CTIP News

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In This Issue:

U.S. Department of Transportation
Federal Highway Administration

The Coordinated Federal Lands Highway Technology Implementation Program (CTIP) is a cooperative technology deployment and sharing program between the FHWA Federal Lands Highway office and the Federal land management agencies. It provides a forum for identifying, studying, documenting, and transferring new technology to the transportation community. More information about the CTIP program is available online at http://www.ctiponline.org

Native Revegetation Web site – The Art & Science of Revegetation

The Coordinated Technology Implementation Program (CTIP) recently launched the Native Revegetation web site (www.nativerevegetation.org) to help disseminate information about using native plants to revegetate roadsides after construction. This web site integrates *Roadside Revegetation: An Integrated Approach to Establishing Native Plants* FHWA-WFL/TD-07-005 and *A Manager's Guide to Roadside Revegetation Using Native Plants* FHWA-WFL/TD-07-006. The Native Revegetation comprehensive manual has been widely distributed and used by professionals throughout the country as well as internationally. It has also been used as textbook in a number of universities. To further build upon the success of the manual and the desire to reach an even wider audience, the web site was created and launched. It is a valuable tool for finding information in order to successfully design, create, manage, and implement native revegetation during a road construction project.

The web site is divided into three main sections: Learn, Train, and Visualize. The Learn section contains all of the information from the roadside revegetation manual and presented in an easy to navigate, chapter by chapter, method. The manual and manger's guide are also available for download. The Train section provides on-line training modules which highlight the major steps in the revegetation process. Each of the six modules is designed to take about thirty minutes to complete. The modules also include relevant links to other web sites for additional information. The Visualize section of the site uses interactive features to show how the different variables can influence the effectiveness of site revegetation. This section also includes links to other relevant web sites for supplemental information.

Please visit the site at http://www.nativerevegetation.org.

For more information or copies of these publications, please contact

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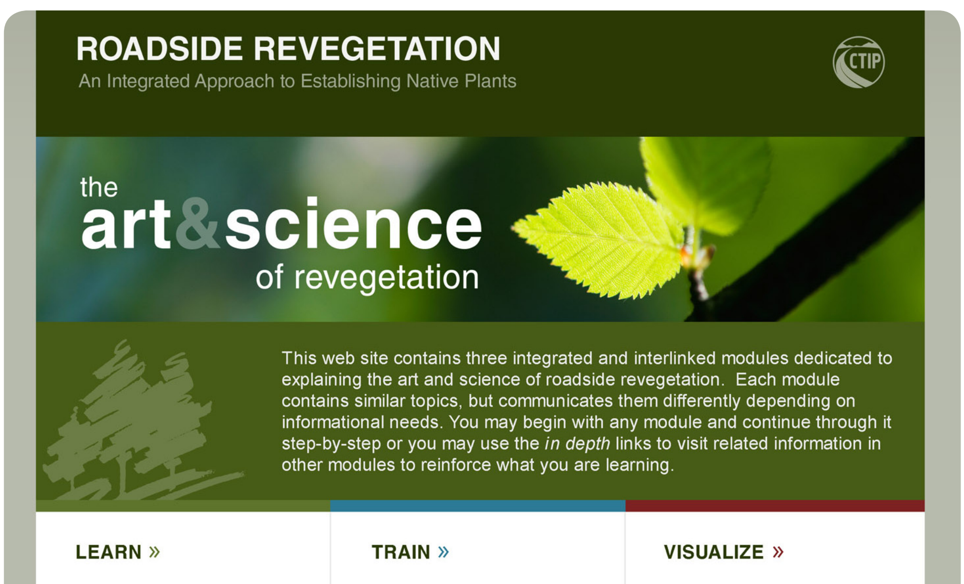


Screenshot of http://www.nativerevegetation.org.

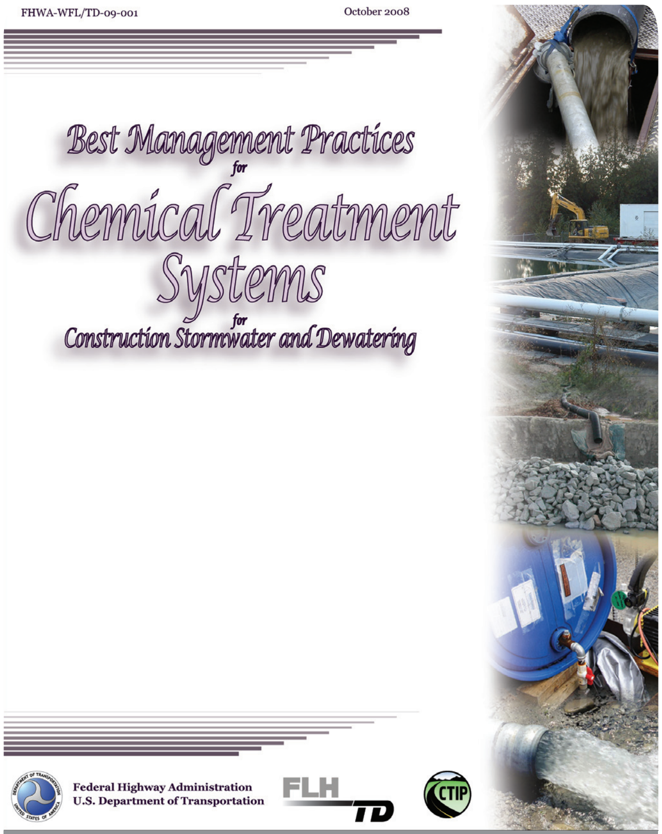
Best Management Practices for Chemical Treatment Systems for Highway Construction

The typical construction footprint is much larger than the road prism and results in disturbance to soil and vegetation. To protect the natural environment, the sediment runoff from the construction site is treated either by physical systems (silt fences, filter fabric, detention ponds, infiltration basins, etc.) or by chemical systems.

Example of a Simple Chemical Treatment System

Chemical treatment systems (CTS) are implemented in areas where traditional, physical erosion and sediment control practices will not meet water quality goals for construction site runoff. They are not intended to replace traditional erosion and sediment control practices, which are the most important and cost-effective approaches to reducing sediment loads in stormwater discharge.

The purpose of CTS is to reduce the amount of suspended sediment which would be released using conventional erosion control systems. This sediment consists of clays and fine silts which are very slow to settle even under ideal conditions in settling basins. The primary mechanism is the introduction of chemical flocculants into runoff, resulting in a binding of the suspended clays and silts together into larger particles which settle more quickly or can be filtered from the stormwater.



FHWA-WFL/TD-09-001

Flow control through CTS is of vital importance for the proper dosing of stormwater runoff. All normal hydrologic analyses must be done to ensure that reasonable peak flows are accounted for along with typical flows from designed storm events. Once analysis is adequately addressed, then the project can deal with the complexities of design and dose rate requirements. Proper dosing, mixing, and settling times are needed for CTS to be effective. Also, matching the right flocculants to a specific sediment and water chemistry is important. In addition, disposal and final stabilization of the flocculated materials must be planned for in advance and monitored during system operation.

Recently, CTIP published *Best Management Practices for Chemical Treatment Systems for Construction Stormwater and Dewatering* (FHWA-WFL/TD-09-001). These best management practices focus on the design and use of active CTS, and do not directly address the use of passive systems. Active systems involve treating pumped stormwater using chemicals that are metered into the flow at a known dose rate. Passive systems use the flow of stormwater to dissolve the flocculants from a solid form (blocks, granules, socks, etc.) prior to a mixing and settling system.

An electronic version of this publication is available for download at:

http://www.wfl.fhwa.dot.gov/td/publications

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Deploying Warm Mix Asphalt Technology

The implementation of warm mix technology substantially reduces the temperatures at which asphalt mixtures are produced. This product has environmental, economic, and manufacturing benefits that would be realized by the agencies implementing this technology and the contracting community. Since the performance of this material is stated to be equal to or better than hot mix asphalt, there should be no concerns associated with using this technology.

During 2007-2008, CTIP funded the placement of warm mix asphalt on a section of roadway in Yellowstone National Park. The results of this technology deployment project are summarized in *Placement of Warm Mix Asphalt on the East Entrance Road of Yellowstone National Park* (FHWA-WFL/TD-09-002). During this project two types of warm mix additives, Advera and Sasobit, were placed and compared to a control section of conventional hot mix asphalt. Using infrared imaging techniques and statistical analyses several important things were discovered. The study findings are summarized here:

- Visible smoke and fumes were substantially reduced in both of the warm asphalt mixes. Workers noted no handling difficulties of the warm asphalt mixtures at the reduced temperatures.
- Temperatures at the hot plant were difficult to regulate at the lower warm mix asphalt temperatures. Hot plant operators may need to make specific burner adjustments when producing mixtures at reduced temperatures.
- From a review of infrared thermal images, both of the warm mixes exhibited a more uniform windrow and mat temperature when compared to the control mix.
- Both warm mix additives examined in this technology deployment aided in the compaction process of the mix. This was exhibited both in mix design specimens that exhibited lower air void content than the control, as well as the as constructed pavement with average core densities higher than the control. All mixtures met the density requirement established in the contract with the warm asphalt mixtures providing the highest density values.
- Tests of the virgin binder that was modified with 1.5% Sasobit indicated a stiffening of the binder both on the upper and lower temperature values. This was not consistent with the results from the testing of the recovered binder from produced mix which did not indicate significant stiffening.
- The tensile strength ratio testing provided consistent results with all three of the mixtures. Based on these results, none of the mixtures exhibited stripping characteristics. The results also indicate that the addition of 1% hydrated lime as an anti-strip agent in all of the mixes proved to be effective.
- The Hamburg rutting results indicate generally good performance by all of the mixtures; however, it was noted that the Sasobit mixture had the lowest rutting depths.
- Similar to the Hamburg results, the Asphalt Pavement Analyzer rutting results indicated good rut resistance for all of the mixtures with the Sasobit mixture having the lowest rut depth.
- There is definite fuel savings realized when using Advera and Sasobit as warm mix additives due to a reduction in the fuel used to heat the aggregates. Additional factors such as construction processes, hot plant operations, plant modifications, and location of project will certainly have an impact on the cost benefit analysis of using these additives. A complete cost benefit analysis was not performed on this project.

This technology deployment effort provided knowledge and experience in the placement and evaluation of warm mix asphalt. In doing so, it provided specific information to the agency and construction industry in the potential for this technology to be used in future Federal Lands Highway construction projects. This roadway will be monitored to evaluate the performance of these mixtures in order to evaluate the long-term performance of the warm mix asphalt when compared to conventional hot mix.

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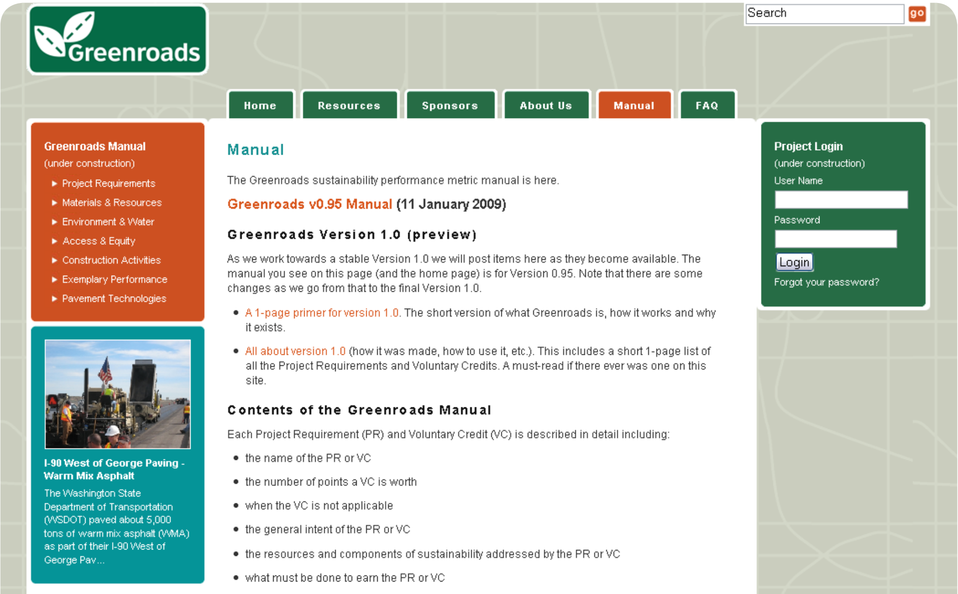
Laydown operation of warm mix.

Greenroads – Best Management Practices for Building Sustainable Roads on Federal Lands

Greenroads is a sustainability performance metric for roadway design and construction. It is essentially a collection of sustainability best practices that apply to roadways. These best practices are divided into two types: required and voluntary. Required best practices are those that must be done as a minimum in order for a roadway to be considered a Greenroad, defined as roadway project that has been designed and constructed to a level of sustainability that is substantially higher than current common practice. These are called "Project Requirements," of which there are 11. Voluntary best practices are those that may optionally be included in a roadway project. These are called "Voluntary Credits and each is assigned a point value (1-5 points) depending upon its impact on sustainability. Currently, there are 37 Voluntary Credits totaling 108 points. Greenroads also allows a project or organization to create and use its own Voluntary Credits (called "Custom Credits"), subject to approval of Greenroads.

When in full operation, project teams would apply for points by submitting specific documentation in support of the Project Requirement or Voluntary Credit they are pursuing. These documents would then be verified by an independent review team and a score assigned. This score may then be used at the owner's discretion and may also be translated to a standard achievement level if so desired: the more points earned, the higher the recognition. Road designers, managers, and practitioners can use Greenroads to:

- Encourage more sustainable practices in roadway design and construction;
- Provide a standard quantitative means of roadway sustainability assessment;
- Allow informed decisions and trade-offs regarding roadway sustainability;
- Enable owner organizations to confer benefits on sustainable road projects; and
- Establish an implementable baseline requirement for roadway sustainability.



Screenshot of http://www.greenroads.us.

The concept of the Greenroads program initially began with the Civil and Environmental Engineering Department at the University of Washington. Since then, the University of Washington has teamed up with CH2M HILL to develop a basic framework for the Greenroads system. Greenroads Version 1.0 was released by the University of Washington in January 2010 (http://www.greenroads.us).

While the initial focus of Greenroads was on urban streets and high volume roads, the CTIP funded project is focused on developing criteria for low-volume rural and scenic roads as well as defining best management practices for building more sustainable roads on federal lands. Representatives from the Office of Federal Lands Highway of FHWA, Washington State Department of Transportation, National Park Service, Fish and Wildlife Service, and USDA-Forest Service are instrumental in developing the criteria for low-volume rural and scenic roads. The draft criteria developed during this project are being piloted on a number of federal lands projects this summer and fall.

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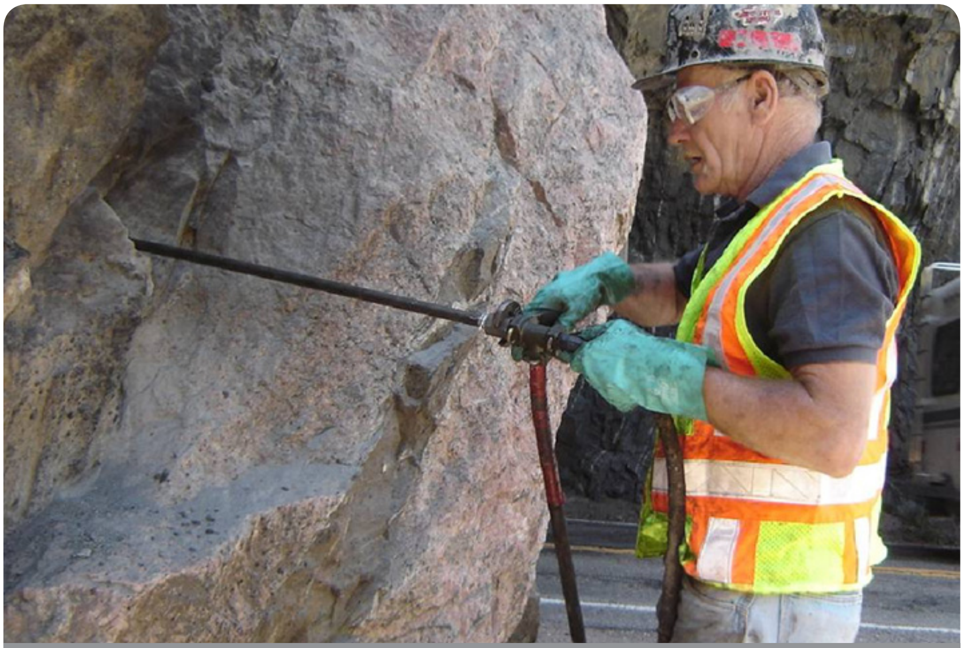
Polyurethane Resin Reinforcement

Since the 1960s, polyurethane resin (PUR) has been used to help stabilize strata in underground coal mines. More recently, other uses for PUR injection have been found in addition to soil stabilization, including slope stabilization, roadway subsidence remediation, tieback anchor repair, tunnel repair, concrete structure rehabilitation, and erosion control. One of the key advantages of PUR is that it has been shown to be effective in stabilizing sensitive historic, cultural, and environmental features, while maintaining the original structure's visual aesthetics.



PUR being injected into the rock slope.

The Federal Highway Administration (FHWA) Office of Federal Lands Highway (FLH) recently investigated the application of PUR injection as a rapidly deployed, cost-effective ground structure stabilization method. Application objectives included the preservation of historic, cultural, and other environmentally sensitive natural and man-made features, while maintaining the original visual characteristics and aesthetic appeal. *Polyurethane Resin (PUR) Injection for Rock Mass Stabilization* (FHWA-CFL/TD-08-004) documents current PUR injection practices and provides guidelines for the selection, use, and specification of PUR products.

Most recently, in cooperation with the Colorado Department of Transportation (CDOT), FLH completed full-scale PUR demonstration projects at a historic tunnel located along State Highway 14 in the scenic Poudre Canyon west of Ft. Collins, CO, and at a dry-stack stone masonry retaining wall supporting State Highway 149 along the Rio Grande River northwest of South Fork, CO. The Poudre Canyon demonstration involved PUR injection and stabilization of a previously bolted section of the western tunnel portal, where annual freeze/thaw cycles and rock mass creep toward the adjacent Cache La Poudre River were contributing to rock mass instability. The South Fork demonstration involved PUR injection within a culturally-sensitive dry-stack stone masonry wall that was progressively failing. In addition to the FLH sites, CDOT also contributed PUR injection data from a recent rock slope stabilization project along highway US 6 in Clear Creek Canyon just west of Golden, CO.

Based on the "lessons learned" from these investigations, application guidance has been developed for the selection of polyurethane resin products and injection methods to stabilize failing rock-masses (e.g., rock slopes, unique rock promontories, escarpments), and to preserve aging and/or deteriorating man-made structures (e.g., historic retaining walls, archeological structures).

PUR stabilization of the historic tunnel located along State Highway 14.

An electronic version of this publication is available for download at: http://www.cflhd.gov/techDevelopment/completed_projects.

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Promoting Bicycling on Federal Lands

Former President John F. Kennedy was once quoted as saying, "Nothing compares to the simple pleasure of a bike ride." In keeping with the spirit of this statement and noticing the advantages of bicycling, the FHWA Office of Federal Lands Highway sought to review current policies and practices regarding bicycling on federal lands. Since increased number of automobiles can cause congestion and may degrade visitor experience, bicycle use is being promoted as more eco-friendly alternative. However, the increased presence of bicyclists on scenic roadways has led to safety concerns.

Common sign designating the presence of bicycles.

Recently published, the *Guide to Promoting Bicycling on Federal Lands* (FHWA-CFL/TD-08-007) highlights the benefits of bicycling, explains current programs that emphasize cycling, and addresses challenges associated with the implementation of bicycles in an automobile dominant culture. In addition to being a good source of exercise, cycling can enhance visitor experience by encouraging them to slow down and observe nature as well as provide access to areas inaccessible to automobiles. Replacing automobile use with bicycles is also advantageous because it reduces air pollution, traffic congestion, and parking shortages.

During this study, twelve specific bicycling programs from across the country were examined and analyzed. For each program, an explanation of the issue that prompted the use of bicycles; details of the program's implementation; and information about the results, struggles, and successes, were provided. A section of the guide is devoted to providing information about policies and challenges pertaining to different Federal agencies. The guide also provides recommendations that address the challenges associated with the implementation and promotion of bicycling.

An electronic version of this publication is available for download at: http://www.cflhd.gov/techDevelopment/completed_projects.

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Travelers enjoying the scenery via bicycles.

Stabilization Selection Guide for Aggregate- and Native-Surfaced Low Volume Roads

Soil stabilizers can be used to treat the upper several inches of soil or aggregate surfaces of low-volume roads (LVRs) when the strength or other properties of the in-place soil do not meet the desired or required levels for anticipated traffic. Soil can be either modified or stabilized by many methods, including chemical, mechanical, thermal, and electrical. Modification is generally short term and includes benefits such as improvement in workability thereby expediting construction and saving time and money. Stabilization generally results in a longer term strength gain.

The USDA Forest service recently published *Stabilization Selection Guide for Aggregate- and Native-Surfaced Low Volume Roads*. This publication was designed to include information for both chemical and mechanical approaches.

The purpose of the guide is to facilitate the selection of modification/stabilization agents and techniques for aggregate surfaced and native/unsurfaced LVRs. The objective is to provide low-cost alternatives that reduce aggregate wear and loss, reduce road-surface maintenance (i.e., blading out ruts), and reduce the time period between major rehabilitation (i.e., between adding new aggregate or the total reconditioning of the road structure).

This guide provides information on available stabilizing agents, appropriate conditions for use, selection procedures, quantity determination, and contact information for manufacturers/suppliers. Emphasis is on the modification/stabilization of existing in-place road surface materials, but many of the methods can be used in the construction of new roads. Construction procedures for application are also presented.

The intended audience includes road managers, engineers, and technicians involved in road maintenance, construction, and reconstruction. Those involved in trail maintenance and construction also may find the guide beneficial, as stabilizers used on trails, particularly accessible trails, help provide a smooth, durable surface.

An electronic version of this publication is available for download at:

http://www.fs.fed.us/eng/pubs.

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Gravel placed on top of a geosynthetic material.

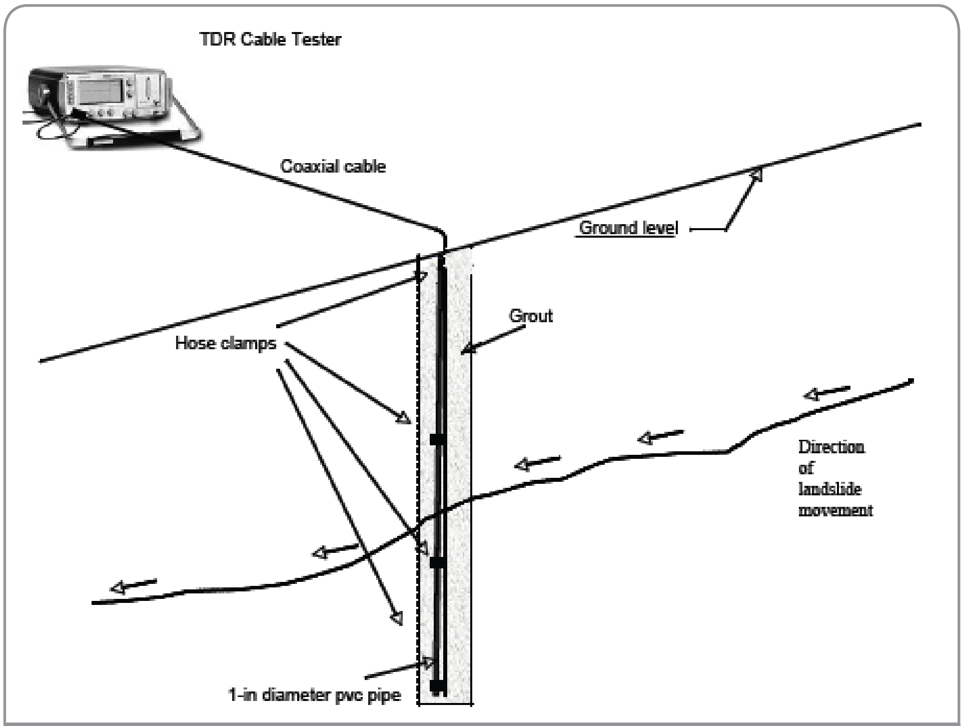
Application of dry chloride.

Spreading and compacting the freshly placed surface material.

Slope Stability and TDR

The stability of a slope is crucial for road construction and maintenance. Slope movement can be monitored by a number of methods and pieces of advanced equipment. However, using time domain reflectometry (TDR) is one of the least expensive methods.

TDR operates by sending a signal through a cable and measuring the reflected waveform. The amplitude and shape of the wave will change based upon the relative change in impedance. By using mathematical equations, the location of the discontinuity can be located. Discontinuity and instability arise due to differential movement of one section of the soil or rock mass relative to another section. When measuring slope movement of a road, the cable is placed in a bore-hole and transects the slide surface so that the cable will be bent, stretched, or sheared. A comparison of a collected signal can be made to the signal obtained when the cable was first placed so that the depth, progression, and magnitude of movement can be tracked and determined.



Schematic illustration of a basic TDR system.

The USDA Forest Service recently published *Simplified User's Guide to Time-Domain-Reflectometry Monitoring of Slope Stability*. It is a simplified guide for the implementation and use of a TDR cable system for monitoring the movement of known and potential landslides. The purpose of this guide is to summarize basic information to assist field personnel in assembling and installing a TDR measurement system, as well as processing the TDR data.

TDR cable being installed.

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Example of the damage caused by slope instability.

Reflective Cracking Treated with GlasGrid

Reflective cracking in pavements occurs where cracks in older, underlying asphalt or concrete layers propagate up through newer overlays. Reflective cracking in asphalt-pavement overlays is typically caused by traffic loading, age hardening, or temperature cycling. When such cracking is present, the traditional remedy has been to apply thicker asphalt-concrete overlays to delay the reappearance of the cracks. In general, for each inch of overlay, existing reflective cracks are deterred from reaching the surface for one to two years.

GlasGrid is a commercially available reinforcing mesh designed to be used with asphalt concrete overlays. It consists of fiberglass strands knitted together and coated with an elastomeric polymer. Similar to the characteristics of asphalt concrete, the fiberglass strands have a high tensile strength and high modulus of elasticity at low elongation.

Installation of GlasGrid on project site.

The USDA Forest Service recently published a *Transportation Management Tech Tips* entitled "GlasGrid Fights Pavement Reflective Cracking at Diamond Lake" to summarize their experience with the product and the results.

Two segments of road near the Diamond Lake recreation complex, located within Oregon's Umpqua National Forest, were showing severe cracking. One segment was characterized by regularly spaced thermal cracks. The other segment was over forty years old and had cracks that had resulted from heat, age, and load distress. In the summer of 2001, a 2 inch overlay was placed on top of the existing road. A test section in each of the two segments used GlasGrid in addition to the hot mix overlay.

For six years, the test sections were monitored and the amount of cracking analyzed. In both test sections, the portion that used GlasGrid performed significantly better than sections that only received the hot mix. GlasGrid performed better in treating the area characterized by longitudinal and thermal cracks compared to the area with multiple pavement distress types.

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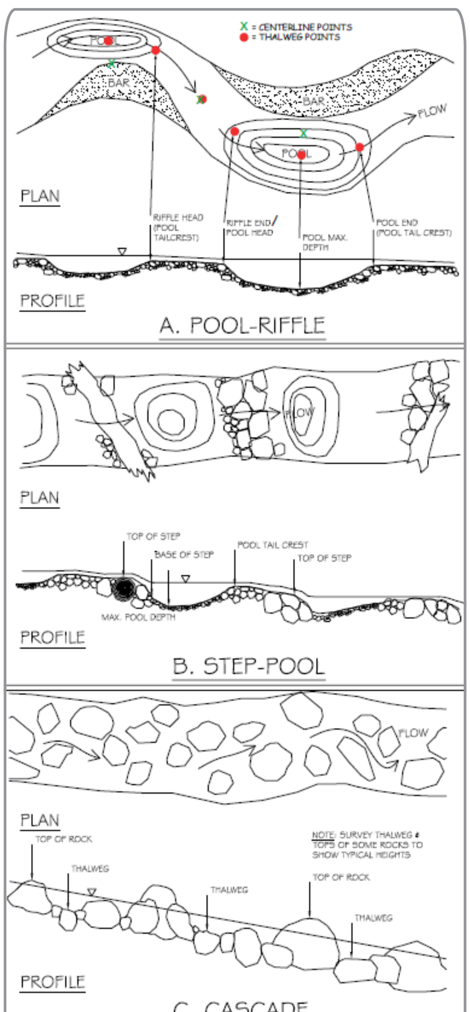
Cracking pavement prior to treatment (left), same section of road shown six years after treatment (right).

Incorporating Stream Simulation in Designing Road-Stream Crossings

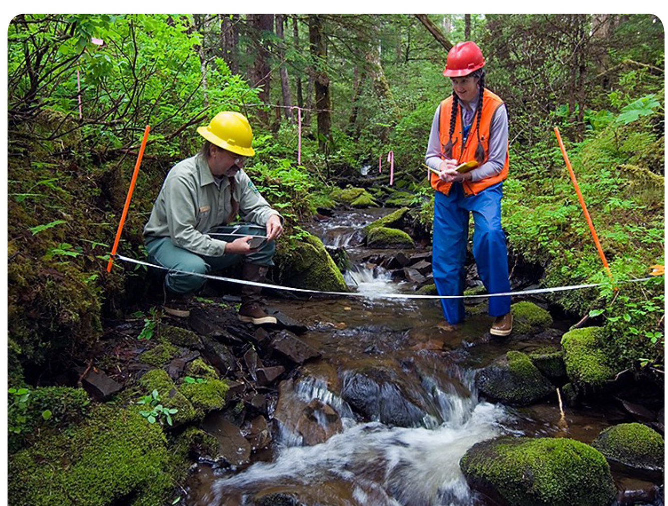
Our knowledge and understanding improves with time and by learning from experience. The importance of road-stream crossings is no exception. The earlier design approach was focused on protecting the road and relatively little attention was paid towards the impact of disrupting a stream. However, it is now becoming apparent that this approach is inadequate and new design guidance is needed for road-stream crossings. Stream simulation is a method for designing and building road-stream crossings intended to permit free and unrestricted movements of any aquatic species. Stream-simulation structures (e.g., culverts and bridges) have a continuous streambed that mimics the slope, structure, and dimensions of the natural streambed. The premise of stream simulation is that since the simulation has very similar physical characteristics to the natural channel, aquatic species should experience no greater difficulty moving through it. Water depths and velocities are as diverse as those in a natural channel, providing passageways for all swimming or crawling aquatic species.

Completed Stream Simulation Culvert at North Thompson Creek in Northwest Colorado

Designing such a passageway can be a daunting and challenging task. Not only are there numerous variables such as understanding and designing for predicted change in the surrounding natural channel, simulating the size and arrangement of bed material, and budget constraints, it requires input from multiple disciplines. The USDA Forest Service recently published a comprehensive manual entitled *Stream Simulation: An Ecological Approach to Providing Passage for Aquatic Organisms at Road-Stream Crossings*. The guide provides methods for site assessment, simulated channel design, and construction of stream simulation crossings and is intended to help facilitate the cooperation between individuals knowledgeable in engineering, contract administration, hydrology, geomorphology, and biology as they work together to design a successful road-stream crossing.



Typical measuring points for determining longitudinal profiles.



Bob Gubernick and Julianne Thompson doing pebble counts in Southeast Alaska

To complement the manual, online training for stream simulation is currently being produced. It is expected to be completed in 2010; check http://www.ctiponline.org for updates.

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CTIP Web site

A new web site was created for the Coordinated Technology Implementation Program (CTIP). The site's web pages are easy to navigate making information more accessable.

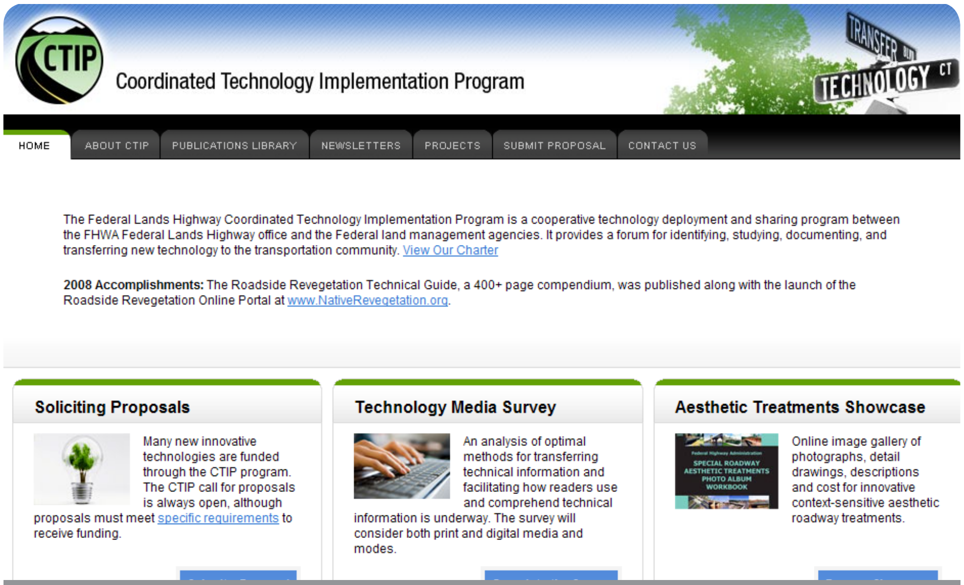
Even though, the CTIP is coordinated through the Federal Highway Administration's Office of Federal Lands Highway, the participation of multiple agencies required a dedicated site for this program. The CTIP involves:

- the Federal Highway Administration,
- National Park Service,
- Bureau of Indian Affairs,
- USDA-Forest Service, and
- U.S. Fish and Wildlife Service.

In the CTIP, these agencies are working together with the goal of identifying, studying, deploying, and promoting new technologies to the transportation community. You can find contact information for each of these agencies on the web sites *Contact Us* page.

The new web site provides all CTIP related information through one portal. This web site is designed to promote information dissemination, knowledge sharing, and communication. The homepage of the web site promotes proposal submission, new surveys, and recent publications. The web site includes a searchable database of all CTIP publications. Many of these publications can be downloaded in electronic format from this web site.

You can visit the web site at: http://www.ctiponline.org



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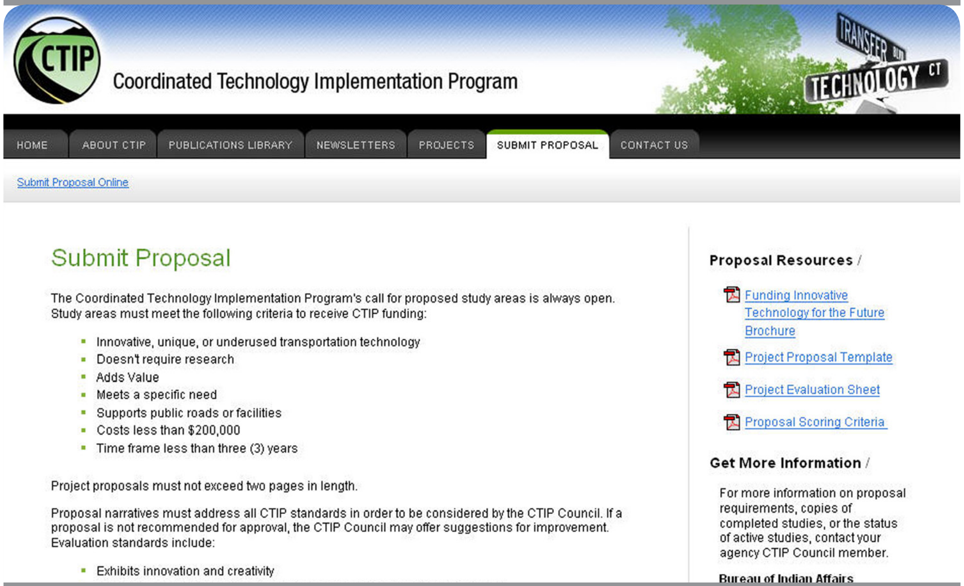

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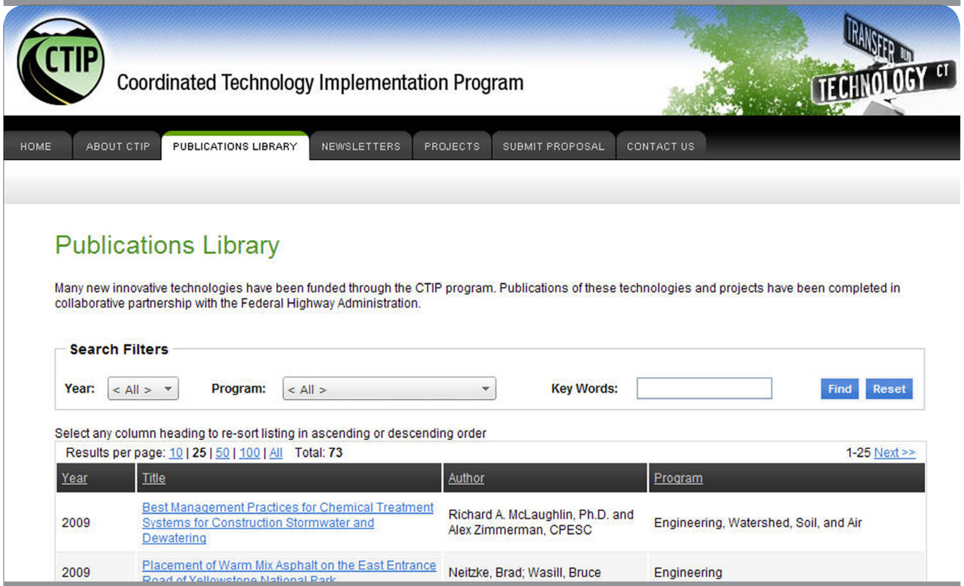

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Recent Publications

Placement of Warm Mix Asphalt on the East Entrance Road of Yellowstone National Park	FHWA-WFL/TD-09-002
Best Management Practices for Chemical Treatment Systems for Construction Stormwater and Dewatering	FHWA-WFL/TD-09-001

Drilled Shaft Axial Capacity, Effects Due to Anomalies	FHWA-CFL/TD-08-008
Portable Seismic Property Analyzer, Identification of Asphalt Pavement Layers	FHWA-CFL/TD-09-002
InSAR Deformation Monitoring, General's Highway, Sequoia National Park	FHWA-CFL/TD-09-003
Sign Retroreflectivity Guidebook	FHWA-CFL/TD-09-005
Hollow Bar Soil Nails: Corrosion Mitigation Recommendations	FHWA-CFL/TD-09-001

Wildlife Vehicle Collision Reduction Study: Best Practices Manual
Soil and Water Road Condition Index – Desk Reference
Soil and Water Road Condition Index – Field Guide
Culvert Scour Assessment
Sign Installation Guide