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Pneumatic tired, individually steered, self-propelled vehicles have been the backbone of the nation's passenger transportation system over 50 years. Every expectation is that this dominant role will continue for many years into the future.

The concept and design of a successor to the automobile has remained elusive. Innovation seems to be aimed at incremental improvements to the auto, or mass transit devices that are intended to divert auto travelers to transit.

Outlined herein is a design for a total successor to the automobile. Auto driving would be confined to remote rural areas and racetracks, and, in miniature form, at carnivals and amusement parks. Nearly all truck movements would also be accommodated by the "System"; as would all mass transit travel other than longer-distance air travel.

SYSTEM DESIGN

No dimensions are given on Figures 1 through 5 illustrating the system concept. Detailed engineering studies would be needed to select the appropriate design parameters. However a few design characteristics might be noted.

Cars

Most automobiles operated in the United States can accommodate six passengers though rarely are they used to this capacity. The cars in the proposed system probably need not hold more than 4 passengers (two couples); since no driving skill is required and the cars would be readily available. A very comfortable 4-seater would measure 4 feet wide and 6 feet long, with pairs of seats facing each other. A 6-foot height would allow walk-in-convenience and speed. Passenger payload need not exceed 1,000 pounds, and the car itself could be held down to another 1,000 pounds or less.

The optimal design selected for the passenger car would also accommodate most freight now moved in urban areas by truck. Only large structural steel members, out-sized pieces of furniture or lumber, and heavy machinery, etc., would not meet the size or weight limitations of the passenger car. Small unit sized goods, now grouped into larger packages, and could be regrouped to fit the system car. Though in some cases a great many more trips would be required, goods movement would occur without attendants except for loading and unloading. Passenger seats would fold out of the way for certain types of goods preloaded pads would be inserted. In time, many outsized goods would be redesigned to fit the system. For example, fire fighting apparatus could be packaged in subassemblies that would converge at the site of a fire.

Guideway

The configuration of the guideway and the undercarriage of the cars illustrated in the figures is an example of a possible design.

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Column spacing is assumed to be about 20 feet. This would give access to the ground comparable to motor vehicular access. While every column could serve as a loading point, in low-density areas only selected columns would be fitted with the required appurtenances. For the design shown in Figure 5 columns serving as loading points would require elevator beams. Cars would be lowered to the surface as in Figure 1. To protect pedestrians the landing pads would probably have to be enclosed, and if sliding doors are used on the cars, door pockets would also be required. One possible elevator mechanism is suggested in Figure 5. Columns would include a threaded channel and cars would raise and lower themselves by mechanically coupling their propulsion system to a screw fitted to the thread. Limitation of guideway curves and grades would be no greater than for motor vehicular ways.

Control and Propulsion System

The functions of the control and propulsion system can be readily specified. Their detailed design, however, represents one of the most difficult tasks achieving the proposed transportation system. Propulsion for the cars would most likely be electric. While battery or fuel cell sources of power may eventually be available, power conductors fitted to the guideway would provide an inexpensive and dependable source. Perhaps the flow of current and change in impedance in the propulsion power circuitry could form the basis of the vehicle detection and inter-vehicle coordination functions of the control system. The advent of microelectronics and initial experiments with automatic motor vehicular operation suggest that the require system may be readily attainable. Fare collection, destination selection, route selection, and empty car flow are other significant elements of the control system which must be detailed. The division of these control tasks between cars and control centers would be a major design problem.

Capacity and Speed

Two elements of traffic flow capability may be considered: terminal capacity and line capacity. In the suggested design each column may serve as two loading points (Fig. 1). Assuming a two-way guideway along each street, 20-foot column spacing, and 25 miles of street for an intensively developed square mile of land, 12,500 loading points would be available per square mile. If the column elevator performance could equal that of modern automatic elevators, car loading as frequently as two per minute could be achieved per column channel. Boarding capacity of the system would then approach 1,500,000 car origins per hour per square mile, or 6,000,000 seat origins per hour per square mile; well beyond the requirements of the most intensively developed square mile on earth – the Grand Central area of Manhattan.

The flow capability of the guideway lines and junctions will depend on the degree of sophistication of the control system. A minimum goal might be the attainment of flow rates comparable to the highest observed motor vehicular rates – 2,100 vehicles per hour per lane. Higher capacity would be obtained by increasing the number of channels or by raising the flow rate through more elaborate controls. Channel proliferation need not be too frightening because of the compactness of the guideway and cars. The six-lane Long Island Expressway, for example, carries, at most 6,300 vehicles per hour per direction. The same cross-sectional area could accommodate 32 guideway lanes with a capability of 33,600 cars per hour per direction.

No particular guideway speed is specified by the nature of the proposed design concept. Top speed would be a function of the structural requirements, propulsion and control system capability, aerodynamic resistance, wind forces, and economic considerations. Probably speeds over 60 miles per hour would increase costs to the point of diminishing return. Perhaps the vehicles might be designed for a 100 to 120-miles-per-hour capability which would be used only on specially designed long-distance guideways. Speed of travel on urban guideways would depend upon the degree of traffic interference, and restrictive curves and grades. No real need for a uniform speed seems to exist. Form a control standpoint uniformity in speed-change and response time is important.

SYSTEM ADVANTAGES

A very effective system of individual vehicular transportation exists throughout the United States today. Why should a new system be developed that can do an equivalent job, but requiring an elaborate mechanical and electronic structure?

Certain inherent weaknesses are built into the present motor-vehicular system:

Driver controlled vehicles, though remarkably easy and safe to operate, still result in over 50,000 fatalities a year on the nation's highways. Despite the ubiquity of auto ownership, a very substantial though declining number of travelers continue to use mass transit services in major areas across the country; in fact, investment in new mass-transit facilities seems to be accelerating. Just over half of the nation's population is licensed to operate motor vehicles; the remainder must depend on friends and relatives or mass transit. Highway construction in urban areas has, in many cases the ever-increasing density of internal combustion exhaust contaminants released into the atmosphere of major cities poses an indefinable but worrisome threat.

The proposed transportation system offers the possibility of diminishing or overcoming entirely these undesirable attributes of the existing technology of travel. Significant improvements in the quality of transportation service might also result. Travel speed could be greater than at present; driverless travel would be more relaxing and would release driver-time for more rewarding activities. Mass-transit travelers would enjoy the individualized transportation now available only to motorists.

Far-reaching changes in land development and society in general, on a regional scale, might occur. The centers of large regions would lose their unique advantage of accessibility attributable to their mass transit systems. But perhaps more important they would lose their extreme disadvantage with respect to parking cost and congestion. Another effect would be the possibility of out-migration from the region's center of those persons who have lived there because of their inability to own or operate automobiles. Another effect would be the capability of transporting the very young between any residence and any school in the region. And, finally, the handicapped and the sick would have improved transportation permitting better access to jobs and to medical care.

The most significant aspect of the system's relative advantage or disadvantage is cost. Unfortunately, very little can be specified about the cost of the proposed system. Some aspects of the Tri-State Region's existing highway and mass transit costs might provide a source of comparison. Close to 20 percent of the Region's economic activity is devoted to the local transportation of persons and goods by auto, truck, taxi, and mass transit. Around \$5 billion a year is spent keeping the Region's nearly 5,000,000 automobiles garaged, fueled, repaired, insured, and washed. At least \$2.5 billion a year more is needed to operate a half-million trucks making local deliveries. About half a billion dollars a year is spent on taxi and mass transportation in the Region. Eight hundred thousand new cars are purchased each year in the Tri-State Region; about 1,200 miles of new local streets are added annually to the region's 45,000-mile road network, and 100,000 parking garages are constructed each year in conjunction with new residential dwellings.

A 50,000-mile network of guideways and perhaps 3,000,000 cars might do the work of the existing Tri-State urban transportation system. If the proposed, heavily capital-oriented system could operate at a \$1,000,000,000 annual cost, then annual savings of \$7,000,000,000 would occur. Capitalized, this savings would mean an investment of \$70,000,000,000. If the investment were split evenly between guideway and cars unit costs could be as great as \$700,000 per mile of guideway, and \$12,000 per car. There is a good possibility that capital cost could be considerably less than these maximums. Concerted engineering design and analysis effort is needed to establish the system's credibility.

DEVELOPMENT PROGRAM

The potential market for the proposed system is vast – as much as a trillion dollars would be needed to construct a nationwide network. If the system were a commercial success there would seem to be a little difficulty in obtaining private investment. The degree to which private capital might be available for exploration and development of the concept is unknown. The extent of investment needed to satisfactorily develop the concept into a "working" system would be great.

Detroit beware!

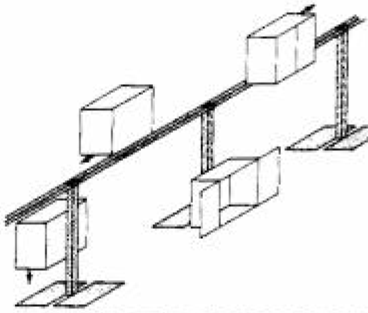
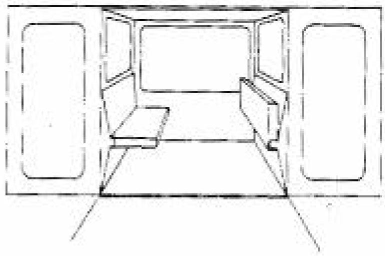


Figure 1. Basic system design. Elevated guideways supported by frequently spaced columns provide the channels of flow. Individual cars track along the guideway and up and down columns. Access to cars occurs at ground level, at the base of a column.



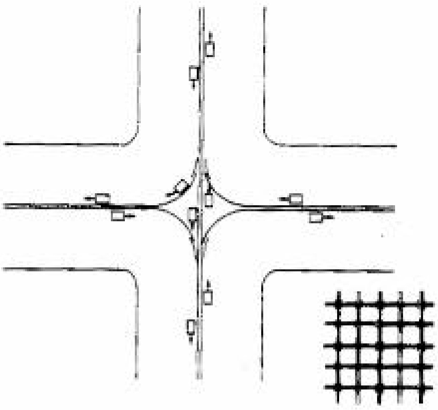


Figure 2. Route location. The guideways would be constructed along all existing streets. Cars would be routed through the system from column of origin to column of destination. Cars would move as fast as they could subject to traffic conditions. Express or bypass guideways would be needed through areas of concentrated traffic generation.

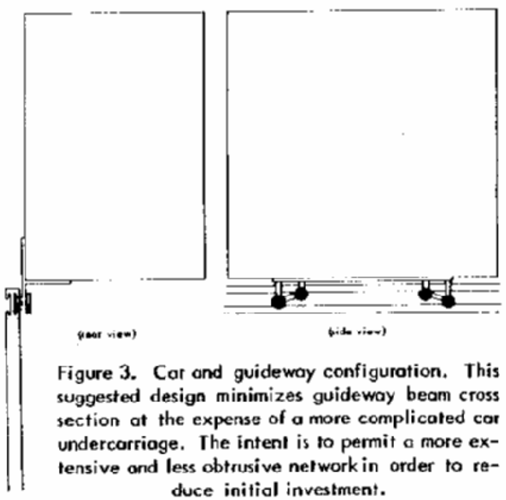


Figure 3. Car and guideway configuration. This suggested design minimizes guideway beam cross section at the expense of a more complicated car undercarriage. The intent is to permit a more extensive and less obtrusive network in order to reduce initial investment.

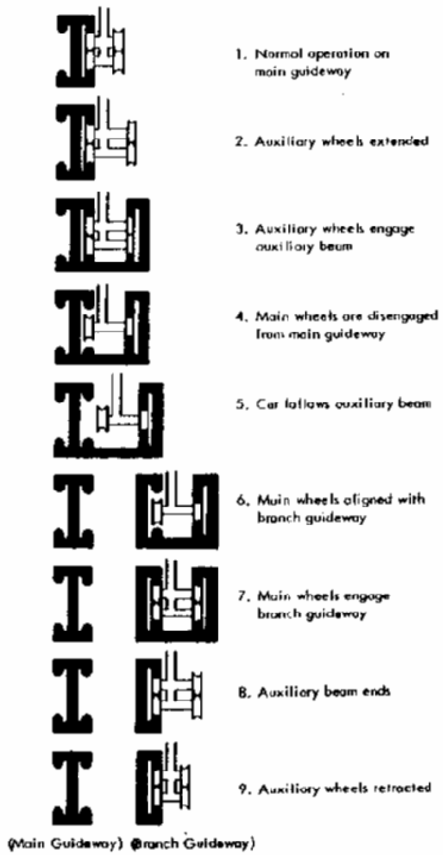


Figure 4. Switching sequence. The track structure remains inert and the switching maneuver is accomplished by the car engaging the branch beam and disengaging itself from the mainline.

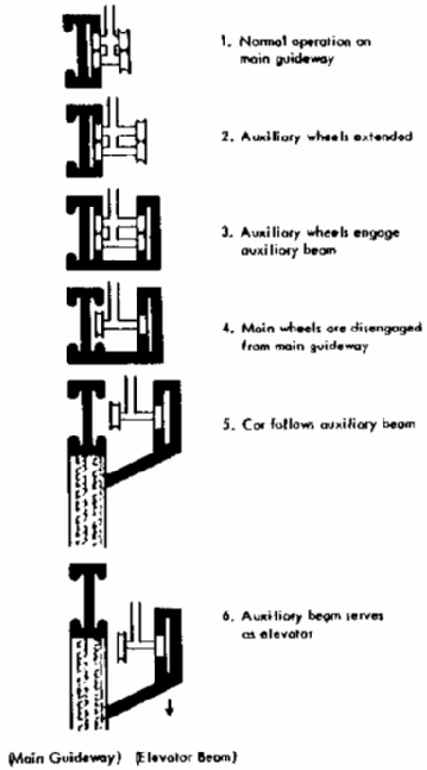


Figure 5. Guideway to column transition. The transition from horizontal to vertical motion is similar to the switching maneuver. The auxiliary beam, engaged, becomes the elevator lowering the car to ground level.