

TRAFFIC ABILITY OF HEAVY VEHICLES ON AN INCLINE

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0. CONTENT

1. Introduction

2. Study area

3. Experiment design

4. Results

5. Conclusions

1. INTRODUCTION

- Traffic ability for heavy vehicles in steep hills is of great concern in Norway due to the geography with many mountain passes and inclines
- Vehicles stopping in the roadway are a big problem on many roads in the winter time
- This is why the Norwegian Public Roads Administration has carried out a project to start looking into what factors influence on the ability for trucks to keep moving also under poor driving conditions on an incline in the winter time



2. Study area



3. Experiment design

Four vehicles with different axle configurations were used in the experiments:

- A. Bogie truck with 3-axled trailer
- B. Semi-trailer with bogie and 3-axled trailer
- C. Semi-trailer without bogie, and 3-axled trailer
- D. Pusher truck with bogie and 3-axled trailer



All vehicles were equipped with a GPS unit that was set up to log position twice a second, giving a detailed speed profile

3. Experiment design



3. Experiment design

The experiments included the following configurations for vehicle 1-3:

- Vehicle and trailer without cargo
- 10 tons cargo
- 20 tons cargo
- With and without use of bogie (vehicle 1 and 2)



3. Experiment design

Tires tested on truck C



Shore value: 72



Shore value: 64



3. Experiment design

Loading trucks

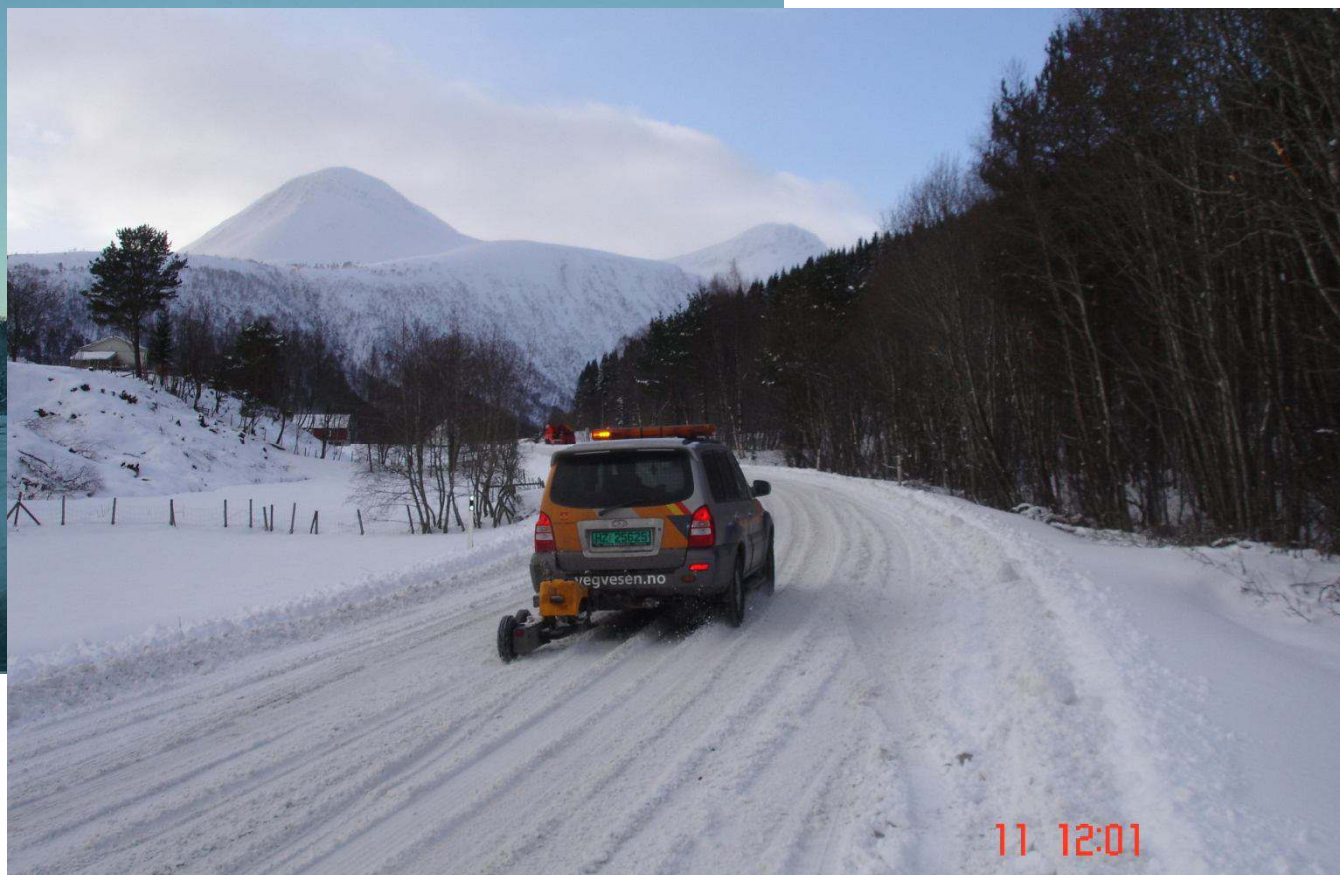


Weighing procedures



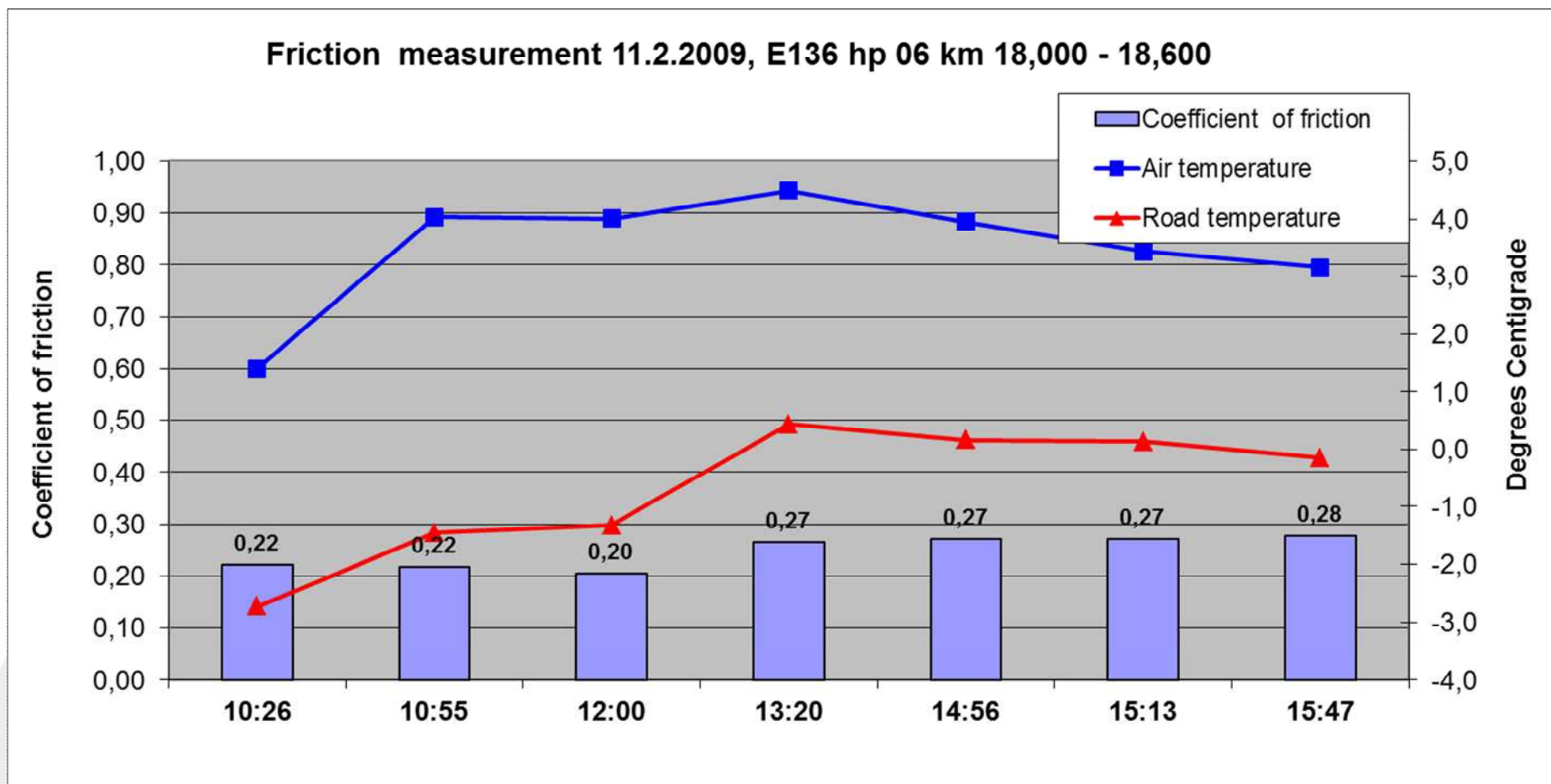
3. Experiment design

Starting point of the test road section



Friction trailer

4. Results



4. Results

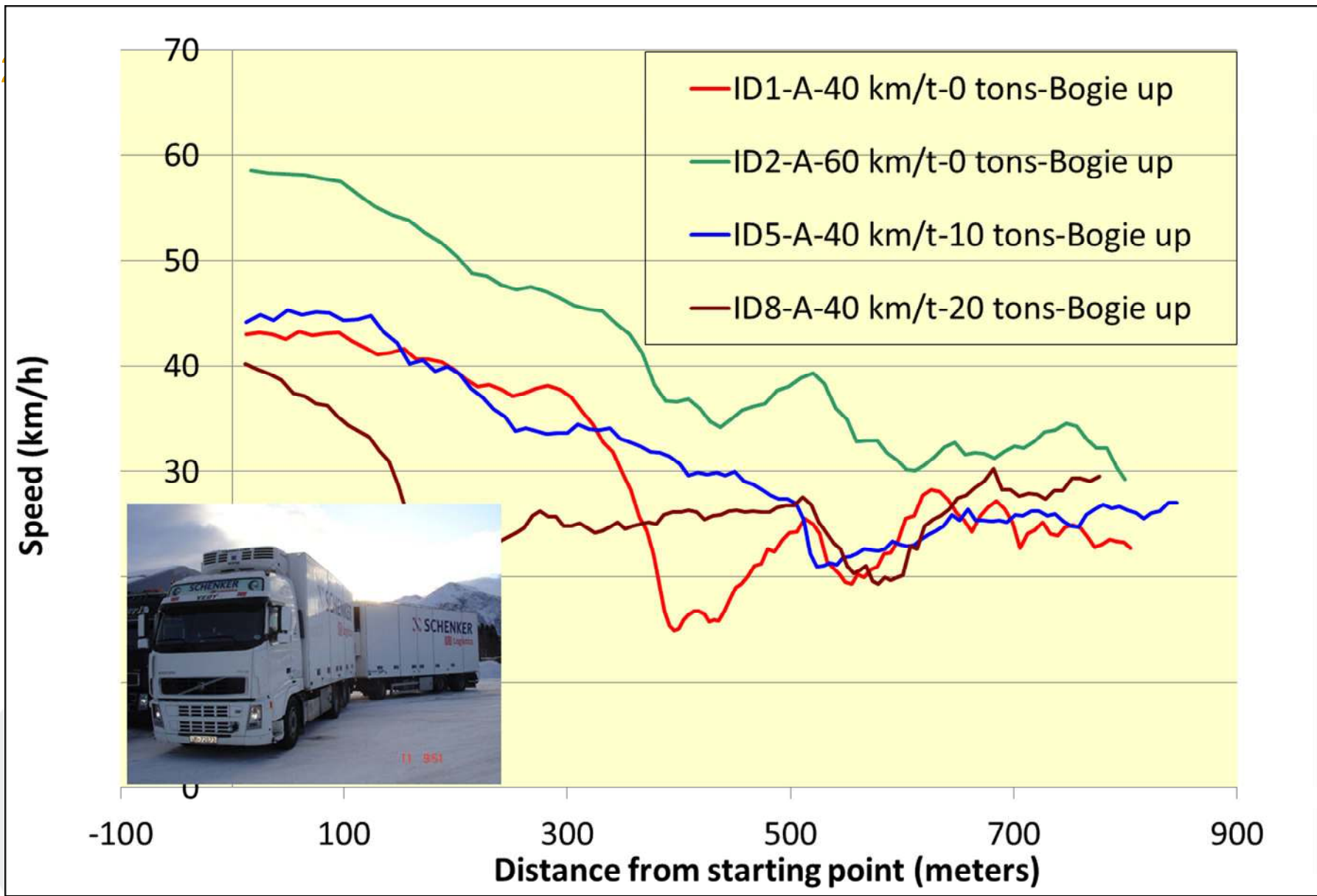


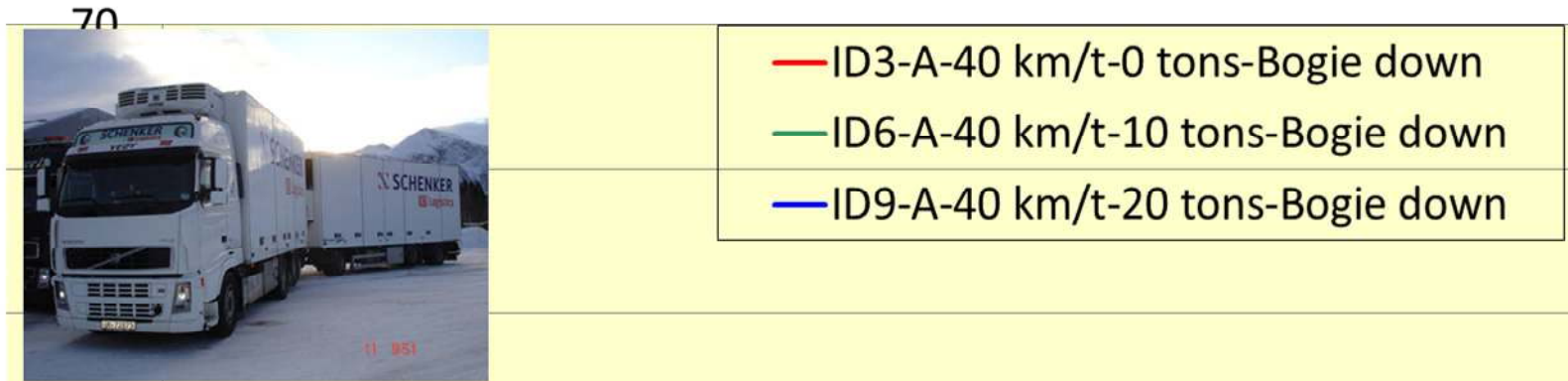
4. Results



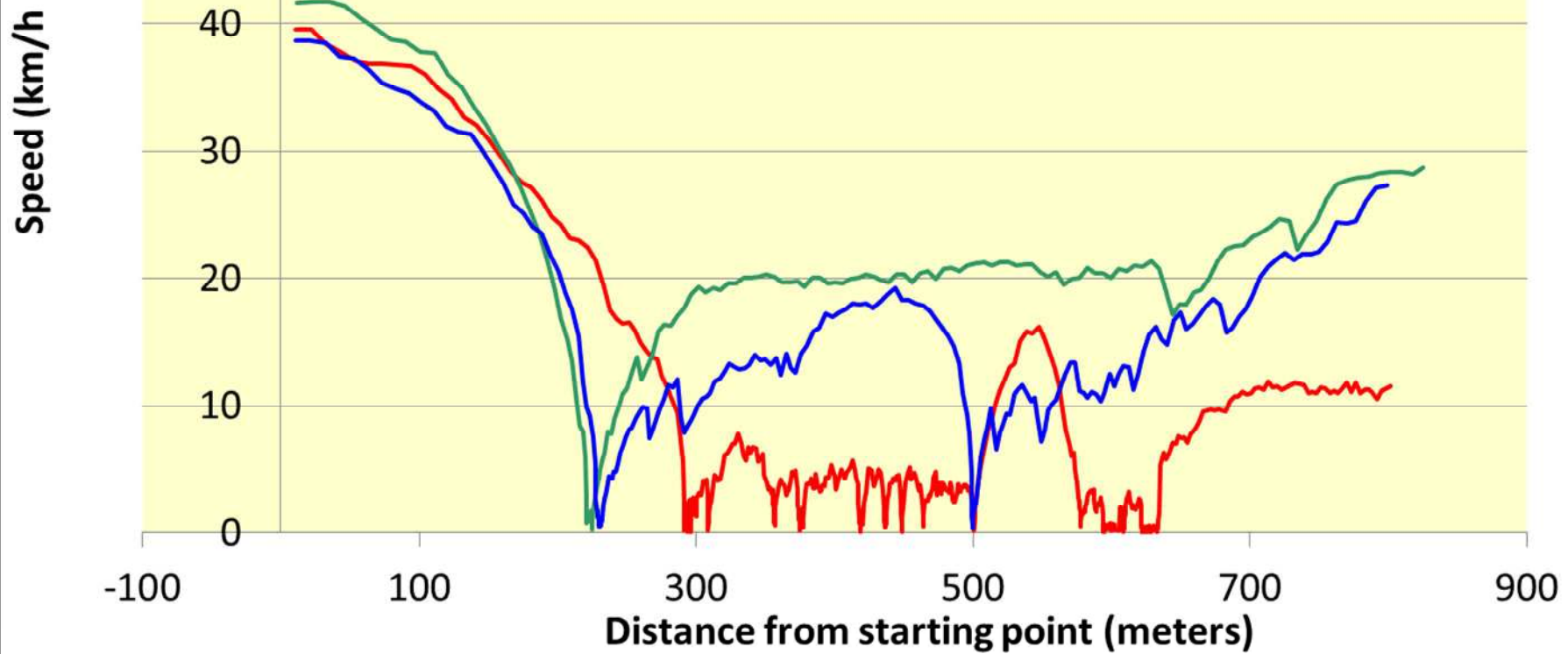
4. Results

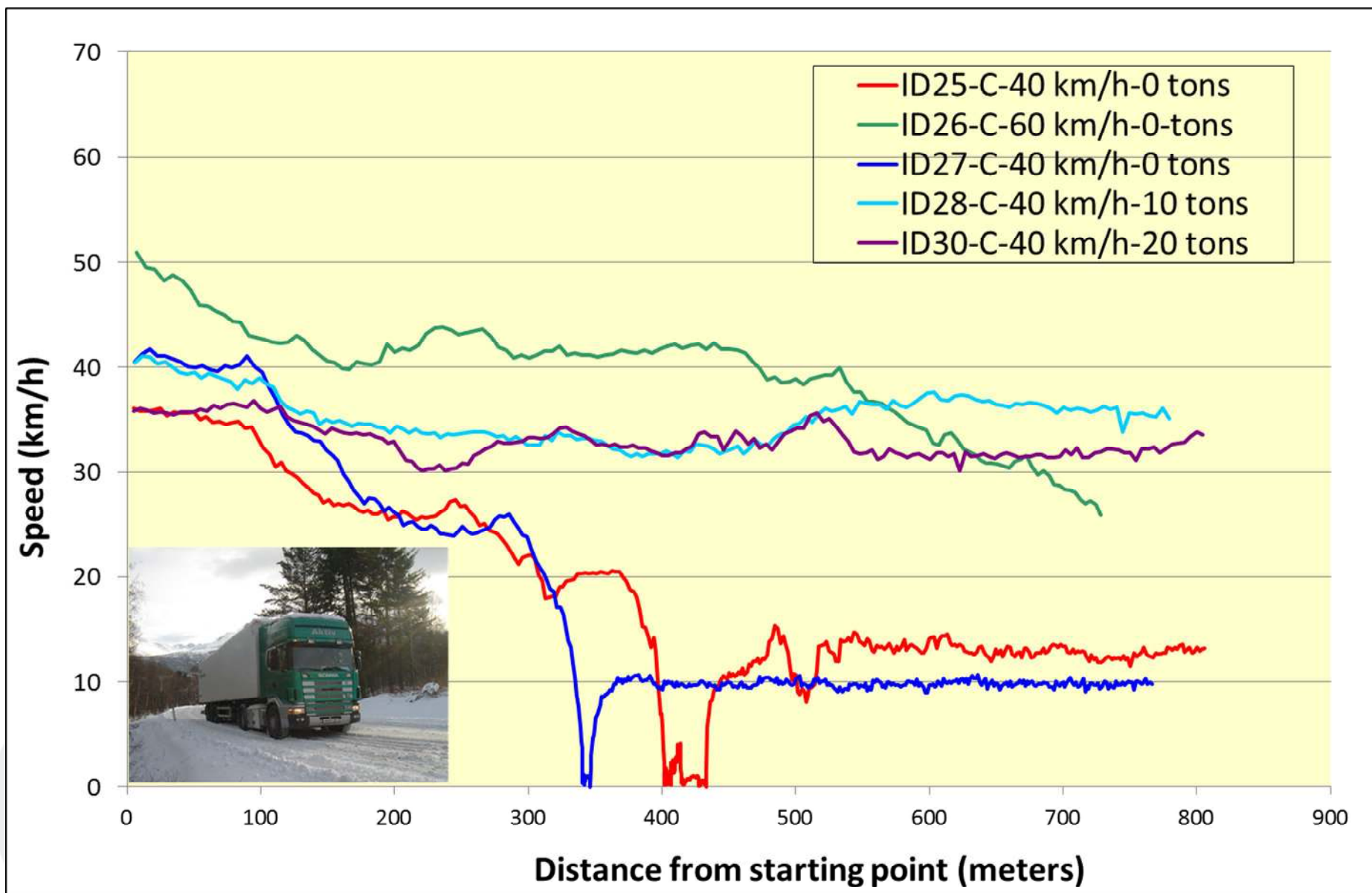






- ID3-A-40 km/t-0 tons-Bogie down
- ID6-A-40 km/t-10 tons-Bogie down
- ID9-A-40 km/t-20 tons-Bogie down





5. Results

Trucks with bogie



With the bogie up, there were no significant problems to drive without stopping, and the amount of load had no significant impact on accessibility

With the bogie down both vehicles stopped in the rise regardless of whether it was loaded with cargo or not

For trucks with bogies the car with the lowest engine power had greater problems than the truck with the highest engine power in that respect that the stoppage generally occurred further down in the rise to the vehicle with the weakest engine

4. Results

Trucks with bogie, after stopping

With no load, it did not help to raise the bogie and both trucks with bogie needed towing assistance to get up the incline

With both 10 and 20 tons of cargo it was sufficient to raise the bogie to start up after stopping



4. Results



Semi-trailer without bogie

With no load and a starting speed of 40 km/h the truck without bogie did not manage to drive up the rise without stopping. 50 km/h was sufficient to drive up the rise without stopping

The truck without bogie had no problems up the hill with 10 and 20 tons of cargo

With hard tires (shore value of 72), truck C had problems with starting up again after a provoked stop

2. Conclusions

The results show that the weight on the drive wheels has significant and decisive impact on the ability to drive up a steep hill

The experiments also demonstrate quite clearly that there can be a great advantage to have a bogie on the tractor

With bogie lifted one increases the weight on the drive wheels substantially, and thus achieve significantly better traction

Often there will be advantageous to increase the axle pressure beyond the 10 tons which is the permissible limit

2. Conclusions

The experiments show that the tire choice could affect the vehicle's traction characteristics

Hard tires have poorer performance than regular tires

Although it was made few runs with the hard tires, it was shown that tire choice had an impact on whether the driver managed to take off after the imposed stop on the rise

It also appears that a friction of 0.25 is sufficient to reduce the problems with the hard tires in relation to traffic flow on slopes

2. Conclusions

Factors influencing on the traffic ability for heavy vehicles on an incline:

- Driving conditions and friction level
- Speed
- Weight on driving wheels
- Axel configuration, with or without bogie
- Type of tire
- Engine power

Thank you for your attention



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