Tire Basics for Instructors

Best Practices for Safety, Speed, and Learning

Cameron Parsons
Product Manager
Toyo Tires USA

Introduction

Cameron Parsons – Product Manager of Competition and Specialty Tires

Motorsports Tires – Proxes R1R, R888R, RR, slick tire programs, short course off-road LOORRS, desert off-road (Baja 500/1000, Mint 400)

Background – Racing driver, instructor, Parsons Racing team owner, automotive journalist/test driver.

TOYO TIRES

Tires 101

Tires are the most important equipment on your car!

- Support the weight of the vehicle
- Provide traction to make the car do what you want it to
- To a lesser extent, act as a form of suspension to soften the ride

Support Weight of the Vehicle

- Construction
  - Bead
  - Inner liner
  - Plies (Carcass & Sidewall)
  - Sidewall stock
  - Cap and tread
- **Inflation pressure**

Provide Traction

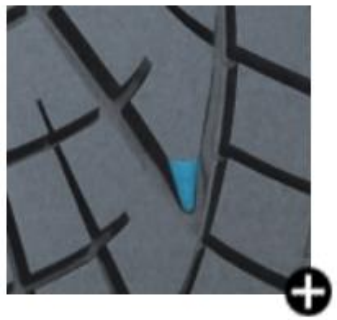
- Construction
  - Bead & Sidewall
  - Carcass
- Tread compound
- Tread design
- Inflation pressure

TOYO TIRES®

Tires 101

Silica-Reinforced, High-Grip Tread Compound

- Improves grip for better handling and performance during high -spirited driving.



Tapered Center Block Edge

- Stabilizes center block movement to decrease irregular wear.
- Helps to increase hydroplaning resistance.

Stability Control Slits

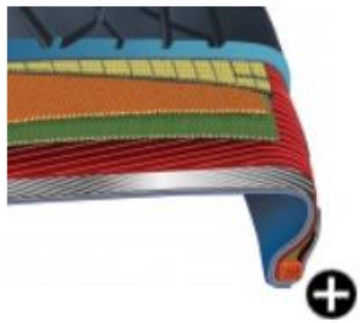
- Provide resistance to irregular wear.
- Improve dry performance by maintaining block stiffness during aggressive braking.

Unidirectional Arrowhead Tread Design

- Provides balanced performance between wet and dry conditions.

Multi-Width EVAC Channels

- Improve water evacuation.
- Widen the shoulder block area to enhance steering.



Advanced Autocross-Inspired Casing With Modified Radial Construction

- Improves steering response and handling.

TOYO TIRES®

Tires 101

Different category tires serve different purposes

- All-Season, Extreme Performance Summer, Competition DOT, etc
- In general, there are trade-offs between different categories.

DOT Competition (~100- UTQG)
- Most responsive
- Quickest lap times
- Least wear life
- Least wet weather use
- Most demanding for control
- More noise/harsher ride

Extreme Performance Summer (~200 UTQG)
- Very controllable
- Great dry traction
- Confidence in wet conditions
- Moderately comfortable and quiet
- Balance of grip and wear life

Max Performance Summer (240+ UTQG)
- Most controllable
- Less dry traction than track-oriented products
- Great wet traction
- Quiet and comfortable
- Long wear life

Track / Most Aggressive

Street / Most Convenient

TOYO TIRES®

Tire Selection

What tire to start with?

Which of these makes a fast driver vs a driver that feels fast?

Tire Selection

For beginners: If the car has a OE tires or summer tires, and they are in good condition, use that!
For intermediates and advanced: Extreme performance summer tires and more track-oriented tires are appropriate ONLY if tires have been a limiting factor.

DOT Competition (~100- UTQG)
- Most responsive
- Quickest lap times
- Least wear life
- Least wet weather use
- Most demanding for control
- More noise/harsher ride

Extreme Performance Summer (~200 UTQG)
- Very controllable
- Great dry traction
- Confidence in wet conditions
- Moderately comfortable and quiet
- Balance of grip and wear life

Max Performance Summer (240+ UTQG)
- Most controllable
- Less dry traction than track-oriented products
- Great wet traction
- Quiet and comfortable
- Long wear life

Track / Most Aggressive ⟷ Street / Most Convenient

OE Tire

- Easiest to control
- Designed for the vehicle in its showroom state
- Most cost effective

TOYO TIRES®

Tire Selection

Your Options From Toyo Tires

Proxes RS1
Racing Slick
Non-DOT

- For track only
- Best grip of all
- Least wear life of all
- Designed for race cars

Proxes RR
DOT Competition
40 UTQG

- For track only
- Best dry grip DOT tire
- Least wear life DOT tire
- For experienced drivers only

Proxes R888R
DOT Competition
100 UTQG

- Very aggressive
- Very responsive
- Great dry grip
- Can be used in mild wet
- Less wear life
- Streetable but made for track

Proxes RA1
DOT Competition
100 UTQG

- More aggressive
- Less wear life
- Wet and dry grip
- Shave for improved dry grip
- Streetable but made for track

Proxes R1R
Extreme Performance Summer
200 UTQG

- Forgiving
- Long wear life
- Wet and dry grip
- Drive to and from the track
- Best for beginners and up

TOYO TIRES®

Tools

TOYO TIRES

Tools

Your most important tools

1. Pressure Gauge – What are cold and hot pressures? How much pressure growth was there? Did the tire overheat (did grip come in quickly but go away)?
2. Probe Pyrometer – Did the tire overheat? Is my alignment off? Are my camber settings correct? Are the tires over or under inflated?
3. Setup Sheets – Log every change, understand the benefits and drawbacks every time.
4. Tire Crayon – Dates, tire position, heat cycle #
5. Tread Depth Gauge – Monitor wear for future reference. More useful for street-driven tires.
6. Infrared Pyrometer – ONLY to be used as a backup if you do not have access to a probe pyrometer
7. Durometer – Monitor rubber hardness changes over time and temperatures

Tools

Date:_____ Driver:_____ Car:_____

Track:_____ Tires:_____

Weather:_____ Session:_____ Tire Heat Cycle:_____

Track Temp:_____ Time:_____ Fast Lap:_____ On Lap:_____

Notes:_____

_____

_____

1)_____ 23)_____
2)_____ 24)_____
3)_____ 25)_____
4)_____ 26)_____
5)_____ 27)_____
6)_____ 28)_____
7)_____ 29)_____
8)_____ 30)_____
9)_____ 31)_____
10)_____ 32)_____
11)_____ 33)_____
12)_____ 34)_____
13)_____ 35)_____
14)_____ 36)_____
15)_____ 37)_____
16)_____ 38)_____
17)_____ 39)_____
18)_____ 40)_____
19)_____ 41)_____
20)_____ 42)_____
21)_____ 43)_____

Driver Feedback

Driver:_____ Car:_____ Date:_____

Track:_____ Session Start Time:_____

Tires:_____ Tire Heat Cycle:_____ Session:_____

	1-5 Rating	Explanation
Braking		
Corner Entry		
Mid-corner		
Corner Exit		
Responsiveness		
Drivability /Controllability		
Overall Traction		

Notes/other observations:_____

_____

_____

TRACK SHEET

Date:_____
Track Name:_____ Session:_____
Driver:_____ Car:_____
Tires:_____ Tire Heat Cycle:_____
Total Weight:_____ Misc.:_____

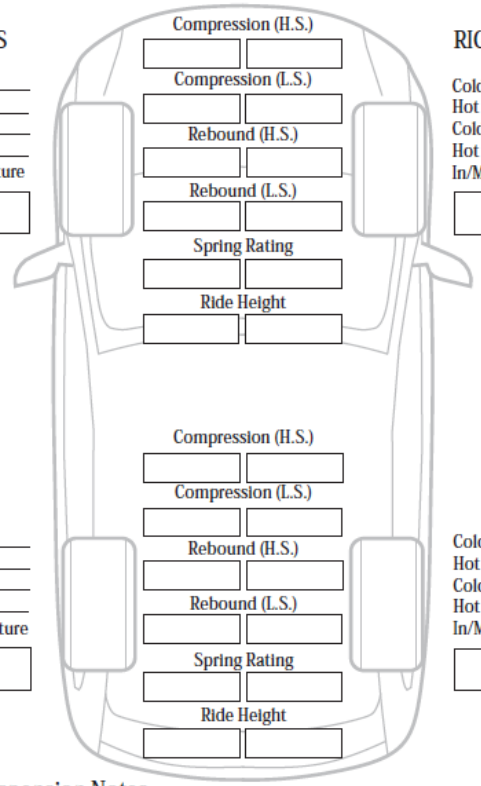
Fast Lap Time:_____
On Lap:_____
Total Laps:_____
Temperature:_____
Track Temp:_____

LEFT SIDE TIRES

Cold PSI:_____
Hot PSI:_____
Cold Durometer:_____
Hot Durometer:_____
Out/Mid/In Temperature

RIGHT SIDE TIRES

Cold PSI:_____
Hot PSI:_____
Cold Durometer:_____
Hot Durometer:_____
In/Mid/Out Temperature



Cold PSI:_____
Hot PSI:_____
Cold Durometer:_____
Hot Durometer:_____
Out/Mid/In Temperature

Cold PSI:_____
Hot PSI:_____
Cold Durometer:_____
Hot Durometer:_____
In/Mid/Out Temperature

Chassis / Suspension Notes

_____
_____
_____
_____
_____

TOYO TIRES®

Inflation Pressure Priority 1: Load Capacity

Standard Load Inflation Table

WARNING! Only use for ISO Metric (ETRTO) sizes. DO NOT use this table for P-Metric sizes.

Single Load per tire in pounds

load Index	Inflation Pressure (psi)														
	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
62	386	408	420	430	452	462	474	485	507	516	529	551	555	562	584
63	397	419	431	441	463	474	485	507	518	529	540	562	570	584	600
64	408	430	444	452	474	488	496	518	540	545	562	573	587	595	617
65	430	452	460	463	496	505	518	540	551	564	573	595	608	617	639
66	441	463	476	485	507	523	529	551	573	584	595	617	629	639	661
67	452	474	487	496	518	535	540	562	584	598	606	628	643	650	677
68	463	485	500	507	529	549	562	584	606	613	628	650	660	672	694
69	474	496	515	529	551	566	573	595	628	633	650	672	681	694	716
70	496	518	531	540	573	584	595	617	639	652	661	694	702	716	739
71	507	529	547	562	584	601	606	639	661	671	683	716	723	739	761
72	518	551	563	573	606	619	628	650	683	691	705	728	744	761	783
73	540	562	579	595	617	636	650	672	694	710	728	750	765	783	805
74	551	573	595	606	639	653	661	694	716	730	750	772	786	805	827
75	562	595	614	628	661	674	683	716	739	753	772	794	811	827	853
76	584	617	634	650	683	697	705	739	772	779	794	827	838	849	882
77	606	639	653	672	694	718	728	761	794	802	816	849	863	882	908
78	617	650	674	683	716	741	750	783	816	827	849	882	891	904	937
79	639	672	693	705	739	762	772	805	838	851	871	904	916	937	963
80	661	694	714	728	761	784	794	827	860	876	893	926	943	959	992
81	672	716	733	750	783	805	816	849	882	899	915	948	968	981	1019
82	694	728	753	772	805	828	838	871	915	924	948	981	995	1014	1047
83	716	750	772	794	827	849	860	893	937	948	970	1003	1021	1036	1074
84	728	772	793	805	849	871	882	926	959	973	992	1036	1048	1069	1102
85	750	794	817	838	871	897	915	948	992	1002	1025	1058	1079	1102	1135
86	772	816	841	860	904	924	937	981	1014	1032	1058	1091	1111	1135	1168
87	794	838	864	882	926	950	970	1003	1047	1061	1080	1124	1142	1157	1201
88	816	860	888	904	948	976	992	1036	1069	1090	1113	1157	1174	1190	1235
89	849	893	920	937	981	1011	1025	1069	1113	1129	1157	1202	1215	1235	1279
90	882	926	952	970	1014	1046	1058	1102	1146	1168	1190	1235	1257	1279	1323

TOYO TIRES®

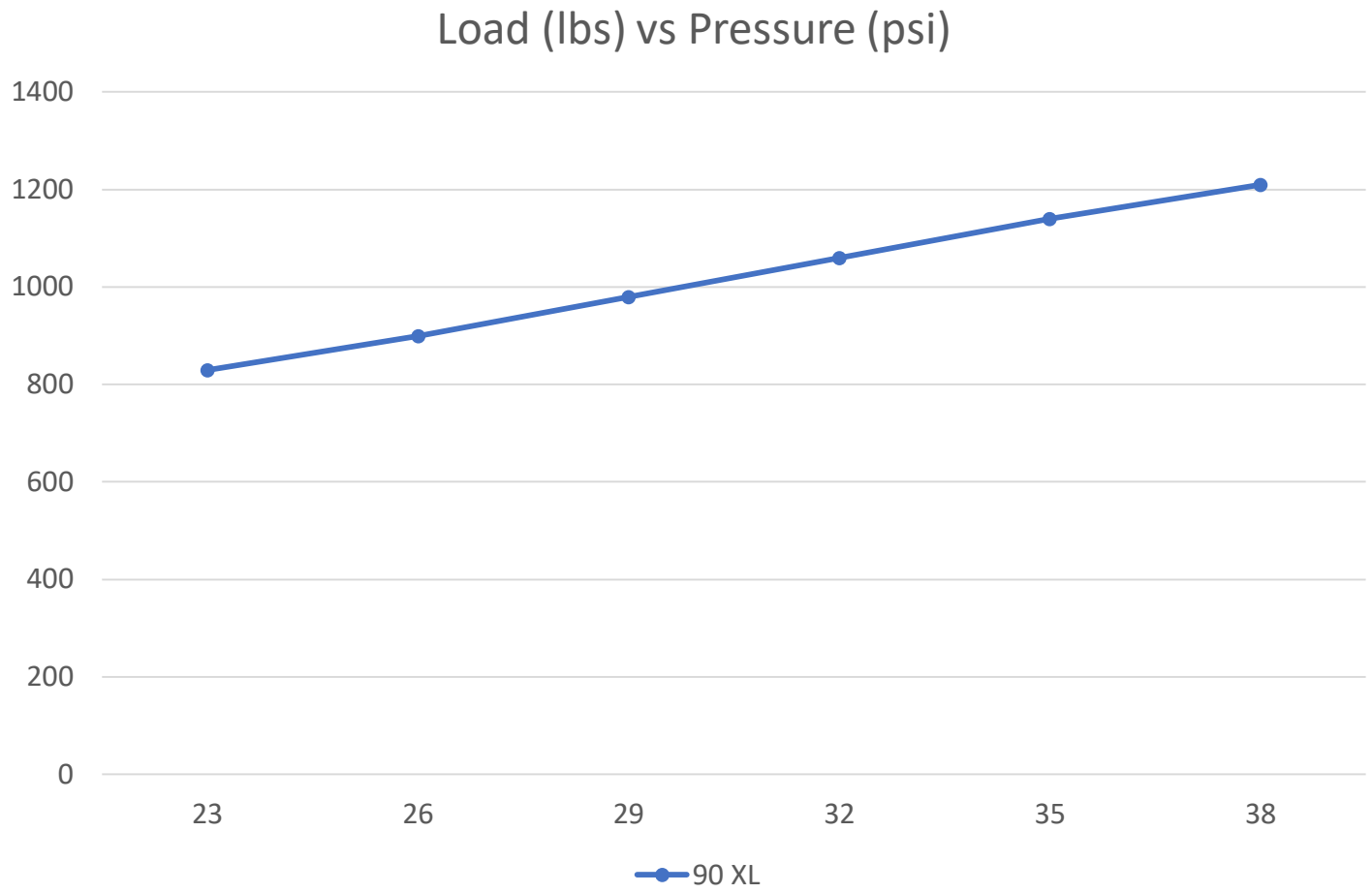
Inflation Pressure Priority 1: Load Capacity

Common error: under-inflation to “soften” a tire

Under-inflation reduces a tire’s load-carrying capacity, inflicting additional stress on the sidewall, building excessive heat and causing damage.

Will each tire inflated to support 1,000 pounds each be sufficient for a 4,000 pound car? No!
Consider:

- Weight shifting
- Vertical G forces (crests)
- Downforce
- Speed



Inflation Pressure Priority 1: Load Capacity

A tire's load capacity is reduced at higher speeds

Percentage of load capacity vs speed

Speed (MPH)	V	W	Y
130	100	100	100
136	97	100	100
143	94	100	100
149	91	100	100
155		95	100
162		90	100
168		85	100
174			95
180			90
186			85

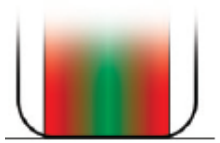
Inflation Pressure Priority 2: Temperature

#1 Goal for temperatures is to reach minimum 160 degrees F, while most R-compound tires will perform at their best closer to 180-200 degrees F.

If you aim to get the most out of your tires, use a probe pyrometer to measure the inside, middle, and outside of each tire's tread surface.

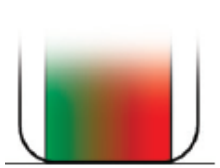
This information will tell you about your alignment settings and tire pressures.

HOT CENTER: The tire is likely overinflated, raising the center and reducing friction and traction on the outside and inside. This can lead to overheating the rubber and excessive sliding.



HOT EDGES: The tire pressure was set too low, feeding most of the traction area to the inside and outside, contributing to sidewall flex and weakened response.

OPTIMUM: Temperatures across the tire are very close if not the same, showing an even level of wear and grip that maximizes the contact patch for optimum performance.



HOT INSIDE: More than 20- to 30-degrees variance spanning from a hotter inside to cooler outside of the tire shows an excess of negative camber. If this pattern shows similarly on both tires side-to-side, this may also point to toe-out, which improves turn-in response but reduces higher speed straight line stability (generally not recommended, as it can make the vehicle difficult to control in corners).

HOT OUTSIDE: More than 20- to 30-degrees variance spanning from a hotter outside to a cooler inside of the tire shows an excess of positive camber. If this pattern shows similarly on both tires side-to-side, this may also point to toe-in, which can improve higher speed straight line stability but reduces turn-in response.

TOYO TIRES®

Inflation Pressure: The Big Question

“What pressure should I run?”

Enough pressure to: 1) Support the load demands of the vehicle, and 2) Build enough temperature in the tread compound to maximize grip.

The factory-recommended pressures are the best starting point for someone with no idea. Once they get quicker, they can target the factory recommendation as a target hot pressure.

Still getting quicker? Use the pyrometer and monitor lap times.

First three laps are quickest, then performance drops: Tires may be overheating (decrease PSI)
Lap times progressively improve until the very end: Driver is learning or tires are not building enough heat (increase PSI)

At the end of it all, ensure that pressures remain above load-carrying capacity. You can check these numbers at Toyo’s website: https://www.toyotires.com/tires-101/tire-load-and-inflation-tables

TOYO TIRES®

Inflation Pressure: Good Practices

- With brand new tires, run a few easy laps to get any remnant release agent removed from tires.

- Safe warmup: gradually build speed. Cold pressures = lower pressures, tires will have less grip and are more prone to damage until the pressures build with heat.

- Whenever possible, start with higher pressures and reduce pressure toward optimal setting.

- When tire measuring/tuning, do not take cooldown lap (IF SAFE TO DO SO), run 100% until entering pit lane.

- Measure tire temperatures and pressures while hot.

- If you don’t have crew to help, measure temperatures before pressure. Temperatures change more quickly.

- Start with the hottest tire, then second hottest, and work your way around the vehicle quickly.

Getting the Most Out of Your Tires

Heat Cycling
For most R-compound tires, a heat cycle can help extend their overall life. Gradually warm up the tire for 1-2 laps, then 1-2 more at 80%, then pit. Let tire cool for a full 24 hours before using again. (Helps compound chemicals bond)

“Flipping Tires”
Asymmetric tires (inside and outside are labeled) will not benefit as much from swapping sides or positions. Directional tires, however, can be flipped on the rims and then swapped side to side.

Dismount tires from the wheels of one side of the car, then mount them onto wheels on the other side so that they are spinning in the same direction as before but on the opposite side of the car.

This will not affect a tire’s total heat cycles, but can extend the life of the tread rubber.

*Depending on how the tread surface wore side to side, camber settings may be less effective

TOYO TIRES®

Common Questions

Q: How should I store my tires?
A: In a cool, dry place where water cannot collect inside. They should be placed away from electric generators, motors, and sources of heat. Storage surfaces free of grease, gasoline, or other substances that deteriorate rubber. Ideally in room temperature, but always at least above 15 degrees F. Only mount them if they have sat in a temperature of 68 degrees F or warmer for 24 hours.

Q: How long will my tires last on track?
A: It depends. Do you drive a Miata or a Corvette Z06? Are you a beginner or advanced? Is it a race tire or a summer street tire? When pushed to their limits and not over-driven, most users get 5-10 heat cycles out of race-specific tires. DOT tires may get up to 20, 30, or even more heat cycles out of them.

Q: How do I know when I need new track tires?
A: First check condition, then rate performance. Assuming a DOT competition tire, is there little to no tread left? Is there an excess of weather and/or heat-induced cracks in the rubber? Does the tire handle significantly different from when it was new?

Q: What is tire “graining?”
A: This is when bits of rubber on the tread get rubbed off and rolled together. Is often a biproduct of overworked tires, particularly when they have not yet reached optimal pressures and temperatures.

The Important Stuff

What anyone who goes on a race track should know and consider about their tires

- What every driver/student should know about their tires
  - What tires are on the car
  - The condition of the tires
  - Factory recommended inflation pressure
  - What the inflation pressure is before driving back home!

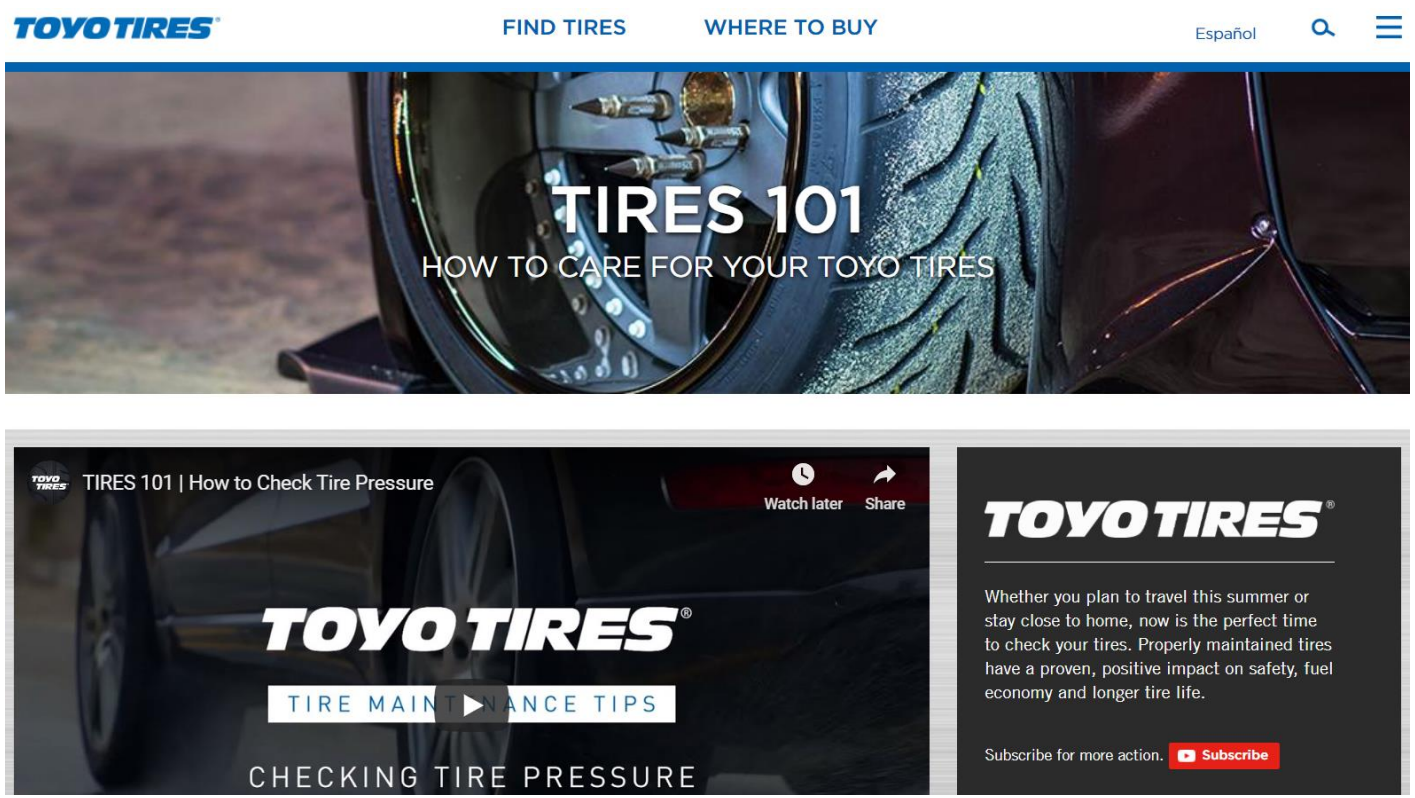
- What every driver/student should learn about their tires
  - Cold inflation pressures / anticipated hot inflation pressures
    - (And to gradually build toward optimal temperature/pressure)
  - How to use the important tools – pressure gauge, pyrometer, setup sheets
  - How old tires feel vs new tires

Resources

https://www.toyotires.com/

https://www.toyotires.com/tires-101

https://www.toyotires.com/tires-101/tire-load-and-inflation-tables



TOYO TIRES