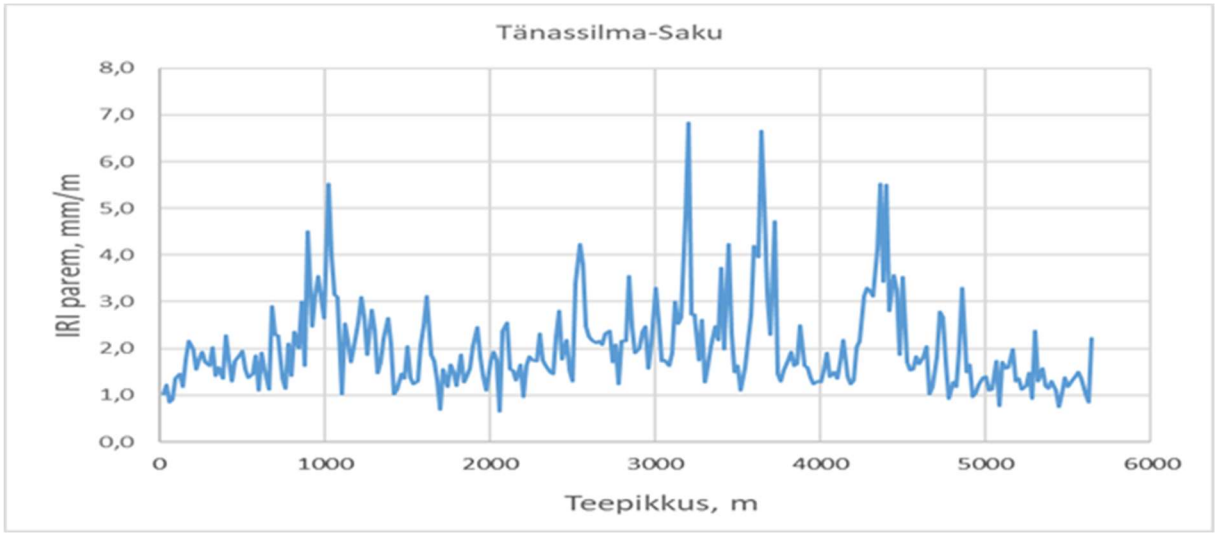
Hello everyone!

Certainly, or hopefully, when driving a car, every driver keeps their eyes on the road and, depending on its quality, adjusts the speed or, if necessary and possible, changes lanes. Most of what the driver does is by instinct, following what their gut instinct and experience tells them to do.

However, in many places, the permitted speed of the vehicle is regulated by road signs. In some places, such a restriction seems unfair, and you may wonder why you now have to drive 40 km/h on a straight section of the road! If you're annoyed but curious, you'll try to find out why such restrictions are established and what are the reasons behind this. In Englo this curiosity sent us to investigate.

We installed an Englo IRIMETER-2 device that measures the roughness of the road surface on a Hyundai i30 and started our research, meaning that we drove through the road sections that piqued our curiosity in Tallinn and its surroundings. IRIMETER-2 is a class 3 measuring device, the information leaflet is attached to the letter. The tests were carried out by Englo's chief engineer Toomas Sõmer and mechatronics engineer Pent Laineste.

We decided to start by checking the roughness of the carriageway of the larger roads around Tallinn. For this purpose, we chose the Saku-Tänassilma road section (see Map 1 below), which doesn't have many intersections and the ones that are there are more isolated, with longer sections of roads without intersections. At the same time, these intersections are much larger than in the city and traffic management is therefore more complex. We used IRIMETER-2 to measure the roughness, i.e. the IRI, of these road sections in different weather and road surface conditions. The lower the IRI, the smoother the road surface.



Tänassilma-Saku
IRI, right lane, mm/m
Road length, m

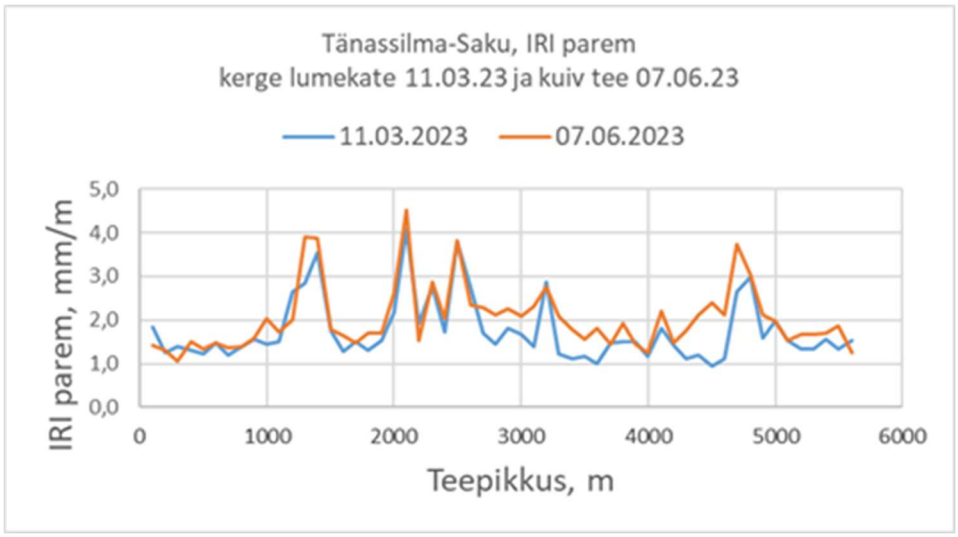
IRI, right lane, mm/m
Remaining values

Graph 1. Tänassilma-Saku measurements 07.06.23, summer tires
Map 1. Saku-Tänassilma road section

Graph 1 shows the results of the roughness measurement of the Tänassilma-Saku road section. A few road sections where the IRI is significantly higher, in some cases even reaching 4-4.5 mm/m, stand out in the graph. These road sections with high IRI values correspond to intersection or bridge crossings; in this test across the Vääna river (see Map 1). On straight road sections, the IRI ranges between IRI 1-1.5 mm/m. Surprisingly, however, when we assessed the roughness of the entire 5.7 km road section, the average IRI come to only 1.7 mm/m. The shorter the road section we needed to measure, the greater the impact of junctions on the average IRI. For example, measuring the road section between 3000-4000 m, the average IRI was already 2.5-3 mm/m. Worth remembering!

It's certainly important for drivers that the road surface is smooth, even if the road is covered with snow or ice or is wet. The driver must drive whenever and wherever they need it, regardless of the weather. The IRIMETER-2 makes it possible to assess the roughness of the road surface in all weather conditions and on all surfaces.

It's quite interesting to compare two measurements, one taken in March when there was light snow on the Tänassilma-Saku road and the other in June when the road was dry, and people were already using summer tires. The comparison is shown in Graph 2. As you can see, the snow cover smooths the road a bit and the IRI is lower, but crossing the intersection has an even bigger impact. The differences in the mechanical properties of winter and summer tires certainly play a role in this as well. A smooth winter road can also mean that it's more slippery. It's a good idea to keep an eye on these things to ensure safe driving!



Tänassilma-Saku, IRI, right lane
Light snow cover on 11.03.23 and dry road on 07.06.23

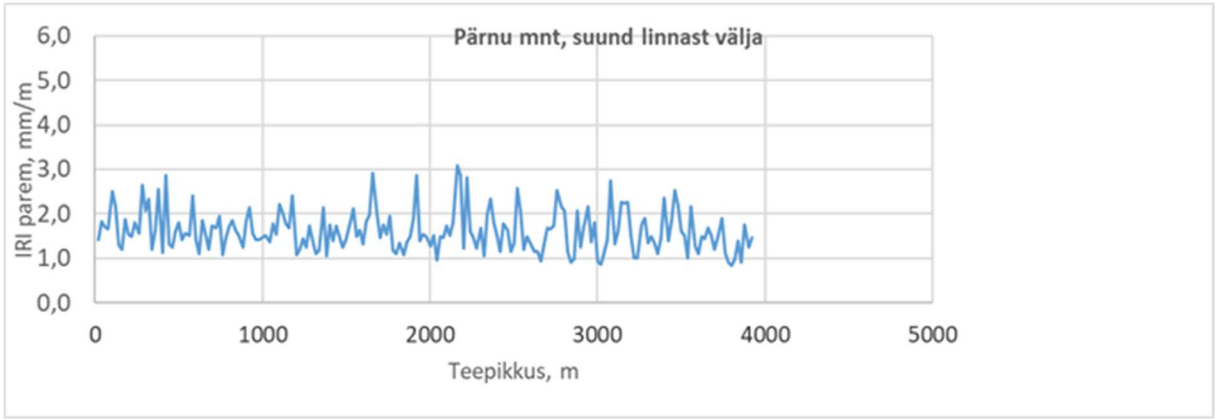
IRI right lane, mm/m
Road length, m

Graph 2. Tänassilma-Saku measurements, 11.03.23 and 07.06.23

Photo 1. Roundabout Photo 2. Exit from the roundabout

It's clear from the above that junctions, roundabouts, etc., have a noticeable impact on the road surface, and especially on its roughness (see Photos 1 and 2).

We wanted to measure road surface roughness on a road where there are no side roads or intersections and where there is a smooth flow of vehicles. For this purpose, we chose the section of Pärnu Rd from the Tänassilma junction to the turn-off to Saue (see Map 2). The results are shown in Graph 3. The graph shows that on such road sections, the roughness of the road surface is more or less uniform, i.e. its rather rough. The vehicle had summer tires.

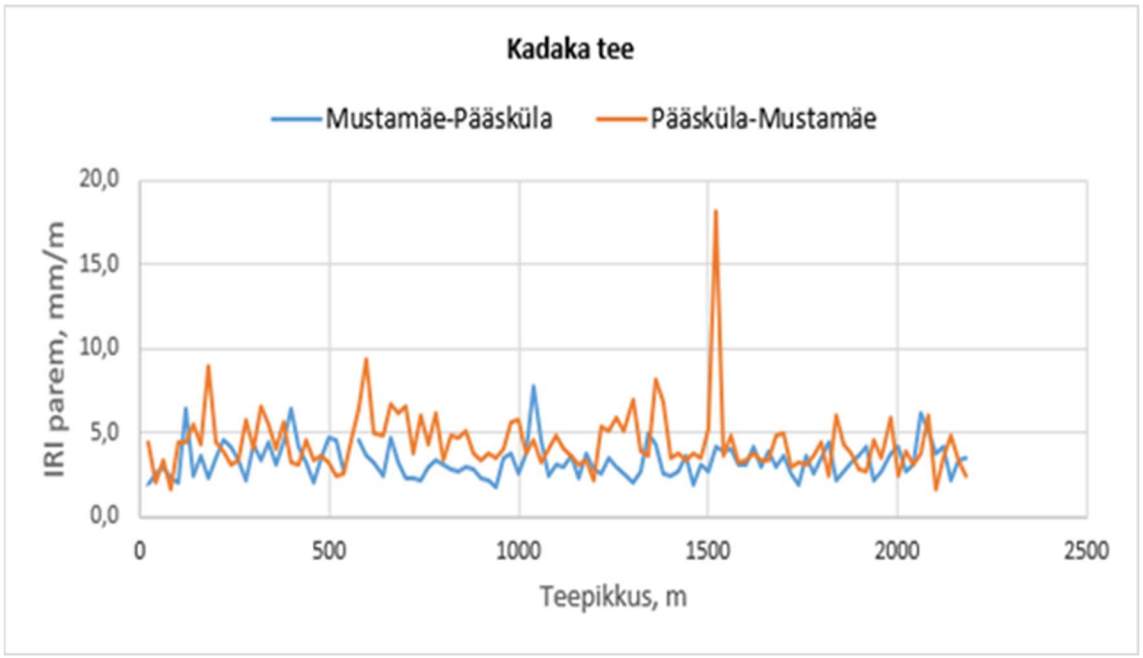


Pärnu road, heading out of the city
IRI right lane, mm/m
Road length, m

Graph 3. Pärnu road. Measuring
Map 2. Pärnu road

In comparison to the above, we also decided to look at the condition, including roughness, of some roads in the city of Tallinn. For this purpose, we chose the Mustamäe-Pääsküla section of Kadaka Ave, which is closest to our workplace (see Map 3 below), as it intersects with many small side streets. The vehicle had summer tires.

Here, traffic is not so much obstructed by small crossroads, but by numerous bus stops, which causes multiple stops and prevents traffic from moving smoothly. The road only has two lanes, so there are virtually no opportunities for overtaking. However, vehicles also want to get out of the side streets and if you're nice and the traffic permits this, you stop and let the others in ahead of you. All these abrupt stops and starts by the vehicles deteriorate the road surface more than smooth, even driving does. As the side streets are relatively densely distributed over the entire Mustamäe-Pääsküla section, it can be assumed that the road surface roughness is more evenly distributed, which is also shown by the data below. Note! One sharp knock has occurred when driving over the sewer manhole.



Kadaka tee
Mustamäe-Pääsküla Pääsküla-Mustamäe
IRI right lane, mm/m
Road length, m

IRI right lane, mm/m
Remaining values

Graph 4. Kadaka Ave measurements on 09.06.23, summer tyres
Map 3. Kadaka Ave

We see on Graph 4 that the IRI is significantly higher here, and this means that the roughness of the road surface is much worse than in the other tests above. But the traffic here is really heavy, with vehicles coming from Pääsküla congregating on Kadaka Ave, as well as vehicles leaving the city from the Mustamäe side towards Pääsküla in the opposite direction. This is particularly evident during

peak hours on working days and on Friday afternoons. It's almost impossible to drive into this flow from side streets during these times.

As we can see from the graph, the average IRI of the lane on Kadaka Road in the direction of Pääsküla-Mustamäe was 4.18 mm/m in this test, and slightly lower, 3.33 mm/m, in the direction of Mustamäe-Pääsküla. There are certainly a number of reasons for this, but one of them may be that there are more side streets leading into Kadaka Road on the lane to Mustamäe than on the lane from Mustamäe to Pääsküla. The measurements taken earlier in the spring with the same vehicle but with winter tires gave similar results.

In our tests, we only saw the effect of a few individual factors on the roughness of the road surface, and thus on driving comfort and safety, but there are certainly many more such factors.

In conclusion, we can say that road construction is a real art indeed!

Finally, a few photos of the measuring points on the Saku-Tänassilma road section:

Photo 3. Bridge across Vääna river

Photo 4. The drive directly across the roundabout

Photo 5. Drive to the roundabout

Thank you for your attention and thoughts!

P.S. Videos of IRIMETER-2 and other devices can be found here:
https://www.youtube.com/@EngloLLC/videos