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In this issue . . .

Loftus Road Extension: ACE & Thermosyphon Design Features

Adapted in part from *ACE and Thermosyphon Design Features Loftus Road Extension Project*, by Douglas Goering, and *UAF gets new connection to Geist*, by Bill O'Neill, UAF *Sun Star*

Scarce snowfall and mild spring temperatures may not be ideal for the ski or snowmachine enthusiast but it made for an easier start on the Loftus Road Extension project in Fairbanks. The short piece of highway between Geist Road and Tanana Drive on the University of Alaska Campus is to be named Morris Thompson Drive, after the late Alaska Native leader.

The design of the project requires that the embankment remain frozen. Beginning construction in April helped to minimize thaw and maintain the integrity of the permafrost. The Alaska Department of Transportation & Public Facilities (ADOT&PF) will include unique experimental features designed to maintain underlying permafrost, extending the project life and creating a safer, more efficient roadway.

The technology employed in the Loftus project isn't new; rather it is new adaptations of proven technologies:

- Thermosyphons
- Air convection embankments (ACE)
- Air convection embankment sideslopes (ACE sideslope)

Thermosyphons: Necessity is Often the Mother of Invention

During the design of the Trans-Alaska Pipeline, engineers had the problem of laying hot pipe on top of frozen ground. Settling and shifting would cause obvious problems. Keeping the ground frozen and stopping the transfer of heat was the solution. The metallic fins that protrude up from the pipeline's vertical support members are part of a thermosyphon, a device using temperature changes in the environment to remove heat from the

continued

ground. The pipeline employs approximately 62,000 of them.

A New Application of a Proven Technology

The Loftus extension will be constructed over a stretch of permafrost. In order to prevent thaw settlement the permafrost must remain frozen. Since the design of the Loftus project includes concrete sidewalks it is imperative to avoid thaw settlement. In order to maintain the integrity of the base it became necessary to employ innovative techniques.

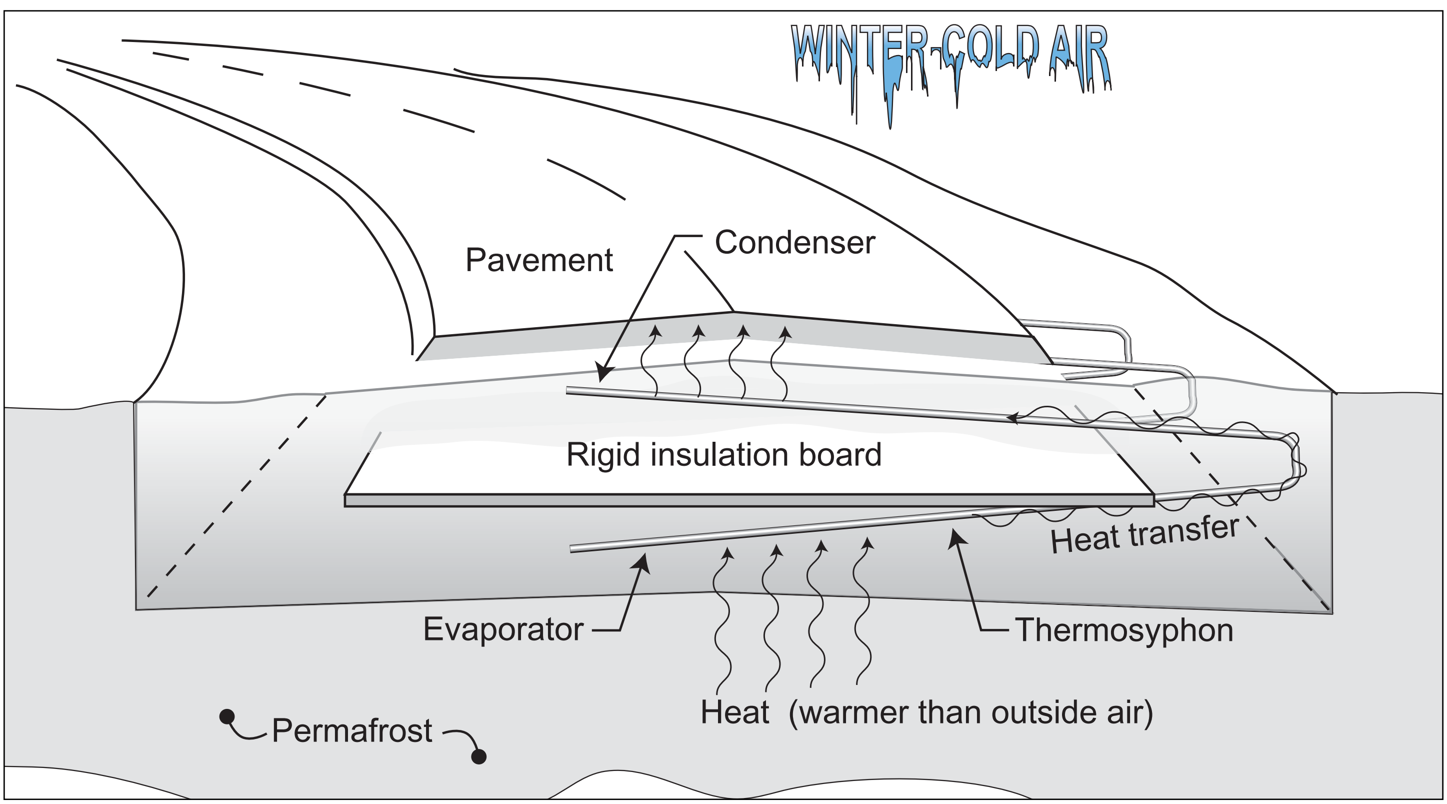
AKDOT&PF will use a new technique called a hairpin thermosyphon to help keep the ground frozen. "Hairpin" thermosyphons are filled with liquid carbon dioxide. During winter months, when the ground is warmer than the air, the carbon dioxide turns into gas at 31 degrees Fahrenheit and travels up the thermosyphon where it cools, turning back into liquid form. This will cause the roadbed to cultivate freezing temperatures during the winter months. During summer months the cooling unit will remain stagnant and will rely on the rigid insulation board to keep heat from penetrating the permafrost. The theory of the cooling unit is to keep the road cold enough, long enough, so that the residual cold will last through the summer and prevent ground thaw.

The experimental design for the cooling unit is completely buried underneath the roadway around a layer of rigid insulation board.

Air Convection Embankment Concept

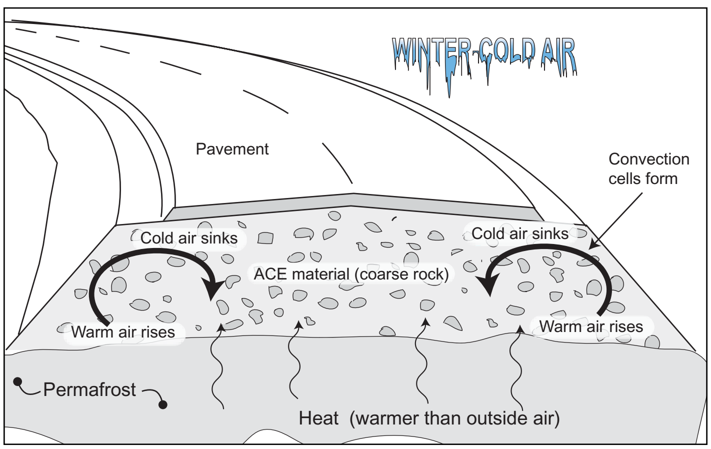
This process involves the use of uniformly sized rock, with no fines content, in the construction of the embankment or sideslope. The voids within the material permits airflow and the ACE process.

The hairpin thermosyphons lie horizontally spaced every few feet, entirely embedded in the embankment. Concept drawings by Russell Mitchell.



Embankment Effect

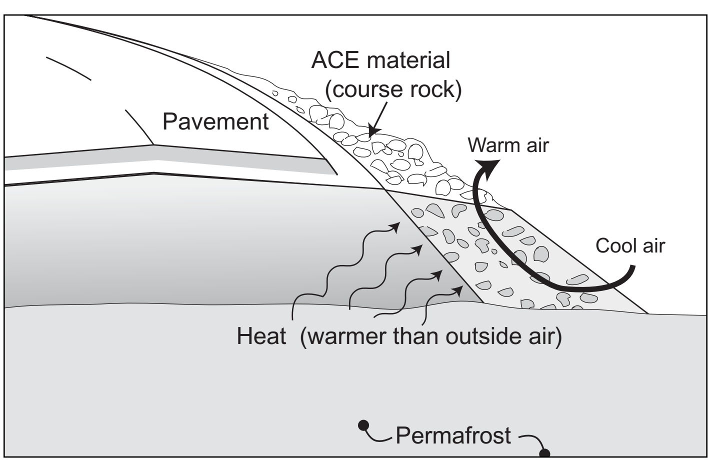
During winter months, the coarse material in the embankment provides an opportunity for convection cells to occur, through the natural upward flow of warm air and downward flow of cool air. As the cool air circulates it draws the relatively warm air out of the embankment and cools the ground The embankment acts as a one-way heat transfer device efficiently removing heat from the embankment and underlying foundation soil during the winter months without re-injecting heat in summer. The passive cooling effect can prevent thaw of underlying permafrost, eliminating thaw settlement.



Embankment effect.

Chimney Effect

The ACE chimney effect also acts as a one-way heat transfer device. When ACE material is placed on the sideslope, the movement of cold air passing through cools the embankment adjacent to the sideslope and transfers the heat to the air. The air is warmed slightly by the warm embankment and then escapes up through the rock.



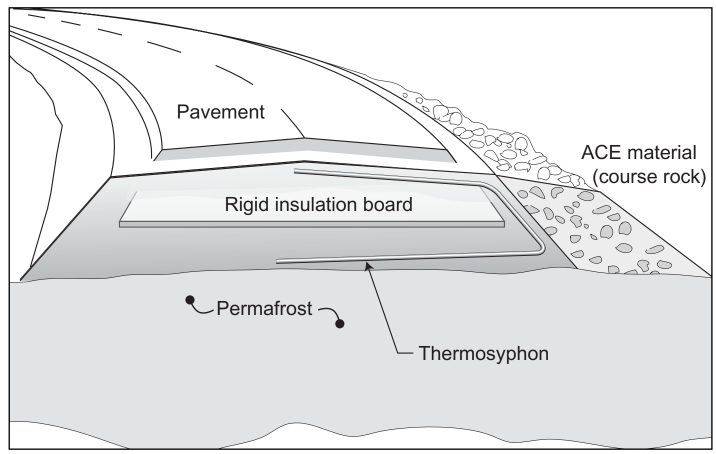
Chimney effect.

Three Passive Cooling Systems Included in Loftus Design

The Loftus project is divided into three test sections where the previously discussed cooling systems are implemented. Each section required a variation or combination of ACE and thermosyphon adaptations, depending on the height of the embankment.

Test Section One: ACE Sideslopes and Themosyphons in the Embankment

The ACE sideslopes and thermosyphons will provide a high level of cooling in the embankment during the winter months, while the rigid insulation board will help maintain residual cold in the summer.



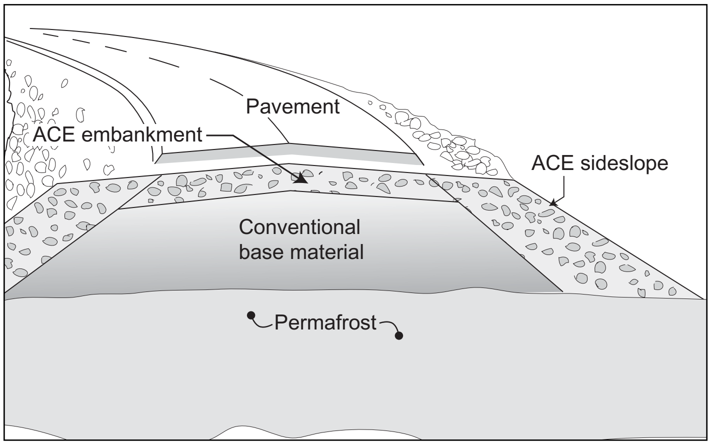
Test section one.

ACE sideslopes with thermosyphons.

continued

Test Section Two: ACE Material Under Pavement and on the Sideslopes

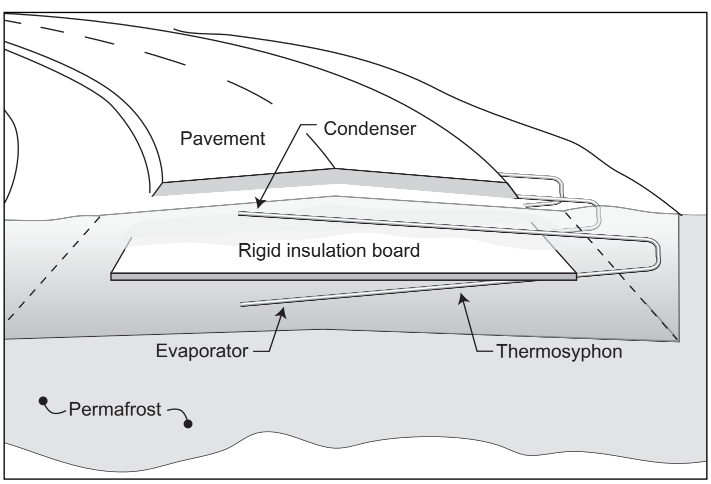
Test section two was designed for use on the north side of the railroad tracks, where the embankment is 10 m to meet the railroad overpass. The system proposed for this section is a 2.5 m layer of ACE material placed on the upper portion of the embankment (below the pavement), with ACE sideslope layers extending down both shoulders. The core of the embankment consists of conventional base material.



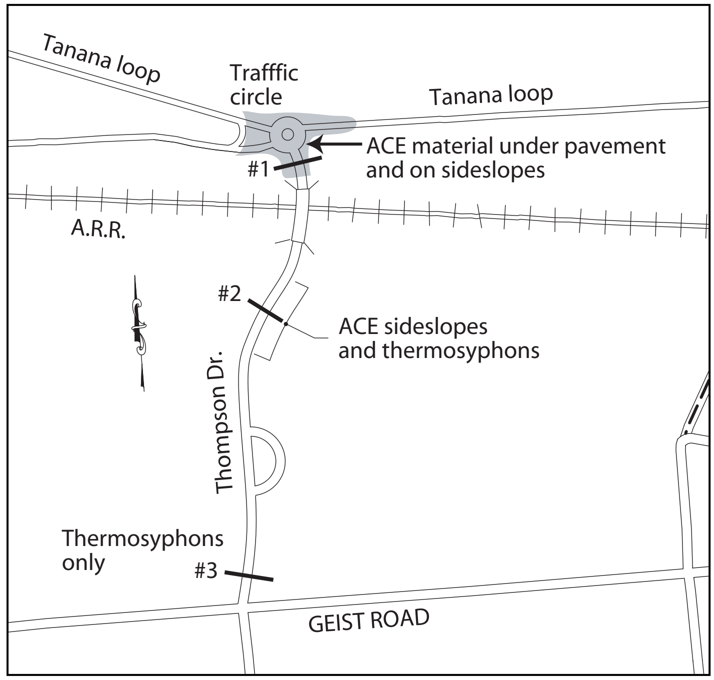
Test section two.

Test Section Three: Thermosyphons

The third passive cooling system proposed consists of thermosyphons. This section is near the Geist Road intersection, where the embankment height is inadequate for an ACE installation. An ACE would not provide enough chimney for the configuration to operate properly.



Test section three..



Test section locations on Loftus Road Extension project.

What do we expect?

We hope to reduce or eliminate thawing of the underlying permafrost and maintain the integrity of the roadway. The innovative and experimental features used on the Loftus project will play a key role in how we build roads in permafrost environments in the future.

Flooding in Salcha a Year-Round Event

Old Richardson Highway northbound.

An ice jam, combined with record warm temperatures, caused flooding in the Salcha area for the second spring in a row. The water spilled over a 1 mile erosion control dike and found its way along old river channels.

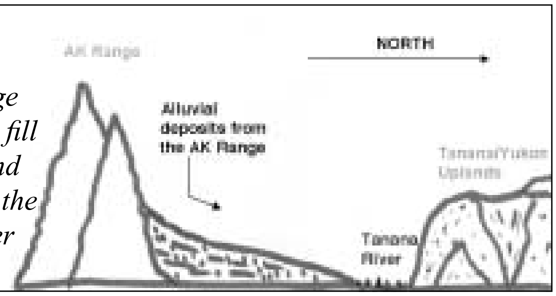
This isn't the first time. As recently as last January, overflow from the Tanana River plugged culverts and overtopped the Old Richardson Highway. Nearly 30 Salcha families were stranded until Alaska Department of Transportation Maintenance & Operations crews assembled an EZ Bridge, set it in place, and constructed temporary abutments.

Ice jam downstream of Boodox Bar. Photo courtesy of National Weather Service.

During the April flood, nearly 90 homes were either surrounded or damaged and another 50 were in jeopardy before water subsided slightly. The flooding caused an estimated $2 million in damages to homes and roads throughout the Salcha area.

"It's the nature of the Tanana River to change channels and it has been migrating northward for years," said Ed Plumb, a hydrologist for the National Weather Service, who believes several factors contributed to this flood event.

Sediment from the Alaska Range continues to fill the valley and slowly push the Tanana River northward.



"We can speculate the unseasonably warm temperatures in November initiated a short breakup, causing ice to jam in the Tanana River near the Boondox Bar. The following cooler temperatures and continued

Old Richardson Highway southbound.

Water from Tanana River spills over erosion control dike. Photo courtesy of National Weather Service.

continued

overflow events over the winter added to the jam size and likely locked it in place. The record high temperatures in late April created a large influx of water into the Tanana River Drainage lifting more ice onto the jams. These local ice movements are the primary effect of the flooding. With all the melt water coming downstream up against these jams, we saw water levels rise 5 feet in half an hour, contributing to the worst of the flooding."

Much of the work done this past winter to repair road damage will need repair again. The abutments to the EZ Bridge washed out, the erosion control dike is no longer intact, and portions of the Old Rich Highway will need improvements.

Salcha is about 35 miles southeast of Fairbanks on the Richardson Highway.

Friday May 2,2003. Photo courtesy of National Weather Service.

One of many Salcha residents begins clean up. Nearly 2 feet of water swept through lower level of this home during the crest of the flood.

Benerth residence, Wednesday April 30, 2003. Photo courtesy of National Weather Service.

An airboat on the Old Richardson Highway on January 5, 2003. Photo courtesy of Sam Harrel, Fairbanks Daily News-Miner.

Planning, Design, and Field Notes

DOT Maintenance workers place an EZ Bridge in place on the Old Richardson Highway. Crews previously created the channel by removing ice-clogged culverts to drain overflow which had backed up and threatened local homes (Jan. 2003).

DOT Maintenance crew built up an abutment, held it in place, and fastened it to EZ Bridge in preparation for the construction of the approach. *See also the back page of this newsletter for another photo* *(Jan. 2003).*

Detectable Warnings: Tactile Cues for the Visually Impaired

By Kim Phillips and Clint Adler, AKDOT&PF Research and T2

Detectable warning systems rely on visual contrasts and a series of raised domes to warn the visually impaired of a transition from a sidewalk to a vehicle roadway. These products come in numerous configurations and require different installation techniques:

- Surface Applied Mats: manufactured from a petroleum-based product, these offer a complete warning system installed in one step by either adhesives or anchors to the walking surface.
- Surface Applied Dots: found in grout, polymer, or metal materials. Installation may be either singly or in series, depending on the product. After dome installation, rendering a background by painting the location usually completes the warning system.
- Cast in Place: similar to surface applied mats, cast in place (CIP) warnings offer both dome and background in one product. Crews install CIP detectable warnings simultaneously with the concrete, forming an integrated bond between the walking surface and the warning system.
- Stamped In: prior to the concrete setting, the contractor stamps the domes into the concrete with either a press or a roller. Painting completes these installations.
- Pavers and Tiles: composed of different materials and thickness. Installers recess them into the walkway so that their top surfaces are flush with the surrounding pavement.

What Systems Did We Evaluate?

During the construction season of 2002, various state and municipal agencies installed detectable warnings in compliance with the American Disability Act Accessibility Guidelines.

We evaluated in-service performance of several types of these detectable warning systems over the winter of 2002–2003:

- Armor Tile Cast in Place
- Armor Tile Surface Applied Mats
- Strongwall SWADA-2000
- Carsonite Pathfinder Tile

What We've Learned So Far

Wintertime durability presents the greatest difficulty for detectable warning systems.

Material Type	Locations	Damage	Cause
Armor Tile Cast in Place	UAF, Anchorage	Domes abraded (UAF)	Cold temperatures and mechanical brooming
Armor Tile Surface Applied Mat	Anchorage	Complete removal of installations, damage to edges, domes chipping off	Snowplows
Strongwall SWADA 2000 Surface Applied Dot	Fairbanks	Domes chip off	Cold temperatures, grout may not be cold-resistant
Carsonite Pathfinder Tile	UAF	Domes chip off, adhesive deteriorating	Snow plows, weathering

Table 1. Material Performance Chart

Cast-in-place Armor Tile

UAF groundskeeping crews use a mechanical rotary brush for sidewalk snow removal that harms the domes. Only those systems that remained covered with snow and ice were spared damage (Photo 1).

The question of how to repair a cast-in-place system is of concern. Since domes can't be replaced, removal and replacement of the entire system becomes necessary.

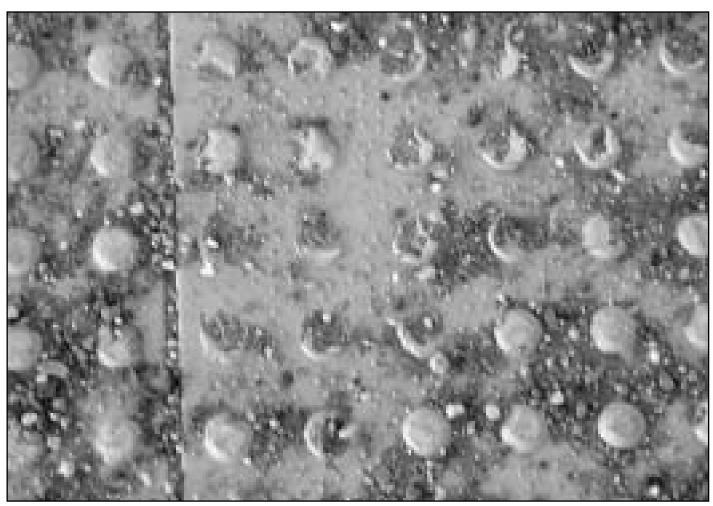


Photo 1. Armor tile cast in place: UAF. Note some domes completely abraded off due to snow removal with rotary brush. Almost all domes experienced some deterioration.

Planning, Design, and Field Notes

Surface-applied Armor Tile

The Armor Tile surface-applied warning system experienced snow removal by plow. Damages to both the domes and the background surface occurred.

In photo 2, note that the edges of the surface applied Armor Tile have lifted up due to snowplow action, presenting a tripping hazard. In other locations, the surface-applied tiles have been completely removed.

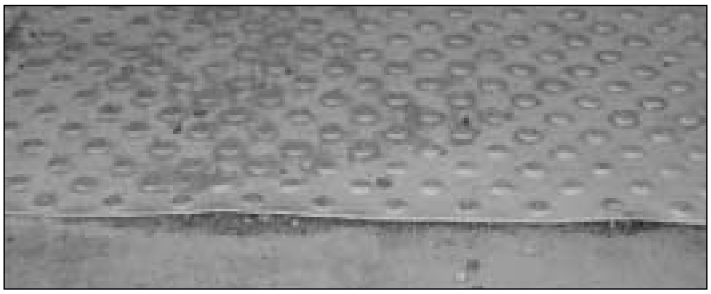


Photo 2. Armor tile surface-applied mat, Anchorage International Airport. Note edges peeling up due to snowplow, creating a tripping hazard. Grayed areas are covered with dirty snow, not grayed due to chemical degradation.

Surface Applied Dots: Strongwall SWADA 2000

Strongwall SWADA-2000 is an epoxy grout compound poured into a mold, which adheres to the concrete surface upon curing. As shown in photo 3, this detectable warning system underwent no winter maintenance. This was typical for all locations in Fairbanks.

Upon emergence from its snowy cocoon, evidence of degradation was revealed. Upon examination of the 15 installation sites, a pattern of damage emerged. We believe cold temperatures caused brittleness of the material. Installations experiencing the greatest amount of foot traffic exhibited the greatest amount of damage.

Photo 3. Strongwall SWADA 2000, Fairbanks: Note completely covered in snow.

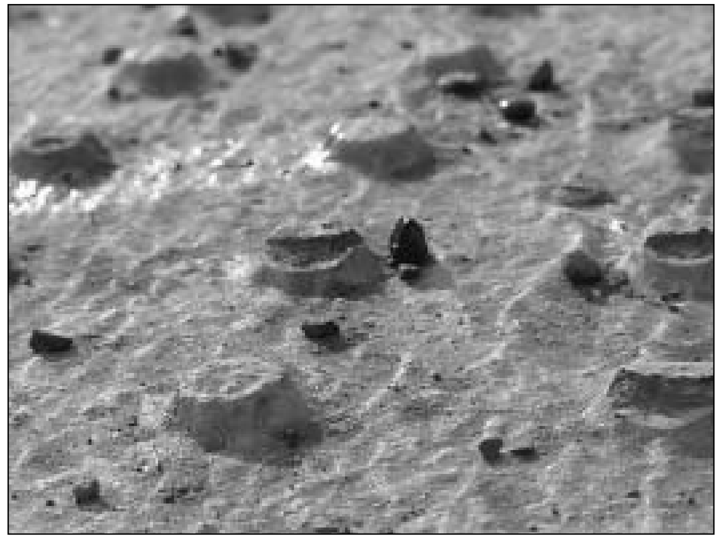


Photo 4. Strongwall SWADA 2000, Fairbanks: Note domes chipping off.

Carsonite Pathfinder Tile

In 1993, UAF installed Carsonite Pathfinder detectable warning tiles in front of the Patty Center gymnasium. Subsequent years of harsh treatment by steel plows resulted in domes sheared off at the edges of the installation. The adhesive continually deteriorates and domes chip off, resulting in a system requiring repairs.

Despite harsh treatment and some deterioration over the last 10 years, it's still an effective system with a pleasing appearance (Photo 5).

Photo 5. Carsonite pathfinder tile, installed at UAF in 1993.

Detectable Warnings (continued)

Will a Cold Winter Increase Damage & Wear?

These products haven't seen the worst. This past year Alaska had less than average snowfall and mild temperatures. We suspect a normal Alaskan winter would result in increased damage to the systems evaluated. An increase in snowfall means an increase in maintenance and the potential for more wear and damage. Obviously, durability will diminish in lasting cold snaps of –30 or colder.

Potential Solutions for the Future

Strategies to extend the service life of detectable warnings must be employed, starting with a search for more durable products or alternate installation techniques.

Two warning systems made out of metallic components are known to exist and may offer greater durability. The first is a "tactile stud" individually embedded into the cement and manufactured by Rockart Ltd., a company located in the United Kingdom. Also, aluminum tiles are manufactured by TG Lining in Holland.

Alternate installation techniques include recessing products so edges are flush with their surrounding surfaces. This will eliminate the chance of surface applied mats or tiles being plowed up during snow removal activities. Elimination of edges, i.e. individually applied domes, may also prevent damage, as long as the domes are durable.

Limitations and Future Research

Regardless of the material, degradation of the warning surface may occur. Even the best system evaluated showed significant wear. Given that the expected life of a sidewalk may exceed 50 years, this is hardly good news.

The AKDOT&PF Research Section also researched other state DOT's experiences with detectable warnings in search of resolution of durability concerns. To date, Wisconsin, Oregon, and Minnesota have begun, but not completed, evaluating warning systems. Over the next year a broader base of information will become available.

Ditch Basics

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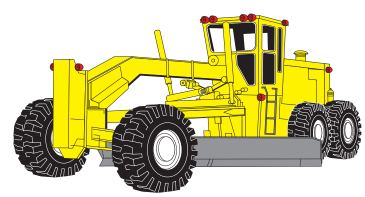


Water in road bases and subgrades is a destructive force, undermining the ability to support traffic, and leading to distresses such as alligator cracks and potholes. Properly constructed ditches allow water to drain not only 2from the road surface, but from subsurface levels as well.

Ditches also catch sediment in the runoff from gravel roads and shoulders, as well as from their own side slopes and channels. Loose vegetation and debris wash in from the right of way. These can quickly clog a ditch, causing it to impound water instead of carry it away. Resulting "ponds" then block any further subsurface drainage. Water may even seep from the ditch back into the road's subgrade and base. A clogged ditch could flood the road during a downpour, with road-killing effect. Regular maintenance is as important as proper construction. This article will cover the basics of ditch maintenance and construction: inspection and removal of debris, shape, slope, depth, lining, and vegetation. It will conclude with some repair guidelines.

Inspection and Cleaning

Regularly inspect and remove debris from ditches. Ask the following questions to help identify further maintenance and construction needs:

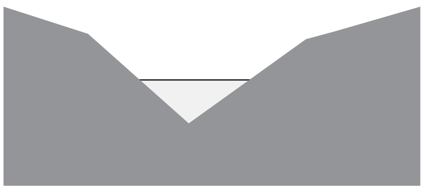
- Is the ditch free of obstructions?
- Could debris-control devices be used?
- Does the ditch have a clear outlet?
- Is the ditch deep enough to intercept subsurface water and thereby drain the subgrade?
- Is the ditch broad enough to minimize erosion of its sides and accommodate flow?
- Is the longitudinal slope uniform; that is, free of high or low points to minimize ponding?
- Is the slope adequate to encourage slow, steady flow?
- Is there any erosion?
- Is a lining needed, or does a lining need repair?

Shape

Road crews construct and maintain ditches in three cross-section shapes:

Triangular (V bottom)

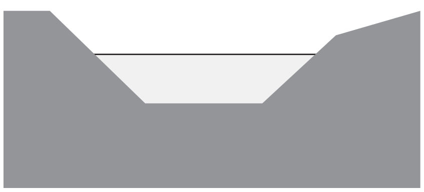
Of the three shapes, it is the most easily made and occupies the least roadside area, but it requires the most maintenance, has the least capacity, and is the most susceptible to erosion.



A triangular or V-bottom ditch.

Trapezoidal (flat bottom)

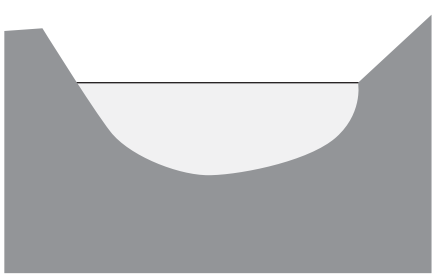
While this shape takes more time and money to make than the triangular, it slows water and reduces erosion better, requires less maintenance, and affords more capacity.



A trapezoidal or flat-bottom ditch.

Parabolic (round bottom)

Best in terms of long-term cost and efficiency, this shape affords about the same capacity as the trapezoidal, with less erosion. Sides accommodate vegetation, which further reduces erosion. It is usually the most difficult and expensive to make.



A parabolic or round-bottom ditch.

Slope

The longitudinal slope affects velocity of water flowing in the ditch. If the longitudinal slope is too steep, the resulting swift flow will erode the channel. If the slope is too close to level, the resulting lazy flow may allow water to collect in the ditch and perhaps infiltrate the subgrade and road base. To ensure appropriate flow, the longitudinal slope should be 1 percent, a gradual drop of 1 foot along every 100 feet of ditch. The slope should never be less than 0.5 percent. The maximum longitudinal slope for an unlined ditch is 5 percent. If the slope exceeds 5 percent, the ditch should be lined to prevent erosion. Each cross slope (side slope) of a ditch that has earthen sides should drop 1 foot for every 2 to 4 feet of its cross section.

Depth

To keep water out of the road base and subgrade, the ditch bottom should be well below the road's base course. A ditch depth of 18 inches is usually sufficient, but the ditch may have to be deeper if the adjacent right of way and terrain are shedding water into the ditch.

The distance between cross culverts or ditch outlets may also influence ditch depth. Inspection will indicate whether the depth is appropriate, or whether culverts or outlets should be installed. Keep in mind that ditches are often too deep.

Lining a deep ditch is difficult, and the depth makes the ditch more susceptible to cross-slope erosion. Deep ditches also pose a potential hazard to motorists, especially on roads with narrow shoulders.

Lining

Erosion of ditch sides and channels, as well as of the roadside environment, creates sediment deposits in ditch channels and in collection points. Excessive erosion of ditch sides can weaken the sides of the road itself. Runoff from gravel roads also creates sediment. Deposition of sediment can diminish longitudinal ditch slope to the point that water backs up. The greater the erosion, the greater the need for ditch maintenance. Lining of a ditch is the most common way to prevent erosion. Linings of sides and channels can be created from soils, stone, turf, plants, asphalt, or concrete. Geowebs can serve to reinforce the natural materials. Materials depend on velocity of flow that the ditch must accommodate.

continued

Ditch basics (continued)

Type of Lining	Flow Velocity (max.ft./sec.)
Soils and Stone	
Rip-rap sides and bottom	15–18
Clean Gravel	6–7
Silty Gravel	2–5
Clean Sand	1–2
Silty sand, clay	2–3
Clayey sand, silt	3–4
Turf and Plants	
Average turf in erosion-resistant soil	4–5
Average turf in easily eroded soil	3–4
Dense turf in erosion-resistant soil	6–8
Brushy sides with gravel bottom	4–5
Dense weeds	5–6
Asphalt and Concrete	
Concrete sides with gravel bottom	8–10
Mortared rip-rap	8–10
Concrete or asphalt sides and bottom	18–20

Ditch linings suitable for various flows.

The table above shows materials appropriate to various velocities. Engineers use a similar table when designing waterways. Road crews can use it as a guide. If a lined, well-maintained ditch is eroding, crews should apply a lining meant for a faster flow. If problems persist, consult a qualified engineer.

Vegetation

Under relatively slow flow velocities, ditch vegetation can effectively minimize erosion and filter pollutants from runoff. Guidelines for lining ditches with vegetation include:

- Establish vegetation before erosion begins.
- Distribute seed, mulch, and, where necessary, fiber mats immediately after any ditch maintenance or repair of storm damage.
- Fertilize, if appropriate, to speed growth, but avoid excessive fertilization, which can negatively affect the quality of both runoff and water that seeps into the ground.
- Mow to control weeds and woody vegetation, but not so close that you reduce the vegetation's ability to disperse rain, slow and absorb runoff, and hold soil.

Repair Guidelines

Road rehabilitation and reconstruction are expensive, and some municipalities omit accompanying ditch repair to save money.

Poor drainage leads to rapid deterioration of roadways. A little extra spent on ditches now will save you an expensive road repair later. Ditch repair should be included in all road repair projects.

Schedule routine repair every five years. Poorly shaped, sloped, or lined ditches require attention more often. To repair ditches in a five-year cycle, divide municipal roads into five areas, and address one area each year.

Repair begins with the regular inspection and cleaning noted at the opening. Inspection and cleaning in the fall allow for a clear view of ditch conditions, and repair plans can be formulated during the winter. Repair should produce ditches with appropriate shape, slope, depth, and lining, according to these guidelines:

- The most efficient and effective ditches have round or flat bottoms (parabolic or trapezoidal cross sections). A backhoe or excavator most easily constructs such shapes. If a grader is used, the wheel should be run in the ditch.
- The ditch bottom should be compacted.
- The longitudinal slope should remain as uniform as possible; so should the cross-section slopes.
- The ditch should immediately be seeded, mulched, and covered with a fiber mat to establish vegetation, or another appropriate lining should be applied immediately.

Debris, erosion, and sediment degrade the performance of ditches. Ditches must be regularly inspected, cleaned, and repaired.

Shaping Gravel Driveways and Intersections

Reprinted with permission of South Dakota LTAP, Ken Skorseth.

Maintaining the correct shape on gravel road intersections as well as gravel intersections with paved roads is a real challenge in the field. Matching driveways to gravel roads can also be a difficult task. This bulletin will briefly describe the correct shape for these situations and give a few tips on how to do the work.

The finished work. The intersecting road now meets the edge of the crowned surface of the primary road and matches it very well.

Intersections

When shaping intersections you must determine if it is designed as a controlled or uncontrolled intersection. If traffic stops or yield from side roads we consider it a controlled intersection as shown in Figure 1. The primary road on which traffic passes through should retain its crown and the intersecting roads should have crown gradually eliminated beginning approximately 100 feet before the intersection. At the point of intersection, the side roads are virtually flat to match the primary road.

When the intersection is uncontrolled as shown in Figure 2, the roads should all have the crown gradually eliminated beginning approximately 100 feet from the intersection. The intersection itself becomes virtually flat, allowing vehicles to pass through without feeling a noticeable hump or dip from any direction. Be careful not to make the intersection lower so that water collects there.

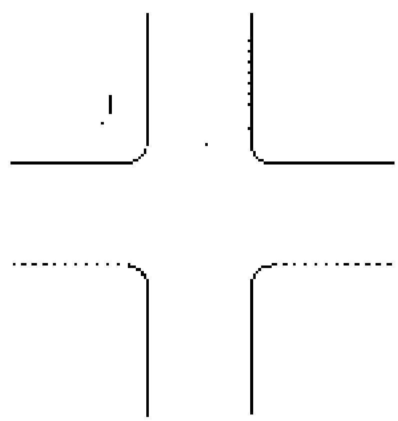


Figure 1: Proper shape of a controlled intersection. Notice through-road retains crown; side roads that have stop or yield signs are shaped to match the edge of the road.

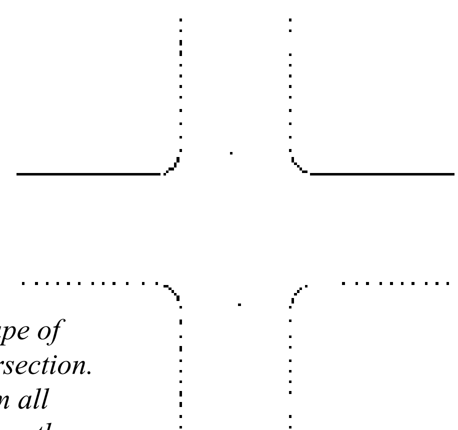


Figure 2: Proper shape of an uncontrolled intersection. Eliminate crown from all directions approaching the intersection.

Shaping Gravel Driveways and Intersections (continued)

Here a motorgrader begins to cut the crown back into the primary road at a controlled gravel road intersection. Surface gravel has drifted out onto the primary road from the side road and this destroys the correct shape on a controlled intersection. Since traffic on the primary road does not stop or yield, it should retain its crown through the intersection.

Restoring the crown in the primary road leaves a dropoff where the intersecting road meets it. This must be corrected.

This shows the result of the first pass made to restore correct shape to this intersection. This work needs to be done with a straight cutting edge on the motorgrader and when moisture is present in the gravel.

The beginning of the second pass.

Here a third pass is made to finish the work of matching the intersecting road to the primary road.

Another view of the finished work which shows clearly that the dropoff has been removed and the roads match very well. (This series of photos is courtesy of the Brookings County Highway Department.)

Shaping Gravel Driveways and Intersections (continued)

Intersections with Paved Roads

Start elimination of crown on the gravel road approximately 100 feet from the edge of the pavement. The gravel should match the paved surface. This requires continual attention since potholes can easily develop at the edge of pavement. Be careful not to push gravel out onto the pavement since this causes a dangerous loss of skid resistance on the pavement. The technique of "backdragging" is useful in these operations. In order to fill a pothole at the edge of pavement, extra material may spill onto the pavement. Simply pick up the moldboard and set it down in front of the material, then back up and spread the excess back on the gravel road.

Driveways

The public road should always retain its normal crowned shape while passing driveways. Too often the gravel builds up on the road at a driveway entrance as shown in Figure 4. This changes the shape of the roadway itself, which can cause loss of control of vehicles. These situations need to be reshaped. The driveway entrance should always match the edge of the public road as shown in Figure 5.

In heavily populated areas with gravel roads, poor installation of driveways can be a real problem. To reduce maintenance problems, implement a permitting process. It should address the proper control of grade to match road edge, adequate width, and drainage. The solution to the problem is demonstrated in a simple operation which is shown on the next page.

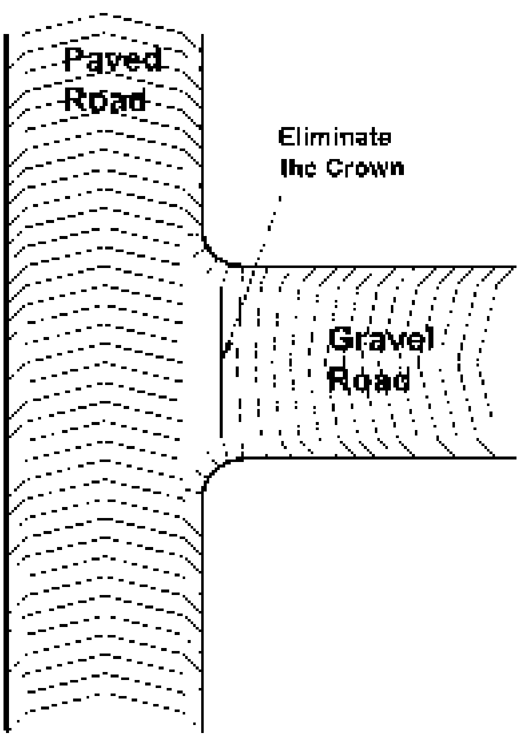


Figure 3: Illustration of a gravel road intersecting a paved road. Gradually eliminate the crown of the gravel road to match the edge of the pavement.

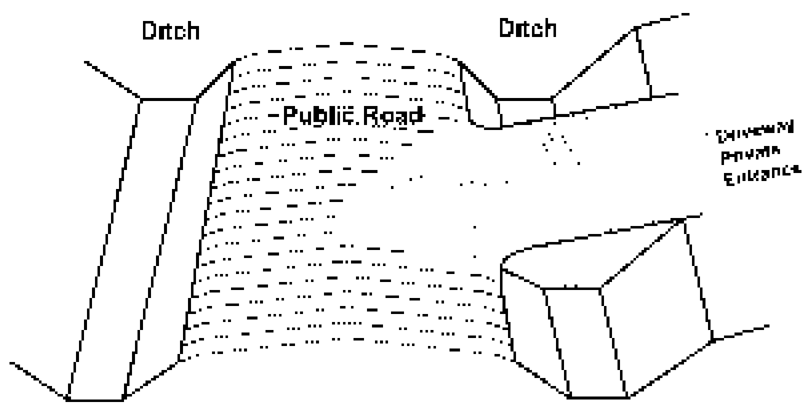


Figure 4: Improper matching of driveway and road edge.

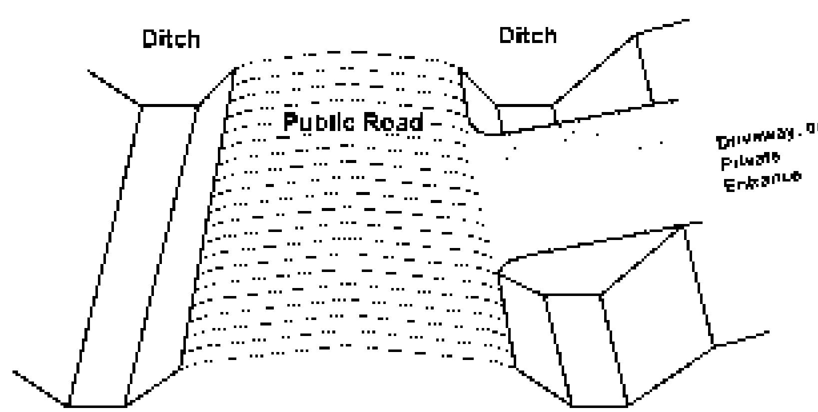


Figure 5: Proper matching of driveway and road edge.

Step 1: the operator restores the crown on the public road by removing excessive material extended from the driveway. Note the dropoff created by the operation.

Step 2: The operator proceeds to correct the dropoff at the end of the driveway by cutting the material loose and spreading it back on the driveway. In this photo, a grader-mounted dozer blade with cutting bits makes the job easier. The above two steps result in a well-shaped driveway entrance that matches the edge of the public road.

Snow Site Storage Design and Placement

Adapted from Siting, Design and Operational Controls for Snow Disposal Sites by Scott R. Wheaton and William J. Rice, P.E.

Is There Concern for Pollutants in Springtime Meltwater from Stored Snow?

At high latitudes, snow plowed from streets accumulates rather than melts. As plowed snow accumulates and exceeds available storage space along streets, it is hauled to central storage areas and placed as a compact snowfill.

A portion of the applied grit and salt, as well as fugitive pollutants from vehicles, becomes incorporated into hauled snow. When spring melt occurs, the stored snowfill releases these pollutants in a complex fashion.

The Municipality of Anchorage (MOA) conducted a four-year study of snow disposal sites from 1998 through 2001, sponsored by the MOA Street Maintenance Department and the Alaska Department of Transportation and Public Facilities, Central Region Maintenance and Operations. We learned that several factors relate to how pollutants are released during melting:

- initial source of hauled snow,
- melt processes of stored snowfill, and
- shape of storage areas and the snowfills.

What Did We Learn?

MOA snow disposal sites have provided local investigators with a detailed understanding of the processes by which the snowfill melts and moves pollutants. The potential for manipulation of these processes is central to new management practices developed by MOA and leads to the basic conclusions of MOA's four-year study:

- Chloride can be controlled passively only through detention and dilution.
- Mobilization of metals and polynuclear aromatic hydrocarbons relates to chloride concentration, but a large fraction can be controlled with particulate capture.
- Particulate loading in meltwater relates to the shape of the snowfill and the pad on which it is situated and can be controlled by manipulation of these elements.

Our observations suggest melt processes within and around a snowfill mass, along with the aspect, shape, and physical characteristics of the stored snow, play central roles in how the snowfill melts and the degree to which pollutants are moved during melting.

Can We Control Pollutants in Snow Sites?

Observation of the melting process at Anchorage snow disposal sites suggests a number of control opportunities. Control opportunities can be generally grouped as they address chloride and soluble pollutants, or particulates and adsorbed pollutants.

Chloride is not readily treated by simple technologies. Passive (nonchemical) treatment of chloride is best addressed through:

- Control of street treatment processes (i.e., reducing use of salt).
- Dilution of early meltwater discharges.
- Application of snow disposal site location criteria.

Analysis of Anchorage salt application practices suggests total chloride loading could be reduced by as much as 60% through use of heated sand sheds. At snow storage sites, detention and dilution of early snowmelt remains a critical element in snow disposal site design and operations criteria. Infiltration into shallow groundwater has been shown to be a viable option in Anchorage for diluting chloride concentrations, but implementation requires knowledge of area hydrogeology and acceptance of potential changes in the structure of local vegetation communities.

The necessity for dilution and the potential for impact to other local resources from elevated chloride requires careful consideration to facility siting.

Size and Shape Does Matter

Turbidity of meltwater is a function of meltwater exposure to fine sediment:

- Turbidity in snow disposal site flows is generated as meltwater exits and cascades off a snowfill, gathering sediment from the surface of the deflating mass.
- Turbidity may be further increased as meltwater crosses a pad surface, particularly if pad surface soils are unprotected, waste soils are exposed, or flow velocities are increased.

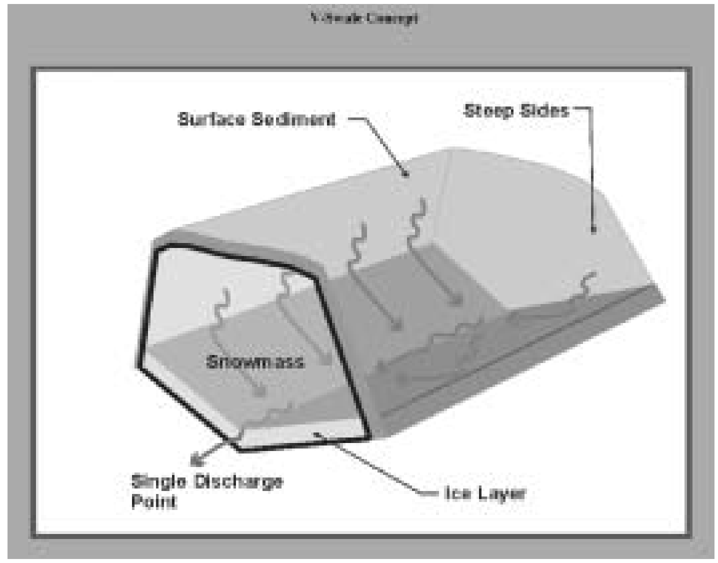
Designing and operating a snow disposal facility to take advantage of the melting process and inherently low-energy environment of a melting snowfill is key in particulate control. Adjusting basic pad shape, in conjunction with operational practices, may reduce meltwater turbidity tenfold.

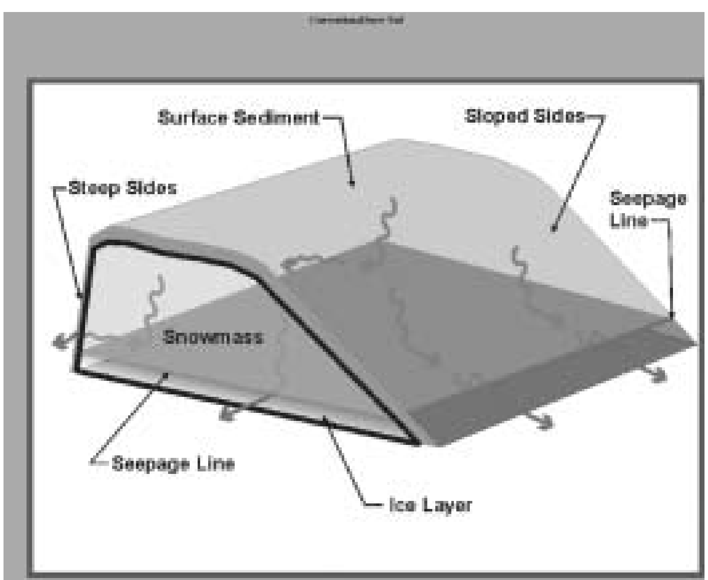
The experimental V-swale pad tested at Anchorage may provide as much as ten times the particulate control over conventional flat pad configurations because:

- The V-swale configuration promotes meltwater movement as saturated flow within a snowfill so that particulates are not mobilized during the early and middle stages of melt.
- Flow directed along the trough of the V-swale ensures a single predictable discharge point so that flows can be further managed and directed to minimize erosion of pad and waste soils. The design also limits late-stage sediment mobilization by helping to short-circuit flows to armored channels.

Researchers found that the following operational practices also reduce meltwater turbidity by reducing sediment exposure to flowing meltwater:

- Placing snow in high, compact masses with steep sides all around minimizes the exposure of accumulating sediment on the snowfill surface to seepage and flow.
- Placing snow in a single snow mass rather than several isolated masses reduces exposure of sediment to upgradient meltwater sources. Sites can also be operated to take advantage of aspect, with snow placed as compact masses at northernmost downgradient locations so that a snowfill will preferentially recede from uphill to downhill. This practice will reduce exposure of downgradient sediment to meltwater flows as the sediment settles to the pad surface in the final stages of melt (and becomes most vulnerable to erosion).
- Incorporating shallow collection reservoirs reduces pad erosion and turbidity by effectively transporting meltwater over significant horizontal distances in a low-turbulence (pooled) environment.
- Use of setback staking and armored channels (oversized to provide room for icing) to direct and contain pad meltwater flows will also limit turbidity.
- Restriction of off-season pad use will minimize disturbance of pad soils and to allow revegetation.





Tips for Snow Site Placement and Design

MOA has developed a set of snow disposal site design criteria for Anchorage. MOA criteria particularly emphasize an essential relationship between siting, design, and operations. Although the criteria are specific to the typical scale of Anchorage snow storage facilities, they should be adaptable to other northern latitude communities.

Siting Criteria

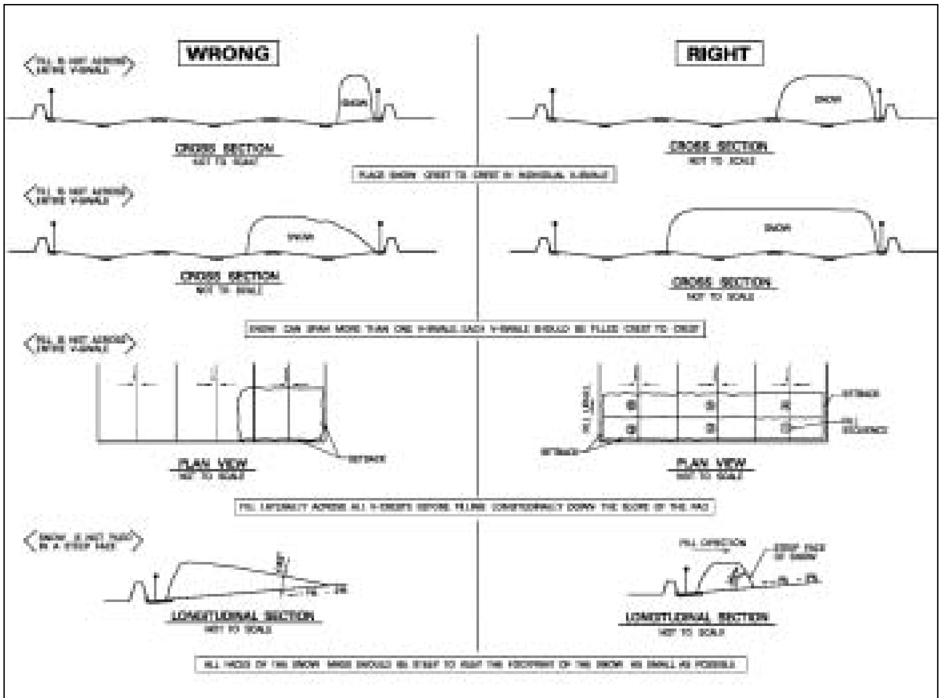
- Avoid meltwater discharge to potable water aquifers.
- Avoid meltwater discharge to 'closed' lakes and wetlands.
- Avoid reduction of functionality of receiving wetlands.

continued

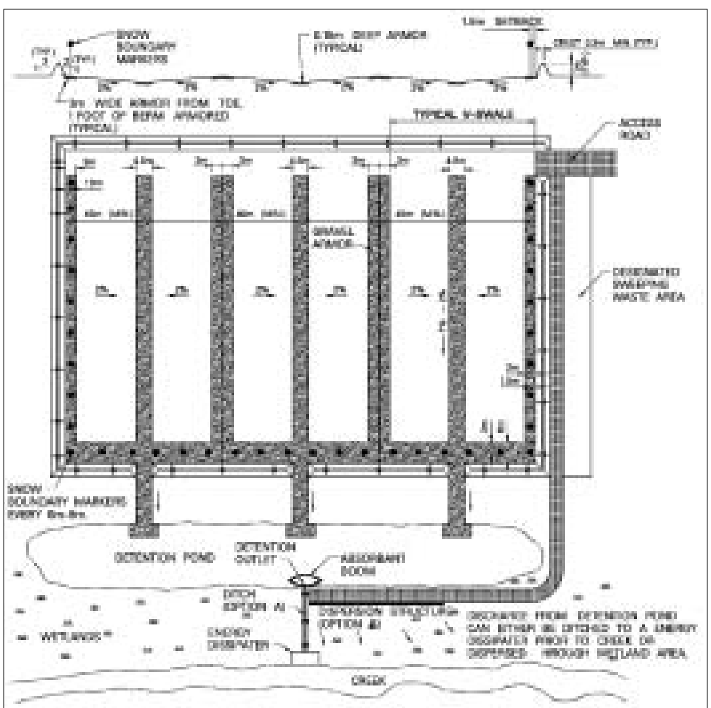
- Avoid meltwater discharge to streams having winter base flows less than 85 L/sec.
- Optimize opportunities for infiltration to shallow nonpotable groundwater systems.
- Optimize opportunities for a site orientation sloping down from south to north.

Design Criteria

- Map local and site hydrogeology within 300-meter (m) of site.
- Construct pad with a single or multiple V-swale configuration (minimum 45 m crest-to-crest swale width, 2% sideslope to central trough, and 1 to 2% longitudinal slope).
- Orient V-swale longitudinal axes downhill from south to north.
- Establish and flag setbacks from swale crests and facility perimeter.
- Armor swale troughs and crests and all facility drainage channels and containment berms.
- "Trackwalk" (imprint with crawler tractor treads trafficking directly upslope and downslope) and vegetate all nonarmored pad surfaces with a mix resistant to an annual 2 to 5 cm sediment burial.



SNOW SITE FILL PROCEDURE



MULTIPLE V-SWALE SNOW SITE DESIGN CONCEPT

- Construct dry detention ponds or other treatment to control chloride and sediment releases.
- Install flow dispersion and energy dissipation controls at all outfalls to receiving waters.

Operational Criteria

- Place hauled snow over the full width of each V-swale.
- Sequence placement of snow starting at the downslope side and working upslope.
- Maintain snow in a compact mass with steep sides.
- Maintain setback from all containment berms and from the discharge end of V-swales.
- Maintain pad vegetative cover and re-grade only to ensure V-swale functionality.
- Restrict access and prohibit off-season traffic and non-snow storage uses.

For questions or a copy of the complete report please contact:

Scott Wheaton, Watershed Scientist,
Municipality of Anchorage, PO Box 196650,
Anchorage, AK, wheatonsr@ci.anchorage.ak.us,
or
William Rice, Senior Engineer,
MWH Americas, Inc., 4100 Spenard Rd,
Anchorage, AK, William.J.Rice@mw.com.

Willow Guide Now Available

Of the 40 willow species known to occur in Alaska, 26 are found in southcentral Alaska. *Willows of Southcentral Alaska,* by Dominique Collet, is written for the novice, landowners, landscaping contractors, biologists, and for any agency involved in restoration or environmental work. The 109-page guide includes several good features:

- Identification keys
- Species descriptions
- Summer descriptions
- Color photos and location maps

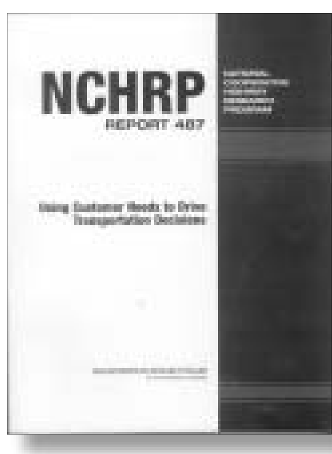
The guide was produced and printed by the Kenai Watershed Forum with donations from several sponsors: Cook Inlet Coastal Program, Kenai Peninsula Borough, Alaska Soil and Water Conservation Districts (Homer, Wasilla, and Kenai), U.S. Fish and Wildlife Service, U.S. Forest Service, Alaska Native Plant Society, Alaska Department of Natural Resources Plant Material Center, and the Alaska Department of Transportation.

To get a free copy of the guide:

- Online electronic version at http://www.kenaiwatershed.org/ourorganization.html
- Alaska Research and Technology Transfer (907) 451-5320 or linda_gavin@dot.state.ak.us
- The Kenai Watershed Forum (907) 260-5449

Now Available: NCHRP Report 487

Using Customer Needs to Drive Transportation Decisions



This report provides guidelines for public sector transportation agencies on how best to address the needs of the customers they serve. Based on a review of current innovative practices, the report presents a series of guidelines to help agencies to understand and use the needs, wants, and values of their existing and potential customers.

Who should be interested in this document?

- Transportation planners and decision makers
- Anyone involved in public relations as it relates to transportation issues
- Design engineers concerned with context-sensitive design

What does this guide contain?

- Categorizes customers into different market segments
- How to identify and prioritize customer needs and service expectations
- How to use service expectations to guide transportation policy
- Transportation best practice and implementation strategies
- Guidelines for practitioners

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Research & Technology Transfer
Research Library,
www.dot.state.ak.us/stwddes/research/left_nav.html

Now Available: NCHRP Report 480

A Guide to Best Practices for Achieving Context Sensitive Solutions

Context sensitive design asks questions first about the need and purpose of the transportation project, and then equally addresses safety, mobility, and the preservation of scenic, aesthetic, historic, environmental, and other community values. Context sensitive design involves a collaborative, interdisciplinary approach in which citizens are part of the design team.

Who should be interested in this document?

- Project managers
- Highway engineers
- Environmental managers
- Public involvement specialists
- Senior managers
- Agency administrators

What are some of the topics in this guide?

- Developing an evaluation criteria/process
- Creating and documenting a full range of alternative solutions
- Achieving environmental sensitivity
- Ensuring safe and feasible solutions
- Tort liability and risk management

No matter the size of a project, assuring for efficiency and project soundness requires a well planned process. Following management elements and an effective decision making process are key to success.

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Research & Technology Transfer
Research Library,
www.dot.state.ak.us/stwddes/research/left_nav.html

Now Available: NCHRP Report 476

Guidelines for Design and Operation of Nighttime Traffic Control for Highway Maintenance and Construction

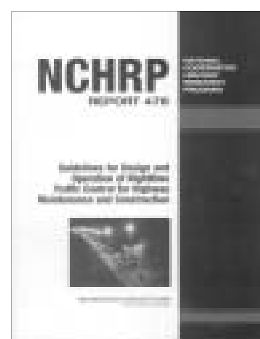
This report presents guidelines to assist highway agencies in developing and implementing a plan for night work that will provide for public safety and satisfy the community

Who should be interested in this document?

- Traffic engineers responsible for development/ maintenance of traffic control plans
- Traffic control technicians or supervisors
- Anyone who currently uses the MUTCD
- Maintenance and construction workers doing nighttime work

What does this guide contain?

- Innovative features suggested by DOTs to respond to special nighttime problems
- glare control
- visibility of workers
- improvement of conspicuity of traffic control devices
- Design requirements for various traffic control options/ devices and safety features
- Implementation and operation of nighttime traffic control
- Typical applications for nighttime work



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VHS, CD, and Adobe PDF acquisitions in the past year are now available in the Research and Technology Transfer (RTT) Library (resources can be accessed via the web site, or contact Linda Gavin at 451-5320 or e-mail: linda_gavin@dot.state.ak.us)

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VHS, (8min)	Stockpile Recovery to Minimize Segregation
VHS, (60min)	Haz Com - Reel - Compliance Package
VHS, (50min)	Modern Marvels: America's Highways
VHS, (50min)	Modern Marvels: The ALCAN Highway
VHS, (3hr6min)	Domestic Preparedness Training Awareness Course: Modules 1-7
VHS, (30min)	CBDCOM Domestic Preparedness Training Program: Employee Awareness
VHS, (30min)	Anti-icing and Deicing
VHS, (2hr34min)	Teleconference Series #27: Invasive Species in Transportation Right of Way: You Wouldn-t Plant Kudzu, Would You?
VHS, (27min)	G-Series Dozer Safety, Maintenance & Operation
VHS, (25min)	Comparable Concepts for Replacement Housing and Business Relocation
VHS, (25min)	How to Get More Out of Your Motor Grader
VHS, (22min)	Scheduled Lives, Stressful Drives
VHS, (1hr24min)	Road Maintenance Training Video Set
VHS, (19min)	Taking Control of Your Motor Grader
VHS, (19min)	Making the Effort Works--Reducing Utility Delays During Construction
VHS, (18min)	Tips from the Pros: Dozer
VHS, (18min)	Safe and Efficient Operation of Hand-Held Cutoff Saws
VHS, (18min)	Effective Pavement Preservation by Identifying Distress Conditions, Causes and Cures
VHS, (17min)	Drainage Pipe Installation
VHS, (17min)	3M Evaluation of Reflective Sign Materials
VHS, (16/22min)	Smoother Pavement: Highways Fit for a King
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VHS, (15min)	Plowing Subdivisions in Townships
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VHS, (15min)	Full Depth Road Reclamation Using Calcium Chloride
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VHS, (10min)	Idea Store: Volume 4, The
VHS, (10min)	Prefabricated Timber Bridge Deck Panels
VHS	A Serious Look at Chainsaw Safety
VHS	Contractor Beware: Your Real-life Guide to Power Line Safety
Software	AKOD
Software	AKPAVE
Software	Berg2
Software	BOUSDEF
Software	Elsym5
Software	FISHPASS
Software	FROST
Software	MUT1D
Software	PAVEINFO
portable document format (pdf)	Dust Control on Low Volume Roads: A Review of Techniques and Chemicals Used
portable document format (pdf)	Long-Term Evaluations of Insulated Roads and Airfields in Alaska (16pgs, 1994)
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portable document format (pdf)	Alaska Soil Stabilization Design Guide
portable document format (pdf)	Structural Systems Research Project Report "TILT: The Treasure Island Liquefaction Test"
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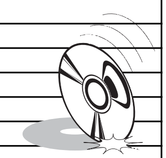

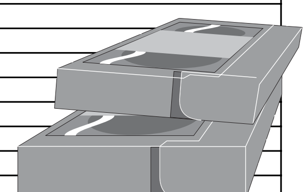

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CD-R	Research & Analysis: Identification of Severe Crash Factors and Countermeasures in North Carolina Final Report
CD-i 11	Meetings, Bloody Meetings

Training and Meeting Calendar

May

Managing the Public Respose (or How to Keep Your Foot Out of Your Mouth). A Click, Listen & Learn Program. May 22

June

Where Does Public Works Fit in Smart Growth Planning? A Click, Listen & Learn Program. June 18.

For information about T2-sponsored training, contact:

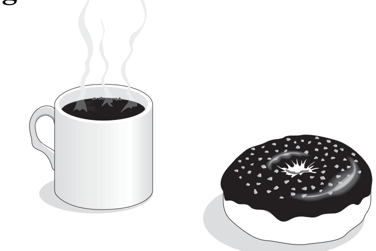
Dave Waldo at 907-451-5323,
david_waldo@dot.state.ak.us

or

Simon Howell at 907-451-5482,
simon_howell@dot.state.ak.us

or go to:

www.dot.state.ak.us, select "**T2 Training**" under "**Hot Topics Quicklinks**," and then choose "**Training**" from the menu on the left.



Meetings Around Alaska

Society	Chapter	Meeting Days	Location & Contact	
ASCE	Anchorage	Monthly, 3rd Tues., noon	Northern Lights Inn	
	Fairbanks	Monthly, 3rd Wed., noon	Captain Bartlett Inn	
	Juneau	Monthly, 2nd Wed., noon*	Westmark Hotel	* except June–Aug.
ASPE	Anchorage	Monthly, 2nd Thurs., noon	West Coast International Inn	
	Fairbanks	Monthly, 1st Fri., noon	Captain Bartlett Inn	
	Juneau	Monthly, 2nd Wed., noon*	Westmark Hotel	* except June–Aug.
ASPLS	Anchorage	Monthly, 3rd Tues., noon	Executive Cafeteria, Federal Building	
	Fairbanks	Monthly, 4th Tues., noon	Ah Sa Wan Restaurant	
	Mat-Su Valley	Monthly, last Wed., noon	Windbreak Cafe	George Strother, 745-9810
AWRA	Northern Region	Monthly, 3rd Wed., noon	Rm 531 Duckering Bldg., University of Alaska Fairbanks	Larry Hinzman, 474-7331
ICBO	Northern Chapter	Monthly, 1st Wed., noon	Zach's Sophie Station	Jeff Russell, 451-5495
ITE	Anchorage	Monthly, 4th Tues., noon (except July & Dec.)	Sourdough Mining Co.	Laune Koziesek, 343-8145
IRWA	Sourdough Ch. 49	Monthly, 3rd Thurs., noon**	West Coast International Inn	
	Arctic Trails Ch. 71	Monthly, 2nd Thurs., noon**	varies (452-1206)	
Asphalt Pavement Alliance	Alaska	3rd Wednesday of every other month	varies	John Lambert 267-5294
PE in Government	Anchorage	Monthly, last Fri., 7 a.m.	Elmer's Restaurant	
Society of Women Engineers	Anchorage	Monthly, 1st Wed. 6:30 p.m. except July and August	varies	Karen Helgeson, 522-6513

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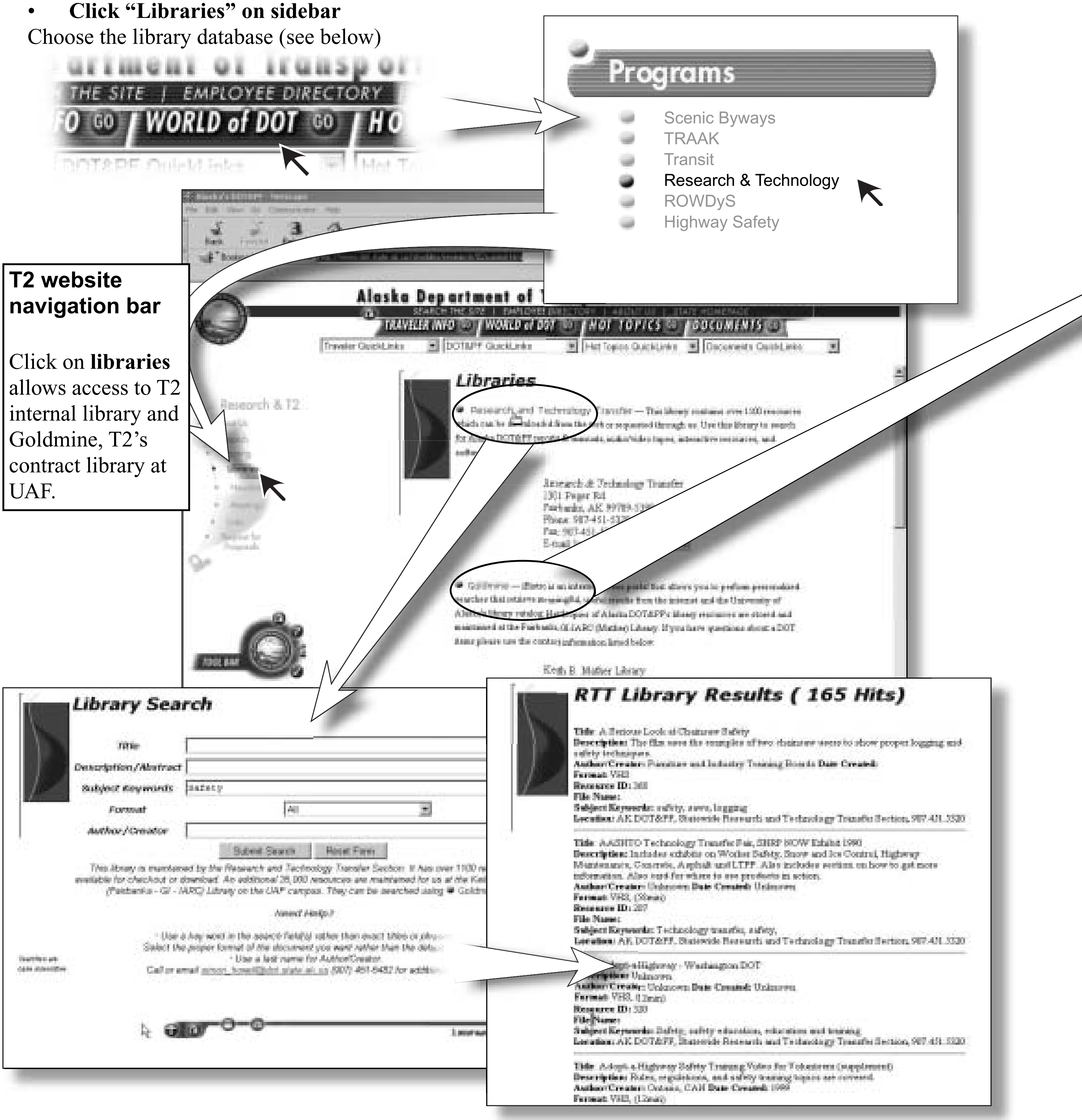
Visit Research & T2 on the web:

- **Click on "World of DOT"**
- **Click on "T2 Training"**
- **Click "Libraries" on sidebar**

Choose the library database (see below)



Keith B. Mather Library Available On Line

The Keith B. Mather Library on the UAF campus houses T2's collection—over 30,000 entries searchable through an on-line database.

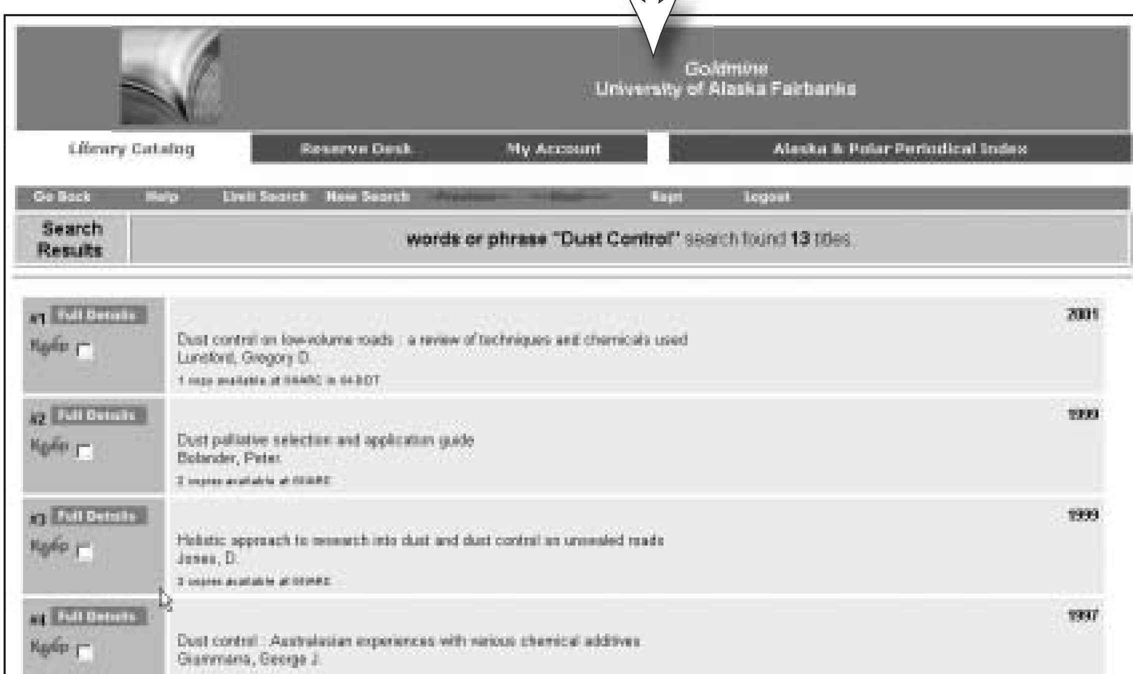
http://goldmine.uaf.edu/uhtbin/cgisirsi.exe/x/0/49/

Goldmine allows personalized searches that retrieve meaningful, useful results from the internet and the University of Alaska's library catalog. Hardcopies of Alaska DOT&PF's library resources are stored and maintained at the Fairbanks-GI-IARC (Mather) Library.

If you have questions about Alaska DOT items or requests for materials contact:

Dave Waldo, T2
(907) 451-5323
david_waldo@dot.state.ak.us

Judy Triplehorn, UAF
(907) 474-7512
gilibrary@gi.alaska.edu



The Goldmine on-line database can be reached from a link on the Libraries page (see middle previous page) on the Alaska DOT&PF's web site.

Flooding in Salcha: see page 5

Above: DOT maintenance crew installing an EZ Bridge on Piledriver Slough, January 2003.

Left: Road closure at the intersection of Old Richardson Highway and Stringer Road. See page 5 of this newsletter for more photos.

http://www.dot.state.ak.us
- rest the cursor on “World of DOT&PF”
- rest the cursor on “Programs”
- double-click on “Research & Technology”

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