

*Automatic Train Control in Rail Rapid  
Transit*

May 1976

NTIS order #PB-254738

**Automatic Train Control  
in Rail Rapid Transit**



UNITED STATES CONGRESS  
Office of Technology Assessment

May 1976

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FEB 17 1976

The Honorable John L. McClellan  
Chairman, Committee on Appropriations  
United States Senate  
Washington, D.C. 20510

Dear Mr. Chairman:

We are pleased to transmit the enclosed report on "Automatic Train Control in Rail Rapid Transit".

Prepared by the Office of Technology Assessment with the assistance of its Urban Mass Transit Advisory Panel, this report describes the technology of automatic train control systems and assesses the operational, planning, and policy issues arising from the use of automated devices to control and direct rail rapid transit vehicles. The report also contains background material useful for understanding the application of automation technology in urban rail transit systems.

The findings presented herein are a synthesis of the views of those participating in the study and do not necessarily reflect the opinions of individual members of the Technology Assessment Board of OTA.

Sincerely,



Olin E. Teague  
Chairman

Sincerely,



Clifford P. Case  
Vice Chairman

Enclosure

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FEB 17 1976

The Honorable Olin E. Teague  
Chairman  
Technology Assessment Board  
Congress of the United States  
Washington, D.C. 20515

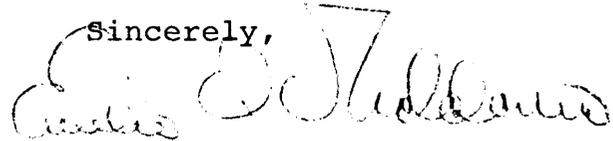
Dear Mr. Chairman:

I am pleased to submit OTA's report on "Automatic Train Control in Rail Rapid Transit," which was requested by Senator John L. McClellan, Chairman of the Senate Appropriations Committee, on behalf of Senator Robert C. Byrd and Senator Clifford P. Case of the Transportation Appropriations Subcommittee.

This report was prepared by the Office of Technology Assessment with the assistance of its Urban Mass Transit Advisory Panel, composed of representatives of the transit industry, engineering firms, planning and development organizations, universities, organized labor, and citizen participation groups.

The material in this report will be used by the requesting committee for hearings related to the Urban Mass Transportation Administration and the Federal Railroad Administration during the coming year. The report will also be available to other Senate and House committees concerned with urban transportation problems.

Sincerely,



EMILIO Q. DADDARIO  
Director

Enclosure

# Preface

This report, prepared by OTA at the request of the Senate Committee on Appropriations on behalf of the Transportation Subcommittee, is an assessment of the technology of automatic train control in rail rapid transit systems. Automatic train control (ATC) is the general designation for a variety of techniques by which machines regulate the movement of rail rapid transit vehicles for the purposes of safety and efficiency. Functionally, ATC includes:

- Train Protection
- Train Operation
- Train Supervision
- Communication

The use of the term “automatic” does not imply that train control or any of its constituent functions is carried out wholly without human involvement in operating the equipment or in overseeing automated devices. Rather, automatic is used to denote systems in which machines perform a substantial part of the routine functions and there is minimal reliance on man as an operational element. Man’s role in such systems is to monitor the performance of automatic elements and to act as the ultimate safety backup.

The history of train control technology has seen extensive, but not complete, replacement of the human operator by machines. The number of people required to run trains, operate wayside equipment, and supervise traffic has been reduced by automation to the point where the newest transit systems now have only a single on-board operator for the train, regardless of its length, and a small cadre of centrally located supervisors.

The increasing reliance on automation, both in existing transit systems and those under development, raises several basic issues about this application of technology. The importance of these issues was recognized by the Senate Committee on Appropriations Transportation Subcommittee who requested the Office of Technology Assessment to study automation in federally supported rail rapid transit projects. Correspondence relating to the request is contained in Appendix I of this report; the following is a paraphrase of the fundamental questions posed in the letter of request:

How does reduction of man’s responsibility for direct operational control affect the safety of transit systems?

What operational advantages are to be gained from automation?

Is automation cost-effective, considering both capital and operating costs?

Does the planning, development, and testing of automatic train control systems give adequate attention to the safety, performance, and cost implications of automation?

Are there policy and institutional factors that influence the selection of a level of automation or that condition the application of automatic train control technology?

Because of the number and complexity of the issues to be addressed, the technology assessment was divided into three separate, but coordinated, studies dealing with (1) the planning process, (2) automated small vehicle systems, and (3) automatic train control in rail rapid transit. Reports on the first two topics have been published in separate volumes.<sup>1</sup>This report deals with the third topic, specifically the degree of automation which is technically feasible, economically justifiable, or otherwise appropriate for rail rapid transit.

The technology assessment presented here is the product of a combined effort of the OTA Urban Mass Transit Advisory Panel and the staff of the OTA Transportation Program. Major assistance was received from Battelle Columbus Laboratories in collecting data and providing technical background information. These materials and other information collected independently were combined by the panel and staff to prepare this report. The panel and staff are also indebted to the urban transit system officials and representatives of the transit industry who gave access to their records and participated in numerous technical discussions.

Since this report is the result of a joint effort, the findings should not be construed as the view of any individual participant. Divergent opinions are included; and, where the subject matter is controversial, an attempt has been made to present a balanced treatment.

The OTA staff members participating in this study were: Dr. Gretchen S. Kolsrud, Program Manager; Larry L. Jenney, Project Director; V. Rodger Digilio, Thomas E. Hirsch III, Bev Johnson, and Teri Miles.

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<sup>1</sup>See *An Assessment of Community Planning for Mass Transit*, February 1976 (Report Nos. OTA-T-16 through OTA-T-27) and *Automated Guideway Transit: An Assessment of PRT and Other New Systems* (Report No. OTA-T-8), June 1975.