TECHNOLOGY

Ivars Peterson reports from Washington, D.C., at the annual meeting of the Transportation Research Board

Bouncing road ice problems away

Adding coarse rubber particles to asphalt produces pavement with increased skid resistance, reduced noise levels and better wintertime ice control. Tests conducted in Alaska indicate that rubber-modified pavement significantly reduces stopping distances on icy roads and increases pavement fatigue life, reports David C. Esch, Highway Research chief for the Alaska transportation department. The flexibility of the mix and the bending of the protruding rubber particles appear to break down surface ice deposits so that the rubber-modified pavement sheds ice more quickly than do conventional pavements. The rubber particles, 2 to 6 millimeters in size, make up 3 to 4 percent of the mix.

"The potential savings in ice-control costs may justify the increased cost of rubberized surfacing," says Esch. These surfacings are likely to be most useful on bridge decks and insulated roadway sections, and where the cost of using sand or salt for ice control is high. Another benefit is the use of a troublesome waste product: rubber from hundreds of millions of discarded, used tires.

Spin storage for trolleys

The electric trolley coach, once a common public transit vehicle, may return to city streets, but this time, it will be indepedent of the network of overhead wires that still power the buses through nine cities in the United States and Canada. The key element in the new trolley coach is a flywheel energy storage system (FESS) that stores enough energy to operate the vehicle up to 8 kilometers between recharges.

L.J. Lawson of the Garrett Corp. in Los Angeles reports, "The FESS concept provides high-quality urban transit service without the noise, odor, emissions and high maintenance burden of a diesel bus, but, unlike the trolley bus, it does not require expensive continuous electrification."

The bus would receive electric energy during a 90-second charging period while operating under overhead wires for a short distance along a route. This energy is used to spin a 16-kilowatthour flywheel, which acts as the energy reservoir in the bus. Once the flywheel reaches its maximum speed, 25,000 rotations per minute, the bus is ready to disconnect automatically from its charging source. The flywheel rotor then acts as a generator. Its output is rectified and connected to a DC traction motor that propels the bus. Even the energy from braking can be used to recharge the flywheel.

Lawson says, "We've verified that the basic flywheel technology has the capability of operating for the kind of life that we see for a transit vehicle." Laboratory testing on the full-scale propulsion system will begin next month, with installation of the system in a transit bus later in the year for further testing. Several transit authorities, particularly in San Francisco, have shown interest in the system.

Fueling with rough roads

A Wisconsin transportation department engineer has confirmed that bad roads cause automobiles to burn more fuel. In a test program under carefully controlled conditions, Frederick R. Ross was able to show that as road roughness increases, fuel consumption rises, but only by 1.5 to 3 percent, not as high as the 30 percent other researchers had reported. Ross notes that the effect of pavement roughness on fuel consumption can be overwhelmed by other factors such as travel speed, road gradient, driving habits and wind velocity. For the three automobiles used in the study, the relationship between fuel consumption and pavement roughness did not appear to be a function of vehicle size.

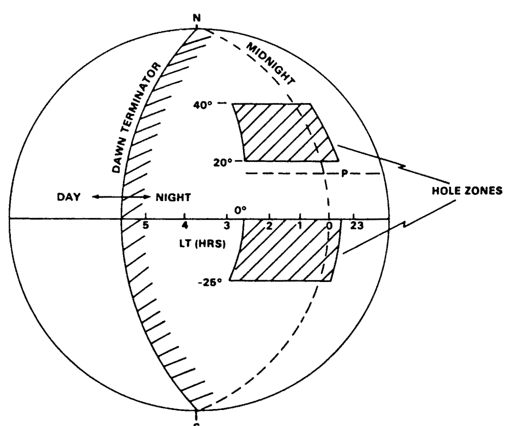
SPACE SCIENCES

Venus: Mapping ionospheric holes

The ionosphere of Venus is a shifty thing, particularly on the planet's nightside. The orbiting Pioneer Venus spacecraft, which took up station in December 1978, found during its first 225-day Venus year that the nightside ionopause (the ionosphere's outer boundary), for example, varied in altitude from about 200 kilometers to as much as 3,600. Among the changeable details of the ionosphere are what has been dubbed "holes"—regions with a greatly reduced number of electrons—similar to phenomena also being studied in the ionosphere of earth (SN: 1/9/82, p. 22).

Unlike the transient holes in earth's ionosphere, the Venusian ones may be permanent, yet horizontally mobile. But Larry H. Brace of the NASA Goddard Space Flight Center in Maryland, together with colleagues from Goddard and the University of California, has now added up the data from the still-working orbiter and concluded that the holes do tend to appear primarily in two specific areas, one each in the northern and southern hemispheres. The researchers have compiled the data to map the holes' sizes, shapes and pattern of occurrence, in hopes that future analysis will shed more light on what causes them.

The individual holes, the researchers report in the Jan. 1 JOURNAL OF GEOPHYSICAL RESEARCH, tend to be oblong, typically measuring about 1,000 km in the north-south direction and about 1,800 km from east to west. From three Venus-years of data, results gathered when the spacecraft's low point was in the nightside ionosphere indicate that the orbiter passed through 49 holes, 38 of them concentrated in two key zones. The zones are not equidistant from the equator, both being shifted instead about 10° northward. They are also offset about an hour toward the dawn terminator from the midnight meridian. (Both of these asymmetries, Brace's group notes, are greater than one would assume solely from "expected solar-wind aberration effects.")



L. H. Brace, et al./JGR

The regions of electron-poor plasma defining the holes seem in general to extend radially outward from the direction of Venus, and the orbiter's magnetometer data indeed show the holes to be "permeated" by strongly enhanced, radial magnetic fields, apparently balancing the plasma pressure outside.

The depleted population of electrons within the holes seems to consist of two distinct groups, one of them coming from but cooler than the surrounding ionosphere, while the other includes much higher-temperature electrons, which may have been transported in from the magnetic field's extended tail. Earlier research indeed suggested that the radial fields may be "downward" extensions from the magnetotail into the nightside ionosphere. Brace's group now notes that the thermal characteristics of the electron population in the holes are at least consistent with the possibility that the radial fields cause the holes by inhibiting the horizontal transport of hot electrons from the surrounding ionosphere.