

class to do the job that it does the best and then to inter-face with each other to provide better transit service to the users and to the communities.

CONCLUSION

This paper has described a concept: a transportation planning tool of a functional classification of transit services. The concept has been applied and worked in a complex real-world test of providing coordinated transit services. It has worked because it makes technical, economic, and political sense. It has enabled implementation of a well-integrated transit system not only from the perspective of the operators but also from that of governmental officials, the general public, and, probably most importantly, the users.

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Institutional and Political Considerations of BART and Bus Coordination in the San Francisco Bay Area

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The experience of the San Francisco Bay Area with discussions and negotiations regarding coordinating bus and Bay Area Rapid Transit (BART) should be of interest to other metropolitan areas currently operating or constructing new rapid transit systems. While the technical aspects of implementing such service, for example, mutual fare-collection systems and realignments of routes and schedules, tend to be the more frequent subject of discussion among transportation professionals, the subtler political and institutional aspects of consideration negotiations can be the deciding factors leading to implementation or, conversely, to the continuation of duplicated transit service and inadequate feeder-bus service to rail transit stations. The service-coordination issue, then, calls for politically acceptable and institutionally feasible responses as well as technical studies. The Metropolitan Transportation Commission, a regional transportation planning agency for the San Francisco Bay Area, armed with the authority to allocate local and federal discretionary transportation funds, has established a framework that acknowledges the political and institutional constraints to BART-bus coordination and facilitates negotiations among the transit operators. While a resolution to the service-coordination issue is still off in the future, the Bay Area experience thus far has implications for other regions faced with similar transit problems.

In view of the continuing need for efficient public transit service in metropolitan areas that have both bus and some form of rail mode and the current construction of rapid rail systems, the issue of Bay Area Rapid Transit (BART) and bus coordination in the San Francisco Bay Area is a timely subject for discussion. While the technical aspects of implementing such coordinated ser-

vice are more frequently discussed by transportation professionals, the subtler political and institutional aspects of interoperator service-coordination agreements are often overlooked. In actuality, to play down the politics of interoperator cooperation may often result in nonnegotiable positions among the individual rail and bus agencies and, ultimately, in the continuation of duplicated transit service and inadequate feeder-bus service to rail transit stations.

This paper will emphasize the process of service-coordination planning among the BART district, San Francisco Municipal Railway (Muni), and the Alameda-Contra Costa County Transit district (AC), and later the Metropolitan Transportation Commission, since the early stages of BART development. Specific recommendations for the more technical aspects of coordination will not be discussed as much as the political and institutional context in which interoperator negotiations took place.

The object of this paper is to point out the political and institutional aspects of coordination negotiations, not to make recommendations for either the Bay Area or other regions faced with the same bus-rail coordination issues.

TRANSIT OPERATORS

The following descriptions of the major public transit operators in the three BART counties is provided as background.

BART

The BART district was created by an act of the California state legislature in July 1957. After years of planning and engineering design, a proposal for a three-county rapid rail transit system was approved by the voters in November 1962, who also passed the \$792 million general-obligation bond issued to finance the construction of the system.

The initial 114-km (71-mile) system began operations in segments in 1972. The last segment, the Transbay Tube, was opened in 1974.

BART serves the counties of Alameda, Contra Costa, and San Francisco with 34 stations, one of which is located in Daly City in northern San Mateo County. Daily weekday ridership in 1978 averaged 143 000 trips. Control of the district is vested in an elected board of nine directors, who represent the three counties in the BART district. BART levies district property taxes to pay bonded indebtedness from construction and a small portion of operating (administrative) costs. Since late 1977, BART has a permanent subsidy for operations from its share of a half-cent sales tax in the three-county district.

AC

AC, the major bus operator in the East Bay, is a public agency created by the state legislature in 1956. It became an operating entity in 1960, when it acquired the assets of the privately owned Key System Transit Lines. AC Transit provides two kinds of bus service: (a) directly to the areas in the district, the cities west of the Berkeley and San Leandro Hills, and (b) by contract to other cities in portions of Alameda and Contra Costa Counties outside of the AC district.

In its district service, all 18 BART stations on the Richmond and Fremont lines and one station each on the Concord and Daly City lines are served by AC. In addition to local and express buses in the East Bay, AC operates extensive bus routes across the San Francisco-Oakland Bay Bridge to the Transbay Bus Terminal on the eastern edge of downtown San Francisco.

AC operates several kinds of contract bus service in areas of central Contra Costa County, east of the Berkeley Hills, which are also served by the Concord BART line. Some cities contract with AC for local service, which includes connections with BART at the Concord, Pleasant Hill, Walnut Creek, Lafayette, and Orinda BART stations. Under contract to the BART district, AC also operates BART Express Bus service to and from portions of the BART district beyond the immediate service of BART stations.

In 1960, the last year of Key System operations, AC Transit had a total patronage of 45 million. By 1970 the patronage was 52 million, and by 1977, five years after BART began phasing in operations, the patronage was 61 million.

The district is governed by a board of directors, seven elected members serving four-year staggered terms. The AC Transit district was the first public transit agency in the nation to be given the power to levy a property tax. The tax rate began at 3 cents/\$100 of assessed valuation in 1960 and was approximately 45 cents/\$100 in fiscal year 1977/78. For that year the property tax assessment brought in revenues of more

than \$21.4 million. However, with the passage of Proposition 13 in June 1978, the tax revenues for the current fiscal year will net only 35 percent of the preceding year's revenues. The difference is being made up with state surplus funds and state Transportation Development Act monies for this year. No long-term funding source has yet been committed to AC for this deficit.

MUNI

MUNI is a passenger transportation utility owned by the city and county of San Francisco and administered as a unit of the city government by the public utilities commission. MUNI operates a diverse fleet of motor buses, trolley buses, streetcars, and cable cars within the city. This service area includes nine BART stations, four of which are in the downtown area. MUNI'S average weekday ridership exceeds 400 000 trips.

MUNI is governed by a five-member public utilities commission appointed by the mayor. Major policy decisions regarding the system—level of fares and rerouting of lines—are subject to approval by the city's board of supervisors. MUNI is largely subsidized by San Francisco's general fund and therefore must compete with other city agencies for revenues.

EARLY ATTEMPTS AT SERVICE COORDINATION

In its original concept, BART was envisioned as a comprehensive regional transportation system providing service between the major employment centers and residential areas of the three BART counties (Figure 1). BART was designed to compete with the automobile in terms of travel times, passenger cost, and passenger comfort. However, in BART's planning, insufficient attention was given to how necessary corollary feeder-bus services were going to be provided. In reality, for BART to be an effective public transit operator, some degree of coordination with AC and MUNI is necessary.

The need for coordination of bus and rail transit services was stated as early as 1956 by the BART commission's engineering consultant. In the report on preliminary plans for regional rapid transit in the Bay Area, the consultant noted (1, p. 77) that

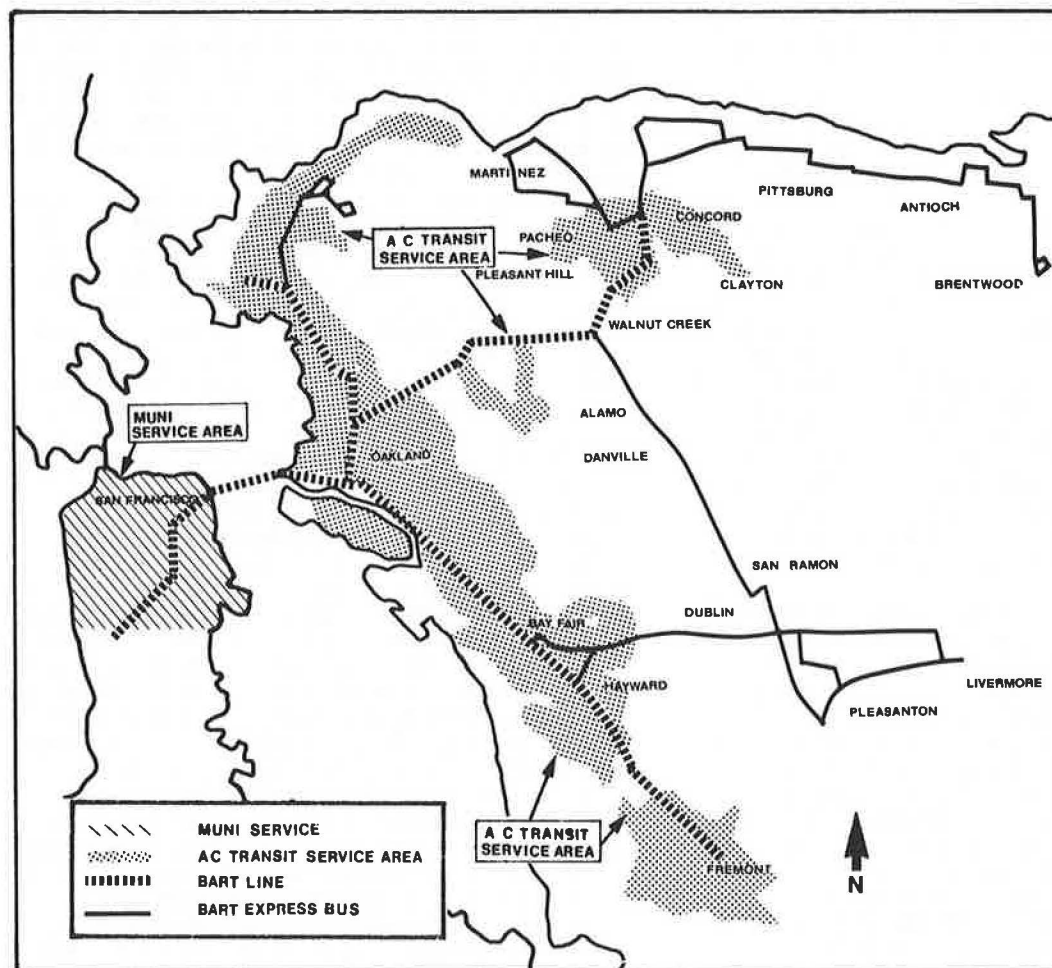
We cannot overemphasize the importance of effective coordination and integration of the rapid transit system with the vast networks of existing surface lines, both local and interurban, in the Bay Area. A coordinated system of surface transit and rapid transit essentially provides two important advantages: traffic is fed into the rapid transit system, which acts as the backbone of public transportation, and unnecessary surface transit competition is effectively channeled into the rapid transit operation. The success of the rapid transit system in the Bay Area will depend upon establishing desirable relationships between the surface and rapid transit lines.

No administrative or institutional process was recommended, however, to facilitate this interoperator integration. BART's consultant seemed to adopt the attitude that integration would occur somehow automatically because it was necessary for BART's success:

We have assumed, therefore, that substantially all existing interurban transit operations serving the Bay Area would, upon the inception of rapid transit service, be redirected and integrated with the new system.

With no regional or even local forum available to begin discussions on this issue in BART's planning phase, the groundwork for inevitable conflicts between BART and AC and MUNI was established.

Figure 1. BART, MUNI, and AC Transit service areas.



BART and AC Relations in the 1950s

BART-AC relations were amicable during the planning phases of these two systems during the middle and late 1950s; the BART board supported AC's 1959 bond election for new capital equipment and acquisition of the Key System. Earlier, AC had proposed continuing the operation of the Key System trains on the lower deck of the Bay Bridge. The toll bridge authority, however, wanted this service eliminated so that this deck could be converted to eastbound rubber-tired-vehicle use. The state public utilities commission also objected to continuation of Key System trains on the bridge. Consequently, the AC board gave up the idea and voted for buses systemwide.

In August 1959, the AC board approved their consultant's Public Transit Plan (2, pp. 20-21), which went before the voters that November. This plan, with the board's support, implied that AC would cease transbay operations once BART began service in this corridor.

Since the Key System now operates most of the transbay buses between the East Bay and San Francisco, the [AC] District must logically assume the obligation of continuing this essential transbay service. This service must be maintained during the six to seven year, or perhaps, longer period required for the Bay Area Rapid Transit District to plan, finance, construct, and place in operation an improved transbay connection. Eventually, however, the District may be relieved of this responsibility so as to limit its functions entirely to the problem of adequate transit within Alameda and Contra Costa Counties ... no part of the equipment purchased with the capital recommended in this report would be duplicated

or wasted when the Bay Area Rapid Transit District would start its operation.

By 1965, however, the AC board had reconsidered this earlier claim and passed a resolution stating that "transbay service should continue to be performed so long as public convenience and necessity actually require them." Throughout this period BART and its engineering consultants and many Bay Area elected officials had expected AC to cede most of its transbay service to BART. But after 1965 AC never again reinforced this expectation.

The Northern California Transit Demonstration Project

Efforts at transit coordination began in 1963 after the passage of the BART bond issue. An informal joint committee was organized by the operations staffs of BART and AC, and, soon after, MUNI officials joined the session. By 1964, the group had developed a work program and applied for federal funding when it appeared that the complexity of issues warranted outside assistance. The result of this proposal was the Northern California Transit Demonstration Project (NCTDP), a consultant's study of BART-bus coordination issues conducted from 1965 to 1967.

NCTDP was designed to be a comprehensive study of all potential issues among the three major transit operators. It was to develop recommendations on a coordi-

nated route network for tying local transit and BART operations into an integrated system, a modernization program for MUNI, passenger transfer procedures, and a mutual fare system proposal to facilitate passenger transfers.

In the introduction to the 1967 NCTDP report, the need for coordination was stressed again as necessary for BART's success. Two sets of coordination problems were analyzed. The first was the impact of BART on existing transit operations of AC, MUNI, and Greyhound. Alternatives to these systems were defined as necessary for operation and maintenance of the balance of services "beyond the influence of rapid transit." Second, interfaces between BART and the established surface transit networks were recommended. Foremost was the operation of feeder services to and from BART. Included were questions of joint fares, collection and handling of fares, transfers of passengers, sharing of revenues, and scheduling. While significant changes in MUNI's and AC's services, routes, and transfers to coordinate with BART were recommended, the NCTDP report lacked an implementation plan. Instead, the final report proposed that the three operators form an inter-agency compact to undertake a more detailed coordination study.

By 1971, that is, before BART began operations, none of the NCTDP's recommendations had been implemented by MUNI or AC. In 1969, San Francisco voters had rejected a bond issue to upgrade MUNI as recommended by NCTDP. This bond issue would have implemented a massive switch from streetcars and electric buses to diesels. Strong neighborhood opposition to this proposal was the death knell for the NCTDP plans in the city. Also, both MUNI and AC, based on what they considered to be the faulty analysis of the study, resisted any change in their service levels or policies.

In mid-1971, joint exercise-of-powers agreements were concluded among AC, BART, and Metropolitan Transportation Commission (MTC) and MUNI, BART, and MTC to again develop recommendations for executing and improving the coordination of transit in the three BART counties. These agreements led to two more federally funded studies—the AC Transit-BART Service Coordination Project and the MUNI-BART Coordinated Transit Planning Project—which were sponsored by MTC and conducted in 1972 and 1974, respectively. Both studies were overseen by boards of control that included representatives from each operator (either AC or MUNI), BART, and MTC. The general service recommendations of these coordination studies included elimination of or reduction in routes paralleling BART, particularly AC's transbay service, which was often seen as in direct competition with BART in this essential corridor, and rerouting of local bus service to serve BART stations.

In spite of these comprehensive studies and joint meetings among operators, few recommendations for major service and route changes to coordinate with BART were implemented by either MUNI or AC. Proposed route additions or adjustments to serve BART were generally adopted, whereas proposed reductions in routes and service levels paralleling BART were not. Certain characteristics of the coordination process were the primary cause of this outcome and will be discussed separately for the BART-MUNI and BART-AC cases.

BART-AC Coordination Project

Overall, the coordination process has resulted in the reduction of some AC service rather than in the elimination of competing lines. In the East Bay local service

area, many existing lines were rerouted as BART phased in service, new bus lines were added, and service frequencies increased to improve feeder service to BART. Also, under contract to BART, AC Transit operates five new BART express bus routes to and from parts of the BART district. On only a small number of lines has parallel AC service been reduced, and only one line has been eliminated altogether because of patronage losses to BART.

In the transbay corridor, service has been cut back because of BART operations but not severely. AC's transbay service operates as a local collector in the East Bay neighborhoods, and the bus then runs express across the Bay Bridge. Even where these bus lines parallel BART, they continue to provide a more convenient, no-transfer, and often faster journey than BART for many transit riders. Total scheduled bus kilometers on AC transbay runs had been reduced by only about 15 percent in the year after BART transbay service began; on the lines experiencing the greatest reduction in bus patronage, headways have been increased from 5 to 10 min in the peak period (3).

NCTDP recommended modifications and abandonments of 30 of AC Transit's routes. Obviously, to date, the actual changes in AC service are minor in comparison. Regarding transbay service, however, it should be noted that BART's capacity in this corridor and general service reliability have not yet reached levels originally anticipated when AC service reductions were recommended. In 1974, before the start of BART transbay service, the BART Board, realizing fewer cars would be available for service than expected, quieted its demands that AC reduce its service to San Francisco.

To begin to understand this lack of implementation of coordination-study recommendations, it is necessary to describe the political and institutional environment in which the coordination process was attempted.

AC has basically always maintained a favorable public image as a transit agency in the Bay Area, while BART's image has certainly been more controversial and generally not as popular. AC established a good record of transit operations in its brief tenure before coordination discussions began with BART, which, at that time, was still an unknown to the public eye.

Coordination discussions also coincided with media reports on BART's money shortages and construction delays. In this light, public opinion in the East Bay not unnaturally sided with AC Transit. Patrons were familiar with the kind of service AC provided, its convenience to neighborhoods, and its costs. BART, on the other hand, was encountering skepticism as to its projections of service levels and travel costs. Also, as a new regional system, BART did not have the same strong local constituency that AC Transit did.

The board of control for NCTDP—representatives of MUNI, BART, and AC—had served strictly in an overseer's capacity, not as a forum for compromise. In fact, the disclaimer at the beginning of the NCTDP report indicates that none of the report's recommendations had the approval of the board of control.

After the report, between 1967 and 1970, BART and AC held 37 meetings or joint sessions on service policy that failed to produce an agreement between the agencies. When BART received the preliminary proposal for AC route changes in 1969, few of BART's preferences, as shown in NCTDP, were met. BART believed that AC should cut back parallel and competing service on transbay routes and reroute these and other lines to feed BART stations. AC, meanwhile, maintained that transbay service should not be cut back, as noted previously. Financial considerations regarding reduction of transbay service were also uppermost in AC Transit's thoughts;

in 1965, transbay was the only break-even portion of AC Transit's operations.

AC and BART then held widely divergent and often nonnegotiable positions on service policy. AC Transit's general manager viewed NCTDP service-change recommendations as "points of departure" for discussions with BART, rather than final recommendations (4). This position was due to the general feeling of AC staff that the NCTDP projections of BART's ability to attract ridership, especially from buses, were overestimated. The AC Transit board in 1971 adhered to the stance that lines paralleling BART should not be abandoned until AC patrons had the opportunity to make a choice between modes once BART began operations.

BART, conversely, preferred NCTDP's recommendations on routing and frequencies, stating that these changes were crucial to the viability of BART as a regional rapid transit system. BART felt that AC, as a technologically flexible system, could and should change routes to maximize use of BART. Being a fixed system, BART was dependent on AC to flesh out its skeletal system, yet AC remained intransigent in its position. BART's dependence on feeder-bus access then became AC's bargaining strength (5), particularly since BART reduced the number of parking spaces available at stations by half due to construction budget constraints.

BART-MUNI Coordination Project

MUNI has improved feeder service to BART by rerouting and increasing service on several lines. But, generally, service paralleling BART has not been downgraded to the extent recommended by NCTDP, in spite of the loss of MUNI riders on these lines. The majority of service recommendations resulting from early coordination studies required that MUNI reduce or totally eliminate parallel service in the BART corridor; feeder service was a minor issue compared to AC's situation. However, largely because of public protest against proposed service reductions in the affected San Francisco neighborhoods, no MUNI line has been discontinued as a result of BART.

Coordination with BART was a low-priority issue for MUNI, whose planners and management felt their system's first priority was to serve trips within San Francisco. MUNI staff felt that few trips would originate on MUNI and end up on BART to the central business district or points in the West Bay. MUNI delivered good service paralleling BART, and public pressure was on MUNI's side to maintain these lines. In spite of San Francisco's decision to not have parking lots at BART stations in the city, there was no local public pressure on MUNI feeder service.

MUNI also had few staff resources available in its planning or engineering departments to work on coordination issues. The need for extensive coordination on the design and construction of the MUNI Metro subway, built one level above BART along Market Street, only served to increase the complexity of BART-MUNI interactions and to deplete available MUNI staff resources.

In November 1969, the San Francisco electorate defeated Proposition B, which would have upgraded the MUNI system according to NCTDP recommendations. The defeat of this proposal for an expanded and modernized rapid transit system in the city indicated that most residents preferred the local MUNI system, which serves local travel needs well, to rapid transit or a combination of feeder-bus service and rapid transit.

The process of implementing any change in MUNI service is also more time-consuming and cumbersome than for most transit systems. San Francisco's city charter requires the approval of the board of super-

visors and the public utilities commission for any MUNI route abandonment. The courts have broadened this interpretation by including any reduction in service within the definition of "service abandonment," thus taking these operating decisions from MUNI management's purview and placing them in the political process. Hearings must be held by the board of supervisors for each proposed change in service. Any evidence of public protest or opposition usually results in the proposed service changes being dropped from consideration. As has been said of this process, "[San Francisco] city government is so muscle-bound because of the obsolete charter that the best transit manager in the country would have been frustrated" (6).

Continuing Attempts to Coordinate Service

The issues of BART-related fare- and transfer-policy changes for MUNI and AC were discussed in the same forum as service policy. To date, BART has had little effect on the fare policies of AC or MUNI. BART's lowest fares, for intra-urban trips, were kept down to be competitive with AC and MUNI. AC did raise their fares in 1978 after the passage of Proposition 13 so that transbay bus fares are approximately the same as average BART transbay fares.

Interim intersystem transfer arrangements have been in existence for AC since BART began East Bay service in 1972 and since MUNI and BART negotiated transfer policies within two years of BART service in the West Bay. It should be noted that BART's fare-collection equipment was not designed to facilitate transfer procedures between systems.

The NCTDP had made recommendations on transfer mechanisms, although their recommended system of two-way transfers was not generally acceptable to AC and MUNI. It was thought to be too complex to be easily understood by the public and would have been handled by bus drivers, thus slowing the boarding process. However, both local transit agencies realized a need to compromise with BART, and the cost-sharing aspect of the purchase of transfer equipment and the exchange of money among operators necessitated a working out of an agreement.

A BART patron boarding an AC bus gets a free bus ticket at a BART station that is good for a trip away from the station; full fare is paid for the bus ride to BART. The cost of the trip discount is paid now with federal Section 5 funds allocated to AC by MTC. BART's early preference was for transfer tickets to be issued by bus drivers and that one-way riders not be given this discount. AC's plan prevailed, however, although improvements to this transfer system are currently being discussed.

MUNI shared many of AC's reservations about the NCTDP-proposed transfer mechanisms. MUNI's dilemma was further compounded when in 1974 they instituted a monthly "fast pass" that cannot be recognized by BART fare-collection equipment. MUNI did adopt a two-way transfer system where paired "from" and "to" MUNI tickets are sold in BART stations for the cost of one MUNI fare. This two-part transfer is of value only to the regular BART rider who does not purchase a fast pass. Like AC, MUNI pays the cost of this system through Section 5 funds. As in the AC situation, MUNI's transfer scheme with BART is considered an interim solution.

Summary

The process of implementing coordinated bus and rapid

rail service is complicated by both technical and political problems. However, the NCTDP and the 1972 AC and 1974 MUNI coordination studies viewed the coordination issue as a technical problem and failed to recognize the political and institutional context in which these issues had to be resolved. Some of the problems not considered included public interests and vested constituencies, fear of change, and simple inertia on the part of the operators. These obstacles to resolution of coordination agreements and ultimate implementation were underestimated in early attempts at resolution of coordinated transit operations in the BART counties.

Adding to these problems was the absence of a real forum for negotiation. No incentives for bargaining and compromise were present in early coordination meetings. No third party was available in the 1960s to play the role of mediator and to provide some incentive for operators to reach a resolution of their differences. This vacuum of authority is where the Metropolitan Transportation Commission (MTC) entered.

CREATION OF THE METROPOLITAN TRANSPORTATION COMMISSION

The final report of NCTDP proposed that the three major operators, AC, BART, and MUNI, form an interagency compact to undertake a more detailed coordination study. Commenting on the NCTDP results, the Bay Area Transportation Study Commission (BATSC), MTC's predecessor, said that "present institutional arrangements are not sufficient for resolution of the issues." BATSC saw the need for the intervention of a regional level of policy-making because local interests (AC and MUNI) were often in conflict with regional (BART) interests.

The state legislation establishing MTC in 1970 instructed the commission to expend some effort to "insure adequate feeder service to public multi-county transit systems." The Transportation Development Act (TDA) of 1971 provided a new source of local funding for transit and also instructed those agencies allocating the act's funds, such as MTC, to set "maximum coordination of public transportation services, fares, (and) transfer privileges" as a priority in allocating TDA monies.

MTC's planning and programming responsibilities have provided opportunities for interaction with the transit-operating agencies. MTC's responsibilities include

1. Review and approval of transit operators' claims for the act's funds (TDA legislation instructs MTC to "approve those claims which will not result in the undesirable duplication of public transportation services, and which will provide for a coordinated public transportation system in the region"),
2. Review and approval of applications for federal and state grants,
3. Sponsorship of formal planning studies related to transit service coordination, and
4. Adoption and updating of a five-year plan of program and project priorities and development of capital improvement programs.

MTC appears to be the appropriate institutional structure for improving coordination among transit operators, particularly through the bargaining power it has in allocating discretionary funds, such as TDA and federal Section 5 monies.

MTC is making some efforts to set standards for operators' performance but has not yet tied funding in with these standards. However, MTC has no direct

regulatory powers. Although some regulatory authority was proposed in early drafts of the MTC legislation, opposition by Bay Area transit operators resulted in the deletion of these provisions.

The Metropolitan Transit Association

Aside from sponsoring the two interoperator coordination studies in the early 1970s, MTC also took steps to organize the transit operators in the Bay Area to facilitate the coordination process. In late 1972, the MTC commissioners proposed a Metropolitan Transportation Federation, modeled on a plan in Hamburg (Germany), where transit properties pooled revenues and coordinated service to move from perennial deficits to a slim profit.

A consultant was hired by MTC to develop a consumer-oriented coordination and promotion strategy. Much of the marketing strategy that was developed was incorporated into MTC's first Regional Transportation Plan (RTP) in 1973 as a diluted version of the Hamburg plan called the Metropolitan Transit Association (MTA).

MTA was described in RTP as a "cooperative federation of transit operators to propose, plan, keep the Commission advised and help implement certain programs of coordination in transit operations." MTA was to include representatives of MTC, the California Department of Transportation, and the policy boards of all the major carriers, both private and public, to act as an advisory body to the commission. Coordination of transit routes and schedules, research and marketing, fare structures, ticketing, and transfer and fare collection procedures among Bay Area operators was a high priority for MTA. However, implementation procedures for MTA's recommendations were limited in the RTP: "The recommendations of MTA would be encouraged by the yearly updating of MTC's RTP and by MTC's control over transit aid funds."

MTA never really got off the ground after RTP was adopted. In the meantime, an informal organization of transit operators, the Bay Area Transit Association (BATA), drew up a series of joint-powers agreements for eventual discussions of coordinated purchasing, service policies, etc. In early 1975, BART's first elected board of directors (the board had previously been appointed by county supervisors) voted against the participation of BART's acting general manager in BATA. Without the involvement of the major regional transit operator, and apparently lacking a strong push from MTC, BATA, like the MTA, never formally met in the mid-1970s, and coordination of services and other aspects of operations among the three major operators in the BART district remained elusive.

Current MTC Role

As constituted by the state legislature, MTC did not have a definitive mission, just broadly stated goals and objectives for the planning and operations of transportation facilities and transit modes in the Bay Area. MTC defined its mission more specifically in its own Regional Transportation Plan (RTP), which must be updated annually.

In the process of establishing the regional plan and financing priorities, MTC had to consult with the implementing agencies in the region. Therefore, the RTP became a product of consensus and collaboration with these agencies rather than a product purely of MTC's own regional perspective on how the various modes of transportation should interface, plan capital improvements, finance services, etc. (7, p. 5). RTP, first written in 1973, then established the process of decision making by MTC, which appears to be more suited

to the role of arbiter in the interoperator service-coordination issue. Although having the potential for substantial management control over the transit operators through the allocation of Transportation Development Act monies and other local and federal operating subsidies, by the mid-1970s MTC had not actually flexed this muscle to influence the cooperation of the three major transit operators in settling the BART-bus service-coordination problem.

However, more currently, although Bay Area transit operators have evidenced ridership gains, fare-box revenues constitute a decreasing portion of total operating revenues. Aside from federal subsidies, new local sources of revenue had to be secured for Bay Area operators. BART had been receiving 0.5 percent of the increased local sales tax since 1969 to cover construction shortfalls; in 1974, this legislation was amended to temporarily extend the sales tax for BART's operating expenditures. In 1976, MTC unsuccessfully attempted to gain control from BART of these sales tax revenues. As a compromise, the state legislature mandated both MTC and the state legislative analyst to develop a long-term financing solution for BART, which ultimately included consideration of the increasing unfunded deficits of MUNI and AC Transit.

A result of MTC's Transit Financing Study was Assembly bill 1107, enacted in September 1977. This legislation provides a permanent base of funding for BART's operation by allocating 75 percent of the half-cent sales tax to BART and the remaining 25 percent to BART, AC, and MUNI for "Improvements in the level of transit services beyond that provided on or before January 1, 1978, on the basis of regional priorities" established by MTC. These latter discretionary funds, however, cannot be allocated to an operator unless it is a member of the MTC-established Transit Operator Coordinating Council (TOCC).

TOCC, which was mandated by bill 1107 and organized in February 1978, is composed of the general managers of the six major public transit operators in the Bay Area and the executive director of MTC. TOCC builds on the existence of the Regional Transit Association (RTA), which was created in March 1977 by the same six operators partly as a defensive maneuver against the threat of an MTC-led association (the subsequent TOCC). RTA, which has no MTC representation, has joint working committees in the areas of service and fares, procurement, public information, management systems, maintenance, operations, legal services, personnel, training, and affirmative action. One of the RTA's objectives is to try to settle major issues among the top management of the transit operators without having to involve MTC in the decision-making process. RTA has had some success but primarily in areas of mutual benefit such as procurement and public information; the high-conflict issues that are more difficult to resolve still exist. RTA and TOCC have separate agendas but generally meet together; MTC provides some staff support for TOCC.

Given the financial problems of the three major transit operators in the BART district, aggravated by the passage of Proposition 13 in June 1978, which limits property tax assessments, the discretionary funds allocated by MTC on the basis of compliance with regional transit objectives are then of increasing importance to the transit operators for maintenance of, at least, existing services. TOCC and RTA now have this additional financial incentive to work out service coordination, with some direction by MTC.

It is too early to predict what the outcome of these stepped-up efforts will be, but proposals for coordinated fare structures and transfer mechanisms are currently

being evaluated and service-level changes will be considered in the near future. MTC, given the appropriate tools and political climate, is becoming a stronger force in mandating the coordination of transit services to best serve transit riders and taxpayers in the San Francisco Bay Area with the limited public resources currently available.

CONCLUSION AND POLICY IMPLICATIONS

The problem of BART-bus service coordination is only partly a technical one: The technical know-how is available to solve this perceived "problem" of duplicated service, as in the transbay corridor, and inadequate bus service to BART stations. The service-coordination issue is primarily an institutional problem of negotiation and implementation. Continuing technical and consulting studies of an advisory nature only tend to prolong the decision-making process by rehashing the same issues and failing to produce politically acceptable mechanisms of execution.

The Bay Area, with its strong political fragmentation and diversity of transit operators and their constituencies, represents a unique example of institutional constraints that have hampered the long-term objective of achieving cost-effective and efficient coordination of transit services.

There are a number of policy implications that can be deduced from the Bay Area experience of attempting to coordinate the transit services of two existing local public transit operators with a new regional rapid rail transit operator.

1. Organizational structure: A loose, cooperative organization of independent operators with potentially competing services will have little incentive among themselves to agree to a regional cost-effective approach to providing comprehensive regional transit service. A single regional authority like MTC can probably provide the best incentives for service coordination if given sufficient legislative mandates, such as MTC's authority to allocate discretionary funds to support regional objectives for transit.

2. Rapid rail transit system design: Coordination issues should be addressed early in the planning and design phases of rapid rail system development. One basic issue in system design is the purchase of fare-collection equipment that is flexible enough to implement a transfer system to buses and therefore does not constitute a barrier to service coordination.

3. Transit service policy coordination: Planning studies have to go beyond the first level of analysis and the listing of recommendations and service options to examination of potential incentives to achieve the optimum coordination of transit service. Items for consideration include ways to compensate transit agencies during coordination trials and option of bus service under contract to the rapid rail transit agency to provide feeder service.

4. Role of regional authority: Coordination discussions among a number of operators are best handled by a separate, regional agency maintaining operations by the transit operators. By setting regional priorities and trade-offs, broad policy changes can be provided through a variety of mechanisms, such as overall system planning, including approval of capital improvement proposals and service levels, and monitoring of operator performance and efficiency coupled with allocating discretionary funds.

While the resolution to transit service coordination

is not yet at hand, the process for reaching a politically acceptable and workable solution has been set in motion by MTC, armed with its authority to allocate discretionary funds for transit, with the cooperation of the transit agencies. With clearly defined objectives and the public interest well in mind, the goal of BART-bus service coordination may be within reach of the San Francisco Bay Area.

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Abridgment

Dade County's Experience with Urban Station Simulation (USS) Procedures

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One of the most important considerations in the design of rapid transit stations is the delay that passengers passing through the station will encounter. It is important that service facilities in the station (turnstiles, escalators, stairways, etc.) have sufficient capacity to process the maximum number of passengers arriving or departing at any given time. Sufficient capacity is mandatory to assure the safety of passengers. Further, ridership tends to increase as the delays passengers experience are reduced.

Urban Station Simulation (USS) is a transit station simulation computer program developed by the Urban Mass Transportation Administration (UMTA) to analyze the capacities of stations. Station planners provide as input to the program the geometric configuration of a proposed station and the proposed capacities of the various service facilities in the station. The USS program then simulates the movements of individual passengers through the station and records statistics on how they are distributed along alternate routes and on the delays they encounter in waiting lines (or queues) that develop at various points.

By reviewing USS reports of such statistics, the plan-

ner can evaluate the capabilities of a proposed station design before resources invested are in detailed design and construction. Capacity problems can be identified and dealt with during the early stages of design. Details of the capabilities of USS have been presented elsewhere (1).

As part of its analysis of transit stations in the Metropolitan Dade County Transportation Improvement Program, the Kaiser Transit Group (KTG) has applied the USS program to designs for the proposed Douglas Road, South Miami, and Dadeland North stations in the southern (Dixie Highway) corridor of the stage 1 Dade County Rapid Transit System. Figure 1 shows the USS model of one of the Douglas Road station configurations that was analyzed.

Links (pedestrian paths) and nodes (decision and delay points) of the model are superimposed on floor plans of the lower (concourse) and upper (platform) levels. Passengers boarding trains originate as walkers (zone 1), drivers who have used the park-and-ride (zone 2) or kiss-and-ride (zone 3) facilities, or transferring riders on one of the several bus lines serving the station (zones 6-10). They enter the station through turnstiles (nodes