

Mountain bike

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A **mountain bike** or **mountain bicycle** (abbreviated Mtn Bike, MTB; or ATB, for all-terrain bicycle) is a bicycle designed for off-road cycling. Mountain bikes share similarities with other bikes, but incorporate features designed to enhance durability and performance in rough terrain. These typically include suspension on the frame and fork, large knobby tires, more durable heavy duty wheels, more powerful brakes, and lower gear ratios needed for steep grades with poor traction.

Mountain bikes are typically ridden on mountain trails, fire roads, logging roads, single tracks and other unpaved environments. These types of terrain commonly include rocks, washouts, ruts, loose sand, loose gravel, roots, and steep grades (both inclines and declines). Mountain bikes are built to handle this terrain and the obstacles that are found in it like logs, vertical drop offs, and smaller boulders.

Since the development of the sport in the 1970s many new subtypes of mountain biking have developed, such as cross-country (XC) biking, all-day endurance biking, Freeride-biking, downhill mountain biking, and a variety of track and slalom competitions. Each of these place different demands on the bike requiring different designs for optimal performance. MTB development has included an increase in suspension, typically up to 8" or 203mm, and gearing, up to 30 speeds, to facilitate both climbing and rapid descents. However, advancements in sprocket design has recently led to the "1x (pronounced one by)" trend, simplifying the gearing to one Chainring/Sprocket in the front and multiple sprockets on the rear of the drive train, more commonly, 9, 10 or 11 .



A full-suspension mountain bike, in this case a Specialized Epic.

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History

The original mountain bikes were modified heavy cruiser bicycles used for freewheeling down mountain trails.

The sport became popular in the 1970s in Northern California, USA with riders using older single speed balloon tire bicycles to ride down rugged hillsides.^[1] Joe Breeze, a bicycle frame builder, used this idea and developed what is considered the first mountain bike.^[2] The 2006 documentary film, *Klunkerz: A Film About Mountain Bikes*, looks at this period of off-road cycling in detail. However, it was not until the late 1970s and early 1980s that road bicycle companies started to manufacture mountain bicycles using high-tech lightweight materials, such as M4 aluminium. The first mass production mountain bike was the Specialized Stumpjumper, first produced in 1981.^[3] Throughout the 1990s and 2000s, mountain biking moved from a little-known sport to a mainstream activity complete with an international racing circuit and a world championship, in addition to various freeride competitions, such as the FMB World Tour and the infamous Red Bull Rampage.



A cross country mountain bike race.

Designs

Mountain bikes can be divided into four categories based on suspension configuration:

- **Rigid:** A bicycle with neither front nor rear suspension; a hardtail with a rigid fork.
- **Hard tail:** A bicycle equipped with a suspension fork, and a rigid frame.
- **Soft tail:** Having neither front nor rear suspension, as with a rigid, the frames and occasionally front forks of these bicycles include some built-in flexibility to absorb small bumps. These designs are much more common in road bikes than mountain bikes.
- **Dual or full suspension:** A bicycle equipped with both front rear suspension. The front suspension is usually handled by a telescopic fork similar to that of a motorcycle, and the rear by a mechanical linkage driving a telescopic shock absorber.

Discipline-oriented designs

There are several different styles of mountain biking, usually defined by the terrain, and therefore bikes employed. Styles of mountain bike riding and mountain bikes have evolved rapidly in recent years leading to terms such as Freeride and "Trail bike" being used to categorise mountain bikes. Definitions for the most widely used terms are listed below.

Cross country (XC) mountain bikes are designed primarily around the discipline of cross country racing, placing emphasis on climbing speed and endurance, and therefore demanding lightweight, efficient bikes. In the 1980s and early 1990s XC mountain bikes typically consisted of a lightweight steel hardtail frame with rigid forks. Throughout the 1990s XC bikes evolved to incorporate lightweight aluminum frames and short travel (65 to 110 mm) front suspension forks. Recently full suspension designs have become more popular among racers and enthusiasts alike, and the use of advanced carbon fiber composites has allowed bike designers to produce full suspension designs under 10 kg. In recent years 29" wheels have largely replaced the original standard of 26"; the US men's and women's marathon cross-country races were won on 29ers in 2009 and 2010.^[4] The geometry of Cross Country bikes favours climbing ability and fast responses over descending



2008 GT Zaskar Pro Carbon Hardtail cross country mountain bike with carbon frame and disc brakes

and stability, and as a result typical head angles are 70–71°. Although intended for off-road use, Cross Country bikes are not designed for use on steep or particularly rough terrain. Put in terms of rider emphasis, XC bikes are designed for approximately 80% uphill or flat riding, and 20% downhill.

"Trail" Bikes are a development of XC bikes that are generally used by recreational mountain bikers either at purpose built "trail centers" or on natural off-road trails. They usually have around 5" (120–140 mm) of travel, weigh 11 to 15 kilograms (24 to 33 lb), and have geometries situated somewhere between full XC and All-Mountain bikes. Examples include the Giant Trance, the Trek Fuel EX series, the Specialized Stumpjumper FSR, and Polygon Collosus T Series, among many others. With less of an emphasis on weight, Trail Bikes are typically built to handle rougher terrain than dedicated XC bikes while having slacker head angles (69-68°) which provides greater stability while descending. Trail bikes are designed for approximately 60-70% uphill, and 30-40% downhill riding.

Enduro/all-mountain (AM) bikes bridge the gap between cross-country and freeride bikes, such as the Trek Remedy series, Specialized Enduro, typically weighing between 13 to 16 kilograms (29 to 35 lb). These bikes tend to feature greater suspension travel, frequently as much as 6 inches (150 mm) or 7" of front and rear travel, often adjustable on newer mid- and high-end bikes. Designed to be able to climb and descend well, these bikes are intended to be taken on all-day rides involving both steep climbs and steep descents, hence the term 'all-mountain'. In terms of aggressiveness, these bikes are intended for anywhere from 50-70% downhill riding, and 30-50% uphill riding, bridging the gap between Trail and Downhill bikes. In recent years, there has been somewhat of a split between Enduro and All-Mountain bikes, with the former placing more emphasis on descent due to the increased emphasis on timed downhill runs in Enduro racing when compared to more typical All-Mountain riding.

Downhill (DH) bikes typically have eight or more inches (200 mm) of suspension travel, and extremely low, slack geometry intended to set the rider in a comfortable position when descending steep trails at high speed. Due to their often high gear ratios, soft suspension, and aggressive geometry, Downhill bikes are ideal only for riding down dedicated trails or race courses, almost universally requiring the bike to be carried uphill rather than ridden. Downhill frames are often intended for racing, and as such are required to be both extremely durable and lightweight. Bicycle designers often make use of similar materials in the construction of Downhill and XC frames and components (e.g. carbon fiber), despite their vastly different purposes, as the ultimate goal of a high strength to weight ratio is the same. In recent years, more advanced frame and component designs have produced high-end downhill bikes with similar weights to average Trail and All-Mountain bikes, with an increasing expectation that complete downhill bikes remain below 40 lbs (18 kg) even in budget models. This advancement, along with increased speeds and forces in racing, and the use of downhill frames for freeride applications, has necessitated or otherwise inspired many unique design features and advancements in design present on Downhill bikes, many of which later find use on less aggressive types of bikes (bash guards, clutch derailleurs, wide handlebars, advanced air suspension, bimetallic brake rotors, slack and long geometry). Several types of bicycle speed records have been registered using Downhill bikes.



Mountain bikes are built tough to withstand jumps and drops.



This is an upgraded entry level Downhill/Freeride bike: Specialized Bighit 2006 with 203 millimetres (8.0 in) of travel in the front and 190 millimetres (7.5 in) of travel in the back

Freeride (FR) mountain bikes are similar to downhill bikes, with less emphasis on weight and more on strength, though many frame and component manufacturers no longer distinguish the two in their downhill oriented products. Freeride bikes have ample suspension and typically have at least 7 inches (180 mm) of travel. Freeride bikes are intended for trail features with large air time, such as jumps and drops, and as such are designed to handle heavy impacts, whether from landings or crashes. Freeride frames and parts are rarely made from carbon fiber due to strength and durability concerns and are instead usually made from aluminum, sacrificing marginal weight gain for more predictable material response under heavy usage. Certain freeride specific bikes can be ridden uphill more easily than downhill bikes, but are inefficient in pedaling and difficult to maneuver while angled uphill. Originally, freeride bikes sat between All-Mountain and downhill bikes in geometry, with frame angles steeper than those found in downhill bikes and higher rider positioning, enhancing maneuverability on technical or low-speed features commonly found on "North Shore" style trails. Freeride bikes typically range in weight from 14 to 20 kilograms (31 to 44 lb), with the wide variability resulting from the variety of components applicable for the purpose. Slopestyle and Dirt Jump bikes are included in this category by some, due to similar purposes, but the distinction in bike design is significant between the three.

Dirt jumping, urban and street mountain bikes lie somewhere in between a BMX bike and a freeride bike. They are either arranged as rigid or hardtail bikes, with 3 to 4.5 inches (76 to 114 mm) of front suspension, and rigid, durable frames with low bottom brackets and short chainstays to improve maneuverability. Dirt Jump bikes often overlap in design with Four-Cross bikes, though that discipline has largely fallen out of favor, with many frames including removable derailleur hangers and/or integrated chain tensioners to allow for single speed and multi-speed arrangements (Four-Cross bikes mostly use derailleurs while Dirt Jumpers usually use single speed setups). Tires on these bikes are usually 24 or 26" diameter, fast-rolling slicks or semi-slicks, with narrow casings (approx. 1.8-2.2"). Dirt jumpers usually have low seatposts and oversized handlebars, to make room for tricks. Most dirt jumpers have an extended rear brake cable installed and have no front brake, which allows the rider to spin the handle bars multiple times without tangling the brake cables.

Slopestyle (SS) bikes are a strange blend of Dirt Jump and Freeride bikes, having the geometry similar to Dirt Jumpers, but with approximately 4" (100mm) of suspension travel in both the front and rear. These bikes are mostly used by professional slopestyle riders, this specific usage being their origin, and as such are designed for the extremely large jumps and high speeds encountered in competition. The frames are either adapted from existing All-Mountain or Freeride designs or designed specifically for the purpose, with durable frame designs and sophisticated suspension linkages to make the most of their minimal suspension travel. These bikes usually have relatively slack head angles, relative to their short suspension travel, with a slightly more aggressive overall geometry than the Dirt Jumpers many are based on. These bikes are often equipped with a mix of Dirt Jump and All-Mountain interface specifications (headset size, bottom bracket style, rear axle width and diameter, rear derailleur hanger) to accommodate both Freeride and Dirt Jump components as necessary to handle the high speeds and harsh impacts associated with their use. Slopestyle bikes are also used for light downhill or trail riding by many, if not riding jumps on the same scale as professional riders, with their durability and sophisticated suspension designs allowing for extra versatility when compared to Dirt Jump bikes.

Trials bikes are set up very specifically for the purpose of bicycle trials. Two varieties of trials bike exist, those with 26" wheels (referred to as 'stock') and those with 20" wheels (referred to as 'mod' - because historically they were modified BMX bikes). They typically have no suspension at all, though some still make use of some form of it. Competition rules require stock bikes to have multiple gears for competition, but most riders never use their shifters. Competition rules do not require mod bikes to have any gears. Many non-competitive riders run single-speed, choosing a fairly low-speed, high-torque gear. Most modern trials bikes have no seat at all, as the rider spends all of his time out of the saddle, and trials riding is not conducive to the use of the saddle as a control interface as in normal mountain biking. These bikes are significantly lighter than almost all other mountain bikes, ranging from 7 to 11 kilograms (15 to 24 lb). This makes maneuvering the bike much easier.

Single-speed (SS) mountain bikes have one set gear ratio. The gear ratio chosen depends on the terrain being ridden, the strength and skill of the rider, and the size of the bike (a bike with 29" wheels often requires a different gearing than a bike with standard 26" wheels). Often single-speeds are fully rigid, steel-framed bikes. These are typically ridden by very fit individuals on mild to moderate cross country terrain.

Mountain cross or "Four-cross" (4X) is a type of racing in which four bikers race downhill on a prepared, BMX style track. These bikes generally fall under the categories of Dirt Jump or Slopestyle designs, with the main distinctions being the use of a derailleur rather than a single speed setup, or slightly slacker head angles than ordinary Dirt Jump bikes for increased stability at race speeds. Four-Cross racing has fallen in popularity recently, with the UCI removing Four-Cross from the World Cup due to excessive erosion and inconvenience caused by the purpose-built race tracks.

Dual slalom (DS) is similar to Four-cross, but instead of four competing cyclists during a race, there are only two, racing in parallel lanes. The courses are in general more technical with smaller jumps than Four-cross courses. Dual Slalom races originally took place on grass slopes with gates and minimal jumps, but are now held on man-made courses. Dual slalom racers will usually use Dirt Jump, Slopestyle, or Dirt Jump bikes.

Indycross (IX) is essentially a Mountain Cross event featuring a wide variety of features run by one competitor per time.^[5]

North Shore bikes are much like freeride bikes in their geometry and downhill bikes in their component makeup. Because north shore stunts have evolved to not only include simple and complex bridges but also large drops and high-speed descents through a series of stunts north shore bikes commonly have as much travel as downhill and freeride bikes, however with much more nimble and maneuverable frame designs, and often lighter weight.

Circle dirt track racing In this class of racing any kind of bikes are used, most commonly a hard tail mountain bike with front suspension. Many different modifications are made to track racing bikes, such as reducing bike weight, increasing brake power, trying different cambers (so that when the bike leans the tire is more level with the track thus creating more grip), and trying different gear ratios.

It should be noted that in the early days of mountain biking, all mountain bikes were somewhat custom, home-built machines, and were used for any number of stunts, tricks, racing or other activities. The general design of the bikes were similar. As the sport grew, more specialized designs and equipment were introduced. The further market segmentation beyond simple front suspension XC began to occur in the mid-1990s, as large bicycle and equipment manufacturers were able to cater specifically to changing demands.

Modern designs

Gears



A simple dirt jump bike.



A rigid fork mountain bike

From the 1980s to the late 2000s, mountain bikes often had either 21, 24, or 27 speeds, with 3 gears in the front and 7, 8, or 9 gears at the rear wheel. Thirty-speed mountain bikes have previously been unworkable, as the mud-shedding capabilities of a ten-speed cassette, and the intricacies of a ten-speed rear *dérailleur* have never been suitable. However, many pro-level mountain bikers have taken to using a narrower 10-speed road chain with a 9-speed setup in an effort to reduce the weight of their bike. In early 2009, component group SRAM announced their release of their XX groupset, which uses a two-speed front *dérailleur*, and a ten-speed rear *dérailleur* and cassette, similar to that of a road bike. Mud-shedding capabilities of their ten-speed XX cassette are made suitable for MTB use by extensive CNC machining of the cassette. Due to the time and cost involved in such a product, they were only aimed at top-end XC-racers. However, 10-speed has become the norm by 2011 and the market leader Shimano even offers its budget groupset "Alivio" in a 10-speed version.^[6] In July 2012, SRAM announced a 1x11 drivetrain called XX1 that does not make use of a front *dérailleur* for lighter weight and simplicity.^[7] In the 2014 Commonwealth Games at Glasgow all leading riders used 1x11 drivetrains. SRAM's new 1x12 gearing was introduced in 2016 as SRAM Eagle. This gives a single chain ring bike better ability to ride climbs.



A 2002 rigid 21 speed Trek 800 Sport

Geometry

The critical angles in bicycle geometry are the head angle (the angle of the head tube), and the seat tube angle (the angle of the seat tube). These angles are measured from the horizontal, and drastically affect the rider position and performance characteristics of the bicycle. Mountain bike geometry will often feature a seat tube angle around 73 degrees, with a head tube angle of anywhere from 60-73 degrees. The intended application of the bike affects its geometry very heavily. In general, steeper angles (closer to 90 degrees from the horizontal) are more efficient for pedaling up hills and make for sharper handling. Slacker angles (leaning farther from the vertical) are preferred for high speeds and downhill stability.

Suspension

In the past mountain bikes had a rigid frame and fork. In the early 1990s, the first mountain bikes with suspension forks were introduced. This made riding on rough terrain easier and less physically stressful. The first suspension forks had about 1½ to 2 inches (38 to 50 mm) of suspension travel. Forks are now available with 8 inches (200 mm) of travel or more (see above under "Design.") Bikes with front suspension and rigid, non-suspended rear wheels, or hardtails became popular nearly overnight. While the hardtail design has the benefits of lower cost, less maintenance, and better pedaling efficiency, it is slowly losing popularity due to improvements in full suspension designs.

Many new mountain bikes integrate a "full suspension" design known as Dual Suspension or "full-susser", meaning that both the front and rear wheel are fitted with a shock absorber in some form as the wheel attaches to the bike. This provides a smoother ride as the front and rear wheels can now travel up and down to absorb the force of obstacles striking the tires. Dual suspension bikes of a similar quality are considerably more expensive, but this price increase brings an enormous off-road performance upgrade as dual suspension bikes are much faster on downhill and technical/rough sections, than other forms of the mountain bike. This is because when the wheel strikes an obstacle its tendency is to bounce up. Due to some forward energy being lost in the upward movement some



A full suspension mountain bike

speed is lost. Dual Suspension bikes solve this problem by absorbing this upward force and transmit it into the shocks of the front and rear wheels, drastically decreasing the translation of forward momentum into useless upward movement. Disadvantages of rear suspension are increased weight, increased price, and with some designs, decreased pedaling efficiency, this is especially noticeable when cycling on roads and hard trails. At first, early rear suspension designs were overly heavy, and susceptible either to pedaling-induced bobbing or lockout.

Disc brakes

Most new mountain bikes use disc brakes. They offer much improved stopping power (less lever pressure is required providing greater braking modulation) over rim brakes under all conditions especially adverse conditions, because they are located at the center of the wheel (on the wheel hub). They therefore remain drier and cleaner than wheel rims, which are more readily soiled or damaged. The disadvantage of disc brakes is their increased cost and often greater weight. Well set up V brakes or older cantilever set-ups, under normal road conditions can be equally, if not more effective in stopping power. Disc brakes do not allow heat to build up in the tires on long descents. Instead, heat builds up in the rotor, which can become extremely hot.



A front disc brake, mounted to the fork and hub

Wheel and tire design

Most mountain bikes use 27.5-inch or 29 inch. (559 mm) bicycle wheels, though some models offer 24 or 26 inch tires. Tire size can be chosen based on bicycling terrain and size of the person. A larger tire can cause geometric problems for a short rider. Bicycle wheel sizes are not precise measurements: a 29 inch mountain bike wheel actually has a 622 millimetres (24.5 in) bead seat diameter (the term, bead seat diameter (BSD), is used in the ETRTO tire and rim sizing system). 622 mm wheels are standard on road bikes and are commonly known as 700c. In some countries, mainly in Continental Europe, 700c (622 mm) wheels are commonly called 28 inch wheels.^[8] 24 inch wheels are used for dirt jumping bikes and sometimes on freeride bikes, rear wheel only, as this makes the bike more maneuverable. 29 inch wheels were once used for only Cross Country purposes, but are now becoming more commonplace in other disciplines of mountain biking. A mountain bike with 29" wheels is often referred to as a 29er, and a bike with 27.5 inch wheels is called a 27.5 mountain bike or 650b bike. Wheels come in a variety of widths, ranging from standard rims suitable for use with tires in the 26 in x 1.90 in to 2.10 in (559 x 48 to 53 mm) size, to 2.35 and 3.00 in (60 and 76 mm) widths popular with freeride and downhill bicycles. Although heavier wheelsets are favored in the freeride and downhill disciplines, advances in wheel technology continually shave weight off strong wheels. This is highly advantageous as rolling weight greatly affects handling and control, which are very important to the technical nature of freeride and downhill riding. The widest wheel widths are sometimes used by icebikers who use their mountain bikes for winter-time riding in snowy conditions.



A Fatbike

Manufacturers produce bicycle tires with a wide variety of tread patterns to suit different needs. Among these styles are: slick street tires, street tires with a center ridge and outer tread, fully knobby, front-specific, rear-specific, and snow studded. Some tires can be specifically designed for use in certain weather (wet or dry) and terrain (hard, soft, muddy, etc.) conditions. Other tire designs attempt to be all-around applicable. Within

the same intended application, more expensive tires tend to be lighter and have less rolling resistance. Sticky Rubber tires are now available for use on freeride and downhill bikes. While these tires wear down more quickly, they provide greater traction in all conditions, especially during cornering. Tires and rims are available in either tubed or tubeless designs, with tubeless tires recently (2004) gaining favor for their pinch flat resistance.

Tires also come with tubes, tubeless and tubeless-ready. Tires with tubes are the standard design and the easiest to use and maintain. Tubeless tires often have better performance because you can run them at a lower tire pressure which results in better traction and increasing rolling resistance. Tubeless-ready tires are tires that can use tubes or go tubeless. A liquid sealant is used without the tube to secure the seal to the rim.^[9] Popular tire manufacturers include Wilderness Trail Bikes, Schwalbe, Maxxis, Nokian, Michelin, Continental, Tioga, Kenda, Hutchinson Specialized and Panaracer.

Tandems

Mountain bikes are available in tandem configurations. For example, Cannondale and Santana Cycles offer ones without suspension, while Ellsworth, Nicolai, and Ventana manufacture tandems with full suspension.

See also

- Bicycle
- Freeride mountain-biking movies
- International Mountain Bicycling Association
- List of bicycle manufacturers
- Mountain bike orienteering
- Mountain unicycling
- National Off-Road Bicycle Association (NORBA)
- Mountain quadracycle
- Transrockies
- UCI Mountain Bike & Trials World Championships



A tandem, full-suspension mountain bike



Wikimedia Commons has media related to ***Mountain bikes***.

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