LETTER FROM TOKYO (2):
Computerizing Tokyo's Traffic

The world's most advanced traffic control experiment may yield lessons for cities around the world

BY JOHN H. DOUGLAS

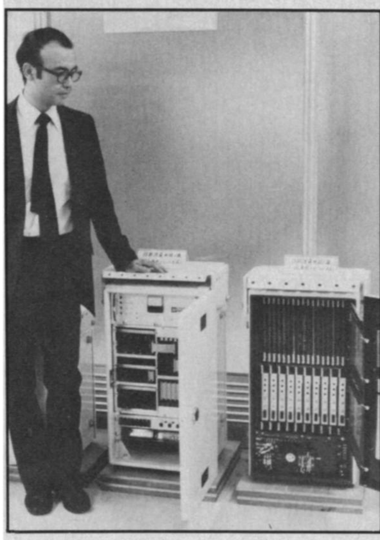
Like a torn cobweb spun by many succeeding generations of spiders, the streets and highways of Tokyo and its suburbs stretch across much of Japan's only large piece of flat land and into the crevices of surrounding mountains. At its best, this incoherent tangle of thoroughfares and alleyways creates insular neighborhoods of almost Parisian charm. Even a few steps can transport one from the bustle of a main road into the traditional atmosphere of isolated security that Japanese value most. Indeed, it can be a nearly ideal compromise for surviving hectic urban life — until you need to go somewhere.

Then, if you drive, you must fight for a place in endless, crawling lines of traffic, as Tokyo's 3 million private automobiles try to squeeze into an antiquated maze of roads. Even by the standards of, say, New York or Los Angeles, almost any time of day or evening is rush hour in Tokyo. And the cobweb of streets is so jumbled that virtually no trip of even two or three miles can be made along a straight route.

At last help may be on the way. Since wider streets and straighter highways would now be practically impossible to impose on the traditional road system, the Japanese government has decided to try to ease congestion by making use of existing roads more efficient. After several years of planning and developing the necessary equipment, the Ministry of International Trade and Industry (MITI) has just launched what is by far the world's largest and most complex experiment in advanced traffic control.

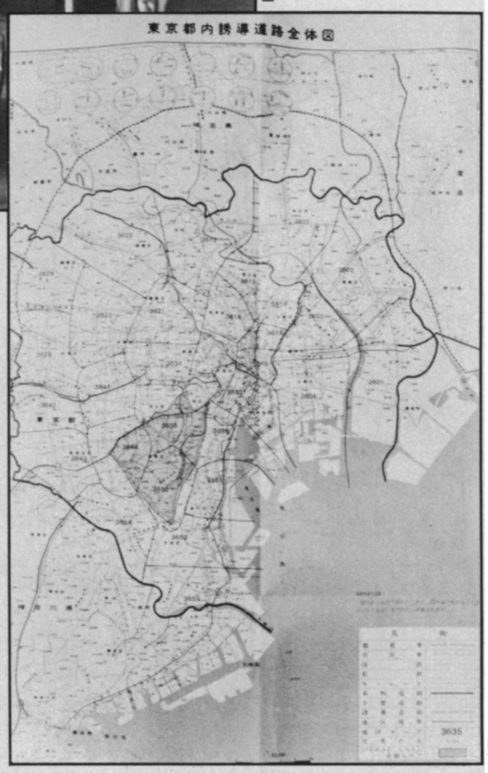
In a 28 square kilometer area covering parts of six wards in southwest Tokyo, a number of sophisticated electronic devices are being used to monitor traffic conditions and give motorists time-saving information. Experiments in this pilot project will continue through the spring of 1978, the culmination of a six-year, $28 million MITI program to develop a "comprehensive automobile traffic control system." If these tests are successful, the system is expected to be turned over to other ministries for full utilization and expansion.

Embassy of Japan



John H. Douglas

Onda explains roadside units.



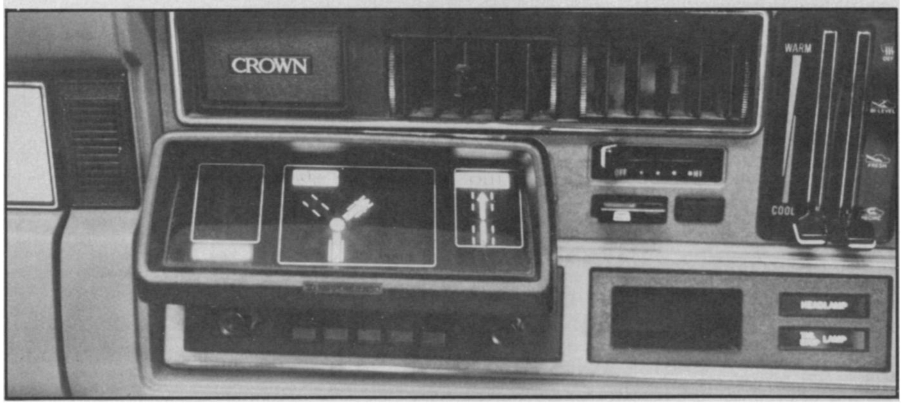
MITI

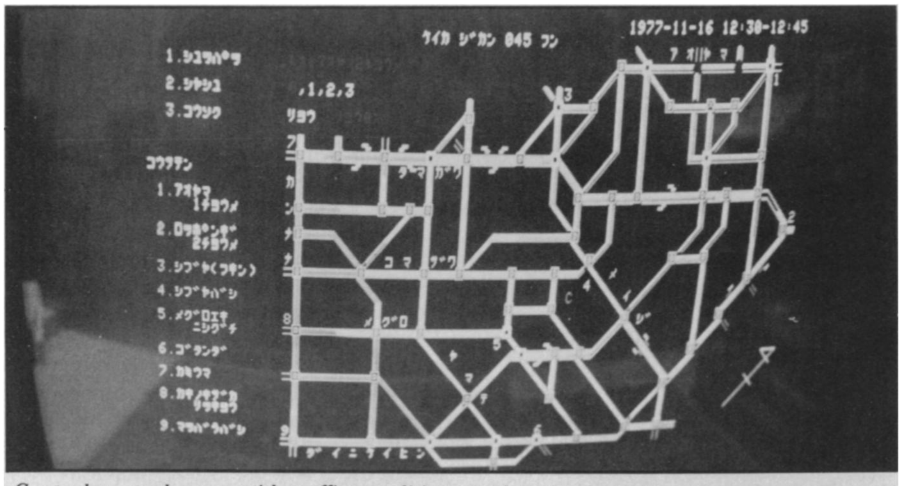
Experimental area shaded on Tokyo map.

This is the second in a series of reports on Japanese science and technology by contributing editor John H. Douglas, who is currently living in Tokyo.

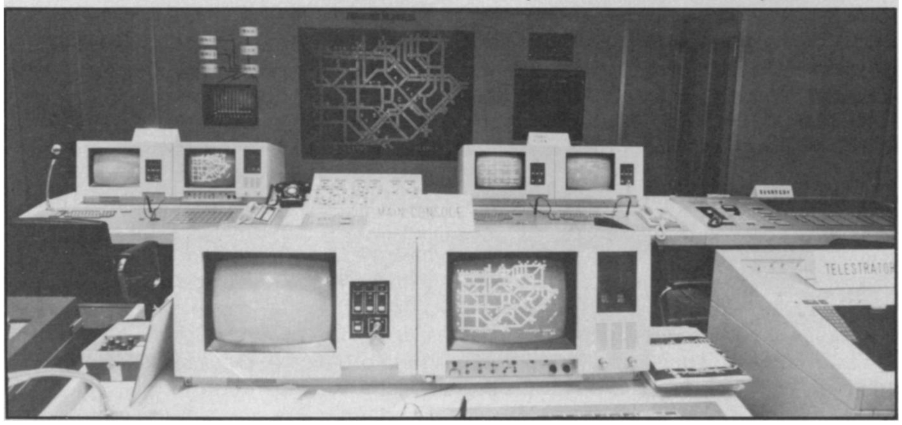
During a demonstration ride with Masahiko Onda, a mechanical engineering researcher with MITI, I got to see how the system operates from the driver's point of view. First, a destination code is entered on a 7-digit encoder beside the steering wheel. This information, together with the

System installed. Route guidance display unit (below) shows approach to Y intersection.





Central control room with traffic conditions and optimum routes on computer screen.



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vehicle's present location, is picked up by loop antennas buried in the street and transmitted to a control center.

At the center, a bank of computers has already been analyzing data on traffic conditions ahead, using reports from other instrumented vehicles and from roadside detectors that use ultrasonic waves to measure traffic congestion and average speeds. Based on this information, an optimum route for reaching the chosen destination is calculated, and at each key intersection the driver requesting guidance is shown which direction to turn.

The display panel used for conveying this information is mounted on the dashboard of the car and consists of a glowing diagram that depicts the coming intersection and the vehicle's proposed course through it. Both liquid crystal and plasma display units are being tested to see which is likely to be cheaper and more reliable. (The plasma unit requires high voltage and the liquid crystal units would be harder to mass produce.)

As we drove along, suddenly the car radio turned itself on and started repeating a recorded message, warning all cars to stay away from the Roppongi area (an exclusive part of town with private clubs and an embassy). For drivers who do not want to invest in the full two-way communications unit, an adapter for existing car radios that will allow them to receive this sort of traffic information may provide a cheap alternative. This part of the system also helps clear the way for emergency vehicles.

Another alternative unit involving only one-way communication is a driving information panel containing seven messages that can be lit up by roadside transmitters. The unit can be used to warn the driver of construction ahead or even to remind him, with a beep, when he is exceeding the speed limit.

Approximately 330 vehicles have now been equipped with all these communication devices, to be used under normal conditions by a variety of operators, ranging from physicians and students to taxi drivers. Another 1,000 vehicles contain transmitters that help the computers measure average travel times along various routes. Roadside display panels in three locations advise all drivers of traffic conditions ahead and suggest alternate routes.

The extent to which the system is automated became apparent at a glance when we returned from the demonstration ride: No one was even in the control room and Onda had to go look for a technician to demonstrate the center's equipment. Indeed, it seemed that most of the people around the center were involved in data collection or mechanical upkeep, leaving traffic management entirely up to the six large computers. Multi-colored display panels blinked from one mode to another, now showing the optimum route for a particular vehicle, then displaying traffic conditions throughout the test area, while re-

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HOMO LOQUENS: Man as a Talking Animal—Dennis Fry—Cambridge U Pr, 1977, 177 p., diagrams & charts, $12.95, paper, $3.95. We learn to speak during the first few years of life without paying the process much attention. Therefore, the whole activity of speech communication is carried on with neither speaker nor listener much aware of the mechanics of the operation. This book for the intelligent layman explains the mechanism of speech, discussing the part played by the brain, tongue, ear and speech difficulties.

THE HUNTING PEOPLES — Carleton S. Coon—Penguin, 1977, 459 p., maps & drawings by Aldren A. Watson, paper, $3.95. Ten thousand years ago all men were hunters; today a scant quarter million hunters remain. This book about hunting peoples living today, originally published in 1971, is now available in paperback.

MECHANICS AND ENERGETICS OF ANIMAL LOCOMOTION—R. McN. Alexander and G. Goldspink, Eds., — Chapman and Hall (Halsted Pr), 1977, 346 p., illus., $37.50. How animals move, how much energy they use, how their muscles work and how they co-ordinate their movements. Animals discussed range from the protozoa to the mammals.

ORCHID BIOLOGY: Reviews and Perspectives, I—Joseph Arditti, Ed.—Cornell U Pr, 1977, 310 p., illus., $29.50. International experts present reviews of information from their fields of specialty about orchids, the largest of plant families.

PHYSICS AND THE SOUND OF MUSIC—John S. Rigden—Wiley, 1977, 286 p., diagrams and graphs, paper, $12.50. Written for those who enjoy music and whose interest and curiosity extends to the means by which musical sound is produced, propagated and perceived. The subject is interdisciplinary, embracing music, physics, psychology, physiology, neurology and architecture.

STOPPING THE WORLD — Martin Schweitzer, foreword by Ansel Adams — Doubleday, 1977, unpaged, color photographs, paper, $5.95. A book of beautiful nature photographs with poetic text. "The natural world is neither good nor bad: it is not inherently moral, but just *is.* Rather than being a source of despair, it is cause for joy and awe, staggering in its mystery, design and magic drama."

THE STUDY OF THE FUTURE: An Introduction to the Art and Science of Understanding and Shaping Tomorrow's World—Edward Cornish et al—World Future Society, 1977, 307 p., paper, $9.50. Includes a history of future study, biographies of leading futurists, case histories of businesses and government agencies exploring the future, the philosophy and methods of the field and an annotated bibliography.

... Traffic

searchers intensely copied down data.

One major exception to this philosophy of leaving traffic control up to the machines involves the transmission of recorded messages. Since the flow of a large number of vehicles might be changed all at once, say away from the Roppongi area, the center personnel first check with police in the affected district. The actual message, though, is composed by computer from prerecorded words and phrases. All the operator does is push a series of buttons to "write in sound" sentences virtually indistinguishable from those spoken by a voice in a single breath.

At the center, one can also see demonstrated an even more sophisticated communication system than that used by the 330 test vehicles. Although far too expensive for immediate practical use, this system employs millimeter-wave broadcasting to transmit enough information to passing vehicles to permit complete mapping of local roads and to show traffic conditions on each. This map can either be displayed on a small television screen or printed on a strip of paper. Two test vehicles are now equipped with this alternative system.

Onda says that the aim of the traffic control system is to reduce average travel time of vehicles in Tokyo by 10 percent, which could be accomplished if even 20 percent of drivers adopted the full system. Individual vehicle units now cost a prohibitive $1,500 or so, but mass produced, he says, they might be available for only $100. Costs for the city, too, would initially be large — roadside transmitters alone would run about $30,000 per intersection. But if one compares these costs to those that would be needed to build more highways (where one could find the space!) the advantage of more efficient road use soon becomes evident.

The detailed cost benefit analysis goes like this: Suppose an initial $86 million construction cost for the full system is depreciated over six years and added to an $11.6 million annual operating cost. Total annual cost is then figured to be $24.8 million. But economic gain from saved travel time, saved energy and an expected decrease in traffic accidents is more than nine times larger — $232 million a year. And compared to the current costs of building roads in Tokyo, the initial investment would be equivalent to building only 4.1 kilometers of new highway!

The outstanding note of caution to this scenario, however, can be best injected by recalling the old joke about a motorist who smashed into the rear end of another car on a freeway. When asked by a policeman why he wasn't driving with the proper five car lengths between him and the car ahead, he replied, "Because there would have been five other cars filling those spaces."

Onda admits that current estimates of the potential benefits of this system rest on the assumption that the number of vehicle trips remains constant. And he points out that Japan's automobile ownership rate is already nearly saturated, with about one car for every three people. However, any large-scale application of the new system will have to be adopted as only one component of a more comprehensive plan to ease urban congestion.

But Japan's experiment already offers some ideas and technology that may be of interest to other nations. The United States Department of Transportation has reportedly already begun to study the results of the MITI project, and smaller experiments are already being conducted by private companies in America and Europe. As in several other areas where the Japanese lead the world in some field of applied research, their extraordinary efforts have been prompted by problems that have become acute here to an extent not yet seen in the rest of the world. Thus, any system that can speed cars through Tokyo's maze of streets should offer even more promise to cities blessed with more orderly traffic patterns. □