

# Optimization of Electrified Propulsion Systems for School Bus Fleets using Scheduled Routes Data

Ahmed Abdel Rahim, PhD



## Background

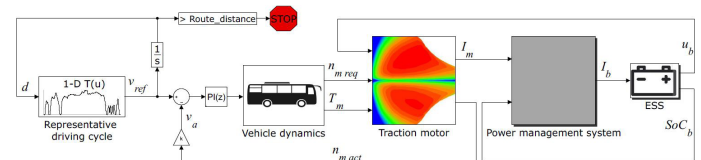
Electrification of vehicular drivelines has been receiving increasing attention from researchers and governments. Despite the significant potential of electrified vehicles to improve propulsion efficiency and reduce environmental degradation in transportation sector, range limitation,

long recharging periods, and short batteries' lifetime are considered the major challenges. Besides, the uncertainty of upcoming driving conditions and rapidly-changing traffics contribute to the complexity of route planning, driveline sizing, and infrastructural requirements. Providing useful insights into daily trip conditions is particularly important for driveline sizing and load scheduling for school bus fleets, hence battery aging and excessive grid-loading can be mitigated.

## Research Project

This research will implement a new approach to develop school-bus driving cycles. Real-time and historical school bus fleet will be collected from different school districts in Idaho. The collected data will be clustered to develop representative driving patterns and cycles. These data will then be used in electrified powertrain modeling and sizing.

The research will examine the operational and environmental benefits that would result from the electrification of school bus fleets, transforming the current pollution emitters fuel-based fleets to the environmentally friendly electrified engines. Representative driving cycles will be generated using both historical and real-time GPS fleet route data. The developed driving cycles will be used to define optimal driveline and fleet sizing of electrified school buses. Three main tasks will be conducted as part of this project. School-bus GPS-based route data will be collected from two school districts in Idaho. One representing rural operations and the second representing urban school-bus operations. Data will be collected for during spring 2022 for a three-month period covering different weather conditions. The collected data will be clustered and analyzed to develop driving patterns and repetitive driving cycles for each school-bus route in the two school districts. Clustering and analysis of the collected speed data will be characterized over route distances to construct representative driving cycles for each route.



## ABOUT THE AUTHORS

The research team consisted of Ahmed Abdel Rahim of the University of Idaho.

## ABOUT THE FUNDERS

This research was funded by the Pacific Northwest Transportation Consortium, with additional support from the University of Idaho.

## EXPECTED DATE OF COMPLETION

March 2023

## FOR MORE INFORMATION

<https://depts.washington.edu/pactrans/research/projects/optimization-of-electrified-propulsion-systems-for-school-bus-fleets-using-scheduled-daily-routes-data/>

