MTC Smart Growth Technical Assistance:
Parking Reform Campaign

Parking Structure Technical Report:
Challenges, Opportunities, and Best Practices

June 2012

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EXECUTIVE SUMMARY

Parking structures are one of the most conspicuous "solutions" to a community's parking challenges. In some cases parking structures are the best solution and numerous examples exist where parking structures have improved parking conditions, the overall transportation network and quality of the neighborhood, and allowed for transit oriented development that would not take place otherwise. At the same time, if not properly evaluated, parking structures can be built in places and in ways that have significant negative impacts.

The level of investment in parking structures in the Bay Area is in the hundreds of millions of dollars. However, there is limited available information or shared knowledge about parking structures and how they impact local communities in both positive and negative ways. This paper identifies key issues and provides guidance for local jurisdictions and transit agencies as they consider the development of new parking structures. It includes the following components:

- A regional overview of parking structures in the Bay Area.
- A summary of the opportunities and challenges related with parking structures.
- An evaluation of parking at transit stations, including a discussion of parking in the context of development at transit stations.
- A proposed framework for local evaluation and implementation, as well as some specific guidance for MTC in its role as a regional funder.

OPPORTUNITIES AND CHALLENGES

Parking structures can substantially benefit a community not only from a parking perspective, but also in terms of site design and development opportunities through the conversion of large surface parking lots. Parking structures also present a number of key challenges that should be carefully considered in the planning and development process.

Opportunities

- **Improved Parking Management:** Parking structures can have significant positive impacts on the overall management and functionality of a district or neighborhood's parking supply. Most importantly, parking structures are often a key component of "shared" parking districts, which maximize parking efficiencies.
- **Efficient Use of Land and Higher Densities:** Parking structures facilitate more efficient use of land by allowing parking to be vertically integrated within a parcel. Limiting the amount of land that is dedicated to parking creates additional development flexibility.
- **Bicycle Parking, Car Sharing, and Electric Vehicles:** Parking structures offer a potential opportunity to improve bicycle access, encourage the use of car sharing, and provide space for electric vehicle charging stations.

- **Design Integration and Sustainability:** Parking structure design has evolved over the years and new innovative techniques now allow parking structures to be more easily integrated within a community or retail district.

Challenges

- **Relationship to Existing Supply:** Planning for the development of a parking structure assumes that there is a parking "need" that cannot be met by another means and that a new structure is the best option. Taking this narrow approach and ignoring the district-wide parking context can ultimately undermine an investment in a parking structure. Simply put, many parking structures are not actually needed given current low utilization rates in nearby parking facilities.
- **Parking Structure Costs:** Perhaps the most obvious impediment to the development of parking structures is their cost. Structure costs are comprised of several components (capital, "soft," operating, environmental, land, and "opportunity" costs) that are often overlooked or underestimated.
- **Impacts on the Surrounding Community:** Parking structures do not operate or function in a vacuum. They have significant impacts that extend beyond the immediate parcel on which they are located, including: community design and aesthetics, internal and external circulation, safety and security, and coordination with other parking management efforts.

PARKING AT TRANSIT STATIONS

Parking at transit stations illustrates the opportunity costs of parking facilities particularly well because there is unique tension between the role of transit stations as transportation "node" versus its emerging role as a distinctive "place" in the community where people live, work, or shop. Parking facilities at transit stations can offer multiple benefits to not only the transit customer, but also the transit agency and surrounding community. In brief, parking at transit stations offers the following benefits:

- Directly contributes to transit ridership.
- Reduces vehicle miles traveled, congestion, and emissions by allowing motorists to switch to transit for a portion of their trip.
- Facilitates the diversion of vehicle trips from congested roadway or freeway corridors.
- Extends the reach of transit systems and addresses "first-mile, last-mile" connections.
- Can limit the degree of spillover parking from transit patrons.
- Can provide limited operating revenue for transit systems.

Parking at transit stations also presents a number of tangible tradeoffs that should be examined more closely when developing station area plans and parking policies for transit systems. These tradeoffs include:

- Land near transit is valuable and that "value" can be leveraged with uses other than parking facilities.
- Existing minimum parking requirements and replacement parking policies result in "over-parked" developments at transit stations. In many instances the existing parking minimums and the associated costs to build the required parking often prevent a project from being financially feasible.
- Transit-oriented development (TOD) offers substantially more benefits than parking facilities alone, including: higher transit ridership, increased use of alternative modes, limited car ownership, reduced vehicle miles traveled and emissions, and increased efficiencies in energy use.

- Parking investments can reinforce a station access framework that is not cost-effective or equitable for other modes.
- Parking facilities at transit station are often underutilized in the off-peak.

This paper highlights three case studies which illustrate how various local jurisdictions and transit agencies have begun to reevaluate parking at their transit facilities. These case studies include:

- BART TOD and Replacement Parking Policies
- Replacement Parking at VTA Light Rail Stations
- Petaluma Station Area Plan Parking Policies

RECOMMENDATIONS

The final chapter of this report proposes a framework local jurisdictions and transit agencies as they seek to evaluate, plan, and implement parking structures in an efficient manner. Additional recommendations for MTC are made about the ways in which it can facilitate more regional dialogue and consensus around parking structure development, as well as provide additional technical assistance to local jurisdictions.

Evaluation and Implementation Framework

Step #1: Define Goals and Objectives. This step is important because it helps stakeholders better articulate the rationale and need for access and parking policies, including consideration of a new multi-million dollar parking facility.

Step #2: Conduct an Existing Conditions Assessment. An existing conditions assessment is useful in establishing a shared understanding of key parking issues, concerns, and attitudes; project or site characteristics; the economic and social factors shaping the discussion around parking; and community goals and objectives. An existing conditions study can also help to shape eventual strategies and determine a comprehensive action plan for addressing key parking issues.

Step #3: Establish an Appropriate Policy Framework. The cost, design, and role of a parking structure will largely be determined by the policy framework of the local jurisdiction in which it is constructed. It is imperative that local jurisdictions adopt parking requirements and policies that are based on actual parking demand and reflective of local parking conditions.

Step #4: Document Full Parking Structure Costs. Parking structures are far more than their "hard" construction costs, but also include "soft" design and planning costs, ongoing operating costs, and environmental costs. A cost analysis should also be sure to include an evaluation of "net" costs per space if the proposed structure is to replace an existing supply of parking. A parking structure cost analysis should include consideration of pricing options. Finally, a discussion and analysis of land values and opportunity costs must be included.

Step #5: Evaluate Multiple Access Strategies. A new parking structure is only one piece of the "access" puzzle. A new structure in a downtown or at a transit station will likely improve access for motorists, but how will such an investment impact transit, bicyclist, and pedestrian mobility? Multimodal access should be a key consideration for local jurisdictions and transit agencies so that they strive to develop comprehensive access plans and strategies from a holistic perspective.

Step #6: Plan and Design Structure to Mitigate Impacts. The final step is to ensure that the parking structure is physically planned and designed in an appropriate manner. In short, the structure should be located and designed so that its potential impacts are mitigated to the greatest degree possible.

MTC's Future Role

Parking is largely an issue of local control. Local agencies determine the parking policies that they believe are most representative of local parking conditions. MTC understands and respects this dynamic, yet as a regional body it is also its responsibility to ensure that scarce regional transportation dollars are spent as effectively as possible and support regional policy efforts. Outlined below are some recommendations for MTC in its efforts to improve and expand its role as regional convener and facilitator of parking reform.

Regional Guidance

It is recommended that MTC develop additional parking structure guidance for local jurisdictions and transit agencies. This policy guidance could be developed according to MTC's existing community typologies and should be designed for easy integration into local parking and zoning codes, as well as local access policies.

Technical Assistance

It is recommended that MTC allocate additional resources to develop tailored technical assistance programs and tools for parking structure development. Unfortunately, many local jurisdictions and transit agencies simply do not have the financial resources to engage in more detailed planning efforts related to these issues. As a result, in many cases there is limited knowledge about local parking facilities and how those assets are utilized. Improving this knowledge base and then empowering agencies with capital and planning grants, as well as simple and user-friendly tools can be one of the most effective roles for MTC moving forward.

Parking Certification Program

Much as the Leadership in Energy and Environmental Design (LEED) certification program administered by the U.S. Green Building Council has helped to spur a sustainable building boom, a parking certification program could help achieve widespread regional adoption of parking reforms.

Funding Requirements

MTC could condition distribution of future regional funding for parking structures on the adoption at the local level of a full suite of parking management policies with parameters set by MTC. By creating specific funding requirements, MTC could help to ensure efficient allocation of regional dollars. While such requirements may increase the burden on local agencies, it is likely that such requirements will maximize project efficiency, reduce costs, and improve overall access management within local communities.

1 INTRODUCTION

MTC and Parking in the Bay Area

Access policies are a crucial component of development in the Bay Area and parking plays a major role in any effort to improve access. Parking policies impact where development occurs, while affecting the cost, convenience, and efficiency of our daily commute and influencing where people live and how they access their needs. In addition, local jurisdictions and regional agencies increasingly understand that access and parking policies are an economic issue which is intimately connected to the vibrancy and success of commercial districts and new development. Access and parking policies also have definitive impacts on the overall functionality of the transportation network, with levels of local congestion heavily influenced by parking behavior. Finally, access and parking policies can impact efforts to meet goals for sustainability and public health.

Parking is often a contentious issue. Parking generates strong opinions, yet parking is also often misunderstood and misinformed by long-standing perceptions, and not by actual parking behavior or data. Recognizing this challenge, cities in the Bay Area are pioneering new approaches to access and parking management in an effort to better understand their parking assets, how they can incorporate multimodal access solutions, and implement strategies that can enable them to manage access and parking in a more dynamic, flexible, and efficient manner.

Because of the complexities of parking policies and their impact on local development and regional goals, many jurisdictions seeking to support smart growth and development of infill in their downtowns and in transit served areas are looking for additional guidance and technical assistance. For example, a 2010 survey[1] of 63 Bay Area cities found that the vast majority of respondents were interested in training sessions on parking fundamentals, site-specific parking workshops, or additional resources to fund parking studies and improve management. The Metropolitan Transportation Commission (MTC) has sought to fill this technical assistance role with its *Smart Parking Technical Assistance Project* and *Regional Parking Campaigns*. MTC's primary goals have been to educate local jurisdictions about the benefits of parking policy reform and provide the technical assistance to evaluate and implement those reforms.

In its role as a technical assistance provider MTC understands that parking is fundamentally an issue of local control, in which cities are responsible for developing parking and other access policies and programs that reflect local conditions and attitudes. Given the diversity of Bay Area cities, it is clear that no one set of parking or access policies are appropriate. In an era of increasingly limited funding resources and emphasis on reducing greenhouse gas emissions, there is a need for careful evaluation about how to best improve multimodal access and parking management. Local jurisdictions have expressed interest in regional support for addressing these difficult and timely issues.

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[1] Design, Community & Environment. *Parking Survey and Training Assessment Summary Report.* MTC, 2010. http://www.mtc.ca.gov/planning/smart_growth/parking/Parking_Survey_report.pdf

Through its targeted technical assistance efforts, MTC continues to seek venues by which to establish regional dialogues, share best practices, and develop regional parking policies. In 2012, MTC's *Parking Campaign* expands on previous technical assistance work. In particular, it focuses on two key issues: 1) reform of zoning codes, especially related to minimum parking requirements; and 2) an analytical process for the evaluation of new parking structures in the context of wider policy goals. The latter topic is the subject of this technical report.

Why Parking Structures?

Parking structures are one of the most conspicuous "solutions" to a community's parking challenges. In areas where there is a perception of parking shortages (whether or not supported by actual parking data), the first response has traditionally been to build more parking, and a new parking structure is often the first choice facility. This is especially the case in downtowns or popular commercial districts, where parking demand can be high and there are often constraints on land area and parking structures can improve land efficiencies. At many suburban transit stations and park and ride lots with some transit service, ample parking is seen as a key component in attracting transit riders. In some cases parking structures are the best solution and numerous examples exist where parking structures have improved parking conditions, the overall transportation network and quality of the neighborhood, and allowed for transit oriented development that would not take place otherwise. At the same time, if not properly evaluated, parking structures can be built in places and in ways that have significant negative impacts.

Numerous parking structures have been built and dozens more have been included in regional planning documents, such as the Bay Area's *Regional Transportation Plan* in cities throughout the Bay Area. The level of local and regional investment in parking structures is in the hundreds of millions of dollars. However, there is limited available information or shared knowledge about parking structures and how they impact local communities in both positive and negative ways. What are the benefits of parking structures? What problems do they present? Do investments in structures, which primarily serve automobile trips, impact access improvements for other modes? How can cities and transit agencies make more informed decisions about multimodal access policies, including multi-million dollar investments in parking facilities? What evaluation tools and types of analyses can be performed? These are all key questions, yet the state of the practice shows that the answers are nuanced and varied.

Purpose of this Paper

MTC has prioritized the issue of better analyzing parking structures in the context of multimodal access, especially given increasing construction and operation costs, declining local and regional dollars, and increasing attention to reducing greenhouse gases. From a regional perspective, it is important that local decision makers, city and public agencies and their staff, and the general public have a better understanding of the issues that should be considered in deciding about parking structures.

Therefore, the primary goal of this paper is to provide a multimodal context, an overview of the benefits, key issues and challenges, and tradeoffs associated with parking structures. Parking structures will continue to be planned and developed at a local level, yet MTC wants to offer a framework for a regional conversation around these facilities, and, ultimately, foster more critical thinking and analysis. This paper is also intended to lay the foundation for creating some effective communication pieces designed to articulate key concepts outlined here to multiple audiences in a user-friendly manner. Finally, this paper will offer initial recommendations and an analytic framework for how MTC, local jurisdictions, and transit agencies can better evaluate, plan, design, and operate parking structures with appropriate consideration of the alternatives in a broader planning context.

It is important to note that MTC and its local and regional partners have already invested significant time and resources towards discussing, evaluating, and developing solutions to these issues. This paper seeks to complement and supplement MTC's ongoing regional parking efforts. In particular, this paper builds off of previous work developed by Wilbur Smith Associates and MTC staff member John Urgo, as well as substantial parking policy work developed by BART and VTA, their staff, and other consultants. Contributions by these organizations and individuals are acknowledged throughout the paper.

Outline of this Paper

Chapter 2 provides a regional overview of parking structures in the Bay Area.

Chapter 3 summarizes the opportunities and challenges related with parking structures.

Chapter 4 takes a closer look at parking at transit stations, including a discussion of parking in the context of development at transit stations.

Chapter 5 provides a framework for local evaluation and implementation, as well as some specific guidance for MTC in its role as a regional funder.

2 REGIONAL CONTEXT

In order to better determine when and where parking structures represent the best access strategy, it is useful to understand the scale of existing investment in parking structures in the Bay Area. This chapter offers a high-level regional overview and provides some context regarding the level of investment in these parking facilities. Moving forward, the region will need to evaluate its ongoing investments in parking structures as demand for investment in other transportation facilities continues to grow, competition for local and regional dollars increases, younger generations seek out more diverse travel options, and policies to reduce greenhouse gases are implemented.

While comprehensive data is not available regarding every built or proposed parking structure for all of the 101 local municipalities in the nine-county Bay Area, this section provides a snapshot of recent and planned parking structures in the Bay Area, focusing primarily on structures where MTC plays a significant funding role (i.e., at transit stations and park and rides/transit stop locations). The information is adapted from a recent analysis by MTC staff, which evaluated numerous parking structures in various stages of development in the Bay Area, with particular attention to structures at transit stations.[2] The projects and cost data were drawn from the San Francisco Bay Area's *Transit Improvement Program* (TIP), *Regional Transportation Plan* (RTP), and the *Station Area Planning* grant program as administered by the Metropolitan Transportation Commission (MTC). Several other parking structures for which data was available were also included.

These projects do not represent a comprehensive list of parking structure projects in the Bay Area, but they do demonstrate the size and scale of projects programmed to receive, or that are currently requesting, regional transportation funds. Figure 2-1 summarizes the cost data (dollar amounts in $YOE) available for the selected parking structures. According to the data, more than $274 million has been spent on recently constructed parking structures, while another $247 million is proposed for 12 additional facilities. The average construction cost per space is just over $28,000, and costs per net new space are substantially higher.

A considerable number of other parking structures are also slated for development. The southern extension of BART to San Jose, for example, will include the construction of two new parking structures at both the Milpitas and Berryessa stations and likely others. As the station planning efforts progress for the new SMART train system in the North Bay, it is likely that new parking structures will also be considered for select stations.

[2] Urgo, John. *Right-Sizing Parking Structures: An Analysis of Structures Parking at Transit Stations.* MTC, 2012.

Figure 2-1 Summary of Selected Parking Structures, Built and Planned

Project Name	# of spaces (gross)	# of spaces (net)	Construction Cost of Structure	Cost per Space	Cost per Net Space
Built					
CBD					
Jack London AMTRAK	1,086	1,086	$32,580,000	$30,000	$30,000
San Jose (4th St. and San Fernando St.)	743	N/A	$60,000,000	$80,754	N/A
Urban					
Fruitvale BART	506	N/A	$12,000,000	$23,715	N/A
Richmond BART	678	193	$26,536,000	$39,139	$137,492
Hayward-City Hall Parking Structure	178	178	$3,500,000	$19,663	$19,663
Hayward-Cinema Place	244	N/A	$7,200,000	$29,508	N/A
Suburban					
Fairfield Transportation Center	400	400	$6,875,000	$17,188	$17,188
Livermore Valley Center Park-n-Ride	502	N/A	$8,518,664	$16,969	N/A
Dublin/Pleasanton BART	1,513	N/A	$42,000,000	$27,759	N/A
West Dublin/Pleasanton	1,180	1,180	$24,000,983	$20,340	$20,340
Pleasant Hill BART Replacement Parking	1,547	75	$51,236,000	$33,120	$683,147
Summary	*8,577*	*3,112*	*$274,446,647*	*$31,998*	*$46,506*
Planned (estimated costs)					
CBD					
Berkeley Center Street Garage	462	41	$18,600,000	$40,260	$453,659
Urban					
Richmond Prkwy Transit Center Parking	710	503	$17,546,172	$24,713	$34,883
MacArthur BART TOD	480	N/A	$15,371,000	$30,208	N/A
South Hayward BART TOD	910	N/A	$22,314,487	$24,521	N/A
Suburban					
Fairfield Transportation Center - Phase 3	600	360	$16,000,000	$26,667	$44,444
Vacaville Intermodal Station - Phase 2	400	400	$10,000,000	$25,000	$25,000
Vallejo Ferry Terminal	750	430	$16,654,000	$22,205	$38,730
Curtola Transit Center	450	209	$14,750,000	$32,778	$70,574
Larkspur Ferry Terminal Parking Garage	970	570	$20,000,000	$20,619	$35,088
Pittsburg/Bay Point Master Plan	2,370	370	$43,000,000	$18,143	$116,216
San Mateo Hillsdale	1,242	1,242	$31,050,000	$25,000	$25,000
Cotati	700	700	$22,400,000	$32,000	$32,000
Summary	*10,044*	*4,825*	*$247,685,659*	*$24,660*	*$36,032*
TOTAL	***18,621***	***7,937***	***$522,132,306***	***$28,040***	***$44,693***

3 OPPORTUNITIES AND CHALLENGES

This section provides an overview of the key opportunities and challenges associated with parking structures. Chapter 2 demonstrates that there has been, and will continue to be, a significant investment in parking structures in the Bay Area. Given the amount of public and private dollars dedicated to constructing new parking structures, it is important that issues related to their planning, design, construction, and implementation are clearly articulated.

More specifically, this chapter makes the case that parking structures can substantially benefit a community not only from a parking perspective, but also in terms of site design and development opportunities through the conversion of large surface parking lots. Parking structures also present a number of key challenges that should be carefully considered in the planning and development process. These challenges are also detailed, with particular attention paid to the growing demand for transit-oriented development, impacts on the surrounding transportation and street network, relationship to other modes of access, and construction and operating costs.

KEY OPPORTUNITIES

Parking structures have proven to be critical investments in many contexts. They have been crucial in the revitalization of downtowns and have catalyzed efforts to resolve persistent parking challenges. In addition, parking structures continue to play an important role in ensuring convenient access to regional transit systems. Outlined below is a summary of the primary benefits that parking structures can provide.

Improved Parking Management

Parking structures can have significant positive impacts on the overall management and functionality of a district or neighborhood's parking supply. Most importantly, parking structures are often a key component of "shared" parking districts. Shared parking is one of the most effective tools in parking management. Because many land uses (a bank and a restaurant, for example) have different periods of parking demand, they can easily share a common parking facility, thereby limiting the need to provide additional parking. Shared parking policies do not treat the parking supply as individual units designated to a particular business or use, but rather emphasize the efficient use of the parking supply by all uses by providing a centralized and common pool of shared, publicly available spaces. Successful shared parking districts have been shown to reduce vehicle trips and parking supply, create a more welcoming environment for customers, and activate public life on the street by transforming motorists into pedestrians.

In downtown Santa Monica, for example, there are more than ten public parking garages that serve as the parking supply for the vast majority of the retail and commercial businesses along the popular Third Street Promenade and surrounding retail streets. As a result of its shared parking pool, customers and visitors need to park only once, while many new businesses or infill projects have been able to limit their parking obligations.

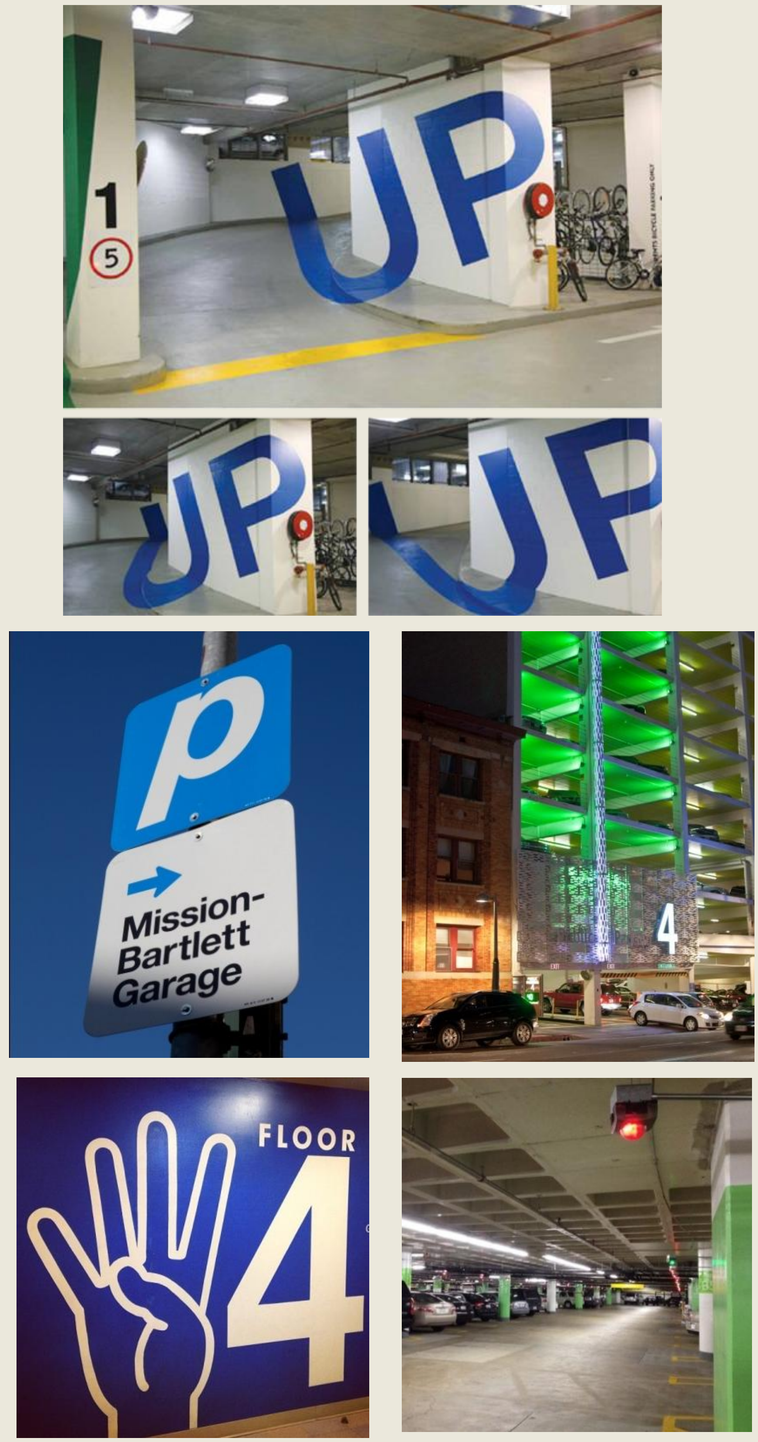
Beyond the creation of shared parking districts, parking structures can also improve parking management in the following ways:

- Convenient, accessible, and appropriately priced off-street parking facilities can reduce competition for limited on-street spaces.
- Centralized parking facilities near large trip generators can reduce the amount of spillover parking into adjacent residential neighborhoods.
- Improved technology systems, such as real-time information on parking availability and internal wayfinding systems, can be easily integrated and dramatically improve vehicle circulation and perceived parking shortages both within the structure and on nearby local streets.
- Given their limited access points, parking structures offer a convenient way to monitor off-street parking occupancy trends and generate useful parking data.
- Parking structures can provide an ongoing source of revenue.

Efficient Use of Land and Higher Densities

Parking structures facilitate more efficient use of land by allowing parking to be vertically integrated within a parcel. On average, a parking space requires about 350 square feet (including area for

Examples of Parking Structure Wayfinding



access and circulation). On a one-acre site in the central business district (CBD), there would be enough land area to fit approximately 125 surface parking spaces[3]. By contrast, a four-story structure on only half of an acre parcel would yield approximately 250 parking spaces. In short, structures allow for more parking spaces on less land.

Limiting the amount of land that is dedicated to parking creates additional development flexibility. For example, higher densities become feasible because the required parking spaces can be accommodated on-site, thereby allowing for potentially higher rates of return. Land can also now be preserved for open space, public space, or additional on-site amenities.

Integrated Bicycle Parking

Bicycle Parking, Car Sharing, and Electric Vehicles

Parking structures also offer a potential opportunity to improve bicycle access, encourage the use of car sharing, and provide space for electric vehicle charging stations. Because the street network and sidewalks are often physically constrained and on-street parking is highly desirable, it can be difficult to find the physical space needed to accommodate bicycle parking or car sharing vehicle spaces. Parking structures are a viable alternative. If designed properly and located in an appropriate location, bicycle parking can be successfully integrated into parking structures. Procuring parking spaces for car sharing vehicles is also often easier within parking structures. While on-street car sharing can be the most efficient approach, structures can provide a good alternative.

Finally, parking structures also offer an opportunity to expand the use of elective vehicles. One of the major impediments to the use of electric vehicles is the limited number of charging stations available in convenient and accessible locations. Spaces in parking structures present a secure location where this infrastructure could be installed in a cost-effective manner that would not require the use of valuable and more limited on-street spaces.

[3] In general, lower density land uses can accommodate fewer spaces per acre. Typical assumptions include: "suburban" (110 spaces/acre); "urban" (120 spaces/acre); CBD (125 spaces/acre).

Design Integration and Sustainability

Parking structure design has evolved over the years and new innovative techniques now allow parking structures to be more easily integrated within a community. Ground floor retail uses can be utilized to activate parking structures and provide additional commercial space. The use of architectural features, such as wrapping or façade improvements, can be used to complement a district's unique aesthetics. Finally, structures can also incorporate solar panels or "green" features to reduce noise, pollution, or water runoff. As discussed below, however, the use of such techniques is costly and may not be enough to overcome the inherent design and circulation challenges related to parking structures.

Examples of Ground Floor Uses, Façade Treatments, and Sustainable Features

KEY CHALLENGES

Parking structures also present a number of unique challenges. Unfortunately, many of the issues associated with parking structures are not fully accounted for during the planning and development process. As a result, once parking structures are built they can often fall short of usage or revenue expectations. This section summarizes the key challenges associated with parking structures with the goal of ensuring that local jurisdictions and planning agencies are fully aware of the potential impacts before proceeding with a multi-million dollar parking investment.

Relationship to Existing Supply

Planning for the development of a parking structure assumes that there is a parking "need" that cannot be met by another means and that a new structure is the best option. To meet this parking demand, parking structures are often developed in the strict context of the immediate land use they are serving and the specific parcel of land on which they are located. Taking this narrow approach and ignoring the district-wide parking context can ultimately undermine an investment in a parking structure. Simply put, many parking structures are not actually needed given low utilization rates in nearby parking facilities.

To illustrate this point, take a hypothetical CBD in which a new 500-space parking garage has been proposed. This garage is considered essential to accommodating parking demand from a proposed commercial and retail development. Within this district, however, there already exist 2,000 off-street parking spaces distributed in parking structures and off-street surface lots within walking distance to the proposed development. During peak periods these 2,000 parking spaces reach a maximum occupancy of only 65%, leaving 700 available parking spaces at the *peak* period of demand. Given the availability of existing supply, it is likely that the new parking structure would not be needed and would fail to meet occupancy or revenue projections.

While hypothetical, the scenario described above is a common occurrence in many jurisdictions for several reasons. First, in most instances such districts do not have a policy framework in place to capitalize on shared parking arrangements, and instead continue to view parking supply as isolated to each individual use. Second, and perhaps more importantly, many cities do not have current parking inventory or occupancy data for their parking facilities, and simply are not aware that there exists available parking nearby. The lack of information is a key impediment to properly evaluating existing parking assets and the need for additional investments in parking facilities.

An evaluation of the district-wide parking context is an essential first step to successful parking facility development. This additional level of analysis, however, can represent a significant challenge to cities that do not have parking data readily available or are not well-positioned to implement shared parking policies.

Parking Structure Costs

Perhaps the most obvious impediment to the development of parking structures is their cost. No matter its size or location, a parking structure is going to require an investment of many millions of dollars. The parking structures discussed in this report are built with public funds, typically as part of a larger transit project or a transit oriented development project. Given the fiscal challenges that local, regional, and state governments are facing, it will only be more difficult to find the necessary resources to fund the construction of parking structures. This section provides a summary of all of the elements that determine parking structure costs. With a full understanding of these various cost elements, local jurisdictions and public agencies will be able to move forward with better awareness of cost and resource implications.

Capital Costs

- *Construction costs:* Construction costs represent the actual cost to build and are often referred to as "hard" costs. It is important to emphasize that construction costs are highly dependent on local and project context. The size, type, physical design, location, shape of parcel, soil condition, water table depth, and topography can all affect construction costs. In recent years, the median construction costs for parking structures across the country were estimated at $16,323 - $18,300 per space.[4,5] Based on the data provided in Chapter 2, however, it appears that construction costs per space in the Bay Area are significantly higher.
- *"Soft" costs:* Capital costs should also include "soft" costs, which typically include project planning and design, architect/consultant fees, legal fees, construction management services, etc. Soft costs are generally estimated as a 25-40% mark up of per space construction costs. Soft costs are also largely dependent on the local context and may also take into account any project contingencies, typically another 10-15%.

Operating Costs

- *Debt service:* The construction of a parking structure will require long-term financing. As a result, there will be annual, ongoing costs to pay off the debt obligation. The level of this annual payment will depend on the initial capital budget and financing rate.

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[4] Rowland, Joey D. "Parking Structure Cost Outlook for 2011." 2011. www.carlwalker.com/press/newsletters

[5] RS Means (2009). "Building Construction Cost Data, 2009." (Kingston, MA: Construction Publishers & Consultants, 2008).

- *Operation and Maintenance*: Parking structures require ongoing investments to ensure their efficient operation and upkeep, including: enforcement, insurance, labor, administration, security, and various maintenance needs (cleaning, lighting, repaving, landscaping, structural upgrades, etc.). These costs are also highly variable, but, on average, it costs $450-1000 per space per year to operate and maintain a parking structure.[6]

Environmental Costs

The development of new parking facilities has impacts on the environment. Parking facilities increase the area of impervious surfaces, contribute to heat island effects, and can impact stormwater runoff.[7] While parking structures can mitigate these effects more effectively than surface parking lots, the externalities still exist. In addition, the provision of parking has been shown to increase vehicle ownership and vehicle miles traveled, thereby increasing congestion and greenhouse gas emissions.[8] Finally, the actual construction of parking facilities consumes large amounts of energy and materials, and also results in additional greenhouse gas emissions.[9]

Environmental costs can be more difficult to quantify and there is limited research available on the specific environmental impacts of parking structures. However, Professor Donald Shoup has often cited environmental impact reports related to parking structure development in Los Angeles, which estimate total external costs (congestion and pollution) of $117 per space per month.[10] A recent national study of parking infrastructure, found that emissions from parking infrastructure costs the U.S. $4-20 billion in health care and environmental damage, or $6-23 per space per year.[11]

"Net" Costs

The concept of "net" costs in relation to parking structures is important to understand. In many cases, parking structures do not increase the gross supply of parking on a one-to-one basis, but instead replace existing surface parking spaces. For example, a 600-space parking structure may be proposed for a parcel of land that already contains a surface parking lot of 150 spaces. Once completed, the new structure will result in 450 net new parking spaces. A metric of cost per net new space provides a more accurate representation of what a parking structure will cost in relation to existing parking supply.

Land Costs

As with all development, the cost of land is a key consideration. One square foot of land in a CBD or near a popular commercial corridor will have higher costs than one square foot of land in a suburban or undeveloped area. As a result, there are definitive points at which structures become more economical than surface parking lots. Figure 3-1 demonstrates this relationship. In this analysis, when land values are below $40-50 per square foot, surface parking lots are more economical (on a per space cost basis). As land values rise, however, parking structures typically become a better investment.

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[6] Litman, Todd. *Transportation Cost and Benefit Analysis II - Parking Costs.* VTPI, 2012. www.vtpi.org/tca/tca0504.pdf

[7] Litman, Todd. *Pavement Busters Guide: Why and How to Reduce the Amount of Land Paved for Roads and Parking Facilities.* VTPI, 2011.www.vtpi.org/tca/tca0504.pdf

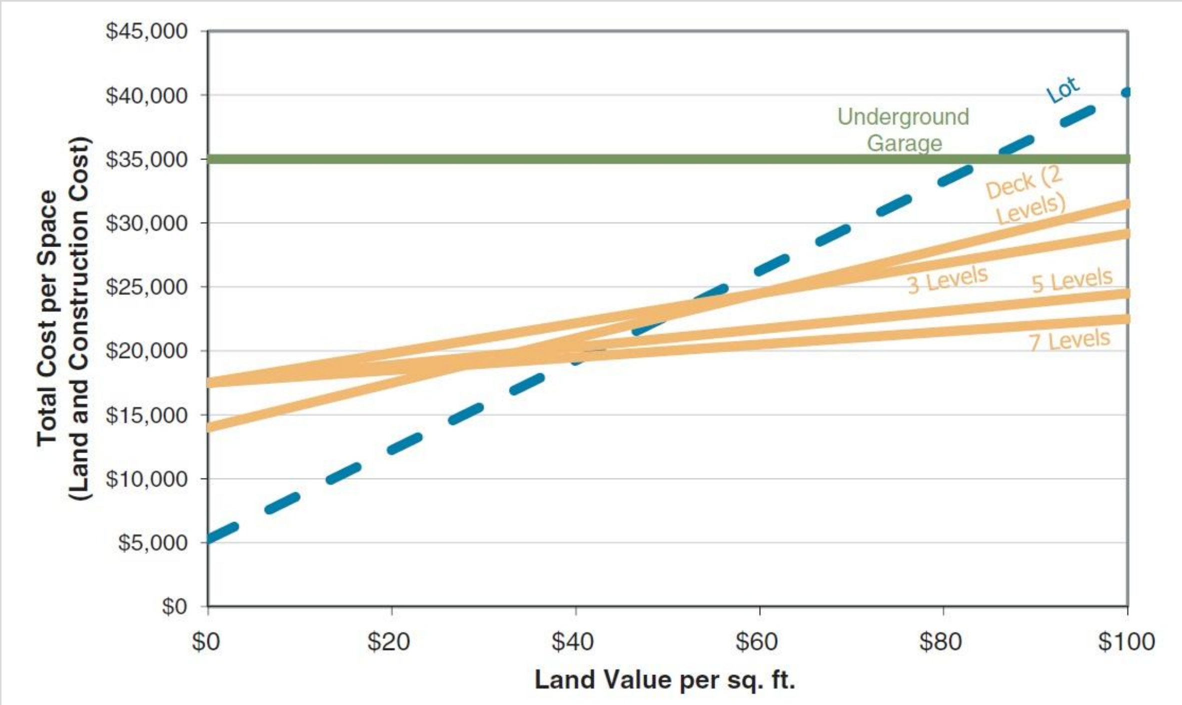
[8] Weinberger, Rachel. "Death by a thousand curb-cuts: Evidence on the effect of minimum parking requirements on the choice to drive." *Transport Policy* 20 (2012): 93-102.

[9] Shoup, Donald. *The High Cost of Free Parking.* Chicago: American Planning Association, 2005.

[10] Ibid

[11] Chester, Mikhail, Arpad Horvath, and Samer Madanat. "Parking Infrastructure and the Environment." *Access UCTC* 39 (2011): 28-33.

Figure 3-1 Effects of Land Value on Type of Parking Facility (2010 costs)[12]



Opportunity Costs of Land

The issue of land costs underscores the fact that there are definitive tradeoffs in choosing to construct a parking structure – land devoted to parking prevents that land from being used for housing, commercial, or office uses. The higher the land costs the greater the potential opportunity costs and tradeoffs. However, investment in the parking structure can also be used to free up valuable land for other purposes of high importance to the community, such as more retail, housing and cultural amenities. Finally, the construction of an expensive parking structure will impact a local jurisdiction's ability to invest in other infrastructure projects, including automobile, transit, bicycle, and pedestrian facilities. The issue of opportunity costs, especially around transit stations, is explored in greater detail in Chapter 4.

Summary of Costs

Figures 3-2 and 3-3[13] provide an illustration of how the various costs described above translate to various parking facility and land use scenarios.[14] Three facility types for three land use districts (suburban, urban, and CBD) are shown with their corresponding land, capital, and ongoing costs. For example, a 4-level structure in the CBD will have capital costs of about $50,500 per space (including land) in addition to $4,135 in ongoing annual costs. This is substantially more expensive than a surface parking lot in a suburban district, which would have capital costs of approximately $8,523 per space and ongoing annual costs of $854 per space.

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[12] Coffel, Kathryn, et al. *TCRP Report 153: Guidelines for Providing Access to Public Transportation Stations.* Washington D.C.: TRB, 2012.

[13] Analysis adapted from VTPI's "Parking Cost, Pricing and Revenue Calculator." www.vtpi.org/parking.xls

[14] Assumptions include: 5% interest rate over 30 years; Soft cost markup: 25% (suburban), 30% (urban), and 35% (CBD); Spaces per acre: suburban (110/acre), urban (120/acre), and CBD (125/acre); Underground parking is assumed to have no incremental land cost; Does not include any property taxes on facilities.

Figure 3-2 Typical Parking Structure Costs, by Location and Facility Type

Type of Facility	Land Costs			Construction Costs Per Space				Total Capital Costs Per Space	Annual O&M Costs Per Space	Total Per Space Costs
	Per Acre	Per Space	Annualized	Hard	Soft	Total	Annualized			Annual
Suburban, Surface, Free Land	$0	$0	$0	$5,000	$1,250	$6,250	$407	$6,250	$300	$707
Suburban, Surface	$250,000	$2,273	$148	$5,000	$1,250	$6,250	$407	$8,523	$300	$854
Suburban, 2-Level Structure	$250,000	$1,136	$74	$20,000	$5,000	$25,000	$1,626	$26,136	$500	$2,200
Urban, Surface	$1,000,000	$8,333	$542	$5,000	$1,500	$6,500	$423	$14,833	$400	$1,365
Urban, 3-Level Structure	$1,000,000	$2,778	$181	$20,000	$6,000	$26,000	$1,691	$28,778	$650	$2,522
Urban, Underground	$1,000,000	$0	$0	$35,000	$10,500	$45,500	$2,960	$45,500	$650	$3,610
CBD, Surface	$5,000,000	$40,000	$2,602	$6,000	$2,100	$8,100	$527	$48,100	$550	$3,679
CBD, 4-Level Structure	$5,000,000	$10,000	$651	$30,000	$10,500	$40,500	$2,635	$50,500	$850	$4,135
CBD, Underground	$5,000,000	$0	$0	$40,000	$14,000	$54,000	$3,513	$54,000	$850	$4,363

Figure 3-3 Summary of Land, Construction, and O&M Costs, by Location and Facility Type

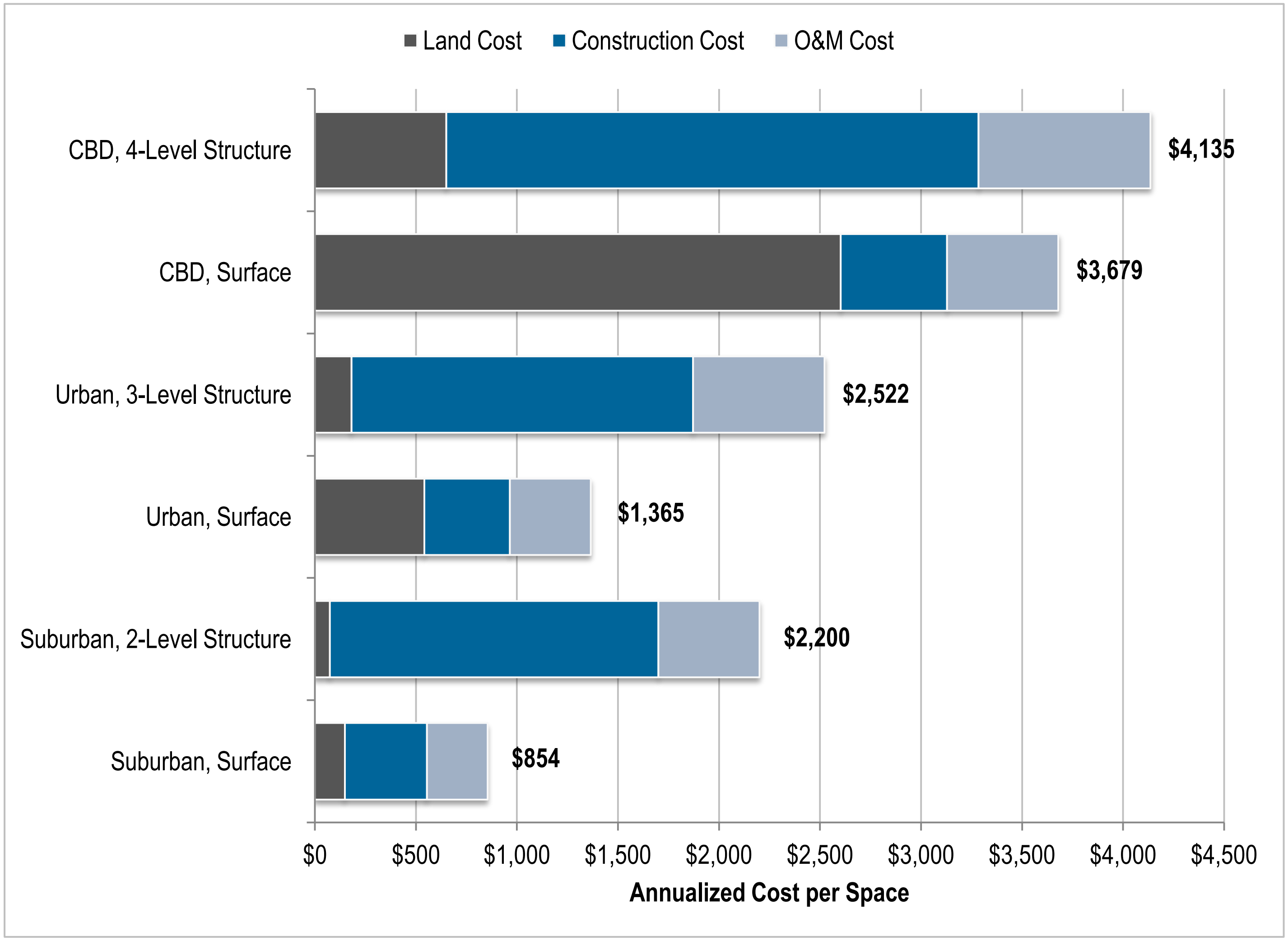


Figure 3-4 demonstrates the comparison of costs per space and costs per net new space. The figure includes two sample scenarios for a new 4-level parking structure built in a CBD. In the first scenario the structure will be built on land that does not contain any existing parking, while in the second scenario a new structure will be built on land that already has 125 parking spaces. As a result, the second scenario will only result in 375 new parking spaces. Evaluating these scenarios according to a metric of net new spaces reveals that parking structures that replace existing parking facilities in fact have much higher costs per space. This is an important distinction to remember when evaluating whether to build a new parking structure, especially on a parcel where parking will be displaced.

Figure 3-4 Costs per Parking Space, Gross vs. Net

	Scenario 1: Build new 4-level garage	Scenario 2: Build new 4-level garage, replace existing surface lot
Number of spaces (gross)	500	500
Number of spaces (net)	500	375
Cost per space (w/ land)	$50,500	$50,500
Structure cost	$25,250,000	$25,250,000
Cost per net new space (w/ land)	**$50,500**	**$67,333**
Annual costs per net new space	**$4,135**	**$5,881**

Impacts on Surrounding Community

Parking structures do not operate or function in a vacuum. They have significant impacts that extend beyond the immediate parcel on which they are located. This section takes a closer look at the potential impacts that parking structures can have on the surrounding streets and community. When planning for a new parking structure local jurisdictions should be cognizant of these potential impacts and evaluate the degree to which they can be mitigated.

Design and Aesthetics

Parking structures present significant design and aesthetic challenges. Parking structures are typically impermeable, single-use structures that take up entire blocks or multiple blocks. They usually present a long, monotonous, and blank "mass" to the street faces on which they sit. Unlike housing or commercial developments that occupy multiple blocks, parking structures cannot utilize internal streets to "break up" the use.

In downtowns that seek to capitalize on short blocks and the high intersection densities offered by a grid network of streets, parking structures can be particularly disruptive. They create barriers both functionally and visually, and can reduce the connectivity that links streets, neighborhoods, and communities. Weaving street-level and pedestrian scale design elements throughout a district also becomes more difficult with parking structures given their unique size and

Impacts on Community Design

dimensions. Within transit stations areas, parking structures can obstruct the most obvious and direct pedestrian desire lines to and from the fare gates. Put simply, most parking structures are unattractive, do little to enhance the streetscape, and undermine vibrancy on streets.

More successful parking structures can mitigate these deficiencies by activating the ground floor with retail or commercial uses. Architectural features like "wrapping" or façade treatments are also commonly employed as a means to improve the visual aesthetics of parking structures. However, these elements do little to address the impermeability of parking structures or improve street connectivity. Furthermore, all of these elements add significant construction and maintenance costs.

Circulation Impacts from Parking Garages

Circulation

Parking structures can be large trip generators that attract thousands of vehicle entries and exits per day. The number of vehicles that access a given parking structure will have substantial impact on the surrounding streets and transportation network. The specific circulation impacts can include:

- Queuing as vehicles wait to enter the structure, thereby creating localized congestion and additional emissions. If along a transit route, this congestion can reduce transit travel times and increase transit operating costs.
- Turning movements in and out of parking structures can create additional conflict points for pedestrians and bicyclists. Turning vehicles that block a bicycle lane are especially troublesome because they force bicyclists to enter the travel lane and maneuver around traffic or ride on the sidewalk.
- Curb cuts that permit vehicles to turn across a sidewalk can interrupt pedestrian desire lines, natural circulation, ADA standards, and force pedestrians to find alternative routes. Consequently, pedestrian activity can decline in the blocks preceding and following the structure access points.
- Internal circulation of structures also often results in inefficiencies of use. Parking structures are designed to direct vehicle circulation upwards as motorists search for the first available open space. Without adequate wayfinding, motorists will often slowly search for an open space in the hope that they do not have to climb to the top floor. The result is more internal congestion and longer searches while numerous available spaces are underutilized on the top floor. Finally, inefficient ticketing and payment methods can also contribute to both internal and external circulation inefficiencies.

Community Safety and Security

Parking structures are particularly challenging from a safety and security standpoint. They tend to isolate the user with limited sight lines, poor lighting, and confined spaces. Not surprisingly, users are especially sensitive to these concerns and will tend to not utilize structures that are unsafe or are perceived to be so. Failure to address issues of safety and security can reduce parking occupancy and undermine the investment in a parking structure. In addition, parking structures that are not considered safe can also impact the surrounding uses by reducing activity and natural surveillance.

Coordination with other Parking and Access Management Strategies

One of the biggest challenges associated with parking structures is ensuring that it is part of a larger access management plan. As a component of the system of access, parking should be coordinated with other modes. Parking policies should be developed to efficiently regulate supply and demand across a geographic area. In most jurisdictions, there is a wide variety of parking types and facilities – on-street spaces, surface lots, or parking structures – with off-street supply usually exceeding on-street supply. Each facility represents one component of an area's parking "supply," yet all of these parking facilities are interconnected, with supply and demand in one facility able to influence supply and demand in all other parking spaces.

For example, motorists are going to instinctively seek out on-street parking close to their destination first, ignoring a "less convenient" parking structure. If pricing signals are also imbalanced, such as free on-street spaces and expensive off-street spaces, there will be an additional financial incentive to circle and circle for on-street spaces. The end result is highly concentrated demand, on-street spaces that are regularly occupied, and the perception that there is "never enough parking." An effective parking management plan should therefore propose strategies that recognize the symbiotic relationship between curb spaces and parking structures, and the distance between the various facilities and destinations, and not treat individual blocks or parking structures as distinct pieces, but rather as a cohesive unit to be managed in a coordinated manner.

Unfortunately, parking structures are often not thought of as a component of a parking management plan. There is rarely a coordinated pricing or regulatory policy between on- and off-street supply. In fact, many parking structures are priced strictly as a revenue source to pay off debt and are in no way linked to actual parking demand. Parking structure costs can, in fact, result in long term operating and bond expenses for jurisdictions that are poorly equipped to handle them, as experienced in the Bay Area. In addition, parking structure costs are often subsidized in an effort to support local businesses, yet such a strategy may not be the most cost-effective approach. Additional planning to incorporate parking structures into an area's overall parking management strategy can require more local resources, but it is a crucial step in solving a community's parking issues.

Planning for the development of a parking structure also often assumes that the only mode of access is driving. In many locations, especially downtowns, town centers, transit oriented developments and transit hubs, access by walking, biking and local transit may be on par with access by car. Thus, it is critical to coordinate the development of parking structures with other access management plans, particularly if these plans include measures which seek to increase the percentage of users who access an area by alternative modes as this may in turn reduce the amount of parking that needs to be constructed.

4 PARKING AT TRANSIT STATIONS

One of the key challenges identified in Chapter 3 are the costs associated with building parking structures. More specifically, the issue of opportunity costs is discussed, as land devoted to parking precludes that land from being used for other uses. Furthermore, investments in parking facilities impact a city or transit agency's financial ability to otherwise dedicate scarce resources to other modal improvements.

A discussion of parking at transit stations illustrates these opportunity costs particularly well because there is unique tension between the purpose and use of a transit station and its surrounding land. Traditionally, transit stations have largely been defined as transportation "nodes," a place that people travel to and from for their daily commute. However, there is a growing recognition of the intrinsic "value" of transit stations, as residents, employers, and businesses all seek to capitalize on the enhanced connectivity that proximity to transit offers. In other words, transit stations are no longer viewed strictly as a transportation facility, but rather as distinctive "places" in the community where people live, work, or shop. This evolution is particularly relevant as the Bay Area and MTC move forward with its development of a *Sustainable Community Strategy* (SCS), which will seek to prioritize growth near transit stations and existing transit corridors.

This chapter examines parking at transit stations more closely and identifies the specific benefits and tradeoffs. This chapter is not intended to provide a comprehensive analysis of TODs or station area planning for TODs, but rather presents a more detailed discussion of the key parking issues specific to transit stations. This discussion is informed by a growing body of research regarding the value of transit and the level of parking demand at transit-oriented development (TOD), as well as recent analysis of parking supply at transit stations and TODs in the Bay Area.

BENEFITS OF TRANSIT STATION PARKING

Parking facilities at transit stations can offer multiple benefits to not only the transit customer, but also the transit agency and surrounding community. In fact, because automobile travel often constitutes a large percentage of the mode share to transit stations, parking is an essential component to the efficient function of regional transit systems. In the BART system, for example, 49% of those taking BART get to the station by automobile, with the automobile mode shares varying by station.[15] For many BART patrons and the agency itself, therefore, parking at transit stations is a crucial asset. In brief, parking at transit stations offers the following benefits:[16]

- Directly contributes to transit ridership, allowing patrons to conveniently access the transit system.
- Reduces vehicle miles traveled, congestion, and emissions by allowing motorists to switch to transit for a portion of their trip.

[15] BART. "2008 BART Station Profile Study." 2008. www.bart.gov/docs/StationProfileStudy/2008StationProfileReport_web.pdf

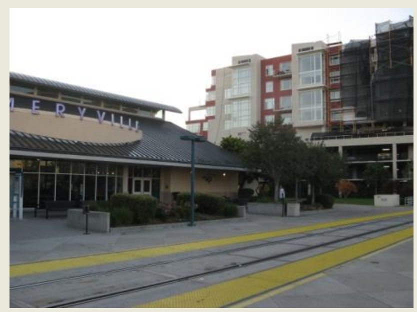
[16] Coffel, Kathryn, et al. *TCRP Report 153: Guidelines for Providing Access to Public Transportation Stations.* Washington D.C.: TRB, 2012.

- Facilitates the diversion of vehicle trips from congested roadway or freeway corridors, especially in the case of non-recurring incidents (i.e. traffic accidents).
- Extends the reach of transit systems and addresses "first-mile, last-mile" connections, allowing transit customers living outside the immediate station area to access the transit system. In areas where feeder transit service and non-motorized options are limited, parking facilities are especially important.
- Can limit the degree of spillover parking from transit patrons into surrounding neighborhood streets.
- Can provide limited operating revenue for transit systems, if parking revenue is not used to recoup the costs of providing parking.

TRADEOFFS WITH TRANSIT STATION PARKING

Parking at transit stations also presents a number of tangible tradeoffs that should be examined more closely when developing station area plans and parking policies for transit systems. These tradeoffs have become more evident in recent years as local jurisdictions, transit agencies, and developers have all sought to maximize the value of transit and station areas through additional housing, office, and commercial development. The success of new transit-oriented developments throughout the country and the Bay Area have shown that station areas dedicated strictly to patron parking forgo many of the positive benefits associated with proximity to transit and impede new development. Specific tradeoffs to consider are discussed below.

Parking Facilities at Bay Area Transit Stations



Land near Transit is Valuable and that "Value" can be Leveraged

There is a growing understanding that transit is more than just a way to get to get around – it also offers a variety of economic, environmental, and social benefits. Current trends also indicate that more and more people, especially among younger generations, are choosing to live in communities well-served by transit and forgo the costs of car ownership.[17,18] As a result, the "value" of transit is increasing.

While the benefits of transit are diverse and its value can be defined in many ways, most research has utilized the yield on property as the standard metric to assess transit "value." As summarized in Figure 4-1, there is a large body of research documenting the positive effect that proximity to transit has on property values for a wide variety of land uses. It is important to note that the research has primarily focused on fixed rail systems, and there is very limited research available on the property value premium

[17] Davis, B., Dutzik, T., & Baxandall, P. (2012). *Transportation and the New Generation: Why Young People are Driving Less and What it Means for Transportation Policy.* Frontier Group and U.S. PIRG Education Group. http://tinyurl.com/7yervax

[18] MTC. (2010). *Choosing Where We Live: Attracting Residents to Transit-Oriented Neighborhoods in the San Francisco Bay Area.* Oakland: MTC. www.mtc.ca.gov/planning/smart_growth/tod/5-10/Briefing_Book-Choosing_Where_We_Live.pdf

of bus rapid transit. Therefore, the "transit" referenced below is specifically referring to stations as part of light rail (e.g. VTA), trolleys (e.g. San Diego Trolley), or heavy rail (e.g. BART or Washington Metrorail).

Figure 4-1 Summary of Estimated Property Value Premium[19]

Land Use	Range of Property Value Premium
Single Family Residential	+2% w/in 200 ft of station to +32% w/in 100 ft of station
Condominium	+2-18% w/in 2,640 ft of station
Apartment	+0-4% w/in 2,640 ft of station to +45% w/in 1,320 ft of station
Office	+9% w/in 300 ft of station to +120% w/in 1,320 ft of station
Retail	+1% w/in 500 ft of station to +167% w/in 200 ft of station

These findings demonstrate that while transit agencies and local jurisdictions may continue benefiting from investments in parking, they also may fail to capture the value that transit gives to surrounding properties. Leveraging that value, or the notion of "value capture," is an increasingly popular concept that seeks to "…harness a portion of the value that transit confers to surrounding properties to fund transit infrastructure or related improvements in station areas."[20] Typical value capture strategies include assessment districts, tax increment financing, joint development, and development fees.[21] As financial resources become more constrained, transit agencies and local jurisdictions will need to evaluate potential development around transit stations and the ability to maximize the full "value" of transit in relation to investments in parking facilities.

Existing TODs are often Over-Parked

Research has consistently shown that the policies which regulate parking at many transit stations are increasingly incompatible with the actual market demand for parking. In short, existing minimum parking requirements, especially for residential properties, require that more parking is built than is used. Furthermore, transit agency parking replacement policies, which often require TOD developers to replace transit patron parking on a "one-for-one" basis, also contribute to a policy environment in which too much parking is provided. Specific parking findings related to TODs include:

- A survey of 31 multi-family housing complexes near rail stations in the San Francisco Bay Area and Portland, Oregon, show peak parking demand is 25-30% below parking supply.[22]
- A survey of 12 TOD residential properties in Santa Clara County found that all sites exhibited an over-supply of parking facilities, on average by 26%. An average of 1.7 parking spaces per dwelling unit was provided, but only 1.3 parking spaces were needed.[23]

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[19] Fogarty, Nadine, Nancy Eaton, Dena Belzer, and Gloria Ohland. *Capturing the Value of Transit.* Center for Transit-Oriented Development, 2008.

[20] Ibid

[21] Ibid

[22] Cervero, Robert, Arlie Adkins, and Cathleen Sullivan. "Are Suburban TODs Over-Parked?" *Journal of Public Transportation* 13, no. 2 (2010): 47-70.

[23] Serafin, Eduardo C., Robert W. Swierk, Ying C. Smith, and Justin M. Meek. *A Parking Utilization Survey of Transit-Oriented Development Residential Properties in Santa Clara County.* San Jose: San Jose State University and Santa Clara Valley Transportation Authority, 2010.

It is important to emphasize that there are tangible financial impacts as a result of parking policies that do not meet the market. In many instances existing parking minimums and the associated costs to build the required parking often prevent a TOD project from being financially feasible. For example, recent qualitative input from developers in the Bay Area indicates that minimum parking requirements, especially at transit stations, are too high and, consequently, negatively impact their ability to finance projects. Research has also found that lowering residential parking requirements by 50% for TODs can result in increased residential densities of 20-33% and savings on residential parking costs from 5-36%.[24] Increased densities and cost savings on parking can result in improved project feasibility and allow for additional station area development.

TOD Offers a Wider Variety of Benefits than Just Parking Facilities

As more TOD projects have been built throughout the country and the Bay Area, it has become clear that the benefits associated with TOD are more diverse and can be more impactful than the benefits associated with strictly building parking. TOD offers not only tangible economic benefits (as described above), but can also have substantial impacts on transit ridership, car ownership and vehicle miles traveled, use of alternative modes, energy use, and community design and quality of life. A summary of the research of these benefits is provided below.

Higher Transit Ridership

- Those who live or work near TOD travel by transit far more. In fact, TOD commuters typically use transit two to five times more than other commuters in the region.[25]
- Transit mode splits are much higher within TODs, as more than 25% of TOD residents regularly commute on transit, as opposed to 5% in surrounding cities.[26]
- Transit use by TOD residents extends into off-peak periods much more than that of commuters who park at stations. This off-peak transit ridership is especially valuable for transit agencies.

Increased Use of Alternative Modes

- TODs have about 3.5 times more walking and cycling than the surrounding metropolitan region (11.2% in TODs versus 3.2% in the region).[27]

Limited Car Ownership

- Car ownership rates increase with distance from the station: .5 vehicles per person living within a ¼ mile of the station versus .75 per person living more than one mile from the station. Of the zero-vehicle households in the Bay Area, 70% live within one mile of a transit station.[28]
- TOD households own an average of 0.9 cars compared to 1.6 cars for comparable households not living in TODs.[29]

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[24] Arrington, G., & Cervero, R. (2008). *TCRP Report 128: Effects of TOD on Housing, Parking, and Travel.* Washington D.C.: Transportation Research Board.

[25] Ibid.

[26] Renne, J. L. (2005). *Transit-oriented development: Measuring benefits, analyzing trends, and evaluating policy.* New Jersey: Rutgers University.

[27] Ibid

[28] Gossen, R. (2005). *Travel Characteristics of TOD and Non-TOD Residents in the San Francisco Bay Area: Evidence from the 2000 Bay Area Travel Survey.* Oakland: MTC.

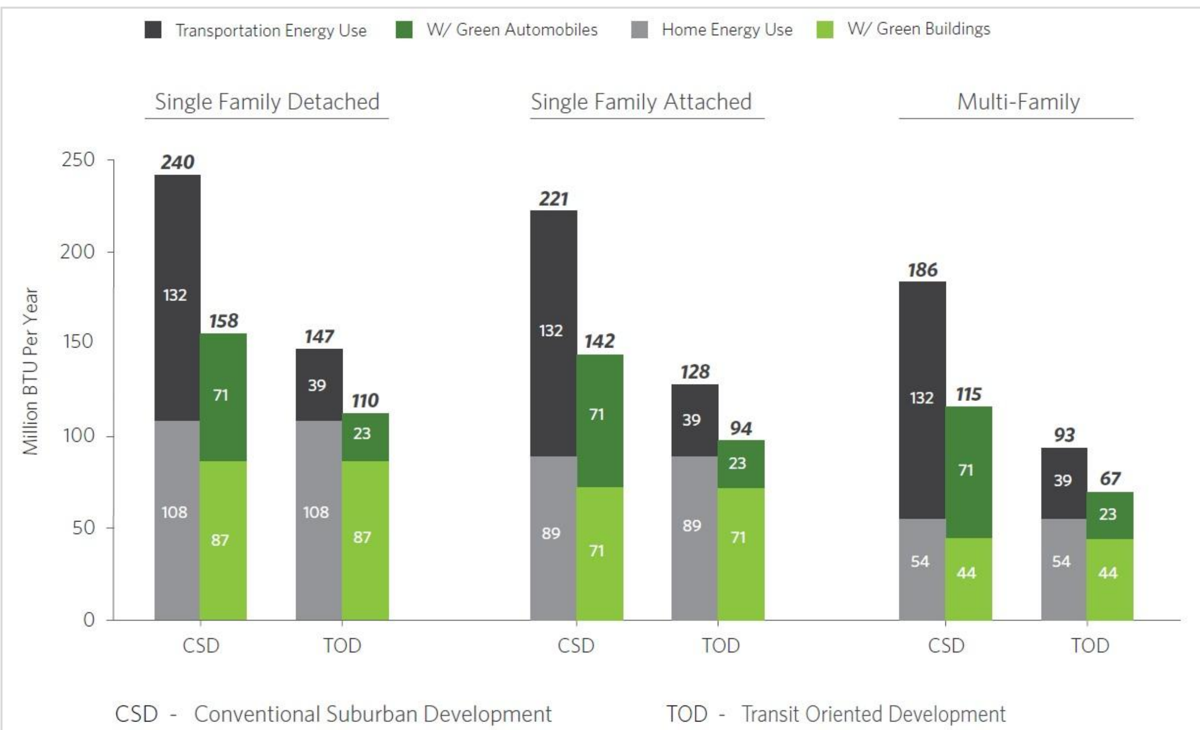
Reduced Vehicle Miles Traveled (VMT) and Vehicle Trips

- VMT per capita increase with distance from transit stations. Households and residents in suburban and rural areas average nearly twice as much VMT as residents within ¼ mile of rail and ferries.[30]
- A survey of 17 TOD-housing projects found that these projects generated an average of 44% fewer vehicle trips than estimated by national standards (3.7 trips per day versus 6.7 trips per day).[31]

Efficiencies in Energy Use

- Home location relative to transportation choices has a large impact on energy consumption. More specifically, if a household moves from a single-family, detached home in a conventional suburban development (CSD) to a house of the same size in a compact, transit-oriented neighborhood, its energy use will be reduced by 39%, as illustrated in Figure 4-2.[32]

Figure 4-2 Summary of Energy Use in Relation to Housing Location and Type



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[29] Renne, J. L. (2005). *Transit-oriented development: Measuring benefits, analyzing trends, and evaluating policy.* New Jersey: Rutgers University.

[30] Gossen, R. (2005). *Travel Characteristics of TOD and Non-TOD Residents in the San Francisco Bay Area: Evidence from the 2000 Bay Area Travel Survey.* Oakland: MTC.

[31] Arrington, G., & Cervero, R. (2008). *TCRP Report 128: Effects of TOD on Housing, Parking, and Travel.* Washington D.C.: Transportation Research Board.

[32] Hernandez, Daniel, Matthew Lister, and Celine Suarez. *Location Efficiency and Housing Type: Boiling it Down to BTUs.* Jonathan Rose Companies, 2011.

Investments in Parking can Reinforce a Station Access Framework that is Limited in its Cost-Effectiveness

Investments in parking at transit stations are often needed, especially in suburban locations with poor transit feeder service and limited pedestrian/bicycle facilities, to ensure patron access to the system. However, such investments can reinforce and self-perpetuate a transit access framework that supports the automobile over access by other modes. First, as described in Chapter 3, parking structures can impact the surrounding streets and existing transportation network in a manner that increases congestion for transit vehicles and creates additional conflicts with pedestrians and bicyclists. The end result is a transportation network that prioritizes automobile travel over other modes. Second, although financing for parking structures is often independent of other modes, millions of dollars spent on planning, designing, and building a parking structure can exhaust an agency's resources for transit, bicycle, and pedestrian access improvements. In fact, many transit agencies have very limited budgets dedicated to station access planning or multimodal access improvements. Most transit agencies have to be opportunistic in their approach to improving multimodal access and often rely on highly competitive grant funding from regional, state, or federal sources to fund specific access improvements.

It is also important to examine the relative cost-effectiveness of various access modes when determining whether to build parking or invest in other modes. MTC's analysis of recently built parking structures at transit agencies found that the daily cost per trip per structure space was $7.65.[33] Costs per trip can be particularly high at transit stations given the high proportion of long-term parking and limited turnover (most spaces in a station parking structure, for example, accommodate only one vehicle per day). By contrast, the relative per trip costs related to the implementation of transportation demand management (TDM) programs or investments in transit, bicycle, and pedestrian facilities can be much lower.

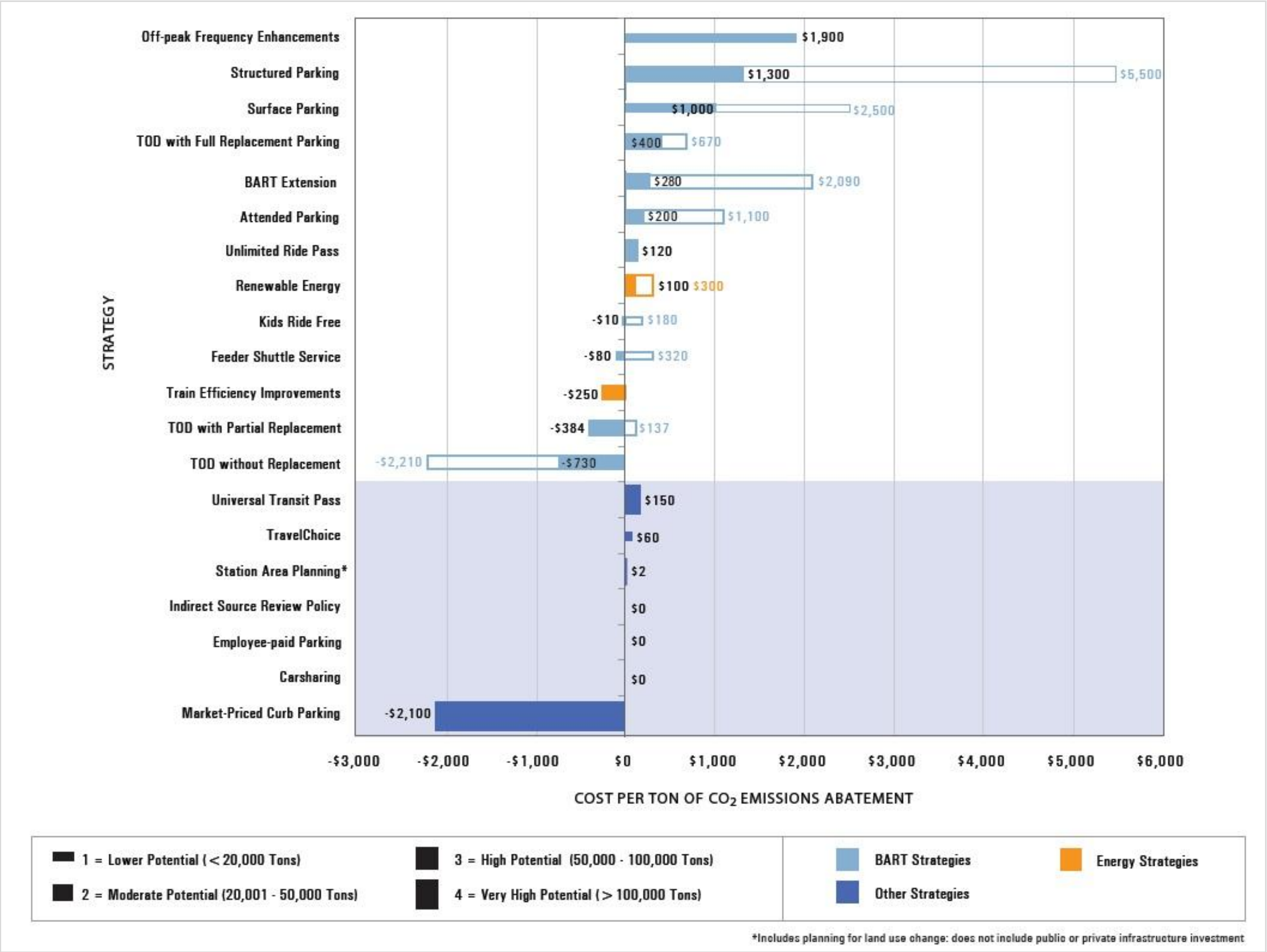
From an emissions reduction perspective, parking facilities at transit stations are also very costly and provide more limited reductions than other strategies. In 2008, BART conducted a study on the cost-effectiveness of potential greenhouse gas (GHG) emission abatement strategies that could be implemented by BART and its partners. A summary of this analysis is shown in Figure 4-3. [34]

This analysis found that of the strategies considered for attracting riders to BART, the least cost-effective were those that required significant new capital or operations spending by BART. Such strategies, which include new parking facilities, more frequent service, and system extensions, generally exceeded an annual cost of $800 per ton. The construction of structured parking, for example, shows moderate potential to reduce GHG by virtue of facilitating access to transit and reducing VMT. However, the cost for structured parking was estimated to be between $1,300 and $5,500 per metric ton, by far the highest per unit cost. By contrast, strategies that include fare incentives, marketing, and feeder shuttle service shows the potential for a competitive level of cost-effectiveness, as these strategies range in cost between $80 and $200 per ton. In addition, a group of scenarios for transit-oriented development on BART property show the potential to be both strong revenue generators and significant reducers of GHG emissions.

[33] Urgo, John. *Right-Sizing Parking Structures: An Analysis of Structures Parking at Transit Stations.* MTC, 2012.

[34] Nelson\Nygaard Consulting Associates (2008). *BART Actions to Reduce Greenhouse Gas Emissions.* BART.

Figure 4-3 Cost per Metric Ton of CO_2 Emissions Abatement (by Strategy)



Parking Facilities are Largely Underutilized in the Off-Peak

Parking structures are typically built to meet estimates of peak demand or ridership. At transit stations, peak demand occurs during the typical weekday commute hours. In the evening or on the weekends, these facilities experience substantial vacancies and their value is not being efficiently used. At transit stations surrounded by parking and with little mix of uses, this effect is particularly pronounced. Shared parking arrangements can reduce inefficiencies, but in many instances transit agencies prohibit shared use of their facilities due to liability or maintenance concerns. With TOD, the transit system can be supported by residential or retail uses during the evening or on the weekends, thereby maximizing the value of the parking facilities at all times of the day.

CASE STUDY: EVALUATING TOD AND REPLACEMENT PARKING AT BART

The challenges and tradeoffs associated with providing parking at transit stations are not lost on transit agencies. For the most part, transit agencies understand that parking is a crucial aspect of improving access to their systems, but that TOD and multimodal investments can offer additional and diverse benefits. Even with this recognition, TOD is still very difficult to implement. Much of this difficulty can be traced to the tension between transit stations as a transportation node and as a “place” with a diversity of uses. For a transit agency that has traditionally been a transit provider, it can be very challenging to transition to the notion of a public agency that is also involved in land development.

The loss of patron parking can be especially troublesome to transit agencies, as parking is seen as vital to maintaining ridership. To alleviate these concerns, transit agencies will typically require one-to-one parking replacement as a condition of development, most often by replacing existing surface parking lots with large parking structures. These policies typically have long-standing histories and can be appropriate in certain contexts. However, transit agencies often “default” to such policies with limited analysis of the tradeoffs and how such requirements can make it difficult to foster TOD projects from both a design and financial standpoint.

BART provides an interesting case study for these issues. As the agency has slowly evolved from strictly a transit (and parking) provider to also a land developer, it has sought a better understanding of the implications of its parking policies and how those policies impact its ability to maximize the value of its transit stations. This section describes the agency’s efforts to develop a new methodology for replacement parking, as well as a more recent analysis of the economics of structured parking at BART stations. These efforts provide lessons learned for other transit agencies dealing with similar issues.

BART Parking Replacement Methodology

Overview

Historically, BART has had a one-to-one parking replacement requirement for any development that impacted its existing parking facilities. As more development has occurred at BART stations in recent years, it became clear that this policy was negatively impacting the agency’s ability to jointly develop its valuable land assets. While agency staff provided for some flexibility with replacement parking on an ad-hoc basis, there was limited consistency about how parking replacement should be evaluated internally and applied externally. The end result was developers consistently asking for waivers from parking requirements and increased uncertainty regarding project approval.

In 2005, a new BART replacement parking model[35] was developed by Richard Willson with the goal of providing internal and external stakeholders with an open and practical planning tool. The model incorporates a wide variety of qualitative and quantitative inputs and seeks to account for not just impacts on parking and BART ridership, but also how projects can support joint development efforts, address BART's overall fiscal health and long-term capacity challenges, reduce drive alone rates, ensure consistency with BART's multimodal access policy, and support regional transit and sustainability objectives.

In brief, the model incorporates four steps. First, specific data inputs are collected for the station area at which the joint development is proposed, such as existing ridership, parking occupancy data, access data by mode, and population and employment within ½ mile. In addition, a synthesis of the policy context and access issues at the station is completed. This qualitative information is utilized to assess whether local partners are willing to make decisions that will support the replacement parking scenario being considered by BART. Second, specific future development scenarios are developed, including: project size, type of land uses, parking assets and policies related to shared parking, parking pricing, and other planned access improvements. In the third step, each scenario is evaluated according to established criteria for that station, such as ridership impacts, parking demand impacts, associated costs and revenues, and mode shifts. The final step is to use the analysis to develop a joint development and access/replacement parking scenario that could be included in ongoing planning processes.

Results

To illustrate outcomes of the model it is best to look at how it was applied at a specific station. The model was tested at the MacArthur BART Station, which is located in a predominantly urban neighborhood north of Downtown Oakland. The station area, specifically the existing 600-space surface parking lot, was proposed for a new joint development project that would include a mix of housing, commercial, and retail uses. Replacement of parking was a key issue for the project as BART was apprehensive about impacts on ridership, while there was concern that full replacement of existing parking would impact project feasibility and also undermine efforts to transform the station area into a transit-oriented community. To facilitate the planning process, the BART Replacement Parking model was utilized to evaluate three potential development scenarios.

- Scenario A: 575 units @ 1.125 parking spaces per unit; 41,000 SF retail @ 4 parking spaces per 1,000 SF; 14,000 SF of medical uses @ 3 parking spaces per 1,000 square feet; 4,500 SF of community facilities with no parking. 100% replacement parking.
- Scenario B: Same development profile. 50% replacement parking. $1 per day parking charge on 50% of the spaces; existing reserved parking program continues.
- Scenario C: 650 units @ 1.125 parking spaces per unit, 103,000 SF of retail @ 4 parking spaces per 1,000 SF; 60,000 SF of medical uses @ 3 parking spaces per 1,000 SF; 6,000 SF of community facilities with no parking. 50% replacement parking at $3 per day, replacing the reserved parking program. Improved shuttle service and transit access.

Figure 4-4 provides a summary of the model results.[36] All scenarios showed increased ridership levels, with Scenario B showing the least impact due to the loss of parking without other modal access improvements. Scenario C shows that even with a loss of 50% of parking, ridership increases substantially due to BART's ability to capture a portion of the trips from the new residential and retail activity, as well as improved transit access to the station. The model also accounted for the projected revenues and

[35] Willson, Richard. *Replacement Parking for Joint Development: An Access Policy Methodology.* BART, 2005.

[36] Ibid

expenditures associated with each development scenario. Each scenario had positive outcomes as compared to the status quo, with Scenario C having the highest net annual impact in terms of ridership, revenue, and planning outcomes.

Figure 4-4 BART Replacement Parking Model Outcomes, MacArthur Station

Criteria	Scenario		
	Medium density TOD, status quo parking	Medium density TOD, 50% replacement, $1/day for ½ spaces	Higher density TOD, 50% replacement, $3/day, + bus access
Net daily boardings	+962	+638	+1,411
Reduction in drive alone share	+	++	+++
Net annual revenue	$495,910	$763,000	$1,316,791
Net annual costs	($111,301)	$50,522	($229,478)
Net annual impact	$384,609	$813,522	$1,087,313

In addition to the MacArthur station, the BART parking model was tested with a number of hypothetical development scenarios at a variety of BART station types. The initial testing of the model reveals a number of key findings related to parking and station area development. As discussed by Richard Willson and Val Menotti,[37] the model indicates that:

- "Requiring less than one-to-one replacement of commuter parking produces gains in ridership and revenues and fulfills most BART goals as compared to requiring full replacement parking. Development feasibility improves as replacement parking requirements are relaxed."
- "Aggressive development scenarios that include no replacement of parking, the institution of parking charges, and more intensive development produce the net greatest benefits, although less ridership gain than moderate alternatives. In contrast, 1:1 replacement of commuter parking, combined with lower density joint development and no use of parking charges, produce negative results for BART."
- "The right decision about replacement parking is dependent on station context. For example, parking at end-of-the-line stations provides an important source of ridership, while mid-line stations are much less dependent on parking for their ridership."
- "A wide variety of alternatives for replacement parking are available, including relocating it off site or at an underused station, or not fully replacing it and instead funding alternative access improvements."

It is important to note that the replacement parking model currently serves as one component of how BART and local jurisdictions evaluate parking and development at stations. The model is imperfect because it does not account for the actual politics of project development. More specifically, it treats all riders the same and does not differentiate between losing one rider and gaining a new one. In reality, however, the loss of a rider is a key consideration for the BART Board of Directors and will strongly influence decisions about parking and development projects.

[37] Willson, Richard, and Val Menotti. "Commuter Parking Versus Transit-Oriented Development: Evaluation Methodology." *Transportation Research Record*, no. 2021 (2007): 118-125.

The model is currently used by staff to initiate discussions about parking and evaluate proposed development scenarios. It provides a strong tool that takes a more holistic approach to addressing the challenge of parking at transit stations. It helps reveal tensions among various goals and illustrates the opportunity costs and lost revenue streams from maintaining surface parking lots near BART stations. In the case of the MacArthur station, the final development plan changed substantially from the model inputs, yet the model was a crucial piece in securing approval of a final development plan that required approximately 75% replacement parking.[38]

Structured Parking at BART

As part of MTC's *Smart Parking Technical Assistance* grant program Wilbur Smith Associates conducted an economic assessment of parking structures at transit stations, focusing on documenting parking structure costs and then evaluating a range of tradeoffs between new parking and TOD projects.[39] BART's suburban-oriented stations served as the primary case studies for the analysis, as they are facing the biggest development pressures of transit stations in the Bay Area. The analysis sought to answer a number of specific questions:

- What is the full cost of surface and multilevel parking?
- What are the BART ridership implications given a number of development scenarios: surface parking, multi-level parking, residential TOD use, office TOD use and retail TOD use?
- How intense would TOD development need to be to provide the equivalent BART ridership of surface parking?
- At what land value does surface parking become uneconomical suggesting conversion to structured parking and/or TOD use?

Using a spreadsheet based model, the analysis revealed a number of key findings that further demonstrate the difficult issues and tradeoffs facing transit stations as they seek to balance the need to provide parking for their customers with the growing desire for station area development that meets a broader set of local and regional goals. Figure 4-5 summarizes the findings related to parking capital costs in the context of land value. These findings reinforce the parking cost discussion in Chapter 2 and further demonstrate the significant capital costs required to build parking. For example, a space in a surface lot is $5,000 per net new space as compared to $25,650 for a space in a five-level parking structure. When factoring in land value, these costs increase dramatically.

[38] http://www.oaklandnet.com/government/ceda/revised/planningzoning/MajorProjectsSection/macarthur.html

[39] Wilbur Smith Associates. *Parking 201: Economic Assessment of Structured Parking at Transit Stations.* Oakland: MTC, 2011. www.mtc.ca.gov/planning/smart_growth/parking/2011/Economic_Assessment_of_Structured_Parking_at_Transit_Stations.pdf

Figure 4-5 Summary of Construction Costs per Net New Space[40]

Parking type	Net New Spaces	Cost per net new space	Cost per net new space w/ land @ $500k per acre	Cost per space w/ land @ $5m per acre
Surface	125	$5,000	$9,000	$45,000
Deck	125	$12,000	$16,000	$52,000
5 levels above ground	500	$25,650	$26,650	$35,650
3 levels underground	250	$38,500	$40,500	$58,500

The analysis next looked specifically at the tradeoffs between parking at a BART station and new development that would partially replace existing parking, with a particular focus on BART ridership impacts. Based on a variety of hypothetical development scenarios at suburban BART stations, the analysis demonstrated the following:

- "Residential TOD would generate 18-26% of the BART transit riders that the equivalent area in BART surface parking would generate. As a result, residential development would need to be 4- 5 stories in height to generate the same ridership as that from the surface parking lot."
- "It also suggests that instead of a one-for-one replacement policy, the actual replacement could be .74-.82 spaces for each displaced BART parking space."
- "In every development scenario housing generates a positive revenue flow, whereas none of the parking scenarios represents a positive cash flow."
- "Parking structures generate more BART ridership than housing per unit of land area. However, this added ridership comes at a high economic cost. In order to offset the difference in the economic cost of providing station parking, as compared with developing housing on the same site, BART would have to charge five to six times more than is the current practice at its suburban station sites."

It is important to note that much like the BART Replacement Parking model, Wilbur Smith's model can function as a planning tool that provides an initial overview of parking and development scenarios. The model allows planning staff to better understand the opportunity costs of parking in relation to new development. As acknowledged by the authors, the model only examines these tradeoffs from an economic standpoint. In reality, BART's view of its land and parking assets is far more nuanced. As discussed above, BART already owns the land at its stations and its parking assets are primarily viewed as ridership and revenue generators. Loss of parking can result in ridership and revenue declines, which has immediate short-term impacts on system performance.

Moving forward, BART is striving to adopt an approach to parking at its stations that accounts for not just ridership and revenue, but also how the station area can support a balanced mix of uses and a diverse ridership base. The efforts described in this chapter can serve as planning tools for cities and other transit agencies as they strive to balance their transportation role with an emerging need to serve a broader community.

[40] Ibid

CASE STUDY: DEVELOPING A REPLACEMENT PARKING POLICY FOR VTA LIGHT RAIL STATIONS

Santa Clara Valley Transit Authority (VTA) recently conducted a parking replacement study which examined how much parking for transit riders should be replaced when VTA develops transit-oriented development at its light rail stations (LRT) stations. The study also evaluated various strategies that can help reduce overall TOD parking demand, including shared parking, priced parking, and Transportation Demand Management (TDM) strategies. The primary objectives of this study were to identify which stations are projected to have parking demand that is greater than the existing supply for the horizon year of 2035, identify strategies for accommodating excess parking demand, and develop a parking replacement evaluation framework to assist VTA in determining which strategies are most appropriate at individual stations.

The scope of this study was limited to stations located within the City of San Jose, the jurisdiction in VTA's service area with which the transit agency has coordinated the most regarding their respective policies related to parking, an essential ingredient of TOD development. VTA has categorized each of the 13 light rail stations that are the subject of this study into three "tiers" based on each station's potential for development and thus its priority in being allocated TOD planning and financing resources.

Tier 1 stations are those with the highest potential for development based on VTA's Joint Development Policy and Priority Schedule, which was influenced by myriad factors, including the land use designations reflected in the City of San Jose's draft General Plan update, *Envision San Jose 2040*, and the amount of developable property at each station. These are the highest priority stations at which VTA would like to replace excess parking spaces with mixed-use development.

Tier 2 stations are those that also have development potential, due to their size and low parking utilization rates, but where VTA does not have near-term development plans or strategies, and therefore are not as high a priority as Tier 1 sites.

Tier 3 stations have very limited potential for future residential or commercial development, either because of physical constraints that make large-scale development infeasible, such as an irregular lot shape or topography, or simply because the lot is too small. Another criterion for Tier 3 stations is proximity to Tier 1 stations so, if necessary, they can absorb displaced parking from Tier 1 station development. Thus, Tier 3 stations are strategically planned to accommodate additional parking, while Tier 1, and eventually Tier 2, stations are planned to support residential and commercial development.

Findings and Recommendations

Based on the analysis of future demand conducted as part of this study, the projected parking demand at five of the 13 VTA light rail stations evaluated will exceed existing capacity in 2035, the horizon year of this study. This projected parking deficit can be accommodated in four ways:

- Constructing additional parking facilities at the impacted stations, the most expensive and least practical alternative.
- Accommodating Tier 1 (and eventually Tier 2) parking demand at nearby Tier 3 stations, the idea behind VTA's tiering system.

- Reducing parking demand by improving access by non-auto modes, supported by the City of San Jose's General Plan, *Envision San Jose 2040*, which calls for substantially increasing the proportion of commute travel using modes other than the single-occupant vehicle.[41]
- Establishing shared parking agreements with nearby land uses that have unused parking during commute hours, such as churches, shopping centers, and in some cases office parks.

A replacement parking evaluation framework was created to help VTA assess which of the four above strategies would be most appropriate at individual stations. This framework is based on BART's *Replacement Parking for Joint Development* methodology. The steps involved in the replacement parking analysis are outlined in Figure 4-6. By considering San Jose City policies, opportunities for TDM measures (including alternative station access modes) and situations appropriate for shared parking with Tier 3 stations and/or other land uses, these steps provide VTA staff with the tools needed to establish realistic replacement parking levels, while helping the success of the agency's TOD program.

[41] This policy sets a drive alone commute rate of no more than 40% (from 78% in 2008). Thus, as new development at and around these stations results in increased ridership, the mode of access to the stations also is hoped to shift and result in an increase in the number of riders accessing the station via non-auto modes.

Figure 4-6 VTA Station-Specific Replacement Parking Analysis

Step 1: Conduct Parking Demand Analysis
1a) Collect updated parking inventory/observed utilization
1b) Determine horizon year (2035) projected parking demand
Step 2:Evaluate Parking Demand Reduction Due to TDM Measures/Access Improvements
2a) Determine whether a TDM/Access (see Chapter 3) should be applied: • Package 1–5% reduction • Package 2–10% reduction • Package 3–15% reduction • Other TDM/access package 2b) Determine the projected parking demand based on the selected package
Step 3: Evaluate Ridership Impact of TDM/Access Improvements and TOD
3a) Evaluate ridership impacts of selected set of TDM measures and access improvements 3b) Evaluate ridership impacts of TOD 3b) Evaluate total ridership impacts of TDM/access improvements and TOD • If acceptable, proceed with Step 4 • If unacceptable, revisit Steps 2 and 3
Step 4: Evaluate Shared Parking Opportunities
4a) Identify presence of either a nearby Tier 3 station for shift in parking or secured sharing opportunity with adjacent land use(s)
4b) Evaluate if the anticipated ridership loss due to shifting parking is outweighed by anticipated ridership growth in Step 3 • If acceptable, proceed with Step 5 • If unacceptable, assume Step 3 only and proceed with Step 5
Step 5: Determine Replacement Parking Needs
5a) Identify adjusted parking demand
5b) Compare to existing parking supply • Identify near-term replacement parking ratio (0—100%) • Identify long-term replacement parking ratio (0—100%) • If need for parking structure is anticipated in the long-term, consider land banking and phasing of construction to a later date

CASE STUDY: PETALUMA STATION AREA PLAN PARKING POLICIES

In the spring of 2012, the City of Petaluma completed the Draft Station Area Master Plan for the City's two planned SMART rail stations. The comprehensive plan includes policies, goals and objectives regarding land use, development opportunities, housing, infrastructure, historic preservation, and parking and circulation. As part of the planning process and development of parking policies for the station areas a parking demand analysis was conducted to determine future parking demand from new ridership and

TOD developments at the two stations for horizon year 2035. An evaluation of existing parking supply and occupancy as well as planned supply expansions was conducted to determine if the projected parking supply would be sufficient to meet projected parking demand. The analysis found that existing parking supplies and planned supply expansions are sufficient to provide auto access to the Downtown Petaluma SMART Station and the associated TOD of nearby parcels. Modest initial ridership projections and opportunities to manage park-and-ride demand as ridership increases — particularly as the planned TOD build-out begins — should minimize the need for new supply, allowing the parking developed on the SMART property to eventually be replaced with new land uses and shared parking.

In addition, a market analysis was conducted to assess the amount of parking needed to both meet lenders' requirements, potential retail tenant models, and to maximize the value of the project (including avoiding eroding its marketable qualities as a true, walking-oriented TOD). Key findings related to parking include the following:

- Parking is a significant cost-factor (and potential cost-barrier) to financing and development of TOD in the Downtown Petaluma Station Area. At an estimated cost of $27,000 per space, it would cost up to $20 million to build structured parking for all land uses on these opportunity sites according to conventional practice. That includes $5 million for each of four potential parking structures on the SMART and Haystack parcels. The cost of this parking is roughly equal to the cost of current City impact fees on a per unit or per square foot basis.
- Market analysis confirms that lenders, developers, and retailers familiar with mixed-use, TOD in the San Francisco Bay Area are have experience with urban development models with little or no parking and are likely to be willing to support development of individual projects in Petaluma with lower than conventional suburban parking ratios, in these rail and transit served locations, provided that shared parking agreements are reached and a comprehensive plan for access and parking management is in place.

Based on the findings of the parking demand analysis and assessment of market requirements and opportunities, the following recommendations for the supply and management of parking and investment in complementary modes of access and transportation demand management programs in Petaluma's SMART Station Areas were made.

- Share Parking- All new non-residential parking in the Downtown Petaluma Station area is proposed as shared parking
- Design Parking For Flexible Use - To support the shared use of new off-street parking resources, parking facilities should be designed for flexible management and use to allow maximum adaptability to new conditions.
- Expand Supply in Phases
- Invest in Transportation Demand Management
- Price off-street parking
- Adopt an on-street parking availability target of 15%
- Manage to achieve the availability target using pricing or time limits
- Prevent spillover parking impacts in surrounding neighborhoods with new permit parking zones
- Establish Parking Benefit Districts

5 RECOMMENDATIONS

Thus far, this technical report has provided an overview of parking structure development. It has highlighted the context of current and planned parking structures in the Bay Area. A summary of the key opportunities and challenges related to parking structure development has also been provided. This paper then closely examined parking at transit stations and its evolving role in the context of growing demand for transit-oriented development in the Bay Area.

This chapter offers some initial recommendations for how local jurisdictions and transit agencies can take the lessons learned in this paper and apply them to future efforts to analyze and develop parking facilities in a multimodal context. More specifically, this chapter proposes a framework for evaluating and planning parking structures and then implementing them in an efficient manner. While a parking structure may indeed be the best investment in certain contexts, it is worth additional upfront planning resources to ensure the long-term viability of a multi-million dollar investment. Finally, this chapter offers some additional recommendations for MTC about ways in which it can facilitate more regional dialogue and consensus around parking structure development, as well as provide additional technical assistance to local jurisdictions.

EVALUATION AND IMPLEMENTATION FRAMEWORK

Outlined below is a high-level framework for how a local jurisdiction might move forward with evaluating its parking needs, developing a plan for an appropriately sized parking structure, and improving other access modes. While presented in chronological order, many of these steps can or should occur at the same time. This process is designed to achieve two primary objectives. First, this process determines whether a parking structure is the best strategy and that the multi-million dollar investment has been thoroughly evaluated. Second, this framework seeks to ensure that parking structures are not designed in isolation, but are instead one component of a larger effort to improve overall transportation access and mobility in a community.

Obviously, local context is a key consideration, and certain elements of the methodology outlined below may not be appropriate for all jurisdictions or projects. The level of local resources will also be a key consideration and may determine the level of analysis that can be performed. Nevertheless, these steps provide a common language for discussing such important transportation projects.

Step #1: Define Goals and Objectives

The refinement of key goals and objectives related to access and the analysis for a new parking structure is a key starting point. This step is important because it helps stakeholders better articulate the rationale and need for access and parking policies, including consideration of a new multi-million dollar parking facility. Some likely stated goals would be to improve access to a downtown district in support of local businesses, to accommodate future development, or to increase access to a major transit station. Additional goals related to broader community development interests may include improving the vitality of the downtown, attracting more residents to the area, and reducing the production of greenhouse gasses. Other goals and objectives may be related to:

- Fostering economic development/ building the tax base for the city
- Facilitating higher density development / adding new residents to the downtown or transit station area
- Building transit ridership
- Reducing local contributions to greenhouse gas production / implementing the local climate action plan
- Maintaining current levels of access/building multi-modal access
- Maintaining or building on current levels of car access/ replacing existing supply of parking
- Mitigating spillover issues

Whatever particular goals and objectives emerge from this exercise, it is a critical step to ensuring that parking issues are addressed as efficiently as possible. A high-level discussion of short-term and long-term outcomes may stimulate alternative or complementary solutions to the construction of a parking structure. In the end, it may turn out that what the community wants in relation to parking could be achieved through alternative means. For example, could issues of parking spillover could be addressed with other parking management and pricing strategies?

Step #2: Conduct Existing Conditions Assessment

When evaluating the potential for a new parking project is to conduct an existing conditions assessment. An assessment of this nature is useful in establishing a shared understanding of key parking issues, concerns, and attitudes; project or site characteristics; the economic and social factors shaping the discussion around parking; and community goals and objectives. An existing conditions study can also help to shape eventual strategies and determine a comprehensive action plan for addressing key parking issues. Outlined below are some of the key elements of an existing conditions assessment.

- **Document Existing Access and Parking Policies:** Establishing a shared understanding of the local access / parking policies is a key initial step. As a result of this exercise, other parking goals and objectives may need to be better defined. For example, the interest in increased parking supply may be less of a response to short-term parking trends, but rather to accommodate future development. Key questions to answer would include:
    - What are the current minimum parking requirements? When were they last revised?
    - How do the existing parking requirements reflect parking demand for different land uses or different zoning districts?
    - Do the current parking requirements support local and regional goals for reduced VMT, more intense mixed-use development, or TOD projects?
    - Do current parking requirements provide development flexibility?

    - What alternative parking strategies, such as shared parking arrangements or unbundled parking, are permitted?
    - Do existing requirements reflect changing demographic trends and travel patterns?

- **Document Parking Conditions:** Another important early step is to document existing parking conditions, trends, and needs. Simply put, before investing in an expensive parking structure it is essential to establish conclusively that a new structure is actually needed. The "demand" for a new parking structure may not be driven by lack of supply, but may instead be the result of poorly managed existing supply. In addition, a study may identify opportunities for shared parking that would mitigate the need for a costly parking structure. An analysis of current parking conditions would ideally include:
    - Inventory of existing supply, regulations, and price of parking
    - Parking occupancy and turnover study of not only the project site, but also the parking facilities (on- and off-street) in the surrounding community or district
    - Origins and destinations of vehicles at the project site and within the larger district
    - Estimates of existing and projected parking demand per land use
    - Identification of underutilized private facilities and opportunities for shared parking arrangements
- **Create a Community and Project Site Profile:** This component would include an evaluation of the project site and the surrounding community. Key information to obtain would include:
    - Existing and proposed land uses, including opportunities and constraints
    - Population and employment trends
    - Key development and real estate market trends
    - Existing transportation assets (such as transit, bicycle, and pedestrian facilities) and proposed transportation system improvements
- **Gather Stakeholder Input:** In addition to quantitative information, it is also important to capture qualitative input from key stakeholders. This information can be used to supplement trends identified by data analysis and offer additional context. Stakeholders could include decision makers, public agency staff, developers, local businesses, and community members. Input could be gathered via public meetings or surveys.

Step #3: Establish an Appropriate Policy Framework

The cost, design, and role of a parking structure will largely be determined by the policy framework of the local jurisdiction in which it is constructed. This policy framework is primarily defined by minimum parking standards and zoning regulations. As discussed previously, most of these parking standards and requirements, especially at transit stations, are incompatible with existing market demand. Therefore, it is imperative that local jurisdictions adopt parking requirements and policies that are based on actual demand and reflective of local conditions.

Policies that are reflective of local conditions would be informed by the information gathered as part of the existing conditions analysis. Key regulatory issues to resolve include:

- Reduced or removed parking requirements in zoning districts or within land uses that have lower parking demand (e.g. downtowns or CBDs, transit stations and transit corridors, etc.)
- Shared parking policies that require or facilitate joint use of spaces among land uses that have different periods of peak demand
- Use of alternative parking strategies to meet or reduce parking requirements, such as: unbundled parking, parking in-lieu fees, TDM programs, bicycle parking, exemptions for mixed-use or TOD developments, exemptions for small parcels, etc.
- District-wide parking policies and plans to ensure that on- and off-street parking facilities are managed in a coordinated manner
- Design, circulation, and aesthetic requirements to ensure that parking structures can be successfully integrated within an existing community
- Replacement parking policies at transit stations to manage new TOD projects

A revised regulatory framework can dramatically increase flexibility for developers and improve project flexibility. Policies that address these key parking concerns can be extremely beneficial to a local jurisdiction by ensuring that the parking structure is designed in a manner that is most appropriate for the local context. Revisions to parking policies can also help local jurisdictions not only better manage its parking supply, but also achieve goals related to housing affordability, congestion, safety, and reduced emissions.

Step #4: Document Full Parking Structure Costs

Another key part of the evaluation framework is a comprehensive assessment of the costs associated with the parking structure to ensure that costs are fully accounted for and understood by stakeholders. As detailed in Chapter 3, parking structures are far more than their "hard" construction costs, but also include "soft" design and planning costs, ongoing operating costs, and environmental costs. A cost analysis should also be sure to include an evaluation of "net" costs per space if the proposed structure is to replace an existing supply of parking.

A parking structure cost analysis should include consideration of pricing options. This should include an analysis of the full recovery costs if borne by users, the cost to recover ongoing operating costs if borne by users, and the current and projected range of pricing of parking in the local context. This cost analysis should feed into the evaluation of other strategies to determine if they can effectively provide some of the desired access at a lower price.

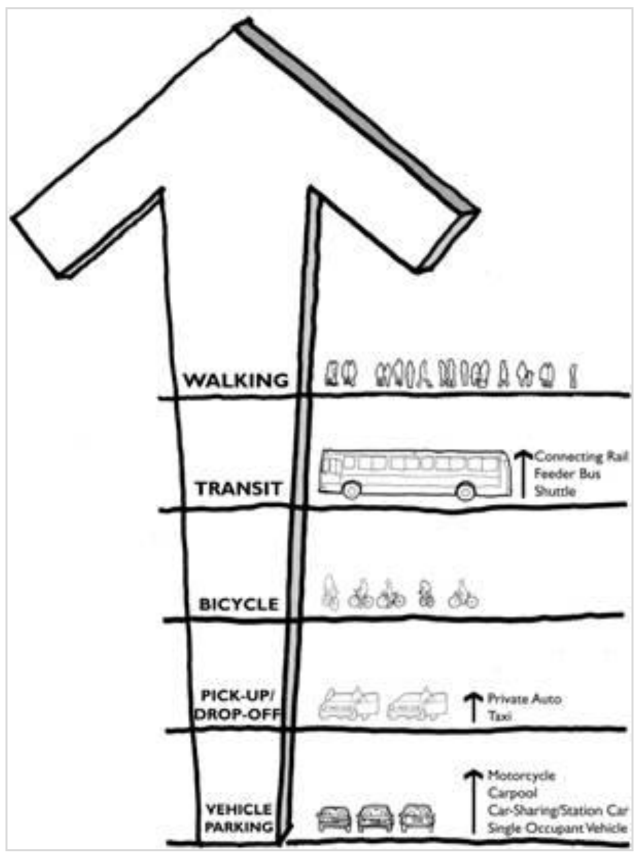
Finally, a discussion and analysis of land values and opportunity costs must be included. For a parking structure proposed at a transit station, local jurisdictions and transit agencies should engage in a robust analysis of how new station area development can impact ridership, net revenue, sharing opportunities, alternative access modes, and whether to replace existing parking supply on a one-to-one basis or on a different basis with complementary policies.

Step #5: Evaluate Multiple Access Strategies

A new parking structure is only one piece of the "access" puzzle. A new structure in a downtown will improve access for motorists, but how will such an investment impact transit, bicyclist, and pedestrian mobility? A new structure at a transit station will better facilitate park-and-ride patrons, but how does that structure complement efforts to improve multimodal access? These should be key considerations for local jurisdictions and transit agencies so that they strive to develop comprehensive access plans and strategies from a holistic perspective.

In recent years, BART has prioritized comprehensive and multimodal access planning for its stations. BART's efforts demonstrate one possible approach for local jurisdictions or other transit agencies. As ridership is projected to grow across the system, BART is seeking to reduce the drive-alone rate in favor of increased use of carpools, transit, walking, and bicycling. Figure 5-1 shows a generalized prioritization of access goals to BART stations, adopted in the 2003 *BART Station Access Guidelines*. Pedestrian access has highest priority, while transit connections should be convenient, safe, and close to the station. Access to bicycle parking and passenger pick-up/drop-off locations should be in the near vicinity of station entrances. BART has also adopted specific modal access targets for its stations and measures progress in the context of those metrics.

Figure 5-1 BART Station Access Hierarchy



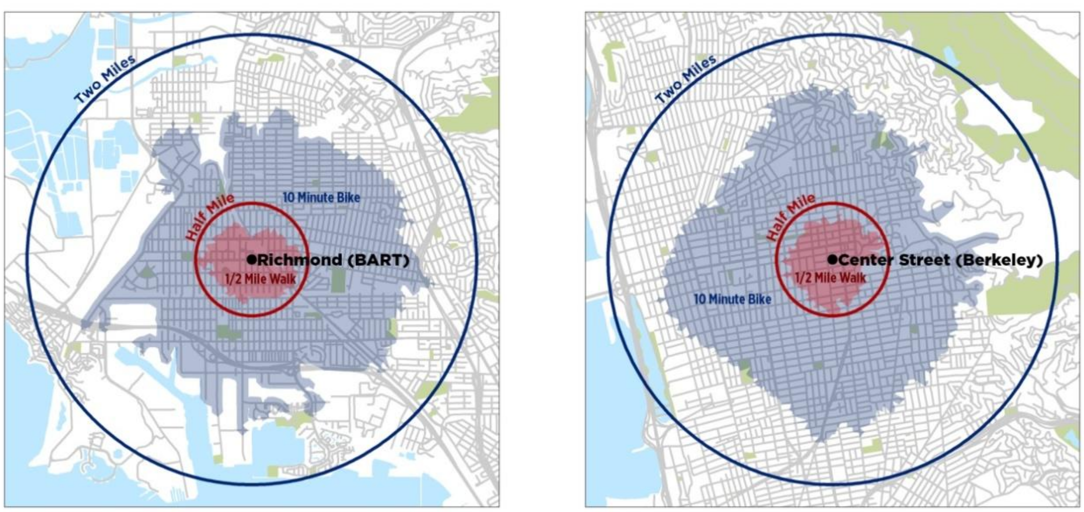
BART has sought to implement this station hierarchy through a series of station access plans for stations throughout the system. These station access plans seek to document existing conditions, identify key issues and opportunities, and prioritize access strategies to, from, and within the station area. They discuss parking needs and opportunities for parking improvements, but in the larger context of complementary multimodal strategies. Station access plans ultimately guide future investments and the programming of BART, local, and regional dollars.

As part of any access study it is important for local jurisdictions to evaluate cost-effectiveness of each access strategy. As discussed in Chapter 3, on a daily per trip per space basis parking structures can be very expensive, especially at transit stations where turnover per space is very limited throughout the day (as opposed to parking in a downtown or commercial district where there are typically more short-term trips). MTC's recent analysis of recently built parking structures at transit stations estimated that the daily cost per trip per space was $7.65. When evaluating a future parking structure, it is important that cost-effectiveness is compared across multiple access strategies. For example, it may cost a local jurisdiction or transit agency millions of dollars to operate a shuttle system to a transit station. However, on a per passenger trip basis, that shuttle service may be less expensive than a new parking structure, while also increasing ridership and reducing local congestion. A similar cost analysis for bicycle and pedestrian improvements and additional TDM programs may also demonstrate higher cost-effectiveness.

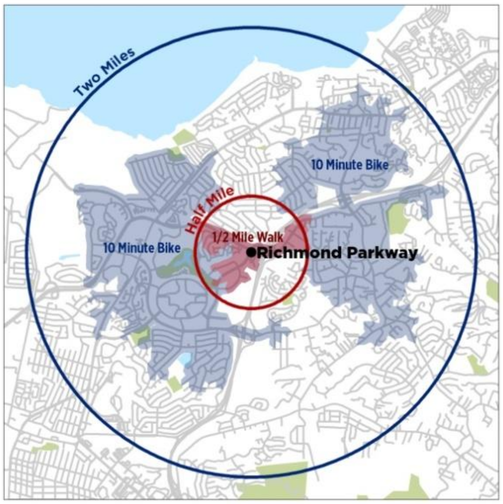
Finally, it is important to emphasize that access planning should also incorporate an assessment of walking and bicycling "sheds" in relation to existing and future population and employment. By identifying actual walking and biking sheds one can better determine where non-motorized access improvements should be made. More specifically, such an analysis should go beyond the simplified ¼ - ½ mile radius around a downtown or station area. In reality, the ability to access a specific destination by walking or biking is not uniform throughout the surrounding radius. Factors such as street network connectivity, intersection density, completeness of the sidewalk or bicycling network, topography, major barriers (e.g. freeways, train tracks, and bodies of water), and mix of land uses are all key determinants of a realistic and comfortable walk and bike shed.

These relationships are demonstrated in Figures 5-2 and 5-3 below.[42] At the Center Street garage in Berkeley and the Richmond BART station, the dense grid street network allows for walk and bike sheds that are evenly distributed and almost "fill" the ½ mile and 2 mile radius. By contrast, the walk and bike sheds at the Larkspur Ferry and the Pittsburg/Bay Point BART stations are much more limited and have significant gaps. The dispersed street network and substantial barriers around these stations can limit the degree to which people can access the station area by non-motorized modes. It should be noted that this analysis does not assess the "quality" of the bicycle and pedestrian facilities (such as sidewalk completeness, crosswalks, or presence of bicycle lanes), but merely looks at potential network access.

Figure 5-2 Examples of Station Area Walking and Biking Sheds



[42] Figures and analysis adapted from: Urgo, John. *Right-Sizing Parking Structures: An Analysis of Structures Parking at Transit Stations.* MTC, 2012.



Source: Adapted from analysis by John Urgo.

Figure 5-3 Population within radius vs. walk or bicycle "shed"

Station	Walking			Biking		
	Within 1/2 mile Radius	Within 1/2 mile "Shed"	% within "Shed"	Within 2 mile Radius	Within 2 mile "Shed"	% within "Shed"
Berkeley Center Street garage	13,814	7,952	57.6%	132,766	86,334	65.0%
Richmond BART	10,374	5,222	50.3%	87,350	51,427	58.9%
Richmond Parkway Transit Center	4,772	1,354	28.4%	61,182	23,394	38.2%
Larkspur Ferry	2,279	5	.2%	46,912	8,510	18.1%

In summary, any development of a parking structure should be part of a larger effort to improve access for all modes of travel. Increases in parking supply should be complemented by a variety of other strategies, including:

- A district-wide parking plan that coordinates on- and off-street parking management strategies
- Transit system improvements, including bus and shuttle services
- Bicycle and pedestrian infrastructure improvements
- Transportation Demand Management (TDM) programs

Step #6: Plan and Design Structures to Mitigate Impacts

If, at the end of this evaluation framework, the decision is to move forward with the development of a new parking structure, the final step is to ensure that the parking structure is physically planned and designed in an appropriate manner. In short, the structure should be located and designed so that its potential impacts are mitigated to the greatest degree possible. The structure location and design should be developed to support local community interests, such as use for evening and weekend parking and support for local businesses during hours of lower demand for transit parking. It should account for key circulation and safety concerns so that vehicle entries and exits do not negatively impact transit, bicycle, and pedestrian movements. At transit stations, parking should be located in a way that maximizes convenience and access for housing and mixed-used development.

The structure should also be designed in manner that ensures safety and security for its users. Finally, it should incorporate design elements consistent with the surrounding buildings so that it can be integrated as seamlessly as possible. All of these considerations can increase project costs, but they are critical to long-term success and, if accounted for early on in the process, should not come as a surprise.

Well-Integrated Structures

MTC'S FUTURE ROLE

Parking is largely an issue of local control. Local agencies determine the parking policies that they believe are most representative of local parking conditions. MTC understands and respects this dynamic, yet as a regional body it is also its responsibility to ensure that scarce regional transportation dollars are spent as effectively as possible and support policy efforts to reduce greenhouse gases. To that end, there is a need for improved regional collaboration and consensus on many parking issues, including the development of new parking structures. Through its regional parking reform efforts, MTC has already invested significant resources in fostering regional dialogue and developing best practices which can be applied throughout the Bay Area. Local jurisdictions have benefited from these efforts, and there is a growing consensus that MTC can and should do more to catalyze parking reform.

Outlined below are some recommendations for MTC in its efforts to improve and expand its role as regional convener and facilitator of parking reform. The recommendations below are tailored specifically to the issue of parking structures, but their larger intent could be applied to parking reform in general. In brief, there are four areas in which MTC can continue to play an important role in parking reform: regional guidance, technical assistance, certification programs, and funding requirements.

Regional Guidance

It is recommended that MTC develop additional parking structure guidance for local jurisdictions and transit agencies. Through MTC's previous parking work, it has developed a "handbook" and various policy papers related to parking reform. This work provides an excellent overview of key parking issues, yet there is limited guidance developed specifically for parking structures. Specific guidance and best practices should be developed for the key elements outlined below. This policy guidance could be developed according to MTC's existing community typologies and should be designed for easy integration into local parking and zoning codes, as well as local access policies.

- Policies that require detailed financial analysis of parking structure construction and ongoing operational costs prior to project construction.
- Policies that address user pricing as a component of parking structure analysis.
- Policies for determining the feasibility of a new parking structure in the context of existing parking supply and potential for shared parking and multi-modal access opportunities. For example, guidelines would establish minimum thresholds related to existing and future parking demand, existing project site and adjacent district utilization rates, and availability of nearby existing supply.
- Policies that coordinate parking structure development with complementary access strategies. For example, development of a parking structure would necessitate an analysis of existing and potential access "sheds" and potential improvement strategies.
- Specific design guidelines that address: parking structure layout, internal circulation, interaction with the existing street network, bicycle and pedestrian conflict points, integration of ground floor uses, incorporation of bicycle parking and car sharing pods, use of architectural elements and sustainable features that improve project aesthetics, and elements that maximize safety and security.

The cost of developing more detailed guidance regarding parking structures to complement MTC's parking "handbook" could cost between $250,000 and $500,000. In addition to developing parking structure guidelines, MTC may wish to develop a regional program to provide on-going assistance to local jurisdictions and to enable MTC to monitor the development of parking structures over time. The annual cost of this program could range from $100,000 to $300,000 depending on the level of oversight.

Technical Assistance

It is recommended that MTC allocate additional resources to develop tailored technical assistance programs and tools for parking structure development. Unfortunately, many local jurisdictions and transit agencies simply do not have the financial resources to engage in more detailed planning efforts related to these issues. As a result, in many cases there is limited knowledge about local parking facilities and how those assets are utilized. Improving this knowledge base and then empowering agencies with simple and user-friendly tools can be one of the most effective roles for MTC moving forward. The types of technical assistance that MTC could provide are numerous and MTC has already engaged in a variety of technical assistance efforts to date. New, enhanced, or expanded technical assistance efforts could include:

- **Grant programs**: The success of parking structure development efforts depends on a planning process that is well-designed, highly transparent, supported by robust data, and responsive to public input. In addition, capital expenses are also substantial. To help overcome these basic resource challenges, MTC could expand its technical assistance grant program to include:
  - Planning grants:
    - Development of local parking ordinances and parking structure policies
    - Development of project-specific parking and access studies
    - Parking studies to revise local parking codes and/or develop parking ordinances for jurisdictions to adopt, develop district-based management, etc.
    - Data collection and analysis
  - Capital grants:
    - Multi-space pay stations that allow for easy payment of fees as well as automatic collection of utilization data and improved operations
    - Internal and external real-time wayfinding systems
    - On-site amenities: bicycle parking and car sharing within parking structures
    - Enhanced enforcement, such as purchasing of License Plate Reader (LPR) vehicles
    - Architectural and sustainable elements within parking structures
- **Parking structure analysis "toolkit":** A toolkit could be developed that includes simplified planning and analysis tools to guide parking structure development. These tools would be made available by local planning staff and decision makers. Potential tools could include:
  - Parking data collection and analysis spreadsheet model
  - Parking demand model (see existing MTC Parking Model developed in 2007)
  - Parking structure costing model that would allow for easy input of cost assumptions (construction costs, soft costs, O&M, land values, etc.)
  - Replacement parking methodology (i.e. BART model) to evaluate parking and development scenarios at transit stations
  - GIS analysis and mapping tools to evaluate various access strategies
  - Model to evaluate cost-effectiveness of various access strategies
- Workshops and outreach program to provide technical support regarding above policies and programs

The cost of providing technical assistance will vary depending on the extent of MTC's technical assistance program. The cost of developing a "toolkit" could range from $100,000 to $250,000 and the cost per workshop could range from $10,000 to $25,000 depending on the scope and duration of the workshop. Planning grants could range from $50,000 to $200,000 depending on the scope of the planning process and capital grants could range from $50,000 to $500,000 depending on the infrastructure that is being implemented.

Parking Certification Program

Much as the Leadership in Energy and Environmental Design (LEED) certification program administered by the U.S. Green Building Council has helped to spur a sustainable building boom, a parking certification program could help achieve widespread regional adoption of parking reforms. Such a program could bestow recognition upon communities and individual employers and developers who lead the way forward as the first to implement policy and program reforms.

- Such a program would establish policy and program reform targets for local governments, developers, and employers that vary based on the transit accessibility of their location and for employers by their industry sector (e.g. regional medical clinics would have different standards than offices housing professional service firms).
- Through a coordinated marketing strategy, MTC would highlight the successful implementation of parking reforms by certified cities, projects, and employers, articulating the connection between parking policies and other community goals.
- MTC and local governments may also consider requiring communities to meet certain certification standards in order to receive planning assistance, infrastructure, or service funds.

TransForm, a Bay Area non-profit organization focused on regional transportation issues, recently created GreenTRIP, a certification program for residential infill projects within the nine-county Bay Area. This certification program rewards residential projects that seek to reduce vehicle trips and greenhouse gas emissions through TDM and parking management. MTC may wish to explore ways in which this program could be expanded, applied to commercial developments, or tailored to achieve specific goals related to structured parking. The biggest challenge for the GreenTRIP program is expanding its reach and ensuring that developers, local agencies, and decisions makers are aware of the benefits of the program.

Funding Requirements

Similar to MTC's Transit Oriented Development (TOD) Policy ("Resolution 3434"), MTC could condition distribution of regional funding for parking structures on the adoption at the local level of a full suite of parking management policies with parameters set by MTC (similar to minimum density requirements for development along transit corridors). By creating specific funding requirements, MTC could help to ensure efficient allocation of regional dollars. While such requirements may increase the burden on local agencies, it is likely that it will maximize project efficiency, reduce costs, and improve overall access management within local communities. Potential requirements for distribution of regional transportation dollars towards parking structures are outlined below:

- Completion of a parking study that documents:
  - Level of parking supply
  - Utilization rates and trends
  - Level of existing and future demand
  - District-wide parking use and availability
  - Opportunities for shared parking and potential leasing arrangements
- Clearly articulated cost projections that fully document project costs (construction, soft, ongoing O&M, debt service, net annualized cost per space, etc.) and potential revenues (including pricing options for new facility)

- Completed multimodal access study that details parking structure impacts on other modes and evaluates how investments in transit, biking, walking, and TDM could reduce the demand for parking (or at least the scale of a proposed parking structure)
- Development of a district-wide parking management plan that addresses parking at both on-and off-street facilities and outlines key management strategies (such as pricing, residential permit programs, revision of TOD parking requirements, unbundled parking, shared parking, etc.)
- Development of a comprehensive TDM program

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Examples of Parking Structure Wayfinding
(from top, left to right)

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Integrated Bicycle Parking
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Examples of Ground Floor Uses, Façade Treatments, and Sustainable Features

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Impacts on Community Design

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Circulation Impacts from Parking Garages

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Parking Facilities at Bay Area Transit Stations

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Well-Integrated Structures

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