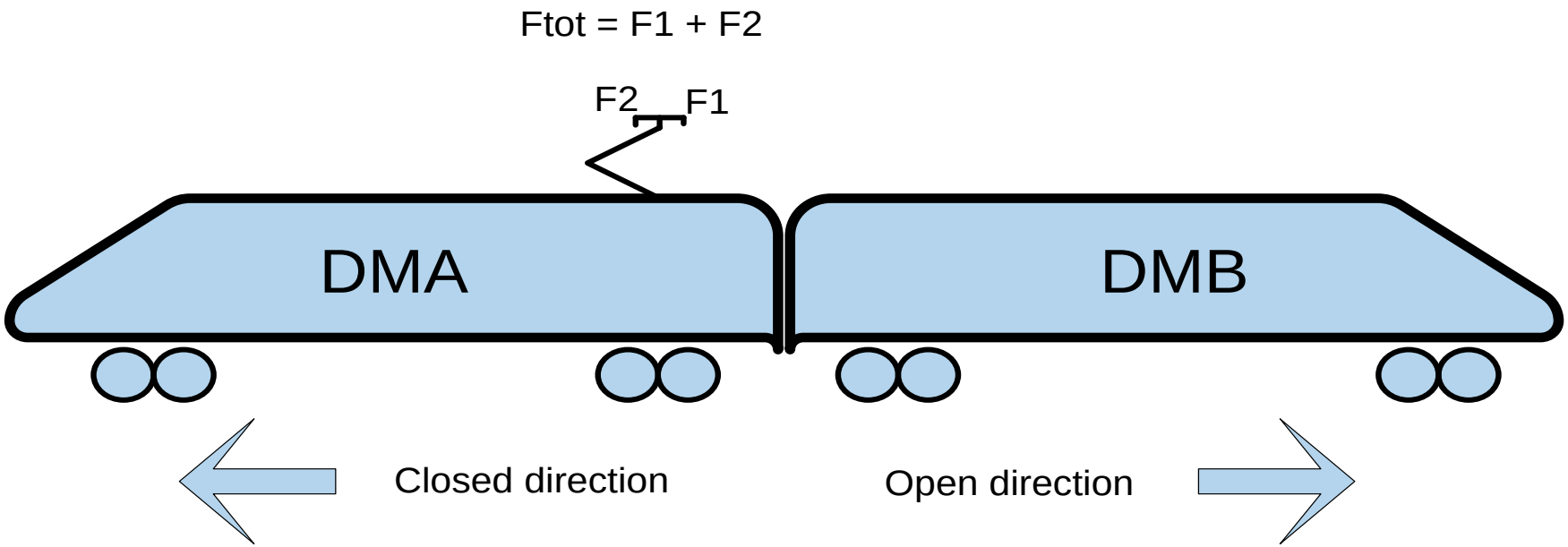
Current collection on existing catenary systems

Reflections from Green Train tests

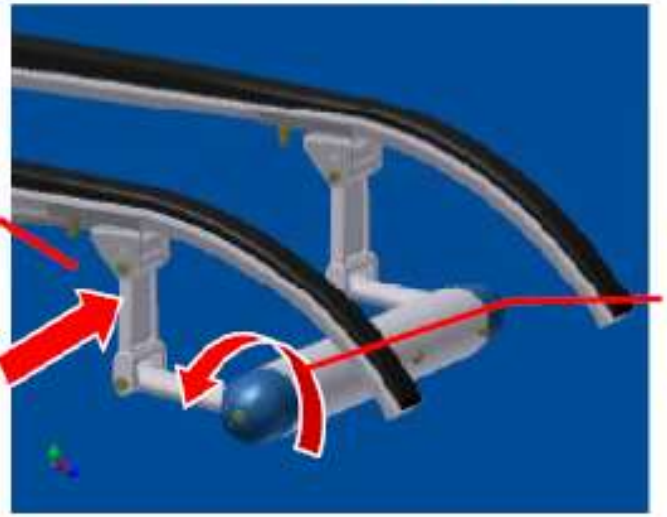
Tohmmy Bustad, Trafikverket

The Green train “test train” and where the pantograph was fixed on the train



During the tests Schunk WBL88 pantograph with **SSS400 pantograph head** was used

- Light
- Suspension system: light and long strokes

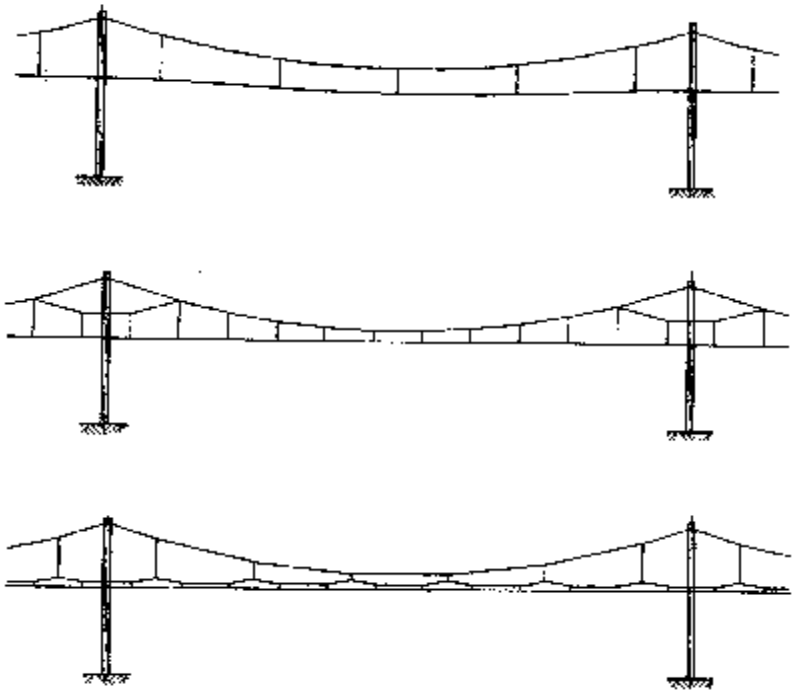


Aerodynamic influence to pan head suspension is eliminated by separation of wind pressure direction and working direction of suspension

Catenary systems used in Sweden

Catenary systems

- ST 7.0/ 9.8 (180 km/h)
- ST 9.8/11.8 (200 km/h)
- ST 15/15 (250 km/h)
- SYT 7.0/9.8 (200 km/h)
- SYT 15/ 15 (250 km/)



Force and uplift levels used for quality assessment of current collection

(BVF 543.33 - EN 50317)

Uplift forces: Pantograph and contact wire

- Max average uplift force at permissible speed (sth): Max $F_{med} \leq 110$ N
- Min average uplift force at permissible speed (sth): : Min $F_{med} \geq 50$ N
- Max uplift force at permissible speed (sth): $F_{max} = F_{med} + 3*\sigma < 200$ N
- Min uplift force permissible speed (sth): $F_{min} = F_{med} - 3*\sigma > 0$ N

Uplift at the stady arm:

U < 120 mm

Permitted force difference between front and rear contact strip (F_1 , F_2):

$0{,}8 \leq F_1/F_2 \leq 1{,}2$

General reflections from the tests (1)

- Despite of speed and catenary system, we always were within the allowed uplift force levels.

- Compared to corresponding high-speed test we did in 1993 with an X2-train between Skövde and Töreboda, we managed to reach 303 km/h on a "soft" catenary system and still be within allowed levels.
  In 1993 problems started already at 240 - 250 km/h.

General reflections from the tests (2)

- The reason why we managed to reach such speed with the test train is probably because of the new high-speed pantograph head (SSS 400)

- Much lighter and not so wind sensitive because of the suspension design compared to the head we used in 1993.

General reflections from the tests (3)

In general we could see uplift forces (average and standard deviations) differ depending on the direction of travel and catenary systems. Not much, but it is notable

- Open knee direction:
  - Higher uplift forces, both average and standard deviations
  - Higher probability for single high peak forces.

- Between Catenary systems
  - "Soft" systems (SYT 7,0/9.8), higher standard deviations levels than our new "rigid" systems.
  - New "rigid" systems" (ST15/15),higher average uplift force

Recommendations based from the tests

Conclusion

For single pantograph with a very light and wind insensitive pantograph head, it is possible to increase the speed even on our existing catenary systems.

It is possible but not a recommendation !

Recommendation could instead be:

For our existing high-speed trains (sth: 200 km/h) it would be an advantage if a very light and wind insensitive pantograph head was used. It would probably increase the reliability and decrease the number of pantograph and catenary demolitions.

Remaining questions to solve

All questions are not solved.
One remaining **big question to solve** is
multiple pantographs with short distances.
For the Green Train concept it is possible to use up to three pantographs with a distance of 100m between them.

And my last words will be:

Thank You for your attention !