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Abstract

This paper presents the results of a qualitative survey of commercial owners, managers, and occupants in the City of Berkeley who have invested in on-site bicycle facilities such as secure parking, showers, changing rooms, and clothing lockers, what we are calling "bicycle-oriented design" (BOD). The sites represent a selection of building types common in the commercial building stock in U.S. cities.

The research is designed to answer three questions about the use of BOD: (1) what were motivations behind the decision to invest in BOD (2) what are the challenges and rewards for investing in BOD? and (3) what types of BOD were chosen? The survey was carried out through structured interviews and by site visits.

This research builds on the growing literature on bicycle facilities by exploring the concept that bicycle infrastructure does not stop at the door. We find a number of motivations and challenges shared across a variety of settings, and the insights derived from the study can be applied to broader situations. Operational needs and a desire for "green" image-building and marketing are important contributors. Space costs, especially the cost of interior space, posed challenges. Solutions at some sites suggest strategies that could be applied in other settings. The results also indicate that many decisions on specific BOD components were made on an ad hoc basis, indicating a potential need for an authoritative source of information and guidelines about BOD because much of the information is scattered across different agencies and sources.

1. INTRODUCTION

The literature on bicycle infrastructure (*1*) (*2*) (*3*) (*4*) (*5*) (*6*) has largely emphasized the facilities on which bicyclists travel during their trips, e.g., bicycle lanes, dedicated paths, paved shoulders, "sharrow" lanes, bicycle boulevards, and bicycle tracks. Our research adds to this work by focusing on the facilities at trip's end, extending the concept beyond the destination's door. While there is in the literature work that has included some consideration of the end-of-journey facilities (*7*), we build on it by looking exclusively at this expanded concept of bicycle infrastructure that addresses bicyclists' concerns about security and shelter from the weather (covered and secure parking), and supports the bicyclist's transition from the commute (e.g., showers, clothing and equipment storage). Bicycle parking is recognized as an element of transportation demand management in the 2010 Chapter 19 of TCRP Report 95, which cites provision of on-site, secure parking and showers (*8*) as a way of encouraging bicycling as an alternative to driving. These elements comprise what we are calling "bicycle-oriented design" (BOD). Similar to the concept that in transit-oriented development (TOD) a transit traveler becomes a pedestrian over the course of the entire trip (*9*), BOD reflects that a bicyclist becomes something other than a bicyclist at the journey's end.

Of note, standard design and building practices, rating systems, building codes, and other policy efforts are starting to incorporate BOD elements. The Leadership in Energy and Environmental Design (LEED) ratings system (*10*) and the American Institute of Architects' Committee on the Environment awards (*11*) include on-site bicycle facilities in their criteria for granting certification or selecting winning projects. The growing list of sustainable or "green" building codes also references them. In California, the state is poised to adopt voluntary green building codes that set standards for short-term and long-term bicycle parking for new buildings (*12*). BOD is playing a role in the federal government's efforts to place greater emphasis on incorporating bicycle transportation into the federal transportation system. The Secretary of the U.S. Department of Transportation has committed to making bicycling an important part of the federal transportation system (*13*) and has formed an Interagency Partnership for Sustainable Communities with the Environmental Protection Agency (EPA) and the Department of Housing and Urban Development (HUD). (*14*)

To assess the opportunities and challenges to BOD implementation in practice, we conducted a qualitative survey of commercial and mixed-use building owners or principals (developers, designers, managers, and tenants) who have chosen to invest in BOD in the City of Berkeley. We used a written survey to structure interviews around three questions (1) what are motivations behind their decisions, (2) what are the challenges and rewards for making investments in BOD? and (3) what types of BOD did they choose?

Our paper discusses the findings from the structured interviews and site visits, which reveal several lessons that can have a broad applicability to decisions about potential forms of bicycle infrastructure, and how and if investments in BOD could be made. We discuss findings about motivations: economic, operational, and regulatory influences, as well as image-building and government "leading by example" (*15*).

2. CONTEXT AND RESEARCH APPROACH

The City of Berkeley has a long history of promoting bicycle and pedestrian travel and safety. It is a compact city in northwestern Alameda County, with a population of 108,000 in approximately 10.5 sq. miles. (*16*) (*18*). The city has a Pedestrian Master Plan, which was updated and finalized in June 2010, and a Bicycle Plan, which is in the process of being updated (*19*). Approximately 10 years ago, it implemented a network of seven Bicycle Boulevards (*20*) providing access to most sections of the city on traffic-calmed streets. It also has some 50 bikeways. The City is served by two stations of the Bay Area Rapid Transit system (BART) and numerous bus lines. Approximately six percent of work trips are made by bicycle, one of the highest rates in the Bay Area (*16*).

While no specific codes have been developed to address interior bicycle facilities in the building, zoning or construction codes, the city has specifications for bicycle rack design and placement (*17*), and the transportation division works with developers to advise them on installation of bicycle racks on sidewalks bordering their projects, according to two of our interviewees. The City's General Plan includes provisions that allow greater residential density and more relaxed automobile parking requirements in developments located near transit. The City has a Bicycle Program that involves citizens and city staff through outreach programs, commissions and panels, and partnerships with other cities and regional agencies. The city's Transportation Commission has a Bicycle Committee that advises the City on bicycle issues. The City led the creation of the signature Berkeley Pedestrian and Bicycle Bridge, opened in 2002 over Interstate 80-580 that runs along its western border. In partnership with a local bicycle shop, BART, and with funding from local transportation grants, the City opened an expanded Bike Station in July 2010 that offers free secure bicycle parking for nearly 270 bicycles, including round-the-clock self-serve parking for

a nominal membership charge. Finally, the City's recently adopted Climate Action Plan calls for significant attention and investment in alternative modes as a one of several strategies to curb greenhouse gas emissions. (*21*) While certain aspects of Berkeley may not be shared by all cities, the observations we have made of these projects are transferable to other settings, including cities that may be considering expanding their bicycle planning and infrastructure in response to concerns such as sustainability or increased density, as well as the numerous cities that, like Berkeley, are characterized by high population density and high car parking costs. Additionally, the fact that these projects were carried out under real financial and other practical constraints increases the transferability of the findings to other settings.

In our study, we survey owners, developers, and managers of a selection of types of buildings in Berkeley. We chose the sites from a pool of candidates derived from listings of Leadership in Energy and Environmental Design (LEED)-certified buildings in the area, the American Institute of Architects' Committee on the Environment (COTE) Award winners, buildings ranked by various "bike"-able metrics (e.g., the League of American Bicyclists' list of bicycle-friendly communities), and in consultation with the key Berkeley City staff, architects, planners, and designers who are active in the area of bicycle planning and design of bicycle facilities.

We narrowed our candidates to four buildings that represent a selection typically found in urban settings: a large, institutional, government complex; a mid-20th century low-rise office structure; a contemporary (2009 construction) office/retail/residential mid-rise with a pending LEED rating; and an adaptive re-use retail/office conversion of a small historic building. While it would be useful to include similar projects where developers chose not to employ BOD, that requires investigation beyond the time and resources of this study (because BOD is such a nascent concept and thus is only recently starting to be an option that developers do or do not choose). Such work would be a useful addition in future research. Our work is based on structured interviews with the owners, developers, and managers of the four buildings as well as site visits to gather information on building characteristics, including types of BOD used, car parking provisions, and number of tenants. Details of each building are provided in Table 1.

TABLE 1 Characteristics of Sites for BOD Infrastructure Survey

Location Surveyed	Setting	Building Type	Size	Number of Occupants	Car Parking Provided	BOD
Lawrence Berkeley National Lab-Building 76	200-acre campus, large institutional, government complex (4,500 daily users)	Mid-20th Century adaptive reuse (formerly industrial)	5,000 sq. ft	250	2,000 (free permits)	7 inside bicycle parking racks on wall, showers, lockers
Berkeley Electronic Press (Bepress)	Commercial street	Mid-20th Century low-rise office structure	6,000 sq. ft.	60	None	11 indoor bicycle parking racks on walls
David Brower Center	Infill, CBD	Contemporary (2009) mid-rise structure	50,000 sq. ft.	175 (300 capacity)	None	17 bicycle spaces in outdoor locked and sheltered bicycle cage, ~10 spaces in adjoining underground car parking garage, showers and lockers.
2130 Center Street	Commercial street, CBD	Early 20-Century (1924) low-rise landmarked structure, adaptive reuse	25,000 sq. ft.	~100	None	20 indoor, secure spaces in a bicycle room accessible by elevator

We hypothesized five motives: 1) financial/economic (either making a property more desirable so that it commands premium prices, rents, or more profitable leasing terms from tenants or purchasers, or attracting tenants that are more financially stable or otherwise desirable), 2) operational (enhancing the internal efficiencies, esthetics, or safety of their buildings), 3) image-enhancing for creating or furthering a environmentally sensitive "green" identity for the developer or the tenant or buyer, 4) legal or regulatory (complying with building and zoning codes or other incentives or disincentives by investing in bicycle infrastructure), and 5) government lead by example.

The four sites we visited and the persons with whom we conducted our structured interviews touch on at least one of each of these motivations, usually two or more.

This research builds on work that has examined the intimate connections between transportation and housing in the context of TOD (*22*) and adaptive re-use of historic downtowns (*23*). It also builds on work connecting parking policies and land use and transportation (*23*) (*24*) (*25*). Finally, it builds on the literature on the economic benefits and disbenefits of real property that is environmentally sensitive and on the knowledge base on facility design (*26*).

Additionally, our examination of BOD investments can be viewed as one way of facilitating community partnerships in which there are both public and private roles. As public institutions consider what if any steps to take to encourage alternative forms of travel, private investments in facilities such as BOD can complement and magnify the effects of the public investments (*15*). Additionally, this research adds to the knowledge base in terms facility design.

3. FINDINGS FROM THE FIELD

This section describes the four cases of our research and elaborates on the private sector's motivations, benefits, and challenges of implementing BOD in practice.

3.1 Lawrence Berkeley National Laboratory (LBNL): Building 76

Setting: 200-acre campus, large institutional, government complex
Building Type: Mid-20th Century adaptive reuse (formerly industrial)
Size: 5,000 sq. ft.
Car Parking: 2,000 permits (free)

The Lawrence Berkeley National Laboratory (LBNL) is a federal facility operated by the University of California as a research campus, hosting students as well as Lab scientists, technical and support staff, and visitors. The Lab is a member of the U.S. Department of Energy's national laboratory system and conducts unclassified research across a range of disciplines, including energy, environmental science, biology, materials science, and computing. While it is under no obligation legally to comply with local regulations imposed by the City and County, certain aspects of its operation fall under state and federal regulations (*27*).

The initial impetus for investing in BOD came from LBNL's motivation to enhance the safety and esthetics of the facility, through eliminating potentially hazardous and unsightly bicycle parking on inappropriate structures. The investment in BOD was also motivated by administration support for efforts that (1) demonstrate a commitment to environmental stewardship by using environmentally sensitive practices, i.e., green branding; (2) as an arm of the U.S. Department of Energy, demonstrate government lead by example (*23*), and (3) to satisfy a voluntary commitment to the City of Berkeley, made at the city's request, to reduce employee parking spaces (*27*).

The Lab sits on a steep hillside above the UC Berkeley campus, which makes walking and bicycling a challenge, and thus its physical setting plays a significant role in land use and transportation decisions. It is a large, hilly site, comprising 150 buildings spread out on approximately 200 acres. The daily population is approximately 4,500 people, of whom 4,000 are lab employees and another 500 are visitors, primarily guest scientists and delivery personnel (*27*). There are roughly 2,000 free parking spaces that are limited to permit holders. Only salaried employees are eligible for permits (students, contract workers, temporary employees and visitors are not eligible). An informal agreement made at the request of the City sets a goal of having at least 1.7 employees per parking space. The Lab administration has established a volunteer transportation demand management committee made up of members of the bicycle coalition and facilities planners to help develop policies to reduce vehicle trips to the site. Under a new policy, vanpools and carpools are being given parking permits in the more desirable locations.

To encourage employees to reduce their vehicle trips to the site, there is a well-used system of free, circulating shuttle buses, whose routes are coordinated with Bay Area Rapid Transit (BART) stations that serve the immediate area. They run at convenient intervals throughout the workday. According to information obtained in our interviews, a 2008 internal employee survey showed that half the employees commuted by some form of alternative transportation (transit or bicycle) three days out of five.

All staff are allowed unlimited rides on the shuttles, and staff use them for internal trips at the Lab as well as trips on and off the site. The system was upgraded with new buses in early 2009, resulting in new bio-diesel vehicles equipped with bike racks on the front and (on most of them) the back (the older buses also had bike racks). With two racks, each bus has a total capacity of seven to eight bicycles and approximately 35 riders. Additionally, the administration is planning on expanding the shuttle bus routes, based on results from an employee survey and a

geo-coded analysis of the locations of employee's residences. LBNL staff estimate that their efforts have already pushed the employee-to-parking-space ratio up to a little above 2.0.

Bicycle use has been encouraged since the 1970s, according to our interviewees, in response to the lack of parking for autos. LBNL also has a "bicycle coalition" on site that claims some 100 members. It has only been recently, however, that the Lab has examined bicyclists' storage and parking needs in a systematic manner Since 2009, based on data gathered from observational studies and in consultation with the bicycle coalition, the lab administration has added conventional bike racks with capacity for nearly 100 bicycles in multiple locations, including a bus stop at the employee cafeteria and outside a building whose outdoor fixtures had been clogged previously with locked bicycles. At one building, a vertical rack for approximately seven bikes was installed at a covered loading dock and entry with limited space. Staff report that the initial impetus came from safety concerns caused by bicyclists' locking their bikes on stairs, blocking fire lanes and emergency access corridors and rolling them into hallways and tracking in water during the winter.

The Lab administration took these interventions a significant step further in one of the first major refurbishments of a building on the campus, Building 76, which houses the physical plant operations and administrative staff. This was part of a larger, long-range effort to streamline Lab operations and make its physical plant more efficient in its use of resources such as energy and water. The building's complete makeover included the addition of indoor secure bicycle storage, showers, and locker rooms. Staff in our interviews attributed this investment in BOD to an overall ambition to operate the Lab as a sustainable facility. The Lab has established a facility-wide program, SustainLBL (*28*), and operates under the guidance of various federal directives, federal laws, energy department policies, and University of California Policies on sustainability (*29*).

The renovation came about in part as a result of a decision to reduce overhead costs for the division by consolidating offices that had occupied leased space in downtown Oakland a few miles away, which cost an estimated $1.8 million a year—the bulk of that sum to pay for leased parking for employees. When the offices were consolidated, no parking could be added, resulting in a net reduction in parking per employee.

The indoor bicycle parking consists of a black rubber coated "bike wall," with vertical racks that can hold eight bicycles in such a way that they do not pose any tripping or other safety hazards. The racks are located in full view of the break room.

Showers were added when the men's and women's restrooms were refurbished as part of the renovation. At the same time, the existing changing and locker rooms were refurbished. The building's site plan also has set aside space for outside bike racks that will be installed once construction on another project is complete. Building 76 was built in the 1940s as a shop facility. More than 60 percent of the Lab's structures are greater than 40 years old. As more of them are refurbished, the Lab administration intends to adopt the techniques used in Building 76, which will result in a significant increase in secure, indoor bike parking, showers, and storage.

3.2 Berkeley Electronic Press (Bepress)

Setting: Commercial street
Building Type: Mid-20th Century low-rise office structure
Size: 6,000 sq. ft.
Car Parking: None

The Berkeley Electronic Press, known as "bepress", was founded in 1999 by Berkeley and Stanford faculty to develop open-source, all-electronic, peer-reviewed academic journals as a way of providing an alternative to traditional paid-subscription print journals. It is a privately held company that has no institutional affiliation with the university.

The offices are located on Telegraph Avenue in Berkeley, roughly three-quarters of a mile southwest of Sather Gate, the south entrance to the UC Berkeley campus. This portion of the street is characterized by low-rise office buildings, storefronts, and cafes, sprinkled with mid-rise office blocks, many of which are medical labs and doctors' offices serving patients who are treated at a large medical campus to the west.

The building where bepress is housed is a mid-20th century two-story office building, re-purposed from a one-story storefront. It has been subdivided into three suites, one of which is occupied by bepress. Bepress occupies roughly 6,000 square feet of space, spread across two floors and a mezzanine and separated by a foyer.

Our fieldwork involved an interview with a top manager of the company and a site visit. Inside the rear entrance, which provides ground floor access to an L-shaped hallway leading to a ground floor office area, the walls have been mounted with two rows of bicycle hooks, creating a capacity for 11 bikes. The company has approximately 60 employees. It does not provide any employee parking.

The decision to install inside bicycle parking was made in 2005, shortly after bepress moved into the offices, which they lease. All of the top management bicycles regularly. The prime motivation was their own convenience in having their bicycles protected from the weather and removed from the reach of bicycle thieves, which are perceived as a problem in the neighborhood. Previously, employees were parking their bicycles in the building's hallway. (Nationwide, bicycle thefts account for 4% of the larcenies recorded in the FBI's database (*30*). It is widely accepted that bicycle thefts are under-reported.

Additionally, our interviewee noted that there is an external benefit to providing bicycle parking as he highlights it in presentations about the company as a selling point to potential employees and customers who have an affinity for new technologies and alternative ways of doing business. As a business selling a new technology approach in an inherently conservative field, the bicycle parking facility "tells customers what kind of culture we are," which communicates a contemporary and environmentally aware image to potential customers and employees.

3. 3 Brower Center

Setting: Mid-rise mixed-used infill project, CBD
Building Type: Contemporary (2009)
Size: 50,000 sq. ft.
Car Parking: None

The Brower Center is a 50,000 sq. ft. office building and part of a larger infill project built on a surface parking lot in central downtown Berkeley. It is half a block from the UC Berkeley campus and the downtown Bay Area Rapid Transit (BART) station. It was conceived as an environmentally exemplary complex to honor David Brower, the founder of an environmental advocacy group, Friends of the Earth. The building is on track to achieve the highest possible LEED certification, which would make it the first such building in Berkeley (*31*). In particular, it incorporates numerous environmentally friendly elements (including gray and rain water use, reclaimed building materials, passive heating and cooling, photovoltaic electricity generation, natural light, and locally sourced materials). It is also part of a mixed-use complex that includes a 97-unit affordable apartment complex, 10,000 sq. ft. of commercial space, and a 46,000 sq. ft. underground garage (approximately 100 spaces for cars and another 10 for bicycles).

The building's BOD elements include a locked, sheltered outdoor bicycle cage that holds 17 bicycles and two showers on the second floor of the building. Additionally, there are 10 bicycle racks on the sidewalks around the perimeter and another 10 racks inside the underground parking garage.

As an infill project, and close to transit, the Brower Center was allowed to be exempt from any parking requirements by the City, which has a variety of requirements, depending on the nature of the project and the section of the city where it is located. One motivation for the BOD was the LEED credit that is granted for bicycle facilities, our interviewee noted. Most important, however, was that the building's "green" pedigree meant that the project developers wanted to promote alternative forms of transportation, including bicycling. The showers serve a dual purpose, our interviewee noted, of enabling commuters to wash up after a ride and to encourage building occupants to exercise during the day.

The project developers used a customized design for the bicycle cage because of the unique dimensions of the space and the project's commitment to use locally sourced or re-purposed materials that fit in with the project's overall esthetic. It has a keypad lock and video camera surveillance. The racks were retrofitted after initial installation to make it easier to lock bicycles more securely. For cost and space considerations, it had to be located outside of the building, and it had to be covered to protect bicycles in inclement weather. Our interviewee noted that the cage is nearly full, and racks on the sidewalks are also heavily used, even as the building is still at low-occupancy (175 of 300 potential occupants), suggesting to our interviewee that the ultimate demand for the cage could be as much as three or four times its current capacity. Given space constraints, there are no plans at this time to expand the cage. However, we observed that the racks inside the underground parking garage were not full during our visit, which occurred during working hours on a workday.

The lack of BOD standards and guidelines was noted by our interviewee as something of an obstacle, necessitating a "learning by doing" process such as security issues with the bicycle cage door and customizing the brackets to hold the bicycles. At least two bicycles had been stolen from the cage, our interviewee noted, partly due to the fact that the door does not close automatically, partly due to early difficulties with the brackets, and the ability to reach through the spaces of the protecting bars and over the top. "It would seem like there should be standards," our interviewee noted, which would have helped avoid some of the early mistakes.

3.4 2130 Center Street

Setting: Low-rise restaurant/office building, CBD
Building Type: Adaptive reuse of a 1924 landmarked structure
Size: 25,000 sq. ft.
Car Parking: None

This building is a landmarked 1924 two-story structure located on one of the primary connector streets linking downtown Berkeley with the UC Berkeley campus' main west gate. It is situated on a block-long section of street that has been altered in recent years to make it more inviting to pedestrians and bicycles (narrowed traffic lanes, widened sidewalks, bulb-outs, bollard-ringed designated on-street bicycle parking, sidewalk cafe seating, street trees and street fixtures). The northern side of this block is owned by UC Berkeley and is the future location of a complex that will house a hotel, convention center and museum. The downtown Berkeley Bay Area Rapid Transit (BART) station is located half a block away. Numerous bus lines also serve the immediate area.

The building has been converted from a repertory film duplex to a two-story, 25,000 sq. ft. restaurant/office project, having originated as a restaurant in 1924. The ground floor contains 14,000 sq. ft. of restaurant space (occupied by two tenants), with a smaller (approximately 1,300 sq. ft.) space on the ground floor. The second floor is office space. In addition, there is an unfinished basement, accessible by elevator. Our interviewee estimated that there are between 75-100 occupants spread over eight separate tenancies.

As this is a historic downtown building, parking was not originally provided in its construction. The developer noted that this is a "burden" in attracting office tenants because a firm's management often expects to be able to park on site. This disadvantage is offset in part by the site's convenient location to the Berkeley campus as it draws tenants from a mix of university affiliates and other non-profits.

The developer is in the process of adding 20 bicycle racks to a basement storage room to create a secure, indoor bicycle storage area. The motivation is tied to the developer's desire to market the site as a "car-free" location, that will appeal to the non-profit tenants he hopes to attract. "We're developers," our interviewee said. "We want to make it an easy decision to rent this space, especially when you have no parking."

There is also an operational motivation: by providing designated indoor secure parking our interviewee said he expects to avoid collateral damage to walls, hallway clutter, and hazards associated with bicycles left randomly around the site. "When they park bikes in the hallways," our interviewee said, "they bang up the walls, fall over, create clutter. It's a lot easier to have a place where they can put them." The indoor storage also alleviates concerns about bicycle theft. "What they like is a space inside their building," this person said of the types of tenants who respond to BOD.

While indoor space is generally at a premium and often too costly to devote to bicycle parking, the basement in this project could not be used for revenue-generating purposes. It was also accessible by elevator, which this developer considered a crucial requirement for bicycle parking. "It is a low-value space that is accessible and reasonably secure." This interviewee noted that foregoing rental income by converting rentable square footage to non-revenue-generating bicycle facilities would be difficult to justify in business terms in many projects, given the narrow margins on real estate projects. This person has developed numerous commercial and residential projects in the area and does not routinely consider including bicycle facilities for financial reasons.

The developer's firm conducted its own research on the types of racks and chose racks similar to those in the nearby Berkeley Bike Station, which opened in July 2010 two blocks away.

Our interviewee noted that BOD is a relatively low-cost way to provide an amenity. However, this person noted that indoor, secure parking can be costly if marginal space is not available. Using current rental rates for the market that this firm serves—$2.50 per sq. ft. per month—and the 10 sq. ft. that our interviewee estimates to be the size of the footprint required by a parked bicycle—each indoor bicycle space represents foregone revenue of $25 per month, significant enough to affect the financial feasibility of a project if the space is otherwise rentable. Incentives in the zoning approval process would make this less of a barrier, this person noted: "It would not be a bad idea to incorporate bike parking in lieu of car parking."

3.5 Key Motivations and Challenges

The five motives we hypothesized are in evidence in at least one of the four cases to some degree: 1) financial/economic, with BOD used to draw tenants in the case of the small project that has no parking and is marketable as a non-car location, 2) operational: improving safety, esthetics and internal efficiencies, which played a role in three of the four sites, 3) image-enhancing, creating a green "brand," which played a role in all four sites; 4) government lead by example, present in one of the sites, which demonstrated a public-private cooperation to achieve

these goals; and 5) regulatory, which we did not see having any direct effect in the absences of regulatory requirements addressing BOD; rather, we found that broader government directives or policies such as infill zoning exemptions and energy-saving directives made BOD more feasible.

The BOD element usually was instigated by the developer or owner and was often part of a larger package of sustainable design elements. In addition to helping burnish the business' image among customers and prospective tenants, employee satisfaction, workplace esthetics and safety played important roles in the decision to invest in BOD. In the case of the government facility, there was a stated desire to "lead by government example." Cost of the BOD fixtures does not appear to be an element in most decisions. Developers and building managers at all four sites expressed satisfaction with the outcome of their investment in BOD, with one (LBL) saying it would be included in a template for future renovations.

Potential barriers to BOD can only be inferred from this survey, as all four sites did invest in BOD. However, we did uncover some challenges through interviews and site visits:

• the cost of internal space: even the relatively small 10 sq. ft. that one of our interviewees calculates as a requirement for a bicycle parking space, can be financially burdensome unless that space is undervalued or unless its cost is somehow offset through easing of other costly obligations (such as the provision of car parking), as would the costs incurred by setting aside revenue-generating space for lockers and showers, and

• the lack of standards and authoritative sources for BOD design elements, requiring owners to research and create their solutions on an ad hoc basis.

4. POLICY IMPLICATIONS AND FUTURE DIRECTIONS

This study provides an early, first look at the motivations and methods used by projects that extend bicycle infrastructure beyond the destination's door to include bicycle oriented design. The case method used here provides fine-grained detail that can inform broader policies that consider pedestrian and bicycle travel. While the survey is limited in size and scope, the findings show that BOD is implemented in a wide range of building types, from contemporary construction to reuse of historic structure. Importantly, developers across a range of projects have devised methods to incorporate BOD.

These individual portraits give insights that are transferable to other similar building types in the area in which this survey took place and to other similar buildings or infill projects, particularly those in older, compact downtowns with limited parking supply.

Several avenues of research suggest themselves as useful next steps based on our interviews and fieldwork: a survey of developers in markets where BOD is being used to determine what constraints lead developers to choose not to incorporate BOD; a complementary survey of developers who have used BOD to determine if they experienced any measurable value-added benefits from the facilities and measures to compare the foregone revenue from space allocated to BOD with these benefits; an examination of developer trade-offs between supplying car parking and bicycle parking and facilities. Additionally, it would be useful to establish a baseline of current BOD requirements, guidelines, and best practices of BOD design elements. This would be useful to policymakers, local officials, and developers as they confront decisions on how or if to encourage BOD. This would build on existing efforts (*32*). More broadly, additional research on the potential relationship between BOD and mode choice and bicycling frequency of building tenants could lead to a greater understanding of what, if any, benefits accrue from these investments, particularly if self-selection may be at play, as has been noted for transit-oriented developments (*9*). Finally, an examination of BOD in the residential context, particularly for infill and TOD projects, could "close the circle" on the commute trip by identifying the opportunities and challenges with incorporating BOD into residential projects.

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