



# Smart Parking Management to Boost Transit, Ease Congestion

## Oakland, California, Field Test Shows Promise

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**T**raffic congestion in the San Francisco Bay Area is notorious, and the projected addition of 1 million new residents by 2020 will intensify the conditions. Increasing ridership on regional mass transit can reduce commuting time, but the rising costs of land prohibit efforts to increase parking at transit facilities.

### Problem

Peak-hour parking at most of the 31 suburban Bay Area Rapid Transit (BART) District stations has been at or near capacity. Heavy traffic congestion and high parking costs in the central city create the economic context for BART use. In suburban areas, where transit access is limited to a .25-mile walking radius and where feeder services are limited, most people drive to regional transit facilities. Roundtrip BART fares range from \$6 to \$8, and the cost of monthly parking passes ranges from \$64 to \$84.

### Solution

Many European and Japanese cities have implemented smart parking management systems to use the parking capacity at transit stations more efficiently. The systems typically provide real-time information to motorists via changeable message signs (CMSs) that post the number of available parking spaces in park-and-ride lots, the departure time of the next train, and the downstream roadway traffic conditions, as well as guidance to open spaces in park-and-ride lots. Quick, convenient automobile access to park-and-ride lots is essential for transit to be competitive with the automobile, particularly in suburban areas.

The California Department of Transportation and BART requested California Partners for Advanced Transit and Highways (PATH) researchers to evaluate the feasibility of the smart parking concept for transit. Researchers implemented a field test at the Rockridge BART station in Oakland from December 8, 2004, to April 7, 2006. Other project partners included the California Center for Innovative Transit at the University of California–Berkeley, ParkingCarma Inc.'s ParkingCarma™ technology, Quixote Corporation, Intel, and Microsoft.

### Attracting Users

Before the field test, exploratory surveys of BART commuters indicated that the lack of parking and the concern that space may not be available at the station limited BART use. The field test involved two real-time user interfaces:

- ◆ Two CMSs on Highway 24, which displayed parking availability information to motorists on an adjacent commuting corridor into downtown Oakland and San Francisco; and
- ◆ A centralized intelligent reservation system, which permitted commuters to check parking availability and to reserve a space via telephone, mobile phone, Internet, or PDA.

BART provided 50 of the 920 total parking spaces for the smart parking field test. Initially, 15 of the spaces were available for advance reservations, and the remaining spaces were available for same-day reservations by commuters who saw the CMSs on Highway 24 and decided to take BART.

The smart parking system integrated traffic count data from entrance and exit sensors at the BART station parking lot with an intelligent reservation system to provide accurate, up-to-the-minute counts of parking availability. Smart parking facilitated pretrip planning by permitting users to reserve a space up to two weeks in advance, but it also enabled en route decision making, providing real-time parking availability infor-



Sensors in the pavement at the parking lot entrance and exit provided a count of space availability.

mation to encourage motorists to use transit. A motorist who was confronted with congestion on Highway 24 could check parking availability on the CMS, exit from the freeway, and park in the smart parking area at the Rockridge BART station.

The project increased the number of parking spaces available to commuters during the peak period of 7:45 a.m. to 8:45 a.m. by converting parking that had been reserved for use after 10 a.m. (The smart parking service operated from 7:30 a.m. to 10:00 a.m., Monday through Friday.) Donations covered most of the capital costs and the operation and maintenance costs; such a project, however, typically would include initial capital costs of \$150 to \$250 per space and continuing operations and maintenance costs of \$40 to \$60 per space per year.

To maximize the number of participants in the project, one user was allowed only three parking reservations during a two-week period. Users who made en route reservations were charged \$1.00 for the service, and those who made pretrip reservations were charged \$4.50.

### User Evaluations

Since the launch on December 8, 2004, the project accommodated more than 13,000 successful parking events. More than 400 participants completed an initial research survey, and 177 completed the final survey in February and March 2006, more than one year later. Participants were required to complete the survey after joining the project, and all participants were asked to complete the final survey. More than 30 percent of survey respondents indicated that smart parking encouraged them to use BART instead of driving alone to their place of work, and 55.9 percent stated the same for commuting to an off-site work location—for example, to attend meetings.

The before-and-after evaluation of the smart parking field test showed the following:

- ◆ The program attracted a new user population to BART—49 percent of respondents would not have used BART to commute if smart parking were not available. Many were encouraged to use BART more often because they could drive to the station.
- ◆ The program resulted in sizable increases in BART's modal share. On average, smart parking users increased their BART ridership by 5.5 trips per month for on-site work commutes and by 4 trips per month for off-site commutes.
- ◆ The program reduced total vehicle miles traveled by 9.7 fewer miles per participant per month on average.
- ◆ The program decreased average commuting time by 2.6 minutes.



### Benefits

The smart parking project showed that more efficient management of a transit station parking lot can improve access to transit and therefore increase ridership. By dynamically managing BART parking, the project helped to manage parking capacity effectively without a new capital expenditure for construction. By enabling en route decision making through real-time parking information on a highway, the system encouraged a new group of commuters to take transit instead of driving the remainder of a trip, particularly when traffic congestion was significant.

The smart parking system that was tested is the first of its kind in the United States, and it enabled both pretrip and en route planning and billing. BART management was initially cautious about the field test but now has incorporated smart parking into the agency's strategy and plans to introduce the technology to other stations in the system.

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Suggestions for "Research Pays Off" topics are welcome. Contact G. P. Jayaprakash, Transportation Research Board, Keck 488, 500 Fifth Street, NW, Washington, DC 20001 (telephone 202-334-2952, e-mail gjayaprakash@nas.edu).

Changeable message signs along Highway 24 encouraged commuters stuck in traffic to exit for smart parking service and complete their trips by transit.