CITA WG1 Safety Systems
Bratislava, 7th of April 2020, teleconference

RBT data analysis (supervision)

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How we started

Two necessary sources for RBT analysis:

- **RBT data** (complete)
- **video**

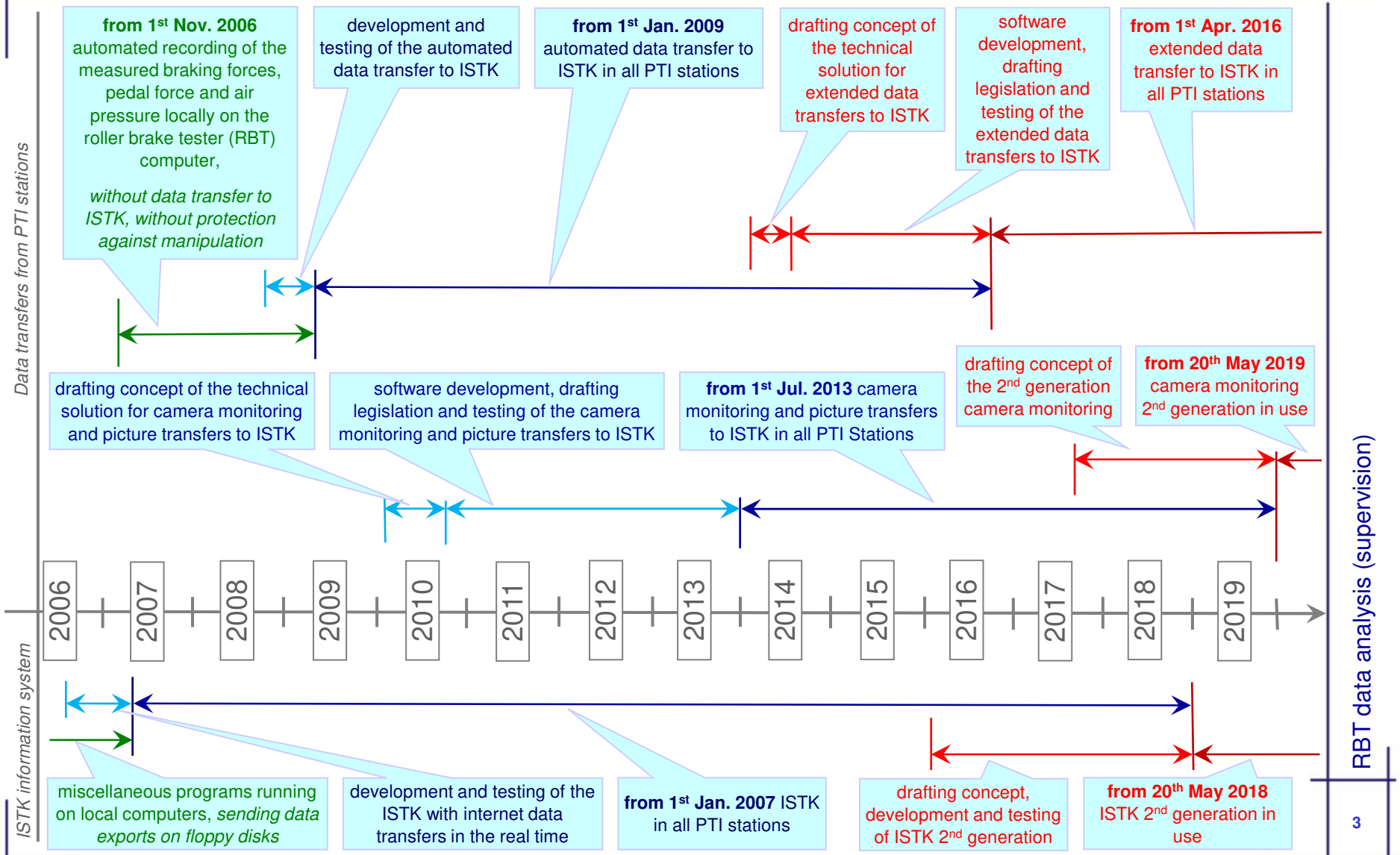
  + central **information system** for data exchange

First analyses done in autumn 2017 for supervision done by MoT.

Since 1th of January 2019 supervision also conducted by TESTEK, a.s.

Short history of IT solution for PTI centers, MoT and other state authorities.

Why data analysis? We have been developing the IT infrastructure for efficient PTI supervision since 2006

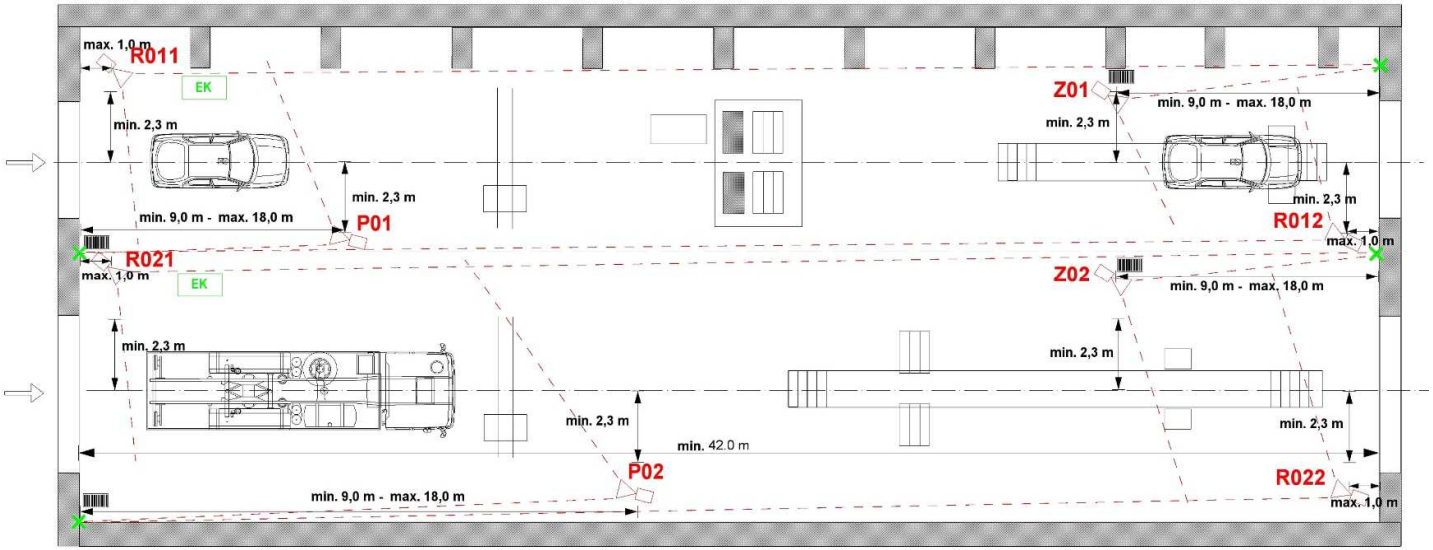


CCTV cameras

since 2018: first version of cameras (less sophisticated) since **2013**

- **entry** and **exit** cameras (with automated recognition of licence plate)
- **two overview** cameras (mandatory to cover 100 % of the PTI line)
  - example: **two** (and more) lines PTI station

Note: overview camera R01 and R021 mutual for PTI and emission check



R011, R012, R021, R021 – overview cameras
P01, Z01, P02, Z02 – entry and exit cameras

CCTV cameras

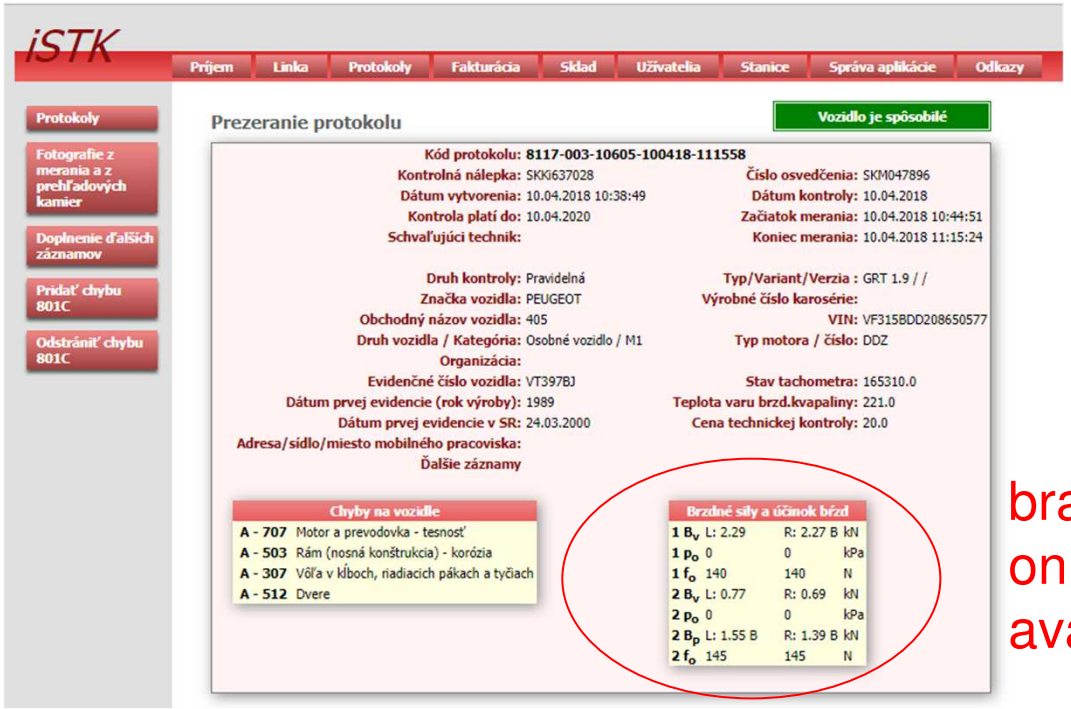
since 2018:

- **pictures** from entry and exit cameras automatically **transferred** to the PTI administration system + in every 2 minutes a picture from both overview cameras – pictures stored for 20 years
- **video footage** from the inspection **stored** locally on hard disk for 2 years
- video footage **accessible** for supervision authorities - locally but also via **remote** administration
- video footage **done** by overview cameras (both) plus video footage of entry and exit cameras

The whole inspection process is covered by cameras (a necessary condition if the supervision should be done by video analysis).

Information system

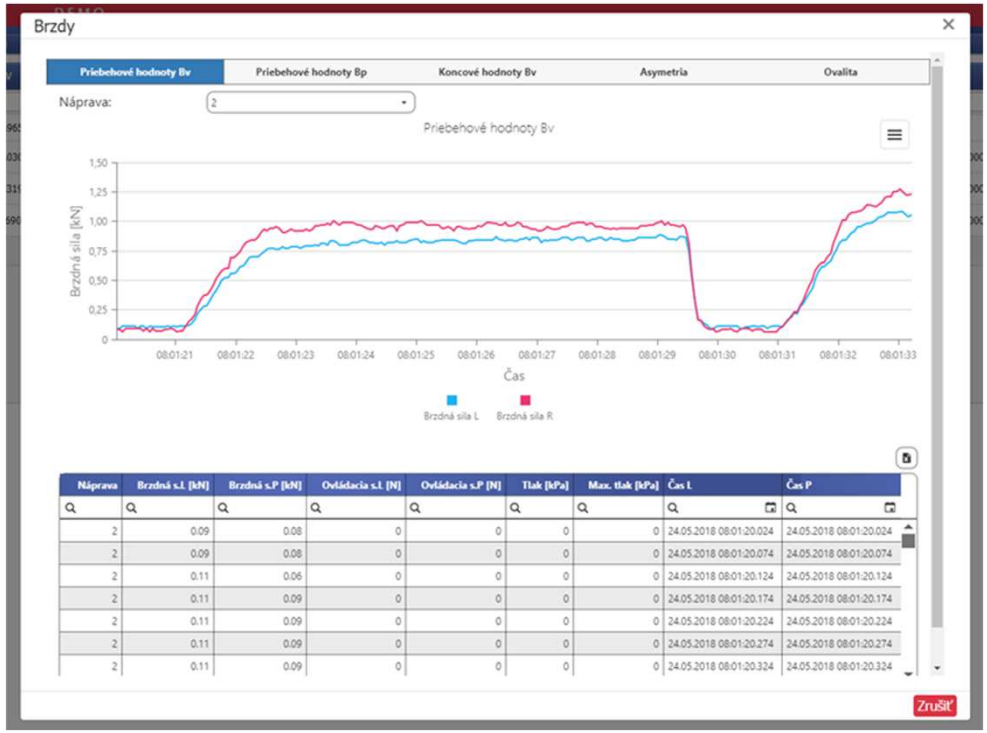
AIS TK – information system for PTI stations and supervision authorities (old version) – since January 2009 **automated recording and data transfer** of measured breaking force, pedal force and air pressure



braking data – only **final** values available (to 2016)

Information system

CIS TK – since February 2016 **extended data transfer**, since **June 2018** new information system for PTI stations and supervision authorities



braking data – **final** values plus **intermediate** values

Information system

CIS TK – since February 2016 **extended data transfer**

Scope of transferred data:

- values of **brake force** and **pedal force** (hydraulic systems) or **air pressure** (pneumatic systems) from the whole **service brake** test measurement (at least 30 seconds) recorded with sampling frequency 10 Hz
- values of **brake force** from the whole **parking brake** test measurement (at least 5 seconds) recorded with sampling frequency 10 Hz
- information about the reaching of **wheel lock** during measurement (for service brake and for parking brake)
- brake force **fluctuation** (ovality, for service brake only)
- **passive resistance** value – self inflicted braking effect without any activation of the brake pedal
- **maximum difference** between the brake force on left and right side of the axle (i.e. continuous **unbalance** - asymmetry)
- **difference** between the brake force on left and right side of the axle **at the maximum brake forces measured** (i.e. final **unbalance** asymmetry)

Video analysis

Methods of manipulation on RBT (since 11/2017):

- braking with **another** axle (usually front axle instead of rear axle /more frequent deficiencies on rear axles/)
- braking with **axle** which is **most loaded** (usually front, vehicles unloaded – mandatory in Slovakia)
- braking with **different** vehicle
- braking with **reverse** gear
- braking **parking brake** with operational brake
- braking **only** in the scope of suitable data (measuring and transferring only the suitable part of data measurement - omitting some parts of intermediate values - new methods as a result of uncovering and detecting the previous one)
- **specific forms** of influencing the brake measurement outcome (braking with foot, reaching of wheel lock manually (foot), spraying the brake discs with different substances, etc.)

Video analysis

Data **recorded** and **transferred** from roller brake tester:

the beginning and end of the rear axle (service brake) measurement: 09:53:29 to 9:53:39 AM

starting point of measurement (Timestamp)

AxleNumber	ns1:Fb_L	ns1:Fb_R	ns1:PercentageAsymmetry	ns1:Fo_L	ns1:Fo_R	ns1:Pb	ns1:PbMax	ns1:Timestamp_L	ns1:Timestamp_R
2	0,13	0,16		0	0			2017-10-25T09:53:29.628	2017-10-25T09:53:29.628
2	0,14	0,15		0	0			2017-10-25T09:53:29.678	2017-10-25T09:53:29.678
2	0,12	0,16		0	0			2017-10-25T09:53:29.728	2017-10-25T09:53:29.728
AxleNumber	ns1:Fb_L	ns1:Fb_R	ns1:PercentageAsymmetry	ns1:Fo_L	ns1:Fo_R	ns1:Pb	ns1:PbMax	ns1:Timestamp_L	ns1:Timestamp_R
2	1,19	1,02		185	185			2017-10-25T09:53:39.778	2017-10-25T09:53:39.778
2	1,2	1		185	185			2017-10-25T09:53:39.828	2017-10-25T09:53:39.828
2	1,21	0,99		180	180			2017-10-25T09:53:39.878	2017-10-25T09:53:39.878

ending point of measurement (Timestamp)

During the measurement of rear axle **in roller brake tester front axle**!

Video analysis

Data **recorded** and **transferred** from roller brake tester:

the beginning and end of the front axle measurement (vehicle SKODA): 10:23:27 to 10:23:33 AM

AxleNumber	ns1:Fb_L	ns1:Fb_R	ns1:PercentageAsymmetry	ns1:Fo_L	ns1:Fo_R	ns1:Pb	ns1:PbMax	ns1:Timestamp_L	ns1:Timestamp_R
1	1,07	1,11		75	75			2018-04-18T10:23:27.024	2018-04-18T10:23:27.024
1	1,13	1,17		75	75			2018-04-18T10:23:27.074	2018-04-18T10:23:27.074
1	1,16	1,25		75	75			2018-04-18T10:23:27.124	2018-04-18T10:23:27.124
1	2,31	2,51		95	95			2018-04-18T10:23:33.474	2018-04-18T10:23:33.474
1	2,48	2,61		95	95			2018-04-18T10:23:33.524	2018-04-18T10:23:33.524
1		2,611							2018-04-18T10:23:33.574

During the measurement of the front axle on **vehicle ŠKODA in roller brake tester front** axle of **vehicle KIA!**

Video analysis

Data **recorded** and **transferred** from roller brake tester:

Manipulative measurement of truck and trailer: vehicle <u>not loaded</u>

During the measurement of six axles of truck and trailer **in roller brake tester <u>permanently</u> front** axle of truck!

Video analysis

Data **recorded** and **transferred** from roller brake tester:

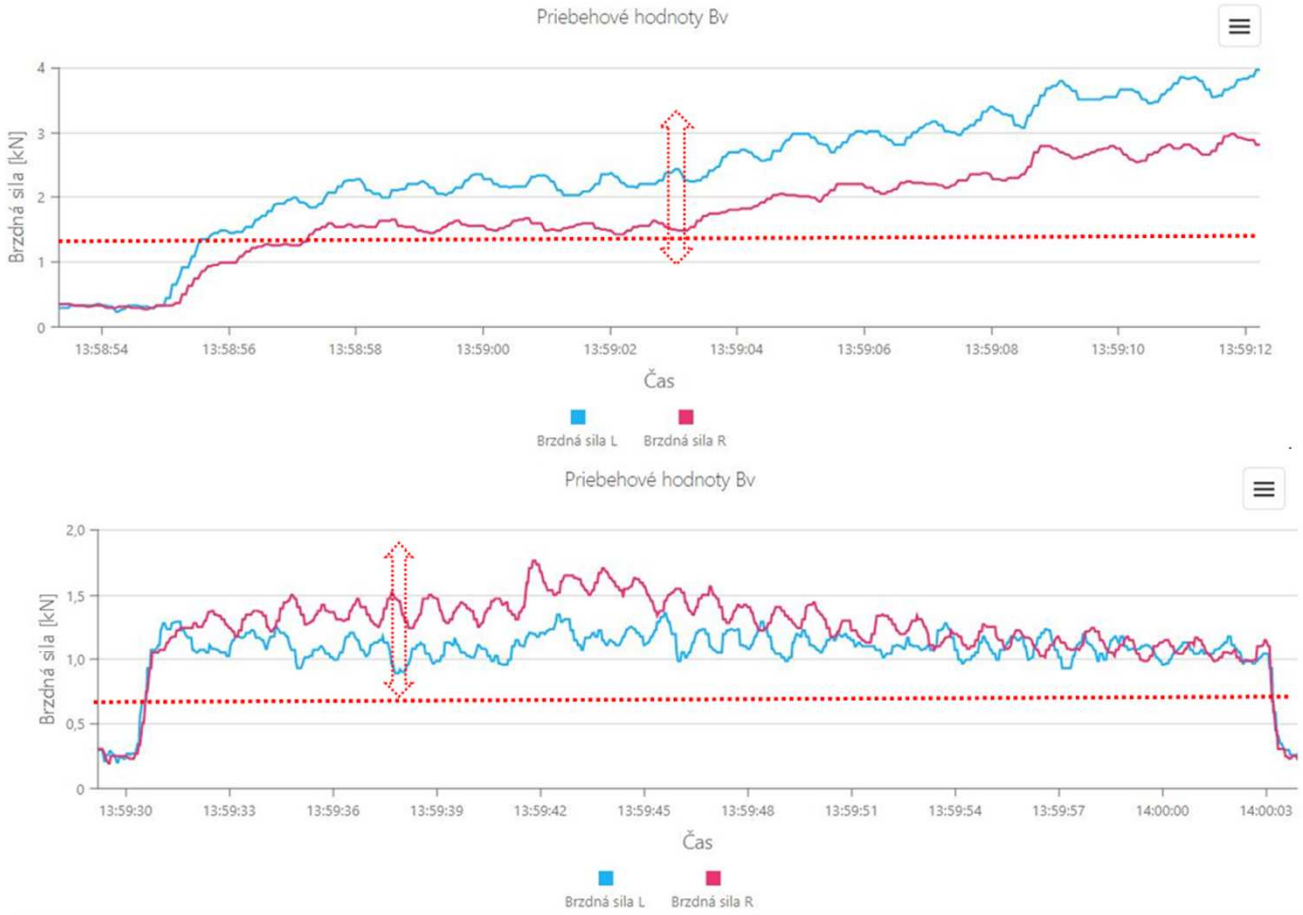
Parking brake

Question? Why did the **brake lights light up** when the parking brake of the rear axle was measured (according to the data transferred from brake tester)?

Video analysis

Data **recorded** and **transferred** from roller brake tester:

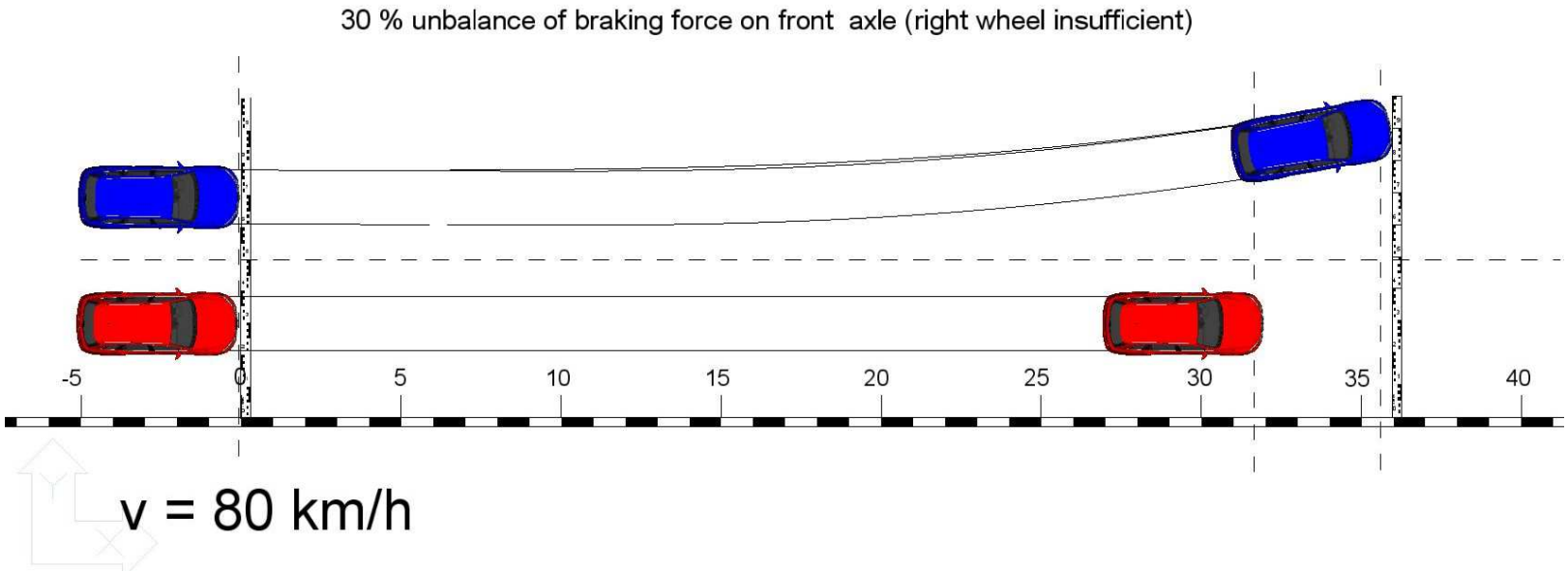
The **unbalance** of the braking force (is it important to evaluate also **continuous** unbalance, not only **final** unbalance?)



Video analysis

Data **recorded** and **transferred** from roller brake tester:

The **unbalance** of the braking force (is it important to evaluate also **progressive** unbalance, not only **final** unbalance?)

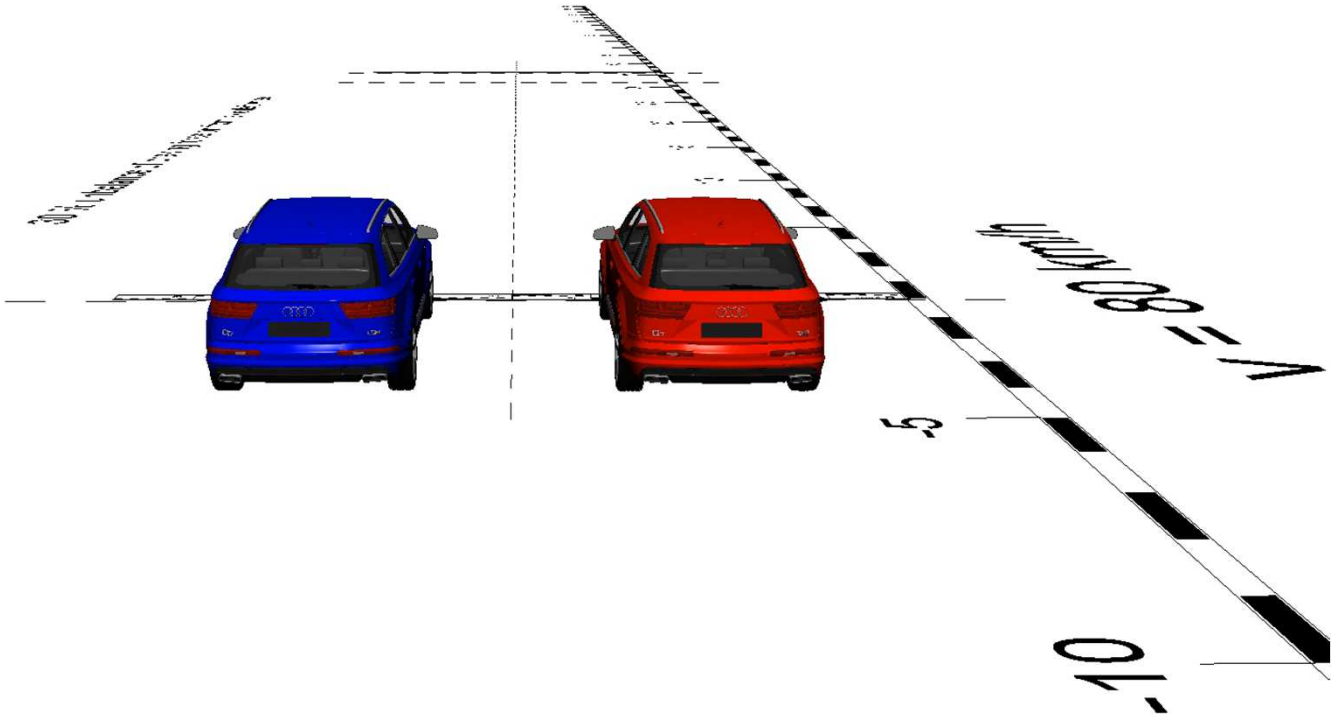


Video analysis

Data **recorded** and **transferred** from roller brake tester:

The **unbalance** of the braking force (is it important to evaluate also **progressive** unbalance, not only **final** unbalance?)

t=0.000 s
v1=80.0 [km/h]
s1=0.0 [m]
v2=80.0 [km/h]
s2=0.0 [m]



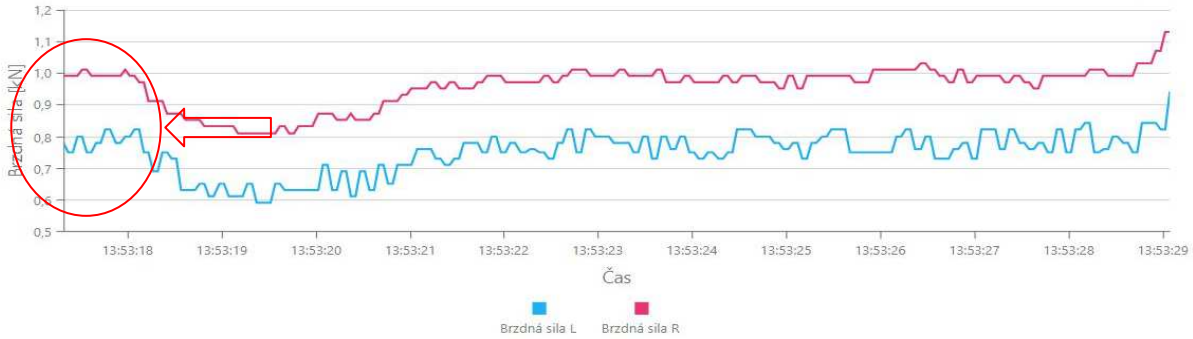
Video analysis

Data recorded and transferred from roller brake tester:

Omitting some parts of intermediate values – starting transfer of data while already brake force applied

Regular inspection - unbalance over 30 % (full measurement data)

Repeated inspection - unbalance over 30 % (only in some part of measurement which were omitted)

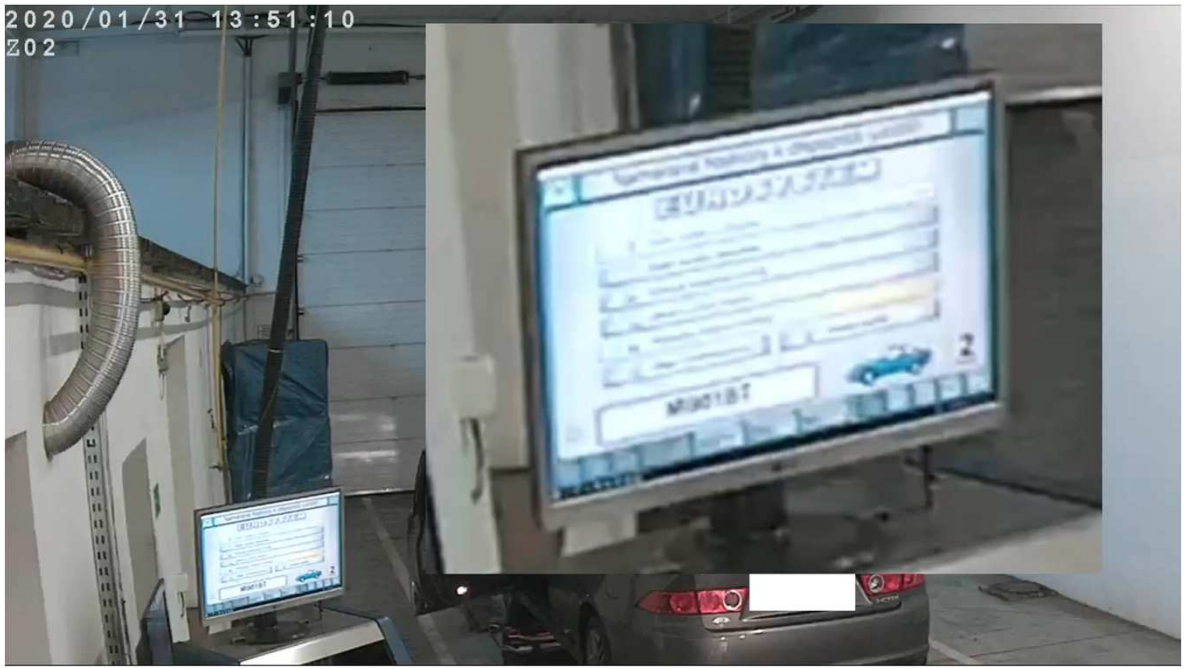


Video analysis

Data recorded and transferred from roller brake tester:

Omitting some parts of intermediate values – **several attempts** to brake rear axle regularly – than data transfer while already brake force applied

- camera on RBT control panel currently not mandatory (limited quality of records), preparing changes in the near future



Video analysis

Data recorded and transferred from roller brake tester:

Question? Why did the **reverse light up** when the service and parking brake of the second axle was measured (according to the data transferred from brake tester)?

Video analysis

Specific forms of influencing the brake measurement outcome:

Why does the technician have **two different kinds** of shoes on his feet (the technician went in the dressing room (during the measurements), but **changed** only one shoe ...)

Video analysis

Specific forms of influencing the brake measurement outcome:

Why is the technician **moving** over the **rolling** brake tester?

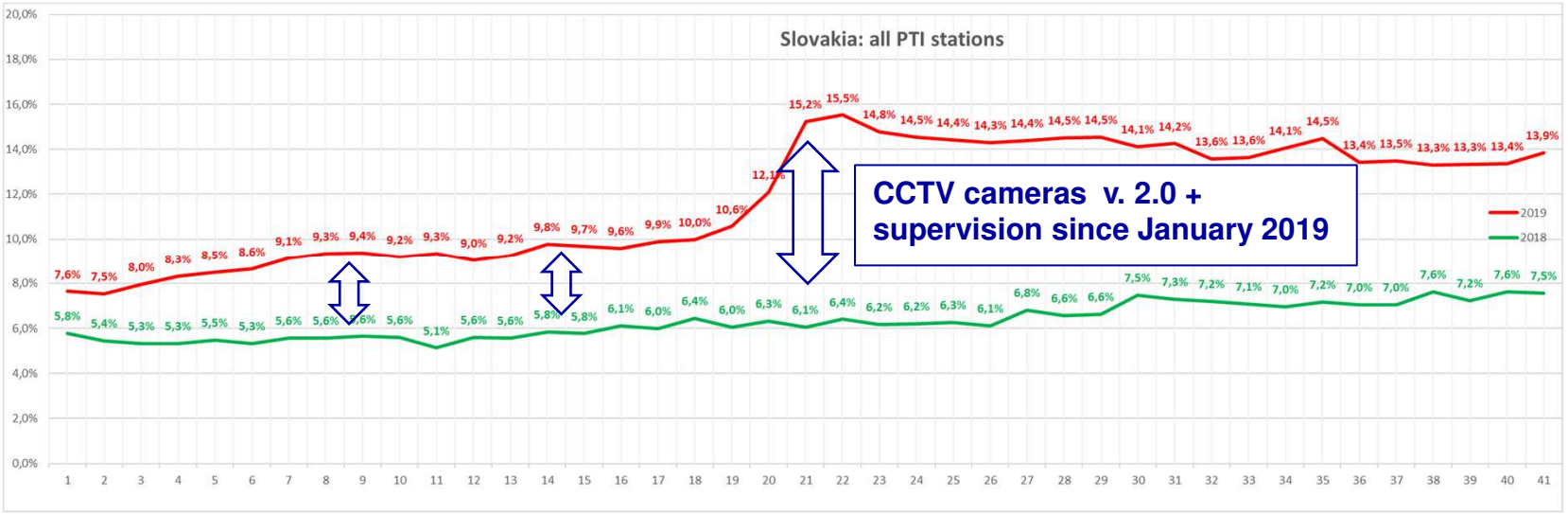
Video analysis

Specific forms of influencing the brake measurement outcome:

What **did** the technician **spray** on the brake discs?

Consequences

number of defects 2019 in comparison with 2018 (weekly)

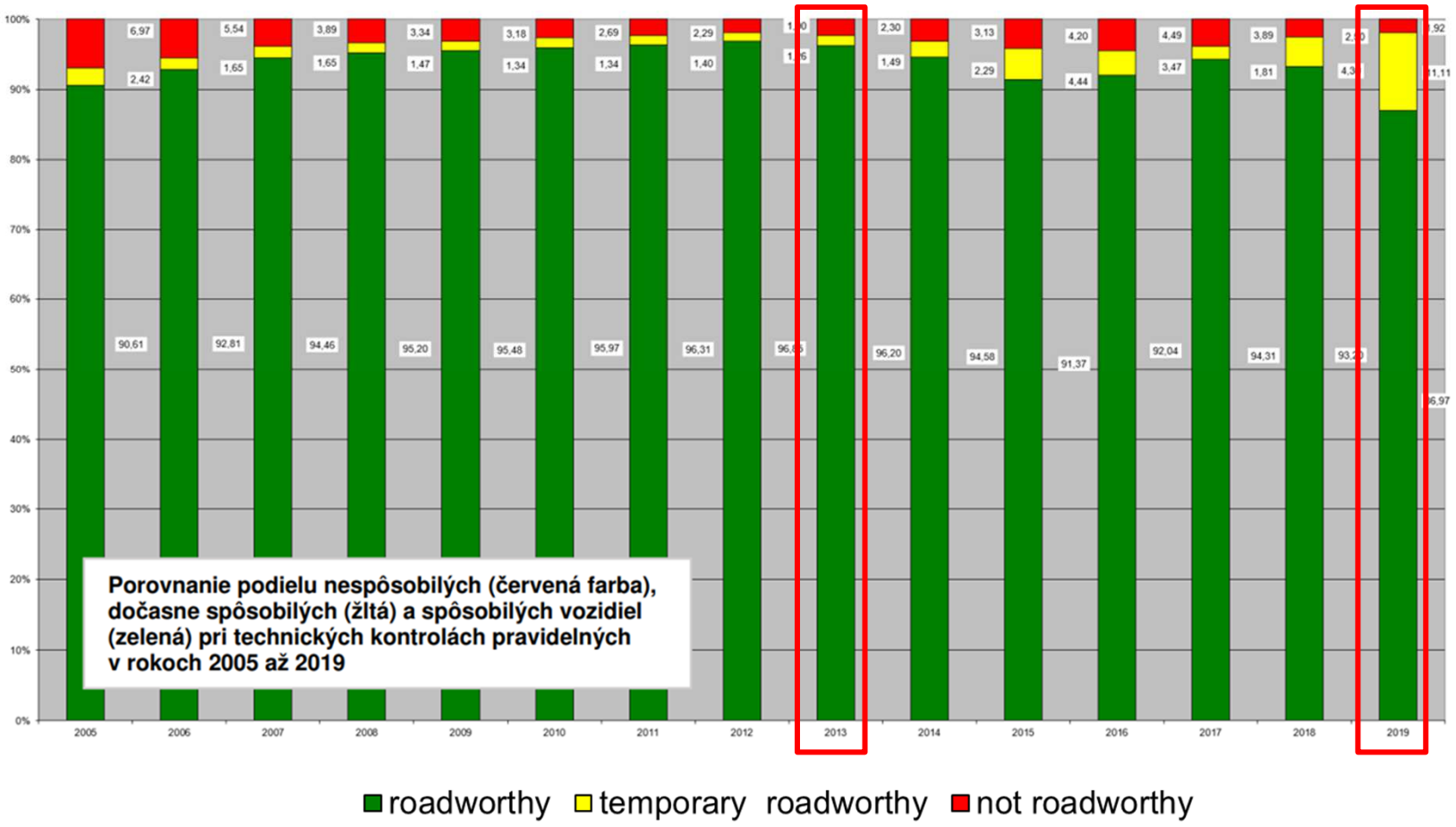


red: not roadworthy + temporary roadworthy (2019)

green: not roadworthy + temporary roadworthy (2018)

Consequences

number of defects since 2005 to 2019



THE END

Questions?

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