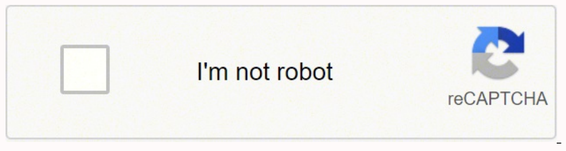

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How to measure vehicle turning radius

Related Resources: calculators Power Transmission Design and Engineering Engineering and Design Applications Vehicle Turning Circle Design and Engineering Equations and Calculators. When a vehicle is cornering, each wheel describes a turning circle. The outer turning circle, or its radius, is the main subject of interest. The calculation is not precise because when a vehicle is cornering the perpendiculars through the centers of all wheels do not intersect at the curve center point (Ackermann condition). In addition, while the vehicle is moving dynamic forces will arise that will affect the cornering maneuver. However, the following formulae can be used for estimation purposes: Calculator Preview: Vehicle Turning Circle Equations and Calculators Distance Between steering axis j = s - 2rO Theorectical value of the outer steering angle cotBa0 = cotβi + j / Ikt Steering angle deviation BF = Ba - Ba0 Turning circle radius rs = Ikt / sinBa0 + rO - 50 ·BF Where: j = Distance between steering axles (mm) Ikt = Wheelbase center to center (mm) s = Track or whele to wheel center width (mm) ro = Scrub radius (mm) the distance in front view between the king pin axis and the center of the contact patch of the wheel, where both would theoretically touch the road. βi = Inner steering angle βa = Outer steering angle rs = Turning circule radius (mm) βF = Steering deviation (deg) 'a0 = Theorectical value for outer steer angle Outer Radius: 40’-40’10” | 12.2-12.4 mInner Radius: 19’4” | 5.9 mVehicle Wheelbase: 40’ | 12.2 mVehicle Length: 45’6” | 13.87 mVehicle Width: 8’ | 2.44 m Something went wrong. Wait a moment and try again. Turning Radius calculation Introduction This article describes the calculation of the turning radius of a car or bicycle. This radius depends on two things: - the wheelbase w , which is the distance between the front- and the rear wheel - the angle a of the front wheel We suppose that only the front wheel is able to turn. See figure below: side view top view Calculation The front and rear wheel follow a circle with the same center. At all times, the direction is perpendicular to the radius. See figure below: movement The radius of the front wheel is R, the rear wheel r. From the figure above we conclude: also ollirg/iStock/Getty Images "Turning radius" is one of those terms that has kind of taken on a life of its own, mostly through public misunderstanding. Technically, a "radius" is half the diameter of a whole circle; interesting information in terms of comparing how well two cars can do a U-turn, but not exactly useful in the objective sense. Most magazines have long since given up using "turning radius" in the colloquial sense in favor of "turning circle" to describe the space a vehicle needs to do a U-turn. But, one is easy to derive from the other, if you're feeling particularly technical. Find a flat parking lot with plenty of open space, and park with your passenger-side door near the edge of the lot. Count on needing 50 feet or so of open space to the left. Have your assistant mark the ground with chalk about an inch to the right of where your right-front tire touches the ground. This bit of extra clearance is necessary, because the tire's sidewall will typically bulge out past the tread. Start the engine, and turn your steering wheel all the way to the left, as far as it will go. Put the vehicle in "drive," and very gently, very slowly let your foot off the brake. Proceed in a circle at idle speed. Stop just before you've reached halfway around the circle -- call it 170 out of 180 degrees. Have your assistant mark the ground next to your right-front tire. Proceed forward another six inches or so, and have your assistant place another mark. Keep stopping and marking the ground every six inches or so until you're pointed back toward the edge of the parking lot. Move the vehicle and park it. Measure from your first reference mark, where you started, to the furthest out of your other reference marks. The distance from the first mark to the furthest mark is your turning circle, or the space your vehicle needs to do a U-turn without hitting a curb. Divide this measurement by two to get your "turning radius." This information is almost useless in the real world, but it's nice to say you have it. Turning circle radius gives an indication of the space required to turn a particular vehicle. Hence, the higher the value of turning circle radius, the higher is the space you need to turn the vehicle completely and vice versa. This parameter is closely related to the steering geometry and the suspension system of the vehicle under consideration. The effectiveness of this specification of a vehicle is clearly evident while maneuvering in a crunchy parking space. Technically speaking, it is the radius (or the diameter) of the circle made by the outer wheels of the vehicle while making a complete turn. Naturally, turning circle differs for every kind of vehicle. Legally, manufacturers must specify the turning circle radius or diameter. Hence, it appears in the specification sheet of every vehicle. How is turning circle radius measured? Measuring turning radius In an experimental determination of turning circle radius or diameter, a vehicle must take a turn either in the left or right direction in full or lock condition i.e. an extreme position of steering wheel. Suppose that such a vehicle is taking a turn towards the right hand side. In such a situation, wheels on the left side will be the outer wheels. Hence, the radius of the circle traced by these wheels will give the turning radius of the vehicle. Alternatively, it is also possible to calculate turning radius based on the wheelbase and other suspension geometry parameters. Thus, the larger the value of turning radius, bigger is the space you need for a vehicle to take a turn. Generally, vehicles equipped with electric power steering have smaller turning radius compared to that of ordinary vehicles. The standards or the requirements of turning circle of the vehicle are specified in various technical standards which are generally developed country wise. The Indian requirements are specified in the Indian standard IS 12222.2011. Read More: What is the Wheelbase in a car?>> Enter the wheelbase length and the turning angle of the front wheels into the calculator to determine the turning radius. Turning Radius Formula The following formula is used to calculate the turning radius of a car. TR = WB/tan(a) Where TR is the turning radiusa is the angle of the turnWB is the wheelbase (distance between centers of the front and back wheels) This formula assumes a perfect theoretical turning scenario. In real-world situations, this turning radius would vary depending on wheel tilt, friction, and many other factors. Turning Radius Definition What is a turning radius? A turning radius is a radius at which a car will rotate, or turn, given a certain wheelbase length and an angle of turn of the wheels. Example Problem How to calculate a turning radius? First, determine the wheel base. This is the distance from the centers of the front and back wheels. For this example, the wheelbase is found to be 5 ft. Next, determine the turn angle. This is the angle at which the front wheels are turned from their neutral position. in this problem, the angle of turn is 10 degrees. Finally, calculate the turn radius. Using the formula, the turn radius is found to be: 5/tan(10)= 28.356 ft. FAQ What is a good turning radius? Most common cars have a turning radius of 35′ so anything smaller than that would be considered good. This is the turning radius of the car assuming the wheels are turned as much as possible. Do bigger tires affect the turning radius? Typically larger wheels will increase the turning radius of a vehicle to more wheel tilt during turning. Is a smaller or larger turning radius better? A smaller turning radius is better for handling and cars that want to perform well on a track will want to try to decrease the turning radius as much as possible. This article has multiple issues. Please help improve it or discuss these issues on the talk page. (Learn how and when to remove these template messages) This article may require cleanup to meet Wikipedia's quality standards. The specific problem is: Needs better sectioning, needs better examples, and clarity in prose. Please help improve this article if you can. (April 2021) (Learn how and when to remove this template message) This article needs additional citations for verification. Please help improve this article by adding citations to reliable sources. Unsourced material may be challenged and removed.Find sources: "Turning radius" – news · newspapers · books · scholar · JSTOR (April 2021) (Learn how and when to remove this template message) (Learn how and when to remove this template message) Diagram showing the path of a driver performing a U-turn. A vehicle with a smaller turning diameter will be able to perform a sharper U-turn. Diagram of turning vehicle. The turning diameter of a vehicle is the minimum diameter (or "width") of available space required for that vehicle to make a circular turn (i.e. U-turn). The term thus refers to a theoretical minimal circle in which for example an aeroplane, a ground vehicle or a watercraft can be turned around. The terms turning radius and turning circle are sometimes used, but can have different meanings (see the section on Alternative nomenclature below). The Oxford English Dictionary describes turning circle as "the smallest circle within which a ship, motor vehicle, etc., can be turned round completely".[1] On wheeled vehicles with the common type of front wheel steering (i.e. one, two or even four wheels at the front capable of steering), the vehicle's turning diameter is a measure of the space needed to turn the vehicle around while the steering is set to its maximum displacement from the central 'straight ahead' position - i.e. either extreme left or right. If a theoretical marker pen was placed on the point of the vehicle furthest from the center of the turn, it would draw a circle and the diameter of that circle would give the value of that vehicle's turning diameter. Theoretically speaking, the tightest turning circle possible for a vehicle is the one where the vehicle does not move either forwards or backwards while turning and effectively simply rotates on its own axis. Taking a rectangular vehicle capable of doing this, its turning circle would in fact be equal to the diagonal length of the vehicle. As an example, some boats can be turned in this way. Turning diameter is sometimes used in everyday speak as a generalized term rather than with numerical figures.[citation needed] For example, a vehicle with a very small turning circle may be described as having a "tight turning radius". Alternative nomenclature Turning radius (r) and turning diameter (d) of a passenger car: The wall-to-wall turning circle is shown at the top and takes the vehicle front overhang into consideration, while the curb-to-curb turning circle is shown at the bottom. Other terms are sometimes used synonymously for turning diameter includes, which can lead to confusion. The term turning radius is sometimes used as equal and interchangeable to the turning diameter. However, strictly mathematically speaking, the turning radius (r) will always be defined as half of the turning diameter (d). The turning diameter thus will always give a higher number for a given vehicle, and the turning diameter measurement is usually preferred by automotive manufacturers.[citation needed] For example, the 2017 Audi A4 is specified by the manufacturer as having a turning diameter (curb-to-curb) of 11.6 m (38.1 ft).[2] However, another page refers to the turning radius of the same vehicle as also being 11.6 m,[3] while the correct turning radius in this example would equate to 11.6 m/2 = 5.8 m. Such mixing of terms can lead to confusion among consumers. The term turning radius has become somewhat popular automotive jargon in the mathematically erroneous sense to mean the full diameter of the smallest circle,[citation needed] but, as mentioned, in mathematically correct usage the turning radius is still used to denote the radius. In practice, the numbers for turning diameter tend to be used more,[citation needed] and the term turning diameter will therefore be more correct in most cases. The term turning circle is another term also sometimes used synonymously for the turning diameter. Some argue that the term turning circle is less ambiguous than the term turning radius, but "turning circle" may introduce its own ambiguities since a "circular measurement" mathematically can refer to several measurements, like for example the radius (r), diameter (2r, twice as big) or circumference (2πr, about 6.28 times as big). As an example, Motor Trend refers to a "curb-to-curb turning circle" of a 2008 Cadillac CTS as 10.82 metres (35.5 ft), but the terminology is not yet settled. AutoChannel.com refers to the "turning radius" of the same car as 10.82 metres (35.5 ft). Turning circle is also sometimes used to refer to the path swept in the manoeuvre,[citation needed] i.e. the arc, or the circle's circumference in the case when the manoeuvre makes a complete turn. Different measurement methods There are two methods for measuring the vehicle turning diameter which will give slightly different results. These two methods are called wall-to-wall and curb-to-curb (US spelling), or alternatively kerb-to-kerb (UK spelling). The kerb to kerb turning circle is smaller than the turning circle as it refers to only a partial circle (~180°) with the vehicle alongside one kerb to start with. To perform a U turn in a forward direction only, the centre of the turn is not coincident with the centre of the road - thus a complete circle would not be possible (without driving onto the pavement to complete the manoeuvre). It also does not take into account that part of the vehicle that overhangs the wheels where as 'turning circle' does. Curb-to-curb A curb or curb-to-curb turning circle will show the straight-line distance from one side of the circle to the other, through the center. The name "curb-to-curb" indicates that a street would have to be this wide before this car can make a U-turn and not hit a street curb with a wheel. If you took the street curb and built it higher, as high as the car, and tried to make a U-turn in the street, parts of the car (bumper) would hit the wall. Wall-to-wall The name wall or wall-to-wall turning circle denotes how far apart the two walls would have to be to allow a U-turn without scraping the walls. One can find these two ways of measuring the turning circle used in auto specifications, for example, a van might be listed as having a turning circle (in meters) of 12.1 (C) / 12.4 (W). Exceptions Turning radius of a vehicle depends on the vehicle type A notable exception to the terminology used in this article in vehicles that are capable of spinning around their central axis, such as certain lawnmowers and wheelchairs as they do not follow a circular path as they turn. In this case the vehicle is referred to as a "zero turning radius" vehicle. Some camera dollies used in the film industry have a "round" mode which allows them to spin around their z axis by allowing synchronized inverse rotation of their front and rear wheel sets, effectively giving them "zero" turning radius. Common uses Aeroplanes Watercraft Wheeled vehicles See also Breakover angle Minimum railway curve radius Overhang (automotive) U-turn (maneuver) Ride height Dubins path References ^ "turning, n." OED Online, Oxford University Press, December 2020, www.oed.com/view/Entry/207704. Accessed 15 February 2021. ^ 2017 Audi A4 - Audi Canada - Product Information Book ^ "Used 2017 Audi A4 Specs & Features". Edmunds.com. Retrieved 2017-08-18. External links Vehicle Turning Radius explanation + visuals Grounds Maintenance Magazine Article about Zero Radius Lawn Mowers Retrieved from "

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