Modeling timber truck speed and fuel consumption in Finland based on CAN bus data and auxiliary information

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Background

• Information on timber truck speed and fuel consumption in varying conditions needed for route optimization and cost estimation
• Data on speed and consumption are automatically collected by trucks’ fleet management systems
• Auxiliary information describing road properties and weather conditions can be connected with the data
• Aim to create prediction models for driving speed and fuel consumption
CAN Bus Data

• A follow-up study in April 2018 – March 2019 with three entrepreneurs
  – Entrepreneur A 8 trucks
  – Entrepreneur B 3 trucks
  – Entrepreneur C 2 trucks
• Combination vehicles: 3 * 68 t + 10 * 76 t
• Scania Fleet Management System operative in all trucks
• Recording interval mostly 10 min
• Roughly 480,000 data points
• Odometer reading, cumulative fuel consumption, coordinates, time stamp
• Average speed and fuel consumption calculated for all the routes between two consecutive tracking points
Weight Data

• Transport management system LogForce by Trimble
  • locations of loading and unloading points and weights of all the loads transported under the system
  • altogether 8287 truck loads, 408 kt

• Receiving mills of Metsä Group, Stora Enso and UPM
  • pulp mills: weight of each timber assortment based on stationary weighing systems
  • sawmills and plywood mills: solid volume of each timber assortment
  • altogether 15 mills
  • 171 kt of these deliveries found in LogForce data (42% of all deliveries in LogForce)
Road and Weather Data

- National road and street database Digiroad
  - Road geometry & attribute data
  - Includes in practice all the roads
- Weather data
  - e.g. rainfall, temperature, wind speed and direction
  - daily average, minimum and maximum values
  - 1 km * 1 km grid
Preliminary Results...
Distribution of Speeds on Routes between Tracking Points

mean 61 km/h
(median 70 km/h)
Distribution of Fuel Consumptions on Routes between Tracking Points

mean 65 l/100 km (median 54 l/100 km)
Fuel Consumptions Filtered (under 100l/100km)
Fuel Consumptions Filtered (under 100l/100km)
Spearman Correlations with Speed

- road properties
- weather
- truck
- misc
Spearman Correlations with Fuel Consumption

- road properties
- weather
- truck
- misc
Discussion

• CAN bus data has good temporal coverage, but low measurement accuracy of distance and fuel consumption
• Average speed and fuel consumption in line with previous studies
• Weight data lacking time of loading and unloading time not exact
• Weather data averaged
• Modeling lacking explanatory variables which could explain peak fuel consumptions
Conclusions

• Pros and cons compared with traditional time studies
• More focus to explain extremely high fuel consumptions
• Better temporal resolution for weather data needed
Thank you!