

Artificial Intelligence for Rolling Resistance

Know a tyre's rolling resistance before it is built.

AIRR learns the link between tread design and measured rolling resistance from your own reference tyres. It then predicts the rolling resistance coefficient of an untested design from its non-skid depth, land ratio, tan δ and tread-block shape, with an expected range, and shows which design changes would reach a lower target.

THE PROBLEM IT SOLVES

Every figure normally needs a built, tested tyre

Rolling resistance is usually known only after a tyre has been made and measured. AIRR gives an estimate straight from the design values, so designs can be compared and targets set earlier, and testing effort goes where it matters.

1 Reference data

Enter the tyres you have already measured: name or code, non-skid depth (NSD), land ratio, tan δ , tread-block shape and the measured rolling resistance. Thirty is the minimum. Once thirty tyres are in, AIRR derives the relationship on its own.

- Tread-block shape is read from a pitch image, or entered as block area and perimeter.
- Each tyre category, passenger car radial and truck and bus radial, is calibrated separately.
- Export a finished calibration and import it on another machine, so a licensed site can predict without repeating the reference tests.

Passenger car radial – ready to predict. Built from 30 tyres; expected accuracy on an untested tyre of this category is $\pm 2.3\%$.

REFERENCE TEST SET

Add a measured tyre

Enter each tested tyre with its measured rolling resistance. Once thirty tyres are in, the application derives the response relationship on its own.

30 OF 30 RECOMMENDED

Tyre

Tyre name or code

NSD

Land %

tan δ

e.g. 205/55R16 XT-2

REFERENCE TYRES – 30

Remove all

#	TYRE	NSD	LAND %	TAN Δ	BLOCKS	RRC
1	PCR 01	7.2	0.639	0.214	1	8.17 ×
2	PCR 02	8.9	0.637	0.154	1	7.12 ×
3	PCR 03	8.2	0.764	0.315	1	9.97 ×
4	PCR 04	7.8	0.725	0.154	1	6.97 ×
5	PCR 05	7.8	0.731	0.314	1	10.56 ×
6	PCR 06	8.9	0.68	0.238	1	8.68 ×

Reference data. Built-in example set of 30 passenger car tyres, showing the readiness banner and the reference table.

2 Prediction

Enter the design values and tread blocks of an untested tyre. AIRR returns the predicted rolling resistance coefficient with its expected range, and places it on the span covered by your reference tyres.

- Every input shows the range your reference tyres tested, and the design is flagged if it sits outside that envelope.
- Expected error comes from leave-one-out cross-validation: each reference tyre is held out in turn and predicted from the rest.
- Keep a session log, download it as CSV, or print a report.

TYRE DESIGN

Tyre name or code

205/55R16 Example

NSD

8.2

tested 6.9 – 9

Land %

0.699

tested 0.615 – 0.774

tan δ

0.226

tested 0.152 – 0.315

Tread blocks

From pitch image

Enter manually

Same length unit for area and perimeter.

Number of blocks

2

BLOCK	AREA	PERIMETER	CHECK
1	104	46	✓
2	86	41	✓

Reset to typical

Add to log

PREDICTED ROLLING RESISTANCE COEFFICIENT

8.33 kg/t

Expected range 8.14 – 8.53 ($\pm 2.3\%$)

reference span 7.0–10.6

6.5

7.7

8.8

9.9

11.0

All entries are inside the tested envelope.

Prediction. Example design on the built-in 30-tyre set: 8.33 kg/t, expected range 8.14 to 8.53 ($\pm 2.3\%$).

3 AI insights

Set a target rolling resistance, or pick a quick target of 3, 5 or 10% lower. AIRR shows which design changes would reach it, one lever at a time and combined, and whether each stays inside the range your tyres covered.

- Levers: tread compound (tan δ), non-skid depth, land ratio and tread-block outline.
- Each route is marked within or beyond the tested range, so extrapolation is never hidden.
- A combined route spreads the change across levers in proportion to the room each has.

TARGET

Design being examined

RRc now 8.33 kg/t · NSD 8.2 · Land % 0.699 · tan δ 0.226 · 2 blocks

Target RRc

7.92

Quick targets

3% lower

5% lower

10% lower

Target 7.92 is a 5.0% reduction on the present design.

SINGLE-CHANGE ROUTES

Tread compound

Lower loss tangent of the tread compound.

covers 100% of the gap on its own

tan δ 0.226 → 0.203

a reduction of 0.023

WITHIN TESTED RANGE

limit within tested range (tan δ 0.152): 7.07

Non-skid depth

Shallower new tread.

covers 52% of the gap on its own

NSD 8.20 → 5.87

a reduction of 2.33

BEYOND TESTED RANGE

limit within tested range (NSD 6.90): 8.12

Land ratio

More land, less groove volume.

covers 8% of the gap on its own

Land % 0.699 → 2.672

an increase of 1.973

BEYOND TESTED RANGE

limit within tested range (Land % 0.774): 8.30

AI insights. Example: a 5% reduction target on the same design, with the single-change routes.

30

Measured tyres to build a category model.

4

Inputs: NSD, land ratio, tan δ and block shape.

2

Categories: PCR and TBR, each calibrated on its own.

$\pm\%$

Expected error quoted with every prediction.

Honest about what it knows

Predictions are estimates derived from measured reference tyres and do not replace physical testing. The AI insights come from the same relationship as the prediction, so they carry the same uncertainty: treat them as direction and relative size, not a promise.

Wear, grip and noise are not modelled. A shallower tread or a harder compound may cost you elsewhere.

Tread-block shape, measured for you

Drop in a pitch image and AIRR finds the tread blocks and measures the area and perimeter of each. From these it takes a single compactness figure for the tyre: the mean of $4\pi A/P^2$ over the blocks, which is 1 for a perfectly round block.

Light-on-dark and dark-on-light images are handled, with an invert button if needed.

Licensed per tyre category, with your data kept local

PCR and TBR are licensed separately, and a licence covers only its own category. Reference tyres, pitch images, calibrations and predictions are processed on your computer. The licence check sends only the licence key and application name to Woodtecher's licence server, and an internet connection is needed to open the application. Time-limited trial licences can be issued for evaluation.

PLATFORM	CATEGORIES	INPUTS	OUTPUTS
Windows desktop application, delivered as a single .exe. Nothing else to install.	Passenger car radial (PCR) and truck and bus radial (TBR), licensed separately.	Measured reference tyres: NSD, land ratio, tan δ , tread-block shape, measured RRC.	Predicted RRC with range, AI insights, session log CSV, printed report, calibration file.

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