What does one degree of toe in a rear tire correspond to?

Start with a tire. We'll take an average tire for the example. If you want to be specific, check out jayski.com's race pages. He gives the actual circumferences for each specific race. Let's take a typical circumference (distance around) of 88 inches. Using

$$Circumference = 2\pi\ (radius)$$

$$radius = \frac{Circumference}{2\ \pi}$$

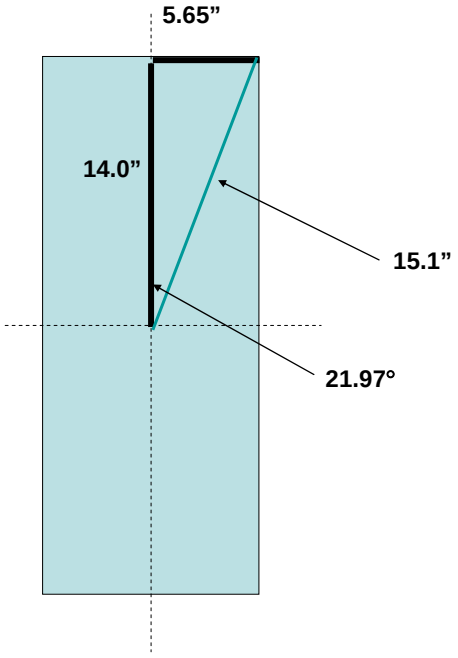
We find a radius of

$$radius = \frac{88.0\ inches}{2\ \pi}$$

$$= 14.0\ inches$$

Tire widths range from 10.8-11.8 inches. Let's take the average (11.3 inches) for our representative tires.

A secret: If you draw things to scale, even using a crude program like PowerPoint, it makes visualizing things much easier. At least it does for me. I've drawn the tire below.



The radius of the tire and half the width form a right triangle. We can find the length of the hypotenuse using Pythagoras' theorem.

$$c = \sqrt{a^2 + b^2}$$
$$c = \sqrt{(5.65\,inches)^2 + (14.0\,inches)^2}$$
$$c = 15.1\,inches$$

And the angle using

$$\tan\theta = \frac{o}{a}$$
$$\theta = \tan^{-1}\left(\frac{o}{a}\right)$$
$$\theta = \tan^{-1}\left(\frac{5.65}{14.0}\right)$$
$$\theta = 21.98°$$

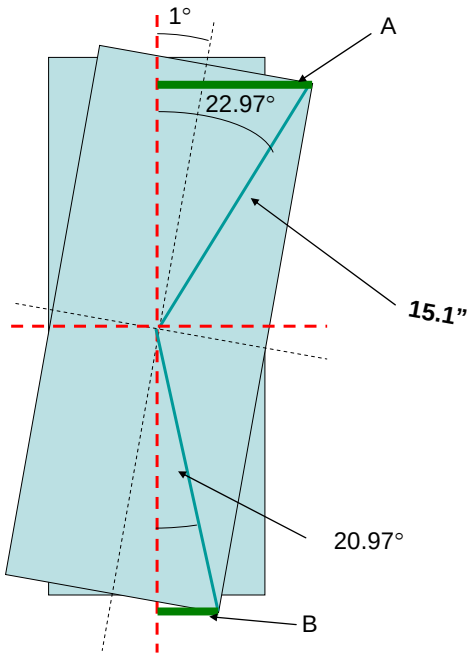
Now we're going to rotate the tire by one degree. I've rotated it by a lot more than one degree in the picture because one degree is too small an angle and you can't really see anything.

Once you rotate the tire, the angle between the upper part of the tire and the vertical is one degree greater than it was: 22.98°. The line labeled 'A' is the distance from the vertical to the front edge of the tire and its length is

$$\sin\theta = \frac{o}{h}$$
$$o = h\sin\theta$$
$$= (15.31\,inches)\sin(22.98)$$
$$= 5.8952\,inches$$

Similarly, the angle the rear corner of the tire makes is one degree less, so the length of the line labeled 'B' is

$$\sin\theta = \frac{o}{h}$$
$$o = h\sin\theta$$
$$= (15.1\,inches)\sin(20.98)$$
$$= 5.4064\,inches$$



If you subtract the length of B from the length of A, you have the offset, which is

$$\text{offset} = \text{length of 'B'} - \text{length of 'A'}$$
$$= 5.8952 \text{ inches} - 5.4064 \text{ inches}$$
$$= 0.4888 \text{ inches}$$

which is pretty close to the 5/8 inch I understand NASCAR is allowing teams. My number is slightly off, which may be due to slightly different widths assumed for the tire.

If you repeat the calculation and use two degrees instead of one, the respective angles are 23.98 and 19.98 degrees. That gives an offset of about one inch. (The small angle approximation actually works!)