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Tire Abrasion : Impact of aerodynamical drag on abrasion value

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Objective of the document

In the current vehicle abrasion method, a limit is set on the total aerodynamical drag of the reference vehicle compared to the candidate vehicle

But this criteria is very difficult to check in its current formulation : F2 parameter of the vehicle road load test used for vehicle homologation (CO2) is not publically available.

We want to check if it is important to keep such a limit, or if it can be removed.

- If it is kept, a more applicable version shall be determined

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Methodology

We used our abrasion simulation tool :

- **includes usage, vehicle mechanics, tire mechanics**
- **Gives the abrasion of the 4 tires of a vehicle, in relative to a reference case**

We used a median severity usage in Narbonnes

- Not exactly the abrasion method, but very close
- In particular, average speed is close to the 77 kph of the ETRTO method

We test different total air drag (S × Cx) versus a reference

- From 50% to 200% of the reference

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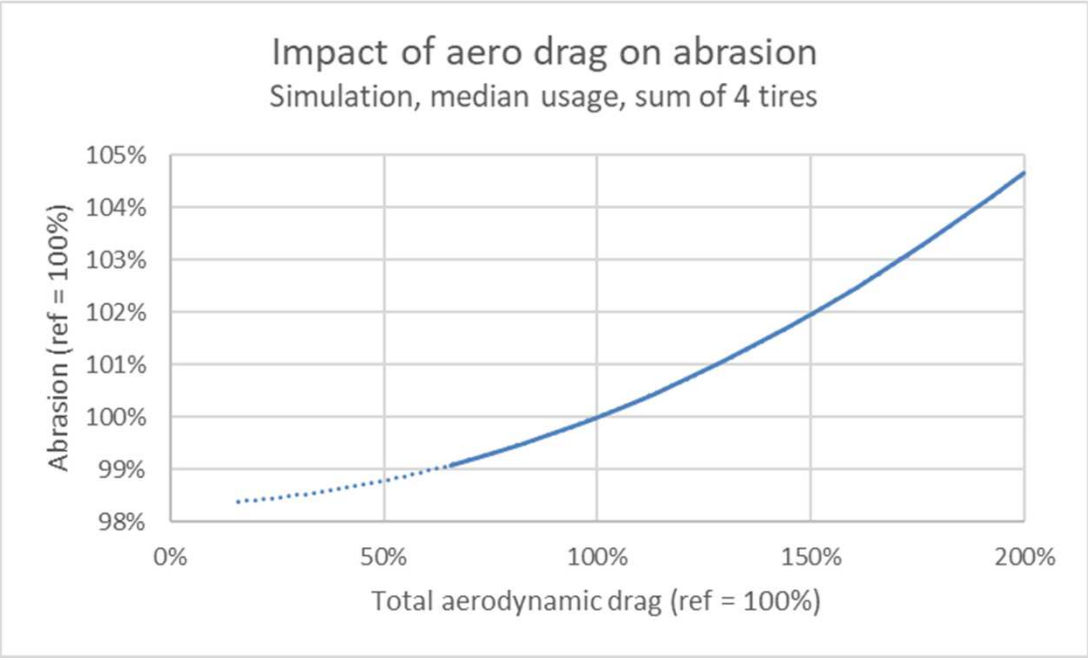
Results

The impact of aero drag is quite small

- +5% abrasion for +100% aero drag



The aero drag of a vehicle depends on its size and of its shape

- $Drag = \frac{1}{2} \times \rho \times S \times C_x \times V^2$
- Frontal area term is linked to height & width of the vehicle
- Drag coefficient varies usually of +/- 30% vs 0.3

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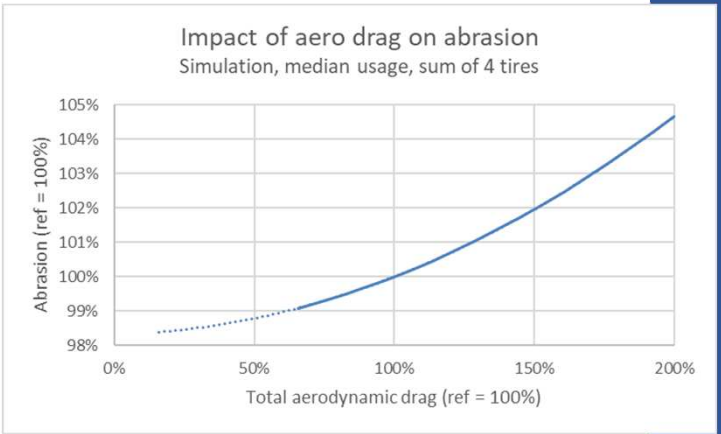
Results

Rough frontal surface of some vehicles

	Peugeot 108	VW Golf 8	Renault Megane	Volvo XC60	Audi Q5
Width (m)	1.61	1.78	1.86	1.9	1.89
Heigth (m)	1.46	1.49	1.505	1.66	1.64
Surface (m²)	2.35	2.65	2.80	3.15	3.10
Delta vs Golf	**-11%**	**0%**	**+6%**	**+19%**	**+17%**



Even with C_x 30% higher or lower, the $S \times C_x$ variation range is limited :

- From -38% to +54% vs Golf 8, for all the vehicles in this table
- Thus from -1% to +2% abrasion

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Results for reference vehicle

Vehicle able to fit the 225/45R17 tire

- https://taille-pneu.com/ (vehicle available in 2023)
- Width & height found on internet

	Surface	Delta vs avg
Min surface	2.48	-5.2%
Max surface	2.80	6.9%
Avg surface	2.62	
Standard deviation	0.07	

Impact on abrasion for ref tire :

- -5% surface gives -0.16% abrasion of the ref tire
- +6.9% surface gives +0.23% abrasion of the ref tire

		Width	Heigth	Surface
Fiat	Avventura	1.706	1.542	2.63
Fiat	Tipo	1.79	1.5	2.69
Fiat	Urban Cross	1.662	1.657	2.75
Honda	ev	1.752	1.512	2.65
Hyundai	avante	1.7	1.46	2.48
Hyundai	celesta	1.765	1.47	2.59
Hyundai	elantra	1.825	1.415	2.58
Hyundai	i30	1.795	1.465	2.63
Hyundai	lafesta	1.79	1.425	2.55
Kia	ceed	1.8	1.447	2.60
Kia	cerato	1.73	1.47	2.54
Kia	forte	1.8	1.435	2.58
Kia	K3	1.78	1.435	2.55
Kia	ProCeed	1.8	1.422	2.56
Mini	Clubman	1.8	1.441	2.59
Opel	astra	1.809	1.47	2.66
Peugeot	308	1.852	1.441	2.67
Renault	Megane	1.86	1.505	2.80
Seat	Leon	1.8	1.456	2.62
Subaru	Impreza	1.775	1.515	2.69
Suzuki	Swace	1.79	1.46	2.61
Toyota	Corolla	1.79	1.435	2.57
VW	Bora	1.74	1.45	2.52
VW	Golf	1.78	1.49	2.65
VW	Lavida	1.806	1.488	2.69

➔ **Considering the very limited impact on abrasion, we propose to simply suppress this constraint on aero drag of the reference vehicle, adding a clause saying that nothing should be added on the vehicle modifying its aerodynamic.**

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Thank you for your attention

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