

Dave Roper's Experience Driving the Nissan LEAF

<http://www.roperld.com/science/NissanLEAF.htm>

<http://www.roperld.com/science/LEAFRoper.pdf>

http://www.roperld.com/science/NissanLEAFTrips_BburgToROA.pdf

http://www.roperld.com/science/NissanLEAFTrips_CburgToROA.pdf

New River Nissan in Christiansburg, Virginia loaned me a 2011 Nissan LEAF demo car to test driving it to various desirable locations from Christiansburg and Blacksburg.

In the first two trips described below I paid attention to the miles-left meter. Then I realized that those values are heavily dependent on the last few miles driven. So, for the remaining three trips I only recorded the number of bars of the twelve bars that remained lit on the battery meter.

The elevation charts were obtained from Google Earth using the Directions tab to map the trip and then the Edit/Show Elevation Profile. The profile was then cut from the screen to create a file for the chart.

Another way to get an elevation chart (<http://www.mynissanleaf.com/viewtopic.php?f=38&t=3721>):
"Combination of [Google Maps](#) and [GPS Visualizer](#)."

First, we go to [Google Maps](#) and use the "Get Directions" link to plot my trip. I'll frequently click on "Show Options" and select "Avoid highways" in order to reduce my average speed to better my range.

Second, we click on "Link" and copy the email link displayed. Then we go to [GPS Visualizer](#), select "Profiles (elevation, etc.)," change my units to "U.S." and then paste the email link in the "Or provide the URL of data on the Web" box. Click on "Draw the profile" to visualize any elevation changes.

At this point, I'll usually go back to [Google Maps](#) and drag the route around and re-run the email link through the [GPS Visualizer](#) in order to determine the route that not only has the shortest distance, but also has the most gradual elevation changes to help better my efficiency."

I prefer this second way.

Range Calculation

<http://www.mynissanleaf.com/viewtopic.php?p=101293#p101293>

Nissan LEAF Range Chart for 24kWh Battery

English

Level Road, No Heating or Air Conditioning, Battery Temp 70F/20C, Windows Closed



35	40	45	50	55	60	65	70	75	Speed MPH
exactly									
- or -									
6.3	5.9	5.2	4.6	4.3	3.9	3.6	3.3	3.0	Miles/kWh
5.56	6.78	8.65	10.87	12.79	15.38	18.06	21.21	25.00	kWh

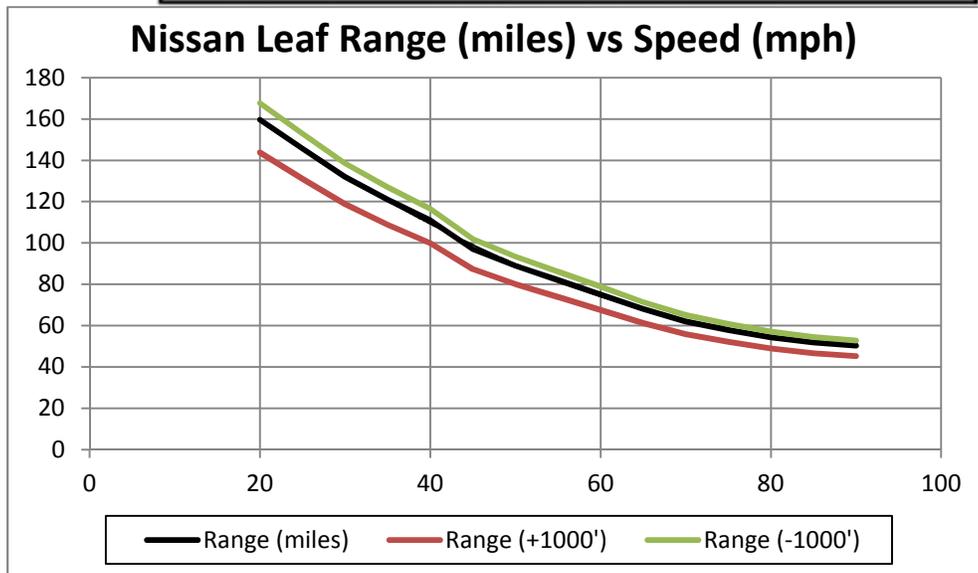
Battery Gids	Fuel Bar	9/bar	8.5/bar	8/bar	7/bar	6.5/bar	6/bar	5.5/bar	5/bar	4.5/bar	Fuel Bar
281	100.0%	132	121	111	97	89	82	75	68	62	12
257	91.5%	125	114	105	92	85	78	71	65	59	11
233	84.0%	116	105	97	85	78	72	65	60	54	10
210	77.9%	107	97	89	78	72	66	60	55	50	9
187	70.8%	98	88	81	71	65	60	54	50	45	8
164	66.2%	89	80	73	64	59	54	49	45	41	7
141	58.0%	80	71	65	57	52	48	43	40	36	6
118	50.9%	71	63	57	50	46	42	38	35	32	5
95	43.4%	62	54	49	43	39	36	32	30	27	4
72	36.3%	53	46	41	36	33	30	27	25	23	3
49	31.3%	44	37	33	29	26	24	21	20	18	2
26	26.0%	32	27	23	19	17	15	13	12	11	1
3	17.4%	24	20	17	14	13	12	11	10	9	Low Battery
1	8.9%	8	7	6	5	5	4	4	3	3	Very Low
0	1.4%										Very Low
Turtle Get Safely Off Road Now! Less than One Half Mile at 25 mph Max Turtle											

mph	35	40	45	50	55	60	65	70	75
Miles/kWh	6.3	5.9	5.2	4.6	4.3	3.9	3.6	3.3	3.0

*** Fuel Bar 1 will remain illuminated with Low Battery Warning; switch to Low Battery range data ***
 Range below Fuel Bar 1 can be significantly reduced with any battery cell imbalances
 This chart's range data is not associated with the LEAF's dash or center console range data
 Data based on 21kWh usable battery capacity factor. **MAXIMUM RANGE at 12mph exactly** (not average speed)
 Add **One mile** of range @ 60mph (or 3.9m/kWh) for every **12 minute** charge at **120 volt** charge w/3.3kW charger
 Add **One mile** of range @ 60mph (or 3.9m/kWh) for every **5 minutes** of charge at **240 volt/16amp** w/3.3kW charger
 For Urban Stop-Go driving, select data from column that matches estimated miles/kWh column, NOT speed

1. Elevation increase: Subtract One Fuel Bar for every 1000 ft/300m
2. Elevation decrease: Add One Fuel Bar for every 2000 ft/600m
3. Wind: Select Speed based on Headwind; 60mph with 10mph headwind equals 70mph data
4. Temperature Increase: Add 1% to range for each 4F/2C above 70F/20C
5. Temperature Decrease: Subtract 1% from range for each 2F/1C below 70F/20C
6. Battery Degradation: Subtract 2% from range for every 10,000 miles / 15,000 km on car
7. Climate Control: Subtract One (Two) Fuel Bar(s) per each hour at 1.5kW (3.0kW) of heat/cool
8. Density Altitude: Increase range 1.5% per 1000 ft/300m for air density above sea level
9. Loading: Heavy cars use more energy than light ones; plan accordingly

DISCLAIMER:
 YOUR RANGE MAY VARY
 USE AT YOUR OWN RISK
 English
 Ver 7d



Mountain Driving

- Increase in elevation subtracts one fuel bar for 1000'.
- Decrease in elevation adds one-half fuel bar for 1000'.

Example Mountain Trip

1. Start from 0 elevation.
2. Climb a mountain to 1000'.
3. Descend to a valley to 500'.
4. Climb a mountain to 1000'.
5. Descend to a valley to 0'.
6. Climb a mountain to 500'.
7. Return on the same route.

- Outbound ascents: $1000' + 500' + 500' = 2000'$ $\rightarrow -2.0$ bars
- Outbound descents: $500' + 1000' = 1500'$ $\rightarrow +0.75$ bars
- Inbound ascents: $1000' + 500' = 1500'$ $\rightarrow -1.5$ bars
- Inbound descents: $500' + 500' + 1000' \rightarrow +1.0$ bars
- Total bars: $-2.0 + 0.75 - 1.5 + 1.0 = -1.75$ bars

Travel at constant speed of 55 mph: level-ground range = 89 miles \rightarrow average of 7.4 miles/bar.

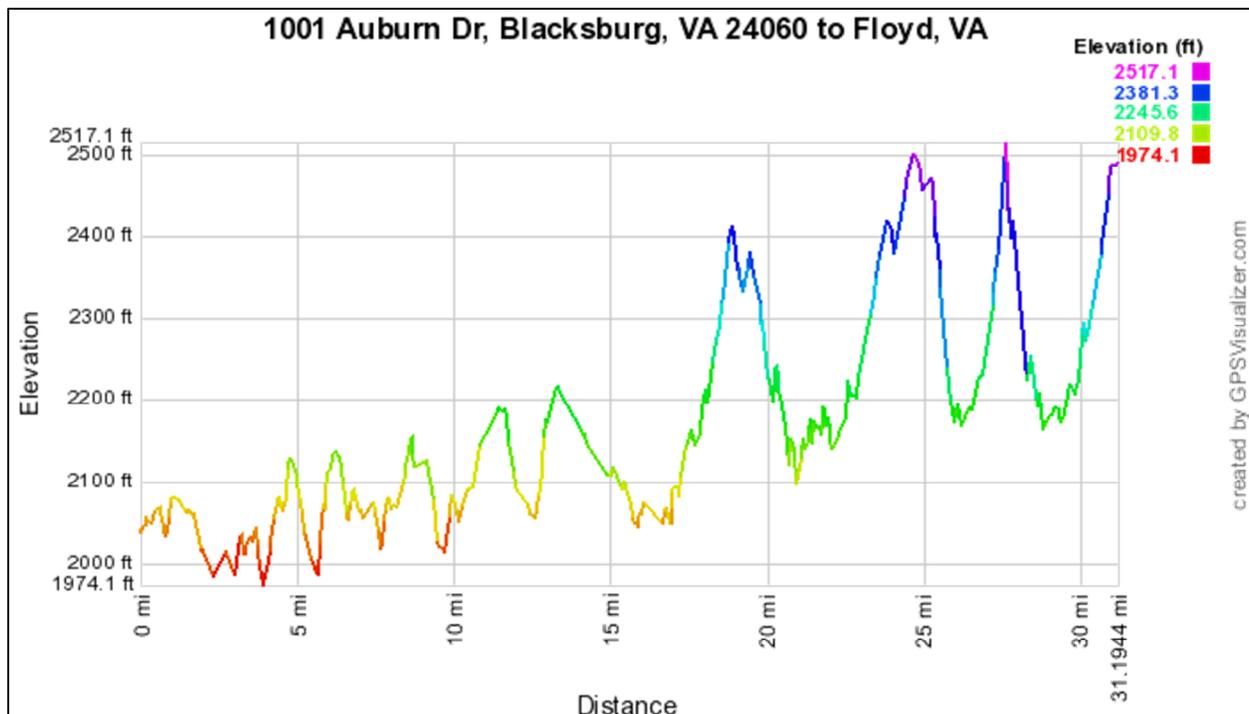
Decrease due to elevation changes = $7.4 * 1.75 = -13 \rightarrow$ range = $89 - 13 = 76$ miles.

Trip 1. Blacksburg to Floyd 31 January 2012

Blacksburg VA (2080') to Floyd VA (2500') (~62 miles round trip, elevation change +420 feet going by I-81 & -420 feet returning; average daytime temperature ~61 degrees):

We started with a full battery of electrons and the car was preheated with house current and always drove in **ECO mode**. The speed varied between 45 and 55 mph. I ran the radio and the climate control at 66 degrees. Then we used the standard "trickle charger" (level-1 120-volts charger) cable that comes with the LEAF to charge for 2.5 hours while there; that is equivalent to about 8 miles of driving. When we got back to my house we had enough electrons to drive another 36 miles. So, we could have easily gotten back without charging there.

The owner of Hotel Floyd told me that I could charge at the hotel's level-2 charger, but I did not.



Trip 2. Blacksburg to Roanoke 1 February 2012

Blacksburg VA (2080') to Virginia Museum of Transportation (303 Norfolk Ave SW) in Roanoke VA (937') (~87 miles round trip, elevation change -1150 feet going by I-81 & +1150 feet returning by Catawba Road; average daytime temperature ~58 degrees):

The car was preheated with house current. When I left home the miles meter read 102, but quickly went down as I started to drive. (After slow driving before stopping and then charging, the miles meter always reads high, apparently because the car remembers how it was driven just before it was previously stopped.) I set the LEAF into **ECO mode** and the speed at 65 mph. I ran the radio and the climate control at 66 degrees.

At the top of Christiansburg Mt. on I-81 the miles meter read 65. When I got to the bottom of the mountain the meter read 83. At exit 137 for Salem it read 65 again. On I-581 I set the speed to 55. When I got to downtown Roanoke the meter read 57.

The LEAF was the first electric vehicle to use the level-2 charger at the Virginia Museum of Transportation (<http://www.vmt.org> , 303 Norfolk Avenue SW, Roanoke, VA 24016, 540.342.5670). One swipes a credit card once for each hour of charging; you can swipe the card as many times at the beginning as the number of hours of charging needed. Every swipe costs \$1.

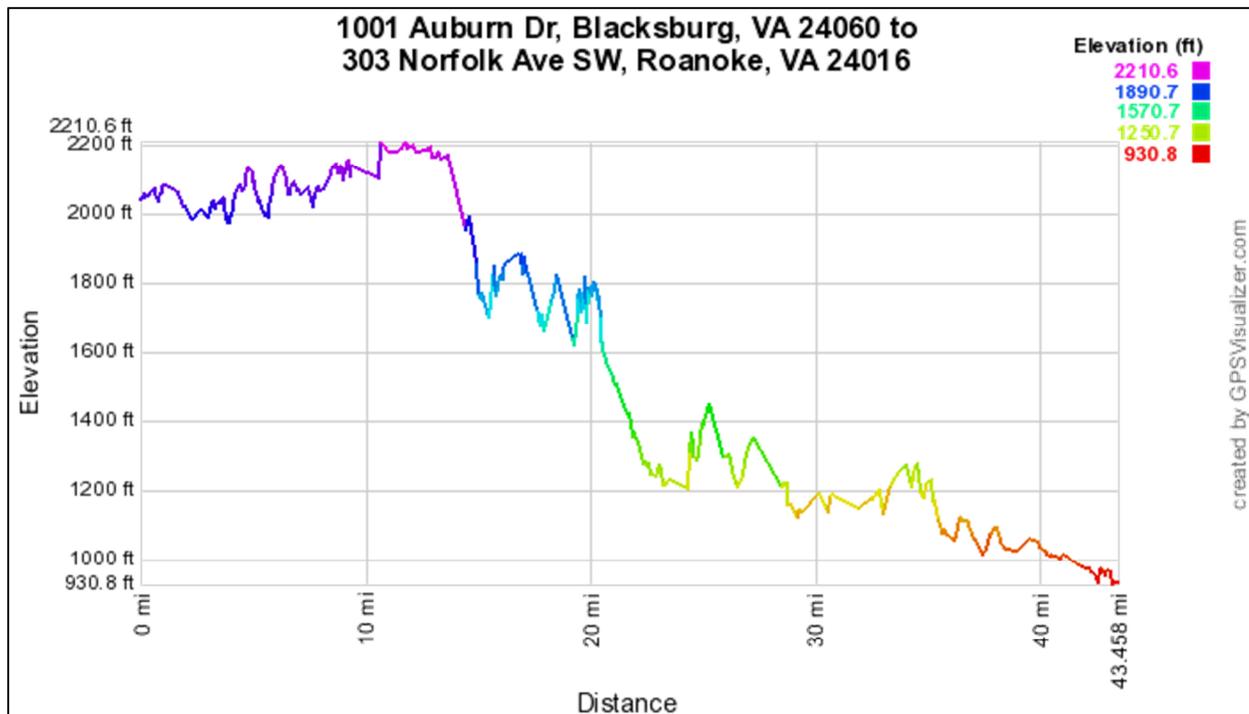
The LEAF charged for about 2.5 hours. It was difficult to get a good figure for the miles meter because the car remembered my slow driving in Roanoke to reach the charger. I think it was about 80, although 114 showed at the very beginning.

I drove 2 or 3 miles off the route to Blacksburg while in Roanoke.

The route back to Blacksburg was Rt. 141 and Catawba Road because I figured that the rolling hills would increase the mileage compared to coming back by I-81. The speed varied between 40 and 50 mph on most of the route back.

When I got back home in Blacksburg the meter read 21 miles. When I got to New River Nissan it read 13 miles.

The bottom line is that one needs at least 2 hours of level-2 charging in Roanoke for a round trip between Blacksburg and Roanoke using the routes I took. Perhaps taking Catawba Road for both legs would reduce it to 1.5 hours of charging in Roanoke.

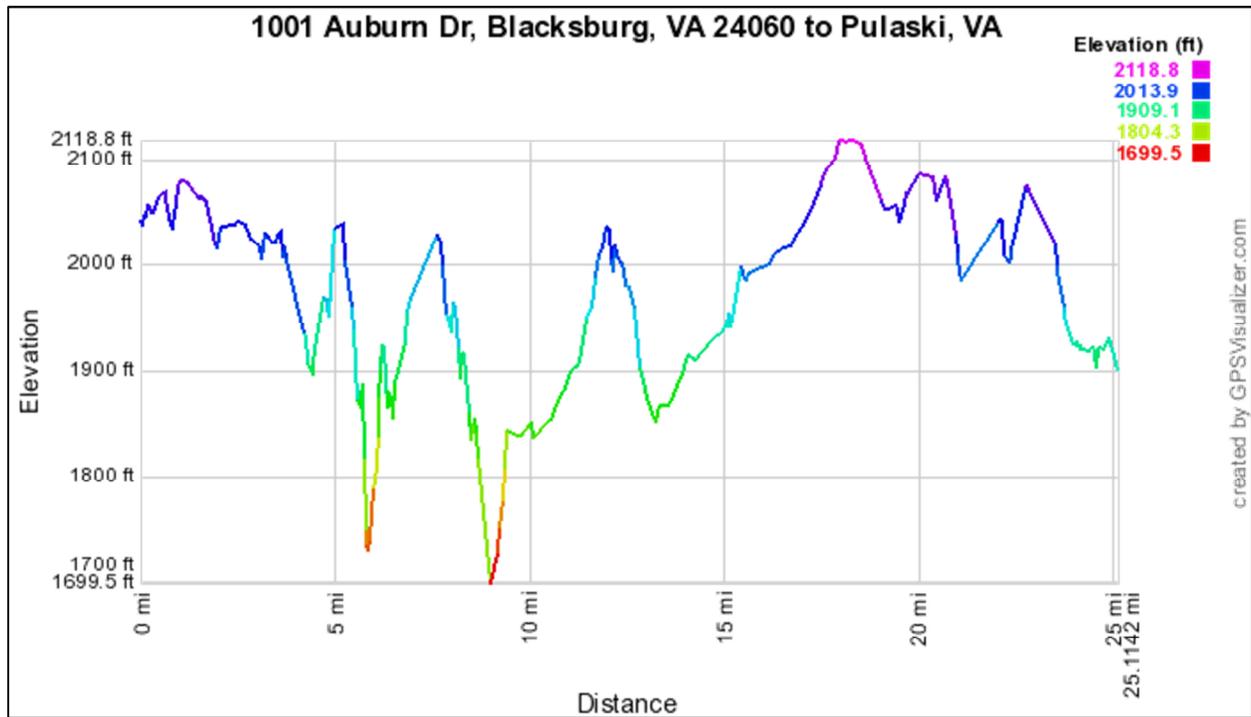


Trip 3. Blacksburg to Pulaski 15 February 2012

Blacksburg VA (2080') to Pulaski VA (1910') (~50 miles, round trip elevation change -170 feet going & +170 feet returning; through Fairlawn, not on I-81; average daytime temperature ~57 degrees):

The battery was full and the car was preheated by house current. I drove at the speed limits all the way and in **Drive mode**. I ran the radio and the climate control at 66 degrees. In Pulaski I drove ~1.5 miles. There were 7 of the 12 battery bars left to use going back to Blacksburg. Back home there were 3 bars

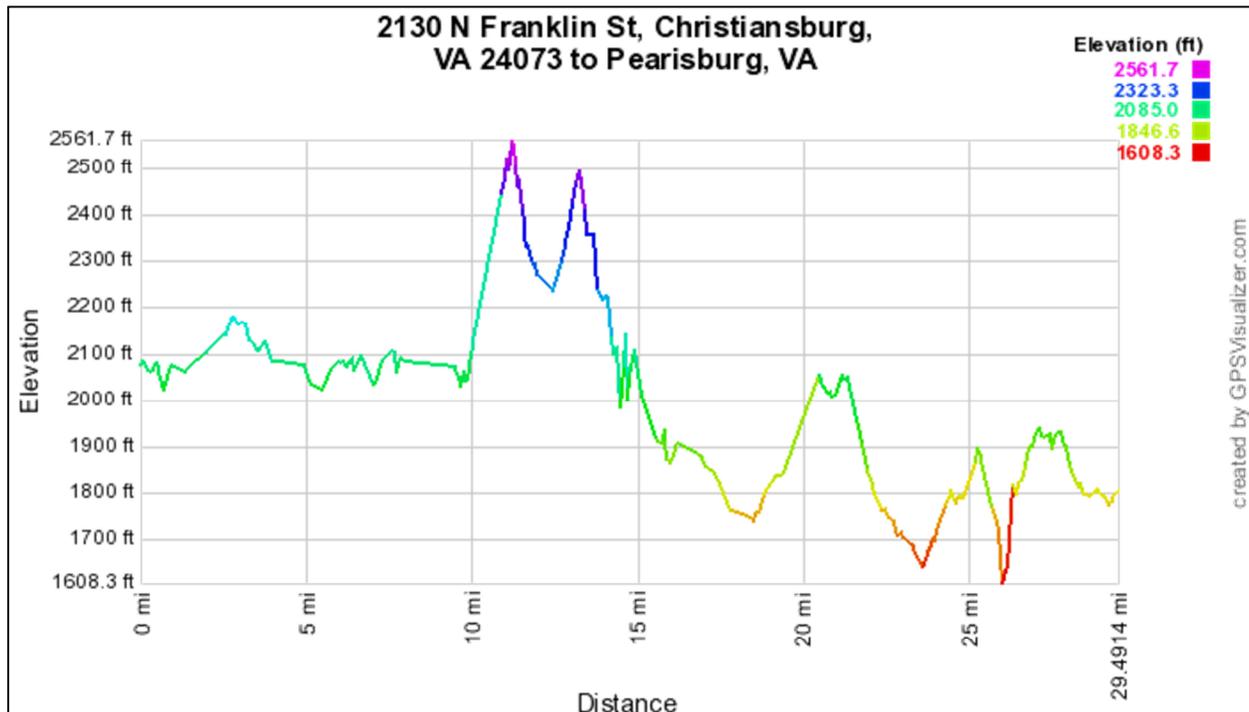
left



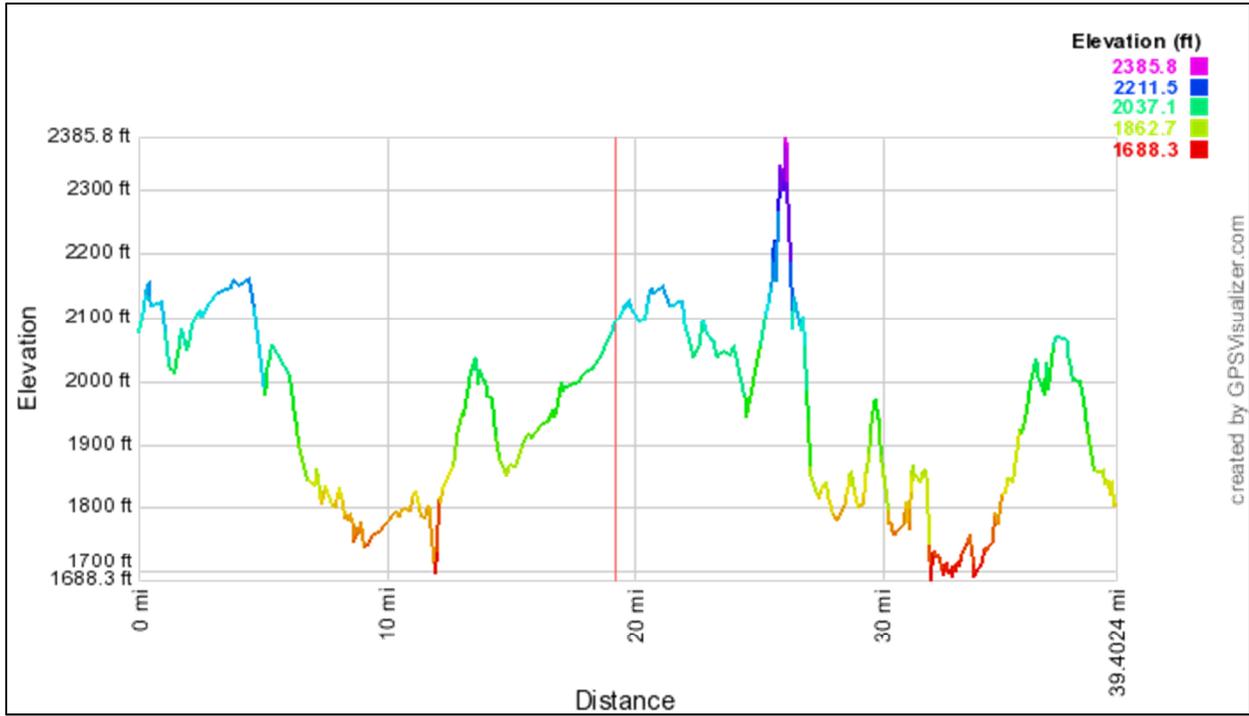
Trip 4. Christiansburg to Pearisburg 8 March 2012

Christiansburg VA (2080', New River Nissan [NRN] @ 2130 N Franklin St) to Pearisburg VA (1770') (~61 miles round trip, elevation change -310 feet going and +310 feet returning; average daytime temperature ~62 degrees):

There are two high peaks that had to be crossed: ~2500 feet and ~2600 feet separated by a valley at ~2200 feet; so the elevation change between NRN and Pearisburg is not really the total elevation change; it is really closer to 2000 feet similar to the Roanoke trip. The battery was full and climate control was set at 66 degrees. The radio was on and I drove at speed limits in **ECO mode** all the way. It was windy, which undoubtedly reduced the range. At Pembroke (1658', 48 miles round trip) I assessed the battery situation and decided that, with 8 battery bars left, it was ok to go on to Pearisburg. There were 7 bars left when I got to Pearisburg. Going up Brush Mountain before heading down into Blacksburg the navigation showed 10 miles to Blacksburg and the "miles-to-go meter" showed 23 miles, so I knew that I would be able to go the 17 miles to NRN. There were 2 battery bars left when I got to NRN.



What if the trip were by way of Dublin instead of Blacksburg?:

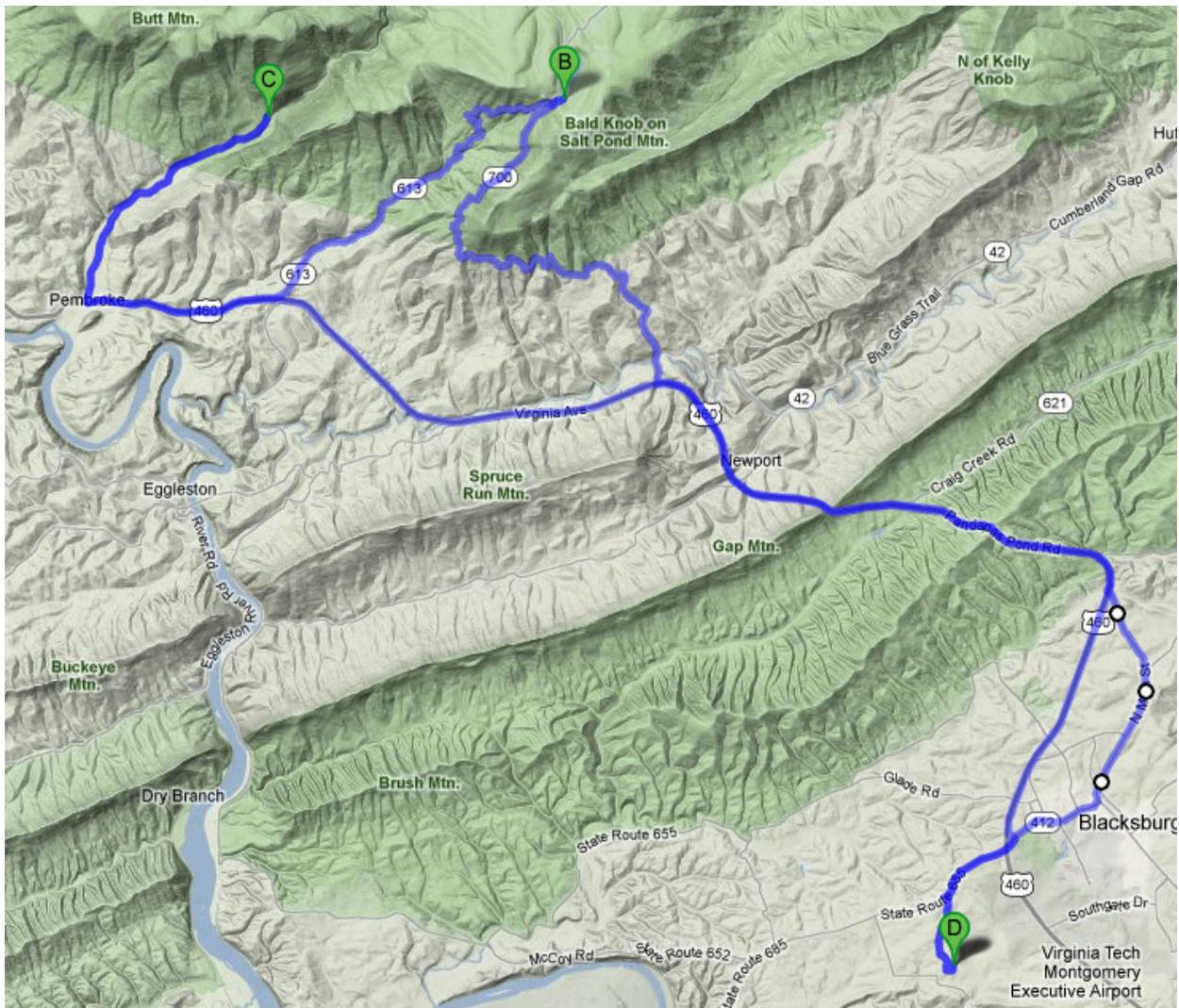


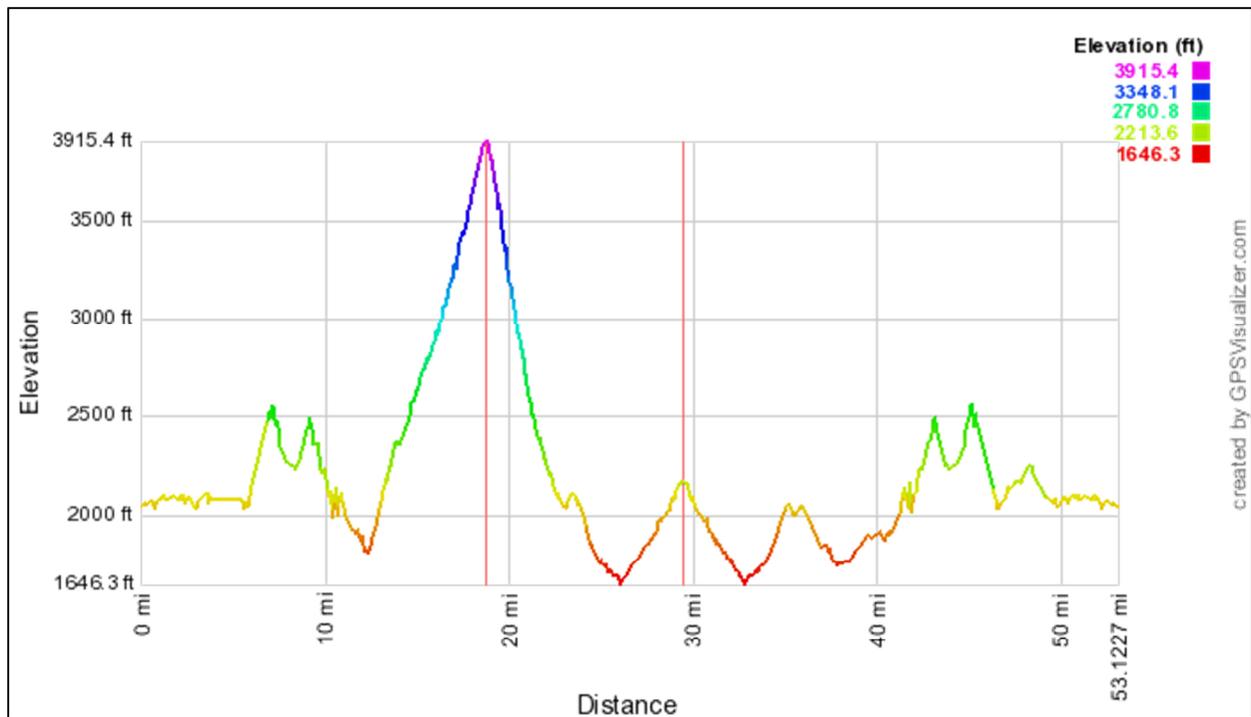
It would be ~10 miles longer, which would be iffy.

Trip 5. Blacksburg to Mountain Lake Hotel VA and Cascades Park 9 March 2012

Blacksburg VA (2080') to Mountain Lake Hotel (115 Hotel Circle, Pembroke VA, 3923'), Cascades Park (2068 Cascades Dr, Pembroke VA 2198', average Blacksburg daytime temperature ~52 degrees)

Drove in ECO mode and at speed limit all the way. Radio was on and climate control was set to 66 degrees. It was windy, which undoubtedly reduced the range. There were two battery bars left when I got back. This was the first trip on which I had the SOC meter (<http://www.wwsite.com/puzzles/socmeter/>). There were 6 battery bars left at Mountain Lake; the SOC meter showed 53% charged. Back in Blacksburg there were 2 bars left and the SOC meter showed 23% charged.



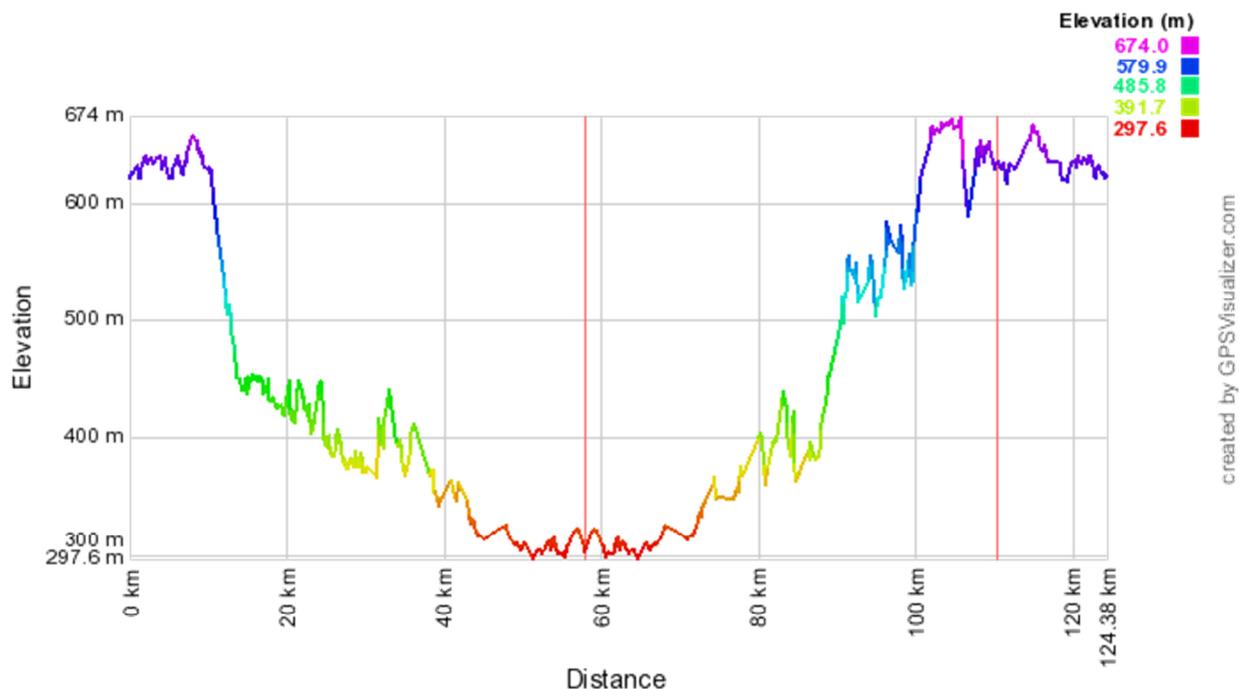


The first vertical line at ~18.5 miles represents the location of Mt. Lake Hotel. The second vertical line at ~29.5 miles represents the location of Cascades Park. The trip back to Blacksburg from Cascades Park is ~23.5 miles.

Trip 6: (Blacksburg to Grandin Theatre in Roanoke, 16 March 2012)

Blacksburg VA (2080') to

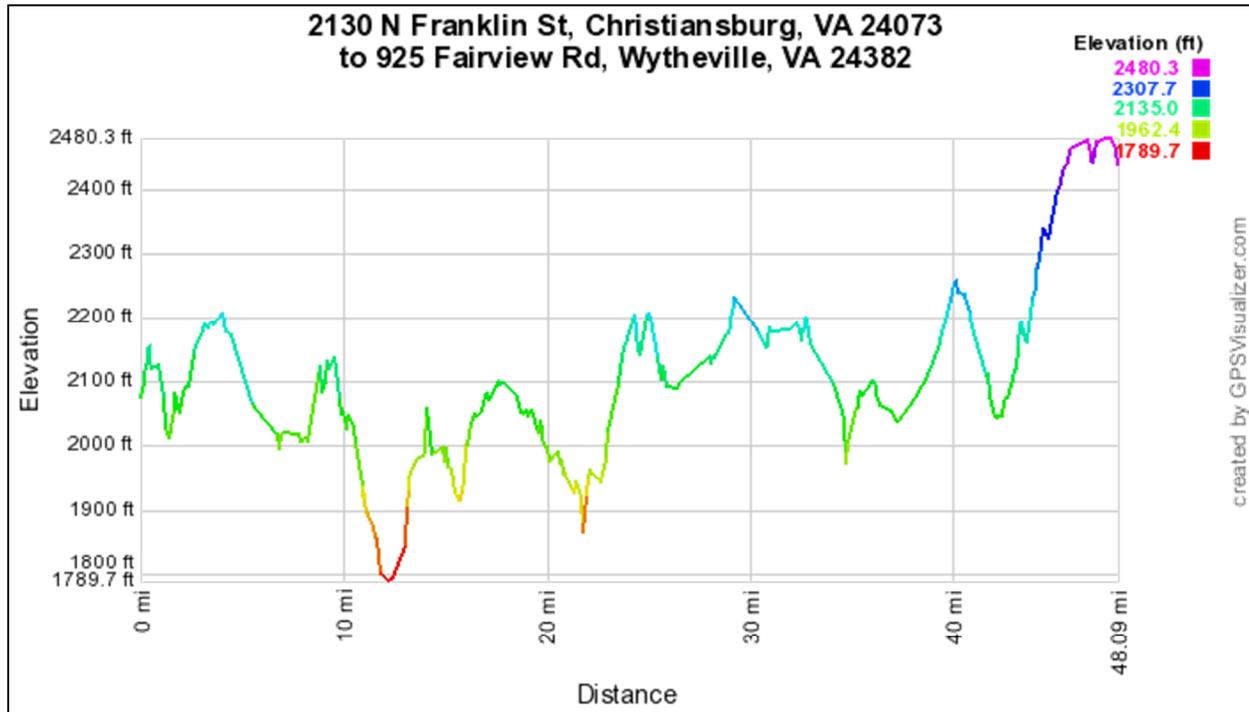
On Friday 16 March I drove a Nissan LEAF from our house in Blacksburg to Grandin Theatre in Roanoke with my wife, Jeanne, in the car. We drove through Ironto instead of Christiansburg going and through Christiansburg on the way back. The speed was essentially the speed limit going and at a cautious 60 mph returning on I-81. In both directions we used exit 137 off of and onto I-81. The climate control was set at 68 degrees and the radio was not on. The lights were on for the return trip. At Grandin the amount left in the battery was 66%; when we got home the battery was 10%.



Trip 7 (Christiansburg to Wytheville ? March 2012)

Christiansburg VA (2080', New River Nissan [NRN] @ 2130 N Franklin St) to Wytheville VA (2400') (~96 miles round trip, elevation change +320 feet going and -320 returning):

I might have to charge some in Wytheville at Evatran (<http://www.pluglesspower.com/>, 925 Fairview Rd.), the maker of an induction charger for electric vehicles. (I have signed up to get one of them eventually.) Charging could be done at Blue Ridge Nissan in Wytheville (1305 East Main Street, 276-228-8621, <http://www.blueridgenissan.com/section/secondary/about-us>). The battery was full and the car was preheated by house current. I ran the radio and the heater at 66 degrees. I would drive at the speed limits in **ECO mode** all the way.



Details about Driving a LEAF up and down a high mountain

<http://www.mynissanleaf.com/viewtopic.php?f=31&t=4952>

Future Trips

<http://www.roperld.com/science/LEAFRoperDriveFuture.pdf>

Charging Stations

[PlugShare](#)

This list is user updated.

Charging stations in southwest Virginia and southern West Virginia (<http://www.roperld.com/science/ChargingStationsSWVaSWv.pdf>)

ChargePoint Network (<http://chargepoint.net/find-stations.php>)

- The nearest level-2/240-volts charger in the network in Virginia is at Charlottesville VA (Blue Moon, 222 W South St., guest use only) ~150 miles from Blacksburg VA. If there were a charging station in Lexington, one could make the trip using it and the one at the VMT in Roanoke.
- The nearest level-2/240-volts charger in the network in North Carolina is at Statesville NC (Energy United, 567 Mocksville Hwy, unrestricted access) ~128 miles from Blacksburg VA. I don't see the possibility of there being a charging station halfway between Blacksburg and Statesville.

Electric Fueling Stations in Virginia: http://www.afdc.energy.gov/afdc/progs/ind_state.php/VA/ELEC

L. David Roper, <http://arts.bev.net/roperldavid/> , roperld@vt.edu , February 2012