Abstracts of Papers

SIMULATION METHOD FOR EXAMINING DUAL-MODE TRANSIT SYSTEMS

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Simulation of large complex systems is a method of evaluating various combinations of system components. This paper describes the use of interactive simulation as a method to analyze various operating policies for command and control of dual-mode transit systems. A detailed discussion is presented in the analysis of various operational concepts. These concepts include the analysis of alternative vehicle control logic, fail-safe headway safety systems, centralized versus distributed control, and on- and off-guideway vehicle management techniques.

COMMUNICATION SYSTEMS FOR DUAL-MODE TRANSPORTATION

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The communications requirements of dual-mode transportation systems are discussed for both the on-guideway and off-guideway modes. Candidate communication systems are classified according to their principle of operation, and the characteristics of the systems are described. The suitability of these systems is assessed on the basis of dual-mode requirements, Federal Communication Commission restrictions, and physical and electrical limitations.

Command and control for vehicles on the guideway are the most critical functions that the communication system supports and require a highly reliable, always available, link. Radiating systems in the land mobile frequency band are unsuitable for command and control because the limited number of licensed channels would force vehicles to wait for an opportunity to communicate. Sufficient spectrum space may be available at higher frequencies, such as the 9-GHz region employed by the circular waveguide, but the equipment and precision installation required may be needlessly expensive. Consequently, the possible communication links are narrowed to nonradiating and contact systems within the FCC limits for unlicensed devices.

Nonradiating systems of the surface-wave type are suitable only if rather stringent limits on lateral vehicle motion and guideway turning radius are satisfied. The restriction on lateral vehicle motion is unlikely to be satisfied, except for tightly confined vehicles on tracks; and the restriction on guideway turning radius is sure to be violated in all cases. Therefore, surface-wave structures can be eliminated as serious candidates, leaving inductive and contact systems for consideration.

Communication through direct contact with a signal rail is generally justified only for systems in which the supporting structure for the rail and the vehicle contact arm have an independent reason for existence. Such systems include those in which vehicles are powered from a wayside rail and those that use an arm in lateral control. The technique of superimposing communication signals on the power rail is likely to be prohibitively expensive because of the large number of vehicles and nodal points that require filtering equipment.

Inductive lines are not required to withstand the mechanical stresses encountered in contact systems, and their installation does not demand as much precision. Consequently, if supporting structures are counted as a part of the system, inductive systems can be expected to be less expensive than contact systems. Most commonly, inductive lines used for communications are buried in the roadway; and, if the command and control system uses inductive fields to detect lateral vehicle motion, it is sometimes possible to satisfy the detection and communication functions with the same inductive lines.

In the off-guideway mode, vehicles are not confined to a relatively small number of arteries, but rather can range throughout a metropolitan area with the freedom of other traffic. Consequently, a communications system with broad coverage is needed. Nonradiating systems can be excluded because they provide communication only over a narrow path. Radiating line sources installed along all possible routes may be technically feasible, but are an inefficient and expensive means of general coverage. Clearly, the best method of providing off-guideway communications is through conventional localized antennas.

EVALUATION OF DEMAND-RESPONSIVE SERVICE FOR DUAL-MODE BUS SYSTEMS

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A basic requirement to be addressed in the development