



Belgian Road Research Centre
Together for sustainable roads



Evenness, Texture and Comfort Measurements of Bicycle Lanes

ERPUG 2023

The work presented in this contribution results from the Belgian pre-normative research project “Surface Characteristics of Bicycle Lanes” (SuChar-BiLan, ref. CCN/NBN/PN22A54), partially financed by the Belgian national standards body (NBN) and the Belgian Federal Public Service (FPS) for Economy.



October 2023

SuChar-BiLan: Prenormative studies in Belgium

Main objective:

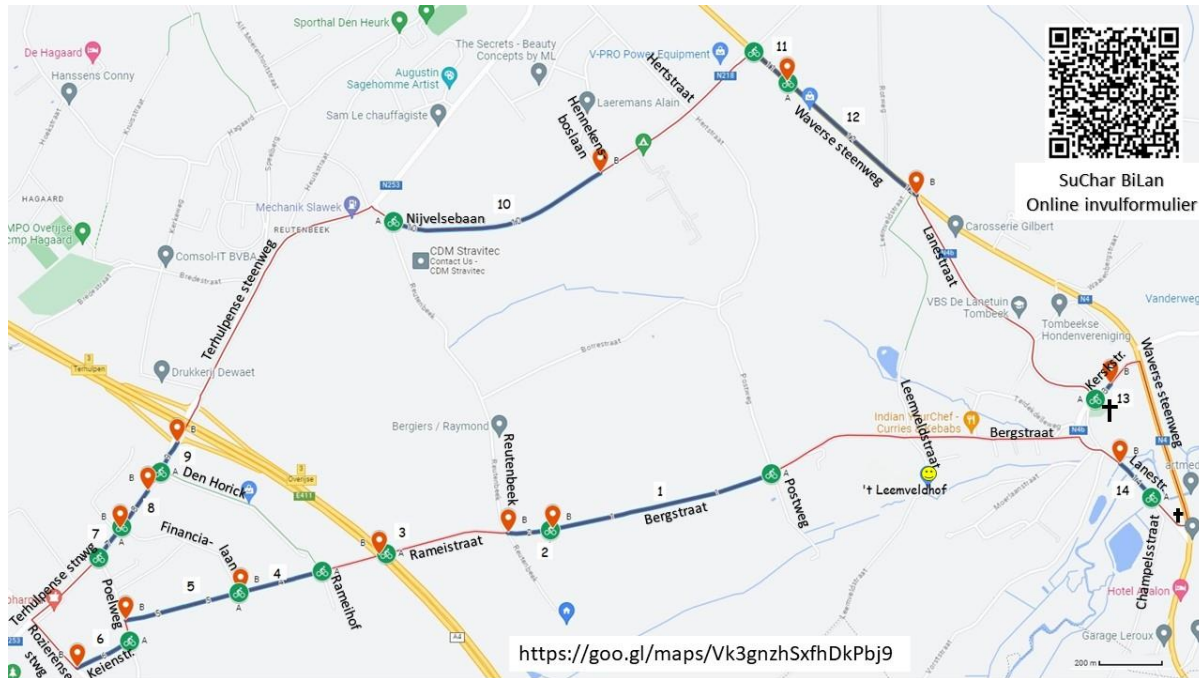
- Support to CEN for developing standards for surface characteristics of bicycle lanes

Recent action(Spring 2023):

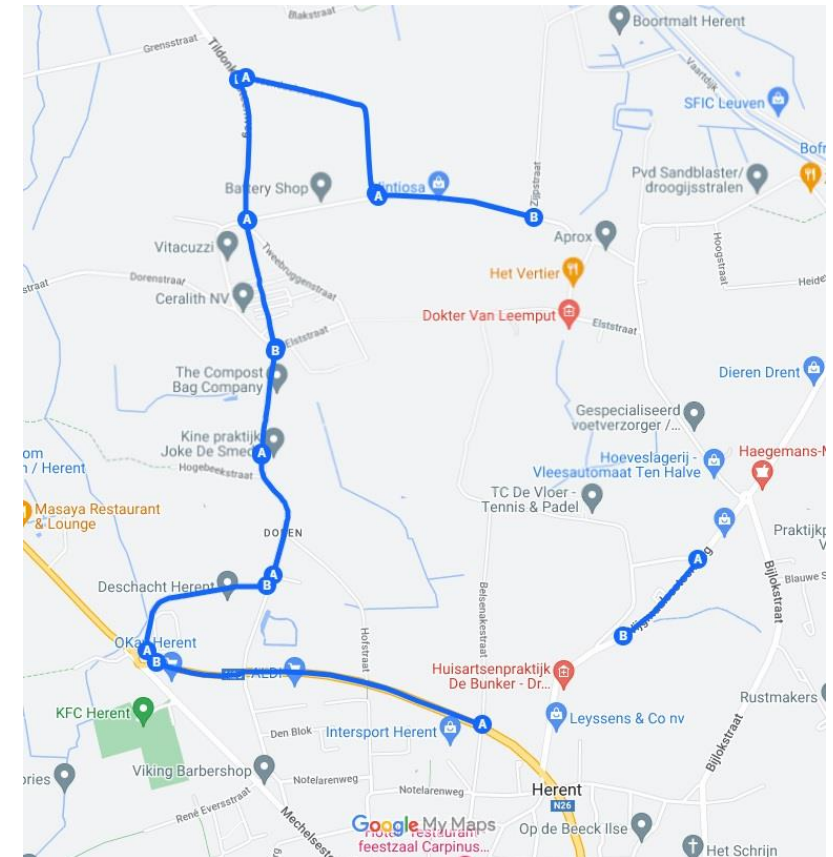
- Selection of test sections of cycle paths
- Execution of test rides and measurements

Tests on sections of cycle paths

- Two “loops” with in total 23 bicycle lane sections with varying surface properties



Overijse-loop with 14 test sections



Herent-loop with 9 test sections

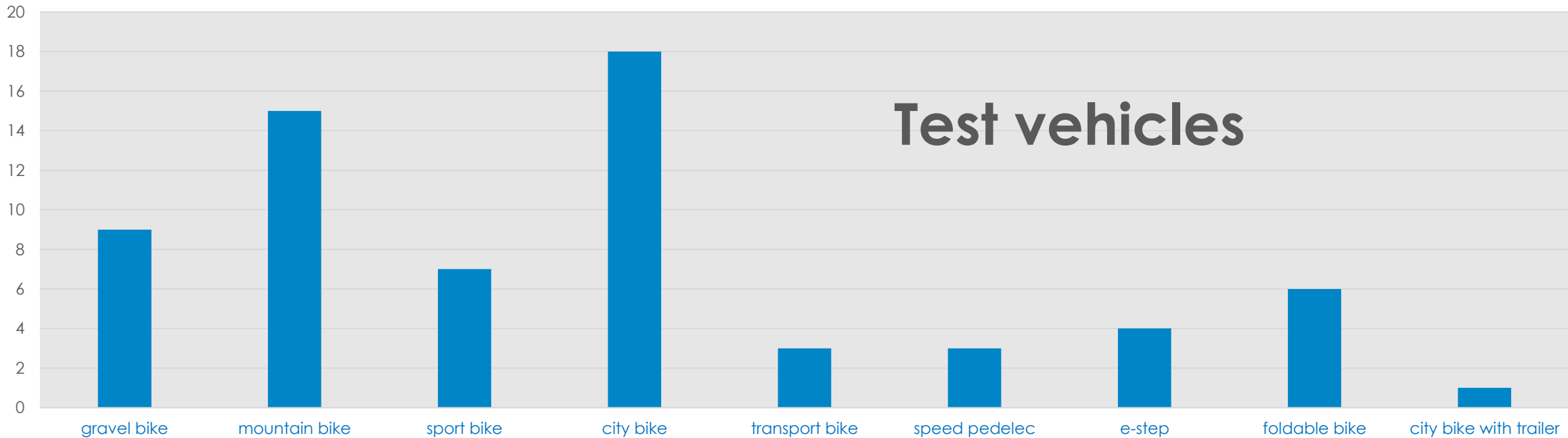
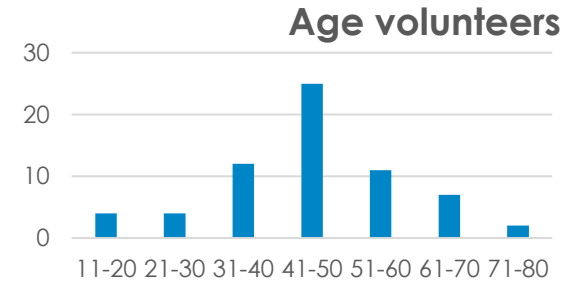
Tests on sections of cycle paths

- 23 test sections with a variety of surface properties: different materials and state of wear



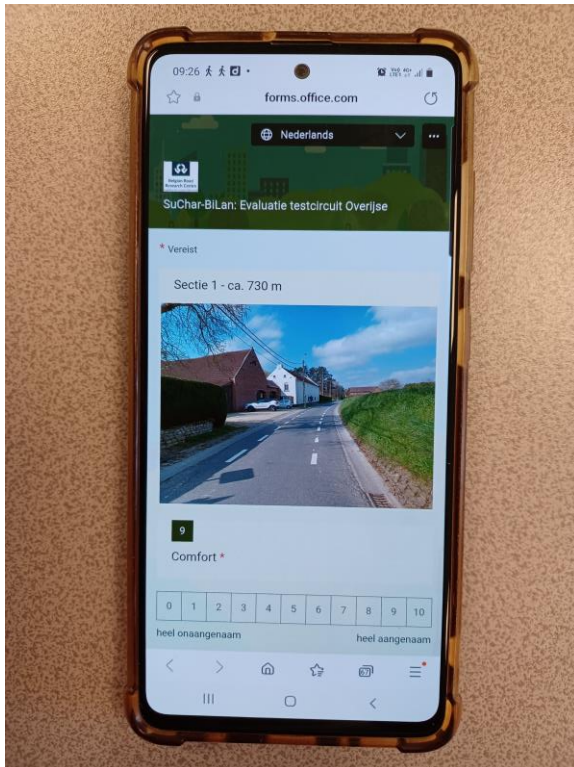
Tests rides by ordinary users (volunteers)

- Overijse: 39 tests by 31 volunteers
- Herent: 27 tests by 22 volunteers
- 70% male, 30% female



Test rides: data collection

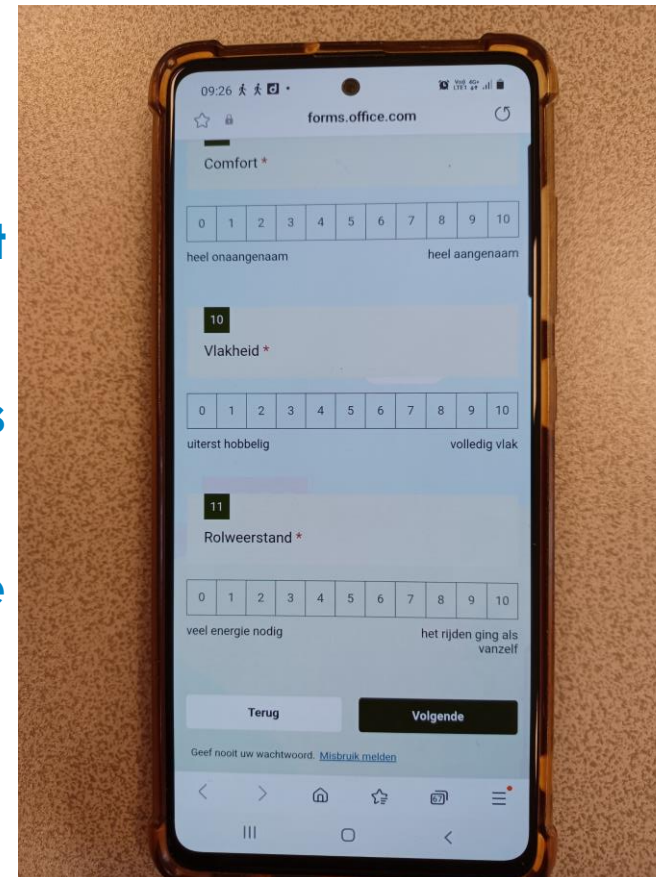
- Detailed instructions for volunteers
- Questionnaire:



Comfort

Evenness

Rolling resistance



To be scored between

0 (very bad)

and 10 (perfect)

Test rides: data collection

- Questionnaire also on paper:

invulformulier

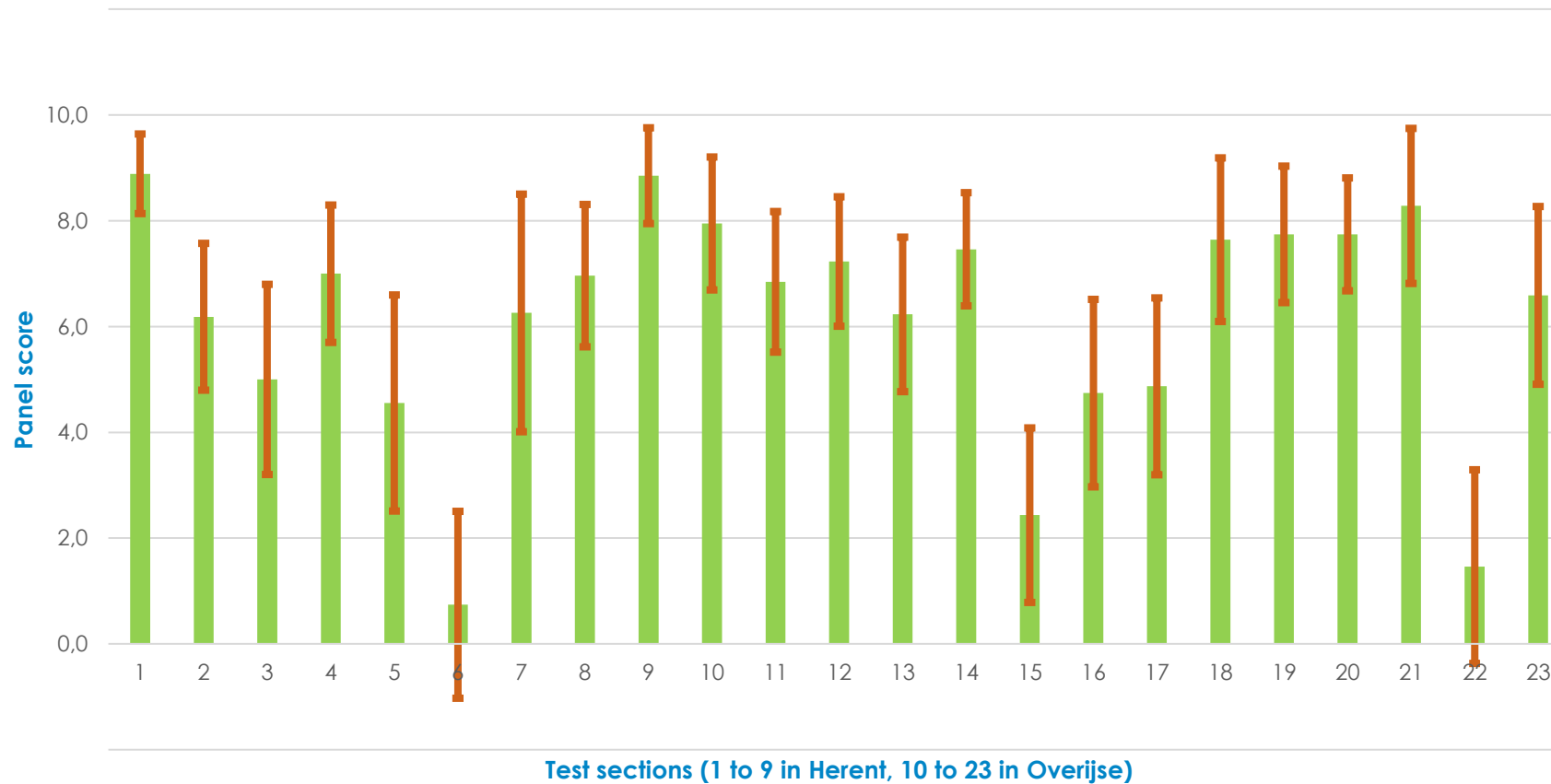
Sectie 1											
	☹										☺
Comfort	0	1	2	3	4	5	6	7	8	9	10
Vlakheid	0	1	2	3	4	5	6	7	8	9	10
Rolweerstand	0	1	2	3	4	5	6	7	8	9	10
Sectie 2											
	☹										☺
Comfort	0	1	2	3	4	5	6	7	8	9	10
Vlakheid	0	1	2	3	4	5	6	7	8	9	10
Rolweerstand	0	1	2	3	4	5	6	7	8	9	10
Sectie 3											
	☹										☺
Comfort	0	1	2	3	4	5	6	7	8	9	10
Vlakheid	0	1	2	3	4	5	6	7	8	9	10
Rolweerstand	0	1	2	3	4	5	6	7	8	9	10
Sectie 4											
	☹										☺
Comfort	0	1	2	3	4	5	6	7	8	9	10
Vlakheid	0	1	2	3	4	5	6	7	8	9	10
Rolweerstand	0	1	2	3	4	5	6	7	8	9	10
Sectie 5											
	☹										☺

Difference with app:

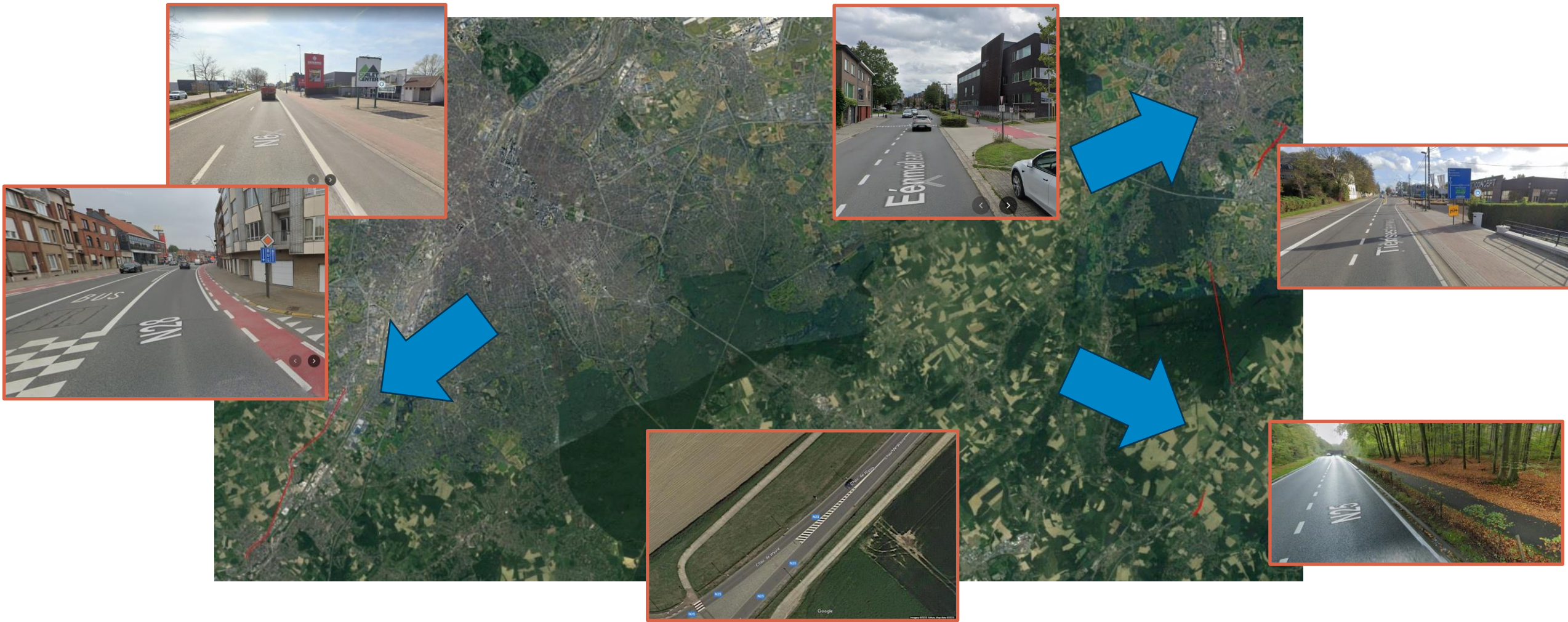
On paper one keeps overview of appraisal of previous sections.

Comfort score per section

Subjective comfort



Additional sections: wider than 1.5m



Machine measurements on the sections

- FPP of BRRC
- FPP of the Flemish NRA
- FCM of Kiwa-KOAC
- ARRB Walking Profiler
- XenoTrack of Xenomatix
- Quad of Lehmann+Partner
- vélo rRuf of DrivenBy
- measurement bicycle of the Belgian Fietsersbond,
- TN Databike of Technologies Nouvelles
- Laser profilometer of BRRC

Evenness

Comfort

Texture

General observations about the devices

Different technologies:

- Laserprofilers
- LiDAR
- Accelerometers
- Cameras

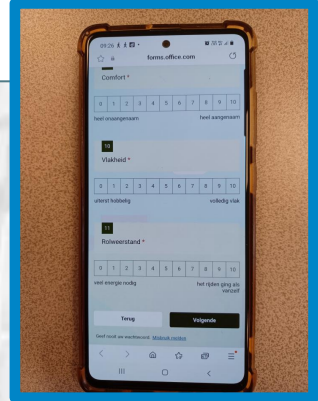
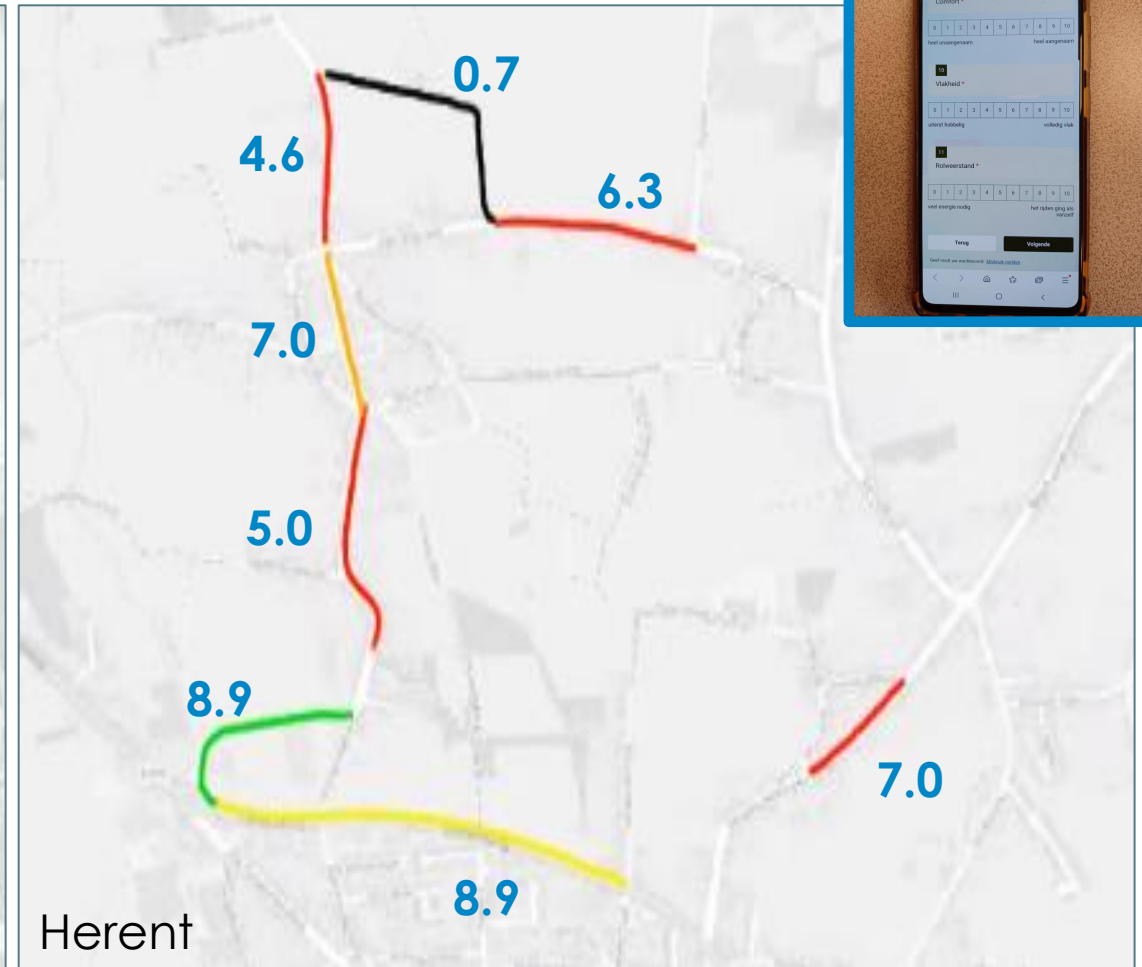
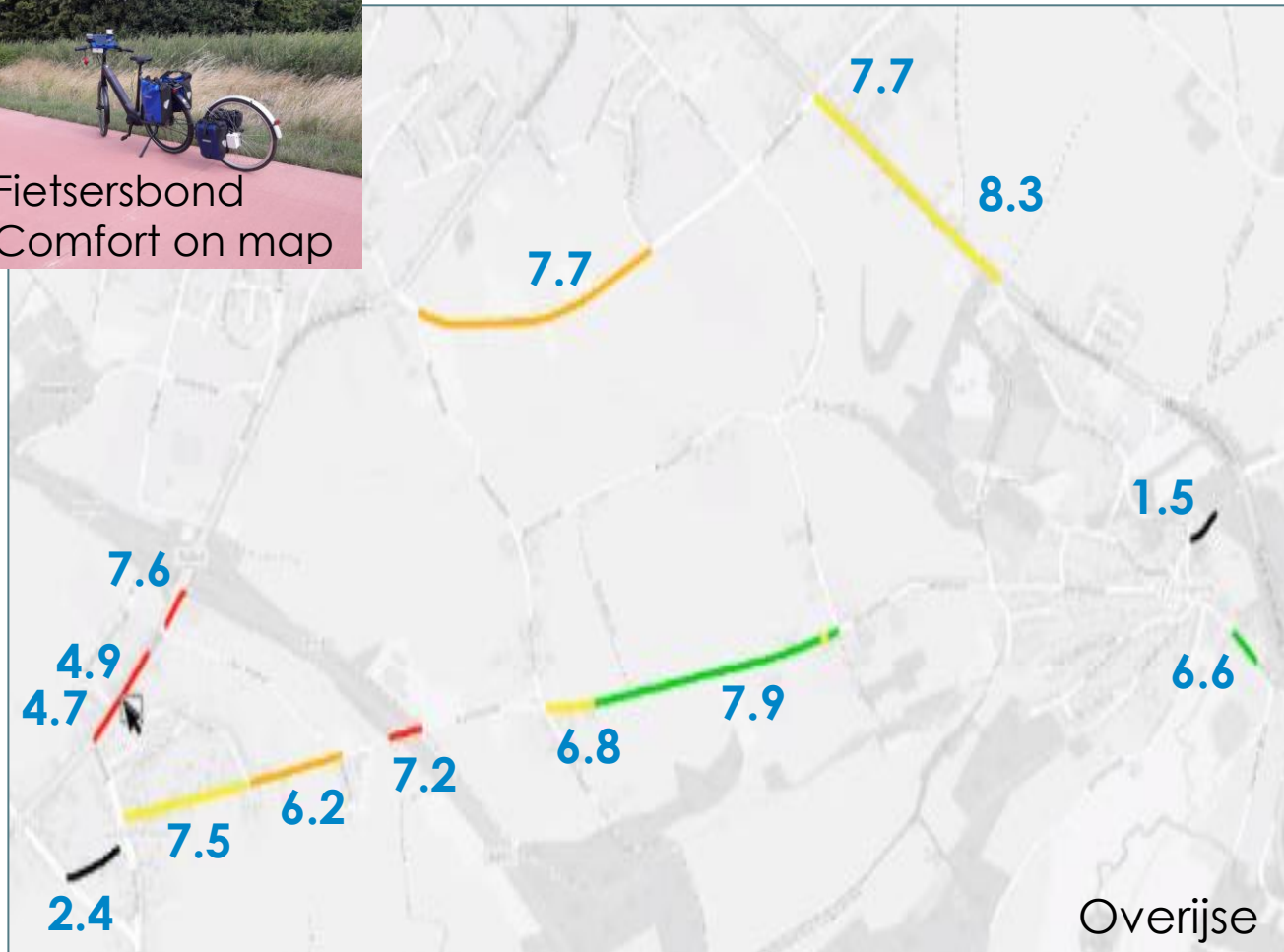
Usually combined with GPS localisation:

- Reporting in GIS environment

Some devices are a bit large (1.3m):

- Belgian (existing) cycling infrastructure is too narrow...

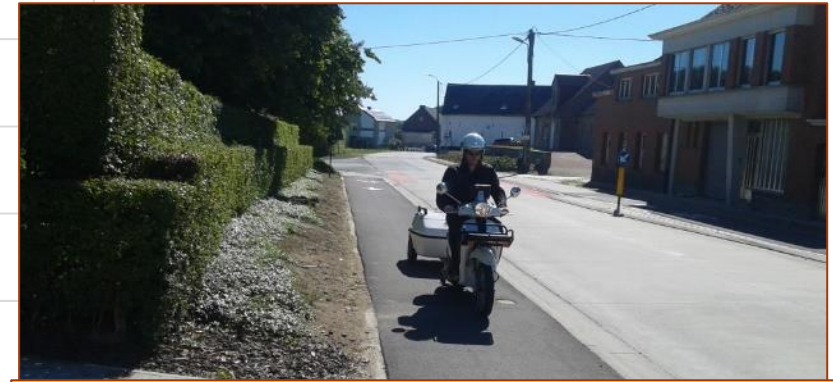
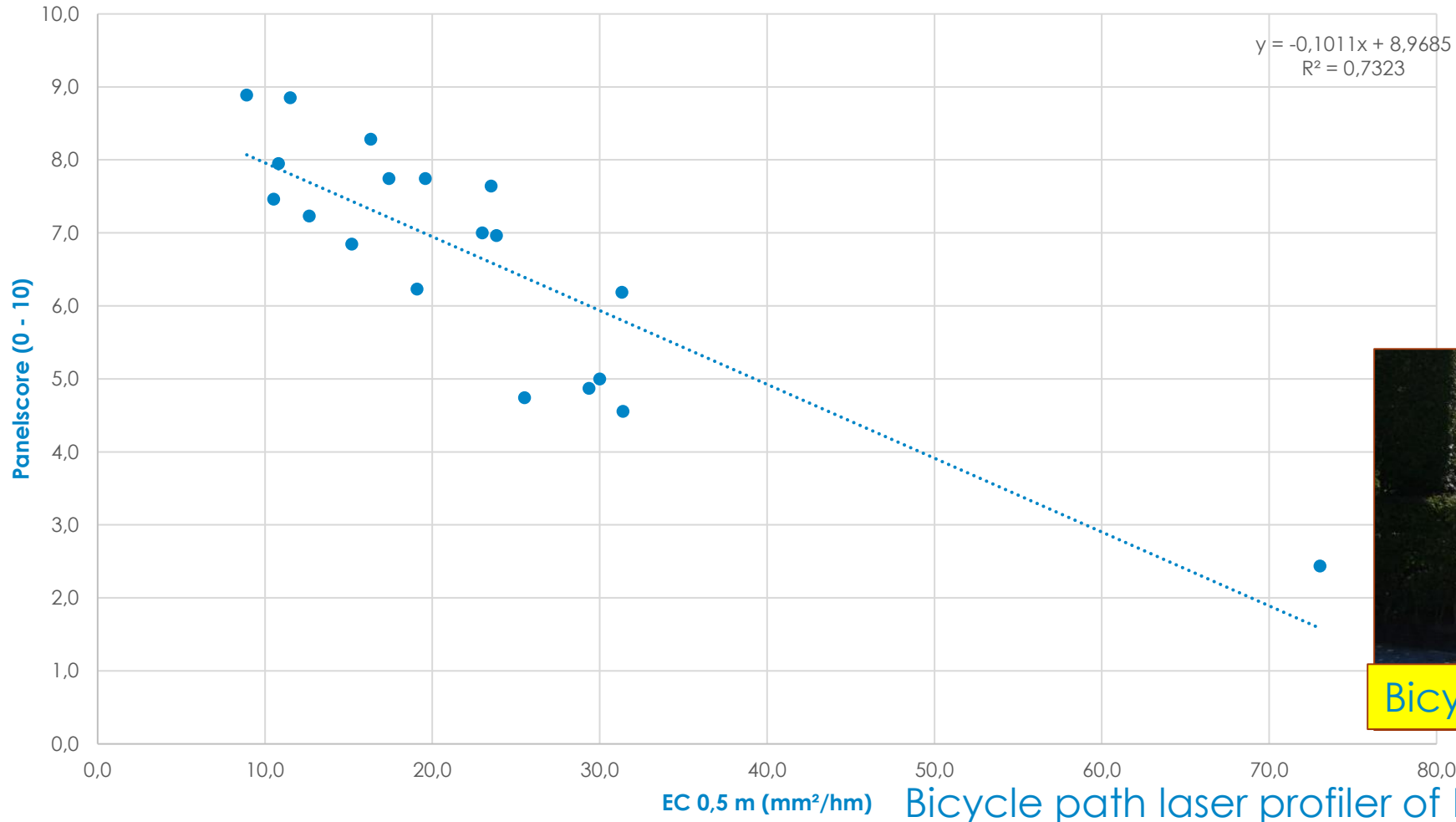
A quick comparison (to be studied further): Comfort score fietsersbond – panel comfort number



panel comfort number as a function of $EC_{0,5m}$



Short wavelengths

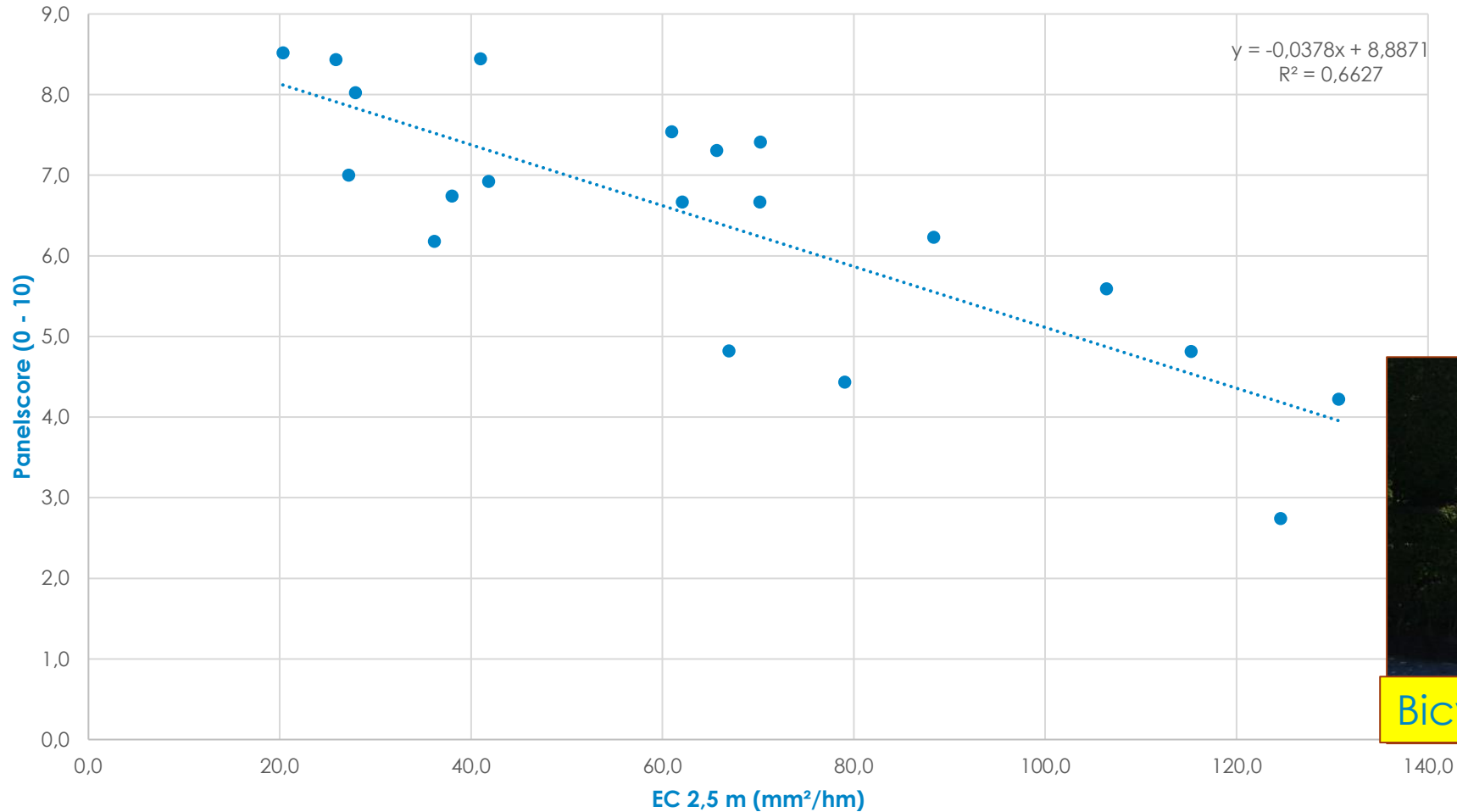


Bicycle path laser profiler of BRRC

panel evenness number as a function of $EC_{2,5m}$

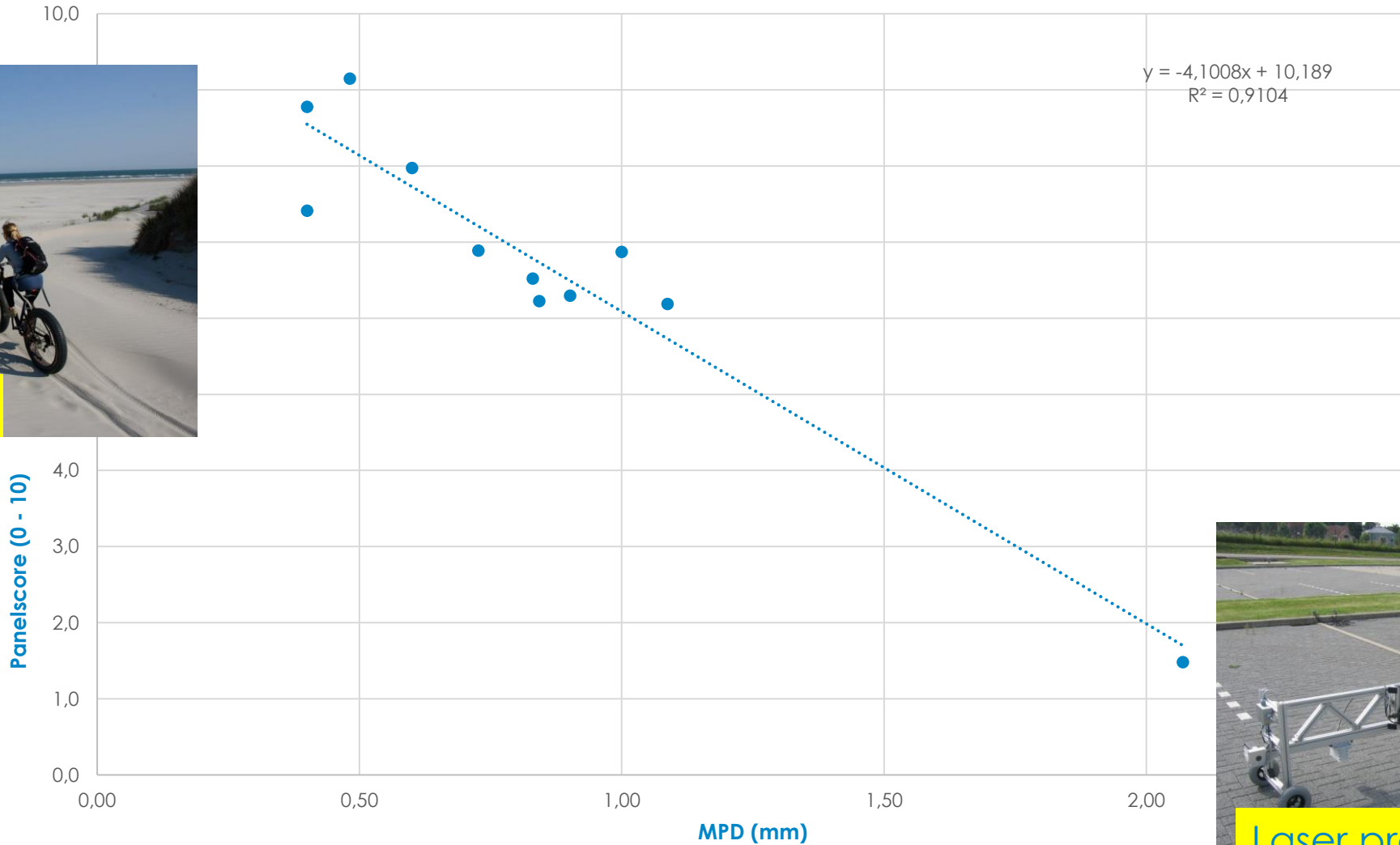


Long wavelengths



Bicycle path laser profiler of BRRC

panel rolling resistance number versus MPD (texture)

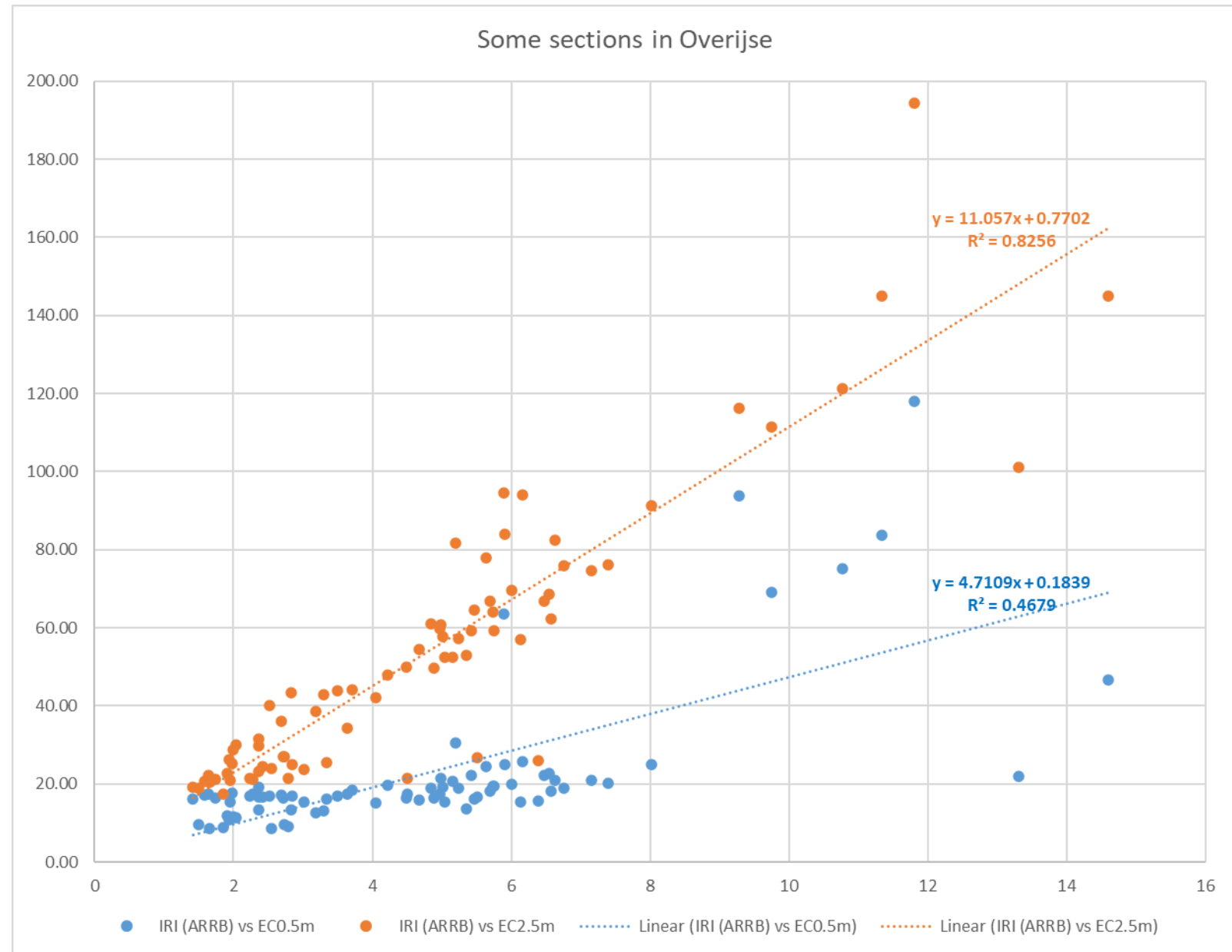


Sneak preview

- A quick analysis of some data...
- IRI and EC_B on 25m blocs.

Not fair because:

- We have more data...
- IRI (ARRB walking profiler) and EC_B (BRRC LPM) are inherently different indicators.
- Measurements not taken at same moment (not RRT conditions).



Near future: more on GIS data and raw data

Reporting in GIS environment:

- Further analysis is still to be done.

Raw data for longitudinal evenness:

- Some devices can report a longitudinal profile
- Hence: we could compute $EC_{0.5m}$, $EC_{2.5m}$, Dutch FCM



More input for future CEN standard
on longitudinal evenness

Upcoming tests on cycle paths

- Test with friction measurement devices:
 - SRT
 - PFT
 - GripTester
 - T2Go
- Objective:
 - Comparison of different devices (not with panel of users)
- Set of sections:
 - a subset of previous campaign + 2 or 3 more
- Laboratory tests of skid resistance



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Carl Van Geem

Senior researcher
Mobility, Safety, Maintenance

T +32 10 23 65 22
E c.vangeem@brrc.be

Tim Massart

Researcher
Mobility, Safety, Maintenance

T +32 10 23 65 43
E t.massart@brrc.be

Anneleen Bergiers

Researcher
Mobility, Safety, Maintenance

T +32 476 924 542
E a.bergiers@brrc.be

Luc Goubert

Senior researcher
Mobility, Safety, Maintenance

T +32 474 508 356
E l.goubert@brrc.be