I-80 Coalition
WYDOT
VSL/Wind/ARCG Updates

September 2011

Variable Speed Limits

I-80 Background Information

- >50% of I-80 traffic in Wyoming is commercial vehicles
- Rural AADT 11,000 vehicles per day
- Frequent adverse weather conditions
  - Strong winds
  - Heavy snow
  - Blowing snow
    - Visibility problems
    - Drifting of snow
  - Icy conditions

I-80 - Background Information

- Frequent closures
- Crash rates are higher than average in the VSL corridors
- Several multi-vehicle fatalities in the corridors

Legislation (WS-31-5-302)

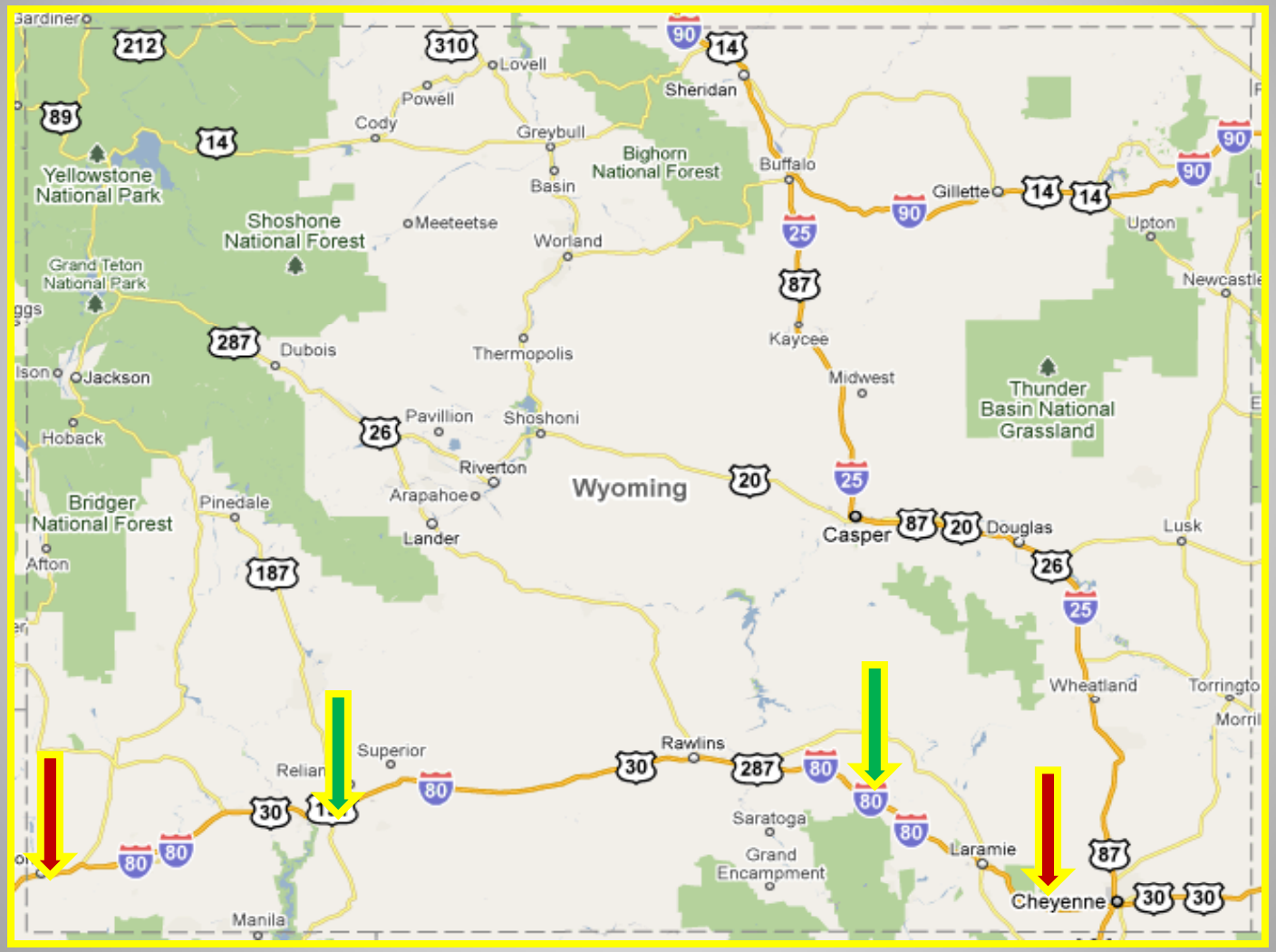
Legislation went into effect 7/1/2008

Grants authority to set the speed limit based on "vehicle or weather emergency"

"…differing limits may be established for different times of day, different types of vehicles, varying weather conditions, and other factors bearing on safe speeds, which shall be effective when posted upon appropriate fixed or variable signs. "

http://legisweb.state.wy.us/statutes/statutes.aspx?file=titles/Title31/T31CH5AR3.htm

I-80 VSLs


Gardiner
212
310
Lovell
Powell
Cody
Greybull
Basin
Bighorn National Forest
Sheridan
Buffalo
Gillette
Upton
Newcastle
89
14
Yellowstone National Park
Shoshone National Forest
Meeteetse
Worland
Grand Teton National Park
287
Dubois
Thermopolis
Jackson
Hoback
Pavillion
Shoshoni
26
Riverton
Wyoming
20
Arapahoe
Lander
Bridger National Forest
Pinedale
Afton
187
25
87
Kaycee
Midwest
Thunder Basin National Grassland
Casper
Douglas
Lusk
Wheatland
Torrington
Morrill
Superior
Rawlins
30
80
Saratoga
Grand Encampment
Laramie
Cheyenne
Manila

Sign Technologies

VSL Approach

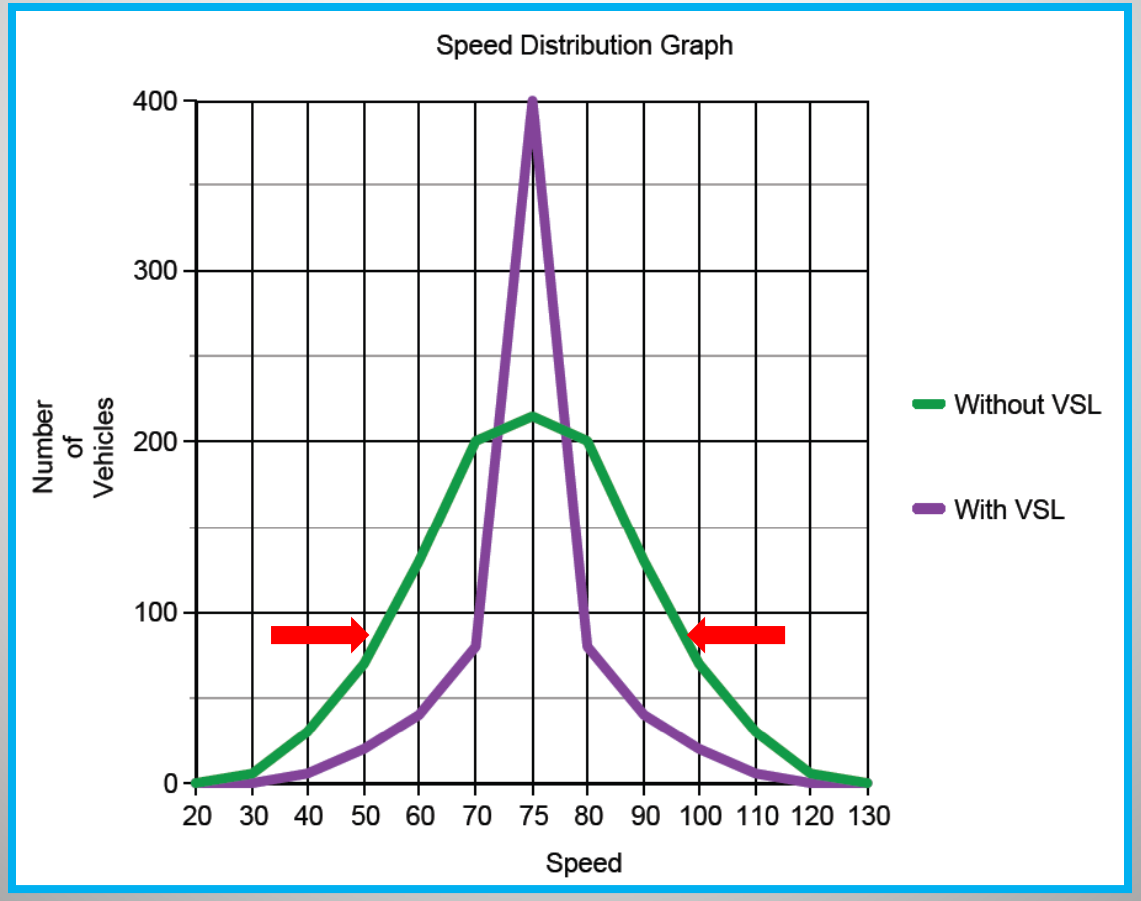
- Provide timely and site-specific regulatory speed limit to guide travelers through the corridor

- VSL's located at interchanges to inform people as soon as they enter the system

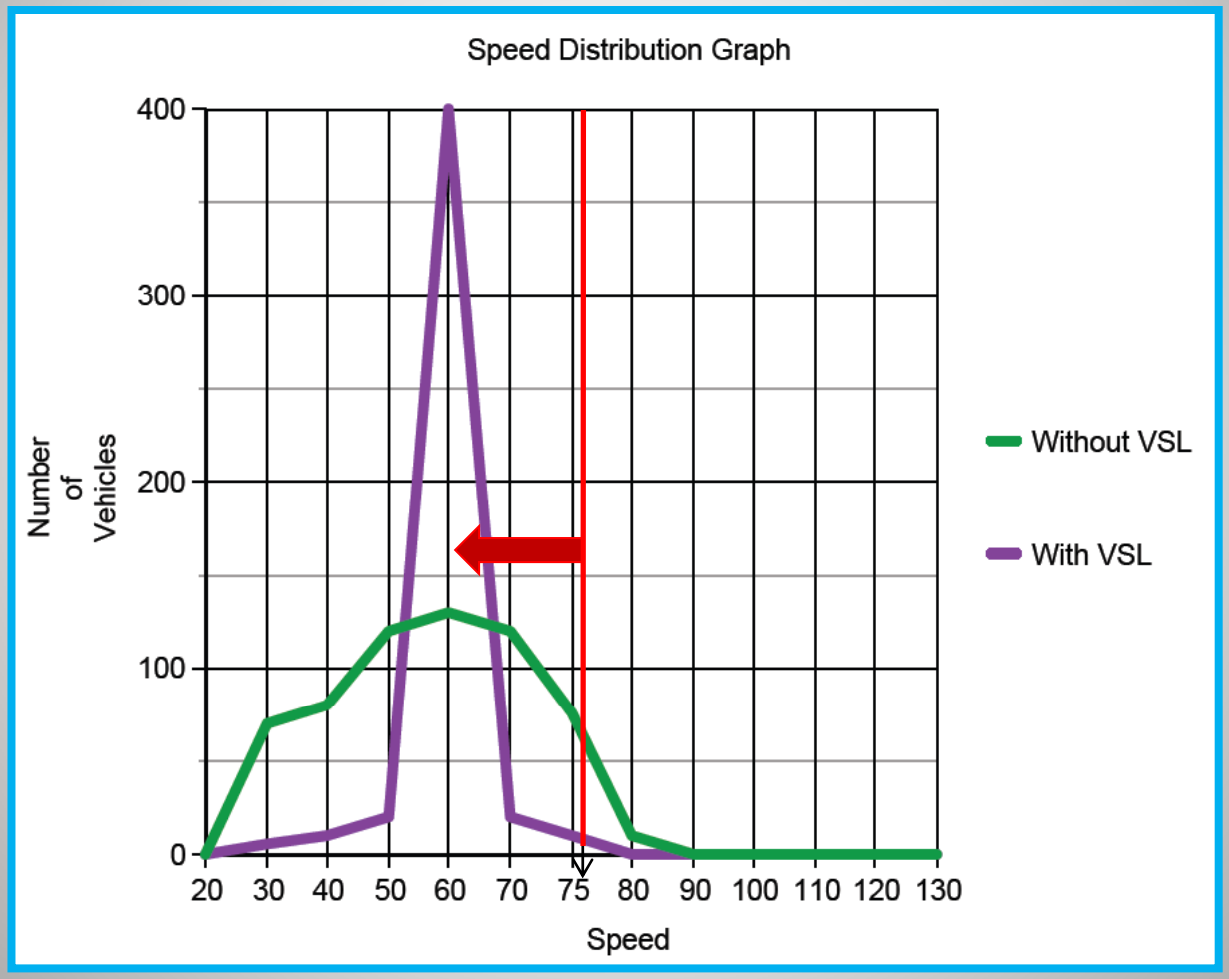
- VSL located on both median and shoulder side for visibility

VSL Approach

Focus: tighten speed distribution



Representative Scenario



Protocol

- Cooperation between:
  - Troopers
  - Maintenance
  - TMC
- Process takes about a minute to:
  - Receive request for speed reduction
  - Reduce speed at roadside
  - Inform the public (website, phone system, text/email notification)

Absence of Visual Inspection

- TMC has approval to adjust speeds based on Speeds or AASHTO Stopping Sight Distances

Reported condition:	WET or DRY	SLICK SPOTS	SLICK
RWIS Surface Status:	Green or Blue	Yellow or Orange	Red
Speed Limit (mph)	Visibility (feet)		
75	> 950	>1625	
65	725 -950	1225 - 1625	> 1700
50	475 - 725	750 - 1225	1025 - 1700
35	< 475	< 750	< 1025

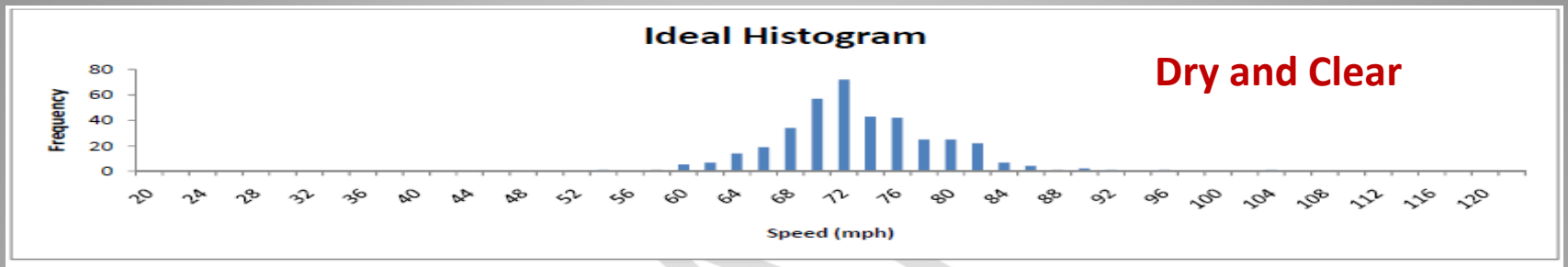


Figure 7 : Ideal histogram MP 256.25 December 1-2, 2009

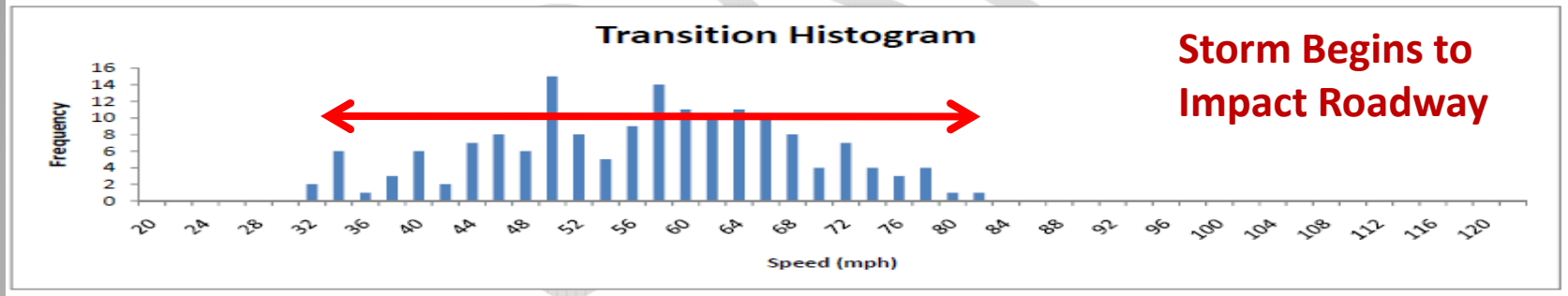


Figure 8: Transition histogram MP 256.25 December 1-2, 2009

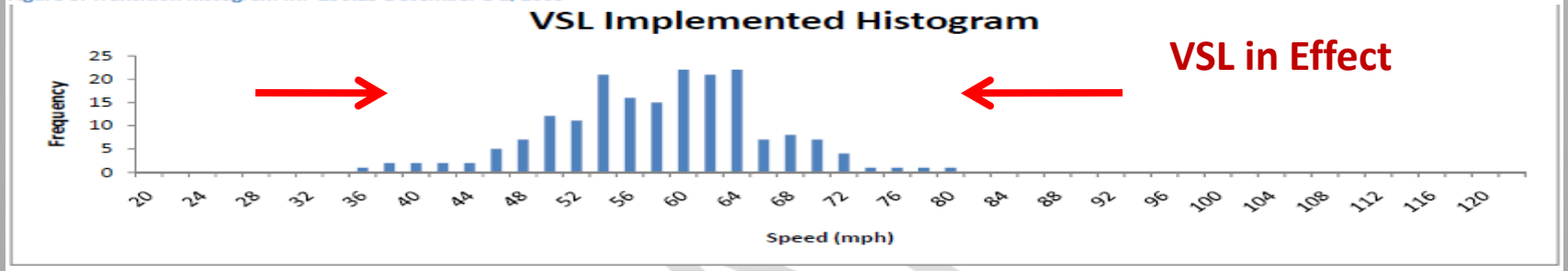


Figure 9: VSL implemented histogram MP 256.25 December 1-2, 2009

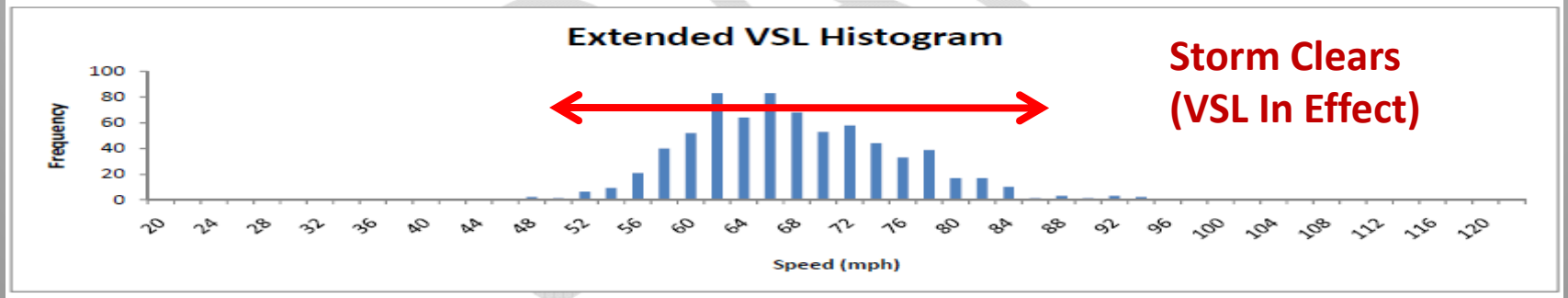


Figure 10: Extended VSL histogram MP 256.25 December 1-2, 2009

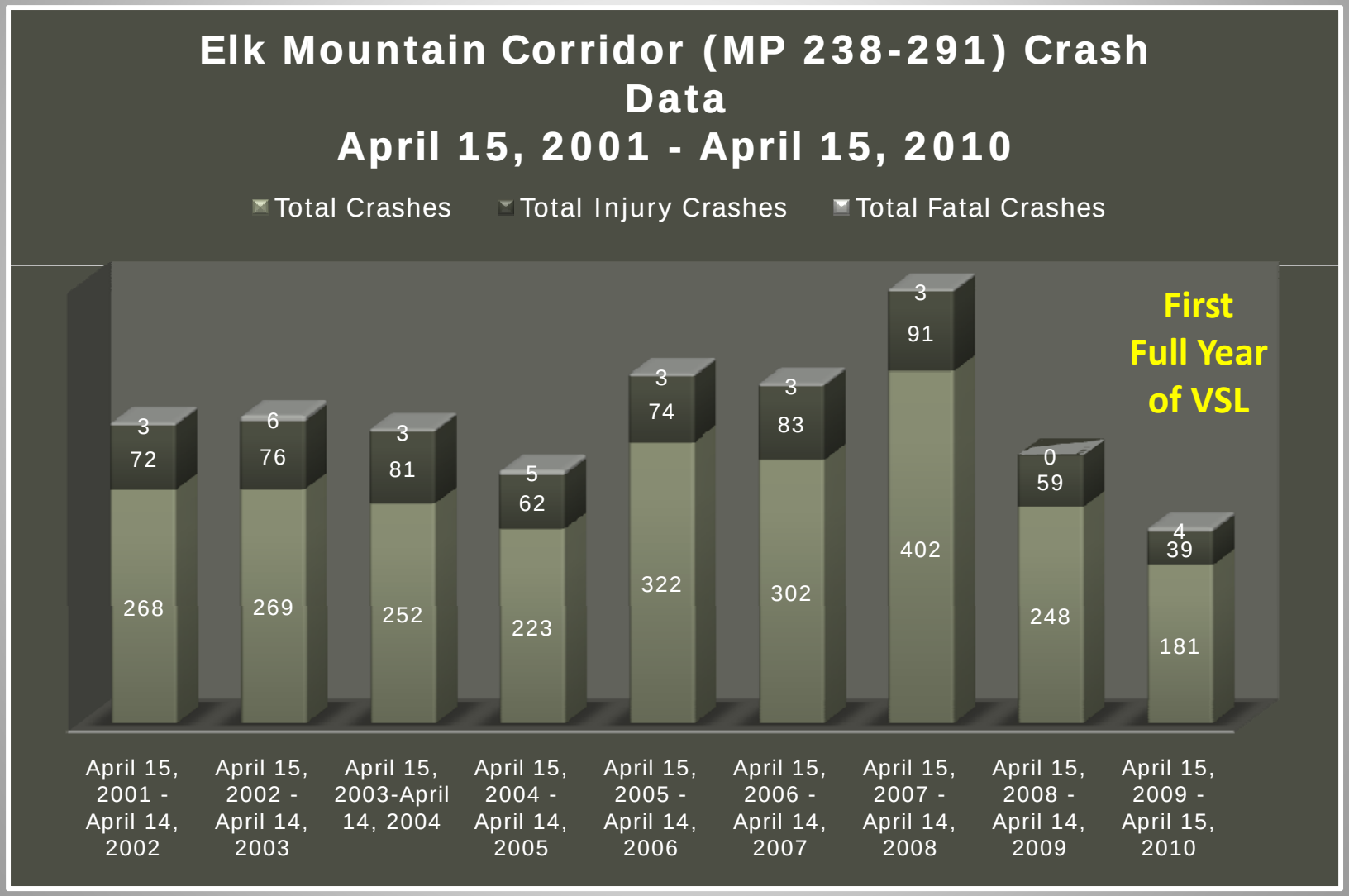
Effectiveness of VSL in Lowering Speeds

- During the period from October 15-December 15, 2009 statistical modeling showed that the VSL reduced speed postings lowered the observed speeds from **6 to 8 mph for every 10 mph** in posted speed reductions
  - This was in **addition** to speed reductions that could be accounted for by the weather conditions
  - Indicates that the speed reductions were not just due to drivers reacting to the newly installed system during the first season

Crash Data

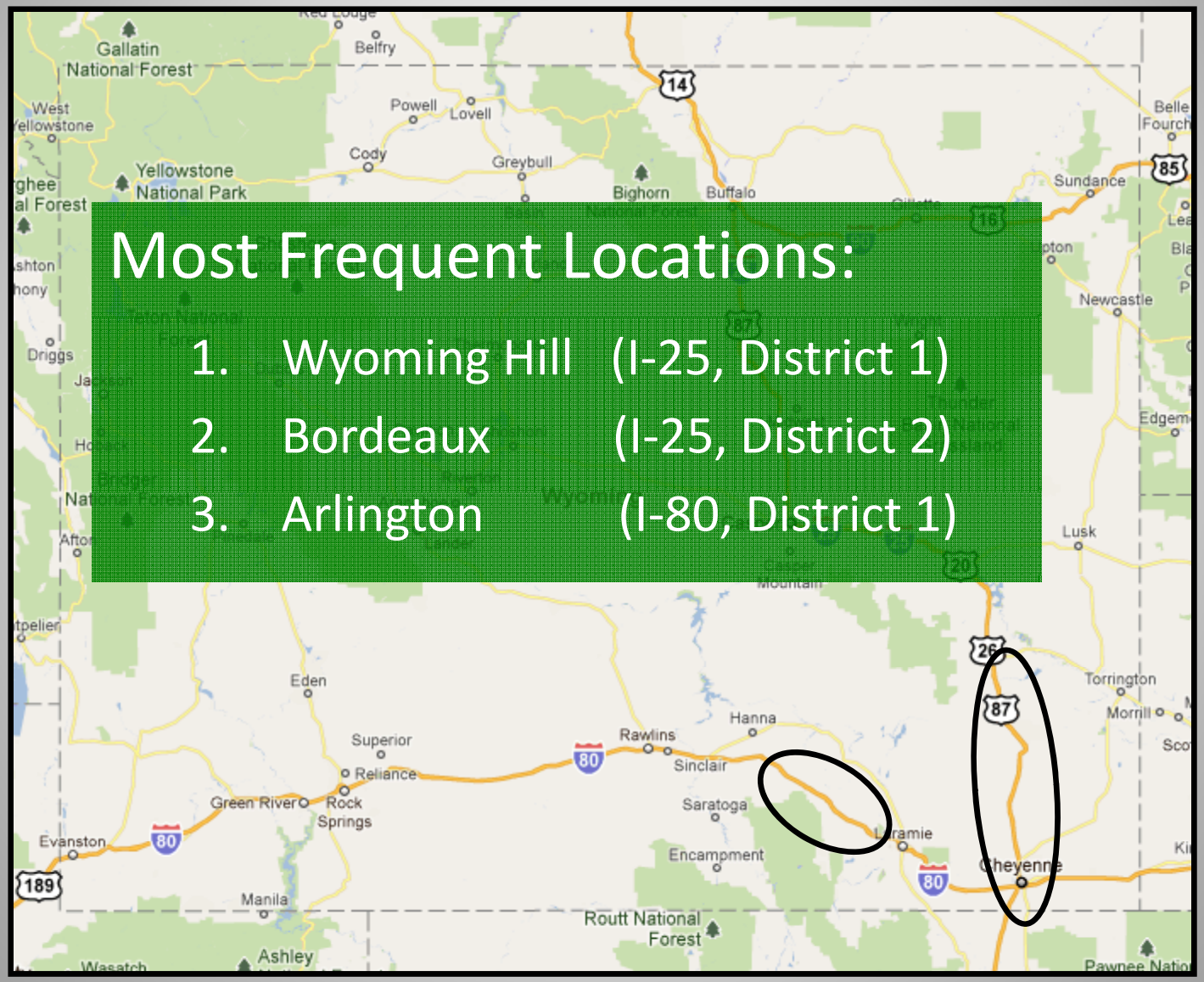
- The nature of crash data requires 3-5 years of observation before final conclusions can be made about the affect of a roadway change. With that said…
- The number of crashes over the April 2009-April 2010 were lower than any of the previous eight years

Crash Data


Elk Mountain Corridor (MP 238-291) Crash Data
April 15, 2001 - April 15, 2010
Total Crashes
Total Injury Crashes
Total Fatal Crashes
First Full Year of VSL
3
72
268
6
76
269
3
81
252
5
62
223
3
74
322
3
83
302
3
91
402
0
59
248
4
39
181
April 15, 2001 - April 14, 2002
April 15, 2002 - April 14, 2003
April 15, 2003-April 14, 2004
April 15, 2004 - April 14, 2005
April 15, 2005 - April 14, 2006
April 15, 2006 - April 14, 2007
April 15, 2007 - April 14, 2008
April 15, 2008 - April 14, 2009
April 15, 2009 - April 15, 2010

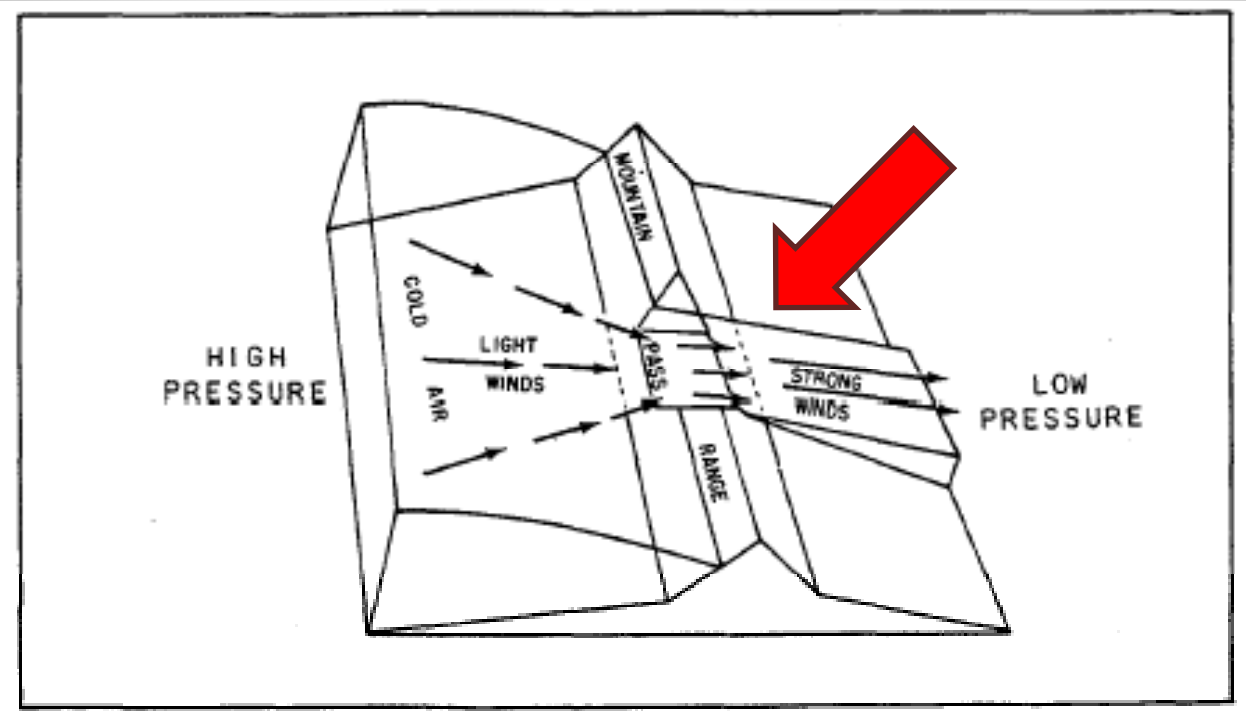
Road Closure to Light, High Profile Vehicles

I-25 & I-80 Corridor

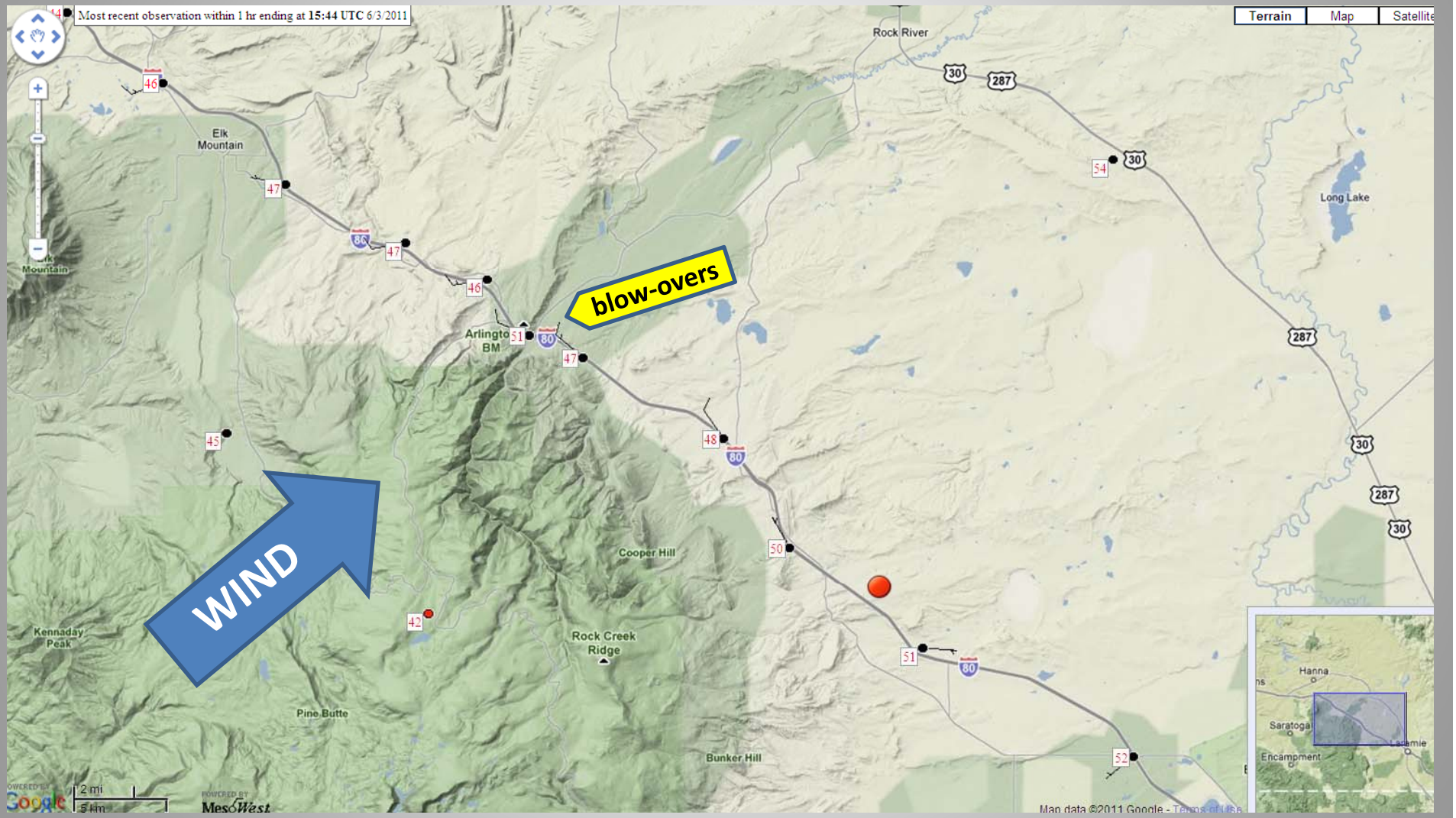


Bernoulli's Principle of Gap Winds

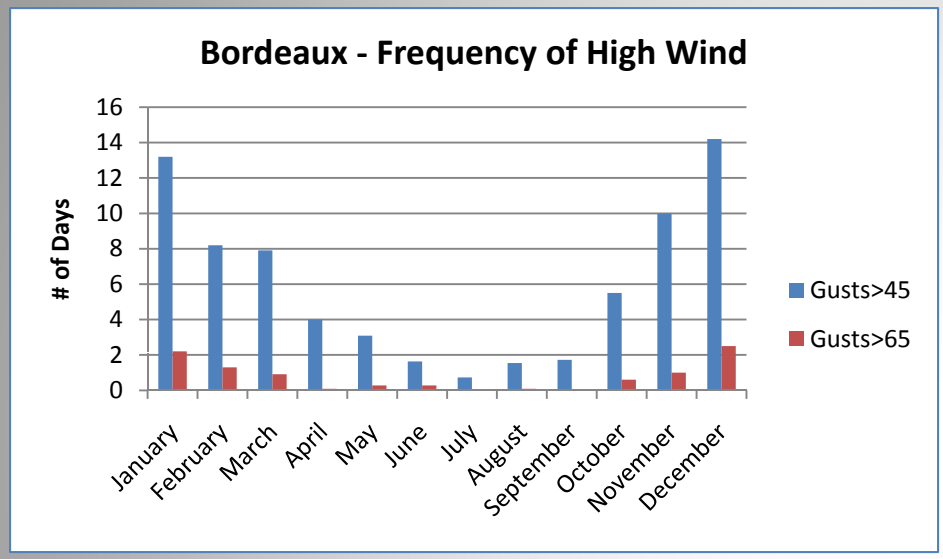
- Significant pressure changes as wind passes through a "funnel", AKA mountain gaps
- Wind velocity accelerates from higher pressure to lower pressure at the gap exit region

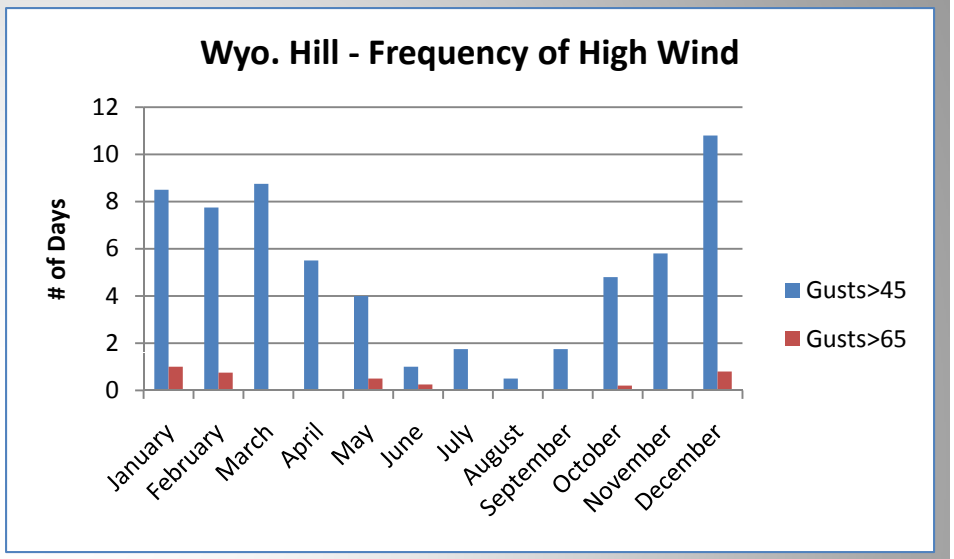


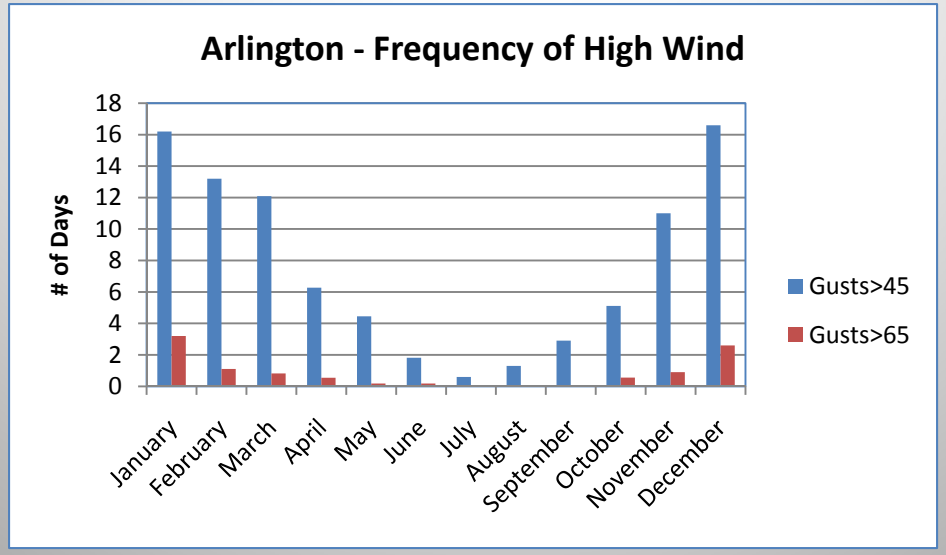
Arlington (I-80, District 1)



High Wind Frequencies (I-80 & I-25)







Critical Months

January
February
March
November
December

*Averages # of days
Between 2000 - 2010

What precipitated C2LHPV?

- Department's goal of promoting commerce AND safety
- Blow over crashes have been a major problem at several locations in Wyoming
- A commercial driver was killed during a blow over event on I-25 (Bordeaux) during the spring of 2011
- Legislation allows WYDOT to authorize travel to certain segments of the traveling public while prohibiting travel to other segments
- Wind-centric forecast from contract meteorologist is improving TMC's abilities

Prior to 3/31/2011

- Advise No Light Trailers when gust exceeded 45 mph
- Blow-over events persisted resulting in closures to all vehicles
- Wind events often resulted in multiple vehicles blowing over


www.wyoroad.info Sun Mar 8 2009 08:16:03 AM
LOW PRESSURE


www.wyoroad.info Wed Dec 1 2010 09:31:00 AM


www.wyoroad.info Sun Feb 13 2011 01:00:54 PM

2008 Bordeaux Crash Data

Dates/Results of Wind Gust >70 MPH for 30 min	
Date	Number of Blow Overs
1/10/2008	2
1/29/2008	1
1/31/2008	1
2/7/2008	0 (See Note)
12/5/2008	2
12/27/2008	1
12/28/2008	0 (See Note)
12/31/2008	3

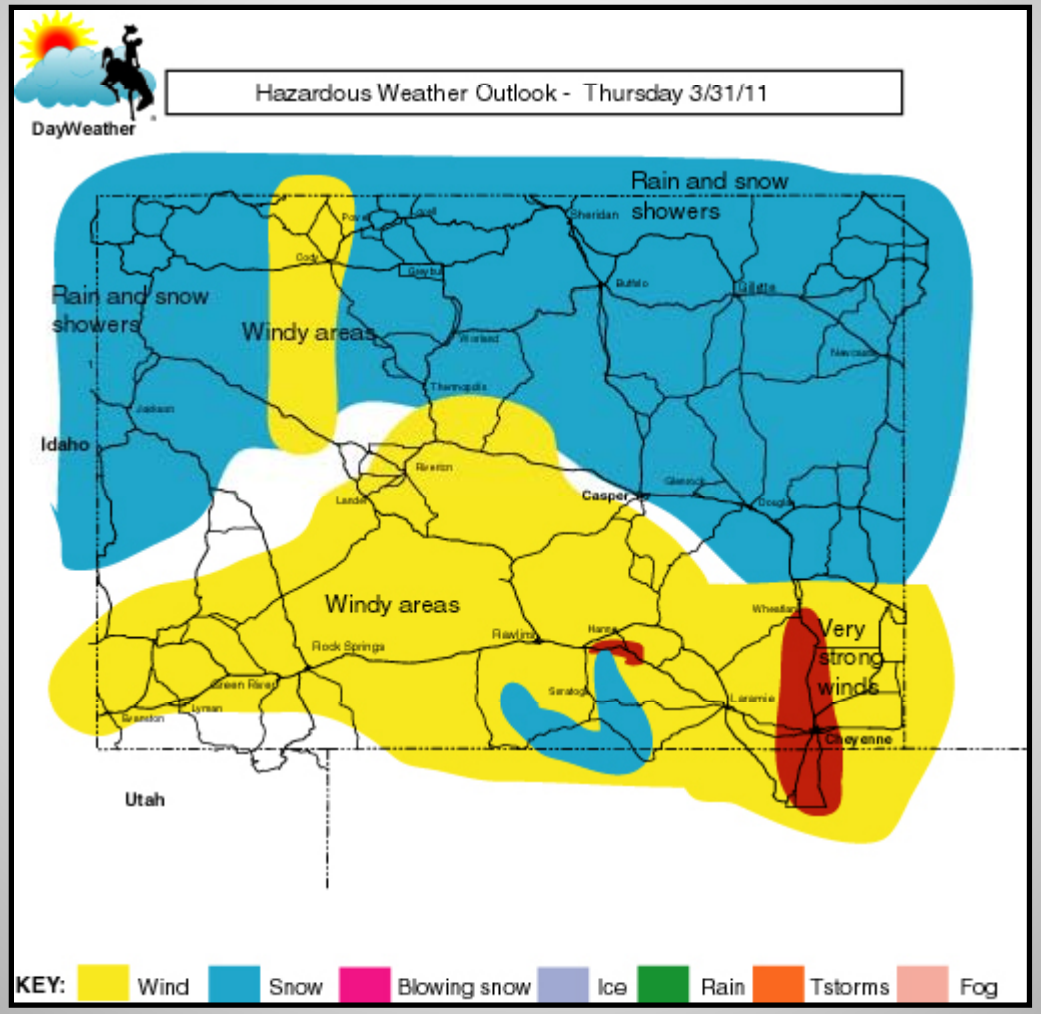
- Note: The road may have been closed due to other factors on dates when zero blow-overs occurred during wind event.

New Process

- Advise No Light Trailers – 50 mph
- Closure to Light, High Profile Vehicles
  - Wind gust 65 mph

    -OR-
  - A single blow-over

Weather Forecast 3/31/11



Wind Forecast – 3/31/11

Average Wind Speed Forecast – Wyoming Interstates & Highways

***This grid provides forecasted wind speeds along segments of interstates and is still in the development stages.*

WYDOT Wind Grid

WD: Average wind direction
WS: Average wind speed (mph)
Strong: Forecasted winds near "Strong Wind" criteria on DRY roads
Caution: Forecasted winds near "No Light Trailer" criteria on DRY roads

The following are average wind speeds only. Higher gusts may occur but are not included in the data below.

		Wednesday, March 30												Thursday, March 31								
		NOON - 3PM			3PM - 6PM			6PM - 9PM			9PM - MIDNIGHT			MIDNIGHT - 3AM			3AM - 5AM			5AM - 9AM		
		WD	WS	Gusts	WD	WS	Gusts	WD	WS	Gusts	WD	WS	Gusts	WD	WS	Gusts	WD	WS	Gusts	WD	WS	Gusts
D1	I-80 (Wamsutter - Rawlins)	W	32	52	W	35	53	W	34	50	W	38	52	W	35	49	W	26	45	W	25	35
	I-80 (Rawlins - Laramie)	W	40	58	W	43	60	W	45	60	W	43	59	W	45	60	W	35	45	W	30	40
	I-80 (Elk Mountain/Arlington area)	W	42	60	W	46	63	W	57	67	W	60	70	W	54	64	W	51	61	W	46	56
	I-80 (Laramie - Cheyenne)	W	41	58	W	45	61	W	45	59	W	44	54	W	43	55	W	40	52	W	35	45
	I-25 (surrounding Cheyenne)	NW	35	52	W	39	54	W	38	52	W	36	52	NW	38	52	W	38	50	W	30	43
	I-25 (Wyo Hill area)	NW	43	63	W	44	59	W	38	53	W	44	58	NW	40	58	W	38	50	W	36	48
	Hwy 30	W	39	53	W	42	58	W	45	58	W	44	55	W	43	53	W	43	53	W	37	47
	Hwy 34	W	39	53	W	42	58	W	45	58	W	44	55	W	43	53	W	43	53	W	37	47
	Hwy 287	W	39	53	W	42	58	W	45	58	W	44	55	W	43	53	W	43	53	W	37	47
D2	I-25 (Cheyenne - Wheatland)	NW	48	58	W	44	54	W	38	48	W	44	54	NW	40	50	W	38	48	W	38	48
	I-25 (Bordeaux area)	NW	25	49	W	33	50	W	38	59	W	37	60	NW	36	58	W	35	55	W	31	45
	I-25 (Wheatland - Douglas)	NW	16	26	W	17	27	SW	13	23	W	15	22	SW	13	23	SW	9	19	W	8	18
	I-25 (Douglas - Casper)	NW	16	26	W	17	27	SW	13	23	W	15	22	SW	13	23	SW	9	19	W	8	18
	I-25 (Casper - Kaycee)	NW	16	26	W	17	27	SW	13	23	W	15	22	SW	13	23	SW	9	19	W	8	18
	Hwy 220 (Muddy Gap - Casper)	NW	16	26	W	17	27	SW	13	23	W	15	23	SW	13	23	SW	9	19	W	8	18
	Hwy 85 (Torrington and Lusk)	NW	12	22	W	13	23	W	13	23	NW	15	25	NW	10	20	NW	12	22	NW	16	26
D3	I-80 (Utah - Green River)	W	20	30	W	22	32	W	16	26	W	12	22	SW	10	20	SW	9	19	SW	8	18
	I-80 (Green River - Rock Springs)	W	26	36	W	29	39	W	30	40	W	33	43	W	28	38	W	20	30	W	16	26
	I-80 (Rock Springs - Wamsutter)	W	25	35	W	32	42	W	30	40	W	33	43	W	28	38	W	20	30	W	16	26
D4	I-25 (Kaycee - Buffalo)	N	9	19	W	5	15	NW	8	18	NW	18	28	NW	15	25	N	16	26	N	12	22
	I-90 (Montana border - Buffalo)	NW	7	17	NW	7	17	NW	15	25	NW	17	27	NW	20	30	NW	16	26	NW	14	24
	I-90 (Buffalo - Gillette)	W	12	22	W	8	18	NW	10	20	NW	17	27	NW	17	27	NW	14	24	NW	16	26
	I-90 (Gillette - Sundance)	W	12	22	W	8	18	NW	10	20	NW	17	27	NW	17	27	NW	14	24	NW	16	26
	I-90 (Sundance - SD border)	W	12	22	W	8	18	NW	10	20	NW	17	27	NW	17	27	NW	14	24	NW	16	26
D5	Hwy 287 (South Pass - Lander)	NW	14	24	NW	13	23	NW	10	20	NW	5	15	SE	1	11	W	6	16	E	3	13
	Hwy 287 (Lander - Dubois)	NW	14	24	NW	13	23	NW	10	20	NW	5	15	SE	1	11	W	6	16	E	3	13
	Hwy 287 (Dubois - Tetons)	S	16	26	S	18	28	S	15	25	S	13	23	S	9	19	SW	12	22	S	6	16
	Hwy 789 (Lander - Shoshoni)	W	33	43	NW	31	41	NW	33	45	W	28	38	W	26	36	NW	20	30	N	15	32
	Hwy 789 (Shoshoni - Worland)	N	13	23	NW	25	35	NW	7	17	NW	6	16	NW	3	13	SW	6	16	W	7	17
	Hwy 120 (surrounding Clark)	N	45	55	NW	47	57	NW	45	60	NW	42	55	NW	43	55	SW	40	50	W	38	48
	Hwy 789 (Worland - Lovell)	W	8	23	NW	13	28	W	8	23	NW	9	24	N	4	19	W	6	21	NW	4	19

Recent LHPV Closure Events

Date	Time	Location	Closure Gust	Max Gust	Blowers/Blowovers after closure
3/31/11	15:10 19:40	Cheyenne to CO State Line	56	56	1/0
4/5/11	02:35 03:54	Cheyenne to Wheatland	70	73	0/0
4/5/11	10:48 18:48	Cheyenne to Wheatland	69	81	*/*

•One blow over reported at Chugwater after closure went in to effect. We believe the vehicle left Cheyenne prior to the closure going into effect. No other blow-overs occurred in spite of a peak gust of 81 mph.

Automated Road Closure Gates (ARCG)

Locations

- I-80 near Cheyenne
- WY22 (mountain pass) – Common location for avalanche control

Technology

- Advance warning signs/beacons
- Actuator on “Wyoming Gate”
- Operation
  - Remotely (software-based)
  - “Garage door remote”
  - Push buttons at roadside cabinet
  - Manual method (crank)

Questions/Comments?