Chapter 7

POLICY AND INSTITUTIONAL FACTORS

INTRODUCTION

Rail rapid transit is a public entity. Transit systems are built with public funds to serve public transportation needs. The public is involved in the conception and planning of the system-both in public referenda to approve the building of the system and in citizen participation programs during the planning process. The planning and operating agencies, themselves, are quasi-public bodies, whose directors are responsible to a State or municipal government or to a local electorate. The operation of the transit system, especially in recent years, may be subsidized with some combination of Federal, State, and local funds. As a consequence, the form and operation of a rail rapid transit system are strongly influenced by public policy and institutional factors,

Three forms of influence can be distinguished: legislative, regulatory, and institutional

Legislative influence is manifested through the content, authority, and impact of laws enacted at the Federal, State, and local levels of government. Generally, such laws serve one of two purposes: regulation or promotion. In the earliest days of public transit, and continuing somewhat after World War II, the intent was primarily regulatory. Laws were enacted to control the private firms that provided public transportation and to ensure that the public interest was protected.

Since the middle of this century, the purpose of legislation pertaining to public transit has shifted to that of promotion and subsidy. This shift was coincident with, and occasioned by, the precipitous decline of the transit industry to the point that it was threatened with extinction. As a result, most of the recent legislation has been aimed at promoting a resurgence of public transportation. These laws authorize the expenditure of public funds (often in large amounts) to design, build, and operate transit systems. These laws also establish and support research programs to advance the state of technology and to broaden its application. While none of this legislation has dealt specifically with automatic train control technology, this aspect of transit system design and operation has benefited from the general increase of financial support for rail rapid transit.

Regulation, although no longer the predominant purpose of legislation, is still a major concern at all levels of government. The oversight and control of transit systems is an important function of Federal and State agencies, especially in the area of safety. Local governments tend to place more emphasis on the regulation of fares and levels of service. The pattern of regulatory legislation is far from static; and, like promotional legislation, it appears to be extending--especially at the Federal level—more widely and deeply into the area of system operation.

Institutional factors are manifested primarily through actions of the transit industry, labor unions, and—to some extent—the public at large. While not so clearly defined or so easy to isolate as legislation and regulation, these institutional factors also serve to shape the course of transit system development and operation.

The purpose of this chapter is to examine the issues raised by ATC in the area of public policy and institutions. In some cases, these ATC issues are not wholly distinguishable from the general context of rail rapid transit system development and operation. These larger, systemwide topics will not be treated, however, except as background to the particular aspects of ATC or the reciprocal effects that policy and institutions have on train control system technology and its application.[87]

SUMMARY OF EXISTING LEGISLATION

Most of the legislation relating to rail rapid transit is of recent origin, and none contains specific provisions for the promotion and regulation of ATC per se. Nevertheless, this legislation (especially Federal laws) does have an indirect effect upon ATC design and development through the general support provided to rail rapid transit technology. The following is a summary of the Federal laws with sections germane to ATC.

Urban Mass Transportation Act of 1964 (PL 88-365)

In general terms, the Act of 1964 provided three forms of financial support:

[87] For an examination of the more general policy issues pertaining to transit system planning and development, see the OTA report, An Assessment of Community Planning for Mass Transit, November 1975 (Report Nos. OTA-T-16 through OTA-T-27).

- Grants or loans to assist State or local agencies in acquisition, construction, or improvement of transit facilities and equipment[88]
- Grants to State or local agencies for planning, engineering, and design studies related to mass transit;
- Grants for research (including new technology) and training.

Funds in all three categories have been used for development and acquisition of ATC systems. Capital grants have been made both for the purpose of upgrading existing ATC equipment (e.g., the recent cab signal installation programs in CTA and MBTA) and for planning and constructing new systems with advanced forms of train control (e.g., WMATA and MARTA). Funds available under the 1964 Act have also been used to support several ATC-related research and development activities, both within DOT and by outside R&D organizations.

The 1964 Act also contains two specific sections that have an influence on decisions related to train control system automation:

- Transit employees adversely affected by any federally assisted project must receive special consideration, including protection of rights and benefits;
- Transit systems must afford accommodation to the special needs of the elderly and handicapped.

Protection of individual workers (not specific jobs) is contained in section 13(c) of the Act. which also requires that clearance for a grant be obtained from the Department of Labor. The Act allows the elimination of jobs, but only as workers presently holding those jobs retire or vacate the positions for other reasons. Thus, economic benefits of workforce reduction through automation of an existing transit system may be deferred for a number of years until retraining, transfer, or attrition can account for the displaced workers. Alternatively, direct compensation can be paid to affected workers, eliminating the jobs earlier but at an earlier cost. As noted previously, however, it appears that few employees are actually put out of work by increased automation of existing systems, New systems do, in fact, have smaller train crews, but this work force reduction is largely offset by the increased need for more and higher skilled workers to maintain the more sophisticated and complex ATC equipment[89].

The Urban Mass Transportation Act of 1964, and its amendments, directs that consideration be given to the means of providing service to, and assuring the safety of, the elderly and handicapped. This has raised problems that are not yet fully resolved within the transit industry. The chief concerns related to ATC are control of door operation and emergency evacuation of vehicles in automated systems without an onboard operator. There is also uncertainty about how accommodation of the elderly and handicapped will affect the service offered to other passengers in normal operations and their safety in emergencies.

Department of Transportation Act of 1966 (PL 89-670)

This Act created administrative and supervisory bodies of the Federal Government that now have a major influence on transit system development and operation as a whole, and ATC in particular. The Act established both the Urban Mass Transportation Administration (UMTA) and the National Transportation Safety Board (NTSB), UMTA is the principal DOT organization by which grants and Federal assistance to transit development are administered. NTSB is charged, inter alia, with overseeing the safety of transit systems and with accident investigation.[90]

Federal Railroad Safety Act of 1970 (PL 91-458)

This Act placed the safety of rail rapid transit systems within the purview of the Federal Railroad Administration (FRA). To date, however, FRA has not actively pursued this interest, apparently because of preoccupation with problems of intercity and commuter railroads, As discussed below in Issue P-z, there is evidence within recent months of

[88] Originally, the 1964 Act provided for two-thirds Federal funding, with one-third State and local matching. In 1973, the Act was amended to increase the Federal share to 80 percent.

[89] See Issue O-12, beginning on page 116, for a further treatment of this point.

[90] The NTSB investigation of the BART Fremont accident, entitled "Safety Methodology in Rail Rapid Transit System Development," August 1973, and an earlier report, "Special Study of Rail Rapid Transit Safety," June 1971, raised several important questions about the advantages and disadvantages of ATC.

more active involvement of FRA in rail rapid transit.

National Mass Transportation Assistance Act of 1974 (PL 93-503)

This law is, in effect, a significant amendment and extension of the Urban Mass Transportation Act of 1964. Its major provisions include allocation of additional funds for urban mass transportation programs and—for the first time—makes Federal funds available on a fifty-fifty basis for operating expenses. Under the 1964 Act, Federal support was available only for capital expenditures.

Some of the sections of the 1974 Act specifically relate to ATC are:

- Section 5 (n) The provisions of section 13(c) of the Act of 1964 are made applicable to all assistance under the formula grant program.
- Section 107 The Secretary must investigate unsafe conditions in facilities, equipment, and operations funded under the Act of 1974, which result in serious safety hazards. If unsafe conditions are found, he may withhold assistance until appropriate actions are taken.

It is still somewhat early to assess the general effects of this Act on transit system development or its specific impact on ATC. Opinion on these subjects is mixed within the transit industry and in the Federal Government, and evidence from transit system operation is still too fragmentary to indicate trends.

State, Regional, and Local Legislation

Before 1964, when the Federal Government became involved in capital grants to mass transit, financial support was almost exclusively the concern of State and local governments. Such support, when given, was usually for publicly owned systems. Private transit operators, while subject to various forms of State and local regulation, typically received no support from public funds and were almost wholly dependent upon the fare box for revenues.

As transit ridership declined and operations became less and less profitable, private operators often severely curtailed services. Eventually, many found it impossible to continue. It became necessary for public bodies to assume control in order to prevent the total loss of these transit systems to the community.

At the State, regional, and local levels, and occasionally by interstate agreement, legislation has been enacted to set up various public or quasi-public agencies for operation of public transit systems. These organizations take a variety of forms. Some are purely operating authorities. Others also have planning responsibilities. Most control all modes of transit in their area of jurisdiction. A few (such as BART and PATCO) operate only a rail rapid transit system.

Many States have formed Departments of Transportation for the purpose of coordinating mass transit activities on a statewide basis, In large part, State DOT efforts are concentrated on obtaining a larger share of Federal funds or increasing the eligibility of local agencies to participate in Federal programs. There has also been considerable support for mass transit at the State level in the form of direct subsidies, special taxing plans, and public assistance programs such as transportation of schoolchildren and the elderly,

It is difficult to generalize about these State and local legislative structures except to indicate that the concern is primarily on the public service aspects of the system as a whole. Technological characteristics, chiefly as they relate to safety, do receive attention in those States which have a public utilities commission established to regulate transit system operation, In some States, however, the transit agency itself is charged with regulating its operation.

ISSUE P—1: IMPACT OF EXISTING LEGISLATION

What effects has recent transportation legislation by the Federal Government had on ATC development and application?

There have been few, if any, effects on ATC specifically. Like other areas of rail rapid transit technology, ATC has received general benefit from increased funding by the Federal Government to support research, development, and application for individual transit systems.

The Urban Mass Transportation Act of 1964 and its amendments has been of enormous help to the rail rapid transit industry for the planning and con-

72-683 O - 76 - 12

struction of new systems and for the modernization of equipment and facilities in existing systems. The benefits of this law stem not only from the large amount of money made available by the Federal Government for capital grants but also from the-incentives offered to State and local governments to participate in capital acquisition and improvement programs by providing matching funds. During the decade since enactment of the 1964 law, major improvements have been made in the New York, Boston, and Chicago rail rapid transit systems, and work on new systems has been started in Washington, D.C., Atlanta, and Baltimore.

The recently enacted National Mass Transportation Assistance Act of 1974 continues the policy of Federal support for mass transit and, for the first time, extends Federal assistance for operating costs. Under the 1964 Act Federal support was provided only for capital improvements and acquisition (two-thirds Federal funds, one-third matching State and local funds). The 1974 Act authorizes UMTA to provide capital grants (on an 80-20 basis) and operating aid (on a 50-50 basis). Table 34, a summary of the UMTA budget for Fiscal Year 1976, indicates the magnitude and distribution of the Federal Government's assistance program for mass transit.

TABLE 34. UMTA Budget for Fiscal Year 1976

UMTA PROGRAMS	AMOUNT (millions of dollars)
Capital Grants	1,100.0
Operating Aid	500.0
(Carryover)	150.0
Technical Studies	38.7
R&D and Demonstration Grants	53.4
Managerial Training	0.6
University Research	2.0
Administrative Expenses	12.5
Total	1,857.2

There is no evidence that either the 1964 Act or the 1974 Act has had a specific impact on ATC technology or its application in existing and planned transit systems. The provisions of these laws are quite general, and there is no explicit or implied support provided for ATC in particular. While there have been ATC programs undertaken with funds made available under the 1964 Act, and some proposed with funds from the 1974 Act, they represent no more than a part of the general pattern of transit system improvement and growth fostered by Federal Government assistance,

There is a widely held view in the transit industry that the 1964 Act may have had the effect of encouraging the development and use of automated train control systems. Because the Act provided grants only for capital improvements or acquisition and not for operating assistance, planners may have been induced to concentrate their resources on capital-intensive features such as automatic train control (which would be eligible for Federal assistance) in the hope of thereby reducing later operating costs (for which Federal assistance funds were not available).

The argument is plausible, but it does not seem to be supported by events. First, the amount of money for train control systems provided by the 1964 Act has been relatively small, probably not . more than 2 to 5 percent of the total capital assistance program, and it is doubtful that such an amount could have had the imputed effect, Second, the ATC projects that have been undertaken in this period and supported by Federal funding have been justified on grounds other than potential manpower savings through automation, At CTA and MBTA, for example, the justification for cab signal installation was safety of operation not labor saving, It should also be noted that the two most automated systems placed in service during the time the 1964 Act was in force (PATCO in 1969, and BART in 1972) were planned and built without expectation of Federal assistance.[91] Further, the new systems in Atlanta and Baltimore, for which preliminary planning and design took place between 1964 and 1974, employ lower levels of automation than the BART system. If the 1964 Act had had the influence purported by some persons in the transit industry, just the opposite would have been expected, i.e., MARTA and Baltimore MTA would have a degree of train control automation equal to or surpassing that of BART. Thus, it seems unlikely that Federal Government policy, as expressed in the 1964 Act, has tended to foster automation.

Federal Railroad Administration (FRA).—The FRA, which has long had jurisdiction over the safety of interstate and commuter railways, has interpreted the Federal Railroad Safety Act of 1970 to

[91]BART did receive some Federal assistance in the latter stages of development and construction, but this was long after the commitment had been made to a highly automated form of train control.

confer upon it (through delegation by the Secretary of Transportation) authority for safety regulation of all transit systems using rail technology. To date, however, FRA has not actually exercised this authority over urban transit systems except to institute a standardized procedure for accident reporting and to announce proposed rulemaking with regard to train protection systems and the safety of door operation.

With regard to train protection, FRA is considering the possibility that cab signals and onboard automatic stopping devices should be required for all rail rapid transit systems. This requirement would apply only to new systems, and some exceptions would be granted to existing systems that have a heavy investment in wayside signals and trip stops. The concern of the FRA with door operation centers on how to prevent accidents in which passengers are caught or struck by doors. Preliminary hearings on door safety have been held and the views of the transit industry have been solicited. FRA has not yet decided the approach to be taken, but their stated intention is to regulate the force and manner of door closure and the safety interlocks between door operation and train motion.[92]

FRA's sphere of authority is confined to the safety of equipment already in use. They are not able to exert direct control over the design process for new systems, However, the FRA can wield indirect control since they could shut down-or prevent the startup of—any new system not meeting the safety regulations in force for operating systems.

Urban Mass Transportation Administration (UMTA).—At the present time UMTA does not perform a regulatory function, in the commonly accepted sense of the term. However, some form of regulatory authority does appear to be implicit within the general responsibility of UMTA to oversee and administer funding for the development of new systems. Certain of UMTA's requirements for transit system development programs verge on regulation—for example, the requirement that transit districts requesting capital grants for new system conduct studies of transportation system alternatives and trade-offs. Also, the Safety Division of the UMTA Office of Transit Management has proposed initiation of a comprehensive "system safety" program, which might later be broadened to cover "system assurance, " Under a system assurance program, the concerns of safety would be integrated with those of reliability and maintainability. If this is done, the domain of regulation would be expanded to include all aspects that contribute to safe, efficient, and reliable transit system operation. While local transit agencies might not be required to conduct such programs by UMTA regulation, the control of grant funds exercised by UMTA would have considerable mandatory force. In fact, several transit agencies have already instituted system assurance programs in anticipation that it might become a future requirement for obtaining UMTA grants.

UMTA may soon begin investigating transit accidents as a regular activity. Section 107 of the Act of 1974 requires the Secretary of Transportation to investigate serious safety hazards in systems whose construction or operation is financed with Federal Government funds, and UMTA is a logical choice within DOT as the agency to carry this out. However, it is intended that such investigations would be conducted only after a serious accident or incident had occurred and not as a routine before-the-fact activity.

In the past 2 years, UMTA has made use of the DOT Transportation Systems Center (TSC) to carry out in-depth investigations of ATC in two new transit systems—BART and the PAAC skybus. The former was an investigation of a newly opened system which was in the midst of controversy over the safety of the ATC system. The latter was an investigation of the proposed ATC system for a transit system still in the preliminary design stage. Of particular interest there was PAAC's intent to operate rubber-tired vehicles with no onboard personnel. At the present time, TSC is also assisting UMTA in design reviews of the MARTA transit system now being built in Atlanta. Among the areas of concern to the TSC participants are the safety aspects of the ATC system design and the effectiveness of the integration of man and machine functions.

Some members of the transit industry have expressed concern about these TSC activities. They fear that TSC might gradually assume a regulatory

[92] In passing, it should be noted that the FRA's concern with the safety of door closure did not arise from rail rapid transit incidents but from operating experience on commuter railroads regulated by the FRA.

function for rail rapid transit--especially by setting down rules, standards, and guidelines that might become the basis for a de facto form of regulation. UMTA's position is that, while TSC may continue to provide technical assistance, there is no intent to assign any sort of regulatory role to TSC.

National Transportation Safety Board (NTSB).—The Department of Transportation Act of 1966 created the NTSB which, while not precisely a regulatory body, has had influence on transit system safety in general and ATC in particular. The NTSB is empowered to investigate rail rapid transit system accidents (as well as accidents in other types of transportation) and to make recommendations to the Secretary of Transportation concerning procedures and equipment that affect the safety of operation. NTSB has made a number of accident investigations and special studies and has produced several significant recommendations.

One report, entitled "Safety Methodology in Rail Rapid Transit System Development" (August 1973) has engendered strong controversy because it included a recommendation for "abandonment of the fail-safe concept." The NTSB view, which is diametrically opposed to traditional railroad and rapid transit practice, has brought adverse comment from all segments of the transit industry. The report went on to recommend that, as a replacement (or perhaps more correctly a supplement) for fail-safe, the industry adopt "an organized approach to accomplishing rapid transit system safety through the application of current safety management and engineering concepts. " Without entering into the merits of the NTSB argument, this report can be cited as a major impetus for the system safety and system assurance programs now being considered by UMTA.

The role of NTSB appears to be expanding. The Transportation Safety Act of 1974 contains provisions which require NTSB to conduct a much broader program of accident investigations than that set forth in the Department of Transportation Act of 1966 that established NTSB. It is estimated that this will involve over 700 additional accident investigations per year in rail transportation alone. While rail rapid transit is not mentioned specifically, NTSB will be expected to investigate all fatal railroad accidents, all accidents involving passenger trains, and all rail transportation accidents resulting in substantial property damage.

ISSUE P–2: REGULATION

What agencies regulate the development and operation of transit systems and how do they function?

There is some regulation (primarily concerned with safety) performed by a combination of Federal and State agencies, but up to now most regulation has been carried out by individual transit authorities acting as self-regulating bodies. Within the Federal Government, regulation is divided among FRA, UMTA, and NTSB.

Regulation of rail rapid transit systems is carried out at three levels of government: Federal, State, and local. In some cases, the transit system operating authority may also be self-regulatory, Until recently the concern of regulatory bodies at all levels has been essentially limited to the area of safety. Since, in the traditional view, safety involves prevention of collisions and derailments, regulatory interest has centered almost exclusively on ATP subsystems and equipment, Now that automation has been extended into train operation and supervision, the scope of regulatory agency concern is broadening to include all aspects of safety and to deal with safety on a system-wide basis. Aside from safety, other aspects of system operation (with possible exception of fare structure and level of service) have received little or no attention from regulatory agencies.

Federal Regulation

Three Federal Government agencies have partial jurisdiction over safety matters. These agencies and their areas of responsibility are described briefly on the following pages.

Under the **1974** Act, NTSB still is not vested with any rule-making authority or power to establish requirements that specific safety-related actions or remedies be effected, As before, the primary role of NTSB will be to investigate and make recommendations to the Secretary of Transportation, who will retain the authority to accept and enforce the recommendations as seen fit,

An important point with regard to NTSB recommendations, which is not always recognized by the

public, is that NTSB does not attempt to evaluate the economic or technical aspects of its recommendations. The sole concern of NTSB is to maximize the safety of a transportation system, The responsibility for evaluating feasibility and cost-benefit is left to the appropriate regulatory agency and the local authorities who must ultimately decide on a course of action.

State Regulation

In many States, regulatory bodies were created in the 1900-10 period to oversee transit operation and protect the public from the monopoly power of private owners. As such, these State agencies were almost exclusively concerned with economic regulation. With the shift of local transit systems to public or quasi-public ownership and operation in the 1940 and 1950 decades, these agencies were left with vestigial responsibilities, and some ceased to exist. Few of these State agencies, then or now, have been active in safety regulation. As a practical matter, then, most local transit authorities are self-regulated in the areas of both economics and safety,

During this study it was found that many transit authorities considered themselves to be essentially self-regulated, but perhaps subject to requirements imposed by such agencies as the State DOT or Public Utilities Commission, the State legislature, or even a regional planning commission of one sort or another. Transit systems serving areas which include the State capital appear to receive substantial attention from the State legislature, although not necessarily in the form of regulation. An example is the State of Georgia Legislature which created the MARTA Technical Overview Committee. This committee is empowered to Iook into any or all aspects of the MARTA system. Also, the State of Minnesota Legislature has taken an active interest in the activities of the Twin Cities MTC and, in 1973, directed that a special study of PRT alternatives be performed because they were not completely satisfied with the results of previous studies.

In some States, the public utilities commission (PUC) has had an active role in the regulation of rail rapid safety, often with specific interest in the ATC system. Two notable examples are in California and Massachusetts.

In 1967, the California PUC issued specific requirements dealing with ATC. Their coverage was somewhat general but they specifically addressed the subject of ATC. These requirements, a result of section 29047 of the California Public Utilities Code, state that BART shall be subject to safety regulations of the PUC and that the commission shall inspect BART facilities for safety of operations and shall enforce the provisions of the section.

The Massachusetts PUC has taken an active interest in the ATC system installed on the MBTA's South Shore extension, and has ordered that fully automatic operations be restricted until such time as the PUC is satisfied that no potentially unsafe conditions exist.

Industry Self-Regulation

Regulation of a transit system by an external agency is not an easy matter, It requires establishing an organization, staffed by technically competent and experienced personnel, to write standards, review plans and designs, and conduct tests and inspections. Even if the necessary personnel could be found, it might not be practical at the State or local level to create such an agency. Typically, a State contains only one rail rapid transit system; and to establish a special authority to oversee a single operating agency might be a governmental extravagance.

For this reason, most publicly owned transit agencies are self-regulated, both for safety and economic matters such as fares and level of service. As public or quasi-public bodies, they respond to the influences of the political system by which they are created and to the economic constraints imposed by the use of public funds.

The opinion within the transit industry is that self-regulation is a workable solution. The excellent safety record of rail rapid transit is cited as proof that a self-regulating body can manage its affairs in a responsible manner, with the public interest as a foremost concern. The opponents of self-regulation, while not questioning the integrity and sense of responsibility of the local transit system officials, point out the inherent danger of vesting a single agency with the authority to conduct transit operations and oversee the results. Both sides of the argument have merit, and one of the basic issues in the area of public policy for rail rapid transit is to find a proper balance between external regulation by a State or Federal agency (or some combination thereof) and responsible management by the local operating authority.

ISSUE P-3: ACCEPTANCE TESTING AND QUALIFICATION

What part is played by regulatory bodies in the testing and qualification of ATC systems?

Except for the public utilities commissions in certain States, regulatory agencies are seldom involved in testing and qualifying a syatem for initial service. Up to now, the Federal Government" has not taken an active role in this area.

Before a transit system is placed in service, each of its major components and finally the system as a whole must be subjected to acceptance and qualification tests. Customarily, this testing is carried out by the engineering staff of the operating authority, often with the assistance of technical consultants and manufacturers' representatives. The State regulatory agency (typically a public utilities commission) may observe some part of the tests and may receive the results for review, but the State agency usually does not take an active role in testing and rarely, if ever, conducts independent tests to verify that the system performs according to standards. Regulatory agencies of the Federal Government (FRA, UMTA, and NTSB) are not involved at all in acceptance and qualification testing, and they do not perceive that they have a legislative or organizational mandate to do so.

Thus, with regard to testing and qualification, local transit authorities tend to follow the pattern of self-regulation. The reasons are primarily those of practical necessity and not explicit Government policy. Automatic train control equipment, like most other components of a modern transit system, is complex and technologically sophisticated. For a local or State agency to conduct tests of this equipment would require a staff of technicians trained in the use of sophisticated instrumentation and experienced in train control system operation. In view of the general shortage of such qualified personnel in the transit industry, State agencies find themselves in a position where they must compete with the transit authority, manufacturers, and consulting firms for the few persons available. Further, State agencies may be at a competitive disadvantage because they cannot offer the salaries, prestige, or opportunities for advancement that are available in an operating transit organization, a manufacturer, or an engineering consultant firm.

Scarcity of technically qualified personnel is not the only reason. The program of testing necessary for a local or State agency to qualify a system for service is virtually the same as the test program normally pursued by the operating authority itself in assuring that the equipment performs according to specification and manufacturers' warranty. Because of this, public agencies have been reluctant to establish separate organizations to engage in efforts that would largely duplicate those of the operating system they are charged with regulating, especially since there may be only one transit system within the entire State. And even if the regulatory agency were willing to do so, it might be difficult to convince the State government and legislature that such would be an effective and necessary use of public funds.

Most State agencies have found that the practical course is to monitor the tests conducted by the local operating agency and to review the findings to assure conformance with established standards, either those of the State agency or those of the transit industry generally, In some instances, the State agency has entered into a cooperative arrangement with the local transit authority, whereby certain tests are conducted by the local authority on behalf of the State or whereby State standards have been adopted by the local agency.

In passing, it should be noted that the primary, and almost sole, concern of State regulatory bodies is the safety of the system, specifically the design features that prevent collisions and derailments. The broader aspects of passenger safety and operational concerns such as reliability and availability are almost never matters of regulatory action,

The history of the transit industry has shown that, because of their size and complexity, new systems are almost never completed by their scheduled opening date, As deadlines are missed, public impatience and political and economic pressure mount. Because acceptance and qualification testing is usually one of the last items on the schedule, the local operating agency is strongly tempted to shorten the test program or to defer a part of it until after the system has opened for service. The State regulatory body, influenced by the same pressures, may find it necessary to acquiesce,

To assure that acceptance and qualification testing is not slighted in these circumstances, some have suggested that the Federal Government (through either UMTA or FRA) should require a

certain amount of testing before a new system is put into service, It is argued that only the Federal Government has the authority and the resistance to local pressure required to ensure that the interest of public safety is not compromised by expediency, There is also an economic justification advanced. The Federal Government, having provided as much as 80 percent of the funds for development and construction, has the major interest in the new system and should assure that full value has been received for the investment of public moneys, A third, and purely practical, reason for Federal Government involvement is-that only at the national level would it be feasible to assemble and maintain a technical organization capable of carrying out such tests.

There are strong counterarguments. As a matter of policy, it is debatable that the Federal Government should enter into an area where State agencies and local self-regulation have traditionally ruled and where the general adequacy of such regulation has been demonstrated. Further, it may not be correct to view financial support of local transit system development as an investment by the Federal Government. Rather, it may be an instance of revenue sharing without the Federal Government acquiring proprietary interest. On practical grounds, the imposition of Federal-level requirements for testing may add unnecessary delay to the acceptance and qualification process because of the need to submit test plans to a Federal Government agency for approval, to have the test results reviewed, and to obtain additional authorizations to open the system for service. There is also the possibility that, if disputes arise between the local transit authority and the Federal Government agency, the acceptance and qualification process might be even further protracted.

The unresolved issue of responsibility for acceptance and qualification testing is part of the larger question of how and by whom should regulation of transit systems be accomplished, The question is not, of course, confined to the subject of ATC; it applies to all aspects of transit systems development and operation, Still, the matter of acceptance and qualification come most sharply into focus in the area of train control systems because of the vital part played by ATC in passenger safety. There is a clear and present need to assure, by some combination of local, State, and Federal regulation and supervision, that technology is used wisely in the public service.

ISSUE P-4: STANDARDIZATION

What effects would standardization have on ATC?

There would be both positive and negative effects. The benefits of a uniform technology lie in the areas of improved system assurance and reduced research and development costs. The major disadvantages are restrictions on innovation and limited freedom of choice in system design.

Few fields of technological endeavor run the full cycle from experimentation to mature development without the introduction of standardization. At some point, the establishment of design and performance standards becomes desirable to check proliferation of design variations, to reduce development costs, to limit technological risk, and to assure that best use is made of existing technology. The real issue is not whether to standardize, but when and to what degree. If standards are imposed too early or too rigidly, innovation and technological improvement may be stifled. If too late, the variety of designs may be so great that the standards become meaningless, and there may be economic hardship for those who own or manufacture equipment that lies outside the prospective standard.

At this time, the matter of standardization of ATC is an open question. Some argue that it would be healthy for the transit industry and the general public whose tax moneys are used to support the development and installation of new ATC systems. Others contend that it would be unwise to standardize now at a time of great experimentation and innovation because many promising avenues of improvement might be cut off. The following is a brief examination of three areas where standardization might be most applicable,

Procurement Specifications

As ATC equipment has become more complex and sophisticated, the specifications governing the design and procurement of this equipment have grown more detailed and explicit with regard to system performance and contractor responsibiIities. At the present time, however, each transit agency procuring a new system or upgrading existing installations writes a more or less unique specifica-

tion, tailored to local needs and conditioned by their individual experience with ATC,

There would be an advantage for all if there were a uniform set of terms, conditions, and procedures for the transit industry. This might take the form of a model specification, establishing a standard terminology and defining basic methods for verifying compliance. A model of this sort need not be a completely rigid document; there should be room for variation to accommodate local needs and concerns. Further, the specification would not establish uniform performance requirements; these would be left to local decision. But it would standardize the phrasing of these requirements and set forth a universal method for acceptance. and qualification testing.

This approach would offer several advantages. It would assure that a well-thought-out document was available to the planners and directors of new systems for guidance in an area where they might be lacking in experience, It would help assure that the best of past experience and current practice is incorporated in new systems. There would also be advantages for ATC equipment manufacturers since a standard set of requirements and procedures would permit contractors to know exactly what is expected of them and would provide continuity and regularity from one procurement to the next. For the public, standardization might lead to benefits such as reduced engineering and development costs and elimination of some subsequent operational problems.

Against these advantages must be set three major disadvantages. A detailed specification is of questionable value for simple procurements; it might result in overly elaborate and unnecessarily expensive provisions without materially enhancing the quality and performance of the equipment. It may not be possible, at the present state of technology and specification writing, to produce a document with sufficient generality to cover all situations and still exercise meaningful control over the details of design and performance. Finally, there is some question whether the methodology of system assurance is sufficiently well developed and precise to permit its application to ATC systems.

ATC Characteristics

There is a tendency for the planners and developers of ATC systems (and transit systems generally) to design to their unique goals and requirements. In some cases, this is justified; nonstandard solutions are needed to meet special local problems and conditions. In other cases, however, it is not clear that the additional benefits of a special-purpose design justify the increased costs. Increased standardization of ATC system equipment offers the promise of substantial economic and operational benefits. On the other hand, there is the risk that standardization could inhibit innovation and technological progress. The major arguments for and against standardization of ATC equipment characteristics are enumerated below.[93]

The standardization of ATC equipment characteristics could produce several positive effects. It would tend to reduce the variety of designs and the proliferation of special-purpose equipment. It would help assure use of the best of proven technology in new systems. Commonality of equipment would make it easier to obtain and stock spare parts (an important consideration for small transit systems), Standardization could lead to some savings in equipment engineering and acquisition costs, and perhaps substantial reduction of debugging costs (which are higher for new designs than for already proven equipment).

There are some possible negative effects of standardization, There is such a wide range of technology now in use in existing systems that it would be difficult to establish a common core of ATC equipment characteristics, There is no one type of design that is clearly superior to others or that is applicable to the broad range of conditions that exist in transit systems, Freezing design characteristics at. this time, when there are some promising innovations just coming on the scene, may minimize the opportunity for technological progress. The decision to select a particular system or systems as standard might work a hardship on those who use or manufacture “nonstandard” equipment and might adversely affect industry competition.

Test Procedures for Train Detection

The basic and proven method of train detection is the electrical track circuit. While the track circuit is highly effective and reliable in most circumstances, there is a long history of difficulty with

[93]Note that the area of standardization is ATC equipment characteristics, not components or specific designs. Component and subsystem design could be improved and refined (for example, to increase reliability) while still retaining the same fundamental characteristics.

electrical train detection on little used track where rust and film may build up and inhibit rail-to-rail shunting by the train wheels and axle. The experience in BART has brought this problem to the forefront of attention in the transit industry, but it, has existed in the background for years in other transit systems. Many in the transit industry believe that is a need for a redefinition of the performance standards for train detection circuits and for improved testing methods.

Standardization of test criteria and procedures would have the primary advantage of providing a uniform and objective way to verify the performance of train detection circuits and would thereby assure that effective train protection is achieved. This would have also a secondary benefit, in that a potential source of misunderstanding (and litigation) between the buyers and sellers of ATP equipment would be largely eliminated. However, there are some offsetting disadvantages. The problem of train detection is so complex and influenced by so many extraneous variables that it may not be possible to develop a single, universally applicable standard and testing method. Even if such a standard and test could be devised, it might prove to be overly conservative and could lead to excessively complex equipment or unnecessarily redundant mechanisms.

ISSUE P-5: SAFETY ASSURANCE

Is action by the Federal Government ***needed to*** ensure the safety of ATC design and ***operation?***

Federal action may be required to establish safety standards, methods of measurement, and testing procedures. Many in the transit industry believe, **however,** that **such** could be brought about internally by the process *of* **self-regulation.**

As noted in the discussion of Issue P–z, Regulation, most transit systems (both operating and planned) are essentially self-regulating in matters of safety. While many members of the transit industry recognize the need for improvement in safety standards and methodology, they believe that the safety record of rail rapid transit demonstrates the effectiveness of self-regulation and that direct action by the Federal Government is not required, They also argue that local self-control, while perhaps not an ideal method, is preferable to intervention by a Federal agency because the local officials are much closer to the needs and problems and more likely to be responsive to the concerns of the public in the area served. This position is not strictly a "hands-off" policy. Many local transit agency officials feel that the Federal Government could be of substantial help in the matter of safety assurance, but primarily in a supportive and advisory capacity and not in the role of a direct regulator.

There are, of course, counterarguments. The increasing complexity of transit systems (and the ATC equipment that controls train movement) has greatly magnified the difficulty of insuring that all elements are safe and reliable throughout the life of the system. The task of safety assurance may thus have grown beyond the capability of a local operating agency to deal with it systematically and effectively. Perhaps only an organization at the national level could command the resources and have the authority to cope with the problem. Perhaps also, only a national organization could be expected to develop a sufficiently uniform and impartial set of standards to ensure that safety matters are handled equitably and consistently throughout all the transit systems in the country. If a transit system is considered not as a local public utility but as part of the national transportation resources, then Federal regulation can be further justified on the grounds that the Federal Government is the only body capable of overseeing the service of national interests.

If external regulation of rail rapid transit safety is deemed necessary, there are three principal matters that need to be addressed: safety standards, methods of measurement, and testing procedures.

Safety Standards

How are the elements of an ATC system to perform under normal and abnormal conditions? What are the requisite fail-safe characteristics of ATC systems? What level of protection must be provided for passengers, train crew, and equipment in the event of failure or malfunction? And finally, what degree of risk must exist before a system or situation is considered unsafe?

Methods of Measurement

There is a need for common definitions and methods of measurement. It would be of little value to standardize ATC systems and to develop a general ATC system specification without also

defining what characteristics are to be measured and how such measurement is to be accomplished.

Test Procedures

The procedural aspects of testing need to be given attention, Uniform procedures would help assure that testing gives valid results and that no important aspect of system performance is overlooked. Uniform procedures would also help guarantee consistency of treatment and evaluation for all transit systems in the country.

ISSUE P–6: PUBLIC EXPECTATIONS

What is the level of public expectation with regard to the safety, dependability, and cost of ATC systems?

The evidence is sparse, but it seems to indicate that the area of highest public concern is safety. The public also appears to expect a high degree of dependability. The costs of ATC are not differentiated from those of the transit system as a whole.

There is almost no information available on the attitudes of the riding public toward transit systems. Judging from newspaper coverage and individual expressions of public opinion through the news media, the public tends to take a transit system for granted until some specific problem occurs. When it does, public reaction is likely to be negative and narrow in focus, centering around the incident itself and ways to prevent recurrence, Public concern is seldom of long duration and recedes as the normal pattern of transit operations is once more established and memory of the incident is eclipsed by other interests.

Transit system operators believe that the public is primarily concerned about personal safety while riding the trains and about security from robbery and crimes upon their person, Again, however, the level of safety (i.e., the number and frequency of accidents and injuries) is such that public concern about personal risk comes to the fore only when a mishap occurs. The case of BART is a classic example. Before the Fremont accident, there appeared to bean unspoken acceptance of the safety of the ATC system, The public reaction to the accident was prompt and widespread (even outside the San Francisco area), but it was greatly out of proportion to the degree of actual injury and damage. Since then the public concern over safety seems to have subsided to an insignificant level and revives only momentarily in response to some new safety incident or publicity surrounding the ongoing engineering tests of the BART system. Transit operating officials in other cities such as New York, Chicago, and Boston remarked during the course of this study that the same pattern of public concern for safety is manifested there in response to accidents and mishaps.

Closely allied to safety in the public mind is the matter of security from criminal acts while riding trains or waiting in stations. Public concern does not seem to center on ATC as such, but rather on the amount of protection afforded them by transit system personnel and police and on the availability of assistance when needed. That is, the public does not take a stand against ATC because it would reduce the level of manning of the trains (and perhaps the stations). Rather, the concern is with the measures that may be employed to compensate for the absence of crewmembers.

An interesting demonstration of the public's views took place in Denver, where a system of small unmanned vehicles was proposed, During public hearings, numerous questions were raised about how muggings and assaults could be prevented or discouraged, what form of monitoring would be used, and what actions would be taken after detection of a crime. The suggestion that vehicles could be monitored by central control "listening in" by two-way radio was considered by some as a form of eavesdropping, and therefore unacceptable.

There seems to be a general feeling that transit systems should be safer than the general urban environment. Crime rates in transit systems are generally lower than in the city at large, and yet the fear of criminal acts seems to be higher in subways than on the streets. Paradoxically, efforts by transit authorities to increase the security of patrons is sometimes a two-edged sword, The presence of transit police may be reassuring, but it may also give the impression that the transit system property is so dangerous that extensive policing is necessary. NYCTA is a case in point, This system has a very large transit police force that actively patrols trains and stations, and yet public concern over "crime in the subways" is perennially high.

With regard to the dependability of service, the public does not usually distinguish the role of ATC from that of other elements of the transit system. Either the trains run on time or they don't. If there are delays or habitual disruptions of service, the public is most likely to lay the blame on management in general rather than any particular component of the system. Also, it seems that the public does not regard lack of dependability as so serious a matter as safety. Nevertheless, the public does cast its negative vote. With the instant dependability of the automobile ever present, public dissatisfaction with transit service usually takes the form of patronage diversion from public to private transportation. Transit system managers, on the other hand, regard dependability as virtually coequal to safety as a way of attracting public patronage. It is perhaps for this reason that transit system publicity tends to stress the speed, convenience, and dependability of mass transit in their advertising to attract riders.

The public attitude toward cost is most diffuse and hard to isolate. If the individual citizen is a member of the fraction of the population that patronizes rail rapid transit, he pays the fare but probably does not think about how the costs are distributed. For the rest of the public the costs of constructing or supporting a transit system (or any specific part such as ATC) is indirect, ill-defined, and probably unnoticed. Where there is public reaction to the cost of a transit system, it usually is in general terms and in connection with a public referendum on the issue of transit system development bonds or taxation. On such occasions, the cost of ATC specifically is submerged in the total cost of the system.