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Land transportation in America today is a paradox of technological development. Our most successful systems seem to cause as many national problems as they solve. Yet our most unsuccessful systems seem to offer many of the solutions we seek. So we are in a period of rethinking and self analysis with respect to national surface transportation development.

In addition to determining the necessary technology and systems consistent with mobility requirements, we must consider the often intangible social goals of the nation. For this reason, many of the systems analysis techniques which have proved so successful in military and aerospace applications cannot be used unaided, or without substantial modification, on transportation planning and other civilian problems. Unlike the space and defense programs, transportation planning must satisfy consumers and non-users and be responsive to both market and political processes. Because of these constraints, surface transportation planning is exceedingly complex.

The need to provide options and alternatives for a decade or more further complicates planning analyses and evaluations. The obligation to respond to the will of the people expressed through the democratic process means that the development of large municipal or regional systems must evolve by consensus, rather than by Federal fiat. Some new systems may incorporate technological breakthrough, but others must be limited by what has been planned or built before in an evolutionary manner.

With these remarks as a preface, I would like to inventory some of the surface transportation programs and projects now being promulgated by the Department.

The most advanced of these, at least in terms of planning and systems implementation, is the Northeast Corridor Project. Other projects are more glamorous and revolutionary, but the high speed trains now operating between Boston, New York, and Washington are the most representative of surface transportation problems and potentials.

Most surface transport planning is either municipal or regional. The long distance market, over 300 to 400 miles, is generally conceded to the highways and airways. And the NE Corridor is probably close to maximum distance for a regional rail system. Even a surface system boasting speeds of 200-300 mph, probably could not compete with the airways in a long-distance passenger market.

Columnist William F. Buckley once mused that if trains hadn't been invented, someone would have suggested tying buses together into one unit; and the idea would have been heralded world-wide.

Our NE Corridor project is designed to prove that the idea of a train is still a good one.

Intercity rail passenger service has been declining rapidly for two decades. In 1967 and 1968 the decline sharply accelerated. Today fewer than 500 regular intercity trains are in scheduled service, down from 1,448 ten years ago. About 50 of those remaining are involved in discontinuance proceedings before the ICC.

Yet the headstone in rail passenger service cannot and should not be erected. As the New York Times recently editorialized, "the case for saving the rails in the public interest is daily strengthened by the steady increase in congestion and frustration on the airways and highways."

The 110 mph Metroliners, now operating 6 round-trips daily between Washington and New York, show evidence of supporting the Time's statement. A Department of Transportation survey indicates that during one six-month period, half of the trains' 228,000 passengers had switched from using other modes. And 84% said that they expected to use the train again.

Nevertheless, there are problems - many of them due to inadequate technology. Roadbeds need strengthening. Equipment breaks down. The first computer-controlled ticket vending machine in the world decides that it doesn't want to compute. And the result is that the Penn Central Company, which owns and operates the trains, has not been able to satisfy long-standing contract requirements covering frequency of service and track standards.

Until these requirements are met, the official full-scale two-year demonstration for which the Department has contracted has not yet started as of this writing. Although we are receiving passenger acceptance data from the present operation, its validity cannot be certain until the specified level of service is achieved.

Once started, however, the demonstrations will provide timely information on the economic feasibility and customer acceptance of improved rail passenger service. From that we hope to make a realistic determination of the capacity of the present rail network.

It may be that we will have to develop a totally new system, starting from the ground up. One such project is the tracked air-cushion vehicle (TACV), which is coming closer to reality. The Department recently contracted with Gruman Aerospace Corporation to design an experimental TACV, able to skim over a one-inch cushion of air at speeds up to 300 miles an hour. The contract calls for detailed design of a 61-foot long, 46,000 pound vehicle and the guideway it would need. Following the design stage, we hope to build a prototype that will be running on a test track by 1974.

In the prototype we hope to use a linear induction motor, the kind recently developed by the Garrett Corporation. The Garrett LIM, unveiled in December 1969, is rated to provide 3,750 pounds' thrust continuously at 250 mph and 7,500 pounds' thrust for five minutes at 300 mph.

The LIM has no moving parts, creates no air pollution, and makes little noise. Because of this, the Department has great hope in the motor as a solution to our surface transportation environmental problems.

In simplest terms, the LIM has two electromagnets that are hung on opposite sides of a large central rail which is firmly secured to the ground. A direct current is passed through the magnets, causing them to move along the rail and pull the car along for the ride.

Basically, the LIM is a simple rearrangement of the classical rotating motor. It can be considered as a conventional rotary motor cut along a radius, unrolled, and laid out flat. A small air gap between the primary and secondary remains, permitting relative linear motion between the two. One of the members must be lengthened in the direction of travel so that motion can continue.

We believe that a LIM powered TACV could be a very significant answer to the problem of airport access, as well as travel in metropolitan corridors.

We are very interested in the success of the French 80-passenger TACV known as Aerotrain. The world's first guided vehicle to ride on air instead of wheels, it was designed to run the 65 miles between Paris and Orleans in less than 30 minutes at speeds up to 185 mph. The Aerotrain is propeller driven by gas-turbine engines. However, the French experience with air cushion travel, coupled with our experience with the linear induction motor, could speed commercial TACV development by several years.

We are looking for a system with maximum safety, minimum internal and external noise, and a ride quality comparable to that of jet aircraft.

To date the TACV program has uncovered no insuperable obstacles. Costs will largely regulate its future - the availability of funds for further operational research, and the costs of actual development and operation both relative to obvious benefits.

We believe that TACV guideways should be less expensive to maintain than conventional rails or guideways of other advanced systems. This is because of the low "footprint pressure" of the air cushion. It is less than 1/10,000th of the impact or point of contact pressure of steel wheels on rails, and less than 1/20th of that of tires on a road. Wear and tear on the guideway and its structures should be accordingly slight.

Tube vehicle systems are potentially the fastest of all ground systems, and we are studying several concepts. Vehicles in a tube may achieve speeds of 500 mph or more.

The tube provides a controlled environment, safe from introduction of foreign objects that might be dangerous at such speeds. One of the greatest assets of such a system is the possibility of attaining high speeds without the large power consumption that results from aerodynamic drag.

The Department has funded several small theoretical and laboratory experiments on tube-vehicle aerodynamics. In some concepts the vehicle operates at ground-level atmospheric pressure; in others at partial vacuum. Some of our engineers believe magnetic suspension may be a requirement in future high-speed ground vehicles, particularly in evacuated tubes.

In non-evacuated tubes, air breathing propulsion and air-cushion suspension can be used. In such a system, vehicles propel themselves by transferring air fore-to-aft in such a way that air in most of the tube remains nearly at rest while the vehicle moves through it.

The Gravity-Vacuum Tube System proposed by one inventor must be sub-surface. In this system, "Gravitrains" would be propelled by a combination of their own weight and pneumatic pressure through inclined underground tunnels, and then on their own momentum would roll upward to surface stations.

Going underground has several advantages, since tube systems apparently will be less than beautiful, and since surface right-of-way costs in urban areas are becoming extremely high. Under the best conditions, tunneling costs are about $5 million per line-mile. If methods can be developed which will reduce typical cases to the $2.5 million level, underground systems are more likely to be developed.

Let me turn for a moment to our most immediate surface transportation problem - moving people to urban areas. In the next 20 to 30 years, the population of the United States will increase by an estimated 50 to 75 percent. Currently about two-thirds of the population resides in urban places. By 1985, this proportion will rise to 80 percent.

Our present urban surface transport system consists essentially of two modes: the automobile and mass transit (bus or rail). Those who put the two modes on a competitive basis are doing a great disservice in delaying a balanced solution to the urban transportation problem. We must improve both modes.

In many U.S. cities today, the average auto speed is 13 mph and 35% of total driving time is spent at idling speed. We now have more than 100 million registered vehicles in the nation, and about 10,000 new cars are added each day.

With cars and buses, our technological problem is essentially one of improving system capacity. Population density and environmental considerations rule out the 18-lane freeway as a feasible answer.

The present system of streets, highways, and intersections must be made to move traffic faster, safely and more efficiently. We have several related research projects in or near the demonstration stage that should significantly increase capacity. These experiments fully utilize the potentials of electronics, data handling, and communications. They are still premised, however, on the driver remaining in control of the vehicle.

One of these is the Electronic Route Guidance System (ERGS). It is the equivalent of having a navigator at your side who knows which streets are the least clogged, and which streets provide the shortest route to your destination. The result would be to equalize the traffic load on all available streets.

Several systems are being tested to control the merging maneuver on high-volume urban freeways. We are also testing a passing-aid system to alleviate the serious traffic flow problems on rural two-lane highways.

Other related projects include motorist-in-distress aids and special administrative actions such as tne best uses of one-way streets, no parking areas, and scheduled street use.

Very often a comparison is made of the capacity of rail rapid transit systems to that of freeways. We often say, for example, that a rapid transit track can move as many people as 20 lanes of freeways. The value of this statement revolves not around the question of capacity, but that of usage. In corridors of low traffic demand, for example, bus rapid transit systems or exclusive right-of-way could adequately provide for the needs of the corridor.

Capacity, while it is a prime factor when speaking in terms of urban congestion, especially during peak hours, doesn't appear to be the factor which provides the user with the incentive to make maximum use of the transit facilities.

It appears that the characteristics which have the most influence are comfort conveniences, frequency of service and fare structure. It is not insignificant that the average age of all motor buses in service is about nine years. The annual replacement for rail rapid transit vehicles is about four percent, suggesting an average age of 12 to 13 years for all such equipment in service. Most commuter rail cars are over 30 years old. The last new streetcar delivered to an American transit company was manufactured in 1952.

We are, however, in the midst of a resurgence of rapid transit investment in this country. And the Department of Transportation is trying to promote that interest wherever feasible. We now have a bill before Congress which provides $10 billion over tne next 12 years for mass transit.

The Department believes the best approach to solving the nation's urban transportation problem is through a balanced system. Essentially, this means a system which provides enough of each mode -- bus, rail transit and freeways -- to serve the varied needs of all segments of an urban population.

At present, only eight metropolitan areas on this continent have rapid transit systems -- Boston, New York, Chicago, Philadelphia, San Francisco, Toronto and Montreal. Washington has a new system under construction.

I would like to mention just a few of the surface transportation innovations evident in these cities. One of the best-known features of the Chicago system is the rapid rail line in the median of the Eisenhower Expressway. This was the first example of the dual use of rapid transit and freeway operations in the same corridor.

Another Chicago feature is the Skokie Swift operation. This is a five-mile connecting rail rapid transit line from the village of Skokie (pop. 70,000) to the Howard Station on the regular elevated line from downtown Chicago. The Howard Station is approximately 10 miles from the center of the Chicago Loop. The only stations on the five-mile route are at each end, thus the cars, which have a top speed of 60 mph, operate at a scheduled speed of 46 mph. This is the fastest speed of any rapid transit section in the world.

Philadelphia has a unique success story in its 14.4 mile rapid rail line connecting the city with suburban Lindenwald, New Jersey. It is regularly drawing more than 40 percent of its passengers from among people who formerly drove to work. It's current daily passenger volume is 30,000 riders. Officials of the Delaware River Port Authority, which runs the line, say it proves that modern technology can create an attractive, successful, and profitable rapid transit system.

The new San Francisco system (BART) consists of a 75-mile rail system of which 14 miles will be in subway and tunnel, 28 miles of aerial lines, 24 miles of surface lines, and a four mile tube under San Francisco Bay. There will be 37 stations on the system. It has been 60 years since a completely new transit system has been built in the U.S. The San Francisco system provides the first application of wealth of new transit technology.

Another innovation in surface transport is Atlanta's new "Town Flyer" shuttle bus service. This system allows shoppers and workers to park for 50 cents at lots near Atlanta Stadium and the Atlanta Civic Center, and then get free express bus rides to and from the downtown area. So far, this system has been encouragingly successful.

I could go on and on with examples of recent developments in surface transportation. But I think that these few are sufficient to demonstrate that we are entering a new era of transportation planning and systems innovation. We constantly need new thinking and new technology and I would offer this as a challenge to you in the coming decade.