SAFETY ENGINEERING

Paying Airline Passenger Safer Than Auto Occupant

Railroads Take First Place in Passenger-Miles Per Passenger Death, But Drop to Third on Other Rating

By ROBERT D. POTTER

DID you ever peer out of your family car to see an airliner rushing by far overhead? And did you think:

"I'm glad I'm safe here in my car instead of 8,000 feet up?"

The thought may have been comforting at the moment but, in reality, the paying passengers on that airliner—and all scheduled airline travel—were safer in 1935 than the drivers of America's motor cars. Only railroad passengers were safer.

Yes, riding in an airplane as a paying passenger on a scheduled flight last year was safer than riding in your own automobile!

If you are reading this you, naturally, were not killed last year by a motor vehicle accident but many other people were; more than 36,000 altogether and some 20,000 of them automobile occupants.

Here are the death figures for airline travel, motor vehicles and railroad transportation for 1935:

The foreign and domestic airlines of the United States traveled 360,559,431 passenger miles and killed 15 passengers. The result is 24,037,290 passenger miles per passenger fatality.

The motor vehicles of America traveled 379,979,800,000 occupant miles and killed 20,070 occupants; and thus traveled 18,932,725 occupant miles per occupant fatality.

Only 18 Killed

The nation's railroad trains last year traveled 18,500,000,000 passenger miles and killed 18 passengers. The result is 1,027,780,000 passenger miles per passenger fatality.

A passenger or occupant mile, it should be explained, is one passenger or one occupant carried one mile.

The railroads with a century of experience behind them and all manner of safety checks and controls not available or practical for automobiles and aircraft may be expected to show—as they do—a superiority in safety to passenger travel. The surprising thing to many people will be the discovery that scheduled airplane travel was safer, last year, than was motoring.

It is one thing to present figures on automobile, airline and railroad deaths for a given unit of mileage traveled and something else to go behind the figures and see how they were determined.

For the airlines, through the Bureau of Air Commerce, and the railroads, through the Interstate Commerce Commission, the figures are known with considerable accuracy. The weakest point in any comparative analysis of the three modes of transportation is the data concerning motor vehicles.

Questions For Study

Some of the questions which may be pondered over include:

1. What mileage did America's motor vehicles travel in 1935?
2. How was that total mileage distributed between motor trucks and private passenger cars?
3. How is the mileage distributed between city and rural driving with their completely different driving conditions and different accident figures?
4. What is the number of miles to a gallon of gasoline which can be assumed for the average motor car on the road today? And the average truck also?
5. How does the number of miles per gallon of gasoline vary between city and country driving?

One agency which makes estimates of the yearly motor vehicle mileage is the Petroleum Economics Division of the U. S. Bureau of Mines which has prepared elaborate charts based on studies of the yearly gasoline consumption. This is the source of information used in the present article.

In 1935, the Petroleum Economics Division estimates, America's motor vehicles traveled 204,245,000,000 miles. This total figure can be broken down into rural and city travel and into truck and private car travel. Rural travel was 100,420,000,000 miles, split two ways: 85,960,000,000 miles for passenger cars and 14,460,000,000 miles for trucks. City travel amounted to 103,825,000,000 miles; 86,607,000,000 miles for private cars and 17,218,000,000 miles for trucks.

From these figures there can be computed the number of occupant miles traveled in motor vehicles by estimating the average occupancy of trucks and private cars. The National Safety Council uses two persons as the average number of occupants of a private motor car and 1.1 persons as the average number of occupants of each truck.

Multiplying the mileage totals by the occupancy, the 1935 occupancy mileage totals are:

	Occupant Miles
For rural highways..	187,826,000,000
For city driving.....	192,153,800,000
Total	379,979,800,000

Now for the death figures. In 1935 some 36,100 persons were killed by motor vehicles, but since here only the death rate for car occupants is wanted, one must subtract the 16,030 pedestrian deaths. Thus 20,070 occupants of motor vehicles lost their lives last year.

Divide the total motor vehicle occupant miles by the 20,070 deaths and one has the figure already given: 18,932,725 occupant miles for each occupant death.

Because of the widely different conditions of motor vehicle operation in city and country it is fairest to the motor car and truck death picture to break it into two parts: rural and city driving and deaths.

Of the motor vehicle death total of 36,100 persons in 1935, some 14,770 of them lost their lives in cities and towns and 21,330 in rural sections. The following table splits these deaths into rural and city and also pedestrian and motor vehicle occupant:

1935	City	Rural
Total Deaths.....	14,770	21,330
Pedestrian Deaths..	10,010	6,020
Occupant Deaths...	4,760	15,310

Occupant Deaths

Concentrate on the occupant deaths only. And recall that the occupant mileage for city travel is 192,153,800,000 miles and for rural travel it is 187,826,000,000 miles.

Divide city travel by city occupant deaths and rural travel by rural occupant deaths and you have:

	Miles
Rural occupant miles per occupant deaths.....	12,268,000
City occupant miles per occupant death.....	40,368,000

Scheduled airline travel, remember,

came out to 24,037,290 passenger miles per passenger fatality.

In any comparison between airplane, the motor car and the railroad train as a means of transportation two aspects must be separated:

(1) The safety of the device for the occupants using it, and

(2) The efficiency of the transportation device—a sociological efficiency as it might be called—in terms of the number of all persons killed for a given travel unit; say 1,000,000 miles.

Efficiency for Death

The two points are quite distinct and require separate treatment. The figures already cited refer, of course, only to the first problem. Consider now the efficiency aspects of the airplane, motor car and railroad train as instruments of death.

Motor cars and trucks have the worst record on the basis of passenger miles covered per passenger death. But highway transport is the most efficient and safe method of transport if the transportation death problem is looked at in another way: A greater number of miles is traveled by autos and trucks for each fatality caused than by airplanes and railroad trains.

Note the following for the number of miles traveled for fatal accident of any kind whatever:

Railroads—375,000 miles per death.

Airlines—1,200,000 miles per death.

Automobiles—5,658,000 miles per death.

Order Reversed

The order, it will be seen, is completely reversed from the passenger mile analysis with the airlines still holding the center position in both cases.

The railroads are, therefore, very safe for their paying passengers, for although 18 passengers were killed last year, not one of them was killed in a wreck or collision. These accidents occurred to persons jumping on moving trains, from car to car, and so on. But, in over-all deaths, the railroads present the reverse picture. In addition to the 18 fatally injured passengers some 555 employes were also killed. And 1680 other people were killed.

These figures, from the Bureau of Railroad Economics, must be divided into the total train miles traveled last year: 845,000,000 miles. The result is 375,000 miles per fatality.

For the airlines, a total of 34,811,105 flight miles was traveled last year, according to the Bureau of Air Commerce. While only fifteen passengers were killed the total deaths from this form of transport was 29, including pilots, hostesses and ground personnel. Thus, commercial aviation killed one person for each 1,200,000 miles traveled.

Motor vehicles traveled 204,245,000,000 miles last year, according to estimates based on gasoline consumption and prepared by the Petroleum Economics Division of the U. S. Bureau of Mines. The automobiles and trucks of America last year killed 36,100 people. Dividing these two figures, one into the other, yields the answer: 5,658,000 miles of travel per fatal accident.

Another way of looking at the killing efficiency of the railroads, airlines, and motor vehicles is, perhaps, a bit fairer to the railroads. It consists of finding the number of passenger miles per death of any kind.

The Figures

The figures with which one works to compute this are given below:

For railroads: 2,253 deaths in 1935 for 18,500,000,000 passenger miles.

For airlines: 29 deaths to 360,559,431 passenger miles, and

For motor vehicles: 36,100 deaths to 379,979,800,000 passenger miles.

The result is:

	Passenger Miles For Each Death
Railroads	8,210,000
Airlines	12,430,000
Motor Vehicles	10,520,000

The whole problem of speed and deaths in transportation raises the question of why men like to go from place to place more quickly and continually invent devices for accomplishing this purpose. Bluntly the question may be asked, "What is the good of all the present-day speed?"

Time is Life

Dr. H. C. Dickinson of the National Bureau of Standards in Washington has made an unusual analysis of this problem which is confirmed, in part, by the figures above.

Time, says Dr. Dickinson, is the common heritage of all men. It is the only thing which all people have to do with as they will. A large amount of time is used in getting from one place to another for pleasure or business. In primitive days, by walking, a person's lifetime was probably equivalent to about 200,000 miles. If a man spent his life-

SAFETY ABOVE

The motorist may congratulate himself that he is on the ground, but he is actually travelling in greater danger than is the air line passenger. On railroads, it is the employe, not the passenger, who may be in danger. Photograph by Fremont Davis, Science Service Staff photographer.

time traveling on horseback or in a horse-drawn carriage he might travel 500,000 miles in his entire life.

Man invented, however, the motor car, the airplane, and the railroad train to enable him to travel farther and faster; and in the process some people are killed just as people occasionally are killed in walking or by riding horseback.

"Compare the wasting of an entire life in covering from 250,000 to 500,000 miles by primitive modes of transportation," urges Dr. Dickinson, "with the life cost of modern travel by automobile where we sacrifice what is left of someone's life for each 10,000,000 passenger miles traveled."

Dr. Dickinson's point is that life is more efficient if we have motor cars and airplanes and railroad trains which kill people occasionally than it is to spend whole lifetimes figuratively crawling from place to place with less loss of life.

The reason why man wants faster airplanes, trains and automobiles is that mass consciousness has a dim but inexpressible realization that the faster way is the more efficient way.

Says Dr. Dickinson:

"We use the automobile not only because we like it but because it saves time, which is life. It enables us to do more in a lifetime, to enjoy more leisure, to produce more of what we want, to 'save part of our lives.' Suppose now that some one proposes to reduce the average speed of automobile travel. If we reduce the average speed so that we cover 250,000 miles less out of each 10 million miles traveled before for each fatality, we shall have lost as much distance as would have been covered in a lifetime of walking. This would represent a reduction of only 2.5 per cent in the average speed of travel. If we did this and thereby saved every single highway fatality, it would be a questionable investment in life saving. But a reduction of 2.5 or 5 per cent in average speed certainly would save very few lives, possibly none at all."

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PHYSICS

Tiny Transparent Balloons Probe Stratosphere Secrets

See Front Cover

SHIMMERING bags of transparent material of the kind used in wrapping cigarette packages are the latest tools of science to tap stratosphere secrets. Soaring to altitudes of 20 miles, these small unmanned balloons are being used to pierce the atmospheric heights far above where men can probe them with giant balloons carrying loads of equipment and human pilots. A vastly wider usefulness to science, research at only a fraction of the former cost, and complete freedom from any possibilities of loss of life are the three motives behind the gleaming balloons now being sent aloft which, through robot scientists in their "gondolas," record and send back to earth the reports from near the "surface" of the sea of air which surrounds the planet earth.

Climbed 100,000 Feet

At the National Bureau of Standards in Washington, D. C., Dr. L. F. Curtiss has sent up such a balloon to an estimated height of over 100,000 feet. From such a height one could look down on the famed Explorer II as it broke the world's altitude record, 72,395 feet, as would the climbers of Mt. Everest on the ground 29,000 feet below.

And at the Franklin Institute's Bartol Research Foundation, Dr. Thomas H. Johnson is sending up similar balloons in studies with which it is hoped to close the last gaps in the mystery of science that has been the cosmic ray.

Low Cost

The cost? Comparatively trivial when viewed in relation to the variously estimated cost of $185,000 spent on the two flights of the National Geographic Society-U. S. Army Air Corps' Explorer I and II.

Dr. Johnson, for example, estimated $25 as the outside cost of the recent ascension from Swarthmore College campus shown in the accompanying photographs. And that figure includes the cost of the tiny shortwave radio transmitter which served as the robot mechanism to send back to his laboratory the stratosphere information.

Considering economics alone, some future gigantic world-wide stratosphere research might send up simultaneously, from over seven thousand spots in the world, these midget balloons for the price paid for the Explorer I-II flights.

Key mechanism in the new midget balloons is the tiny broadcasting set which sends back, at regular intervals, the information being recorded on the scientific instruments. The sending set used by Dr. Curtiss of the National Bureau of Standards consists of only two radio tubes with electric power supplied by an ordinary dry cell battery like those used to operate a doorbell. Its total weight is only a few pounds.

In the Bartol Research equipment of Dr. Johnson there is also apparatus which dumps a total of ten pounds of sand ballast wherever the upward ascent of the balloon stops.

Weather Men Pioneered

Pioneer explorers of the upper air were the weather men who have ever sought to learn new facts about what is happening high over the earth. To study air currents they first sent up small free balloons and watched them through telescopes. Or they sent up large kites with wind-speed recording mechanisms. Today, with the new system of weather forecasting known as air-mass analysis, daily airplane flights are made at many stations throughout the country to probe the temperature, pressure and velocities of upper air winds.

But the quest for higher altitudes and more information has brought in the newer radio balloons. Twenty-mile ascensions have been achieved and in U. S. S. R., where such research has been especially active, a record of 26 miles altitude has been reported. All the while, the robot radio operator aboard the balloon sent back its messages.

For Cosmic Ray Research

It is in the field of cosmic ray research that scientists have great hopes for the radio balloon technique. That is the motive behind Dr. Johnson's preliminary Bartol Research ascensions.

A whole new region of the stratosphere can thus be studied, it is believed. Scattered measurements made with tiny balloons bearing automatic recording cosmic ray instruments have already been made in years past. The apparatus of Prof. Robert A. Millikan, California Institute of Technology, was typical. The balloons, with their instruments, were sent aloft in Texas with a note attached asking the finder to return the equipment and collect a small reward. Most times the equipment came back, but sometimes it was lost.