Science

# Behind Travel Troubles

You May

## Not Be Able to Avoid Travel Woes, But You Can

# Understand Them


Holiday travelers make their way through the terminal at Miami International Airport on Tuesday. (David Adame/AP Photo)

**By AMANDA ONION**

ABC NEWS

**Nov. 24, 2004 —** Ominous weather across the country means many Americans may be suffering through long, white-knuckle days of traveling this holiday season. And, while there's little to be done about traffic or the weather, at least you can think about the science behind it.

In recent years, researchers have searched for explanations behind common traveling hazards and annoyances from slippery roads to bumper-to-bumper traffic to flight-delaying weather. Below is a summary of some of their findings.


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## Slippery When Wet

Most drivers have experienced skidding out of control when it's raining and the pavement is wet. The cause may seem obvious, but, in fact, physicists have been debating for years what could be the main cause behind the problem.

This November, a team of scientists offered their theory in the journal "Nature Materials," to explain how even a drizzling rain can cause a 25 percent reduction in friction between tire and road at speeds below 40 mph. They discounted molecular attraction between atoms within the pavement and the tire's rubber since they calculated only 1 percent of a tire touches the pavement at a given time, thanks to the curvature of the wheel and the rough surface of the road.

Instead, Erio Tosatti of the International Center for Theoretical Physics and his colleagues determined the biggest factor was the way water pools within the tiny valleys of road pavement's rough surface. The effect is a smoother surface, which reduces how much the tire's surface is deformed upon contact. The less deformity of the tire's surface, the less friction. And friction is what keeps the driver in control.

In heavier rains, drivers can experience the more dramatic effect of hydroplaning. According to the National Safety Council, hydroplaning happens as water on the road builds up in front of a car's tires faster than the car's weight pushes it away. The water pressure then lifts the car up and causes it to slide on the layer of water between the car's tires and the road.

To avoid either problem, drivers are advised to make sure their tires' treads are in good shape and inflated properly and when rain falls, to slow down and try to avoid large puddles.

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## Stuck in Traffic

After crawling along a packed roadway at a snail's pace for hours, nothing about traffic may seem to make sense. But, in fact, scientists have found there are a few constant variables when it comes to congestion: flow, speed and density.

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As you might expect, greater traffic density usually leads to slower overall speeds. And the better the flow, the less likely cars will interfere with each other and speeds increase. But what may not seem so obvious is at some point traffic flow can improve with density.

According to studies by Bernardo Huberman at the Xerox Palo Alto Research Center and Dirk Helbing at the University of Stuttgart, Germany, there is a unique point at which more cars on the road can improve congestion. This is when, as Huberman explains, traffic begins to move as a single solid mass, rather than as separate, fluid-like entities.

When all lanes of a highway are filled, traffic can still move along at a fairly steady clip as long as large enough gaps remain between cars. Lead-foot drivers may find driving in such a solid flow frustrating, but Huberman says the constant speeds in the lanes actually makes for a more efficient pattern than when cars are slowing and speeding around each other in random patterns.



Incidentally, "solid-state" traffic may also be safer. Studies show that most accidents on highways occur when drivers are speeding up or slowing down. When everyone is stuck in the same steady flow, drivers may not get to enjoy the exhilarating rush of flying by others in the fast lane, but they may be less likely to end up in a crash.

## Grounded by Weather

It may not be a comforting thought, but the Federal Aviation Administration estimates that, on average, every commercial aircraft is struck by lightning about once a year. Still, one can take solace in fact aircraft are well equipped to handle the occasional jolt.

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The aluminum casing of planes is a good conductor and guides the electricity from a lightning strike along the outside of the airplane and into the air. In fact, only one U.S. airliner has been downed by lightning when, in 1962, a Pan American Boeing 707 was struck and a spark ignited fuel vapor in a tank, causing an explosion. Since then airplanes have been designed in ways to prevent such ignitions.

So if lightning strikes aren't a major hazard, how can a thunderstorm ground your flight? A bigger risk may be the violent winds and hail that are associated with the storms. Sharp changes in wind direction and speed, called updrafts and downdrafts, can cause extreme turbulence in the air and can make aircraft difficult to control. During takeoff and landing, wind shear can cause a plane to skirt off course and into trouble. If heavy enough, hail can cause damage to a plane's windshield or engines.

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Another major weather hazard for pilots, particularly for pilots of smaller planes, is the buildup of ice on a plane's surface during flight. This happens when a plane flies through cloud water droplets that are small enough to remain in liquid form even when the surrounding air temperature is below freezing. In this state they are likely to latch and freeze on a passing plane's wing surfaces, which can alter the craft's aerodynamic properties.



It was in-flight icing that likely caused the crash of the small plane carrying rock 'n' roll legends Buddy Holly, Ritchie Valens and the Big Bopper in 1959. But passengers are safer now from the icing hazard thanks to a couple areas of improved technology. De-icing solutions that are sprayed onto planes melt away any buildup of ice on the plane, while anti-icers effectively lower the freezing point of water on the plane's surface and prevent ice buildup during flight.

Meanwhile, scientists at the National Center for Atmospheric Research in Boulder, Colo., are working an advanced radar system that can help pilots locate and avoid clouds containing the dangerous tiny water droplets that cause icing.

"This will take out a lot of the guesswork," said Marcia Politovich, director of NCAR's icing program. "We think it will show exactly where the water is. That information could ultimately turn into an important warning system for pilots."