# E-Truck System Definition and Modeling

PACCAR

The Motivation

- The goal is to design an electrically powered commercial truck that meets the efficiency of traditional diesel trucks. This involves a detailed analysis and translation of diesel truck performance characteristics into the design requirements.
- This phase is essentially the blueprint and our scope will not cover the development of physical prototypes or physical implementations.

Objectives

- **Develop a SysML model:** We aim to create a detailed SysML (System Modeling Language) model that accurately represents the architecture of the electric truck.
- **Define Requirement Specifications:** Alongside the SysML model, we will draft a comprehensive requirements specification document. This document will outline all technical and performance criteria that the electric truck needs to meet.

SysML Models
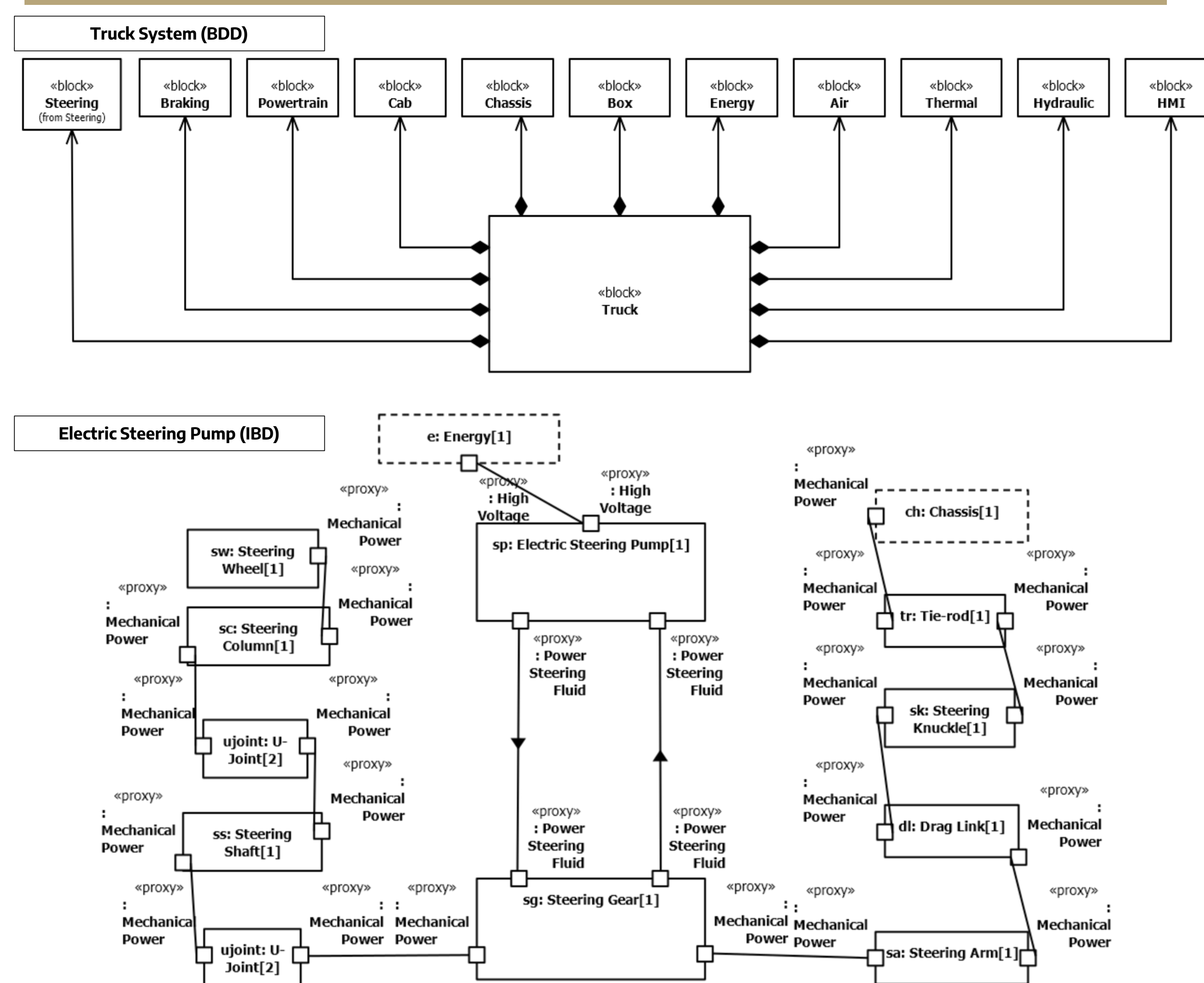
Vehicle Attributes

- Safety
- Vehicle Dynamics
- Package
- Reliability
- Thermal
- Aerodynamics
- Costs
- Performance and Drivability
- Customer Life Cycle
- Product and Process Complexity
- Energy Consumption
- Interior climate comfort
- Noise, Vibrations, and Harshness (NVH)
- Security
- Weight
- Ergonomics
- Interior climate comfort
- Communication and entertainment
- Styling and appearance
- Emissions

Highlighting Some Requirements

- 26,001-33,000 lbs: Class 7
- ~400 kWh of battery capacity
- Energy consumption 1.29–1.93 kWh/mi on urban roads and 2.09–2.90 kWh/mi on highways
- Charger selected: CCS1
- Rigid body resonance 10-25 Hz
- Exterior noise goal for 20kph (12.247 mph): 56-75 dB
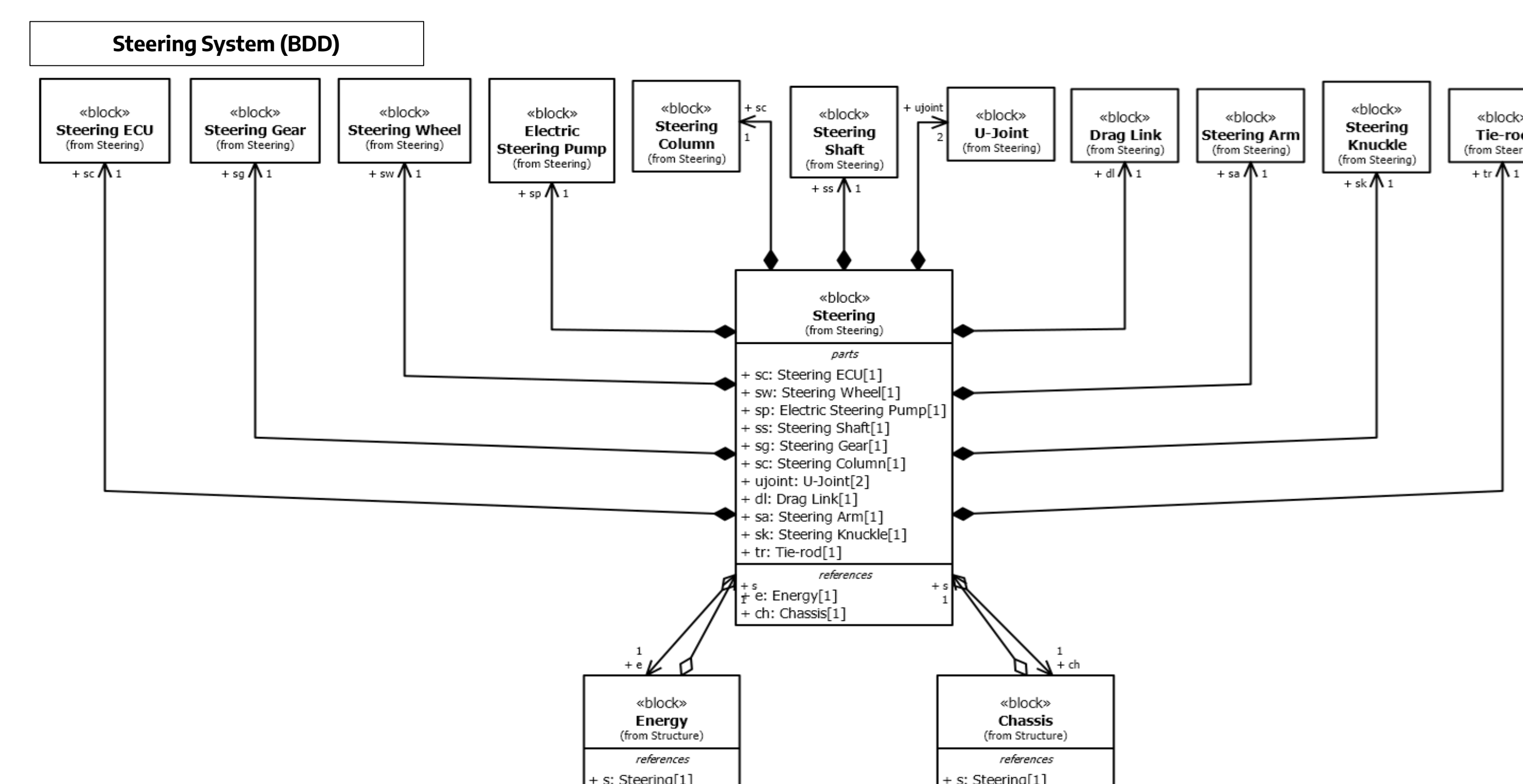
Results and Validations
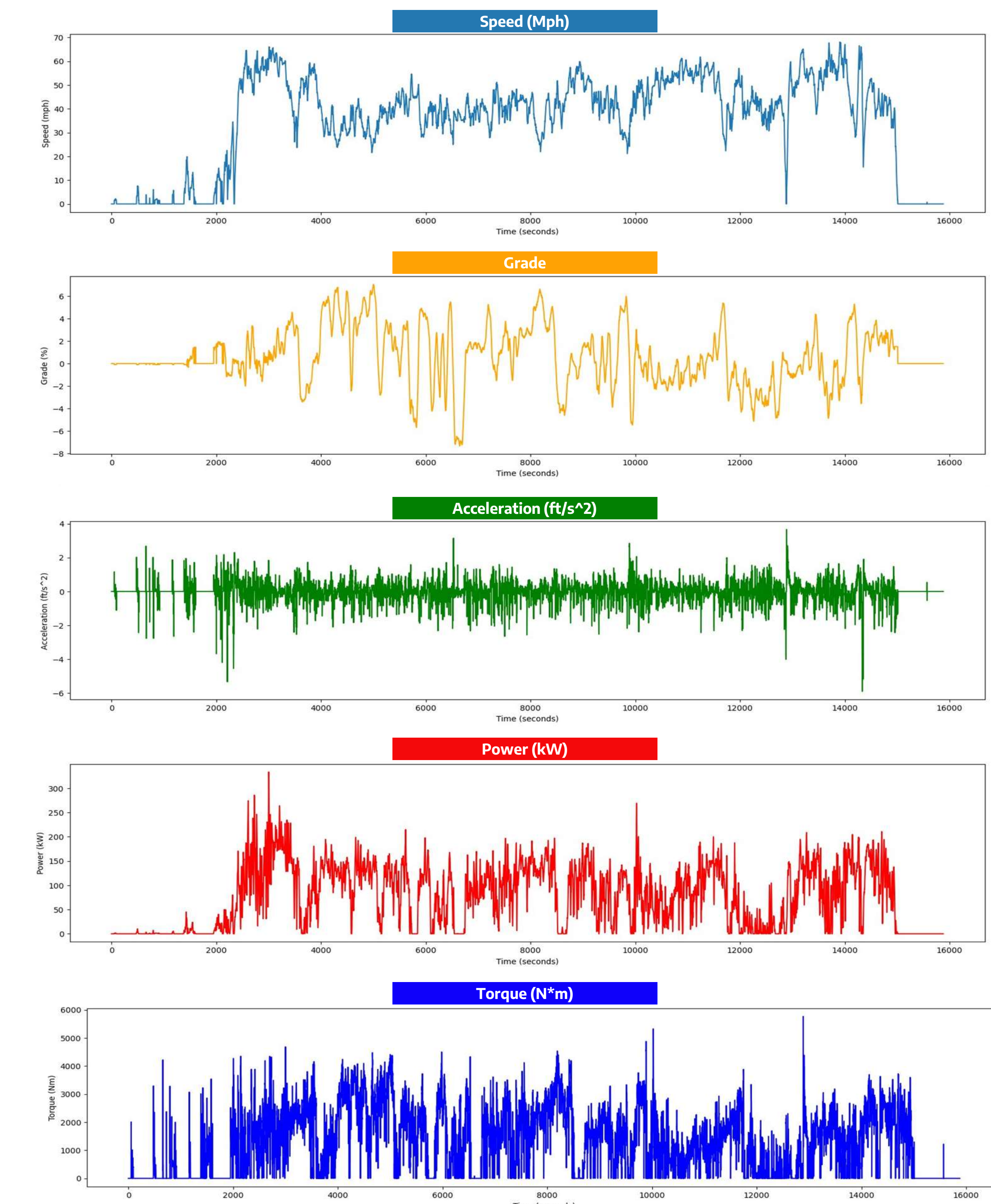
Drive cycle represents 70% of all local delivery trucks in the NREL Fleet DNA database.

- Total Energy: 262 kWh
- Max Grade: 6.32 %
- Speed at Max Grade: 32 mph
- Continuous Power: 173 kW
- Peak Power (10 s): 280 kW
- Peak Instantaneous Power: 439 kW
- Continuous Torque: 3800 Nm
- Peak Torque (10 s): 8400 Nm

Acknowledgments

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Software Used

windchill
Gaphor
UML/SysML Modeling
codebeamer