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Methodology and Experiment Design

To examine the impact of different parameters on the energy consumption of light commercial vehicles, a full factorial design of experiment was created. Varying vehicle mass, route type and additional consumers as seen below, results in 64 test cases:

- Vehicle mass: 1195 kg; 2000 kg; 2800 kg; 4050 kg
- Additional consumer power: 0 kW; 2 kW; 5 kW; 10 kW
- Route type: Urban Postal; Urban; Rural; Highway

Route Types

The chosen routes (Figure 1) all result in a similar distance, but due to different speed in different times, which impacts the energy required by the additional consumer.

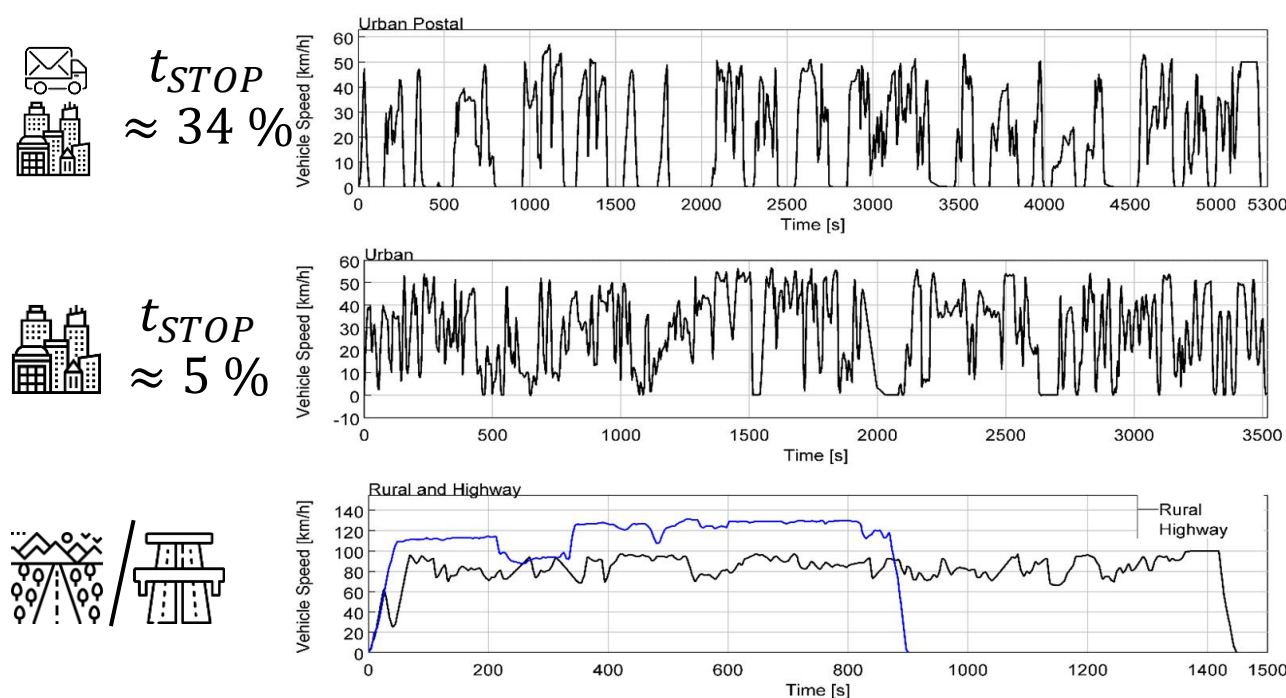


Figure 1: Speed Profiles of the Routes

Results in Consumption and Range

The combination of different parameter levels leads to a wide variety of consumptions and hence to large differences in the driving range. These are shown in Figure 2 for all cases with no (Case 1 to 4) and with a 10 kW additional consumer (Case 13 to 16) at different mass levels.

For the given battery capacity of 18,8 kWh in the last case with the highest mass and additional consumer power the range shrinks to 25 km.

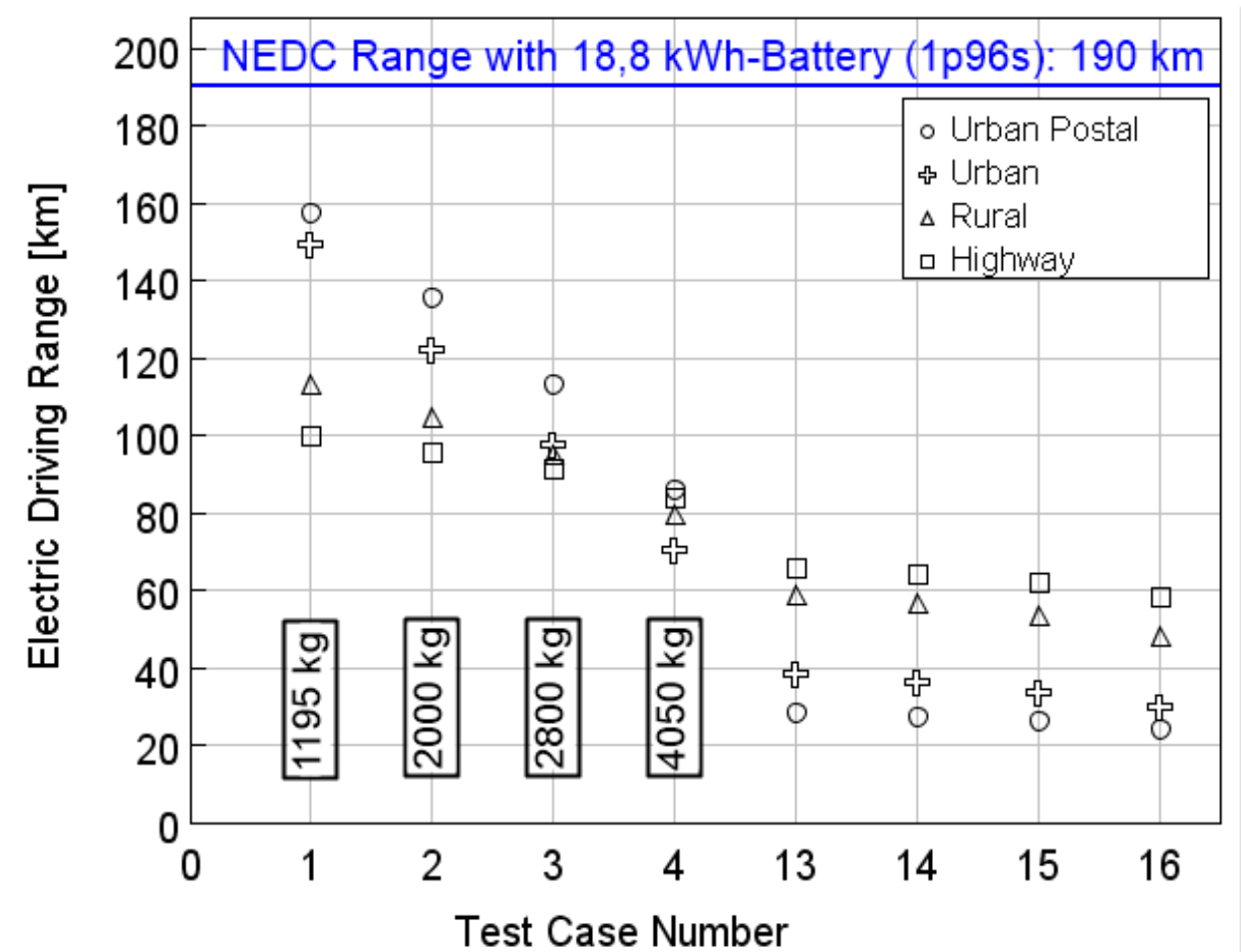


Figure 2: Driving Ranges of all Test Cases

Impact on Power Demand

Although the additional consumer is the most impactful parameter for consumption and range, the mass has to be considered. E.g. the two cases with a 10 kW additional consumer and 1195 kg in Case 13 and 4050 kg in Case 16 in the Urban Postal route have large differences in their power demands (Figure 3). The maximum total power demand in Case 16 is about 100 kW. So the battery must also be suitable to the needs in terms of power supply.

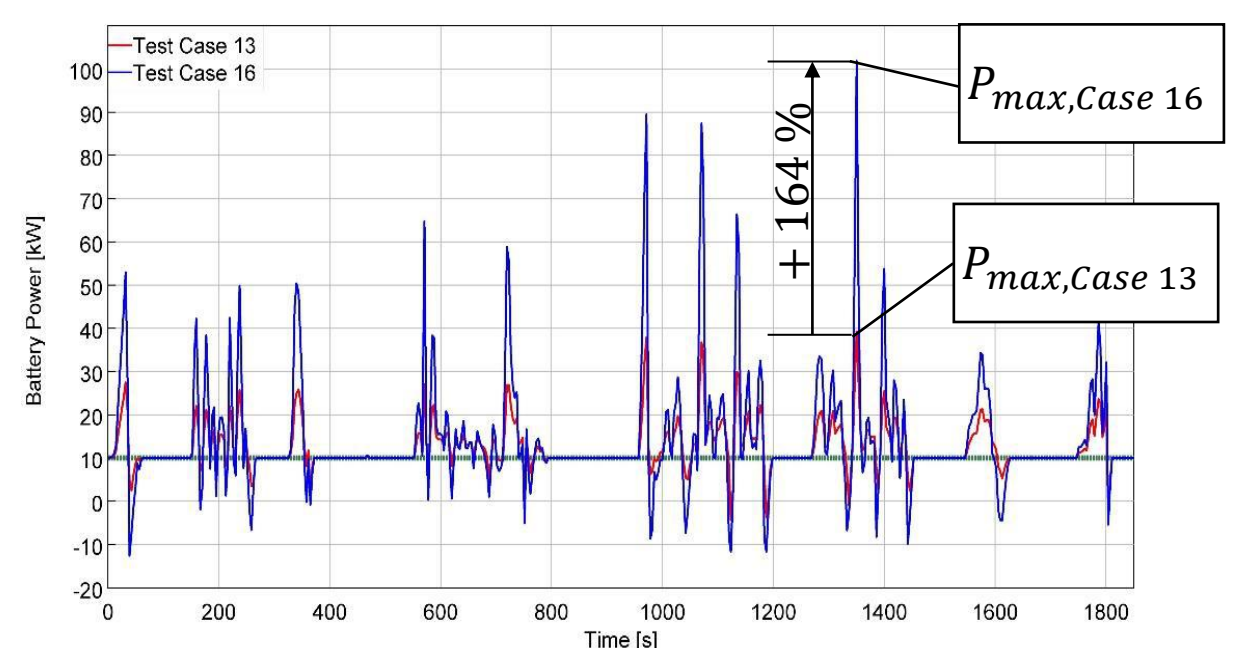


Figure 3: Power Demands

“To deliver fresh sausage in the city you have 25 km “