What if They Closed 42d Street and Nobody Noticed?

ON Earth Day this year, New York City's Transportation Commissioner decided to close 42d Street, which as every New Yorker knows is always congested. "Many predicted it would be doomsday," said the Commissioner, Lucius J. Riccio. "You didn't need to be a rocket scientist or have a sophisticated computer queuing model to see that this could have been a major problem."

But to everyone's surprise, Earth Day generated no historic traffic jam. Traffic flow actually improved when 42d Street was closed.

To mathematicians, this may be a real-world example of Braess's paradox, a statistical theorem that holds that when a network of streets is already jammed with vehicles, adding a new street can make traffic flow even more slowly. Seeking Out a New Street

The reason is that in crowded conditions, drivers will pile into a new street, clogging both it and the streets that provide access to it. By the same token, removing a major thoroughfare may actually ease congestion on the streets that normally provide access to it. And because other major streets are already overcrowded, diverting still more traffic to them may not make much difference.

Dr. Joel E. Cohen, a mathematician at Rockefeller University in New York, says the paradox does not always hold; each traffic network must be analyzed on its own. When a network is not congested, adding a new street will indeed make things better. But in the case of congested networks, adding a new street probably makes things worse at least half the time, mathematicians say.

Dr. Cohen and Dr. Frank P. Kelly of the University of Cambridge in England published the most recent analysis of the traffic paradox in the current issue of The Journal of Applied Probability. In their paper, they show that the paradox occurs when the traffic is described by a sophisticated statistical model. Previous work had used what Dr. Cohen describes as an overly simple and less realistic model.

The traffic paradox was first described in 1968 by Dr. Dietrich Braess of the Institute for Numerical and Applied Mathematics in Munster, Germany. He found that when one street was added to a simple four-street network, all the vehicles took longer to get through.

Dr. Braess's result was "very surprising," said Dr. Richard Steinberg of A.T.&T.'s Bell Laboratories in Holmdel, N.J. Dr. Steinberg and colleagues studied how often the paradox would hold true, and determined in 1983 that "it is just as likely to occur as not."

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He and his colleagues also turned up a paradox of their own: that in some situations, "when you add more delays along a route, more people use it." Honk, Honk

Dr. Cohen and Dr. Kelly have now examined traffic networks with a sophisticated analytic method known as queuing theory, which describes traffic jams in terms of vehicles lining up on the streets. They found a simple traffic network in which adding a street increased travel time.

Their model starts with a V-shaped divide in the street, forcing drivers to go right or left. Those who bear left soon come to a garbage truck blocking one lane, and cars squeeze into a single lane to get by it. Ahead is a traffic light, which creates more delays. Finally, cars pass through the light and leave the network. Cars that bear right at the V face a traffic light and then some road construction that forces them into a single lane.

Now, Dr. Cohen and Dr. Kelly say, suppose a traffic engineer tries to improve things and adds a new street, from the garbage truck on the left to the construction on the right. The new street has its own traffic light in the middle. The addition of this connecting street, they find, slows everyone down by nearly 50 percent. Everybody Gets Selfish

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Dr. Cohen said he had not done a formal analysis to see how often additional streets clog traffic, but he added, "My intuition is that it must happen a lot." He finds support for his intuition from game theory, which says that if everyone in a game acts selfishly, everyone suffers. The traffic jam is analogous to such a game, Dr. Cohen said.

He cited a German paper, published in 1969, reporting that the City of Stuttgart had tried to ease downtown traffic by adding a new street. But congestion only got worse, and so, in desperation, the authorities closed the street. Traffic flow improved.

New York's Transportation Commissioner, Mr. Riccio, has a doctoral degree himself (in engineering, from Lehigh University), and he said he favored using mathematical models to try to improve traffic flow. "I believe in these models," he said, and added that he would welcome a call from Dr. Cohen to discuss how his work could apply to New York City's daunting traffic problems.