PART THREE

Building a Great Trail

The largest growing demographic for OHV recreation is people over 50 years of age.

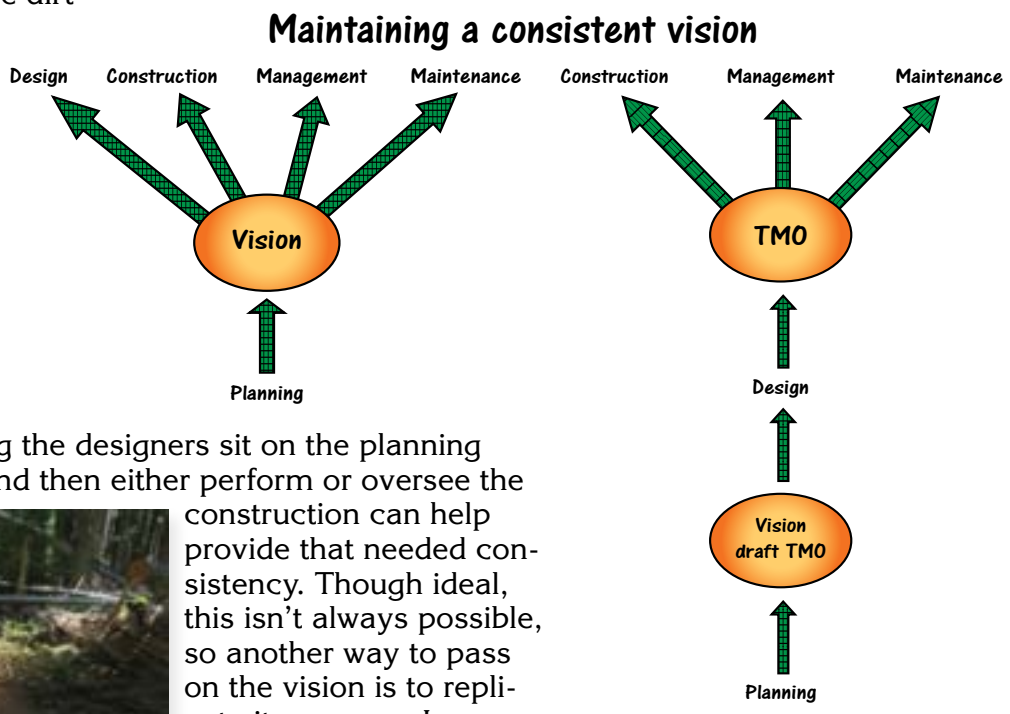
Chapter Sixteen
Construction

The Past is Not the Future

Construction is a time of excitement. But take time to get it set up before turning dirt.

A plan and a design have been created with care. With construction, the vision becomes a reality. For the designers, after days, weeks, or months of scouting and flagging, there is nothing more gratifying than seeing the flagline become a trail and to finally ride it. It is a WOW feeling and hopefully a WOW experience. Construction is an anticipated time and one of excitement. Everyone on the project team becomes rejuvenated with the smell of freshly turned dirt, the clanging of tools, and the sound of equipment as a trail becomes inscribed on the landscape.

This is a great moment in creating a great trail, but what happens after that moment may not be so great. There can be pitfalls; and when the vision in the project team's mind doesn't match the product on the ground, there are problems. Keeping construction flowing smoothly and avoiding potential problems starts before the dirt is turned in a process called preconstruction. Certainly one of the challenges throughout the continuum is maintaining a consistent vision: passing the torch from one component to the next. The obvious way to meet this challenge is to reduce the number of times the torch gets passed. Having the designers sit on the planning team, design the trails, and then either perform or oversee the construction can help provide that needed consistency. Though ideal, this isn't always possible, so another way to pass on the vision is to replicate it on paper. In preconstruction, maps, drawings, and specifications are written and assembled so that someone potentially unfamiliar with the project and the project area can look at the material and build the desired product on the ground. The process of transferring the vision is not an easy one, so investing time in developing a comprehensive construction packet can facilitate a smooth and complete flow of information and result in a great trail on the ground.



This is a new trail that was ridden in. The lack of a constructed tread has resulted in deep ruts created by compaction and displacement.

Section 1: Preconstruction

Determine Construction Option

One of the first tasks is to determine how the trails will be constructed, or even if they will be constructed. Whether a trail will be constructed by hand or machine-built has usually already been determined in the design and outlined in the final TMO.

Determine Construction Method

Once the decision has been made to construct the trails, there are four basic methods to accomplish that goal: force account, volunteers and groups, contract, and hybrid contract.

The **force account method** is when the agency performs the work with its own personnel and equipment. The agency must have skilled personnel and enough of them to efficiently perform the work. The other key ingredient is having the proper size and types of equipment to accomplish the construction tasks.

A crew of volunteers gets ready to work on trail maintenance

With the **volunteers and groups method**, a local club or organization takes on the construction of the project. Volunteer labor is often used as match dollars in grants, and many grantors require or will score an application higher if there is a volunteer component. There are also agencies and associations (like the Student Conservation Association) that have organized trail crews available for hire. With both of these, having skilled personnel, experienced supervision, and the proper equipment is essential.

The **contract method** is the most common option. A solicitation is prepared to hire a contractor to perform all or most of the work.

A **hybrid contract** is where the vendor is required to utilize and train volunteers to accomplish portions of the work. Though maybe not the most efficient, this method is popular because local enthusiasts receive necessary trail training that they can use later on for maintenance or implementation of another project. As with the volunteers and groups method, the volunteer component provides contributed funding, or match dollars, for grants.

Armed with a variety of tools, this paid crew from a local village is ready for construction.

The Preconstruction Packet

The construction method selected will determine the scope and complexity of the documents needed for the preconstruction packet. One of the documents that forms the foundation for all of the other preconstruction data is the trail management objective (TMO). Drafted after developing the concept plan and finalized after location and design, the TMO provides key information that triggers guidelines and parameters for design, construction, and maintenance. The TMO guides whether a rock gets taken out for a smooth tread or left as a technical feature. The TMO must be treated as a guideline and adjusted for regional and actual site conditions (there are too many variables with any trail to have a one-size-fits-all set of parameters). It shouldn't be used as an agency-wide standardized document. It is intended to be trail specific. Construction drawings and specifications are then drafted to convey the desired output to whoever is performing the work.

Pitfalls

If the packet is complete and well written, the vision can be adequately transferred to the contractor, but that doesn't always happen. Here's why:

Pinnacle Peak TR #801	
Trail Log	
Mile Post	**Description**
0.00	Begin construction at Pinnacle Peak trailhead. Install entrance management barriers and signing as per typical section EM1.
0.05	Install 18"x14' dual wall plastic culvert with headwall.
0.65	Construct armored rolling dip + lead-off ditch right.
0.86	Choke tread width down to fit between the two boulders. Do not disturb the boulders.
0.91	Cut danger tree 25' on left.
1.01	Construct turnout right.
1.22	Begin 6" compacted trail hardening rock.
1.29	End trail hardening rock.
1.35	Junction with TR#802 right. Construct T junction as per typical section JCT2.
1.41	Entering rock garden for 35'. Track equipment over this section and do not excavate rocks.
1.48	Outslope grade sag to drain left. Construct sump as staked.
1.52	Construct turnout left.
1.59	Do not disturb rock step-up. Construct easy-out on left as staked.
1.73	Junction with Road 2315-650. End construction.

A trail log is one useful piece of information for the preconstruction packet. More information is available at greatohvtrails.com

Lack of training. In general, it appears that there is a lack of training on preparing and administering an effective trail contract. In some cases, it has also become a very complicated and time-consuming process. Because of this, some agencies tend to avoid contracts or submit poorly crafted contracts.

Inadequate contract time. Often it takes longer than anticipated for agencies to prepare the contract, but still have a drop-dead date to expend grant funds and that results in a short contract performance time. A short contract time reduces the pool of available contractors and increases costs because the contractor loses flexibility to schedule this work with other projects or is forced to perform when weather or soil conditions may not be ideal.

Missing, incomplete, or inconsistent documents. If the agency doesn't have the time or the skills to craft a good contract, there can be errors. This leads to contract delays, perhaps change orders, and increased administration and contract costs. It takes time for a contractor to submit a bid. If the work to be performed is unclear, the bid cost will likely go up.

Using inapplicable terms or specifications. Using non-OHV terms like "freeride" or "coasters" indicates to a contractor that the agency really doesn't understand what it is doing or what it wants. This could increase bid costs. Because they are considered the standard, some contracts have requirements for tread outslope, the 50 percent rule, and the 10 percent average grade rule. Agency personnel should ensure that the terms used will provide the product they want before they automatically insert those terms into an OHV contract.

Inadequate cost estimate. Contracts often get cancelled when the bids exceed the agency's estimate. This adds time and cost to the whole contracting process and may delay the implementation of the project. Someone knowledgeable in trails, structures, equipment, and the sequencing and performance of trail construction should prepare cost estimates.

Cookie-cutter contracts. To save time or due to lack of training, cut-and-paste contracts are prepared, but no two projects are identical. The agency can individualize a project and transfer the vision in the supplemental contract clauses, special project specifications, project-specific drawings, and the trail log, but these typically receive the least attention in a cookie-cutter contract. These types of contracts can create poor communication, which can result in a higher bid cost, higher contract administration costs, and a product on the ground that may not be the desired product.

The cheapest isn't necessarily the best. There may be someone locally who is enthusiastic and inexpensive, but does just anyone with a skid loader understand the intricacies of trails and have the proper equipment to build a great trail? If the work goes out for bid, many agencies are required to accept the lowest bidder. The reason to have well-written specifications and drawings

is to make it clear to all what the intent is and what constitutes an acceptable product. That helps put all bidders on the same page and helps narrow the range of bids.

If the agency does not require accepting the lowest bid, it is very important to clearly describe how the bids will be evaluated. These criteria can be very specific, right down to the type (not brand) of equipment and its capabilities, experience in relevant motorized trail work, level of operator skills and training, etc. Spending time crafting the Evaluation of Quotes will provide flexibility in selecting the best bidder.

Evaluation Criteria	
1.	Experience in performing mechanical OHV trail construction and reconstruction.
2.	Experience in operating a trail dozer with a blade of 48" or less. Operators must have 2000 hours minimum operating time.
3.	Demonstrate experience in operating in a variety of soil types and topography.
4.	Demonstrate understanding of the physical characterisitics necessary for a motorized trail to be rideable while protecting surrounding resources. These characterisitics include design (difficulty level, user needs, safety); engineering (inslope, outslope, tangents, circular curves, superelevation, drainage, "rideable flow"); resource protection (conserving soil, maintaining aesthetics, protecting vegetation, using care and discretion when parking or turning equipment, protecting sensitive plant populations and cultural resources).
5.	Actual OHV riding experience of the contractor and/or employee. (Riders generally have a better understanding of the items in #4.)
6.	Ability to follow and perform scheduled preventative maintenance on a trail dozer.
7.	Ability to recognize mechanical issues before they become mechanical breakdowns.
8.	Ability to train others in trail dozer operations.
9.	Member of the Professional Trailbuilders Association.

Section 2: Construction

The Construction Process

"Construction" means moving dirt and includes new trail construction, existing trail reconstruction, or trail relocation. Regardless of who does the construction, the nine-step process is, or should be, the same.

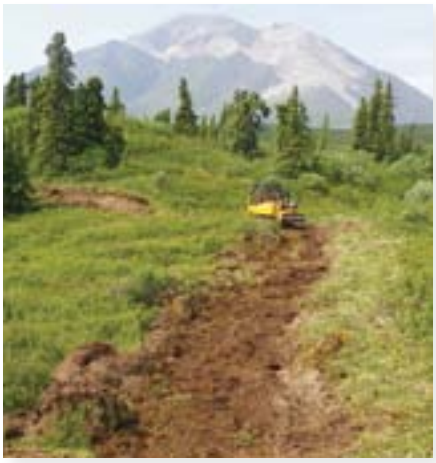
In remote areas, campsites for the crew are often required. These must be designated and approved in the preconstruction process.

Sometimes sizable areas are needed for staging equipment and materials.

Working ahead of the trail dozer, this crew has cleared the trees and heavy brush.

The dozer is removing the organic layer of vegetation and grubbing stumps. Note the high-cut stump for increased visibility and leverage.

An excavator is a good tool for grubbing and slash disposal because it can pluck stumps, scatter material without damaging other vegetation, and strategically place material to help control use.



This trail has been cleared and grubbed. Rough access is being pioneered in.

1. **Mobilization.** This is the movement of personnel, equipment, and materials to the job site. In remote areas, this can involve the establishment of base camps. Depending on the site location and complexity of the work, mobilization can be a substantial and costly task.

In most cases, access and work by heavy equipment must be sequenced and completed before the final trail prism can be shaped.

Once pioneered, the next passes build the cuts and fills to shape the trail prism and establish grade.

2. **Clearing.** This is the cutting of trees and heavy brush within the trail corridor (normally top of the cut to toe of the fill).

3. **Grubbing.** This is the removal of stumps and their roots.

4. **Slash disposal.** This entails the removal of all woody material from within the trail corridor.

The slope board and sheepsfoot roller are good finish grading tools.

A 37" wide mini-excavator constructs a single track trail and it looks wide and rough.

5. **Pioneering.** The next step is to rough in a tread or create a bench for the equipment to work on.

6. **Structures.** Unless there is other access, work on non-tread structures like bridges, culverts, and retaining walls as soon as there is adequate access to get materials, personnel, and equipment into the site. Depending on the terrain, this could start as soon as the pioneering is completed. Other structures like rolling dips, ditches, and sumps occur during excavation and embankment since excavated structures are usually used as a source of borrow material to help raise the grade of the trail tread.

Once riders have established a line, vegetation quickly re-establishes itself in the uncompacted portion and the trail now has a nice 18" natural-appearing tread.

7. **Excavation and embankment.** This is the process of establishing the grade and the desired trail prism. Cuts are excavated and fills or embankments are constructed.

8. **Finish grading.** Often referred to as the last pass, this is the final shaping and compacting of the trail tread and any related tread structures. This work must be consistent with the TMO and trail log.

The lack of pruning in the finish work has created poor sight distance at this trail junction. The ATV (arrow) is barely visible. The close decal spacing on the junction marker makes the numbers harder to read.

9. **Finish work.** This is all of the work that "makes it look pretty."

It includes:
- Final shaping and smoothing of cut and fill slopes;
- Pruning and lopping of roots protruding from the tread or cut slope;
- Installation of signing, cattle guards, fences, and gates;
- Constructing headwalls;
- Obliterating stockpiles, and equipment storage areas, staging and camping areas;
- Removing damaged vegetation;
- Closing undesignated areas;
- Final scattering of slash;
- Removing all flagging, stakes, or other construction controls;
- Seeding or replacing forest litter on all disturbed soil areas.

A new trail always looks rough and wide for the first year after construction. There has often been a lot of disturbance and it takes time for those impacts to heal. Once vegetation starts to re-establish and the unused portions of the trail tread and site get covered with forest litter, the trail will quickly appear to be narrower and more natural. However, this will only occur if the trail has been located, designed, and constructed properly.

Note: Though the process is the same for most trails, the sequencing of the process may not be the same due to the vegetation, topography, or complexity of the project. On many machine-built trails, grubbing, slash disposal, and pioneering occur simultaneously.

Management

No matter how the work is performed, there is a need for some level of construction oversight and project management. The agency usually provides this management, and the designers help to carry the project vision through construction. This work can also be outsourced to a contractor. Construction management includes project coordination, compliance inspection, documentation and reporting, information sharing, recognizing and avoiding pitfalls, and recognizing the need for change.

The project manager meets with a stakeholder to discuss maintenance of a road used by both parties. Meetings like this help foster relationships that are based on open communication and trust.

Project coordination. This can involve a multitude of tasks, including ensuring that materials and supplies are ordered and delivered so that the work can proceed in a timely fashion; sequencing the work so it flows smoothly and logically; scheduling, coordinating, and overseeing volunteer work parties or other trail crew work; ensuring that any required permits are secured; scheduling any required resource surveys; ensuring conformance with any seasonal work restrictions; meeting with stakeholders to

discuss issues or concerns; ensuring that construction controls are in place or replacing any that are missing or damaged; renting or repairing equipment; and purchasing any necessary tools or supplies that are needed by the work crews.

Compliance inspection. Regular inspections help keep the projects running smoothly.

The inspector:
- Ensures the specifications are adequate to produce the envisioned product.
- Ensures the work meets the intent and project specifications.
- Coordinates necessary parties to resolve any discrepancies between the product and the specifications.
- Ensures workers are in compliance with any required safety certifications.
- Strives to increase safety awareness, conducts safety briefings, and discusses job hazard analyses (JHAs).
- Observes the work and discusses any unsafe practices or conditions.
- Ensures compliance with any required work shutdowns for fire, wildlife, weather, etc.

Documentation and reporting. There is a saying "If it isn't in writing, it didn't happen". Document the progress and quality of the work, preferably on a daily basis. Take photographs. There can never be enough photos. It may be several months later before the team discovers that it needed documentation regarding events on a particular day. Ensure that volunteer records or records of any other personnel, materials, or equipment that is used as match for grants are kept.

Information sharing. Everyone likes to be in the know, and some parties need to know what is happening with the project. Use photos to prepare regular project updates for management, advisory committees, grantors, stakeholders, or the media. Photos are a great tool to document the progress of the project, increase project awareness, and increase political and public support for the project or agency.

Recognizing and avoiding pitfalls. Experienced trail project managers know how the work should be performed and when it should be performed. When something is out of sync or is heading in the wrong direction, taking immediate action to discover the cause can avert downtime, accidents, or other delays in the work progress or quality.

Trail construction is fun and rewarding because the team can see the trail take shape on the ground, but it can also have inherent hazards and risks. It is important to take appropriate action to minimize those hazards and mitigate the risks. This is especially important for equipment operations. Workers need to be trained in how to safely approach and how far to stay back from working equipment.

The operator is looking down to see what might stop him if something happens on steep ground. With loose soils, a spotter needs to be on-site.

There are times when equipment can be working in precarious locations. Some agencies require spotters or equipment safety personnel to be on site any time the equipment is working, but certainly when the risk is high, a spotter should be on site as should the project manager.

The project managers also need to be aware of the resource concerns and values in the project area and to take appropriate action when those are encountered. It is not uncommon to suddenly see an unusual population of plants; discover a TES nest or den; or unearth a bone, tooth, or arrowhead. Someone needs to be watchful in these situations because there are often legal protection requirements and what happens next can delay or stop the project altogether. Being forthright about any discoveries can build trust and credibility with resource specialists.

Recognizing the need for change. Implementation is the last chance to get it right. In spite of all of the concerted efforts in planning, design, and preconstruction, sometimes the intent just doesn't fit the ground as anticipated. The project managers need to be on the alert for these situations so changes can be made early before large amounts of time, money, or materials are invested.

Pitfalls

Weather delays. Either extremely dry or wet weather can preclude effective or safe trail construction or even access to the project site. If contract time is inadequate to accommodate these delays, a contract modification may be required that could delay construction or increase costs.

Material delivery delays. Sequencing, poor project management, or inclement weather can delay the delivery of materials and supplies. Depending on the amount of other types of work to be performed, this could delay or stop the construction progress. If the agency was responsible for providing these materials, a delivery delay could result in a claim and increased contract costs.

Any delay in material delivery, project sequencing, or weather could impede the completion of this major structure and perhaps other trail or project work.

This chicane was not designed. It was created by the equipment operator who wanted to make the trail more challenging. This should not be done.

The trail was designed (flagline) to go up a rock step-up which would have been consistent with other features on this trail, but the builder chose to avoid it by moving off to the right and putting in a 90 degree turn above the tree. The result is a loss of a challenge feature, tread durability, and flow.

Tip, Trick or Trap?

Tip: Great trail construction isn't about how much dirt you move, it's about how much dirt you conserve

Creative license. There are times when the flagline needs to be changed, but there are also times when the crew leader or equipment operator takes creative license and arbitrarily changes the design. Unless the crew leader or operator is also the project designer, this is inappropriate. If the trail has been properly designed, there has been a thought process involving analysis and informed decisions for the location of every flag and every aspect of the design. But the worker may not know, understand, or agree with those decisions. Any changes should be discussed with and approved by the designer or project management.

Failure to adhere to specifications on a complex trail like this can result in structure failure, resource impacts, and the loss of a considerable investment.

Unskilled operators. Equipment operators can make or break a project and make the construction process a joy or a hassle. They can take a great trail design and build a poor trail or take a poor trail design and create a great trail.

Inexperienced work crews or contractors. When it comes to trail construction, there is no replacement for experience. Trails can be intricate and require a great deal of innovation, field design, and finesse. Having someone who knows what to do, when to do it, how to do it, and how to appropriately adjust it for the site is invaluable. No matter how good the drawings and specifications are, they can't teach someone how to do the work. A local crew may be inexpensive, but if they're inexperienced and make mistakes, the long-term costs of maintenance, repair, or replacement can far outweigh the initial construction savings. Comprehensive specs and drawings along with a well-written evaluation of quotes may help ensure an experienced contractor and a quality product.

The deeper the cut, the higher the likelihood of encountering solid rock. Having air tool capabilities makes this less of an obstacle.

Inadequate oversight or contract administration. It doesn't do any good to prepare a thorough preconstruction packet if that packet isn't effectively administered in construction. Inexperienced oversight and inspection can lead to as many problems as inexperienced workers or operators. Unskilled oversight, infrequent site presence, unfamiliarity with the process or the end product, or permissive inspection that allows non-conformance with the specifications can all lead to poor agency-contractor relations, claims, and a substandard product. It can be difficult to confront someone when the product or procedure is not meeting a specification, but a contract is a legal and binding document for both the agency and the contractor. Both parties are at risk of claims when there is non-compliance with the specifications. The contract administrator manages that risk.

Equipment down time is project down time. The project manager and operator discuss the source of and remedy for a hydraulic leak.

Inadequate documentation. When something goes wrong, there is an immediate need to find out why it went wrong. It takes time and effort. There can never be enough photos, and daily diaries can never be too thorough.

Preconstruction errors. Preconstruction is the communication bridge between design and construction. No matter who performs the construction, shortcuts taken in the preconstruction process can become very evident and costly in the construction process.

Unanticipated site conditions. Any time excavation is involved, there is a chance of encountering any condition that was not evident from surface investigation. This can result in a design change, contract modification, lost time, and lost progress on the project. This risk can be minimized by digging at least cursory test holes during the design process. Any subsurface information should be outlined in the preconstruction documents. Bid costs will likely rise when excavation is required and subsurface information is nebulous.

Equipment breakdowns. With equipment, the question is not if, but when, there will be a breakdown. They rarely occur at an opportune time or location. No one can afford to have back-up equipment or a warehouse full of parts on site, so equipment downtime can mean project downtime unless there are other types of work to be performed.

Accidents. Trail construction has hazards and risks, but certainly a nightmare for any project is to have a vehicle, equipment, or personnel accident. Regardless of fault, everyone loses when an accident happens. Lost time, lost money, personal injury, workmen's compensation, an investigation, or a damage claim can result; it's all ugly and uncomfortable. Projects and OHV programs have collapsed due to accidents. Work diligently to manage the risk.

Change Construction Method. How a trail is to be constructed affects how the trail is located. A hand-built trail is not located the same as a machine-built trail. It can be a mistake to take a trail that was intended to be machine-built and build it by hand. A hand crew will take the path of least resistance and go around trees, stumps, and rocks. This will alter the designed flow of the trail and possibly the drainage. Likewise, a trail that was designed for hand-build may squeeze between features or go over terrain that a machine cannot traverse. If the construction method is going to be changed, take the time to adjust the flagline first.

Great trails are created through planning, design and construction. Great trails are kept through great maintenance and management.

Post-construction Management

A trail is most susceptible to the forces of compaction, displacement, and erosion during the first year after construction. Protect the investment. Consider closing the trail immediately after construction and let it sit over the winter or whenever the wet season occurs. Sometimes demand and political pressures are so high that this option is not practical, so consider closing the trail until there have been a couple of wet weather events. These options are especially important if the trail has been constructed during the dry season and the tread and embankments are unconsolidated. The weather will help provide natural compaction and cohesion.

A speed event was conducted on this trail shortly after it was constructed. The result: deep ruts and failure of designed drainage. Weather events will help consolidate a new trail tread, premature speed events can destroy it.

If possible, the first use on a trail should be light and low impact so displacement is minimized and compaction can occur slowly and evenly over the whole tread surface. Severe impacts can occur if an event is scheduled during that first year. With most soil types, a newly constructed trail cannot sustain a high volume of use in a short period of time.

Don't schedule a speed event within the first year of constructing a trail.

A Closer Look...

There is a perception that since trails have a small footprint, they are simple: anyone can design one and anyone can build one. That misconception has resulted in poor riding experiences, erosion, visual scars, resource impacts, and ultimately closures. Though riders or the motorized use are often blamed for these impacts, it was the poor location, design, and construction that created them. With a closure, riders lose recreation opportunities which often are not replaced. What isn't often recognized is that a closure represents a failure by the agency to effectively provide for and manage the use. One of the purposes of this book is to help agencies avoid that situation by giving them the tools to create great trails, either by building new ones or fixing old ones. A great trail is a success story. It's a win-win for the environment, the agency, and the riders. We can achieve that success only by the effective and equal implementation of all five components of the Great Trail Continuum.

Need more? Learn more here...

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

Standard Specifications for Construction of Trails and Trail Bridges on Forest Service Projects, National Technology and Development Program, October 2014; http://www.fs.fed.us/recreation/programs/trail-management/trailplans/

A Look Back...

Here are some of the elements discussed in this chapter:

- Preconstruction is the bridge between planning, design, and construction
- Preparing a detailed, comprehensive preconstruction packet will help carry the vision forward into construction, facilitate the construction process, and help ensure a quality product
- The supplemental contract clauses, special project specifications, project-specific drawings, and the trail log are the key places to individualize the project and transfer important information to a contractor
- Recognize the common preconstruction pitfalls and invest the time and effort required to avoid them
- The construction process is essentially the same for every project: mobilization, clearing, grubbing, slash disposal, pioneering, structures, excavation and embankment, finish grading, and finish work
- Whether performed by the agency or contractor, good construction management and contract administration are essential to ensure proper sequencing of the work, quality control, conformance with specifications, and coordination and communication between the agency, stakeholders, and the contractor
- Good post-construction management of the trail by temporarily closing or limiting use will help protect the integrity of the new trail and facilitate the re-establishment of vegetation

Chapter Seventeen
Conversion and Closure Techniques

Ride Right Today, Ride Again Tomorrow

Constructing an OHV project often involves natural surface roads. Almost every OHV trail project includes these roads to some degree, whether it's using natural surface roads as trails or converting abandoned roads to trails. There are benefits and risks to both, but often it is easier from an environmental analysis standpoint to re-purpose an existing impact rather than create a new one.

An excavator places debris and installs logs in a herringbone pattern to close off hillclimbs on a sensitive grassland. Note the hand-seeder and bucket of seed ready for immediate application.

Effective closure and rehabilitation techniques are essential to controlling and directing the use and providing resource protection. They are essential tasks when converting natural surface roads to trails. They also allow the managers to demonstrate the effectiveness of the program, which can reap significant political rewards that may garner support for the project, agency, and manager.

Converting Natural Surface Roads to Trails

A road conversion is not a paper exercise. It is all too common for managers to take a natural surface road, delete it from the road inventory, add it to the trail inventory, put up a sign, and call it a new trail. This is really the first step, but it does nothing to address the inherent issues with roads nor does it address the lack in quality of the recreation experience. Not dealing with those issues will likely result in resource impacts and management problems if not management failure. The second step is to physically transform the road corridor into a natural-looking trail corridor with a fun, flowing trail.

Field trips with stakeholders, media, and agency personnel are an excellent way to document progress on key issues and highlight your successes. They provide real-world perspective and foster communication and trust. The political power of these field trips cannot be overstated.

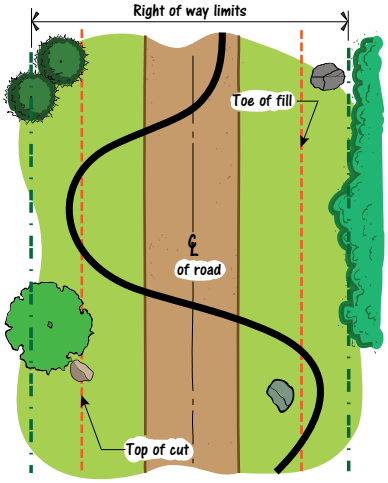
With a little creativity, many natural surface (NS) roads and abandoned railroad grades can be converted into quality trails. Leaving roads as they are and calling them trails results in trails that are too straight, too fast, too boring (too easy), and have poor drainage and poor water management. The objective of a successful conversion is to transform those negatives into positives.

Here are some key points on how to accomplish a successful conversion:

- Determine the operating parameters: what is considered "the road"? Is it the physical road or is it the road right-of-way? The right-of-way is wider than the road and will give designers more options to be creative. If it's the road, then normally that definition should be from the top of the cut to the toe of the fill.
- As with everything else, provide variety. If some segments of the NS road provide a good experience and have sustainable elements, leave them as is and work on other segments.
- In the segments that are left in their current condition on the existing alignment, narrow up the roadbed to the designed trail width, if possible, to reduce the size of the tread watershed.

- To provide horizontal flow, create a serpentine alignment within the road corridor. The degree of sinuosity will depend on the intended difficulty level and the amount of available vegetation and topography to provide screening and relief.
- To create vertical flow and roll, take the trail up to the top of the cut and back down or better yet, take it to the top of the cut and down to the toe of the fill if the topography will allow. This provides drainage and reduces the size of the tread watershed. It also provides a roller-coaster effect that increases the fun factor.
- If the NS road prism is flat, a serpentine alignment will still help with drainage by reducing grade and increasing the number of turns. If the NS road has a ditch line, run the trail through the ditch for drainage. If there are no other options, install rolling dips.
- Remove culverts in minor drainages and replace them with armored drains. This will reduce potential maintenance problems, provide a drain by dipping down into the channel, make the trail appear more natural, and increase the experience of the rider.
- If there is latitude, leave the NS road occasionally to dive into adjacent thickets or rock piles. A thicket allows the designers to tighten the alignment and reduce speed. Rocks provide an opportunity to increase challenge and variety.
- Drag in rocks, logs, stumps, and brush to help define and protect the integrity of the serpentine design. Transplanting clumps of living vegetation provides a natural-looking barrier. The objective is to break up and disguise the old road corridor as much as possible.
- Seed all disturbed areas, including the new trailbed, with a mix designed for the region. In the east, this may consist of replacing forest duff, which contains seeds and natural mulch for protection, and in the west it usually requires the application of a seed mix. Seeding the trailbed

Strategically placing readily available material can produce a significant difference in the horizontal alignment.



Converting roads to trails

Just moving the alignment onto this old berm increases horizontal and vertical flow and provides two drainage points.

Removing culverts reduces maintenance, restores natural hydrology, provides a dip for trail drainage, and improves aesthetics.

A ditch is being cut along this trail to drain the trail tread and intercept water seeping out of the inside bank. Note that the excavated material is being used to raise the elevation of the trail tread.

Tip, Trick or Trap?

Trap: If road conversion is just a paper exercise, it will likely fail

helps stabilize the soil during the first season, allows rapid establishment of vegetation on any unused (therefore uncompacted) portions of the trailbed, and helps combat invasive species. This will also help the trail appear more natural.

- To provide a good seedbed, rip all unused and unvegetated portions of the old roadbed.
- In the right growing climate, even if no other work is done, just stopping vegetative maintenance will allow brush to start encroaching into the road prism. Usually, just removing full-size vehicle use will eventually allow re-establishment of vegetation in the unused portion of the roadbed.
- Install entrance management structures, signing, and filters as needed.
- An excavator is a versatile tool for conversions since it can build trail, rip and close the old surface, pluck and place stumps and rocks, transplant clumps of living vegetation, and drag in debris.

The designer took advantage of this old landing to leave the road corridor to provide sinuosity and drainage.

This is a poor example of road to single track conversion because it's too straight and boring, but it does demonstrate how vegetation will re-establish itself once full-size vehicle use is removed leaving a near-perfect tread width of 12". Unfortunately, most of the vegetation is invasive and the road corridor should have been seeded to help combat this.

This road was half-ripped and entrance management was installed to deter full-size vehicles. Nine years later, vegetation has re-established and the road looks like a trail. The landscape is dynamic and it is important for designers to possess long-term vision.

Here the trail pitches up to the top of the cut bank, around some trees, and then back down again. Though short, it provides diversity for the rider, sinuosity, and drainage.

Not desirable, but we don't operate in a perfect world. This is a steep road approach and erosion was an issue. To reduce the tread watershed and provide effective drainage, half of the road was converted to a ditch and the excavation was used to raise the grade of the remaining half. Water was diverted off the trail at the top of the hill and a culvert was installed under the road at the bottom of the hill. It's working well and it looks good.

An excavator is a good tool for conversions. Here it is digging a hole to place a strategic rock. Boulders appear more natural and are harder to displace if they are dug into the ground rather than placed on top of the ground.

Rocks define a serpentine corridor which slows the riders before approaching the bridge. In this wet environment, this old road corridor will quickly transform into a great trail.

This road to trail conversion is adjacent to a major trailhead and campground and the kiddies kept riding the ripped up portion. We finally installed these juniper posts to deter that activity and they worked. Utilize the 4E's to implement, evaluate, and adjust as necessary.

Nothing was done to this road except remove the full-size vehicle use and stop vegetative maintenance. In this good growing environment, it has quickly converted to trail width complete with leg slappers. It would have been better to have a serpentine alignment, but at least in this segment, the road corridor is obscured.

One nice thing about a roadbed is that it can provide a wide platform to accommodate creative design. This feature provides drainage, but it also provides three approach lines and three different experiences. If more native rock had been available, three levels of technical challenge could have been provided also.

It isn't pretty, but stumps were available and the price was right. In a dry environment, it becomes more difficult to define and produce a serpentine alignment.

Tip, Trick or Trap?

Tip: Ensure that the use pattern has been successfully changed before investing in expensive rehabilitation treatments like transplanting or native seed mixes

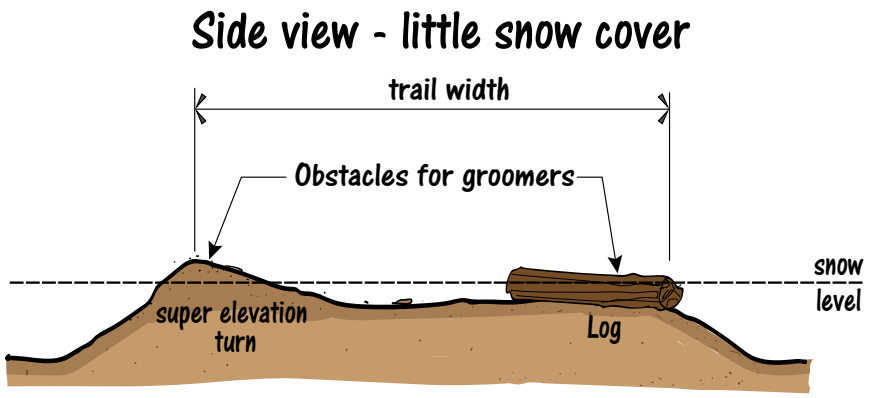
This is a poor conversion of a road to a trail. The road goes right up the bottom of this draw, the fall line, and there is no drainage for ½ mile. Though the grade is low, there has been enough erosion for the trail tread to have dropped more than 2 feet in 15 years. This will continue unless the trail is relocated out of the draw. With this gentle topography, a serpentine trail crossing to both sides of the draw would have been far more sustainable and fun.

This is great use of an old roadbed and a good example of techniques to reduce the size of the tread watershed. Half of the old road has been turned into a ditch to lead water into the culvert. Then the designer pitched up onto the cut bank to create a grade reversal which also added flow. Excess road width on the left side was removed (arrow) and used as fill to build a bench for the trail on the old cutbank.

Using Snowmobile Routes and Trails as OHV Trails

Because they are existing infrastructure, there is a temptation to use snowmobile trails as multi-season trails. There are pros and cons to using snowmobile routes and trails that the managers must evaluate to make an informed decision.

Routes. Many snowmobile trails utilize existing roads. If that is the case, then the normal road risks need to be considered: too flat, too straight, too fast, too boring, poor drainage, and large tread watersheds. Because most snowmobile trails are groomed, the ability to convert a snowmobile trail to an OHV trail is normally limited. Snowmobile groomers are not able to make as sharp or tight turns as an OHV. In areas with marginal snow depths, the groomers will not lay down a trail that will cover up superelevated turns or other obstacles in the OHV trail.



Trails. If the snowmobile trail is an actual trail and not a route, then there is another set of considerations:

- Since snowmobiles operate over frozen ground, the trail may cross over surfaces that are not sustainable or available when the ground is not frozen. These can include wet areas, farm fields, or drainage ditches. Prior to opening a winter trail to summer motorized use, the trail tread must be reviewed during spring or wet conditions to verify its sustainability.
- To hold snow, snowmobile trails are often located in draws to provide shade. This works for winter use, but in the summer, those draws can be water courses with soil, riparian vegetation, and wildlife concerns.
- To hold snow, snowmobile trails are often located on north-facing slopes. These slopes may have water issues in the summer.
- Snowmobile trails are not usually designed for wheeled vehicles. A snowmobile trail goes over the ground and, for the most part, stumps and groundcover vegetation are not disturbed. An OHV trail lies on or in the ground. Snowmobile moguls get groomed out, but OHV ruts will channel water.
- Because they are groomed, snowmobile trails will have a wider corridor and flatter horizontal and vertical curves. This can compromise the trail experience and decrease challenge and flow.
- Drainage is normally less of an issue on snowmobile trails, so there can be long, steep grades and large tread watersheds that will be detrimental and not sustainable for an OHV trail.

The trailhead for this OHV trail is a snowmobile parking lot and access limitations forced co-location of the trails. A serpentine OHV trail meanders down this snowmobile trail corridor and it works well at this site. In 5 years, the Yield Ahead sign has not been hit by the groomer, but note how the Yield symbol has faded.

If the decision is to use a groomed snowmobile trail, then managers and designers can incorporate the same techniques described for natural surface road to trail conversions, but on a conservative scale. Whatever is done must not hinder grooming operations, including OHV trail signing. If winter signing is not applicable to summer use, then those signs should be covered or replaced with multi-use signs or changed to fit the season.

Effective Closure and Rehabilitation Techniques

There are political benefits of effective trail closure and rehabilitation. Past impacts need to be rectified to ensure future use. Although riders tend to see closure as a negative, a loss of riding opportunity whether it was good or bad, closures are usually a necessity for effective OHV management. The goal for an effective closure is to plan it and implement it so it changes from a lose-win to a win-win scenario.

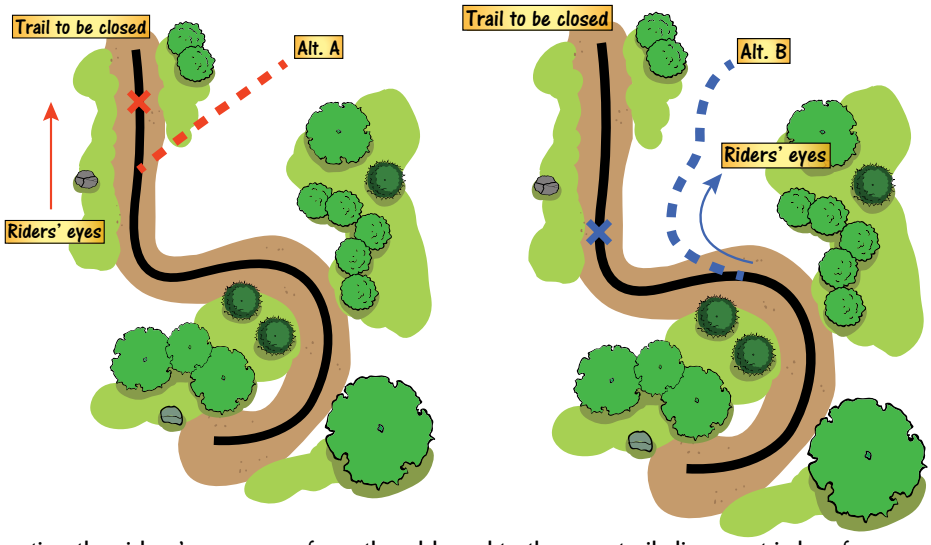
Whether closing a trail, trail segment, road, or area, the closure and subsequent rehabilitation process is essentially the same. To determine the best closure strategy, consider the intensity of use (high versus low), duration of use (historic versus recent), proximity to high traffic areas (trailheads, staging areas, destinations), visibility (who can see it, from how many vantage points, from how far away?), growing climate (wet versus arid), political climate (risk to public safety, agency risk, risk to resources to be protected), and management history (new program versus established program, good versus poor compliance or success).

Tip, Trick or Trap?

Tip: Avoid closing one trail before opening another

Below are the nine steps to success. Not all of these steps have to be implemented, but the chances of success will increase with an increase in the number of steps taken.

1. **Provide an alternate route.** Before starting closure and rehabilitation work, it is essential that the existing use is redirected.



Directing the riders' eyes away from the old road to the new trail alignment is key for increases compliance.

The best way to accomplish that is by:

- Providing an alternative route that still connects Point A to Point B, if possible;
- If circumvention is not possible, providing an attractive route(s) someplace else;
- Ensuring that any new trail is of a higher quality (longer, more fun, more challenging) than the one being closed; and
- Informing the riders of these changes before starting the closure process.

The key point is to not close a trail before opening another route and to try to give riders something more than they lost. When riders realize that they can still get to where they want to go or have a new higher quality opportunity, compliance with the closure will significantly increase.

2. **Manage the riders' eyes.** If managers don't want the riders to go somewhere, avoid focusing their eyes on that location. This is especially important for closures and rehabilitation. Focus the riders' eyes away from the corridor to be closed so the closure will be more effective.

3. **Restore natural drainage patterns.** If the trail to be closed is a fall line trail, water will run down it and not in the natural drainageways. Install lead-off ditches to intercept this water and direct it back into the natural drainage course.

4. **Install erosion control.** Controlling water volume and velocity is essential to effective closure and rehabilitation. Erosion control structures need to be installed to heal the impacts of past erosion and reduce the potential for future erosion.

Here are some considerations for erosion control methods:

- In deeper trenches, install check dams to help divert water into the lead-off ditches above.
- Between ditches or if ditches are not required, installing check dams in the trench at regular intervals will decrease the velocity of the water and allow it to drop its sediment load. The sediment provides a seedbed to aid in the re-establishment of vegetation. Eventually, the sediment will build up and help stabilize the sides of the trench.
- Check dams are normally made of logs or rocks, but sandbags and hay bales also work well. They are more temporary, but they usually last long enough for vegetation to get re-established.

Steep, unstable ground forced the trail to stay on the existing roadbed, but the designer has created a nice sinuous flow. Ripping the unused portion of the road increases water absorption and decreases the tread watershed.

- If check dams are not required, install soil, rock, or log waterbars at regular intervals.
- Placing logs or rocks in a herringbone pattern works well to control water and stabilize the erosion process. Using sandbags, hay bales, or straw wattles works well if native material is not available.
- Even just throwing woody debris into the trench will help.
- Placing logs at an angle across hillclimbs will serve as waterbars and help deter use.
- For roads, remove culverts and restore natural drainage channels.

It was a struggle to revegetate this road corridor. Seed was tried first and failed. Next transplanting was done and it failed also. Finally, a wildfire burned it and the next spring, it looked great.

5. **Rip or scarify.** Scarifying is scratching the surface and ripping is gouging the soil 12 to 18 inches deep. The goal is to break up the compacted soil to make it a good seedbed and to increase the soil's capacity to absorb water. Whether to rip or scarify depends on the soil type and depth of compaction. Whichever method is used, it is best to rip in a sinuous line rather than a straight line. This is accomplished by alternately locking one track and then the other. The "S" pattern improves the aesthetics of the product, loosens the soil better, produces smaller clumps of soil, reduces the potential flow of water down the ruts, and often drags in vegetation and debris from the sides of the road or trail.

6. **Disguise the corridor.** This involves dragging in rocks, brush, stumps, logs, and clumps of vegetation to break up the line of the old corridor and visually disguise it. At a minimum, this is done as far as the eye can see at the termini of the closure. But if the trail can be seen from other vantage points, then the whole length of the closure needs to be treated. As in road conversions, an excavator is a good tool to quickly accomplish this work. Don't go overboard with falling trees or piling brush to block the corridor. The goal is to make the corridor look natural and a mass of jackstrawed trees can actually draw attention to the corridor. That being said, it can be difficult to close and disguise a corridor that has been used traditionally by wildlife or livestock. In these cases, fencing or heavier debris placement is needed to discourage use.

Depending on the tree species and size (juniper works well), consider creating living barriers by making a backcut only and carefully pushing the tree over so it remains attached to the stump. The tree will stay green and provide more of a visual barrier to disguise the corridor, and a tree that is attached to the stump is much harder to move out of the way.

7. **Re-establish vegetation.** In most places, this is best done in the fall so the seed can germinate with the warmth and moisture of the spring; however, it is also best to seed or replace forest duff immediately after the ripping or scarifying. Some soils can form a crust that can inhibit the penetration of the seed into the soil and reduce germination success. Transplanting clumps of vegetation with the roots intact can provide an instant visual barrier that will last.

In some regions, seed doesn't take well and there can often be better success by transplanting native vegetation. This can be labor-intensive and expensive, but it can also make a great volunteer project.

Consult with a specialist to determine the best seed mix for the climate and region or if native seed mixes are required. If it is unclear if the use pattern has been changed, then seed with a quick-growing annual seed. This will supply the needed visual effect and soil stabilization in the short term until the more expensive treatments can be applied for the long term.

Fires can be devastating, but their heat releases seeds that have been buried dormant in the soil for years. That's why burned areas are so green the following spring. Fire can be a good tool to establish vegetation in difficult areas and to help hide visual scars on open slopes.

Adding straw or other mulch on top of the seed helps protect the seed from displacement during weather events and fosters germination by providing a cooler and wetter microclimate.

8. **Install signing and barriers.** Sometimes just the disguising will be enough to deter use, but signing and barriers are often needed for a site that is highly visible or has had a high level of traditional use. Sometimes a sign can be installed first and if that doesn't work, then back it up with a barrier. A good sign explains the closure, the reasoning for the closure, and redirects the riders to the new routes.

The living barrier is a great technique for a well-anchored, long-term visual obstruction. No undercut and the backcut is only deep enough to be able to push the tree over.

Here are some thoughts regarding signing and barriers:

- Always install the sign in the middle of the trail to be closed, not off to the side. The sign makes more of a statement and more of a barrier when placed in the middle of the trail.
- Whenever possible, drag in a log, brush, or even sticks and place them directly behind the sign. Though small, this creates an additional visual barrier, but more importantly it helps in managing the riders' eyes, which are usually scanning for the path of least resistance. A simple stick can turn the riders' attention elsewhere.
- Signing that explains the rationale for the closure can increase its effectiveness.
- It takes more time and money, but a manmade barrier is more effective at deterring use than natural debris. A tree can fall down and riders are used to seeing natural debris. When a conscious effort is made to install a barrier, it makes a stronger statement both visually and psychologically.
- Put debris behind a sign and a barrier in front of the sign.
- Barriers send a message, but they don't need to be a physical deterrent. Often a simple low barrier is equally effective and less visually intrusive than a multi-rail fence.
- Do not use tank traps as a barrier when closing roads. Ripping and debris are more effective and reduce agency risk.

- Rarely does installing only a sign alone work. Back up the sign with ripping, debris, or barriers.
- Don't invite failure or risk. Never install a fence or barrier across a trail that has not been ripped, blocked, and signed as closed.

9. **Utilize the 4Es.** Effective application of the 4Es is essential to the success of any closure effort.

Some key points are:

- Engineering is used in the design and placement of erosion control structures. It is also used in the design of the signing and barriers. Opening another, nearby route that is designed before the trail is closed will increase compliance.
- Educate the riders. Use posters on the kiosk; place notices in club newsletters, the media, the agency or trail system website; or use social media to inform riders of the closure and why the trail is being closed. They may not agree with it, but compliance will be better if they understand the rationale behind the closure.
- In some situations, enforcement may be needed, but again effective engineering and education will reduce the need for enforcement.
- Evaluation is critical. The site must be monitored for effectiveness and any breaches or missing signs must be fixed immediately. People sometimes initially push back, but persistence by the agency will usually squash that quickly since most people have better things to do. When dealing with the public, nothing is ever 100 percent guaranteed.
- Make necessary adjustments. As compliance is ensured and the vegetation is becoming established, consider removing the signs and then the barriers to avoid drawing attention to the site.
- Finally, document successes. What method(s) worked the best? Take before, during, and after photos. They can be a valuable tool to garner political support and to help ensure the acceptance and success of future actions. Conduct field trips with stakeholders, media, and agency personnel to highlight the management successes.

Expect setbacks, but use the 4Es to determine the cause and beef up the engineering, education, or enforcement to correct them.

An example of poor sign placement. Granted no one will run over this sign since it's protected by the tree, but with no ripping, disguising, or barrier, this closure is totally ineffective.

If the ATV wasn't in the picture, one would wonder which trail is closed, or maybe both are open and the sign means no cross-country travel. This sign fails to clearly communicate the intent of management.

This was a high-use, historic trail that went through several sensitive plant populations. A by-pass trail was constructed and in four years, there was only one breach which happened immediately after the closure. There was a Trail Closed sign, but the botanist recommended taking it down since the trail was healing up so well. A few years later, the barrier was removed as well. The small bitterbrush plants in the foreground were transplanted by hand.

An excavator has just finished scarifying, adding drainage, and scattering debris. The project manager followed by taking down stakes and flagging and seeding all disturbed areas.

This is the same site nine months later with 100% compliance. A good example of effective rehab and closure.

These are good, simple signs that are effective and to the point.

This is a sandy site that had been rehabbed two years earlier. The soil is stable and vegetation is starting to re-establish. The "path" on the outer edge of the trail has been made by cows. This will deter the revegetation and water may eventually run down that path. Rider compliance has been 100%.

It appears that use has been eliminated on this well-disguised road and the revegetation is well on its way. Depending on where the riders' eyes are focused, it may be time to consider taking down the sign since it is now drawing attention to a site that is pretty well camouflaged.

There are risks of using tank traps for closures. They make a poor closure device and invite failure. Once again, the road leading up to the structure and beyond it was not ripped or blocked. This road is adjacent to a subdivision where residents wanted OHV access to the forest. Converting this road to a trail may have been a better management strategy than trying to close it. When possible, work with human nature rather than against it.

Managing OHV use in the desert can be tough since it's physically possible to ride almost anywhere. Here, riders were short-cutting a curve in the trail, but after placing a simple row of rocks as a visual deterrent, there are no tracks on the short-cut. No signs and no expensive barriers were needed to change the use pattern.

Just above this site, a ditch was installed to direct water into the natural drainageway. Check dams were installed in the trench near an equipment access point. Woody debris was placed in a herringbone pattern between check dams. The treatment was a little overboard, but the political sensitivity was very high. The far left photo is how the area looked on the day of treatment. The left photo was taken two weeks later.

The woody debris effectively manages the riders' eyes at this site, but the signs give a mixed message. The area is closed, so stay on the closed trail? Stay on Trail or Stay Home should be used as an education sign on an open trail, not a closed one.

This low, simple barrier and some Area Closed signs have effectively protected this pumice flat with several populations of sensitive plants.

Review the considerations for developing a closure strategy. Obviously, just putting up a sign and a fence which is now cut was not adequate. Without an alternate route, trying to close a trail that appears open is difficult without ripping and blocking. The riders get blamed for these breaches, but poor management is equally at fault.

This is a good example of what not to do. Obviously, there had been an issue with OHVs riding through the creek, but a well-designed fence or barrier directing riders to the bridge would be far more effective and visually appealing than this clutter.

Before and five years later. Once a hot-bed of controversy, a major trail ran through this stream that feeds a community water supply. The access trail was effectively closed and rehabbed and the site has totally recovered. WOW. This book is about great trails, but a great trail is a package that includes not only the trail, but the successful management of the trail and the area around it.

Once in the dense trees all of these hill-climbs have been effectively blocked and rehabbed, but a lack of funding has prevented further work at this site adjacent to a prior staging area. The sign alone is ineffective and look at the amount of sedimentation. In an area dominated by OHV management success, this highly visible site gives the impression of failure and sends the wrong message to visitors on their way to the new trailhead.

This section of road has been effectively closed and around the corner, the rest of the road has been converted to a trail. Leaving the road marker here only invites a breach by a full-size vehicle.

Some areas require intensive techniques, but with the proper funding, materials, and expertise, successful closure and rehab can be achieved.

This more formidable barrier was destined for failure due to improper and ineffective closure techniques.

A Look Back...

Here are some of the elements discussed in this chapter:

- There are benefits and risks in converting roads to trails. If done properly, the risks are minimized and the benefits are maximized.
- Effectively converting a road to a great trail requires creativity and vision.
- The versatility of an excavator makes it a good machine for both conversion and closure.
- Before considering using snowmobile trails as OHV trails, understand the site and the risks to make an informed decision.
- Successful closure and rehabilitation techniques are essential to controlling and directing the use and providing resource protection.
- By demonstrating adept OHV management, there can be political benefits that can bolster project support.
- Effective closure includes implementing as many of the following steps as possible in a given situation:
  - Provide an alternative route. Avoid closing one trail before opening another.
  - Manage the riders' eyes.
  - Restore natural drainage patterns.
  - Install erosion control.
  - Rip or scarify.
  - Disguise the corridor.
  - Incorporate effective measures to revegetate the site (seeding, transplanting, burning, spreading forest litter, etc.).
  - Install signing and barriers. Do not install a fence across a trail that has not been ripped or blocked.
  - Utilize the 4Es.
- A great trail is a package; it's a composition of elements that includes not just the trail, but the successful management of the trail and the area around it.