TECHNOLOGY FOR
Alaskan Transportation

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PLUS...

Local Technical Assistance Program

To Pave, or Not to Pave

by Billy Connor and Bob McHattie, AlaskaDOT&PF Statewide Research

Q: When should you pave an existing gravel road?

A: When it makes economic sense.

Of course! What could be easier? Well, stop for just a moment, and think about how to determine when paving a gravel road makes economic sense.

What design factors should go into the decision? The amount of traffic? The kind of traffic? Characteristics of the existing road structure? Roadway function? Maintenance scheduling and costs? Dust and health hazards? Vehicle wear and tear? Travel time? Safety?

The gravel versus pavement decision may require selecting from several alternatives. For example, a gravel surface can be stabilized or maintained in various ways, or replaced by any one of several common asphalt pavement types. And, which of several methods do you use for making the economic comparison, i.e., determining which of several alternatives makes the most economic sense?

In comparing alternatives, it's important to realize that a dollar spent today for construction has a much higher value than one dollar spent on maintenance, say, ten years from now. In other words, to compare alternatives, it's not enough to simply add up the total amount spent throughout the design life of a project; you also account for when the money will be spent.

There are several standard ways of comparing economic alternatives that take this "time-value-of-money" into account. Each of these methods provides a dollar-cost figure (in terms of today's dollars) for each alternative so the alternatives can be directly compared. When the period of time used for these comparisons is the design life of the project, the economic comparison is then based on "life-cycle cost analysis."

Paving an existing gravel road sounds simple, sort of like adding icing to a cake: just add asphalt to the road. But in reality, it isn't that simple. While any cake can support icing, your existing road most likely won't support the asphalt. Don't pave an existing road because it seems like a good idea; you need a pavement design. Furthermore, a pavement design must consider the thickness of the entire pavement structure. This includes not only the asphalt pavement layer but the strength of aggregate materials to a depth of 42 inches beneath the pavement. If the pavement structure is too weak, then the asphalt layer will quickly crack and maintenance will become very expensive. This is especially true of thin surface treatments such as "chip jobs" and high float pavements. Surface treatments don't add any strength to the

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Getting Rid of Winter Gravel

Spring brings warm weather, melting snow, mud puddles and mounds of unsightly sand and debris on our highways and sidewalks. The Alaska DOT&PF's Northern Region maintenance station in Fairbanks formulates an aggressive sweeping program for about three weeks every spring to clean transportation facilities. The sweeping activities typically start the end of April and run through the middle of May with three different crews working around the clock. Sweeping continues through the end of May with a scaled back effort to clean up hot spots and finish low priority intersections. As conditions warrant throughout the summer, they use the sweepers to clean up gravel spills by the public and accident scenes.

Alaska DOT&PF crews clear gravel from the Wendell Street bridge Fairbanks,

In Anchorage, the DOT&PF Central Region's contract specifies that the first sweep begins no later than April 15, and be completed by June 5. Both Alaska DOT&PF and the Municipality of Anchorage (MOA) Public Works have been providing their contractors (and their own sweepers) with small amounts of liquid magnesium chloride to add to their onboard water tanks to allow them to start earlier in the season. The magnesium chloride keeps the water from freezing onto the road on those frosty spring days. Due to summer construction activities, spills, and track out, a second sweeping is scheduled for mid-summer. This second sweep starts on July 15 and is completed by August 15.

DOT&PF in Fairbanks has two dedicated special pickup sweepers and three additional units that kick brooms can be mounted on. They have borrowed additional units from Fairbanks International Airport or University of Alaska Fairbanks maintenance crews as required. Many of the streets in the core area of Fairbanks have curbs and gutters, which requires picking up the sand with special sweepers. In Juneau, where the streets do not have curbs and gutters, Juneau City & Borough (JCB) Public Works plows much of the snow into the drainage ditch alongside the roadway. They use just a rotating broom that moves the chips into the ditch. Unfortunately, this eventually causes the ditches to be at the wrong grade, so they have to be cleaned out. Central Region DOT&PF supplements sweeping efforts with a State owned and operated "Envirowhirl" waterless sweeper. This machine is very efficient and allows very little dust back into the atmosphere.

JCB uses several street sweepers. One is a vacuum sweeper that acts like a big truck mounted vacuum cleaner. This machine sucks the chips, dirt, cigarette butts, gum wrappers, and everything else from the sur-

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Library Freebies

Alaska T2 is streamlining the library. We are giving away extra copies of publications first-come, first-served, based on the date and time of your fax. Below is a selection of publications with extra copies. If you are interested in obtaining one of the publications, mark it and fax this form to T2 at (907) 451-5340.

__AK-RD-83-30 Earthquake Hazards in the Alaska Transportation Corridors (61 pages, 1983) Gedney, L.D.,Estes, S.A. &Marshall, D.L.

__AK-RD-83-32 Ventilation Study of State Court and Office Building at Fairbanks, Alaska (31 pages, 1983) Kailing, Stephen H.

__AK-RD-83-34 Multi-Year Maintenance Costs of Selected Alaskan Highways (76 pages, 1983) Reckard, Matthew K.

__AK-RD-83-35 Bridge Deck Repair Techniques (108 pages, 1983) Powers, Steve & Tilman, Clyde

__AK-RD-83-36 Solar Assisted Culvert Thawing Device, Phase II (43 pages, 1983) Zarling, John P. & Murray, Douglas H.

__AK-RD-83-38 Summary of Research - FY83 (86 pages, 1983) DOT & PF Research Section

__AK-RD-84-01 Experimental Roadways on Permafrost - Interim Study Reports as presented to the 4th International Conference on Permafrost (18 pages, 1983) McHattie, Robert L., Esch, David C., Zarling, John P., Connor, Billy & Goering, Douglas J.

__AK-RD-84-02 Fuel Cell Power Plants in Rural Alaska (40 pages, 1983) Malosh, J.B.

__AK-RD-84-03 Public Facility Building Codes (69 pages, 1983) McGlothlin, Balivet Co., Olson, David B., Raj Bhargrave Associates & HMS, Inc.

__AK-RD-84-04 Estimating the Durability of Alaskan Flexible Pavement Structures (63 pages, 1983) McHattie, Robert L.

__FHWA-AK-RD-84-05 Vehicle Load Effects on Alaskan Flexible Pavement Structures (63 pages, 1983) Johnson, J.B.

__FHWA-AK-RD-84-06 In-Situ Thermal Conductivity Measurements (41 pages, 1983) Atkins, Ronald T.

__AK-RD-84-10 Air Duct Systems for Roadway Stabilization Over Permafrost Areas (55 pages, 1984) Zarling, John P., Connor, Billy & Goering, Douglas J.

Please print your name and address below, and fax to:

Alaska Transportation Technology Transfer Center
2301Peger Road M/S 2550
Fairbanks, AK 99709-5399
Fax: (907) 451-5340

Name:_____ **Title:**_____ **M/S:**_____
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Dealing with Washboarding

Adaptation of an article by Ken Skorseth, Field Operations Manager, South Dakota, "Alaskanized" by Bob McHattie, PE, Alaska DOT&PF Statewide Research

One of the most aggravating gravel maintenance problems that plague grader operators, managers, and elected officials is corrugation. The slang term often used in the field is "washboarding." It is an appropriate description, because driving on a corrugated gravel surface is much like driving over a giant washboard. This problem generally brings more complaints from the public than any other gravel maintenance problem. It not only produces an uncomfortable ride, but moderate to severe washboarding can cause a driver to have reduced control of his/her vehicle. It actually becomes a safety problem.

Causes

It is impossible to deal with the problem of washboarding if you don't clearly understand what the causes are. There is not one single cause. The causes of the problem can be put in three general categories. Before we discuss these categories, we need to eliminate a myth that exists in the minds of many people. That myth is that motorgraders cause washboarding. They do not! It is true that graders can cut certain distortion into a gravel surface, but it will never look like the corrugated surface in the photo. When an operator runs a grader too fast, the machine can begin to "lope" or bounce. The humps and dips this causes will be farther apart and will be cut at an angle across the roadway— the same angle that the moldboard is adjusted to while blading.

1. Lack of moisture

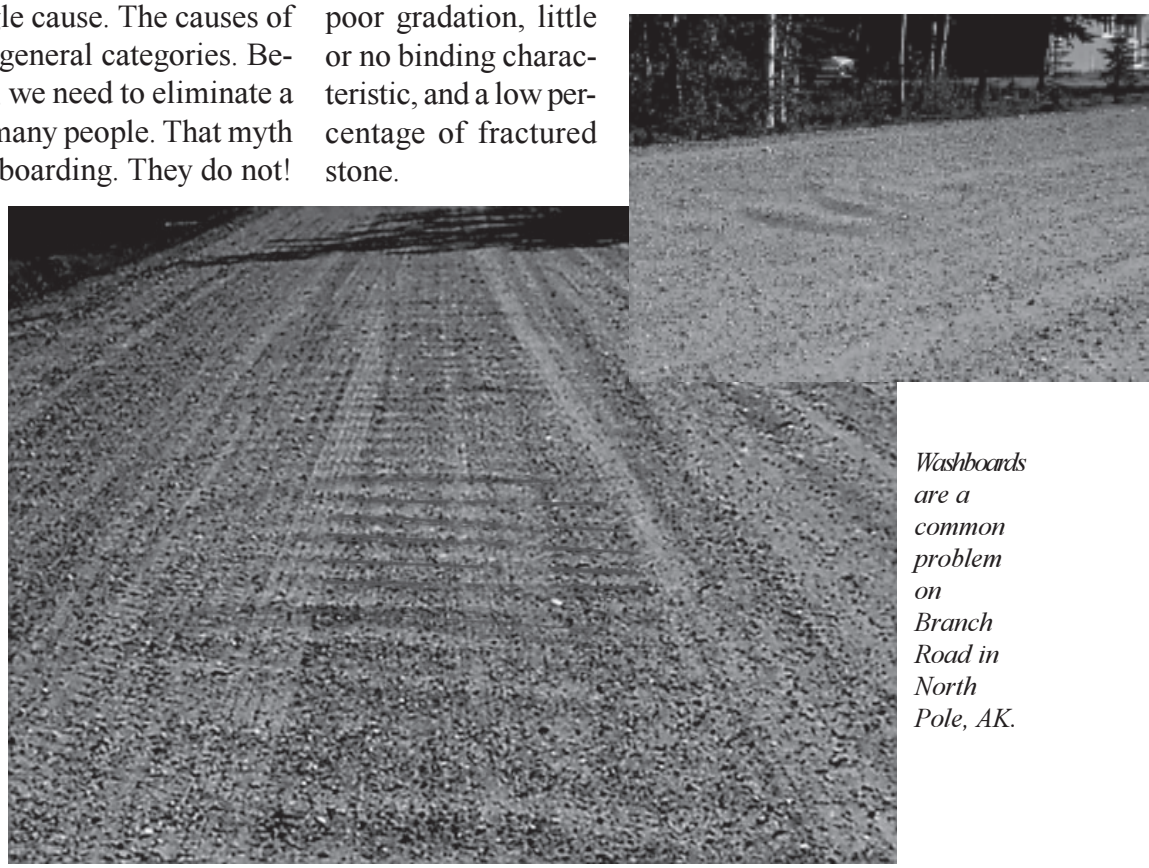
When frequent rainfall occurs, washboarding is greatly reduced. But that is not guaranteed, and in high traffic areas, just a few days without rain can really cause problems. Prolonged dry weather can cause washboarding in almost any situation, even with relatively low traffic.

2. Traffic

People's driving habits can really aggravate the problem. Hard acceleration and hard braking are the greatest problems. Because of this, washboarding generally appears first at locations such as intersections, coming into or going out of sharp curves, business entrances, and even driveways. As vehicle tires lose a firm grip on the road and begin to spin or skid just a little, a slight amount of gravel will be displaced. After this is repeated a number of times, the material will align itself into the "washboard" pattern. A US Forest Service study has shown that light vehicles with small wheels and light suspensions cause more washboarding than loaded trucks.

3. Poor Quality of Gravel

There are several things to consider in determining quality. Washboarding will almost certainly develop if the surface gravel has poor gradation, little or no binding characteristic, and a low percentage of fractured stone.



Washboards are a common problem on Branch Road in North Pole, AK.

What Can We Change?

What we need to ask ourselves at this point is: which primary causes can we change? We cannot predict rainfall, and in some areas prolonged dry weather can be expected. With the exception of a few special situations, it is cost prohibitive to haul water. We would have to conclude that the amount of moisture available is something we cannot change.

It is all but impossible to change the driving habits of people as well. Some departments have made an effort to educate the public in this matter. The results have been disappointing. People are generally in a hurry and will continue to accelerate hard, drive fast, and apply their brakes firmly.

Of the three major causes, we can really only change one. We can take a hard look at the material we use and see if changes are possible. In prolonged dry weather, almost any section of road with a high traffic count will develop some corrugation, but good gravel will definitely reduce the problem.

What is Good Gravel?

Good surface gravel should have a nice blend of stone, sand, and fines. Generally, the maximum stone size should be ¾ inch. Also, crushed gravel that has a high percentage of fractured stone will have much better "aggregate interlock" and will stay in place in the road surface better than rock with a naturally rounded shape. This also gives the road better strength. But, as mentioned earlier, you need a good mix of sand-size particles and fines. The ideal blend produces a gravel that will compact into a dense, tight mass with an almost impervious surface. This will reduce washboarding dramatically. Only by sampling and testing gravel can you really make a good judgment as to what the quality is.

Perhaps the least understood factor in obtaining good surfacing gravel is the right percentage and quality of material that passes the #200 sieve (P200). In order to resist washboarding, the gravel must have a good cohesiveness (binding) characteristic. In the field, managers and operators talk about good gravel that has plenty of "binder" in it. What this really means is that the gravel must be well graded, must contain the correct amount of P200, and ideally, should contain a small amount of clay. Individual particles of true clay are so fine that the naked eye cannot see them. However, when gravel containing the right amount of clay particles is exposed to moisture, compacted, and dried, the clay provides a very tenacious cementing action as it clings tightly to itself and all larger particles. Well-graded gravel compacts easily into a dense material, while the clay component adds the binding quality necessary for the gravel to re-

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News & Views

Deputy Federal Highway Administrator Invites Community Applications For "Smart Growth" Grants

by Lisa Haakon Pogue, Director of Technology Transfer, LTAP Clearinghouse, APWA

Deputy Federal Highway Administrator Gloria J. Jeff announced that communities can apply for federal help to fight local sprawl under an innovative U.S. Department of Transportation initiative called the Transportation and Community and System Preservation (TCSP) program.

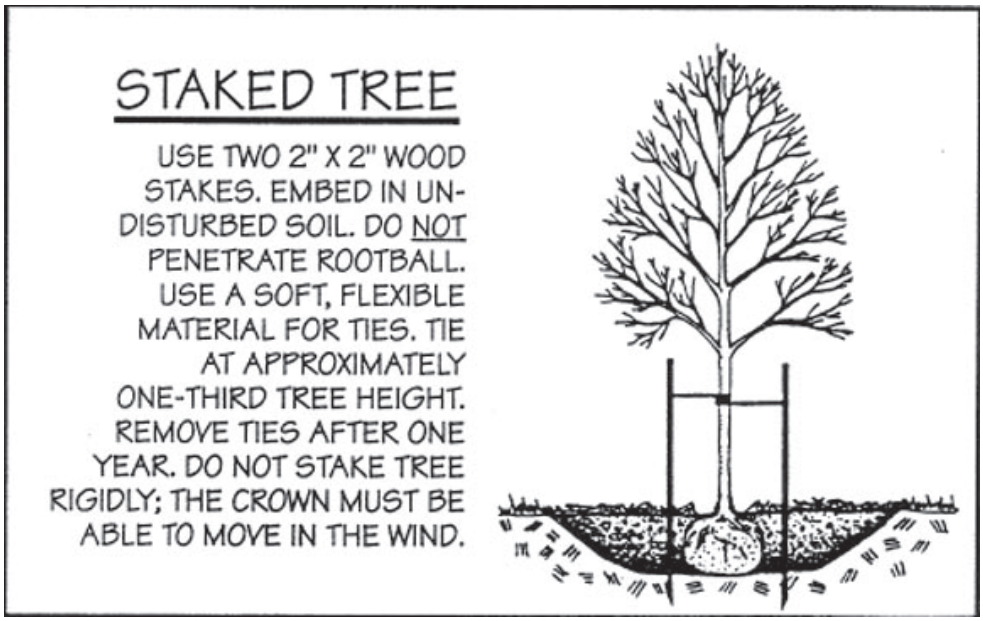
TCSP provides grants to communities to help them solve problems involving transportation, land development, environmental protection, public safety, and economic development. The program was established in the Transportation Equity Act for the 21st Century (TEA-21), the six-year surface transportation law signed into law June 9, 1998.

The Federal Highway Administration provides extensive information on the program on its web site: www.fhwa.dot.gov. The Federal Register notice (Docket No. FHWA-98-4370) can be accessed at www.nara.gov/fedreg or at www.access.gpo.gov/nara.

◊ From the FHWA Web site the following dates were included in the May 10, 1999 Federal Register Notice: DATES: Requests for FY 2000 grants should be received in the appropriate FHWA Division office by July 15, 1999. Proposals for FY 2000 TCSP research should be received in the FHWA Office of Planning and Environment by September 15, 1999. Comments on program implementation, research needs, and priorities should be received by the DOT Docket Clerk on or before July 15, 1999. •

Alaska DOT&PF Tree Specs

The Alaska Department of Transportation and Public Facilities' Northern Region issued a new Regional Specification for planting trees and shrubs that should result in better health for post-project plantings. Section 621 of the specification addresses regulations on soil preparation, layout and coordination, plants, procedures, maintenance, and basis of payment. The new Regional Specification includes detailed drawings of the planting requirements.



A group from three agencies collaborated to develop the Regional Specification. Eric Gerke of ADOT&PF's Northern Region Design and Engineering Services, Environmental Section worked with Dan Ketchum, Alaska Department of Natural Resources Division of Forestry, Urban & Community Forestry, Anchorage; Pete Simpson, ADNR Forestry, Urban and Community Forestry, Fairbanks; and Patricia Holloway, Ph.D., University of Alaska Fairbanks, Agricultural and Forestry Experiment Station. The four workers used their expertise to rewrite the specifications to enhance the success of planted trees and shrubs in a northern climate. The goal is to achieve aesthetically pleasing landscapes as well as to assure that we spend funds efficiently by having successful growth.

The arrow points to the wire ties supporting this tree. The tree has grown crooked and the top is dead.

Because DOT&PF's Statewide Specification doesn't yet incorporate current forestry and horticulture knowledge (the spec currently relies on information available in the 1960's), it does not consider the varied growing climates in Alaska, nor the different growing seasons from the North Slope to the Southeast Coast. It also outlines planting requirements that once were accepted practice, but which are now considered detrimental to tree and plant growth. Two of the most critical are 1) using wire to stake trees, with no requirements to later remove the wires, and 2) the lack of requirement for wood chips or mulch around the tree dripline.

Wire supports cause girdling and can restrict the flow of water and nutrients to the top of the tree, essentially stopping growth. The staked wires make the trees inflexible, which means that the force of snow blown from snowplows snaps the trees. The new specification requires using a polypropylene webbing for tree support, and requires removing the stakes and webbing after a year.

Adding wood chips and mulch around the base of planted trees helps keep moisture in the ground so the tree doesn't die during dry weather. Decomposing wood chips provide a nutrient base to the tree and keep weeds

down to reduce maintenance costs. The new regional specification also includes watering requirements, such as how much to use in the first few weeks after planting (newly planted trees need gallons of water), as well as when to water and when not to water.

Photographs of tree planting along the Johansen Expressway in Fairbanks show the typical damage that occurs. First, wire supports were used in accordance with the statewide spec, which stunted tree growth; below the wire, tree growth is relatively healthy, while above the wire, the branches are barren. Second, the stakes and wires weren't removed. Because the trees weren't able to flex, snow blowing from plowing operations snapped the trees just above the wires.

Wire ties around the trunk of this tree caused girdling.

Landscaping is becoming a more important element in construction projects, and the ability to do it properly is mandatory. The new Northern Region Specification requires having a certified arborist to: 1) select trees and shrubs from nurseries or tree farms; 2) supervise planting; and 3) assist with planting area maintenance. A full copy of the specifications is available from Grant Lewis, Northern Region Contracts Engineer, (907) 451-2320; or contact T2 for more information. •

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face of the street and the gutters into a big hopper. This material is disposed of, not reused. Since it rains so much in Juneau (seventy inches or more each year), lots of the chips and other debris ends up in the catch basins that collect the storm water during rainfall. These catch basins are cleaned using the same type of vacuum sweeper; it sucks the debris out of the catch basins into the truck's hopper for disposal. Another type of sweeper is like a glorified carpet sweeper, which simply uses a rotating broom to sweep the debris onto a conveyor belt that takes the material to a hopper. This sweeper does not work as well as the vacuum sweeper, but is a lot quieter, so it can be used at night without disturbing people so much.

An estimated 3,000 cubic yards of sand material is spread on the highways in the Fairbanks core area every winter to provide traction for motorist. Approximately 1,000 cubic yards of the sand is picked up and hauled away with snow removal operations. This snow and sand mix is hauled to snow dumps located around the Fairbanks area. Another 1,000 cubic yards finds its way off the highway and into the ditches by bouncing off vehicle tires, or is placed there by snow plowing operations. They sweep up the remaining material using the special sweepers and haul it back to the maintenance yard for reuse as road fill or shoulder material. In the winter of 1998-99, the JCB used about 3000 tons of chips for traction aid on the city maintained streets. This is more than usual because that winter had more than the average snowfall. Like Fairbanks, much of this material is removed when the snow is removed from the streets and roadways. The snow is then dumped into the Gastineau Channel, and the chips go with it.

For the several years, both the Alaska DOT&PF and MOA Public Works have been moving away from standard sand/salt mixes and increasing the use of liquid deicers. Liquid magnesium chloride has become the product of choice. It is being used straight in advance of storms for anti-icing, and being applied directly to prewet traction sand to cause more of the sand to stick to the road. These new practices have dramatically reduced the total amounts of both sand and salt applied to the streets. The total amount of sand used in Anchorage has been reduced approximately 45%, from 40,000 tons in 1994 to 22,000 tons in 1998. Salt use declined from 2.6 tons in 1994 to 2.1 tons in 1998, a reduction of about 20%.

Alaska DOT&PF has looked at the possibility of reusing the swept up material as sand the following winter. The sand is very dirty (high fines content) and full of debris such as sticks, paper and other foreign material. The cost to rescreen and wash the material to remove all the unwanted particles is not cost effective. Sweepings from both DOT&PF Central region and MOA are stockpiled in their respective yards for future testing and disposal. Materials picked up by contract forces become the property of the contractor. Fairbanks found a good use for this material: filling sinkholes and settlement areas on the highway system. •

Intrusion Alarms

by John Hibbs, P.E. Kentucky LTAP Center

The companies that specialize in traffic control electronics have been very cooperative in the development and manufacture of SHRP-type intrusion alarms with continued improvements being made to increase their convenience and reliability.

At most work sites, traffic, even high-speed traffic, is just a few feet from workers. Because of the constant danger, the Strategic Highway Research Program (SHRP) zeroed in on developing work zone safety devices—like those called for by the National Transportation Safety Board after an accident in West Virginia. A truck loaded with new vehicles failed to stop for a work area. Multiple lives were lost and an investigation by the National Transportation Safety Board similar to that for an airline tragedy resulted. The resulting intrusion alarms or worker warning devices detect errant vehicles entering the work area where traffic is not intended. A horn is sounded and flashing lights give warning so the workers can run to safety. The detectors use either an electronic beam or a pneumatic hose to detect the presence of a vehicle.

The Traffic Management Systems model is mounted on the traffic drums. The Central Security model is shown nearest the bottom of the picture, and the Watchdog model is near the center. The tall unit with the light on top is the receiver for the newest ASTI model. The two units nearest the display panel are the Safe-Lite models.

A survey completed by Leland Smithson, Maintenance Engineer for Iowa DOT, revealed that 28 states have tried intrusion alarms, and 15 are using them. LTAP centers have used the devices mostly for exhibit. Each center received at least one device, and some received two. Kentucky has tested about a dozen from six different manufacturers. The Kentucky results were disappointing for two reasons. The first reason was that the devices were being updated so frequently, testing operations were interrupted on a continuous basis for certain models during the 18-month testing period. This is actually a positive finding in that the units keep getting more reliable and easier for workers to use by features like solar panels to keep batteries charged. The second and most disappointing finding was that workers were generally not interested in using the devices. The one exception was the use of the microwave unit that has the built-in radar drone to activate all radar detectors of passing vehicles. Workers liked this unit and could note the slower speed of traffic. The key operational problem on the large interstate pavement rehabilitation project was that construction traffic kept actuating the units, resulting in false alarms. However, on this same project one subcontractor responsible for the bridge deck rehabilitation work liked the units. This was possibly because two workers on a similar bridge work project were killed by an out-of-control truck in the same area only a year before.

Two Kentucky maintenance teams found a new use for the Safe-Lite system that is equipped with both a pneumatic hose and a push-button switch to activate the horn. The push-button switch was added at the request of a state, so that the detector unit could be mounted on a shadow or vehicle for a paint striping operation. The horn is mounted on the paint application vehicle. Thus, if a fast moving vehicle passes the shadow vehicle and it appears destined to hit the paint striping vehicle, the push-button switch can be pressed by the shadow vehicle driver to warn the lead driver (paint striper) so that evasive action can be taken to safeguard the highway user and avoid damage to the rear of the striping ma-

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chine. The two Kentucky maintenance teams concluded that the intended use on vehicles would be good, but they obtained more use from the device by placing the detector near a flagger's station so that he/she could hit the button when an uncontrollable driver was approaching the work site. The horn unit was positioned near the workers. The result was that the flagger was able to warn workers when danger was approaching without waiting for the vehicle to hit the pneumatic tube. Certainly, a second or two of additional warning could be of great value for the crew trying to escape danger.

Following the test projects in Kentucky, a highway contractor came to the Kentucky DOT and asked to use the units on another interstate pavement and bridge deck repair project. The ASTI unit was used for the complete construction period without any problems or difficulties with the solar panels keeping the batteries charged. The difference between the two similar projects was that the earlier one had contract provisions requiring use of the intrusion alarms as a contract requirement. Use on the later project was at the contractor's own initiative and interest in providing safety for the workers.

The evaluation completed in Kentucky showed all of the devices to be reliable. No situations occurred where an uncontrolled vehicle entered the work area, but many alarms occurred on one pavement repair project where the construction traffic kept triggering the alarms.

The most severe test for reliability occurred at the Kentucky State Fair where the ASTI unit was used in a mock construction zone for viewers to test the device by stepping between the traffic cones. The horn was muffled with tape to keep the sound level at a tolerable level as the device was activated about 100,000 times during the nine days and nights that the exhibit was open. Approximately 900,000 people visited the fair. Some children took great delight in triggering the alarm several times before leaving the exhibit area, but the solar panels were able to keep the batteries up and operational for the full nine days without failure. The only light source was the interior lighting of the exhibit area.

Most of the local government agencies in Kentucky that had opportunity to use the devices did not consider their traffic challenges to be sufficient to warrant use of intrusion alarms.

From all of these results, it is generally concluded that more promotional work needs to be done with high-

Intrusion alarms protect a crew evaluating pavement line stripes. The left alarm is the Columbia model, the middle is the Safe-Lite model, and the right is the ASTI model. These are all receivers (the transmitters are 300 feet up-stream).

way construction, operations, and maintenance managers, for them to buy intrusion alarms as protection devices for their workers. This concern is being demonstrated with the use of brightly colored clothing and hard hats. However, if left up to the initiative of many workers, they would not bother with orange vests or hard hats. These are now requirements for most project situations. Occupational Safety and Health Administration officials should consider requiring the use of intrusion alarms under situations where workers are exposed to high-speed traffic with no physical protection such as concrete dividers.

In summary, the following recommendations are given for use of intrusion alarms:

- In accord with the National Transportation Safety Board's recommendation, project managers should be encouraged to provide the additional protection for workers from high-speed, high-volume traffic where separation is only provided by a minimum of distance and devices like cones.
- The Occupational Safety and Heath Administration regulations should be supplemented to require the use of intrusion alarms for high-speed traffic with no physical protection such as concrete dividers.

The known companies that are now supplying intrusion alarms are given in the table on page 18, along with a brief description of the capabilities and approximate cost.

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Traveling Presenter:You are What You Pack

For traveling presenters, the catch phrase, "Don't leave home without it" applies to much more than a corporate credit card. Whether it's a breakout session at a convention, a sales pitch in a client's office or the second stop in a 12-city training seminar tour, the one thing you can be sure of is your arsenal of presentation tools.

You are the most important element in your presentation. There's no doubt about that. But in today's media-saturated world, a successful presentation requires more than simply standing in front of an audience and delivering a speech. That's where your presentation tool kit comes in.

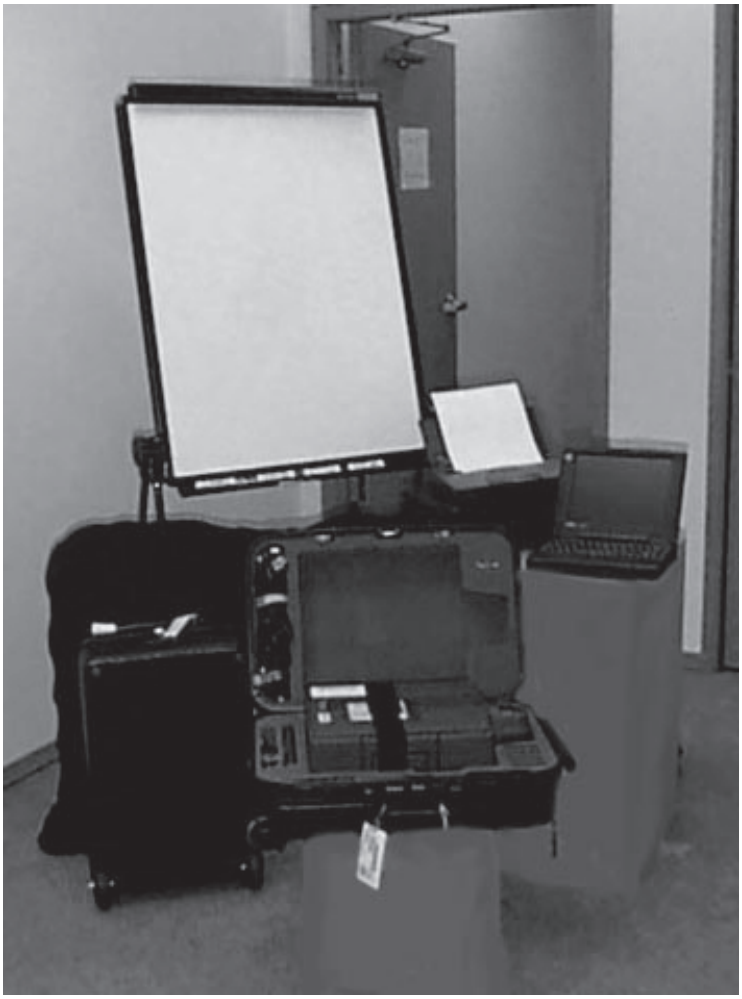
The standard presentation tool kit - the communication technologies and tools that help you deliver your message more effectively – has changed dramatically during the last few years. Notebook computers and LCD projectors are slowly replacing transparencies and overhead projectors as the technology of choice for many frequent business communicators. And that shift from analog to digital based communication gives presenters new power and flexibility to wow the audience and drive the message home, not to mention making it possible to use a new group of presentation tools on the road.

But there are trade-offs. As anyone who has ever toted a notebook computer, a projector, and any additional media through an airport terminal knows, the term portable is relative. Even a seven-pound notebook gets heavy when you're rushing between gates at an airport. Despite the difficulty of carrying presentation technology with them, most presenters agree that the importance of their messages warrants overcoming the difficulties. Delivering a killer presentation is every traveling presenter's mission, and most will do anything to make that happen, including dragging along extra pounds of technology.

What makes up the ideal traveling presentation tool kit? A multitude of possibilities exist, from the newest technology to the old standbys, all designed to help you deliver a more effective presentation. Here are some common weapons in the arsenal of a successful road warrior.

Notebook computer and presentation software

There are many advantages to delivering an electronic slide show or interactive multimedia presentation from a computer you carry with you. First and foremost, an electronic presentation is a powerful communication medium because it combines text, color, animation and graphics to visually enhance your message. Second, carrying an electronic presentation on your notebook means it can be changed in your hotel room the night before your speech, if necessary. That's something that can't be done with 35mm slides or overhead transparencies. Finally, an electronic presentation suggests you are a cut-



A prepared presenter may travel with a laptop, portable printer, flip chart, or multimedia projector like these available from the Alaska T2 center.

ting-edge user of communication technology — an increasingly important image in today's high-tech business climate.

Lightweight, ultra portable projector

Unless you're delivering to fewer than three people, your notebook's LCD display is too small for presenting. The solution is a projector that will throw your image on a screen. Many manufacturers now offer "ultra portable" LCD projectors that weight less than 12 pounds. That's still heavy when you're carrying it from airport terminal A to D, but it's much better than the 25-pound monsters available just a few years ago. The main benefit of lugging a projector along is that you have complete control over your presentation — the computer for playing your presentation and the projection system for displaying. Provided, of course, your equipment doesn't malfunction.

Wireless remote control device

A wireless remote frees you from having to stand next to your computer while presenting. Instead, you can move around and use the remote control mouse to navigate. Certain remote controls allow you to highlight or annotate areas of the screen for added visual emphasis.

Removable storage drive

When you're away from the office, backup becomes imperative. Removable storage drives, such as the Iomega Zip or the Syquest EZFlyer, are inexpensive tools that can mean the difference between success and disaster. Although a floppy disk will suffice as a backup for a basic software file, if your presentation includes memory-intensive media, such as scanned photos, 3D graphics, animations, or digital video, you'll need the storage space a removable storage drive offers.

Hard-copy backups

Savvy presenters bring overhead transparencies, flipchart pages or at least paper printouts of their presentation slides. You never know what's going to happen, but a with a hard-copy backup, you're always prepared.

Other presentation technologies are starting to show up in the traveling presenter's tool kit as well. These technologies may not be considered necessities — and they'll certainly add weight to your luggage — but the following tools are worth a close look if you're a constant traveler, a gadget freak or someone looking to further customize presentations.

Portable printer

Being unable to print is a frustrating part of being away from the office. Sure, you can use the hotel's business center, but missing software print drivers and inexperienced staff may thwart you. Some presenters carry lightweight portable printers made by Brother, Citizen, Hewlett-Packard and others. These small units add a few more pounds to your suitcase but generally provide decent output and can really come in handy.

Digital camera

Some technically savvy presenters have discovered that a digital camera makes it easy to customize presentations hours before they're delivered. Using a digital camera, you can snap photos of the city, the hotel or conference center, or even audience members the day before you present, then incorporate them into the slides of your presentation that night. Doing this is as easy as connecting a cable to your notebook and downloading the images into your presentation software program.

Cellular phone

Anyone who owns a cellular phone can attest to its incredible convenience, especially when you are traveling. A cell phone allows you to call for directions from the rental car, check voice mail messages while in the taxi cab, and be accessible at all times.

Personal digital assistant (PDA)

Although still in their infancy, PDAs such as the Apple Newton and US Robotics Pilot, continue to grow in use and popularity. And some traveling presenters are realizing their advantages. They not only help you organize your travel schedule electronically, but also your contacts and address book — even brief notes that you can download to your computer back at the office. The next generation of PDAs, which will likely ship at the year's end, will offer substantially improved handwriting recognition — the last hurdle to overcome for this technology to go mainstream.

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tain its high density and stability against washboarding. This is what we want in our gravel.

Alaska tends to be a little unfortunate with regard to clay. While well-graded gravel can often be obtained, it usually contains very little or no clay binder. Such material tends to compact easily, but washboards rapidly. Another and very important disadvantage associated with the lack of binder is that traffic action (especially large trucks) creates a huge amount of dust whenever the material is dry.

Gravel pits, like this one in Fairbanks, play an important part in obtaining good gravel.

In Alaska, maintenance costs increase to compensate for the lack of natural binder. High costs come from frequent grading and, on some gravel highways, the application of calcium chloride that serves as a temporary binder. There are commercial, permanent binders available, including processed clay additives, which may someday become economically viable in Alaska. AASHTO provides simple guidelines intended for well-graded gravel surfacing materials containing a small amount of natural clay. They recommend an 8 percent minimum P200 content (Alaskan specifications usually call for between 10 and 15 percent P200), and a Plastic Index range of 4 to 9 with a maximum Liquid Limit of 35. Occasionally, Alaskan gravel can be obtained that contains just the right amount of natural clay and fits these requirements – if you can find it, use it if possible.

Sampling and testing of gravel is the only sure way to determine gravel quality. Gravel that is short of stone will not have strength in wet weather. Too much stone will make the gravel hard to compact and it will "float" in dry weather, piling up between the wheel tracks and along the shoulders. Too few fines will not allow the gravel to form a crust. Excess fines can cause moisture retention and workability problems during construction, and excess clay will make the road slick in wet weather after construction. Testing is the answer to reduce these problems.

In terms of clay percentage, it's important to point out that it's easy to get too much of a good thing. For example, gravel containing 1 or 2 percent clay (by weight) may fit the AASHTO criteria and might make an ideal surfacing material. However, as little as 4 or 5 percent clay can cause an assortment of construction and post construction problems to the point that no clay at all would be the far better alternative.

Work to Obtain Good Gravel

We have briefly defined what good surface gravel is. Obtaining it in the field is the real challenge. Yet, this is the place to begin fighting washboard problems. Start by establishing good specifications. We generally see close control of materials used in base and the asphalt or concrete on our major construction projects. However, when surface material is produced for the "plain old gravel road," very little attention is given to the specification. We have seen everything from no specification at all to a few cases where very good specification is established. The difference in how the material performs on the road is dramatic! A good specification for one area may require use of a particular materials site, if it offers a natural clay component. Good specifications for another area, where materials sources lack clay, might require might require the addition of commercial binding additives. **Avoid** materials sources with excess clay.

The real keys are to increase your knowledge of materials and then follow through by specifying what you want. Make this clear before you crush or supply gravel, whether you do this with your staff or you let bids. Communicate with your supplier. Some pits or quarries do not have a good natural blend of material. In some cases, material, such as clay or stone, may have to be hauled in and blended at the plant. However, material can often be improved by simply working the pit differently. Communicate and cooperate!

Sometimes, changes have to be made while the material is being produced. We are aware of one situation where clay on the surface of the pit became too wet to process through the crusher. The contractor and buyers agreed on an arrangement to rent an Ag tractor and chisel plow to use for drying the clay quickly in order to process it into the gravel. This increased the cost of material, but they knew the long-term benefit would be better gravel that would require less blading, would remain bound, would stay in place longer, and would reduce washboarding.

Don't overemphasize a cheap initial cost for material. You will pay either way: by purchasing cheaper material up front and spending more to maintain and replace it over the years as well as taking more complaints from the public, or by paying more for quality material that requires less maintenance, lasts longer, and generates fewer complaints. Remember that trucking often makes up 70 percent or more of the total cost of gravel placed on roads. Spending more to increase the quality of the gravel itself does not change the total cost as much as you might think.

We also understand that truly good quality gravel is very hard to obtain in certain areas. At the very least, you should consider hauling the best materials you can find for washboard trouble spots. Use regular material available to you for the rest of the road system. For example, one township in SD used "millings" (recycled asphalt) near busy intersections and found this material reduced washboarding dramatically. They certainly could not afford this for the whole road system, but they found it cost effective for troublesome areas.

Pulling material from the shoulder of the roadway and mixing it with loose gravel on the surface works best in spring..

Maintenance Tips

It is not always possible to haul new and better quality gravel to reduce our washboarding problems. What can a grader operator do to reduce the problem? Once again, the operator has to change the material any way necessary. Simply blading over washboards and filling the depressions between the ridges proves almost useless. Cut all of the material loose to a depth of 1 inch or more below the bottom of the washboard area to handle washboarding best. This also brings up some fines to mix with the surface material. Then re-lay the material to the proper crown and shape. Remember, dry conditions cause washboarding, so never do this without good moisture in the material. It may pay to quickly run to the problem areas after a good rain, work them, and then resume normal blading.

Another useful tool is the replaceable bit-type cutting edge. This type of cutting edge tends to have a shallow scarifying effect and makes cutting material loose and mixing it easier. One of the most effective ways we've seen these used is on a front-mount dozer blade. The operator can drop the dozer to cut out a washboard area and use the moldboard to shape the area. A conventional scarifier also works, but be careful about going too deep and bringing up dirt and large rock from the subgrade and contaminating the gravel.

Pulling in material from the shoulder area of the roadway and mixing it with the loose gravel on the surface works best in the spring before too much vegetation grows on the shoulder and moisture is present. Generally, the materials don't work as the best binder, but it does have some benefit in restoring some fines to the gravel.

A couple more advanced methods work well, but are probably affordable only in high traffic locations. One of these requires treating the gravel with either Calcium or Magnesium Chloride. These are not permanent binders, but are a tremendous aid in keeping gravel in place. They work by simply drawing moisture from the air. This keeps the surface slightly damp, and the material tightly bound through a binding effect, called "apparent cohesion." The effect lasts until these chloride salts are washed out of the surface layer. The real key to success with these products is to treat gravel that is very well graded.

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Date	Event	Sponsor/Contact	Location
June 24-26	Construction Criteria Base to exhibit at A/E/C Systems '99	NIBS, (202) 289-7800, Fax: (202) 289-1092, askrabalak@nibs.org	Los Angeles, California Los Angeles Convention Center
July 7-8	Demonstration Project 97: Scour Monitoring & Instrumentation	T2 Center, Sharon McLeod-Everette (907) 451-5323, Fax: (907) 451-5340	Anchorage, Alaska
July 7-8 July 13-14	Pavement Design	T2 Center, Simon Howell (907) 451-5482, Fax: (907) 451-5340	Fairbanks, Alaska Anchorage, Alaska
July 12-16 July 19-23	Grader Operator Training	T2 Center, Sharon McLeod-Everette (907) 451-5323, Fax: (907) 451-5340	Soldotna, Alaska Palmer, Alaska
July 22	Traffic Management Technology	Register online at: http://www.cohu.com/cctv/tmt.htm	Anchorage, Alaska
August 3-6 August 9-12	Systematic Development of Informed Consent	T2 Center, Sharon McLeod-Everette (907) 451-5323, Fax: (907) 451-5340	Juneau, Alaska Anchorage, Alaska
August 16-19	10th International Conference on Cold Regions Engineering	ASCE,CRREL, Dr. Suflet (603) 646-4275, jzufelt@crrel.usace.army.mil	Lincoln, New Hampshire Mountain Club on Loon
October 26-27 October 28-29 November 1-2	Americans with Disabilities Act (ADA) Training	T2 Center, Simon Howell (907) 451-5482, Fax: (907) 451-5340	Fairbanks, Alaska Anchorage, Alaska Juneau, Alaska
October 25-27 Oct. 28-Nov. 1 November 3-5	Design, Construction, and Maintenance of Safe Roadsides	T2 Center, Sharon McLeod-Everette (907) 451-5323, Fax: (907) 451-5340	Anchorage, Alaska Fairbanks, Alaska Juneau, Alaska
November 30-December 2	NHI 13132: Hot Mix Asphalt Construction	T2 Center, Sharon McLeod-Everette (907) 451-5323, Fax: (907) 451-5340	Anchorage, Alaska
January 31-February 6, 2000	ISCORD 2000, Sixth International Symposium on Cold Region Development	Convenor GPO, ++61-3-6233 5492, fax: ++61-3-6233 5497, thughson@oaa.tas.gov.au	Hobart, Tasmania, Australia University of Tasmania
August 8-9, 2000	The Cold Weather Show	Osprey USA, (703) 451-1444, Fax (703) 440-1272	Arlington, Virginia Hyatt Regency at Crystal City

Meetings Around Alaska

Society	Chapter	Meeting Days	Location
ASCE	Anchorage Fairbanks Juneau	Monthly, 3rd Tues., noon Monthly, 3rd Wed., noon Monthly, 2nd Wed., noon*	Northern Lights Inn Captain Bartlett Inn Westmark Hotel *except June-Aug.
ASPE	Anchorage Fairbanks Juneau	Monthly, 2nd Thurs., noon Monthly, 1st Fri., noon Monthly, 2nd Wed., noon*	West Coast International Inn Captain Bartlett Inn Westmark Juneau Hotel *except June-Aug.
ASPLS	Anchorage Fairbanks Mat-Su Valley	Monthly, 3rd Tues., noon Monthly, 4th Fri., noon Monthly, last Wed., noon	Executive Cafeteria, Federal Building Ethel's Sunset Inn Windbreak Cafe; George Strother, 745-9810
ITE	Anchorage	Monthly, 4th Tues., noon	Sourdough Mining Company
IRWA	Sourdoughs Ch. 49 Arctic Trails Ch. 71 Totem Ch. 59	Monthly, 3rd Thurs., noon** Monthly, 2nd Thurs., noon** Monthly, 1st Wed., noon	West Coast International Inn **except July & Dec. Oriental Garden Restaurant Mike's Place, Douglas
ICBO	Northern Chapter	Monthly, 1st Wed., noon	Zach's Sophie Station
AWRA	Northern Region	Monthly, 3rd Wed., noon, Brown Bag Lunch	Rm 531 Duckering Bldg., UAF, Larry Hinzman, 474-7331
PE in Government	Anchorage	Monthly, last Fri., 7am	Elmer's Restaurant

SHRP Winter Maintenance Strategies Now Part of University Curriculum

The innovative winter maintenance techniques evaluated and enhanced under the Strategic Highway Research Program (SHRP) are making their way into the university classroom and making progress toward becoming part of the standard curriculum for the next generation of civil engineers. The University of Iowa now offers a semester-long course that incorporates the SHRP techniques.

The class, Contemporary Topics on Civil and Environmental Engineering—Winter Highway Maintenance, is "aimed at providing a solid theoretical underpinning for the practice of winter maintenance" for undergraduate and graduate civil engineering students and professional engineers, says Wilfrid Nixon, who developed and teaches the course. And to ensure that the course is readily available to highway engineers and practitioners outside of Iowa, the university is also making it available over the World Wide Web.

"As a university, we tend to speak to our own community, not practitioners. I hope the Web course is a way to bridge that gap," Nixon says. The details of how the course will be presented are still being worked out, although it appears that it will not be in real-time. Instead, course lectures and homework assignments will be posted, and students will submit homework by email.

The course covers all the basics of winter maintenance, including the types of attributes of different types of winter storms, the use of plows, and the difference between deicing and anti-icing. Students also learn about deicing materials and how to calculate the amount of chemical needed to address a given amount of snow or ice on pavements. In addition, they learn how to compare the costs and benefits of various winter maintenance techniques. The course work includes a final project, in which students must design a winter maintenance strategy for a hypothetical highway agency.

The Winter Highway Maintenance course was first offered last semester. Participants included undergraduate and graduate civil engineering students, and Iowa DOT engineer, and county engineers from Iowa.

The course takes advantage of information collected as part of the SHRP assessment project. Nixon advises students to review the SHRP RoadSavers case studies (available from the Alaska T2 Library) that describe how highway agencies are using SHRP winter maintenance technologies. The Lead States team also provides information and education materials for RWIS/anti-icing. And Lead States team members Paul Keranen of the Minnesota Department of Transportation (DOT) and Dennis Burkheimer of Iowa DOT helped to evaluate the students' final projects last year.

Lisa Radloff, who took the course last year and who now works for the aviation services department at Howard R. Green Company, an engineering consulting firm in Cedar Rapids, Iowa, says "Wifrid Nixon's Winter Highway Maintenance course should be taken by all county and city engineers and anyone else who manages winter maintenance programs."

The next course will start in August and run through December. It will be open to students and practicing engineers. Classes will be held once a week. Nixon says that class participants will be able to earn continuing education credits.

For registration information, contact the University of Iowa's Center for Credit Programs phone: 800-272-6430; email: credit-programs@uiowa.edu; Web: www.uiowa.edu/~ccp. For information on course content, contact Wilfrid Nixon, 319-335-5166; fax: 319-335-5660; email; wilfrid-nixon@uiowa.edu.

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CONVERSION AND ROUNDING

The conversion of inch-pound units to metric is an important part of the metrication process. But conversion can seem deceptively simple because most measurements have implied, not expressed, tolerances and many products (like 2-by-4s) are designated in rounded, easy-to-use "nominal" sizes, not actual ones. People working in a particular profession or trade gain an intuitive feel for the allowable tolerances of the measurements and products they use and learn the difference between nominal and actual sizes. It is this knowledge that must be relied upon when converting to metric measures.

For instance, if anchor bolts are to be imbedded in masonry to a depth of 8 inches, what should this depth be in millimeters? A strict conversion (using 1 inch = 25.4 mm) results in an exact dimension of 203.2 mm. But this implies an accuracy of 0.1 mm (1/254 inch) and a tolerance of ± 0.05 mm (1/508 inch), far beyond any reasonable measure for field use. Similarly, 203 mm is overly precise, implying an accuracy of 1 mm (about 1/25 inch) and a tolerance of ± 0.5 mm (about 1/50 inch). As a practical matter, an acceptable tolerance for setting anchor bolts is at least ± 1/4 inch or 6 mm. Applying this tolerance to 203.2 mm, the converted dimension should be in the range of 197 mm to 209 mm (actually, the range is 197 mm and higher since 8 inches is only a minimum dimension). Metric measuring devices emphasize 10 mm increments and masons work in a 100 mm module, so the selection of 200 mm would be a convenient dimension for masons to use in the field. Thus, a reasonable metric conversion for 8 inches, in this case, is 200 mm.

This example may sound complicated but in fact we mentally round to easy-to-use numbers all the time and think nothing of it. What the example does illustrate is the need for experience, common sense, and consideration of how measures are used. Much has been written about conversion, but the basic points to remember are these:

- Use experienced professionals to perform conversions, not clerical staff with calculators, and use automated conversion programs with care.
- Understand the allowable tolerances for the measurements you are converting.
- Convert with the end application or use in mind, remembering that it is easiest for field personnel to measure in 10 mm increments.
- Practice—soon you will get the "feel" for conversion and gain confidence and speed.

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overall pavement structure. A surface treatment placed on a soft pavement structure will be destroyed – and the road will once again be gravel, sometimes within days of placing the pavement.

You also have to consider existing elements, such as the height of an existing powerline. Perhaps your design calls for increasing the base thickness, plus adding an extra two inches of pavement, but during construction you suddenly realize the powerline is too low. All at once, you've rocketed beyond the firm, familiar ground of a gravel road paving project— now you're mired in a utility relocation project, too.

How do we assess the value of issues, taking into consideration both what the public agency has to think about and the concerns of the public? Traffic volume and type of vehicles, maintenance costs, safety, roadway function, and pavement structure are important factors in any public agency's decision process. From the agency's viewpoint, traffic and maintenance go hand-in-glove. There is a direct relationship between the two; as traffic goes up so does maintenance. However, traffic does not account for all of the roadway damage. In time, the environmental affects of sun, rain, hot and cold, all take a toll on the roadway. It's fairly easy to quantify costs associated with construction, routine maintenance, and most forms of environment-related damage.

On the other hand, user cost information is hard to get, but can be a critical factor in comparing alternatives. The traveling public (the user) often sees the decision process from a very difference perspective. The user is probably most concerned about such things as travel time, vehicle wear and damage, safety, and dust. Each one of these

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Digital Cameras... What's the big deal?

by Bradley J. Roberts

Instant gratification is the first big deal about digital cameras, since you can review the images almost instantly. On-the-spot changes in picture composition without the waste of film or waiting for the return of lab film is the economic and time resource deal. Don't like what you see? Erase it and try again. Easily transfer pictures to a computer and post-process the images (lighten, sharpen, color correct, crop, etc) with an inexpensive software package. There is no film to develop or development costs, no labs, and no waiting. Within minutes, captured pictures can be easily and privately transmitted via e-mail to the office, clients, family, and friends.

Digital camera purchases have surpassed conventional 35-mm SLR camera purchases for the past 3 years. Entry-level point-and-shoot cameras costing less than $1,000 are the biggest market share, with business use growing significantly. Three overlapping market segments have emerged: family, business, and semiprofessional users. The availability of inexpensive CD-Writers for photo storage and printers capable of photo-realistic output make a digital camera a smart add-on. PC Magazine Online has two excellent articles about the present and future of digital cameras.

Crossing the Threshold: Digital Cameras - PC Magazine - from February 10, 1998. ***http://www.zdnet.com/pcmag/features/digicam2/_open.htm***

Digital Cameras: Closing the Gap - PC Magazine - from January 19, 1999. ***http://www.zdnet.com/pcmag/features/digicam99/index.html***

Here are three summaries of digital camera uses in our work.

Right of Way

by Pat Thayer, Alaska DOT&PF, Northern Region

In property management, I use digital cameras for picture implementation into leases, permits, and other documentation. I also use digital cameras for sending photos by email to our Maintenance and Operations Division. Right now, Delta Junction is the only maintenance station on line armed with a digital camera. Therefore, property management regarding encroachments, leases, permits, etc., in the area are excellent. We are able to take care of situations immediately. Clearly seeing the problem is the biggest asset. Pictures say a thousand words, especially when they remove the necessity of a 180 or 200 mile round-trip drive.

Internet Update

Flagging tutorial offered online

The Cornell Local Roads Program has developed a flagging and work zone safety tutorial for use on the World Wide Web. This tutorial is intended as a refresher for experienced municipal officers and staff, and an introduction to flagging for community members and WWW surfers.

The tutorial can be found at: http://www.cals.cornell.edu/dept/aben/localroads/intro.htm.

According to the program newsletter, *Nuggets & Nibbles*, the tutorial was developed to allow those unable to attend such workshops an opportunity to receive training in another way. While the tutorial, available 24 hours a day, does not replace flagger instruction programs, it can help explain some basic concepts.

The format of the tutorial allows users to choose lessons using a table of contents, or to go through the tutorial in a linear fashion by following the prompts at the bottom of each page. It was designed using the Netscape 2.0 browser to allow for easy access.

The tutorial contains four lessons:

- Lesson One: The MUTCD.
- Lesson Two: Work zone safety and responsibility.
- Lesson Three: The work zone.
- Lesson Four: Flagging equipment procedures.

Each lesson includes optional review questions. There are also instructions for navigating through the tutorial, flagging tips that can be printed out and used at safety meetings, a list of flagging and work zone resources that are available in New York State and on the Web, and an evaluation. •

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Construction

by Billy Connor, Alaska DOT&PF, Statewide Research

Digital cameras are gaining popularity in construction for several reasons. First, they give instant feedback. This means no waiting for the film to develop, which in rural areas equates to weeks unless we air freight the film to town for one hour processing. Expensive! With digital cameras, photos of projects can be taken and printed in minutes if necessary.

Digital photos can be e-mailed to managers so that project people and the manager can see the same thing. This often saves the manager a trip to the site to discuss a problem. If necessary, the photo can be distributed to a large number of people.

Filing of photos is a continual problem. I expect the digital photos will be archived on CD for storage.

Finally, the cost of the camera can be saved in film processing in less than one season.

Technology Transfer

by Chris Janssen, Alaska DOT&PF, Alaska T2 Center

In Alaska's T2 Center, we use a digital camera for most of the projects that we need to take photos. Having photos in digital format is particularly helpful when producing the newsletter and the web page. Most of the pictures in this newsletter were taken with a digital camera, or were obtained via email. Being able to see the pictures before printing is one benefit of using digitally formatted photos. Before, we had to guess what the finished page would look like with the pictures inserted. Now, we can crop, shrink, shift, even manipulate just about any aspect of the photo with the help of software.

If you check out T2's web page you will see a variety of pictures from recent training classes T2 has sponsored. Using the digital camera to take the photos allowed us to download them and place them directly on the site.

Digital camera technology still doesn't give the avid photographer all the options of a traditional SLR camera, but it is rapidly catching up. Some of the newest cameras have zoom, manual and auto, red-eye reduction, and timer features.

Adapted with permission from Technology Development News, January 1999, Federal Highway Administration. •

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Company - Type Detector	Features	Cost & Contact Person
Infrared Electronic Beam ASTI Transportation Systems Newark, DE 19702	Air Horn (150 dba) w/Strobe, Solar Panels for Batteries.	$3,200 Frank Simko 302/328-3220
Microwave Electronic Beam Traffic Management Systems St. Louis, MO 63122	Two Horns (125 dba) w/Strobe and Cores Unit for additional Lights. Solar Panels for Batteries.	$3,000 Jack Toman 800/274-0966
Pneumatic Tube Actuator and Radios between Two Units, Safe-Lite Systems, Newtown, PA 18940	Push button switch allows use on two moving units like paint striper or flagger can actuate the horn (120 dba).	$1,990 George King 215/968-9296
Pneumatic Tube Actuator, Hard wire connector between Two Units, Columbia Safety Sign Corporation, Woodland, WA 98674	Wire for connecting units (120 dba) is distributed and transported by reel.	$625 John Valdez 206/225-7688
Pneumatic Tube Actuator, Action West, Kelso, WA 98626	Wire for connecting units (120 dba) is distributed and transported by reel.	$880 Michael Williams 206/577-9150
Pneumatic Tube Actuator, Central Security and Electric Inc, Rolla, Missouri 65401	Radio signal connecting units (135 dba).	$1,200 Nichlos Barrack 314/341-2562
Pneumatic Tube Actuator, WATCHDOGTM, Kenco International Ligonler Valley, PA 15658	Pneumatic Tube and wire signal to horn is continuous up to 600 feet long to protect the total work area. Tube and wire is distributed by reel on back of pickup. 135 dba horn.	$2,295 Bill Douglas 800/653-6069

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The other method is to use reclaimed asphalt as part of your surface gravel. This product is not available everywhere, but as more of our pavements reach the end of their lives, they are being recycled in various ways and the material is sometimes available to local agencies. It is usually a high quality product. We have seen the best results with a 50/50 blend of recycled asphalt and virgin gravel. In this mix, the asphalt becomes the binder and the material usually has a good binding characteristic and will resist washboarding. It can still be worked with a grader. The asphalt should be crushed to a maximum size of about 1.5 inches, and the recycled/virgin blend should be placed at a minimum compacted thickness of 3 inches. As mentioned earlier in the article, even if this is not affordable for a large section of road, it works well in trouble spots.

Here is another tip: when placing new material on a washboard area, always cut and rework the area before adding the new material. If this is not done, the washboard pattern in the original worksurface will invariably reflect right up to the new surface and your problems quickly begin all over again. It is also important to have the road properly crowned and shaped. Sometimes, the original material will have to be used as shouldering material since adding an additional thickness of new material will make the finished surface too high.

Summary

The three causes of washboarding are lack of moisture, traffic, and poor material. There is really only one that you can change — that is the gravel itself. Scarifying, pulling more fines from the shoulders, etc., modifies the gradation of gravel, but the real key is making a great effort to get a high quality surface gravel in place, particularly in washboard-prone areas. With high traffic in prolonged dry periods, even this will not guarantee elimination of washboarding, but it will definitely reduce it. There will also be a real bonus in reduced blading requirements, less material loss from whip-off, and less dusting.

Adapted with permission from SD LTAP Special Bulletin #29, South Dakota Local Technical Assistance Program. •

Training Covers Summer Operations

A record one hundred eleven people attended Alaska DOT&PF's T2-sponsored training with a hands-on emphasis between April 26 and May 12. T2 presented two classes in several locations: grader operations and work zone traffic control.

Art Wittanen, a trainer for Operating Engineers/Employers Training Trust, taught a weeklong class on grader operation for finish blade operations in the Glennallen area and in Fairbanks. DOT&PF offices in Valdez, Tazlina, and Fairbanks, as well as the City of Fairbanks, provided the equipment and supplies needed for the class to be intensively hands-on. Already proficient grader operators honed their skills by learning job layouts, support grading, finish grading, compaction, ditching, sloping, automatic blade controls, and dealing with asphalt concrete pavement, including mix design, D-1, and aggregates.

Grader Operator training in Fairbanks.

John Tidwell, instructor with the Tennessee T2 Center, taught a one-day class, NHI 38060, Work Zone Traffic Control for Maintenance Operations on Rural Highways. He presented the class in Anchorage, Soldotna, Fairbanks, and Juneau. Tidwell's training included an in-class exercise that required groups to work as a team to develop and set up a work zone traffic control plan. Using a plan sheet showing a work zone, each group developed a traffic control plan. Then, with replicas of traffic cones and other traffic control devices, they installed the plan on the "worksite." •

Publications for Loan

Place a check by the publication you would like to borrow.

_____ **Pavement Rehabilitation and Design**, Transportation Research Board - National Research Council, TRR 1568, 1997

_____ **Mechanically Stabilized Backfill and Properties of Geosynthetics and Geocomposites**, Transportation Research Board - National Research Council, TRR 1474, 1995

_____ **Strength and Deformation Characteristics of Pavement Sections**, Transportation Research Board - National Research Council, TRR 1448, 1994

_____ **Use of Anti-Stripping Additives in Asphaltic Concrete Mixtures**, Transportation Research Board - National Research Council, NCHRP Report 373, 1995

_____ **Pavement Management Systems**, Transportation Research Board - National Research Council, TRR 1397, 1993

_____ **Asphalt Concrete Mix Materials**, Transportation Research Board - National Research Council, TRR 1436, 1994

_____ **An Overview of Highway Privatization**, Center for Transportation Research, Bureau of Engineering Research, University of Texas at Austin, Research Report 1281-1, Feb. 1994

_____ **Roadside Safety Issues**, Transportation Research Board - National Research Council, Circular #435, January 1995

_____ **Compaction of Difficult Soils and Resilient Modulus Testing**, Transportation Research Board - National Research Council, TRR 1462, 1994

_____ **Use of Anti-Stripping Additives in Asphaltic Concrete Mixtures**, Transportation Research Board - National Research Council, NCHRP Report 373, 1995

_____ **Traffic Engineering Handbook**, Institute of Transportation Engineers, 4th Edition, 1992

_____ **Before-and-After Analysis of Advanced Transportation Management Systems**, Texas Transportation Institute, Texas DOT, Research Report 1467-3, 1997

_____ **National Transportation Product Evaluation Program**, American Association of State Highway and Transportation Officials, Report 98 NTPEP 137, 2nd Edition, May 1998

_____ **Commodity Flow Feasibility Study**, Montana Department of Transportation, FHWA/MT-98-001/8143, March 1998

_____ **Desirables and Weeds for Roadside Management – A Northern Rocky Mountain Catalogue**, Montana State University, FHWA/MT-97/8115, Dec 1997

_____ **Statewide and Sub-area Transportation Model Feasibility Study**, Idaho Transportation Department, Final Report FHWA-ITD-RP130, Dec 1997

_____ **A Comparative Study of Performance of Different Designs for Flexible Pavements Volume I, II, III**, Department of Civil Engineering, North Carolina DOT, FHWA/NC/96-004, July 1996

_____ **The Next Decade**, US DOT, FHWA, FHWA-RD-98-109, 1998

_____ **Report to The AASHTO Board of Directors from The AASHTO Standing Committee on Research on the FY 1999 Program for the NCHRP**, National Cooperative Highway Research Program, May 1998

_____ **Briefs of Research Problem Statements**, National Cooperative Highway Research Program, May 1998

_____ **New York State DOT Performance Evaluation of WABO Two part Silicone Sealant**, Watson Bowman Acme, 1998

_____ **Long Term Pavement Performance Status Report**, US DOT, FHWA, FHWA-RD-98-136, Vol.1, No 5, July 1998

_____ **Frost-Shielding Methodology and Demonstration for Shallow Burial of Water and Sewer Utility Lines**, CRREL, CRREL Report 98-4, June 1998

_____ **Structural Analysis of DEW Line Station DYE-2, Greenland 1983-1988**, CRREL, CRREL Report 98-3, June 1998

_____ **Design Pamphlet for the Determination of Design Subgrade in Support of the 1993 AASHTO Guide for the Design of Pavement Structures**, US DOT, FHWA, FHWA-RD-97-083, Sept 1997

_____ **Design Pamphlet for the Backcalculation of Pavement Layer Moduli in Support of the 1993 AASHTO Guide for the Design of Pavement Structures**, US DOT, FHWA, FHWA-RD-97-076, Sept 1997

_____ **Backcalculation of Layer Moduli of LTPP General Pavement Study (GPS) Sites**, US DOT, FHWA, FHWA-RD-97-086, Sept 1997

_____ **Development of Training Material for Highway Construction Personnel**, Transportation Research Board, National Research Council, Number 228, July 1998

_____ **Information Systems for Road Management: Draft Guidelines on System Design and Data Issues**, World Bank, Policy Planning and Research Staff, Infrastructure and Urban Development Department, Report INU 77, Sept 1990

_____ **Pavement Recycling Guidelines for State and Local Governments - Participant's Reference Book**, US DOT, FHWA, FHWA-SA-98-042, Dec 1977

_____ **FHWA Study Tour for European Traffic Monitoring Programs and Technologies**, US DOT, FHWA, FHWA-PL-97-032, August 1997

_____ **Site Characterization for Explosives Contamination at a Military Firing Range Impact Area**, CRREL, Special Report 98-9, August 1998

_____ **Design and Implementation of Automatic Vehicle Identification Technologies for Traffic Monitoring in Houston, Texas - Phase 2 Final Report**, Texas Transportation Institute, Research Report 1999-1F, May 1997

_____ **Guidelines for Evaluating Superheavy Load Routes**, Texas Transportation Institute, Project Summary Report 3923-S, Oct 1997

_____ **Evaluation of Innovative Coordination Methods Utilizing ITS Technology for Traffic Signals**, Texas Transportation Institute, Project Summary Report 2971-S, Oct 1997

_____ **Data and Information Required in Feasibility Studies for Private Toll Road Projects by States and Private Entities Involved in the Evaluation, Approval or Financing of Private Toll Road Projects**, Texas Transportation Institute, Research Report 1756-1, Feb 1998

_____ **Procedures and Criteria Used to Evaluate the Financial Viability of Private Entities Involved in the Approval, Financing and/or Evaluation of Private Toll Road Projects**, Texas Transportation Institute, Research Report 1756-2, April 1998

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Road Savers: Case Studies, SHRP, FHWA-SA-96-045. *Mike Halladay.* Manual includes Road Savers tips and case studies from various states that have used Strategic Highway Research Program research. Research covered in the manual includes: Superpave System; Long-term Pavement Performance; Snow and Ice Control; Work Zone Safety; Concrete and Structures; and Pavement Preservation.

Professional Development Course Training Manual: Biotechnical Soil Stabilization, IECA. *John McCullah.* This manual presents approximately two dozen biotechnical erosion techniques or practics, including the application, principles, materials, and construction techniques. It is a compilation of information from manuals, books, and references drawn from many bioengineering experts.

Practical Approaches for Effective Erosion and Sediment Control, IECA. The document contains course notes and diagrams about erosion control principles and processes, stormwater erosion control plan requirements, best management practices, and how to develop and erosion control plan.

Asphalt Cement and Asphalt/Polymer Blends, TRR 1391. *Transportation Research Board.* Report deals with asphalt and asphalt additives. Investigations include the kinetics of asphalt oxidation to understand the mechanisms of age hardening, studying pressure aging vessel for asphalt cement, the development of a new apparatus and procedure for extracting asphalt binder from hot mix and pavement samples, a laboratory aging device and procedure , as well as others.

Evaluation of Asphalt Additives: Lava Butte to Fremont Highway Junction, Oregon Department of Transportation. *Bo Miller, L.G Scholl.* The report covers the four-year performance of test sections of dense-graded hot mix asphalt concrete with additives. The study found that none of the test sections with additives performed better than the control.

Parks/Chena Ridge Air Convection Embankment Performance Report, December 1996 to September 1998, Transportation Research Center, INE/TRC 99.06. *Douglas J.Goering.* The report follows the thermal performance of the experimental Air Convection Embankment (ACE) which was included as an experimental feature in the Parks/Chena Ridge Interchange Project.

National Transportation Product Evaluation Program: Report of 2 Year Outdoor Exposure Test Deck Data on Sign Sheeting Material, Report 98 NTEPEP 144, December 1998. *Virginia DOT, Arizona DOT, Louisiana DOT, Minnesota DOT.* This report deals with the NTPEP evaluation of sign sheeting material submitted by manufacturers in 1996. Of the states involved in the testing process, Louisiana conducts the initial laboratory evaluation, and took part in operating test decks with Arizona, Minnesota, North Carolina, and Virgina.

Rapid Stabilization of Thawing Soils for Enhanced Vehicle Mobility; A Field Demonstration Project, CRREL Report 99-3. *Kestler, Shoop, Henry, Stark, Affleck.* This report evaluates a variety of stabilization techniques for thawing soils for suitability for rapid employment to enhance military vehicle operations. The study evaluates several lightweight fills, geosynthetics, and tire and wood mats for their expediency, ease of construction, trafficability, and durability.

Guidelines for Mixture Design and Thickness Design for Stabilized Bases and Subgrades, TTI Research Report 1287-3F. *Little, Scullion, Kota, Bhuiyan.* The report deals with base course and subgrade stabilization. It suggests moderate and light levels of base stabilization significantly improve structural contribution of the layer without, usually, producing a rigid structural layer. •

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agency and user costs might be quite different depending on the type of roadway surface (alternative) being considered. As more of these costs (including user costs) are accounted for, the chance of selecting the best alternative gets better.

Is it beginning to look like this business of deciding whether to pave a gravel road may not be so simple after all?

One way to compare the economics of various alternatives is to use a Present Worth analysis. For our purpose, Present Worth analysis calculates the amount of money needed in the bank today to cover all present and future expenses throughout the design life of the project. In this commonly used method of comparing economic alternatives, you decide on an interest rate and design life that is the same for all alternatives. An interest rate of 7% has recently been applied to life-cycle cost analysis for DOT&PF. Selection of a design life depends on many factors, and it ranges from as little as 5 to more than 20 years. You must also define each agency and user cost that will be accumulated over the design life of the project, and the time when each cost will apply. For each alternative, each one of the individual costs are multiplied by the Present Worth Factor* and then added together. The resulting sum is the total cost of the alternative, i.e., the life cycle cost of the alternative, in terms of today's dollars.

A gravel road should be paved when it makes good economic sense to do so and not before. This article suggests a framework for selecting between gravel and hard-surface pavements based on both agency and user costs. The message here is to be realistic in estimating all costs associated with the intended design life of the road, and, when considering asphalt pavement, design a pavement structure that is strong enough to provide the required design life. Do a life-cycle cost analysis for each gravel and asphalt pavement alternative that you are considering, then compare the results. And may the best (and lowest cost) alternative win!

***Present Worth Factor (P/F, i, n) = 1/ $[(1+i)^n]$ where: i = annual interest rate, and n = number of years between the present and time that a cost is incurred.**

For more information, contact:
Billy Connor, ADOT&PF Research Manager, (907) 451-5479
Bob McHattie, ADOT&PF Research, (907) 451-5462
Scott Gartin, ADOT&PF (907) 269-6244 •

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Local Technical Assistance Program
Department of Transportation and Public Facilities
2301 Peger Road M/S 2550
Fairbanks, AK 99709-5399

Return Service Requested

T^2 Center Staff

Sharon McLeod-Everette, *Manager, 907/451-5323,sharon_mcleod-everette@dot.state.ak.us*
Simon Howell, *Training Specialist, 907/451-5482, simon_howell@dot.state.ak.us*
Christel Kennedy, *Administrative Clerk, 907/451-5320,christel_kennedy@dot.state.ak.us*
Christina Janssen, *Newsletter Editor, 907/451-5321, christina_janssen@ dot.state.ak.us*

T^2 Center Advisory Board

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