Curing Road Acne

by Damian J. Kulash

The high performance cold mixes discussed in this article are designed for greater durability under adverse placement conditions such as: cold weather; where adjacent material is structurally deteriorated; where there are dirt and water in the hole; or where compaction is difficult.

Potholes and acne have a lot in common: they are rough, embarrassing, and unsightly blemishes. They are usually avoidable. Solutions to both depend as much on behavioral as technological considerations.

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Generations of teenagers have been told by dietitians and mothers how to avoid acne: don’t eat fatty foods and your acne problems will vanish. True, but useless. Each generation of teenagers ignores this advice whenever seduced by french fries and hamburgers.

Generations of maintenance engineers have also learned how to fix potholes right: you cut away the weakened surrounding pavement, you clean out all the loose material, you dry out the hole, you fill it with good quality hot-mix asphalt, and compact it properly. Again, true but useless. This advice simply can not be followed in the peak of the annual pothole season, when there are too many holes, too much traffic, and too little time to close lanes.

To avoid acne, not eating french fries is a very economical solution in theory, but a poor one in practice. It is inconsistent with actual behavior. At some point, pharmaceutical companies realized that the behavior of teenagers was fiercely unalterable, and they invented high-cost, but effective solutions: miracle creams that make acne vanish overnight. To parents, these creams appeared at first to be an unnecessary extravagance. But when the behavior of teenagers is taken into account, they are the most cost-effective solution.

Likewise with potholes. Various companies realized that maintenance engineers could not afford the crew time or lane-closure time to do it right. So they developed a number of proprietary cold-mix materials for patching potholes. They looked like an expensive extravagance at first, but they may be the most cost-effective solution when actual behavior is taken into account.

Maintenance engineers do not ignore the “correct” techniques for pothole patching through ignorance or stubbornness. They ignore them when they are impossible or unsafe. For example:

- the local hot-mix plant may not be open during the cold season when potholes appear, and when no asphalt paving work is going on;
- during the peak periods when holes are emerging, new holes may appear faster than the entire workforce can handle, and public safety demands that some temporary expedient be taken to postpone “permanent” repairs; and
- some roads with holes may be too congested to permit the necessary lane-closure time to cut, clean, dry, fill, and compact the potholes.

Under these conditions, when new potholes are springing up faster than crews can keep up with them, maintenance managers turn to “throw-and-go” materials and methods. “Throw-and-go” patches are just that: you throw the patching material in the hole, back the truck over it once or twice to compact it, then you go to work on the next hole. No sawing, no removal of loose material, no drying. It’s fast, cheap, and interrupts traffic as little as possible. These advantages are seductive during the heat of the annual pothole battle.

But when conventional cold-mix materials are used in throw and go operations, the results are disastrous. SHRP’s survey of state users (see below) showed an average repair life of only four months under these conditions. Motorists sometimes notice holes getting patched one day and popping back up hours or, at most, days later. Loose patching material is scattered around. Dangerous, rough holes reappear. Maintenance forces are made to appear unresponsive and incompetent.

Between the extremes of “doing-it-right” and “throw-and-go” with conventional cold-mix, there is a range of other generic and proprietary solutions. Many of these are carefully designed cold mixes using polymer-modified binders and carefully graded aggregates. Unlike conventional cold-mix materials, these high performance cold mixes are designed for greater durability under adverse placement conditions such as: cold weather; where adjacent material is structurally deteriorated; where there are dirt and water in the hole; or where compaction is difficult. Available information about these high performance throw-and-go materials is encouraging. For example, some 20 states that use them report an average patch life of 13 months for some proprietary throw-and-go materials, as compared to 4 months for conventional cold mix.

That is less than the 21-month life of a carefully applied hot-mix patch done right, but it is far superior to conventional cold-mix throw-and-go patches.

These survey responses undoubtedly reflect some hearsay and some guesswork, and they say nothing about climate, hole size, traffic, or other factors that could have substantial effects. To obtain more systematic, reliable information on how different techniques perform, SHRP is working with six states (California, Illinois, New Mexico, Texas, Utah, and Vermont) in a carefully designed experiment to evaluate different techniques. As we begin this experiment, it is useful to explore the possible implications of the survey findings, because they provide valuable insights about the balls to watch in the experiment.

For example, suppose that a 4-person crew can patch 25 holes a day “doing-it-right” or 75 in a throw-and-go operation, and the other cost and expected-life numbers in Table 1 are true.

Then the unit costs per hour for labor, materials, and equipment come to $7.12 per hole for conventional throw-and-go materials, and $26.45 per hole for hot-mix (Table 2). When adjusted for how long the patch lasts, however, proprietary throw-and-go materials look least expensive, and conventional throw-and-go materials look like a waste of money, due to there very short lives.

If this illustration proves to be typical, it
is less costly and less disruptive to use good throw-and-go materials. The textbook guidance on how to do it right may be wrong, as well as useless.

Using bulk materials on hand may be wasteful. Conventional throw-and-go patching uses asphalt emulsions and aggregates that highway agencies buy in bulk for other purposes. These are the lowest cost materials and their purchase is easy to justify. I hear maintenance engineers say nothing good about cold-mix patches done with available materials. They know they don’t work. But they are the only thing available sometimes, as a result of budgetary or purchasing restrictions. SHRPs experimental results will provide a reliable basis for maintenance engineers to use to document that these limitations lead to wasteful practice. This should open the door to more effective approaches.

As SHRPs patching experiment proceeds, labor cost is the ball to watch. In the case of conventional throw-and-go patching, materials cost only pennies per hole. The crew cost-per-hole runs 10 to 20 times the materials cost. The states participating in SHRPs patching experiment will be closely monitoring crew requirements as well as patch life. If the impressions in the above illustrations are verified, maintenance engineers, purchasing departments, and agency managers will have a reliable basis for rejecting low-cost conventional materials, and justifying higher-performance materials that are less costly in the long haul.

Good throw-and-go materials may be best. In the above illustration, proprietary cold-mix materials compare favorably with placement of compacted hot-mix materials in cut, cleaned, dried holes. This could be verified in SHRPs patching experiment. But the ball to watch here is not some small economic advantage either way. If the two approaches are even close, the key factors in actual practice will not be the economics, but the lane-closure time, inconvenience to motorists, safety to motorists and workers, or lack of availability of hot mix.

Getting good information on the expected life of different treatments, under different placement conditions, is the key objective of SHRPs experiment. As the above discussion suggests, these comparisons must be drawn broadly enough to include all of the costs and benefits. They will be useful to maintenance engineers, procurement offices, and management.

Good taste prevents dwelling on acne problems. You do not see headline stories about Jane Doe’s latest bout with zits. Not so, with potholes! They are second only to failed bridges in getting media juices flowing. Potholes are visible and highly annoying. They are uncomfortable to drive over. They cause delays. They throw steering out of alignment, bend wheel rims, loosen hubcaps, and even snap axles. They cause accidents and injury. They are used by the media as a symbol of the incompetence of highway agencies and their contractors.

Whether fair or not, the fact is that potholes do impose huge and unacceptable cost in money, safety, travel delays, and vehicle repairs, not to mention professional image. The highway engineering profession cannot ignore the high stakes involved, and it has not. Solutions involve action on three fronts, although progress on each front varies:

Program support. The financial support needed to construct and maintain highways in proper condition is an indispensable part of any solution. Yet an unmanageable gap remains. At all levels of government in the United States, highway expenditures per vehicle mile in 1990 were about half of what they were in 1960. We are eating more french fries and spending less on skin cream.

Durable new-construction designs. Here the outlook is brighter. We are learning to design pavement structures and wearing courses that are less susceptible to potholes and other forms of distress. The creation of the Strategic Highway Research Program (SHRP) within the 1987 Highway Act, and the massive investment being made by the states, the Canadian provinces, and international partners in SHRP’s Long-Term Pavement Performance project, will result in pavement-design and pavement-management techniques that prevent potholes and other forms of distress.

Cost-effective pothole repair. The states are working together through SHRP to evaluate a range of patching technologies—how well they perform, factors affecting their performance, and what they cost in crew time, equipment, materials, and lane closure time. The results will help engineers determine what is most effective, and will help them procure materials that work.

Many of the high-performance throw-and-go materials were developed as proprietary products by private companies. They did the research needed to formulate effective binders and mixes. Public agencies also have developed their own generic, high-performance patching mixes. The choice among the various high performance materials obviously depends on the cost and performance of the materials in any particular region. In making this comparison, of course, a state needs to account realistically for its own production and distribution costs.

Like miracle creams for acne, some of the proprietary patching materials are high-performance solutions that come about because private industry sensed a need and developed an effective product. Certainly the highway sector has benefited from this private investment, and removing unreasonable barriers that block the use of these products will give a continuing incentive to industry to anticipate, and help solve, important highway problems in the future.

The above information was reprinted from FOCUS, May, 1991, a Strategic Highway Research Program (SHRP) newsletter.
Grading Gravel Roads

by Walter Somero

Last year the T Center hosted a grader operator training course run by the Maine T Center staff. We put 20 operators through a one-day classroom style workshop and a full day of one-on-one “hands-on” grader training. Gordon Huckins, road agent for the town of New Hampton graciously helped us with this course.

Earlier this year we began a new grader operator program geared to New Hampshire municipalities. Twenty operators were trained at a one-day classroom and later had a full day of “hands-on” training in their own town from Walter Somero of Sharon, NH. In assisting us with his experience and wit, Walter did a great job. Both experienced and inexperienced operators have expressed a high appreciation for the one-on-one training with Walter.

One of the byproducts of the course was a written statement from Walter giving some tips on the basics of grading in New Hampshire. It was a statement designed to be used as a general understanding of grading for the inexperienced operator. However, we liked it so much that we thought you might be interested in a copy – to this purpose we’ve printed it below.

Thank you Walter for traveling all around our state and for a job well done!

I hope I can help you people on the maintenance and grading of your gravel or dirt roads.

Each and every road is different as to the material, width, elevations of grades, ditches, slopes etc...

If I am on a road which has a lot of leaves in the ditches, I will take the grader and set the blade on a fairly straight angle, leaving the crown side up and the ditch side touching the dirt a little bit. The leaves are pushed up or down the road until I come to a place where I can push them off the road or over a bank. A front end loader or backhoe loader is a great help for doing this.

Next, I start down the middle of the road with the blade at a slight angle and cut the old crown and potholes and washboard. This also loosens the old hard surface. With the new graders you can roll the moldboard where it will cut a lot easier and dirt will move a lot easier. I have a 57 Cat 12 grader with manual controls. Sometimes they kick back at me, so I have to work a little harder.

My theory on cutting the old crown is that a road should have a good flat base to start building the crown. Cutting also lets the material that I bring into the center to start my crowns adhere to the base.

When I am making my first pass and the blade hits, rocks, or nuggets I dig them out. I push them into the side of the road or over a bank where they will not bother you the next time you grade the same road. When I dig out a big rock I fill in the hole with dirt and roll it with the tires for a little compaction.

On my next pass, from the outside edge towards the middle, I leave dirt in the middle. On these first passes from the ditch, angle the blade, so the blade in the ditch has a tendency to cut instead of bulldozer. You’ll find that when you do this, the dirt will move along the moldboard a lot easier. Do not run the rear wheels on this windrow. I always try to straddle the windrow both with front and rear wheels. With the new machines you can articulate the machine to keep off the windrow.

When I start the second and third passes I try to take as much of the old windrows as possible, that are left from previous work, and mix it in with its gravel to make a binder. It also makes your road a little wider each time you grade. The dirt out there on the edge is winter sand and dust and it is good usable material.

After I get much of this material out into the road, I start mixing it back and forth always keeping in mind where the center of the road is; as that's where the crown starts to form.

Angle the blade so you carry the dirt along with the machine, you don't have have dirt coming out of both ends of the blade. When the machine moves along, the dirt will drop and fill hollows and sags.

Once you set the blade to begin to finish, leave the controls alone; this way the road will be a lot smoother.

I don't believe you can grade and shape a gravel road with two or three passes. I was working with a man one time, he said, "How do you know when it's coming okay? Do you look back?" I told him, "I never look back for fear of what it looks like." While you are grading you can feel the machine as it's forming the crown in your road. I make six or seven passes on some roads. The width has a lot to do with determining the number of passes.

Do not go too fast when grading, as the rubber tires have a tendency to bounce. The slower you go the better your road will come. And people will say "Who did this work?" not, "How much did it cost?"

Take pride in your work. If you have to make a couple of extra passes to make it look good, do so. I carry a stone picker with me and when I am finishing I do not leave stones in people's driveways. Get out if you have to and put them on a stonewall or on the banks, or whatever.

Anticipate what is going to happen when you are grading and shaping your roads. Where is the water going? How can you make it go to a culvert? Water is one of the problems we are trying to eliminate.

Making ditches is also another problem on some roads. I do not make deep ditches on hills, as the water running down a hill will make a ditch deeper. Try to keep big rocks out of these ditches. If you have to, take the moldboard and push them into the banks. In the spring of the year when ditches are full of water and soft, I run the grader tire in the ditch to make what I call a "Wheel Ditch".

I believe most of the towns use York rakes for finishing off. What I do is start on the ditch side and rake to the center from both sides and then I rake from the center out. Do not grade too deep and pull all this good dirt back into the ditch, let it feather out. There again, if you have some bigger stones roll out, stop and throw them off. Also, do not go too fast, as this rake will make some of the best washboards you can ask for.

I have a tow roller that I use. I pull it with a pickup truck after raking. Mine was made from the front roller of an old three-wheeled roller. This rolling pushes in a lot of the rocks and also smooths the road surface. On some hills I roll with the grader tires as it makes the ditches a little harder and prevents wash.

I hope this information will be helpful to you. If there are any questions I will be glad to try and answer them.

Grading is an art, a skill, and a science. It is extremely important for most of the towns in our state to have a good grader operator and maybe a backup operator as well. Due to the positive feedback that we have received, we are going to continue this training program. It will begin again in the Spring. Should you or anyone in your town be interested in grader operator training please contact the New Hampshire T Center for more information or to get on the list for our next session.

We recommend this course to beginners, intermediates, and advanced operators alike.
Thinking About A Computer?

If your thinking about buying a computer but you have no idea of what you'll do with it once you get it... the two largest transportation software clearinghouses in the U.S. have some good news.

McPrimer Announces McPrimer

McPrimer is a 150-page primer accompanied by a self-paced, self-scoring tutorial disk covering introductory PC topics. It gives a complete overview of the Disk Operating System (DOS) and an introduction to a few applications to first-time computer users. The tutorial disk allows users to move at their own pace and provides hints and quiz scoring feedback to assure success.

Topics covered include:

- PC hardware systems and how they work
- Key DOS commands and file management tasks
- Advanced DOS activities of batch file creation
- Hard drive management, organization and back-ups
- Introduction to Lotus 1-2-3
- Word processing and database concepts

A typical beneficiary of this learning system is the person new to PCs, or one with some experience but desiring refinement in the areas mentioned above. Many first-time users have a fear concerning accidental data loss or just plain embarrassment from "ordinary" questions. McPrimer eases the user through these concerns quickly and in a relaxed, enjoyable manner at their own pace.

Author Peter Diotte is a certified instructor with degrees in engineering and business. Mr. Diotte's publication is used by many introductory students in classrooms and work places alike. It is the writer's hands-on teaching experience and long term business systems consulting and programming that has led to the development and refinement of this superior introductory text and disk.

McPrimer can be purchased from the McTrans Center for $20, plus a $5 processing fee per order, which includes the tutorial disk and a companion instruction book. Quantity and academic discounts are available. For additional information or to order McPrimer contact:

McTrans Center
University of Florida
512 Weil Hall
Gainesville, FL 32611-2083
Phone: 904-392-0378
Fax: 904-392-3224

Help for New Computer Users

PC-TRANS has put together the perfect tool for the new computer user called The Bootstraps Kit. Like a cowboy's saddlebag, this kit provides all the basics the transportation person needs for hitting the trail with microcomputers. Most of us feel some hesitancy when faced with changing what we do or how we do it. However, clear, basic information is often all that's needed to instill the confidence to give "it" a try. New computer users should find PC-TRANS' Bootstraps Kit to be the confidence builder they need to get going with computers.

First there's a video titled Can A PC Help You? that, in easy-to-understand language, familiarizes you with the components of a computer system; guides you through the planning process for purchasing your own computer system; and lets you hear from transportation people how they're using microcomputers and the benefits they've experienced.

The second lifesaver is McPrimer, going through this software tutorial program will give you a working knowledge of computer hardware, DOS, hard drives, batch files, word processing, databases and spreadsheets (Lotus 1-2-3).

Locating and selecting transportation software programs can be a frustrating and time-consuming task for any computer user. PC-TRANS solves that problem by including their PCs in Transportation Software Directory. This valuable resource lists over 600 transportation software programs in the areas of transportation planning, civil and traffic engineering, transit and paratransit operation, and facilities and freight management.

To help you in selecting your transportation software, PC-TRANS has listed some good, basic transportation programs of which you can select two of your liking as part of the kit. The specially selected listing includes programs in: transit, surveying, traffic and highway engineering, management aids, transportation planning, communications and text processing. And if you already have the Can A PC Help You? video, McPrimer, or the PCs in Transportation Software Directory, or feel that a software program would better serve you, you can select instead to receive up to five programs from this listing.

Next, to keep you tall in the saddle, PC-TRANS has arranged to provide you with a free subscription to PC Novice. This enjoyable magazine explains the basics in computer operation in an understandable and unintimidating manner for the PC novice.

And, to keep you up on the latest in transportation software, included in the kit is a free subscription to PC-trans, the bi-monthly magazine published by PC-TRANS.

The Bootstraps Kit could retail out at over $200.00. It includes the video, PC tutorial, directory, two transportation software programs (or up to five software programs) and subscriptions to PC Novice and pc-trans. However, PC-TRANS is providing all this tremendously helpful information, plus a "surprise" gift, in one neat kit for only $150.00.

To make sure you're prepared when you hit the computer trail, get PC-TRANS' Bootstraps Kit. Contact Eileen McNichol at the following address:

PC-TRANS
2011 Learned Hall
Lawrence, KS 66045

Phone 913-864-5655
Fax 913-864-3199

Act before March 1, 1992, and receive an additional bonus.
Winter Operations Checklist

Before Leaving the Garage:
- Check all items on vehicle trip ticket.
- Check spreader chains, shovel, hoses, spill plates, and spreader settings. 
  Danger: Do not pull on gate with hands! If the gate is stuck, use a tool (shovel, screwdriver, etc.)
- Call base for radio check.
- Check spreader operation in the area of the salt bins.
- Check plow blades for cracks or other damage, check bolts securing blades to moldboard.

Salting Operations:
- Start assigned section according to street priority list.
- Periodically check spreader and salt pattern.
- Maintain consistent speeds as appropriate for conditions (average 15 to 18 mph).
- Raise the dump bed no higher than the bottom of the rear window while the vehicle is in motion, and never raise it with a full load.
- Salt all streets, with salt hitting on crown (centerline of the street).
- Salt all cul-de-sacs.
- When truck runs out of salt, call supervisor and return to base on his instruction.
- When finished with assigned section, call the supervisor for next assignment before returning to base.
- Inform supervisor of approximate salt usage for each section.

Salt Spills:
- If a small amount of salt is spilled, shovel it back into the spreader.
- If larger amounts are spilled, call the supervisor for instructions.
- Salt spilled at the public works facility will be corrected following completion of salting operations. A designated employee will use the end-loader to scrape loading area and push salt back into the bins.

Plowing Operations:
- On leaving the garage for snow-plowing, lower the plow and plow to the assigned section.
- Document start and finish points, and give this information to the supervisor upon returning to base.
- When plowing, use second and third gears, and plow at speeds appropriate for conditions (average 15 to 18 mph.)
- When plowing tandem, maintain ample stopping distance between trucks. Rear driver is to help lead driver with backing-up and turning maneuvers.
- When plowing downtown streets, check with the supervisor as to the placement of the snow.
- Make sure all wide intersections are cleaned thoroughly: push all snow back curb-to-curb, and make sure all intersections have rounded corners.
- In cul-de-sacs, make one pass with the larger truck (a smaller truck will follow for thorough cleaning.)
- If the plowing section includes alleys, make sure these are plowed. Unless instructed otherwise, make two sweeps - one in each direction - so that the snow is divided equally on both sides.
- If a section has center islands, plow snow to the islands, unless instructed otherwise.
- When making the last pass, position the plow just off the curbs. But if plow damage to curbs is incurred, document the information and give it to the supervisor.
- Try to avoid mailboxes. In the event a mailbox is damaged during snow plowing, document the incident and report it to the supervisor upon completion of plowing procedures.
- Do not place snow in front of hydrants, and mailboxes, if at all possible.
- Should the plow strike an object (e.g., inlet, manhole cover) check plow for possible damage. If a plow needs new blades, bolts, or curb shoes, document same on the trip ticket so that necessary repairs are made promptly.
- When returning to base, clean all salt, snow, and ice off and out of trucks before parking them in the garage.
- Snow-plowing sections are primary assignments. Vehicles and manpower may be switched as needed.

Salting and Plowing Accident Procedures:
- If a witness to an accident, notify base of the following.
- Location - street address and cross street, if possible.
- Indicate whether emergency medical assistance is needed.

Reminders:
- Location of twisted or downed stop signs, broken and hanging tree branches, leaking fire hydrants, and damage to any part of the village infrastructure should be documented for proper follow-up.
- Make sure turning maneuvers are executed slowly.
- Use extra caution during nighttime driving.
- Use the two-way radio only for emergencies and for job related communication.
- Before starting downtown cleanup, refer to the proper section of this manual for proper procedures.
- After salting or plowing, make sure the interior of the vehicle cab is clean of all debris.

Equipment Cleanup:
- Immediately upon completion of operations and after remaining salt is dumped back into the bins, wash all vehicles thoroughly in the wash bay.

The above checklist was reprinted from the PA Local Roads Program Tech. Info. Sheet #47.
COMPACTION

One of the most important steps in an asphalt overlay project

Background

Experienced engineers generally agree that compaction of asphalt concrete is one of the most critical factors affecting the performance of bituminous pavements. Asphalt mixes consist of asphalt cement, aggregates and air voids. Good asphalt mixes contain carefully selected proportions of each of the three. If good compaction is not achieved, however, diligent selection of materials and the best mix design will not result in a long-lived pavement.

Definition

Compaction is the process whereby the asphalt-aggregate mixture is mechanically forced into a smaller volume causing: (1) air voids to be reduced, (2) aggregate particles to be reoriented and forced into close contact creating granular interlock and causing the particles to be strongly cemented together, and (3) increased density. Density itself is not the important engineering property but simply indicates when low air voids and intimate particle contact have been achieved with a particle mix.

Importance of Compaction

The Chicago Testing laboratories, and confirmed by other investigators, reported that in all investigations of premature failure of asphalt pavements, more than 80 percent were due to poor compaction of mixes placed during the late fall construction season. Common problems when asphalt pavements fail prematurely are stripping, raveling, rutting or shoving, and asphalt hardening leading to brittle fatigue failure. These problems can have a variety of causes but in most cases are a result of poor compaction. If there is insufficient compaction, air void content will by high and - of great importance - voids will be interconnected. With high air void content, both water and air can flow through the mat, each causing harm.

more than 80 percent of pavement failures are due to poor compaction of mats placed during the late fall

Water can create hydrostatic pressures under traffic causing debonding of particles and also can cause damage during freeze-thaw cycles. Both water and air intrusion rapidly increase the rate of oxidation of any asphalt mat causing the material to become brittle.

Asphalt concrete mixes are designed so that after proper compaction, sufficient air voids remain in the mat to allow a small amount of further densification under traffic. Voids also provide space for asphalt movement when the mat is kneaded by traffic loading and when the asphalt cement expands due to temperature changes. Insufficient voids result in overfilling with asphalt causing flushing of the binder to the surface and loss of pavement stability as aggregate particles are forced apart. Thus a good mat should have some air voids but not too many.

What Effects Compaction

The ease of compaction is affected by both the materials used and construction practices.

Aggregates

Aggregates influence compaction through both shape and surface texture. Angular particles are more difficult to compact than rounded ones. Particles with harsh surface texture are more difficult to compact than rounded ones. Particles with harsh surface texture are more difficult to compact than smooth ones and block-shaped particles are more difficult to compact than those that are plate-shaped. However, those particles having shapes or textures that cause difficulty in compaction are the same ones that give high stability. For example, aggregate consisting of marbles would provide a mix that would be easy to compact but would have low stability.

In addition to particle shape and texture, gradation also influences ease of compaction. Mixes with high proportions of coarse particles are difficult to compact. With other factors being equal, a mix that is graded uniformly from large through small size aggregate will be easiest to compact. Don’t be fooled by the easy workability of finely graded or over-sized mix. Although easily worked, they will tend to shove under a roller and will be difficult to compact. Such mixes are said to be “tender”. Mixes with excessive material near the size of the No. 30 sieve are often “tender”.

Particle strength and absorbency also affect compaction. Weak particles will crush under rolling, creating uncremented faces that decrease the tensile strength of the mat and provide open surfaces for water penetration. Absorbent aggregates can increase particle-to-particle friction by soaking up hot asphalt cement that otherwise would act as a lubricant under compaction.

Asphalt Cement

The grade (based on penetration or viscosity) of asphalt cement influences the viscosity of the hot binder in a mat. Binder is a mixture of asphalt cement and dust (aggregate particles passing the No. 200 Sieve). Mixes with low viscosity binders will compact easier of course. If compacted while hot enough, however, any grade of asphalt should have a viscosity low enough to act as a lubricant. High asphalt film thicknesses make compaction easier. However, as discussed above, excessive asphalt will fill all the voids and begin forcing particles apart, creating an easily worked but unstable mix.

Construction Practices

The hot asphalt binder provides a lubricant for compacting the aggregates. When the binder cools below about 185 degrees F, however, it prevents the particles from being pulled apart - a desirable characteristic for the finished roadway - but also prevents particle movement and thus stops further compaction. Further rolling, instead of compacting, tends to fracture aggregate causing more problems. Thus, although rolling should begin at a much higher temperature, it is essential that compaction of a conventional asphalt mix be completed while its temperature is above 185 degrees F. Temperature of the mix during compaction is a function of:

- How hot the material comes out of the plant,
- How much cooling takes place during transportation,
- Layer or lift thickness (thicker lifts hold heat longer),
- Weather conditions (air temperature and wind),
- Temperature of the surface on which the mix is being placed.

It’s important to notice the relationship between mat thickness, base and air temperature, and time before the material cools to 185 degrees F, when further compaction cannot be accomplished. Mix temperature is that measured behind the paver at a depth of 1/4 inch to 1/2 inch below the surface. As mat thickness decreases, the
Compaction...
continued from p. 7

material cools rapidly. For example, at 60 degrees F base and air temperature, a mat 3 inches thick will cool to 185 degrees F in about 30 minutes. A mat 1-1/2 inches thick will cool in only about 10 minutes. This illustrates the importance of early rolling of thin lifts.

Rolling

The three types of self-propelled rollers currently used are: (1) steel wheeled static, (2) steel wheeled vibratory, and (3) pneumatic rubber tired. Each type does its job by applying pressure over a contact area. As the material is forced into a small volume and mix temperature drops, the resistance to further movement increases preventing the roller from penetrating into the mat. Usually, the largest amount of compaction takes place during the first pass and then rapidly diminishes with subsequent passes. Vibratory rollers should compact much more rapidly.

Over-compaction

Although over-compaction is a common worry, it is seldom a real problem. Over-compaction occurs when a mix is reduced in volume to a point where air void contact is lower than the design value. Usually compaction is designed for about 3 percent air voids on interstate highways, and usually the best compaction efforts during construction can reduce the mix to about 5% air voids. Traffic, over a period of years, provides the additional compaction to achieve design air void percentage.

Crushing of aggregate, perceived by some to be over-compaction, is really caused by poor practices. Aggregate crushing can be caused by:

- Using aggregate that is too large with respect to lift thickness,
- Using aggregate with low strength,
- Improper use of vibratory roller,
- Using a steel-wheeled roller on a mat that is too cold to be compacted.

When mat temperature falls below 175 degrees F, steel-wheel rolling for compaction should cease. In general, over-compaction should be of very little concern, while poor compaction is of major concern. Adequate attention to this single detail can add several years to the service lives of many pavements.

KUTC Newsletter, University of Kansas Transportation Center, Vol. 13, No. 1, February 1991.

Billing for Sign Damage

It all adds up to Big dollars

The city of Menomie, Wisconsin, has a system for billing drivers who damage street signs, lights, and traffic signals. Ninety percent of the time they recover the full replacement cost.

So, you may be thinking, it's only $25 or $50 to replace that damaged parking sign - hardly worth the paper work. But think about the time somebody knocked over a $3,000 street light pole. And multiply that $25 or $50 times the number of replacements you make a year. The result can be significant.

Besides, as Vada Husby, Menomie City Treasurer/Controller, says: "People need to be responsible for their actions. It's worth it even if it's a small amount."

Menomie's system is simple. The police department sends copies of accident reports to the street department when there is sign damage. The sign technician makes the repairs and then notes on his time sheet; the time, materials, and equipment he used.

The streets department secretary writes a bill when she does the payroll. Repair charges include: labor, fringe benefits, materials, and equipment costs. The bill goes to the city treasurer for routine collection.

Tagging System

The Wisconsin Department of Transportation has developed a system of tags to help it match accident reports with sign damage bills. The investigating officer attaches one part of the tag to the damaged sign, and tears off the end with a matching number to staple to the report.

When an accident report comes in, the DOT's Risk Management Office automatically notifies the driver, the insurance company and the car's owner of the bill for damages. Then the department uses an automated billing system to print bills and send collection letters.

Think about it. How much is your sign budget every year? Could you get some of that back simply by setting up a billing system?

Reprinted from The Bridge, Summer, 1991, a publication of the Michigan T^ Center.
Plow Rally A Huge Success!
Photos Taken at the Whitefield Rally

Above: Lester Bousquet and Harvey Paquin of Lisbon compete in front plow mounting event. After the scores were tallied Bousquet and Paquin proved to be a winning combination.

Above: David Bowles and Dana Haynes rapidly inspect a defective truck while Bruce King of Hanover keeps score. Ed Tibbets (not pictured), Whitefield's mechanic, deserves a great deal of credit for setting this truck up.

Right: One of the big themes throughout all of the Rallies was safety. Here a sign reminds the slalom driver and wing to buckle up.

Left: As one of the municipal teams begins the slalom course others look on in anticipation.

A common conversation between the crews was plowing. They traded ideas about frozen culverts, salting, sanding, plowing, and the like. Everyone benefited from the free flow of information.

Below: Harold Aldrich and Ron Leavitt of Sugar Hill work on blindly hacking a compressor over 100 feet before making a sharp angle between strategically placed cones.

Below: Donny Boyle and Gerald Fenner of Littleton get set to tackle the winding slalom course full of obstacles such as simulated parked cars, mailboxes, and the like. A difficult task for even the most experienced team.
Be prepared!

Will your fire extinguisher work?

Dry chemical extinguishers are most commonly used on vehicles due to their low cost and effectiveness. Check extinguishers for charge and test them when necessary. The dry chemical used in extinguishers is similar to baking soda, which will pack tightly. The powder is expelled from the extinguisher tank by nitrogen gas. Since the dry chemical sits in the bottom of the shell with pressurized nitrogen on top, a stem extends from the valve to the base to pick up dry chemicals and expel them when needed. If the dry chemical is allowed to pack tightly into the bottom of the tank shell, and the stem allowed to shake slightly, an opening is hammered into the packed powder around the stem. When the valve is opened the nitrogen gas will fail to push any more than the dry chemical within the stem from the tank. The charge of nitrogen is quickly expended and the extinguisher is rendered useless.

To avoid a worthless extinguisher, shake the unit while holding it upside down. Or, thump the extinguisher on the floor or with the heel of the hand to loosen the powder.

Dry powder residue will cause an extinguisher valve to fail to completely close, allowing the nitrogen propellant to leak out slowly. Thus, a dry chemical extinguisher must be recharged after a single use. To protect the valve assembly from damage, mount the extinguisher securely. Place it in a visible and highly accessible spot within the vehicle cab.

The action of the dry chemical is to smother the fire. Aim it at the base of a fire only. If the extinguisher is inoperable or has been expended, the roadside may provide a means of extinguishing the fire. Sand or dirt may be thrown on the burning object, preventing oxygen from reaching the fuel source. Wet rags or clothing will also be effective.

The above was excerpted from the Principles of Equipment Operation, Safety, and Maintenance, a Cornell Local Roads Program publication. For copies of this 58 page manual contact the New Hampshire Technology Transfer Center at 1-800-423-0060 or send in your request using the mailer attached to this newsletter.

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TECHNOLOGY TRANSFER CENTER (T²C)
University of New Hampshire
Department of Civil Engineering
Transportation Research & Computation Group
Durham, New Hampshire 03824-5391

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