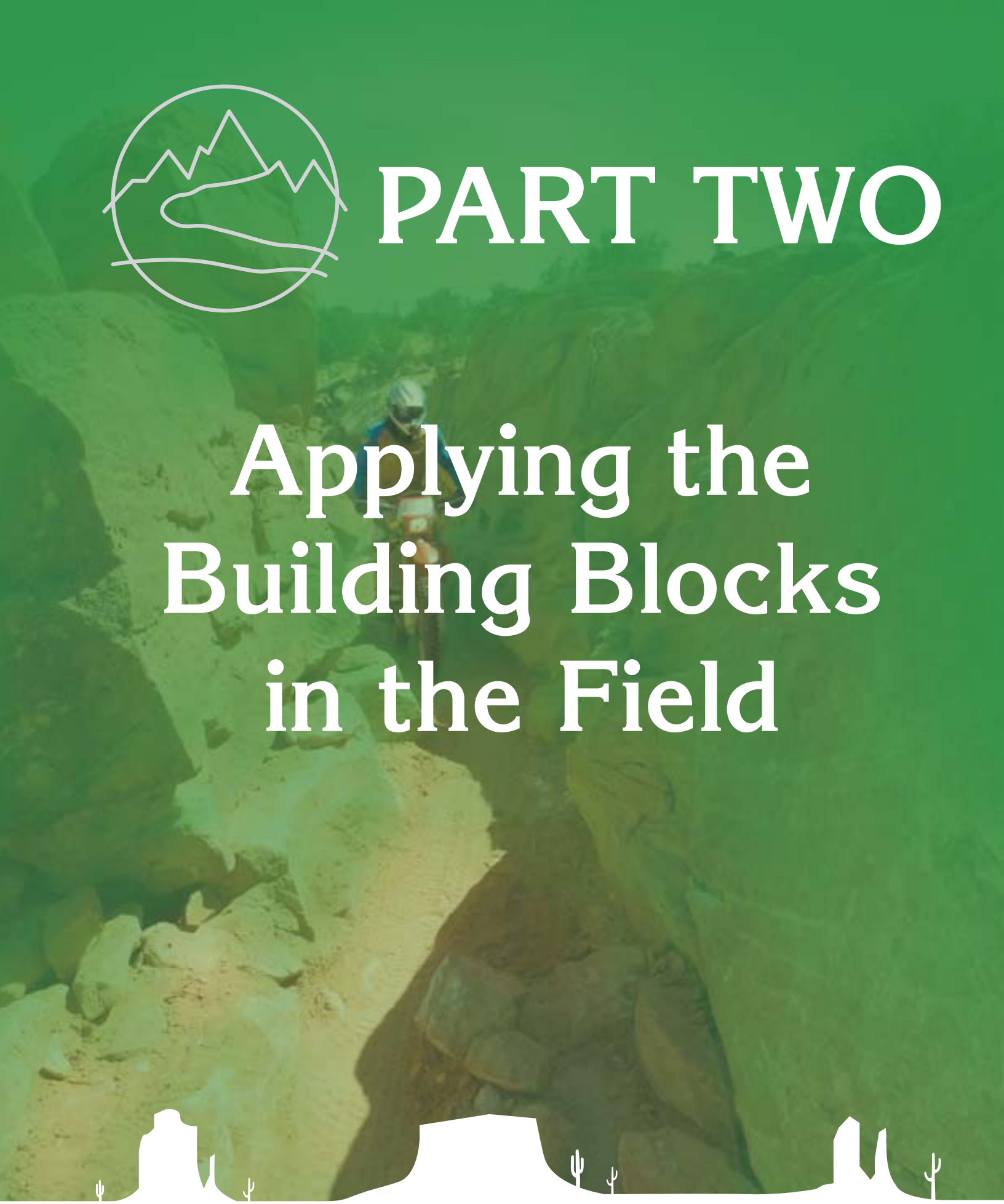


# PART TWO

# Applying the Building Blocks in the Field

More and more girls and women are enjoying OHV recreation.

# Chapter Eleven
## Conducting Assessments

Observe, Record, Report

The fourth E in the all-important 4Es is Evaluation, which is an assessment, appraisal, or review. If managers don't know the current conditions, they won't know how to plan, act, or react.

Assessments, which can be either routine or formal, are part of a continual process used in every component of the Great Trail Continuum:


- **Planning:** What could or should be out there? This is used to develop the vision, trail concept plan, and draft trail management objectives (TMOs).
- **Design:** Does the location and design of the trails match the vision, the concept plan, and draft TMOs? Are the desired experiences and opportunities being provided?
- **Implementation:** Do the trails conform to the TMOs, design guidelines, and sign plan? Is the vision being realized on the ground?
- **Maintenance:** Are the trails being maintained in accordance with the TMOs? Is the frequency and level of maintenance adequate? Are there signs of non-sustainability?
- **Management:** Is there a high level of customer satisfaction? Are use types or use levels changing? Is the team successfully managing the use? Are resources being protected?

### Routine Assessments

Routine assessments are daily or regularly scheduled inspections of the trail or trail system. The motto "Observe, Record, Report" forms the basis for these inspections. Every person in the field should be performing monitoring for obvious safety or maintenance issues. These should be recorded on an informal daily monitoring form and be accompanied by pictures, GPS coordinates, or other documentation as necessary. This report is then given to management so action can be scheduled. It is important to note that the project file should also have documentation of what is working and going well. This information can be used in preparing reports to upper management or in developing grant applications.

Blowdown is a common occurrence on most forested trails. Routine and timely inspections are essential to get these trees cut out before braiding and other impacts can occur.

Field personnel who perform routine inspections need to have a basic knowledge of engineering and the physical forces covered in Chapter 4, comprehension of trail durability versus trail

degradation, an understanding of structure function and maintenance, and the ability to recognize routine problem indicators. Personnel need to detect the difference between what is there versus what should be there. The goal of routine inspections is to detect symptoms before they become problems. Field personnel don't necessarily have to know how to fix the issue, just observe it, record it, and report it.

## Formal Assessments

Formal assessments are more comprehensive, detailed, and often look at the bigger picture that includes not just sites on the ground, but how those sites affect the overall effectiveness of the program. Rather than being proactive, a formal assessment is often requested as a reaction to an issue that is no longer a symptom, but a problem. A formal assessment answers the questions: What could be there? What is there? What should be there? How do I get to where I should be? The final report usually has three parts: observations, where the site is examined and evaluated to answer the first two questions (above); commendations, what is good or going well; and recommendations, actions to correct what isn't good and answer the last two questions (above). Often, these reports are precursors to a management action, used as a project basis (Purpose and Need), and incorporated into NEPA documents or management plans.

There are three main types of formal assessments: feasibility or site assessment, safety assessment, and condition survey or assessment.

**Feasibility or Site Assessments.** What activities could or should occur on a given site? What are the opportunities and what are the obvious constraints? A feasibility assessment is usually conducted at the project initiation phase, which could be at the beginning of a new project or the expansion of an existing project.

The assessor should understand:
- The vehicle types that use the trails
- Desired rider experiences
- Climate
- Vegetation
- Soil types
- Site hydrology
- Resource concerns, issues, and constraints
- Transportation planning
- Facility design
- Trail design
- Engineering and the physical forces
- GPS, data collection, and mapping software

**Safety Assessments.** A safety assessment examines agency risk and the risk to public safety. Perhaps there has been a tort claim, an increase in the number or severity of accidents, increased search and rescue incidents, customer complaints, or just an uneasy feeling or question by management. For objectivity, it is highly recommended that the assessor be unfamiliar with the site.


The assessor should understand:
- Transportation planning. Is there effective access and movement of people to and through the site?

- Facility design
- Trail design, including grade, alignment, consistent difficulty, conformance with TMOs, and a thorough understanding of challenge versus risk
- Use types and levels of use
- Rider demographics and ethics
- Seasonality and day use versus night use
- Soils
- Climate
- Effective signing, including guidelines for shapes, colors, sizes, symbols, reflectivity, messages, and placement
- Effective mapping
- Engineering, including guidelines for stopping distance, sight distance, junction design and spacing, road crossings, structure placement and approaches
- The physical forces
- Emergency communications and emergency plan
- Accident history
- Enforcement issues
- Actual liability versus perceived liability (it is helpful to have expert witness experience)
- The effective application of the 4Es

**Condition Survey or Assessment.** A condition assessment usually focuses on the physical condition of the trail and related facilities, but it can also look at the bigger picture and address safety and risk issues. It answers questions like: How often does this occur? Why does this occur? What else is occurring? Is the trail condition consistent with design and maintenance guidelines in the TMO? Does the trail provide the desired experience? Is the trail sustainable or is it degrading due to poor location and design or changes in use levels, use types, or maintenance? Are the structures sound and functional? Do the facilities provide good customer information and service? Are resources being protected? Is there compliance with the rules and regulations? Is off-trail use occurring? Is the trail providing a high-quality recreation experience and customer satisfaction? Does the site appear professionally managed and maintained?

Using the 4Es, the condition assessment examines trail issues (drainage, erosion, tread degradation) and recommends solutions (maintenance, reconstruction, structures, hardening, or relocation). Recommendations can also include staffing, training, or equipment needs. As with safety assessments, a condition survey is best done with someone who is knowledgeable, but not routinely familiar with the site.

The assessor should understand:
- Facility design and construction
- Trail design and construction, including grade, alignment, consistent difficulty, and conformance with TMOs
- Trail maintenance techniques and equipment
- Use types and levels of use
- Maintenance or reconstruction frequency
- Previous condition surveys
- Soils
- Climate
- Hydrology of the site
- Effective signing, including guidelines for shapes, colors, sizes, symbols, reflectivity, messages, and placement
- Engineering, including guidelines for stopping distance, sight distance, junction design and spacing, and intersections
- Structures, including placement and approaches and trail hardening techniques.
- Equipment needs and capabilities

### Tip, Trick or Trap?

**Tip:** A qualified engineer must inspect structures that have been engineered such as bridges and retaining walls on a regular basis. Unless qualified, an assessor can only note the indicators of structure degradation and recommend further inspection by an engineer.

- The physical forces
- The effective application of the 4Es
- Costs for recommended actions
- GPS, data collection, and mapping software

## How Do I Know If I Have a Problem?

Safety and condition assessments examine issues, but often managers may not recognize an issue or the indicators of an impending issue. Inexperienced personnel or familiarity with a site can blur the team members' vision, which is why a fresh set of eyes is best for conducting these assessments. Listed below are some of the issues or indicators that an assessment could highlight.

**Issue**: Ineffective drainage due to riders by-passing log and-belted waterbars

**Concerns**: Trail widening, erosion, resource impacts

**Action(s)**: A) Replace log with belted waterbar and install barriers to force riders over waterbars; B) Replace waterbars with rolling dips; C) Relocate trail off old roadbed to create grade reversals

**Issue**: Creek draining into trail

**Concerns**: Erosion, lack of drainage. If the creek wants to be where the trail is, then the trail is in the wrong place

**Action**: A) Install culvert; excavate creek channel so it is lower than the trail elevation and runs through the culvert. B) Relocate the trail (preferred).

**Issue**: Deadfall tree hung up above trail

**Concerns**: Rider safety, agency risk, lack of inspection frequency

**Action**: Increase trail inspection and maintenance frequency

**Issue**: Fall line trail is now the drainage line

**Concerns**: Rider safety, erosion, sedimentation, poor trail location

**Action**: A) Relocate the trail (preferred). B) Drain the trail at the top of the hill (yellow arrow), line the ditch with cobble rock to dissipate the water energy and reduce sedimentation (blue arrow), ensure that water drains off the trail at red arrow, harden the trail if necessary.

**Issue**: Ineffective drainage

**Concerns**: Rider safety, saturated trail tread, resource impacts

**Action**: A) Increase size of sump, harden trail tread, or B) relocate the trail

**Issues**: Regulatory message does not meet sign shape, color, and placement guidelines. Poor quality workmanship

**Concerns**: Rider safety; ineffective signing; untrained, unskilled, or complacent personnel

**Action**: Increase personnel awareness and training, install proper regulatory signs

## Tip, Trick or Trap?

**Tip:** Never close a trail by simply putting a fence across it. The result will be failure.

**Issue**: Trail marker not clearly visible. Marker does not meet placement or recognition guidelines

**Concerns**: Rider safety and orientation, lack of trained personnel, poor maintenance practices

**Action**: Increase personnel awareness and training, replace or reinstall marker with proper placement on right-hand side of trail

**Issue**: Trail washout due to under-sized culvert

**Concerns**: Rider safety, erosion, sedimentation

**Actions**: A) Conduct watershed analysis and install properly sized culverts; B) Install a ford or bridge if that option is allowed

**Issue**: Metal fence posts protruding into trail corridor

**Concerns**: Rider safety, agency risk, livestock retention, lack of maintenance personnel awareness

**Action**: Replace fencing, train maintenance personnel

**Issue**: Lack of toilet maintenance

**Concerns**: Poor customer service, public health, poor agency image

**Action**: Clean and stock toilet. Increase facility inspection and maintenance frequency. Determine how often this situation occurs and discuss with management if appropriate.

**Issue**: Gate with no warning signs or object markers and it cannot be locked in the open position

**Concerns**: Rider safety, agency risk, compliance

**Action**: Install temporary markers for visibility. Educate management on proper signing and gate management techniques


**Issue**: Good sign, but there is no gate

**Concerns**: Lack of pasture management and stock control. Potential range and recreation conflict

**Action**: Install temporary gate if stock is present. Notify range and recreation management to get permanent gate installed. Remove sign if no longer required.


**Issue**: Sign has been vandalized

**Concerns**: Leaving this sign can send the message these activities are acceptable.

**Action**: Install new sign, determine how often and where this activity is occurring

**Issue**: Ineffective cattle guard due to lack of maintenance

**Concerns**: Lack of pasture management and stock control, potential range vs. recreation vs. permittee conflict

**Action**: A) Increase inspection and maintenance frequency. Schedule clean out. Educate maintenance personnel on proper equipment and grooming operation at cattle guards. B) Replace with an arched cattle guard.


**Issue**: Confusing signing

**Concerns**: Rider education, rider control, management control

**Action**: Educate management on proper signing techniques, reconfigure this installation

**Issue**: Renegade trail developing (ahead)

**Concerns**: Rider control, resource impacts, lack of inspection or management action

**Action**: Install reassurance marker with left arrow at entrance to renegade trail, install barrier or debris at entrance behind marker, drag in debris to block trail, rake out tracks. Increase inspection frequency and awareness of off-trail use and impacts.

**Issue**: Inconsistent decal placement

**Concerns**: Lack of decal spacing decreases marker legibility, lack of personnel training, lack of decal placement protocols, personnel complacency, lost riders

**Action**: Train personnel in decal application and the need for consistency, establish decal placement protocols if none exist

**Issue**: Poorly maintained trailhead kiosk

**Concerns**: Lack of rider education, potential lack of rider control, sends the wrong message to the public, poor agency image, complacent personnel

**Action**: Clean and refinish kiosk, install new posters and education materials, cover with polycarbonate sheet if this is a recurring issue

**Issue**: Pavers are moving due to lack of proper bedding and containment

**Concerns**: Rider safety, failure of the installation

**Action**: Reconstruct the installation with proper bedding and containment

**Issue**: One broken concrete plank in ford structure. Two others have shifted position

**Concerns**: Rider safety, movement or failure of ford bedding, additional breakage, structure failure, lack of regular inspection or awareness of the issue

**Action**: Have structure inspected by qualified personnel, perform recommended reinforcement or reconstruction, ensure that regular inspection occurs, educate inspection personnel

**Issue**: Loss of cover material has resulted in direct tire contact and partial failure of geoweb structure

**Concerns**: Rider safety, continued structure failure, lack of maintenance, lack of regular inspection or awareness of the issue

**Action**: Reconstruct installation using grass pavers or other trail hardening technique, increase maintenance frequency, educate inspection and maintenance personnel

**Issue**: Tread inconsistent with TMO, tread degraded due to lack of drainage and loss of fine soils

**Concerns**: Rider safety, erosion, lack of effective or timely maintenance, failure of drainage structures (if there are any), poor trail location

**Actions**: Increase drainage awareness of inspection and maintenance personnel. A) Relocate trail if feasible. B) Reconstruct trail and install rolling dips if feasible. C) Change TMO and leave trail as is if resource impacts are acceptable.

**Issue**: Missing rub rail, uneven, loose or broken decking material, loss of structure integrity

**Concerns**: Rider safety, moss could indicate stringer rot, lack of bridge inspection, lack of structure maintenance

**Action**: Have bridge inspected by an engineer, sign as closed if structurally unsound, repair or replace structure, ensure that regular bridge inspections occur, increase awareness of inspection or maintenance personnel.

**Issue**: Inadequate hardening of bridge approaches, bridge elevation too low

**Concerns**: Resource impacts, trail widening, rider safety, lack of trail drainage, lack of inspection and maintenance

**Action**: Drain water off trail before the bridge, extend bridge approach hardening, educate trail personnel on proper inspection and maintenance techniques

**Issue**: Failure of trail hardening and drainage structure.

**Concerns**: Rider safety, agency risk, trail braiding, resource impacts, improper hardening technique, inadequate drainage structure design, poor trail location, lack of skilled trail personnel, lack of hazard warning signs.

**Action**: A) Install warning signs. B) Explore relocation options. C) Examine agency constraints for fish and water. D) Remove tires and culvert if possible. E) If relocation is not an option, raise grade of approaches and construct a ford. F) Conduct training for trail personnel.


**Issue:** Confusing sign message, poor visibility, lack of conformance with sign shape, color, and reflectivity guidelines

**Concerns:** Resource impacts, lack of sign plan, lack of knowledge of effective signing methods

**Action:** Determine existence of sign plan, if none, develop one; educate personnel on effective signing; revise message and install proper regulatory sign

**Issue**: Rill indicates water is running too long due to lack of drainage

**Concerns**: Erosion, resource impacts, tread degradation, lack of awareness of problem indicators, lack of inspection and maintenance

**Action**: Educate trail personnel on problem indicators and proper maintenance techniques, determine water source, install drainage, or relocate the trail

**Issue**: Inadequate and unsafe trail maintenance. Log on left protrudes into trailway. Log on right is on immediate trail shoulder and could be hit by an inattentive rider.

**Concerns**: Rider safety, agency risk, lack of risk awareness by inspection and maintenance personnel, inadequate training of maintenance personnel

**Action**: Cut logs back out of trailway, educate trail personnel on risk awareness and proper logout techniques

**Issue**: Due to compaction and displacement, trail tread is lower than surrounding ground resulting in flooding during the wet season

**Concerns**: Rider safety, water quality, saturated trail tread, poor recreation experience

**Action**: Construct lead-off ditches and sumps to drain water away from trail, use excavated material to help construct turnpike, apply gravel to harden tread

**Issue**: Log obstacles to slow down riders are becoming obscured by vegetation

**Concerns**: Rider safety, agency risk, lack of risk awareness by inspection or maintenance personnel, complacency of personnel

**Action**: Educate trail personnel on risk awareness and proper maintenance techniques, trim or remove vegetation in roadway, monitor trail to ensure vegetation does not cover obstacles

**Issue**: Damage to plastic culvert due to loss of cover material

**Concerns**: Collapse of the structure, maintaining water flow, lack of maintenance, lack of awareness of inspection and maintenance personnel

**Action**: Inspect the interior of the culvert for efficient water flow, inspect integrity of the pipe wall, if still usable, cover with a dirt and gravel mix that will bind together. If not useable, replace culvert and add adequate cover. Educate inspection and maintenance personnel.

**Issue**: Rocks are blocking culvert outlet

**Concerns**: Culvert blockage and washout of culvert and trail, poor risk awareness of inspection and maintenance personnel, poorly constructed culvert headwall

**Action**: Remove rocks, clean out culvert, rebuild headwall, educate inspection and maintenance personnel

**Issue**: Breached trail closure

**Concerns**: Ineffective closure techniques: sign placement, no ripping or disgusing of trail, no education. Management failure has resulted in lack of rider compliance.

**Action**: Repair fence, install temporary closure signs at nearest trail junction, install closure notice on map at trailhead, educate management on proper closure techniques

**Issue**: Decals degrading due to exposure to weather and UV rays. Fiberglass marker is fading and starting to "bloom", improper decal placement.

**Concerns**: Reduced legibility, short-term durability, rider compliance, lack of a sign plan or sign protocols. Markers placed on back of sign are in wrong location and may not be seen by riders.

**Action**: Ensure there are trail marker protocols that include covering decals with clear overlaminate tape. Educate trail personnel on effective signing techniques. Replace markers as needed

**Issue**: Improper trail maintenance

**Concerns**: Rider safety, agency risk, lack of maintenance personnel training and awareness

**Action**: Cut log back entirely out of trailway. Educate maintenance personnel on proper logout techniques and risk management

## Tip, Trick or Trap?

**Tip:** Challenge is an expectation, risk is a surprise

**Issue**: Water running down trail, trenched trail tread

**Concerns**: Erosion, resource impacts, degraded trail tread, trail widening, lack of or poor maintenance of drainage structures

**Action**: A) Educate trail personnel on problem indicators and effective maintenance techniques. B) Determine source of water, add rolling dips or other drainage. C) Relocate the trail.

**Issue**: Bridge abutment footing is eroding

**Concerns**: Rider safety, inadequate structure inspection, lack of immediate action, impending structure failure

**Action**: Order an immediate bridge inspection to determine footing integrity, close trail and bridge if warranted, check inspection frequency and records, educate personnel on risk awareness, determine repair actions

**Issue**: Sediment deposit indicates excessive water volume and velocity

**Concerns**: Erosion, resource impacts, tread degradation, lack of awareness of problem indicators, lack of inspection and maintenance

**Action**: Educate trail personnel on problem indicators and proper maintenance techniques, determine water source, install drainage

**Issue**: OHV accident on the trail

**Concerns**: Rider safety, agency risk, cause of accident, lack of rider education and safety awareness

**Action**: Visit accident site and determine cause if possible (alignment, clearing width, obstacle, signing, rider error, etc). Take pictures, talk to witnesses, document incident, and inform management. Examine frequency and locations of other accidents to determine any commonality or trends.

## Tip, Trick or Trap?

**Tip:** Every known accident should have some level of investigation to determine cause and agency risk

Problem indicators can be obvious or subtle, but they are all precursors of future management or maintenance issues. Many of these issues appear to be maintenance related, but they could also indicate issues with trail location, construction techniques, budget, priorities, available personnel, skilled personnel, complacent personnel, material availability, equipment availability, a lack of an assessment, or extended intervals between assessments.

Some problem indicators that often show up in assessments include the following:
- Increased frequency and cost of maintenance
- Large deposits of sediment after weather events
- The appearance of sediment deposits on bridges
- The development of ruts on grades or the creation of muddy sections on flatter areas
- Trail braiding or widening to get around pot holes, ruts, rocks, etc.
- The development of rock gardens because all of the soil fines have washed off the surface
- The intended difficulty level has increased, at least in portions of the trail
- User-created trails are developing to avoid or short-cut the nasty areas

Too often, trail managers choose to pour time, money, and materials into fixing a poorly located trail when the remedy of relocation would be less expensive and far more sustainable in the long run. Assessments can help managers identify the source of problems and make the right decisions to correct them.

## Need more? Learn more here...

*Designing Sustainable Off-Highway Vehicle Trails*, Kevin G. Meyer, USDA Forest Service, Technology & Development Program, November 2013

*Trail Planning, Design, and Development Guidelines*, Minnesota Department of Natural Resources, 2006

## A Look Back...

Here are some of the elements discussed in this chapter:
- Assessment, or evaluation, is a constant process that managers should use throughout the Great Trail Continuum
- The motto “Observe, Record, Report” is the backbone of assessments
- Field personnel should conduct daily routine assessments or inspections
- Field personnel need to be trained in what to observe and how to protect the trail infrastructure
- The goal of routine assessments is to detect symptoms before they become problems
- Formal assessments answer: What could be there? What is there? What should be there? How do I get to where I should be?
- There are three main types of formal assessments: Feasibility, Safety, and Condition
- Feasibility assessments examine site potential and the activities that could or should occur on that site
- Safety assessments examine risk potential to the public and the agency and recommend actions to reduce that risk
- Condition assessments focus on the physical condition of the trails and facilities to determine conformance to the TMO, level of customer service, quality of the recreation experience, level of sustainability, maintenance or reconstruction needs, and corrective actions
- Assessments should be timely and should be proactive rather than reactive
- Problem indicators can be obvious or quite subtle, but if ignored there could be dramatic resource impacts and management issues

# Chapter Twelve
## What Makes a Great Trail Great?

Protect Your Riding Area; Stay on Designated Routes

"Wow! That was fun!" What sets one trail apart from all the other trails and makes riders say this at the end of the day? Was it the setting and the landscape, the challenge, the recreation experience, or something else? Something about that trail evoked feelings and emotions. Managers must find the elements that made those riders say "WOW!"

Often, when riders are asked what makes a great trail great, the responses include:

- Fun
- Offers varying degrees of challenge
- Good signing and trail maps
- Variety
- Loops
- Enough length to meet the riders' needs
- Scenery, viewpoints, destinations
- Open areas
- Learner loops and places for kids to learn and ride
- Opportunities for camping
- Provides resource protection
- Good parking, kiosk, and restroom facilities
- Flowmentum

Did a wind storm create a mess or an opportunity? Is it an accident that this trail is sandwiched between the root wad and the tree? Does something like this even register as "cool" to a rider? Read on….

Note that all of these except for "fun" are physical features that are provided through good planning, location, and design. "Fun" is at the top of the list because it is often the first rider response, but what is "fun"? In reality, a fun experience is created by having all of the other bullets. Fun is actually a subjective assessment of the experience. It is an emotional response and the greater the trail experience, the higher the emotional response. Five factors come together to trigger that great trail emotion: capitalize on the physical elements, understand and design for the human elements, create trail flow, provide for the riders' needs, and create variety.

### Tip, Trick or Trap?

**Tip:** Developing a WOW trail experience is similar to a painter creating a masterpiece

What makes a great trail great? Location, location, location. All five of the above factors center around trail location, which leads to emotions and experiences. The key to a great trail location is knowing what to look for and then finding it, so taking the time to do a thorough reconnaissance is essential.

Talk about picture perfect! This view has outstanding foreground, middleground, and background with a variety of colors, shapes and textures. WOW, what will be around the next turn in the trail?

## Capitalize on the Physical Elements

The physical elements are the features of the landscape that the planners or designers have available to help mold the quality of the trail experience. These features can be grand or subtle.

If you ride by giant sequoias every day, this could be a ho-hum experience. For everyone else, it is a WOW. The contrasting black fire scar accents the shape of this feature and looks like an entrance to a cave and it sets this tree apart from the others.

First, planners and designers must find the WOW. Every region has its own WOW. Experiencing that variety of WOW is why groups of riders travel to different areas and regions. Whatever that feature is, good planners and designers will find it and showcase it.

Second, planners and designers must find the little wow, the subliminal absorption. The riders absorb the physical elements on two levels. The first level is the conscious level. The riders consciously see the big, showy elements above and think, "WOW, that is cool!" The second level is the subconscious level. The riders see the wow, but the riders don't remember seeing the smaller wows because those wows aren't registered at the same time as the larger wows. Instead, these smaller wows get recorded in the riders' subconscious minds as small but cumulative images. At the end of the day, the riders' minds add the subconscious images with the conscious images to create a subjective assessments: "WOW, that was really COOL!" But when asked what made the riders say that, the response is often a nebulous "stuff" because the riders don't consciously know.

The astute trail locator with creative vision will seek out these subliminal images and locate the trail so the riders' eyes see them, even though it is a subconscious recognition. This awareness of the little things can play a big part in making a great trail great.

This burn has a bunch of uprooted trees, but this is the only one with a peep-hole through it. Subtle, but uniquely different.

Great trail vision. The locator found this gap in the rocks and then figured out a way to get the trail there. Being nestled in the landscape produces the same feelings as panoramic views above the landscape.

When the trail locator finds a unique feature like this, it gets logged into the GPS as "must be here." Seeing and riding through an attraction like this is a WOW experience and a great photo opportunity.

Winding through the rock canyon is an incredible experience and a WOW moment. This will be talked about at the campfire for several years.

Creative location. How cool is this to ride through? Unique? Memorable? Yes. Depending on approach speeds, alignment, and sight distance, this may need a warning sign.

This could be an old log deck or old bridge stringers, but it is a feature that stands out in this sea of green. Why? It has more mass than everything else in the setting and it is a horizontal structure when everything else is vertical.

Suffer from vertigo? How can the ability to access a viewpoint like this not be a WOW experience? Will this moment be talked about at the end of the day?

Before the fire, these boulders may not have been visible or unique, but now they provide a stark contrast in color, form, and texture from the rest of the landscape. The trail locator needs to figure out the best view angle and direct the trail and the riders' eyes toward it.

Except for some outstanding vistas, this landscape had few WOWs. When the designer found this rock, the trail HAD to go under it. It offers a unique shape, the only shade, and the only water. The colorful lichen on the rock adds to the feature. Note the cobble rock to harden the spring crossing.

Obviously, this is a great view and the riders' eyes have been directed right at it, but equally striking are all of the contrasting shades of green. Other than the mountain top, all of the other shapes and textures are green.

This unique rock formation is pretty well hidden from view, but thorough reconnaissance discovered it. The rider will pass by it in one second but the shutter will have snapped and the image captured in the riders' minds.

Locals get used to seeing things that could be little wows to non-locals. This gnawed beaver tree is an interesting feature to non-locals. The size of the tree and the size of the gnawed chips set this tree apart from the other skinny ones. It would have been better if we could have located the trail between the log and the stump, but there wasn't room without disturbing the site.

This tree has had a tough life. These are called character trees because they are so different from all of the others. It is fire-scarred and has been hit by lightning at least twice.

Not grand in scale, but grand in shape. When all the other shapes are vertical, this heart stands out. Can you imagine having your family stop and pose for a shot through the heart? Neat.

This area is almost like traveling through a fairy-tale. Running the trail into the vegetative tunnel made the whole trail experience a WOW.

The colors, textures, and shapes in this overhanging rock make it a little wow.

The flowing shape of this trail harmonizes with the landscape. It fits, so the rider also feels like he fits into the landscape.

Every part of the country has a unique beauty. Find it and highlight it. When the desert is blooming, it is glorious, which transfers to the rider as a glorious day.

This charred stump is different and contrasts nicely with the fall grasses and shrubs.

## Understand and Design for the Human Elements

The arrangement of the physical features on a trail can trigger an emotional response within the rider. There are two components of this element: human perception and feelings.

**Human Perception**. What riders see, the order in which they see it, and how they interpret what they see forms a perception of the trail that molds the judgment of the experience. That perception is formed by the arrangement of natural features to form shapes, anchors, gateways, and edges. A trail that capitalizes on these features is one that will trigger an emotional response.

Some ways planners and designers can capitalize on human perception include the following:

**Shapes**. Does the shape of the feature fit into the perception of what is natural?

**Anchors**. Use anchors to bond the trail to the landscape.

The trail following this linear seismic line does not have a natural shape and fights with the landscape. There is no opportunity to change the viewshed or the experience of the rider.

Even though this trail has been hardened, it still has an inviting shape that appears natural.

This huge rock with cool ferns growing out of the top firmly anchors this trail. The fact that the trail wraps around it rather than just passing by it makes this feature a stronger anchor.

An excellent example of great trail location. Being anchored by both the huge tree and the rock, the trail fits and flows with the landscape.

This landscape doesn't offer a lot of structure which is why the trail absolutely had to pass through and be anchored by these rocks.

**Gateways**. Use a gateway as a threshold that riders pass through. It confines the trail and frames it with the landscape. Two anchors side by side can become a gateway.

Talk about a dramatic gateway! This WOW will be etched in the riders' memories.

All of the glory doesn't have to go to the designers. Here, the maintenance crew had the vision to turn this blowdown snag into an interesting gateway.

A couple of smaller rocks had to be pushed out of the way, but the designer had the vision of what would remain, a great gateway.

The bridge itself is a gateway, but the trail has been carefully located and designed to fit between these two trees which enhances the gateway effect.

In a landscape pretty much devoid of gateway structure, this cattleguard becomes the gateway and it frames the riders' eyes of the great background view.

**Edges.** Use edges such as cliffs, streams, fencelines, vegetative changes (either natural lines or ones formed by wildfires or logging), ridge tops, rimrock, etc. Part of human nature is that riders tend to gravitate toward edges, so when a trail follows an edge, it is satisfying one of the human needs. Like anchors and gateways, edges confine riders and the trail.

This Russell fence provides a scenic edge for this trail. Though artificial, the edge fits the landscape and enhances the rider experience.

Good trail location. This trail follows the edge of the vegetative change and it curves with the natural curve of the tree line. Had the trail gone through the middle of the meadow, it would not fit our perception of "natural."

This lava flow provides a dramatic and beautiful edge for this ROV trail.

Part of our human nature is to gravitate towards water, so the stream provides an edge for this trail. The sight and sound of a babbling brook makes a great photo or lunch opportunity.

**Human Feelings.** Shapes, anchors, gateways, and edges are all a spatial arrangement of natural features. Because they trigger an emotional response from the rider, they are powerful design tools. Those tools form the perception of the trail, but the trail's location and design also stimulate feelings. By having positive feelings about the trail, the trail experience and thus the recreation experience is likely to be positive also. Great trail planners and designers create feelings of safety, efficiency, playfulness, and harmony.

**Safety.** Am I within my comfort zone? Am I going to be able to make it back to the trailhead? Everyone has a different comfort zone, therefore it is imperative that the condition of the trail be effectively communicated to the public. It must be designed according to its TMO, maintained according to the TMO, and be signed accordingly. Riders can get out of their comfort zone when signs are missing, the tread does not appear stable or of adequate width, trees haven't been cut out, or the trail is so overgrown it is hard to distinguish the tread from a game trail. All of these make the riders question what they're getting into.

Comfort zone does not mean the trail is free of challenge. Comfort zone is how a rider feels on the trail on a given day. Individual riders will have differing levels of comfort on the same trail. Trails are not one size fits all. Challenge is part of the experience the trail provides. Riders make a conscious decision to seek out challenges and many riders are in their comfort zone doing so. If challenge is imposed on the rider by surprise, it then becomes a risk, and risk can lead to liability.

If design, construction, or maintenance forces the rider outside of his comfort zone, the agency is at risk.

Above, the drivers on the rim chose safety for their comfort zone. The driver in the hot tub chose risk. As the recovery strap is attached, he risked his pride as well.

This trail is totally overgrown with vegetation. When riders wonder, "are there hidden logs or rocks?" they are probably outside of their comfort zone.

Hmmm, what am I getting into? Will I need those after the next section of trail?

**Efficiency.** This is the use of the landscape and structures to efficiently meet the riders' needs.

With efficient design, the rider would rather be on the trail than off it because it is the path of least resistance, it's the fastest, and it is fun. Why is this important? When efficiency is lost, trail widening, braiding, and resource impacts can occur. Efficiency is lost when:

- Riders bypass soft, wet, heavily eroded or excessively rough areas.
- Riders bypass structures like waterbars or trail hardening.
- Moguls develop due to speed and straight alignment.

Above and left, well-designed and constructed structures increase the efficiency of the trail which increases resource protection.

Right, these pavers have been lined with logs placed in a herringbone pattern. The logs not only encourage riders to stay on the structure but also deflect runoff water into vegetation before entering a stream.

Left, the original trail on the right became soft and rutted, so it was more efficient for riders to cut through the trees. Some riders will choose to ride the rutted route because that is the experience they want and the efficient route they want to take. But most riders will choose the shorter and drier route as the most efficient path, thus widening the trail and damaging vegetation.


Riders will usually ride as fast as their machines and their skills will allow them. That is part of the challenge and the experience. Because of that, speed limits do not work. Control speed through tight alignment and narrow clearing.

The end of this paver installation was improperly constructed resulting in a poor approach to the structure. It is no longer the efficient line and riders are choosing to go around it.

**Playfulness**. A trail that is playful moves with the landscape and uses the landscape to create flow and a fun factor. The creative use of anchors, gateways, and edges is playfulness. A continual change in horizontal and vertical alignment is playfulness. Continually changing the viewshed of the rider is playfulness. Constantly changing the experience of the rider is playfulness. Playfulness is one reason that roads do not make good trails. Roads tend to be straight and predictable. Trails are curvilinear with a sense of wonder around each curve. Roads cut through trees, trails go around them. Roads blast through rocks, trails go around them or over them.

**Harmony**. Harmony is a riders' feeling about how well the trail fits the landscape. A harmonious trail utilizes shapes, edges, anchors, and gateways and is designed to be playful and efficient while keeping the riders in their comfort zone. Harmony puts it all together. Harmony has rhythm and flow. A highly engineered trail with multiple structures and trail hardening is less harmonious than a primitive natural surface trail. A newly constructed trail isn't as harmonious as an established trail. A machine-built trail may not be as harmonious as a hand-built trail.

Use whatever topography is available to play with the landscape. The location of this trail fits the landscape, adds flowmentum and fun factor, and improves drainage.

This trail is both playful and efficient. The rider wants to stay on it and can't wait for the next corner.

This is a great example of playful location. Criss-crossing this dry draw creates a rollercoaster effect that is fun and sustainable.

Though an open landscape, this trail with two climbing turns blends into and harmonizes with the setting. The key to that is to minimize cuts and fills and to use whatever vegetation is available to screen the trail.

These trees twist and turn and so does the trail. Everything fits and flows together. Harmony is a perception that everything is right. As a perception, what is harmonious for one rider may not be harmonious for another.

The riders will tell you when the trail is not in harmony. Placing the trail in the flat portion of this area caused water to pool on the trail. Riders tried to keep out of the water and trail braiding occurred.

This ridgeline trail bisects the landscape and doesn't fit the natural shapes and contours. It doesn't vary the viewshed of the rider and it's boring because it is so predictable. Ridgetop trails are fall line trails and generally don't drain well. This trail definitely fits into the category of too long and too steep.

This is a much better example of how a trail that follows the ridgeline can harmonize with the landscape. The serpentine alignment switches from one side of the ridge to the other. This creates drainage and varies the rider viewshed. Very little of it is on the actual ridgetop except for the last rise. When the rider tops that crest, he is presented with a panoramic and totally WOW view of several mountain ranges.

The trail will tell you when it is not in harmony with the landscape.

## How the Human Elements Affect Design

The riders' perception and reaction to the four factors of the human feeling is what makes a great trail great. The physical trail laying on the ground may be sustainable but it doesn't become a great trail until the combination of the human elements stimulate the riders' emotions and cause the rider to exclaim: "WOW, that was a great trail!"

It is important for the designer to understand this relationship between physical shapes and emotional responses and then to creatively seek and arrange those shapes, anchors, edges, gateways, the big WOW, and the little wow into a sequence that will create an image in the riders' minds and stimulate the riders' emotional responses. The trail is the connecting link between each one of those elements.

Triggering the positive emotional response also includes the riders' perception of the trail as part of the environment. The more that the trail fits the landscape, the more the trail will be perceived by the riders as being natural and the more likely that the trail will stimulate those emotional responses within the riders. The level of that response can be controlled by the physical relationship between the trail and the feature. Altering

### Emotional responses to trail shapes

The following shapes may induce predictable emotional responses

Shared use paved trails

**Straight:**
* Point-to-point travel is the main focus
* Straightness overrides natural forms
* Utilitarian character, entices limited emotional response
* Encourages fast travel
* Predictable, with heavy reliance on adjacent scenery for visual appeal

**Straight segments:**
* Direct and practical, but with some acknowledgement of natural features where it curves for an obvious reason
* Feels arbitrary if it alternates between curves and straight sections for no apparent reason (consistency of form is an important design principle)

**Constant radius curves:**
* Urban over natural character
* Geometric and less tied to natural form
* Pattern associated with long-distance travel

**Gentle, flowing curves:**
* Relaxed, supportive, natural
* Allows travel at many speeds
* Flowing curves exist for apparent reasons in response to the landscape
* Settled, harmonious feel, especially if well anchored in the site
* Not constant or similar

**Sharper anchored curves:**
* Balance is tipped toward yielding to natural
* Site is dominant over trail, although if curves are not anchored it feels like a manipulation

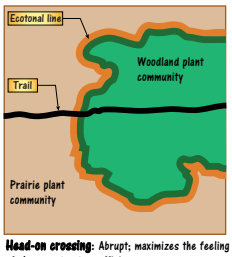
**Very abrupt curves, anchored:**
* Forceful, must yield to site
* Entices visitor to look for shortcuts, including cutting switchbacks

Natural surfaced trails

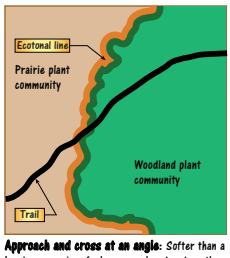
**Natural shapes:**
* Nature based, wild, uncontrived, self-anchoring - the essence of nature itself
* Often considered the master shape because it entices a variety of emotional responses

### Following, approaching, and crossing edges

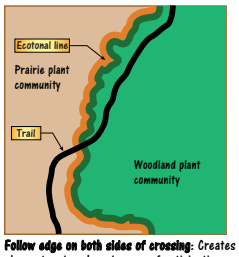
These examples show various ways a trail can interact with a woodland or grassland edge. Note that ecological impacts need to be considered anytime an ecotonal area is impacted by a trail, either running along it or crossing through it.




**Head-on crossing:** Abrupt; maximizes the feeling of sharp contrast or efficiency

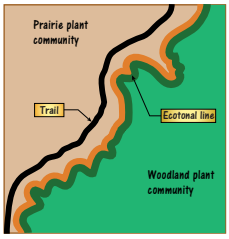



**Approach and cross at an angle:** Softer than a head-on crossing, feels more relaxed and gentle

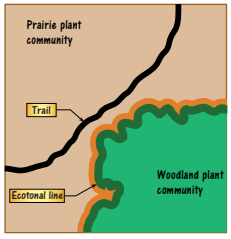



**Follow edge on both sides of crossing:** Creates pleasant and anchored sense of anticipation that is satisfied at the actual crossing


**Cross the same edge repeatedly:** Creates dynamic excitement and feeling of rapid change, feels well integrated into the site



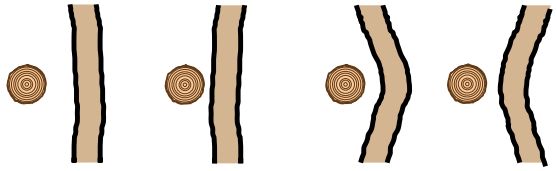

**Follow without crossing:** Respects the edge and is anchored by it




**Skirt in one place:** Commonly used where a sensitive area is on the side of the edge without the trail.

### Effects of anchor placement

Anchors have different effects with different layouts...



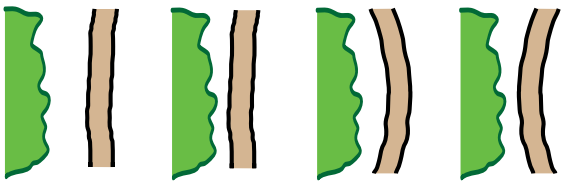
Weak anchor due to its distance and lack of response by the trail

Stronger anchor by proximity, but trail does not respond to the anchor

Stronger anchor because trail wraps around it

Stronger anchor because the trail approaches it - with the anchor in the sightline

The same effects hold true with edges.....



Weak from distance

Stronger by proximity

Stronger by wrapping

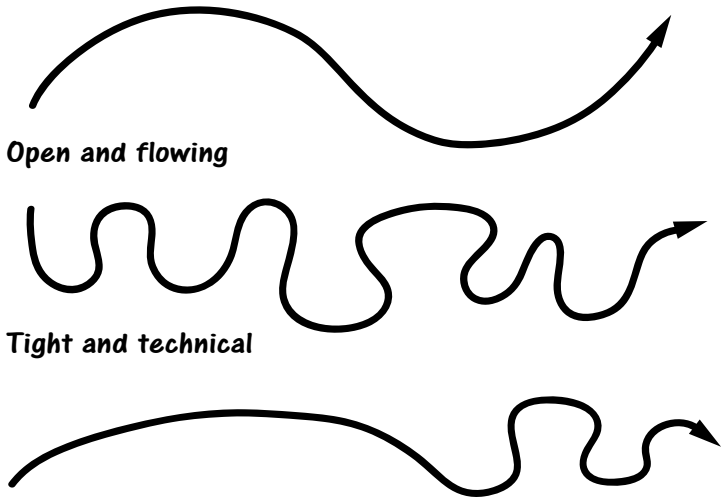
Stronger by approach

the approach, proximity, or length of time in the proximity of a feature can create a stronger or weaker response.

## Create Trail Flow

Flow is the continual horizontal and vertical movement of the trail on the landscape without conflicting with the landscape. Flow is the rhythm of the trail and the riders feel that rhythm as the riders flow with the trail. That flow and rhythm stimulates emotional responses within the riders which is why it helps make a great trail great.

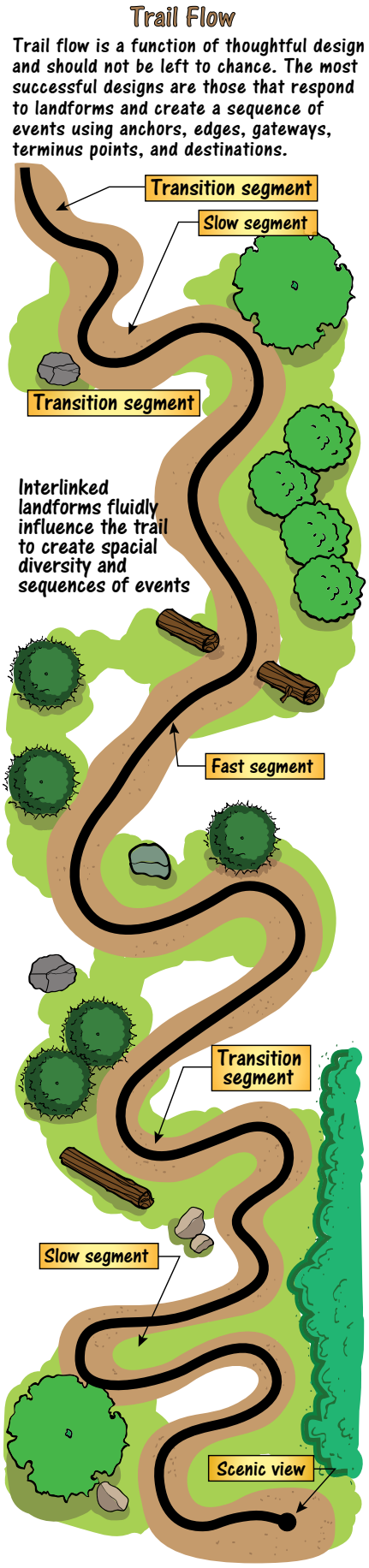
Designers purposefully create flow, rarely does it happen by accident. As designers flag in a trail, they should be riding the trail in their mind and tracking the experience they are creating. Sure, they must keep track of the grade, alignment, and drainage points, but they also must seek out anchors, gateways, edges, and viewpoints. Those experiences need to be mixed up so the riders are encountering variety and cannot wait to see what is around the next curve. Designers control the viewshed of the riders. On a trail with good flow that view should be constantly changing. Flow can be open and gentle or tight and technical. A trail that carefully transitions from one to another adds variety and increases the recreation experience.



*Open and flowing*

*Tight and technical*

*Poor flow - abrupt transitions from one type of flow to another.*




A trail with flow has the following:

- Rhythm, but this does not mean speed. Rhythm is the ability to throw a machine back and forth from corner to corner.
- High fun factor.
- Good control of the riders' view scape. The trail goes where the riders' eye thinks it's going to go. If it doesn't, that creates an awkward moment that can result in tread impacts and risk to rider safety.
- Feels "natural," not artificial or contrived.
- Natural transitions between trail conditions.
- Allows the riders to carry momentum which reduces the need for hard braking or acceleration and therefore reduces tread impacts and maintenance. This is often called "flowmentum."

**What do People Want From Their Experience?**
- Connect to nature
- Escape from stress, re-create
- Fun
- Challenge, exercise
- Camaraderie, bonding
- Variety of experiences and difficulty
- Loops

**Where Do People Want to Go?**
- Highest point
- Water
- View
- Dramatic and unusual experience
- Historic interpretive site
- View wildlife
- Food

This snag is a character tree that is silhouetted by a dramatic panoramic view. The trail has been consciously located to frame the picture and direct the riders' eyes at the best possible angle.

## Provide for the Riders' Needs

If at all possible, take the riders where they want to go and provide a variety of experiences while doing it.

## Create Variety

Edges, shapes, gateways, and anchors need to be creatively mixed up and have short duration. The fenceline makes a cool edge, but not for mile after mile. A great trail will utilize the fenceline briefly, leave it to offer the rider some other features or experiences, and then maybe come back to the fenceline.

### Tip, Trick or Trap?

**Tip:** The images in this chapter and their effects on the riders are powerful tools. The trail designer who incorporates these tools is one who will create a great trail.

## A Closer Look...

Artists have their color palette, but the landscape is the palette for the trail designer. The artist has seven elements with which to create art: line, color, value (contrast), shape (2D), form (3D), texture, and space (scale or depth). Most of these terms have been used to describe the illustrations in this chapter because the trail designers use these same elements to create the images that will mold the riders' perception. Is creating a great trail art or science? It is both.


GET
READY...


WOW!

## Need more? Learn more here...

*Elements of Art*, http://www.northernhighlands.org/cms/lib5/NJ01000179/Centricity/Domain/40/Elements-of-Art.pdf

*Natural Surface Trails by Design*, Troy Scott Parker, Natureshape LLC, 2004

*Trail Planning, Design, and Development Guidelines*, Minnesota Department of Natural Resources, 2007

## A Look Back...

Here are some of the elements discussed in this chapter:

- A great trail is actually an emotional response to the trail. Five factors come together to trigger a great trail emotion: physical elements, human elements, flow, provide for the riders' needs, and create variety.
- Capitalize on the physical elements
- Find the WOW
- Find the little wow (subliminal absorption)
- Understand and design for the human elements: perception and feelings
- Human perception is formed by:
  - Shapes
  - Anchors
  - Gateways
  - Edges
- Human feelings are how riders feel about a trail's:
  - Safety
  - Efficiency
  - Playfulness
  - Harmony
- Designers and planners should creatively and frequently use shapes, anchors, edges, and gateways to form the riders' perception and feelings about the trail
- Manage and maintain the trail to perpetuate those qualities
- Create trail flow. Flow is the rhythm of the trail. Momentum + Rhythm = Flowmentum.
- Provide for the riders' needs by taking them where they want to go and provide the experiences they are looking for. The key is variety
- What makes a great trail great is the riders' perception of it. That perception is controlled by the designer
- The landscape is the designers' palette and like an artist they use the elements of line, color, value, texture, shape, form, and space to create the images that will mold the riders' perception of a great trail

# Chapter Thirteen
## Trail Location and Design

One Size Doesn't Fit All. Ride the Right Sized Machine.

Locating a great trail and protecting the natural resources can be a challenge, but it is worth the effort.

The key to a great trail is in the location of the trail and in the arrangement of certain physical features that can stimulate powerful perceptions and feelings. Indeed, the landscape is like a giant trail jigsaw puzzle. The pieces are out there, but where? And how do they get arranged? Is there more than one way to solve the puzzle and if so, which is the best way?

The challenge for the locators is to find the pieces and arrange them in the best possible way. In every scenario, there is always a way to solve the puzzle. It may take design tools or management tools or both, but there is a solution. It may not always be ideal, but that is okay. Creating a great trail is about making informed decisions and making the best of a given situation. It is not a perfect world and there is no such thing as a perfect trail.

### Know the Complete Picture

When finding the best location for a trail, the locators provide for the riders' needs by managing the vehicle use and the riders' viewshed, speed, and experience all while protecting the natural resources. That is a heavy load to carry and it takes careful decisions to effectively place a trail on the landscape that meets all of those objectives.

The effort takes both physical and mental energy and can leave locators exhausted in both capacities. The locators need to be mentally sharp and physically prepared for a tough day of walking in the field. But the result of all this effort will be a well-designed, environmentally friendly trail that is fun to ride and a great success.

**Making Great Trails Requires:**
- **Understanding**
- **Knowledge**
- **Engineering**
- **Passion**
- **Vision**
- **Creativity**
- **Conscientiousness**

Good locators must know the complete picture. They must know and understand these eleven elements about the project site before going into the field:
- The issues
- The politics
- Resource values and constraints
- Management constraints
- Existing conditions
- The vision
- Trail management objectives (TMOs), including type of vehicles, difficulty level, experience type, and methods to build and maintain
- The soils
- The climate
- The vegetation
- The topography

Locators should take a close look at the scope and complexity of these eleven items. Each has equal weight and all except the vision and the TMO can change from one side of the ridge to the other. Great trails don't happen by accident, they are created by thoughtful and purposeful design. If someone on the project team doesn't have the range of skills and experience required, it is worth seeking professional assistance.

## The Trail Location Process

1. **Know the Complete Trail Picture.** All of the eleven items are important to know, but the TMO has a direct bearing on almost every flag the locators hang. Generic TMOs were created during the development of the concept plan. Those TMOs could change if necessary during the location process once actual site conditions are thoroughly examined, but they are a place to start. The vehicle type will affect trail width, grade, and the physical forces applied to the trail. How the trail will be constructed will determine whether the team goes around a stump for hand-build or through the stump for machine-build. The intended challenge level will affect whether the team goes around the rock for an easier trail or over the rock for a more technical trail.

This great rock feature is almost totally concealed by vegetation and would not be visible in an aerial photo or from another vantage point on the ground. It was found only through thorough reconnaissance.

2. **Use the Concept Plan.** Considerable work was invested in developing the concept plan, so it is a good place to start. Locators should use it as a guide, but recognize that it will likely change once more reconnaissance is performed and actual site conditions are identified.

3. **Identify Termini and Control Points.** In developing the concept plan, opportunities and constraints were identified as positive and negative control points. Knowing the termini and the control points can significantly shrink the size of the landscape and restrict where the trail can or can't go. Since they are so important, these points should be verified during the location and design processes. Also, depending on the amount of field time invested in developing the concept plan, the locators should look for additional opportunities or constraints.

4. **Break Up the Elephant into Chewable Chunks.** Figuring out how to access a large landscape can be overwhelming. The locators should use logical terrain features (like ridgeline to ridgeline) to break the landscape into smaller parcels. They should take careful notes, photos, and GPS data to help them join the parcels together.

5. **Conduct Total Reconnaissance.** Features can be hidden and soils can change dramatically. The locators should thoroughly explore each parcel to uncover its opportunities and constraints. GIS modeling can display a corridor with the optimum side slope, soils, and vegetation. While this can be a handy tool, it can also be a trap if the locators fail to look outside of this corridor. Some of the best terrain features can be found in areas that could be classified as unsuitable. The locators should find the features and then make their own determination as to whether or not the trail should or could be there.

### Tip, Trick or Trap?

**Tip:** It is easier to make a great trail when the trail locator and designer are the same person or team

6. **Connect the Dots.** Once the controls are identified, what is left is to connect one control to another. While this sounds easy, the last thing locators want to do is just arbitrarily connect the dots. The space between controls is where the designers can play with the landscape, find those big and little WOWs, and provide variety and fun to enhance the riders' experience. This is the fun and creative part of trail location and design.

Here are some key points:

- Remember that OHVs have motors and riders like to use them. Keep the trail moving.
- Getting there isn't half of the fun, it's all of the fun.
- Miles equal seat time equals smiles.
- The best line usually isn't the first line, the easiest line, or the logical line.
- Mistakes will happen. The key is to learn from them.
- There is no such thing as a perfect line. Instead, there are options to make the best of a given situation.

The blue line is the logical line; base of the slope, natural opening, easy walking, could be a game trail. The yellow line is a better alternative with more flow, drainage, and it keeps the riders' eyes moving.

7. **Revise the Concept Plan.** Once all of the landscape parcels are connected together with actual flag lines, chances are that there have been a bunch of changes in loop configurations, junction locations, trail difficulty, and even trail use type. Locators should make sure that the plan is still compliant with the environmental documentation and update the concept plan. It will then become the design plan, which will be used through construction and maintenance.

8. **Develop Final TMOs.** The TMO has key information that triggers important design-build-maintenance parameters. Now is the time to update and finalize the TMOs so they can accompany the design plan through the remaining portions of the Great Trail Continuum.

9. **Prepare a Trail Log if Necessary.** The trail log is a list of work items that the designers prepare for the construction crew or contractor. Items would include: turnouts, rolling dips, chokes, special challenge features, easy-outs, drains, all structures and their size and length, trail hardening, and any special design items or notes. The trail log is where the locators and the designers have the opportunity to communicate their vision and intent with whomever is doing the construction. The trail log and the TMO are key documents used to develop a construction contract packet.

## Work with the Landscape

Once the locators have done their job, it is time for the designers to step in. Since the landscape is the pieces of the giant trail system jigsaw puzzle, it is important that the designers recognize and understand the clues to each piece. This allows the designers to make informed decisions regarding the environment and rider experience, and thus assemble the pieces into a great trail.

**Read the Landscape**. The landscape gives the designers information about topography, climate, vegetative type, soil type, soil stability, moisture content, water sources, drainage, wildlife and stock use, features, and of course the potential opportunities for a quality trail experience. To the eyes of experienced designers, the landscape will indicate potential habitats for sensitive plant and animal species. Looking at existing impacts like roads, skid trails, game and stock trails, and existing recreation trails will give them clues as to soil stability, storm impacts, and the maximum grades that can still be sustainable. Some landscapes are breathtakingly heterogeneous and dramatic and others are incredibly homogeneous and bland. Both can be beautiful and both provide challenges for designers. Heterogeneous landscapes can offer exciting feature-rich trail experiences, but they can be difficult to preserve the viewshed, harmonize with the landscape, hide the trail from the riders and from other viewers, and effectively manage the OHV use. Homogeneous landscapes generally have fewer viewshed concerns, but can test the designers' ability to find and create an exciting trail with a lot of variety.

Below are some examples of what the landscape can tell designers.

The pistol-butted trees on the slope indicate that the soil is moving. The slabs of rock that are showing (arrows) probably means that there is a shallow lens of soil over the rock and that's why it's moving. It's been burned, but vegetation is sparse anyway which allows for overland flow of water. The tread watershed, combined with the wide trail and sleep slope causes water to flow down the trail. The result is erosion.

This is a bench where a steeper slope levels off for a short distance before getting steep again. Often, there can be springs or wet areas at the base of the steep slope and the taller green grass (arrow) may indicate that. The drier location for a trail is on the nose of the bench as it starts to steepen. There could also be viewpoint potential there.

The bushes are willows and they grow in wet environments. Though no water is visible, the dark strip of grass (arrow) indicates that water is not far below the surface. This is probably a very wet drainage in the spring. Notice how the shade of green intensifies from the top of the mound downslope to the fence. Water has drained from the highlands into the lowlands.

Aspen are generally an indicator of water, but look how brown the grass is below the aspen. Also note that the ground cover is grass and not leafy shrubs and forbs. The evergreens are Ponderosa Pines which grow in rocky or free-draining sandy soils, so the water table is not near the surface.

Here, the evergreens mixed with the aspen are fir trees which prefer wetter environments or soils that have more clay and hold their moisture. Notice how green the ground cover is here; leafy shrubs and forbs with less grass. The water table is closer to the surface here and a trail cut into the slope will probably intercept sub-surface water in the spring.

Though totally dry now, this patch of beaver-gnawed stumps is a red flag. Standing water was here once and it could be here again. The fact that the stumps are white probably indicates that they were in or under water when they were chewed. With further reconnaissance, the remnants of the beaver den were found.

This is WOW terrain and a trail locator's dream. The site is high and dry with a mixed pine-fir stand. Plenty of exposed rock means durable tread material and opportunities for natural challenge features. Scattered rock outcrops allow the trail to be in the trees and then pop out in the open for a spectacular view and a varied trail experience. Snags and juniper ground cover provide little wow subliminal features.

This is ideal ground for a trail. The trees are fir, their stems are bowed. The ground cover is green, but low-growing, so the site is relatively dry. The trees are nicely spaced so that a trail could easily sinuate around them. Downed trees help deter off-trail use and their stumps can provide subliminal features.

What appears to be a nice little meadow with an opportunity for a view is really a bog and another red flag. Bogs are a wetland and a place to avoid if possible. An interesting thing about bogs is that they can occur in the highlands as well as the lowlands, any place where water can become trapped, and they may or may not be associated with a stream or body of water.

A contiguous patch of green like this is a red flag for water. To cross this at the outlet (foreground), the designer would choose the narrowest low spot with higher ground on each side. Even then, trail hardening or a structure would probably be required. A better alternative would be to stay on the high ground in the back (arrow) and avoid the low ground entirely.

There is some excellent opportunity here for some technically challenging trail and outstanding viewpoints. Finding a way through steep, rocky terrain or deep, nasty canyons can be an arduous task for the designer. A good place to start is to find a game and stock trail and follow it. Chances are they have already found the best route through the area. If there isn't one, maybe there isn't a route and you could be in trouble.

## Tip, Trick or Trap?

**Trick:** In rugged terrain, look for a stock and game trail. Chances are that they have already found the best route through.

There are many causes of slope failures: poor soil, saturated soil, soil on top of an impervious layer like rock, too much weight on the soil, erosion from a significant water event, etc. If it has happened once, it can happen again. As a designer, try to figure out why a slope failed, then avoid placing your trail within that same set of conditions. This failure is easy to spot, but older ones with trees are not so obvious. If you see a stand of trees on a slope or at the base of a slope and all of the trees are at different angles, it is probably an old slide.

Patches of standing water show how high the water table is. Though this ground seemed firm to walk on, it would not support the weight of vehicles and severe damage to this important ecosystem could occur. Crossing a bog can offer variety and an interpretive opportunity, but generally requires an expensive structure like boardwalk.

These are very old, highly-fractured rock formations that have been eroding and disintegrating for eons. The soils on a slope like this will have a high rock content and be quite durable. Note the rock showing in the trail tread.

Depending on the tree species, exposed roots can indicate a shallow soil layer with rock underneath. This can increase construction costs and cause you to change your location. If you don't see rock, dig a test hole to find out.

Scree slopes are areas of fractured rock or boulders that have been deposited over the centuries by the deterioration of a rock cliff or mountain top. They can offer technical challenge, views, and a varied riding experience. However, due to the forces of snow creep or avalanches, rocks can continually be deposited in the trail tread and maintenance can be high. To minimize this and to better harmonize with the landscape, a trail should cross at the top or bottom, not mid-slope.

A look at the landscape can also reveal changes in aspect, such as north-facing slopes versus south-facing slopes. The soils, vegetation, and micro climate can change, sometimes dramatically, from one side of the ridge to the other. North-facing slopes are generally cooler, wetter, and have more dense vegetation than south-facing slopes. Changing aspect is a good way to add variety and enhance the rider experience. It is also a good way to increase the durability of the trail tread. If the north aspect appears to be so wet that hardening or structures may be required, try putting more of the trail on the south side. Likewise, if the soils on the south slope are not durable because they are non-cohesive, try switching to the north slope for better conditions.

This photo shows the dramatic change possible from a south facing slope on the right to a north facing slope on the left. From a design and management standpoint, being in the trees offers more options to hide the trail and wind the trail.

In snow country, the aspect of the slope could be a consideration. North-facing slopes will hold snow longer than south-facing slopes. If two segments of the trail or trail system are on south slopes and the only connector between the two is high up on a north slope, the trail system will have no connectivity until all of the snow melts up high. When riders come to a snow field, they will look for a way around it and this could lead to management problems and resource impacts. If possible, designers should consider putting in another connector trail at a lower elevation. This will allow the trail system to be fully utilized earlier in the year and can provide another loop opportunity after all of the snow is gone.

The prevailing direction from which storms approach should also be considered by the designer. If there is topography, storms will generally dump more water on the windward side than on the leeward side.

The landscape changes in every region of the country and with that, the clues change. In order to locate a sustainable trail, designers must understand that landscape or consult with someone who does.

**Make the Trail Flow with the Landscape.** Making a trail flow starts with viewing a landscape, identifying the places the trail could go, and then visualizing the least intrusive route to get there.

While this may be a fun hillclimb and may even be sustainable given the soils, climate, and use levels, it does not flow with the landscape.

This location flows better, drains better, and uses the features of the landscape to enhance the riders' seat time and experience.

When putting trails into the landscape, consider:

- The trail should not interfere with the natural drainage patterns. It should dip into and climb out (drain) at all of the natural drainage points.
- Use the vegetation and topography to make the trail blend in with the landscape.
- Since a contour can be a straight line, follow the contour corridor without being on the contour. Keep the trail moving in a horizontal and vertical W pattern.
- Some edges conflict and others harmonize. The trail is an edge that can fall into either category.
- Laying lightly on the landscape means minimizing trail cuts and fills, which impact the landscape.
- Incorporate gateways and anchors that tie the trail (and the riders) to the landscape.

Even in an open landscape, this trail flows with the terrain, drains with the terrain, and has minimal impact on the terrain.

This trail would have had less visual intrusion on the landscape if it had been located in the trees (arrow), but the terrain was steeper on that slope and it lacked places for enough climbing turns to gain the elevation that this trail needed to gain to hit control points.

This trail is beautifully located. It is well anchored with the humongous rocks and it flows well from rock to rock. The riders' eyes almost ricocheted from one to the other.

Locating a fun, sustainable, and visually unobtrusive trail on an open landscape can be challenging. Note the undulating W shape of this location. If nothing else, this trail will drain well.

Dramamine anyone? A little too long and repetitive, but perhaps there was no option. It's not an ideal world. A sustainable trail beats no trail and sustainability trumps rider experience.

To drain and flow with the landscape, a trail across this slope could have a minimum of six grade reversals

This contour trail probably connects one saddle to another. It is definitely sustainable, but perhaps a bit too conservative. It's a line that bisects the landscape rather than flow with it and the riders' eyes are fixated on the same point for too long. Human nature is to go to the highest point, so perhaps the trail could have gone there. Down lower, there are trees and more roll to the topography, so a trail there could have more flow, roll, and fun factor.

**Use the Landscape to Enhance the Rider Experience.** Every landscape has topographic or vegetative features that can be creatively used to enhance the rider experience. There can be big WOWs or subliminal wows, but like gateways and anchors, the challenge for designers is to find them and piece them together.

In a thick deciduous forest the opposite effect may be desired by breaking the rider out into the open.

An example of using an enclosed canopy of vegetation to create a tunnel effect. Everyone enjoys going through a tunnel because it is so different. Being encapsulated by the vegetation creates the same response in riders. In a deciduous forest, doing this can mean increased maintenance to keep the vegetation trimmed back.

Here are some thoughts:

- Winding around or over boulders, stumps, or other features can provide a small grade reversal while enhancing the rider experience.
- Roots and rocks left in the trail bed add to the rider experience and can help drain the trail or at least slow the velocity of water.
- Rocks and thickets provide opportunities for technical trails. Seek them out.
- In dense forests, especially deciduous forests, opportunities for viewpoints can be limited. Consider doing some selective thinning to create or enhance a viewpoint and then manage that site for its view by keeping the vegetation cut back.
- Go through medium-height vegetation with an enclosed canopy to create a tunnel effect for the riders.
- Look for what is different in the landscape and take the trail there.

What is the different feature in this landscape?
It is the field of boulders and taking the trail there will vary the riders' experience.

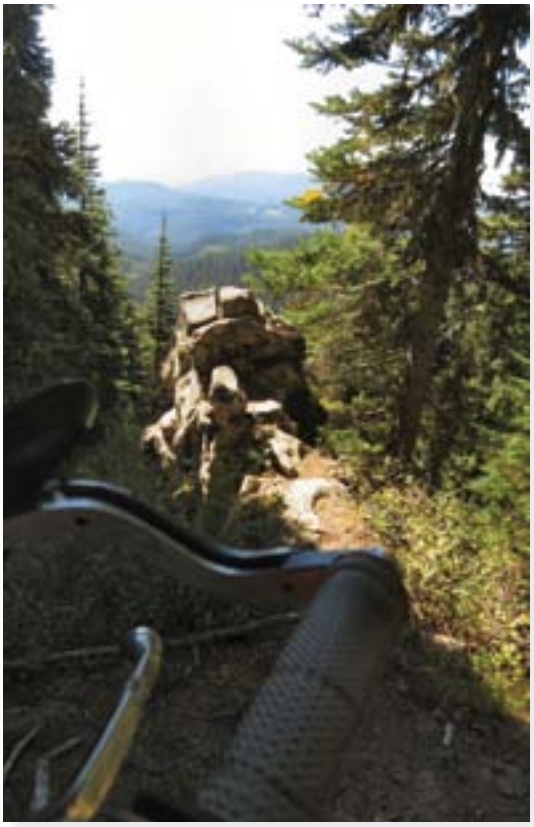
This isn't dramatic, but running the trail over this little rock knob creates a grade reversal and a varied experience for the rider. If this had been a more technical trail, the line may have crossed lower over the more jagged rocks if they were solid enough to withstand the use.

Running the trail between these two root wads is an outstanding example of creatively using what the landscape gives you. This not only creates a gateway, it provides a dip in the trail which can help drain water. Note: examining root wads and their holes is a good way to ascertain underlying soil conditions.

Rather than be on the ridgeline and have its inherent drainage issues, this trail is staying below the ridgeline to: A) screen the trail from others, or there could be another trail just on the other side of the ridge and screening the trail deters short-cutting; B) reduce sound impacts on the other side of the ridge; and C) tantalize the rider by denying the view, keeping the trail in the trees for interest, and then popping out on the ridgetop by the equipment for a WOW view.

This rolling terrain in the Midwest has some great trail opportunities. With some selective thinning, a nice viewpoint of the valley below could be created.

We've talked about playing with the landscape and this trail does that very well. The original trail (blue line) was a fall line trail with a 38% grade. The new trail (yellow line) extends seat time, is more durable, and way more fun to ride. Yes, this roller coaster still has some steeper grades, but the rider can see them coming and flowmentum will carry the rider through the turns without undue tread impacts.



Natural features like roots and rocks can act like waterbars to help drain the trail. Utilize these when options for grade reversals are limited. To preserve these, a light hand is necessary during construction and maintenance, so the designer must note these sections in the trail log or these subtle opportunities could be lost.

Utilize shapes, colors, textures, and lines to enhance the viewshed and interest of the rider. This picture is beautifully framed with rocks and trees in the foreground against a panoramic background. Was this an accident, or did an astute designer locate the trail to direct the riders' eyes at this feature?

What is different here is the three trees. The objectives for the designer were to maximize the experience of the rocks and emphasize the subliminal view of the three trees. Cows can produce decent single track trails. The two blue lines are cow trails that take good lines through the rocks and over to the ridgeline. The designer could have followed either one of those and they wouldn't have been "wrong" options. They just wouldn't have met the objectives as well.

The other feature that is different is the patch of low-growing juniper (arrow). The designer stayed low and close to the rocks to maximize that experience, popped out onto the ridge to treat the rider to a WOW view, and then turned to direct the riders' eyes at the trees before continuing on to the top of the rock feature. There is another trail just over the crest of the ridge, so the designer kept the trail below the ridgeline (yellow line) to hide this trail from the other while directing the riders' eyes up to the top of the next rock feature on the left.

## Layout and Design Fundamentals

Here are eight tips to create a great trail.

Avoid monotonous scenarios like this. Once the riders have absorbed the initial view, they will roll on the throttle to get through this as fast as they can so they can maybe see or ride something different.

**1. Speed is an issue.** Reduce speeds to:

- Increase seat time.
- Decrease tread impacts, displacement, and maintenance costs.
- In many soils, tangents equal speed equals moguls. Moguls decrease the rider experience and increase the potential for braiding and widening. Reducing speed reduces moguls.
- Potentially increase rider safety and decrease agency risk.
- Enhance the fun factor.

How to achieve those benefits:

- Limit the riders' sightline. If riders can't see far, they will reduce their speed.
- Keep the horizontal alignment tight and curvilinear.
- Roll the vertical alignment.
- Tighten the clearing limits.
- Minimize the use of roads.
- Avoid one-way trails.
- Provide obstacles and challenge features to the extent the TMO will allow.

### Tip, Trick or Trap?

**Tip:** If riders find what they want on a track they won't look for it off the trail.

2. **Topography is a friend.** Head for the hills and avoid flat ground. Use topography for:

- Increased opportunity to effectively drain water by rolling the grades, which reduces the size of the tread watersheds.
- Less potential for damage due to severe weather events.
- Reduced potential for trail braiding and widening.
- Reduced potential for off-trail use.
- Generally more opportunities to reduce speed.
- Generally more opportunities to provide challenge.
- Enhanced rider experience.

It is difficult to manage and drain water on flat ground. In spite of the flat trail grade, there is enough water volume and velocity to cause severe damage. This trail should have been located on either slope above the flat ground.

How to achieve those benefits:

- Seek whatever slope is available, preferably between 15 and 45 percent.
- Don't be afraid of steeper slopes. Steeper is almost always better than flatter.
- Most roads provide a flat surface and therefore have the disadvantages of flat ground. Minimize the use of roads.

3. **Vegetation is good.** Vegetation allows:

- More water absorption and lower overland flow, which results in less water entering the trail prism.
- Reduced splash erosion.

The benefits of dense, woody vegetation include:

- Decreased opportunity for tread widening or braiding.
- Increased opportunities for a tight curvilinear alignment, which decreases speed and increases seat time.
- Decreased opportunity to shortcut and straighten the alignment, thus a decreased opportunity for speed.
- Decreased opportunity for off-trail use, which results in better management.

- Generally, a decreased visual intrusion on the landscape due to more opportunities to hide the trail with vegetation.
- Increased rider experience.

If this isn't a great trail, it's certainly a great day. This vegetation is perfect to confine the riders, provide a great view, and leg-slappers make them feel like they are pioneering a trail. Vegetation can be trees, brush, or even tall grasses and sedges.

How to achieve those benefits:
- Taking the easiest path to walk or ride may not be the best location for the trail.
- Generally, locate the trail in the tallest and thickest vegetation available.
- Occasionally, pop out into more open vegetation to provide variety and viewpoint opportunities, then dash back in to the thicker vegetation.
- Keep the trail as narrow as possible and avoid the use of roads.

4. **Water is an issue.** Manage water to:
- Reduce volume and velocity of water, which reduces potential erosion and sedimentation.
- Reduce braiding and widening due to saturated trail treads or ponding.
- Reduce ruts and rills in the trail tread.
- Slow degradation of the trail tread, which results in less maintenance.
- Increase rider experience.
- Potentially increase rider safety.

In locating a trail, the designer must look for all contributing sources of water and design to mitigate them. Located in the bottom of a normally dry draw, snow melt is entering this trail prism and has nowhere else to go but down the trail. Water is also coming down the steeper trail grade on the right. This was an error in design. If the water ran longer or if the grade was steeper in the draw, this trail would not be sustainable.

How to achieve those benefits:
- Avoid flat ground.
- Avoid the fall line.
- Reduce the size of the tread watershed by rolling the grades and reducing tread width.
- Add drainage structures if grade reversals cannot be provided.
- Reduce the trail grade and make grade pitches shorter.
- Minimize the use of roads.
- Utilize soil stabilization and trail hardening techniques.

5. **Create a recreation experience, not a transportation experience.** Benefits of a quality recreation experience include:
- Provides for the riders' needs.
- Reduces speed and increases seat time and recreation activity time.
- Increases the fun factor.
- Increases compliance with rules and regulations.
- Increases ownership and stewardship of the trail by the riders. This will help protect and maintain the trail through volunteerism.
- Facilitates OHV management because riders want to stay on the trails.
- Potentially reduces resource impacts.

How to achieve those benefits:
- Unless providing a touring or destination experience, minimize the use of roads or creatively convert them to trails.
- Play with the landscape and the rider experience.
- Designers should ride the trail in their minds as they are laying it out. If they aren't enjoying it, the riders won't either.

- Provide variety and creatively utilize the landscape.

6. **Avoid Point A to Point B location.** Avoiding the straight line will:
- Keep the riders engaged. Constantly changes the riders' viewshed and creates variety and intrigue.
- Allow the trail to flow and blend with the landscape, which enhances the rider experience as well as the aesthetics of the trail.
- Decrease the size of the tread watershed and thus increase sustainability and decrease potential resource impacts.
- Decrease speed, which increases seat time and decreases tread impacts.

This road was 18' wide and a designated 4WD "trail." It was a transportation route that was converted for recreation use, but it had no recreational value. But then, a creative manager filled half the road with boulders of increasing size. The result? Outstanding! Now rigs can dive off into the rocks if they want to or stay in the now narrow trail and watch their buddies try not to break something. Seat time was dramatically increased as was the rider experience.

How to achieve those benefits:
- Unless it is absolutely necessary to hit control points, do not use the Point A to Point B approach in trail location. Avoid running grade lines.
- Exception: the trail to the restroom should be straight.
- Play with whatever the landscape has to offer.
- Do not be goal-oriented. The goal is to get there, but not necessarily quickly.
- Provide flowmentum. OHVs have motors and riders like to use them. Keep the trail flowing up and down and side to side.
- Avoid the fall line and generally avoid ridgetop trails.
- Minimize the use of roads.

Grade lines do not harmonize with the landscape.

7. **Head for the rocks.** Rocks can:
- Offer visual and riding diversity, which can enhance the rider experience and fun factor.
- Increase opportunities for challenge.
- Satisfy human nature to get to the high points since the high points are often rock outcrops.
- Provide an increased opportunity for dramatic viewpoints.
- Provide a durable and sustainable trail tread.
- Soils with high rock content can resist the forces of compaction and displacement.

How to achieve those benefits:
- Do a thorough reconnaissance of the area. While some rock outcrops are obvious on aerial photos or maps, others can be in unlikely places or hidden in the trees.
- Whenever possible, seek rocky soils rather than sandy or silty soils.

It was a surprise to find this neat rock feature hidden in the foliage. In dense vegetation like this, it can be difficult to find interest features and variety for the rider. Seeking people familiar with an area can help.

8. **Manage the riders' eyes.** Controlling the riders' eyes helps:
- Enhance rider experience by providing intrigue and visual diversity.
- Frame the landscape for the riders to focus on the big WOW and little wow.
- Potentially increase control of the riders and decrease resource impacts.

How to achieve those benefits:

- Keep the trail moving horizontally and vertically to avoid long views of the same scene.
- Designers should focus the riders' eyes on where they want the riders to go and what they want the riders to see, not where or what the designers don't want the riders to go or see.
- Creatively utilize the physical and human elements in the landscape.

If the intent is to keep riders out of this corridor, why focus the riders' eyes right at it? Why not put the sign in the middle of the corridor where the riders' eyes will readily see it? Why not fall some trees to help disguise the corridor?

## Special Design Situations

**Road Crossings.** One place with potential risk is a road crossing. Roads can be low standard with low traffic volume and speed or high standard with high traffic volume and speed, but the trail crossing design is the same for both.

When designing road crossings:

- Verify if the road authority requires a permit or approval of the site and crossing plans.
- Locate the crossing on a tangent, not a curve.
- Make the tangent long enough to provide adequate sight distance for the speed of the traffic on the road.
- Place the crossing at or close to 90 degrees to the road.
- Keep the trail grade at the crossing as flat as possible so OHVs can stop and start easily without impacting the trail, road fill slope, or road shoulder. If there is a steep uphill, like riding up the road fill slope, riders will increase their speed to get up the hill. This will carry them into the road without the ability to see traffic or stop. If there is a steep downhill, riders could find themselves sliding into the roadway.
- Construct a level area if the grade is not flat. It must be excavated or filled to a sufficient size for the vehicle to come to a complete stop before entering the road shoulder.
- Install signing as per the guidelines for the road standard in the project's management plan or sign plan. If Stop or Yield signs are used, Stop Ahead or Yield Ahead signs must also be installed.
- Harden approaches to paved road crossings, providing a paved apron, to protect the road shoulder from damage.

Putting rock on this approach does nothing except make it easier to spin tires. The post (arrow) is for a Yield sign, but there is no flat area to stop a vehicle and get started again. The result will be damage to the road shoulder and an unhappy stakeholder.

This paved road approach is flat and has plenty of room for OHVs to stop and look before crossing. But even with a flat approach, the road shoulder has been damaged. A paved apron one vehicle length long would prevent this.

**Creek Crossings.** Many areas do not allow for tire and water contact or it may be allowed in only intermittent or non-fish-bearing streams. Check the classification of the stream and follow the crossing guidance in the management plan or other environmental document.

Here are some things to keep in mind for creek crossing:

- A permit may be required to approve the site or operate equipment near or in the creek; or there may be restrictions for the time of year that activity can occur.
- Crossings should be on creek tangents, not on curves. Tangents will have the flattest approaches and most level creek bed. Curves can have holes in the creek bed and scour on the outside bank.
- Crossings should be as close to 90 degrees as possible. This minimizes potential impacts to the creek and adjacent riparian zones.
- Trail approaches should be as flat as possible to minimize sediment delivery to the creek.
- Drain water off the trail before entering the creek.

This approach has been built up with fill (arrow) so there is a level platform to stop, look, and start. Note the Yield sign. This is a functional and professional looking road crossing. It costs more, but public safety is worth the cost.

Pavers must be properly bedded and anchored or they will fail. Note the creekbed littered with pavers. There should be one approach to the creek, not three. A ford constructed of concrete planks cabled together would have worked better.

This crossing has relatively flat approaches, but large boulders at the approach and in the creek could cause potential impacts.

Flat water and a gravelly creek make this a better crossing, but it's longer than it needs to be because it is not perpendicular to the creek.

**Bridge Sites.** Bridge sites need to be carefully selected and properly engineered. If at all possible, avoid having a bridge site down in a canyon where the only access is by having steep trail grades that lead directly down to the bridge, which can deliver sediment directly into the creek.

For bridge sites:

- Ensure that there is sustainable trail access to the bridge site.
- Trail approaches should be as flat as possible.
- Bridge approaches should be elevated (but not steep) so water can drain off before the bridge and debris can't be carried onto the bridge.
- If the approaches can't be raised, design the trail to drain water off before crossing the bridge and harden the approaches.

This is an excellent bridge approach. Raising the trail grade to the bridge forces water off the trail and helps prevent dirt and rock deposits on the bridge deck. Water drained off the trail has plenty of natural vegetation to flow through before entering the stream. This will slow the velocity and filter out sediment.

This bridge is in the bottom of a grade sag so water and sediment collect and drain in the middle of the bridge. When this creek is flowing, sediment will be delivered directly into the water. If this was a perennial, fish-bearing stream, this bridge site would not be acceptable.

This is a common, but poor bridge approach. This long grade has no drain. All of the water and sediment will be deposited directly into the creek. Vehicles trying to brake going down or accelerate going up will churn up more soil that will also end up in the creek. Old roads are often used for bridge access because they are existing and provide a means to get equipment and materials into the bridge site. This is okay, but using the road as a trail afterward isn't. A properly designed trail should be located and constructed and the old road closed.

The trail turns and dives down to the bridge at a steep non-sustainable grade. Look at the amount of sediment (arrow) that is getting ready to be flushed down to the bridge.

**Ridges.** It is human nature to want to get to the top, and a ridge trail is often at the top or leading riders to it. Ridges can offer dramatic views, wind-blown character trees, unusual rock formations, and almost always a change in topography and vegetation. All of these are good, desirable features; however, the goal for the trail designers is to arrange these in a series of big WOWs and little wows that treats and enhances the rider experience. Ridgetop trails can be undesirable because they often: follow the fall line, can be difficult to drain, do not provide enough riding diversity, do not vary the viewshed of the riders, do not frame the unique features for the riders, and divide rather than harmonize with the landscape.

Ridges provide a change in topography, vegetation, and viewshed. This trail may be heading toward the rock knob for a great view and some rocky terrain. Water coming down the fall line will drain off at the first rise (arrows). The trail will drop below the ridge to drain before going up to the ridge again.

This fall line trail becomes an edge which bisects the landscape. Considerable amounts of water will drain from both sides into the saddle. The lower grade is too long and a rolling dip should be constructed at the arrow. The upper grade, though fun is too steep. Notice how it is widening out, probably from riders avoiding ruts or exposed rocks.

Most ridgelines have game or livestock trails on them, so the easy path for the trail locators is to follow them. This is a trap. A better alternative is to wind a serpentine trail up the ridgeline, crossing from one side to the other. This creates positive drainage, varies the landscape for the riders, improves the aesthetics of the trail, and can create some dramatic views and scenic diversity.

**Saddles** are low points in ridgelines and as such they are natural targets for trail locators to cross over a ridgeline. However, they can drain water from both directions and any trail passing through the saddle can intercept this water. The designers must carefully assess the drainage patterns in a saddle and design the trail with drain points on each side of the saddle.

**Meadows.** Everyone enjoys looking at a meadow. Meadows offer vegetative diversity and beauty, often a chance to see wildlife, and usually a chance for a great panoramic view. As in a ridgetop trail, why put the trail through a meadow and divide, rather than harmonize with, the landscape? If possible, it is better to locate the trail in the trees, give the riders brief glimpses of the meadow to tantalize them into wondering what a full view would be like, pop them out to the edge while directing their eyes at the meadow and a WOW view, and then take them back into the trees again for variety before treating them once again to a view of the meadow. Designers should play with the riders' eyes and the rider experience to create a great trail.

This is a great trail. The trail comes close to the meadow without going through it. The riders are treated to beautiful views of the meadow framed by the aspen.

Here are some points about meadows:

- Meadows often provide photo opportunities; avoid placing the trail in the middle of the shot.
- Meadows can be sensitive ecosystems; minimize the fragmentation of that ecosystem.
- Meadows are often wetter environments, so trails located there could have water management and durability issues. The trees usually provide a drier environment.
- Crossing a meadow higher on the slope can be better than crossing lower where it is often wetter.
- Large meadows can be hard to avoid entirely, so the goal is to minimize intrusion into the meadow.
- It is better aesthetically and from a drainage standpoint to cross a meadow laterally on the contour rather than vertically down the slope.
- Indiscriminate off-trail use can severely impact a meadow. To help prevent this, it is essential that the riders' eyes be kept moving and that the fun factor be kept high. The trail needs to be more efficient (desirable to ride) than the meadow.

**Climbing Turns.** If the side slope is less than 25 percent and there is room for a curve radius of more than 8 feet, locating a climbing turn is almost always a better alternative than a switchback. Why? Climbing turns maintain flow-mentum, are easier to ride by most riders, and have less tread impacts and resulting maintenance.

This well-designed set of climbing turns harmonizes with the landscape and provides great flow and fun factor. Note the drain points (blue arrows). The cow trail (yellow arrow) probably went to the same point on the ridge, but the designer was smart not to follow it.

Considerations for climbing turns:

- By their nature, the middle of the arc on a climbing turn will be on the fall line and will pick up water. To mitigate this, it is essential that water be drained off the trail before the top of the turn and immediately after the bottom of the turn. Use grade reversals (preferred) or rolling dips.
- On steeper side slopes, sometimes a large rock outcrop, bench, or the uprooted stump of a large tree can provide a flatter area for a climbing turn.
- It is essential that climbing turns have a smooth and constant radius. Some inexperienced equipment operators will tend to square them off by making a sharp turn at the bottom, go straight up the hill, and make another sharp turn at the top. This defeats the purpose of a climbing turn.
- Vehicles with locked or solid axles can negatively impact tight climbing turns. Minimize this by making the radius as large as possible (35 feet minimum would be desirable).

### Tip, Trick or Trap?

**Tip:** Many people do not know how to ride switchbacks and that's why they don't like them and why they are such high maintenance. If you have the topography at the trailhead, consider constructing a training switchback as part of the learner loop or youth training area.

**Switchbacks.** In terrain steeper than 35 percent or rocky, gnarly terrain that won't accommodate a climbing turn, a switchback becomes a necessity. Switchbacks have a radius of less than 8 feet and they can be very challenging to ride if they are not designed and constructed properly.

Some designers install switchbacks even when they could use a climbing turn, just to increase difficulty. A switchback is not a challenge feature and should not be used as such. It is a trail structure that is necessary to change direction and gain elevation. Switchbacks can be expensive to construct and even more expensive to maintain, especially if they are poorly designed. Most riders don't like them because they are difficult to ride and this can create severe tread impacts. Using them as a challenge feature only exacerbates the impacts and the maintenance costs.

Here are some thoughts on switchbacks:

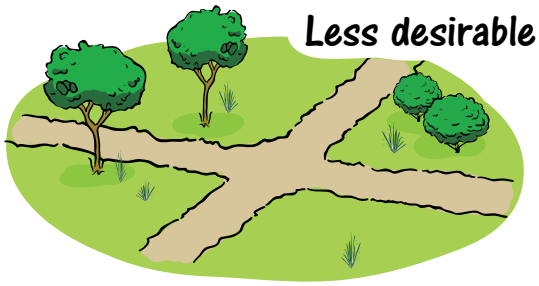
- A switchback consists of three parts: a lower approach, landing or turning platform, and upper approach.
- Like climbing turns, it is essential that switchbacks have a constant radius. Most do not and that is why they are difficult to ride.
- As in climbing turns, it is important that the trail is drained above and below the switchback.
- It is also essential that the radius be as large as possible.
- Many installations will require significant excavation and embankment in order to construct the proper radius and have a flat landing. Due to steep topography, retaining walls will often be required on the cut or fill side and this will increase the cost and complexity of the installation.
- The flatter the grade through the landing, the more rideable it will be, but it also increases the amount of excavation and embankment. Not flattening the grade through the landing will result in a highly displaced and eroded gully.
- During initial construction, the tendency is to minimize the excavation, embankment, and retaining structures. Don't do this. It can result in an unstable structure that is difficult to ride and requires high maintenance or repeated reconstruction.

A nicely-designed switchback. Notice how the grade of the upper approach flattens off before the landing. This adds significantly to the rideability of the structure. The landing is long and wide to allow room for a smooth turn on a circular curve.

This switchback has almost no landing, no flattened approaches and is not easy to ride because it consists of two 90 degree turns rather than one circular curve. Obviously, the geography here limited options and that's the real world. This is also a most difficult trail, so the switchback is consistent with the TMO.

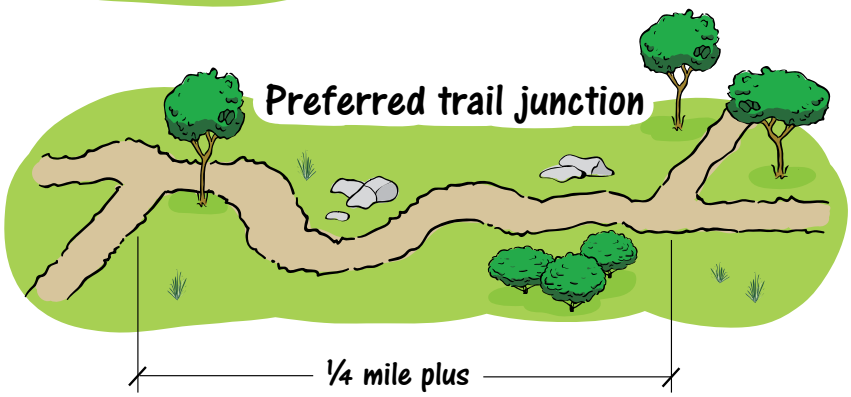
This structure has a nice circular curve, but no flattened approaches. Note the drain above and there's one below also which is good. It may have been better for drainage and rideability to use the top of the exposed rock as a flat area for the lower approach and part of the landing.

**Trail Junctions.** A well-planned trail system should have multiple loops, so well-designed trail junctions are required to access those loops. Trail junctions serve as decision points that help disperse the riders and enhance their experience by providing variety.



**Less desirable trail junction**

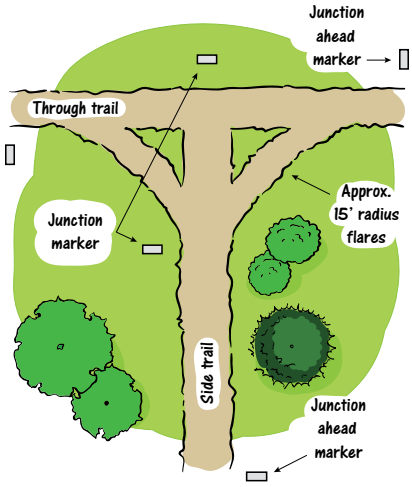
**When possible, it is desirable to locate trail junctions or intersection points for loop trail systems at least ¼ mile apart.**



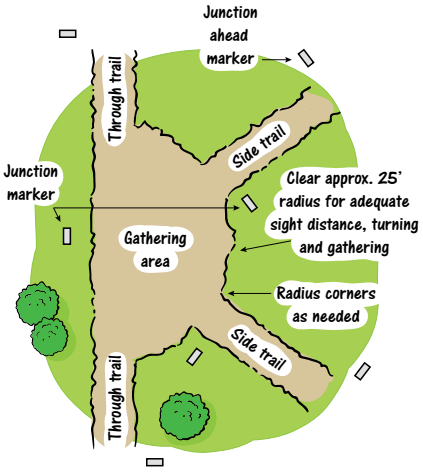

Things to keep in mind for trail junctions:

- Since junctions disperse the riders, on high-use trail systems it is beneficial to have several junctions in the vicinity of the trailhead to provide quick dispersal.
- Junctions are places where there can be high tread impacts from stopping, starting, and turning; therefore, trail junctions should be located on flat areas where grades can be kept to a minimum.
- An adjoining trail can dump a considerable amount of water onto the trunk trail. Each trail leg should have a drain prior to the junction.
- Junctions can be sources of congestion as riders stop to look at the map or wait for their companions. Depending on the expected volume of traffic, the trail width should be increased to allow riders to park off to the side and still allow room for other riders to safely pass through.
- Mitigate congestion at intersections. Provide as much advance sight distance as possible, use a dog-leg or tighten the alignment to reduce speed, and install warning signs or decals as per the sign plan.
- Some riders may ride by a junction, decide that is where they wanted to turn, and then make a U-turn. Expect off-trail impacts in the vicinity of junctions, so avoid locating them in proximity to sensitive resources. Barriers may be required to control and direct use.
- For increased safety, T-junctions are preferred over 4-way junctions.
- To avoid constant starting and stopping, junctions should be spaced as far apart as possible; a quarter mile is desirable.
- In dense trail systems like OHV parks, consider grouping junctions together into hubs to reduce the number of junctions.

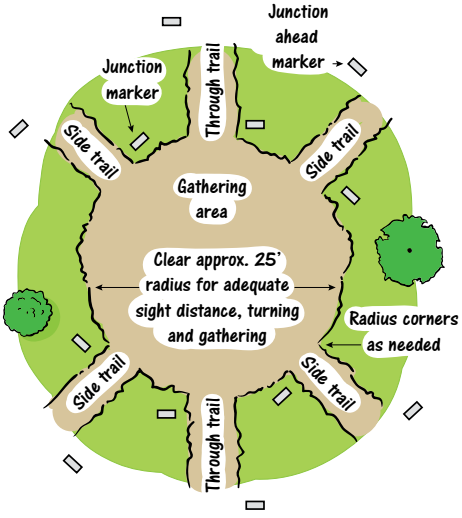
**Typical T-junction**




**Typical half hub junction**




**Typical hub junction**



- Because they are flat, saddles make a tempting location for junctions; however, saddles are natural drain points for the fall line and since water can drain into them from both directions, they can collect a considerable amount of water. Design to drain off this water or locate the junction on the slope slightly above the saddle.

This is a T junction and the through trail (left and right) is in a draw bottom. Though the grade on the joining trail is not steep, look at the amount of water and sediment that has been deposited. Obviously, the water is running too long without a drain. Flatter ground and grades can trick a designer into thinking that water and erosion won't be an issue. Management direction was to use as many existing trails as possible and minimize new construction. That was a mistake. The through trail should have been relocated out of the draw bottom to join the other trail closer to the top of the break in the topography.

One half of a hub junction where five trails join a through trail. An OHM rider has seven choices. The trails on the left and right are OHM (note the width restrictors) and the trail in the middle is ATV.

There isn't much left of this trail which joins another trail on the ridgetop in the saddle. The fall lines on the ridge are steep, so the water has volume and velocity and thus erosion. Saddles can be a trap for unwary designers.

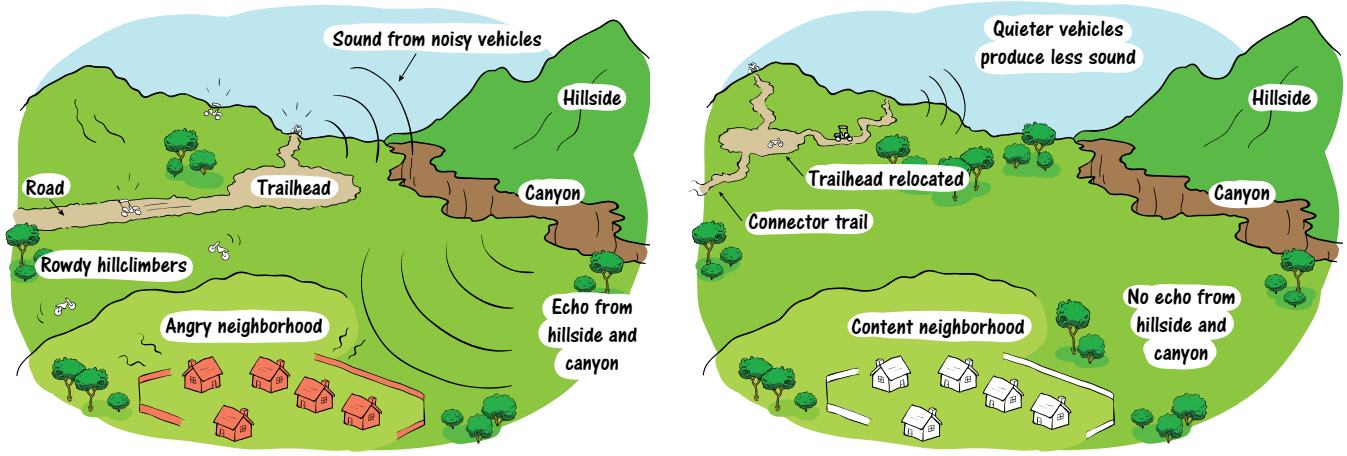
**Sound Intrusion to Residents.** Sound is produced by physical vibration that creates audible waves of pressure. Design can mitigate sound. Unwanted sound perceived as noise produces a negative psychological reaction. It cannot be mitigated outside of sound mitigations.

Mitigate sound by:

- Restricting vehicle sound emissions to a maximum of 96 dBA using test procedures established by the Society of Automotive Engineers under Standard J1287. Sound doubles for every three decibels; therefore, an OHM at 96 dBA is half as loud as one at 99 dBA.
- Designing for slow speeds in the vicinity of noise sensitive property (NSP) by using tight, curvilinear alignment and flat grades. Avoid trailheads, play areas, and hillclimbs around NSP.

With residences ahead, sound has more chance to be buffered by vegetation and topography down on the flat than up on the side of the slope.

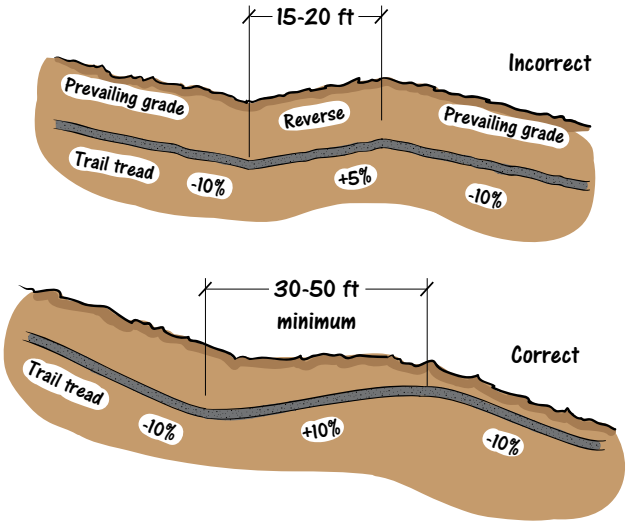
- Putting sound source a farther distance from NSPs. The amplitude (or intensity) of the sound wave decreases with distance.
- Placing berm of earth, a ridge, or dense standing vegetation between the sound source and the NSP can help block or reduce sound waves.
- Designing for the shape of the topography. Some areas can act like a megaphone to amplify the sound. Avoid placing high sound-producing activity in the bottom of a draw high up on the slope or near a body of water that has NSP.
- Placing running trails parallel to NSP to keep from directing or funneling sound into those areas.




**Grade Reversals.** Grade reversals provide positive drainage, low maintenance, and are the most effective way to reduce tread watershed size. As such, they are the primary tool available for the designers to manage water. Many people refer to a rolling dip as a grade reversal. Technically it is, but a grade reversal is a drainage feature designed into a trail during location and a rolling dip is a constructed drainage structure that is added to a trail.

Here are some key points about grade reversals:

- To be effective, the grade must reverse, not just flatten.
- The height of the grade reversal must be sufficient to remain effective after the tread is cut in during construction and after the lowering effects of compaction and displacement. Making a grade reversal too small is a common mistake for trail designers.
- If at all possible on a new trail, design in grade reversals and avoid using rolling dips.
- Whenever possible, use the alignment to help turn the water in the desired direction. A curve to the right will help water turn to the right.




A grade reversal will not fail and does not have the maintenance of a rolling dip. Note: On a sideslope like this, water will puddle up on the inside of the curve (arrow). This can be an issue in wetter climates where the water will sit and saturate the soil. Depending on the topography, it can sometimes be avoided by having 25-50' of 0% grade before reversing the grade. When outsloped, this flat area provides an opportunity for the water to drain off the trail.

- Make the length of the reversal as long as possible. A good minimum is 30 to 50 feet.
- Use the terrain to create grade reversals. Roll into and out of natural draws and depressions.

To harmonize with the landscape, drain the trail at all natural drainage points. In arid regions, do not design a shallow fill across a draw like this or runoff from a weather event like a thunderstorm will wash it out. Likewise, avoid designing a deeper fill with a culvert unless the culvert is adequately sized for significant weather events and the inlet is heavily armored.

**Turnouts.** There are many benefits to two-way trails, but with steep topography or dense vegetation, opportunities to pass other riders can be limited. In addition, when riders try to squeeze by, weight on the outside of the trail can damage the trail shoulder making the trail narrower and potentially unstable. This can be remedied by designing in turnouts. As in roads, turnouts offer a place of refuge from an oncoming rider or a safe place out of the lane of traffic to rest, look at the map, or take photos. Turnouts are usually placed at the outside of horizontal curves, the crest of vertical curves, in thick vegetation with limited sight distance, or on very steep ground where riders don't want to back up. Spacing between turnouts depends on traffic speed, volume, and the physical conditions of the site.

Here are some considerations regarding turnouts:

- The width should be adequate to allow safe passage by two of the widest vehicles allowed on the trail.
- The length should be sufficient to accommodate one of the largest vehicles allowed on the trail to move in and out of the turnout.
- Turnout tapers should allow for safe and smooth ingress and egress from the turnout.
- Turnouts are a place of refuge, not risk. They should be cleared of all stumps and trees that could interfere with riders seeking quick refuge.
- Riders need to be able to clearly see the traffic on the trail to safely pull out of a turnout.
- On very steep ground and with unstable soils, a retaining wall may be required to support the turnout.
- To maintain flow and increase rider safety, turnouts should be designed as ride through, not ride in and back out.

Manage your risk. A rider accelerating to get up the hill on the right cannot see this stump that was left in the middle of the turnout. This is an accident waiting to happen. Turnouts are a place of refuge, not risk.

The vegetation indicates that this turnout is not used often, but the sideslope below this is steep with limited passing opportunities. Going downhill, a prudent rider would pull in here to let uphill riders pass without losing their momentum.

On steep ground like this, a retaining wall would be required to build a turnout. Fortunately, the vegetation is open enough to see other riders coming and you learn to look and listen before leap-frogging from one turnout to the next.

The problem with a pull-in, back-out turnout like this is that the riders' eyes are focused forward and the turnout corridor tricks the riders into thinking the trail goes straight, then at the last minute, they realize that the trail turns and they need to also. This situation can affect rider safety and lead to tread impacts.

## Troublesome Spots

Sometimes there are management constraints that preclude the desiger from following the recommended guidelines. When this situation occurs, designers and planners should check the environmental document and talk to the manager. The intent of the plan document can often give designers more latitude than they may think. Depending on the political climate and the comfort level of the manager, a quick resource survey and letter for the file may be all that is needed to relocate a troublesome trail. The tips below will help mitigate the issues if the trail must go in a less than ideal situation.

**The Fall Line.** What if I have to be on the fall line?

- The important thing is to recognize that the trail will be picking up water and design to get rid of it as soon as possible.
- Drain the trail before hitting the fall line and immediately after leaving the fall line.
- Minimize the length and grade of the trail on the fall line.
- Avoid overbuilding a fall line trail. Leave rocks and roots that can help divert water off the trail or at least slow its velocity.
- Install rolling dips or belted waterbars if possible. Belted waterbars must have barriers installed to force the riders over the waterbar. The barrier should be big enough to deter use and be installed in a herringbone pattern to help drain water off to the side. If the grade is steep, a rolling dip or waterbar will interrupt flowmentum and may cause additional tread impacts.
- Install filters as part of entrance management to restrict use and impacts from unskilled riders.
- Accept the fact that impacts will occur and budget for increased frequency and cost of maintenance.

A technique similar to this can direct riders over belted waterbars. In open country, the barriers need to be long enough so it is more efficient to ride over the waterbar than around it.

This primitive road feels like a trail and provides a quality recreation experience as it meanders into the remote backcountry. The rolling topography provides some challenge, a mix of riding experiences, great views, and a lot of seat time.

Wider vehicles need wider trails and roads can at least partially fill that need. However, it's important to recognize that the operators of these vehicles are still looking for the same range of experiences as narrower vehicles, from touring to technical. Depending entirely on roads may not provide the desired range of experiences.

**Using Natural Surface Roads for 50-Inch Trails.** If natural surface (NS) roads can be converted to trails, take advantage of the opportunity. There are pitfalls of using NS roads, but the reality is that NS roads are going to be used as trails, so the key is to minimize the pitfalls (tread watershed) and maximize the experience. The experience that the NS road provides depends on two factors: the standard of the NS road and the setting that the NS road is in. The road standard is determined by factors like speed (high versus low), alignment (straight versus serpentine), and surface type (gravel or native).

This NS road provides more of a transportation experience. Being wide and straight, it is relatively boring.

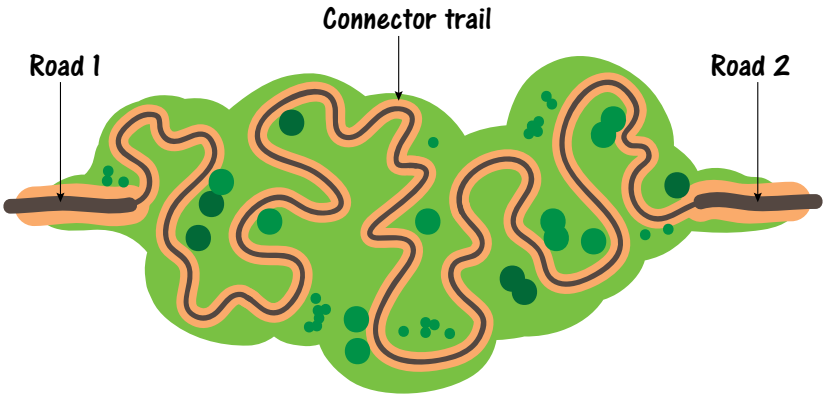
The setting is what is around the NS road. What is there for the riders to see and do the riders want to see it? Are their eyes confined to a corridor or are they open to a panorama? Is there scenic diversity? A high standard road tends to provide a transportation experience while a low standard road tends to provide a recreation or trail experience. However, a high standard road in a highly scenic setting can easily transform the experience from transportation to a quality recreation experience.

Right and above, both of these higher-standard roads provide scenic quality and diversity that creates a quality recreation experience. Rather than roll on the throttle, one is inclined to stop, say Wow, and snap photos.

Here are some thoughts regarding using natural surface roads for trails:

- If given a choice, select the natural surface roads that provide the best recreation experience. These are generally:
  - roads with lower traffic volume and speed;
  - a rougher, more primitive road;
  - a road with vertical roll (grade reversals) to reduce the size of the tread watershed;
  - a narrower road (this also reduces the size of the tread watershed);
  - a curvilinear road; and
  - roads that access viewpoints or destinations or offer a chance to see wildlife.
- Existing culverts and ditch lines need to be functional.
- Rolling dips may need to be added for drainage to reduce the tread watershed.
- Decreasing road width minimizes the size of the tread watershed.
- Utilize variety. Mixing up the road standards, scenic views, and riding experiences is a key to quality.

**Connect One Natural Surface Road to Another.** This is a common scenario. The connector will often be the only chance to provide a high-quality trail experience. Seize the opportunity to maximize that experience. If there is only a quarter mile between the two natural surface roads, try to squeeze in one-half to three-fourth mile of fun trail.




**Using Flat Ground.** Flat ground is not a sustainable trail location. However, sometimes it is required or desirable to use it.

When placing a trail on flat ground:

- Drain water off the trail before reaching the flat ground.
- Minimize the amount of trail on flat ground if possible.
- Design with sinuosity and avoid tangents. This will help decrease water velocity and increase chances to drain water off the trail.
- Incorporate structures like sumps, lead-off ditches, puncheon, and turnpike or use trail hardening techniques where necessary. Ensure that excavation from sumps and lead-off ditches is used to raise the grade of the trail bed.
- Perform regular assessments and address problem indicators before they become issues.
- Avoid falling into the trap of assuming there won't be erosion because the ground and grades are flat.

Recognize issues before they become problems. It is cheaper and more efficient to be proactive than reactive. By waiting to relocate the trail until a bypass trail develops, this fix now includes additional costs for closure, rehab, signing, and possibly barriers.

**Inability to Relocate the Existing Trail.** If a trail can't be relocated:

- Utilize structures and trail hardening techniques as necessary to stabilize and drain the trail. Rolling dips and belted waterbars may not be ideal, but they can work if they are installed and maintained properly.
- If trail is not in conformance with the TMO (especially in regard to difficulty), change the TMO, then ensure that the signing and mapping agree with the new TMO.

- Install a filter as part of the entrance management to ensure that only technically capable riders can access the trail.
- Accept the fact that impacts will occur and budget for increased frequency and cost of maintenance.
- If impacts to sensitive resources are occurring and there is no way to mitigate those impacts, an option is to close the trail. Use this as a last resort only.

Properly designed filters can reduce use levels and impacts caused by unskilled riders.

## Some More Tips

**Watch for the Red Flags.** The need for multiple structures and trail hardening installations can be a red flag indicator of a poor location due to poor soils, wet ground, or unstable ground. Perhaps the trail shouldn't be there. Are there other options? If not, then plan for an increased maintenance budget.

In soils with a crust, water drains off in sheets or multiple rills until the crust is saturated. The best way to cross a slope like this is with a 0% grade so water can flow across the trail. With any other grade, the designer must recognize that the trail will intercept and carry this water and locate frequent grade reversals or drains.

**Water, Water, and More Water.** It can't be emphasized enough. Managing water is a primary key to a sustainable trail. The designers must look for all water sources entering the trail bed. The more water that comes onto the trail, the more often the designers must design ways to get it off the trail.

**Too Steep, Too Long.** The most common causes of trail rutting and erosion is from the grade being too steep, or the grade being too long without a drain or grade reversal. Or worse yet, the grade is both too steep and too long. The combination of the two is hard to mitigate. The steeper the trail grade is, the closer it becomes to a fall line trail with all of its inherent issues. How steep is too steep and how long is too long? There are many variables: soil type, climate, storm patterns, tread watershed size, use type, and use level, to name just a few.

**Is It a Good Line?** Since design is about making decisions, one of the best tests of a line is to walk it again after a couple of days. Designers should ask themselves the same critical questions: should I be here or there? If the answers are the same, they probably have the trail in the right location.

If possible during construction, designers should physically ride the trail. If something isn't right, they can fix it while the equipment is still there. If the designers can't ride the trail until after construction, they should acknowledge the fact that there is no such thing as a perfect trail. The important thing is that if a designer has made a mistake, the mistake should be corrected if possible and not made again elsewhere.

**Is It a Fix or a Solution?** Is adding a rolling dip or throwing pavers on a grade that is too long and too steep a fix or a solution? The problem is that the tread watershed is too large and the problem is still there even if mitigated with a dip or pavers. There is an installation cost, a regular maintenance cost, and a repair cost due to a significant weather event or poor installation. Too often, managers choose a bandage fix over the solution of relocating the trail. Putting the trail where it ought to be improves resource protection, enhances rider experience, and can cost the program less money in the long term.

Adding trail hardening to a long, straight, fall line trail. Is it a fix or a solution?

**Take a Trip.** Good designers learn from their experiences. They should visit or ride other trail systems so they can ride good trails and bad trails. They should assess what made the bad trails bad and avoid those scenarios in their design. Likewise, they should assess what made the good trails good and incorporate those scenarios. Better yet, they should embellish those good points to make a good trail great.

**Design for the Riders' Eyes.** Designing for the riders' eyes means putting the trail where the riders think it will be. If the trail does something unexpected, it can be difficult for the riders, which can lead to resource impacts and risk. That is why the designers must understand the vehicles and the rider experience. When locating a trail, designers should ride the trail in their mind as they are laying it out. Does it flow? Does it feel right? What is the TMO for the trail?

Some riders like the challenge of difficult situations. However, in some situations, such as in soft soils, challenge can increase maintenance costs. That may be okay if that is the best way to meet the riders' needs and if it is consistent with the TMO. Design is all about making decisions: what best fits the site parameters.

Above, coming around this curve, the riders' eyes go straight toward the people on the ridge. Instead the trail makes a 90 degree turn and pitches up the ridgetop. Several riders dabbed and others fell as a result of this surprising compound curve. A better location would be the dashed line which follows the riders' eyes plus adds a much needed drainage point. Right, the trail is widening on the left (arrow) as riders are trying to dump speed and correct for the tightening turn. What would happen if there was a tree there instead of dirt and grass?

**Get Help.** Trail location and design are parts of a very complex process that requires journeyman knowledge and experience in a multitude of disciplines. If team members don't possess that level of knowledge, get help; otherwise either the trail or the resources or both could suffer. The belief that trails are simple and anyone can design one is false, and it shows when the team has to go back and try to fix the mistakes.

## A Second Look...

The evolution of trails: Due to the forces of compaction, displacement, and erosion, trails will change over time. With sustainable design, those forces can be slowed and managed, but not stopped. When first constructed, the tread often appears smooth and sanitized and riders often reject them as being unnatural. But in time, rocks and roots will appear, loose rocks will get rolled out of the way, and some of the features that were easy to negotiate become a little harder to negotiate. So the experience and challenge level can change. This is due to a trail settling into the landscape and the effects of thousands of vehicles and hundreds of weather events. Change is not necessarily bad and is often beneficial, but it should be anticipated by the designers and managers and reflected in the TMO, so that after the trail has settled in, the challenge level still falls within the parameters of the TMO. In maintenance, signs get replaced, blowdowns get removed, hazards get addressed, structures get inspected and addressed, and spot tread maintenance occurs, but rarely does the entire tread get maintained. If the condition of the trail after evolution will not be acceptable, then the designers must take steps now to keep the trail in its as-built condition.

A new trail.

The same trail after it has settled in. The tread is firmer and more well-defined, and embedded rocks are starting to get exposed.

A newly constructed rock waterbar with a smooth approach. (Note: these will work if the rocks are large and well-embedded to resist the tire impact forces.)

The same installation after it has settled in. No longer a smooth approach, the rock has become a challenge feature which is okay if that is consistent with the TMO.

## Need more? Learn more here...

Alaska Trails Training Modules, Mike Shields, www.alaska-trails.org
*Trail Design and Layout*
*Turns: Design and Layout*

*Best Maintenance Practices*, Maine Motorized Trail Construction and Maintenance Manual, Bureau of Parks & Lands, Off-Road Division, May 2011

*Designing Sustainable Off-Highway Vehicle Trails*, Kevin G. Meyer, USDA Forest Service, Technology & Development Program, November 2013

*Natural Surface Trails by Design*, Troy Scott Parker, Natureshape, 2004

*Off-Highway Motorcycle & ATV Trails: Guidelines for Design, Construction, Maintenance and User Satisfaction*, 2nd Edition, Joe Wernex, American Motorcyclist Association, 1994

*Trail Construction and Maintenance Notebook*, USDA Forest Service, Technology & Development Program, 0723-2806-MTDC, July 2007

*Trail Planning, Design, and Development Guidelines*, State of Minnesota, Department of Natural Resources, Trails and Waterways Division, 2007

*Trails Management Handbook*, USDA Forest Service, FSH 2309.18

## A Look Back...

Here are some of the elements discussed in this chapter:

- Trail location and design are about choices and informed decisions.
- The designers provide for the riders' needs, manage the OHV use, and protect the resources.
- The designers must know and understand the issues, politics, resource values and constraints, management constraints, existing conditions, vision, TMO, soils, climate, vegetation, and topography.
- The trail location process includes: know the complete trail picture, use the concept plan, identify termini and control points, break up the elephant into chewable chunks, conduct total reconnaissance, connect the dots, revise the concept plan, develop final TMOs, and prepare a trail log.
- Locators should learn to read the landscape and understand what it is telling them.
- Designers should design the trail to flow and harmonize with the landscape.
- Designers should use whatever the landscape offers to enhance the rider experience.
- Layout and design fundamentals include: speed is an issue, topography and vegetation are good, water is an issue, create a recreation experience rather than a transportation experience, avoid Point A to B location, head for the rocks, and manage the riders' eyes.
- Certain situations need special design techniques: road crossings, creek crossings, bridge sites, ridges, meadows, climbing turns, switchbacks, trail junctions, sound intrusion to residents, grade reversals, and turnouts.
- It's a real world, not an ideal world. There are mitigations available when designers can't do what should be done.
- The need for structures and hardening can be red flag indicators of poor soils and a poor location. Designers should look for options.
- Managing water is a primary key to sustainability.
- The biggest causes of trail problems are trails where the grade is too steep or too long or both. Designers should avoid that scenario.
- A bandage fix can be more costly than the solution of relocating the trail.
- Design for the riders' eyes by putting the trail where the rider expects it to go and avoiding awkward moments that result in tread impacts and increased maintenance.
- Experience is the best teacher. Designers should draw on their own experience and the experiences of others. This book touches on the intricacies of design, it does not make someone a designer. Designers should recognize when help is needed and get it.

# Chapter Fourteen
## Designing for Challenge

Ride Safe, Ride Smart, Always

## Section 1: Challenge versus Sustainability

Like any other modality, an integral part of trail riding is challenge: riders constantly push themselves to determine how good they are and how good are their machines. Challenging trails or features can provide a boost of fun, excitement, extended seat time, camaraderie, and self-confidence if the rubber side stays down. By choice, they take riders out of their comfort zone. Adrenaline is pumped out as riders negotiate challenge and are left with a rush of endorphins as they complete the challenge. This creates a chemical high that contributes to the "WOW! That was a great trail!" feeling at the end of the day. These experiences and sensations are desirable and when trail planners provide them, they are definitely providing for the riders' needs.

Riders are constantly testing themselves and their machines

The issue, though, is how to provide for those needs and still have a sustainable trail. As one group of riders said: "We want sustainable trails, but don't take away our hillclimbs." In most cases, this is an oxymoron. In an era of rules like the 50 percent rule and the 10 percent average grade rule, it can be easy to design out excitement and challenge. That is why trail planners focus on making informed decisions on a given site rather than on conforming to rules. In many cases, planners and designers may have more latitude than they think.

### Providing Sustainable Challenges

There are five ways to create and provide challenge: 1) utilize natural features; 2) utilize design features; 3) utilize manufactured topographic features; 4) utilize natural topographic features; and 5) utilize manufactured design features. A good designer will use all five, either independently or together, to create the desired experience.

1. **Utilize natural features.** These are features like rock outcrops, boulders, rock step-ups, scree, slab rock, slick rock, and cliffs. Notice that these are all rock features. Rock is generally more durable than soil and offers opportunities for a varied and challenging riding experience. Riding a smooth surface trail can be fun, but throwing in some rocks occasionally can increase that fun.

Soil type also fits into the natural feature category. Often, designers don't have a choice of the soil type that the trail goes through, but if they do, soil type can definitely affect challenge level. In dry climates, sandy soils are more challenging than silt or clay. In wet climates, silt turns to mud and clay turns into slick gumbo, but wet sand holds up quite nicely.

Very steep, but very durable. Bulldogging can be part of the challenge and definitely part of the experience. The crude board bridges a vertical step-up and the designer was being cursed, but what was talked about the most around the fire that night?

Although rocks are durable, the soil around them usually isn't as durable. Going from rock to rock can work well, but going from rock to soil to rock may result in considerable soil displacement. On some trails, ledges will continue to get higher as tires displace the soil at the base of the ledge. Eventually, even experienced riders may start looking for a bypass. Designers should anticipate this and harden the approaches to these features if possible.

Erosion has probably occurred to expose this bedrock, but now it is durable and provides a great challenge feature. Challenge varies by vehicle type. This feature could be moderate for an ROV or 4WD, difficult for an OHM, and very difficult for an ATV.

2. **Utilize design features.** While topographic features may be limited, there are a host of design features available, including grade, vertical alignment, horizontal alignment, obstacles, clearing, tread, and exposure.

Okay, we know that this is a fall line trail that doesn't harmonize with the landscape, BUT, it is a fun, challenging hillclimb. Given the durable soil type, climate, level of use, and type of use, this trail is sustainable though it could be managed better to reduce the number of approach lines. Design is about assessing the site and making informed decisions.

**Grade** is one of the challenge features that riders like the most, but it's also one that can cause the most impacts. The key is for designers to look at a given situation and make an assessment on how steep the grade can be. Grade pitches, even short ones, can increase the interest and variety of the trail.

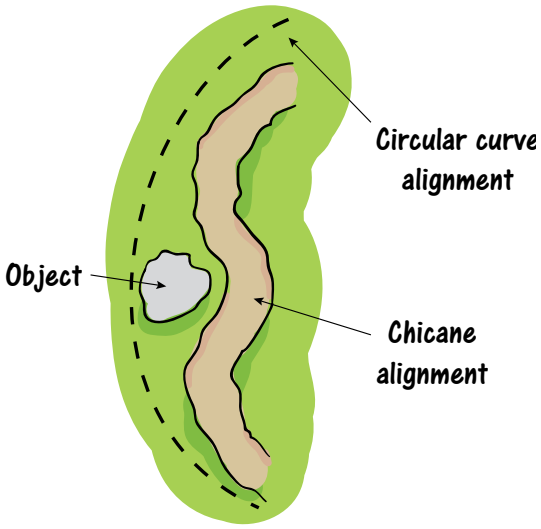
Even if there aren't steeper pitches, keeping the **vertical alignment** moving increases difficulty while increasing sustainability and fun factor, and reducing speed.

Good horizontal and vertical movement

As with vertical alignment, it is important to keep the **horizontal alignment** moving. Take advantage of tree or brush thickets to tighten up the alignment. The tighter it is, the more technical it is. If ATVs and ROVs have to back up to negotiate a turn, up to a point it makes the trail more challenging. Compound curves, broken back curves, and non-circular curves can increase difficulty by decreasing flow, but they can also increase tread impacts.

**Chicanes** are another tool to slow down riders and increase challenge. A chicane is a feature that creates another set of turns, so a chicane hugs a rock or a tree where a circular curve goes around the rock or tree. Chicanes interrupt flow and are okay on tight and technical alignments, but shouldn't be used on open and flowing alignments without slowing the riders down first.

## Chicanes




A good example of a chicane. An ATV riding at speed around the curve gets thrown at the tree with the flagging on it. Flow is reduced and challenge is increased, but is this appropriate on an Easiest trail? It could be depending on the alignment before and after this section.

This is a very abrupt chicane. The tree tends to stick out into the middle of the trail. It's been hit by the equipment and could easily grab an unwary rider, especially one riding toward you in this picture. Is this challenge or risk? One designer called it risk and another designer said challenge.

**Obstacles** are a great way of increasing challenge. The issue with using obstacles is that they can be removed over time through maintenance or by well-intentioned riders trying to help out. If obstacles are intended to be left for challenge features, they must be documented in the TMO, and the intent of the TMO must be communicated to the maintenance personnel. Riding over obstacles like roots, rocks, and stumps can increase the degree of challenge.

Roots can increase challenge, especially ones like this that are at an angle and on a curve.

Six elements can affect the degree of challenge with obstiacles: size, frequency, stability, traction, location, and position.

1. Size. Certainly, larger objects are more challenging to ride over than smaller objects. There are guidelines for size, but really, there are too many variables to say that one size is more difficult than another size. Using a variety of obstacles can also affect the challenge of a trail.

2. Frequency. Getting over a single rock is one thing, but negotiating a rock garden is another as abrupt physical forces direct forward momentum sideways or backward.

3. Stability. Riding over an obstacle that is loose or rolls is more challenging than riding over one that is firmly embedded.

4. Traction. Challenge increases when traction decreases, so an object that is wet, smooth, or slimy with moss or mud is more difficult to negotiate than one that is dry and rough.

These loose rocks of different sizes and shapes increase the challenge of this climb.

5. Location. Obstacles on curves are more challenging to negotiate than those on tangents because the riders are trying to turn the vehicles against forces that are directed forward and outward. Loosing tire contact or hitting an obstacle that throws the vehicle outward forces the rider to quickly react to keep the vehicle going in the direction of the turn. On a tangent, riders are more likely to see objects approaching and gauge speed and position appropriately, but that advantage is generally lost in a curve.

6. Position. Obstacles that are, or have surfaces that are, at an acute angle to the trail tread are more challenging to negotiate than those that are perpendicular to the trail tread. As the degree of angle decreases, the degree of challenge increases.

These angular log waterbars add to the challenge of this trail, however, the challenge features shouldn't be your drainage structures. Forces are exerted on these by vehicles going uphill and the log in the middle was probably displaced by those forces.

Putting all of these elements together, the most challenging scenario would be many large, loose, slippery, and smooth obstacles placed in a curve. What if the trail doesn't have any obstacles? Import them, or instead of wasting slash during trail clearing, bring some of it back in after construction and stake it in place to create obstacles.

This log adds challenge by being at an acute angle to the trail. It tends to throw the rider out of the curve rather than into the curve. No bark means less traction and when it's wet the challenge level increases.

Soil type can play an important part in deciding whether or not to incorporate obstacles. It takes traction to negotiate obstacles. While soft soils can increase technical challenge, that can also equate to unwanted tread impacts and maintenance costs as less skilled riders spin their tires to negotiate obstacles.

The properties of most soils change as the weather changes and with that the rideability and challenge changes, sometimes dramatically in just a few hours. This is a factor that designers need to consider when playing with alignment and features. As friction or traction changes, so does the level of challenge. Also, as the cohesiveness of the soil decreases, its resistance to displacement decreases, so what was a durable challenge feature one day, may not be so durable the next day.

The same idea in good soils will work just fine. Logs should be staked so they don't move. It also makes them less likely to be cut out by a well-intentioned rider.

**Clearing width** should be kept tight. The narrower it is, the slower the riders will go. They'll go even slower if there is a risk of losing a fender or breaking plastic. That risk equates to challenge. Having green leg slappers or brush scraping down the side of a vehicle not only slows and confines the use, it gives riders the illusion that they are pioneering a trail. It also affects their perception of safety.

Though short and not very steep, these soils displace easily when wet. This trench will continue to get deeper until the soil type changes or the tread is hardened. If it is hardened, the challenge level may decrease, but the grade and terrain feature will be perpetuated.

Vertical clearing or pruning height can also challenge riders and enhance their experience. Designers can create a tunnel effect; but brush is one thing, immovable objects like logs are another, especially if vehicles without roll bars are using the trails. Designers need to take extreme care to ensure that the speed is down and that riders have adequate time and visibility to see the overhanging log. This practice places the agency at risk. What if the log breaks and becomes a spear? What if vegetation grows in so riders can't see it coming? It's a poor practice and not worth the risk.

The stump and tree on the tread shoulder increase the challenge of negotiating this curve. Though easy for an OHM, it's very tight for an ATV.

There are guidelines for clearing height and width, but many of them appear to be founded on reducing agency risk rather than increasing rider experience. Designers should look at the TMO and then assess what features or opportunities they have on site to create the desired experience.

A rough, inconsistent **tread** is more challenging to ride than a smooth, consistent one. The design elements for tread are: width, irregular tread surface or rugosity, and irregular tread plane.

**Width.** A narrower tread has the same effect and benefits as narrower clearing. Note: Narrower equals challenge equals reduced speed; wider equals less challenge equals increased speed. Changing the tread width can add variety and challenge if it's consistent with the TMO. A good design tool is a choke, which is a narrowing of the trail tread accompanied by a restrictor like trees or rocks. These are similar to a gateway or anchor except that the tread width is less than the design standard. Chokes slow riders down by reducing their perception of safety: "Am I going to fit through that?" These are good in advance of junctions, technical sections, or anyplace else designers want the riders to slow down. Unless the speed is already slow or the trail is extremely technical, it is essential that riders have adequate sight distance to see the choke coming and prepare accordingly to negotiate it.

You can see this vertical obstacle coming, it's marked with an arrow, and it definitely slows the rider down. Challenge, yes; worth the risk, no. It is too low.

The high sides and rocks increase the difficulty of this trail and leave little room for a margin of error.

A narrow tread on an open slope like this reduces the margin for error, reduces the riders' perception of safety, and therefore increases the feeling of challenge.

A similar tool is the perceived choke. With these, the tread does not narrow up, but the clearance between trees or obstacles does. Usually, the trail corridor is cleared for a specified distance wider than the trail tread so that tree trunks are away from the trail shoulder, but tree limbs could still protrude into the trailway. Except for single track, OHV trail treads are wider than the machine. When there is zero clearance from the shoulder to the trees, there is adequate width for the ATV, ROV, or 4WD to pass through, but the riders' perception is that it is too narrow and they will brake hard.

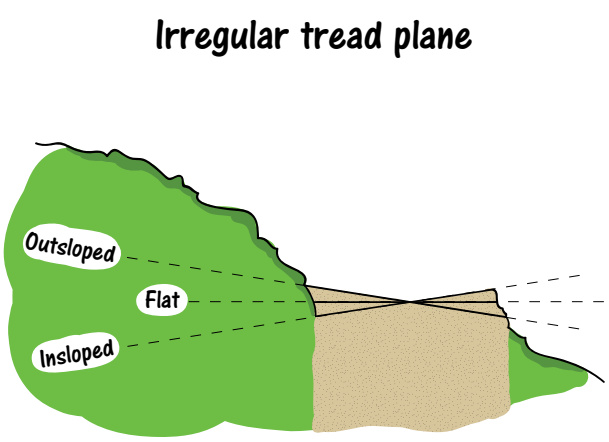
Here the tread is so narrow that riders must put a tire up on the rock on the left to get through. This can tip the vehicle toward the right which increases the risk of a bent rim, a broken bead, and scratched or broken plastic.

This is a good choke. Passing through this, the riders tend to stand as they wonder if the foot pegs are going to clear the rocks.

This is a great choke with a narrow tread and tight vertical confinement. The risk of losing plastic or damaging fingers is high as the bars have to be angled to fit through the gap. The rock obstacle in the middle of the tread (arrow) adds to the challenge.

Chokes serve as anchors and gateways. If the restrictors are less than wheel height, the riders will slow up much less than if they were above wheel height because they are less of a perceived threat. The higher the restrictors, the more intimidating they become.

**Irregular tread surface or rugosity.** This would include rutted or uneven trail treads. This increases challenge because riders often cannot choose their line and are forced to fall into a rut or try to stay out of one. Ruts are often associated with poor drainage and erosion or lack of maintenance, but they can be beneficial. If the issue is drainage, fix the drainage and leave the ruts for challenge if consistent with the TMO. Or, don't fix it if the erosion isn't damaging.




There are some obvious drainage issues going on here, but the irregular tread surface and the ruts that zig-zag from one track to the other make this hill quite challenging and fun. If the source of the water was dealt with before it reached the crest of the hill, this level of challenge could be perpetuated.

**Irregular tread plane.** The normal trail prism is flat, insloped, or outsloped, but what if the tread did all three randomly and unexpectedly? Pitching side to side changes the directional physical forces of the vehicle and requires corrective action by the riders. This increases the challenge level. In slippery soils, an outsloped curve on a steep slope can be dicey to negotiate.

In playing with natural features and design features, designers can increase the challenge by reducing flow. Rocks, obstacles, irregular tread widths and planes, clearing widths, and irregular alignment all affect how the trail flows and thus how easy or difficult it is for the riders to negotiate that flow.

When a rider is placed in a situation where a mistake could lead to equipment damage or loss, personal injury, or death; that is called **exposure**. Exposure equals challenge. Exposure is usually, but not necessarily, associated with cliffs or very steep, open sideslopes. When a rider is on a narrow trail and it is 1,000 feet almost straight down to the river; that is exposure. Add in an outsloped tread, obstacles, and slick soils and the degree of exposure has been compounded.

Exposure is the ultimate mind game. Here the driver of the ROV can't see the ground in front or the tire placement as the machine is negotiates down the rock.

From a challenge standpoint, the designer has several options: exclude exposure sections, include exposure sections if consistent with the TMO, change the length of exposure, and change the frequency of exposure.

To manage risk, it is important that exposure be reflected in the difficulty level of the trail, usually black diamond or double black diamond depending on the degree of exposure. Good entrance management and filters should also be employed to inform and limit unskilled riders. Since exposure can be an extreme challenge, it should be highlighted on the trail map and website and should include additional signing at the trail entrance.

Extreme? Yes. Edited photo? No. Who would do this? More than you think.

## Tip, Trick or Trap?

**Trap:** Designers can fall into the trap of laying out trails which keep them comfortable or ones they like; not what keeps their customers comfortable or happy.

Like chokes, there is real and perceived exposure. Real is when riders are on the edge of the cliff and perceived is when they think they're on the edge of a cliff. When a vehicle is pitched up and off-camber and riders can't see what the ground is doing in front of them or where and how the tires are going to come down, that is perceived exposure. This is a really cool tool.

Certainly not as dramatic, but exposure nonetheless. The designer can control the degree of exposure.

3. **Utilize manufactured topographic features.** Manufactured topographic features include the remnants of extraction activities like rock pits, quarries, open-pit mines, and borrow pits; old landings; drill pads; processing and transfer sites; and runways (that is, any large area that has been used for another activity). What is good about these? They are already heavily impacted sites, so they are often a wash from a resource standpoint. As such, they offer an opportunity to be used as OHV facilities where high impact use could occur with little impact on the environment.

In this project area, designated open areas in cinder pits like this provide the only hillclimb opportunities. Cinders are like marbles so they enhance the challenge for the riders.

The sites in remnants of extraction activity areas could be used for OHV training areas, mudding, pit squid activity, hillclimb, and rock crawl by 4WDs, ROVs, and ATVs. These sites are often referred to as play areas or open areas that have little or no development.

The large areas that have been used for another activity could now also be used for OHV training areas, MX tracks, and technical challenge courses like terrain parks and endurocross. These activities require a higher level of development and often a higher level of maintenance for which management may not want to assume responsibility.

There are segments of people in the OHV community who have little interest in trails. These include rock crawlers, dune riders, mud riders, MX riders, pit squids, and often younger kids. Open areas provide places for these activities to occur. Some people think that open areas are just sacrifice areas. Not so. Like trails, they are designed and managed for a specific use or activity. In addition to providing a place for challenge and high-impact activities, open areas are excellent OHV management tools. When legal areas exist to do non-trail related activities, trail managers or rangers can direct the use away from non-legal areas to the legal areas. It is always better to work with human nature than against it.

An argument against open areas is that if designers provide for that use, they are telling the public that those activities are acceptable. Not at all, and in fact the opposite. What designers are saying is that those activities are not acceptable elsewhere, but they are acceptable here and only here.

Liability often comes up in discussions about open areas. The bottom line is that there is liability in everything. The issue is how the risk is managed. Play or open areas need to be signed that the area is to be used at the riders' own risk. The designers may add rocks for a rock crawl, a couple of simple dirt mounds for kids, or a mudding area, but as long as the designers aren't constructing technical features like doubles, triples, and table tops that require precise construction and maintenance, the risk is low. Unless a trail team member carelessly does something that changes the condition of the site without signing or warning of the change (like dumping storm-damaged culverts or a bridge, removing the back half of a mound, or creating a vertical face where it was once sloped), the risk is managed.

This small ½-acre open area is just an oval with four mounds of dirt for kids to ride. It has received heavy use and the mounds have worn down to a ¼ of their original size and need to be rebuilt.

As a test, 4WDs were invited to try out this OHM and ATV play area. They had a blast! Heavy equipment was brought in to enhance some runs and it is now a designated rock crawl facility as well.

Almost any size area can be used from a quarter acre to 40 acres or more. Depending on the expected use level, the bigger the better; but anything is usually better than nothing.

Since open areas are designated sites, there needs to be signing to identify the site, and the perimeter of the area should be clearly marked with boundary markers.

4. **Utilize natural topographic features.** Natural topographic features include any area where unrestricted cross-country riding is allowed. These are usually sand dunes, scab flats, rock knobs, or hills that have durable soils. These open areas are natural features, not commercially impacted features. Like the open areas discussed above, they are designed and managed to accommodate a specific use or activity and they need to be signed accordingly. They can offer high speed, high fun, and high challenge.

In the winter, open areas can offer a whole different experience and challenge level.



Some examples of effective open area signing. If the project includes open areas, their signing should be included in the sign plan.

Riding sand is an entirely different OHV experience. If it looks easy, it isn't and the challenge can be extreme.


High rock content make the soils in these hills suitable for open hillclimbing.

An area with boulders, rock slabs, and step-ups can be perfect for trials riders.

Natural terrain like this can provide some WOW challenge opportunities. The driver and this machine performed some awesome maneuvers. Large rock formations like this can also make great areas for a trials course.

One use for natural topographic features is as observed trials courses. What trials riders can do on a motorcycle is amazing. Like rock crawl, they need a variety of large obstacles and since it is a spectator sport, public access to the site is important. Very slow speeds and very low tire pressures make this a low-impact activity. Trials doesn't require a large area, only a few acres can be sufficient if the area has the right mix of terrain features. If designers have a suitable site, they could consider designating it for trials practice and events.

5. **Utilize manufactured design features.** In spite of all the tools available above, the reality is that there are many places that can't provide sustainable, quality technical challenge. Either they don't have the topography, features, or soils; or are too dry or too wet. Yet riders still want and need challenge, so how do designers provide that? It's time to think outside of the box and create it. By creating it, designers have the control to design what they want, where they want it. Management of the use, rider experience, and the resources can all benefit from that. The mountain bike community discovered this several years ago and has upped the challenge and fun factor with the development of coasters, ladder bridges, terrain parks, pump tracks, and freeride facilities. The OHV community could learn and benefit from these examples.

Other than site constraints and possibly funding, the ability to manufacture features is only limited by a person's level of vision and creativity. The opportunistic designer or manager keeps an eye out for free or low-cost material sources by staying in tune with other construction activities in the area that could have win-win potential: a road or building project that needs a waste site for dirt, stumps, logs, or rock; a building being demolished that could be a source for bricks or concrete chunks; a tire shop that needs to dispose of used or recalled tires; and the list goes on. Repurpos-

To provide more challenge opportunities in this project area, this designer imported material to create an ATV rock crawl. Cool!

Great innovative design. Take a flat trail on a ridgetop and dig alternating holes to create a "twister." It's fun, technical, and provides perceived exposure because your eye is pitched up and you cannot see where your tire is or how far down it will go.

It won't last forever, but the trees are more durable than the soil on this project and it made a great challenge feature that the riders enjoy.

A nearby highway project needed a waste area for rock and an OHV manager needed more 4WD challenge opportunities. A win-win deal was struck and a U-shaped rock garden was created. While only about 300 feet long, it can provide hours of seat time. Note the strategically placed winch tree(s) and signs for straps required.

Using old culverts and cement, this rock crawl adds difficulty by using the slope. A hillclimb without erosion. Neat.

The cement and rock structure has different levels of difficulty on each side to offer a 4WD rock crawl to various skill levels. It was simple to build and will last a long time.

ing materials destined for a landfill or other disposal facility helps the environment while helping designers provide for and manage the OHV use.

Liability often comes up in this discussion also, but again the mountain bikers have set the example for risk management by incorporating tools to limit liability, including entrance management, filters, effective signing, easy-outs, access control, design standards, and inspection and maintenance protocols.

What makes a great trail great? Variety. Use the ways outlined in this chapter to create variety and mix them up, but even then, do riders want to bounce over rocks and roots, squeeze between trees, hang on the edge of a cliff, or have poor flow for 20 miles? That type of trail isn't fun. To the extent that it's consistent with the TMO, challenge features should be intermixed with all of the other design tools that truly make a great trail great.

This entire trail was squeezed between trees so you had to stop or back up to get through. It was slow, you never got out of first gear, it had no flow, and the trail was no fun. The best part of the trail was the end of the trail.

There are plenty of creative options mentioned above to provide technically challenging experiences, but there are some things that shouldn't be done.

Don't:

- Reduce maintenance level, quality, or frequency. The degree of maintenance must agree with the TMO. Arbitrarily reducing maintenance can lead to tread degradation, erosion, resource impacts, rider safety concerns, and risk.

A well-intentioned, but misinformed maintenance worker deliberately cut out this tree to add more challenge to the trail.

Challenge? Not really. Agency risk? Yes.

This is a durable natural feature, but where is the line between challenge and risk? If an ATV is the design vehicle, utilizing this feature may have crossed it. This does not look that difficult, but poor soils or poor sight distance due to the alignment may have prevented getting a run at it.

- Reduce or remove drainage to increase challenge.
- Arbitrarily change the difficulty rating and signing without changing the TMO. The signing must agree with the TMO. If it doesn't, the agency is not managing its risk.
- Allow continued high-impact riding in natural areas not managed as open areas.
- Use unprotected wet area crossings that will develop into undesignated mud bogs.
- Design trails that will create unacceptable visual scars or be socially insupportable.
- Create a technical feature that is inconsistent with the TMO. This can trap riders, increase resource impacts, and increase agency risk.Remember that challenge is an expectation, risk is a surprise. Minimize the surprises.

# Section 2: Using Existing Trails

Managers often ask, “Can I use exisitng trails?” The answer is the standard: “It depends.” A designated trail system is usually comprised of routes that come from three sources: 1) user-created trails that become incorporated into the system; 2) roads, trails, skid trails, seismic lines, or other routes that are repurposed as OHV trails; and 3) purpose-built trails that have been designed for a specific use or activity. The problem routes are usually those that were incorporated under the first two categories. Planners and designers should use these trails judiciously because although they have low up-front costs, they have inherent problems and risk that can result in high long-term operational costs.

This trail provides a high degree of challenge, but the other issues are obvious.

## Four Components of Sustainability

There are four components to trail sustainability: 1) resource sustainability, 2) political or social sustainability, 3) experience sustainability, and 4) economic sustainability. These are powerful. If a trail does not have all four components, it could fail.

**Resource sustainability.** Will the trail provide resource protection in the long term? This is the definition that most people use when referring to sustainable trails.

**Experience sustainability.** The agency can have a resource sustainable trail, but what if the riders don’t like it? Will the trail provide the desired recreation experience in the long term? Will the experience stay at the same level in the long term?

**Political or social sustainability.** The agency can have a great trail that has both resource and experience sustainability but is in the wrong place and is unsupportable from a political or social standpoint. There could be visual impacts, noise impacts, or the social impact of “I don’t want to see that activity there.”

**Managerial sustainability.** There are several aspects of managerial sustainability. One aspect is economic sustainability. A trail in the wrong location can sometimes be mitigated by increasing maintenance and monitoring. But at some point, the cost of having the trail in that location may not be worth it. Another aspect is defensibility. Is the land manager in a position to be able to justify the trail in that location? Also are the skills of the maintenance and monitoring personnel suitable for the trail? Does the trail meet the needs of the riders?

## A Case in Point…

When asked where there might be a place to have hillclimbs, the riders said: “Here, this is the perfect place for sustainable hillclimbs. They’ve been there forever and they’re the greatest.” They were right. There was durable soil, favorable climate, few ruts, almost no erosion, and high fun factor and challenge. Other than a visual scar, there were few adverse effects from years or decades of use. For all practical purposes, they had resource and experience sustainability.

Except those hillclimbs were located in a huge meadow that was determined to be a sensitive grassland environment; they were visible from a main recreation access road; they contributed noise impacts to residents; and they represented years of abuse and misuse to an intolerant community and media. They weren’t politically sustainable and today they are closed and rehabbed.

## Erosion

Erosion is an ongoing process. It can be managed, but never stopped. Some of the best trail and technical challenge opportunities have been created through erosion, so erosion isn't necessarily bad. It depends on where it is occurring and its effect on other resources. If other resource values are low and there is no stream connectivity, the movement of soil particles from point A to point B is not loss, it's relocation. If the land manager feels comfortable with the effects, keeping the erosion may be an option. Given the same scenario with the same manager in a different location, the answer could be different.

At least with what we can see here, this great challenging trail can still be drained pretty easily by flowing in the direction of the blue arrow. If this is open to OHMs and ATVs, it would be nice to define at least one alternative path through the boulders.

In looking at a heavily eroded trail, it is easy for a designer to give up and say: "There is nothing to be done with this except close it." That may be true, but some type of drainage needs to be installed just to close and rehab the trail, so if that effort has to be made anyway, perhaps it's worth keeping the trail, or at least portions of it. Here are some management options:

- Close and rehab the trail.
- Relocate the trail.
- Keep the trail as is and allow the trail to continue to degrade.
- Keep the trail as is and take steps to reduce further degradation.
- Keep the trail as is and restrict or regulate the type and volume of use.
- Use a mixture of all of the above.

Each situation is unique, so designers should start with an assessment. An engineer, soil scientist, hydrologist, botanist, or other specialists may need to be part of the team. It's not a perfect world and creating great trails is about making informed decisions. Here are some key questions to ask when assessing a trail:

- Does the trail still provide a desired recreation experience? Is it a high-quality experience?
- The trail is eroded, but how much will it continue to erode and at what pace?
- Is the trail down to bedrock? Is the bulk of the damage already done?
- Can the erosion be managed? Where is the water coming from? Can that water be diverted into natural drainages?
- Is the trail on the fall line or in a natural drainageway?
- Can the trail be drained? With deeply entrenched trails, this could be difficult and expensive.
- Does the water from the trail have direct connectivity to a stream?
- Where are sediments carried by the water being deposited?
- What is the risk to resources if the trail is kept as it is?
- What is the risk to the resources if the trail is drained?
- Is the trail or the project in a fish bowl of controversy?
- Is the trail or the manager's decision politically and managerally sustainable?

This trail provides a high degree of challenge, but the banks are being eroded by overland flow. Some sloping and armoring of the banks would help, especially at major drain points. It would also help to remove some of the rocks and trees to reduce the weight on the edge of the bank.

This assessment and any resulting action decisions should be well documented.

## Options to Consider

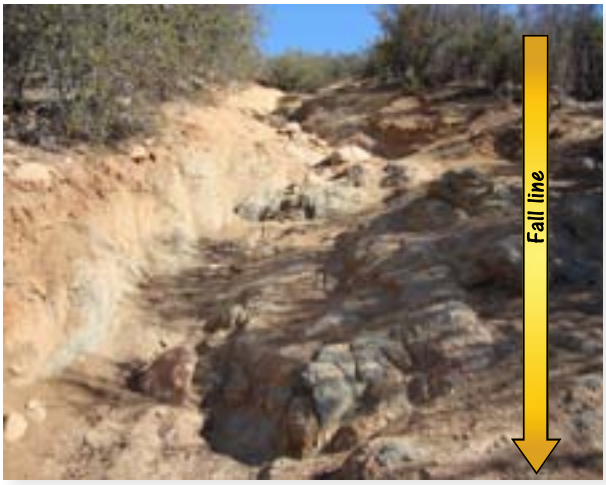
The answers to the above questions will determine the options for moving forward. Using a severely damaged existing trail is rarely the best choice, but in some cases, it may be the only choice. Heavily eroded trails essentially become stream channels by intercepting all of the water flowing overland from above. Correcting the water flow can be difficult and expensive, but not impossible. There are costs to implement these actions and costs to maintain them. Here are some things to consider:

The topsoil has eroded away, but what is left is a durable and challenging trail tread. At least in this trail segment, the erosion is either done or is manageable.

- Try to restore the natural drainageways. Water needs to flow down the landscape, not down the trail.
- In areas with heavy overland flow of water, diversion ditches could be installed above the trail to intercept this water and lead it into the natural drainageway. This will significantly reduce the size of the tread watershed and help protect the banks of the trail from further erosion. Most likely, the diversion ditches would need to be lined with rock to dissipate energy and prevent scouring of the ditch.
- If the banks of the trench are eroding heavily and diversion ditches are not installed, apply a blanket of rock to the banks to resist further scour.
- Construct rideable check dams. These would fill up the trench and essentially create a rock rolling dip. These could be used to either force water off the trail or slow the velocity of the water and drop its load of sediment. The check dam rock would need to be heavy and angular to resist displacement by tire action.
- Pop the trail out of the trench occasionally. This forces water off the trail and down the trench. Then construct a dam of dirt and rock and drain the trench into a natural drainageway. The trail can then re-enter the trench until the next drainage opportunity. This must be done at regular intervals so that the natural drainageways do not become overloaded with the trail runoff.
- Excavate the lower edge of the entrenched trail to create a ditch. Line it with rock and drain it wherever possible.
- Manage the trail by closing it during periods of high rainfall or saturated soils to reduce impacts.
- Reduce further displacement and erosion by armoring the tread. This keeps tire action away from the soil and reduces the velocity and scouring forces of the water running down the trail.
- Use the portions of the trail that can be drained and relocate the portions that can't.

Ruts contribute to challenge and so does this clay soil. To stabilize this, explore options to drain the water off before it gets to this slope (arrows).

Talk about a durable tread. This trail has eroded down to bedrock, but bank erosion will still occur. Look for opportunities to drain the water off or line the bank edges with rock.




There are few options to "fix" a fall line trail. This is a drainage and it always will be. If this is a small watershed, an option could be to divert water from this drainage into the next one if that doesn't overload the hydrology of the other drainage, then use this trail as is. Other options could be: close and relocate; or continue to use the trail as is if it is meeting the TMO.


Though entrenched, this trail runs across the slope and there may still be opportunities to punch through the bank on the lower side to drain it.

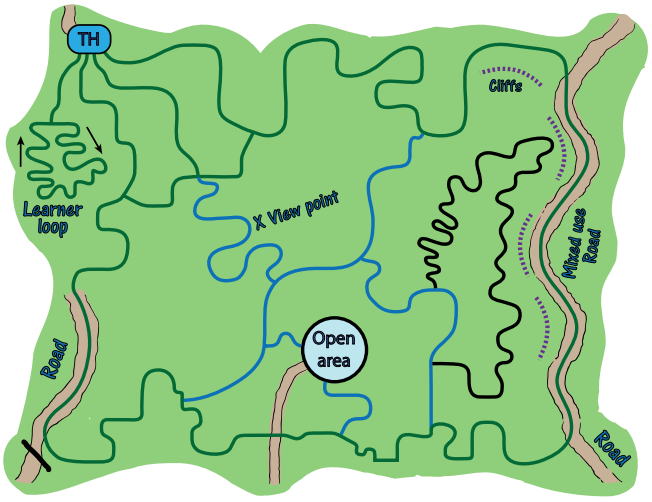
There could be an opportunity here to pitch up out of the trench and force the water to drain down to the left.

Some soils scour very easily once water volume and velocity reach a critical point. Once started, the scour accelerates to create a ravine. Potential remedy: Find a point to drain the trench, then fill it up with cobble rock. Install an armored rolling dip (arrow). Find the source of all of this water and drain it off farther up the trail.

How steep is too steep? This isn't that steep, but it's too steep for these soils in this climate. Add in too long and too straight and you get a trench. This needs to be analyzed, but now that it's eroded, the residual grade may be sustainable. If not, trail hardening armoring would help. Look at draining water off above and below this section.

# Section 3: A Different Approach to Challenge

So far, this chapter has discussed incorporating natural and manufactured features and designing for challenge. After designers have incorporated those features, they normally label the trail with a blue square (More Difficult), black diamond (Most Difficult), or double black diamond (Extremely Difficult). In reality though, only a percentage of the trail actually contains those challenge features, yet the whole trail is labeled to reflect the worst condition. In many cases, a black trail isn't all black, it's blue with a few black spots. Granted, there are those trails that are gnarly from start to finish and those should be labeled accordingly, but what about those that aren't consistently gnarly?



Here is a traditional trail plan with Green, Blue, and Black trails

Designers can install filters so that only riders with the proper skills can access a trail, but if only 20 percent of the trail is gnarly, there is 80 percent that could still be ridden by lesser skilled riders, but those riders can't access it. Is that the best utilization of a trail resource?

If designers don't install filters, what generally happens with the challenge features? The lesser skilled riders start looking for a way around the challenges. These are called easy-outs. Why this occurs relates directly back to the riders' feelings about safety and efficiency. The easiest and most comfortable line may not be the straight line. This can result in braided trails and resource impacts.


As with many challenge features, the less skilled or less comfortable riders start looking for a way around them.

There are three remedies for the problem of unskilled riders ruining or breaching technical features: design easy-outs, design technical options, or design with multiple lines.

## Design Easy-Outs

If the tendency is to ride around a feature, why not design the feature with an easy-out so the trail team can control and manage the use? If all of the technical features on a trail had easy-outs, the overall difficulty rating may be lower and more riders of varied skills could utilize the trail. Easy-outs don't have to be easy, they just need to be easier than the challenge feature.

Here is another consideration: maintenance. If equipment is going to be maintaining the trail, how does it get over a challenge feature without damaging it? An easy-out can provide a bypass for the maintenance equipment as well as the riders.

## Design Technical Options

Even better than designing easy-outs is to design the entire trail as green or blue with technical outs where the riders have a choice of staying on a less technical route or riding a more technical section. The technical sections can be very short to take advantage of a boulder feature, or longer for a rock garden, but they all loop back to the main trail. If the trail was a double track, there could be both single-track and double-track technical options. Here are some advantages of

designing technical options rather than a technical trail.

- More riders can use the entire trail. In areas where trail development is limited, this could be a significant advantage.
- Better utilization of the land base because one trail can offer several challenge levels.
- A group of riders of varied skill levels can ride together. This extends time for camaraderie, bonding, social interaction, and it's especially good for families.
- Riders can choose the amount of challenge they are comfortable with on any given day or time; and it may depend on the make-up of the group.
- Less risk of resource impacts due to the creation of easy-outs because the main trail is the easy-out.
- Fewer tread impacts caused by under-skilled riders attempting higher-skilled features. This equates to less maintenance.
- Options, like an easy-out, could allow a bypass for maintenance equipment so the more technical lines do not get damaged.
- Better utilization of available features.
- With the lack of available natural features, manufactured features can be incorporated adjacent to the main trail.
- Higher fun factor and increased rider satisfaction.

This is a great example of designing a feature with an easy out.

This rock step-up feature was the only technical area in this trail loop. Riders began to form an easy-out to the left of the area. A better solution would be to create a designed easy-out around the rock feature.

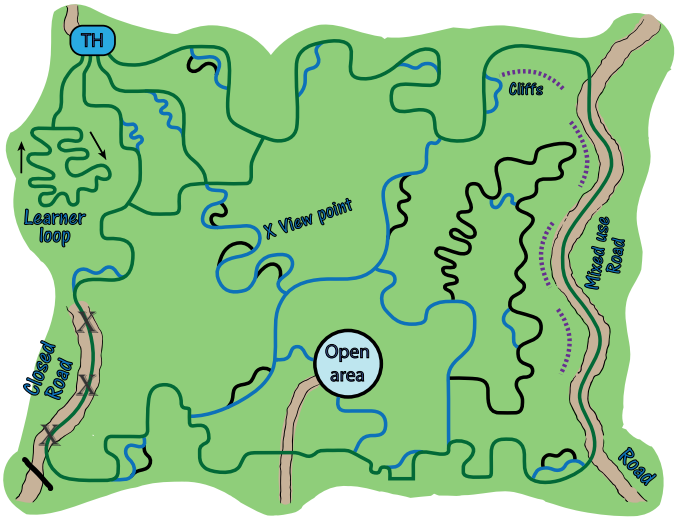
This was an error in planning and design. This is a nice hillclimb with durable soils and a great rock step-up near the top. For this reason, the trail was rated as Most Difficult, but the trail leading up to this feature was not difficult and the lack of entrance management lured under-skilled riders into the feature with no way around it, so braiding started to occur. Also, the trail on each side of this needed machine maintenance, so it wasn't long before the dozer found an easy way down the slope and of course the riders soon followed. This feature should have been initially designed with an easy-out so the agency could have controlled its location and better managed the operational use.

## Design with Multiple Lines

Another technique from the mountain bikers is designing features with multiple approach lines, so one feature can offer several different challenge experiences depending on the riders' feelings of safety and efficiency on a given day. Providing challenge features with choices increases the fun factor and decreases tread impacts. Of course, not all features can have multiple lines, but this is a great technique that should be incorporated wherever possible by the innovative designer. Again, an advantage of multiple lines is that one of them could allow a bypass for maintenance equipment so the more technical lines do not get damaged.

It's short, but it takes advantage of a challenge feature without affecting the challenge level of the main trail.

The riders have a choice; smooth or rough. Signing is essential for rider information and risk management.




The same trail plan with technical options has far more diversity.

This rider actually had a choice of four lines over these boulders. It is far more fun to have a choice than be locked into just one line.

This was manufactured to provide a choice of at least three approach lines.

Climbing up this slab rock, riders will have an option of several lines and challenge levels.

## A Look Back...

Here are some of the elements discussed in this chapter:

- A common dilemma is how to provide challenge and still maintain sustainability
- There are five main tools to help solve this dilemma:
  - Utilize natural features
  - Utilize design features
  - Utilize manufactured topographic features
  - Utilize natural topographic features
  - Utilize manufactured design features (man-made features)
- Maintain a variety of features and experiences. 100% gnarly is 0% fun.
- In order to protect resources, be consistent with the TMO, and manage risk; there are several things that should not be done when providing challenge
- There are four aspects to sustainability: resource, political or social, experience, and managerial. Without all four, a trail or project could fail.
- Erosion can be managed but not be stopped, and it can create challenging trail features
- In dealing with existing impacts, management has several options depending on resource values and political sustainability:
  - Close and rehab
  - Relocate
  - Keep the trail as is and allow the trail to continue to degrade
  - Keep the trail as is and take steps to reduce further degradation
  - Keep the trail as is and restrict or regulate the use
  - Use a mix of all of the above
- Taking a different approach to challenge can have many benefits, including better utilization of the trail resource
- Challenge feature easy-outs help protect resources while better managing the OHV use and providing a bypass for maintenance equipment
- Designing the trails with technical options gives the riders a choice of challenge based on their feelings of safety and efficiency on a given day. This allows for green, blue, and black challenge levels all on the same trail.
- Designing a challenge feature with multiple approach lines is a creative way to provide riders with choices, which can enhance their experience

# Chapter Fifteen
## Facility Needs and Design

Know How to Make It Go, or Know How to Ride? Get Trained

Outstanding design! This beautiful kiosk in this wonderful backdrop is setting the stage for the rider to have a WOW experience.

All trails start at a trailhead or other facility. Those facilities may be the first and only opportunity for the agency to interact or communicate with the riders; therefore, they serve as a welcome center for the customers. As such, they play a key role in OHV management and rider experience. Human feelings and perceptions are powerful elements in making a great trail great. When pulling into a facility, an impression will be made in the mind of the rider. First impressions are lasting impressions and they can form in less than one tenth of a second. That mental image will include feelings on several important components:

- Welcome. Do I feel welcome here?
- Accepted. Does the agency care about me and my activity?
- Care. Does this appear to be a well-managed and maintained facility and therefore trail system?
- Thoughtful. Has this been designed for my vehicle? Can I even get turned around?
- Safe. Is this a safe place for me and my equipment?

A negative answer to any one of these questions could trigger a negative impression of the site, the agency, and the experience the riders are about to have. A positive impression opens the riders' minds for receptive communication and acceptance of the rules, regulations, and expected etiquette. Being free of negativity as they start down the trail, the riders can absorb the experience without bias, which sets the stage and opens the door for a WOW experience at the end of the day.

When designing facilities, it's important to go back to the niche and vision for the project. Who are the customers? Where are they coming from? How many are there? What vehicle types will they bring? Will there be events? The answers to these questions affect the planning of the trail system as well as the design of the facilities. If the bulk of the customers travel less than 100 miles to ride, the trail will have predominantly day use. If customers travel more than 100 miles, the trail will become a destination where riders will spend a weekend, long weekend, or longer. From day use to destination, the vehicle type may change from pickups and trailers to motorhomes and toy haulers; the composition of the customers may change from individuals, buddies, or a family to groups of families, extended families, and clubs. This affects the number of people who could be at the facility at any one time and thus the size, design, and amenities of the facility. If the trail is a destination, riders will need overnight facilities like motels, RV parks, and campgrounds.

Many OHV riders travel and camp together.

OHV riders are not afraid to travel, and some travel long distances to explore different parts of the country and enjoy different riding experiences. Many

travel in groups that range from a few people to 50 to more than 100. Get to know the customers and what they desire. If they have RVs, many desire a simple open area where their group can circle the wagons and camp together. These group sites often have no power, water, or sewer hookups. Others desire full hookups plus heated toilets and shower facilities. These are expensive, so don't build them if they aren't needed. Here is a key point: Most OHV riders would rather have a million dollar trail system than a million dollar campground.

Just as it is important to meet the riders' needs of quality and varieity on the trails, it is important to meet their facility needs as well. Keep the design simple and basic initially, but have room and the infrastructure to allow for future development and expansion. It's a good strategy to implement the trails before the facilities, otherwise people have a place to park, but no place to ride. Then observe the use and needs of the facility and make adjustments to meet the needs of the customers.

### Tip, Trick or Trap?

**Tip:** Most OHV riders would rather have a million dollar trail system than a million dollar campground

## Trailhead and Staging Area Design Considerations

The difference between a trailhead and a staging area is that a trailhead provides trail access for casual riders and a staging area provides access to trails and other activities like MX tracks, enduro-cross or technical terrain tracks, training areas, and concessions. A staging area usually has a larger parking area and often is used to stage events, so there may also be a pit area, starting area, gas row, and spectator area. When not being used for events, staging areas often provide an open area for dispersed camping where there is plenty of room to circle the wagons. Most OHV parks have staging areas whereas most forest trails have trailheads.

This trailhead has a host of amenities including a gravel parking lot, kiosk, picnic tables, covered group picnic area, and accessible toilet.

Other than size, both can have similar components. These include site signing, the trail access point, parking area, toilets, kiosks, loading ramps, and miscellaneous structures. For the most part, general design concepts will be covered, rather than specific design criteria.

**Site Signing**. As obvious as this component seems, there are too many OHV recreation sites that do not have an adequate identification sign out on the main road. Even though the site may be clearly visible from the road, someone who has never been there before doesn't know if this is the intended destination or if it's several miles farther up the road. Riders could also be arriving at night when the facility can't be seen from the main road. Ensure that the sign is clearly visible, is reflective, and the text is legible and sized for the speed of the vehicles on the road.


The letter size on this guide sign is commensurate with the 75 MPH speed on the highway. However the upper portion of the sign is no longer legible.


This guide sign is too high and too far off the road shoulder. It's not easy to see during the day and may not be visible at night.

This recreation site sign looks professional and helps form the riders' first impression.

If the site is off the main road on a secondary road, there should be a guide sign on the main road and a site sign on the secondary road at the actual entrance to the facility.

**Trail Access.** This is the access point to the trail(s). It is preferable to have access to multiple trails rather than just one trail. This allows for quick dispersal, provides loop options, and reduces traffic volume and thus potential tread maintenance.

Even with no vehicles in this trailhead parking lot, the trail access point (arrow) is barely visible. There is a sign board there but nothing is posted on it.

Here are some key points on the trail access area:

- When pulling into a parking lot, especially a large one, a common problem is not knowing where the trail access point is and not being able to see it. Depending on the trailhead design, it could be blocked by vegetation or other vehicles. A site map or guide sign at the trailhead entrance can help remedy this.
- A lot of vehicles go through the trail access area, so barriers are often necessary to control and direct the use.
- Entrance management signing and vehicle width restrictors should be used here.
- This is the last opportunity to grab a map before hitting the trail(s), so a map box at this point is very handy.
- If there are poor soils, trail hardening is often required in this area due to the volume of traffic.

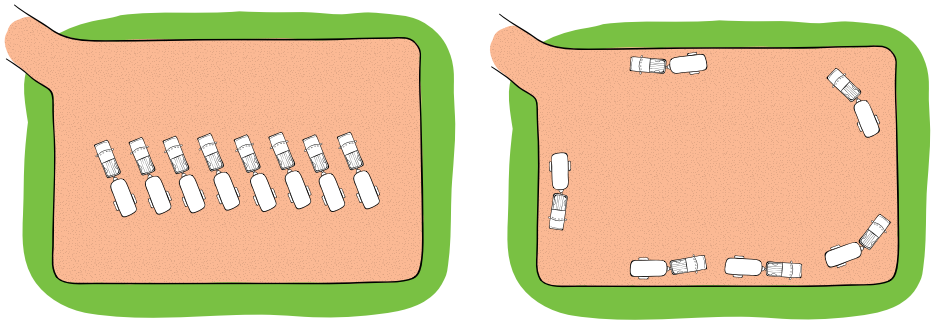
This guide sign at the trailhead entrance helps orient new visitors.

Well designed, this trail access gives the rider a choice of four trails. This adds variety and helps disperse the riders quickly.

**Parking.** When large vehicles with trailers need to be accommodated, managing traffic flow is very important to efficiently utilize the available space. The size and configuration of the parking lot is a huge factor in determining the riders' first impression of the site. Anyone with a trailer will park so they don't have to back up to get out. Design to minimize the need for backing.

Here are some thoughts on parking:

- The design of the parking lot should clearly indicate to the visitor how to park in it.
- Square parking lots with a single ingress or egress point are common, but do not function well. They have poor traffic flow and inefficient use of space. Since the design does not indicate how to park, the first vehicle can park anywhere, and if it parks in the wrong way, it can significantly reduce parking capacity.
- A square parking lot works better with an ingress point on one end and egress point on the other.
- Though often a necessity, minimize head-in, back-out parking. It is one thing to see a pickup coming before backing up and another to see a kid on a minibike, which could be traveling at a much faster speed. If head-in parking is provided, make the spaces



How parking was planned — How people really park

With an unmarked parking lot, the first vehicle to park will determine the parking pattern for all of the other vehicles.

shorter so only vehicles without trailers can use them.

- Pull-through parking is preferred with separate ingress and egress points. This type of lot has flow, safety, and space efficiency.
- Many people do not use or need a loading ramp because they have their own. Provide adequate parking length for the vehicle plus trailer, its loading ramp, and room for the OHV to navigate off and on that ramp without being in the travel lane. This space is significant.
- As far as capacity, bigger is usually better. However, with a small trail system, use levels can be controlled by limiting the parking lot capacity. However, this may cause riders to park outside of the lot along access roads, which can create its own set of safety and impact issues. Usually, barriers or restrictions are required to manage this use.
- Depending on the length of the design vehicle, the width of pull-through parking lots should be 100 feet minimum, but 110 feet is optimum. A pickup with a fifth-wheel toy hauler or a motorhome with a trailer can easily be 60 feet long or longer.
- Flares on the ingress and egress points should have a 35- to 50-foot radius.
- An all-weather surface improves functionality throughout the seasons and reduces dust.

This rectangular parking lot is too narrow. With vehicles parked on both sides, another vehicle with a trailer will think twice about pulling in because he may not be able to get turned around.

Drivers have done a good job parking themselves in this postage stamp lot, but vehicles are oriented four different directions and the odds are high that someone can't get out or an emergency vehicle couldn't get in.

This one way in, one way out, pull-through design has great flow. The angle of the sides "tells" the drivers the angle to park and there is a sign at the entrance to park in the center. There is now a kiosk at the trail access point where three trails take off.

These treated timber parking delineators are expensive, inhibit parking lot maintenance, and don't work well to organize the parking. People will be driving over them and tripping over them. A Park in Center sign would help. The angle of the parking should be determined by the angle to the parking lot entrance. If it isn't, one row of timbers would be sufficient to guide the first vehicle.

Manage parking lot drainage through design. The low point of this lot is at the trail access point so all of the water flows down the trail. Attempts to harden it will be futile and the best option is to relocate the trail access point.

This pull through lot is 110' wide. When there is an event, there is room to park along both shoulders and vehicles without trailers can double park in the center.

- Asphalt is nice, but large expanses tend to crack and require maintenance. Depending on temperature extremes, a flexible pavement may work better if there is a good base. One thing nice about a hard surface is that riders won't cut cookies on it.
- Do not stripe or otherwise mark the parking spaces. Each vehicle is different and requires a different amount of space.
- When calculating parking capacity, designers should remember that this isn't a grocery store parking lot with each vehicle squeezed in with the next. Without a parking attendant, riders will not park tight. Allow room for doors on each side to be fully open and room for people, gear, and OHVs to be unloaded without scratching the next vehicle. A good average is 15 feet in width per vehicle, but at a 60 degree angle, this equates to about 18 feet on the parking lot centerline (so a 500-foot long pull-through parking lot would have a capacity of approximately 28 vehicles).

**Toilets.** Nothing leaves a lasting impression more than a toilet that is clean and relatively odor free. Cleanliness is a maintenance issue, but odor is mostly a design issue. Too many toilets are located where it is convenient rather than where it will function the best. The critical design element for a sweet smelling toilet is airflow, which involves not only prevailing wind currents but thermal currents as well. Become knowledgeable of the science before siting a toilet. Air should move in the vent, down the riser, and up the vent stack. When users raise the toilet seat lid and a rush of nasty air hits them in the face, the airflow has not been managed correctly.

Porta-potties have had a urinal and a riser for years. Including one in the vault toilet makes sense, but there is also more to clean.

Here are some considerations:

- Vegetation management is often required to provide and maintain proper airflow.
- To increase thermal currents, maximize sun exposure to the vent stack.
- A solar-powered fan in the vent pipe can help manage airflow.
- To prevent people from parking, riding, or racing through the entryway, an L-shaped privacy screen is recommended.
- Site the toilet so air from the vent blows away from areas where people will congregate.
- There is a tendency to locate the toilet adjacent to the kiosk. From a privacy standpoint, this is undesirable. People tend to gather at the kiosk, but who wants a gathering next to the toilet?

This facility not only has an accessible path to the toilet, it has an accessible parking and unloading pad. Good design.

- A common game for kids is to lob rocks into the vent pipe. This can be prevented by installing a conical-shaped wire screen over the vent pipe. A flat piece of screen may not be visible by the kids and the cone shape deters needle and leaf build-up. The screen must have a big enough mesh so as not to impede airflow; do not use window screening. Also, the screen must be checked periodically to ensure that spider webs are not restricting the airflow.
- A tip for maintenance personnel: If they wouldn't be comfortable having their spouse and kids use the facility; clean it. No one else would want to use it either.
- Having a hand sanitizer dispenser is a welcomed amenity and shows that the agency is willing to take that extra step toward providing quality customer service.
- One of the benefits of OHV recreation is that many people with disabilities can participate in the sport and enjoy a quality outdoor experience. Because of that, the toilet and the pathway to it should be accessible. Better yet, include an accessible parking pad in front of the toilet.

**Kiosks.** The kiosk is the focal point of the trailhead. As such, it can be used to help draw attention to the trail access point. Unless there is a site host, the kiosk is the place for the agency to communicate with the riders and for the riders to gather the necessary information to plan their ride. Studies have shown that the period to have the riders' attention is very short, so focus the information on what is most important to the riders, not necessarily the agency. Key messages need to be limited in number, stand out, and be brief.

Here are some key points:

- Being a focal point, the kiosk should fit architecturally with the landscape. Utilizing native materials can help with this.
- Display posters in an organized, uncluttered fashion. Focus only on the most important messages.
- A map with a You Are Here indicator should be one of those important messages. Having it laminated is even better.
- Avoid displaying a bunch of 8 ½ x 11 inch pages of agency rules and regulations. Few people will ever look at them. If it is absolutely necessary that these be "posted," put them on the back of the kiosk, on one panel of a multi-panel kiosk, or on a separate kiosk.
- Reserve space for current condition posters like fire closure, weather closure, hunting season, and an event.
- Some kiosks have interpretive posters and messages. Due to the short attention that kiosks receive, these messages may be more useful out on the trail system where they can serve as a destination and extend recreation activity time.
- A polycarbonate cover helps protect posters from the weather and vandalism.
- On large trail systems with multiple access points, it can be helpful to have the site name on the kiosk so when riders arrive by trail from some other point, they can quickly ascertain their location.
- Be sure there is at least one map box stocked with maps.
- If there is an option, the kiosk and the posted materials will sustain less sun damage if the kiosk faces to the north or east.

This kiosk at a trailhead contains a laminated map of the trails, a quick reference of which vehicles are allowed on the trails, and other information the riders should know, all covered with a polycarbonate shield. The seasonal closure is clearly evident. This is a good example of a good looking, well-kept kiosk.

This facility has recently been constructed. There was room here to put more distance between the kiosk and the toilet.

Too much stuff. There might be some good information here, but no one is going to read through all of the fine print and agency regulations to find it.

A simple, but nicely arranged kiosk with key messages. Note the two map boxes and the name of the site.

Most agencies have kiosk height guidelines. Why have a kiosk if you can't read the information?

- A message board off to the side can be a handy feature for lost and found items and notes to help riders find others in their group. This can help reduce the proliferation of posting paper plates on trees or damaging signs and posters that are on the kiosk.

The vertical see-through slats are a nice design, but not functional. Wind and rain blowing through the slats rips and saturates posters.

This bear claw kiosk is a great design and certainly appropriate for the area: Bear Creek. The message board is a handy addition. Without it, paper plates get tacked up on the expensive kiosk panels.

- A picture is worth a thousand words, so using posters with pictures that convey the desired or undesired behavior can save space, reduce verbiage, and be quite effective at delivering the message.

**Loading Ramps.** Loading ramps have become almost a standard amenity at trailheads. However, when space is confined, they take up valuable real estate and can interfere with normal traffic flow. People got their vehicles loaded before they got to the trailhead, do they need a different way to unload them? Observe the use patterns and talk to the customers. This is one of those features that could be planned, but implemented at a later date if needed.

This is a neat and compact trailhead that fits architecturally with the site. Without a barrier behind the loading ramp, it could be used as a jump.

This was built as a volunteer work party project using old railroad ties. It's not fancy, but it works. The barriers prevent kids from using it as a jump.

This is a nice ramp, but weather and tire action are eroding the approaches. They need to be hardened to keep it functional.

With the concrete and the railing, this ramp was expensive to construct. It is accessible, but the approaches in the gravel probably aren't. If the concrete truck is going to be there, why not pour a concrete parking pad and approach to the ramp?

Here are some key considerations:

- Loading ramps are relatively easy to build and make great volunteer workday projects. As such, they make good match projects for grants.
- Many are constructed with two heights and this can be a nice feature.
- One of the biggest issues with loading ramps is that the kids or pit squids use them for jumps. This can be mitigated by installing a barrier behind the ramp so they can't get a run at it.
- Loading ramps and their approaches are subject to higher than normal physical forces and therefore higher levels of displacement. They should be hardened with rock or other material.
- For gravel parking lots, instead of installing a loading ramp, consider installing an accessible parking pad(s) of suitable width and length (16 x 40 feet minimum) to facilitate loading and unloading by the disabled. This should be signed for use by the disabled only.

**Miscellaneous Structures.** Some amenities can be desirable depending on the climate and use patterns of the site. A good time to flush out the need for these amenities is during the planning phase of the continuum, or by monitoring use patterns and implementing them after initial facility development. Miscellaneous structures include the following:

Concrete picnic tables are durable and they deter theft, but the shade moves and they don't. With no shade and smoke from the fire drifting toward the table, will it get used?

This metal table is also durable and could be anchored with a chain so it can be moved, but not easily stolen.

Desperate for relief from the heat, these riders sought the only shade…. Desirable? No.

This highly developed trailhead has several shaded picnic tables, accessible walkways, and interpretive signs. Great job!

Community kitchen structures like this are expensive, but provide a place for groups to get out of the sun or rain. Be sure to validate the demand before building one. The architectural design fits nicely with the industrial mining theme for this park.

This is a nicely designed trailhead with barriers to control and direct the use, a quality three-panel kiosk, two-hole toilet, and a welcome shade structure.

Picnic tables are relatively inexpensive and a nice amenity. Rather than pack food, many riders will come back to the trailhead for lunch before heading out for an afternoon ride. Sitting at a table usually beats sitting in the dirt or in the back of a pickup. The more time riders are at the trailhead for other activities like an MX track or youth training area, the higher the need for picnic tables.

The same for fire rings. Trailheads are mainly for day use, but some families will build a fire midday so the kids can roast marshmallows. There is a need to have a safe place for a fire and to manage where fire rings occur so they don't appear on the asphalt or scattered around on the gravel parking lot. If overnight use is allowed at the trailhead, tables and fire rings become a necessity.

In the heat of the summer, just about everyone wants to take a break or eat in the shade, but there are many places that just don't have trees.


Above, though the Stop sign gets your attention, it tends to shout at you and aesthetically doesn't fit.

Good design. The fee station is separated from the information kiosk in the background. The sign: "The fee you pay here stays here" is an outstanding message that customers appreciate. Compliance tends to increase when people know that fees come back to help them.

Shaded picnic tables are one of those amenities that let riders know the agency cares. One issue is that the sun moves but picnic tables don't so the shade is not always where riders want it. Another issue is that picnic tables are expensive, so how many should be built? If the parking lot is full, not everyone can have a table in the shade, but even a couple is a nice touch. A community kitchen is more costly, but can accommodate more people. As with tables, if there are other activities occurring in and around the trailhead, there could be a demand for a covered eating or meeting area. Designers should scope it out before they incorporate it. A structure like this could be harder to justify in a grant request.

In a user-pay society, fee stations are a necessity, not an amenity and a logical place for them is at the kiosk. The key point here is to not clutter the kiosk with OHV information and fee requirements. Focus the riders' attention on one, and then the other. Have a multi-panel kiosk or a separate kiosk with a panel dedicated to the fee requirements.


This three-panel kiosk separates fee requirements from other information.

## Campground Design Considerations

Variety has been stressed throughout this book, and it is applicable to campgrounds as well as trails. Customers arrive as individuals or in groups of all sizes, so the camping facilities should be designed to accommodate a range of group sizes and a range of vehicle types and sizes from tents to RVs. Many agencies have design guides for campgrounds; unfortunately, some of those focus on sites for tents and pickup campers but not on big rigs with trailers. Driving a big rig with a trailer through recreation facilities gives one an entirely different perspective on adequate road width, clearances, and turning radii. Navigating a big rig should be mandatory training for any recreation facility designer.

Just like a trail designer, a facility designer needs to understand: the riders and their needs, the range of transport vehicle sizes they will bring, and the group sizes possible. Keep the design considerations in mind to meet the needs of all the types of campers: the grade, turning radius, vertical and lateral clearances, back-in spurs, pull throughs, objects hidden from view, group sizes and areas, site protection, and the kiddie effect.

OHV riders often pull large toy-haulers. Campgrounds and parking areas need to consider the length of the vehicles, plus room to unload in the back.

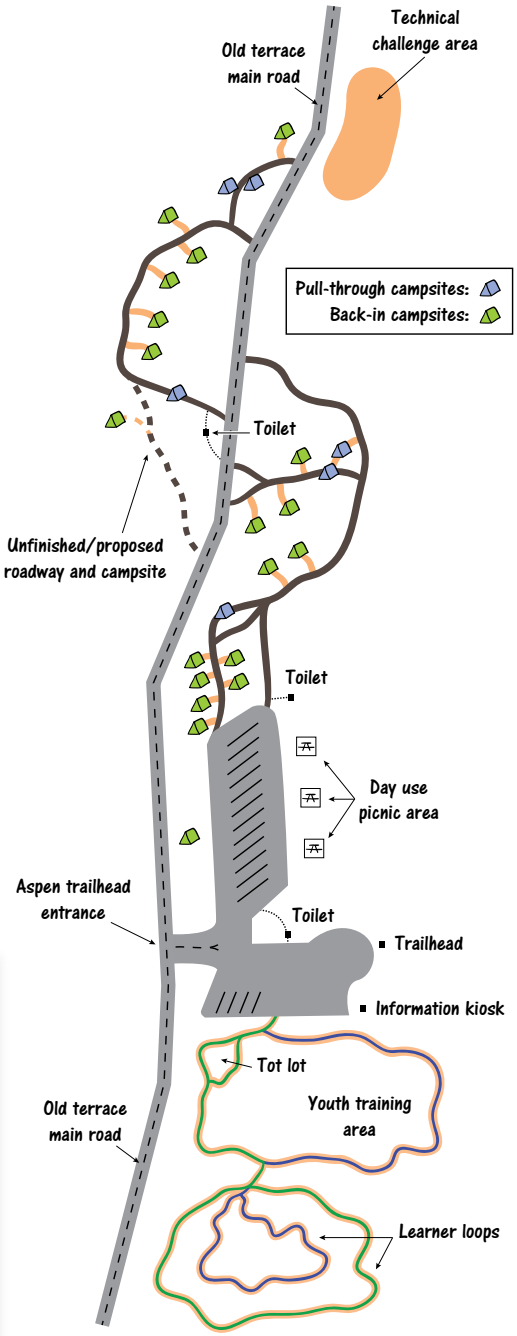
Notice how campers tend to block themselves in for additional privacy and security. Large sites provide capacity and configuration flexibility. This site is 30 x 44' deep.

This site is 40 x 50' deep and can be used by one vehicle or several as shown here.

**Mix it up.** Depending on the vegetation and other site constraints, designers should try to accommodate as many combinations of vehicles and types as possible. This would include spurs and pull-through spaces for a single vehicle and for two, three, four vehicles and up. Then configure their arrangement to be intermingled and best utilize the available space. All of the pull-through spaces don't have to be together, the single sites don't have to be together, etc.

Riders with tents are using this smaller 20 x 30' native surface site. Don't pave or gravel every section of the camping area.

It took a lot of time and effort to try to level this RV. The result? An unsafe condition and negative image of the agency.

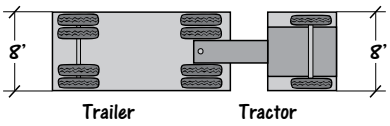


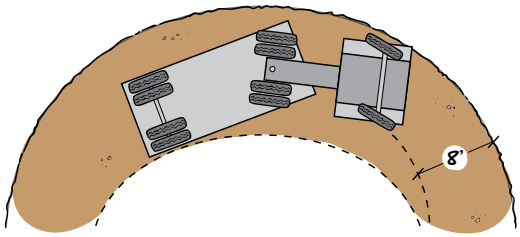

This OHV trailhead and campground complex is only half complete, but there is a good mix of amenities and of sizes, shapes, and type of camp spurs. Site constraints forced a long and narrow design

**Grade.** The engineers often want more grade than is necessary to drain the site. Design for the customers, not for the engineers. From a camper's perspective, there is nothing more frustrating than not being able to level up in a camp spur. RV refrigerators need to be close to level, but just as important the people want to be level. Whether riders are in a tent or RV, it is not comfortable spending the weekend off-camber.

If the spur slopes down at a 5 percent grade, a vehicle with a 200-inch wheelbase would need to raise the rear axle 10 inches. Few RVs can do that safely, and all RV manufacturers warn owners to never lift the front or rear tires off the ground since the vehicle could roll. Even on a gravel surface, water will run with a 1 to 2 percent grade.

**Turning Radius.** Two factors affect how sharp a curve is and how drivable it is: the curve radius and the length of the curve. The smaller the radius and the longer the curve, the sharper the curve will be. On any curve, the rear wheels of a vehicle do not follow the same path as the front wheels. The longer the vehicle (and trailer), the wider the offset between the front wheel track and the rear wheel track. This is compounded by the sharpness of the curve. Road designers compensate for this off-tracking by adding curve widening to the inside of the curve. This added lane width can be considerable (up to 20 feet), but in an effort to maintain a natural setting, road widths and clearing widths are often minimized in recreation sites. If sharp curves are designed into an OHV facility, curve widening must be factored into the road width. If it isn't, road damage, or worse yet, vehicle damage, can occur. Consult the agency road design guidelines or AASHTO Green Book guidelines.



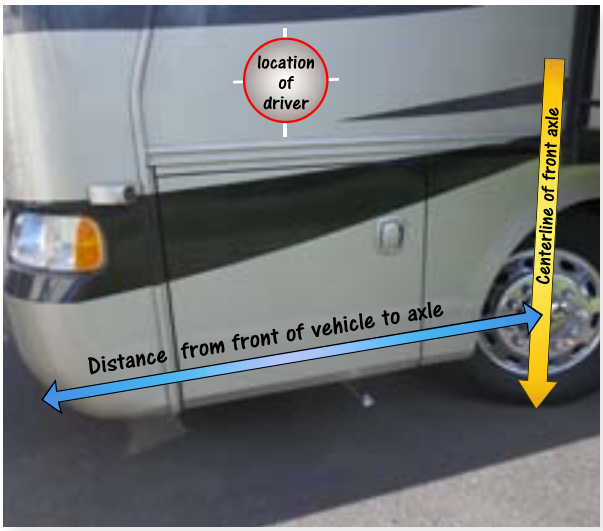

The belly dump truck makes a good test vehicle for roads and spurs in a big rig OHV facility.

During facility construction, a good way to test the design is with a belly dump truck. If it can't negotiate the turns or the pull-through spaces or if it scrapes trees horizontally or vertically, fix the design.

**Vertical Clearance.** It can be very disconcerting to drive through a campground road, hear limbs scrape the roof of a vehicle, and wonder if there will be damage to a clearance light, roof vent, an air conditioner unit, TV antenna, satellite dish, or the roof itself. A standard pruning height has been 14 feet, but many motorhomes are 12 feet high and fifth wheels can be 13.5 feet high. If the wind is blowing, the limbs are wet, or full of cones, a 14-foot height is not sufficient. A 15- to 16-foot pruning height is recommended.

Maintenance personnel need to be looking up when patrolling campgrounds. Broken limbs or debarked limbs are clear indications of inadequate clearance.

**Lateral Clearance.** Clearing width can become a factor on both roads and camp spurs. If curve widening has not been factored into the design, lateral clearance is an issue because the trailer is going to be off the road and scraping trees. With motorhomes and big trucks, the front wheels can be several feet behind the front corner; therefore, on a sharp curve, the front wheels could be on the road, but the front of the vehicle could be off the road. Without adequate lateral clearance, this could prevent a large vehicle from negotiating a sharp curve.




The front axle of this motorhome is behind the driver. The front tire could be on the edge of the pavement, but the front of the vehicle 5' off the pavement.

This slideout extends 36", but the storage bay door extends 52". Trees, bollards, or logs used to define the site can also restrict its use with inadequate lateral clearances.


The back of this motorhome extends 11' behind the rear wheels. If there is sufficient clearance behind the parking bumper and bollards or barriers are kept below 14", a 40' vehicle could fit into a 30' spur.

This site has good lateral clearances. Note that the rear of the 5th wheel is extended over the log barrier.

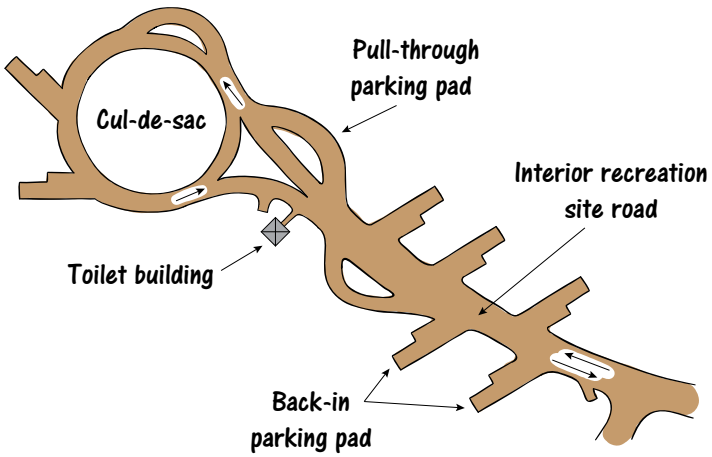
On camp spurs, there needs to be enough lateral clearance for awnings, slideouts, and slideout awnings. Storage bay doors can be 52 inches wide and extend beyond the slideouts. The total clear space required for a big rig with the patio awning out can be 22 to 25 feet.

Clearance in the back of the spur is important also. Most RVs have a rear overhang from the back axle to the rear of the vehicle. If trees are cleared and bollards or barriers are kept low enough, a long vehicle can fit into a fairly short site.

**Back-in Spurs.** Spurs utilize space more efficiently than pull-through sites, but big rig drivers will almost always choose a pull-through just to avoid backing up. Back-in spurs usually afford more privacy and in some ways more security because there is only one access point. The key to back-in spurs is their angle to the road. The smaller the angle, the easier the spur is to back in to. The spur angle should not exceed 60 degrees unless the road is very wide or there is another unoccupied site directly across from it. The reason for this is that without extra width, there is inadequate space for the front of the tow vehicle to swing out so the trailer can be straightened.

This spur is at a 90 degree angle to a road that is only 12' wide. Depending on the wheelbase of the vehicle combination, it is very difficult to back a trailer into this site. The first three bollards on the left side have all been hit.

Because the spur angle was sharp and the road had inadequate width, the front tire of this tow vehicle went off the road and over this culvert. This could result in damage to the road shoulder, culvert, and vehicle.




Whenever possible, avoid two-way campground roads. Traffic increases and safety decreases. With this design, every back-in spur is on the driver's blind side.

Given a choice, drivers of tow vehicles will choose a back-in spur on their left over one on their right. Why? Because the driver has a clear and close view of his mirror and a good line of sight down the tow vehicle and trailer, which makes backing up easier. Mirrors on the right are farther away and are often wide-angle, which makes the images smaller, harder to see, and harder to judge distances.

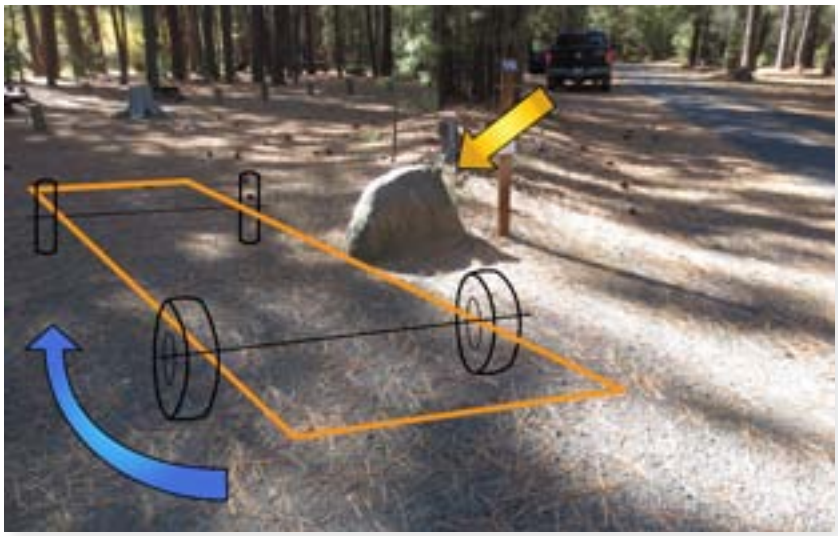
This pull-through has poor flow that can trap drivers. When pulling in from the upper end, the drivers are hugging the bollards on the left and watching the trees on the right (not shown) to make sure their trailers clear them. Then the radius of the bollards tightens up forcing the drivers to crank the wheel some more or back up. All three of the bollards in the foreground have been hit.

**Pull-through spaces.** The obvious advantage of a pull-through is that it eliminates backing in to a sometimes awkward spur. There are some vehicle combinations that cannot be backed up without unhooking, so those vehicle drivers will almost always choose a pull-through over a back-in.

A pull-through space can be designed for a single vehicle and trailer combination, the center can be widened out to accommodate two vehicles, or widened and lengthened to hold four vehicle combinations. Since pull-through spaces take up more space than spurs, designing them as mini-group sites can help make more efficient use of that space.

To accommodate big rigs, pull-through spaces need to flow well, so they're best designed as straight or on a long shallow curve. If the curve is too tight, a big rig with a trailer cannot pull in or pull out.

**Objects Hidden from View.** These are the bollards or boulders that designers place on the corners or edges of the site for enhanced aesthetics and confinement of the use. Unfortunately, when backing a trailer into a site, the drivers' eyes are focused on where the trailer is going, not on where the front of the tow vehicle is going. These objects become obstacles that are a hazard and are cursed by customers. Another factor is that the higher the drivers sit, the less visibility they have of the ground adjacent to their vehicles. Any objects placed in those locations are actually placed in the drivers' blind spots. Objects like this need to be either set back out of harm's way or be tall enough to be clearly visible by the drivers.



How could someone not see this rock on the right? Once committed to pulling in, the rock is on the blind side of the drivers and their eyes are focused on the stump ahead which is encroaching on the width of the pull-through. While tightening up their turn to clear the stump, off-tracking could put the trailers into the rock.

**Group Sites and Areas**. Having a group site(s) or large open area in which to circle the wagons is definitely an amenity that large families or groups will utilize. These can have utility hookups, but most groups can easily dry camp for a long weekend and would rather camp together than have utility hookups. Why do people circle the wagons? Camaraderie and just as in the old days: security; all of the OHVs, tools, and kids toys will be inside the circle.

The ability to circle the wagons enhances the experience of a group. Note the variety of vehicle types: toyhaulers, trailers, motorhomes, tents, and pop-up tent trailers.

This unique design allows RVs to square the wagons while still having full utility hookups. Sites can be occupied individually or a group of four can camp together. Note the single fire ring in the middle.

This cable barrier helps control the spread of this dispersed site and deter the kiddie effect.

This large circular site with multiple utility hookups can be occupied by individuals or it can be reserved for a single group.

**Site Protection.** A concern with any developed or dispersed camp is limiting the spread of the site and protecting vegetation. People like to camp under the trees, but doing so can damage root systems, compact the soil, and affect water absorption. Barriers are often used to confine and control the use.

There is always a need for bollards or other barriers around campgrounds and trailheads. During construction, or as vegetation needs to be managed during the life of the facility, consider cutting the stumps a little higher and chamfering the tops. It's a nice touch and it provides a great natural barrier.

Innovative parking corrals are used to control access and protect this sandy environment from vehicle impacts.

While parking and camping is still allowed in the trees, barriers have been installed around other clumps of vegetation. The beneficial effect is obvious.

**The Kiddie Effect.** OHV riding and camping is a family activity and it's always great to see families having fun together. The bigger kids can usually go ride with their parents on the trails, but where do the little kids ride or learn to ride? Most often, they will end up riding around the camp or riding around the campground on the roads. They will ride all day long until they run out of energy or fuel. This constant noise and dust can be annoying to other campers but it can also present some safety concerns.

Left to their own devices, unsupervised and uneducated kids can do a lot of unintentional damage. They're looking for fun and can find that by riding a closed trail, a closed area, or by creating a trail between campsites.

A father leads his son around the campground. More often than not, the child is riding unsupervised.

This kiddie track is developing next to a large, regularly used dispersed camp.

In the vicinity of most dispersed kiddie-created camps that are regularly used by families, a kiddie-created track will soon develop. The kids need a place to ride, but these contribute to the spread of dispersed camps and impacts to vegetation and soils.


It is difficult to close off a trail or road adjacent to a dispersed camp. The chopped up road provides a great challenge for the kids.

Designers can manage the kiddie effect by incorporating tot lots, kiddie tracks, and youth training areas as part of their OHV facility design. Like play areas, these give the kids (and their parents) a designated, managed place for that activity. These facilities get the kids off the roads and away from the intimidation of older riders and bigger machines. Signing these areas as tot lots, kiddie tracks, or learner loops help to keep older kids and pit squids out of the area. Riders don't get any points for showing off in a tot lot.

## Skill Development Area Design Considerations

Areas to develop skills should be associated with OHV trailheads, staging areas, and campgrounds. They help manage the use by providing a designated place for training, riding, and skill development. They also extend the recreation activity time because they provide activities other than just trail riding. These should be sited quite close to the trailhead or campground, but be located to minimize noise and dust intrusion to other recreationists.


Signed learner's loops help prevent the kiddie effect and keep pit squids out of the area.

Skill development areas include learner loops, kiddie tracks, tot lots, youth training areas, and technical terrain courses. All except learner loops provide spectator activities where riders and their family or group can participate or watch.

**Learner Loops.** A learner loop is a one-way training trail that teaches throttle, clutch, brake, and balance control. To accomplish that,

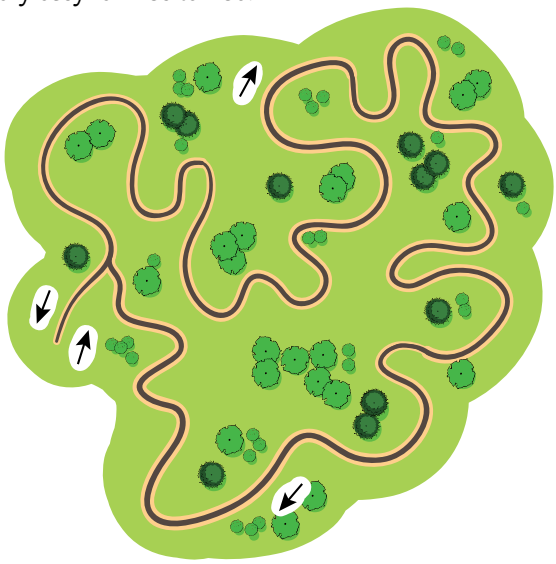
these are often tight, technical, low-speed trails. In theory, they should prepare the rider to negotiate whatever can be expected on the trail system. If the trails have rocks and logs, the learner loop should have rocks and logs. If the area doesn't have those features, they can be imported. If the main trail has switchbacks, the learner loop should have a switchback if the terrain allows. If there are single- and double-track trails, there should be single- and double-track learner loops.

This learner loop has an ATV trail going off to the right and a single track trail going straight ahead. Both were designed to be very easy for kids to ride.

A learner loop isn't just for kids; it's for anyone who needs to develop their riding skills. They can be any length, but many are one-fourth to one-half mile long. These loops are dense so they can fit into a small area. If they are long enough, they can also serve as a warm-up loop.

The new training area at the El Mirage OHV Recreation Area has a training area, a tot lot, and a youth training area. All areas are well signed and there are age appropriate safety messages along the fences. This area was well designed and constructed.

A learner loop can also be designed as a play loop. It can be open and flowing or tight and technical, but the curves are usually highly superelevated to produce a high fun factor. Where possible, they play with the landscape to produce a roller-coaster ride. These teach skills, but the high fun factor can keep kids occupied for a long period of time.


Learner's loops teach the skills needed for the trail system.

**Kiddie Tracks.** These are usually a small oval track, fully enclosed with barriers or fencing, with a controlled access point. They are usually signed to limit the age and vehicle displacement (cc). The track usually has some mounds of dirt of varying heights or other obstacles, with easy-outs, to ride over. Some have shaded picnic tables or bleachers so parents can watch their kids play on the track. Size depends on available space, but a nicely sized track can fit on one-half acre.

Designers should keep the kiddie effect around dispersed camps in mind and manage the impacts by selecting a couple of the high-use sites and building a small kiddie track at them. The kiddie tracks should be shown on the map so families with small kids can find them. Then all undesignated tracks should be closed off and use directed to the designated sites.


Tread Lightly!'s Lightfoot has just enjoyed a ride at this kiddie track. This one is restricted to kids under 15, under 5'5'' tall, they must be supervised, and speed is limited to less than 10MPH.


This kiddie track has shaded bleachers which provide a comfortable place for parents to supervise and interact with their kids.

**Tot Lots.** Tot lots are designed for the little kids just getting started. They are a simple oval track or may have a few easy curves. They are flat with no superelevation and no mounds so that a rider on a small 50cc bike with training wheels can easily navigate them. They are fully enclosed with a single access point and are signed to restrict engine displacement. Depending on soil type, a tot lot may need to be hardened since soft soils are difficult to ride with small tires and small engines, or by kids on their first ride.


A tot lot is a happy place as proud parents watch and photograph their kids. Without the intimidation of bigger bikes and kids, skills and confidence can develop quickly.

A tot lot can be any size depending on available space, but 50 x 100 feet is more than enough. They don't need to be very big because the machines and riders are so small. Also, a small track makes it easier for the parents to supervise and run alongside their youngster.

**Youth Training Areas.** All of the previous area can be called a youth training area (YTA) or be part of a larger training area. A YTA usually provides a range of activities to accommodate a wider range of ages and skill levels. Some have a tot lot; kiddie track; an ASI or MSF training area; a learner loop; and an obstacle area with mounds, rocks, logs, or other natural or manufactured features. All of this can be provided in less than 2 acres. They are fenced, signed, and have restricted access. Picnic tables in the shade give parents a place to watch their kids.

**Technical Terrain Courses**. A formal technical terrain course is called an endurocross track, and it is a competitive event track that is a spectator activity like MX, rock crawl, and trials. However, they can also be designed and used for casual recreation. These are technically challenging so they provide a much higher level of skill training than the other facilities above, but they are fun and definitely extend recreation activity time. One nice thing about them is that they can occupy almost any size or shape land parcel since a lot of obstacles can be positioned into a very small space.


The El Mirage Youth Training area has several skill building stations, each with an easy-out. Educational posters are placed on the fence surrounding the area.

Manufacturing challenge features are what a technical terrain course is all about, using whatever materials are available and creatively arranging them into a fun and challenging course. Materials can be rocks, logs, stumps, tires, culverts, concrete chunks; anything that can be ridden over and be durable. Unless obstacles are intended to move to increase difficulty, like a loose log run, features must be designed to be anchored or immobile. Like everything else, having a variety of features increases the challenge and fun.

Adding skill development areas can take little space, but they add tremendous value to a trail system. However, like the trail system, the development areas need to be designed correctly from the beginning, built with quality materials, and have regular maintenance.

Endurocross courses use a variety of obstacles to create a very technical course in a small area.

Concrete pipe, a short hillclimb with angled log obstacles, or a mound of logs can provide a tremendous amount of technical challenge and fun. When others in the group watch, their recreation activity time is being extended and enhanced.

Vertical and horizontal tires of various sizes are durable, cheap, and a blast to ride. A rock garden is a fun feature and this could be followed by a sand pit. The only limits are the designer's creativity and imagination.

This triangular log feature is very simple, but between the angles and the odd spacing between them, they are quite challenging to ride.


Where appropriate, a mud pit is a popular feature. Allowing legal, designated areas helps protect the resources where it isn't appropriate.

Trails riders can do some amazing things with their motorcycles. A small space and a little ingenuity is all it takes to make a great trials riding area.

## Need more? Learn more here...

*AASHTO Green Book*, https://bookstore.transportation.org/collection_detail.aspx?ID=110&gclid=CNDwtbDgosECFVBffgodyioAQA

*Park Guidelines for OHVs*, George E. Fogg, NOHVCC, 2002

*SST Installation Guide*, USDA Forest Service, Technology & Development Program, http://www.fs.fed.us/t-d/pubs/pdf/03231303.pdf

## A Look Back...

Here are some of the elements discussed in this chapter:

- OHV riders aren't afraid to travel, and they often travel in groups. Facilities need to accommodate a variety of group sizes.
- OHV facilities need to be designed for a variety of vehicle types, sizes, and combinations from pickups with tents to motorhomes with trailers.
- Designers must understand OHV riders' facility needs, use patterns, and the capabilities of their travel vehicles.
- Trailheads and staging areas have seven design components: site signing, trail access, parking, toilets, kiosks, loading ramps, and miscellaneous structures.
- Educated riders are responsible riders. A well-organized kiosk with key information and education messages is an important communication tool for the agency.
- Design considerations for campgrounds include: a variety of spur sizes and configurations, grade, turning radius, vertical clearance, lateral clearance, back-in spurs, pull-through spaces, hidden objects, group sites and areas, site protection, and the kiddie effect.
- Design considerations for skill development areas include learner loops, kiddie tracks, tot lots, youth training areas, and technical terrain courses. These provide designated, managed areas for skill development, training, and challenge.
- Skill development areas extend recreation activity time, enhance the OHV experience, and help manage the use.