

Preliminary Route Analysis

Skaneateles School District

June 2025

Prepared for:



Skaneateles Central
School District

Prepared by:



INF Associates



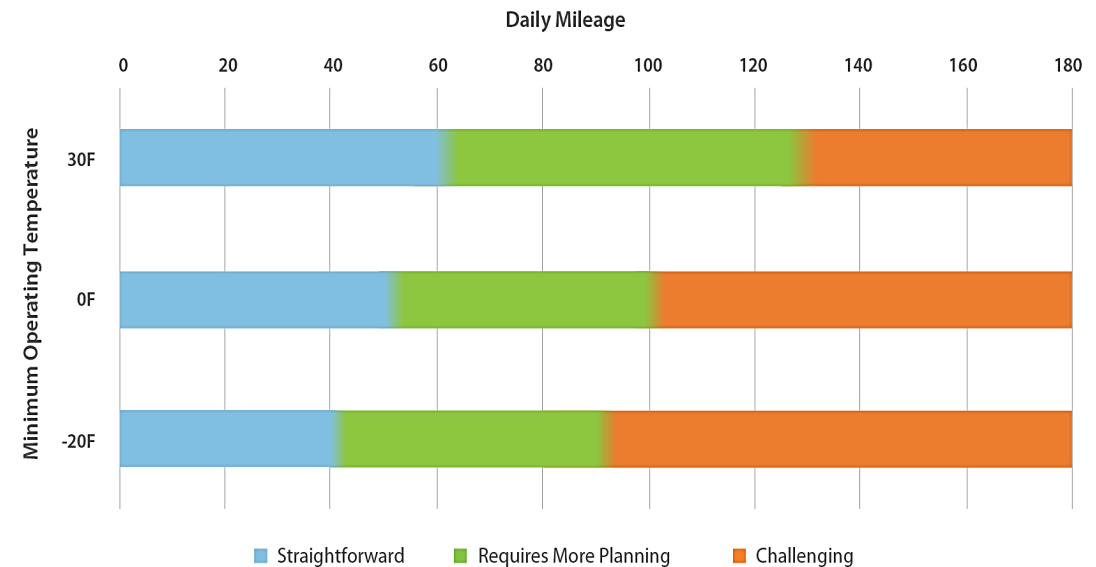
FEP Background

Fleet Information

- 24 contracted Buses
 - 3 Type A (1 spare)
 - 21 Type C (9 spare)
- Buses parked at 819 West Genesee St, Skaneateles NY 13152

Current Regulations

- **2027:** All school buses purchased after July 1, 2027, must be zero-emission (can request 2-year extension)
- **2035:** All school buses in operation after July 1, 2035, must be zero-emission



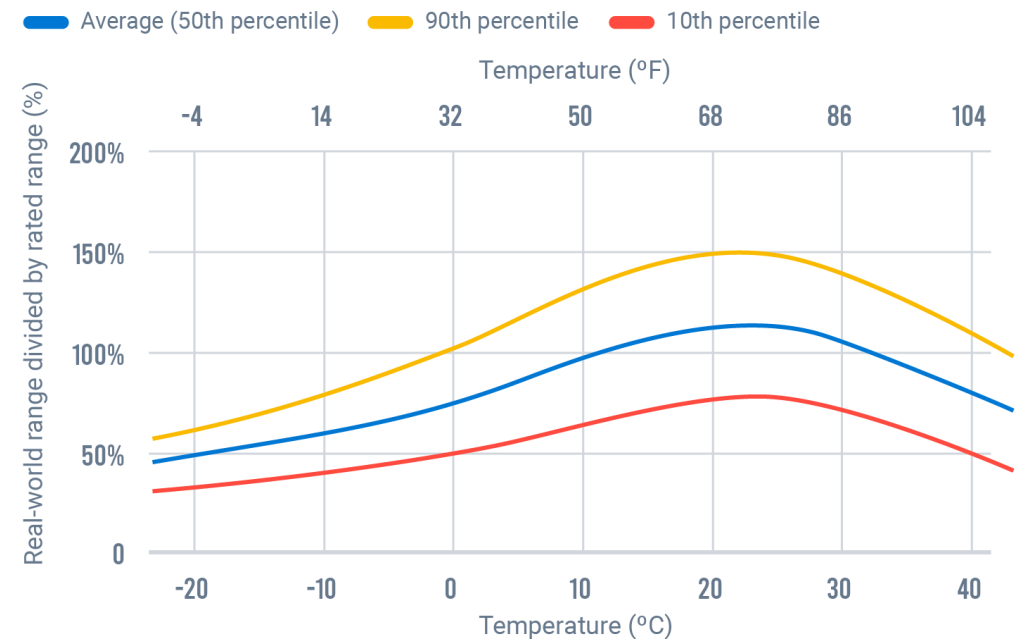
Route Analysis Inputs

Temperature

| Month | High (°F) | Low (°F) |
|-----------|-----------|----------|
| January | 31° | 16° |
| February | 34° | 17° |
| March | 43° | 24° |
| April | 56° | 35° |
| May | 77° | 46° |
| June | 79° | 55° |
| July | 81° | 61° |
| August | 79° | 59° |
| September | 72° | 52° |
| October | 60° | 42° |
| November | 48° | 32° |
| December | 37° | 23° |

Source: NOAA

Real-world range vs. rated range



Source: Geotab

Route Analysis Inputs

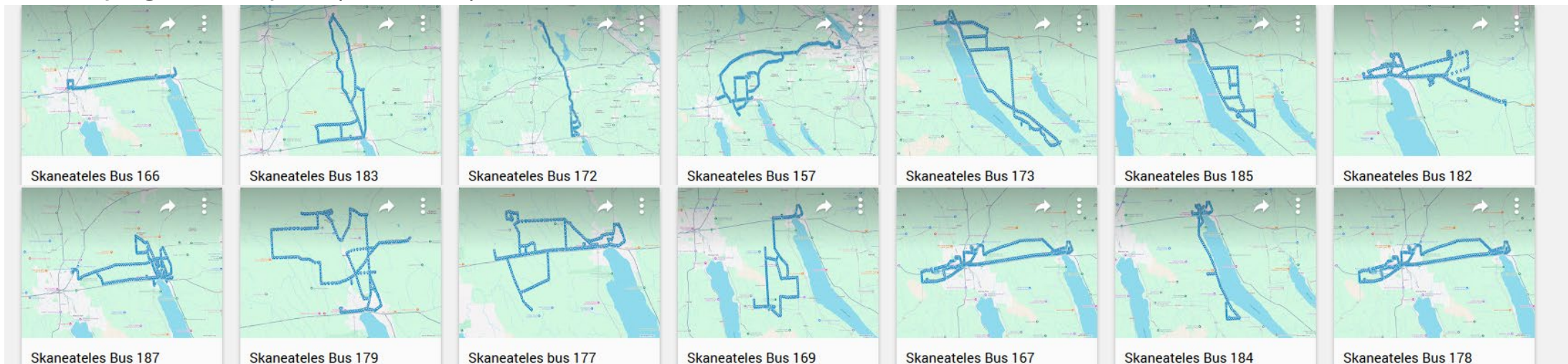
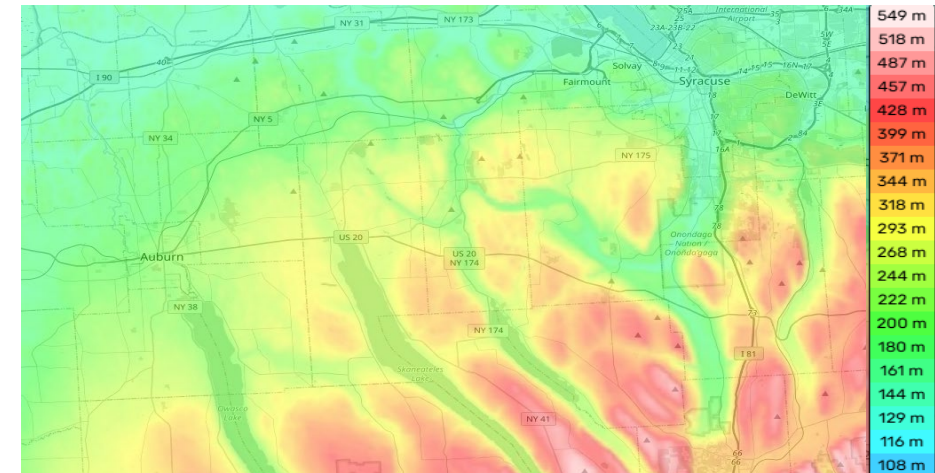
Topography

Topography Effects

- Increase in power demand on uphill roads
- Reduced power demand on downhill roads & regeneration of power from braking technology

Assumptions in Route Analysis

- Average uphill road angle of 2°
- 30% recapture of energy during regenerative braking downhill
- Varying % flat inputs (20%-80%)



Route Analysis Inputs

Inputs with Weather and Topography Effects

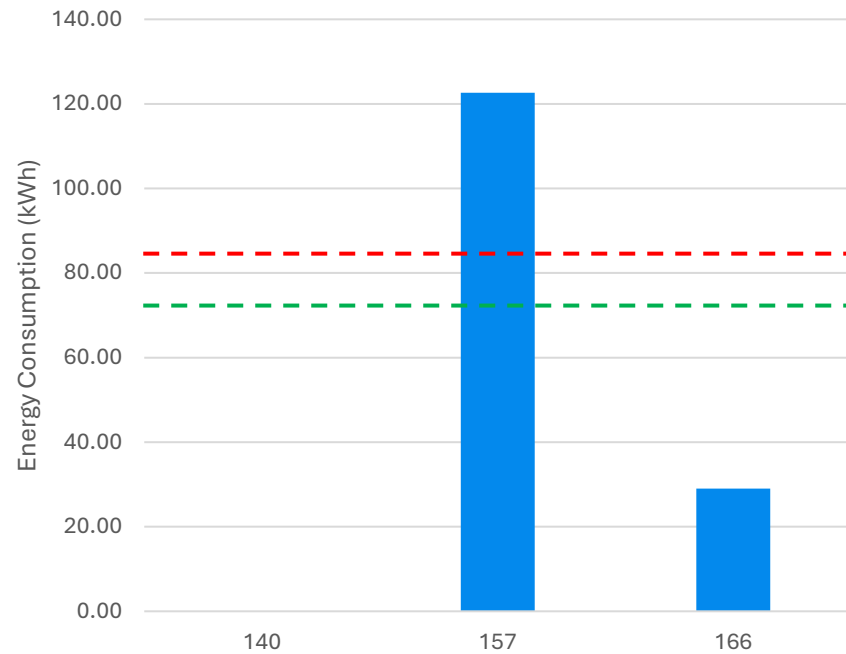
| | Van | Type A | | Type C | |
|--|----------------|-------------------------|----------------|---------------------------|-------------|
| | Ford E-Transit | Blue Bird Micro Bird G5 | BYD "Achiever" | Blue Bird Vision Electric | BYD Creator |
| Nameplate Capacity (kWh) | 89 | 175 | 156 | 196 | 289 |
| Nameplate Range (miles) | 159 | 200 | 105 | 150 | 175 |
| Battery Efficiency (kWh/mile) | 0.59 | 0.88 | 1.49 | 1.31 | 1.65 |
| Usable Battery | 89%* | 89%* | 89% | 89%* | 89% |
| Usable Capacity (kWh) | 79 | 156 | 139 | 174 | 257 |
| Usable Range (miles) | 142 | 178 | 93 | 134 | 155 |
| Efficiency Loss in Cold Weather | 25%* | 25%* | 25%* | 25%* | 25%* |
| Efficiency in Cold Weather (kWh/mile) | 0.80 | 1.25 | 2.12 | 1.87 | 2.20 |
| Usable Range in Cold Weather (miles) | 99 | 125 | 65 | 93 | 117 |
| Efficiency in Hilly Areas (kWh/mile) | 0.85 | 1.58 | 2.53 | 2.91 | 3.35 |
| Efficiency in Hilly Areas & Cold Weather (kWh/mile) | 1.22 | 2.26 | 3.62 | 4.16 | 4.47 |
| % of Route That is Flat | 50%* | 50%* | 50%* | 50%* | 50%* |
| Useable Range in Hilly Areas & Cold Weather (miles) | 78.6 | 88.8 | 48.4 | 57.9 | 72.5 |

Note: *Assumed Inputs

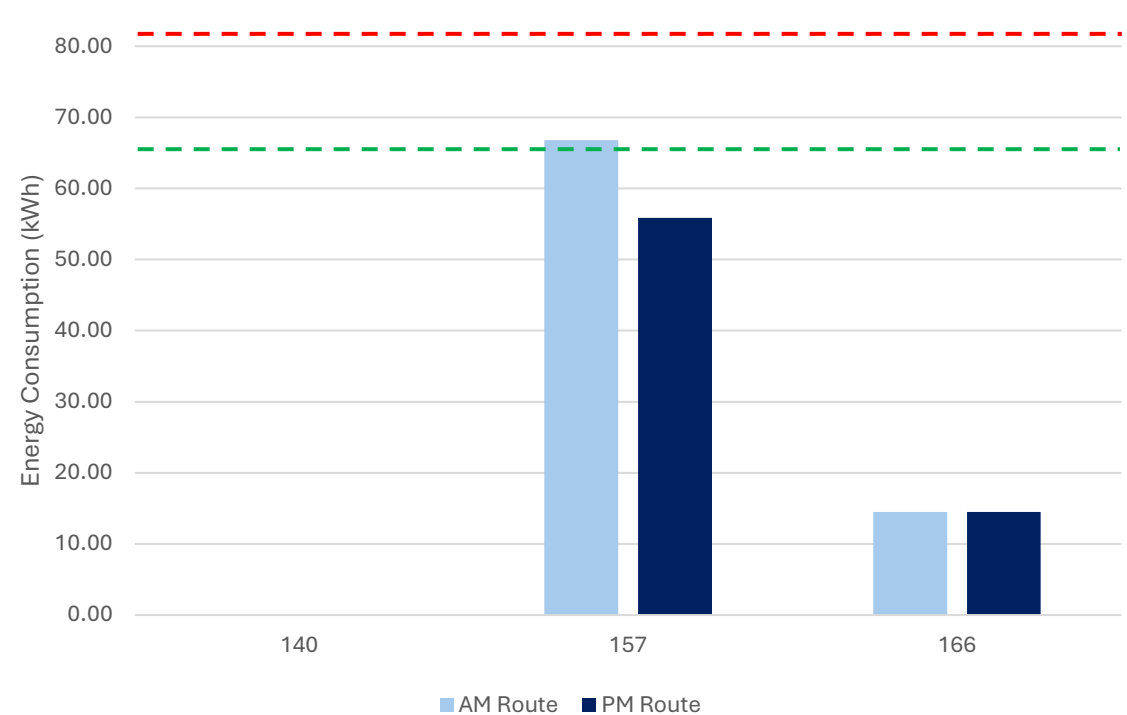


Preliminary Route Analysis Results – Type A

Daily Energy Consumption (kWh) - Vans



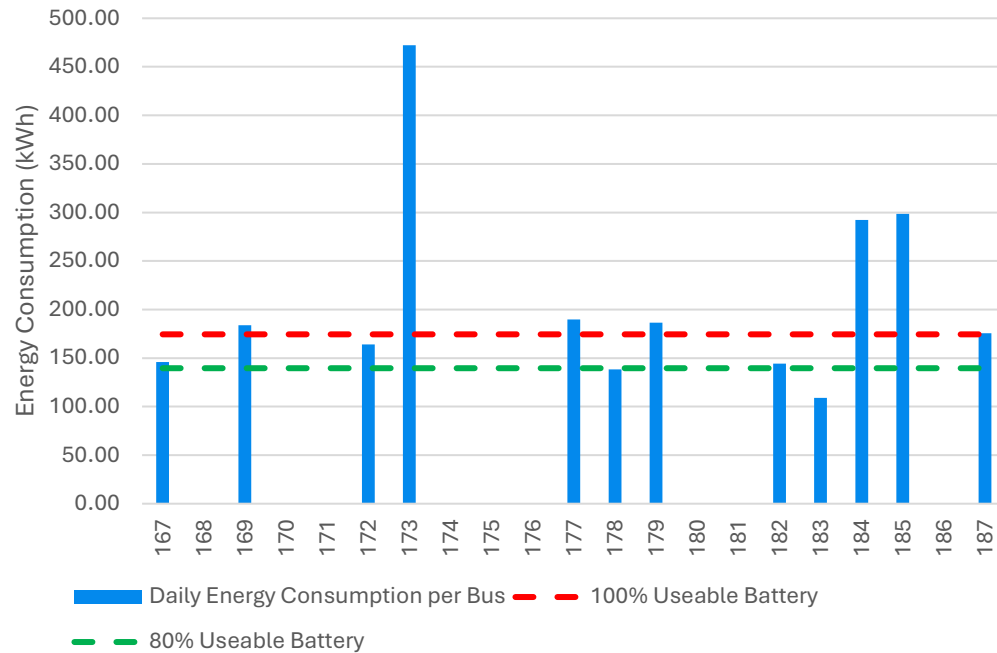
AM & PM Energy Consumption (kWh) - Vans



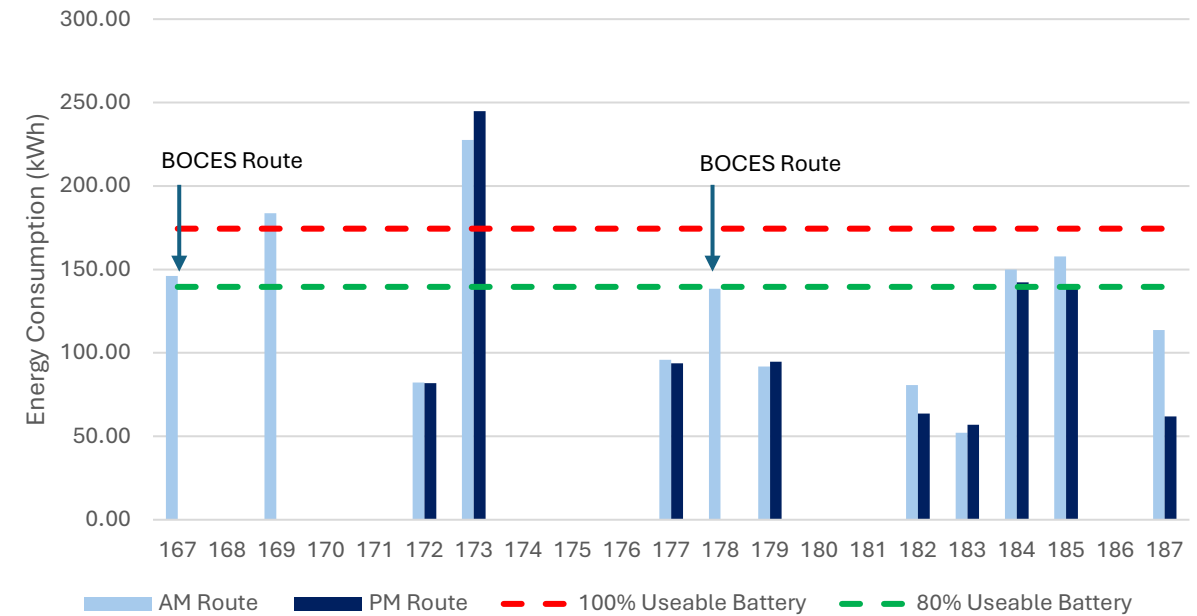


Preliminary Route Analysis Results – Type C Blue Bird

Daily Energy Consumption per Bus - Type C Buses



AM & PM Route Energy Consumption per Bus - Type C Buses

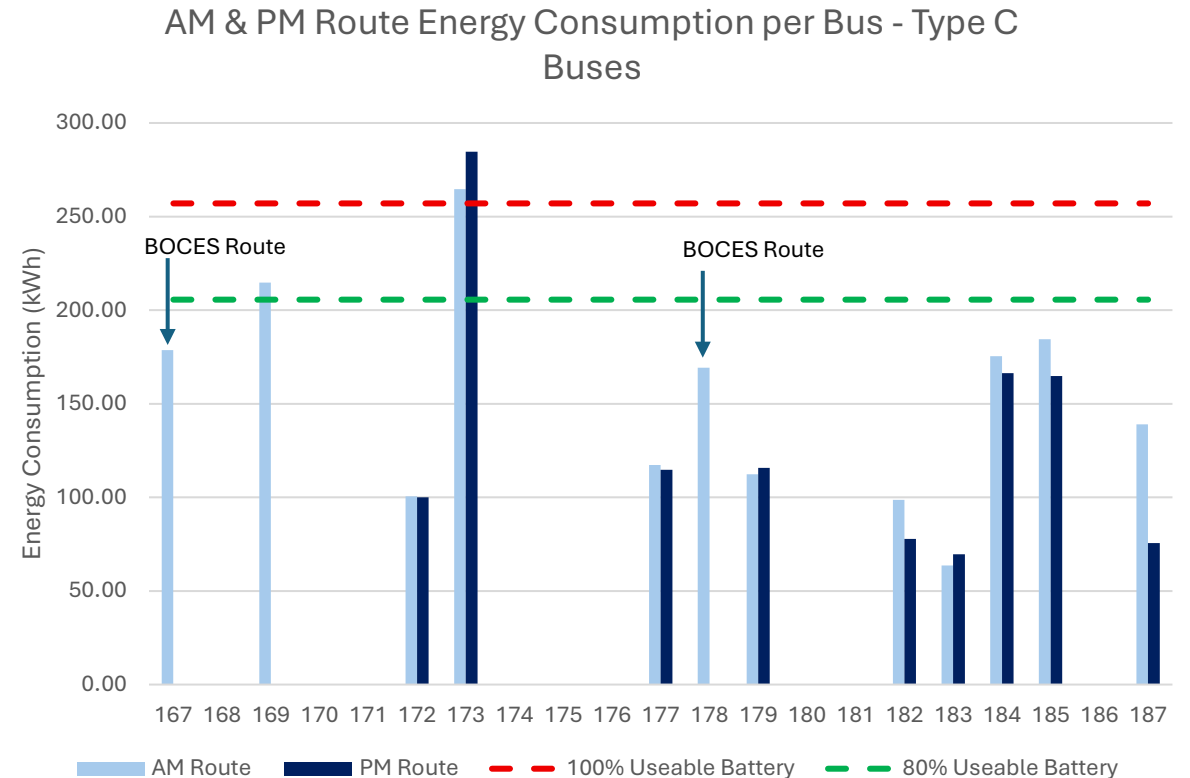
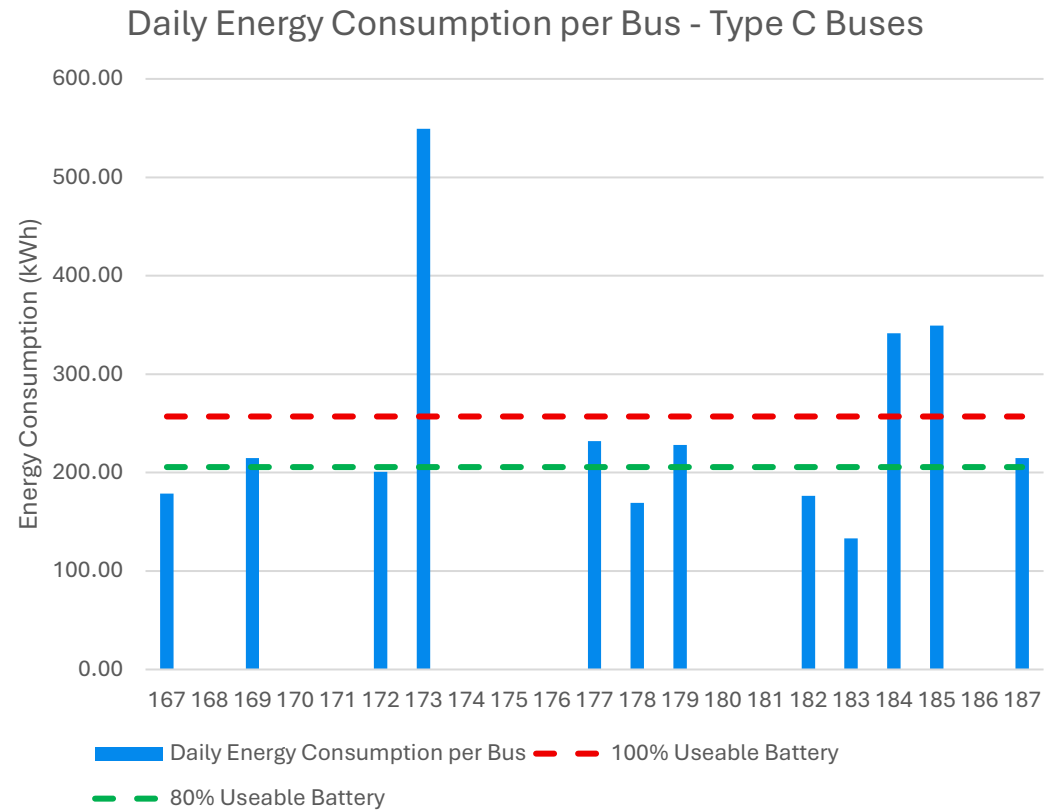


- BOCES routes calculated as daily route since they do not return to the parking facility between routes
- Bus 167 dwells at BOCES facility for ~2 hours
- Bus 178 dwells at BOCES facility for <1 hour
- Chargers at BOCES can make daily routes feasible



Preliminary Route Analysis Results – Type C

BYD Creator



Route Analysis Summary

- **Straightforward:** Completes both routes with a 20% SOC remaining and requires either a low-power midday charge or no midday charge
- **Requires More Planning:** Completes both routes and requires a higher-power midday charge
- **Challenging:** Does not complete one or more of their routes or ends route under 20% SOC


| | Van/Type A | Type C* |
|------------------------|------------|---------|
| Straightforward | 1 | 5 |
| Requires More Planning | 0 | 2 |
| Challenging | 1 | 5 |
| Spare | 1 | 9 |

**Results shown for Blue Bird Vision only*

Route Analysis Summary

Blue Bird Vision Power Consumption (kWh) with Varying Distance, Temperature, and Topography Inputs:

| | 25% Flat | | 50% Flat | | 75% Flat | |
|-------|---------------|--------------|---------------|--------------|---------------|--------------|
| miles | Ideal Weather | Cold Weather | Ideal Weather | Cold Weather | Ideal Weather | Cold Weather |
| 10 | 25.10 | 33.46 | 21.09 | 28.12 | 17.08 | 22.77 |
| 20 | 50.19 | 66.92 | 42.17 | 56.23 | 34.15 | 45.54 |
| 30 | 75.29 | 100.39 | 63.26 | 84.35 | 51.23 | 68.31 |
| 40 | 100.39 | 133.85 | 84.35 | 112.46 | 68.31 | 91.08 |
| 50 | 125.48 | 167.31 | 105.43 | 140.58 | 85.38 | 113.84 |
| 60 | 150.58 | 200.77 | 126.52 | 168.69 | 102.46 | 136.61 |
| 70 | 175.68 | 234.24 | 147.61 | 196.81 | 119.54 | 159.38 |
| 80 | 200.77 | 267.70 | 168.69 | 224.93 | 136.61 | 182.15 |
| 90 | 225.87 | 301.16 | 189.78 | 253.04 | 153.69 | 204.92 |
| 100 | 250.97 | 334.62 | 210.87 | 281.16 | 170.77 | 227.69 |

 Values that go over 80% of the bus's useable battery (140 kWh)

 Values that go over the bus's useable battery (174 kWh)

Recommendations

- Prioritize Straightforward buses for first phases of electrification
- Pair long AM routes with short and/or later PM routes
- Small charges at BOCES facility, if available
- Currently infeasible routes electrified last
- Driver training, cabin pre-conditioning both very important to extending range



SKANEATELES

CENTRAL SCHOOL

Next Steps

- Charge analysis
- Preliminary phasing plan
- Utility submission