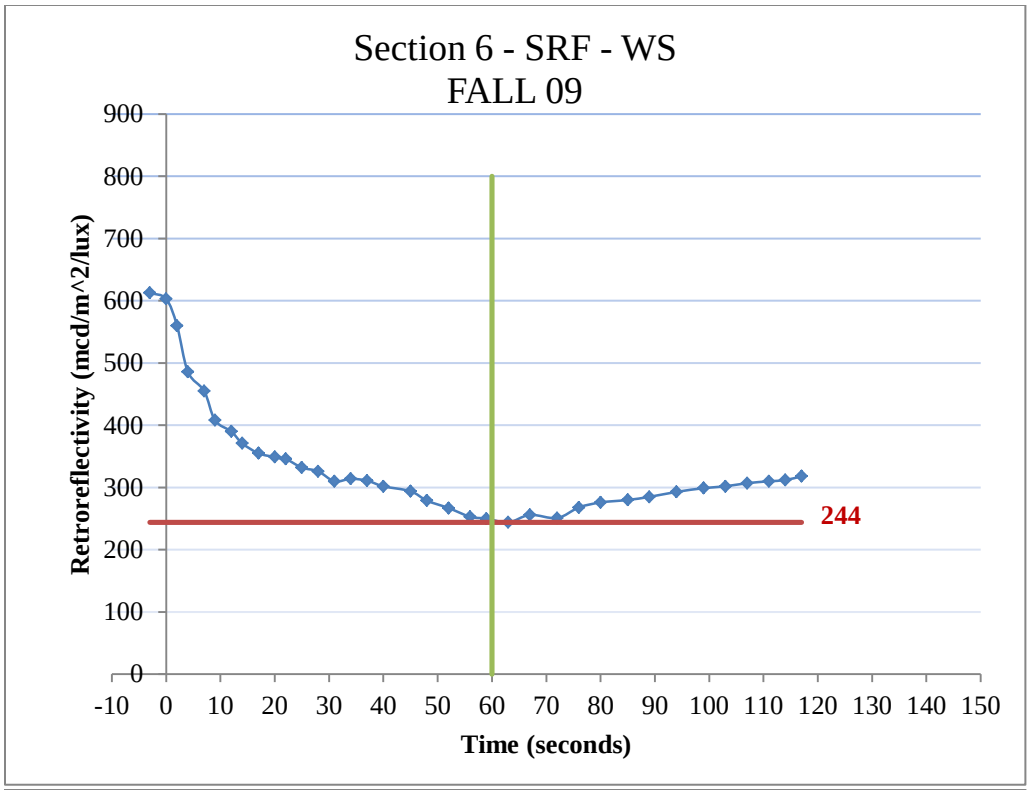

Section 3 - GRV - WS
FALL 09
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Time (seconds)
186

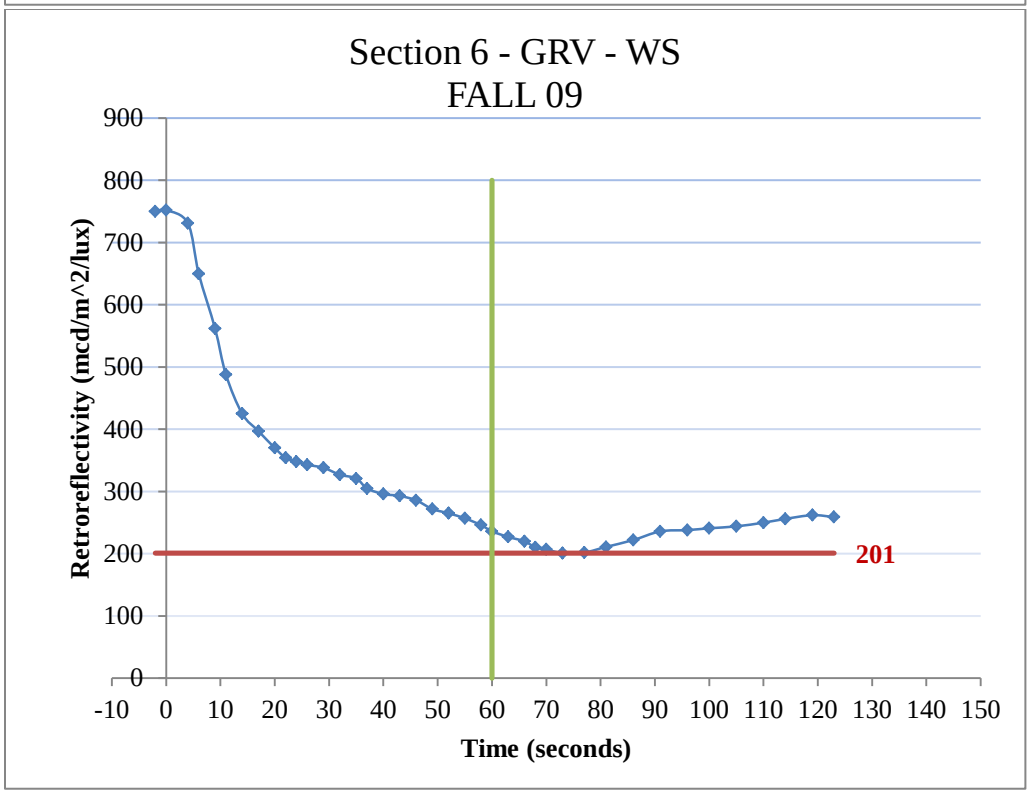

Section 4 - SRF - WS
FALL 09
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Time (seconds)
274

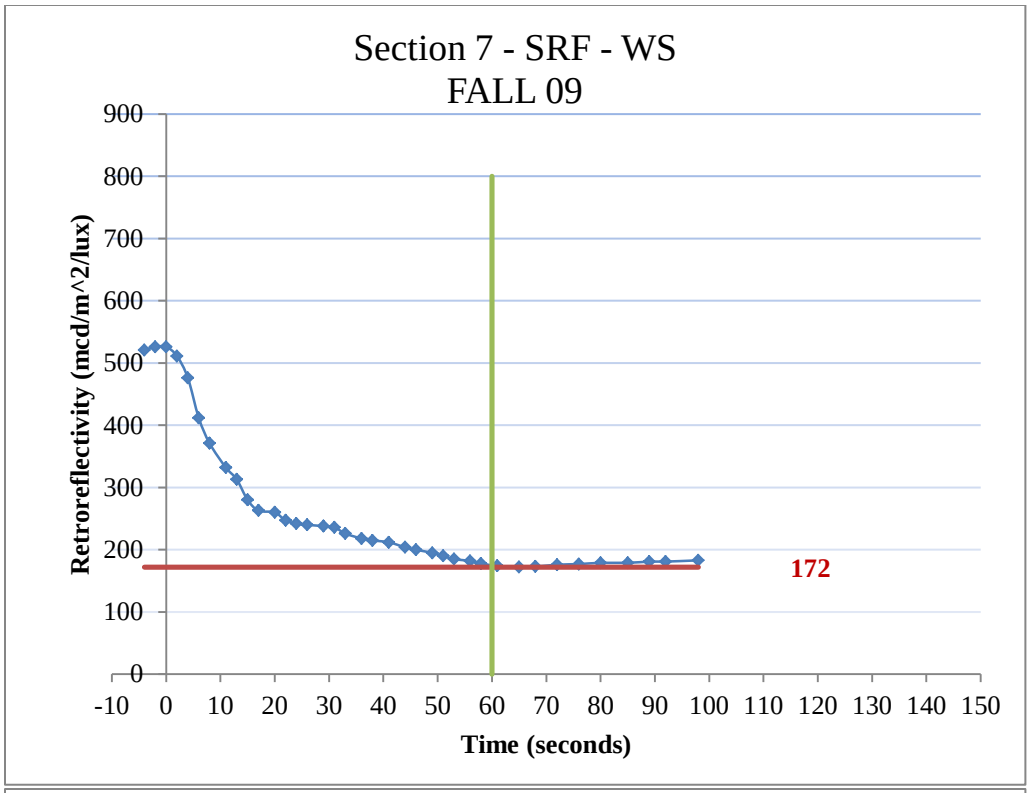

Section 4 - GRV - WS
FALL 09
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Time (seconds)
270

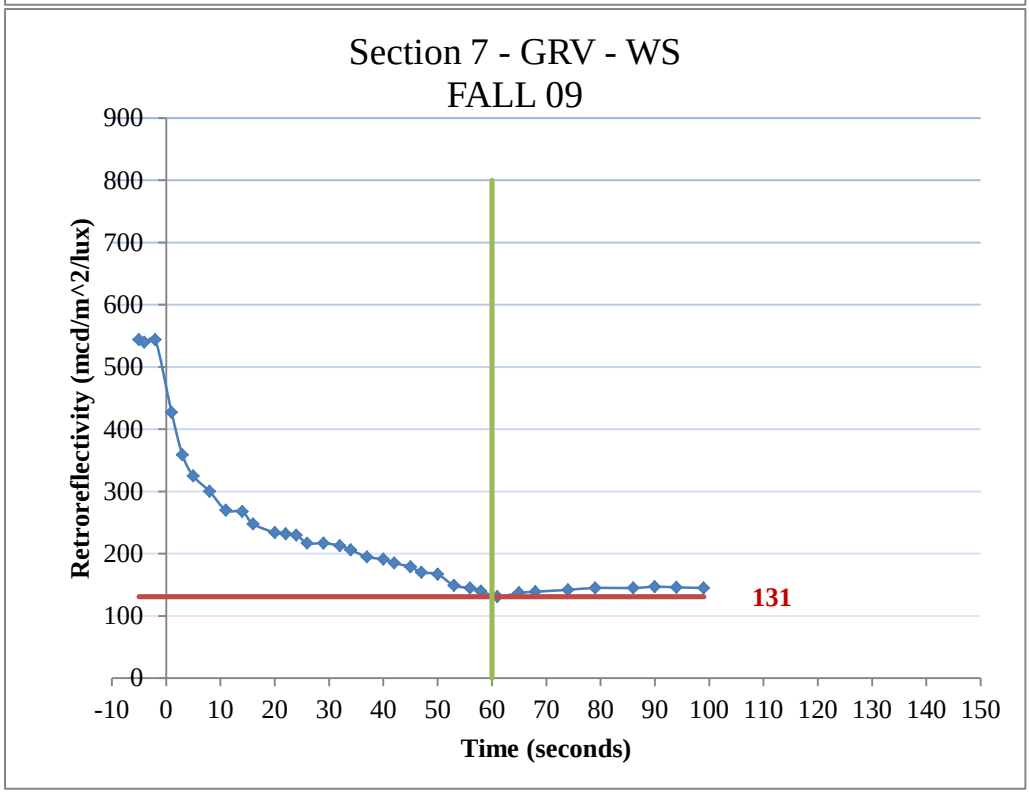

Section 5 - SRF - WS
FALL 09
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Time (seconds)
218

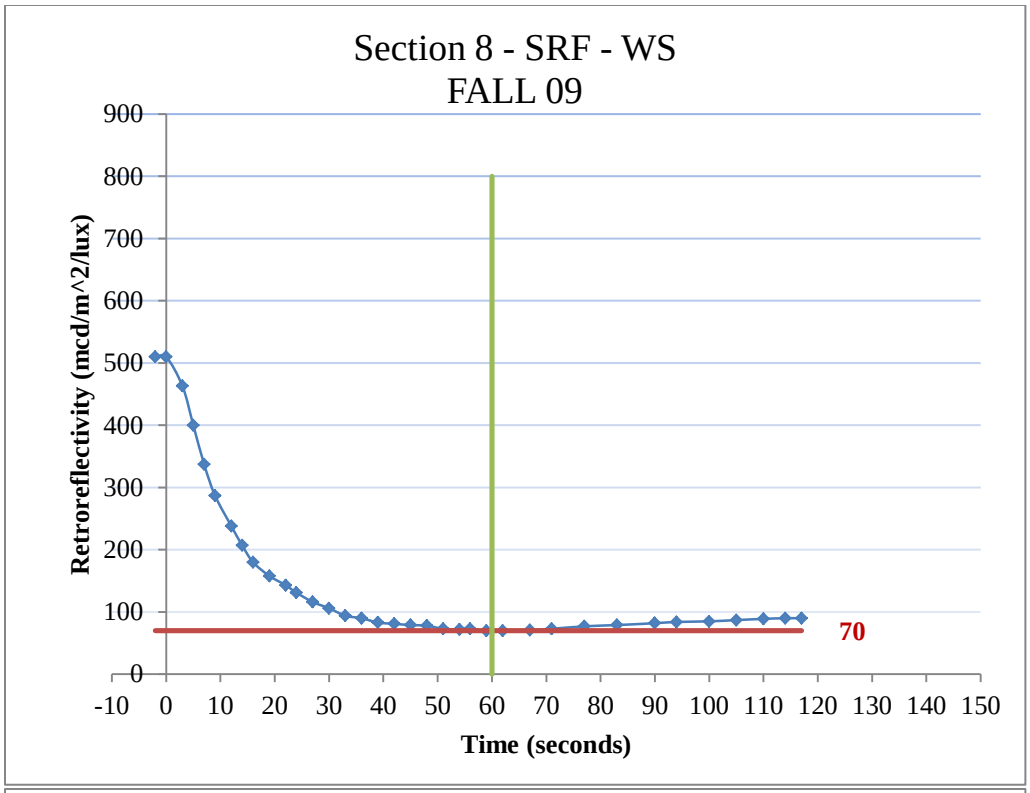

Section 5 - GRV - WS
FALL 09
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Time (seconds)
216

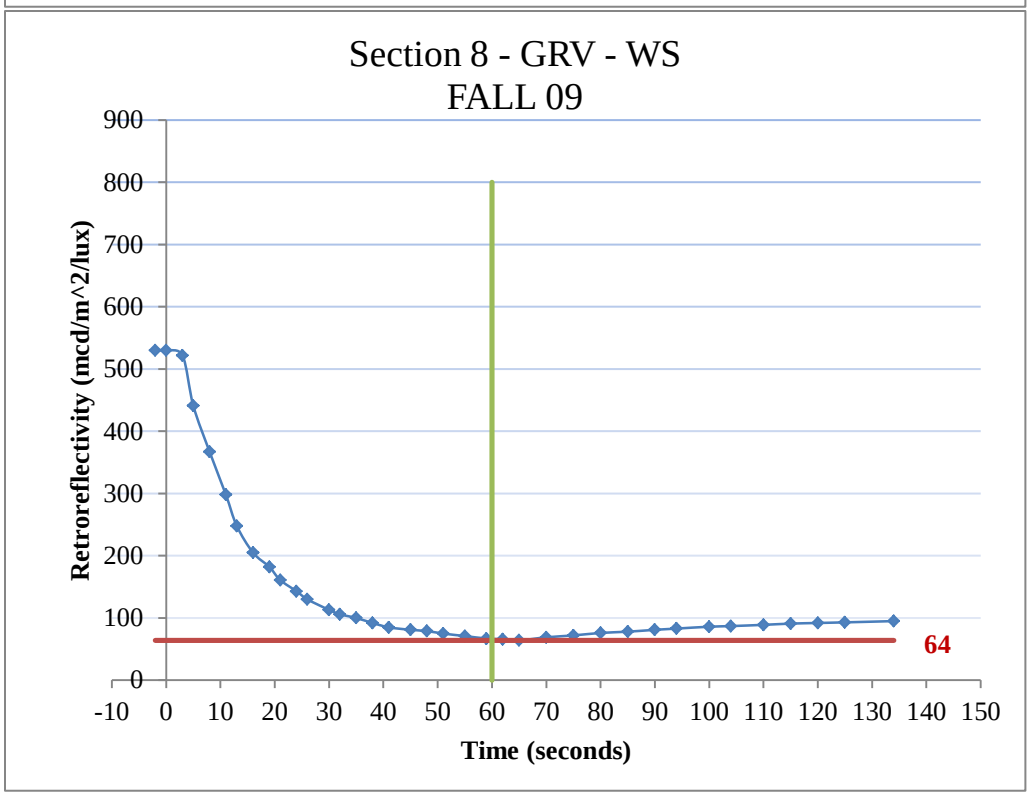

Section 6 - SRF - WS
FALL 09
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Time (seconds)
244

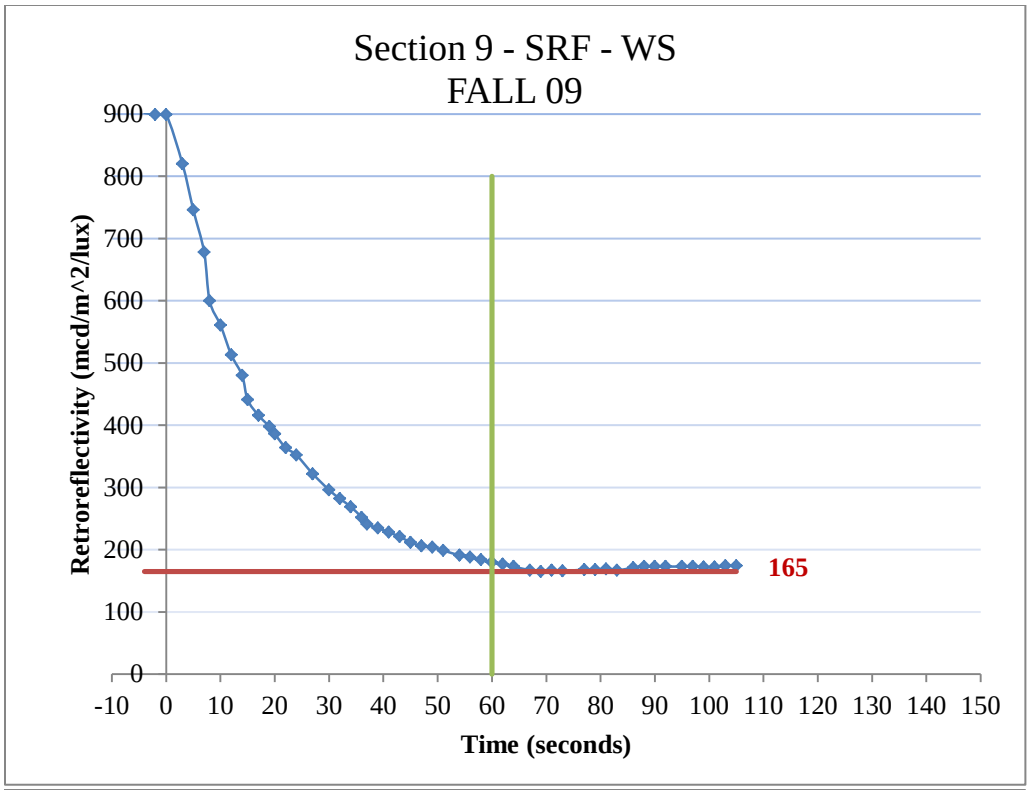

Section 6 - GRV - WS
FALL 09
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Time (seconds)
201

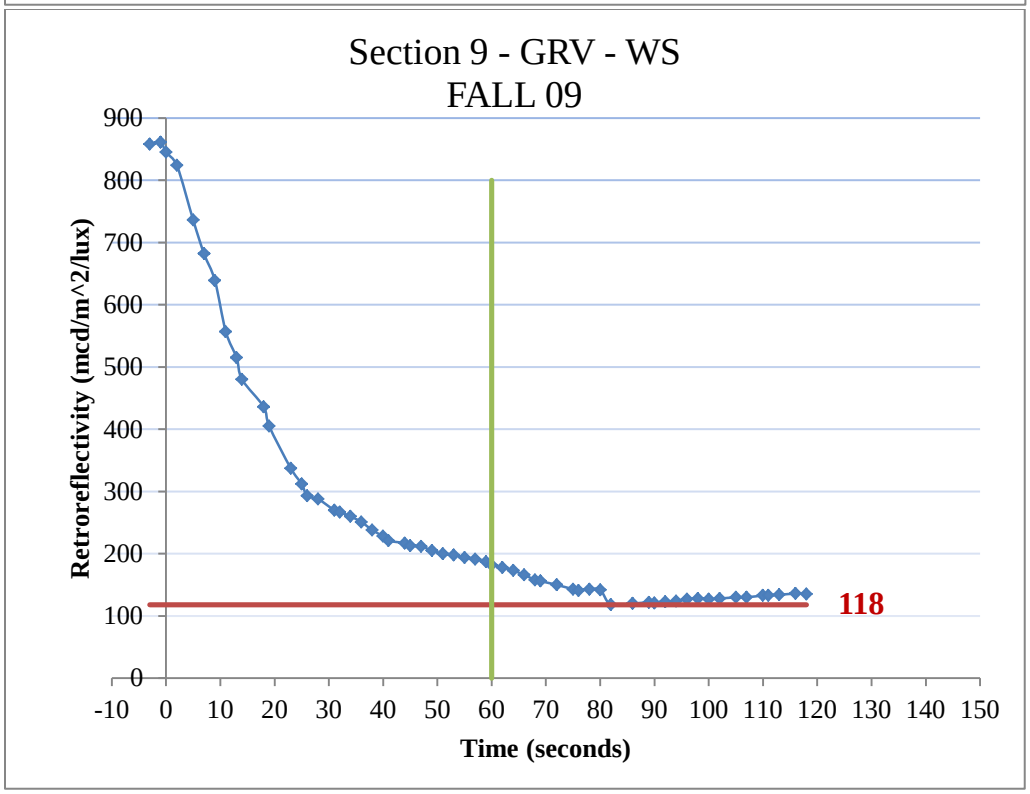

Section 7 - SRF - WS
FALL 09
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Time (seconds)
172

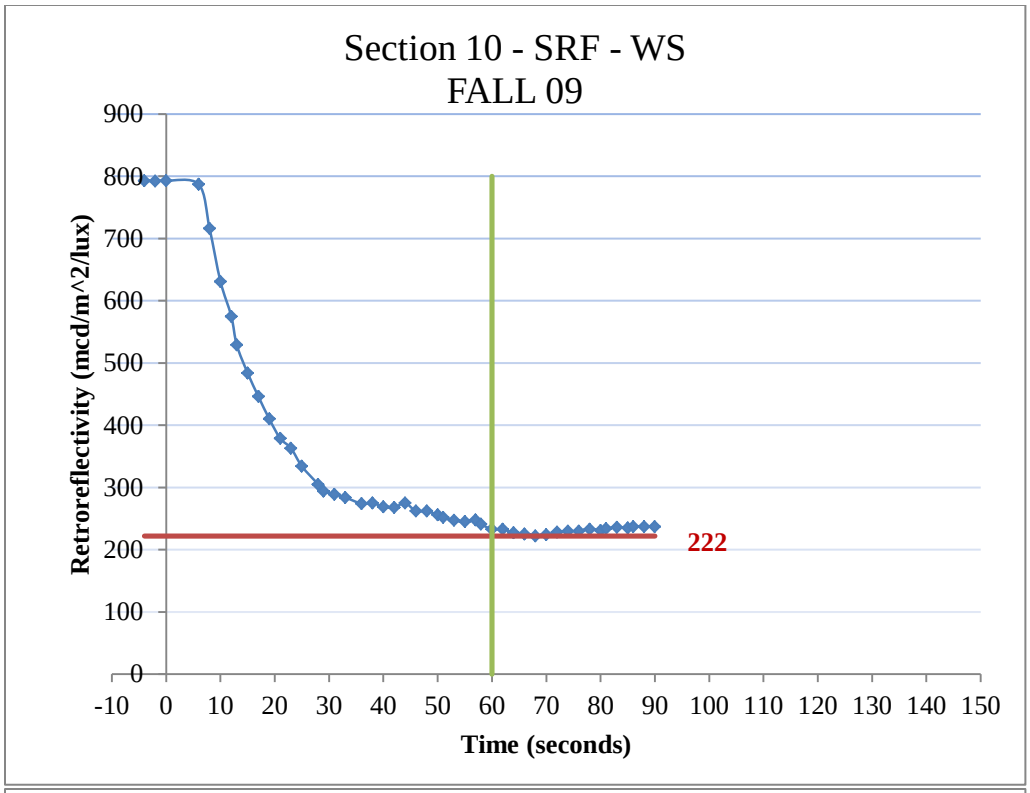

Section 7 - GRV - WS
FALL 09
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Time (seconds)
131

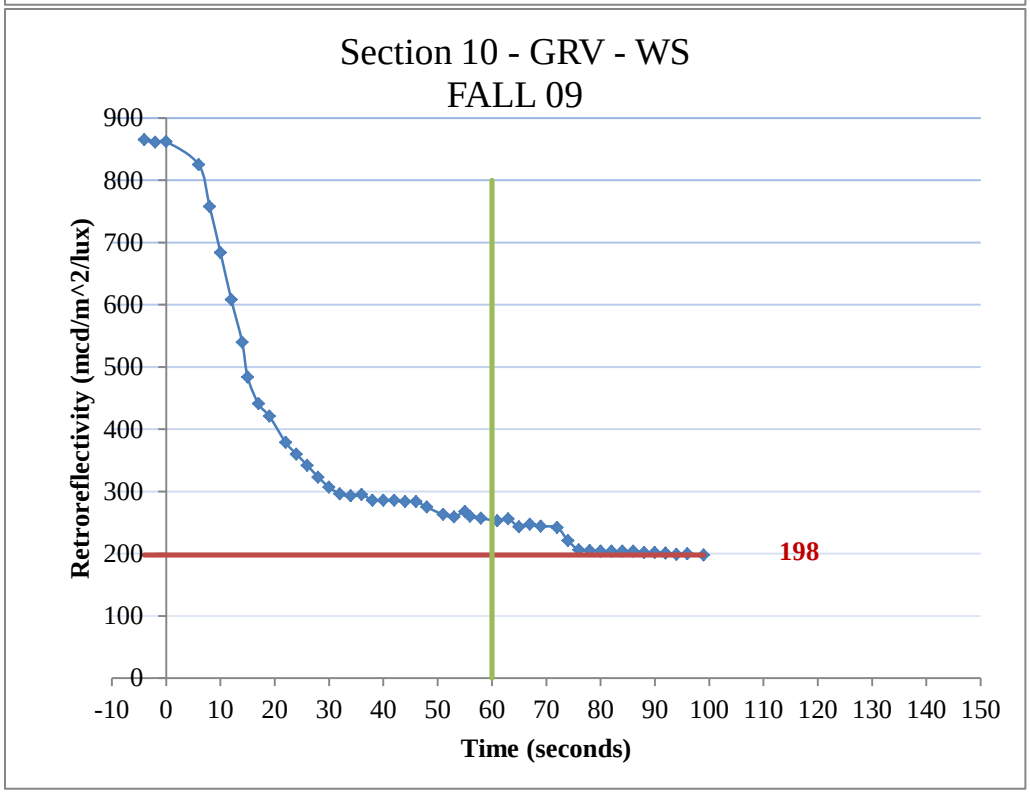

Section 8 - SRF - WS
FALL 09
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Time (seconds)
70

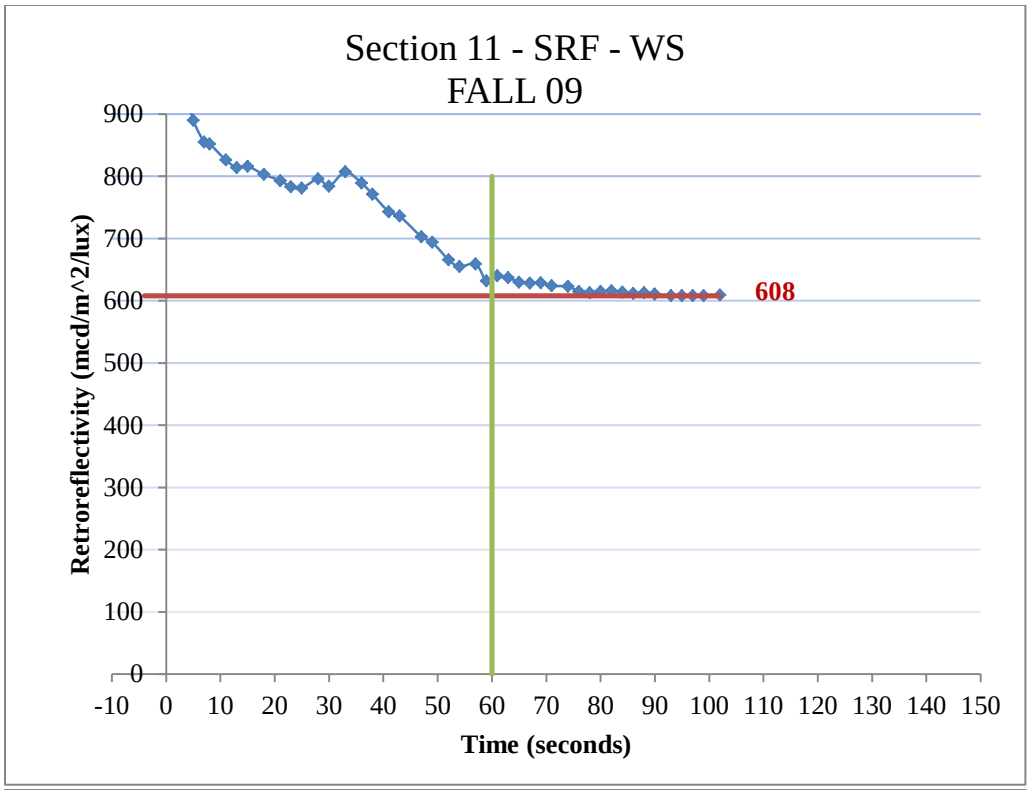

Section 8 - GRV - WS
FALL 09
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Time (seconds)
64

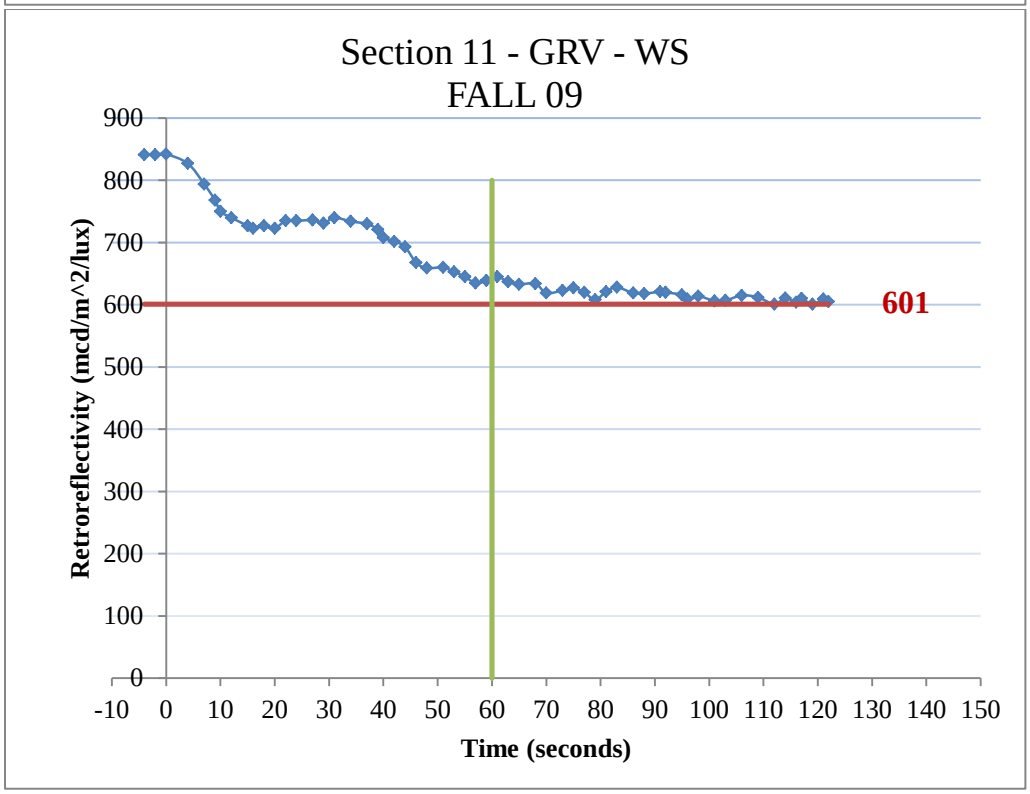

Section 9 - SRF - WS
FALL 09
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Time (seconds)
165

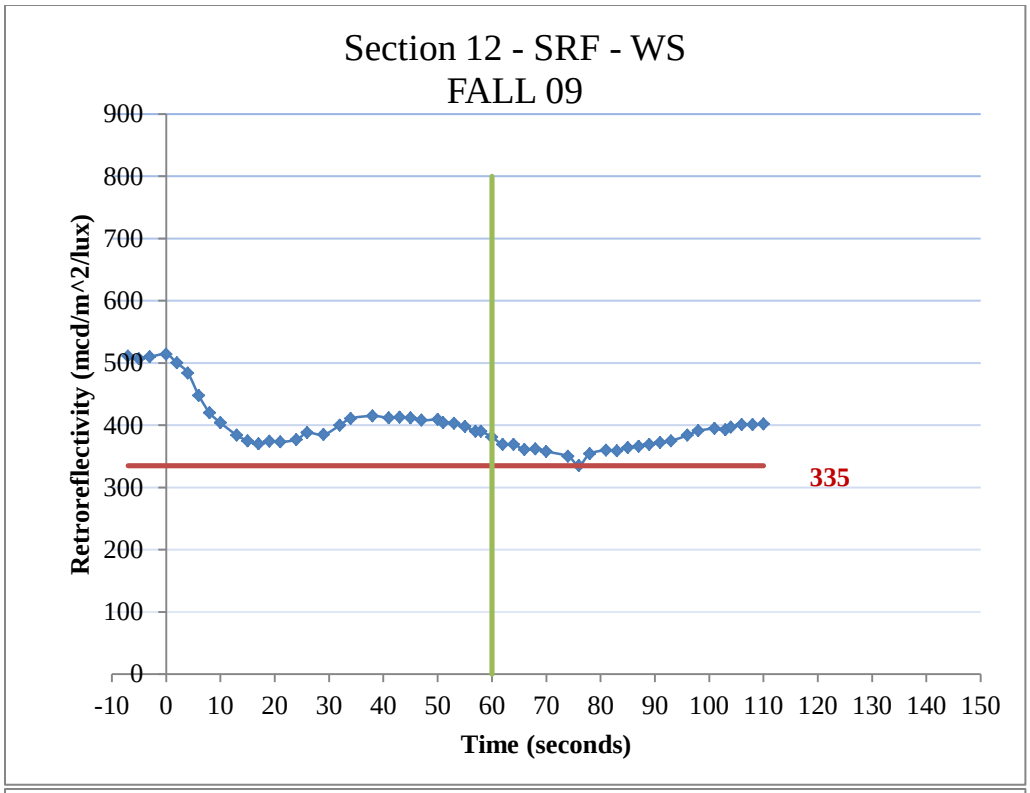

Section 9 - GRV - WS
FALL 09
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Time (seconds)
118

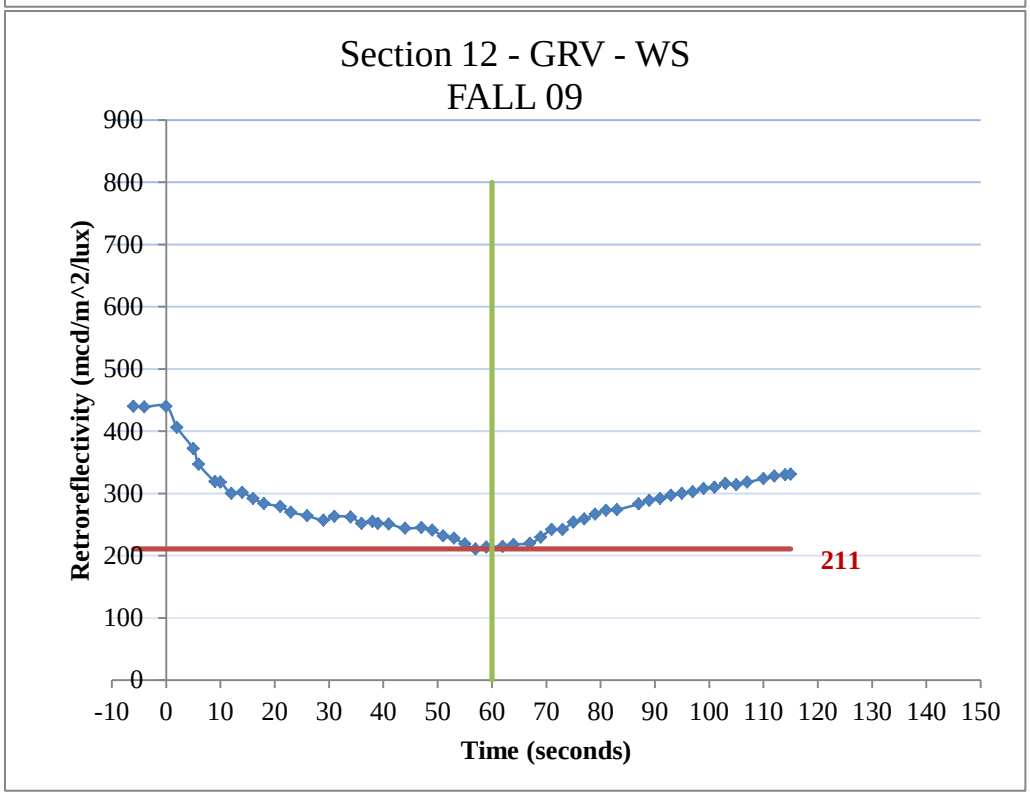

Section 10 - SRF - WS
FALL 09
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Time (seconds)
222

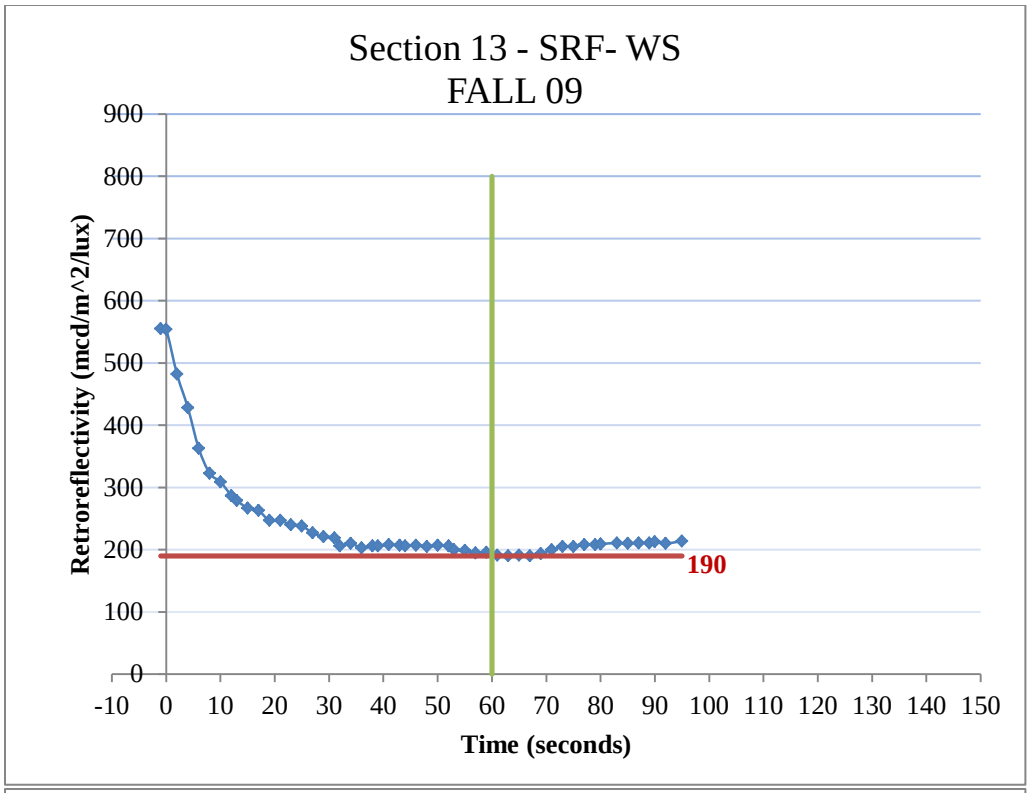

Section 10 - GRV - WS
FALL 09
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Time (seconds)
198

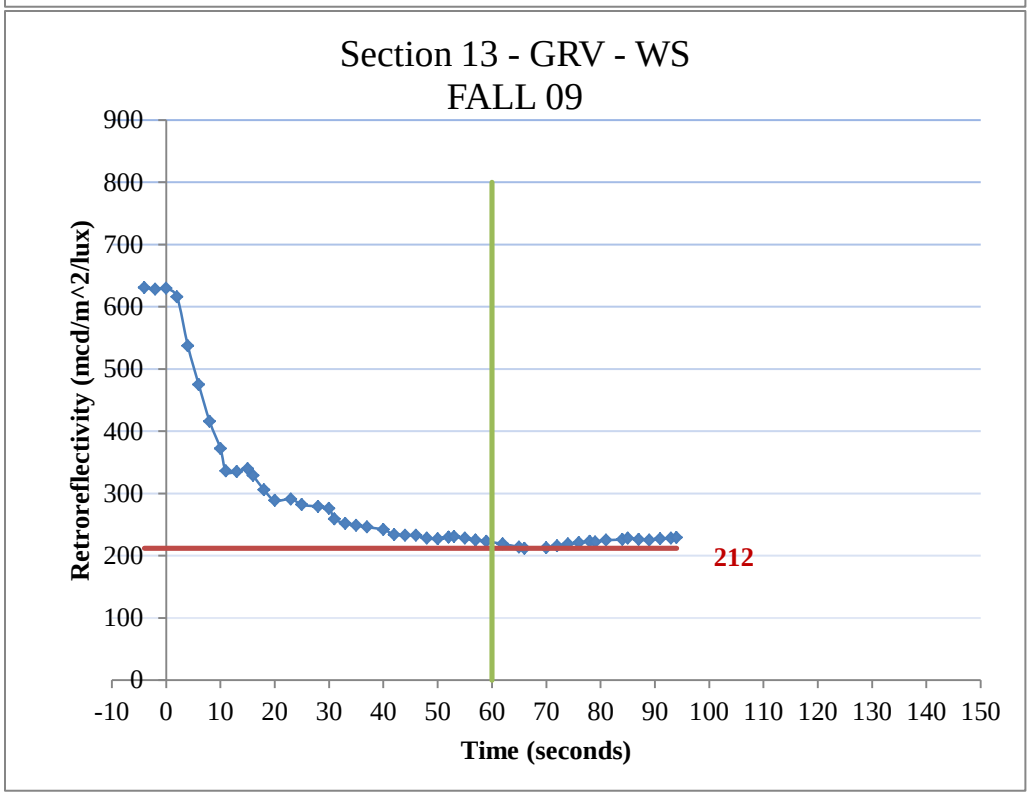

Section 11 - SRF - WS
FALL 09
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
608
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Time (seconds)

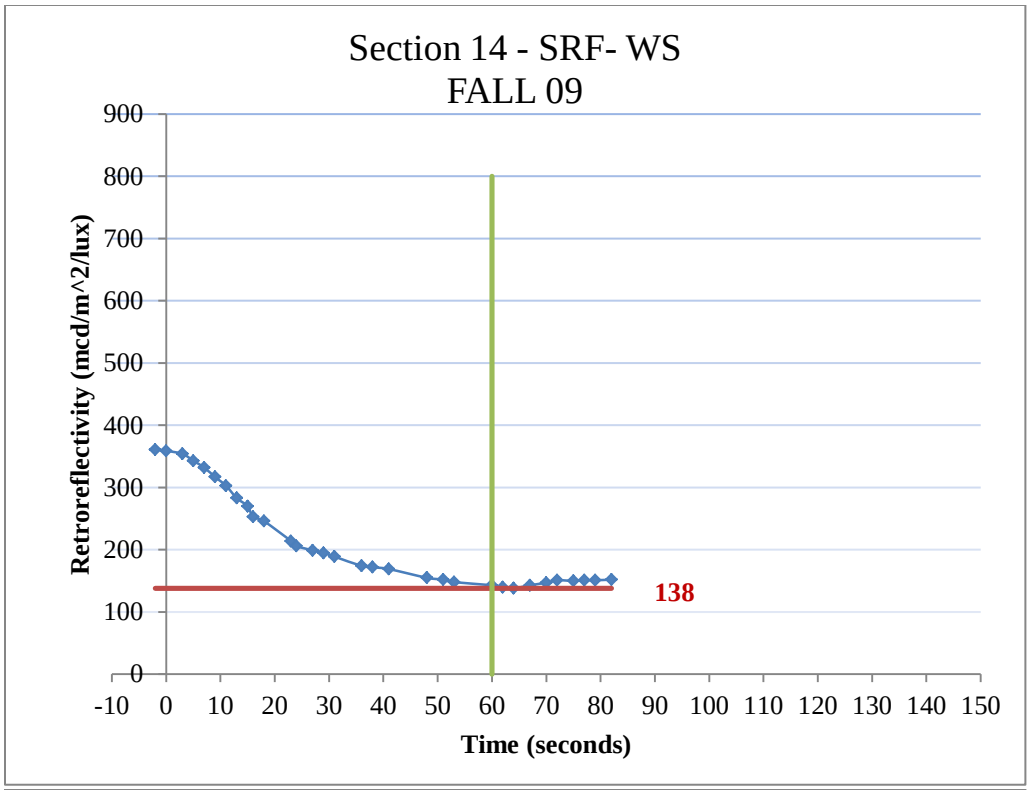

Section 11 - GRV - WS
FALL 09
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
601
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Time (seconds)

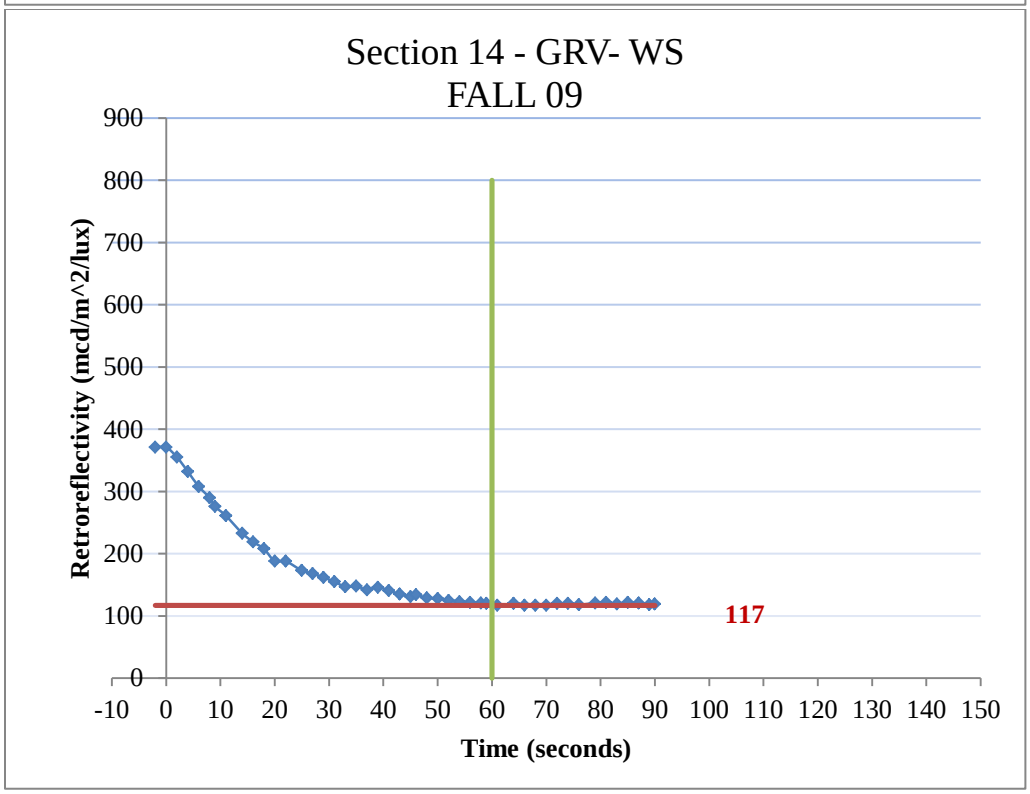

Section 12 - SRF - WS
FALL 09
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Time (seconds)
335

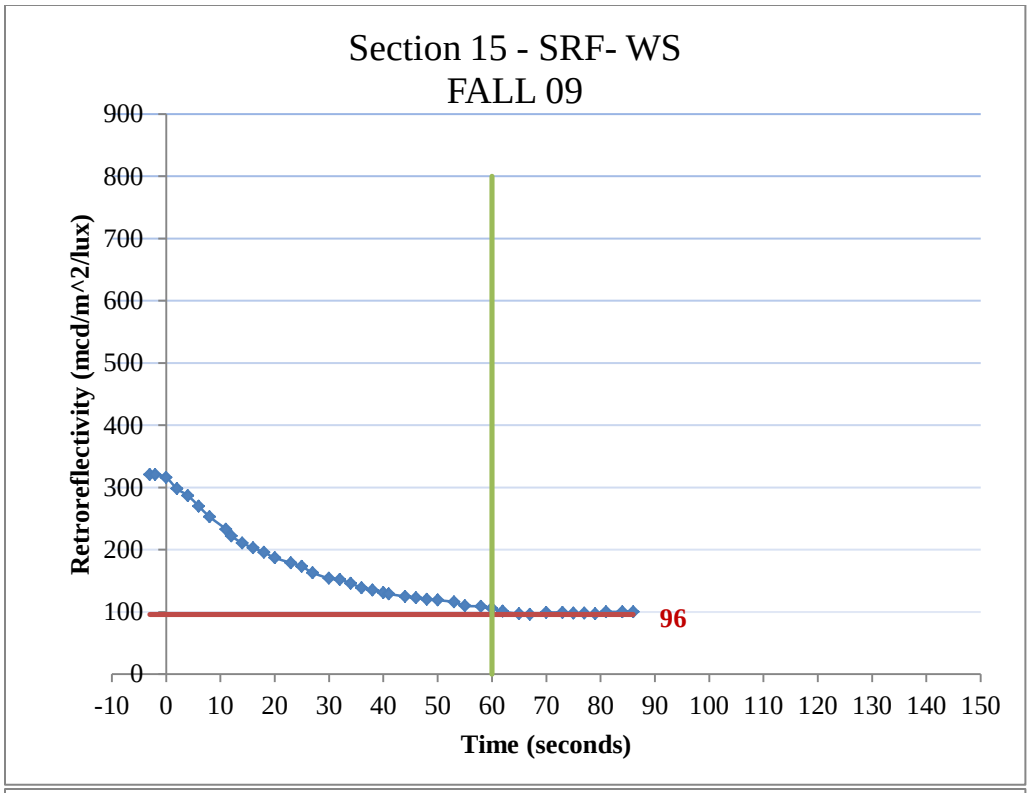

Section 12 - GRV - WS
FALL 09
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Time (seconds)
211

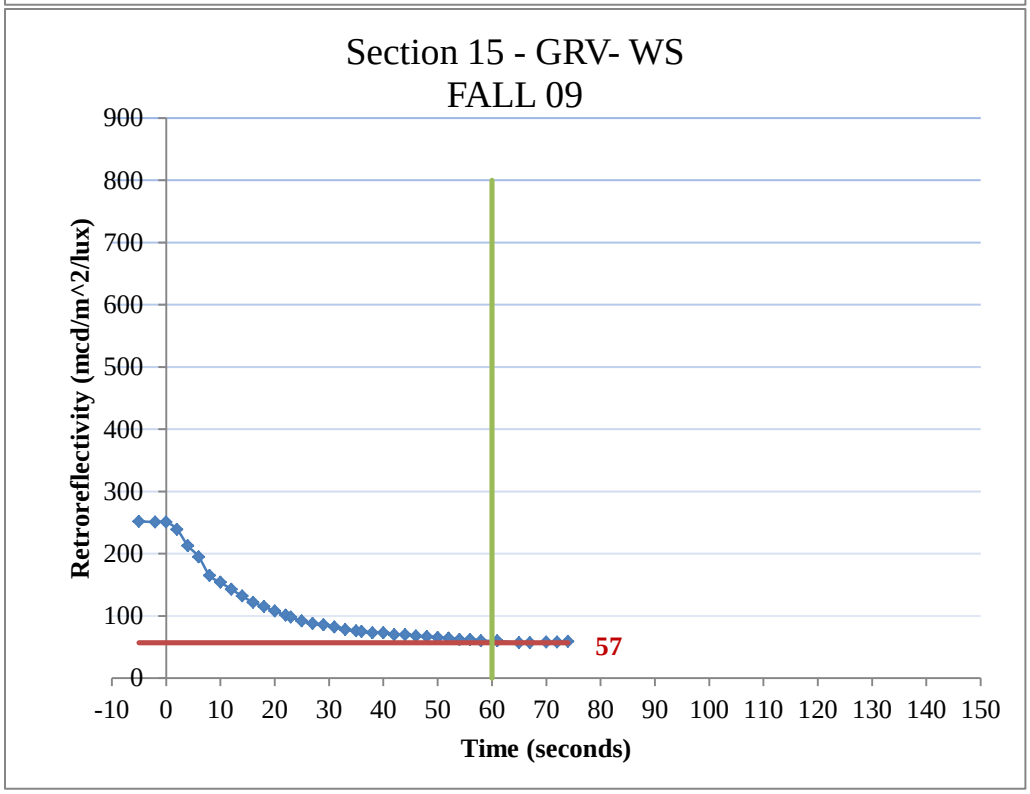

Section 13 - SRF- WS
FALL 09
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Time (seconds)
190

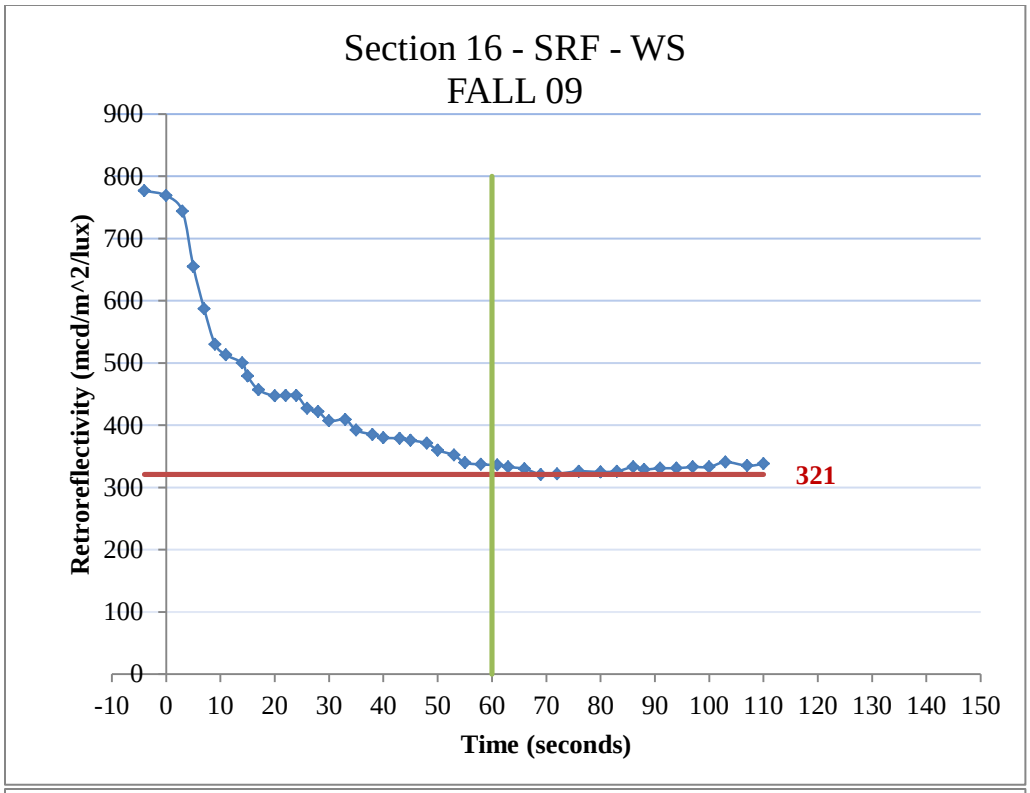

Section 13 - GRV - WS
FALL 09
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Time (seconds)
212

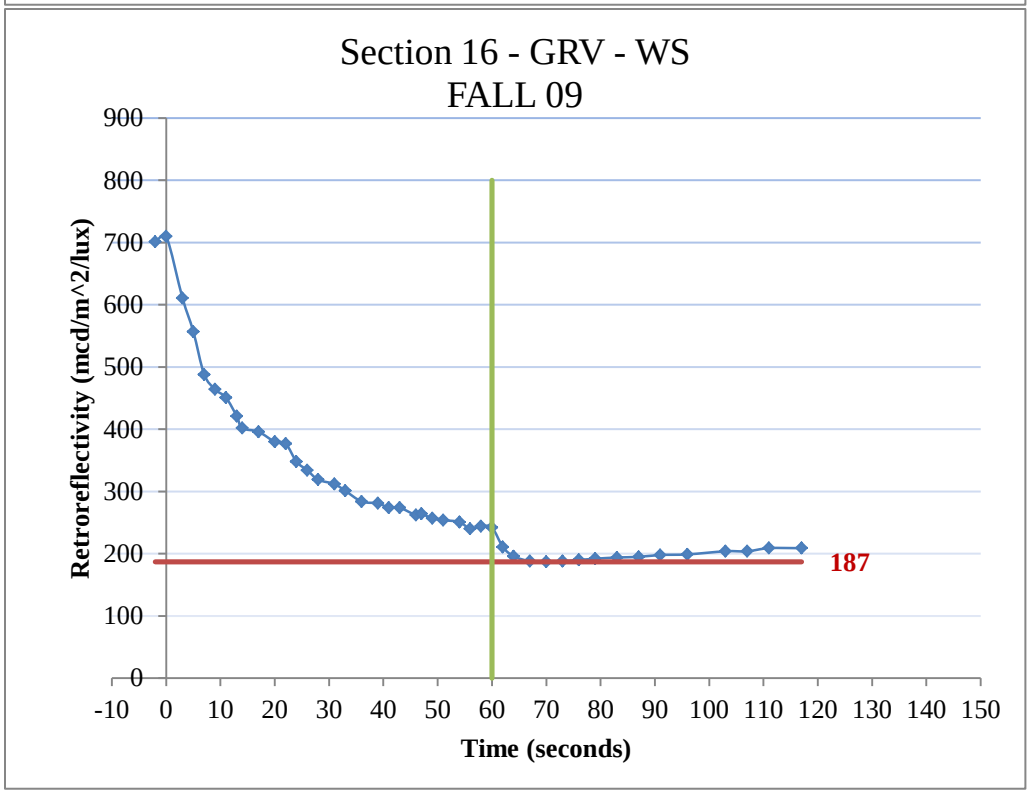

Section 14 - SRF- WS
FALL 09
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Time (seconds)
138


Section 14 - GRV- WS
FALL 09
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Time (seconds)
117

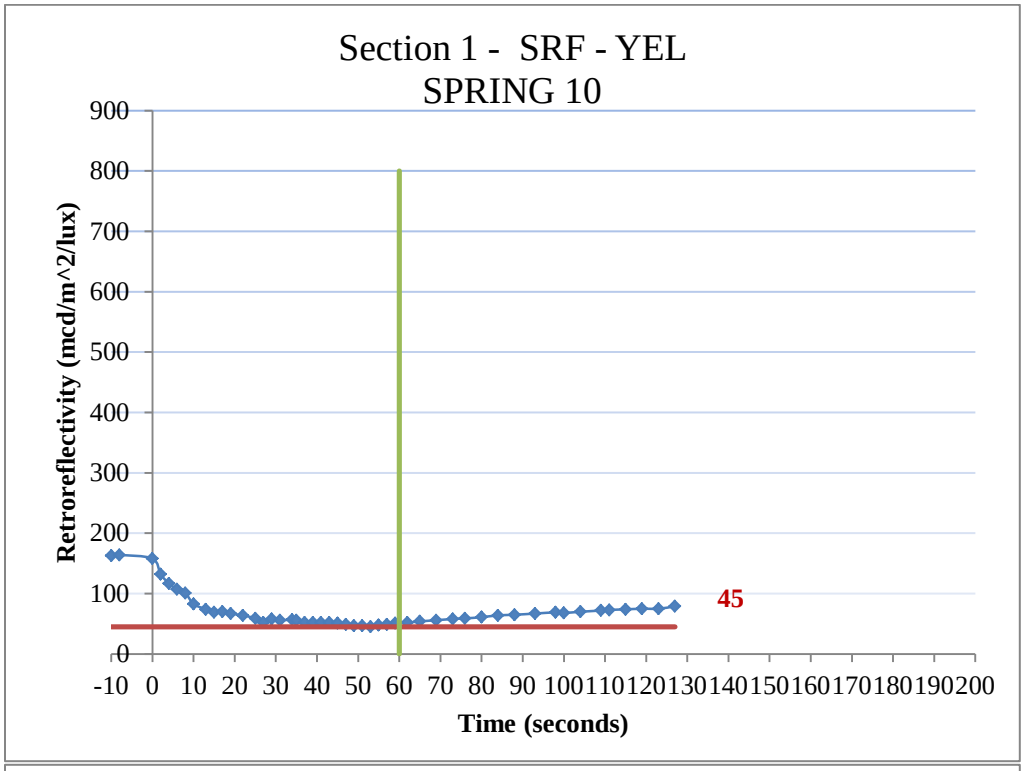

Section 15 - SRF- WS
FALL 09
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Time (seconds)
96

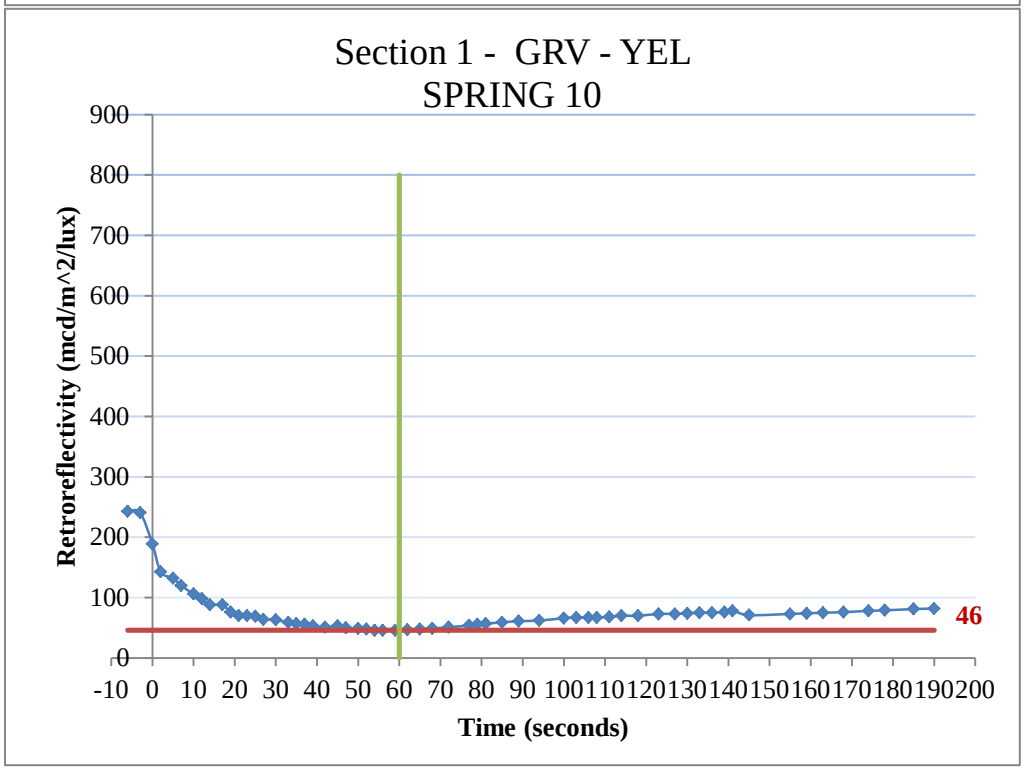

Section 15 - GRV- WS
FALL 09
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Time (seconds)
57

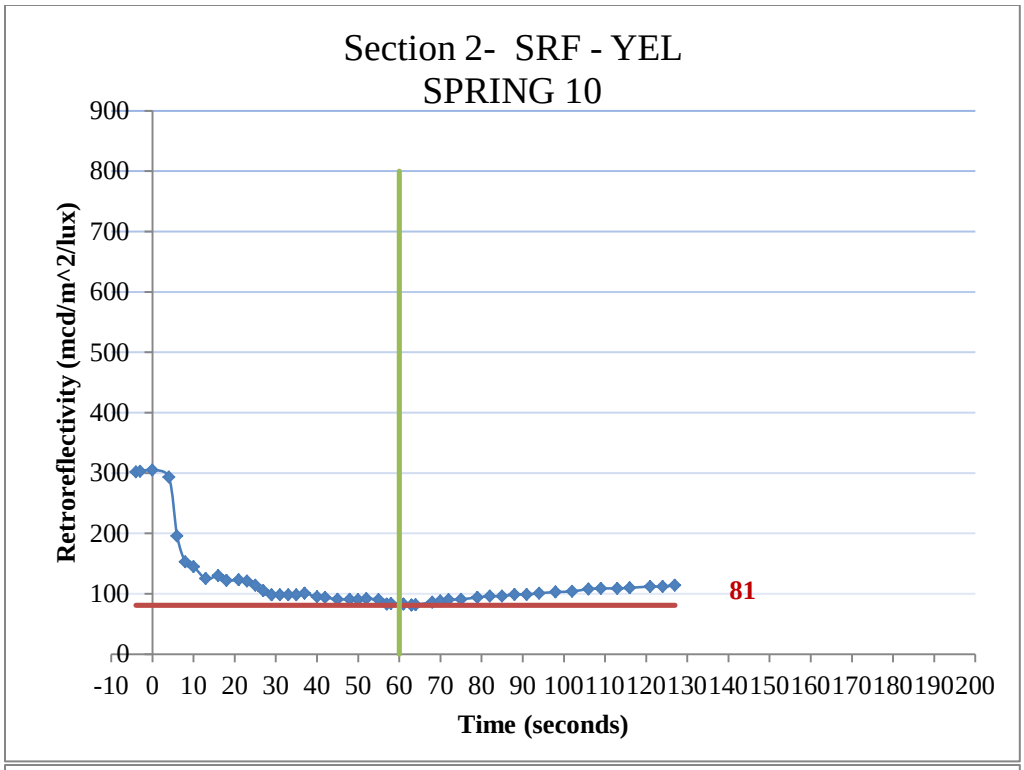

Section 16 - SRF - WS
FALL 09
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Time (seconds)
321

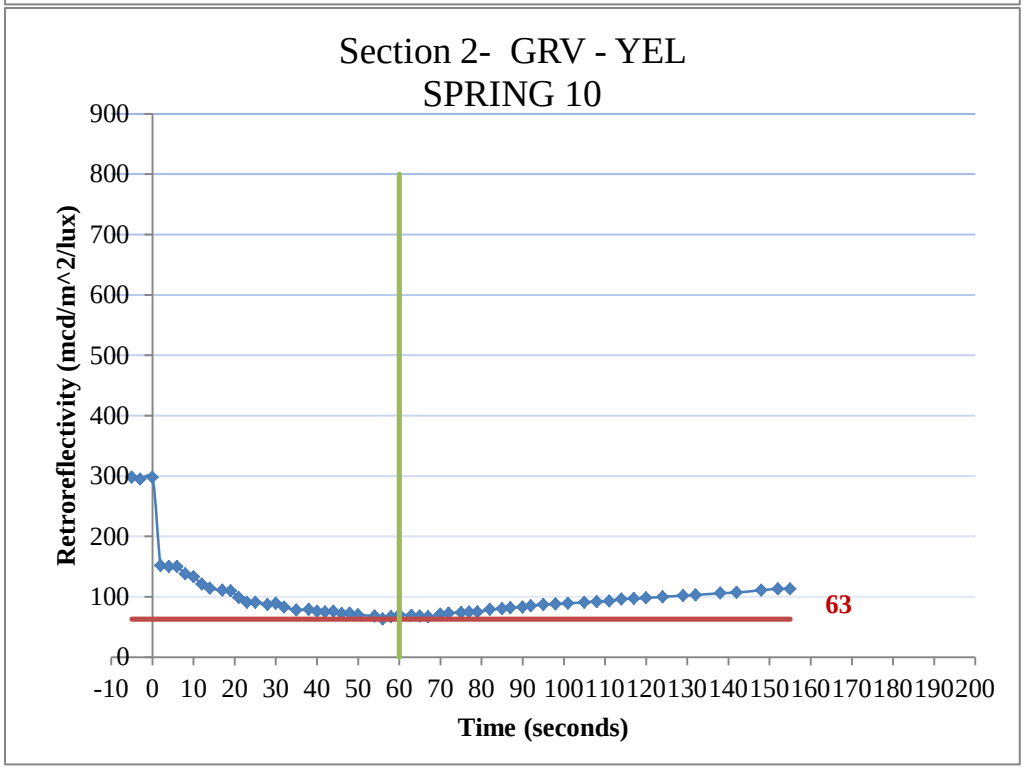

Section 16 - GRV - WS
FALL 09
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Time (seconds)
187

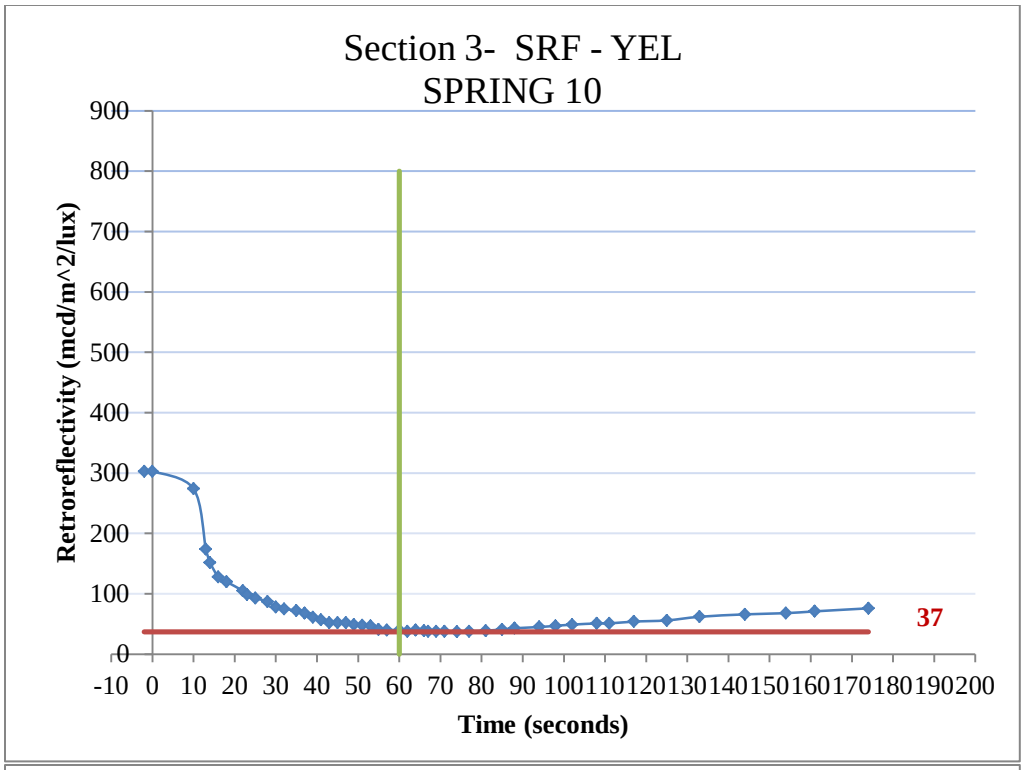
Yellow Edge Line

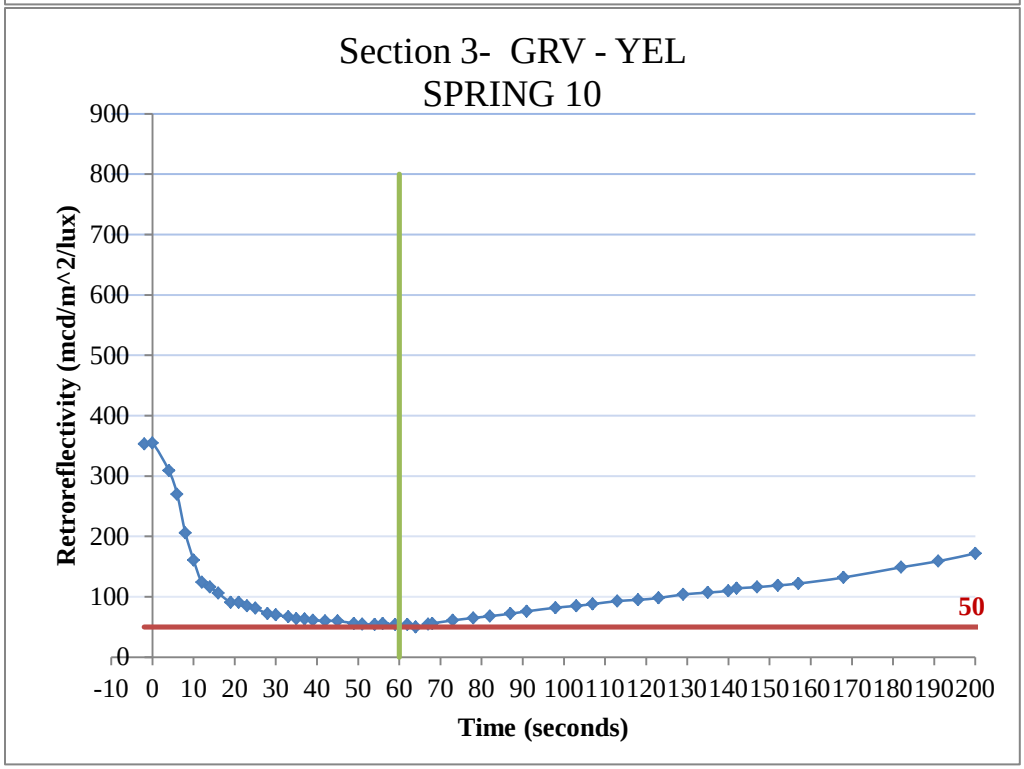


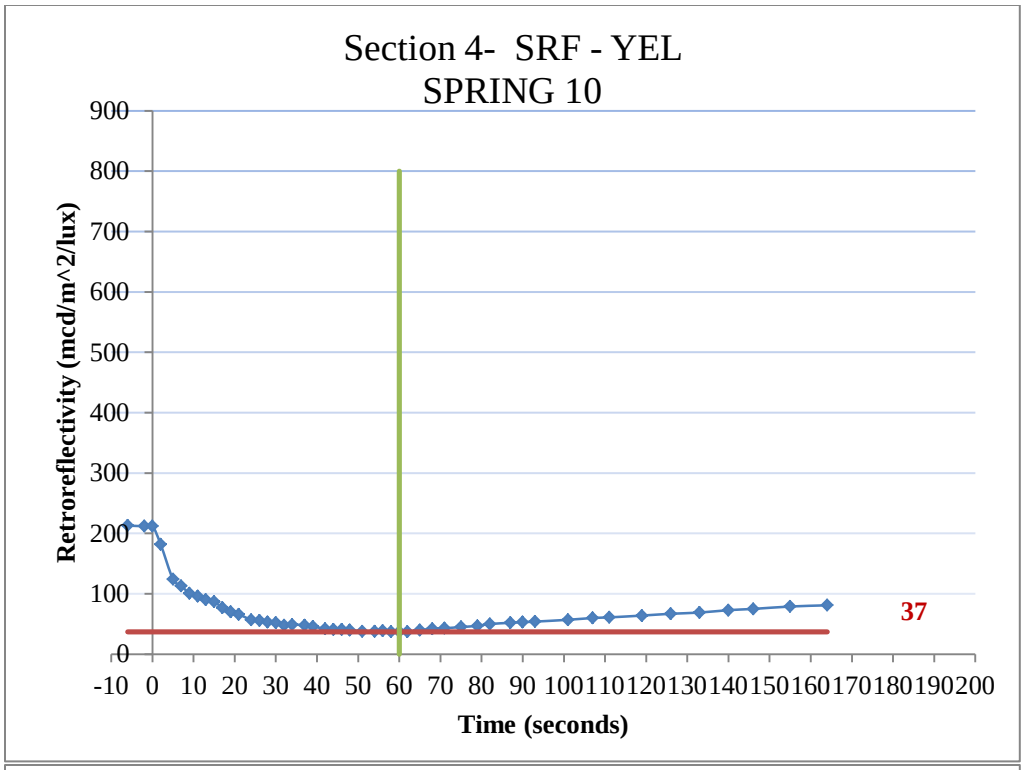


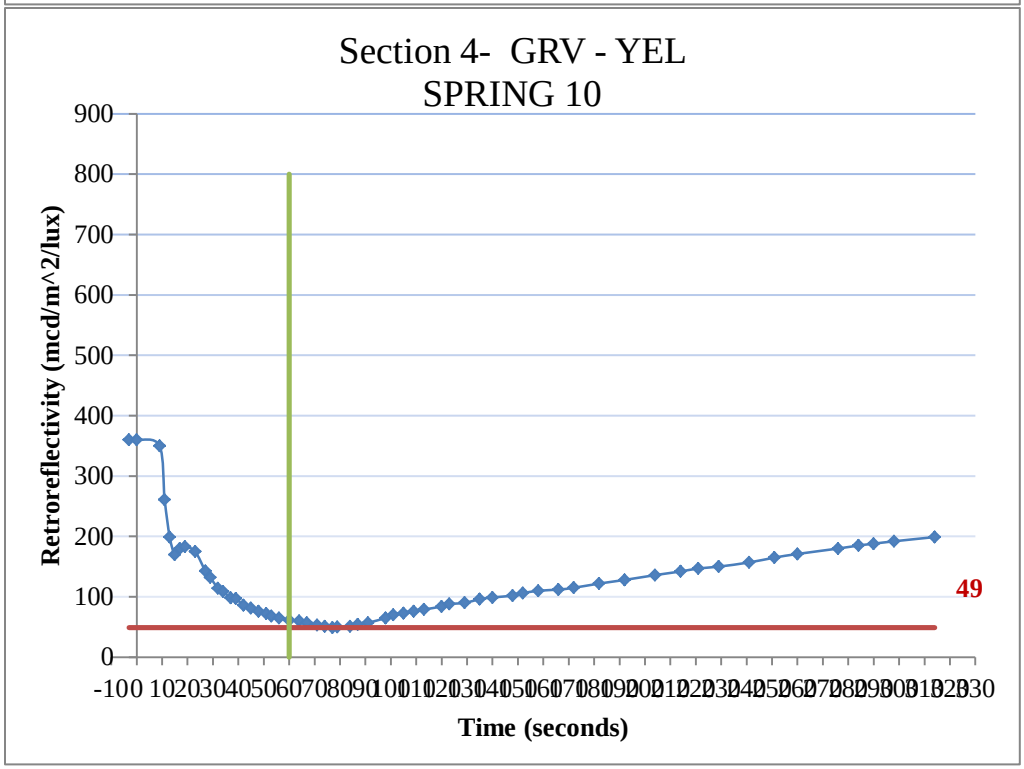

Section 2- SRF - YEL
SPRING 10
Retroreflectivity (mcd/m^2/lux)
Time (seconds)
81

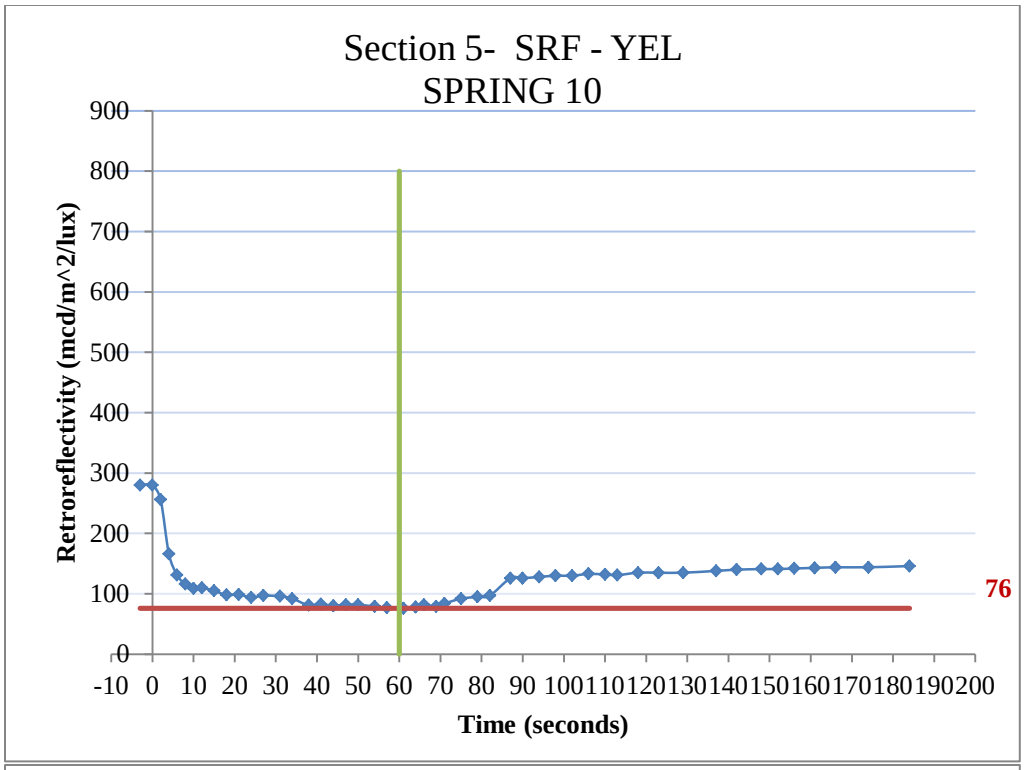

Section 2- GRV - YEL
SPRING 10
Retroreflectivity (mcd/m^2/lux)
Time (seconds)
63

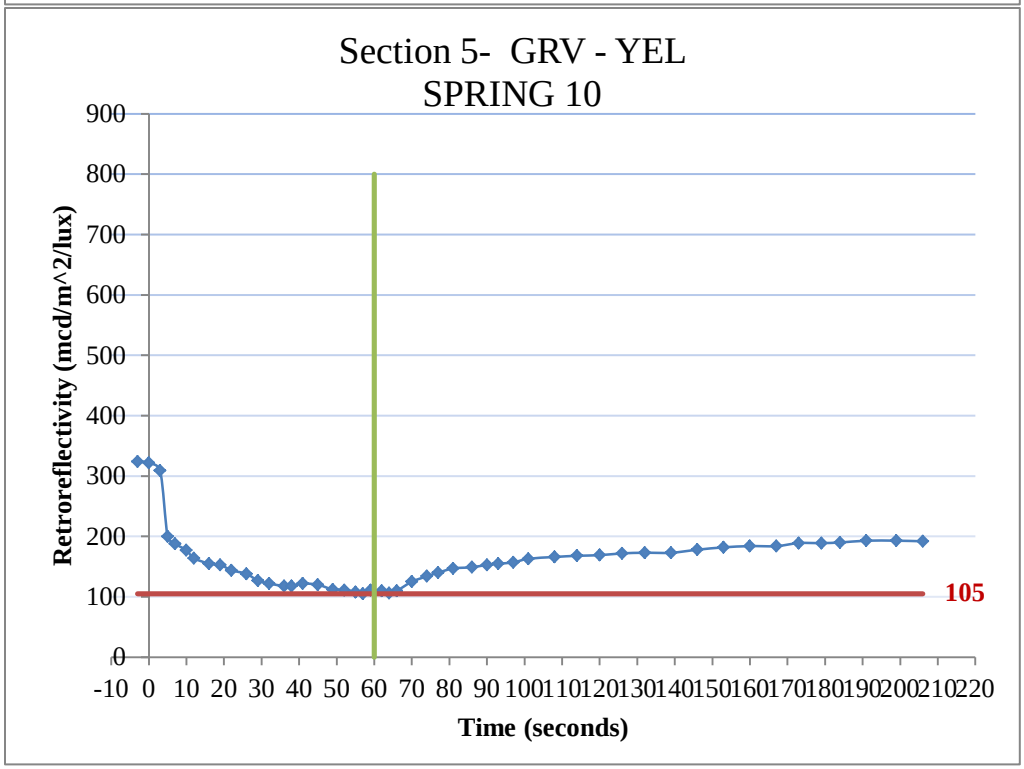

Section 3- SRF - YEL
SPRING 10
Retroreflectivity (mcd/m^2/lux)
Time (seconds)
37

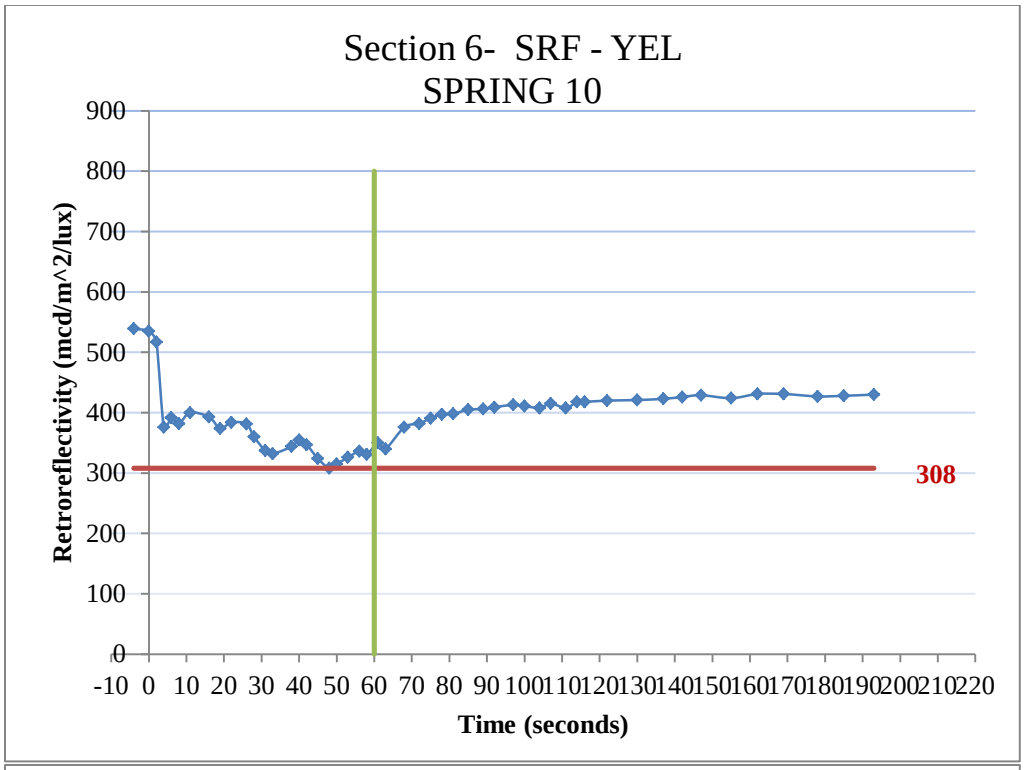

Section 3- GRV - YEL
SPRING 10
Retroreflectivity (mcd/m^2/lux)
Time (seconds)
50

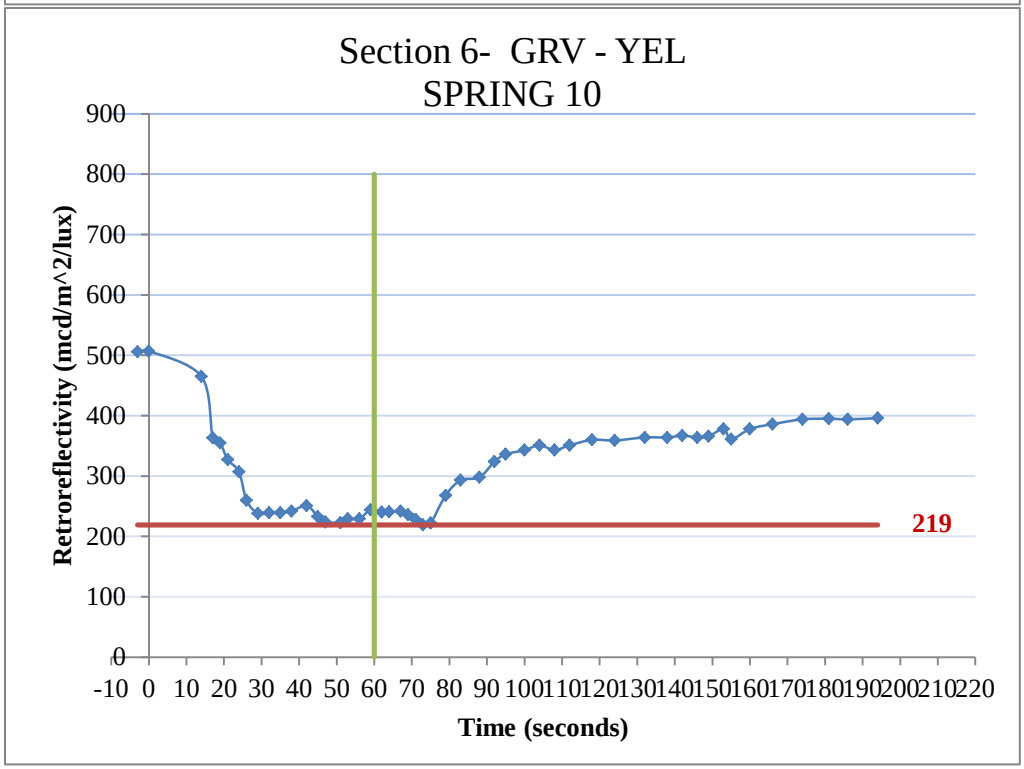

Section 4- SRF - YEL
SPRING 10
Retroreflectivity (mcd/m^2/lux)
Time (seconds)
37

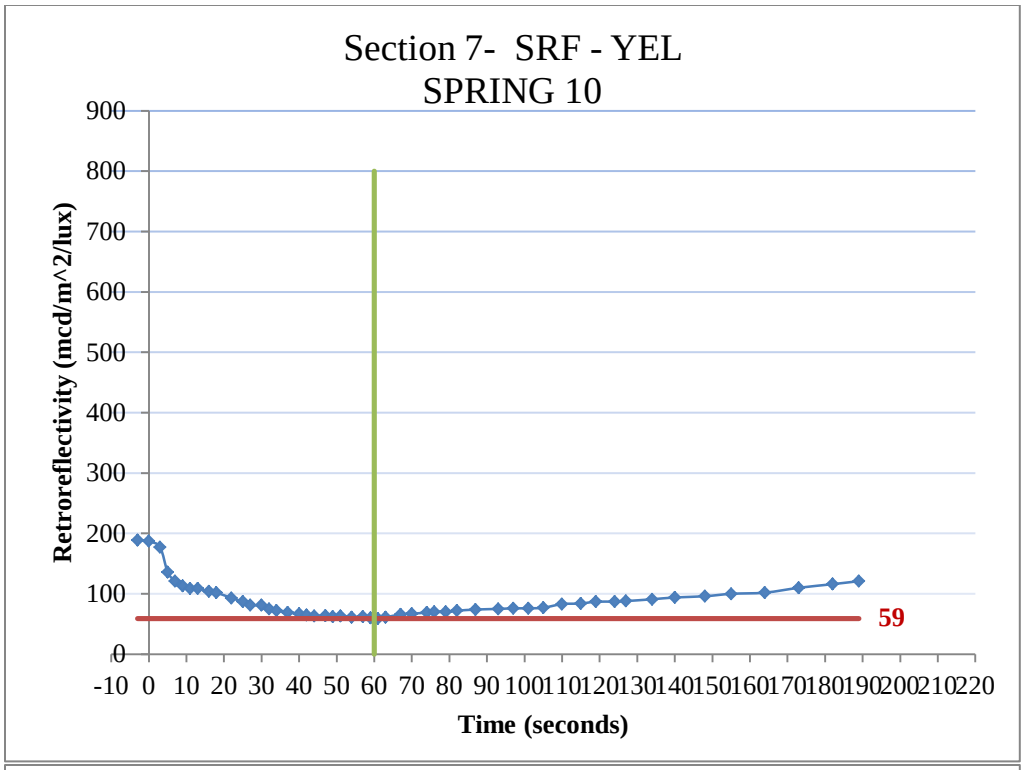

Section 4- GRV - YEL
SPRING 10
Retroreflectivity (mcd/m^2/lux)
Time (seconds)
49

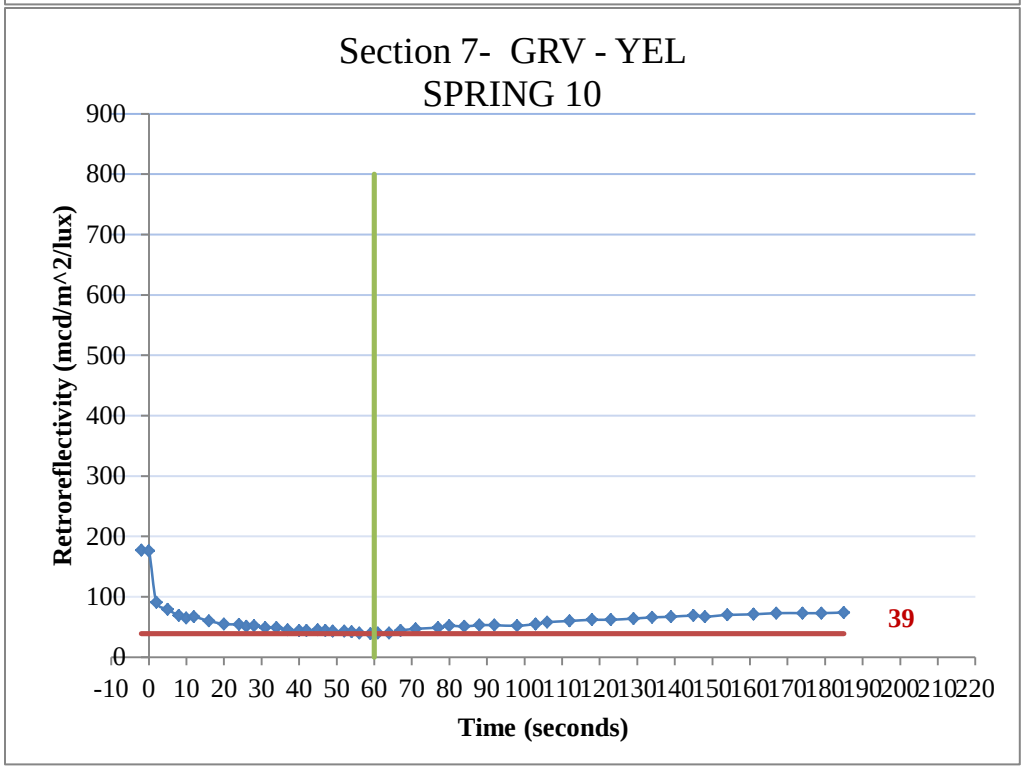

Section 5- SRF - YEL
SPRING 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Time (seconds)
76

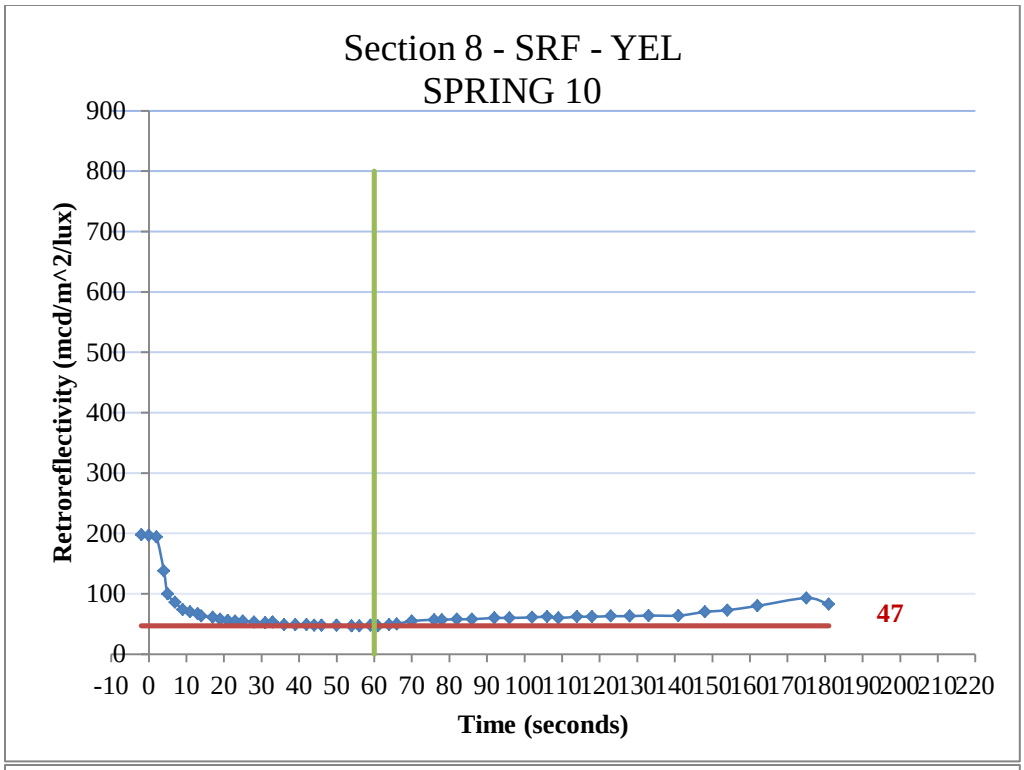

Section 5- GRV - YEL
SPRING 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220
Time (seconds)
105

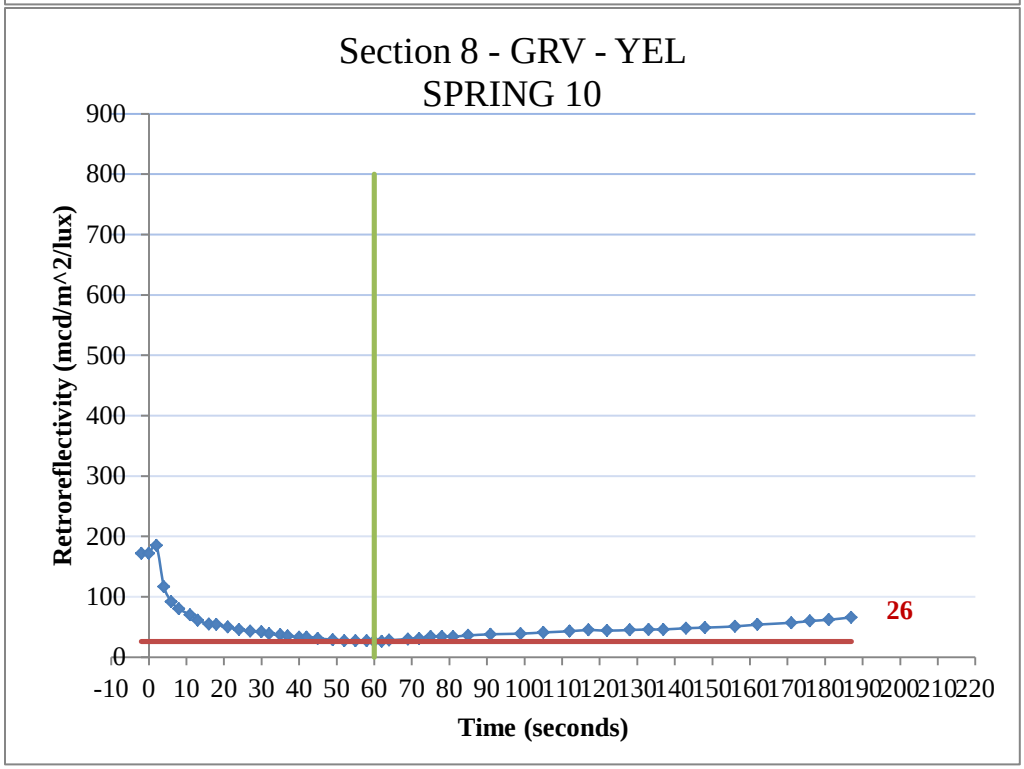

Section 6- SRF - YEL
SPRING 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220
Time (seconds)
308

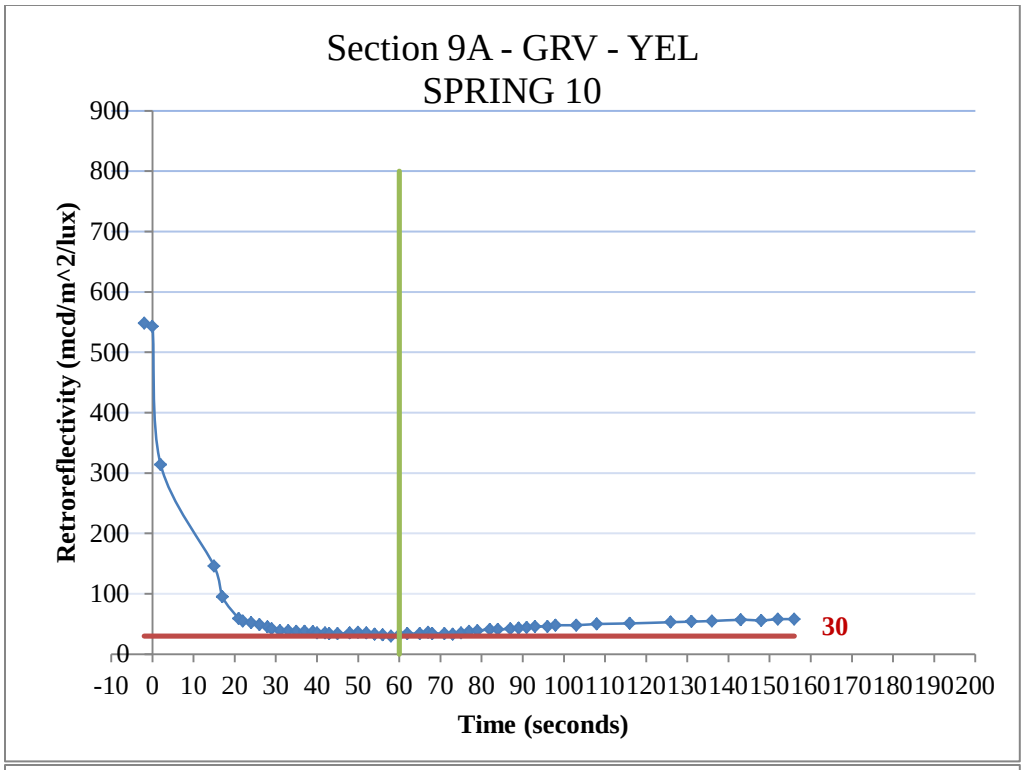

Section 6- GRV - YEL
SPRING 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220
Time (seconds)
219

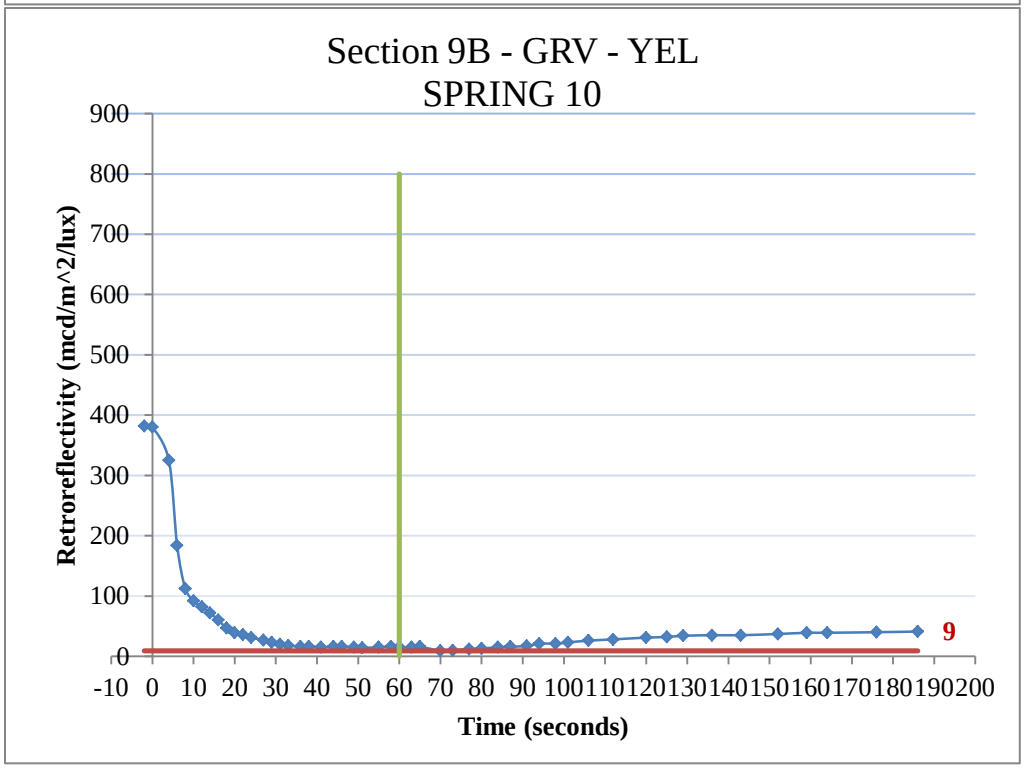

Section 7- SRF - YEL
SPRING 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
59
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220
Time (seconds)

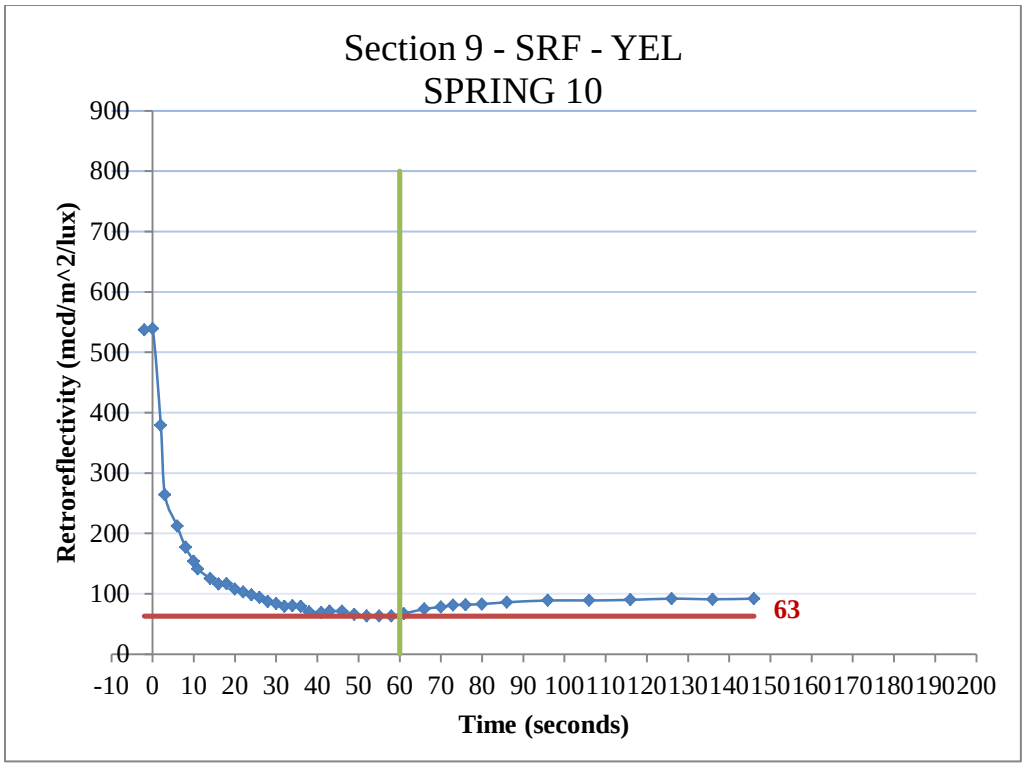

Section 7- GRV - YEL
SPRING 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
39
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220
Time (seconds)

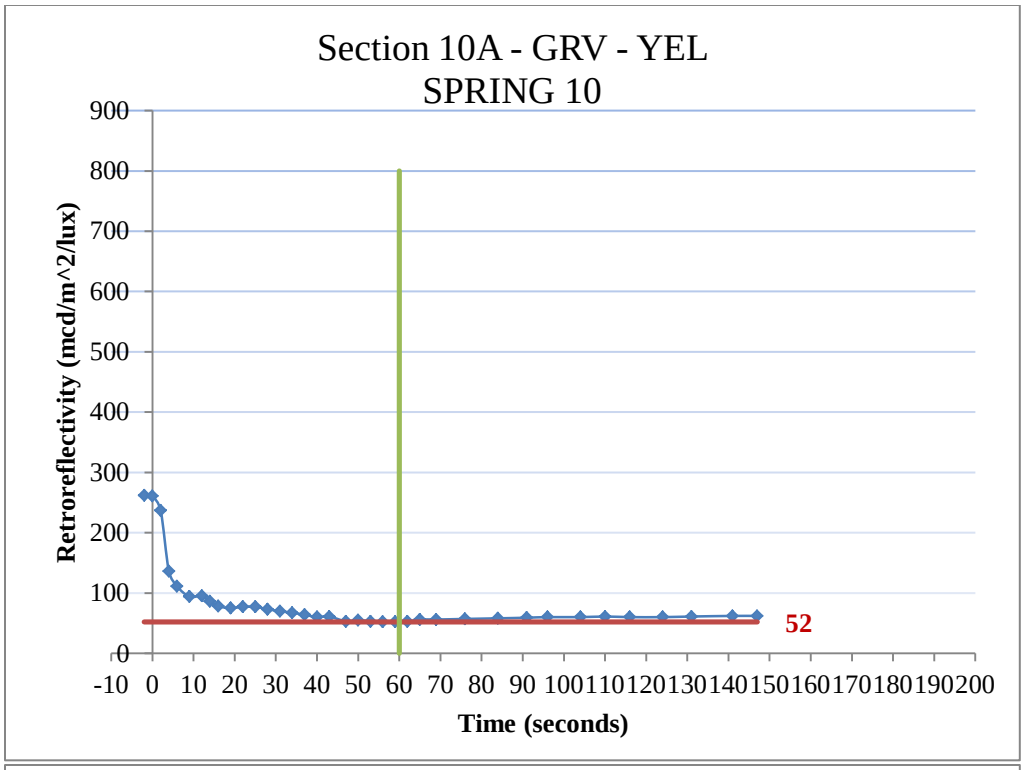

Section 8 - SRF - YEL
SPRING 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220
Time (seconds)
47

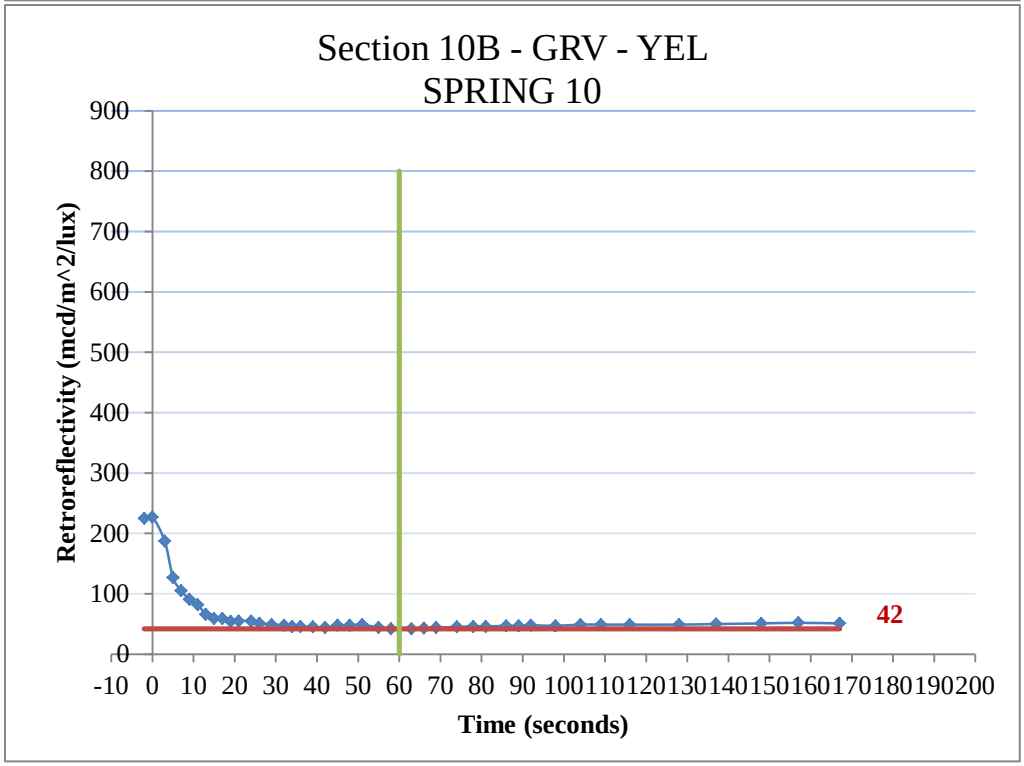

Section 8 - GRV - YEL
SPRING 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220
Time (seconds)
26

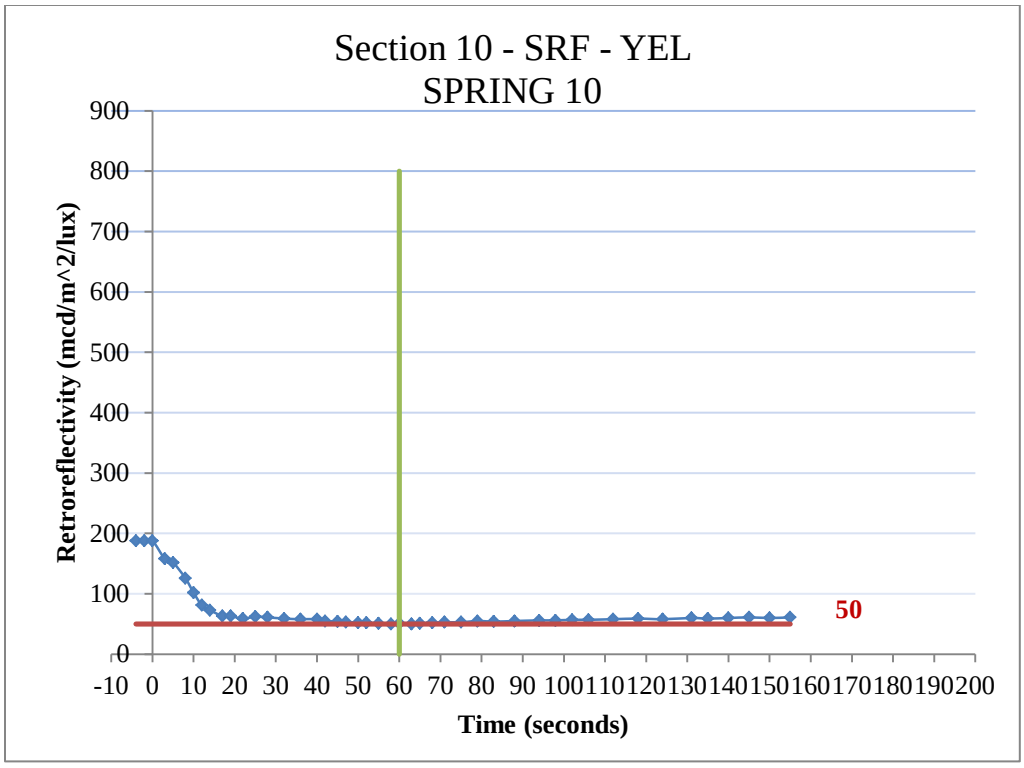

Section 9A - GRV - YEL
SPRING 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Time (seconds)
30

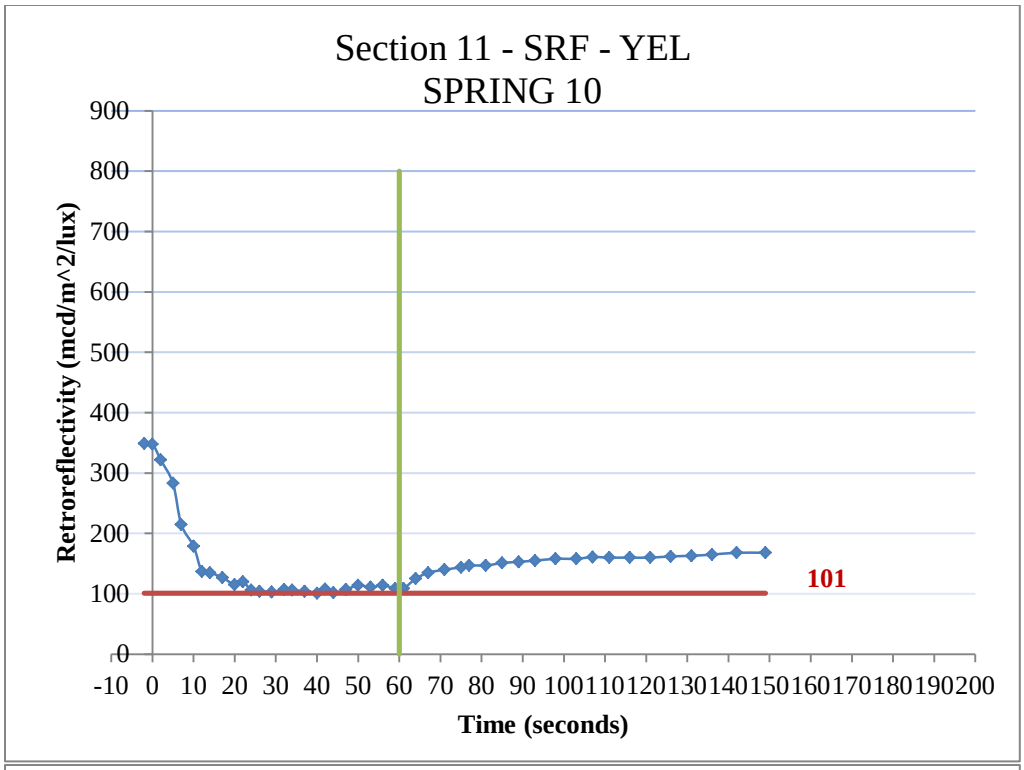

Section 9B - GRV - YEL
SPRING 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Time (seconds)
9

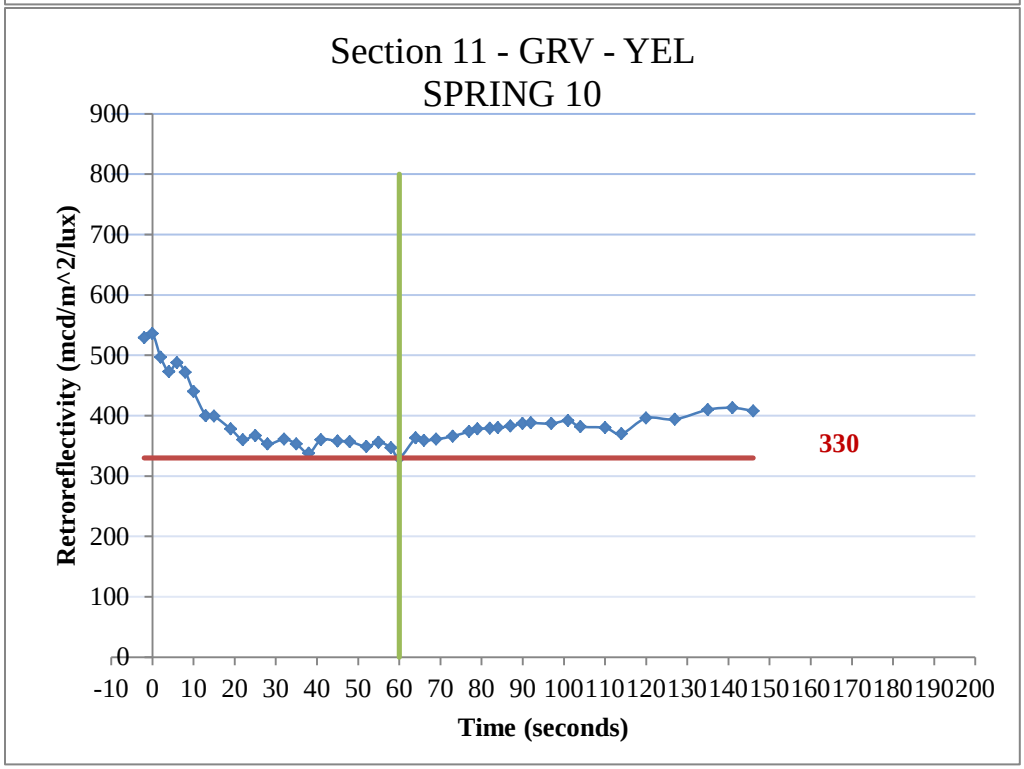

Section 9 - SRF - YEL
SPRING 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Time (seconds)
63

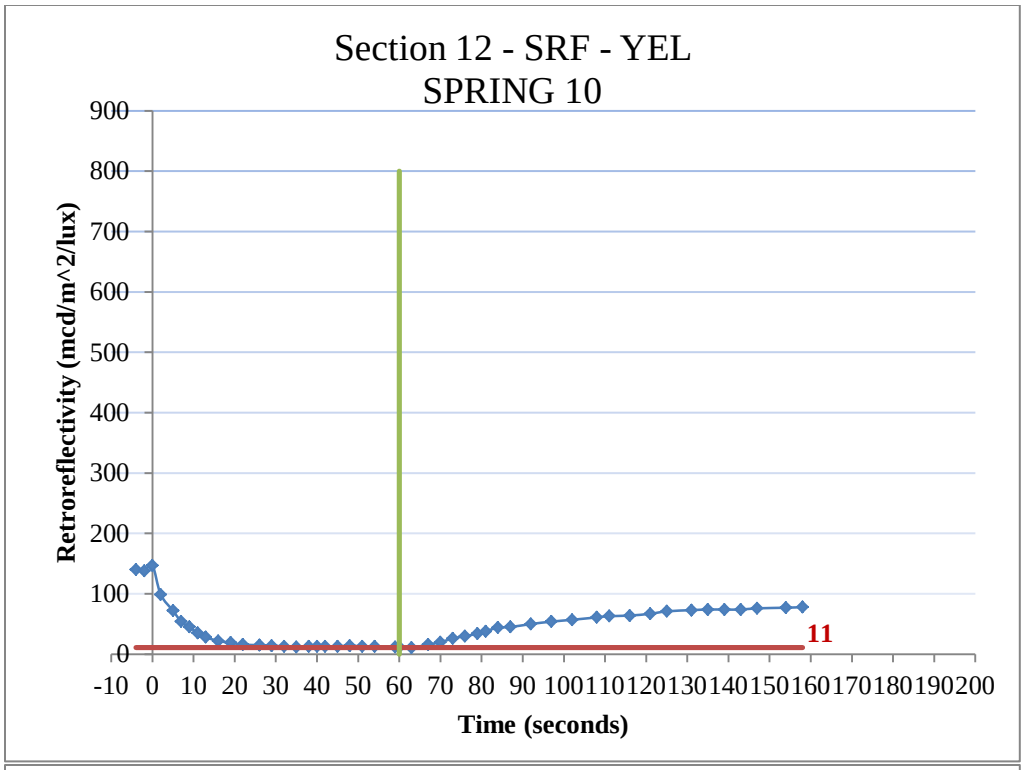

Section 10A - GRV - YEL
SPRING 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Time (seconds)
52

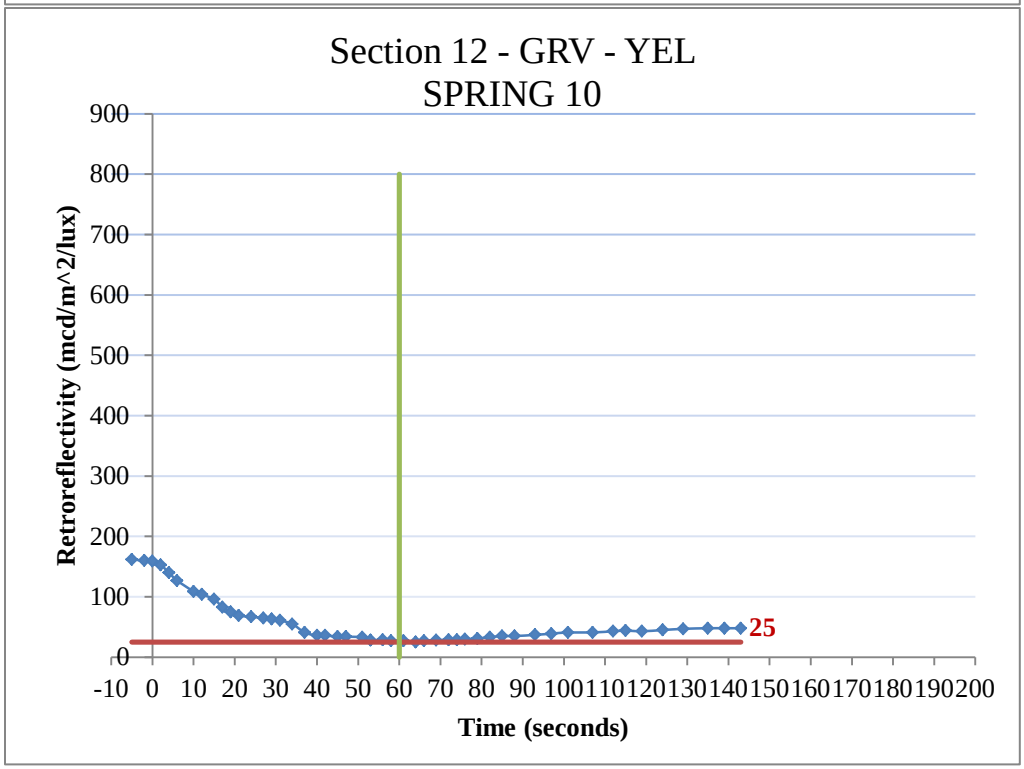

Section 10B - GRV - YEL
SPRING 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Time (seconds)
42

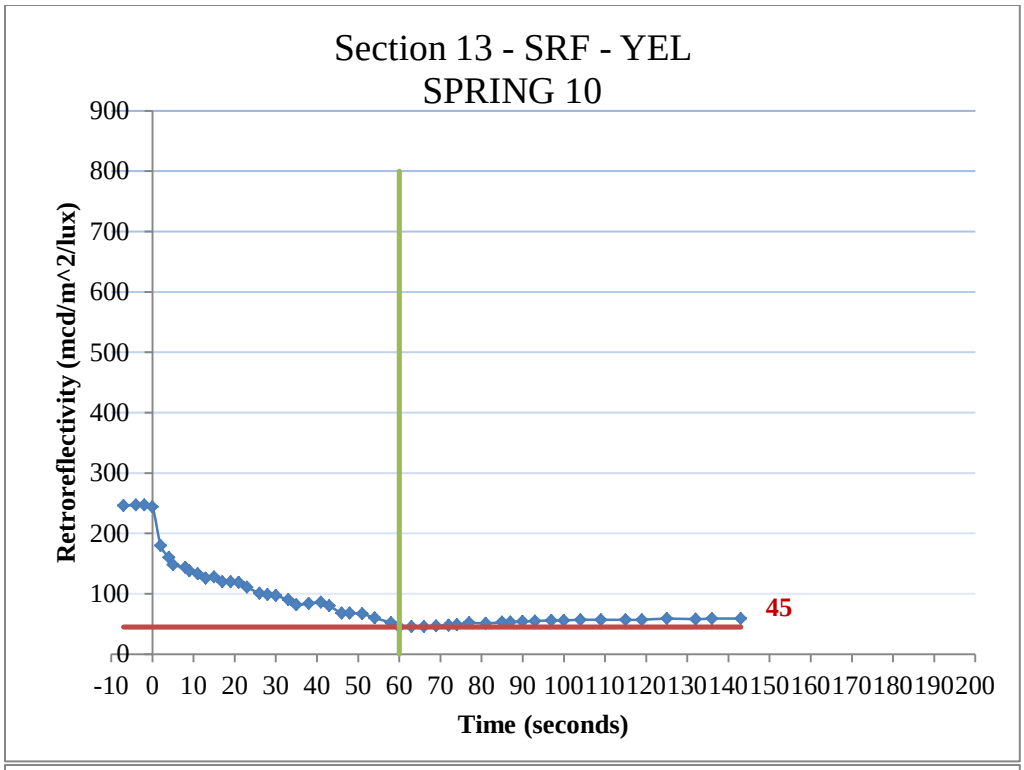

Section 10 - SRF - YEL
SPRING 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Time (seconds)
50

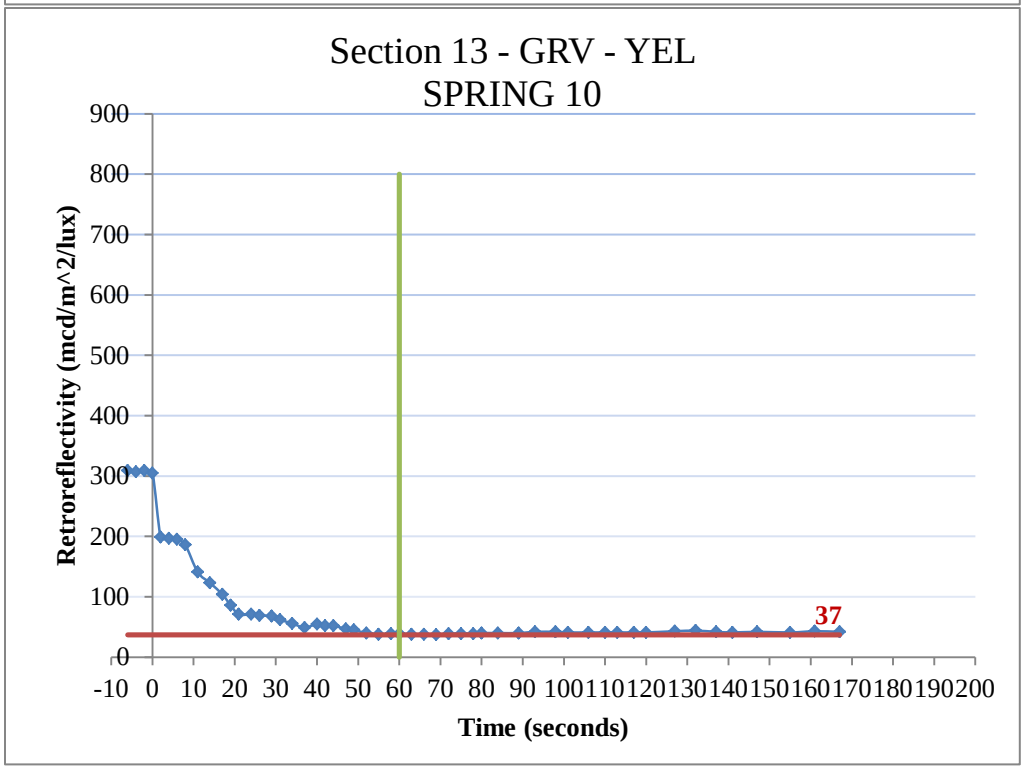

Section 11 - SRF - YEL
SPRING 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Time (seconds)
101

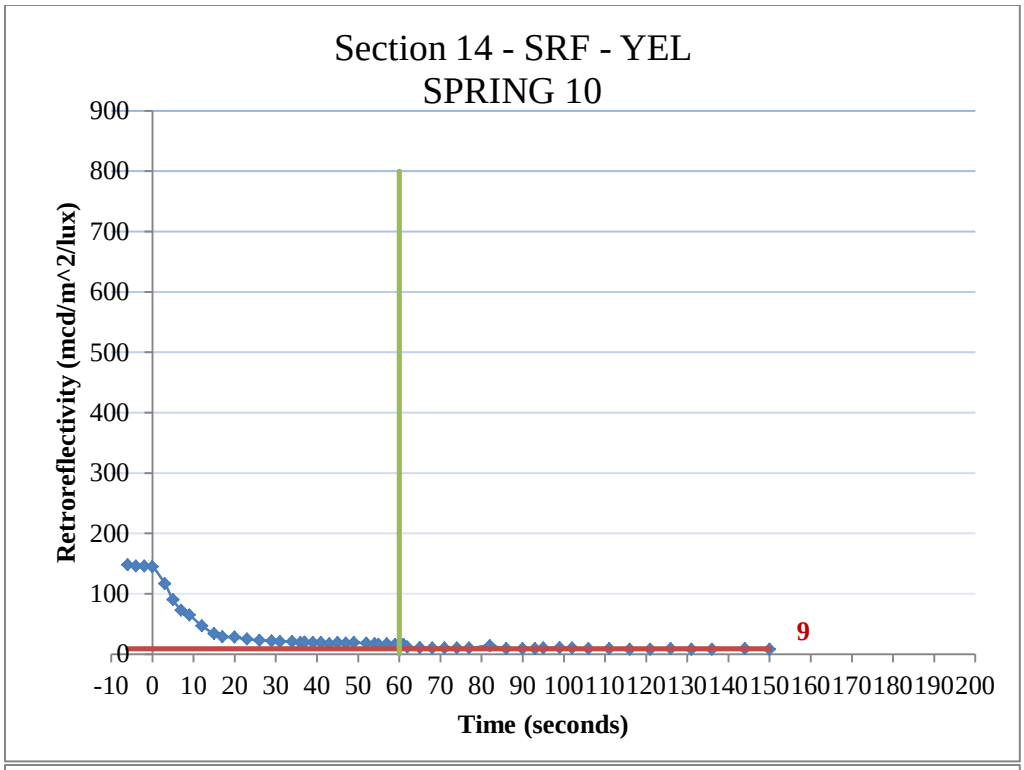

Section 11 - GRV - YEL
SPRING 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Time (seconds)
330

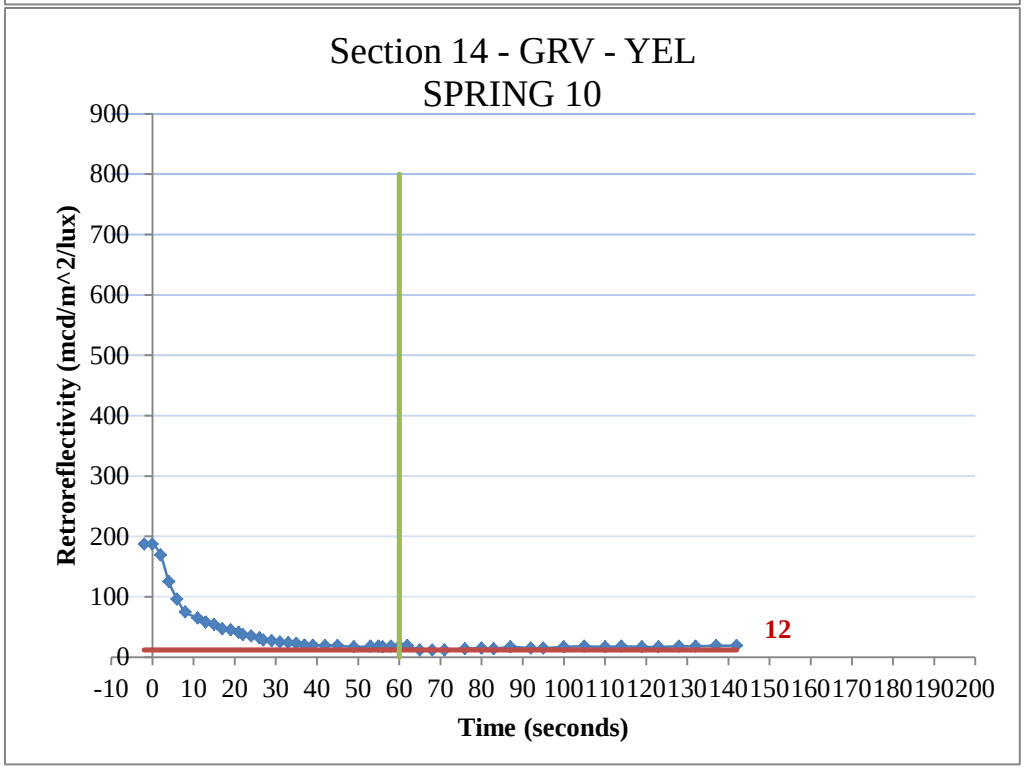

Section 12 - SRF - YEL
SPRING 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Time (seconds)
11

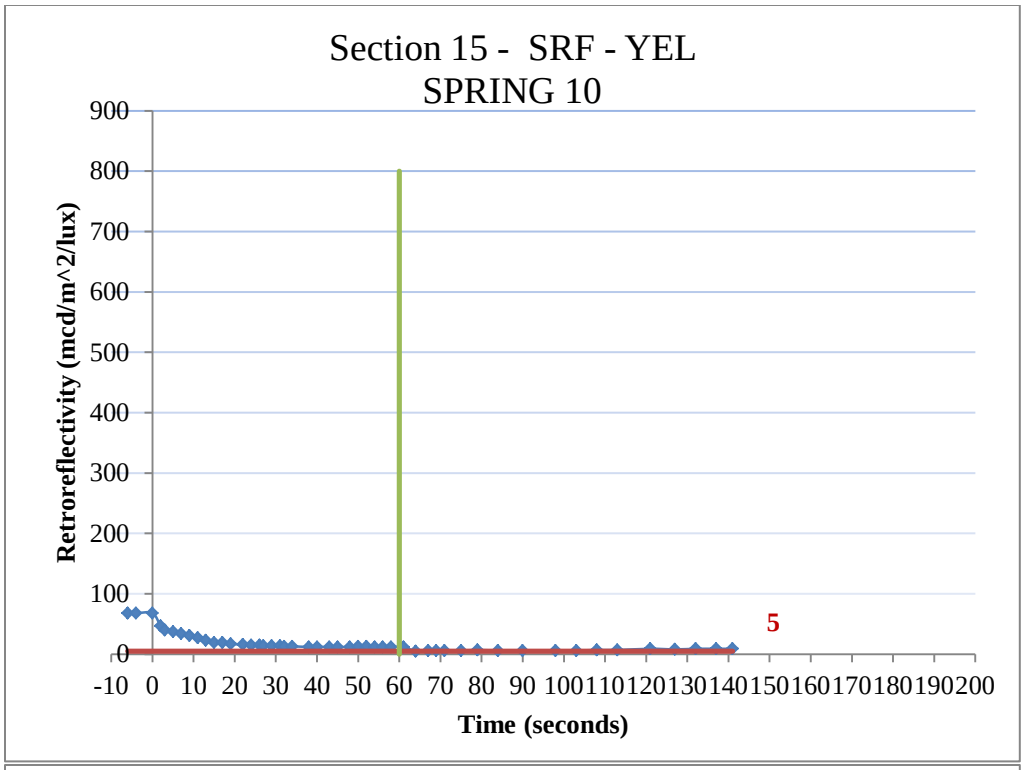

Section 12 - GRV - YEL
SPRING 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Time (seconds)
25

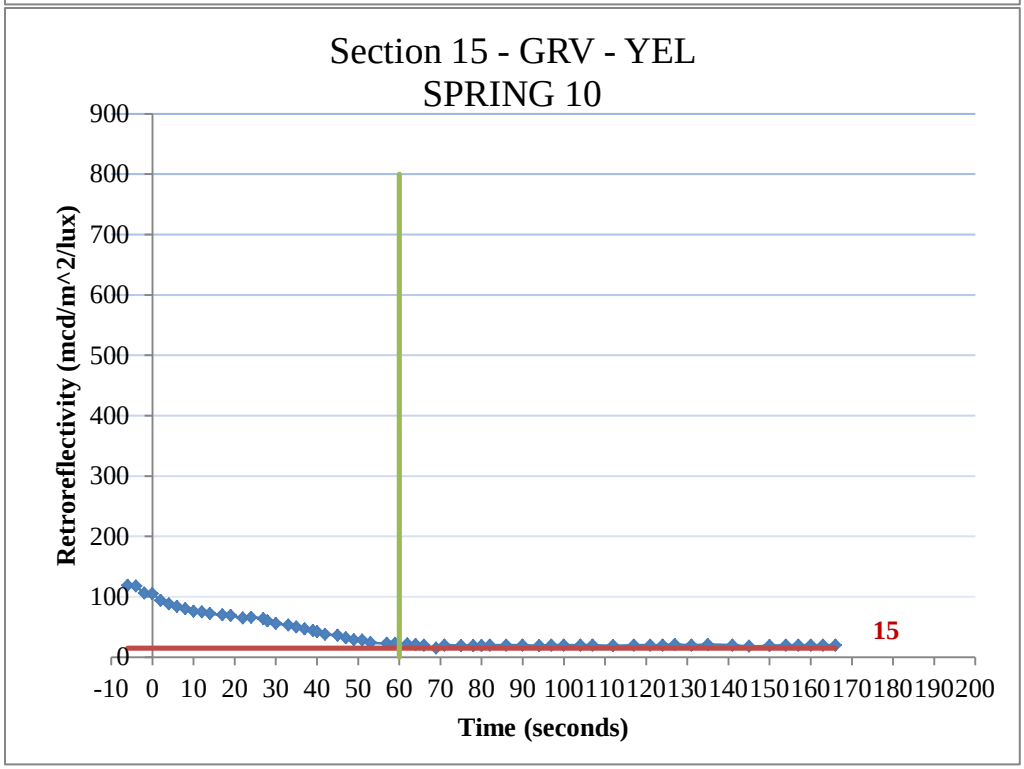

Section 13 - SRF - YEL
SPRING 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Time (seconds)
45

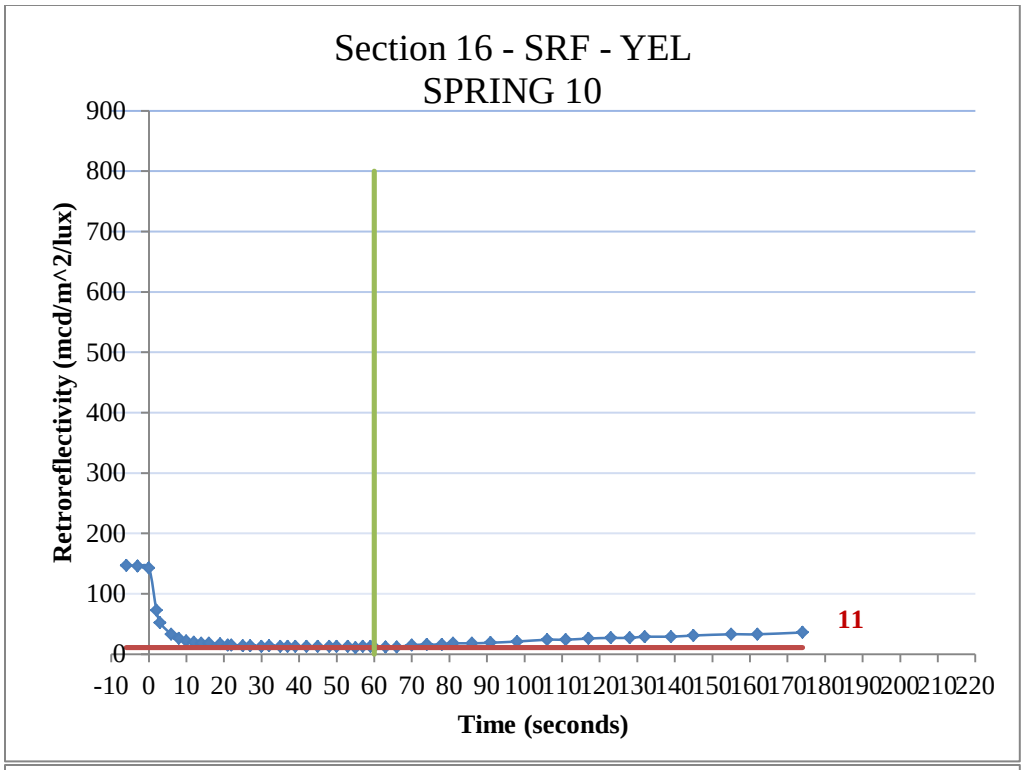

Section 13 - GRV - YEL
SPRING 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Time (seconds)
37

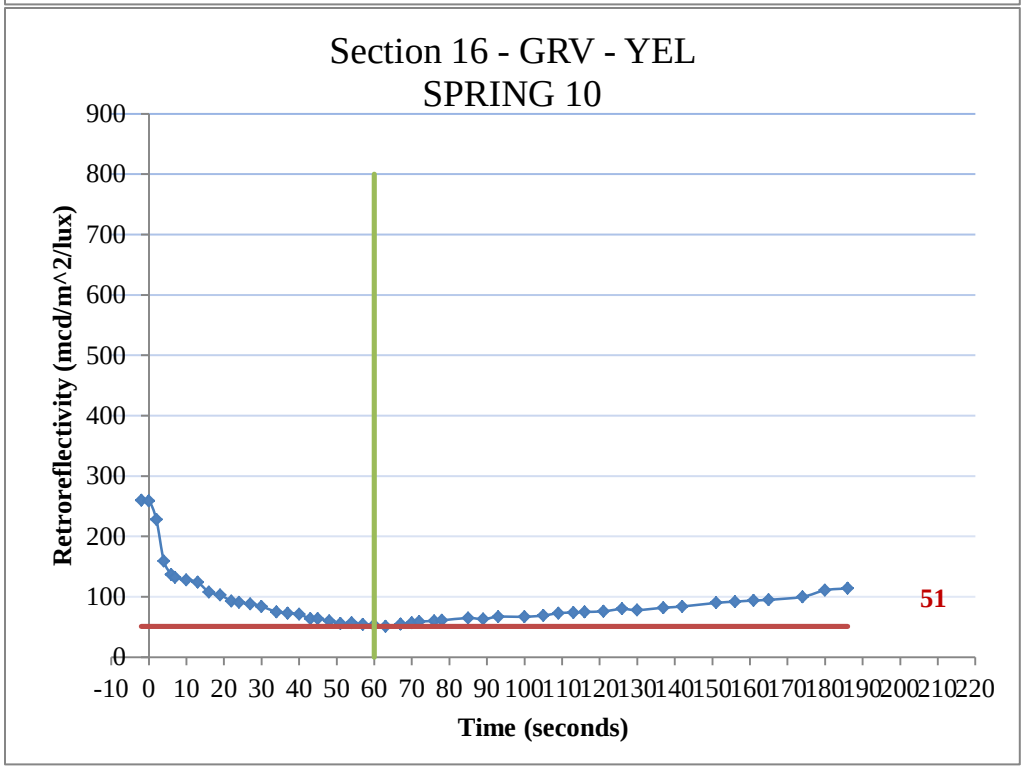

Section 14 - SRF - YEL
SPRING 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Time (seconds)
9


Section 14 - GRV - YEL
SPRING 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Time (seconds)
12

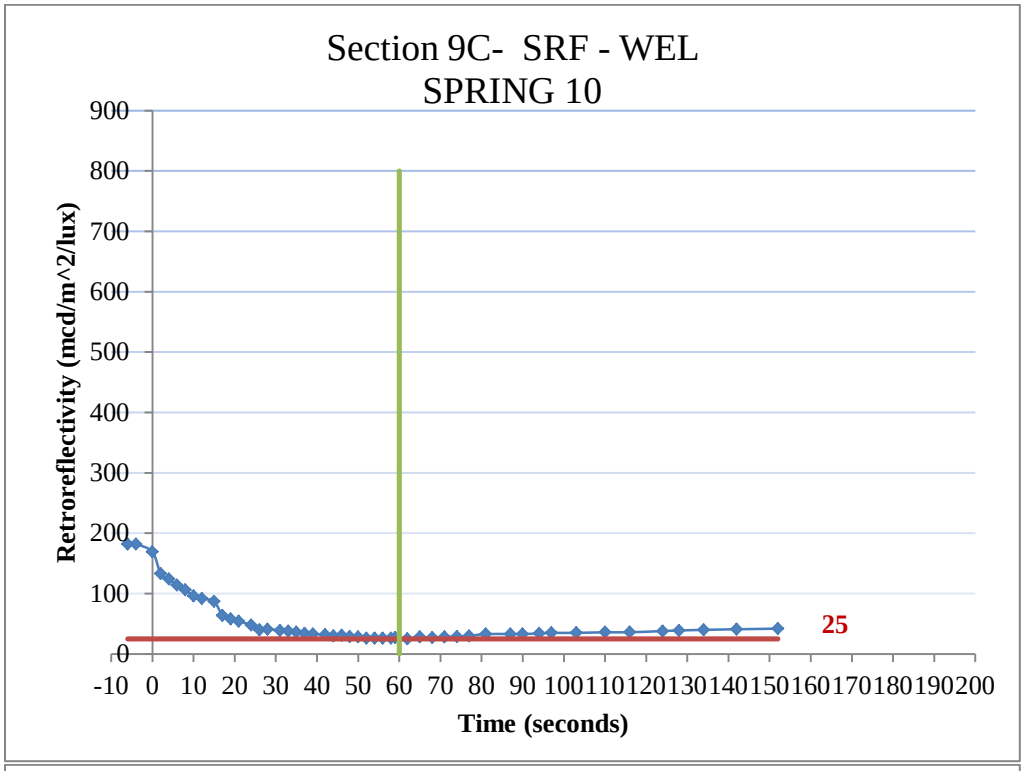

Section 15 - SRF - YEL
SPRING 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Time (seconds)
5

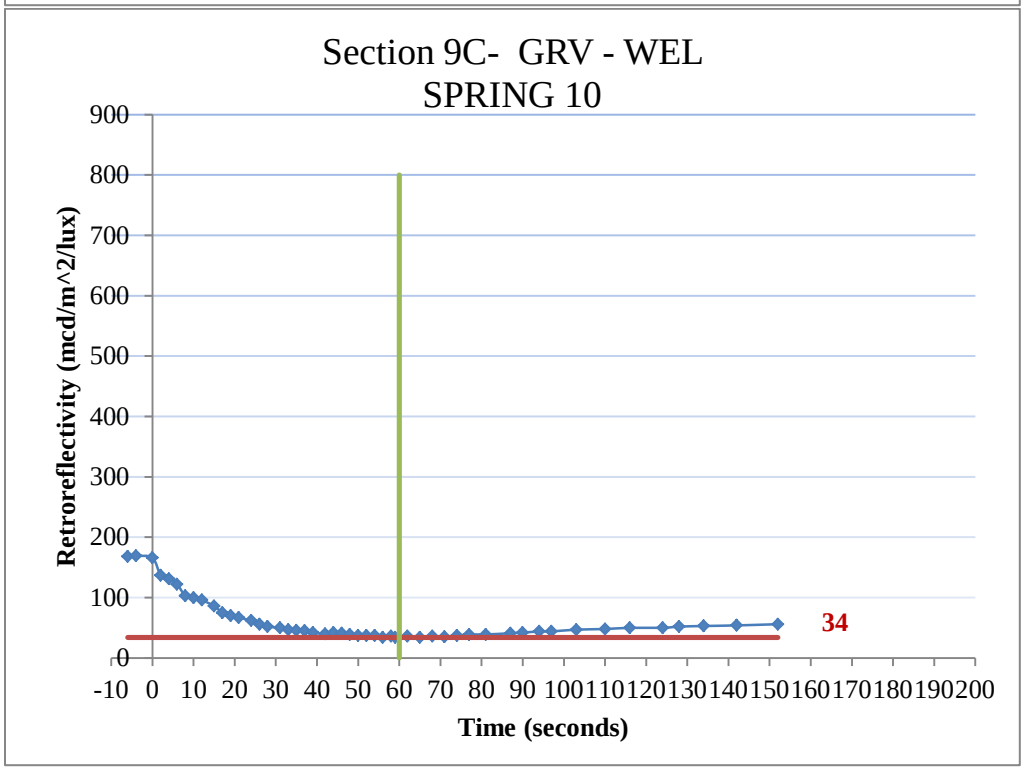

Section 15 - GRV - YEL
SPRING 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Time (seconds)
15

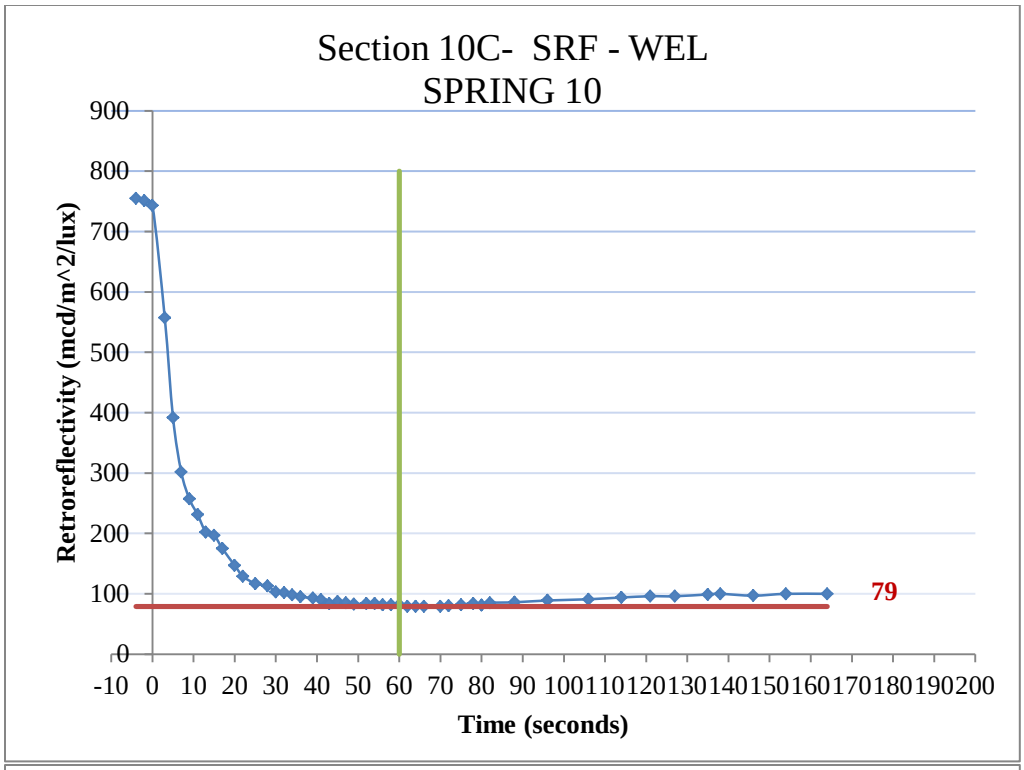

Section 16 - SRF - YEL
SPRING 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220
Time (seconds)
11

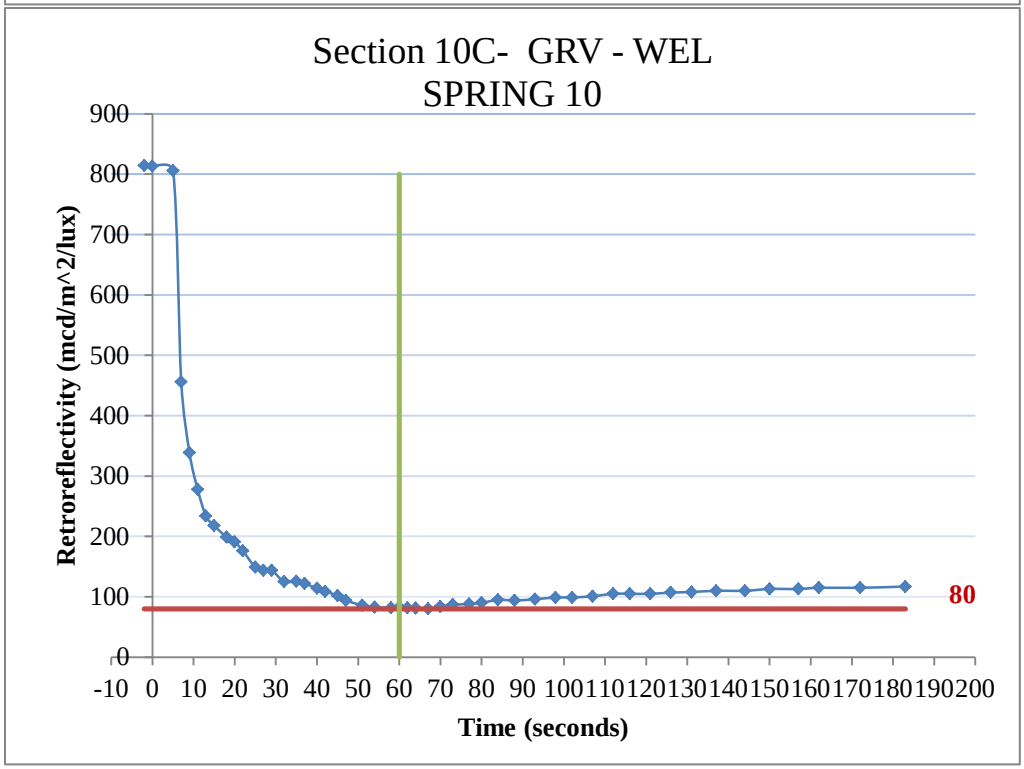

Section 16 - GRV - YEL
SPRING 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220
Time (seconds)
51

White Edge Line

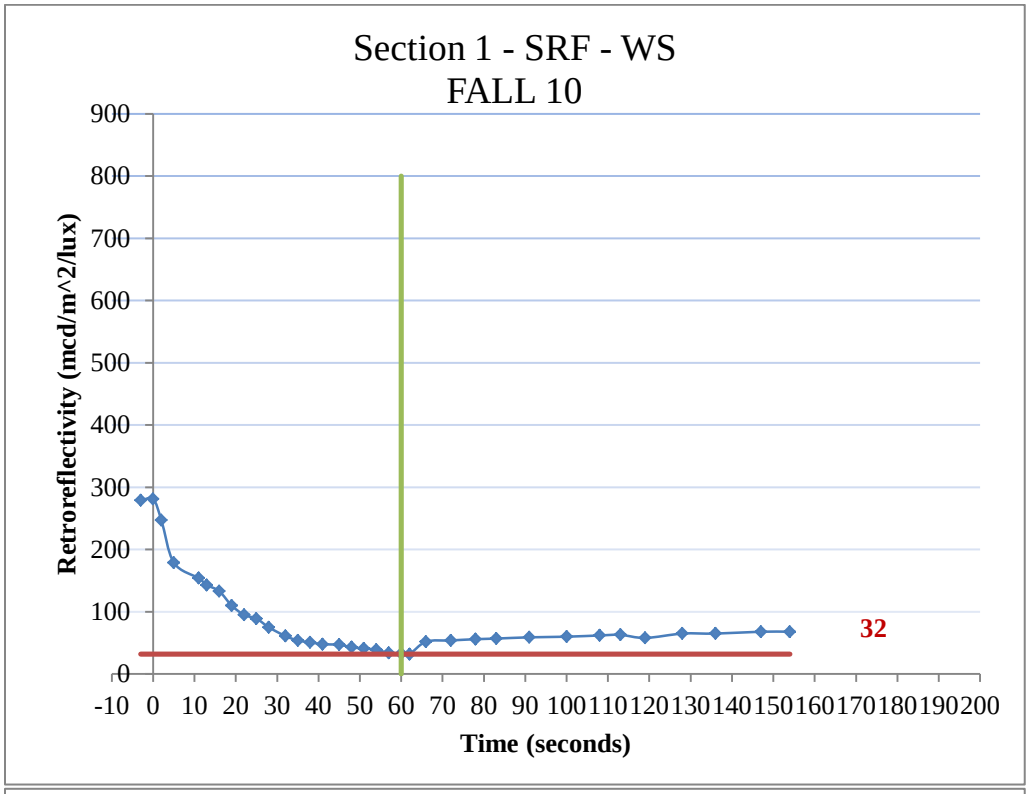


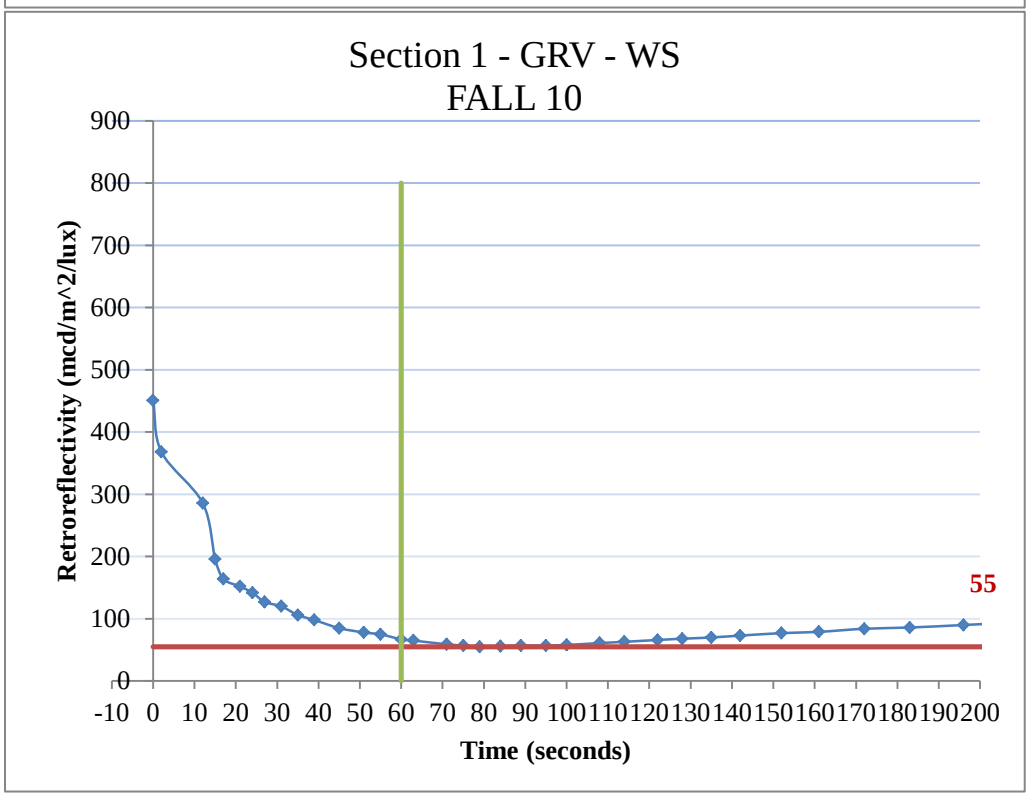


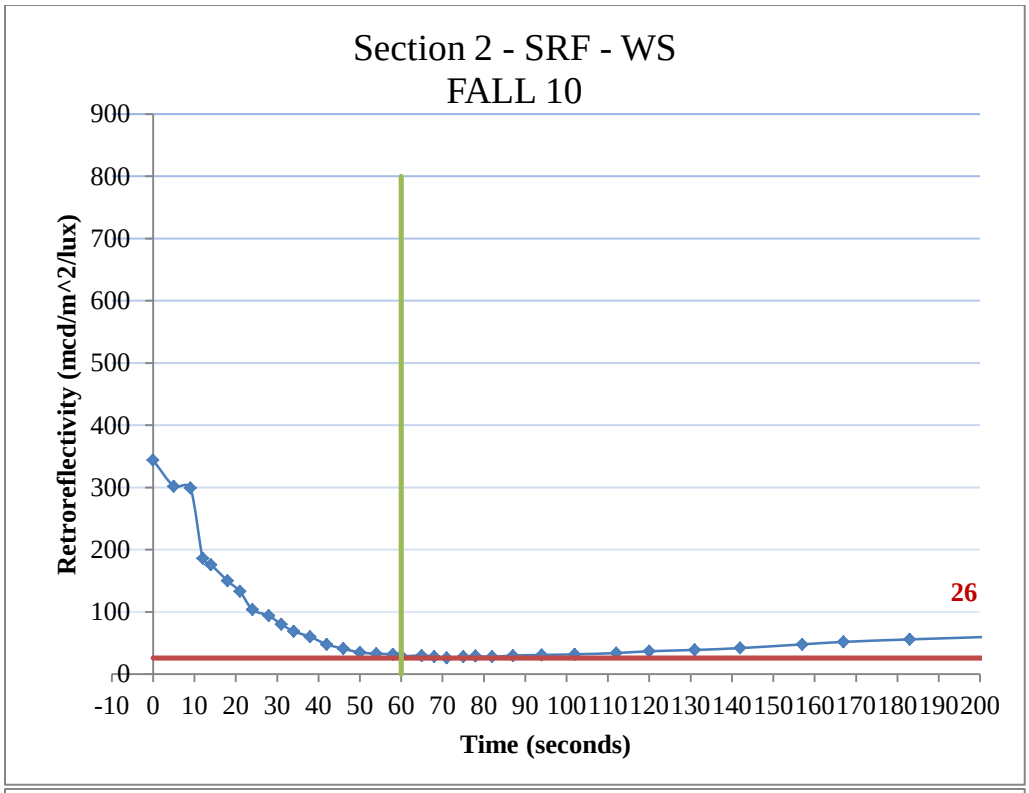

Section 10C- SRF - WEL
SPRING 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Time (seconds)
79

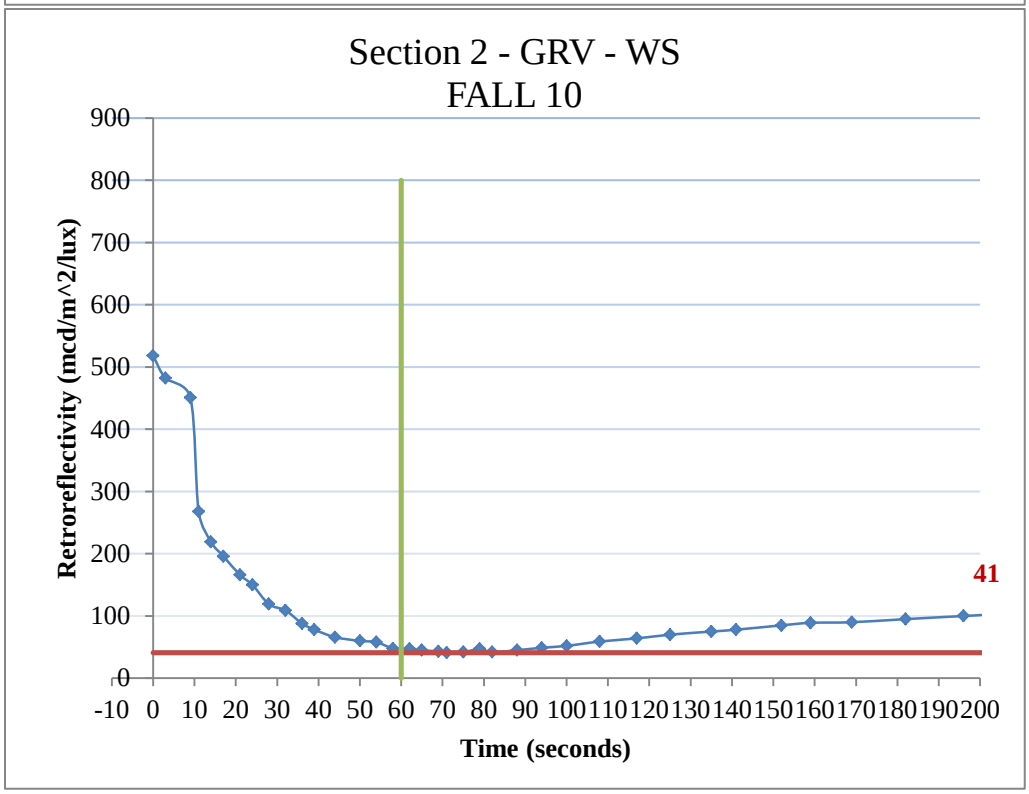

Section 10C- GRV - WEL
SPRING 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Time (seconds)
80

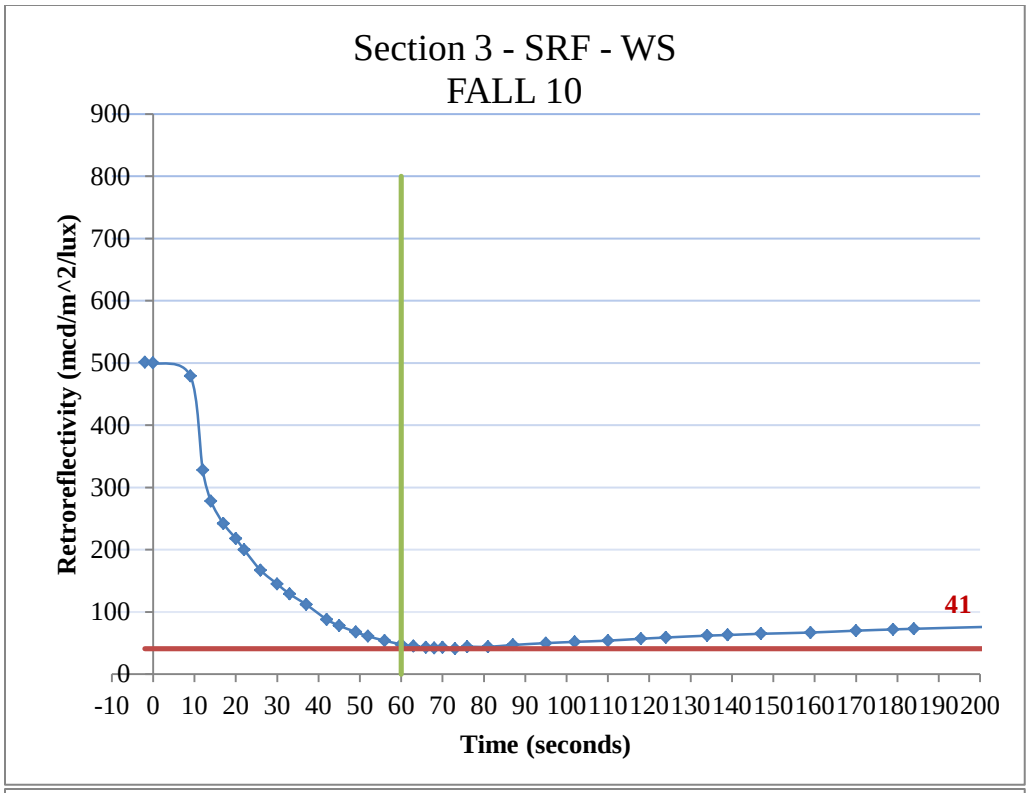
White Skip Line

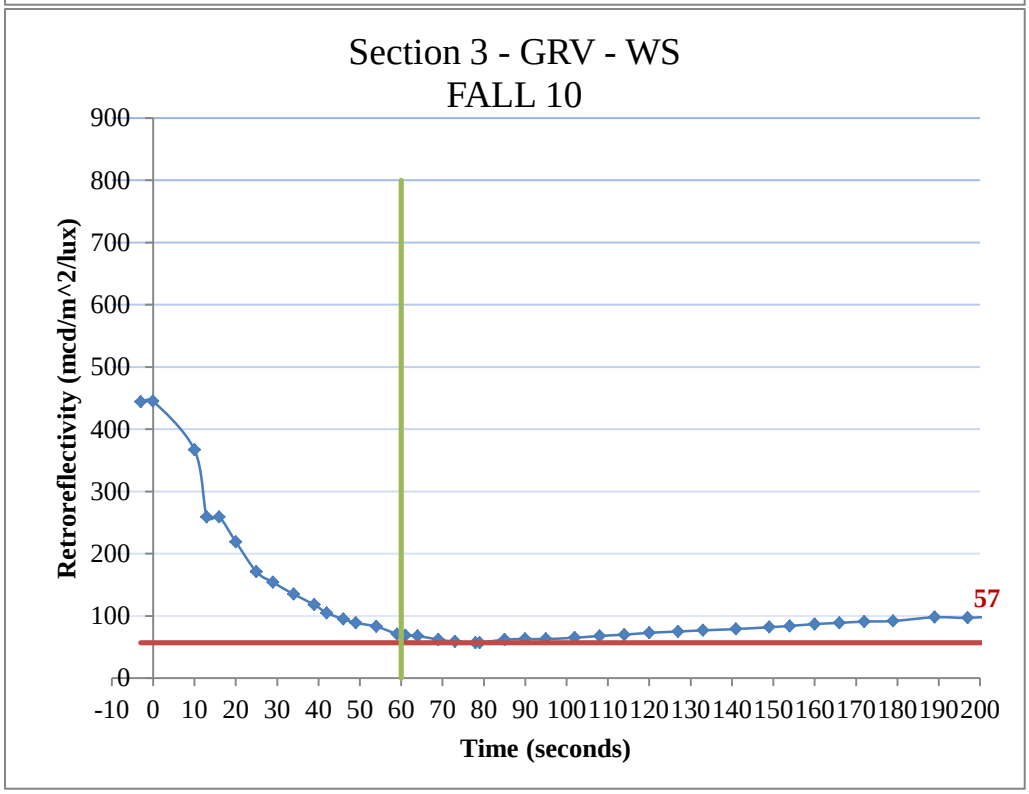


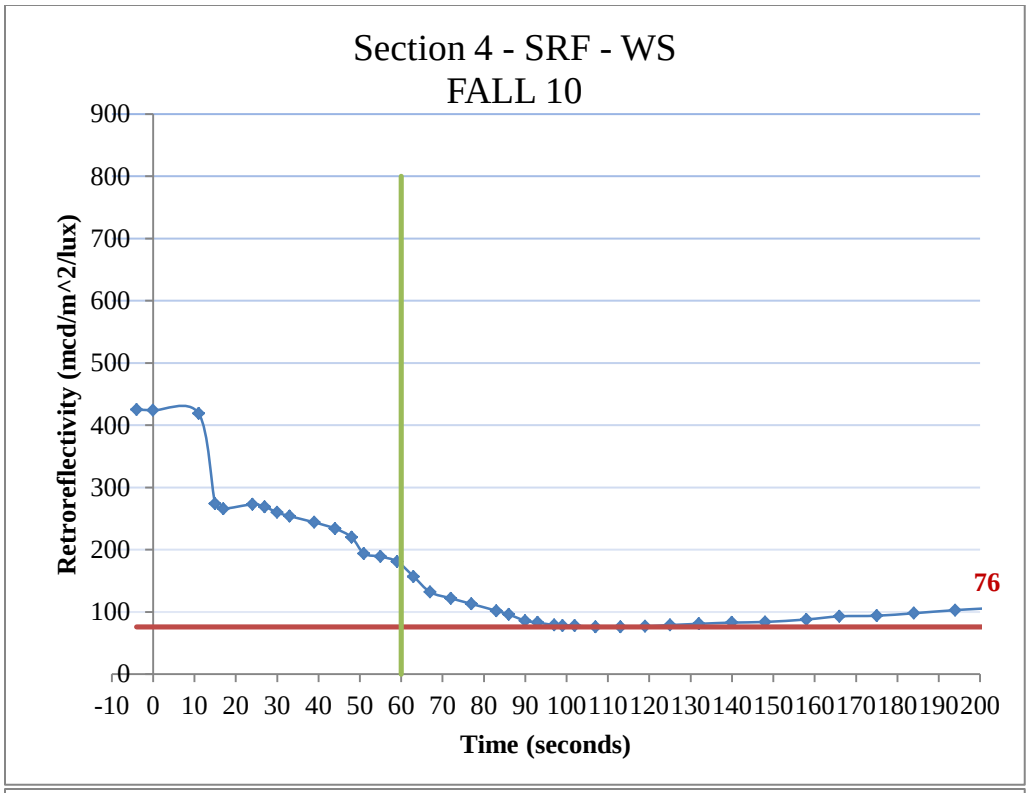


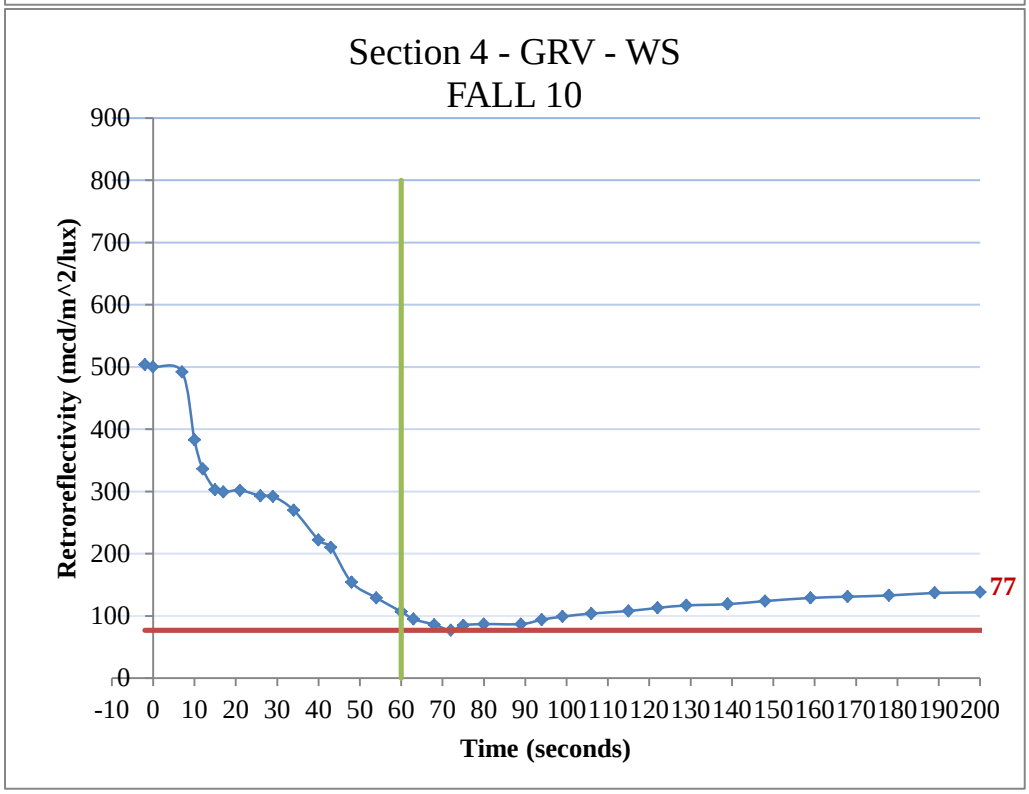

Section 2 - SRF - WS
FALL 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Time (seconds)
26

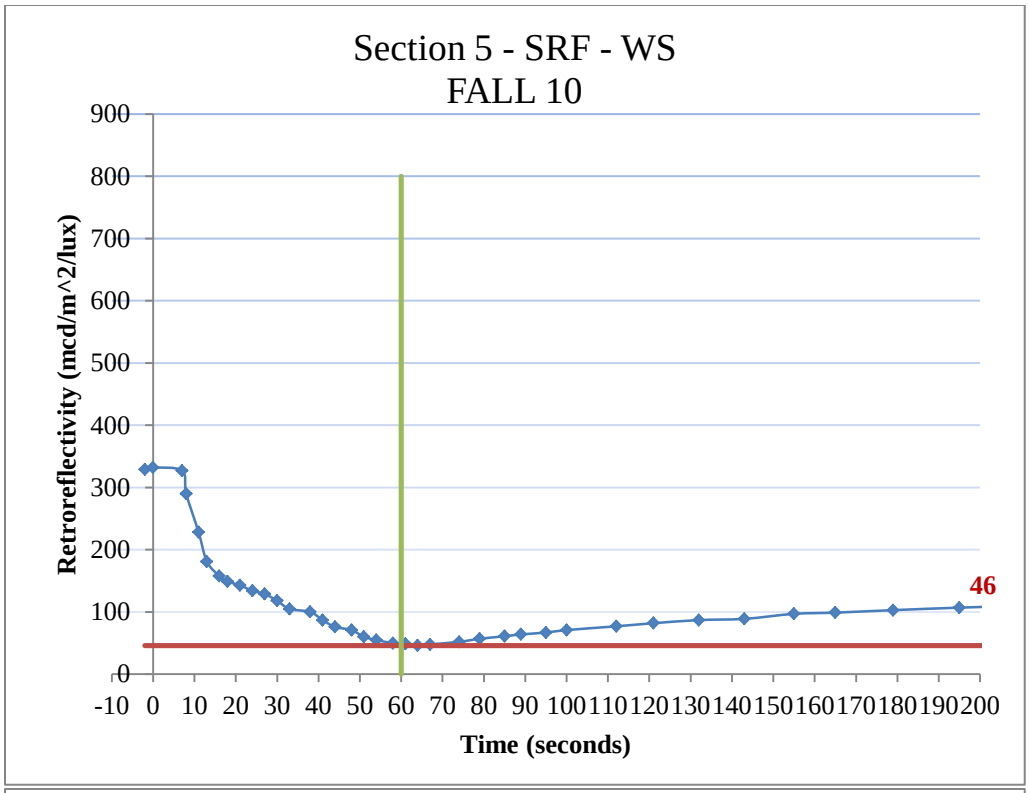

Section 2 - GRV - WS
FALL 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Time (seconds)
41

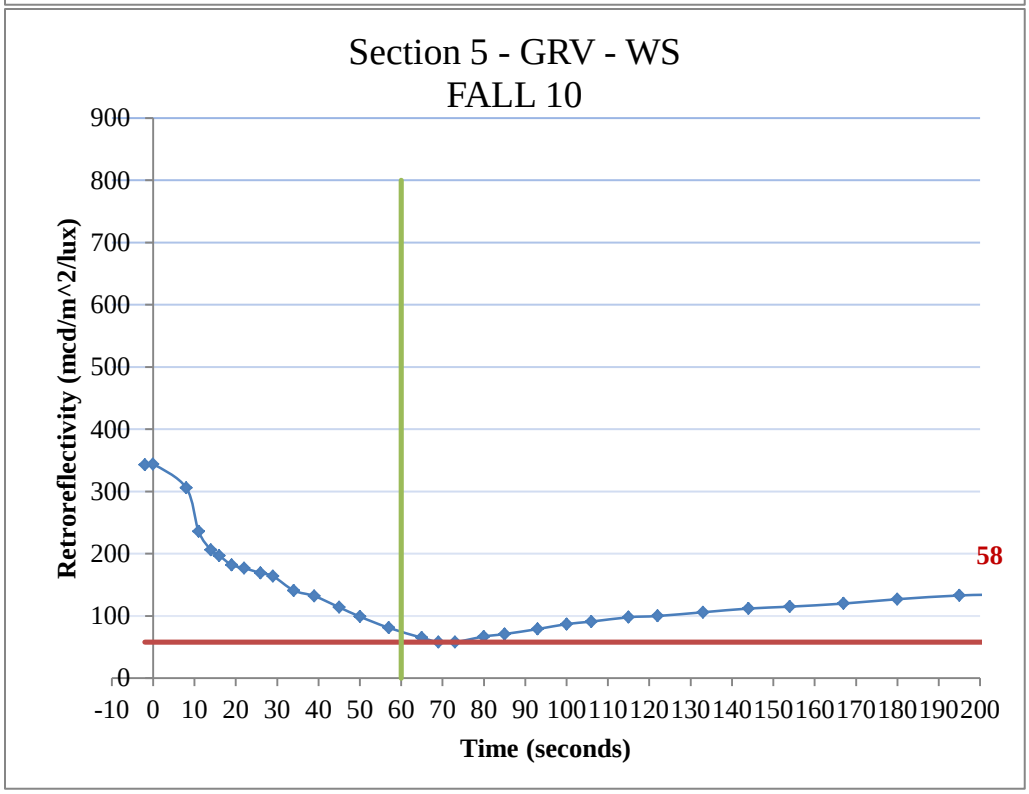

Section 3 - SRF - WS
FALL 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Time (seconds)
41

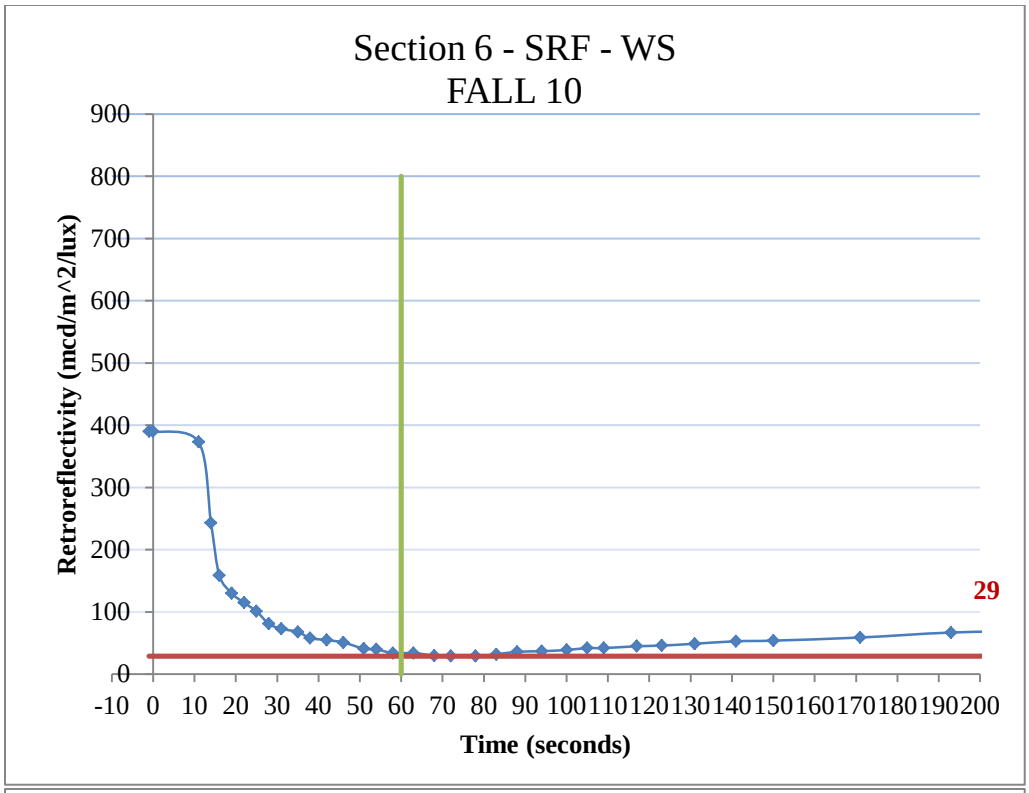

Section 3 - GRV - WS
FALL 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Time (seconds)
57

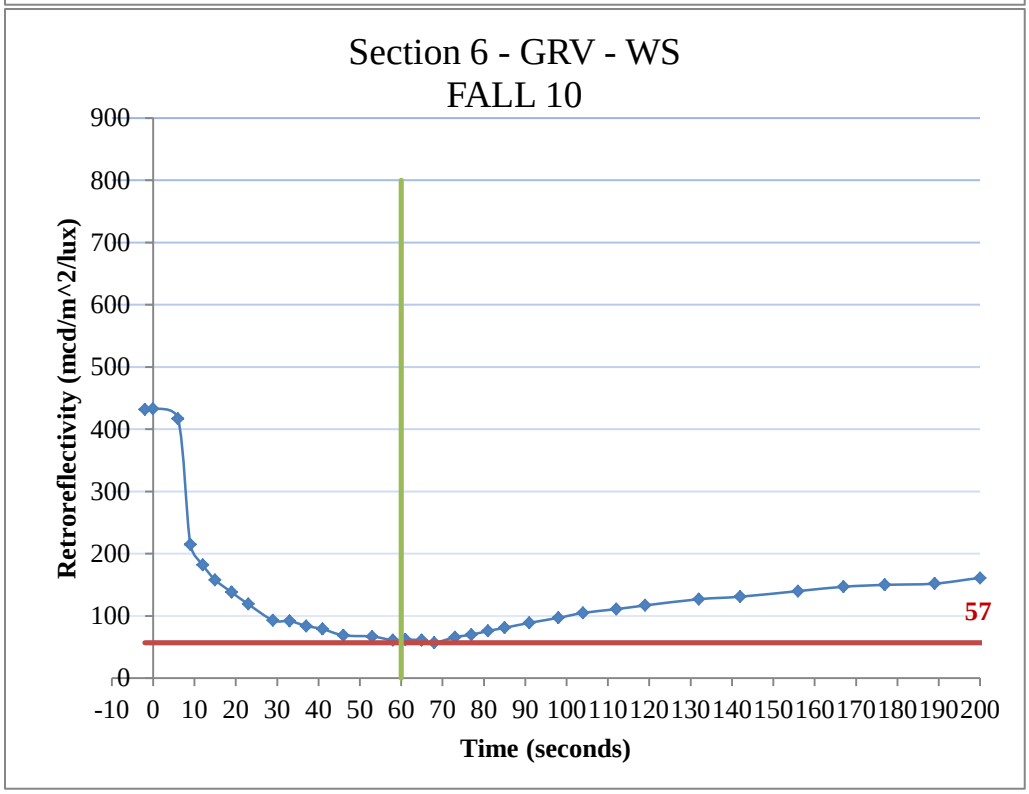

Section 4 - SRF - WS
FALL 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Time (seconds)
76

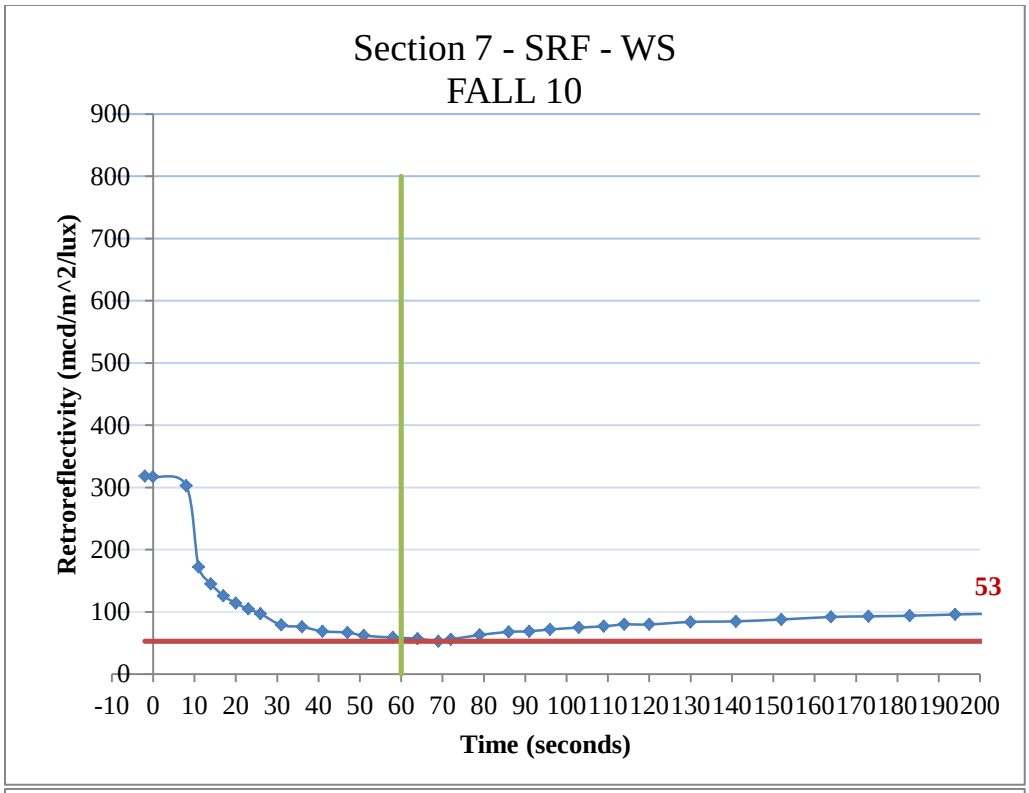

Section 4 - GRV - WS
FALL 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Time (seconds)
77

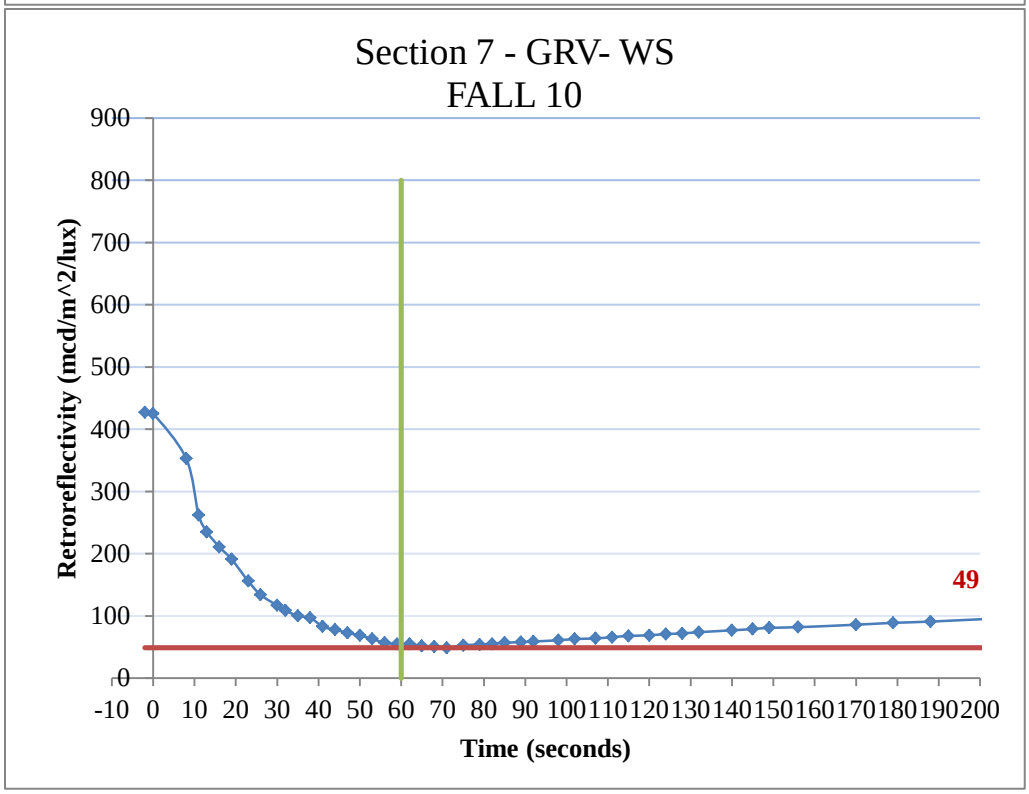

Section 5 - SRF - WS
FALL 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Time (seconds)
46

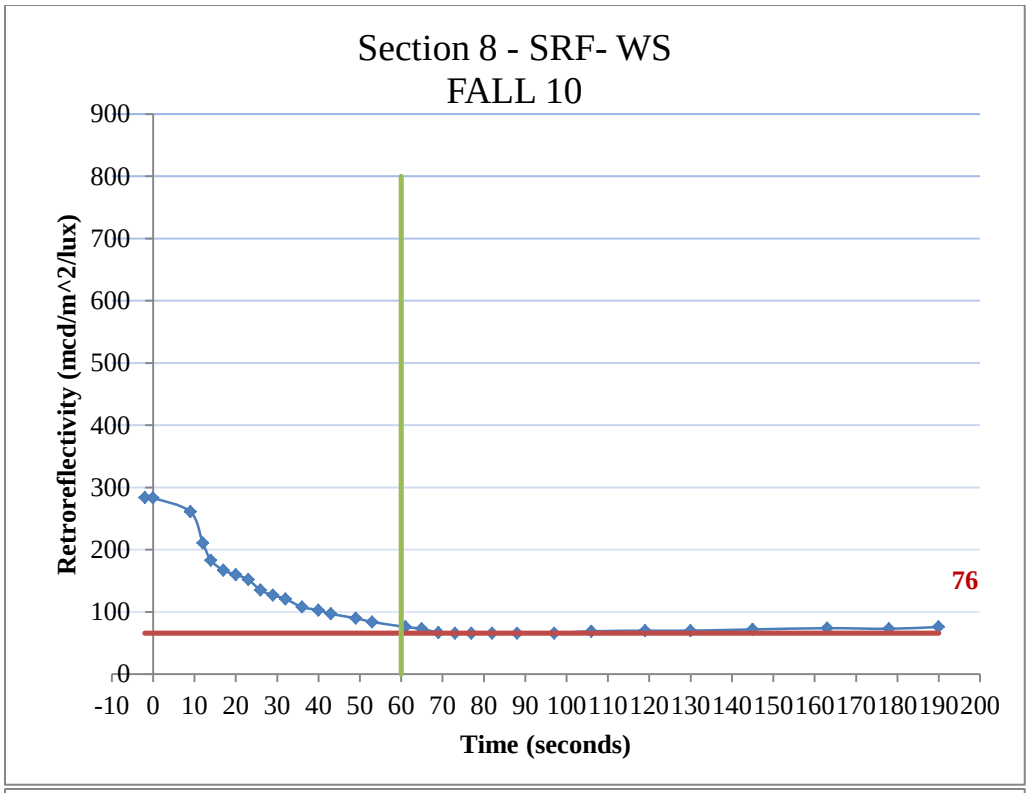

Section 5 - GRV - WS
FALL 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Time (seconds)
58

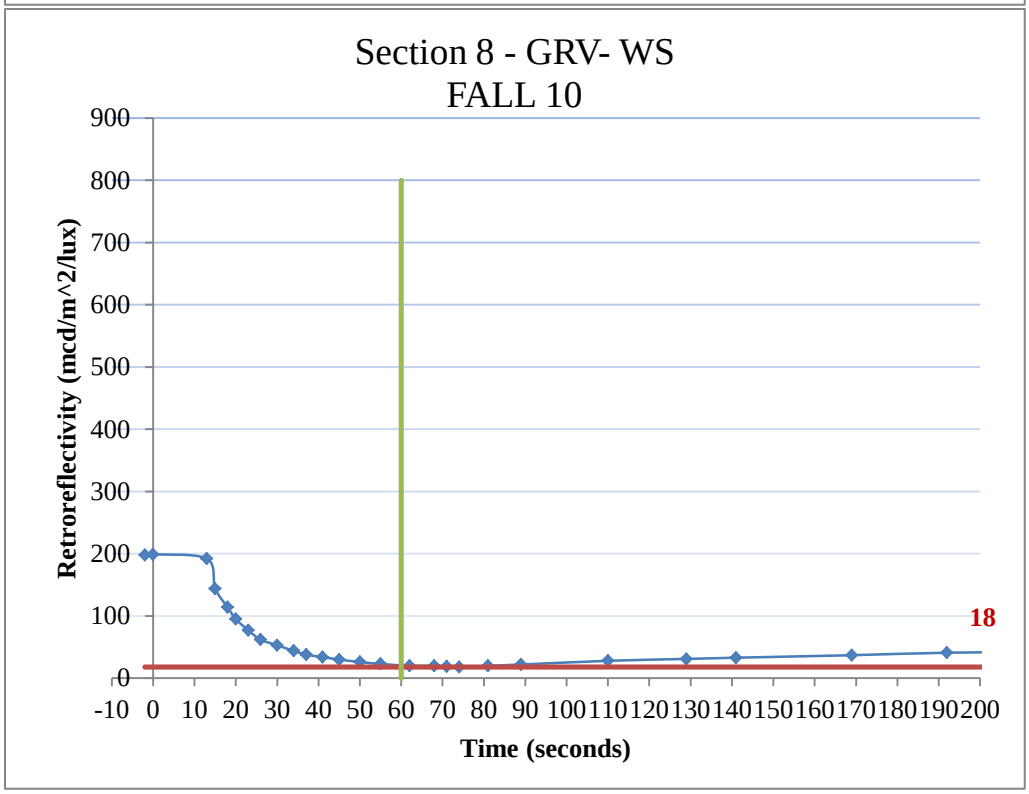

Section 6 - SRF - WS
FALL 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Time (seconds)
29

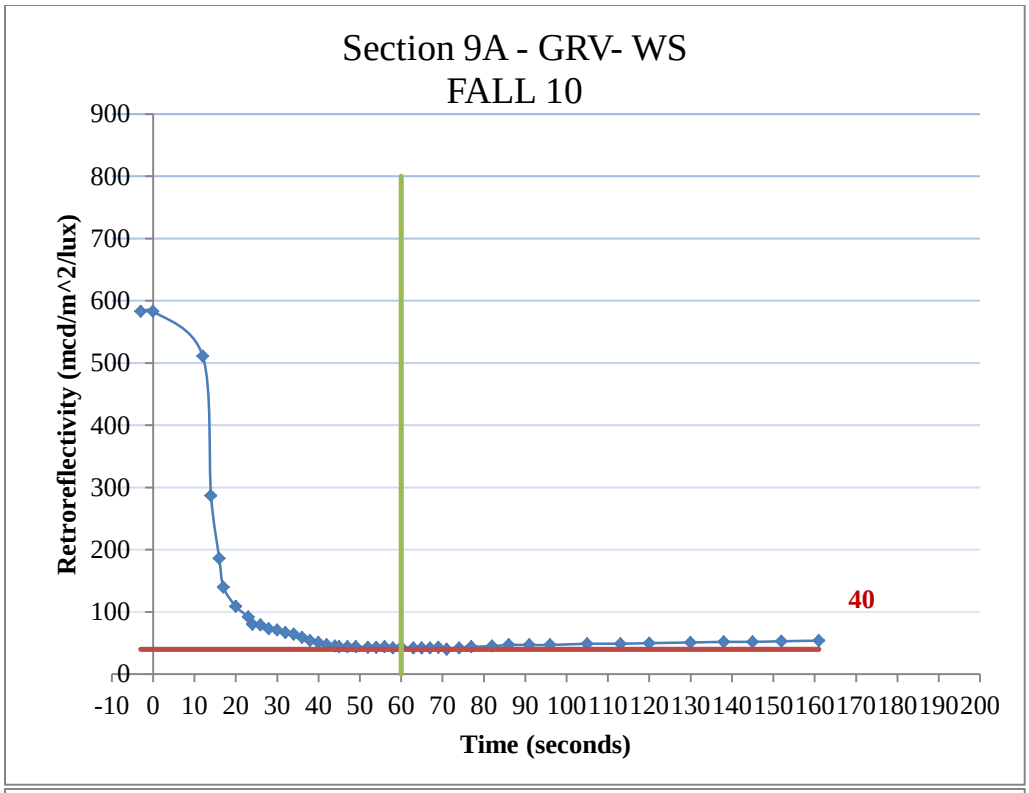

Section 6 - GRV - WS
FALL 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Time (seconds)
57

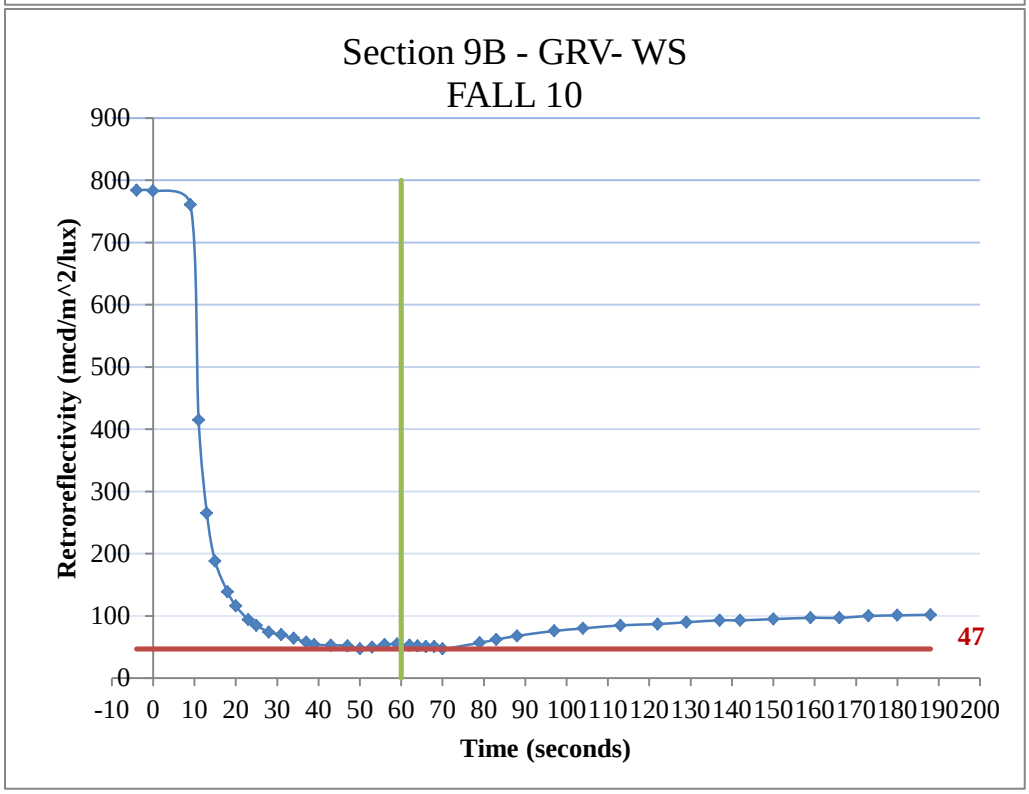

Section 7 - SRF - WS
FALL 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Time (seconds)
53

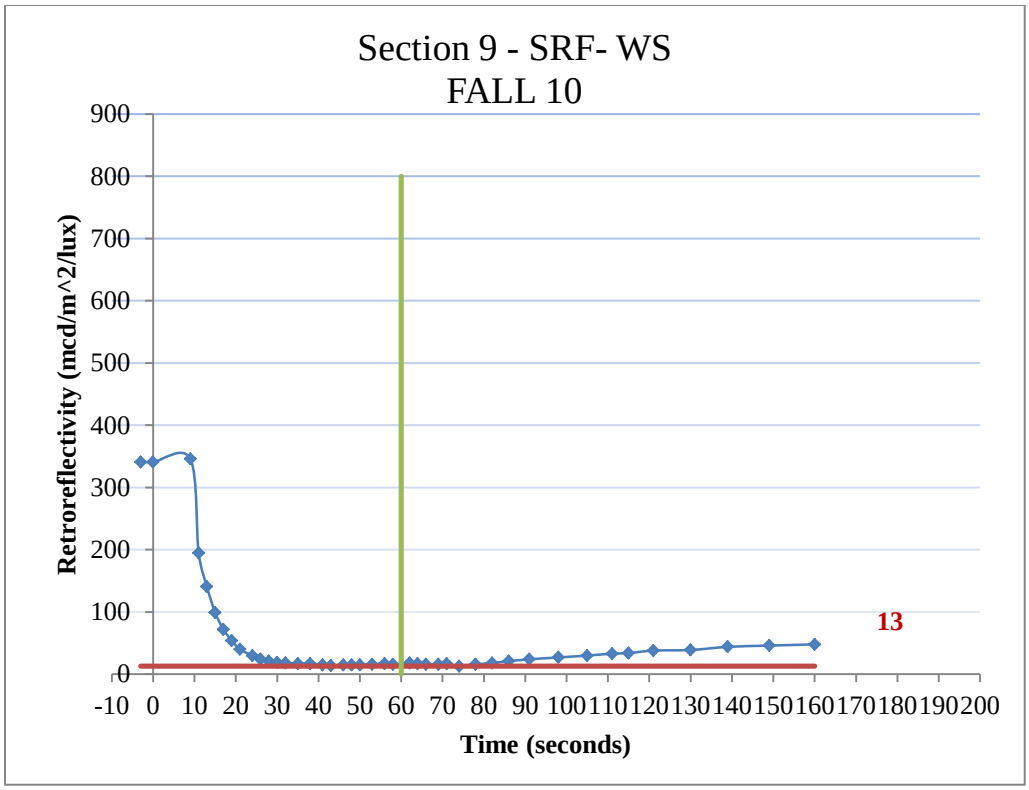

Section 7 - GRV- WS
FALL 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Time (seconds)
49

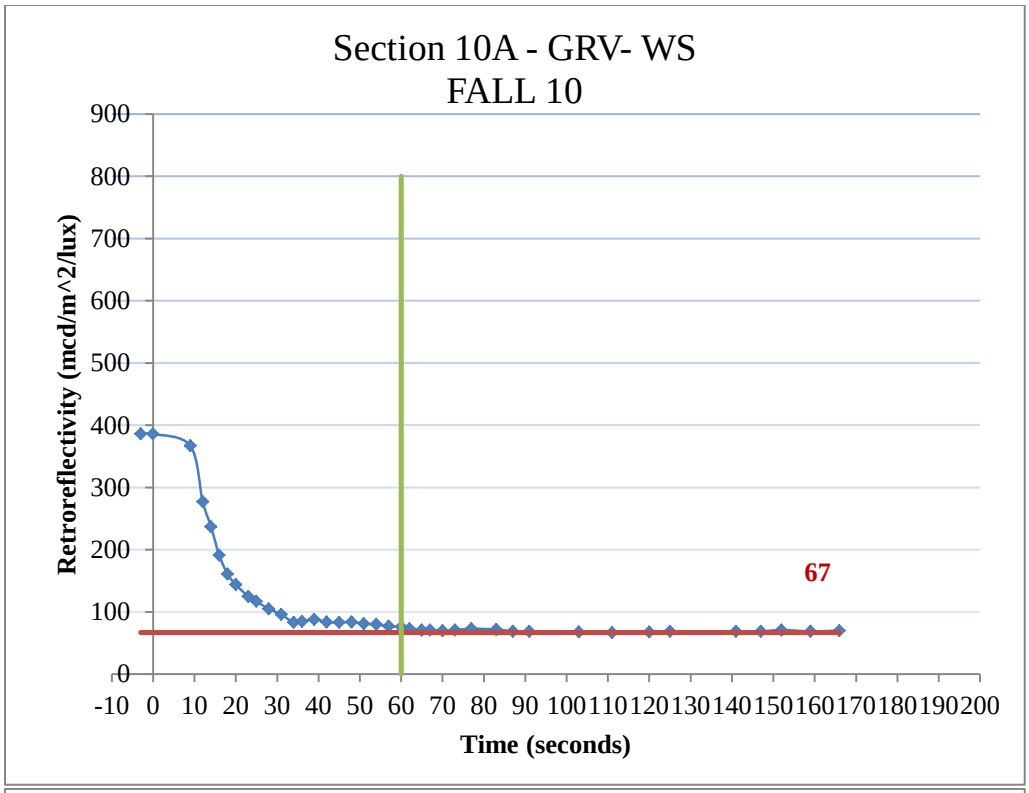

Section 8 - SRF- WS
FALL 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Time (seconds)
76

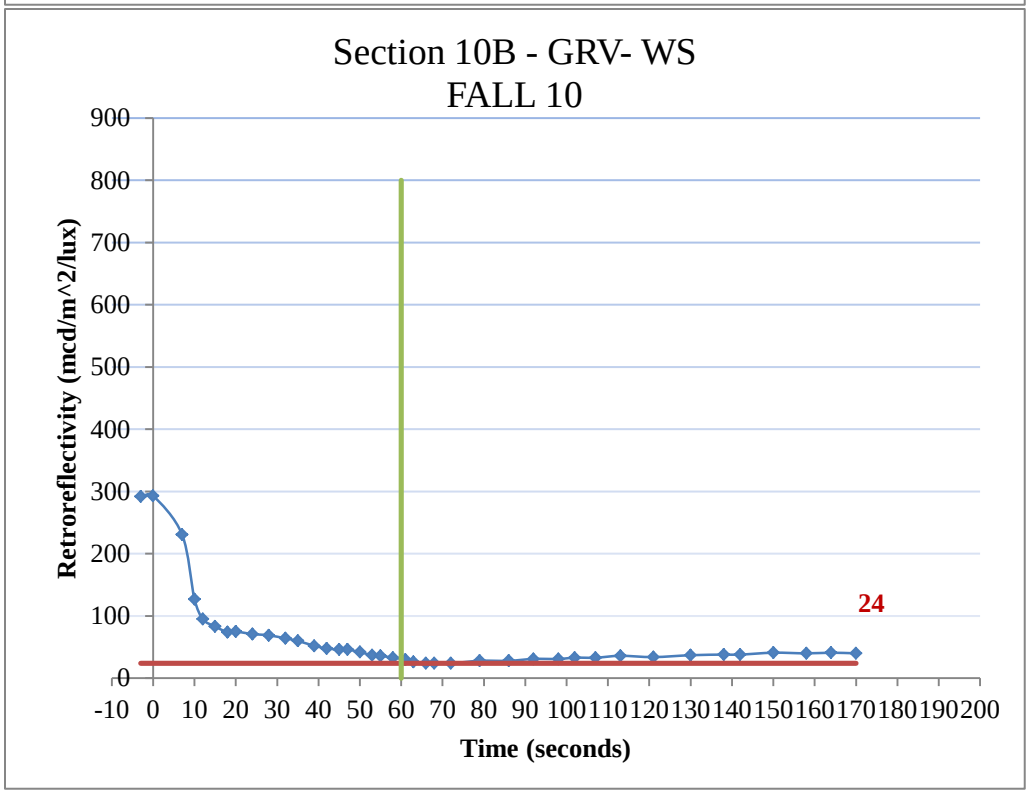

Section 8 - GRV- WS
FALL 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Time (seconds)
18

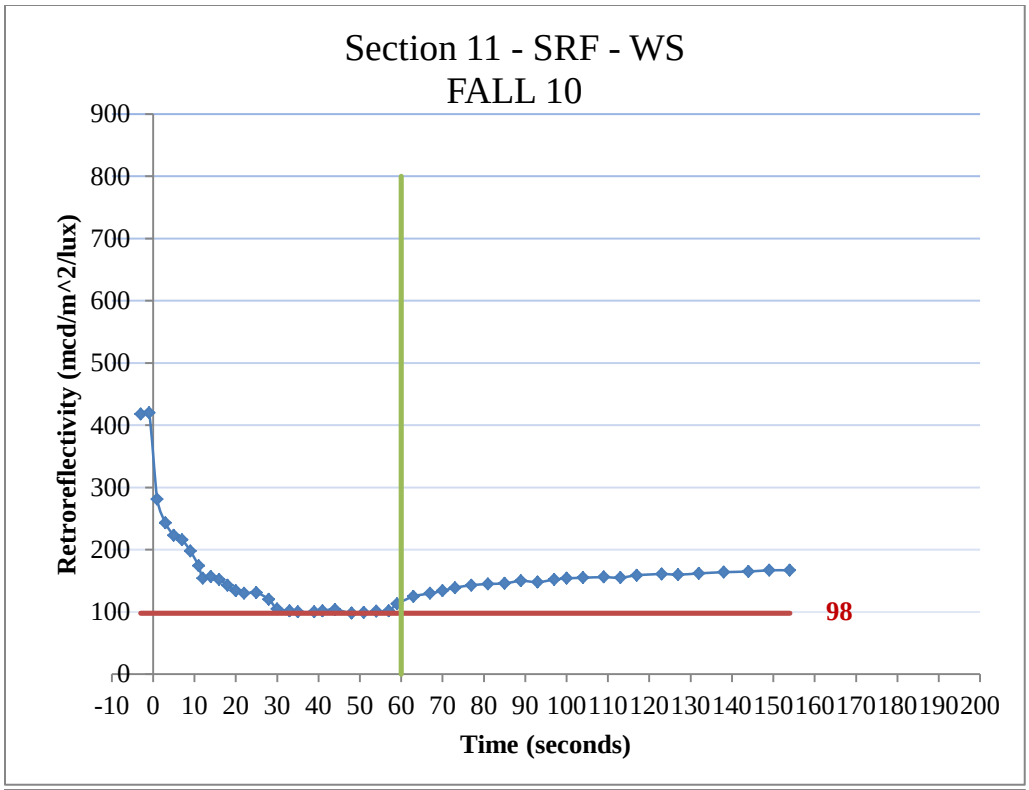

Section 9A - GRV- WS
FALL 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Time (seconds)
40

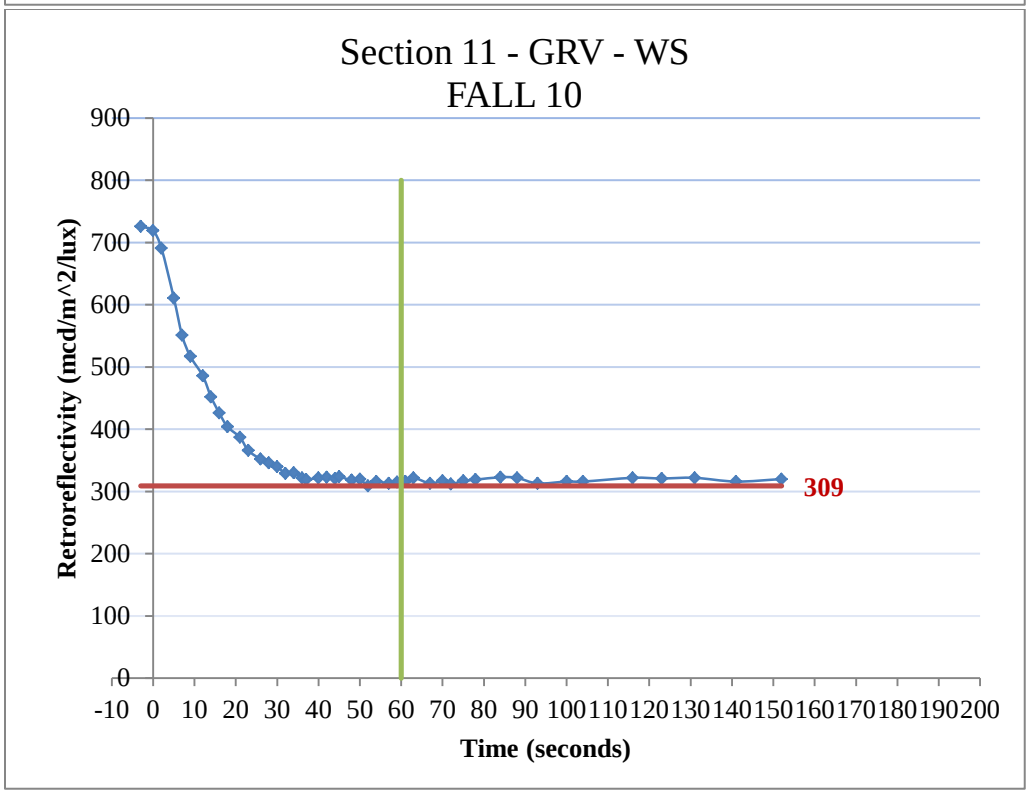

Section 9B - GRV- WS
FALL 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Time (seconds)
47

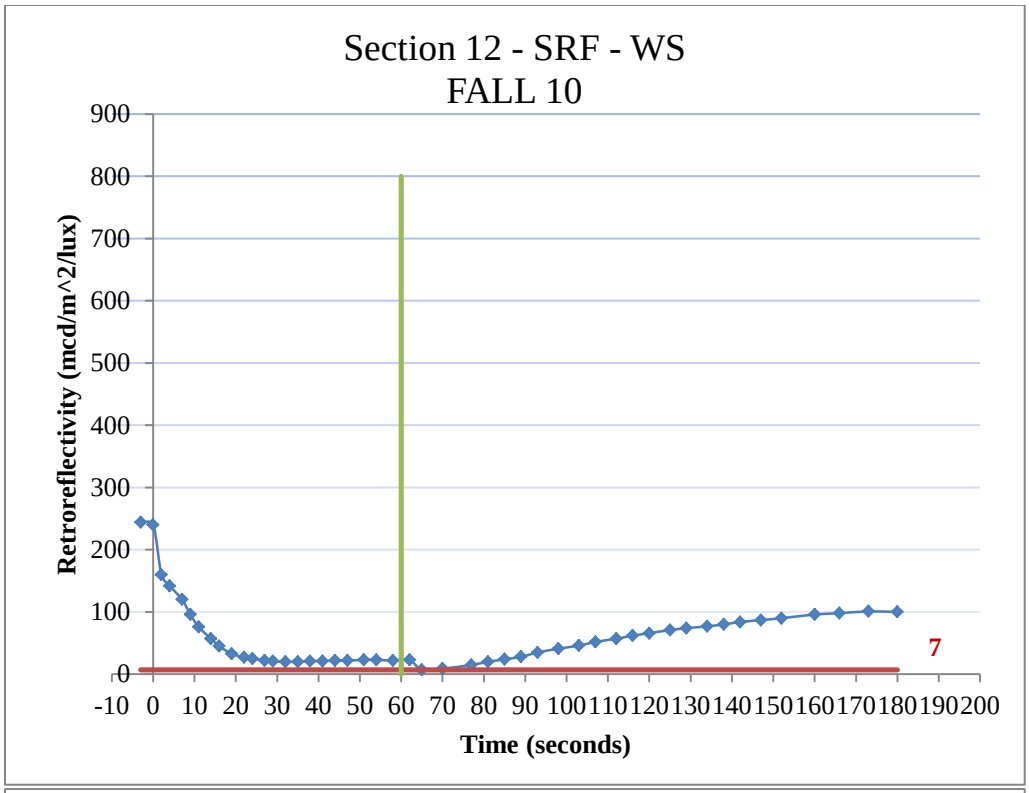

Section 9 - SRF- WS
FALL 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Time (seconds)
13

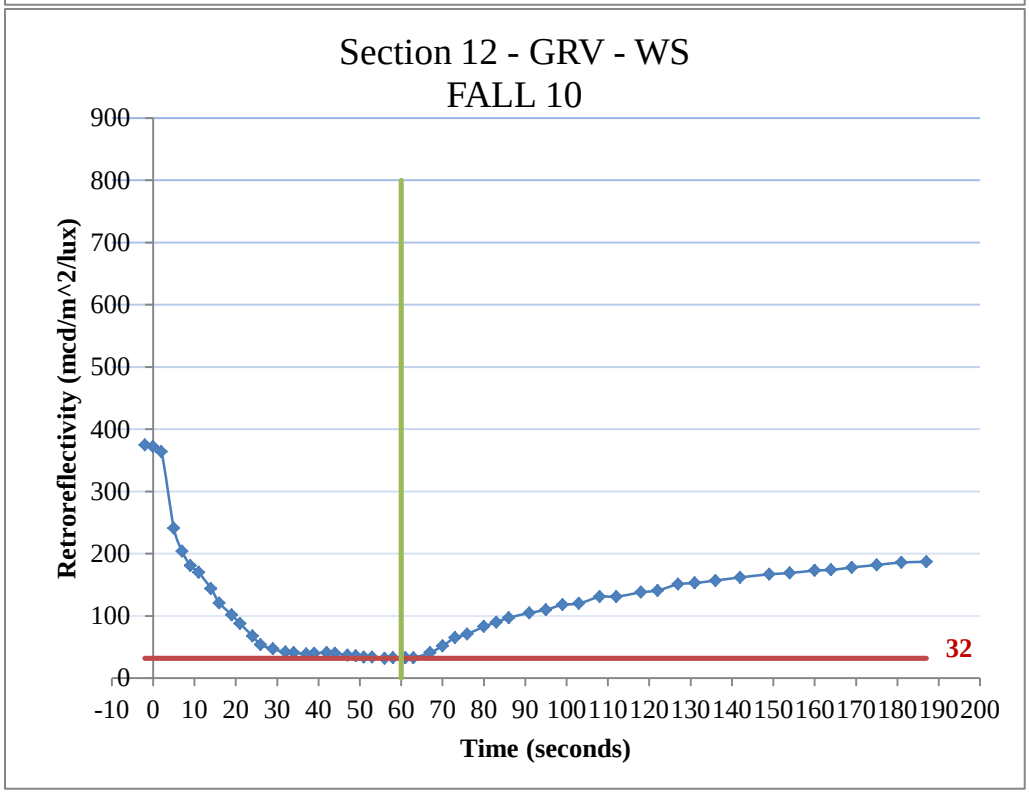

Section 10A - GRV- WS
FALL 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Time (seconds)
67

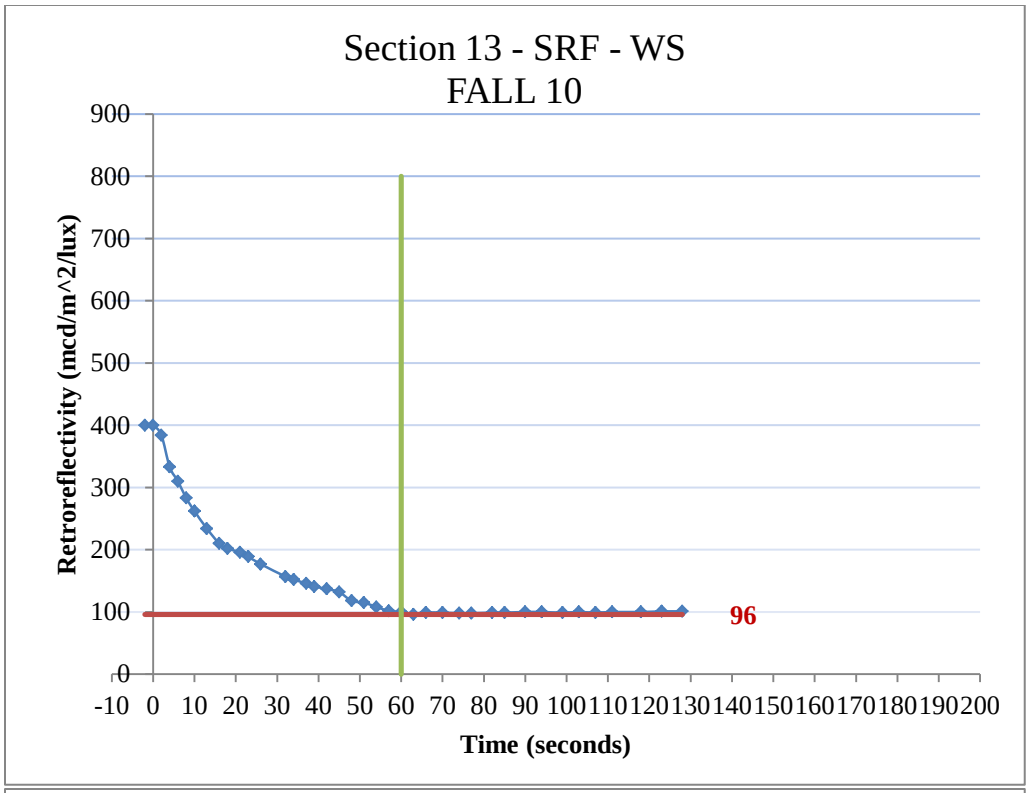

Section 10B - GRV- WS
FALL 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Time (seconds)
24

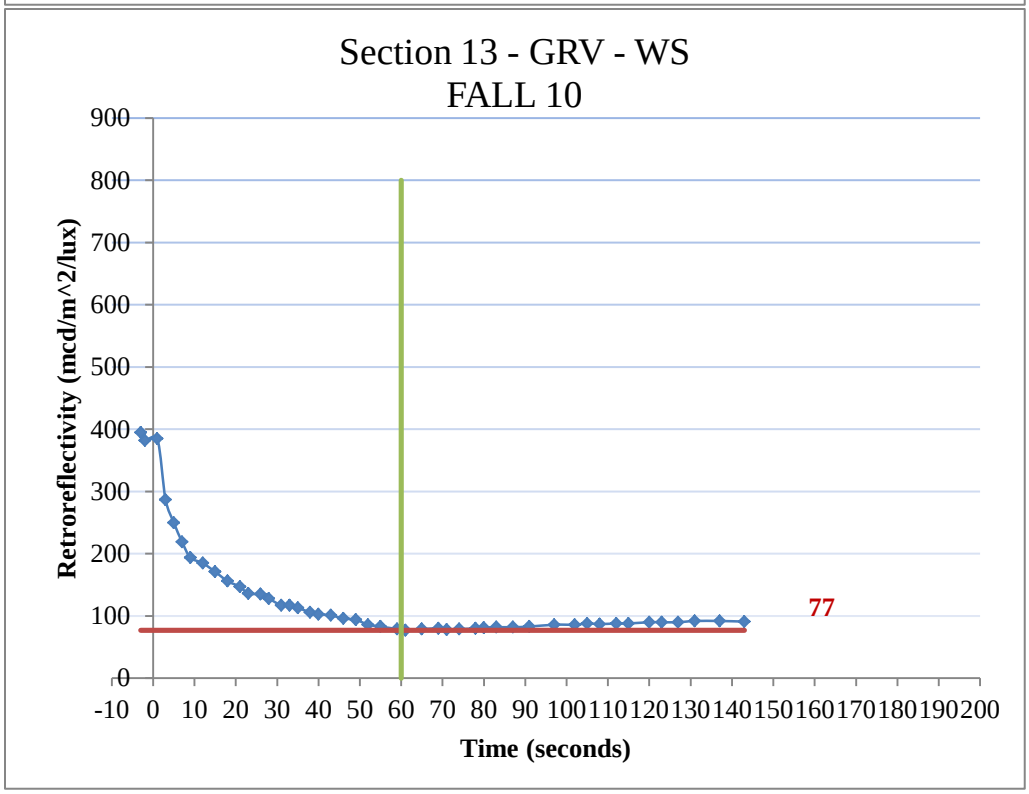

Section 11 - SRF - WS
FALL 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Time (seconds)
98

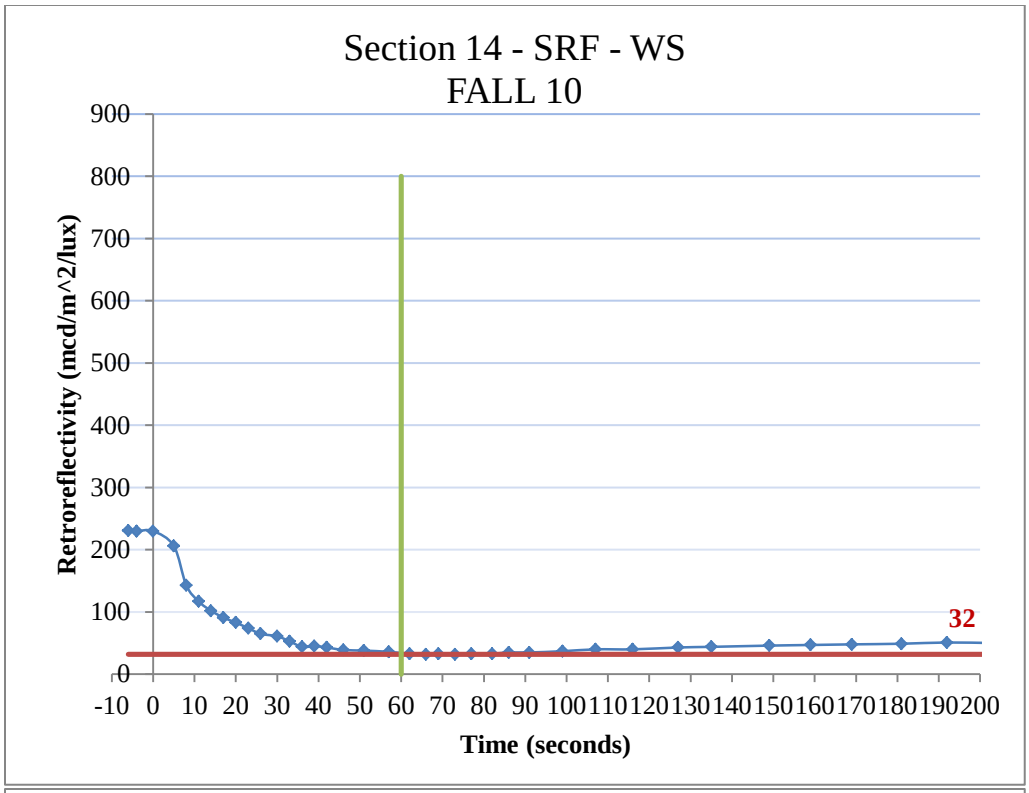

Section 11 - GRV - WS
FALL 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Time (seconds)
309

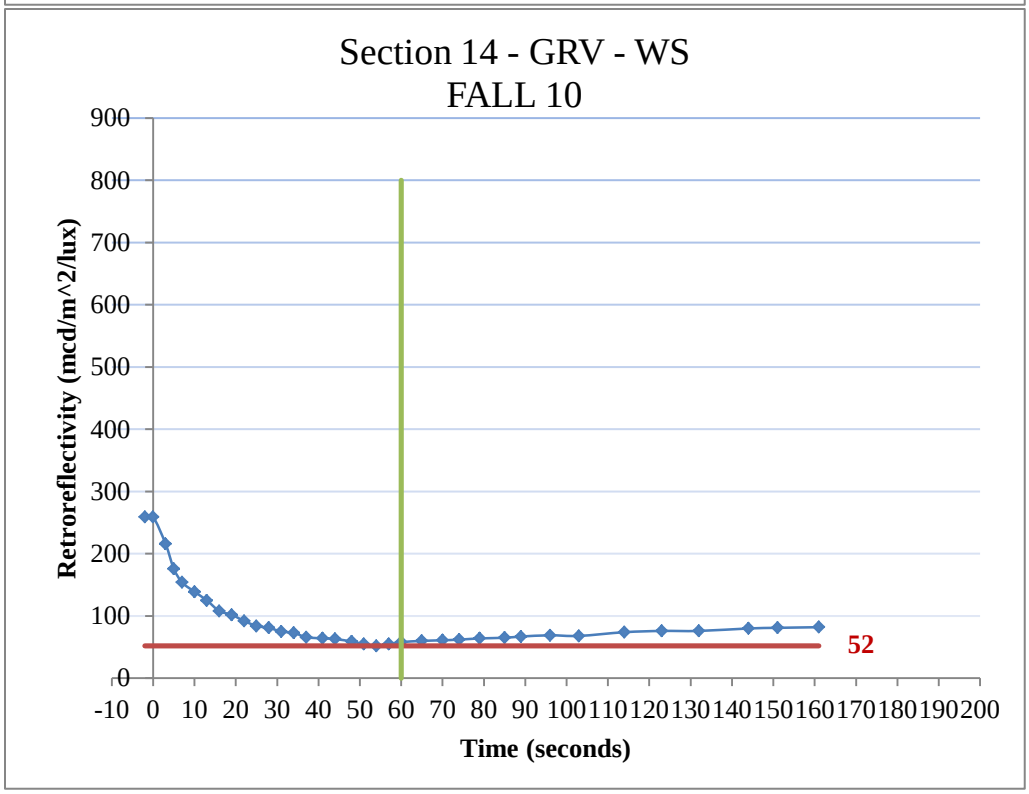

Section 12 - SRF - WS
FALL 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Time (seconds)
7

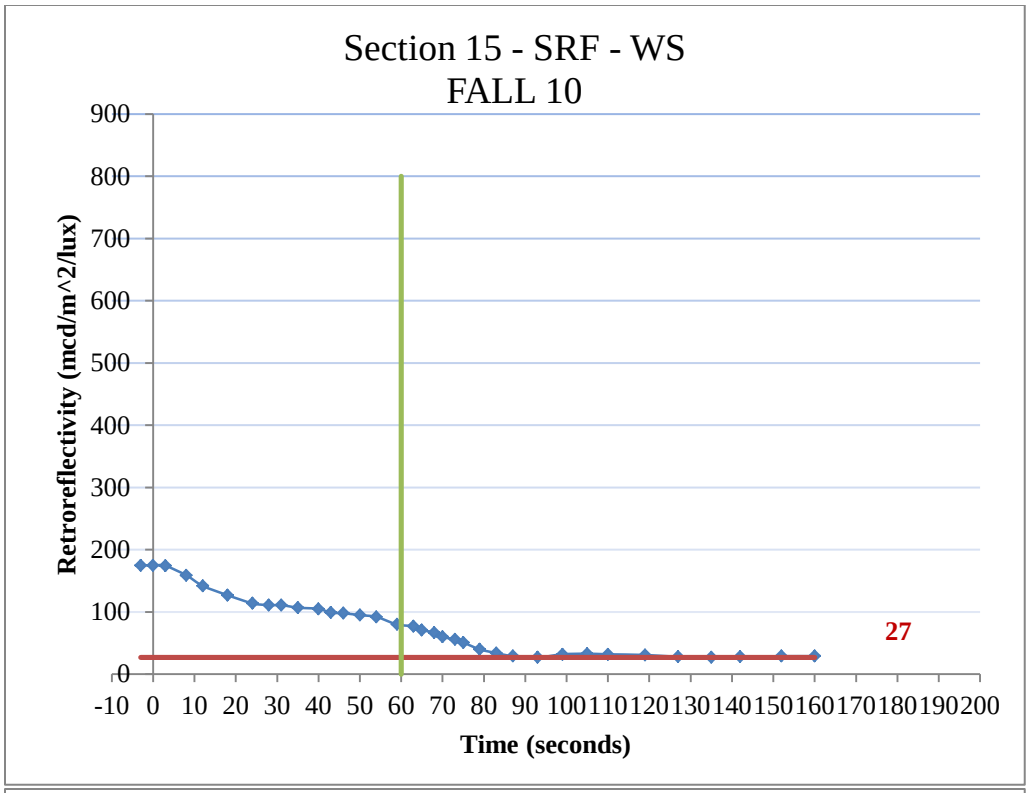

Section 12 - GRV - WS
FALL 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Time (seconds)
32

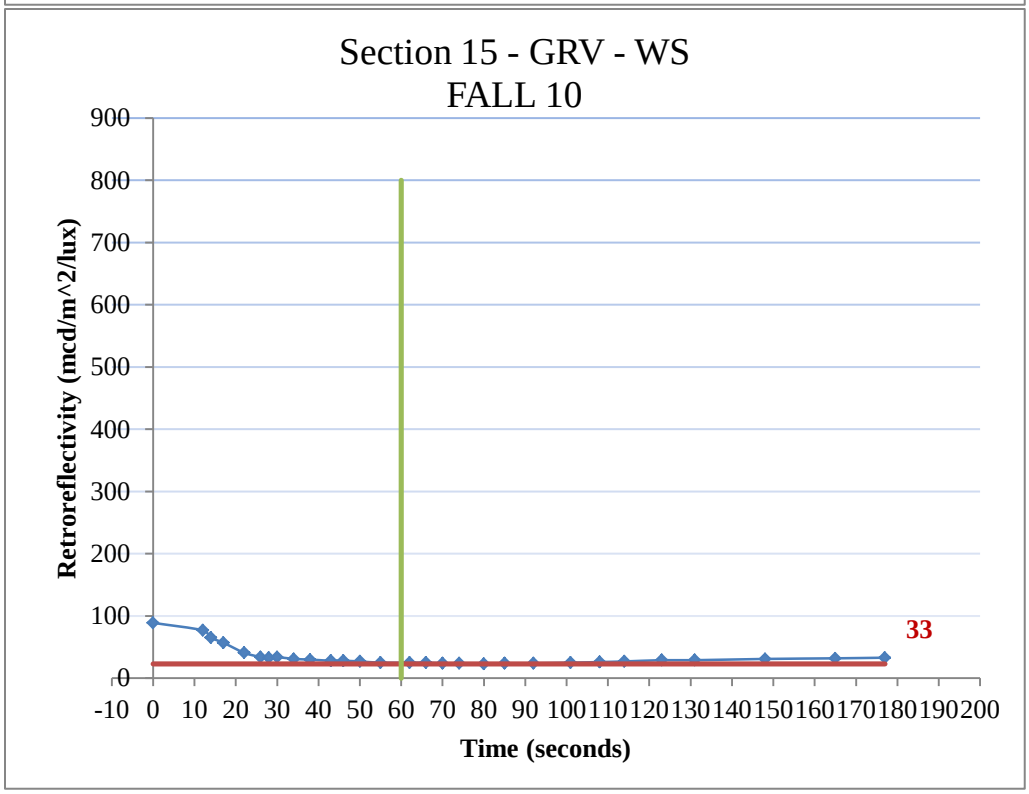

Section 13 - SRF - WS
FALL 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Time (seconds)
96

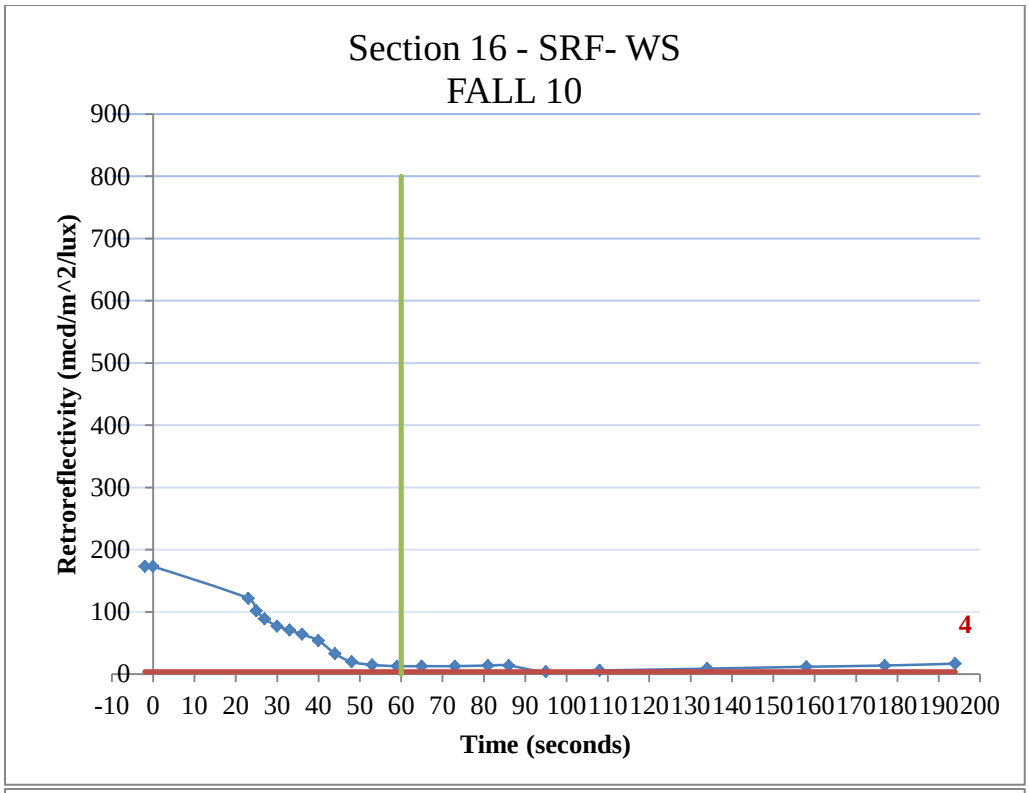

Section 13 - GRV - WS
FALL 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Time (seconds)
77

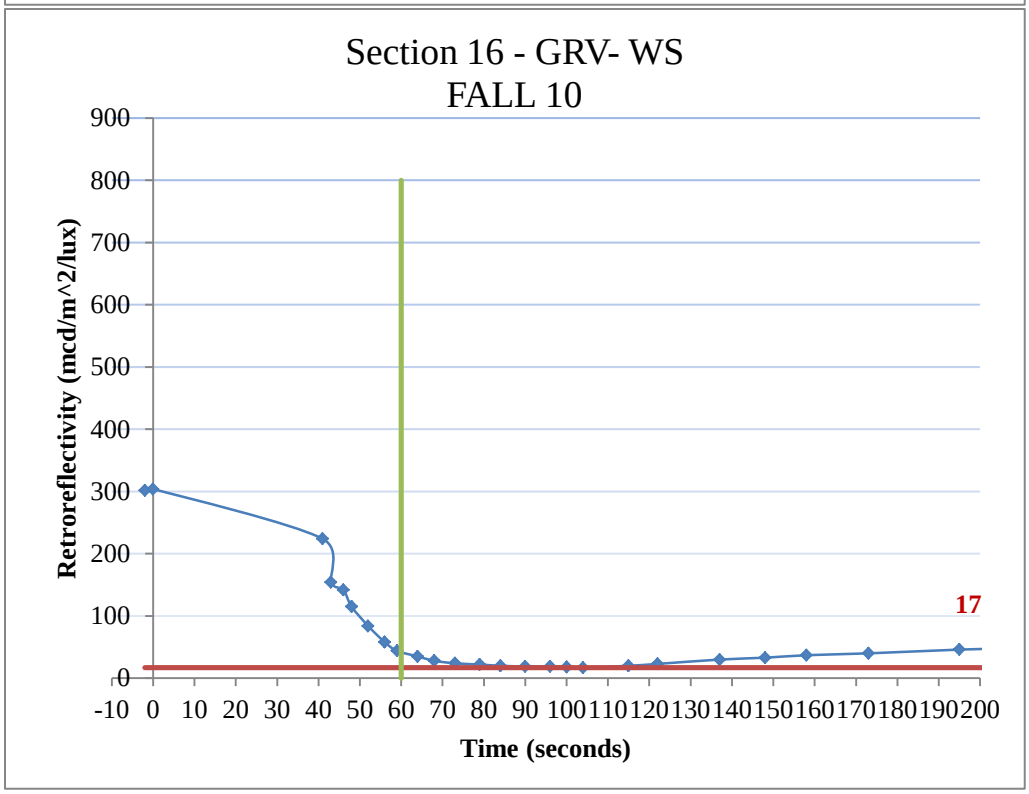

Section 14 - SRF - WS
FALL 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Time (seconds)
32


Section 14 - GRV - WS
FALL 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Time (seconds)
52

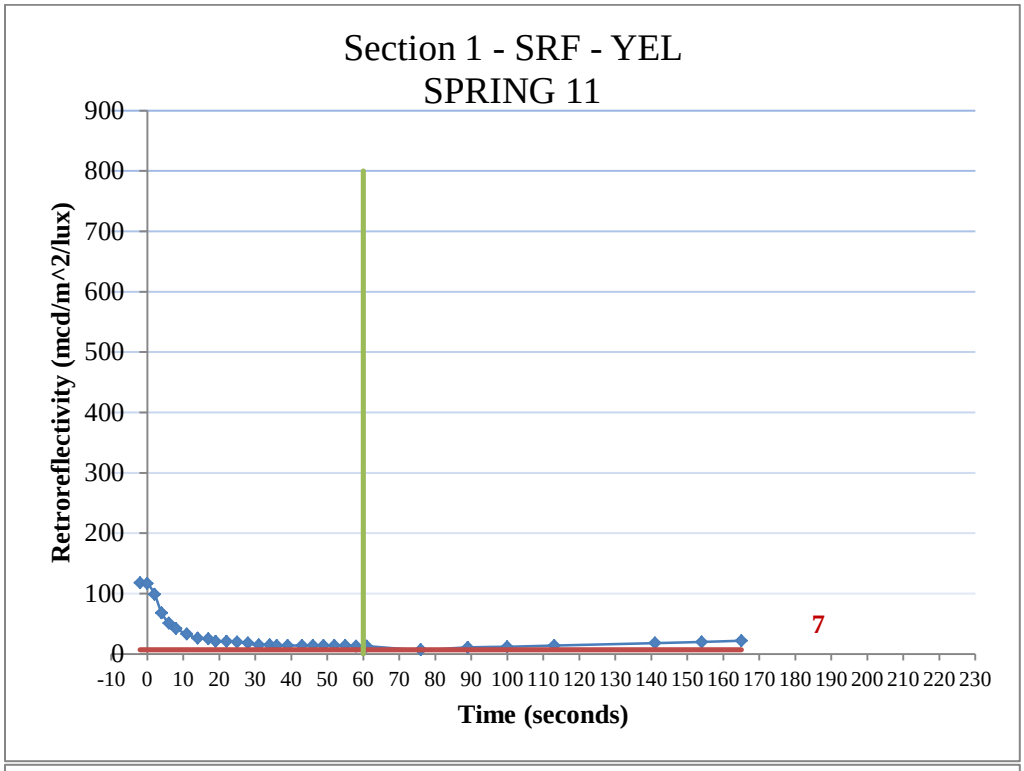

Section 15 - SRF - WS
FALL 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Time (seconds)
27

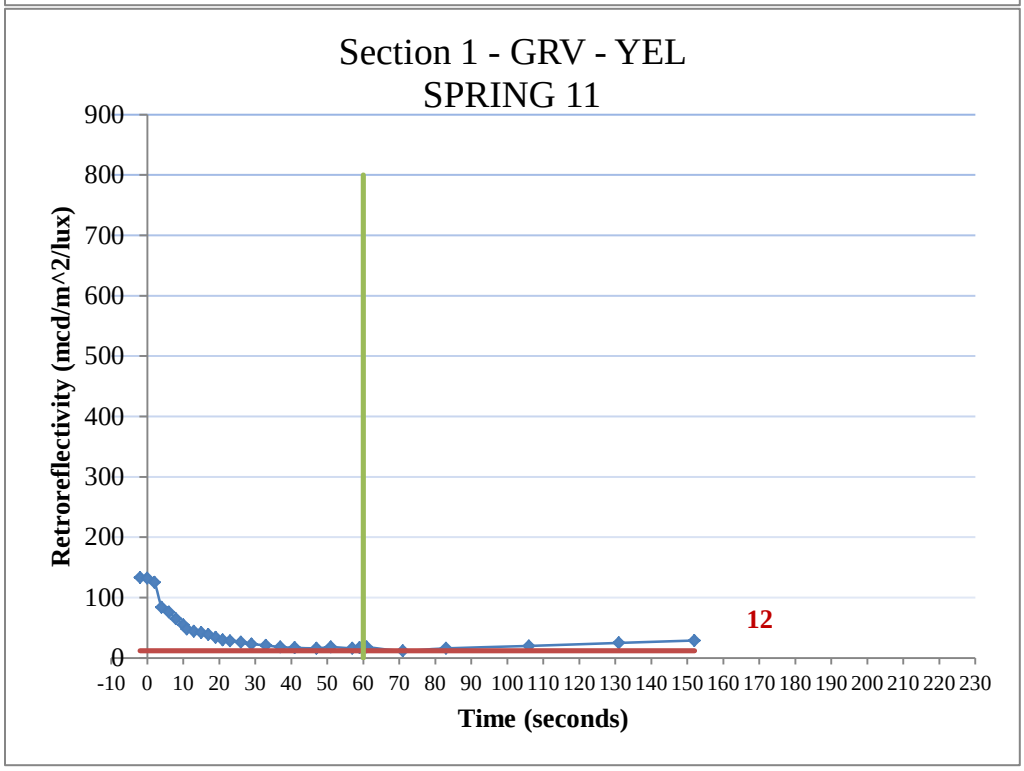

Section 15 - GRV - WS
FALL 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Time (seconds)
33

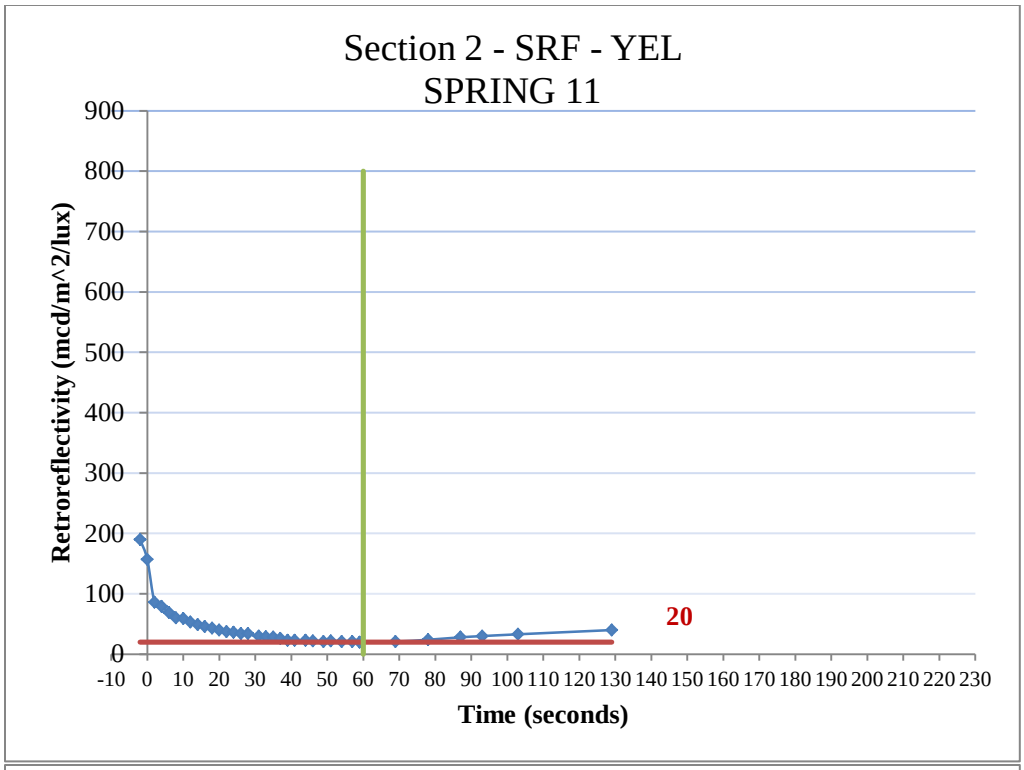

Section 16 - SRF- WS
FALL 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Time (seconds)
4

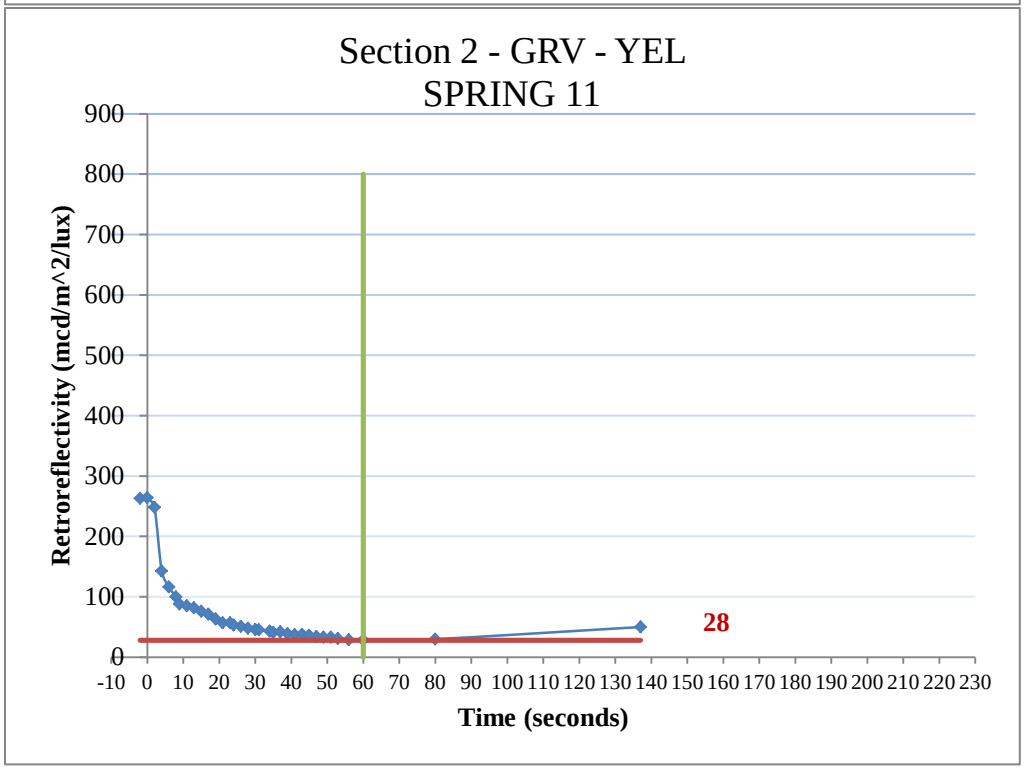

Section 16 - GRV- WS
FALL 10
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Time (seconds)
17

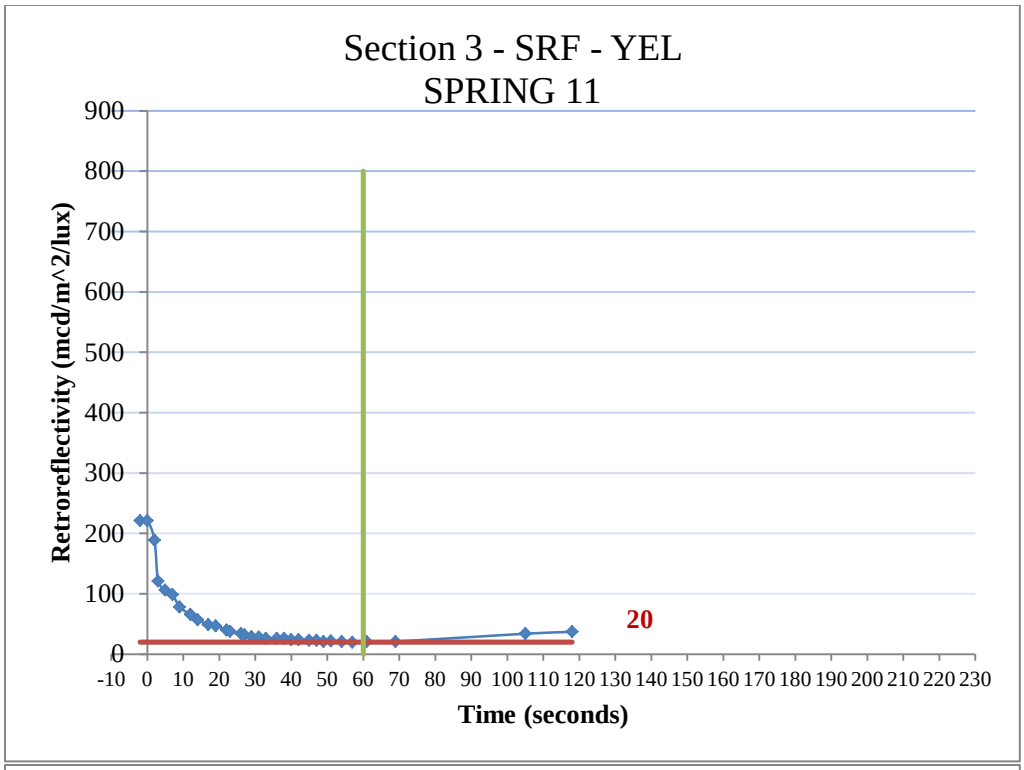
Yellow Edge Line

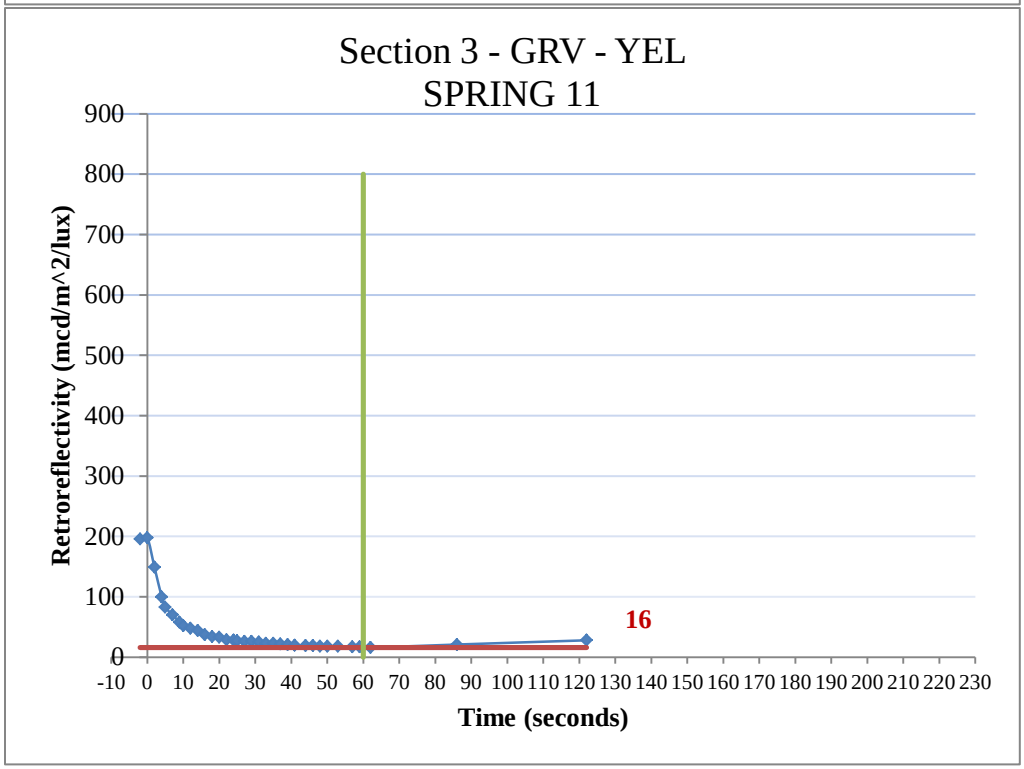


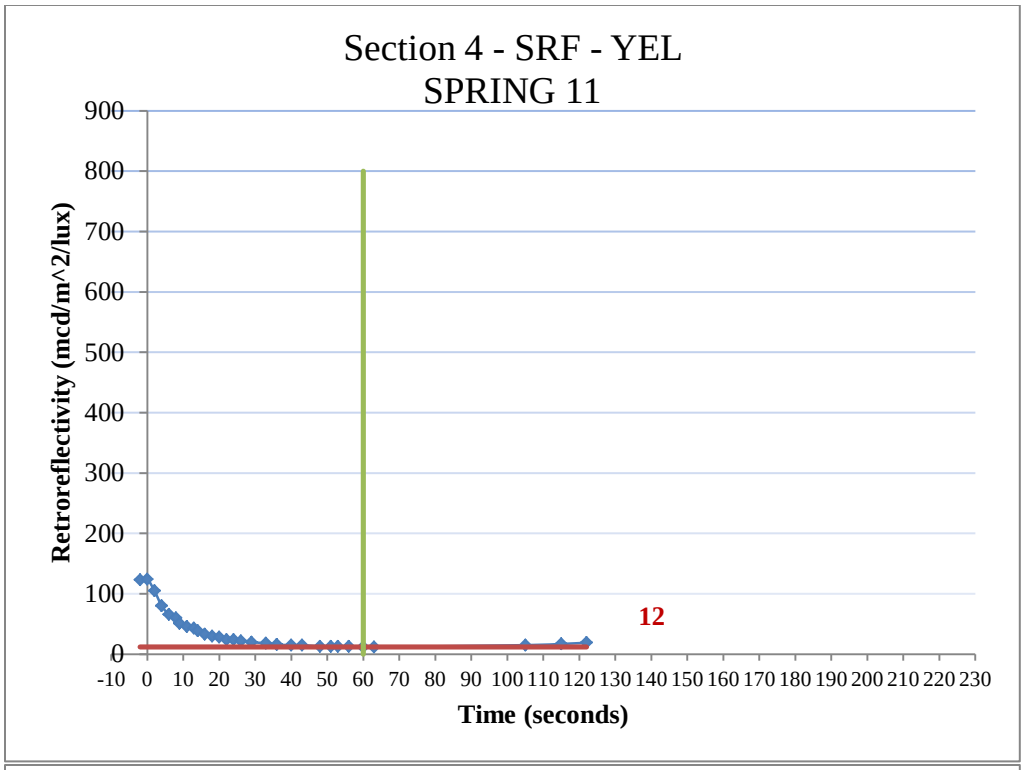


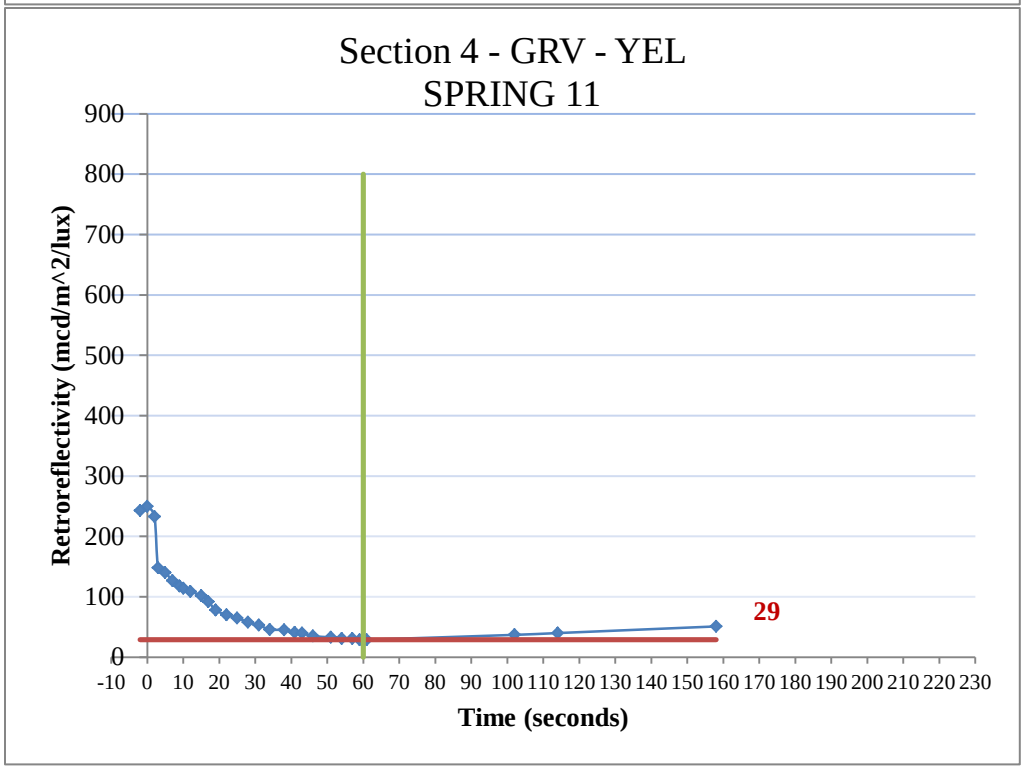

Section 2 - SRF - YEL
SPRING 11
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
Time (seconds)
20

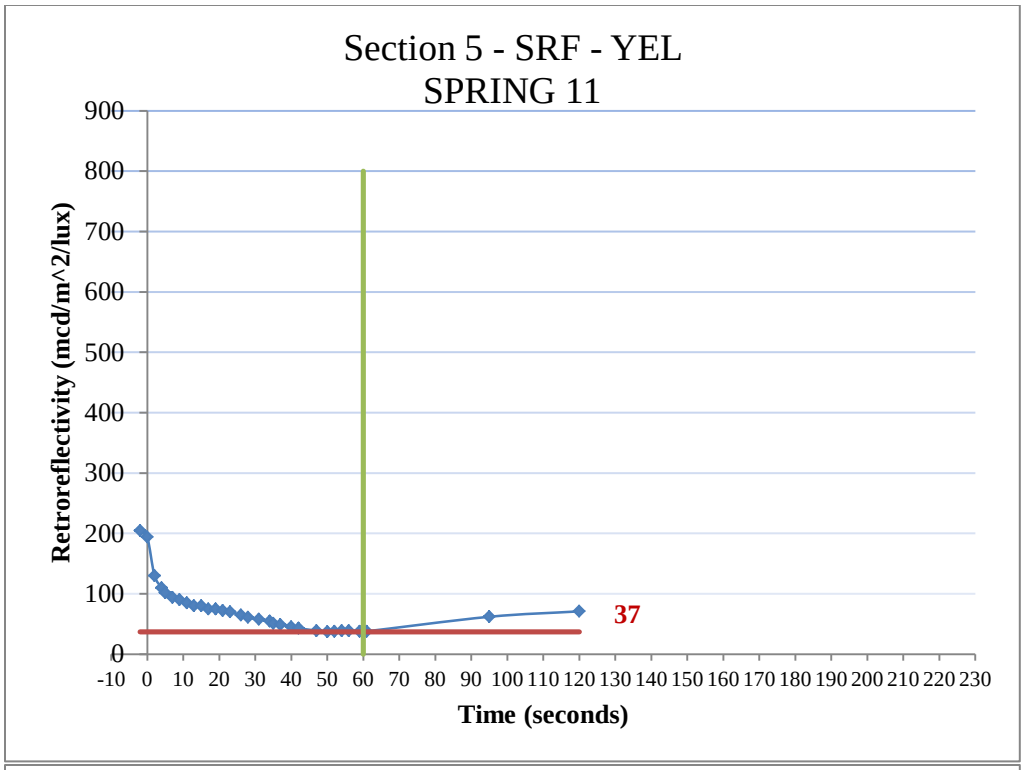

Section 2 - GRV - YEL
SPRING 11
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
Time (seconds)
28

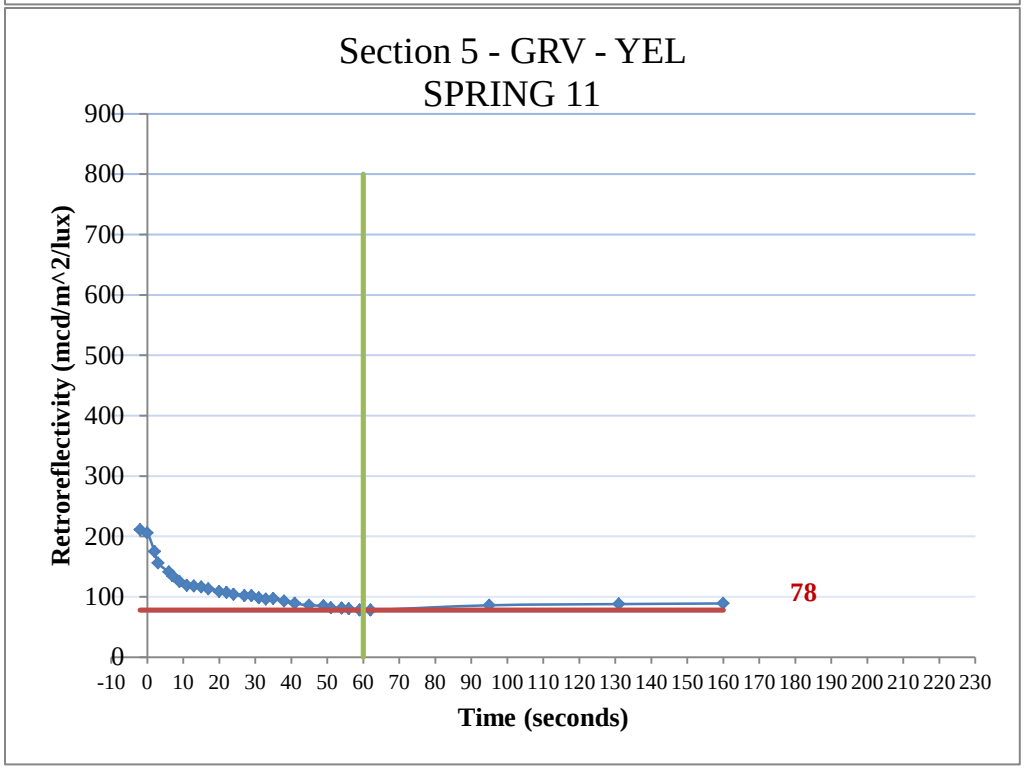

Section 3 - SRF - YEL
SPRING 11
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
Time (seconds)
20

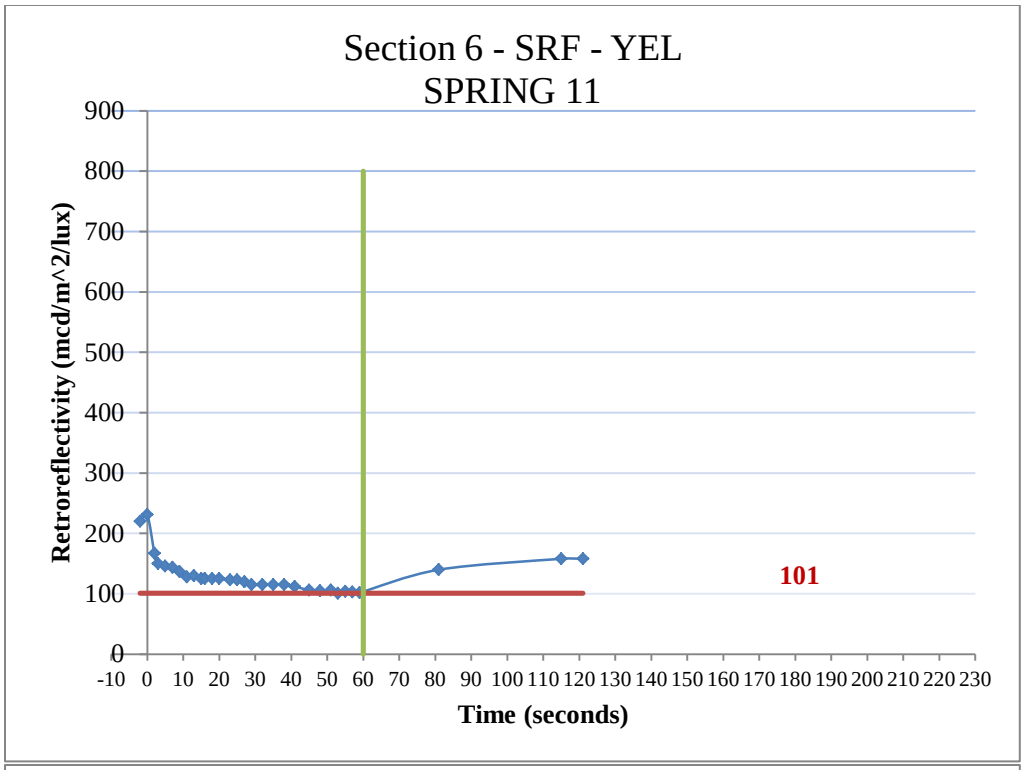

Section 3 - GRV - YEL
SPRING 11
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
Time (seconds)
16

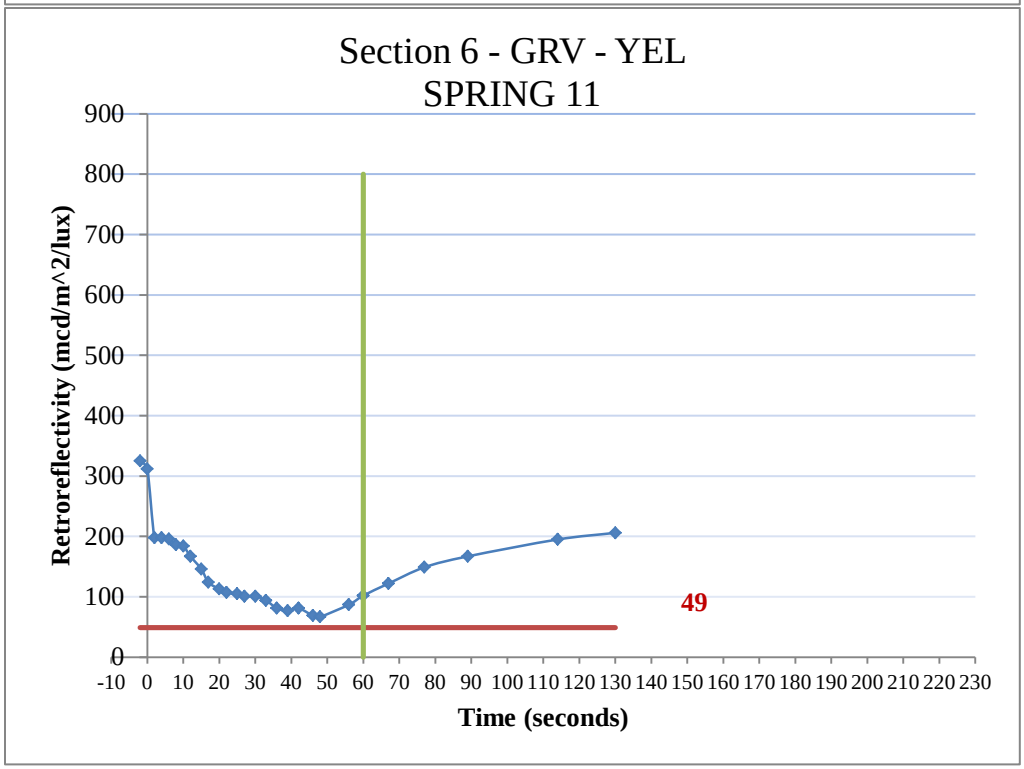

Section 4 - SRF - YEL
SPRING 11
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
Time (seconds)
12

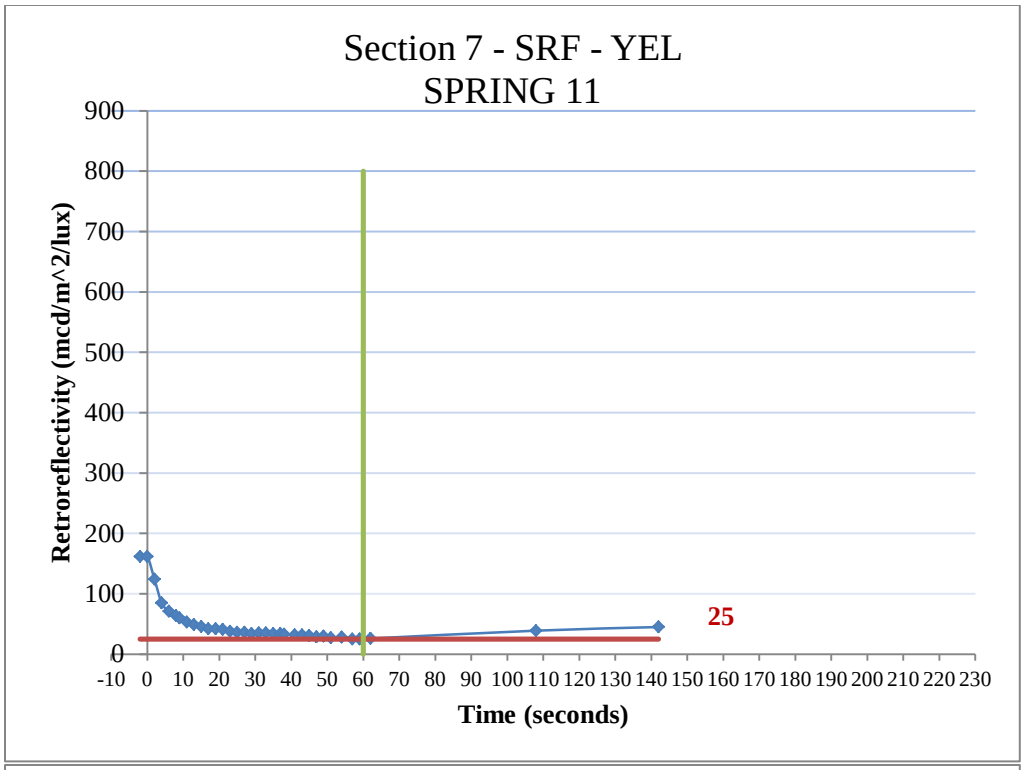

Section 4 - GRV - YEL
SPRING 11
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
Time (seconds)
29

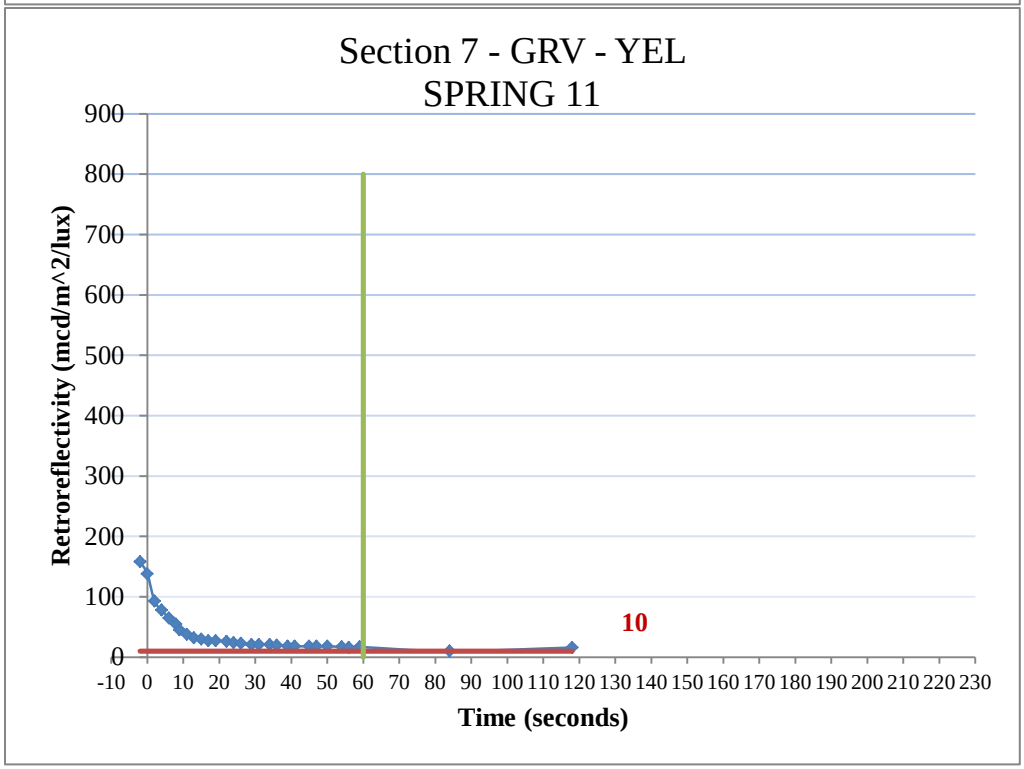

Section 5 - SRF - YEL
SPRING 11
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
Time (seconds)
37

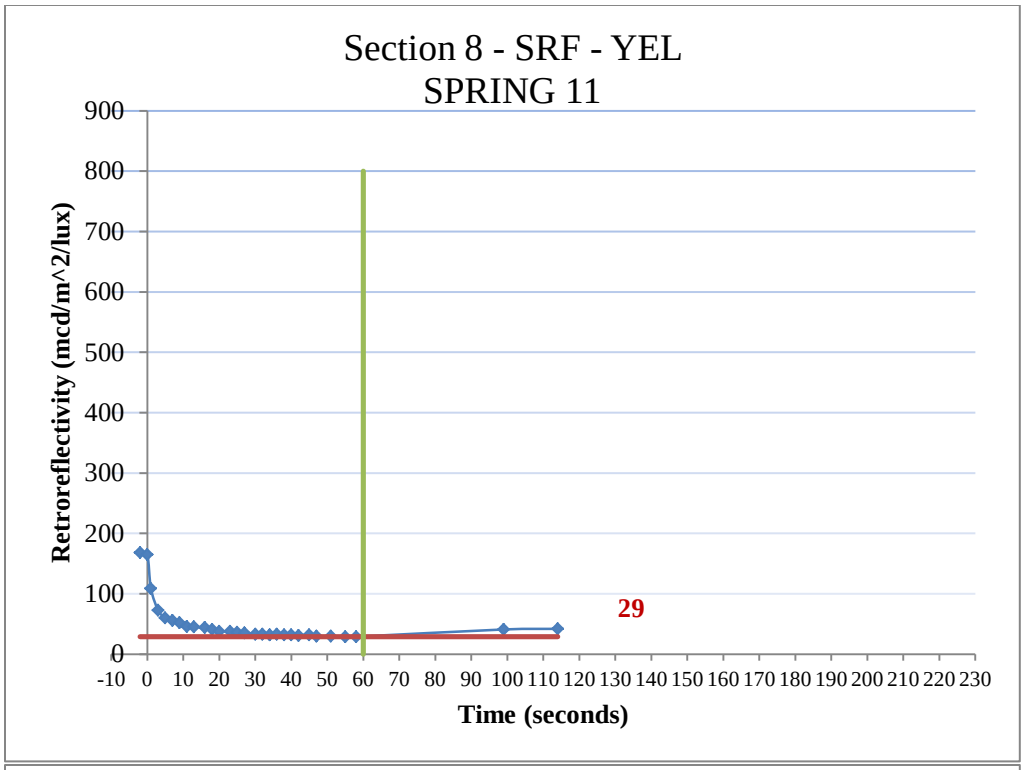

Section 5 - GRV - YEL
SPRING 11
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
Time (seconds)
78

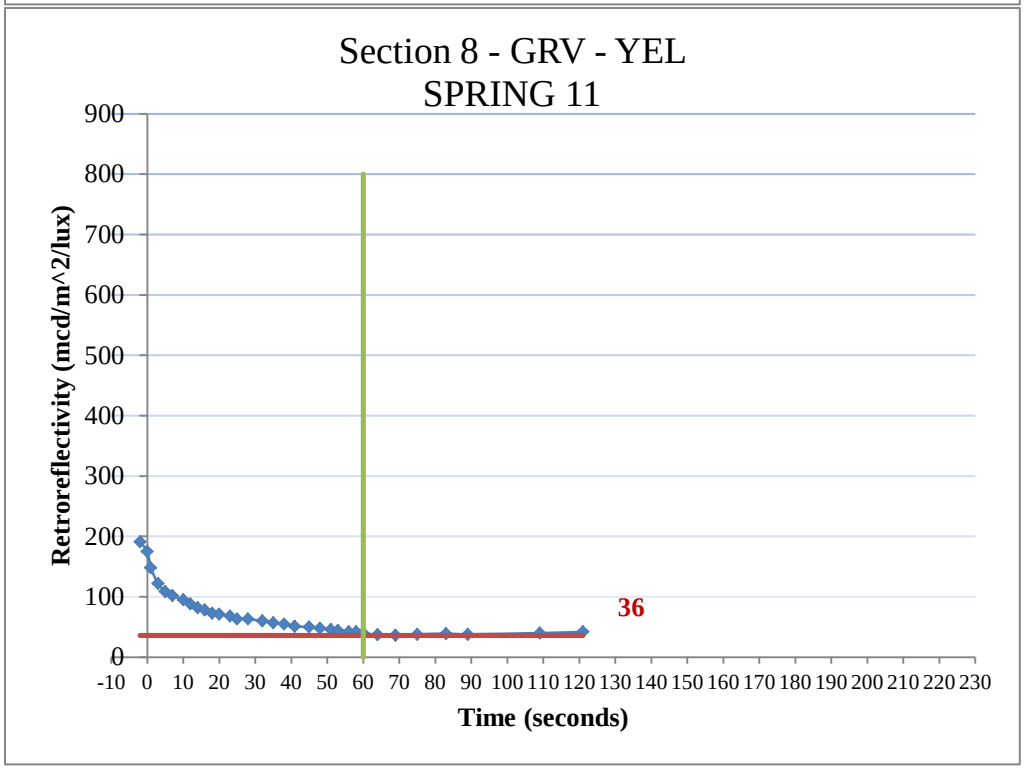

Section 6 - SRF - YEL
SPRING 11
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
Time (seconds)
101

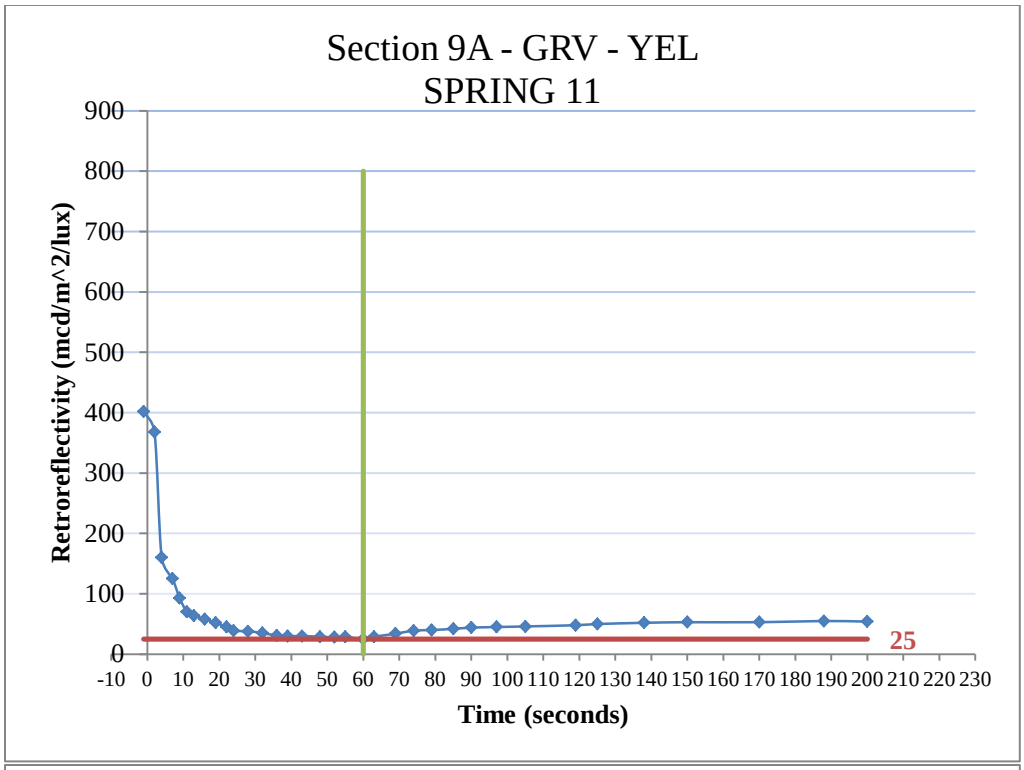

Section 6 - GRV - YEL
SPRING 11
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
Time (seconds)
49

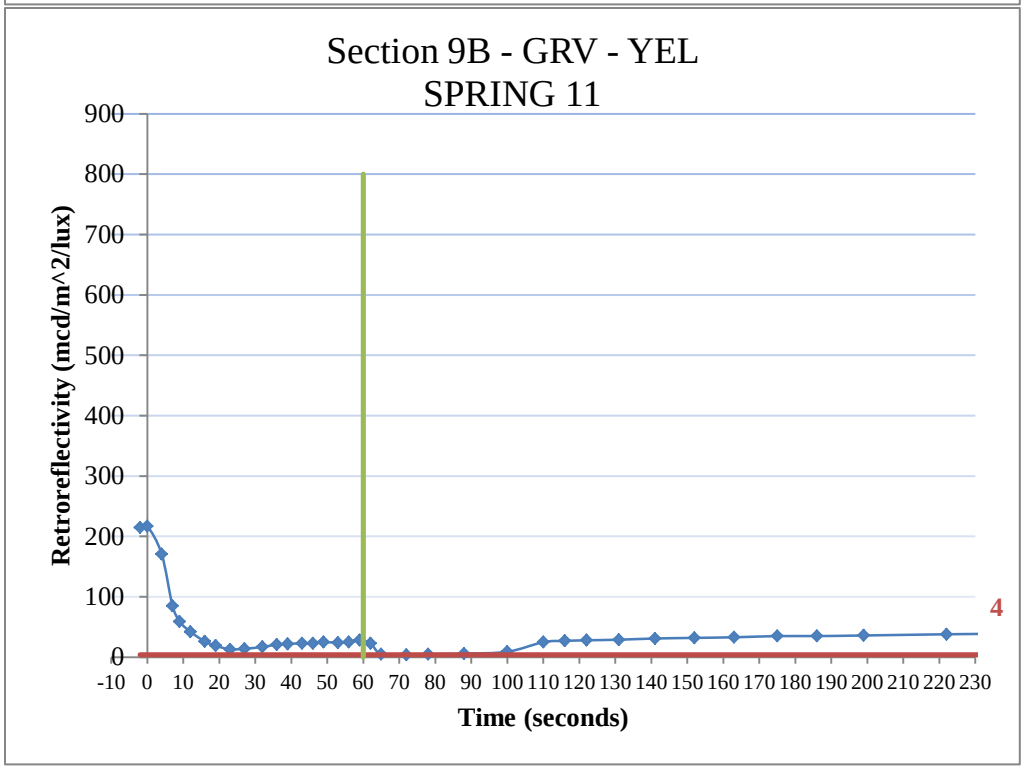

Section 7 - SRF - YEL
SPRING 11
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
Time (seconds)
25

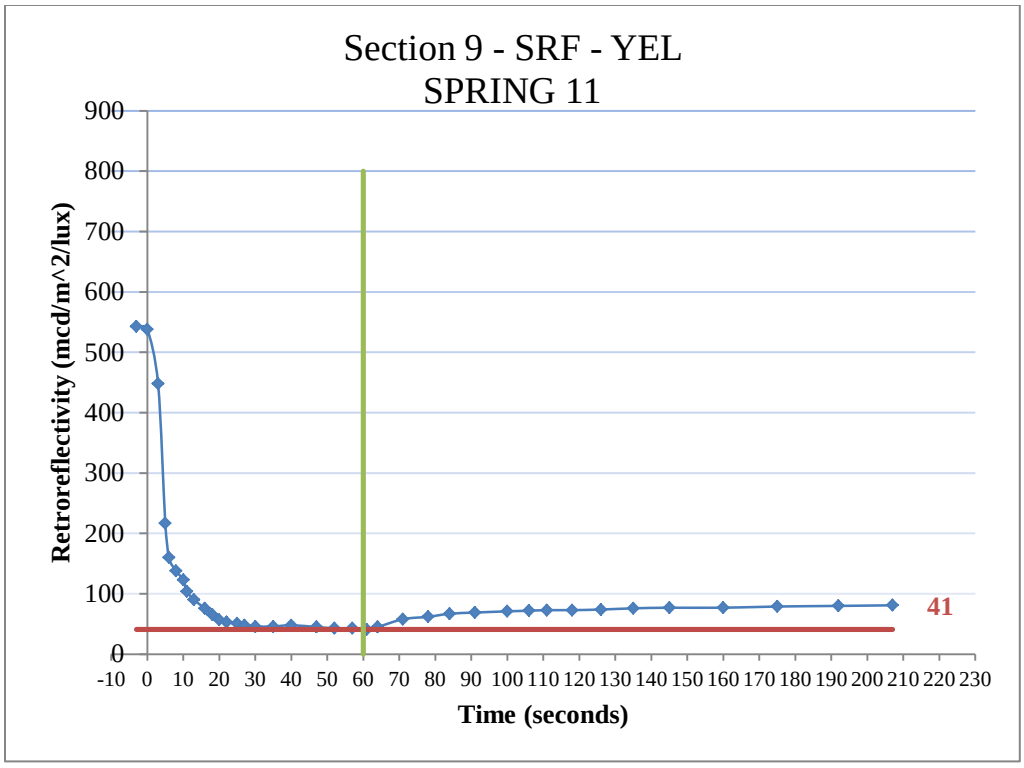

Section 7 - GRV - YEL
SPRING 11
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
Time (seconds)
10

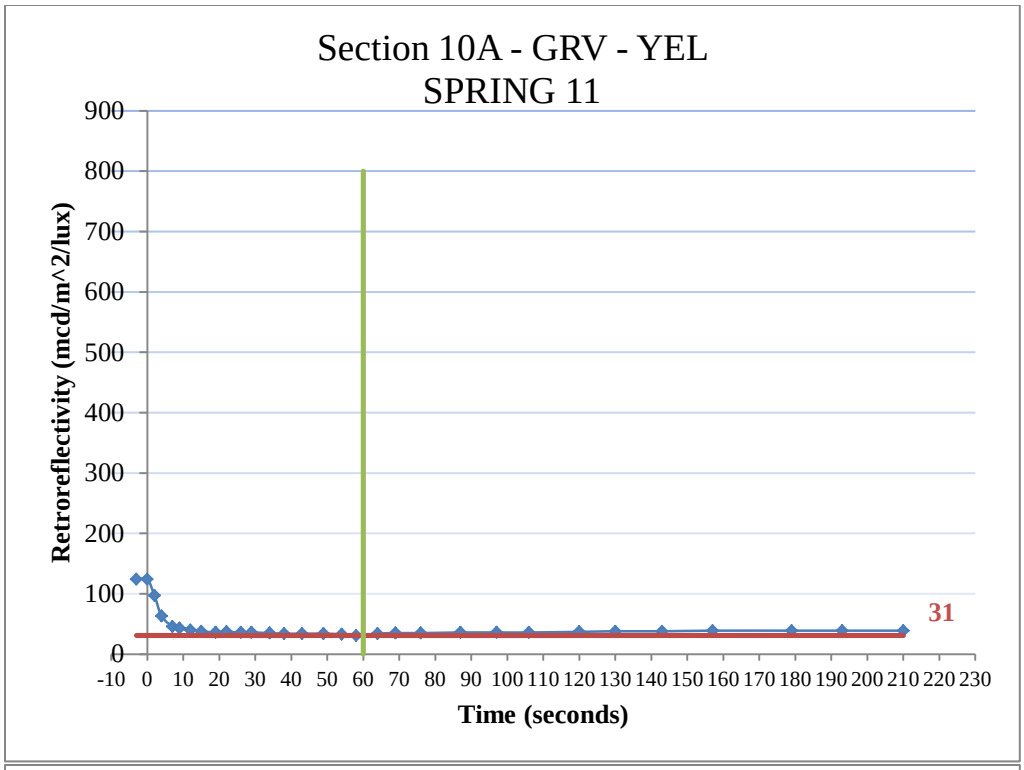

Section 8 - SRF - YEL
SPRING 11
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
Time (seconds)
29

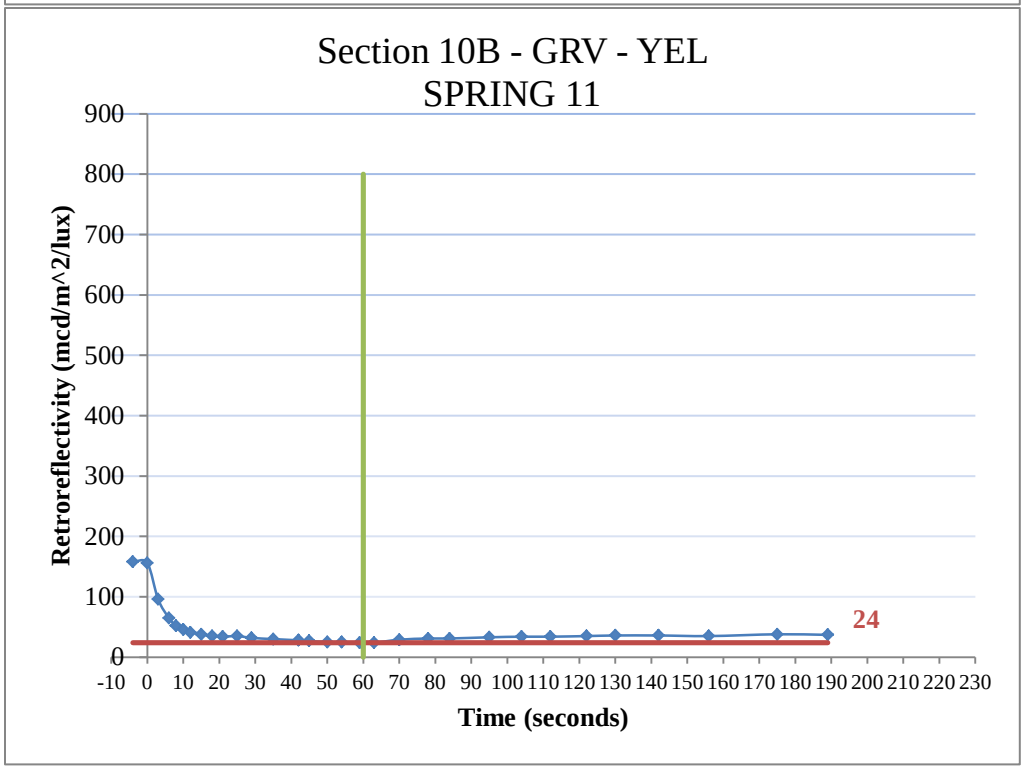

Section 8 - GRV - YEL
SPRING 11
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
Time (seconds)
36

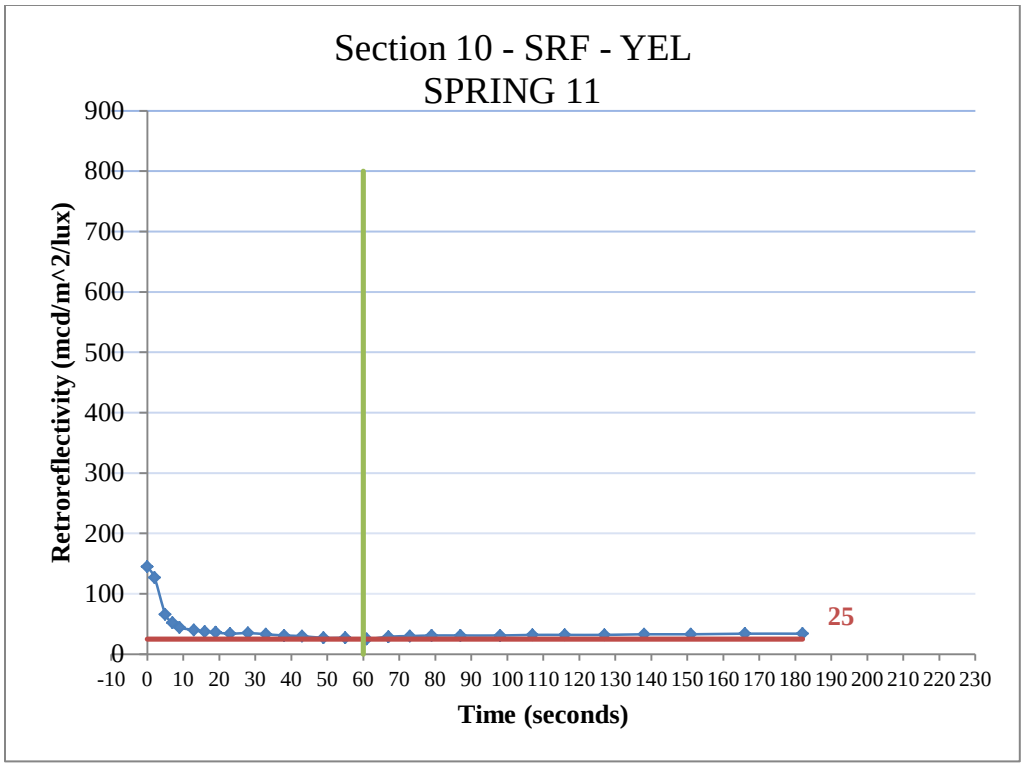

Section 9A - GRV - YEL
SPRING 11
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
Time (seconds)
25

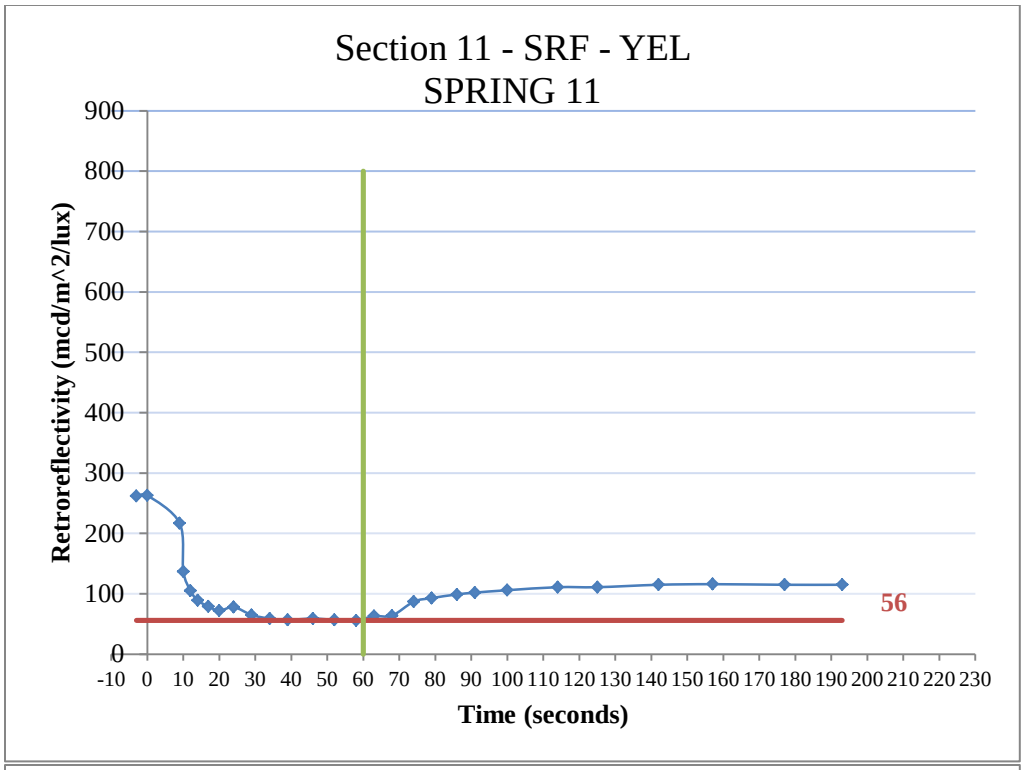

Section 9B - GRV - YEL
SPRING 11
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
Time (seconds)
4

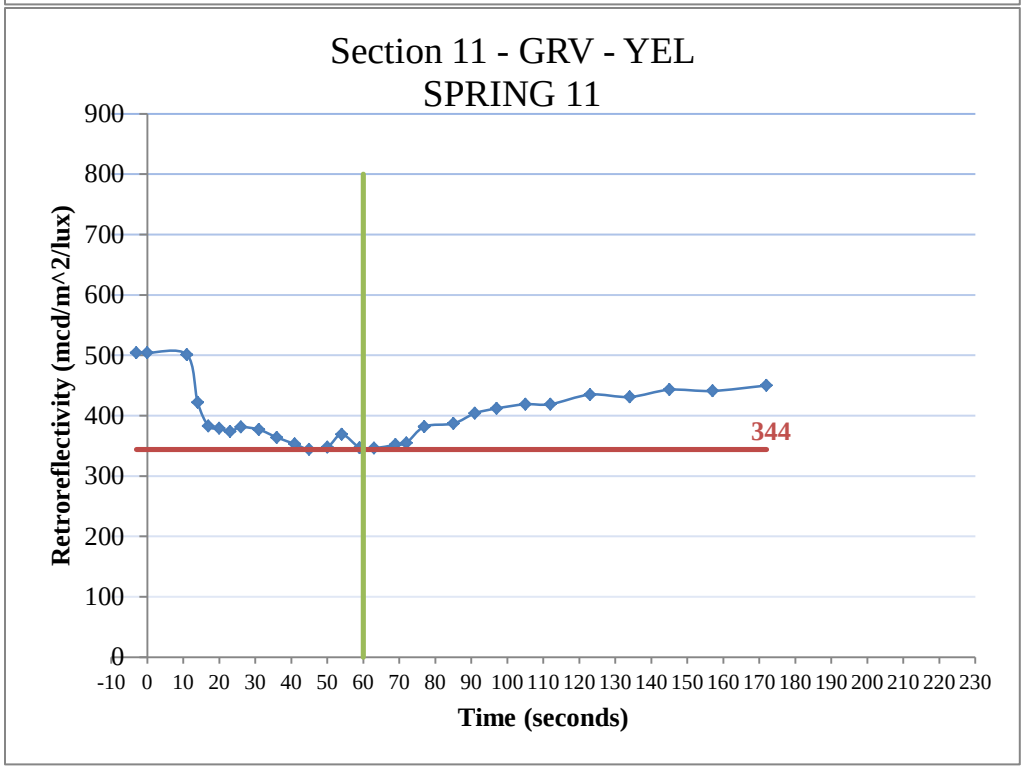

Section 9 - SRF - YEL
SPRING 11
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
Time (seconds)
41

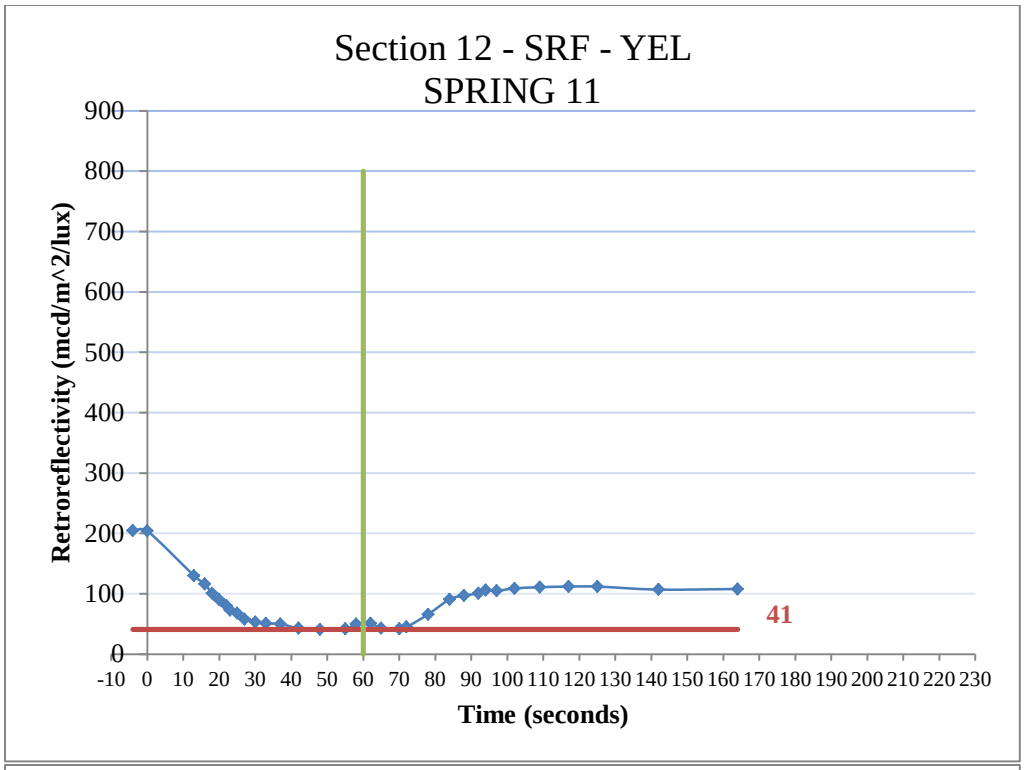

Section 10A - GRV - YEL
SPRING 11
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
Time (seconds)
31

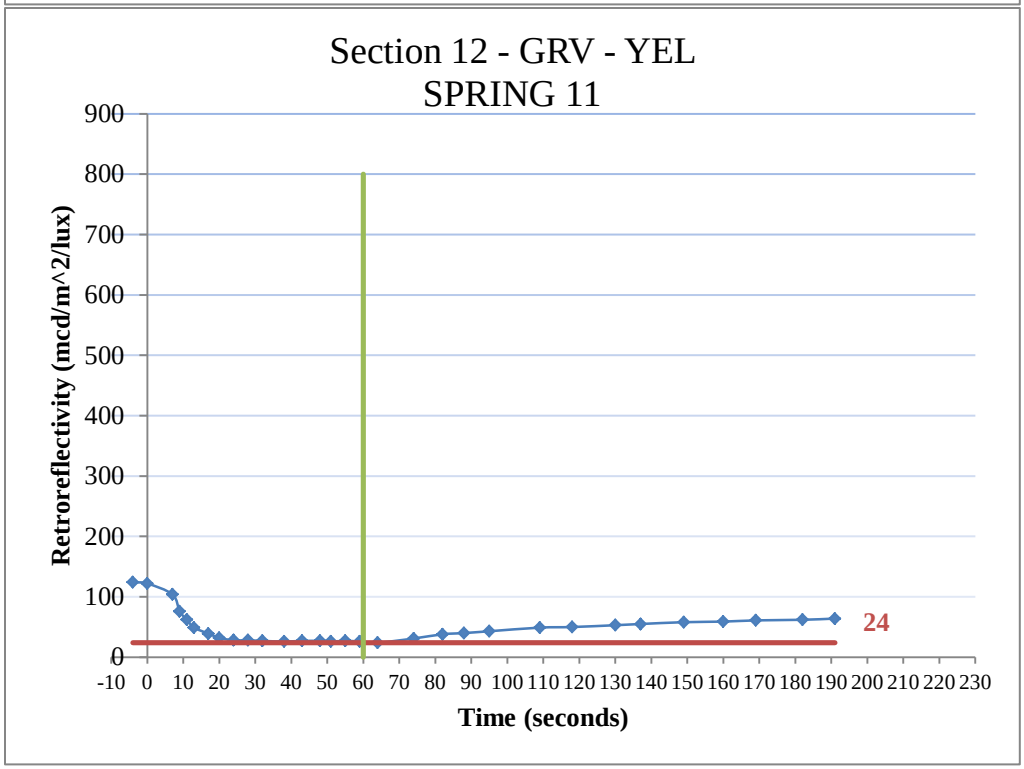

Section 10B - GRV - YEL
SPRING 11
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
Time (seconds)
24

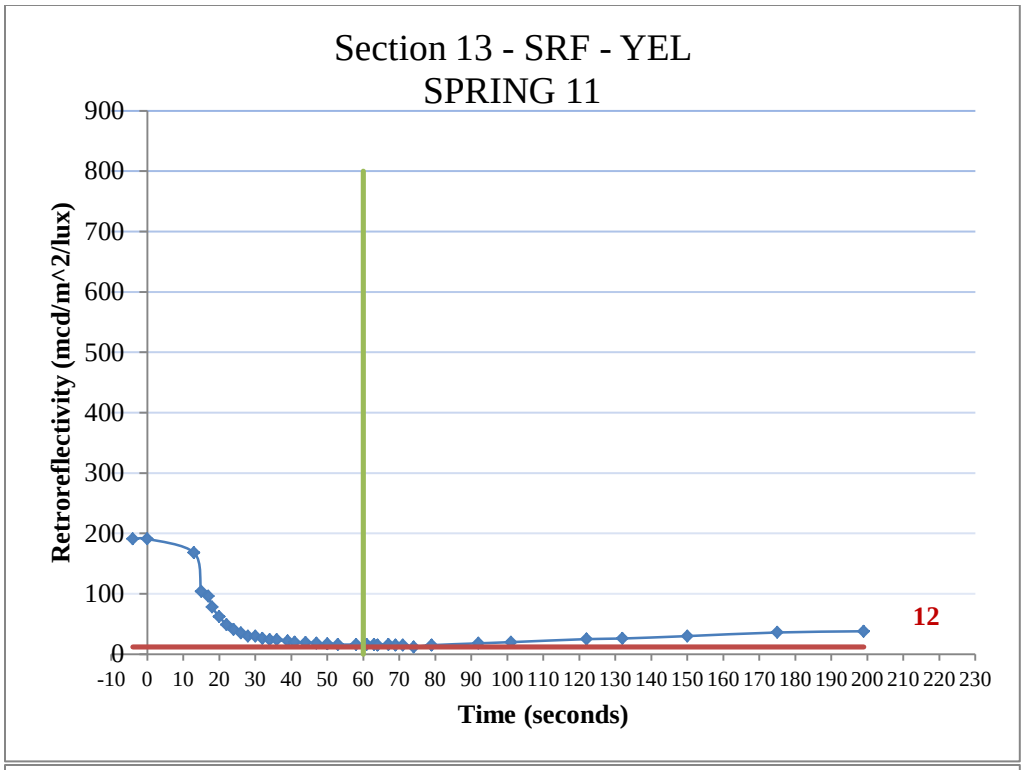

Section 10 - SRF - YEL
SPRING 11
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
Time (seconds)
25

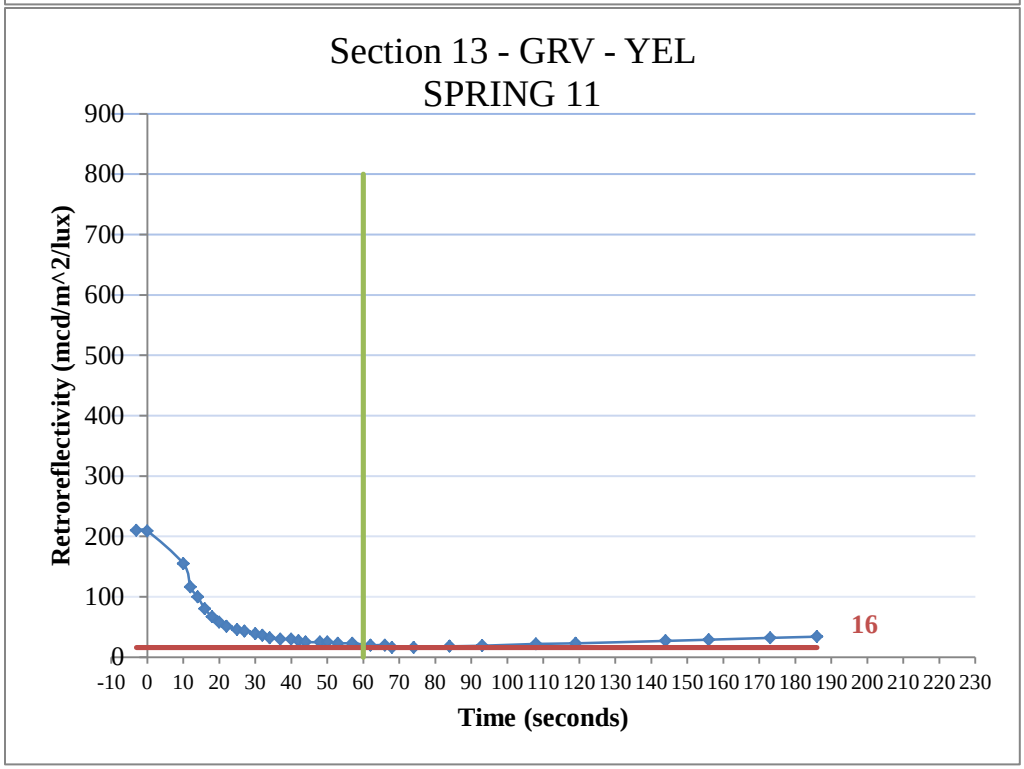

Section 11 - SRF - YEL
SPRING 11
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
Time (seconds)
56

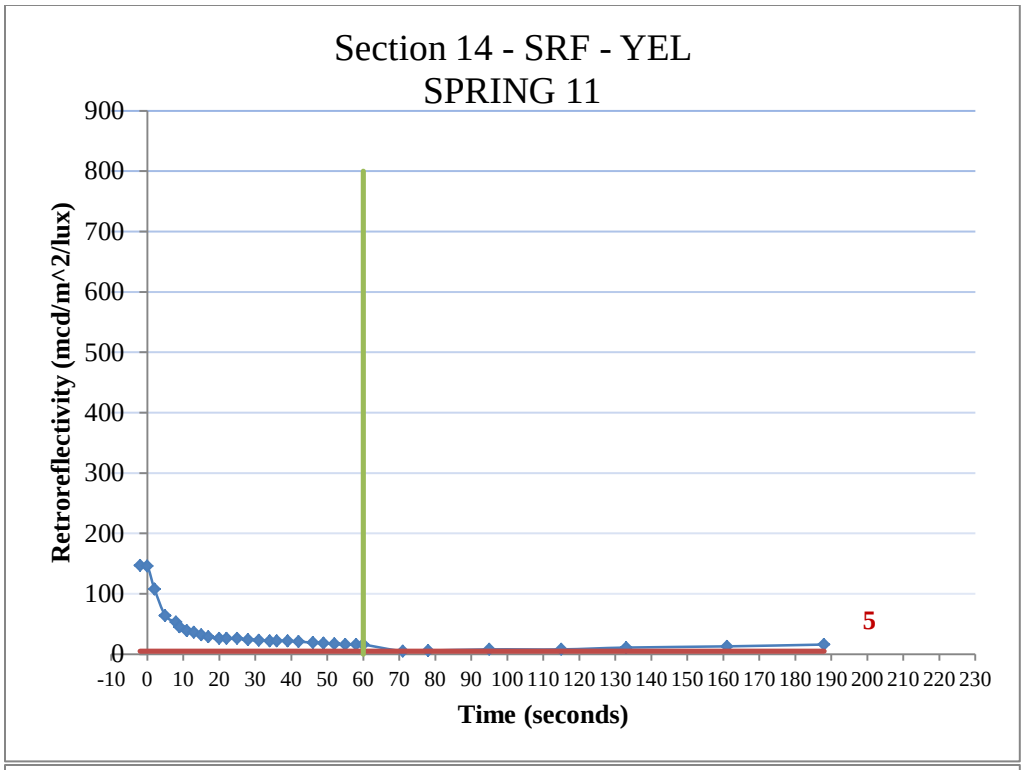

Section 11 - GRV - YEL
SPRING 11
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
Time (seconds)
344

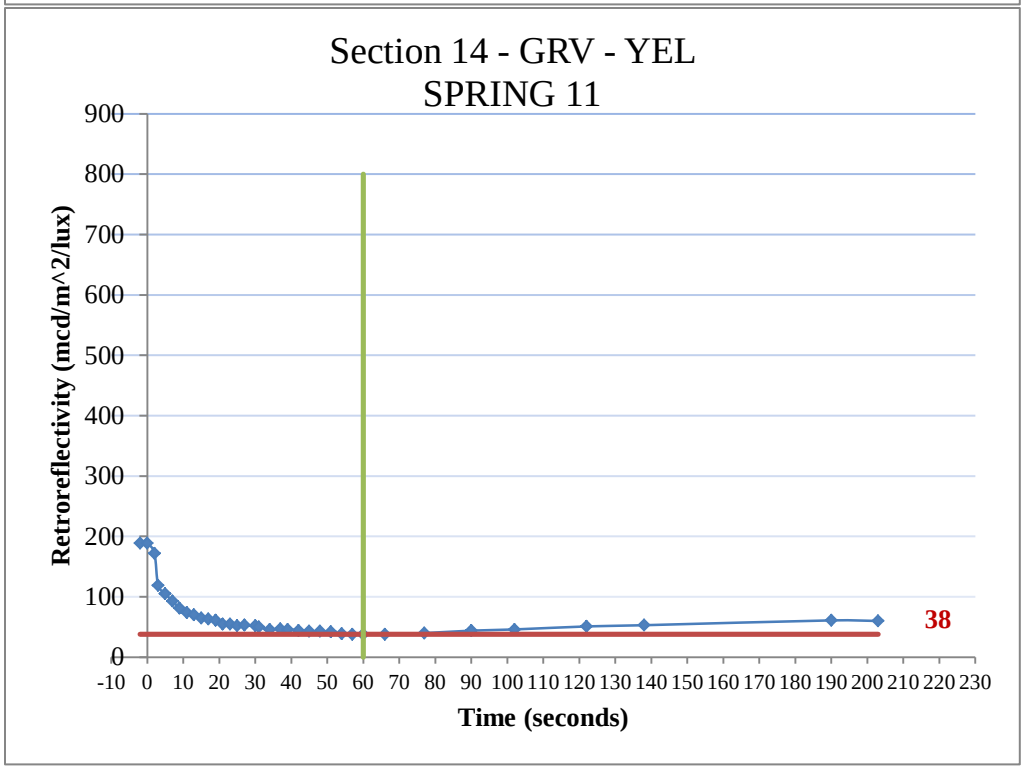

Section 12 - SRF - YEL
SPRING 11
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
Time (seconds)
41

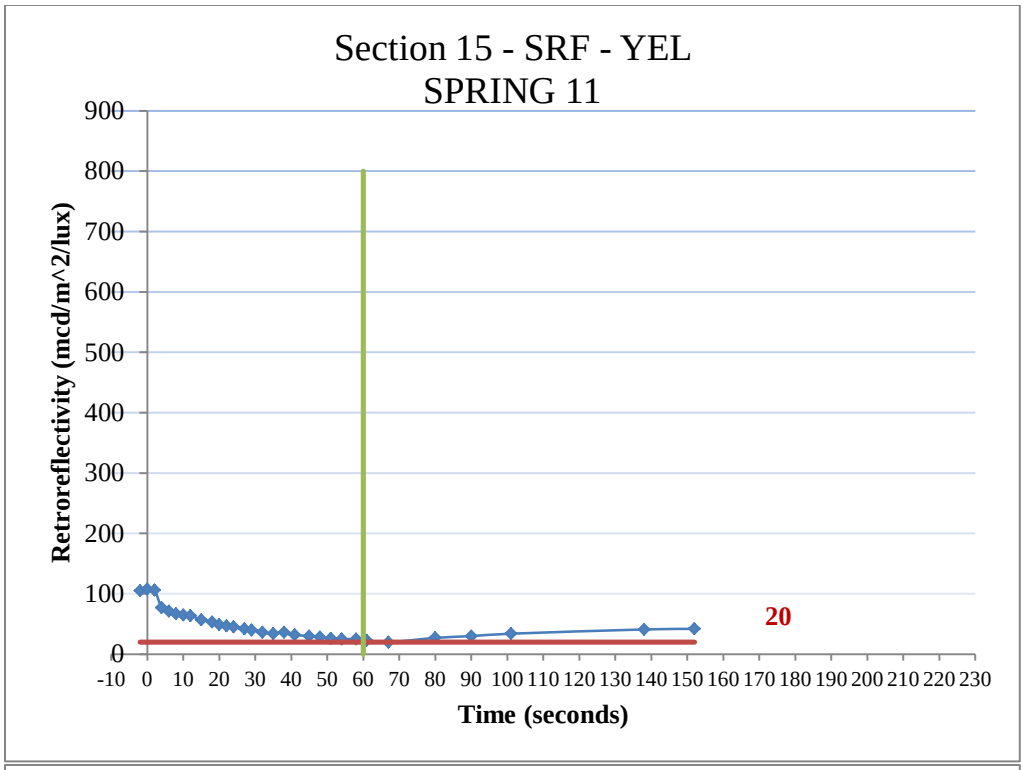

Section 12 - GRV - YEL
SPRING 11
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
Time (seconds)
24

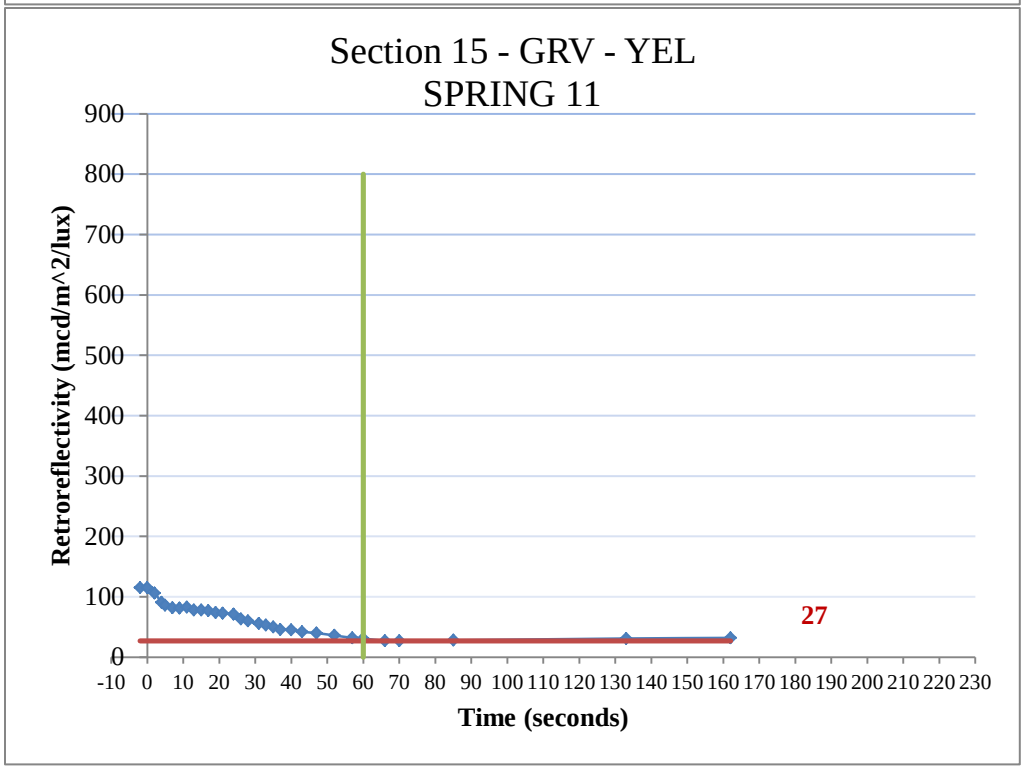

Section 13 - SRF - YEL
SPRING 11
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
Time (seconds)
12

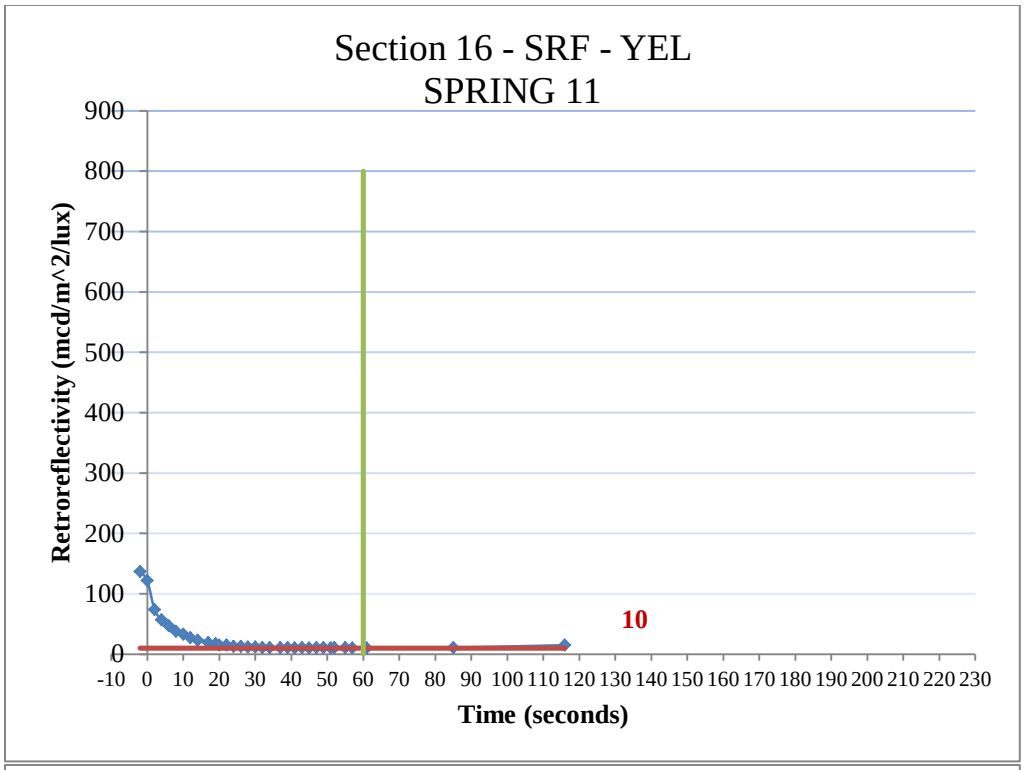

Section 13 - GRV - YEL
SPRING 11
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
Time (seconds)
16

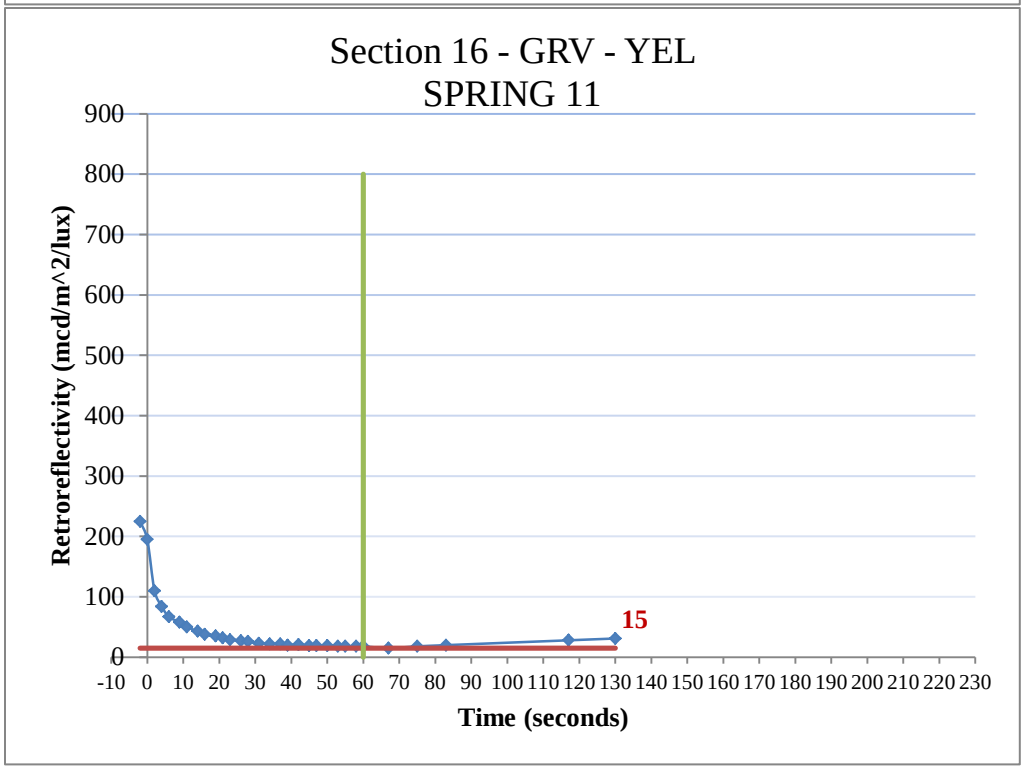

Section 14 - SRF - YEL
SPRING 11
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
Time (seconds)
5


Section 14 - GRV - YEL
SPRING 11
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
Time (seconds)
38

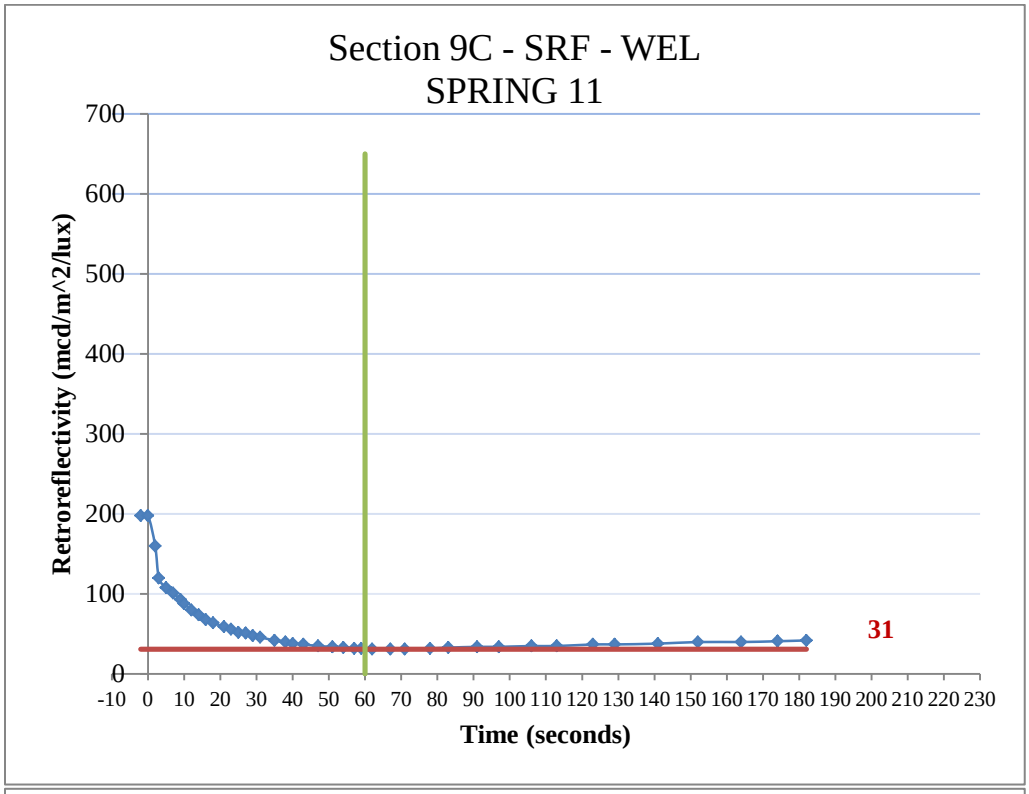

Section 15 - SRF - YEL
SPRING 11
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
Time (seconds)
20

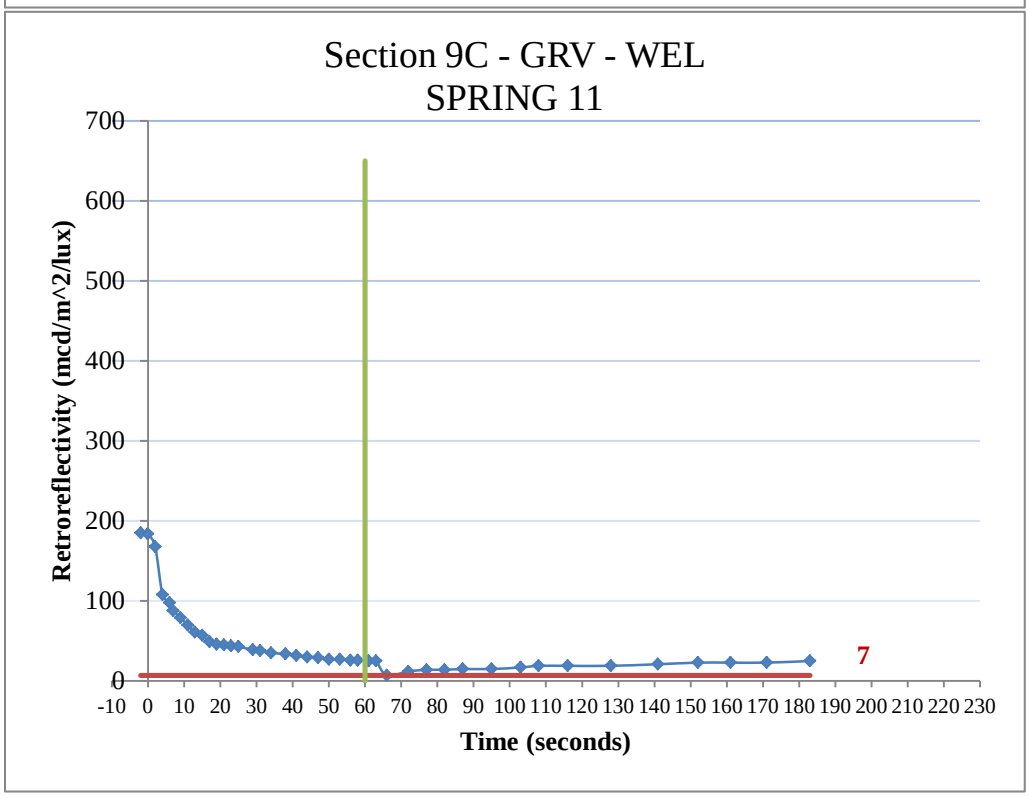

Section 15 - GRV - YEL
SPRING 11
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
Time (seconds)
27

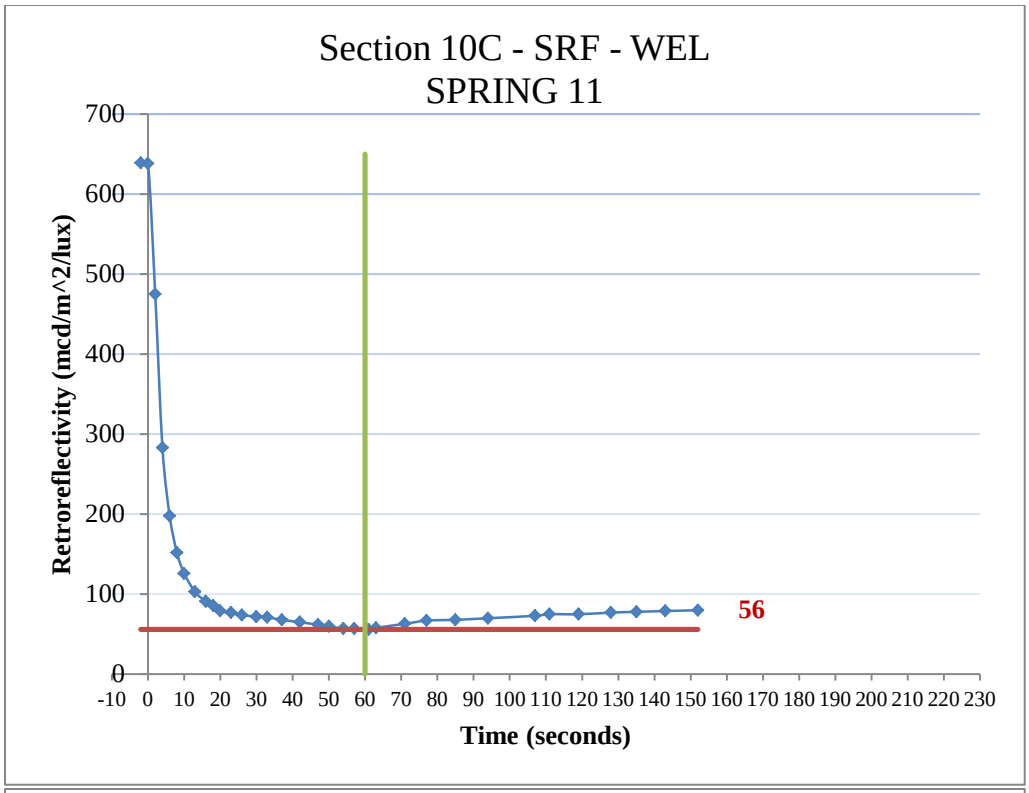

Section 16 - SRF - YEL
SPRING 11
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
10
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
Time (seconds)

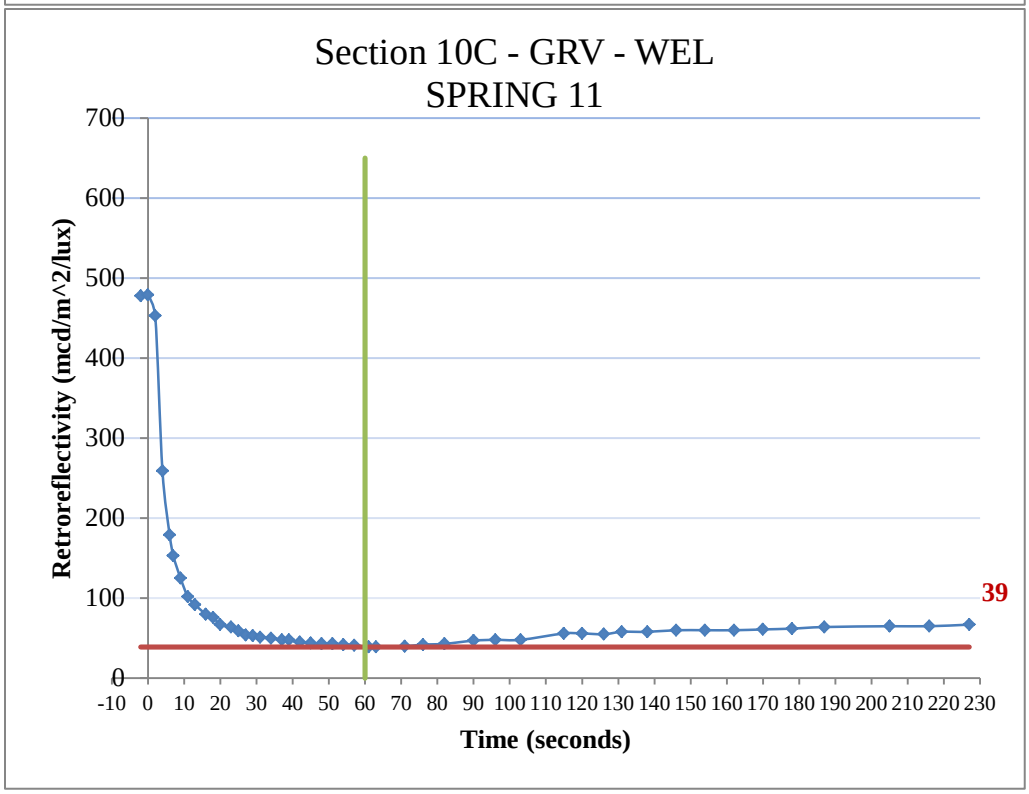

Section 16 - GRV - YEL
SPRING 11
Retroreflectivity (mcd/m^2/lux)
900
800
700
600
500
400
300
200
100
0
15
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
Time (seconds)

White Edge Line

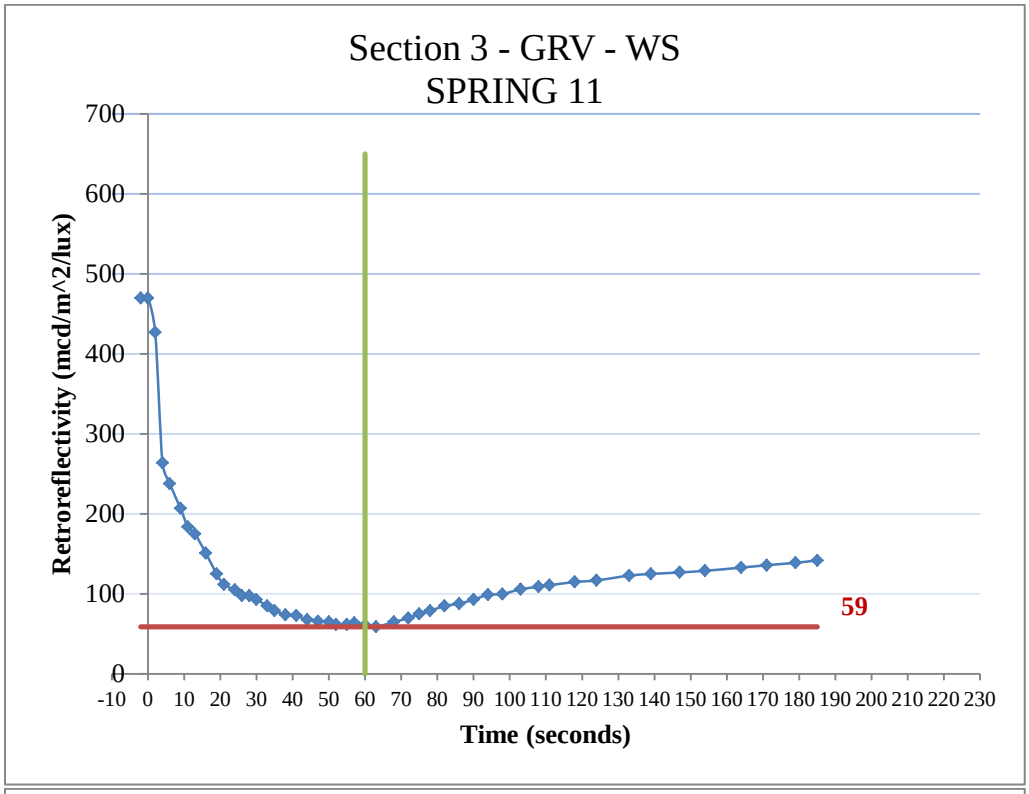


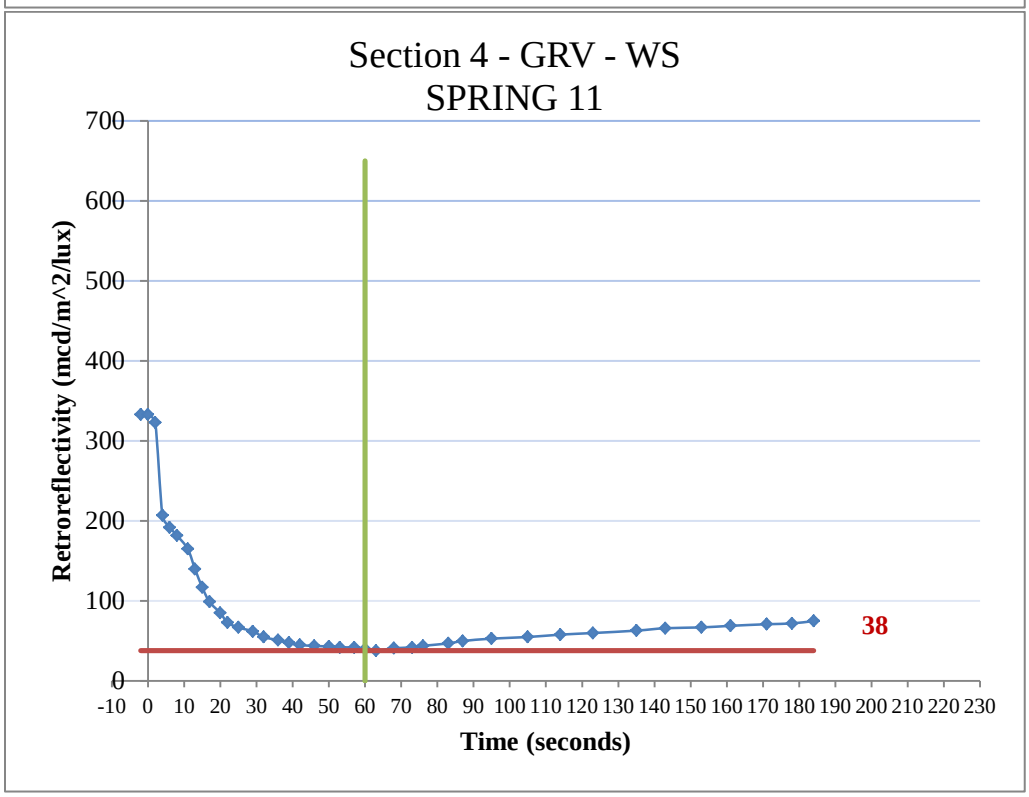


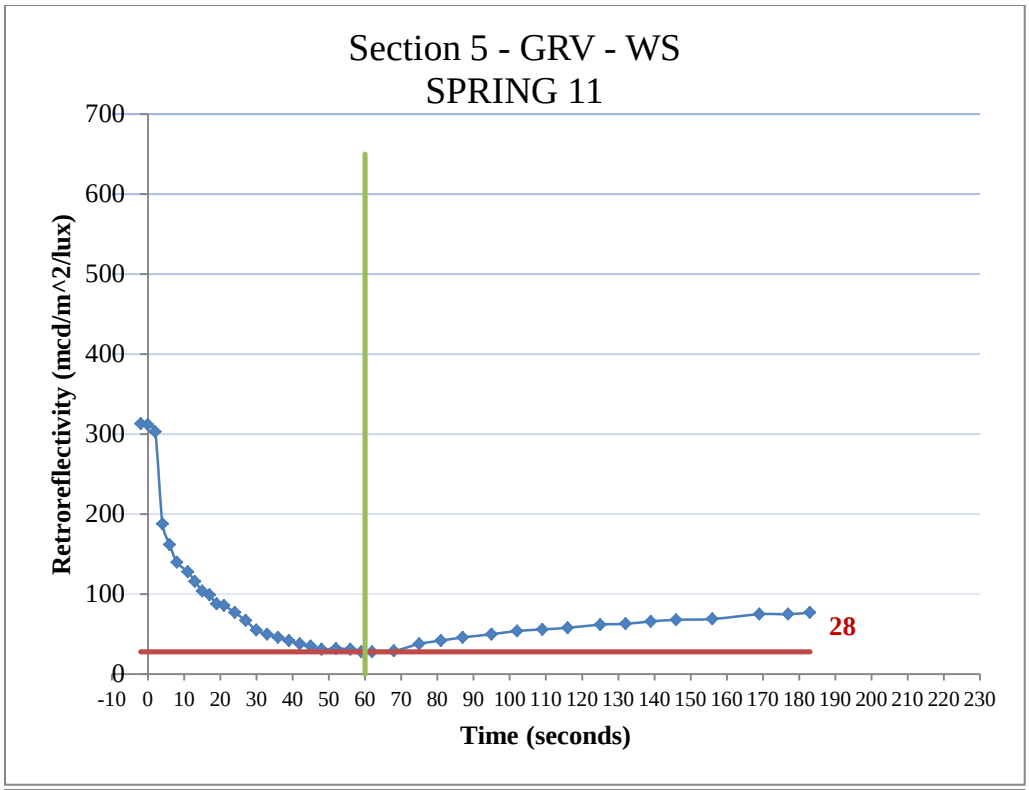

Section 10C - SRF - WEL
SPRING 11
Retroreflectivity (mcd/m^2/lux)
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
Time (seconds)
56

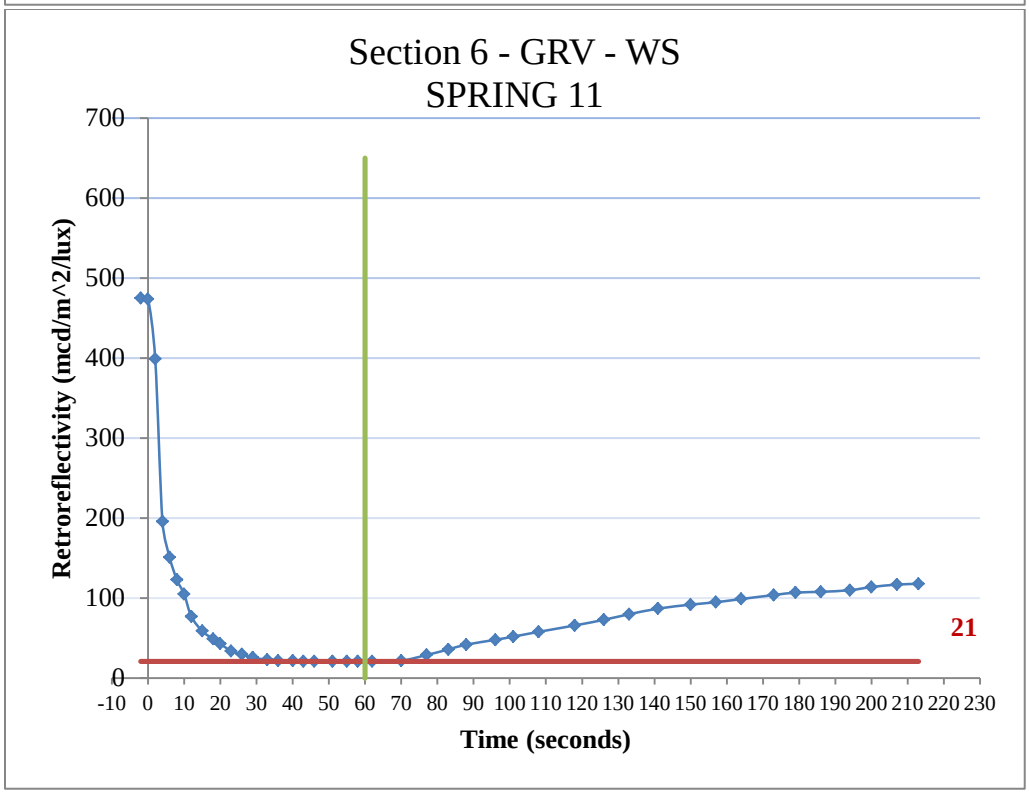

Section 10C - GRV - WEL
SPRING 11
Retroreflectivity (mcd/m^2/lux)
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
Time (seconds)
39

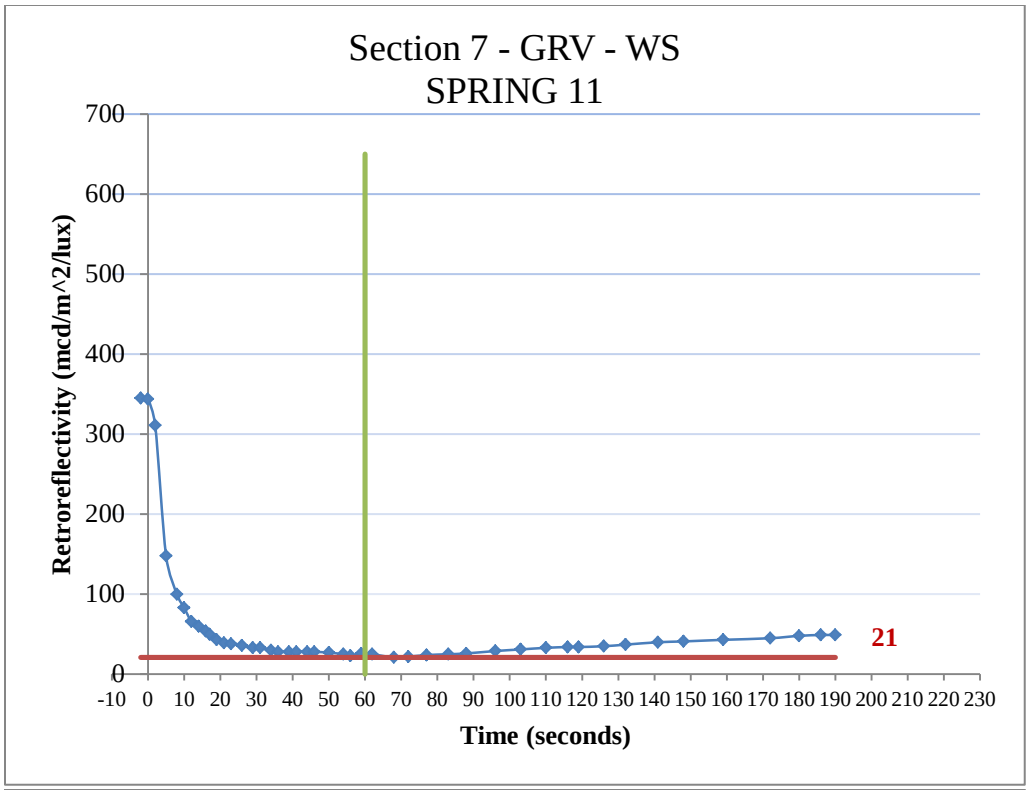
White Skip Line

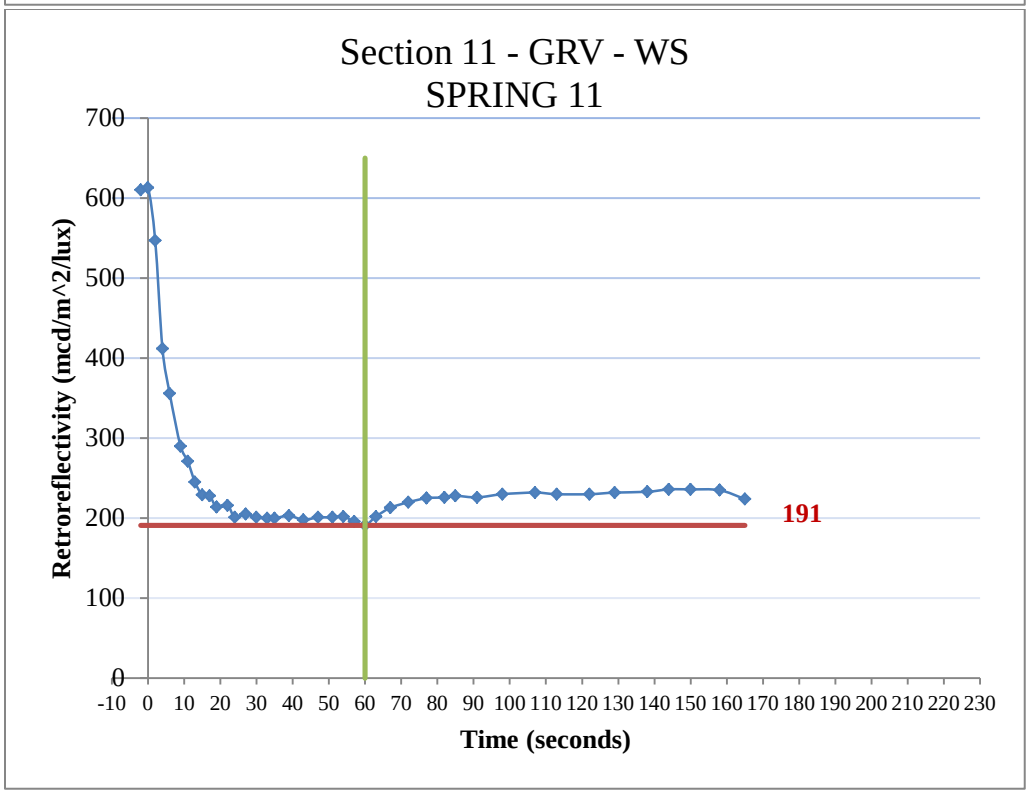


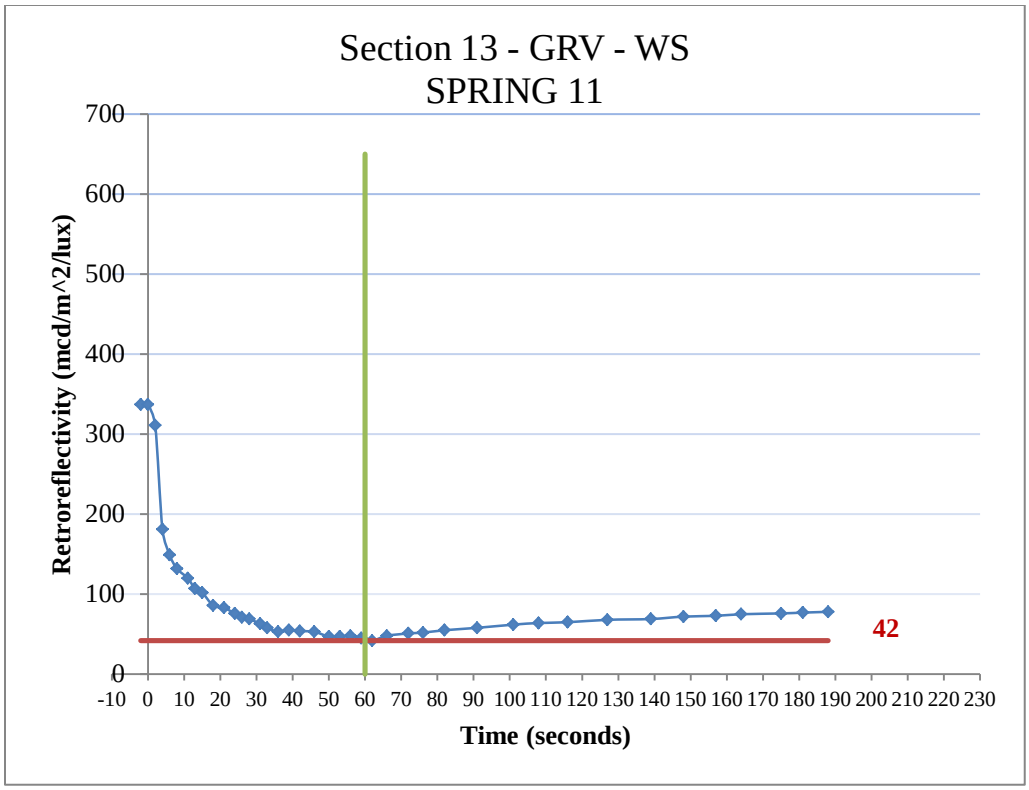



Section 5 - GRV - WS
SPRING 11
Retroreflectivity (mcd/m^2/lux)
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
Time (seconds)
28


Section 6 - GRV - WS
SPRING 11
Retroreflectivity (mcd/m^2/lux)
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
Time (seconds)
21


Section 7 - GRV - WS
SPRING 11
Retroreflectivity (mcd/m^2/lux)
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
Time (seconds)
21


Section 11 - GRV - WS
SPRING 11
Retroreflectivity (mcd/m^2/lux)
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
Time (seconds)
191


Section 13 - GRV - WS
SPRING 11
Retroreflectivity (mcd/m^2/lux)
700
600
500
400
300
200
100
0
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
Time (seconds)
42