GENERAL SCIENCE

Atomic Defense Tunnels

Atomic shelter in tunnels could be combined with tunnels deep under city streets used for advanced transportation systems in leading American cities.

➤ COMBINING CIVIL DEFENSE protection against atomic bombs with advanced transportation systems for leading American cities was proposed in Berkeley, Calif., to the American Association for the Advancement of Science.

A gigantic project which would cost perhaps $35 to $40 billion to protect 75 million people in the 17 largest cities in the United States was described by Dr. Eugene P. Wigner of Princeton University, a physicist who participated in the atomic bomb development. He worked at Oak Ridge, Tenn., National Laboratory with a research group.

A crisscross of tunnels, 30 to 40 feet deep underneath city streets, would provide protection against atomic blast and fallout and at the same time provide the channels for underground automobile traffic and parking and, in some cases, high speed rail transportation.

The projected high speed rail transportation plan along the northeast coast of the nation extending from Boston to Washington, D.C., would become a part of the Civil Defense program as well as provide transportation.

Projected subway systems would be modified to provide the shelter as well as transportation for millions of people.

The capital city of Washington, D.C., which is in the beginning stages of a subway project could utilize the troglodite Civil Defense system. New York, Detroit and Chicago and other cities similarly could combine subway systems now in the planning stages with the projected Civil Defense system.

The new concept of shelters as protection against the direct effect of nuclear weapons was developed principally at the Oak Ridge National Laboratory. The blast shelters would consist of concrete pipes or cylinders of about 10 feet in diameter placed underground primarily by tunneling. There would be parallel and intersecting tunnels that could be reached through many entrances from any point on the streets above in about 10 minutes time. It is visualized that families could reassemble in this interconnected system. Medical and other care could be provided wherever needed. Concrete tunnels could provide sufficient protection against all but explosions quite nearby.

Use of subway stations or extensions of excavations for subways and railroads would increase the number of people that could be accommodated in the shelters. Plans include utilization of the shelters in the most crowded portions of the cities as parking places in ordinary times.

Estimates suggest that the cost of building this system of underground transportation and protection would be about $300 per person for the protected population. Because of the use of a tunnel system for parking and transportation, people generally would become familiar with the underground system and thus be able to use it promptly when atomic attack is feared.

Studies show that for New York, the major part of the tunnel system could be utilized as an auto highway extension across Manhattan midtown between the Lincoln tunnel and the Queens midtown existing tunnel. Under the plans which are in preliminary stages, a network of tunnels under streets from 63rd Street north to 13th Street south and between 2nd and 10th Avenues, would handle a population of two million by day and one million by night. There would be room for 30,000 cars to be parked. The tunnel system in New York would need to be about 110 feet down to bedrock because of the maze of utilities and wires close to the surface.

The plan is to utilize streets as the routes for the tunnels because it would not then be necessary to purchase the land utilized by them. Washington, D.C., seat of the nation's capital which is to a larger extent than in most cities Federally owned, is a likely try-out area for the combined defense transportation scheme. A subway plan is in the early stages of discussion. The defense possibilities in all probability will be injected into this plan in order to give the tunnels a dual purpose. This would greatly reduce the cost of two separate systems.

The first study of the tunnel-civilian defense plan was made in Detroit covering a five-by-five-mile area of the city to serve about one-quarter million people in shelters. The Detroit plan did not include the utilization of the extensive salt mines that exist under Detroit.

Completion of a tunnel system would probably take five to 10 years even if the whole plan was not attempted at one time.

There has been some apprehension on the part of those who have discussed civil defense measures that an increase in civil defense protection on an extensive schedule might create fear on the part of potential enemies and precipitate a nuclear war. Renewed activities in the United States would be considered a threat for the future.

It is known that Russia probably has a better system for protection against nuclear fallout than the United States. The subway systems in Moscow and Leningrad are believed to be extended to provide shelters and entrances to the subways are understood to have blast doors such as would be installed in the proposed American system.

Rotterdam, Holland, has a new subway system in which atomic shelters have been incorporated by enlarging stations.

Whether the combined transportation-civil defense underground tunnel system will be advocated by the Office of Civil Defense and Federal Government in the near future has not yet been determined, although the Office of Civil Defense has been participating in the studies.

On the program at Berkeley, both those favoring the tunnel shelter system and those fearful of the effect that it would have on strategic planning both in this country and abroad presented their views.

The cost of the national project could be very large, but spread over a period of years as it would need to be, and allotting much of the cost to needed transportation systems, $5 billion a year would be an estimate of appropriations needed from Federal funds. Whether recommendations will be made to the next Congress is problematical.

• Science News Letter, 89:3 January 1, 1966

Communications to the 132nd meeting of the American Association for the Advancement of Science at Berkeley, Calif., are covered in this issue by staffers, Watson Davis and Patricia McBroom. More coverage will appear in the next issue.

PHYSIOLOGY

Fish Aid Memory Study

➤ THE STUDENT who crams facts into his brain before a test probably is learning just what he thinks he is—not much.

Observations of human learning have for some time indicated a difference between "long-term" and "short-term" memory. Now research on goldfish has gone a long way toward explaining what it is.

Dr. Bernard W. Agranoff, professor of biological chemistry at the University of Michigan's Mental Health Research Institute, told scientists at the American Association for the Advancement of Science meeting that memory is not "fixed" immediately but at a specific interval following training.

He found with goldfish that by using a drug he could block the establishment of permanent but not temporary memory.

The drug used was puromycin, a naturally occurring antibiotic somewhat poisonous to humans. Training consisted of teaching the goldfish to swim over a hurdle upon a light signal to avoid an electric shock.

When Dr. Agranoff injected puromycin before training, the fish remembered the trick for a couple of days, but forgot it on the third. Normally they would remember their electric lesson for months.

If puromycin was injected from one to 30 minutes after training, the same long-term memory loss was seen. But if the drug was injected an hour after training, there was no effect on memory whatsoever.

This means memory is established within an hour after training but probably not before 30 minutes in goldfish.

Dr. Agranoff suggested that short-term memory might be bioelectrical and long-term memory chemical.

Puromycin blocks new protein synthesis necessary for the formation of new cells. That much is known. Since the drug can disrupt permanent learning, it is logical to assume memory is a chemical process that requires cell growth.

• Science News Letter, 89:3 January 1, 1966