



# Glossary

**AASHTO** – American Association of State Highway and Transportation Officials.

**Abney** – The predecessor of the clinometer; measures percent and degrees of slope. It is larger and requires both hands to use, but when calibrated properly, it can be more accurate than a clinometer and it doesn't require binocular vision to use.

**abutment** – The foundation or substructure that bears the weight of a structure.

**agency** – The entity responsible for managing or administering the project site.

**All-Terrain Vehicle (ATV)** – A motorized off-highway vehicle designed to travel on four low pressure tires, having a seat designed to be straddled by the operator and handlebars for steering control.

**ASA** – American Standards Association

**belted waterbar** – A strip of conveyor belt sandwiched between two pieces of treated lumber and buried in the trail tread with just the belting exposed. The belting is stiff enough to direct water off the trail, but is flexible enough so that vehicles can easily cross it.

**Best Management Practices (BMPs)** – State-of-the-art techniques or philosophies to help ensure resource protection, sustainability, and management success.

**blowdown (windfall, deadfall)** – Trees, limbs, or brush blown down or broken off by an event of nature.

**bollard** – A short wood or metal post buried in the ground and used as a barrier to block or delimit vehicle access. Some are placed and locked into receptacles so they can be removed to allow administrative access.

**buffer zone** – An area usually of a fixed width around a sensitive property where access or activities are restricted or prohibited.

**control point** – Points, lines, or polygons that affect where a trail is located. Positive control points are places where the trail has to go or the designer wants the trail to go (trail termini, saddles, cliffs, creek crossings, road crossings, viewpoints, features that will enhance the rider experience). Negative control points are places where the trail should not or cannot go (wet areas, flat areas, sensitive resource areas, fall lines, property or project boundaries, features that will detract from the rider experience).

**critical vehicle** – The vehicle used to design a structure or facility. Usually, it is the longest, widest, and heaviest vehicle expected to use the facility. Choosing the wrong critical vehicle can adversely affect the functionality of the facility.

**curve** – Any line that is bent into an arc and is not straight. Any three points not in a row define a curve.

**curvilinear** – A horizontal alignment that is predominately curves rather than tangents.

**damp soil** – Some of the voids between the soil particles contain water, but most do not. The damp surface allows water to infiltrate during rain events rather than repel water like dry soil.

**dense graded** – A rock mixture where the voids between the bigger rocks are almost totally filled with progressively smaller particles; ie, few voids. Dense graded rock binds well, but doesn't drain well. It is great for tread surfacing or hardening.

**double track (dual track)** – A trail with or wide enough for two parallel tracks. Its wider tread is designed for vehicles with an axle and three or more wheels. ATV, ROV, and 4WD vehicles use double track trails.

**dry soil** – None or almost none of the voids between the soil particles contain any water. The surfaces of some super-dry soils will repel water.

**dual sport bike** – A street-legal motorcycle that is built for the trail as well as the pavement.

**easy-out** – A bypass or alternate route around a challenge feature. This helps protect the integrity of the challenge feature and allows a group of riders with different skill levels to ride together.

**erosion** – The removal of soil and rock particles by the forces of wind and water. It is a natural process that cannot be stopped but can be managed. The forces of vehicle tires can accelerate erosion, but sustainable design practices and techniques can mitigate those effects and decrease the rate of erosion.

**exposure** – An element in determining trail difficulty or challenge. Exposure is the risk of vehicle damage, personal injury, or death if the rider fails to negotiate the trail.

**fall line** – The direction or path that water takes to run down a slope. Trails located on the fall line will intercept water, which could lead to erosion. The steeper the grade, the more it approaches the fall line.

**filter** – A technical feature at the entrance of a trail that indicates the challenge and skill level required ahead. Those riders who cannot traverse the filter should ride another trail. Under-skilled riders can create severe impacts attempting to negotiate challenge features. A filter reduces use, protects the integrity of the trail, potentially increases rider safety, and helps the agency manage its risk.

**flow** – The rhythm of the trail created by repetitive horizontal and vertical undulations in the trail alignment that allow speed to be maintained without harsh braking or accelerating. It creates a smooth and fun trail experience.

**flowmentum** – Trail alignment that provides high flow and allows the rider to carry his or her momentum through curves or up short grades. Flowmentum increases the fun factor and can decrease tread impacts and maintenance costs.

**forb** – a broad-leaved herb growing in a field, prairie, or meadow.

**four-wheel drive vehicle (4WD)** – A full sized motorized vehicle, usually wider than 60 inches.

**grade** – The amount of elevation change between two points expressed as a percentage. Often referred to as rise over run, it is the elevation change between the two points divided by the horizontal distance between the two points.

**grade break** – The point where there is a change in the prevailing grade to either steeper or flatter grade. Both are places where there could be an opportunity to drain water off the trail.

**grade reversal** – Changing the vertical alignment of the trail from negative to positive grade for a sufficient distance and elevation to force water off the trail. As used in this book, a grade reversal is a natural feature designed into the trail layout. It does not refer to a drain dip or rolling dip constructed into the trail.

**high-density polyethylene (HDPE)** – A tough plastic used in plastic culverts, arches, and other materials. It is also a common substrate for signs.

**horizontal alignment** – The series of tangents and curves that form the plan view of the trail.

**knick** – A section of trail that is removed to allow water to drain from the trail tread.

**line** – A line is a connection between any two points. A line may also be the path of a trail or the path a rider takes (i.e. riders' eyes scan for the easiest line to follow in rough terrain).

**linear** – A horizontal alignment that is predominately tangents rather than curves.

**Maintenance Level 2 (ML2) road** – USDA Forest Service roads open for use by high-clearance vehicles and not suitable for passenger cars. Low traffic volume and low speed roads; surface smoothness is not a consideration.

**Maintenance Level 3 (ML3) road** – USDA Forest Service roads open and maintained for travel by prudent drivers in standard passenger cars. Subject to the requirements of the Highway Safety Act.

**mitigation** – An action taken to lessen or eliminate potentially adverse impacts from a management action, recreation use, or design choice.

**mixed-use road** – A road that is open for use by highway legal and non-highway legal motor vehicles.

**motocross (MX) track** – A closed course consisting of a compressed winding dirt track with hills, jumps, hairpin turns, and whoops.

**NEPA** – National Environmental Policy Act. The process of analyzing and evaluating the environmental effects of a ground-disturbing project on federal land.

**NMS** – NOHVCC Management Solutions. A consulting service of NOHVCC.

**NOHVCC** – National Off-Highway Vehicle Conservation Council.

**OHM** – Off-Highway Motorcycle. A motorcycle designed to be used off-highway. Also referred to as trail bike, dirt bike, or enduro bike. Can also be a dual-sport bike or a trials bike.

**OHV** – Off-Highway Vehicle. For the purposes of this book, OHV refers to an ATV, 4WD, OHM, or ROV.

**OHV specialist** – A person with knowledge and experience in OHV recreation, management, planning, project implementation, and operations and maintenance.

**open graded** – A rock mixture where the voids between the larger rocks are not filled with smaller particles. Being of fairly uniform size, open graded rock does not bind well, but does drain well so it is good for drainage structures like French drains.

**Optimum Moisture Content (OMC)** – The point where just enough of the soil voids are filled with water to make the soil bind together very well. The OMC will vary by soil type.

**pistol-butted** – A tree that is curved at the base similar to the curve of a pistol handle. This indicates unstable ground that has or is moving due to poor soils, high water content, or a combination of the two.

**plasticity** – Cohesive and able to be molded into a shape. In soils, plasticity relates to the clay content. The higher the clay content, the more plasticity the soil has.

**poorly graded** – A rock mixture that usually has a maximum size, but the percentage of smaller sizes is uncontrolled and inconsistent so some voids may be filled and others may not. Pit run material which is rock taken directly from the source and is not crushed or mixed is generally poorly graded.

**PTBA** – Professional Trailbuilders Association.

**radius** – The distance from the center of a circle to any point on the circle. The radius of a circle is half of the diameter.

**Recreation Off-highway Vehicle (ROV)** – often referred to as side-by-side or UTV (Utility Type Vehicle). Motorized off-road vehicles designed to travel on four or more tires, intended by the manufacturer primarily for recreational use by one or more persons and having the following characteristics: a steering wheel for steering control; a Roll Over Protective Structure complying with ANSI/ROHVA-1, an Occupant Retention System complying with ANSI/ROHVA-1; non-straddle seating; maximum speed capability greater than 30 mph; less than 80” in overall width, exclusive of accessories; engine displacement of less than 1,000cc; identification by means of a 17 character PIN or VIN.

**Recreation Opportunity Spectrum (ROS)** – A recreation planning land classification system that defines an area by the probable recreation experience it provides in terms of setting and level of development. The setting is measured by the number of people expected, producing different levels of solitude and the evidence of human use as shown by management activities and degree of development. There are six settings ranging from Primitive to Urban.

**retroreflective** – The ability of a surface to return light back to its original source. Retroreflective signs and pavement markings bounce light from vehicle headlights back toward the vehicle and the drivers’ eyes, making signs and pavement markings more visible, brighter, and easier to read for the driver.

**rill** – An eroded groove or channel created by moving water. Their size can vary from being barely visible to being several feet deep.

**riparian** – Relating to a habitat rich in flora and fauna that is adjacent to lakes, streams, and other bodies of water.

**riparian zone** – The vegetated area along water bodies that generally consists of trees, shrubs, and grasses that are the interface and transition between the upland and water environments. In some areas, policy and legislation set the width of the riparian zone.

**road authority** – The agency or entity who either owns the road or is responsible for its operation, maintenance, and management.

**rock garden** – A section of trail composed almost entirely of loose or embedded cobble rock or boulders. Removing one rock only exposes another rock so the rocks keep coming to the surface like flower buds in a garden.

**rock gradation** – The maximum size and the percentage of progressively smaller particle sizes in an aggregate mix. For example, a 2” minus aggregate will have a maximum size of 2” with a mix of smaller sizes. The percentage of each smaller size is often spelled out in the specifications for the mix.

**rolling dip** – A drainage structure usually added to an existing trail to reduce the size of the tread watershed. It involves excavating a sag and building up a crest to create a flattened or reversed grade to help drain water off the trail. To stay functional, a rolling dip requires regular inspection and maintenance.

**saturated soil** – All of the voids between the soil particles are filled and the soil is incapable of holding any more water. The soil is at its weakest point, has no bearing capacity, and turns into mud. Additional water can no longer infiltrate the soil, causing water to flow off or of pond on the surface. Since soil particles are in suspension, they can be carried off and lost.

**scour** – The removal of soil particles due to the velocity and volume of water.

**serpentine (curvy, snaky)** – Trails with back-to-back curves with short or no tangents. A serpentine alignment contributes to flow and fun factor.

**single track** – A narrow trail with only one track or tread to ride. Designed and intended for single-file motorcycle use.

**slick rock** – A term used to describe the red smooth slab rock in the canyon country of the southwestern United States. It is generally sandstone and it is not slick, even when wet.

**splash erosion** - Soil particles displaced by the impact of a drop of rain hitting unvegetated ground. These small displaced particles are then easily washed away during the rain event.

**staging area** – Similar to a trailhead except that in addition to providing access to trails, it can also provide access to other activities like MX, endurocross, training areas, and concessions. A staging area has a large parking area and is used to conduct events so there may be a pit area, starting area, gas row, spectator area, etc.

**stakeholders** – Individuals, groups, or entities that have a direct and active interest in the project site. This could include riding clubs, private inholders, range permittees, timber interests, mining interests, irrigation districts, other tenure holders, neighboring residents, utility companies with corridors through the project site, etc.

**substrate** – The base material used for signs; usually wood, plywood, fiberglass, polyplate, high-density polyethylene plastic, or aluminum.

**superelevated turn** – A curve where the outside of the tread is higher than the inside; banked or insloped. It offsets centrifugal forces and allows riders to carry their speed through a turn. It can reduce tread impacts from braking and accelerating and increase flow and fun factor.

**tangent** – A straight line or straight trail alignment. The line between any two points is a tangent.

**TES** – Threatened, endangered, and sensitive plant or animal species.

**trailhead** – An access point to a trail or trail system. Used predominately for casual or recreation use rather than competitive or event use. Common amenities include a parking area, kiosk, and toilet. Some have an adjacent campground or area for dispersed camping.

**trail log** – A list of construction details or work items that a designer prepares for the construction crew or contractor. The items are usually listed by mile point, GPS waypoint, or station (one station = 100 feet, so station 13+50 is 1350 feet in from the beginning of the project).

**tread watershed** – The area between tread drainage points that collects water onto or drains water into the trail. This includes the area of the trail itself and the area above the trail that topographically drains into this trail segment.

**turnout** – A designed and constructed area wide enough for two vehicles to pass. A turnout can be any length, but the minimum length is that which accommodates one designed vehicle. A turnout usually has ingress and egress transitions called tapers. A turnout can be desirable in areas of thick vegetation or steep topography.

**vertical alignment** – The series of tangents and curves that form the profile view of the trail.

**waterbar** – A drainage structure used to divert water off the trail tread. The trail is outsloped at a 30 to 45 degree angle followed by a barrier of dirt, rock, logs, or rubber belting material. Waterbars are high maintenance and are not recommended on OHV trails.

**wet soil** – The voids between the soil particles are filled beyond the OMC and there is too much water for bonding. The tread surface is easily rutted and surface ponding will occur.



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*Off-highway  
vehicle riding is a  
great way to get  
into the outdoors*



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# About the Author



Dick Dufourd has been an avid motorized recreationist for more than 40 years and participates in every OHV segment from motorcycles to ATVs to snowmobiles to 4-wheel-drive vehicles. He has a strong recreation engineering background and spent 35 years with the USDA Forest Service where he gained extensive experience designing and building roads, trails, parking areas, and campgrounds. He became the Central Oregon Interagency OHV Program Manager where he was responsible for developing and managing summer OHV opportunities for the USDI Bureau of Land Management and the USDA Forest Service. This included implementing seven OHV trail systems with 640 miles of trail and eight designated play areas. He secured more than \$3 million in grants, developed volunteer programs and trail patrol programs, designed an OHV specific cattle guard, and developed trail grooming drags and other equipment. As the OHV Master Performer for the USDA Forest Service in the Pacific Northwest Region, he was able to consult widely and gain additional experience.

In 2005, Dick retired and formed an OHV consulting business with his wife and partner of 40 years. Through RecConnect LLC, he has gained broad experience in feasibility studies, site assessments, safety assessments, signing, planning, trail and facility design, location, construction oversight, and project management and has now implemented more than 1,500 miles of OHV trails in the United States and Canada. That experience plus the ability to successfully identify and mitigate issues, work with multiple agencies, and work positively with stakeholders and the media has made Dick one of the top OHV authorities in North America.



*A great trail lies lightly on the ground and flows and harmonizes with the landscape.*

*It is the path that takes us into the natural world and the pathway that links that world to our inner selves.*

## *The End of a Great Trail*

