



2015 Pursuit Rated Winter Tire Performance Evaluation



Michigan State Police Precision Driving Unit

STATE OF MICHIGAN
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and
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GENERAL INFORMATION

The Michigan State Police maintains a patrol fleet of over 1000 cars. Historically, protocol for tires was to use summer tires from mid-spring through mid-fall and then change to winter tires. While this system equipped the vehicles with what was considered the best tire for the seasonal driving conditions, several inefficiencies were experienced. The tires were not always being worn completely out before changing to the next season's tires. Depending on the individual tire dealership, these partially worn tires were not being stored for their off-season and returned to service later on. If the tires were stored for their off-season, many dealerships would charge a storage fee and a mounting and balancing fee to put them back on the vehicle.

The Michigan State Police Precision Driving Unit, in conjunction with Vehicle and Travel Services, made the decision to research an all-season tire that could be utilized through both seasons. If an acceptable tire was discovered, it could remain on the vehicle throughout its useful life eliminating the waste of discarding a partially used tire. This would also eliminate storage fees and twice yearly mounting and balancing fees.

In 2007, the Chevrolet Tahoe was equipped with a factory tire that troopers in the field were not satisfied with its tractive qualities. Research into all-season/snow tires led to the discovery of the Nokian WRG2 tire, which was the only V speed rated tire available in the Tahoe size. Immediate feedback from the troopers in the field driving Chevrolet Tahoes equipped with Nokian tires was positive.

In 2011, the Michigan State Police Precision Driving Unit was tasked with testing tires marketed as pursuit rated police tires. The results of this testing can be found at www.michigan.gov/msp. This testing confirmed the Nokian tire as being quite capable on multiple vehicle platforms. The decision was made to move away from seasonal tires and transition the Michigan State Police patrol fleet to the Nokian WR2 All-Season tire. This decision was implemented in May of 2013.

The winter of 2013-2014 was an exceptionally harsh winter. Temperatures and snow fall accumulations significantly exceeded norms for severity. Troopers in the field began complaining of the tractive qualities of the Nokian tire. Most of the issues being reported were of being stuck in the roadway with rear wheel drive Dodge Chargers equipped with the Nokian tire. They requested returning to the Goodyear Ultra Grip tire. Immediate testing was performed at the Precision Driving Unit. Acceleration and braking runs were made on the exercise pad in 6 inches of snow using a rear wheel drive Dodge Charger with traction control activated. Results of this testing showed the Nokian tire to have slightly more traction on acceleration runs. Braking was virtually identical between the two tires.

Due to the quantity of complaints coming from our northern most posts, the Michigan State Police command staff issued the directive to test tires in the winter conditions experienced in the Upper Peninsula of Michigan. Arrangements were made to utilize the Keweenaw Research Center in Hancock, MI. The last week of January 2015, was chosen as the test date in hopes of experiencing the lowest seasonal temperatures of the year.

The testing directive also included that we explore other tires that may provide more traction during winter conditions. As the rear wheel drive Dodge Charger was experiencing the most complaints, the decision to use it as the testing platform was made. This vehicle is capable of 152 mph requiring a W speed rated tire. Criteria for test tires was then established as follows:

- The tire must hold a W speed rating (capable of speeds from 150 to 168 mph)
- The tire must come in all sizes required by our patrol fleet
- The tire must be rated as a snow or an all-season tire

Schneider Tire Outlet of Marne, MI researched all tire manufacturer products meeting this criterion. The following is the list of tires tested. It should be noted that upon receipt of the tires, the Firestone Firehawk PVS was discovered to be a V rated tire. Though it did not meet the minimum requirement of W speed rating, it was still tested as it appeared to have a very aggressive tread pattern.

- Nokian WRG3
- Goodyear Ultra Grip
- Firestone Firehawk
- Firestone Firehawk PVS

The above mentioned tires were tested in P225/60R18 size on the rear-wheel drive Dodge Charger and in P245/55R18 size on the all-wheel drive Dodge Charger.

TESTING METHODOLOGIES

After speaking with several subject matter experts in both the vehicle and tire manufacturing arenas, a list of four tests were developed to evaluate each tire. The tests developed were acceleration, braking, steady state turn, and hill start tests.

The acceleration testing was done in three parts. The first acceleration test performed was a full throttle, traction control activated acceleration run. A series of ten acceleration runs was completed. The second acceleration test performed was a traction control deactivated run allowing the driver to modulate the throttle to develop maximum acceleration. The third acceleration test was a rolling start test. The vehicle was allowed to slowly accelerate to 5 mph before applying full throttle with traction control activated. This test was designed to eliminate initial wheel spin experienced when accelerating a vehicle from a full stop. Each acceleration test was run with a termination speed of 30 mph.

The brake testing was performed at the end of each acceleration run. A full ABS brake activation from a target speed of 30 mph was performed.

Both of the above tests were measured using a Kistler CDS-GPS CGPSLA 100 Hz antenna and logging unit. This equipment was able to capture time, speed, and distance measurements. For acceleration runs, the system was triggered on vehicle movement. For braking runs, the system was triggered by a pressure pad placed on the brake pedal. Both of the above tests were performed on Vehicle Dynamics Area 1 at the Keweenaw Research Center.

The steady state turn test was performed on a 300 foot diameter, groomed snow circle. Testing was accomplished by setting the vehicle's cruise control at 25 mph and completing a full lap around the circle. The speed was then increased in 1 mph increments using the cruise control switch. A full lap was done at each speed. The test continued until measureable understeer or oversteer was experienced in the test vehicle.

The hill start test was performed on groomed snow grades of 7%, 10%, 15%, and 25%. The vehicle was driven up the slope until the drive wheels were on the measured grade. The vehicle was then accelerated up the grade. Acceleration runs with the traction control in both on and off modes were made on each grade. After completing testing on the 7% grade, the testing would move on the 10% grade. Testing was discontinued when the tire would no longer climb the grade it was being tested upon.

Measurement for the above two tests were made using a Vericom 3000 instrument. This instrument has the ability to measure longitudinal and lateral G forces without the need for a speed or distance measurement.

Tires were stored in an unheated utility trailer when not in use. This was done to stabilize the tire temperature to environmental conditions experienced during testing. This would be similar in nature to a patrol vehicle continuously parked outside. Between tests, tires were changed inside of a heated building on a hoist. The tires were exposed to heat for less than 10 minutes. After the tire change, the vehicle was returned to outdoor conditions and allowed to sit briefly before testing was continued.

Keweenaw Research Center employees made drag factor (μ) readings three times daily in the test areas. These readings were used to determine consistency of the test surface throughout the day. Drag factor values are located on page five.

All tires were mounted on a vehicle and driven 20 miles on an asphalt paved roadway to scuff the tread prior to testing. The scuffing process was performed using the same vehicle, route, and driver for all tires.

The test driver and passenger remained the same for each vehicle in the test eliminating inconsistencies between test runs. The following personnel were assigned to test the following platforms:

- Sgt. Mike McCarthy and Mr. Mike McPike (Kistler): RWD Dodge Charger Acceleration and Braking
- Sgt. Rob Schwalm and Sgt. Andy Douville: AWD Dodge Charger Acceleration and Braking
- Lt. Ron Gromak and Sgt. John Bruno: AWD and RWD Dodge Charger Steady State Turn and Hill Start

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MU MEASUREMENTS

Tuesday, January 27, 2015

Morning Temperature: 8° F
Afternoon Temperature: 27° F

Vehicle Dynamics Area 1 (VDA 1)
(Packed Snow)
10:30 a.m. – 0.23
4:00 p.m. – 0.21

300 Ft. Circle
(Packed Snow)
4:00 p.m. – 0.22

Wednesday, January 28, 2015

Morning Temperature: 20° F
Afternoon Temperature: 30° F

Vehicle Dynamics Area 1 (VDA 1)
(Packed Snow)
10:30 a.m. – 0.19
4:00 p.m. – 0.18

300 Ft. Circle
(Packed Snow)
10:30 a.m. - 0.20

ACCELERATION RUN SUMMARY SHEET

Tire & Vehicle	Initial Velocity (mph)	Average Distance (feet)	Average Acceleration Rate (ft/s ²)
Nokian RWD Traction Control	30.00	197.34	4.91
Nokian RWD No Traction Control	30.00	193.54	5.00
Nokian RWD Rolling Start with Traction Control	30.00	204.48	4.73
Goodyear Ultra Grip RWD Traction Control	30.00	204.83	4.73
Goodyear Ultra Grip RWD No Traction Control	30.00	164.67	5.88
Goodyear Ultra Grip RWD Rolling Start with Traction Control	30.00	207.91	4.66
Firestone Firehawk RWD Traction Control	30.00	263.93	3.67
Firestone Firehawk RWD No Traction Control	30.00	259.90	3.72
Firestone Firehawk RWD Rolling Start with Traction Control	30.00	268.71	3.60
Firestone Firehawk PVS RWD Traction Control	30.00	213.12	4.54
Firestone Firehawk PVS RWD No Traction Control	30.00	173.97	5.56
Firestone Firehawk PVS RWD Rolling Start with Traction Control	30.00	216.35	4.47
Nokian AWD Traction Control	30.00	96.93	9.99
Nokian AWD No Traction Control	30.00	97.06	9.97
Nokian AWD Rolling Start with Traction Control	30.00	101.26	9.56
Goodyear Ultra Grip AWD Traction Control	30.00	93.99	10.30
Goodyear Ultra Grip AWD No Traction Control	30.00	92.50	10.47
Goodyear Ultra Grip AWD Rolling Start with Traction Control	30.00	91.07	10.63
Firestone Firehawk AWD Traction Control	30.00	135.67	7.14
Firestone Firehawk AWD No Traction Control	30.00	131.40	7.37
Firestone Firehawk AWD Rolling Start with Traction Control	30.00	132.39	7.31
Firestone Firehawk PVS AWD Traction Control	30.00	88.60	10.93
Firestone Firehawk PVS AWD No Traction Control	30.00	85.90	11.27
Firestone Firehawk PVS AWD Rolling Start with Traction Control	30.00	86.21	11.23

NOKIAN RWD

0-30 ACCELERATION WITH TRACTION CONTROL ON

MPH	RUN NUMBER										AVERAGE
	1	2	3	4	5	6	7	8	9	10	
2	1.05	1.05	1.16	0.99	1.00	1.27	1.32	1.34	1.04	1.63	1.19
4	5.31	4.64	5.38	5.24	5.11	4.59	5.03	4.97	4.70	5.50	5.05
6	10.91	9.76	10.78	11.46	10.66	10.46	10.97	10.30	10.12	10.52	10.59
8	17.91	15.32	16.42	18.16	18.41	16.83	16.86	17.38	16.15	16.33	16.98
10	25.67	22.23	25.07	26.54	26.92	25.67	25.48	24.89	23.93	25.13	25.15
12	36.09	32.26	34.76	35.42	37.87	34.67	34.43	34.41	32.75	35.10	34.78
14	47.67	41.39	45.97	46.74	50.32	45.01	44.74	44.88	44.25	46.88	45.79
16	61.77	53.76	59.07	58.88	63.53	56.89	58.07	57.37	56.09	59.77	58.52
18	76.44	66.26	72.50	73.04	76.92	70.65	71.15	71.67	70.54	75.06	72.42
20	93.85	82.60	86.91	89.07	94.24	86.83	87.61	85.84	86.95	89.03	88.29
22	110.89	98.49	104.22	106.08	111.91	104.14	104.22	103.72	102.39	109.86	105.59
24	130.79	117.44	123.55	126.13	130.69	123.34	122.40	123.28	122.28	129.17	124.91
26	152.63	139.24	144.42	146.51	150.60	144.55	142.78	146.25	143.92	148.57	145.95
28	176.77	163.01	170.48	170.03	173.94	167.80	165.38	171.21	168.32	173.52	170.05
30	201.48	192.82	199.10	200.14	200.90	193.53	191.14	198.88	196.02	199.39	197.34

0-30 ACCELERATION WITH TRACTION CONTROL OFF

MPH	RUN NUMBER										AVERAGE
	1	2	3	4	5	6	7	8	9	10	
2	-	1.15	1.10	1.33	0.96	1.02	1.01	0.90	1.05	1.06	1.06
4	-	4.50	4.98	4.68	4.77	4.26	4.52	4.15	3.74	4.59	4.47
6	-	9.63	10.18	10.63	11.03	10.66	9.92	10.35	10.28	9.51	10.24
8	-	17.01	16.62	16.44	17.54	18.10	16.65	17.04	16.79	16.83	17.00
10	-	24.91	23.31	24.75	25.63	26.13	25.34	26.12	24.89	25.59	25.19
12	-	35.64	33.20	34.43	35.34	35.81	35.68	35.93	34.76	36.59	35.26
14	-	46.56	43.03	46.47	46.83	46.19	48.29	47.45	45.62	48.71	46.57
16	-	58.54	55.17	58.59	59.69	57.68	61.68	60.91	59.19	61.11	59.17
18	-	72.26	68.26	71.72	74.85	72.07	76.38	76.19	72.63	74.83	73.24
20	-	87.64	84.40	87.75	91.05	85.86	92.71	92.88	87.79	89.54	88.85
22	-	107.43	100.24	102.92	114.52	102.46	110.39	110.89	104.84	106.01	106.63
24	-	127.26	122.16	121.91	134.67	120.54	129.22	129.39	121.87	123.75	125.64
26	-	147.68	142.16	141.22	156.44	141.01	150.07	148.86	144.82	142.81	146.12
28	-	171.17	171.73	166.76	177.31	165.02	171.19	169.07	165.79	168.66	169.63
30	-	196.44	194.46	192.67	201.20	190.18	195.58	191.58	190.19	189.52	193.54

**Run 1 data was discovered to be corrupt after testing was completed and was discarded

5-30 ACCELERATION – ROLLING START

MPH	RUN NUMBER										AVERAGE
	1	2	3	4	5	6	7	8	9	10	
5	12.82	6.70	8.13	6.44	6.18	6.64	6.88	6.92	7.06	8.47	7.62
7	24.29	12.57	14.03	12.08	11.31	12.36	12.49	13.21	13.57	13.57	13.95
9	31.13	19.92	22.15	19.93	19.58	19.46	20.64	20.42	21.23	21.68	21.61
11	40.24	29.19	31.56	28.80	29.53	28.83	30.45	29.95	30.95	31.05	31.06
13	50.98	40.24	42.73	39.60	39.76	39.04	41.44	41.10	42.65	41.28	41.88
15	62.49	53.11	57.61	51.12	53.78	49.61	53.33	52.96	55.84	53.42	54.33
17	77.81	66.81	73.14	64.30	69.29	63.50	70.08	67.34	68.71	66.97	68.80
19	95.91	83.63	90.14	79.23	86.03	77.67	85.77	82.59	85.71	81.47	84.82
21	115.32	101.70	108.13	97.09	104.38	94.43	106.86	100.34	103.11	98.36	102.97
23	136.58	119.27	127.01	115.50	122.84	112.09	125.02	120.87	125.19	117.08	122.15
25	158.03	140.58	152.32	137.62	142.18	130.71	144.85	139.66	147.69	137.46	143.11
27	178.64	163.40	173.26	159.60	166.06	155.24	169.09	162.31	170.80	159.82	165.82
29	205.76	187.20	195.92	184.76	189.74	182.29	193.81	185.34	196.61	186.05	190.75
30	219.23	202.49	208.62	197.05	205.86	195.49	206.45	199.35	209.99	200.24	204.48

GOODYEAR ULTRA GRIP RWD

0-30 ACCELERATION WITH TRACTION CONTROL ON

MPH	RUN NUMBER										AVERAGE
	1	2	3	4	5	6	7	8	9	10	
2	0.99	1.26	0.81	0.78	0.95	1.06	0.94	0.82	0.95	0.84	0.94
4	3.77	4.27	3.75	3.49	3.90	3.48	4.54	3.66	4.52	3.87	3.93
6	8.28	8.38	7.88	7.61	7.73	8.02	9.19	6.98	8.51	8.25	8.08
8	13.98	14.29	13.90	12.93	13.30	13.42	14.47	13.56	14.93	14.30	13.91
10	21.67	21.53	21.40	21.82	21.34	21.32	22.49	21.65	21.36	22.37	21.70
12	30.02	30.39	30.53	31.97	29.94	31.49	30.50	30.70	31.54	30.93	30.80
14	42.13	41.77	42.20	42.86	40.02	42.39	42.02	42.73	41.82	41.16	41.91
16	54.18	53.63	55.77	54.96	53.82	54.64	54.82	55.50	56.24	53.92	54.75
18	69.50	68.45	72.75	68.80	68.75	68.98	69.84	71.32	71.14	68.09	69.76
20	90.16	82.20	90.09	85.65	85.44	84.41	86.72	88.32	87.56	85.28	86.58
22	111.77	99.83	109.11	105.58	104.67	101.72	105.93	108.72	109.34	106.01	106.27
24	132.79	117.14	133.55	125.83	126.21	120.04	127.18	131.22	128.84	126.55	126.94
26	155.13	140.84	154.45	149.46	149.06	141.30	151.00	154.43	152.37	148.48	149.65
28	180.33	164.00	177.86	174.31	174.75	165.71	175.72	181.28	176.71	173.38	174.41
30	213.76	189.88	202.28	205.06	208.64	194.08	207.47	216.01	205.12	205.99	204.83

0-30 ACCELERATION WITH TRACTION CONTROL OFF

MPH	RUN NUMBER										AVERAGE
	1	2	3	4	5	6	7	8	9	10	
2	0.91	0.99	0.90	1.05	0.94	0.93	0.96	1.51	0.78	0.90	0.99
4	3.28	3.55	4.19	3.13	3.35	3.26	3.17	4.83	3.75	3.36	3.59
6	7.17	7.40	8.82	7.53	7.82	7.42	7.94	10.04	7.81	6.86	7.88
8	12.55	12.83	15.07	13.35	16.33	12.53	13.85	16.92	13.86	12.34	13.96
10	19.07	19.10	21.04	20.90	23.74	18.96	21.06	24.88	20.06	18.95	20.78
12	27.31	26.74	30.26	29.17	32.22	26.00	28.88	33.19	28.45	26.81	28.90
14	36.25	35.40	38.91	38.73	40.75	34.60	37.57	41.75	38.16	36.69	37.88
16	47.07	45.49	50.69	48.52	53.39	44.71	49.70	51.83	49.61	48.44	48.95
18	59.79	59.05	61.86	61.58	65.04	57.87	60.75	63.38	61.86	61.27	61.25
20	73.30	72.90	75.36	75.35	78.35	71.29	75.43	75.51	76.15	74.96	74.86
22	88.23	86.95	89.30	92.65	95.36	87.49	91.75	89.03	92.79	90.66	90.42
24	102.93	103.34	104.17	109.11	110.54	105.13	108.70	103.83	111.17	104.65	106.36
26	119.25	119.74	119.28	127.16	125.96	124.77	124.01	118.88	125.43	122.49	122.70
28	135.94	139.24	137.98	151.48	147.09	143.50	145.95	137.08	152.15	139.89	143.03
30	155.53	163.82	155.27	172.71	168.21	164.31	178.96	157.34	173.02	157.51	164.67

5-30 ACCELERATION – ROLLING START

MPH	RUN NUMBER										AVERAGE
	1	2	3	4	5	6	7	8	9	10	
5	5.68	5.87	5.80	6.50	7.34	6.79	7.10	5.76	6.84	6.26	6.39
7	11.46	10.82	9.85	12.59	13.15	12.43	11.38	10.90	12.01	11.04	11.56
9	17.55	16.89	16.45	21.40	19.01	20.02	18.06	17.31	19.03	19.01	18.47
11	24.72	26.60	23.61	30.51	27.68	29.75	26.08	24.98	30.73	27.80	27.25
13	34.68	36.86	33.30	40.56	37.32	38.99	37.24	34.51	43.13	38.95	37.55
15	47.00	48.90	44.88	52.91	49.70	51.18	51.87	46.83	55.71	53.18	50.22
17	62.33	63.29	58.77	67.68	63.57	64.64	65.96	60.72	71.43	65.53	64.39
19	80.53	79.42	73.77	84.79	82.93	80.40	83.66	75.85	89.28	81.15	81.18
21	98.92	97.82	95.57	103.73	100.42	97.21	103.39	94.82	108.12	98.27	99.83
23	122.31	117.02	116.03	122.94	117.88	116.69	124.42	114.04	131.05	118.95	120.13
25	143.85	141.86	137.45	147.01	135.57	137.48	147.75	135.00	153.81	142.11	142.19
27	166.20	167.36	160.81	173.18	157.37	162.89	175.30	160.28	177.77	164.44	166.56
29	192.52	194.39	189.13	200.67	185.15	190.88	204.17	185.56	205.71	192.79	194.10
30	203.85	206.62	207.51	213.93	195.07	207.76	216.55	198.48	220.97	208.35	207.91

FIRESTONE FIREHAWK RWD

0-30 ACCELERATION WITH TRACTION CONTROL ON

MPH	RUN NUMBER										AVERAGE
	1	2	3	4	5	6	7	8	9	10	
2	1.03	1.21	2.22	1.38	1.66	1.48	1.74	1.43	2.28	1.52	1.60
4	6.54	4.85	7.41	5.41	6.70	5.57	6.13	5.63	7.54	5.58	6.14
6	14.48	10.74	14.29	11.78	12.74	11.84	13.80	11.33	15.71	12.80	12.95
8	23.72	18.50	23.53	19.35	21.91	19.76	23.98	19.16	25.53	21.26	21.67
10	34.84	30.45	34.17	29.51	34.11	28.44	34.72	28.55	36.55	32.07	32.34
12	47.82	43.44	46.80	41.83	47.40	39.07	52.67	39.47	49.21	44.37	45.21
14	67.23	57.15	59.90	56.82	64.18	51.41	69.37	52.18	64.24	58.76	60.12
16	85.58	75.59	76.53	72.59	84.80	65.79	86.24	67.23	79.97	75.05	76.94
18	102.85	94.46	96.20	90.37	108.10	82.09	103.29	86.59	97.59	94.38	95.59
20	124.39	116.52	119.18	111.28	133.28	102.20	124.57	109.39	118.93	116.33	117.61
22	145.86	141.91	145.53	136.75	156.64	123.05	146.92	131.16	145.09	139.15	141.21
24	168.62	172.00	173.71	162.40	181.90	149.14	174.83	159.30	168.81	164.76	167.55
26	197.96	200.00	199.40	191.49	213.04	178.02	202.50	189.16	199.35	190.85	196.18
28	225.78	229.73	234.62	222.04	246.97	207.01	234.45	220.77	227.99	225.85	227.52
30	262.22	264.63	269.35	259.23	288.10	244.71	268.81	257.12	261.24	263.86	263.93

0-30 ACCELERATION WITH TRACTION CONTROL OFF

MPH	RUN NUMBER										AVERAGE
	1	2	3	4	5	6	7	8	9	10	
2	3.06	1.43	1.04	1.30	1.43	1.44	2.13	1.09	1.49	1.17	1.56
4	12.13	5.62	6.53	5.34	7.17	5.84	8.36	5.98	5.50	5.16	6.76
6	20.07	12.69	14.13	11.95	14.53	12.50	16.68	12.98	12.31	12.16	14.00
8	30.89	23.10	24.36	20.56	23.76	20.40	26.60	25.05	22.46	21.59	23.88
10	42.52	33.90	36.89	32.92	35.52	33.22	37.59	43.26	33.74	31.68	36.12
12	57.69	48.77	49.97	44.75	47.39	48.02	48.25	61.39	49.82	44.11	50.02
14	73.74	68.12	63.67	57.36	64.01	68.14	66.92	81.49	64.30	59.87	66.76
16	91.59	85.51	79.46	73.22	85.79	85.92	85.20	102.72	81.77	78.09	84.93
18	109.1	105.72	98.08	90.76	104.94	103.08	104.62	121.22	101.81	96.06	103.54
20	127.74	125.99	120.45	115.94	125.35	123.15	125.13	145.19	125.01	115.18	124.91
22	151.33	147.30	141.17	143.33	152.95	147.14	147.23	167.92	147.32	134.25	147.99
24	172.76	170.72	169.70	169.97	193.14	172.81	171.90	191.34	173.26	158.91	174.45
26	194.98	197.39	193.79	205.49	217.76	196.39	197.34	215.06	198.15	183.32	199.97
28	219.58	221.47	220.55	235.08	245.08	222.69	225.30	247.49	240.91	218.18	229.63
30	253.51	247.18	252.62	266.84	272.61	247.34	255.36	281.46	270.74	251.32	259.90

5-30 ACCELERATION – ROLLING START

MPH	RUN NUMBER										AVERAGE
	1	2	3	4	5	6	7	8	9	10	
5	7.69	7.59	8.37	7.12	7.66	8.09	8.41	7.73	8.17	7.46	7.83
7	14.24	14.00	15.29	13.34	14.17	14.72	17.44	14.26	16.00	16.09	14.96
9	22.96	22.47	24.20	21.60	23.80	23.58	29.77	23.31	25.47	26.07	24.32
11	33.03	33.64	36.53	32.77	35.24	34.17	44.73	34.42	37.13	38.16	35.98
13	47.68	48.36	50.77	46.09	49.19	45.15	58.45	48.56	50.70	52.53	49.75
15	64.07	61.90	68.32	60.40	66.21	58.80	76.25	61.99	67.17	67.54	65.27
17	86.97	81.88	90.30	79.81	94.45	74.37	96.08	85.21	85.40	83.40	85.79
19	110.07	101.81	110.78	102.02	126.24	91.42	115.57	105.23	115.77	101.15	108.01
21	134.65	125.81	137.60	124.71	152.74	111.77	137.10	129.13	143.56	121.22	131.83
23	165.29	151.00	166.70	157.81	177.77	136.62	162.75	153.78	173.62	147.65	159.30
25	192.63	179.48	199.39	183.14	204.47	166.74	190.80	178.61	198.55	173.71	186.75
27	221.89	213.84	227.52	218.64	232.84	200.93	217.94	206.49	232.60	204.22	217.69
29	253.24	247.51	265.48	249.81	265.86	233.11	248.08	239.94	264.83	233.09	250.10
30	270.84	265.38	285.69	269.84	284.16	252.12	265.53	260.47	283.65	249.44	268.71

FIRESTONE FIREHAWK PVS RWD

0-30 ACCELERATION WITH TRACTION CONTROL ON

MPH	RUN NUMBER										AVERAGE
	1	2	3	4	5	6	7	8	9	10	
2	1.25	0.75	1.03	0.83	0.95	0.88	1.11	0.86	1.53	0.78	1.00
4	5.16	3.21	4.43	3.30	4.08	3.26	3.71	3.09	5.38	3.15	3.88
6	9.99	7.06	7.93	7.11	8.12	7.27	7.62	7.53	9.31	7.04	7.90
8	15.31	12.03	14.16	12.45	14.72	12.22	13.50	12.63	15.34	12.23	13.46
10	25.11	19.93	22.36	19.28	22.86	19.41	21.36	19.12	24.03	19.60	21.31
12	35.03	29.73	32.25	29.14	32.18	28.13	30.60	27.51	33.84	28.32	30.67
14	47.10	40.03	46.08	40.46	44.99	39.20	43.19	37.98	45.73	40.57	42.53
16	62.62	52.84	59.26	53.41	59.01	51.55	57.84	49.40	58.08	52.51	55.65
18	79.37	67.61	75.37	68.62	75.82	65.58	75.26	64.05	74.79	68.30	71.48
20	95.97	86.05	94.63	86.50	92.98	82.11	92.58	82.31	92.52	85.62	89.13
22	116.30	106.57	114.07	108.09	109.12	100.69	113.79	99.24	110.90	106.56	108.53
24	138.41	129.25	136.64	129.63	130.26	121.14	135.13	120.76	131.00	129.71	130.19
26	164.12	154.07	159.30	155.84	152.18	143.94	160.76	143.48	154.67	155.44	154.38
28	190.60	181.74	185.16	185.06	177.13	168.37	188.78	169.92	178.50	183.47	180.87
30	217.15	215.43	219.88	219.34	209.69	197.93	220.86	202.47	211.57	216.86	213.12

0-30 ACCELERATION WITH TRACTION CONTROL OFF

MPH	RUN NUMBER										AVERAGE
	1	2	3	4	5	6	7	8	9	10	
2	1.24	0.87	0.91	1.34	0.78	0.84	0.89	0.99	0.80	0.86	0.95
4	3.75	3.54	4.62	3.62	3.80	3.29	3.20	3.77	3.31	3.68	3.66
6	8.77	8.39	8.64	7.31	8.74	7.72	7.51	8.28	7.10	8.07	8.05
8	15.22	14.75	14.26	12.64	14.52	13.59	13.92	14.34	12.60	13.84	13.97
10	23.24	22.45	20.75	20.10	21.89	20.80	20.78	25.01	19.37	20.78	21.52
12	32.11	31.89	28.69	30.00	30.87	28.33	29.46	38.14	28.26	28.97	30.67
14	42.67	43.33	37.37	41.69	40.63	38.80	38.96	51.26	38.48	41.13	41.43
16	54.26	55.11	47.48	53.30	52.34	49.50	49.58	66.30	49.37	55.22	53.25
18	65.11	68.99	60.64	68.36	64.96	62.66	61.91	81.26	60.12	72.24	66.63
20	80.61	83.34	75.21	83.68	78.54	76.39	76.37	97.10	74.03	85.14	81.04
22	98.55	98.74	91.13	100.86	94.26	94.37	91.03	115.63	90.20	103.55	97.83
24	113.84	116.71	106.02	118.38	112.31	113.96	106.71	134.60	109.32	120.60	115.25
26	128.25	133.41	120.09	135.64	130.27	130.58	121.70	156.06	126.81	139.55	132.24
28	146.33	151.36	141.79	156.13	150.72	147.23	141.25	179.46	146.11	157.24	151.76
30	167.20	171.58	167.19	179.15	171.10	169.14	162.32	201.26	167.88	182.83	173.97

5-30 ACCELERATION – ROLLING START

MPH	RUN NUMBER										AVERAGE
	1	2	3	4	5	6	7	8	9	10	
5	6.52	6.06	5.28	8.50	6.00	5.83	5.06	6.52	6.56	6.13	6.25
7	12.02	10.38	10.14	13.17	10.42	10.25	9.65	11.74	11.17	10.69	10.96
9	19.80	15.50	17.61	20.17	17.06	16.37	15.08	20.30	17.71	16.49	17.61
11	27.89	25.82	29.20	30.63	27.24	24.17	22.80	31.01	26.34	24.17	26.93
13	39.32	35.07	41.10	42.75	38.14	36.81	32.89	41.80	38.33	33.65	37.99
15	52.07	48.19	53.20	56.87	52.11	50.37	45.56	54.30	50.49	46.99	51.02
17	69.18	62.53	67.67	71.91	68.80	66.14	58.15	68.63	65.00	61.57	65.96
19	84.47	78.50	86.26	89.07	85.37	83.06	73.66	85.88	81.77	79.30	82.73
21	106.65	99.57	104.84	107.28	103.78	102.06	90.67	103.18	99.51	98.58	101.61
23	128.74	123.56	126.74	128.48	124.23	121.84	110.02	122.69	117.86	119.92	122.41
25	153.35	148.05	148.32	151.40	148.30	143.92	132.94	143.64	141.81	145.51	145.72
27	180.35	171.00	176.33	176.73	174.33	169.70	156.82	168.18	170.81	170.92	171.52
29	208.29	200.41	201.34	207.58	204.07	197.48	184.96	195.41	201.36	203.33	200.42
30	219.64	213.85	217.49	223.31	222.56	215.11	200.45	212.31	217.62	221.12	216.35

NOKIAN AWD

0-30 ACCELERATION WITH TRACTION CONTROL ON

MPH	RUN NUMBER										AVERAGE
	1	2	3	4	5	6	7	8	9	10	
2	1.32	1.03	0.82	0.67	0.98	0.77	0.58	0.67	0.61	0.72	0.82
4	2.94	2.58	2.11	2.58	2.90	2.62	2.45	2.14	2.14	2.71	2.52
6	5.18	5.28	4.60	4.79	5.93	5.14	4.93	4.49	4.35	5.60	5.03
8	8.47	8.56	7.85	8.15	8.99	8.36	7.80	7.73	8.01	8.88	8.28
10	13.06	12.62	12.28	13.84	14.53	12.44	11.90	11.96	11.80	13.26	12.77
12	17.73	17.47	16.87	18.50	20.49	18.00	16.32	15.96	15.80	17.91	17.51
14	24.94	23.64	23.27	26.57	26.91	23.72	21.61	21.57	21.07	23.44	23.67
16	32.76	30.73	30.31	33.40	34.52	29.84	27.65	27.66	26.81	29.32	30.30
18	39.27	38.90	37.72	41.57	42.47	37.05	34.27	34.33	33.43	36.41	37.54
20	47.02	46.24	47.90	51.38	51.52	44.76	41.54	42.51	41.14	43.23	45.72
22	54.91	53.78	56.60	63.19	61.57	53.57	50.51	50.37	49.13	51.46	54.51
24	64.21	62.62	67.52	71.47	71.94	62.53	59.95	59.40	58.10	60.76	63.85
26	74.02	72.66	77.10	81.12	84.70	72.02	69.13	69.02	67.49	69.38	73.66
28	85.81	83.70	87.98	91.72	97.21	82.68	80.29	80.31	78.40	81.10	84.92
30	95.51	95.94	99.44	103.06	112.20	94.56	92.91	92.19	90.52	92.96	96.93

0-30 ACCELERATION WITH TRACTION CONTROL OFF

MPH	RUN NUMBER										AVERAGE
	1	2	3	4	5	6	7	8	9	10	
2	0.60	0.58	0.86	0.78	0.91	0.85	0.69	0.85	0.70	0.69	0.75
4	2.29	2.84	2.42	2.06	2.15	2.26	2.31	3.07	2.57	2.53	2.45
6	4.59	5.68	5.14	4.57	4.40	5.05	4.47	5.95	5.37	5.44	5.07
8	7.86	9.28	8.60	7.66	7.50	9.02	7.12	9.76	8.75	9.75	8.53
10	11.94	13.13	13.53	11.70	11.30	13.42	10.68	14.02	12.63	14.29	12.66
12	16.50	17.86	18.09	16.15	15.72	18.89	15.63	19.51	17.14	20.05	17.55
14	22.00	23.46	23.54	21.55	21.00	24.12	21.34	25.38	22.53	26.49	23.14
16	28.56	30.18	29.43	27.98	27.18	30.61	27.67	32.54	28.84	32.64	29.56
18	35.13	37.05	36.84	35.52	34.49	38.13	34.75	40.18	36.44	41.16	36.97
20	42.95	45.78	43.88	43.07	42.76	45.65	41.61	49.18	44.57	49.32	44.88
22	51.14	53.41	52.87	52.19	51.36	54.16	50.35	59.41	52.77	58.39	53.61
24	59.89	63.44	62.24	61.04	61.26	62.76	60.53	74.23	62.73	71.10	63.92
26	71.90	73.45	72.10	71.31	70.23	73.49	70.78	83.67	72.06	80.69	73.97
28	82.21	84.66	82.25	82.96	81.23	83.33	82.49	94.20	82.78	92.91	84.90
30	93.15	97.60	95.46	94.08	94.91	94.75	94.57	106.49	94.76	104.84	97.06

5-30 ACCELERATION – ROLLING START

MPH	RUN NUMBER										AVERAGE
	1	2	3	4	5	6	7	8	9	10	
5	5.37	4.12	4.95	4.47	3.30	4.10	4.06	3.77	3.90	3.81	4.19
7	9.99	7.67	9.20	7.75	6.62	6.85	7.46	6.23	6.90	6.78	7.55
9	15.20	12.84	14.67	12.56	11.09	10.56	12.45	9.94	10.83	11.14	12.13
11	19.22	17.69	21.62	16.22	15.06	15.12	17.18	14.13	15.01	15.56	16.68
13	24.34	22.66	29.36	21.45	20.55	20.44	22.16	19.08	20.31	20.80	22.12
15	30.24	28.73	37.73	27.63	26.43	26.04	27.73	25.42	26.86	27.28	28.41
17	36.69	35.26	49.02	34.56	32.88	32.62	34.83	32.13	33.89	33.78	35.57
19	43.75	42.11	63.55	42.33	39.95	40.39	42.42	40.15	41.03	41.48	43.72
21	52.47	49.87	73.57	50.26	48.19	48.16	51.08	48.62	49.56	50.46	52.22
23	61.01	58.35	83.66	59.86	56.86	57.76	59.93	57.84	58.66	59.39	61.33
25	70.32	67.93	95.83	70.20	66.27	67.41	70.01	67.64	69.18	68.94	71.37
27	82.64	78.48	113.76	80.91	78.55	77.95	81.20	78.42	81.18	78.76	83.19
29	93.94	90.31	124.51	94.13	90.50	88.87	93.49	91.72	93.86	90.30	95.16
30	99.63	96.32	131.71	98.70	95.14	97.12	99.08	98.03	100.48	96.42	101.26

GOODYEAR ULTRA GRIP AWD

0-30 ACCELERATION WITH TRACTION CONTROL ON

MPH	RUN NUMBER										AVERAGE
	1	2	3	4	5	6	7	8	9	10	
2	0.60	0.88	0.50	0.58	0.64	0.48	0.56	0.59	0.72	0.62	0.62
4	2.07	2.39	1.65	2.43	1.81	1.69	1.65	1.83	1.85	1.94	1.93
6	4.53	4.96	3.97	5.07	3.93	4.20	4.10	4.08	3.90	3.92	4.27
8	7.73	8.54	6.76	8.54	6.80	7.10	7.16	6.86	6.73	6.79	7.30
10	12.49	12.75	10.22	12.26	10.61	11.30	10.55	10.27	10.44	10.31	11.12
12	16.38	17.54	14.70	16.98	14.47	16.05	15.37	14.78	14.62	14.29	15.52
14	22.47	22.50	19.61	22.77	20.02	21.59	20.63	19.75	19.72	19.65	20.87
16	28.43	31.08	26.51	28.78	25.91	28.45	27.50	25.86	26.13	24.84	27.35
18	36.10	38.46	32.47	35.76	33.38	35.19	34.75	32.53	32.68	31.68	34.30
20	43.02	47.29	40.42	43.31	41.15	42.81	43.75	40.33	40.07	38.96	42.11
22	51.63	57.93	47.97	51.43	49.79	50.95	52.58	47.79	49.03	47.42	50.65
24	60.36	71.13	57.42	60.85	58.12	59.96	63.61	56.80	58.22	56.19	60.27
26	70.14	81.24	66.66	71.07	68.20	69.50	74.47	66.24	68.47	65.62	70.16
28	80.23	91.73	77.84	82.32	79.67	80.74	87.78	76.31	79.05	76.60	81.23
30	92.34	104.14	90.22	94.32	90.89	93.18	105.26	87.99	93.19	88.34	93.99

0-30 ACCELERATION WITH TRACTION CONTROL OFF

MPH	RUN NUMBER										AVERAGE
	1	2	3	4	5	6	7	8	9	10	
2	1.24	0.60	0.60	0.62	0.46	0.69	0.42	0.54	0.42	0.49	0.61
4	2.63	2.11	1.89	1.69	1.69	2.22	1.68	1.73	1.65	1.73	1.90
6	5.06	4.40	4.04	4.02	3.36	4.45	3.78	3.77	3.47	3.84	4.02
8	8.96	7.62	7.43	6.87	6.53	7.74	6.71	6.51	6.02	7.20	7.16
10	13.06	12.51	10.59	10.93	9.75	11.94	10.38	9.78	9.46	11.00	10.94
12	17.19	17.50	15.36	15.61	13.92	18.59	14.44	14.27	13.47	15.46	15.58
14	23.15	23.38	20.79	21.21	18.94	23.58	19.72	18.71	18.10	21.29	20.89
16	29.46	29.00	27.04	27.81	24.56	29.83	26.53	24.17	23.89	26.87	26.92
18	35.64	36.35	33.72	34.54	30.25	37.66	32.71	29.58	30.68	33.22	33.44
20	42.94	46.02	41.11	41.48	37.59	45.11	40.57	36.84	37.46	39.98	40.91
22	51.76	55.18	50.28	49.25	45.06	59.17	47.89	44.41	45.34	47.95	49.63
24	60.98	66.81	58.29	60.14	53.53	67.74	56.95	52.16	53.92	56.12	58.66
26	71.19	78.73	68.58	73.43	62.07	76.70	66.06	61.40	64.05	65.41	68.76
28	81.43	93.75	80.22	87.36	72.20	86.11	76.61	70.44	73.47	75.51	79.71
30	91.13	110.02	95.86	107.93	82.88	96.40	89.57	79.82	85.40	85.96	92.50

5-30 ACCELERATION – ROLLING START

MPH	RUN NUMBER										AVERAGE
	1	2	3	4	5	6	7	8	9	10	
5	4.15	4.28	4.63	3.57	3.24	3.78	3.81	4.40	4.08	3.77	3.97
7	7.16	7.58	7.80	6.51	5.99	7.04	7.55	7.76	8.12	6.88	7.24
9	12.74	12.42	11.87	10.39	10.53	11.55	12.90	11.32	12.11	10.92	11.68
11	16.40	17.12	15.14	14.24	14.51	15.32	18.10	15.06	15.49	15.09	15.65
13	20.91	22.47	20.02	18.83	18.56	20.61	22.35	19.64	19.84	20.69	20.39
15	26.29	28.46	25.36	24.06	24.29	25.86	27.31	25.11	25.11	26.47	25.83
17	32.16	34.46	31.95	29.88	30.12	33.04	34.02	31.25	30.91	33.12	32.09
19	40.11	41.65	38.62	36.37	37.12	39.50	40.00	38.90	37.12	40.01	38.94
21	47.74	49.47	46.52	43.52	44.08	47.56	48.53	46.31	45.42	47.84	46.70
23	55.56	58.35	55.08	51.32	52.65	56.68	55.78	55.32	53.61	55.78	55.01
25	65.04	67.81	63.63	61.19	61.33	65.79	65.25	65.30	62.81	65.29	64.34
27	75.07	77.05	74.26	70.58	71.87	76.01	75.29	74.35	73.01	74.88	74.24
29	86.52	87.39	85.83	82.00	82.47	87.91	86.05	85.66	85.36	85.98	85.52
30	92.48	92.86	91.70	87.49	88.56	94.18	91.24	90.77	90.22	91.24	91.07

FIRESTONE FIREHAWK AWD

0-30 ACCELERATION WITH TRACTION CONTROL ON

MPH	RUN NUMBER										AVERAGE
	1	2	3	4	5	6	7	8	9	10	
2	0.86	0.81	0.80	0.96	0.82	0.89	0.88	0.72	0.90	1.10	0.87
4	4.04	2.50	3.39	3.03	3.51	2.70	3.17	3.21	2.94	3.62	3.21
6	7.71	5.39	7.34	6.36	7.50	5.60	6.90	7.05	7.12	6.99	6.80
8	12.99	9.88	12.61	10.26	12.92	9.73	12.22	11.78	12.09	11.11	11.56
10	18.73	14.93	18.79	17.24	18.62	15.05	17.98	16.92	18.17	16.52	17.30
12	24.76	21.13	26.08	23.48	25.90	21.11	24.60	23.41	24.97	22.57	23.80
14	32.60	27.75	34.80	31.28	33.52	28.33	33.80	30.53	32.87	30.36	31.58
16	41.58	35.84	45.09	39.41	43.21	35.85	43.21	39.16	42.08	38.28	40.37
18	50.42	44.45	54.56	53.09	54.31	45.83	55.00	47.40	54.96	47.69	50.77
20	61.18	53.70	65.92	63.78	65.81	56.72	66.21	58.49	68.74	58.18	61.87
22	72.62	65.90	78.03	75.98	78.47	69.74	78.36	69.69	82.62	69.53	74.09
24	86.14	77.98	91.76	88.81	94.13	81.72	92.95	81.99	96.65	83.26	87.54
26	101.55	90.99	104.18	104.12	110.65	95.60	109.83	96.27	112.26	96.91	102.24
28	116.68	106.00	120.24	120.26	127.39	111.82	126.47	112.11	128.68	114.18	118.38
30	134.79	121.66	138.63	137.22	144.22	126.81	144.77	131.22	146.34	131.07	135.67

0-30 ACCELERATION WITH TRACTION CONTROL OFF

MPH	RUN NUMBER										AVERAGE
	1	2	3	4	5	6	7	8	9	10	
2	1.08	0.84	1.32	0.83	0.84	0.73	0.70	0.86	0.96	-	0.91
4	2.89	3.21	3.08	2.88	2.60	2.68	2.54	3.40	2.62	-	2.88
6	6.72	6.40	6.55	6.76	5.61	5.58	6.08	6.30	5.51	-	6.17
8	11.51	10.38	10.67	11.51	10.37	10.04	10.14	11.48	9.28	-	10.60
10	17.25	15.38	15.97	18.38	16.07	14.74	15.37	16.29	13.88	-	15.93
12	23.97	21.09	22.48	23.90	22.71	21.20	22.45	23.24	20.07	-	22.35
14	32.18	27.16	31.27	31.53	30.89	28.41	30.92	33.14	26.94	-	30.27
16	40.98	35.28	40.25	41.06	38.20	36.60	39.60	42.90	35.40	-	38.92
18	50.32	43.90	50.24	51.23	47.52	45.29	49.55	53.91	43.55	-	48.39
20	62.00	53.57	61.27	64.19	56.73	55.77	60.85	64.79	54.74	-	59.32
22	73.32	64.56	74.34	76.79	70.66	69.73	72.88	76.51	65.41	-	71.58
24	86.60	75.56	87.47	91.11	82.19	83.46	83.95	90.51	79.61	-	84.50
26	100.46	88.75	101.66	104.54	95.57	100.65	98.31	103.09	93.55	-	98.51
28	116.61	105.08	117.78	123.48	108.96	117.16	112.90	119.22	109.05	-	114.47
30	132.92	121.63	134.54	142.49	124.74	135.39	129.80	136.12	125.01	-	131.40

**Run 10 data was discovered to be corrupt after testing was completed and was discarded

5-30 ACCELERATION – ROLLING START

MPH	RUN NUMBER										AVERAGE
	1	2	3	4	5	6	7	8	9	10	
5	5.77	5.02	5.52	3.99	5.08	5.95	6.02	4.85	5.35	5.92	5.35
7	10.25	9.05	9.92	7.86	8.93	9.75	9.80	9.36	8.88	10.49	9.43
9	16.51	14.30	14.96	12.41	14.30	15.47	14.76	13.88	15.40	15.22	14.72
11	23.98	20.78	20.75	18.46	20.26	23.05	20.68	19.33	20.50	20.73	20.85
13	31.38	27.68	28.00	25.14	26.20	32.63	27.53	25.68	27.42	28.44	28.01
15	39.75	35.46	36.85	32.73	34.88	41.22	36.53	33.78	35.16	38.58	36.49
17	49.71	44.34	46.08	41.01	44.10	50.35	45.60	41.62	44.41	48.17	45.54
19	62.85	53.27	57.35	50.63	54.25	61.12	56.24	50.62	54.98	59.60	56.09
21	76.70	63.42	69.59	61.26	64.96	73.80	67.00	60.72	66.11	70.14	67.37
23	88.33	75.47	81.33	73.86	77.80	86.30	79.51	71.55	78.75	83.70	79.66
25	103.21	87.05	95.89	86.39	91.87	101.27	92.68	84.20	92.57	97.01	93.21
27	117.52	101.89	111.11	100.54	106.31	118.72	107.03	98.71	106.27	115.56	108.37
29	134.16	116.74	126.05	117.72	121.73	136.93	122.75	113.57	121.50	132.79	124.39
30	142.19	124.58	132.80	125.01	129.88	145.36	130.53	121.81	130.52	141.22	132.39

FIRESTONE FIREHAWK PVS AWD

0-30 ACCELERATION WITH TRACTION CONTROL ON

MPH	RUN NUMBER										AVERAGE
	1	2	3	4	5	6	7	8	9	10	
2	0.66	0.75	0.56	0.48	0.39	0.68	0.54	0.59	0.47	0.61	0.57
4	2.18	1.71	1.69	1.48	1.67	1.68	1.77	1.82	1.58	1.68	1.73
6	4.31	3.66	3.54	3.44	3.81	3.69	3.86	3.74	3.50	3.81	3.74
8	7.14	6.26	6.39	5.99	6.40	6.30	6.50	6.19	5.84	6.41	6.34
10	10.40	9.43	9.77	9.22	10.57	9.40	10.30	9.58	9.61	9.62	9.79
12	14.49	13.60	13.64	13.08	14.55	13.20	13.82	13.75	14.02	13.36	13.75
14	19.62	18.16	18.52	17.41	20.14	17.82	19.16	18.68	18.73	17.91	18.62
16	25.28	23.51	24.59	23.02	25.92	22.82	24.72	24.37	24.90	22.96	24.21
18	32.00	30.31	31.17	29.09	32.51	29.63	31.14	31.79	32.22	29.56	30.94
20	39.82	37.40	38.18	35.80	40.43	36.30	38.45	39.47	40.58	37.30	38.37
22	48.08	46.37	46.27	43.81	48.72	44.56	47.43	48.58	49.60	44.82	46.82
24	57.06	55.44	55.03	52.30	57.40	53.11	56.47	57.92	59.64	53.39	55.78
26	67.30	65.01	63.76	61.62	67.81	60.83	66.77	67.61	70.32	62.31	65.33
28	79.51	76.47	75.79	72.32	78.75	70.56	78.47	79.14	79.80	72.94	76.38
30	90.44	90.49	86.77	83.18	90.59	80.69	95.42	92.24	91.66	84.54	88.60

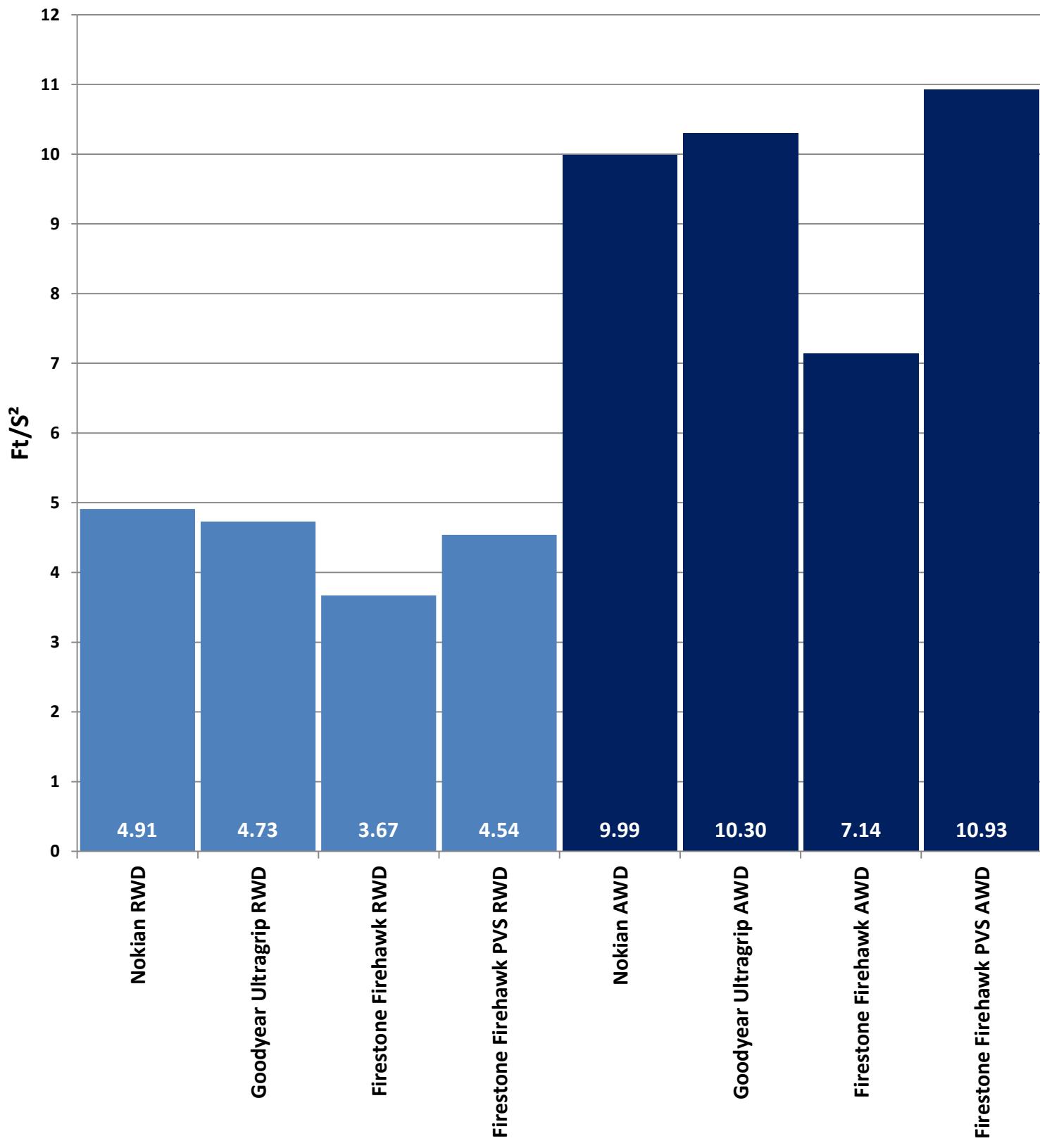
0-30 ACCELERATION WITH TRACTION CONTROL OFF

MPH	RUN NUMBER										AVERAGE
	1	2	3	4	5	6	7	8	9	10	
2	0.53	0.88	0.71	0.65	1.13	0.50	0.72	0.47	0.49	0.49	0.66
4	1.61	2.44	1.90	1.74	2.25	1.54	2.17	1.58	1.63	1.63	1.85
6	3.97	4.52	4.13	3.58	4.10	3.33	4.15	3.49	3.72	3.61	3.86
8	6.90	7.14	7.24	6.05	6.97	6.09	7.18	6.29	6.97	6.24	6.71
10	10.86	10.91	10.62	9.53	10.19	9.37	11.95	9.38	10.53	9.54	10.29
12	14.95	14.83	14.46	13.50	14.21	13.56	15.19	13.78	14.80	14.15	14.34
14	20.23	19.83	19.68	18.58	19.02	18.84	20.28	18.02	19.75	18.74	19.30
16	25.88	25.69	25.79	24.67	24.79	24.24	26.23	23.62	25.09	26.73	25.27
18	32.28	32.44	31.90	30.69	31.46	32.13	32.37	29.70	31.48	33.69	31.81
20	39.24	39.30	39.52	37.38	38.37	39.34	39.18	37.02	39.46	41.82	39.06
22	47.02	47.44	48.43	45.17	46.39	47.80	47.37	44.76	48.17	48.88	47.14
24	54.03	55.38	57.85	53.08	54.85	57.04	56.22	52.31	56.37	58.52	55.57
26	62.80	64.67	66.59	62.18	64.19	66.71	63.90	61.20	64.67	69.82	64.67
28	73.16	73.84	77.03	72.63	75.46	77.19	73.82	71.52	74.69	80.06	74.94
30	84.48	85.43	88.13	83.79	87.39	87.13	85.23	82.98	84.63	89.77	85.90

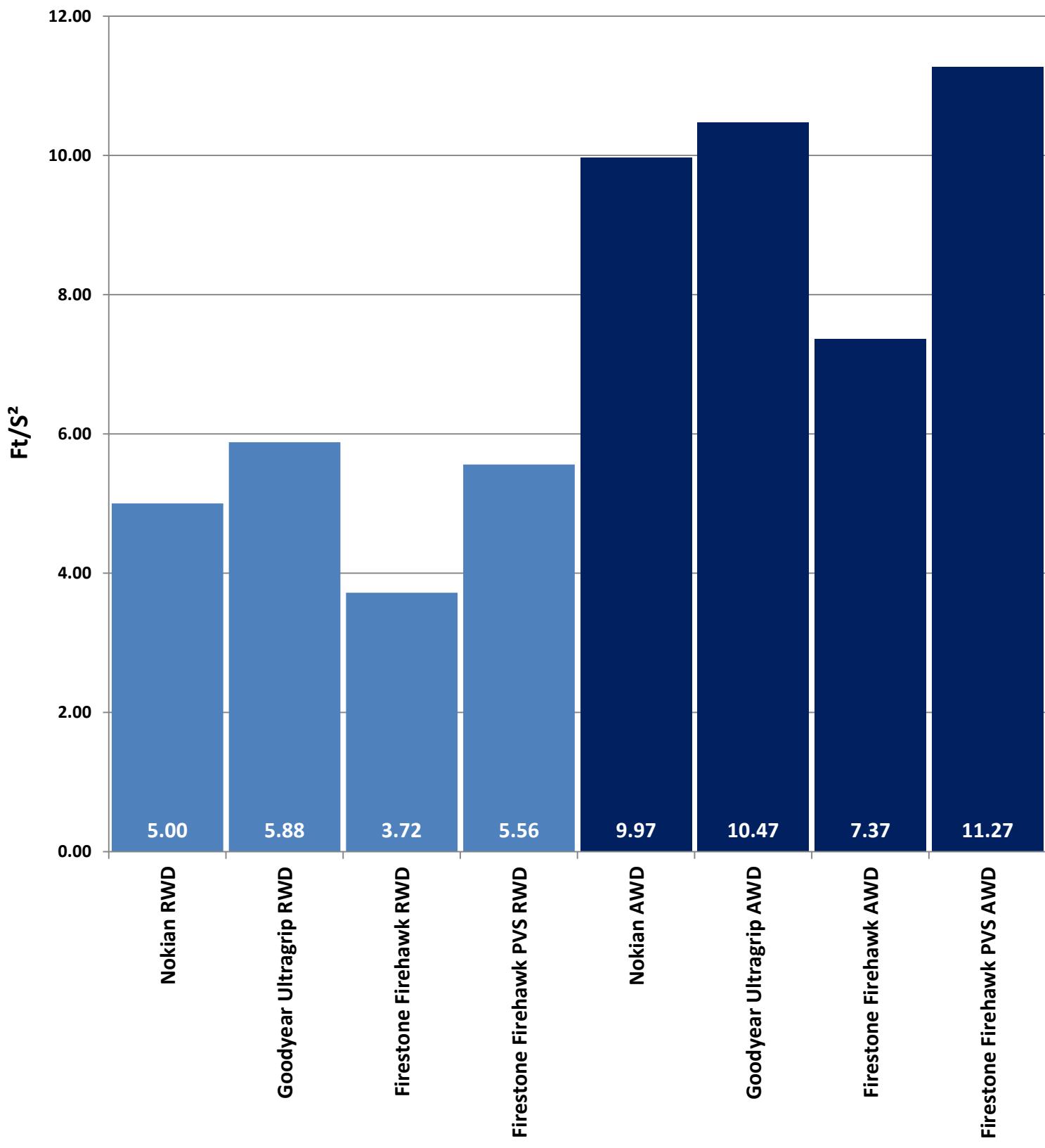
5-30 ACCELERATION – ROLLING START

MPH	RUN NUMBER										AVERAGE
	1	2	3	4	5	6	7	8	9	10	
5	3.11	4.17	4.03	2.78	4.59	5.11	3.70	3.56	3.54	3.83	3.84
7	6.03	7.01	6.94	5.78	8.33	8.62	6.86	6.43	6.80	6.96	6.98
9	9.13	10.30	11.83	9.75	12.94	12.37	10.35	9.75	10.16	10.21	10.68
11	12.87	13.95	15.50	13.49	16.84	16.01	14.48	13.36	13.43	13.57	14.35
13	17.08	18.43	19.46	17.62	21.63	19.87	19.48	17.38	18.39	17.24	18.66
15	22.02	23.74	24.44	23.12	27.36	24.83	25.31	22.01	22.96	22.03	23.78
17	28.14	30.51	29.78	29.00	33.01	30.23	31.54	27.68	29.05	27.58	29.65
19	35.35	36.18	35.99	35.80	40.52	37.08	38.31	34.40	36.22	33.20	36.31
21	43.00	44.07	43.86	42.49	49.12	43.75	46.18	40.94	43.52	39.69	43.66
23	52.52	52.87	51.83	50.34	58.67	51.48	54.35	48.11	51.31	47.66	51.91
25	62.33	62.18	60.28	59.18	67.11	59.81	63.04	56.67	60.44	55.71	60.68
27	72.96	72.07	70.14	69.50	77.11	68.26	71.48	65.76	70.19	64.50	70.20
29	84.24	82.59	81.59	81.24	87.36	77.57	83.15	75.66	80.75	73.50	80.77
30	90.53	87.79	87.08	86.14	94.71	82.48	87.24	81.44	86.01	78.69	86.21

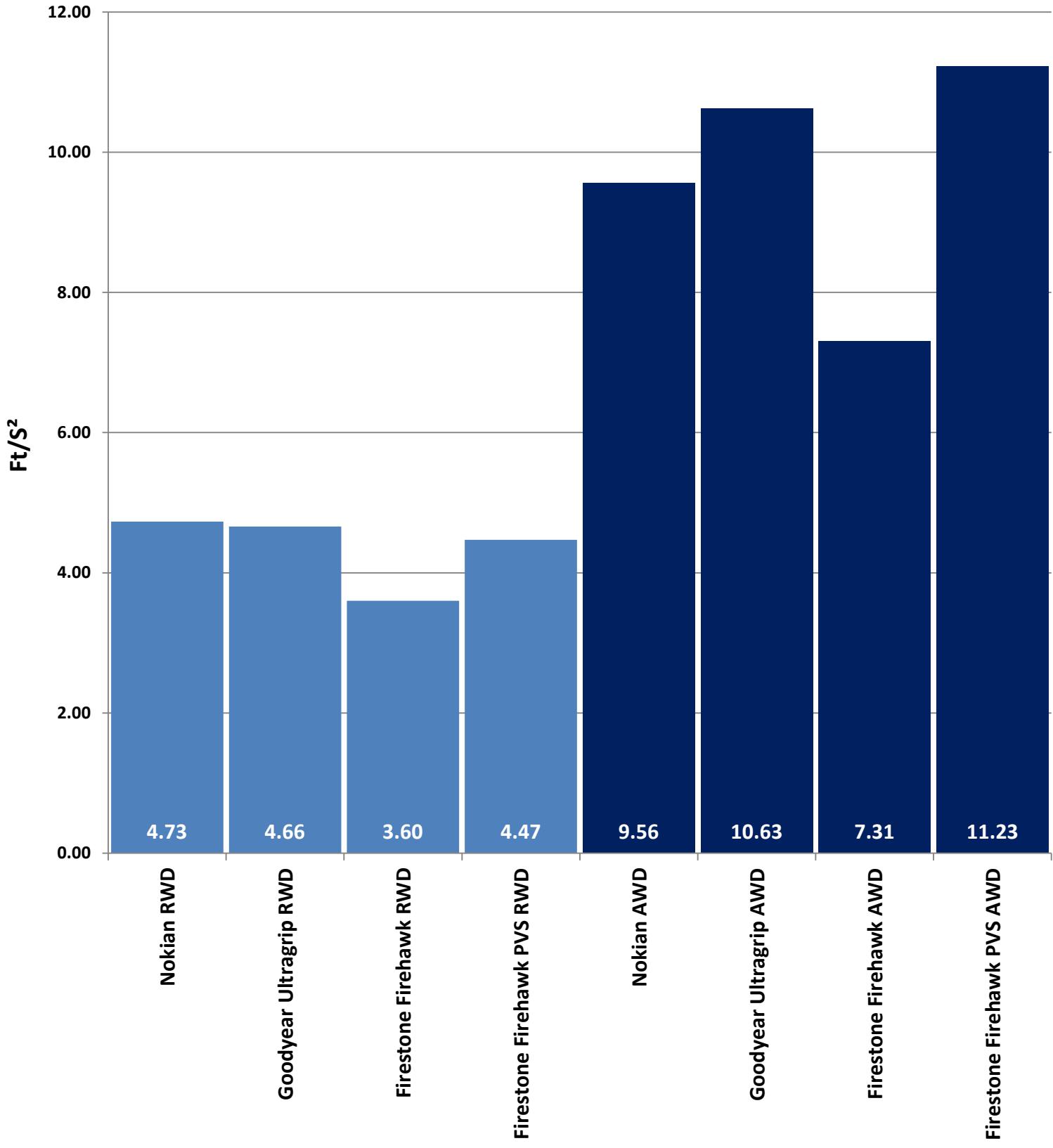
0-30 Acceleration Run with Traction Control On



0-30 Acceleration Run with Traction Control Off



5-30 Acceleration Run Rolling Start



DECELERATION RUN SUMMARY SHEET

OVERALL BRAKING COMPARISON

Tire Brand	Average Deceleration Rate
Nokian RWD	10.53
Nokian AWD	10.76
Goodyear Ultra Grip RWD	10.63
Goodyear Ultra Grip AWD	10.49
Firestone Firehawk RWD	8.53
Firestone Firehawk AWD	7.76
Firestone Firehawk PVS RWD	10.40
Firestone Firehawk PVS AWD	10.73

DECELERATION RATE FORMULA

$$\text{Deceleration Rate (DR)} = \frac{\text{Initial Velocity}^*(\text{IV}) \text{ squared}}{2 \text{ times Stopping Distance (SD)}} = \frac{(\text{IV})^2}{2 (\text{SD})}$$

EXAMPLE:

$$\begin{aligned}\text{Initial Velocity} &= 89.175 \text{ ft/s (60.8 mph x 1.4667*)} \\ \text{Stopping Distance} &= 171.4 \text{ ft.}\end{aligned}$$

$$\text{DR} = \frac{(\text{IV})^2}{2(\text{SD})} = \frac{(89.175)^2}{2(171.4)} = \frac{7952.24}{342.8} = 23.198 \text{ ft/s}^2$$

DECCELERATION RUNS

NOKIAN RWD

Stop #	Initial Velocity (mph)	Stopping Distance (feet)	Deceleration Rate (ft/s ²)
1	30.84	93.72	10.92
2	31.69	102.51	10.54
3	32.38	105.73	10.67
4	31.77	103.62	10.48
5	30.90	93.34	11.00
6	30.42	91.86	10.84
7	31.76	102.40	10.60
8	32.23	102.88	10.86
9	32.31	107.40	10.45
10	30.18	91.93	10.66
11	30.75	95.31	10.67
12	30.45	93.05	10.72
13	30.29	94.86	10.40
14	31.64	103.05	10.45
15	30.62	92.97	10.85
16	30.71	98.57	10.29
17	30.70	95.97	10.56
18	30.30	93.45	10.57
19	28.63	82.26	10.72
20	31.34	101.75	10.38
21	30.80	98.25	10.39
22	31.07	99.74	10.41
23	30.83	96.37	10.61
24	32.51	112.05	10.15
25	31.84	103.46	10.54
26	31.27	102.05	10.31
27	31.07	100.45	10.34
28	29.96	95.87	10.07
29	29.73	91.38	10.40
30	32.12	112.14	9.90
AVERAGE DECELERATION RATE:			10.53 ft/s ²

DECELERATION RUNS

GOODYEAR ULTRA GRIP RWD

Stop #	Initial Velocity (mph)	Stopping Distance (feet)	Deceleration Rate (ft/s ²)
1	30.74	94.95	10.70
2	30.42	96.47	10.32
3	29.91	89.41	10.76
4	30.78	94.27	10.81
5	31.63	101.56	10.60
6	32.18	106.27	10.48
7	31.06	94.07	11.03
8	30.60	95.24	10.57
9	30.21	89.26	11.00
10	30.88	96.45	10.63
11	30.73	90.42	11.23
12	31.47	96.54	11.03
13	30.87	91.75	11.17
14	30.61	98.44	10.24
15	30.17	88.73	11.03
16	32.31	106.31	10.56
17	30.65	92.21	10.96
18	30.74	98.56	10.31
19	29.60	88.36	10.67
20	30.74	96.71	10.51
21	29.56	84.23	11.16
22	31.35	101.89	10.38
23	31.47	98.89	10.77
24	30.91	100.13	10.26
25	29.58	87.47	10.76
26	30.72	99.48	10.20
27	31.55	102.16	10.48
28	31.47	102.65	10.38
29	31.08	98.79	10.52
30	30.54	106.63	9.41
AVERAGE DECELERATION RATE:			10.63 ft/s ²

DECELERATION RUNS

FIRESTONE FIREHAWK RWD

Stop #	Initial Velocity (mph)	Stopping Distance (feet)	Deceleration Rate (ft/s ²)
1	29.69	102.99	9.21
2	31.13	125.02	8.34
3	30.42	110.66	8.99
4	31.09	120.09	8.66
5	31.86	123.17	8.86
6	31.61	132.64	8.10
7	31.06	115.04	9.02
8	31.21	127.28	8.23
9	30.42	115.49	8.62
10	29.85	117.96	8.12
11	30.59	116.85	8.61
12	30.59	121.78	8.26
13	29.74	106.76	8.91
14	34.03	149.38	8.34
15	31.31	123.66	8.53
16	31.36	124.25	8.51
17	31.34	122.90	8.60
18	30.78	134.63	7.57
19	32.14	125.44	8.86
20	30.29	120.21	8.21
21	27.96	95.50	8.80
22	31.02	122.27	8.46
23	31.34	121.69	8.68
24	31.97	134.24	8.19
25	32.41	126.64	8.92
26	30.05	120.96	8.03
27	31.05	114.28	9.07
28	31.29	129.21	8.15
29	31.21	117.73	8.90
30	30.61	125.12	8.05
AVERAGE DECELERATION RATE:			8.53 ft/s ²

DECELERATION RUNS

FIRESTONE FIREHAWK PVS RWD

Stop #	Initial Velocity (mph)	Stopping Distance (feet)	Deceleration Rate (ft/s ²)
1	31.19	98.87	10.58
2	31.45	103.90	10.24
3	31.56	101.47	10.56
4	31.33	100.73	10.48
5	30.83	95.12	10.75
6	30.75	94.21	10.80
7	31.44	95.35	11.15
8	31.29	97.29	10.82
9	30.00	91.13	10.62
10	30.45	97.81	10.20
11	30.67	89.05	11.36
12	31.35	104.84	10.08
13	31.27	97.06	10.84
14	31.77	105.30	10.31
15	30.63	96.44	10.46
16	31.81	107.04	10.17
17	31.59	102.49	10.47
18	30.55	102.61	9.78
19	31.88	104.26	10.49
20	30.49	101.76	9.83
21	30.51	93.00	10.77
22	30.09	94.92	10.26
23	31.51	100.06	10.67
24	30.02	102.95	9.42
25	30.69	93.51	10.83
26	30.34	109.62	9.03
27	30.55	93.67	10.72
28	31.83	115.31	9.45
29	29.69	90.16	10.52
30	30.88	98.60	10.40
AVERAGE DECELERATION RATE:			10.40 ft/s ²

DECELERATION RUNS

NOKIAN AWD

Stop #	Initial Velocity (mph)	Stopping Distance (feet)	Deceleration Rate (ft/s ²)
1	31.86	98.92	11.04
2	29.63	88.88	10.62
3	32.11	100.54	11.03
4	31.45	98.41	10.81
5	30.58	91.65	10.97
6	30.97	96.79	10.66
7	29.98	88.33	10.94
8	30.54	94.31	10.64
9	30.14	91.78	10.65
10	30.60	90.61	11.12
11	30.53	91.54	10.95
12	31.66	101.54	10.62
13	31.22	96.68	10.84
14	31.89	100.26	10.91
15	32.13	101.05	10.99
16	31.05	97.71	10.61
17	31.72	98.86	10.95
18	31.77	100.00	10.86
19	31.76	100.33	10.81
20	31.16	97.63	10.70
21	30.12	92.53	10.55
22	31.47	100.27	10.62
23	30.43	93.80	10.62
24	32.74	108.78	10.60
25	32.79	106.31	10.88
26	31.92	103.33	10.61
27	31.46	98.99	10.75
28	30.67	100.42	10.08
29	31.90	100.60	10.88
30	31.44	100.96	10.53
AVERAGE DECELERATION RATE:			10.76 ft/s ²

DECELERATION RUNS

GOODYEAR ULTRA GRIP AWD

Stop #	Initial Velocity (mph)	Stopping Distance (feet)	Deceleration Rate (ft/s ²)
1	30.24	89.68	10.97
2	30.27	94.63	10.41
3	31.01	94.09	10.99
4	31.44	103.20	10.30
5	30.89	95.18	10.78
6	30.84	102.71	9.96
7	31.65	101.95	10.57
8	30.96	102.21	10.09
9	30.79	94.02	10.85
10	30.73	99.85	10.17
11	29.28	85.46	10.79
12	30.95	103.68	9.94
13	32.12	101.40	10.94
14	30.65	104.47	9.67
15	31.90	97.58	11.22
16	30.40	102.93	9.66
17	31.14	97.93	10.65
18	31.09	99.41	10.46
19	31.73	102.21	10.59
20	31.82	107.95	10.09
21	28.44	81.12	10.72
22	30.62	96.30	10.47
23	31.17	94.28	11.08
24	31.84	102.81	10.61
25	31.25	95.42	11.01
26	30.87	101.63	10.09
27	29.62	88.49	10.66
28	31.55	106.86	10.02
29	30.73	92.20	11.02
30	30.84	104.65	9.78
AVERAGE DECELERATION RATE:			10.49 ft/s ²

DECELERATION RUNS

FIRESTONE FIREHAWK AWD

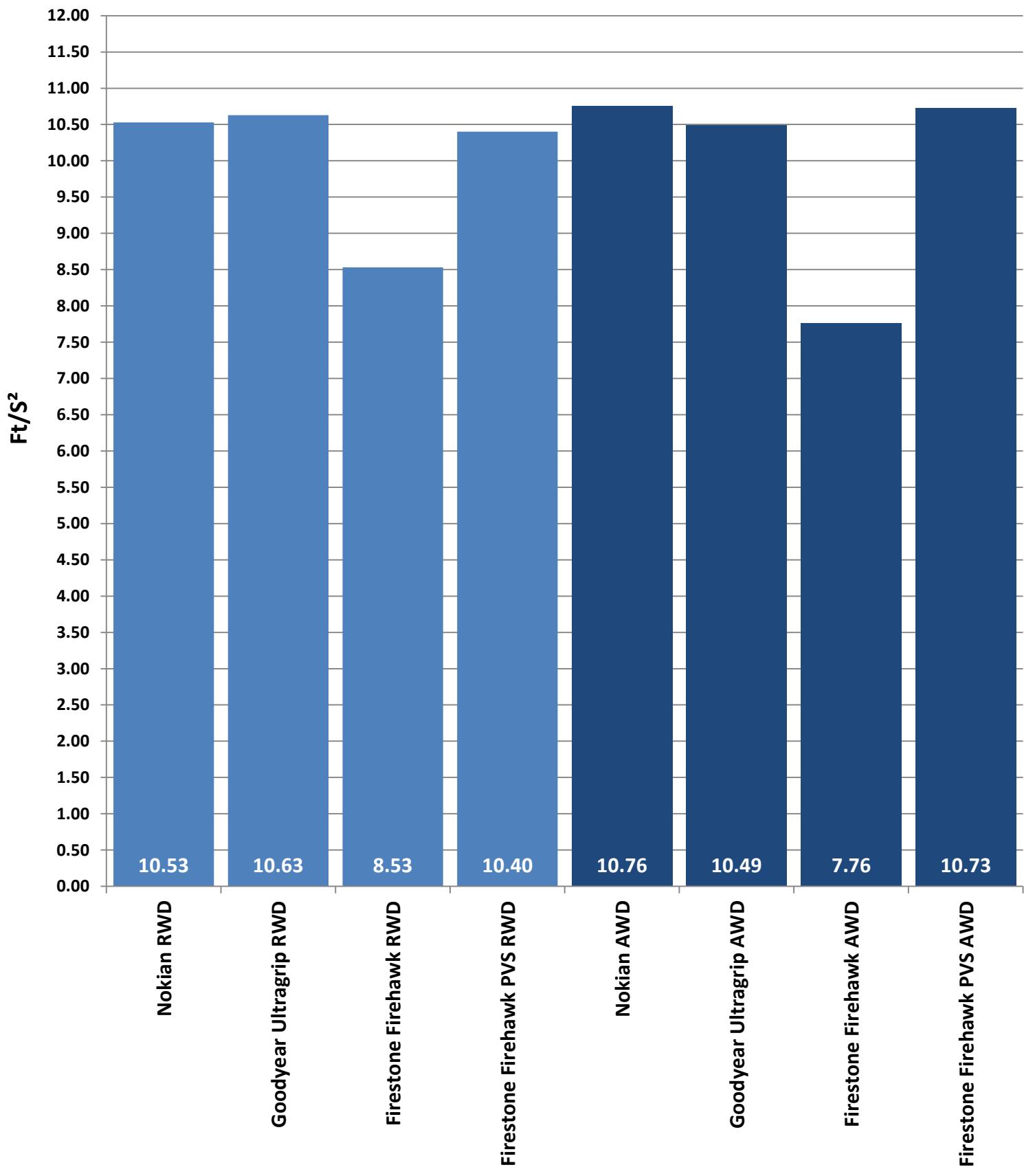
Stop #	Initial Velocity (mph)	Stopping Distance (feet)	Deceleration Rate (ft/s ²)
1	31.15	125.55	8.31
2	31.55	145.16	7.38
3	30.75	122.19	8.32
4	31.87	142.85	7.65
5	31.01	129.67	7.98
6	29.94	127.15	7.58
7	31.42	132.45	8.02
8	32.35	148.79	7.57
9	31.31	132.19	7.98
10	31.21	138.96	7.54
11	30.84	126.00	8.12
12	31.58	147.07	7.29
13	31.96	137.39	8.00
14	30.70	131.61	7.70
15	31.17	126.74	8.25
16	30.74	135.48	7.50
17	31.69	137.58	7.85
18	31.75	145.34	7.46
19	30.92	132.74	7.75
20	31.33	136.68	7.72
21	31.66	135.96	7.93
22	32.09	147.36	7.52
23	31.89	137.27	7.97
24	31.06	139.95	7.41
25	30.13	123.46	7.91
26	31.24	142.05	7.39
27	31.41	133.37	7.96
28	30.99	140.41	7.36
29	30.27	122.83	8.02
30	32.31	154.63	7.26
AVERAGE DECELERATION RATE:			7.76 ft/s ²

DECELERATION RUNS

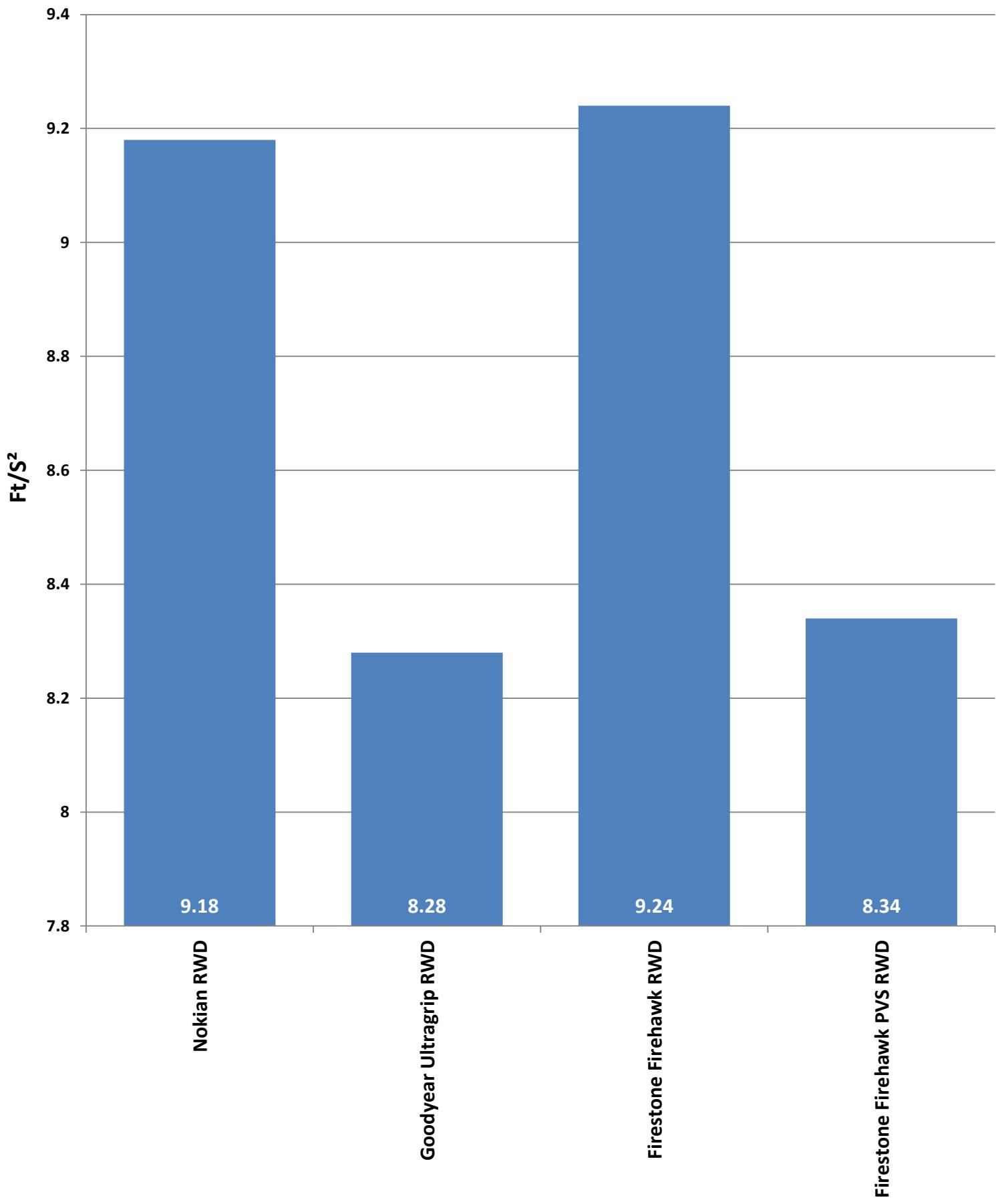
FIRESTONE FIREHAWK PVS AWD

Stop #	Initial Velocity (mph)	Stopping Distance (feet)	Deceleration Rate (ft/s ²)
1	32.61	104.58	10.94
2	30.86	98.02	10.45
3	31.79	100.71	10.79
4	31.20	96.08	10.90
5	31.25	94.23	11.15
6	30.50	95.05	10.53
7	30.85	92.40	11.08
8	30.76	98.93	10.29
9	31.52	93.30	11.45
10	30.83	99.72	10.25
11	31.44	95.79	11.10
12	30.97	97.14	10.62
13	31.12	98.32	10.59
14	30.53	96.97	10.34
15	30.72	91.55	11.09
16	31.30	109.27	9.64
17	31.98	99.39	11.07
18	30.68	92.67	10.93
19	30.73	91.10	11.15
20	30.11	92.57	10.53
21	32.41	103.72	10.89
22	31.11	97.51	10.68
23	31.12	93.90	11.09
24	31.97	109.02	10.08
25	31.41	98.95	10.72
26	31.87	103.56	10.55
27	31.42	97.30	10.91
28	30.84	104.65	9.78
29	31.02	90.83	11.39
30	30.90	93.96	10.93
AVERAGE DECELERATION RATE:			10.73 ft/s ²

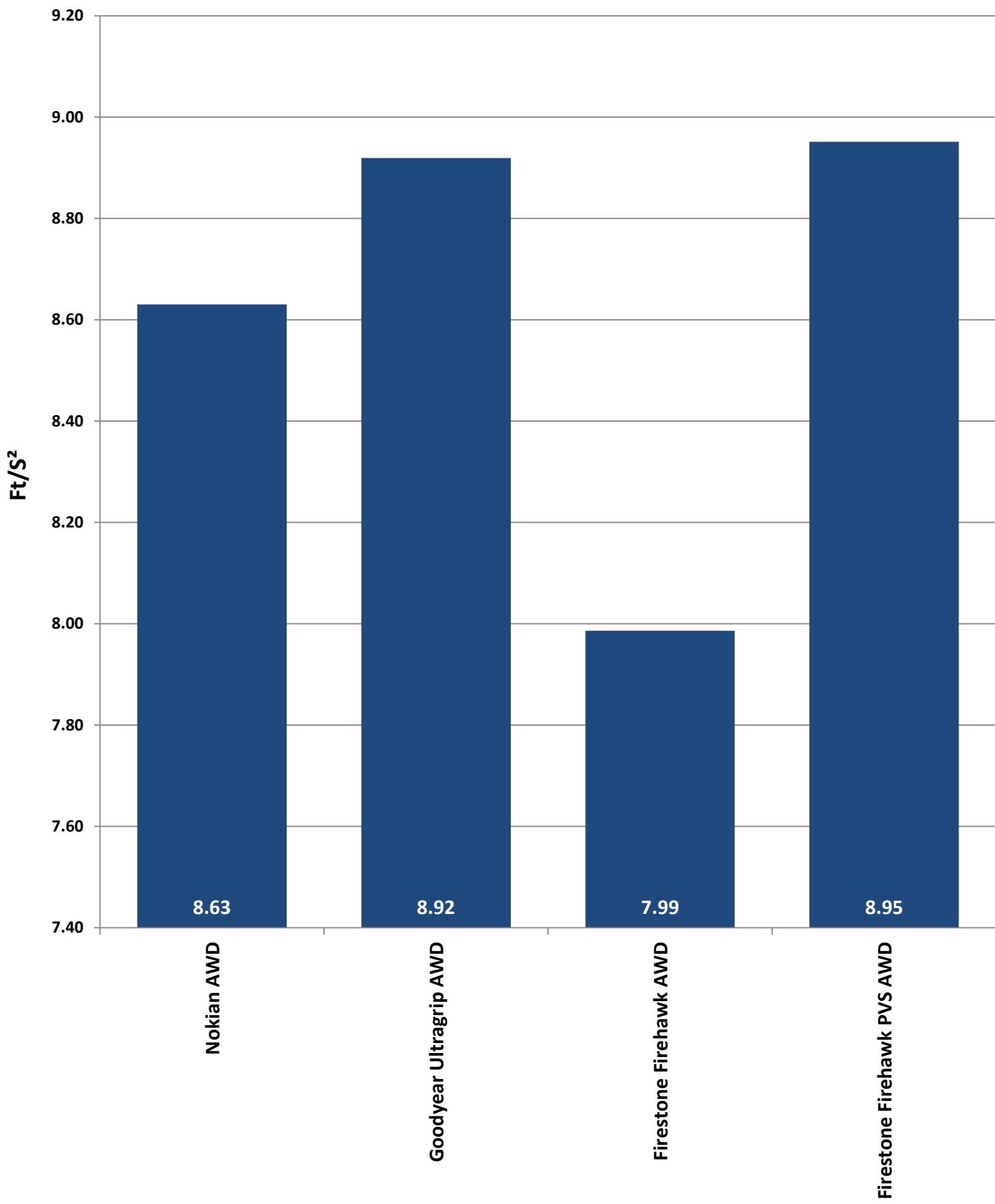
DECELERATION RUNS



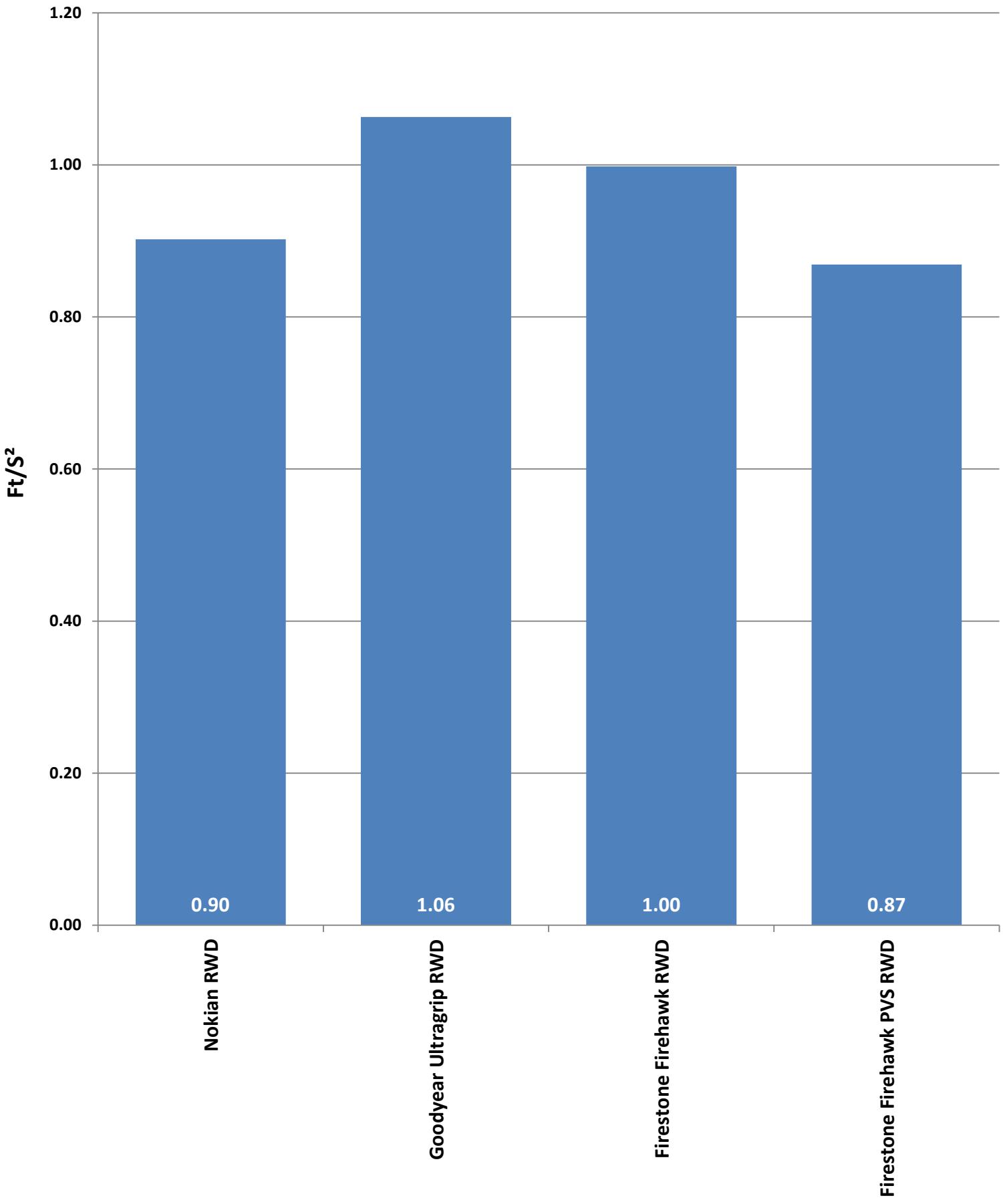
RWD LATERAL ACCELERATION



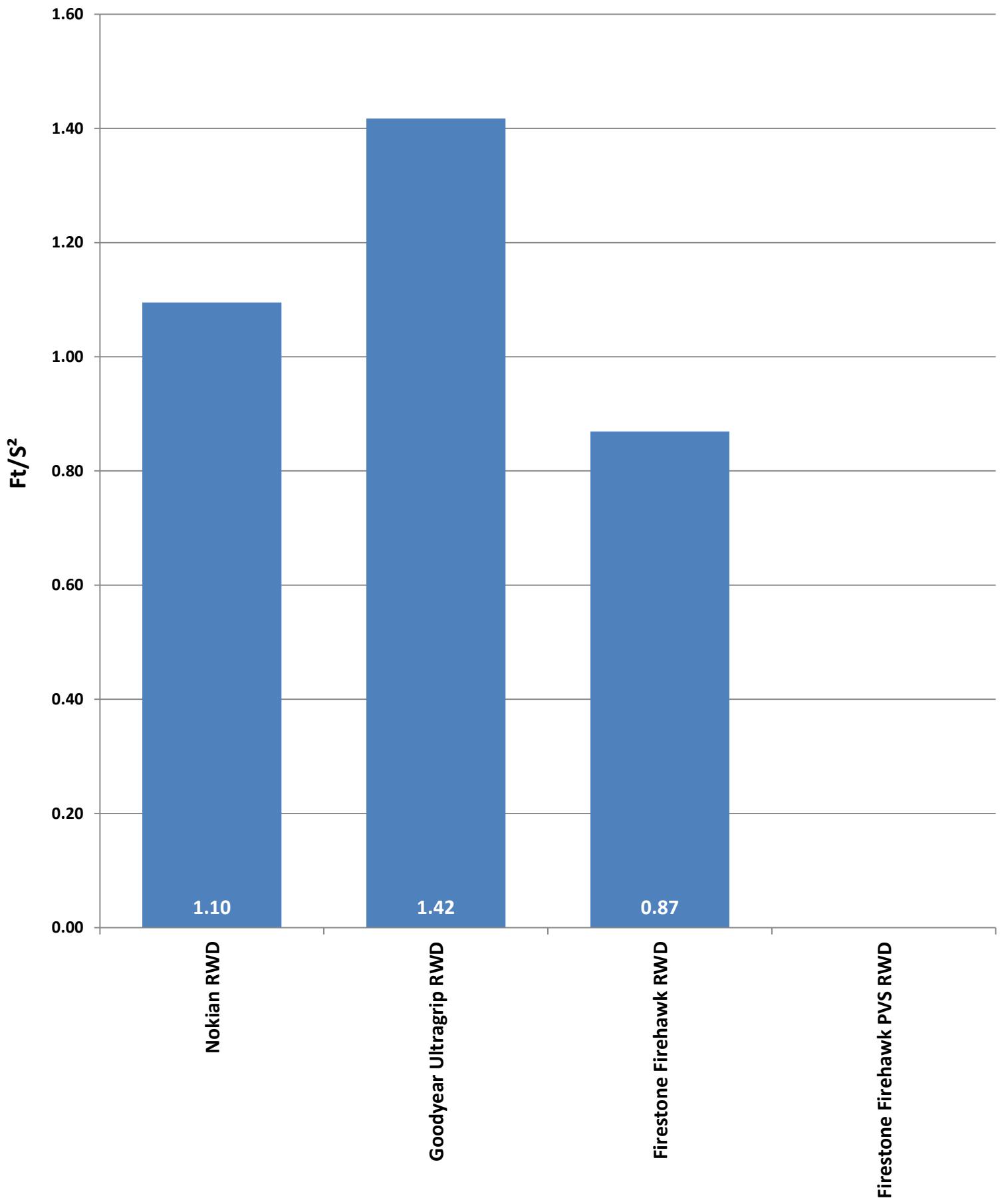
AWD LATERAL ACCELERATION



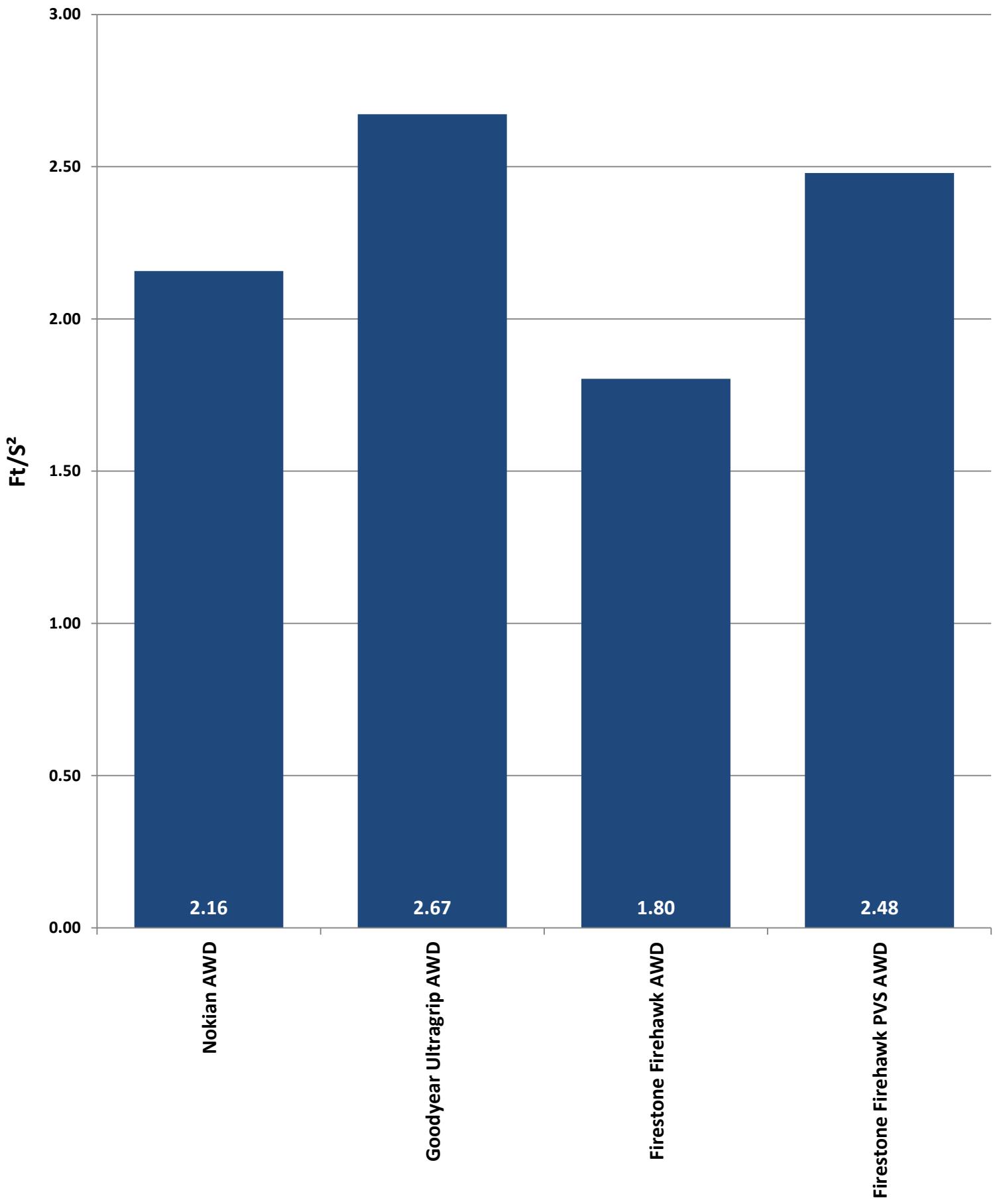
RWD 7% HILL CLIMB



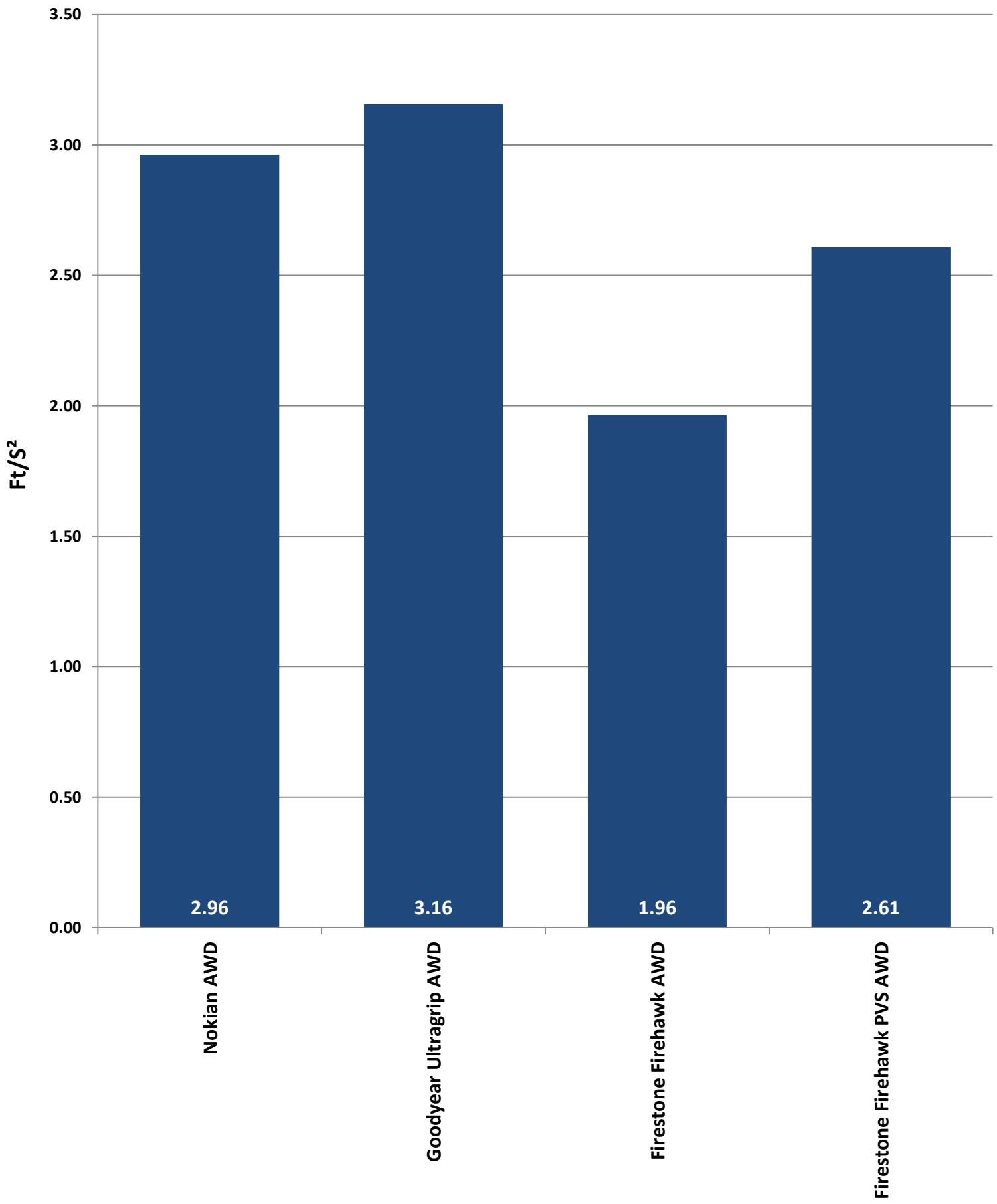
RWD 10% HILL CLIMB



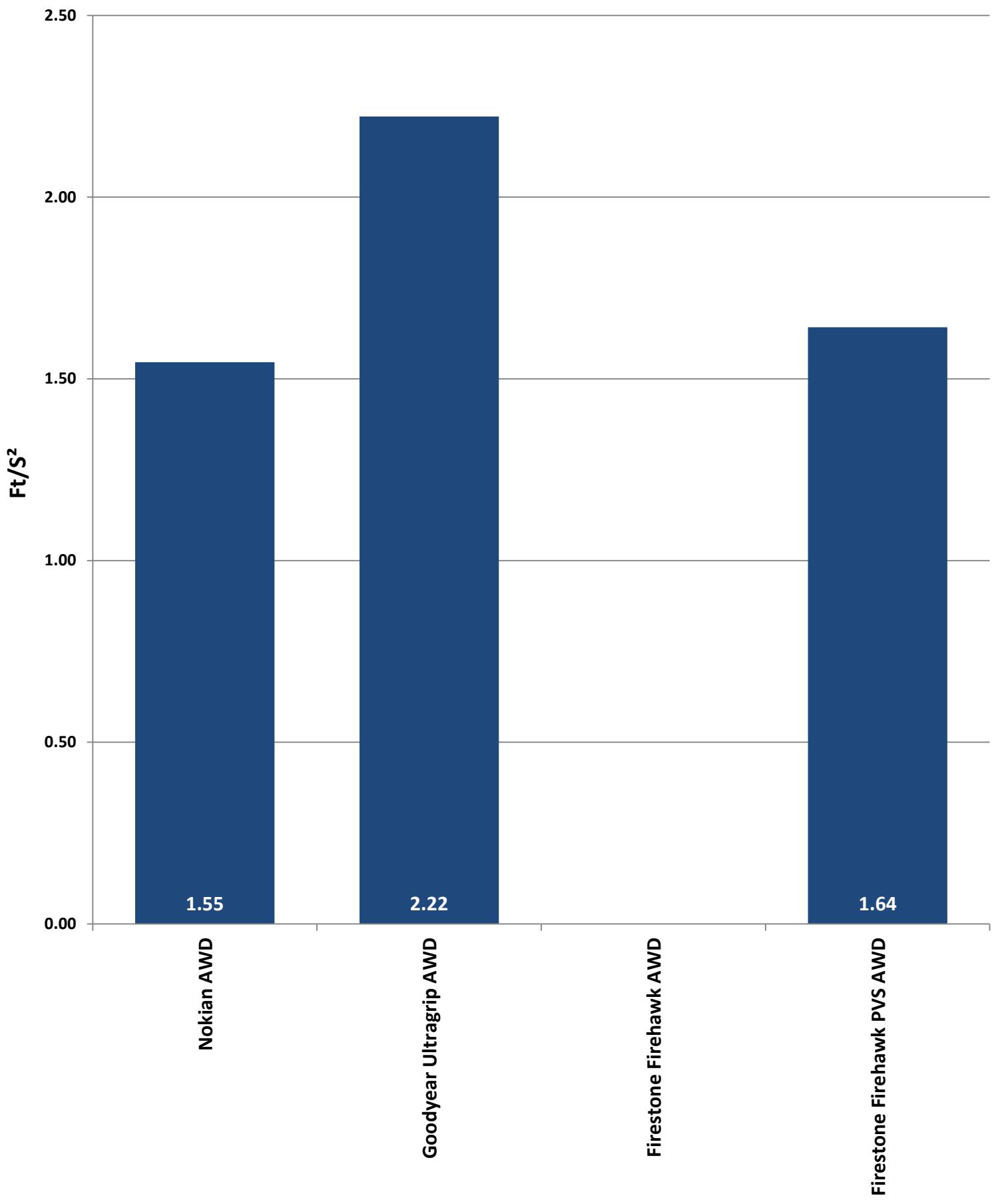
AWD 7% HILL CLIMB



AWD 10% HILL CLIMB



AWD 15% HILL CLIMB



AWD 25% HILL CLIMB

