

**ALASKA STATE LEGISLATURE  
SENATE TRANSPORTATION STANDING COMMITTEE**

April 20, 2006

1:37 p.m.

**MEMBERS PRESENT**

Senator Charlie Huggins, Chair  
Senator John Cowdery, Vice Chair

**MEMBERS ABSENT**

Senator Gene Therriault  
Senator Albert Kookesh  
Senator Hollis French

**OTHER LEGISLATORS PRESENT**

Representative Carl Gatto

**COMMITTEE CALENDAR**

Pavement rutting in Anchorage, Alaska

**PREVIOUS COMMITTEE ACTION**

No previous committee action to consider.

**WITNESS REGISTER**

DR. J. LEROY HULSEY, Ph.D., P.E., S.E.  
Associate Professor, Civil Engineering  
Fairbanks, AK

**POSITION STATEMENT:** Discussed pavement rutting.

GERALD J. DESJARLAIS  
Denali Materials  
3815 W. 40th Avenue A.  
Anchorage AK 99517

**POSITION STATEMENT:** Discussed pavement rutting.

REPRESENTATIVE CARL GATTO  
State Capitol, Room 411  
Juneau, AK 99801-1182

**POSITION STATEMENT:** Discussed pavement rutting.

MICHAEL SAN ANGELO

Department of Transportation & Public Facilities  
3132 Channel Dr.  
Juneau, AK 99801-7898

**POSITION STATEMENT:** Discussed pavement rutting.

**ACTION NARRATIVE**

**CHAIR CHARLIE HUGGINS** called the Senate Transportation Standing Committee meeting to order at [1:37:41 PM](#). Present at the call to order were Senator John Cowdery and Senator Charlie Huggins, Chair.

**PAVEMENT RUTTING IN ANCHORAGE, ALASKA**

DR. J. LEROY HULSEY, Ph.D., P.E., S.E., University of Alaska Fairbanks, said he is principal on a state-funded research project to investigate pavement-rutting problems in Anchorage, Alaska. He outlined the steps his team is taking toward development of a testing plan to evaluate possible solutions, and introduced Gerald Desjarlais to present their research plan and preliminary findings.

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GERALD J. DESJARLAIS, President of Denali Materials Inc., presented slides from a survey on pavement rutting and stressed that rutting is contributing to premature pavement failure; it is expensive, a safety problem, and a public inconvenience. He said that the scope of work on his research grant request is to: review previous work by Alaska Department of Transportation (DOT), solicit data from other states, identify causes of rutting, test to identify rut-resistant paving material, and analyze data to develop appropriate pavement sections using those materials.

He explained that there are four possible causes of rutting: Plastic flow, which is a function of mixed design and constructability, or testing on the job to ensure the material you are putting down on the grade truly reflects what was designed in the lab; studded tire wear; base and sub-base failures which cause the flexible pavement to deflect; stripping and raveling.

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MR. DESJARLAIS showed a slide of Tudor Road just before resurfacing last year, which shows no evidence of sub-grade failure, just a fairly typical example of plastic flow in which asphalt is flushed to the surface. He noted that the conditions

on Tudor Road were typical of what they found on the other six highways tested. The sampling locations used were Glenn Highway at the Muldoon exit, Diamond Boulevard, Old Seward, Tudor Road at Tudor and Burgaw, Gambol and East Thirteenth, Benson and Old Seward, Burgaw and East Sixth, and the new pavement on Tudor Road. They took core samples in the travel lanes and between them for comparison.

SENATOR COWDERY asked if heavier vehicles have a greater effect on plastic flow.

MR. DESJARLAIS answered yes, that wheel loading is a big factor.

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CHAIR HUGGINS commented that one of the discussions the legislature has had about the transportation of pipe for the gas pipeline, is that moving it by truck would overload and destroy the road structure.

MR. DESJARLAIS responded that weight is a factor, but the sub-grade is not failing at the test sites, so the state is building good roads; it just has mix problems.

CHAIR HUGGINS asked how much the rutting factor would be reduced if they got the mix right.

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CHAIR HUGGINS recognized Representative Carl Gatto and invited him to join the discussion.

MR. DESJARLAIS said that he has a lot of slides and data on that very question, including some slides illustrating that the vast majority of flow occurs in the top lift. On Glenn Highway however, the second lift is deteriorating badly and they aren't sure why. He said that a study by Barter and Johnson (1996, 1997) reported that Alaska spends \$5 million annually to repair stud-related pavement damage, but they have not found anything that establishes studded tires are the cause.

SENATOR COWDERY asked if the mixes in use today have changed much over the past ten years or so.

MR. DESJARLAIS replied that they are studying that now, but he believes they will find that mixes have changed a lot.

REPRESENTATIVE CARL GATTO asked how much of the asphalt laid in the state of Alaska is made with Alaskan oil.

MR. DESJARLAIS replied that almost all of it is now made with Alaskan oil.

REPRESENTATIVE GATTO asked if there is any data comparing roads that were built with asphalt made from foreign oil and those that were built using Alaskan oil. He also asked about the hardness of the rock that is used in the sub-grade.

MR. DESJARLAIS said that he would discuss the hardness of the rock later, but that Alaskan oil contains significant amounts of paraffin, which might make softer asphalt.

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SENATOR COWDERY said he understands that sweet crude makes a better product than North Slope oil, but he isn't sure whether it is available. He also said that he has talked to DOT about it but his suggestions were not well received.

MR. DESJARLAIS confirmed that Senator Cowdery is correct about the superiority of crude oil in the mix. He said they have been working closely with Department of Transportation on this project and that both Newt Bingham and Mike San Angelo of DOT have been very cooperative and helpful.

He presented a slide of Glenn Highway near the Muldoon exit, which illustrated pitting in the road, and pointed out that the rocks are not ground down; traffic is picking out the fines [fine, binding surface materials] around them, allowing the rock to come out. Possibly using harder aggregate and larger stones in the surface core could slow this process. Alaska doesn't have a lot of large stone however, so river gravel is more commonly used, and the harder aggregate might not help without larger surface stone. Arizona is incorporating rubber into the surface core and it's holding up very well, so there are other options that might work. This study focuses on plastic flow because, of the sites they have sampled, only the Glenn Highway exhibits this picking phenomenon.

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CHAIR HUGGINS commented that there is a major variance in rutting along the Glenn Highway from one area to another, and asked what Mr. Desjarlais attributes that to.

MR. DESJARLAIS answered that he thinks it is due to different aggregates and different mix designs. He noted that, on the new paving on Tudor Road, they found tiny variations in asphalt and

gradations, and one side is holding up better than the other. He thinks the answer might be modified pavement asphalt, perhaps with more polymers, or incorporating rubber as they've done in Arizona, rather than using harder aggregate.

CHAIR HUGGINS asked if Arizona uses any recycled rubber in the asphalt.

MR. DESJARLAIS replied that all of it is recycled. He added that Alaska tried using rubber in asphalt about 15 years ago, but it wasn't very successful because the federal government was mandating the amount of rubber that had to be incorporated into the pavement and there was no control over the type of rubber being used. In Arizona, they are using a pretty fine mesh that comes from grinding off the outside of truck tires, which yield much better rubber than other types of tires.

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SENATOR COWDERY mentioned that California has also used rubber in asphalt successfully.

REPRESENTATIVE GATTO said he heard that California has had a problem with oxidation in rubber from passenger car tires, so he thinks they've shifted to butyl rubber.

MR. DESJARLAIS replied that the Manhole Adjustment Company, Inc. in Los Angeles California provides asphalt rubber to contractors for use in mixes and has gotten the state to write specifications requiring that it contain a certain amount of tennis ball rubber, which might be a factor in oxidation. The anti-oxidizing agents in tires are actually beneficial. Approximately 60 percent of primary roads in Arizona have a thin layer of asphalt rubber surfacing, and they have had spectacular results. He remarked that asphalt oxidizes too, which contributes to failure, especially in hot countries. Seal coating is frequently used to combat it.

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REPRESENTATIVE GATTO remarked that he heard last year that Michelin made a tire called an Ice tire, which is as good as a studded tire.

SENATOR COWDERY said he owns Bridgestone tires that are similar to the Michelins and they are highly effective all-season tires.

REPRESENTATIVE GATTO added that they are not aggressively treaded so, compared to studded tires, they have less impact on road wear.

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MR. DESJARLAIS asked what the tires look like.

SENATOR COWDERY replied that they look like sawdust tires; they are softer rubber and are self-cleating.

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MR. DESJARLAIS said that George Way P.E. in Arizona showed him a slide presentation of a badly damaged intersection at 1, 5, and 10 years after paving a portion with a one-inch layer of a mixture of 8-10 percent liquid asphalt containing 20 percent rubber. The road has continued to deteriorate, but there is not one reflective crack in the rubber asphalt surface after 10 years.

CHAIR HUGGINS wondered if there is a difference in braking distance on a rubber asphalt surface.

MR. DESJARLAIS replied that he has seen a video of trucks on wet pavement and the rubber asphalt surface does not throw up the rain; it seems to be flowing off.

CHAIR HUGGINS asked Mr. Desjarlais to repeat his overview of their research grant for Senator Cowdery.

MR. DESJARLAIS said that about two years ago, he and John Lu visited the civil engineering lab at University of Alaska Fairbanks (UAF) and decided to use it to research Alaska's pavement rutting problem. They obtained a grant to UAF for the study and have tried to take a fresh approach to the problem, focusing on the actual cause of road rutting, rather than treatment of the symptoms.

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MR. HULSEY said that Dr. Rad did a lot of the research on rubberized asphalt in California for Manhole Adjusters. He also mentioned that he, Dr. Rad, and John Lu obtained a grant from DOT to compare traction on Bridgestone tires to studded tires and were surprised to find that the Bridgestone winter tires surpassed studded tires in tractability in almost every test.

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MR. DESJARLAIS asked Senator Cowdery how much his Bridgestone ice tires cost.

SENATOR COWDERY could not remember.

MR. DESJARLAIS reiterated that studded tires are definitely a factor in creating road wear, although not as great a factor as they were previously thought to be.

REPRESENTATIVE GATTO said he assumed that studded tires would be more effective than ice tires on wet asphalt once the tires have locked.

MR. HULSEY replied that they tested the stopping distance of various tires on the wet runway at Fairbanks International Airport and did not find that to be true.

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SENATOR COWDERY said that might be due to widespread use of antilock brakes in modern cars.

MR. DESJARLAIS showed a slide of the cores from the Stone Matrix Asphalt (SMA) surface on Glenn Highway and pointed out that SMA is fairly porous. The slides show that the second lift has deteriorated almost completely and the asphalt has flushed off, leaving uncoated aggregate. He also showed slides comparing the depth of ruts on the Glenn Highway starting at 200 ft. distance from the Muldoon exit, up to the exit itself. Rutting is fairly consistent at 70 mph, but as traffic slows down nearer the exit, the rutting becomes shallower. He said this is the exact reverse of what happens in plastic flow.

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CHAIR HUGGINS asked if that is studded tire wear.

MR. DESJARLAIS replied yes, that the high speed is what causes studded tire wear.

REPRESENTATIVE GATTO suggested a mechanism for the trends exhibited in the charts.

MR. DESJARLAIS showed slides of rutting caused by plastic flow on Dimond Boulevard, starting at a distance from the stoplight and increasing as traffic slows to a stop.

SENATOR COWDERY said that when Dimond Boulevard was paved two years ago, ripples formed in the road within two weeks after paving was complete.

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MR. DESJARLAIS noted that the Stewart Highway did the same thing when it was paved 6-8 years ago. He presented a summary of their preliminary research results on plastic flow. None of the sampled sites showed evidence of sub-grade deflection or surface raveling and, of the six sites tested to date, only the Glenn Highway showed any indication that studded tires might be the primary contributor to rutting. They are not yet sure what impact the failed mix on the second lift might have on rutting at this site. Testing on the other five sites shows clearly that rutting is the result of plastic flow. Fortunately, this can be managed utilizing the latest technological developments in mix design adapted to Alaska's conditions.

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MR. DESJARLAIS presented slides and information from an extensive study conducted in Colorado in 1992, which concluded, "when air voids in the wheel path were less than 3 percent, there was a high probability of rutting from plastic flow." He explained that a proper mix design is one in which there is a skeleton of aggregate, from the largest to the smallest, and stone-on-stone contact so that it cannot compress. Each particle is then coated with liquid asphalt to glue it all together, which creates what is called "maximum density." At maximum density, there should be four percent air voids, or open areas remaining.

He went on to say that the structure of a road is sub-grade, granular base, and surface layer and most road rutting occurs on the surface layer. If there are excessive air voids, it is an unstable mix that will deteriorate and ravel. Insufficient air voids cause plastic flow, which is exacerbated by the addition of too much liquid asphalt. He said that these results have caused engineers to rethink asphalt composition. He compared the Marshall Mix Design, which accounts for most of the asphalt in Alaska, to the Simple Performance design, and stressed that the Marshall Mix performance test cannot predict the durability of pavement in the lab. The Simple Performance test can do that, but the equipment required is very expensive.

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REPRESENTATIVE GATTO asked about the susceptibility of concrete roads to studded tire damage.

MR. DESJARLAIS said that it does occur on concrete roads and they are more subject to picking than asphalt, but there is no plastic flow. He speculated that building concrete roads in Alaska would be prohibitively expensive, particularly with the poor sub-grades used in the state. Concrete can bridge some irregularity, but Alaskan roads would have to be prepared just as they are for asphalt, which is not necessary in the Lower 48.

REPRESENTATIVE GATTO asked if anyone has considered using an overlay fabric between the top lift and the next lift.

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MR. DESJARLAIS said that he has done that in Anchorage, on Arctic Boulevard. The purpose of an overlay fabric is to prevent reflective cracking and it has proven highly effective. Polymer modified asphalt does the same thing, and many of the roads in Anchorage are surfaced with it. Liquid asphalt has a Performance Grade, or PG rating; PG 52/28 means that grade of asphalt performs to a certain level between 52 and 28 degrees Celsius. Because that is the only grade of asphalt available in Alaska, polymer (styrene-butadiene-styrene [SBS]) is added to make it more resilient in extreme temperatures.

REPRESENTATIVE GATTO asked if a driveway has the same mix as a highway.

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MR. DESJARLAIS replied that driveway mixes are much finer and unstable in general, and would not be suitable to use on a highway.

He said that with regard to design vs. constructability and quality control, it is important to realize that laboratory simulation can only sample a very, very small part of the overall quantity. It will cost the state and the contractors money, but it is important to have better quality controls in place in the plant and in the field. He also said that the focus has been on things that are inconsequential; it is important to focus on the composition of the blends. He emphasized that process control is more important than composition testing.

MR. DESJARLAIS' next slides provided a comparison of the percentage of voids in different layers of the old and new pavements on Tudor road. They illustrate that the mix on the top lift before re-paving was down to .02 percent. It probably had four percent voids originally, but it kept compacting and

flowing, until there were virtually no voids left. The westbound lanes of the new pavement contain local aggregate; the eastbound lanes contain hard aggregate with the same broadband mix design as that on the westbound lanes. He said that he assumes the westbound lanes will begin to rut within a few months but that it has nothing to do with hard or soft aggregate, but with the mix design.

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REPRESENTATIVE GATTO suggested moving the stripe on highways to distribute wear and reduce rutting.

MR. DESJARLAIS replied that it is a thought. He concluded that plastic flow is a major cause of rutting due to mix design and techniques, inadequate constructability and inadequate testing. He again stressed that process control is of the greatest importance.

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MR. DESJARLAIS suggested requiring 3-4 percent polymer for roads, and making testing a priority in that process as well as in the making of hot-mix asphalt.

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SENATOR COWDERY said that he has observed that contractors bid on a job based on the specifications that are required, not to do the best possible job, which creates design flaws.

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REPRESENTATIVE GATTO asked what happens on runways.

MR. DESJARLAIS replied that the construction of runways is radically different from the construction of highways. The standards for runways are much higher.

REPRESENTATIVE GATTO asked whether the autobahns are asphalt or concrete.

MR. DESJARLAIS replied that most of them are asphalt, and described the construction method used on that type of project.

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CHAIR HUGGINS asked Mr. Desjarlais to explain de-icing to Representative Gatto, particularly as it relates to the bridges in the MatSu.

MR. DESJARLAIS said that he has been consulting with a company that developed a system to prevent ice from forming on bridges and tunnel entrances and exits. There is a sensor (peltier device) set into the pavement that detects moisture on the road and, when the temperature drops below 39 degrees Fahrenheit, a thermal electric heat pump warms up to two degrees Celsius over freezing to melt any ice or snow off the road, then cools down to as much as 25 degrees Fahrenheit below the surface temperature of the road and records the freeze-point of moisture on the surface. Once the freeze-point has been established, when the temperature gets within two degrees of that point, an anti-icing chemical is sprayed on the bridge. This technology will be used on the Knick River Bridges.

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REPRESENTATIVE GATTO said he heard that it would be frightfully expensive.

MR. DESJARLAIS replied that it would only cost a million dollars for the main bridge over the Knick River, both north and south spans, plus 200 feet on each side approaching the bridge.

SENATOR COWDERY remarked that just after adding a new runway at the Anchorage International Airport, planes sitting on that runway were actually turning the asphalt when they turned their wheels to move.

MR. DESJARLAIS said he remembers that. The top lift was sliding and completely separating from the second lift. The runway has now been chip-sealed with polymer modified asphalt.

CHAIR HUGGINS mentioned that the committee would like to have an asphalt summit when all of the research is complete.

MR. DESJARLAIS agreed and said that they should hold another summary meeting for stakeholders involved in the project.

CHAIR HUGGINS asked how much longer the graduate student has left.

MR. HULSEY said that he has at least a year. Lab work should resume in September and they should have more faculty at the lab at that time.

MR. DESJARLAIS said that the UAF lab could be used to solve problems in mix design instead of just throwing money at them.

CHAIR HUGGINS asked about Billy Connor's grant and wondered whether he will be using the UAF lab.

MR. HULSEY answered that Mr. Connor has a 5-year grant of University Transportation Center funding to bring top researchers in the field of transportation-related problems to Alaska, and that he will be using the UAF lab. He commented that the lab is fortunate to have first-rate equipment, including environmental chambers to test samples in cold weather conditions, but it needs funding to keep the equipment properly calibrated.

MR. SAN ANGELO said that DOT supports the work that is being done on this.

CHAIR HUGGINS adjourned the meeting at meeting [2:55:53 PM](#).