Commuter Parking Versus Transit-Oriented Development

Evaluation Methodology

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Transit agencies face a tension between providing commuter parking at rail stations and encouraging transit-oriented development (TOD) on the land the parking occupies. This paper describes a multiobjective model designed to facilitate decision making about TOD and commuter parking. The model, developed by the San Francisco Bay Area Rapid Transit District (BART) in California to facilitate station planning and development, examines ridership impacts, fiscal impacts, and qualitative factors. The analysis shows the conditions under which positive ridership and fiscal outcomes occur if BART deviates from its practice of requiring one-to-one replacement of commuter parking. Using the MacArthur and San Leandro stations as case studies, the analysis reveals the substantial opportunity cost of retaining transit agency land in surface parking as well as the sensitivity of results to local conditions and policy. The spreadsheet-based methodology is adaptable to a wide variety of situations. The paper concludes with observations about how this model affected perceptions and policy deliberations of transit agency staff and elected officials.

Requiring one-to-one replacement of rail transit commuter parking for all transit-oriented developments (TODs) on transit agency land can be a misguided policy. Although this approach may be appropriate in some settings, transit agencies should examine the full range of ridership, fiscal, and other impacts when making these choices. This paper describes how the Bay Area Rapid Transit District (BART) in California developed a model to improve decision making on TOD and commuter parking. For most of its history, BART's replacement parking practice had been that any development on BART land must replace, on a one-to-one basis, the existing commuter parking. This long-standing practice undermined the economics of TOD on BART land, as few projects produced positive ground rents. This paper also considers the role of this model in addressing conceptual challenges that often impede change. The authors worked on this model as a staff member (V.M.) and a consultant (R.W.).

BART has a coherent planning framework that includes a strategic plan and implementing policies, but BART's precedent-based, across-the-board practice concerning replacement parking had impeded the implementation of TODs. The lack of an analytic method to address different views on replacement parking affected the expectations of staff, negotiation positions, organizational roles, the politics of the BART Board, and relationships with cities, other transit agencies, developers, and other stakeholders.

Replacement parking is an important issue in the broader context of TOD. Belzer and Autler (*1*) and Ditmmar and Ohland (*2*) identified the tension between the role of transit stations as a transportation node and as a place (commuter parking and bus terminals versus TOD), and noted the fragmented regulatory and policy environment for considering TOD (transit agency, city, and many others). Cervero et al. (*3, 4*) criticized full replacement parking as placing a high value on near-term ridership generated from parking and riding instead of realizing broader benefits that result from creating communities around transit stations. The literature on TOD discusses parking requirements for new development more frequently than how transit agencies should decide on replacement parking policy (*5, 6*).

BART SYSTEM

BART provides 305,000 daily transit trips at 43 stations and manages more than 46,000 parking spaces in surface parking lots and structured garages. As indicated in Figure 1, the system covers 104 mi of track linking four Bay Area counties (Alameda, Contra Costa, San Francisco, and San Mateo).

BART has provided heavy rail transit service to the Bay Area for 34 years. As federal, state, regional, and BART's own policies on transportation and land use coordination have evolved, interest has grown in concentrating the region's residential and employment growth around a "network of neighborhoods," with BART as the regional transit armature. One obstacle to fully realizing TOD at these stations is tension between this goal and BART's need to provide access to its suburban stations (traditionally emphasizing automobile access). BART's Board of Directors is directly elected to represent districts that vary widely in spatial and demographic characteristics. BART's 2003 Strategic Plan is at the top of a multi-tiered planning process (*7*). It provides a broad vision, agenda, policy, and strategy. BART uses policy frameworks to flesh out approaches to specific issues.

The following specific replacement parking questions are facing BART: (*a*) what level of commuter parking (if any) should be replaced when joint development projects are built on BART's station-area land, and (*b*) should there be an across-the-board policy or a case-by-case decision-making process contingent on local context?

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FIGURE 1 BART system map.

REPLACEMENT PARKING ISSUE

BART is a major land owner in the Bay Area region, with land assets in strategic, high-value locations. Land devoted to parking generates revenue from the fares paid by automobile access commuters. Parking creates operating costs for BART, but for many years did not generate direct revenues. BART now charges for parking at many stations and has recognized that its land assets can generate more revenue through parking charges, additions to parking supply, ground rents from joint development, or a combination of those elements. The key to unlocking this revenue potential is to find creative station access and replacement parking solutions for BART, local communities, and other stakeholders.

BART's approach to this issue was shaped by the following factors:

- Ridership increases associated with economic and population growth, combined with increasing roadway congestion;
- Increased use of parking management techniques at BART stations;
- Increased interest in TOD; and
- A need for stable, unrestricted revenue sources to augment fare and grant revenues.

BART's long-standing practice was requiring one-to-one replacement parking even though the 1984 Station Area Development Policy allowed for deviations. That policy seeks an economic return from joint development over and above replacement parking. It allows for parking goals to be established on a line basis. BART's 2000 Access Management and Improvement Policy (Access Policy) allows for variation from one-to-one replacement in the following policy: "Parking . . . could be increased or reduced to achieve higher ridership in the context of overall station area development and access planning" (*7*). There had been modest deviations from one-to-one replacement in a few projects, but the process was ad hoc and created uncertainty for cities and developers. This replacement parking practice was out of step with BART's policy direction because it focused on only one access mode (those who drive and park) and was not performance based.

Despite the flexibility mentioned previously, BART staff were reluctant to propose TODs with significant deviations from one-to-one replacement because of a lack of consensus at the department and board levels. As a result, TOD and joint developments were occurring at a slow pace. Replacement parking for TODs was costing more than $15,000 per space, preventing otherwise desirable joint development projects from being implemented.

CONCEPTUAL BLOCKS AND ROLES OF A MODEL

Conceptual blocks can impede thinking about this issue. For example, one conceptual block is a view among agency staff or directors that "the developer owes us replacement parking." This way of thinking conflates the replacement parking issue with value capture. Strict replacement provisions are only one way of capturing the value provided by the transit-accessible site.

Another conceptual block is the possibility of ridership loss if full parking replacement does not occur. To explore this issue, the effect of converting 1 acre of surface parking to a TOD with no replacement parking was shown. With data on ridership, mode choice, and other factors, the analysis confirmed that there would be a net ridership loss under this scenario unless the TOD was high density. As a surface parking lot, 1 acre provides about 124 spaces. That number of spaces generates 136 daily boardings under the model's assumptions. If half of those boardings are lost because BART riders are unable or unwilling to find an alternative BART access mode, then BART would lose 68 daily boardings or 136 rides (assuming two trips per station boarding). If the surface parking is replaced by residential development at 60 units per acre, then those residents would generate 66 rides per day under the BART mode share estimates and ITE trip generation rates. The potential loss of 70 rides in this scenario contributed to a view that rejected any alternative to full replacement parking. An either-or way of thinking—parking or development—was blocking consideration of alternatives.

THE MODEL

Process

Principles to guide the model were developed in consultation with BART managers representing the affected internal departments (*8*). Input was also sought from four California cities that would serve as test cases for the methodology (Concord, Oakland, El Cerrito, and San Leandro). Finally, input was sought from developers, cities, transit operators, community members, funding partners, and elected officials in a series of workshops organized as part of BART's Joint Development Policy Review panel.

Most external stakeholders supported BART moving toward a new approach to replacement parking because they saw how the one-for-one practice impeded TOD. Replacement parking decisions require the involvement of multiple stakeholders and agencies, so an open, iterative methodology was preferred. In particular, bus operators and other access providers have a strong influence on future station access. Also, community starting points for considering these issues vary widely, depending on local perspectives about density, parking regulations, and land use issues. The model did not include other stakeholders' issues, focusing instead on BART's objectives and providing a suggested analytic approach for use by other stakeholders. It sought to achieve a balance between comprehensiveness and practicality, avoiding the impression of an analytic black box.

Process principles concerning the model include (*a*) integrating with other BART policies; (*b*) fostering creativity by developers, transit partners, and others; and (*c*) providing transparency and predictability to all parties. Quantitative outcome principles include (*a*) enhanced ridership, and (*b*) BART's fiscal health. Qualitative outcome principles include (*a*) reducing drive-alone station access, (*c*) long-term management of BART capacity, (*c*) consistency with other BART plans, (*d*) context-appropriate projects with local support, and (*e*) contribution to regional objectives. The model anticipates that additional criteria may apply to specific station areas and allows for that possibility.

Structure

The model relies on a four-step framework applied at the station level. It includes the following:

1. Identifying policy and context issues that affect TOD scenarios;
2. Building scenarios of TOD, parking, and access strategies;
3. Evaluating those scenarios; and
4. Selecting preferred strategies and writing solicitation specifications.

The first step is to summarize the policy context and opportunities to increase station ridership, assembling data on station characteristics (current ridership, parking capacity and occupancy, feeder transit, and other access modes), population and employment within a ½-mi radius, and the direction provided by BART's adopted policies and local jurisdictions' land use plans. The second step is preparation of access and TOD scenarios. These scenarios are detailed and refined later when a development team has been selected and the proposals have matured. In the third step, each scenario is evaluated based on a linked spreadsheet model and other assessment based on the established criteria for that station.

Figure 2 presents the structure of the quantitative portion of Step 3 of the process—evaluating scenarios to determine the net fiscal impact for BART. The top of the figure shows ridership estimate procedures, based on the proposed development program, BART ridership factors, and major access investments. The model estimates ridership loss due to reduction of parking supply (if fully occupied) and the introduction of parking charges. The access mode shift estimate is sensitive to the availability of nonautomobile access modes at each station. These procedures require the analyst to enter local data on aspects such as station access mode choice, to make expert judgments about appropriate elasticities, and to gain information on the development intensities likely to be allowed by the local land use jurisdiction. The bottom of Figure 2 shows the logic of the financial impact calculations, taking into account revenues and costs from new ridership, parking, ground leases, and other programs.

Analysis Factors and Variables

Table 1 presents the main sources of data used in the model. The values of each data element are defined specific to the particular station and TOD context. They must be updated over time to ensure that the model inputs are valid and to recognize trends in external factors such as gasoline prices, real estate demand, and local land use policies.

The model relies on a process of structured, data-driven expert judgment to assess ridership impacts of parking charges and parking supply reductions. A nested logit model of commuter mode choice would be a desirable method of making these predictions, but such a model has not been developed for the Bay Area. The model's structure allows for such a model to be included in the future. However, sensitivity analysis with different elasticity effects shows that their impact does not play a large part in the overall revenues and costs.

CASE STUDIES

The merits of alternative approaches to replacement parking and TOD depend on local real estate and transportation conditions. To illustrate the functioning of the model, this section presents the results of analysis for two case study stations. The MacArthur Station case study, which is presented in more detail, shows the trade-offs for an urban station context; the San Leandro case shows the trade-offs for a more suburban station context.

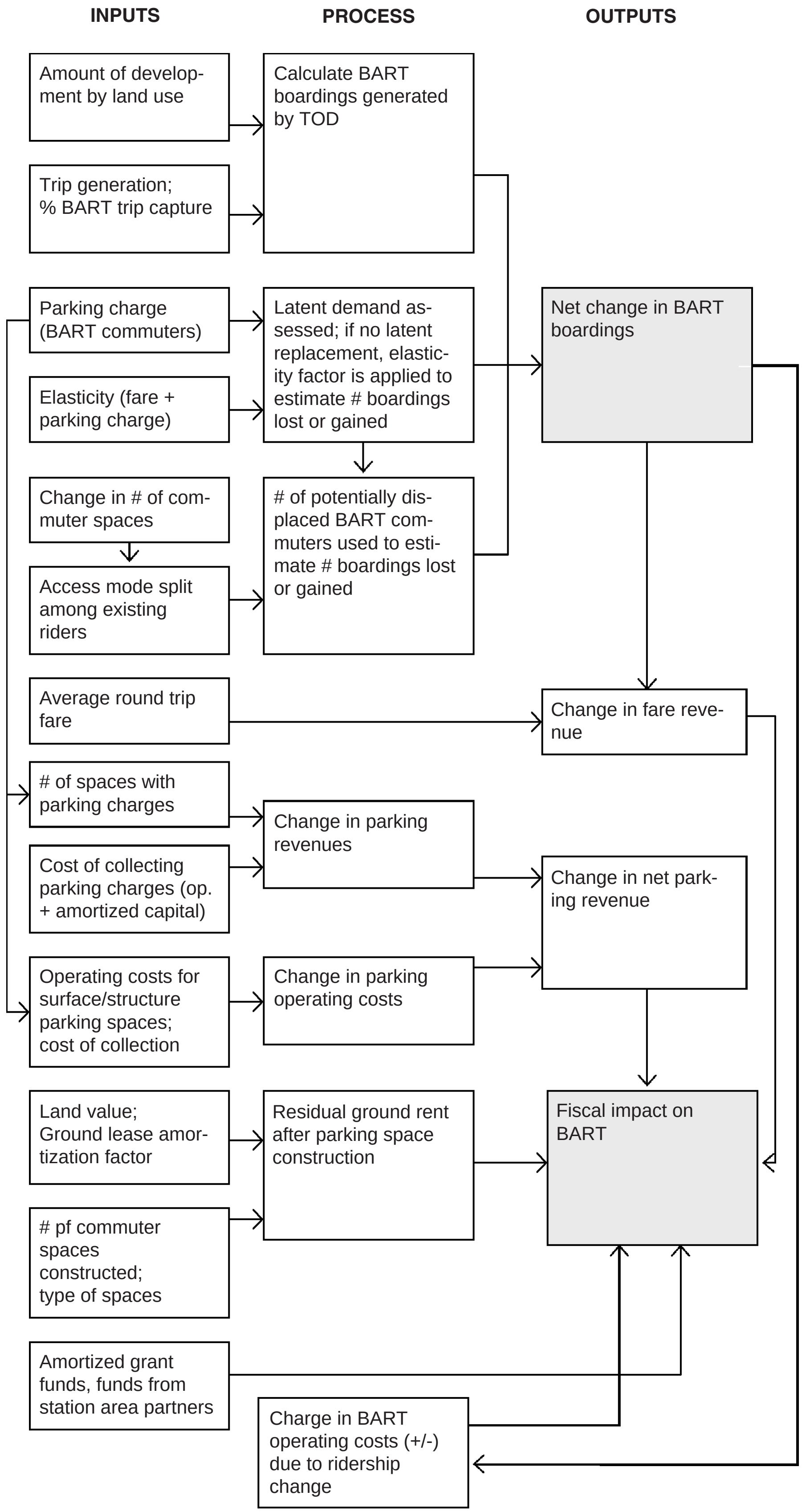

FIGURE 2 Conceptual structure of ridership and fiscal model.

TABLE 1 Sources of Data (*9*, *10*)

Type of Data	Primary Sources
TOD scenarios—development intensity, land value, ground lease amortization rates, construction costs, change in the number of commuter spaces, parking charges, likely grant fund availability	BART property development department, using data collected as part of ongoing joint development and expert judgment, with feedback from cities
Fares, operating costs, parking operating costs, cost of collecting parking charges	BART access department, based on ridership surveys, financial records
Trip generation rates for TOD	ITE trip generation handbook
% BART capture of transit trips for new development	California assessment of transit ridership in TODs (*9*)
Access mode split among existing riders; availability of alternative station access modes	BART surveys of station access (*10*)
Elasticity of demand for transit and parking	Review of literature on parking and fare elasticities

MacArthur Station Case Study

The MacArthur Station is a centrally located station in the city of Oakland (see Figure 1). This East Bay location provides an urban setting, with 9,531 persons living within a ½-mi radius and 5,619 jobs within a ½-mi radius. Table 2 indicates a relatively low level of existing BART parking (603 spaces) and high levels of use of alternative access modes. There are many possible variations for replacement parking—for example, no replacement, alternative access provisions, replacement at another station, and so forth. Community views on replacement parking are mixed. Figure 3 shows the surface parking lot that makes up a large part of the joint development site.

Table 3 describes three scenarios that were tested with the model. Although the methodology can isolate the effect of one change at a time, the scenarios vary multiple factors: intensity of development, amount of replacement parking, parking ratios for the development, parking charge policies, and investments in alternative access modes. Constructing comprehensive scenarios reflecting conservative and aggressive approaches was the best way to show the impacts of alternatives. Predicted ridership impacts are shown at the bottom of Table 3.

Table 4 summarizes the financial impact. All scenarios show positive outcomes compared with the status quo. No ridership loss is predicted to occur in the scenario that includes parking charges because latent demand for station parking is predicted to replace any riders lost because of those charges. Scenario A produces negative ground rent, indicating that additional funding sources would be necessary to make the project feasible. However, the overall fiscal impact is positive because the increased fare revenue overcomes the negative ground rent. Scenario B produces a more positive fiscal outcome, although ridership gain is the smallest of the three scenarios. Scenario C indicates the potential of higher parking charges, other access improvements, and aggressive development plans in producing the greatest overall benefits in terms of ridership, revenues, and urban-planning outcomes. It includes BART funding $1 million in bus transfer capital facilities and funding ongoing transit and shuttle access. Ground rent shown is associated with changes in parking requirements only. It does not reflect additional ground rent associated with the higher development intensities of some scenarios or other forms of revenue participation.

The full evaluation includes narratives concerning qualitative criteria such as station access mode shift, compatibility with long-term BART capacity, and compatibility with local and regional goals. The high land value of this location drives the positive financial results of Scenarios B and C, but that information did not supersede qualitative issues such as community vision(s) and trust in the city and BART. Instead of driving the selection of an alternative, the quantitative analysis provides information on trade-offs associated with the choices.

San Leandro Case Study

The City of San Leandro is also in the East Bay but provides a lower density land use context (see Figure 1). This is a suburban location with lower potential for dense development that was not ready for

TABLE 2 MacArthur Station Context

Characteristic	Condition
Station weekday ridership ’04 (exits)	6,028
Average weekday round trip fare	$4.86
Weighted average service density	23 trains per hour
Station draw	Generally within a 1 mi radius of the station
Parking utilization @ 1:00 p.m.	100%
# BART spaces per weekday rider	0.10
Other parking-related access issues	Private parking providers at nearby West Oakland station charge $6 per day, indicating strong market demand.
Other station access modes	Transit—20%, pedestrian—27%, bicycle—4%

FIGURE 3 MacArthur Station joint development site.

TABLE 3 MacArthur Station Scenarios and Ridership Impacts

	Scenario A—Medium Intensity Project with Status Quo Parking	Scenario B—Medium Intensity Project with Reduced Parking	Scenario C—Higher Intensity Project with Aggressive Parking Policies
Assumptions			
Housing (units)	575	575	650
Retail (sf)	41,000	41,000	103,000
Medical office (sf)	14,000	14,000	60,000
Community use (sf)	4,500	4,500	6,000
BART parking on-site	603	302	302
Parking for TOD	853	853	1,323
Parking charges for general use spaces	None	$1 per day on 151 spaces	$3 per day on all spaces
New transit–shuttle programs	None	None	Relocated bus transfer facility. Improved AC Transit or private shuttle.
Ridership impacts			
Joint development	962	962	1,636
Change in BART commuter parking supply	0	–324	–324
Other access programs	0	0	100
Net impact on boardings	962	638	1,411

AC = Alameda and Contra Costa Counties.

the parking charges on commuter spaces. Table 5 summarizes the characteristics of the station and station area.

Table 6 indicates that none of the scenarios produces a favorable fiscal result. This reflects the lower density, lower land value associated with the scenario as well as the lack of revenue production from parking. These results show how the cost of building replacement parking in structures creates a financial impediment to TOD in lower-density areas. In these stations, it may be best to wait until market values go up, increased density is allowed, or parking pricing and on-street parking management is accepted.

Validation

It would be desirable to validate the model by testing a TOD that has been built on BART parking. Unfortunately, BART has not completed a major TOD on station area parking without parking replacement, so before-and-after data are unavailable. Partial validation is available from BART's experience with parking charges in terms of the impact on ridership and costs of collection. As BART moves forward with TOD on station area parking, careful before-and-after data collection will permit validation.

CONCLUSIONS BASED ON MODEL TESTING

The model provides a method for transit agencies to evaluate alternatives to one-to-one replacement parking for their joint development projects. TOD projects can produce a substantial stream of revenue from increased fares and ground rent. Finding creative access and replacement parking arrangements can make joint development feasible and unlock a reliable, unrestricted cash flow. The model results show that leaving transit agencies' land resources in surface parking involves a substantial opportunity cost in some station contexts.

Applying the model to multiple station contexts leads to the following general conclusions about the parameters of joint development

TABLE 4 MacArthur Fiscal Analysis

	Type of Fiscal Impact	Scenario A—Medium Intensity Project with Status Quo Parking	Scenario B—Medium Intensity Project with Reduced Parking	Scenario C—Higher Intensity Project with Aggressive Parking Policies
Annual revenue factors	Fares from net change in riders	$622,810	$412,759	$913,448
	Parking charges (net)	$0	$24,141	$77,243
	Ground rent after replacement parking ($30/sf land value)	($126,900)	$326,100	$326,100
Annual cost factors	BART parking operating costs (maintenance, security,)	($111,302)	$50,522	$50,522
	BART participation in operating costs for new access modes	$0	$0	($180,000)
	BART participation in access capital improvements (annualized)	$0	$0	($100,000)
Net annual impact (sum of revenues and costs)		$384,609	$813,552	$1,087,313

TABLE 5 San Leandro Station Context

Characteristic	Condition
Station weekday ridership ’04 (exits)	4,790
Average weekday round trip fare	$5.28
Weighted average service density	21.6 trains per hour
Station draw	Generally a 1- to 1.5-mi radius of the station
Parking utilization @ 1 p.m.	100%
# BART spaces per weekday rider	0.26
Other parking-related access issues	Relocation of parking would facilitate city redevelopment plans. Overflow parking is occurring on private property.
Other station access modes	Transit 15%, pedestrian 18%, bicycle 2%.

and replacement parking strategies. The model has been applied to a dozen station contexts in the BART system. Table 7 summarizes the most influential variables and their impact on the creation of net fiscal benefit in three generalized settings. Within this general framework, the introduction of more aggressive commuter parking pricing and greater development density improves performance.

Market feasibility and pro forma analysis are needed to use this model fully, because different TOD scenarios influence not only parking replacement costs, but also the potential scope and revenue creation and underlying land value of the joint development project. In addition, model accuracy would benefit from more sophisticated methods of estimating the ridership impact of commuter parking supply reductions and pricing initiatives.

COMMENTARY ABOUT PROCESS

The analytic work indicates that eliminating subsidized surface parking from the TOD equation improves outcomes. This may appear to be intuitively obvious, but TOD decision making is local and precedent based. In this instance, the BART staff and board needed an analytic tool before they changed a standard practice with a 20-year history.

Developing this model revealed tensions among organizational units’ goals, but it also provided a basis for working on those tensions. If conflicts over the replacement parking strategy were below the surface during the one-to-one replacement parking practice, they became explicit with the development of the model. Although the first use of the model was to test hypothetical scenarios, the content of those scenarios drew attention and arguments. It was difficult for participants to separate the model from the policy ideas being tested. There was pressure to make the scenarios realistic, meaning more narrowly defined.

For the elected members of the BART Board of Directors, the logic of the model (e.g., a rider is a rider) did not correspond to the logic of representing constituents. For example, the net change in ridership includes riders lost because of reductions in commuter parking, and riders gained because of transit demand from new development. The model is indifferent to losses and gains as long as the net change is an increase. But politically, the detriment of losing an existing rider (read constituent) is more costly than the benefit of gaining a new rider. The use of the model in dialogue created a fuller explication of the values and objectives of the board of directors.

Models can disrupt implicit and negotiated arrangements, but they also provide a way to discuss (and analyze) alternatives in which conflicts can be productively engaged. At first, many comments about the model concerned whether particular technical estimates were accurate or biased. The model was designed in an open manner that allowed for the addition of more accurate or sophisticated techniques at any step. Over time, however, the participants began to recognize that the model would be used not to impose one department’s answer on another, but as a structured way of having a conversation that addresses both technical and value issues. In some ways, the experience was backward planning: disagreements about the model helped participants understand value differences and interests and the different missions of their respective departments.

Staff close to BART’s joint development activities knew about the problems that full replacement parking created for joint development, as some development solicitations had not been successful. What was lacking was a way to understand the effects of this practice. The model put in sharp relief the consequences of change and of the status quo. For example, some staff took the view that surface parking is a form of land banking to keep BART’s options open for expansion. The model made visible the opportunity costs of such a course of action, which in a number of cases was forgoing $1 million of unrestricted revenue per year. Set in that perspective, other approaches could be considered, such as acquiring land in the future should it be needed.

Ownership of any model is critical to its long-term use. In this case, staff were closely enough involved in its development that they were empowered to use it, question its assumptions, and make modifications as appropriate. The model is being used and modified by other consultants. In short, the model now lives in the day-to-day activities and discussions at BART, which is now considering expanding its scope to capture benefits and costs in the broader station area.

TABLE 6 San Leandro Fiscal Analysis

	Type of Fiscal Impact	Scenario A—Low/ Mod. Density, 110% Parking Replacement	Scenario B—Low/ Mod. Density, 90% Parking Replacement	Scenario C—Moderate Density, 80% Parking Replacement
Annual revenue factors	Fares from net change in riders	$154,394	$67,067	$84,783
	Ground rent after replacement parking	($251,046)	($149,046)	($98,046)
Annual cost factors	BART parking operating costs (maint., security)	($81,221)	($44,683)	($26,384)
	New operating costs for BART service	$0	$0	$0
	BART participation in operating costs for new access modes	$0	$0	$0
	BART participation in access capital improvements (annualized)	$0	$0	$0
Net annual impact (sum of revenues and costs)		($177,873)	($128,641)	($39,646)

TABLE 7 Generalized Results of Model Testing

Scenario	Development Density (market and entitlement)	Replacement of Commuter Parking	Parking Charges for Commuters	Station Access Alternatives	Net Fiscal Benefit
Suburban setting	Low	Full	None or minimal	Few options to auto access	No
Urbanizing setting	Medium	Partial	Yes, modest level	Emerging multimodal	Yes
Urban setting	High, mixed use	Partial or none	Yes, market based	Full multimodal access	Yes (plus)

The parking replacement–TOD model provides a bridge between general planning principles and well-informed incrementalism. In the authors' view, it creates a better way to discuss choices—a way that can be more precise about trade-offs. It helps untangle the often complicated package of technical and value claims in traditional policy debates to the benefit of staff, decision makers, and the public.

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