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TECHNOLOGIECAMPUS GENT

Maximum assistance factor of four for speed pedelecs?

Bram Rotthier

Eurobike

31st August 2017

Speed pedelec research @ KU Leuven

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PhD research

Quantification of technical performances, cyclist experience and safety of speed pedelecs for commuter use

- *Technical properties*
- *Legislation*
- *Behaviour*
- *Safety*
- *Potential*
- *Barriers*

KU Leuven, technology campus Ghent

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Speed pedelecs & maximum assistance factor

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Speed pedelec

- Electric two-wheeler
- Pedal assistance up to 45 km/h
- Typical maximum continuous rated motor power of 350 W or 500 W

European legislation

Technical requirements, driver's licences…

Local legislation

Traffic code, education…

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∈ L1e-B category

Local legislation

Traffic code, education…

Belgium: dedicated speed pedelec category

European classification of light two-wheel powered vehicles

- Exempt from type approval
  traditional electric bicycles, vehicles primarily intended for off-road use and designed to travel on unpaved surfaces…

- L1e: Light two-wheel powered vehicles
  - L1e-A: Powered cycles

    Primary aim to aid pedalling, ≤ 25 km/h, ≤ 1000 W

  - L1e-B: Two-wheel moped

    ≤ 45 km/h, ≤ 4000 W
    - Cycles designed to pedal

    → ≤ 35 kg, adjustable rider positioning, maximum assistance factor of 4…

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🡐 Speed pedelec

Definition of *"cycle designed to pedal"*

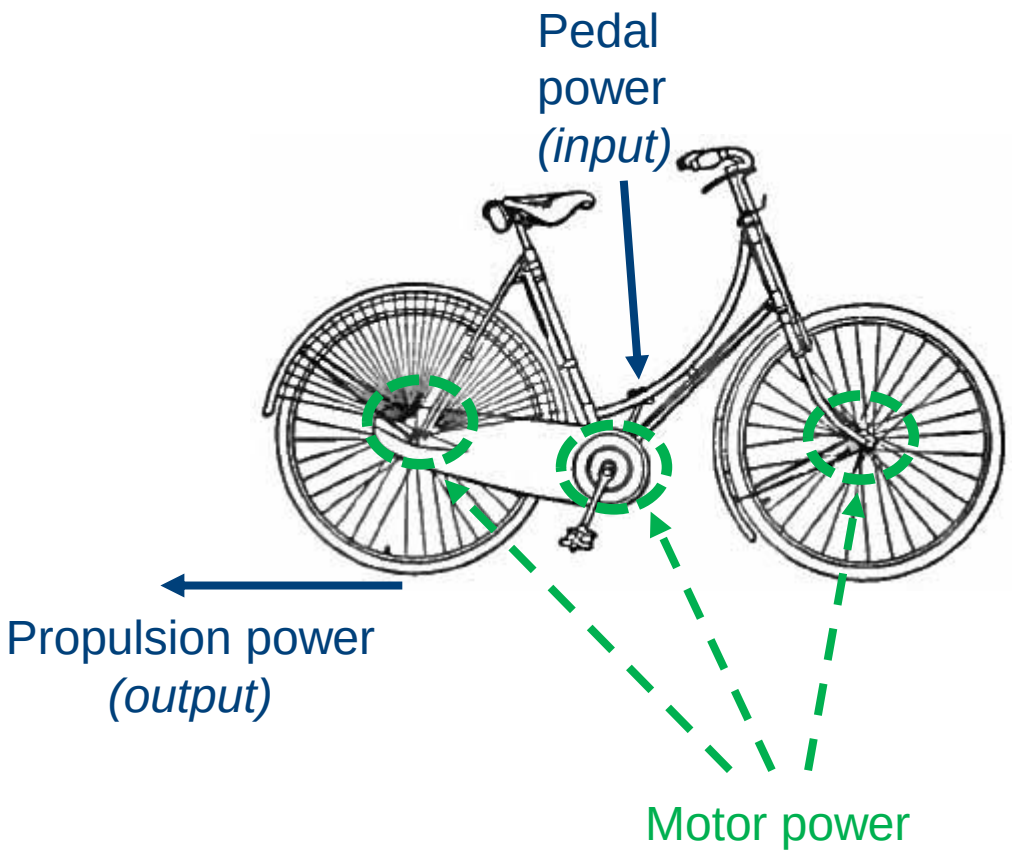
RVFSR, Annex XIX*

Requirements regarding vehicle structure integrity

1.1.2. Cycles designed to pedal of vehicle category L1e-B shall have a mass in running order ***≤ 35 kg*** *and shall be fitted with* ***pedals*** *enabling the vehicle to be propelled solely by the rider's muscular leg power. The vehicle shall feature* ***adjustable rider positioning*** *in order to enhance the ergonomic posture of the rider for pedalling. The auxiliary propulsion power shall be added to the* ***driver's pedal power*** *and shall be less than or equal to* ***four times the actual pedal power****.*

**COMMISSION DELEGATED REGULATION (EU) No 3/2014*

Maximum assistance factor *(MAF)*



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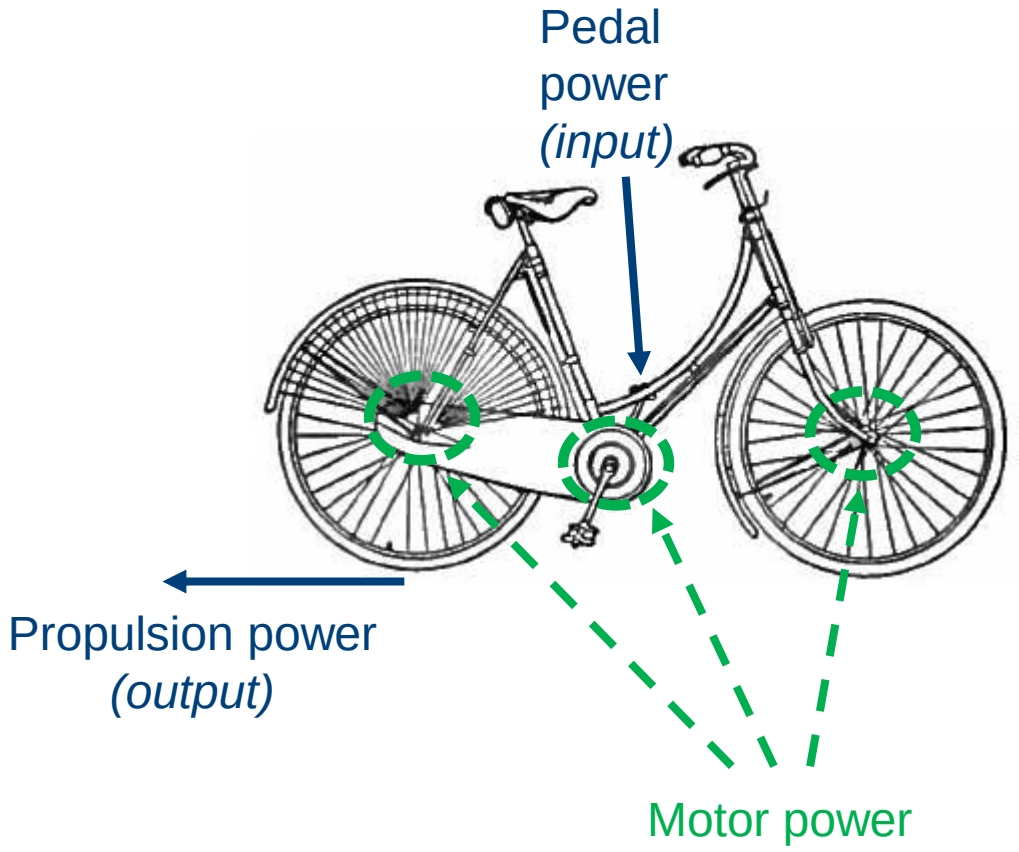

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$$\approx \frac{motor\ power}{pedal\ power}$$

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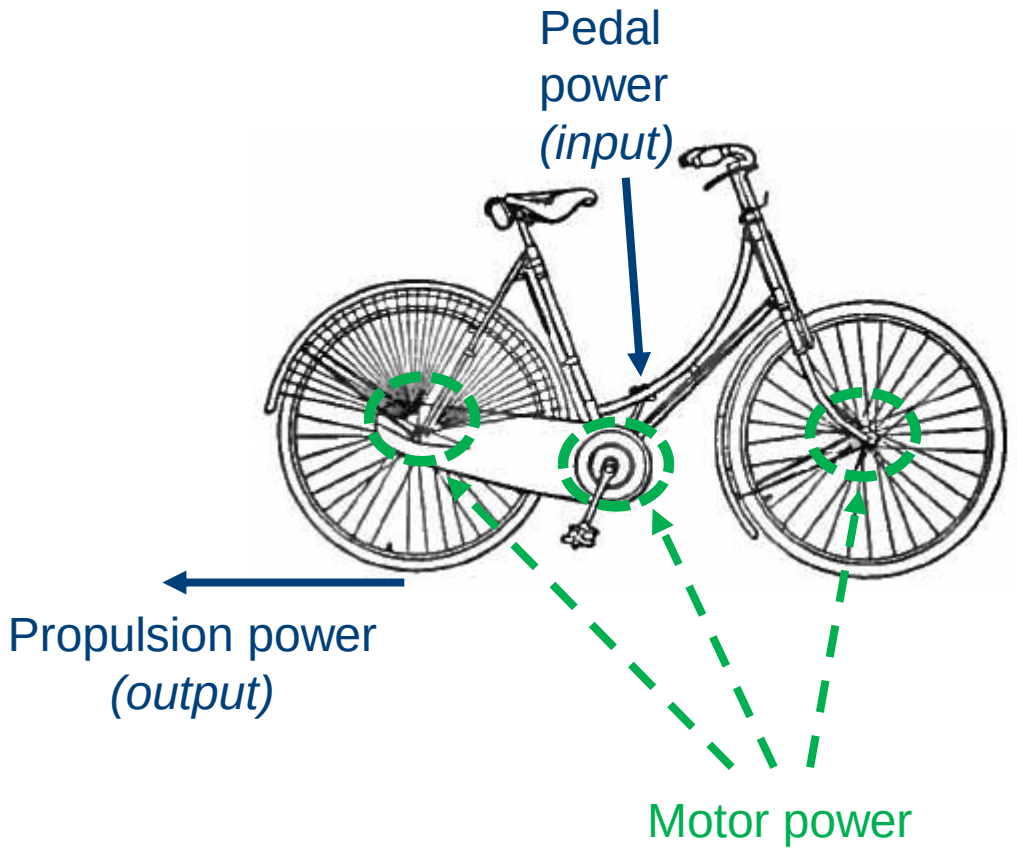

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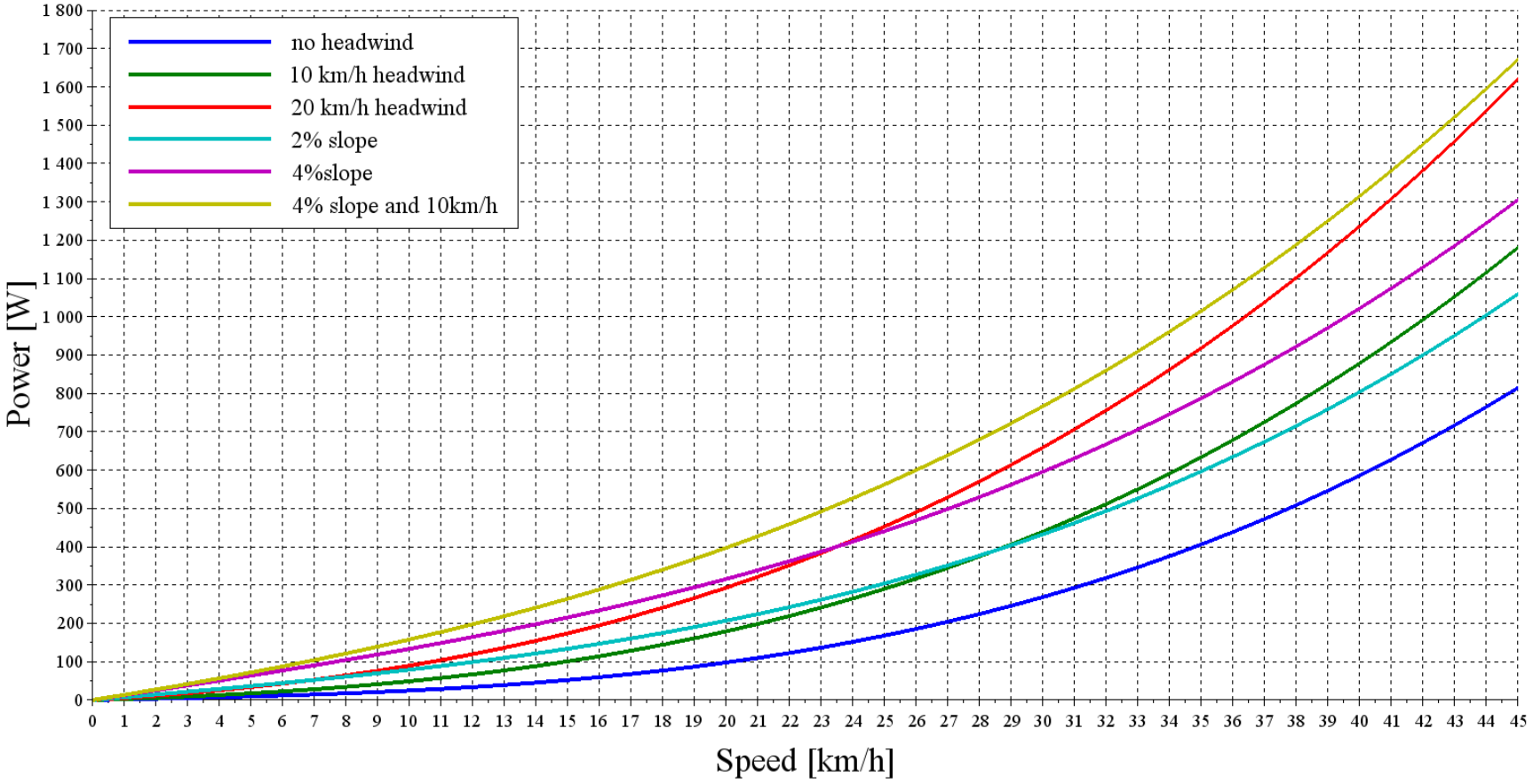
Maximum assistance factor (MAF)
→ maximum measured in 3 operation points:

Point of operation	Simulated rider input power (+/– 10 %) in (W)	Target vehicle speed (i) (+/– 10 %) in (km/h)	Desired pedalling cadence (ii) in (rpm)
A	80	20	60
B	120	35	70
C	160	40	80

Commission delegated regulation (EU) No 134/2014

Propulsion power ⇔ vehicle speed



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Assistance factor ⇔ vehicle speed

Pedal power	Assistance factor	No wind, no slope
100 W	4	38 km/h

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150 W	6	45 km/h	43 km/h	40 km/h

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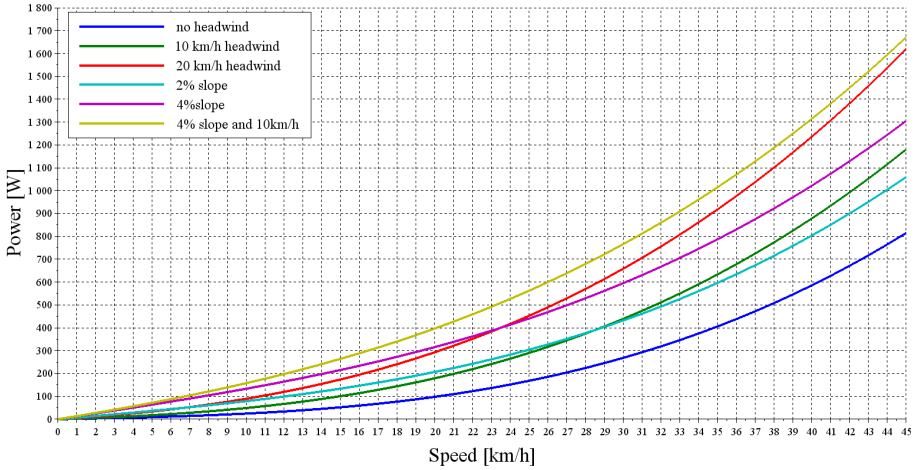

- Preliminary results of a survey among Flemish speed pedelec users indicate that punctuality is very important.
- The limitation of the maximum assistance factor makes the speed pedelec more sensitive to environmental factors.
- Only stronger riders will reach the expected maximum assistance speed of 45 km/h.

MAF ⇔ testing procedure

Operation points to test the maximum assistance factor

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(i) If the target vehicle speed cannot be reached, the measurement shall be performed at the maximum vehicle speed reached
(ii) select gear closest to required rpm rate for the point of operation

Source: *Commission delegated regulation* (EU) No 134/2014

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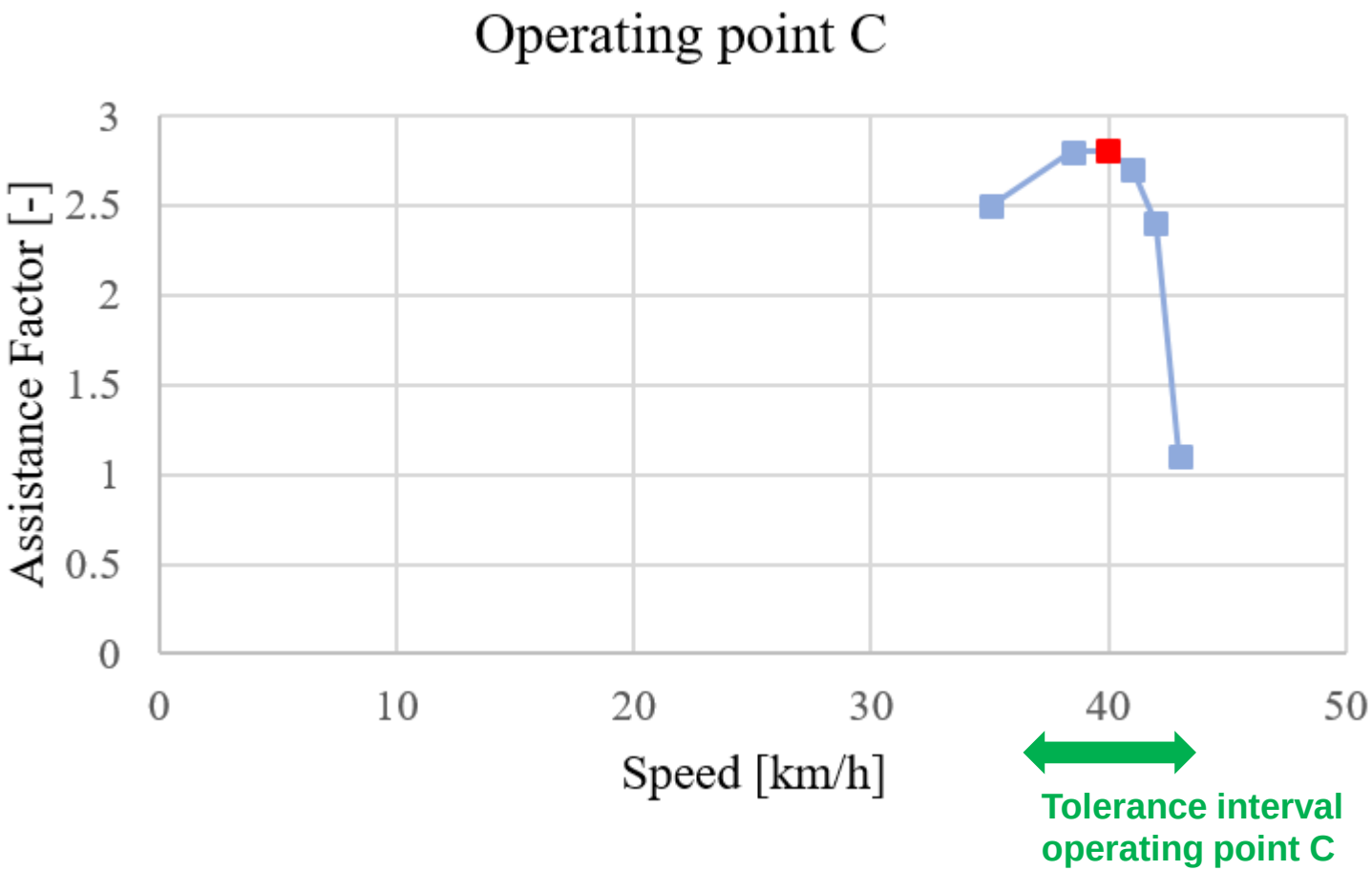

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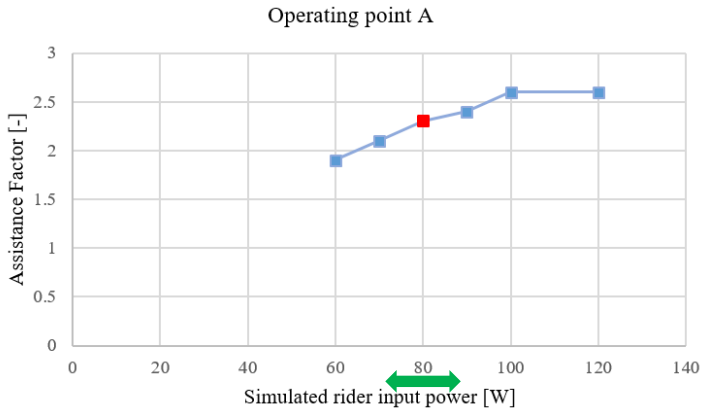
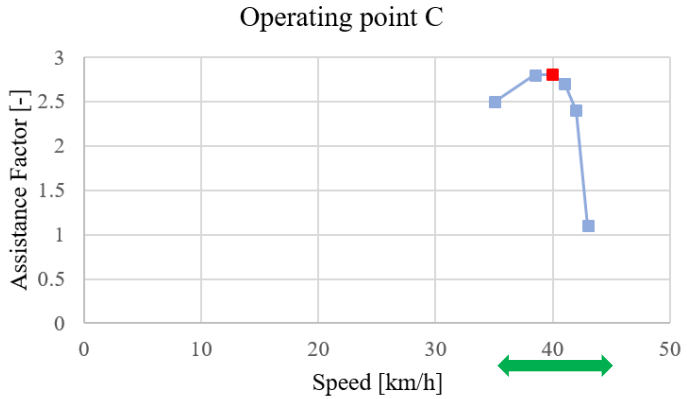
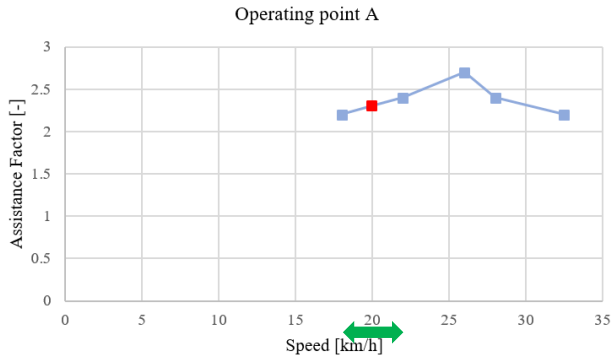
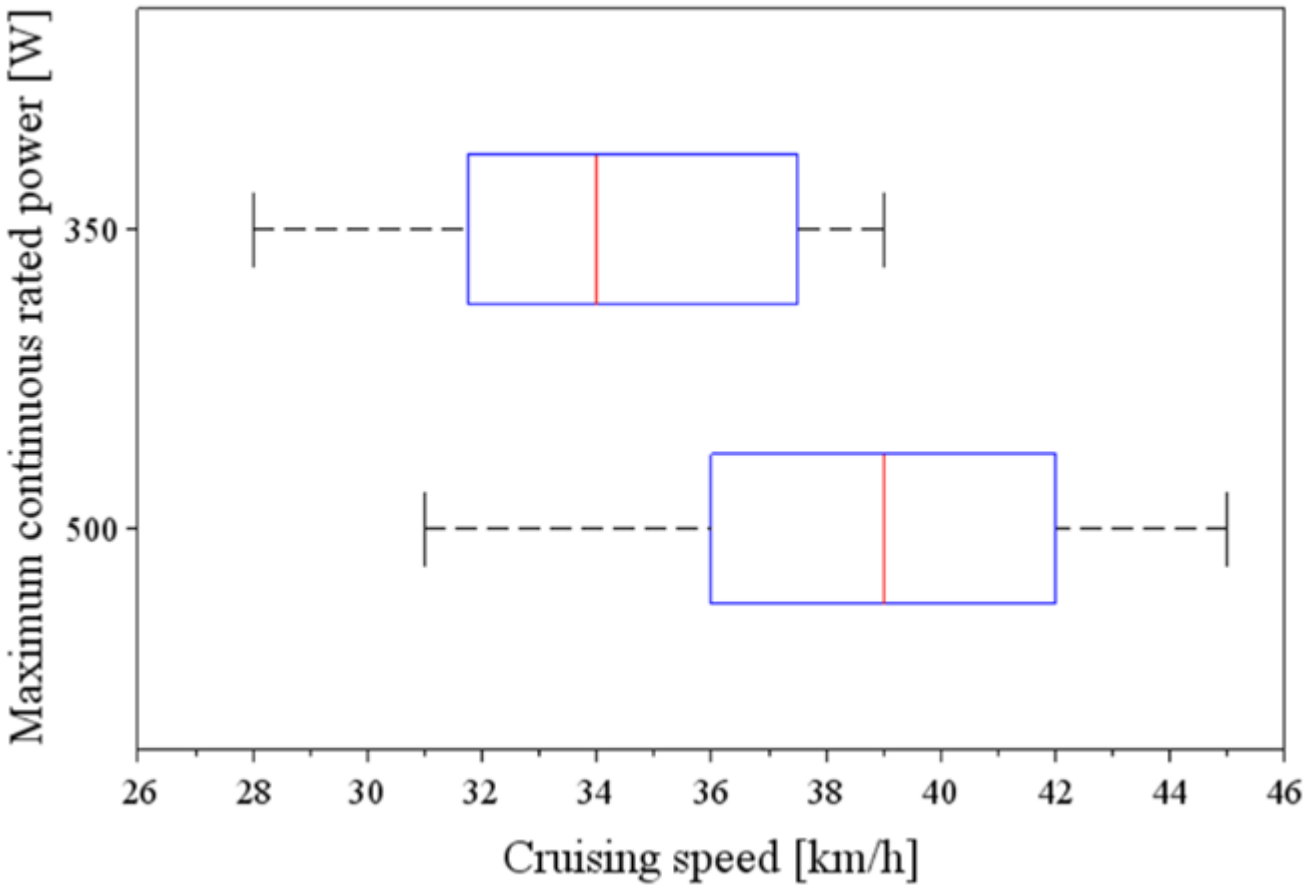






- The testing procedure only measures the maximum assistance factor in 3 predefined operating points.
- The tolerances in the official testing method allow for deliberately choosing the lowest value in a certain interval.

MAF ⇔ Current speed pedelec assistance factors



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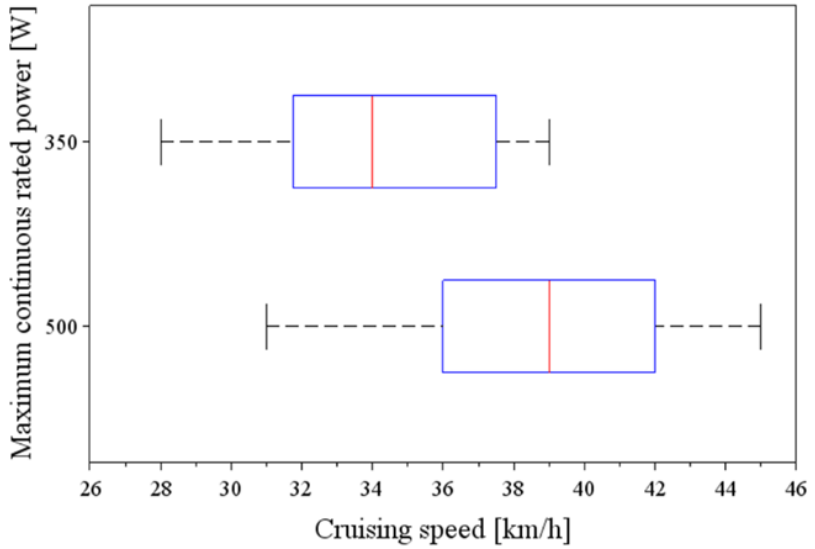

- Measurement of cruising speed of speed pedelec users suggest that cycles with assistance factors higher than four are commercially available.

- This is legally possible since there was no limitation of the maximum assistance factor for vehicles type approved in accordance with directive 2002/24/EC.

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- Smooth control of the motor power seems to be more important

Speed pedelecs that do not comply with factor 4?

- Can still be type-approved as a L1e-B vehicle (if it complies with the L1e-B classification criteria), but not as a *cycle designed to pedal*

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- Can still be type-approved as a L1e-B vehicle (if it complies with the L1e-B classification criteria), but not as a *cycle designed to pedal*

- Thus these vehicles:
  - Do not have to comply with tests for forks and frames as stipulated in ISO 4210:2014*
  - Are subject to electric range test§

**Commission delegated regulation (EU) No 3/2014*

§ *Commission delegated regulation (EU) No 134/2014*

Future

*"The limitation to 'four' of the ratio of auxiliary propulsion power and actual pedal power for cycles designed to pedal set out in Annex XIX should be subject to further scientific research and assessment. Upon availability of scientific data and statistics on vehicles placed on the market, the ratio 'four' referred to above may be revisited in a future revision of this Regulation."**

** Commission delegated regulation (EU) No 3/2014*

Conclusion

- The maximum assistance factor of four:
  - Is causing slower and more fickle speed pedelecs
  - Is discriminating weaker riders
  - The testing procedure allows for deliberately choosing a lower value in the tolerance interval
  - Speed measurements indicate that currently speed pedelecs with higher assistance factors are available (and are not causing safety issues)
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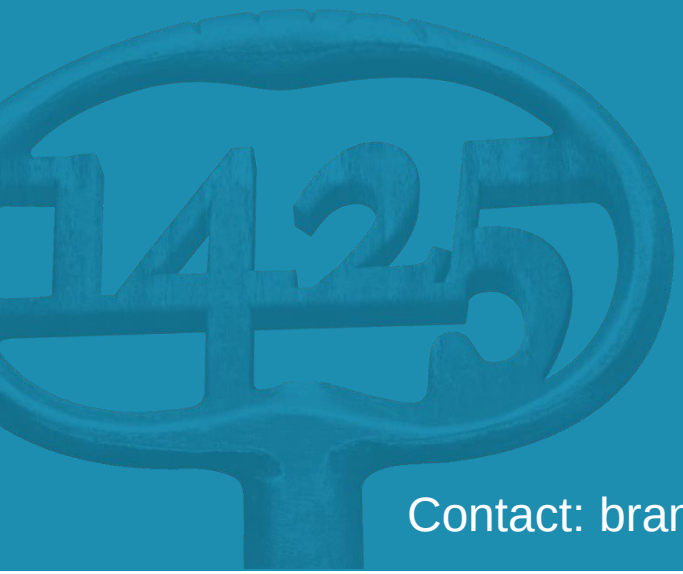
- The EU Commission may revise this limitation in a future revision of the type approval legislation.



Thank you for your attention!

Questions, suggestions or remarks?

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