

# TRAFFIC ENGINEERING DESIGN



Bicycle & Pedestrian Planning  
Intelligent Transportation Systems  
Land Use & Transportation Planning  
Parking  
Smart Growth  
Traffic Calming  
**Traffic Engineering Design**  
Traffic Operations & Simulation  
Transit Planning & Simulation  
Transportation Systems Planning  
Travel Demand Forecasting

Fehr & Peers staff possesses vast experience and expertise in the design of traffic engineering facilities. Coupled with our skills in planning and operations, our design services enable us to play a key role in the implementation of improvements from inception to completion. This continuous involvement throughout the project development process proves to be a valuable asset to our clients.

## COMPREHENSIVE APPROACH

We have developed a highly effective approach for our traffic engineering design projects, including:

- **Extensive Field Reviews** – As-built plans are useful, but field data is far better. We find that the more time we spend in the field during design, the fewer unknowns arise during construction.
- **Close Coordination with Reviewing Agencies** – We work very closely with the reviewing agencies to ensure local standards are met for not only the lead agency but also the local utilities and service providers.
- **Close Coordination with Other Design Firms** – Since our work is usually directly related to other design elements, close coordination with other design firms is crucial to a project's success.
- **Thorough Quality Control Program** – We employ our internal quality assurance/quality control program on each project.
- **Responsive During Construction** – We pride ourselves in being readily available to answer technical questions from contractors, perform inspections, and assist as needed to keep projects on schedule.

## SPECIALIZED SERVICES

Our areas of specialized expertise in traffic engineering include:

- Intelligent Transportation Systems
- Traffic Signals
- Signal Interconnect Systems
- Bicycle/Pedestrian Signals
- Emergency and Railroad Pre-emption
- Signing and Pavement Delineation
- Ramp Metering
- Street, Walkway, and Bikeway Lighting
- Traffic Control/Management Plans
- Intersection Design
- Roundabouts
- Traffic Calming Devices

### **SAND HILL ROAD IMPROVEMENTS – PALO ALTO, CA**

Fehr & Peers was retained by Stanford University to manage all transportation improvements, traffic signal timing, and construction traffic planning for the Sand Hill Road projects in Palo Alto. The projects consisted of major infrastructure and land-use elements with a total construction cost of approximately \$100 million. Fehr & Peers worked directly with the City of Palo Alto, Stanford University's contractors, Santa Clara County, and Caltrans as part of an interdisciplinary team, to design, plan, and implement the projects. Specific elements of the project included:

1. Design of 12 signalized intersections including video detection and traffic signal controller upgrades through a three-year phased construction and implementation process.
2. Design of a fiber-optic interconnection system to transmit data to the city's future central control center.
3. Traffic signal timing and coordination plans for two major corridors.
4. Traffic signal timing changes to facilitate safe and efficient traffic flow during construction.
5. Other logistics such as construction employee parking, delivery routes, pedestrian, and bicycle safety.

### **WOODSIDE ROAD CORRIDOR IMPROVEMENTS – REDWOOD CITY, CA**

Fehr & Peers was retained in a key role for the widening of Woodside Road (State Route 84) from U.S. 101 to El Camino Real in Redwood City. Fehr & Peers determined the need for widening the four-lane state highway to six lanes to improve existing deficiencies and to accommodate projected traffic demand. The firm's preliminary analysis and engineering led to the city's request for design engineering services to widen Woodside Road on a fast-track schedule. Fehr & Peers' role in the design project was to prepare plans, specifications, and cost estimates for traffic signal modifications, signing, striping, and roadway illumination plans.

Critical issues related to the widening included adding a through lane in each direction with Caltrans' current 110-foot right-of-way and converting an existing four-lane bridge over the Southern Pacific Railroad to six lanes by widening to the inside. A number of design constraints were present in the corridor, which created unique challenges including a pedestrian overcrossing with an offset center column in the median, existing residential units along Woodside Road, and a five-leg intersection at the junction of Woodside Road with Broadway and the U.S. 101 southbound off-ramp.

### **(WOODSIDE ROAD CORRIDOR IMPROVEMENTS, CONTINUED)**

Fehr & Peers prepared plans, specifications, and cost estimates for four traffic signal modifications, street lighting, signal interconnect, and signing and pavement delineation on Woodside Road between El Camino Real (State Route 82) and the U.S. 101 interchange in Redwood City. The signal modifications were at the Woodside Road intersections of Broadway, Bay Road, Spring Street, and Middlefield Road. Street lighting analysis was performed to determine appropriate lighting equipment and illumination levels for the corridor. Fehr & Peers also developed signal timing plans using SYNCHRO and CORSIM micro-simulation software, and assisted in the signal timing field implementation and 'fine-tuning' of the coordinated system.

### **STATE ROUTE 99 WIDENING PROJECT – STOCKTON, CA**

Fehr & Peers prepared the plans, specifications, and cost estimates for the traffic engineering elements of the widening of State Route 99 in Stockton, California. The project included the addition of a third mainline travel lane in each direction from the Crosstown Freeway (i.e. State Route 4) to Hammer Lane, as well as operational improvements to four interchanges along this section. Design plans were prepared for the mainline signing and ramp metering facilities, as well as the traffic signals and street lighting improvements at each intersection. In addition, the design plans included several Intelligent Transportation Systems (ITS) elements such as fiber-optic facilities, closed-circuit television, changeable message signs, and weather stations. All plans were processed through the City of Stockton, Caltrans District 10, as well as Caltrans Central Region and Headquarters offices.

### **U.S. 101/RALSTON AVENUE INTERCHANGE – BELMONT, CA**

Fehr & Peers prepared plans, specifications, and construction cost estimates for two traffic signal installations, two traffic signal modifications, signal interconnect, city street lighting, freeway lighting and sign illumination as part of the U.S. 101/Ralston Avenue/Marine Parkway Interchange Improvements in Redwood City and Belmont. The project limits on Ralston Avenue/Marine Parkway were between the intersections of the Oracle Parkway/Shoreway Road and Hiller Street. New traffic signal installations were for the intersections of the U.S. 101 northbound off-ramp/Island Parkway/Marine Parkway and the U.S. 101 southbound off-ramp/Ralston Avenue. Fehr & Peers also conducted lane closure analyses and prepared a technical report outlining the results.

### **STATE ROUTE 4 WIDENING – PITTSBURG, CA**

Fehr & Peers prepared plans, specifications, and cost estimates of the traffic engineering elements of the widening of State Route 4 to an eight-lane freeway in the vicinity of the Railroad Avenue interchange in Pittsburg, CA. The freeway widening included provision for a potential BART extension within the median and a station adjacent to Railroad Avenue. The plans were separated into three contract packages to facilitate a very aggressive design and construction schedule. Fehr & Peers' role in the project was to prepare the traffic signal designs at six intersections, traffic control plans, traffic signal interconnection, ramp metering, highway lighting and sign illumination, local street lighting, and highway signing and pavement delineation.

### **I-880 WIDENING PROJECT – SAN JOSE, CA**

Fehr & Peers prepared plans, specifications, and cost estimates for the installation of ramp meters and modifications to the freeway signing associated with the widening of Interstate 880 from Montague Expressway to North First Street in San Jose, California. The freeway widening added a third through lane in both directions and auxiliary lanes at several interchanges. The widening required relocating and modifying the existing overhead signs. Many of these signs were lighted and the sign locations were coordinated with the design of the freeway lighting system. Roadside signs were inventoried and relocated as needed. The freeway widening included installing a ramp metering system on six on-ramps. The design of the ramp metering system included freeway count stations at the interchanges. The plans were prepared in Caltrans metric format using AutoCAD. The project was funded through the Santa Clara Valley Transportation Authority's (VTA) Measures A and B. The VTA was the contracting agency and both Caltrans and the VTA reviewed the improvement plans.

### **11TH STREET IMPROVEMENTS – UNION CITY, CA**

Fehr & Peers was retained to provide traffic engineering design services for the proposed intermodal station in Union City, California. Fehr & Peers worked with a multi-disciplinary team to assess the site access and circulation characteristics of the proposed station, including pedestrian/vehicle interactions between the BART station, "kiss and ride," and bus transit facilities. Subsequent to the technical assessment, Fehr & Peers worked with the team to develop appropriate pedestrian-level treatments to enhance pedestrian safety in the vicinity of the proposed intermodal station. Fehr & Peers also assisted in developing the geometric approval drawings for the access roads and on-site circulation. Finally, Fehr & Peers developed the design plans for the roadway and pedestrian-level lighting and traffic signal installations.

### **JEFFERSON BOULEVARD WIDENING – WEST SACRAMENTO, CA**

Fehr & Peers provided transportation planning and traffic signal and street lighting design services for the Jefferson Boulevard widening project in West Sacramento, CA. Fehr & Peers' services included preparation of a traffic study to evaluate lane configurations and design issues at eight study intersections on Jefferson Boulevard (State Route 84). Fehr & Peers also prepared plans, specifications, and cost estimates for three traffic signal installations, five traffic signal modifications, and street lighting on Jefferson Boulevard from Marshall Road to Stone Boulevard. Fehr & Peers also provided bidding and construction assistance following the plan's approval.

### **I-215/I-515 INTERCHANGE – HENDERSON, NV**

Fehr & Peers provided a variety of design services related to the I-215/I-515 Interchange Improvements in Henderson, NV. First, we prepared plans, specifications, and cost estimates for the Traffic Management Plan (TMP), ITS elements of the TMP, and the traffic control plans of the I-215/I-515 Interchange Improvements in Henderson, NV. The plans were part of the overall design package submitted to the Nevada Department of Transportation (NDOT) for the following roadway facilities: I-215 freeway mainline between the I-215/Stephanie Street interchange and Lake Mead Drive; Lake Mead Drive between I-215 and Reserve Boulevard; I-215/Gibson Road interchange; and portions of the I-215/I-515 interchange. We also assisted with the planning and design of the pedestrian/bikeway facility that runs parallel to I-215 and Lake Mead Drive between Gibson Road and Reserve Boulevard. Finally, we prepared the Change of Access Report that NDOT submitted to FHWA for the I-215/Gibson Road interchange.

### **UC BERKELEY PEDESTRIAN SIGNALS – BERKELEY, CA**

Fehr & Peers was retained by the University of California, Berkeley to provide design services for the preparation of construction documents for the Lawrence Hall of Science traffic signal in Berkeley, California. Fehr & Peers also worked with the university to develop terraced parking and pedestrian circulation facilities at the Lawrence Hall of Science. These studies included redefining the street separating the hall and the parking for curb-side bus loading and focused pedestrian crossing areas. Bus staging areas were also developed for periods when several school buses were on-site at one time. The existing circular drive was redesigned to incorporate handicap parking, private passenger car loading, deliveries, and staff parking. Subsequent to the initial design and implementation, the university retained Fehr & Peers to design a pedestrian traffic signal at the primary pedestrian crossing area connecting the hall to the terraced public parking areas.



### **BICYCLE LANE IMPROVEMENTS – SUNNYVALE, CA**

Fehr & Peers was hired by the City of Sunnyvale to provide traffic engineering design services to install bike lanes on Santa Trinita Avenue and Knickerbocker Drive. In addition, shoulder stripes were installed on Mathilda Avenue between Bordeaux Drive and Moffett Park Drive and signing and pavement legends for “Share the Road” were added on Wolfe Road between Old San Francisco Road and Maria Lane. The bike lane installation on Santa Trinita Avenue required the removal of one through lane in each direction, but added a two-way center left-turn lane in addition to the bike lanes. Bicycle detector loops were installed in the bike lanes at the Stewart Drive and Arques Avenue intersections. The new detector loops were spliced to the existing detector lead-in cables for the removed through lanes.

### **STATE ROUTE 36 IMPROVEMENTS – SALT LAKE CITY, UT**

Fehr & Peers was retained by the Utah Department of Transportation (UDOT) to perform traffic engineering design services associated with the State Route 36 improvement project. Our work included the preparation of plans, specifications, and cost estimates for three new traffic signal installations, one signal relocation, street lighting for 10 intersections, and a signal interconnect system for the entire corridor. We also assisted UDOT with the lighting at the 2400 North Park and Ride lot by incorporating their lighting designs into the plan sheets for the intersection improvements.

### Freeway and Interchange Improvements

Fehr & Peers staff has completed the plans, specifications, and cost estimates for scores of projects involving freeway improvements, new interchanges, or interchange modifications throughout the western United States. The following table displays selected projects and the types of design services we completed.

Project	Traffic Signals	Ramp Metering	Signing & Striping	Lighting	Traffic Control	ITS Elements
U.S. 101 Auxiliary Lanes San Mateo, CA	✓	✓		✓		✓
U.S. 101/Ralston Ave. Belmont, CA	✓	✓		✓		✓
SR 4 Widening Pittsburg, CA	✓	✓	✓	✓	✓	✓
SR 4 East Bypass Brentwood, CA	✓	✓		✓		✓
I-5/Hammer Lane Stockton, CA	✓	✓		✓		✓
I-5/Downing Avenue Stockton, CA	✓	✓		✓		✓
SR 99 Widening Stockton, CA	✓		✓	✓		✓
SR 99/Hammer Lane Stockton, CA	✓	✓	✓	✓		✓
U.S. 50/Folsom Blvd. Folsom, CA	✓	✓		✓		✓
U.S. 50/East Bidwell St. Folsom, CA	✓	✓		✓		✓
SR 65/Pleasant Grove Rocklin, CA	✓	✓		✓		✓
SR 65 Widening Lincoln, CA	✓		✓	✓	✓	
SR 65/Twelve Bridges Dr. Lincoln, CA	✓		✓	✓		✓
I-880 Widening San Jose, CA		✓	✓	✓		
SR 36 Improvements Salt Lake City, UT	✓			✓		✓
I-215/I-515 Henderson, NV					✓	✓
U.S. 95 Improvements Las Vegas, NV		✓				✓