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Authors

Johnston, Robert A.
Sperling, Daniel
DeLuchi, Mark A.
[et al.](#)

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Robert A. Johnston
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Steve Tracy

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University of California
Berkeley, CA 94720

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Robert A. Johnston
Daniel Sperling
Mark A. DeLuchi
Steve Tracy

Division of Environmental Studies
Department of Civil Engineering
University of California at Davis
Davis, CA 95616

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POLITICS AND TECHNICAL UNCERTAINTY IN TRANSPORTATION INVESTMENT ANALYSIS

ROBERT A. JOHNSTON, DANIEL SPERLING,[†] MARK A. DELUCHI,
and STEVE TRACY

Division of Environmental Studies
Department of Civil Engineering,[†]
University of California, Davis, CA 95616, U S A

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Abstract—Cities often opt for rail transit even when agency evaluations conclude that other alternatives are superior in performance and efficiency. The choice of light rail transit (LRT) in Sacramento, California serves as a case study. When adjustments are made for overstated assumptions and irregular manipulations of data in the Sacramento evaluation, the LRT project is somewhat inferior on all technical grounds to other proposed alternatives. This article asks why a local decision was made to pursue the light rail option. The LRT choice is examined in the broader context of government structure and decision-making, earmarked state and federal funding, and local planning. It is shown that local decision makers have broad economic and social concerns that are not incorporated into standard technical evaluations, and that they are provided with highly uncertain projections, especially for ridership. Not surprisingly, local politicians were skeptical of the technical evaluations and weighed local values and strategic funding factors heavily in their decision. While we do not advocate porkbarreling, we believe that the choice of LRT, to the extent that it reflected legitimate local concerns, was valid. We suggest improvements in transit evaluation methods and observe that the 1984 changes in UMTA evaluation procedures appear to consider uncertainty correctly and to include local political support in a meaningful way.

INTRODUCTION

Cities are eager to build rail transit systems. In early 1984, over 30 rail projects were being planned in the United States, with an estimated cost of over \$17 billion (Wall Street Journal, 1984).[†] Yet while cities eagerly seek rail projects, many researchers instead advocate increased reliance on bus transit and more efficient personal transportation technologies (Altshuler, 1981; Hamer, 1976; Lave, 1978; Webber, 1980). Rail transit is criticized for high energy use and high capital costs and for being inferior, in all but the most densely populated areas, to alternatives based on high-occupancy vehicle (HOV) lanes and dedicated bus lanes. This study will document why, despite experts' admonishments of perpetual operating deficits and poor performance, local leaders continue to perceive fixed rail transit favorably.

After identifying the values of the local politicians that were not given enough weight in the U.S. Urban Mass Transit Administration (UMTA) evaluation of Sacramento transit alternatives, we discuss the 1984 changes in the UMTA evaluation method. These changes incorporate local political support for project implementation into the analysis. The new UMTA procedures also take into account the high degree of uncertainty in ridership and other performance projections.

The decisionmaking context

Before studying the reasons for the local decision, it is useful to understand the policymaking context that permits local officials to choose rail transit modes

in spite of the findings of technical agency evaluations. Strong political and administrative direction is lacking on the national level, and is distorted on the local level by the fragmented planning, funding, and decision-making process (Altshuler, 1981, pp 12–13; Ashworth, 1981; Levin and Abend, 1971, pp 232–236, 248–271). National leadership in transit planning and development has been erratic because of the polycentric structure of the national government and because of a fundamental belief in, and institutional reliance on, local choice. The pluralistic and relatively nonideological national government structure relies on a continual interplay of interest groups to obtain consensus, resulting in constantly shifting priorities (cf. Altshuler, 1981, pp 12–14; Wildavsky, 1964). Congress is composed of persons representing states or subareas within states; these representatives respond to local agendas. Executive agencies (e.g., UMTA), where the President and his appointees could exercise leadership, are generally supervised closely by Congressional committees, where members watch out for local interests. As a result, there is no national transit agenda, and UMTA does not have full control even over the transit grants process.[‡]

[‡]An example of lack of consistent leadership and lack of control are illustrated by the following anecdote. On December 4, 1985, Senator William Proxmire gave his monthly "Golden Fleece" award to the UMTA Administrator for "wasting" \$30 billion of taxpayer money over 20 years on transit subsidies. The Administrator is reported to have smilingly accepted with a remark that the award was well deserved, noting, moreover, that it was Congress that had authorized those funds (Engineering News-Record, January 9, 1986, p. 17).

[†]For a worldwide summary, see *Mass Transit*, 1985.

Associated with the fragmentation of the federal government are procedures that earmark funds for particular types of projects and programs (Ferejohn, 1974). According to the Congressional Budget Office, earmarking of funds prevents evenhanded evaluation and selection of alternative transportation modes (CBO, 1978, pp. 13–15, 22–23) and distorts local planning and decision-making.

But even within one program area, such as transportation, benefit-cost and cost-effectiveness analyses are limited to a small number of measurable variables. For example, Mohring (1965) has set forth a reasonable procedure for optimizing freeway expenditures in the United States, but his analysis ignores the many noneconomic costs of freeway construction that have severely curtailed this program (Altshuler, 1981, pp. 31–42).[†] Similarly, while urban renewal could sometimes be shown to be fiscally beneficial to cities, it created many social costs, leading to its unpopularity (Wilson, 1967, pp. 491–582).

Nevertheless, many officials and staff members of transit funding agencies place great weight on the results of transit evaluations and on underlying research. These results are quantitative and seemingly unambiguous. These studies, however, are not made from the viewpoint of the local decision makers. Linstone (1984) critiques purely technical approaches to planning and advocates adding organizational and personal perspectives. "Decision-making inherently involves organizations and individuals, whose perspectives are very different from those of 'rational' systems analysts or technology assessors." (p. 4).[‡] Wachs (1985) states that in "policy debates" the "technically precise enumerations of cost and benefits . . . may be less important than debates about the elements of cost and benefits which should most appropriately be included within a policy study" (p. 12). He claims that the rational planning and evaluation mode of agency behavior may produce largely irrelevant studies and that other modes of analysis and decision-making need to be examined. Building on work by Allison (1971), Altshuler (1974), and Lee (1977), Meyer and Miller (1984) advocate a transportation planning process that recognizes the importance of (1) building consensus among local politicians and implementing agencies and (2) recognizing the uncertainty of key performance forecasts (pp. 85–86). Their process involves the consideration of impacts of concern to local interest groups, as well as standard efficiency and cost-effectiveness measures (pp. 373–378). In summary, if project evaluations were done in a comprehensive and scientifically valid manner that elicited widespread confidence, then there would be a greater basis for agreement between local officials

and funding agencies in choosing transit investments. We will return to this topic at the end of the article.

Setting

The city of Sacramento is the capital of California and the fourth largest metropolitan area in the state. Urban development extends from the rich croplands along the Sacramento River eastward onto the gently sloping lower foothills of the Sierra Nevada range. Urban population was concentrated until after World War II in a small incorporated area (Sacramento City) to the south and east of the intersecting American and Sacramento rivers. Suburban development soon spread to unincorporated areas in the east and northeast, bordered roughly by two freeways, U.S. 50 and Interstate 80. Crash and noise impact zones for two Air Force bases straddling the area helped to constrain urban use to within this wedge. Rapid suburban growth continues in this unincorporated area of Sacramento County. New waves of growth have slowly spread southward and northward from the central city onto prime agricultural lands. During the 1990s these areas will receive considerable growth, as will the urban area to the west, in Yolo County. By the year 2000, then, the metropolitan area will have developed more evenly around the central business district (CBD).

High rates of growth are expected in the Sacramento metropolitan area at least through the remainder of the century, stimulated mostly by the growing concentration of "high technology" firms to the east of the city. The county population was 783,381 in 1980, and is projected to grow to 1,187,000 people in the year 2000 (Sacramento Area Council of Governments, 1984).

Population density is low. Even by the year 2000 in the most dense area (between U.S. 50 and I-80 where the light rail transit [LRT] project and its feeder buses will be deployed), population density is not expected to exceed 3,000 persons per square mile, equivalent to less than two dwelling units per acre (UMTA, 1982). This density is much lower than the 9–12 dwelling units per acre (equivalent to over 20,000 persons per square mile) that Pushkarev and Zupan (1977, p. 188) have postulated as the *minimum* limit for successful deployment of light rail transit.

When transit alternatives were being studied in the late 1970s, Sacramento's central business district contained 78,000 workers, which is relatively high for a metropolitan region of this population, but low compared to cities that already have light rail systems. State government dominates CBD employment, accounting for about 25% of the total (California Department of General Services, 1977). Approximately 12 million square feet of nonresidential floor space are concentrated in the CBD. Generally, 20 million square feet is considered the minimum required to support a *single* LRT line when the line is built on an unused right-of-way (such as a freeway median or old railroad bed) (Pushkarev and Zupan, 1977, p. 161).

[†]Dickey has reviewed the limitations of benefit-cost and cost-effectiveness analyses in transportation evaluation (1983, pp. 343–370).

[‡]Linstone draws on earlier work by Allison (1971), who in turn elaborates on work by Simon (1957) and others. Schein (1965), Likert (1961), and Bennis (1961) explored the limits to rational models in organizational psychology.

Parking is relatively inexpensive and abundant. Free all-day curb parking can be found within 3 blocks from the CBD, and 1- and 2-hour and all-day parking meters with rates of \$0.25 per hour are common in the CBD. Parking garages generally charge \$3 to \$5 for all-day parking and \$45 to \$70 for monthly parking. Paved surface lots are less expensive. State government workers pay \$21–\$37 per month for 4,000 spaces.

Bus service in the LRT study area is generally light, though good express service is provided at peak hours in the I-80 and U.S. 50 corridors. The electorate in the region has tended not to support transit services, turning down by 56% to 44% in 1979 a proposal to increase the existing sales tax from 6.0% to 6.25% to generate revenue for transit services (Schuman and Nelson, 1982, p. 23).[†] Only about 1.6% of trips in the study area are by transit. In contrast, in the similar-sized Calgary area where a new LRT system is being put in place, 18% of trips are by transit (Chumak and Bolger, 1984).

The major highways generally operate without substantial congestion, experiencing occasional standstills and delays over a period of one to two hours in each peak period. Population growth is expected to result in increased delays, but, "the service provided by the [I-80 and U.S. 50] highways is expected to remain relatively good [in the year 2000] with the slowest segments operating at 25 to 30 mph [during peak hours]" (UMTA, 1982, p. 5).

In summary, the Sacramento region appears to be unsuited for rail transit. It has low residential densities, plentiful and inexpensive parking in the CBD, and an extensive and relatively uncongested freeway network.

LRT history

In the mid-1970s, concern in Sacramento was growing over leapfrog development and the role of freeways in encouraging such development. In 1974, in response to community protests, the County Board of Supervisors voted to delete three planned but unbuilt freeways. In February 1975, a group of rail enthusiasts and environmental activists formed the Modern Transit Society (MTS), the organization that was to be the major lobbying force for light rail transit in Sacramento. MTS was philosophically committed to transit (especially rail transit) as an alternative to freeways (Hultgren, 1984; Schumann, 1984).

The original idea for the LRT system came from an MTS proposal in 1975 to build an historic trolley

in the downtown area. The City Council heard the proposal on December 11, 1975, and requested on September 9, 1976 that the Sacramento Area Council of Governments (SACOG) study the idea (Sacramento City Council, 1975, 1976a). Councilmember Connelly and the MTS were enthusiastic; others were cautious and critical (Suttertown Good-Time News, 1976). The Northeast Area Transportation Task Force (NETTF), appointed by the city and county to study the need for proposed freeway routes, recommended in August 1976 that the freeways be withdrawn and that funds be transferred from the proposed I-80 bypass to "light rail transit systems with extensive feeder bus service" (Northeast Area Transportation Task Force, 1976, p. 2). In September the City Council discussed, but did not act upon, the NETTF recommendation to drop the bypass and investigate light rail (Sacramento City Council, 1976; see also Sacramento County Board of Supervisors, 1976).

Later in 1976, key people in the California Department of Transportation and SACOG began to take a hard look at alternatives to the I-80 bypass, perhaps with rail systems in mind (Gianturco, 1985; Rudin, 1985). Thus some of the ideas, plans, and decisions that provided the initial impetus for alternatives studies in the I-80 corridor appear to have been developed independently of the MTS historic trolley proposal. The MTS, however, did influence the NETTF (Hoffacker, 1985).

SACOG reported to the Council on September 29, 1977 that their consultant, Wilbur Smith and Associates, had concluded that "a limited scale special purpose CBD trolley" would be practicable and worth further study (Sacramento City Council, 1977b). Several council members expressed interest in extending the trolley to the suburbs as a commuter line (Sacramento City Council, 1977b). By mid-1977 the trolley was developing a wide range of support, but several months later, after the passage in June 1978 of Proposition 13 (which limited local property tax rates), the project was shelved temporarily (Sacramento Bee, 1978b). It was revived in a different form in August 1978 by Adriana Gianturco, Director of the California Department of Transportation (Caltrans). Looking to initiate transit projects in California, she offered to help fund a study of the feasibility of light rail transit in the U.S. 50 corridor (Sacramento City Council, 1978a; Gianturco, 1985; Sacramento Bee, 1978c). The city accepted, aware of growing local support (Sacramento City Council, 1978a; Sacramento Bee, 1978d). Both major local newspapers had editorialized in favor (Sacramento Bee, 1978a; Sacramento Union, 1977). Regional Transit (RT) had approved, and was later designated lead agency for the study, and a survey by the Regional Transit District showed that 56.9% of the public favored LRT in Sacramento (Sacramento City Council, 1978b). The League of Women Voters, environmental groups, the Sacramento Chamber of Commerce, and other business and labor organizations had spoken in favor of the historic trolley (Sac-

[†]At the time, RT was experiencing bus maintenance and overall management problems and its image in the press was poor (Personal communication, James E. Roberts, Project Director, Sacramento RT, January 25, 1986). A poll in 1984 showed 45% in favor of a small sales tax increase for LRT, far short of the required two-thirds majority (Sacramento Bee, 1984c). Despite a growing population, daily transit patronage has dropped from 76,700 in 1981 to 56,000 in 1983 (for various reasons such as lower gasoline prices and service cutbacks to meet California fare-box return ratio requirements) (UMTA, 1983).

ramento City Council, 1977b, Sacramento Union, 1977) Caltrans supported LRT in response to the wishes of Governor Brown and key state representatives to encourage transit and discourage freeways. Also, Gianturco had taken much criticism for the recently established HOV lanes on the Santa Monica Freeway in Los Angeles (Gianturco, 1985). In summary, Caltrans was pushing hard for light rail, the county was playing a passive role (Collin, 1985), and serious opposition was lacking (Sacramento City Council, 1977b, Hultgren, 1985a). As early as 1978, then, LRT had won tentative support from the public and the key people in power. Much of this support was premised on the availability of federal funds.

Meanwhile, as a result of a series of federal legislative acts, beginning with the 1973 Federal Highway Act (see Edner, 1984), the institutional mechanism was in place for diverting funds from approved (but still unbuilt) segments of the Interstate Highway system to transit projects. The one remaining unbuilt segment in Sacramento in 1975 was a 5.2 mile bypass that was to straighten the alignment of Interstate 80 (now Business 80) and increase its capacity. In 1978, Caltrans, transit supporters, and environmentalists were successful in convincing the City of Sacramento and SACOG to join with Caltrans to examine alternatives to the planned 5.2 mile freeway addition in the I-80 corridor. The I-80 Multi-Modal Corridor Study, published in 1979, pointed out current and expected future deficiencies in the transportation system and, without promoting any particular solution, suggested that major transportation improvements were needed (California Department of Transportation, 1979).

Meanwhile, the MTS, Caltrans, and others lobbied the City Council, proposing that the roughly \$125 million that was "set aside" for the I-80 bypass (about \$25 million from the state and \$100 million from the federal government) be used instead for transit in the corridor. In August of 1979 the City Council voted 8 to 1 to drop the bypass plans and consider alternatives (Sacramento Bee, 1979; Sacramento City Council, 1979b). Shortly thereafter, Caltrans initiated the aforementioned light rail feasibility study for the U.S. 50 corridor, with Regional Transit (RT) as the lead agency.

California Governor Jerry Brown and Sacramento Mayor Phil Isenberg requested on January 11, 1980 that the 5.2 mile unbuilt interstate segment be deleted, and that the funds be transferred to another unspecified project (Sacramento City Council, 1980a).†

†Technically, the metropolitan planning commission (SRAPC, now SACOG) and the Governor had to approve of the deletion, the affected local governments (the city in this case) acted through SACOG (Gianturco, 1985, Caltrans, 1979, p. 9, 1978 Surface Transportation Assistance Act). At the insistence of Supervisors Collin and Sheedy, the county chose not to be actively involved in the decisionmaking (Sacramento County Board of Supervisors, 1979a, 1979b, 1980b). According to then-Caltrans Director, Adriana Gianturco, Mayor Isenberg was at first opposed to dropping the bypass. She helped change his mind

Approval came from UMTA and FHWA four months later. Preparation of a draft environmental impact statement (DEIS) was begun immediately. At about this time, the city and county endorsed the U.S. 50 corridor light rail feasibility study (Sacramento City Council, 1980b; 1980d, Sacramento County Board of Supervisors, 1980a), which had concluded that light rail transit would be a "feasible and desirable" solution to expected problems in the Highway 50 corridor (Sacramento Regional Transit District, 1980, p. 85). One month later, in June of 1980, the City Council accepted Gianturco's proposal to include both corridors, Interstate 80 and Highway 50, in the DEIS (Sacramento City Council, 1980c, 1980e; Sacramento Union, 1980a). The DEIS evaluation was influenced strongly by local interests, but was organized along normal UMTA lines. Released in April 1981, the DEIS (UMTA, 1981) analyzed a set of transportation alternatives for the two corridors. The document served not only as a draft EIS, but also as the feasibility study. The alternatives were analyzed largely in terms of anticipated impacts and performance in the year 2000. The following proposals, a set somewhat reduced from those identified in the earlier corridor studies, were examined:

1. No Build—To hold the current street and highway and bus systems static (while the Sacramento area population rises an estimated 30%–40% by the year 2000 [Sacramento Area Council of Governments, 1984]). Buses would be upgraded, for a cost of \$42 million. The total capital cost with related minor roadway improvements was \$72 million.

2. TSM—To hold the basic road system static, but to more than double the bus fleet from 229 to 481 buses, and to institute a transportation systems management (TSM) program that would include such measures as freeway on-ramp metering, traffic signal timing, parking fee increases, and turning lane improvements. Capital costs for buses were \$53 million and the total cost was \$137 million.

3. HOV—To include, in addition to the above TSM actions, high occupancy vehicle (HOV) lanes that would be separated from normal traffic. Roughly 14 miles of new HOV lanes would be constructed in the I-80 and U.S. 50 corridors, and some existing lanes set aside on connecting surface streets to improve flow between the freeways and the CBD. These lanes would be available only to buses, vanpools, and cars with three or more occupants. The bus fleet size would also be more than doubled, from 229 to 474 (a slight reduction in number from the TSM proposal, the difference being justified by the faster travel speed allowed by the HOV lanes, which improves fleet efficiency). Bus costs were \$52 million and total capital costs were projected to be \$182 million.

4. LRT—In addition to the above TSM actions, to construct an 18.8 mile U-shaped light rail transit route that would run through an existing downtown

and encouraged local involvement in the decision, even though Caltrans "could have rammed the withdrawal through Governor Brown's Office" (Gianturco, 1985).

pedestrian mall, along urban arterials in both exclusive lanes and mixed traffic, along exclusive right-of-way already purchased for the deleted I-80 bypass, and on lightly used (but not yet purchased) right-of-way owned by the Southern Pacific Railroad along U S. 50. Trains would operate on 15 minute headways with three-car trains in the I-80 corridor, and two-car trains on the U S. 50 segment of the route. The extra cars would be uncoupled, stored, and recoupled in downtown Sacramento as the trains passed from one corridor to the other. There were to be 28 stations, 17 of them simple platforms, and 10 with parking lots to accommodate a total of about 6,270 vehicles. Six "timed-transfer" stations were to be incorporated into a redesigned bus route system so that feeder buses would arrive at the stations just before the trains departed. The bus fleet would be increased from 229 to 397 buses. The LRT system itself was to be constructed with just \$6.6 million from local sources (the city, county, and regional transit district), \$25.9 million from the state, and \$98.5 million from the federal government.[†] In addition, buses would cost \$43 million and related roadway improvements another \$62 million, for a total capital cost of \$232 million.

The remaining six alternatives were various combinations of the TSM, HOV, and LRT proposals, for example light rail in the I-80 corridor and TSM in the U S. 50 corridor. The HOV and LRT alternatives would have used all of the federal money, either for those projects alone, or together with related transportation infrastructure improvements.

The DEIS was followed in June 1981 by SACOG's "Preferred Alternative Report" as required by UMTA (SACOG, 1981). Light rail was selected and endorsed by the city council (Sacramento City Council, 1981c), county supervisors, and regional transit board. The LRT alternative was selected despite the fact that the proposed LRT project was expected to serve only a small proportion of transit passengers, and thus would still require a large bus fleet. In contrast, the HOV proposal would have met the projected transportation demands with a much smaller capital cost, and would have required no rail lines and only 474 buses—just 77 more than the LRT alternative. The selection of the LRT proposal was justified in part by such weak claims as: "[LRT was] one of the two most efficient," "close to the top," "in the top group," and "one of the top two." Other

justifications were: "[LRT is] most likely to improve air quality [and is] least dependent on petroleum" (SACOG, 1981, p. 27).

The Sacramento Transit Development Agency, a local joint powers agency created in March 1981 (Sacramento City Council, 1981a) to implement the locally preferred LRT alternative, spent the next two years developing the Final EIS for the project and seeking funding commitments from UMTA and the California Transportation Commission (CTC), the state's transportation policy body. Staff members from SACOG, UMTA, and the CTC raised a wide range of objections (dealt with below).[‡] They questioned the wisdom of funding such a capital-intensive fixed guideway project in low-density Sacramento, pointed out design deficiencies in the system itself, and criticized the methods and conclusions of the DEIS. Still, testimony and statements by interest groups and individuals at hearings and in both local newspapers were consistently in favor of LRT (Hultgren, 1984, 1985a, 1985b, Connelly, 1984, Collin, 1985; Sacramento Union, 1980b, 1981, 1984, 1985; Sacramento Bee, 1978a, 1980a; Sacramento City Council, 1977b, 1979a, 1981d). At the August 28, 1979 meeting of the City Council, most of the three dozen citizen speakers opposed constructing the I-80 bypass and supported the light rail alternative (Sacramento City Council, 1979b). Two years later, on June 16, 1981, when the Council selected LRT as the preferred alternative, a lopsided majority endorsed the decision (Sacramento City Council, 1981b, 1981d).

UMTA staff members and administrators, in spite of their objections to the light rail system, could not withhold funding. Interstate transfer funds are viewed as an "entitlement," and proposals to spend them are not subject to the same standards as normal projects. In response to pressure from Sacramento's Congressional representatives who sought the huge influx of federal dollars into their districts (Fazio, 1984), Congress earmarked funds in UMTA's FY 1983 budget for the construction of the LRT system. The only position left for UMTA was to insist that no additional funds, beyond the approximately \$100 million available from the Interstate Transfer Program, would ever be given to the Sacramento LRT starter system for capital costs.[§]

A similar approach was taken by the CTC. In spite of Commissioner Walter Ingalls' comment that light rail "is the wrong system, in the wrong town, at the wrong time" (Fitzpatrick, 1983), the state share of funding was provided. The federal grant was so large in proportion to the state's share that no one at the CTC wanted to be responsible for losing it. Like UMTA, the CTC ultimately had to approve funding, and be satisfied with going on record that no addi-

[†]In December, 1985, the \$131 million LRT system was nearly completed and the actual costs were \$100.7 million federal, \$28.9 million state, and \$30.9 million local. Of this \$159.5 million, \$1.53 million came from private landowners for joint developments near stations. About \$8 million in State funds and \$2 million in federal funds were gained in 1982-1985, during project engineering and construction, for railroad crossings, freeway ramps, and local street improvements associated with LRT. The local share increased dramatically to cover cost runups encountered during the engineering design phase. The city added \$22 million in redevelopment (tax-increment bond) funds (Sacramento City Council, 1985). In January 1987, the total cost was \$169 million.

[‡]SACOG staff opposed the biased assumptions in the DEIS and lost the argument. The FEIS work was assigned to STDA.

[§]We note here that the "federal" interstate funds come primarily from gasoline taxes, paid by users of freeways.

Table 1 Comparative analysis of alternatives in I-80 and U.S. 50 Corridors

Indicator	Range in Values	Rating for LRT Alternative	Best Alternative†
Total daily transit trips (urban area, 10 ³)	99–115	112	HOV
Line haul service (10 ³ person trips)	36–67	50	HOV
I-80 Corridor auto trip reduction in AM peak	3,300–7,500	5,200	HOV
Travel time to downtown (min)			
from North Highlands	73–79	77	HOV
from Rosemont	31–38	36	HOV
Reduction in central city parking demand	4,700–8,300	7,400	HOV
Total cost per transit passenger in year 2000 (1980 \$)‡	1.33–1.49	1.45	HOV
Capital costs (10 years, 10 ⁶ 1980 \$)	136.5–232.2	232.2	TSM
Year 2000 O&M cost§ (10 ⁶ 1980 \$)	50.5–52.5	50.5	LRT
Year 2000 O&M cost per transit passenger (1980 \$)	0.87–1.01	0.89	HOV
Energy saved (10 ⁹ Btu)	139–316	232	HOV

†“No build” alternative not considered in this table

‡Stream of costs are converted to equivalent annualized basis for comparison purposes

§“O&M” = operation and maintenance

Source: UMTA and STDA, 1983 (referred to as FEIS in text), summary tables. The other data categories in the table and report are total vehicles, total revenue miles, total revenue hours, total transit trips for I-80 area, present value of total costs, percent of jobs within 45 min for minorities, added jobs (temporary/permanent), displacement of dwellings and businesses, impacts on parks, interstate transfer funds utilized, state/local capital funds required, O&M shortfall, air quality, noise, vibration, electrolysis, aesthetics, public services, construction impacts, and historic sites.

tion: state money would be made available to complete starter system construction (CTC, 1983a).

LRT had only one remaining procedural hurdle to clear: approval of the final EIS by UMTA, which was accomplished in August 1983. Despite the criticism of LRT from the funding agencies' staffs, the final EIS was little changed from the DEIS released two years earlier, particularly in its failure to show that the proposed system was superior to the other alternatives except for “urban development potential” and “year 2000 operating and maintenance costs” (UMTA, 1983, Exhibit 2-23) (see Table 1).†

The issue of concern here is not federal funding allocation procedures, however, but rather the overwhelming local political support which was at odds with the CTC and UMTA technical evaluations. In Sacramento, the allure of unconditioned federal money certainly influenced local choices,‡ but that

money could have been spent on the HOV alternative. Some decision makers did not seriously consider the HOV option in the analysis of alternatives (Gianturco, 1985; Collin, 1985), and among those who did, most were extremely skeptical of the attractiveness and productivity of HOV lanes and bus transit (Gianturco, 1985; Collin, 1985; Johnson, 1985; Hultgren, 1979; Sacramento Regional Transit District, 1981; Sacramento Union, 1981, 1980b; Sacramento Bee, 1980a, 1980c).

ANALYSIS OF ALTERNATIVES

Results of the analysis of Sacramento LRT, conducted as part of the Final EIS (UMTA, 1983) are presented in Table 1. The fourth column indicates, for the two corridors, which alternative ranked best for each selected indicator (based on objectives of low cost, diversion of trips to transit, etc.). The third column presents the value for the light rail alternative, and the second column presents the range of values for the full set of alternatives.

Light rail was not rated as the best alternative except according to one indicator: year 2000 O&M cost. But even according to this operating cost criterion, it was superior only on an aggregate basis. That is, while the EIS asserted that the light rail system would require the smallest operating budget of all the alternatives, on a per passenger basis the HOV option was superior—because the HOV option would carry more transit passengers than the LRT. According to all other criteria—including reductions in peak-period trip times, reductions in CBD parking, energy saved, total cost per passenger trip, total transit trips, and, of course, capital cost—LRT

†We note that an FEIS does not legally have to have the text changed to include discussion of comments on the DEIS and the agency's responses to the comments. These two sections may be appended to the DEIS text. We also note that the role of an EIS is not to show that the proposed project is superior, but merely to document the impacts of the proposed project and the alternatives.

‡Sacramento Mayor Isenberg reminded the City Council in June of 1980 that “we have the chance to glom on to as much money as we can, federal and state” (Isenberg, 1980). County Supervisor Illa Collin, and SRAPC's Mike Hoffacker at a 1979 board meeting emphasized that “we must act quickly and get out an EIS by the deadline or else we could lose it all—we could lose all the funds” (Sacramento County Board of Supervisors, 1979b). (See also CTC 1983b, p. 10, “The state does have an opportunity to capture a very substantial federal grant for California”, UMTA, 1982, p. 2, Isenberg, 1984, Shore, 1985, “We get a ratio of four or five dollars to every dollar the City puts in. It's still a good deal for the City”, and Rudin, 1985).

was found to be inferior to the HOV and TSM alternatives, and in many cases, far inferior

In spite of this poor showing, the Final EIS (FEIS) maintained that, "it is important to keep in perspective what is being purchased. When more exclusivity [in right-of-way] is provided, transit can function more reliably, thus increasing its attractiveness to potential patrons. The capital expenditures associated with [LRT] will purchase 18.8 miles of exclusive transitway, compared to 14.7 miles for [HOV], a difference of 28 percent" (UMTA, 1983, p. 2-38). This "exclusivity" argument plus the lower absolute operating costs of LRT were the main reasons used in the EIS to justify LRT's designation as the preferred alternative.

Biases

The poor showing of LRT in the evaluation should have been even worse. The assumptions and structure of the analysis were slanted decidedly in favor of the LRT alternative by the local analysts who formulated the alternatives and conducted the evaluations, using UMTA's format and criteria.

In several cases, the non-LRT alternatives were made to seem less attractive. First, the expanded bus fleets used to constitute the HOV and TSM options were scaled upward in direct proportion to forecasted population growth. This upward scaling was not done selectively to provide higher levels of service where demand was expected to be greater, and lower levels where demand would be less. Costs, revenues, and ridership were simply extrapolated into the future. Thus the HOV, and especially the TSM, alternatives perform relatively poorly on a cost basis (for instance, in terms of cost per passenger) because of an assigned oversupply of buses in many areas. (The forecasted performance of the LRT options also suffer from this biased assumption, but to a lesser extent because they include fewer buses.) UMTA staff, commenting on the DEIS, stated that by not expanding bus service selectively "to an appropriate level using loading standards applied consistently to all alternatives, [the] result is a TSM alternative that is inefficient in its design as well as in its performance" (UMTA, 1982, p. 14). The TSM alternative designed for the DEIS was never reformulated. A proper alternative that reflected the philosophy of TSM would rate far better than the one formulated for the DEIS and FEIS.

Another source of bias was the factor used to annualize operating costs. The FEIS multiplied the estimated daily cost of TSM and HOV bus operations by 322 to annualize the costs. But for LRT operations it multiplied daily costs by only 290. UMTA, commenting on the DEIS, noted that the 322 factor may be appropriate for local bus service, but not the express bus service which LRT intended to largely replace and which would not operate on weekends. Consequently the annual cost of express bus service was overstated. If the factor applied to express bus service in the HOV option were changed to 290, the same as that used for LRT, the projections of annual

HOV operating costs would decrease about \$2 million (UMTA, 1982, p. 9). This error was acknowledged in the DEIS (p. 3-94) and FEIS (p. S-2, footnote) but was not incorporated into the FEIS analysis.† If the figure for HOV operating costs was adjusted, then HOV aggregate operating costs would be lower than those for LRT, and the HOV alternative would then be superior to LRT by every technical indicator.

The California Transportation Commission (CTC) identified other local biases in the analysis of alternatives. The CTC asserted that unreasonable assumptions resulted in an underestimation of operating costs for LRT (CTC, 1983b). For instance, the Sacramento LRT operating cost estimate is only \$4.74 million for the first full year of operations in FY 1986, while the San Diego Trolley, with a shorter line, fewer vehicles, actual ridership only 55% of that estimated for Sacramento, high utilization (an average farebox return ratio of 84% in 1981 and 1982), and a reputation for frugality, had a 1983 operating budget of \$4.5 million (CTC, 1983b, p. 8). Thus, one is led to suspect that the overall operating budget for Sacramento LRT was understated.

The estimate of administration costs also appears to be greatly understated. The projected FY 1986 budget for Sacramento LRT (not including buses) provided \$4.42 million for fleet operations, but only \$0.32 million (6.75%) for administration. In contrast, the average budget share for administration for all light rail operators in the United States running 25-49 vehicles was 20.2% (U.S. DOT, 1982), suggesting that the \$0.32 million administration estimate may have been understated by as much as a factor of three. The CTC also noted other unrealistic elements in LRT's projected operating cost, including an understatement of labor costs.

Indicative of the manipulation of the analysis was the projection in the DEIS that LRT daily ridership would be 28,000, a figure criticized by UMTA (1982) as unrealistically high and only reluctantly reduced by the Sacramento Transit Development Agency (STDA) to 20,500. The lower figure was resisted by STDA (though adopted in the FEIS) with the argument that, "adoption of this estimate would result in a condition of no transit ridership growth between 1982-83 and 1985-86. It is virtually inconceivable that this could occur in an urban area where population is growing by 2.5-3.0 percent annually, but no more freeways are being built, downtown employment is growing faster than new parking spaces are being constructed, and parking costs in the downtown are increasing" (UMTA, 1982, p. 2-31). Yet elsewhere in the FEIS it is noted that daily bus patronage in the Sacramento area decreased from 76,700

† "[We] assume 322 equivalent working days per year for the bus system. The number implicit in the LRT estimate—290 days—would also be appropriate for express bus operations. Thus the total annual bus costs are somewhat overstated, especially for the all-bus alternatives" (UMTA, 1983, p. S-2, emphasis added).

in 1981 to 65,000 in 1982 and 56,000 in 1982-1983 (Exhibit 2-20)

Potential design flaws

Apart from the weak justification for LRT, there are other reasons to doubt the viability of the project, mostly having to do with excessive cost skimping. To gain approval for the LRT project, Sacramento was forced to agree that all starter system costs in excess of the federal and state contributions would have to be borne 100% by the local area (CTC, 1983a). As a result, the proposed LRT system for Sacramento was designed to minimize capital costs so that Interstate transfer funds would cover most of the construction costs. The resulting no-frills, cost-cutting approach to the project was apparently encouraged by local political leaders to make the project more palatable financially to the city, county, and state. This approach threatens LRT's success.

For example, the approved project is largely single tracked (about 60%). Single track operation, with six sidings for passing, requires strict adherence to the operating schedule by all trains in order for the system to operate efficiently, which greatly threatens system reliability. It also requires that headways be no less than 15 minutes in the Sacramento system, a fairly low level of service, though probably adequate to meet the low initial demand forecasted for the system. The entire system could be paralyzed by equipment malfunctions, or excessive dwell time at one station by one train, for instance to accommodate disabled passengers or because of minor mishaps. In areas with mixed traffic, conflicts with motor vehicles and the possibility of traffic accidents further reduce reliability and threaten disruption (UMTA, 1982). The recently opened San Diego LRT was originally intended to be largely single tracked, but before operation began, double tracking was initiated (made possible by a state funding windfall lobbied for by a local state legislator).

Choices of route location are further indications of cost skimping. To take advantage of inexpensive rights-of-way (some already in public ownership), the system uses routes on the periphery of Sacramento's densest suburban areas. Indeed, both LRT lines are located along freeways (Business 80 and U.S. 50) away from the wedge of dense population. The advantage of these route locations is lower land costs; the disadvantage is greater inconvenience for potential riders in reaching the stations. It may be that long-term viability is being traded for short-term construction cost savings.[†]

Overall evaluation of Sacramento LRT

A technical re-evaluation of costs and performance of Sacramento LRT, using standard transit

evaluation procedures, reveals a project that apparently has little to recommend it into the foreseeable future. It is a fixed guideway project located in a low-density metropolitan area superimposed upon an automobile-dominated transportation system. Because of its peripheral routing, patrons will generally have to use two modes to reach the CBD, travelling to LRT stations by car or bus and then transferring to LRT trains. LRT patrons will therefore suffer inconvenience and long total trip times. Given the existence of a high-quality, relatively uncongested freeway network, the proposed, single-tracked LRT system is not likely to attract a large ridership.

From a cost standpoint, Sacramento LRT appears to be a barely supportable project. Its high capital cost makes it one of the least desired of all alternatives, when considered from a societal perspective. Even from the standpoint of a local resident, an unbiased conventional cost analysis would show the LRT project to be slightly inferior to the HOV option. And if an efficient bus-based TSM option had been formulated, LRT likely would be inferior to that option as well, even on an aggregate operating cost basis.

The LRT option, as indicated earlier in Table 1, will perform badly according to other noncost evaluation criteria. It is somewhat inferior to the HOV option in saving energy, reducing CBD parking demand, reducing travel times, and increasing transit patronage.

THE LOCAL PERSPECTIVE

Clearly, the LRT option was not selected on the basis of conventional evaluation criteria. Indeed, the manipulation of the feasibility study (DEIS) indicates that LRT was probably preselected. Why, then, did decision makers settle on LRT, even before the official alternatives analysis? What factors, other than technical criteria, were important in the decision? Were these other factors defensible? We have identified five types of local concerns that superseded the findings of the agency evaluations.

1. Earmarked state and federal funds

HOV was eligible for the \$100 million in federal funds, but not the \$25 million in state funds, which were reserved for "exclusive guideway" projects (UMTA, 1983, pp. 2-14, Sacramento Regional Transit District, 1981, p. 20). Thus local officials would have foregone \$25 million if they had chosen HOV over LRT. Not only did the Governor and Caltrans director favor LRT, but so did State funding legislation.[‡] Furthermore, the TSM and HOV alternatives would not have spent all of the federal transfer funds (the TSM alternatives would have spent \$34-\$61 mil-

[†]Right-of-way acquisition costs, including the maintenance shop, LRT vehicle storage yards, and parking at stations, were only 11% of the total project costs (Roberts and Kershaw, 1985, p. 5).

[‡]Rigid disbursement procedures that target particular transportation modes and projects are a larger problem distorting transportation investment. For a discussion relative to airport planning, see Sax (1973).

lion and the HOV alternatives only about \$73 million directly on the HOV buses and roadways [UMTA, 1981, Table S-4, Sacramento Regional Transit District, 1981, p. 12]). The other monies could have been spent on other transportation projects, however.

Even if they preferred the HOV alternative, local officials perceived that from a game-playing perspective they could maximize their gain of federal and state monies by opting for LRT now, since future state and federal funding would most likely not be available for LRT, but would be for HOV. The decision was important because most grants to local governments do not permit local choice of modes. Indeed, HOV lanes and stations could be built later in increments, adding to their chances for future funding and, indeed, local decision makers and interest groups did expect that, in any case, HOV lanes would be built later (Hagedorn, 1984, Connelly, 1984).†

2 Perceived lower operation and maintenance costs for LRT

Another explanation of support for LRT in Sacramento is rooted in the growing deficit in transit operating costs and the growing reluctance of local, state, and federal governments to cover those deficits. The federal government is disinclined to continue providing operating subsidies, the Reagan administration has sought to eliminate them completely. In California, operating subsidies are capped by statutory restriction, transit operators must cover a specified percentage of operating costs with fare revenues (about 28% in Sacramento) to be eligible for operating subsidies. Many operators, including the Sacramento Regional Transit District (which operates buses and has recently assumed responsibility for the LRT line) are having great difficulty meeting that threshold. Sacramento RT views LRT as an integral component of its strategy to increase the farebox-return ratio. As do most transit operators, RT expects their rail service to have lower operating costs per passenger than bus, mostly because of its lower ratio of drivers to carrying capacity, and therefore to have a higher farebox-return ratio. Sacramento RT already has begun restructuring the route network to facilitate feeder service when LRT is completed. It is widely expected that the substitution of LRT lines for buses will reduce operating deficits (UMTA, 1983; Isenberg, 1984, Connelly, 1984, Johnson, 1985, Collin, 1985, Sacramento City Council, 1981d, Sacramento Union, 1980b). In fact, Regional Transit's avowed financial inability to operate and maintain the number of buses required by the HOV option was instrumental in convincing many decision makers that LRT was the only feasible al-

ternative (Hultgren, 1985b, Johnson, 1985). The RT board continually underscored the lower operation and maintenance costs of LRT, urging that, "O & M costs are the bottom line" (Johnson, 1985), and "the O & M statistics favoring LRT over HOV are so obvious that you wonder why anybody would have trouble understanding them" (Sacramento Bee, 1980b) ‡

We suspect that these presumed cost savings may be illusory because maintenance costs for LRT, with its more specialized and complex maintenance requirements, will likely be higher on a unit basis than stated. Hamer (1976) reviews studies of transportation costs, and concludes that rail transit has higher total and O&M costs than autos or express buses on busways, for oneway, peak-hour line volumes of up to 12,000 passengers (pp. 36-43 and 57-58). Articulated buses increase the cost advantage for buses up to peak-hour oneway volumes of 20,000 (Hamer, 1976, p. 51).

The point, however, is that local conventional wisdom, based on biased assumptions, held that LRT would have substantially lower operating costs than buses.

We do not condone the fudging of assumptions as was done by the STDA staff in the DEIS §. Correcting the year 2000 total O&M cost projection is illuminating. If we add \$2 million to account for the too-low days-per-year factor used, as acknowledged in the DEIS (p. 3-94), and we add \$0.5 million to project a reasonable administration cost (both items were criticized by the CTC [1983b]), the LRT figure rises from \$50.5 million to \$53 million. The new, more realistic prediction is only about 5% higher and the O&M projections for *all* of the alternatives are still within a 5% range. This difference is clearly within the range of error for such projections. Proper representation of these projections would have made the fudging unnecessary, by showing that the alternatives were indistinguishable on this measure. We believe that the City Council did not take the O&M cost estimates too seriously, however, in spite of the complaints by the CTC and by UMTA, because of perceived limitations to the technical evaluation, in general.

3 Perceived evaluation shortcomings that slight LRT

Local decision makers pointed out that given the uncertainty of technical analyses, they viewed LRT as at least technically comparable to HOV. This attitude was remarkably uniform across all local officials we interviewed. In fact, in every case local officials, as well as local planners, argued that technical evaluations are inherently biased against rail transit. They claimed that evaluations do not give enough

†There is some evidence that the Army Corps builds less-efficient dams before it builds more-efficient ones in river basins, in order to maximize total project expenditures in the long run (Regev and Lee, 1975). Sacramento officials seemed to be strategizing in this way.

‡Private O&M costs for HOV (autos) were not accounted for (Roberts, 1986).

§We are unable, and unwilling, to determine if the local elected officials directed the STDA staff to fudge the O&M assumptions.

weight to LRT benefits such as elimination of diesel smoke at street level, slightly reduced freeway noise, reduced traffic congestion in the CBD, and focusing of urban growth. A widespread feeling existed in Sacramento that the state and federal transportation agency staffs were biased against rail transit. Then-Mayor Isenberg believed "the feds were more interested in buses and the CTC is oriented to freeways" (Sacramento Bee, 1984a). John Schuman, the then-executive director for STDA, pointed out that any analysis of transit alternatives will involve a local predilection for light rail, because UMTA only requires an evaluation of alternatives when the local officials desire a rail system (UMTA staff members denied this). Furthermore, Schuman believes that local planners view the UMTA staff members as biased in favor of buses and HOV (Schuman, 1984). For example, the HOV cost estimates omitted private parking costs for cars and vans in the CBD (Roberts, 1986). Overall then, the local community was highly skeptical of the findings of any evaluation study.

Ridership Local decision makers argue that evaluations of rail transit also do not take into account the superior ridership-generating characteristics of rail transit (Schumann, 1984, Gianturco, 1985, Collin, 1985, Johnson, 1985, Connelly, 1984, Rudin, 1985). Caltrans Director Gianturco, Councilman and ex-Regional Transit Board Member Johnson, and Supervisor Collin all stated without hesitation that they believed the public was much more likely to ride in trains than in buses or carpools. Indeed, Schumann noted that a 10% increment to transit patronage was added to modeled forecasts for the Portland LRT system to account for rail transit's "elusive mystique," but that UMTA disallowed that factor for Sacramento. Given the poor demonstrated ability to forecast ridership on new rail transit systems in North America, reliance on point estimates to distinguish among alternatives seems unwise.[†]

Land use efficiency Many local planners and officials felt the evaluation was flawed because it failed to consider rail transit's ability to guide urban growth (see also Cervero, 1984). Rail transit is permanently fixed, it provides the structure for future clustered development around the stations. Bus transit and freeways do not offer those advantages, they argue.

[†]We compared ridership projections with actual ridership in the first stabilized year for new rail transit systems in North America. The results for our incomplete data set, are [(actual-projected)/projected]: Miami Metrorail, -89%, San Francisco BART, -41%, Calgary LRT, -31%, Cleveland LRT, -13%, Baltimore HRT, +5%, Edmonton LRT, +13%, and San Diego LRT, +17%. We observe that the errors are large and tend toward overprojecting ridership. Since most of the other performance measures are partially determined by projected ridership, transit evaluation seems uncertain. Perhaps evaluation under a range of ridership values would yield more useful results. We could not find an ex post analysis, such as this, in any transit planning text or journal, or in UMTA publications. Apparently system proponents and agency reviewers do not systematically learn from prior experience.

Freeways encourage auto use and sprawling development, while bus transit does not guide urban growth because it is not a fixed and reliable service which prospective developers and employers can treat as given in their decision to site high-density residential developments, offices, and factories (although one can imagine creative urban governments that might contractually guarantee a certain level of bus service to a prospective developer or employer for perhaps 20 years or more). City Councilman and ex-Regional Transit Board Member Grantland Johnson asserted that, "if we want rational use of land, we have to have fixed systems" (The Sacramento Observer, 1982), and that "fixed guideway systems affect growth patterns" (Johnson, 1985). Long-time LRT study committee member Anne Rudin, Sacramento's current Mayor, averred that "light rail transit will help us plan for growth" (Sacramento Union, 1985). County Supervisor Illia Collin, "interested in controlling long-term growth," believed that LRT would better affect land use than any other option, and even claimed that the county opened the Highway 50 corridor for development in expectation of light rail there (Collin, 1985). City councilman Roberts, at a 1978 hearing on the feasibility of the historic trolley, suggested that LRT would be the most growth-directing transportation alternative (Sacramento City Council, 1978b), a notion apparently shared by most of his fellow policy makers. Although research is inconclusive, if not skeptical, of rail transit's growth-managing abilities, many local planners and officials felt otherwise, reducing the credibility of the report in their eyes.[‡]

[‡]In general, arguments that rail transit will cause clustering of new urban land uses near stations have been shown to be weak, with one clear exception: uses *within* CBDs do tend to locate near the stations. Uses do not appear to cluster near stations outside the CBD, however, and there do not appear to be shifts of growth from outside the CBD to inside (Altshuler, 1981, pp. 399-400, Johnston and Tracy, 1983, Knight and Trygg, 1975). Cities in the United States with rail transit actually have below-average growth rates (Hamer, 1976, p. 14). But these generalizations may not apply to the Sacramento case. Sacramento County rescinded three unbuilt interstate and state highway segments during the 1970s. Freeway congestion could become a problem before the year 2000 and force growth into the CBD. The CBD is the center of California's state government offices and the state has committed to a policy of keeping the offices there (California Department of General Services and State Architect's Office, 1977). Some local planners expect the light rail system to serve the state's employees quite well (Hoffacker, 1984). Pushkarev *et al* (1982, p. 189) assert that Sacramento is a "possible candidate" for light rail, since it has a relatively large CBD and unused rights-of-way. Vuchic (1981) claims (with some evidence) that rail transit increases ridership in any urban corridor, due to high level of service and visibility (pp. 84-86). He also believes that rail transit brings about efficient land use patterns and that LRT can be appropriate in cities of 200,000-300,000 population (pp. 462-465). City officials certainly expect the LRT system to enhance the CBD, otherwise they would not have contributed an additional \$22 million in redevelopment funds. A rejuvenation of the dying K Street pedestrian mall is foremost among the hopes. Upgrading of two neighborhoods on the I-80 line is also ex-

Environmental effects Environmental activists also felt the evaluation was flawed in not treating environmental and energy benefits adequately. Although the actual benefits may be small or non-existent, except in the CBD, the deployment of rail transit was expected by officials and the public to lower air pollution and reduce energy consumption by diverting trips away from autos and express buses and by relying on "cleanly" generated electricity rather than petroleum fuels. In 1979, during the second great energy crunch, many decision makers wished to avoid selecting petroleum-using transit projects, not only out of a concern for air quality (bus exhaust was thought to be especially obnoxious), but in the interests of "energy independence" as well (Hoffacker, 1984, Collin, 1985, Sacramento City Council, 1981d, Hultgren, 1984, Modern Transit Society, 1978, Sacramento Union, 1981, 1985, Sacramento Bee, 1978a, 1980a, Rudin, 1985). Although the energy and air quality benefits will be negligible at best with LRT, the widespread perception to the contrary, even among planners, further reduced the credibility of the technical evaluation †

4 The permanence and glamor of LRT

Local decision makers also preferred LRT because of its permanence (Isenberg, 1984, Johnson, 1985; Collin, 1985). Large costs sunk into a fixed system would likely necessitate continuing support and perhaps even improvements, such as double-tracking and additional routes. In fact, both of these system expansions were studied in 1984, before construction began on the starter system (Sacramento Bee, 1984b).

Civic and business interests often perceive modern rail transit as adding sophistication to the community and providing the extra traffic capacity to downtown that eases future congestion and allows more growth in office space. Anne Rudin, heavily involved in LRT planning and decisions from the outset, saw light rail as "representing good urban life in Sacramento" (Sacramento Bee, 1983e), helping to create "a colorful, bustling downtown" (Sacramento Union, 1985), by "attracting shops, malls and restaurants" (Sacramento Bee, 1983a). Other public officials and pro-transit groups shared her sentiments (Isenberg, 1984, Connelly, 1984; Hagedorn, 1984, Hultgren, 1984, 1985a, Collin, 1985, Modern Transit Society, 1978).

Voters in 1979 rejected a 0.25% extra sales tax to

support RT bus service, by 56% (for) to 44% (against), less than the two-thirds majority required in California to approve new local taxes (Schuman and Nelson, 1982, p. 23). Perhaps politicians see LRT as capable of gaining fiscal support through such a dedicated local tax in the future (there are incidental references to the possibility that both HOV and LRT will need a dedicated local tax in the DEIS at pp. 4-191 and 4-192).

5. Other political motivations

Politicians have little reason to oppose LRT investments, and many reasons to support them—even more so now than in the 1960s and 1970s. Through the mid-1970s, the new generation of rail transit technology was still untested and therefore of unknown reliability. The initial modern rail transit technologies (e.g., light rail in Boston, heavy rail in the San Francisco region) indeed were unreliable and justifiably criticized. At the same time, there had been expectations that rail transit would reduce, even eliminate the growing operating cost deficits of mass transit.

By the 1980s, rail transit technology was no longer new or risky; it had been improved and was fairly reliable. The earlier cost performance expectations had dissolved; massive operating deficits were accepted as the new reality. As a result of improved technological performance and diminished expectations of financial performance, future rail transit projects are unlikely to be perceived politically as failures. Rail transit is likely to enhance the image of politicians who support it, both during and after their tenure in office,‡ although extreme disasters, perhaps including the Miami Metro, may turn out to be exceptions §

The interests and perspectives of local political leaders tend to place them in support of rail projects. They observe that rail transit projects are viewed as positive along most dimensions by diverse constituencies: they appeal to business and environmental interests, transit-dependent travelers, and to the general civic pride of residents.

The Sacramento light rail project has enjoyed broad public support. A survey in 1984 showed that about 63% of respondents in the city and the county supported LRT (Sacramento Bee, 1984c). A 1983 poll had showed 61% in favor (Sacramento Bee, 1983f). More impressively, the support has been remarkably broad. At the 1981 City Council meeting endorsing LRT, Mayor Phil Eisenberg enthused that it was "the only government proposal that had such a wide variety of support from people who normally

pected. Thus, even though research suggests that new rail transit affects land use changes only under the most auspicious circumstances, there are enough caveats and uncertainties that analysts and lay persons alike would not be wrong to claim potential land use benefits from Sacramento's LRT. As of early 1986, over \$1.5 million had been committed by private landowners near stations for "joint developments" to increase access to their buildings.

†Lave (1978) and Hamer (1976, p. 28) have demonstrated that rail transit is less energy efficient than buses (and even some recent-model autos) and that it increases building in CBDs, resulting in more auto trips in the CBD, which lowers air quality.

‡In personal interviews, though, officials (perhaps self-righteously) claimed that LRT's most ardent supporters were not concerned with political advancement but were "genuinely convinced by the merits of the project" (Gianturco, 1985, Collin, 1985). We hypothesize, however, that the wider base of support is premised on the low political risk to those individual politicians.

§Miami Metrorail has very low ridership (Dorschner, 1985). See footnote on page 468.

do not even talk to each other" (Sacramento City Council, 1981d) The Preferred Alternative Report (SACOG, 1981, p. 48) lists an unusually diverse group of supporters, from the Sierra Club to the Sacramento Board of Realtors. Public testimony at city (and, to a lesser extent, county) meetings was decidedly supportive and representative of a wide range of interests (Sacramento City Council, 1977a, 1979a, 1979c, 1981b).

Local officials credit the extraordinary number of public hearings (about 200) and the persistence and ability of grass-roots pro-transit groups—mainly the MTS—with galvanizing public support and providing a sense that the decisions were well considered and well-backed. Isenberg and Anne Rudin from the City Council and Collin and Ted Sheedy from the County emphasized that the LRT study was "exhaustive—the most in depth ever done—even overdone" (Sacramento City Council, 1977b, also Sacramento County Board of Supervisors, 1979b). Isenberg, Collin, Gianturco, Connelly, the Sacramento Bee and the Sacramento Union acknowledged that without the efforts of the MTS, there may have been no LRT (Sacramento City Council, 1981d, Collin, 1985; Gianturco, 1985, Sacramento Bee, 1983c, 1983d; Sacramento Union, 1978). MTS members lobbied heavily at public hearings, often presenting public declarations of support, and were consulted by politicians and planning and transportation staff (Sacramento City Council, 1977a).

Light rail detractors were few and far between. City Councilman Blain Fischer was a consistent opponent, asserting that light rail will go only "to nice areas where people have cars" (Sacramento City Council, 1978b), to the neglect of the poor and that the romance with light rail "will end in divorce" because of "terrific upkeep costs" (Sacramento City Council, 1981d, Sacramento Bee, 1981a). A number of individuals and businesses that stood to benefit from the I-80 bypass opposed dropping it, but most of these were mollified when the minor improvements they wanted were made anyway (Gianturco, 1985, Hultgren, 1985a, Sacramento City Council, 1979b). A few neighborhood groups felt that LRT would bring in too many people and cars (which resulted in some stations being dropped in order to reduce opposition) (Sacramento Bee, 1982), and several individuals were concerned about pedestrian/LRT conflicts on the downtown K Street Pedestrian Mall (Sacramento City Council, 1981d, Sacramento Bee, 1981b). One local columnist wrote against light rail (Sacramento Union, 1983) and RT's general manager in 1980 also opposed LRT (Sacramento Bee, 1980b),[†] but the local opposition was relatively insignificant.

Local leaders see little hope of building new high-

capacity arterials and freeways, such projects are extremely expensive and would likely face determined opposition from affected neighborhoods. It would be a long and painful process, politically and financially, to gain approval for a new freeway in built-up areas of the county now. Even projects such as new bridges face opposition from people who complain of the aesthetic impact on scenic vistas and the increases in neighborhood traffic. On the other hand, as noted above, a light rail project does not generate nearly as much opposition (Connelly, 1984). It has the advantage that it occupies a narrow right-of-way. In lower density non-CBD areas, there are often abandoned or little-used railroad rights-of-way that can be used for rail transit. In the denser central city areas, light rail may share the right-of-way with vehicle traffic, sometimes in medians or shoulders separated from vehicles, at other times sharing traffic lanes. LRT generally does not require substantial expropriation of residential land, displacement of people, or disturbance of existing neighborhoods.[‡]

CONCLUDING DISCUSSION

We identified five types of arguments that support LRT. Even though in some cases they were based on mistaken local perceptions of project effects, these are motivations typically pursued by local leaders and citizens groups striving to improve the image of their city and to attract capital and to enhance their political standing. There appears to be a worldwide perception that modern rail transit is a low-risk, high-profile, public works investment that bestows prestige on the local area (see Sperling, 1981). Sacramento, dwarfed in size and sophistication by the Los Angeles and Oakland/San Francisco metropolitan areas, seeks that prestige.[§]

Our findings agree with those of Lupo *et al* (1971) in their examination of U.S. transportation politics. They found that rail "transit extensions tend to be justified in terms of what they will do to land use along their route" (p. 201), and that "other motivations sometimes enter into the design of transit plans. One 'other motivation' is to reduce the need for unpopular additional highways. A second is the doubtful assumption that expansion of rapid transit systems will result in a reduction of the transit deficit" (p. 202).

Leaders in Sacramento and other metropolitan areas hesitate to look too closely at the likely financial, environmental, and transportation effects of deploying rail transit. They know rail transit (especially light rail transit) is an infrastructure investment that is realizable, they sense it is not a "bad" investment

[†]This general manager opposed LRT and was fired, ostensibly for poor management practices. The RT Board sought, and found, a new manager who supported LRT. The DEIS was in progress during this period.

[‡]Only three businesses and eight dwellings were demolished (Roberts and Kershaw, 1985, p. 5).

[§]Supervisor Collin declared that with the advent of LRT, Sacramento "would not be a cowtown anymore" (Collin, 1985). John Schumann asserted that Sacramento warrants LRT because it "is no longer just a valley town" (Sacramento Bee, 1983b). (See also Sacramento Bee, 1984c.)

in that it will provide a level of service roughly comparable to bus transit. A transit investment of \$130 or \$160 million for an area the size of Sacramento is not exceptional. Sewage treatment plants may cost \$200 million or more and urban freeways may cost \$50 million or more *per mile* in metropolises of this size. Indeed, the LRT project was intended to replace (cost-wise) only a 5.1 mile straightening of an existing freeway. LRT in Sacramento is marginal in what it offers, but it is also a marginal investment increment to the transportation and infrastructure base. Given the constraints on funding new transportation improvements and the favorable image of rail transit, it is not surprising that cities close their ears to criticism from funding agencies and clamor for new rail transit projects.

Recommendations concerning transit evaluation

This review of the Sacramento LRT experience shows that the evaluation of transit alternatives by UMTA suffered serious shortcomings. The first problem was the lack of consideration of all valid local concerns in the evaluation. The federal and state transportation planners involved characterized many of the local concerns as "political." The local officials, however, felt strongly that many important considerations were underemphasized in the transit evaluation.

The second problem in the Sacramento transit evaluation was the lack of concern for uncertainty in the projections (Ascher, 1979). Recent history indicates it is very difficult to make accurate projections. One cannot confidently model mode choice decisions and accurately project transit ridership, much less specify the long-term effects of transit deployment on land use, economic development, and environmental quality.

These two problems, local relevance and technical accuracy, interact. In Sacramento, the uncertainties in the analysis were so large that a convincing case for or against rail transit could not be made *on narrow cost-effectiveness grounds*. The past use of an arbitrary 10% "mystique" ridership factor by UMTA (in Portland) illustrates the inability to forecast demand and evaluate performance reliably. The failure to specify uncertainty in the forecasts weakened the credibility of the study. Local politicians and RT officials focussed their attention on total O&M costs, the single technical measure by which LRT was found superior, yet there was little recognition of the uncertainty of that projection in the documents. Indeed, the small O&M advantage for LRT was, as demonstrated in this paper, arrived at through biased assumptions. The O&M costs for LRT and HOV were not significantly different, even if the LRT figure was corrected. However, Wildavsky and Tenenbaum (1981) note that, "where the political arena is polarized, small differences among estimates are magnified if participants feel they have a stake in the estimates" (p. 229). That observation was vividly illustrated in Sacramento.

Uncertain performance measures were used by UMTA to create a false distinction. System productivity measures are usually framed as total annual cost per rider or per new rider. Ridership is difficult to forecast, however. Rail systems recently completed in North America have actual riderships that range from 89% below to 13% above predicted levels (see footnote on page 468). Local officials saw the UMTA staff as being political in asserting that HOV was superior on the basis of total cost per passenger, when the projections differed by only about 11% (see Table 1).

How then can transportation agencies improve their evaluation methods so that uncertainty is acknowledged and the important values of local interest groups are considered? UMTA is advisory to Congress. Congress and its committees generally show concern for both national efficiency and for local desires in their decision-making. It seems to us that UMTA can have more influence on transit funding decisions if it incorporates legitimate local concerns into its evaluations and if it acknowledges uncertainty in all of its performance and impact projections.

We believe that there can be valid local concerns beyond system performance. Local groups may predict national efficiency gains not included in the normal UMTA efficiency criteria. Local pride is an example of a nonmarket benefit that could be larger with LRT than with HOV in an alternatives analysis of a corridor. Amenity values have long been recognized as national efficiency gains in economics (see Fisher, 1981, for a review). Another welfare gain under LRT in a corridor study could be the greater reduction in diesel fumes in the CBD. These national efficiency effects should be counted in a transit evaluation, at least to distinguish among alternatives that are a tie on system performance criteria. We do not consider some of the local concerns noted in the previous section as legitimate evaluation criteria, including the local maximization of federal and state grant monies and the enhancement of political careers. Nevertheless, we conclude that there were valid local concerns that were not included in the evaluation.

Scholars have long suggested that local concerns be formally evaluated in water project planning (Bromley, *et al.*, 1971). This problem was officially recognized in water resources planning by Senate Document 97 in 1962 and in the Water Resources Council's 1973 Principles and Standards for plan and project evaluation. This system explicitly recommends the evaluation of nonmarket economic benefits and costs, such as environmental quality and social well-being, as well as traditional components of national economic efficiency.

In transportation planning, major official studies have produced broad evaluation frameworks that take local concerns into account (see Manheim, *et al.*, 1971). The OECD (1976) states that, "cost-benefit analysis is an important part of the decision mak-

ing process but is insufficient and cannot replace the role of the decision maker" (p. iii). An overview of politically relevant urban development policy evaluation methods is provided by Litchfield *et al.* (1975). Johnston (1977), for instance, found that the evaluation criteria for the third London Airport study were narrowly confined to aggregate performance indicators, against which the alternatives did not vary significantly, and that much more important project impacts were ignored.

Concern for these other impacts is often expressed in political decisionmaking. Wildavsky and Tenenbaum (1981), in a study of U.S. energy policy, state that, "more often than not data have prescribed the outer limits of agreement but, within the arena, politics have dominated data" (p. 308). We argued in the Introduction that such distributional politics is normal in the United States. What we need for the evaluation of major transit investments, then, is a system that gives primary weight to performance criteria but that invokes additional legitimate local criteria when alternatives are fairly close on these cost-effectiveness projections.[†]

UMTA recently adopted a revised system for evaluating transit investments (UMTA 1984a, UMTA 1984b). This method uses technical performance projections to prescribe "the outer limits of agreement," but also allows local political considerations to figure prominently, within those bounds. UMTA faces the same problem with Congress as it did with the Sacramento City Council: the evaluation system needs to be technically sound, while not relying too heavily on shaky technical projections, and must be broad enough to include legitimate welfare concerns not represented in technical measures but raised by local officials. While UMTA's evaluation procedure used to analyze LRT in Sacramento failed these tests, the subsequently adopted method appears to be more acceptable as a policy evaluation tool.

The UMTA system uses two performance threshold tests to eliminate "clearly unattractive proposals" (UMTA 1984b, p. 3). Before entering alternatives analysis, a corridor must have at least 15,000 daily linked transit trips and the transit mode must have a total annual cost per new rider of \$10.00 or less (for 1985 funding proposals). These two screening criteria are not very restrictive and are designed to cut off only very inefficient projects early in the funding process.

To pass from alternatives analysis into preliminary engineering, projects must pass three additional performance threshold tests: (1) transit ridership must be proposed to increase as a result of the investments, (2) the preferred alternative must be the least expensive alternative at that level of ridership, and (3) the project must have a total annual cost per new rider of \$6.00 or less (for 1985 proposals). The cost per new rider constraint is lowered from the \$10.00

used in the first screening to reflect the greater certainty of the more complete studies, at this stage. It is still not a very restrictive constraint, however.

At both screening stages, projects are only loosely ranked according to the technical measures into high, moderate, and low categories. Within these categories, projects are not discretely ranked, due to technical uncertainty in the projections. For example, total annual costs of \$1.50 and \$1.70 per new rider "are considered indistinguishable" (13% difference) (UMTA 1984b, p. 17). Further ranking within the three categories is carried out "judgmentally." This rating relies primarily on the degree of local financial commitment and, to a lesser degree, on the adoption of appropriate local land use and CBD parking policies.

While the 1984 UMTA evaluation system is intended for annual, city-to-city (new start) project comparisons, it also applies to evaluating alternatives in one city, as when interstate transfer funds are to be spent. It appears that if this evaluation method had been applied in 1981 and 1982 to the evaluation of LRT in Sacramento, the evaluation would have concluded that HOV and LRT were indistinguishable in terms of total cost per passenger (11% difference), O&M cost per passenger (2% difference), and total O&M cost (4% difference) (Table 1).[‡] Instead of the federal and state transportation officials pointing to the total cost per passenger projections (favoring HOV) and the local officials espousing the total O&M cost projections (favoring LRT) and arguing past each other, everyone could have agreed that these two alternatives were a tie on these criteria and moved on to other criteria, such as local pride and political support for implementation.

The new UMTA transit evaluation method admits to technical uncertainty, which increases its political acceptability and its scientific validity. It also leaves room for the value of local political effort, increasing its appeal to local officials and to Congress. Local political "support," per se, is not given much weight by UMTA, however. The UMTA political criteria do reward local politicians, however, for taking actions to enhance future transit system performance. Once their project is in the top general class of projects, local officials can advance its rank by increasing the local financial capital contribution, adopting a dedicated funding source for O&M, enacting supportive zoning policies around stations, and restricting CBD parking. These criteria which reward concrete local action may serve to direct local political energies into system improvement, rather than into futile disagreements over performance projections.

[†]Such a method technically can be classified as "satisficing combined with lexicography" (MacCrimmon, 1968).

[‡]The Sacramento evaluation relied on total cost per rider, rather than total cost per new rider, as UMTA now does. We ignore this and other problems (the 15,000 daily linked trips constraint and the increasing ridership constraint) in applying the 1984 UMTA evaluation method to our case. We will critique the details of the UMTA evaluation policy in a subsequent article.

The Sacramento experience shows the need for such an evaluation system

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