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## #32 – Bicycle Boulevards — Bryant Street Example

### **PALO ALTO, CALIFORNIA**

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### **Background**

A three-mile residential street was transformed into a mostly stop-free bicycle arterial that serves cyclists of all levels. This “bicycle boulevard” treatment is straightforward and would be replicable in many cities.

### **The Bicycle Boulevard Concept**

Bicycle travelways are generally classified as shared roadways, shared roadways with signs, bike lanes and shared-use paths (*Guide for the Development of Bicycle Facilities*, AASHTO 1999). Each type attracts cyclists according to their desire for directness, avoidance of motor traffic and other factors. In the absence of vehicle calming and diversion measures, direct through routes for cyclists often also attract through motor traffic, decreasing their attractiveness for less traffic-tolerant cyclists of all ages.

A bicycle boulevard is a treatment of a low-volume, local street shared roadway that creates a mostly stop-free “arterial” for bicycles while diverting most through motor traffic. Motor vehicle parking and access to all properties is unchanged. Through motor traffic is diverted by bicycle-permeable street closures and mandatory-turn devices spaced every half-mile to a mile. Most stop signs face most cross-streets, creating two-way stops favoring the boulevard. The city of Palo Alto, CA, implemented what is believed to be the nation’s first bicycle boulevard by transforming Bryant Street.

### **Countermeasures**

#### **Bicycle Boulevard History in Palo Alto**

Discussion of bicycle-priority streets arose in Palo Alto during the environmental movement of the 1970s, reflecting the community’s desire for bicycle routes with low vehicle traffic to complement busier bike-laned streets. Safety was a secondary goal to be achieved mainly by lowering motor vehicle volume and reducing car-bike conflicts. The city’s first bikeway network plan was adopted in 1972, and its 1976 Comprehensive Plan called for a network of bicycle boulevards and identified several possible streets. The 2000 Draft Bicycle Transportation Plan further develops the proposed bicycle boulevard network.

For its first bicycle boulevard, the city evaluated three parallel streets serving the same north-south travel corridor (Bryant, Waverley, and Cowper). All are residential except for three blocks through downtown, and all have parallel parking for their entire length except for some diagonal parking downtown. All three serve the same destinations, including several schools, and function as nearby multi-lane through streets favored by motorists. At the northern city limit all three streets end near a bicycle and pedestrian bridge across a major creek, enabling extension of the route into the adjacent city (Menlo Park). Each had a signal at one of the two east-west arterial streets they crossed. One (Waverley) was a bus route.

Bryant was selected because it was not a bus route, it had an existing pedestrian bridge across a creek that diverted through motor traffic — a key bike boulevard feature, and it already had a signal at the southern arterial street that would be crossed. The bicycle boulevard conversion was implemented in two segments each 11 years apart, in part because of the anticipated expense of placing a signal at the crossing of the northern arterial street.

The southern segment, extending 3 km (1.9 mi) from East Meadow Drive to Churchill Avenue, was implemented in 1981 and involved four major elements. The first was a bicycle- and pedestrian-only crossing of a creek that had a wooden pedestrian bridge that was scheduled for replacement. Because of the anticipated increase in bicycle travel due to the boulevard transformation, the old bridge, just one block from an elementary school, was replaced with a bicycle-only bridge aligned with the street centerline and a separate pedestrian-only bridge aligned with one of the sidewalks. These were actually constructed after the boulevard segment opened. The other elements were two bicycle-permeable street closures, and the changing of all stop-controlled intersections to two-way stops on the cross streets except at two intersections that remained four-way stops. The latter change enables uninterrupted pedaling for a mile or more between four-way stops and signals.

The northern segment, extending 1.9 km (1.2 mi) from Churchill Avenue to the northern city limit, was implemented in 1992 and involved three major elements. The first, constituting most of the cost, was a new signal at Embarcadero Road, a four-lane residential arterial street carrying 25,000 vehicles daily, combined with islands that force right-turn-only movements for motor vehicles on Bryant. The cost of the proposed signal attracted a great deal of non-cyclist opposition because of an existing signal one block away. Cyclists responded that a two-block detour added turning movements and compromised navigability, and that interaction with buses on the parallel street was undesirable. The city added the signal and coordinated it with the adjacent signal to minimize delays on the arterial street. The second element was a bicycle-permeable street closure just south of Channing Avenue, which also attracted opposition due to resident concerns over traffic diversion and impacts on an urgent-care medical facility. After a six-month trial, the closure was replaced with a neighborhood traffic circle one block south at Addison. The third element was stop sign changes similar to those implemented on the first segment.

## Evaluation and Results

### First (Southern) Segment

Bryant's first bicycle boulevard segment was evaluated during a demonstration period from May through October 1982, just after its implementation. Results are reported in the staff's *Bicycle Boulevard Demonstration Study – Evaluation* report of December 9, 1982, which states:

Comparative bicycle counts were taken at three locations on Bryant and at three other locations prior to and during the bike boulevard study. Counts were taken during a twelve hour period (7:00 a.m. – 7:00 p.m.) on mid week days. Base counts were taken in May 1981 and April 1982; counts at these locations were taken again in October 1982.

Twenty-four vehicular traffic counts were taken at eighteen locations along the bike boulevard corridor. These counts included locations along Bryant as well as parallel and cross streets where changes in traffic patterns were anticipated. Base counts were taken in May 1981 and 1982; counts were taken again in October 1982.

The results showed that bicycle traffic on Bryant increased dramatically – 85 percent and 97 percent for two key locations – and that Bryant's rate of increase in bicycle traffic exceeded that of other streets. Bryant was found to carry 475 to 725 bicycles per day depending on location. Bike traffic decreased substantially on two nearby parallel multilane streets favored by motorists (-35 percent and -54 percent for two key locations).

Motor vehicle volumes within the overall corridor, encompassing Bryant and several parallel streets, remained fairly constant. All but three of the streets in the corridor carried considerably less than 1,000 vehicles per day, quite acceptable for local residential streets. Motor traffic on Bryant near the two street closures declined by 52 percent (953 to 457 vehicles) and 65 percent (481 to 170), respectively. Motor traffic diverted by the closures split about evenly to the two closest parallel streets.

The Palo Alto Police Department reported that collisions remained at a low level on the southern segment. No collisions occurred near the street closures.



Bryant at Matadero Creek: Separate bicycle and pedestrian bridges.



Bryant at Lowell: Typical street closure.



Bryant approaching Embarcadero: Turn restriction sign.



Bryant at Addison: Neighborhood traffic circle.

Staff sent a letter to all residents within one block of Bryant along the corridor, and 18 individuals responded. Before implementation, neighborhood residents raised several kinds of concerns—increased speeding, motorcycle and moped violations of the street closures, and residence access issues. Speeding complaints were received soon after implementation but dropped off. Twelve-hour motorcycle and moped counts at the two street closures noted 79 moped violations and 4 motorcycle violations. (Mopeds fell out of fashion after the 1970s, and few if any motorcyclists currently use Bryant for through travel because nearby parallel multi-lane streets serve their needs.) One complaint related to driving schools using the streets and their new cul de sacs as practice areas, but after being contacted the schools agreed to use other routes. The police and the fire department reported no serious impairment of emergency response (Palo Alto has a fully connected street grid that offers many route options).

There was some concern about changes to cyclist behavior at intersections on a route with most stop signs removed in the bicycle travel direction. On a weekday in October 1982, a member of the city's Bicycle Advisory Committee observed cyclist behavior at one of the remaining four-way stops on Bryant's first segment. Three hundred to 400 cyclists were observed during each of the morning and afternoon commute periods. Most scanned for cross traffic, some scanned and slowed, and a few made a complete stop. This is typical of cyclist behavior at other stop-controlled intersections in the city.

### Second (Northern) Segment

Bryant's second bike boulevard segment was implemented in 1992. Unlike the first segment, whose full length underwent a six-month demonstration, the only trial element was the street closure four blocks north of the new signal. One reason for testing this element was its location next to an emergency medical care building, though that facility subsequently relocated out of the corridor. The trial's results appeared in the staff report of July 15, 1993 titled *Evaluation of Six-Month Trial of Bryant Street Temporary Street Closure for the Bicycle Boulevard Extension*. Only one parallel street block experienced traffic increases predicted to be "noticeable" by the "Traffic Infusion on Residential Streets" methodology used by neighborhood traffic management researchers. Staff recommended that the closure be made permanent, but residents persuaded the city council to replace it with a neighborhood traffic circle at the nearest intersection to the south. That circle went through its own trial period and is now permanent.

Because of the lack of a street closure on the segment from the northern arterial to downtown, this segment still attracts considerable short-distance through motor traffic. Motor vehicle volumes there are higher and car-bike interactions more frequent than on the boulevard's purely residential southern segment.

### Other Feedback

Some cyclists on Bryant have remarked that motorists approaching on stop-controlled cross streets sometimes fail to yield to non-stop through cyclists on Bryant. When each boulevard segment was first installed, the city temporarily added yellow "Cross Traffic Does Not Stop" warning plates below cross-street stop signs to educate drivers about the traffic control change. In both phases these were removed after several months because they are nonstandard traffic control devices and because their size impacts sightlines.

As was the existing practice for bicycle-permeable street closures in Palo Alto, the two closures on the boulevard's southern segment were both placed just behind the corner curb returns at intersections, forming an apparent three-way junction that was actually four-way for bicycles. It was found that motorists approaching such intersections do not always scan for and yield to bicyclists traversing the street closures. Palo Alto now installs new street closures several car lengths back so intersections appear as four-way for all parties.

### Subsequent Evaluation

The city has conducted occasional counts of bicyclists at various locations since the completion of the Bryant bicycle boulevard in 1992. Eight-hour intersection counts conducted in May 1997 tallied 385 bicycles at one location on Bryant. Staff attributes the substantial reduction from 1982 levels to cultural changes—the bicycle's share of commute and utility trips has dropped since the first energy crisis, and a greater fraction of students are driven to school as compared to 20 years ago. The city recently hired a full-time transportation systems management coordinator devoted to facilitating adult and student commute alternatives including bicycling.

### Conclusions and Recommendations

The bicycle boulevard treatment successfully transformed a local street into a bicycle throughway while retaining motor vehicle access to all properties. Bicycle volumes increased substantially, and bicycle trip times compare favorably with parallel route options. Bryant Street has become a widely known and well-used through route on the San Francisco Peninsula, both for inter-city commutes and intra-city trips, including student commutes to elementary, middle, and high schools. In honor of her multi-decade role in the street's transformation, the city recently designated the

street to be the Ellen Fletcher Bryant Street Bicycle Boulevard.

The process of identifying potential bicycle boulevards is straightforward, and implementation is relatively simple compared to full-on traffic calming. Other cities throughout the country have implemented bicycle boulevards or are considering them. One Bay Area example is Berkeley. There is a future example in nearby Sunnyvale, where Borregas Avenue, a local street currently severed by two freeways, will become a bicycle boulevard when those gaps are closed by new bicycle-pedestrian bridges.

## Costs and Funding

California's Transportation Development Act, Article 3 (TDA-3) program dedicates a small fraction of the state sales tax on gasoline for bicycle and pedestrian transportation projects throughout the state. TDA-3 is allocated by city population so it is a fairly predictable — albeit variable — funding source.

For the first (southern) segment of the Bryant bicycle boulevard, Palo Alto obtained \$35,000 of FY 1983-84 TDA-3 funds for a new bicycle bridge across a creek. The remainder of the funding for this segment came from city Street Improvement funds.

The second (northern) segment cost \$243,000 in 1992, including the traffic signal. The signal — including interconnection to the city's control system and the adjacent signal — was paid for with \$75,000 of FY 1992–93 TDA-3 funds and \$99,000 of city Traffic Signal Capital Improvement Project funds. The balance of \$69,000 came from the city's Street Improvement Program.

Cost estimates for bicycle boulevards in other locations will largely depend on the capital improvements needed to divert through motor traffic (such as bike and pedestrian-only waterway bridges and bicycle-permeable street closures), calm remaining motor traffic (such as traffic circles), and create bike route continuity across major streets (new signals, bridges or underpasses).

## References

*Bicycle Boulevard Demonstration Study - Evaluation*, City of Palo Alto Transportation Division, December 9, 1982. [Staff report for city council action.]

*Bryant Street Bicycle Boulevard Extension Report*, City of Palo Alto Transportation Division, September 1991.

*Evaluation of Six-Month Trial of Bryant Street Temporary Street Closure for the Bicycle Boulevard Extension*, City of Palo Alto Transportation Division, July 15, 1993. [Staff report for city council action.]

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TIRE (Traffic Infusion on Residential Neighborhoods) Index, cited by Palo Alto Transportation Division staff in their July 1993 staff report (listed above) as: "Source: *Barton-Aschman Associates, Inc. from Goodrich Traffic Group, based on work by Donald Appleyard*".

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