time distributions I have assumed - I won't go into any detail on these - I have assumed what are known as "price-on arrivals," and "exponential service times." These seem to represent fairly well what actually happens in any such situation. It is also assumed that the tollbooth has been in operation long enough so that a steady or routine state of operation has been established. It can be shown in this case that the average number of cars at the gate at any given time is 1½, and the average delay involved is about 9 seconds.

Starting with simple problems like the one just described, queuing theory has been extended and elaborated in many ways. These include such features as multiple servors; multiple waiting lines with special rules as to which one a customer enters; priority of service to certain customers; and the effect of impatient customers who either don't enter a line or leave it before being served. Application of the technique can help managers to design or improve systems in which congestion occurs, by indicating the best number and configuration of serving points and waiting lines, not only for reducing congestion and delay, but also with a view toward overall operating economy.

The factor of economy is an important one. If the system were operated only for the convenience of its customers and enough servors could be provided so that a customer would practically never have to wait in line, such a policy would mean that many servors would stand idle much of the time. And presumably, each servor represents a certain portion of the system's operating cost. To run the system economically, therefore, some balance must be achieved between the cost of customer delay and that of servor idle time.

Queuing theory techniques have been applied to many types of operation, and new applications are being found all the time. Operations that have been analyzed successfully in the past include air, rail and highway traffic management; production line operations; service at store counters; telephone trunking; the mainten-