

Profile of an Organization

Institute of Transportation Studies University of California, Berkeley

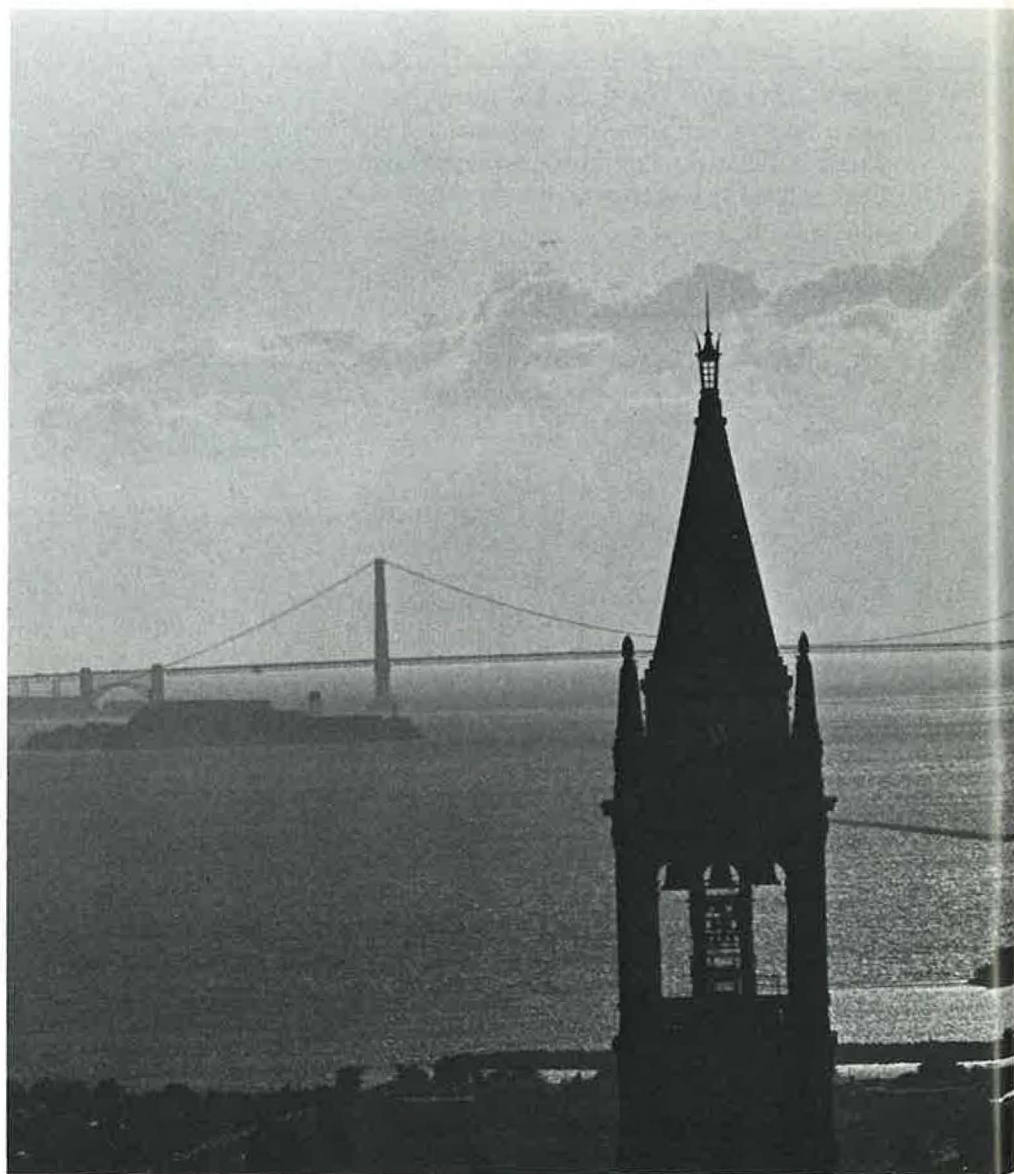
ROBIN NIELSON-CERQUONE

The following article is part of an occasional series presented in TR News that profiles transportation research organizations. The establishment and goals of the Institute of Transportation Studies at the University of California, Berkeley, as well the institute's past research activities and current research program, are discussed in this article.

In the winter of 1988, the Institute of Transportation Studies marked its fortieth anniversary. There was much to celebrate. In its four decades on the Berkeley campus of the University of California, ITS has grown in size and scope.

From a small group of engineering faculty and an \$80,000 budget in 1948, the organization has emerged as a major institution in the transportation field. Over 75 faculty members are associated with ITS throughout the university, and the institute now receives more than \$6 million annually in funding. Berkeley's graduate program in transportation engineering, newly created in 1948 and supported by ITS since its beginning, is now one of the largest in the country and one of the top-ranking academically.

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Interdisciplinary Nature

Society's transportation needs have grown broader and more complex, and ITS has expanded beyond the borders of engineering to meet them. Research in traffic engineering and transportation materials takes place side by side with research in the political, social, and environmental aspects of transportation. These studies are conducted in many departments of engineering and in other disciplines—city planning, sociology, political science, economics, business administration, public policy, and public health.

A sampling of research projects illus-

trates the breadth of the institute's programs. Research teams are analyzing the routing of freight over land and sea, developing what could be more efficient systems. ITS sponsored a conference on the feasibility of ferry service on San Francisco Bay, a move that seems almost prophetic after the October earthquake prompted ferry revival. One researcher is relating accident rates to the stress levels of bus drivers in the San Francisco transit system. Others have projected how transportation improvements could affect the depressed economies of the rural Northwest coast, and how a better balance between jobs and housing could help decrease congestion and air pollution.

Research is funded by federal, state, and private grants. During fiscal year 1988–1989, ITS received funding for 35 research projects and grants for nine training or technical assistance programs. In addition, the institute itself awards small grants for research from its state-provided baseline budget. ITS at Berkeley funded 21 projects in fiscal year 1988–1989, among them studies of the transpacific airline network, the social history of the automobile, in-vehicle information systems to relieve highway congestion, and vehicle routing procedures.

In the Beginning

The ITS agenda was not always quite so varied and diverse. ITS was originally established to assist state agencies that needed to develop new transportation projects quickly. The year was 1947, and the civil infrastructure badly needed rehabilitation after the neglect of the war years. Automobile use was on the rise. The relatively young field of air transportation was suddenly booming.

And California was growing. In the mid-1940s, the California Division of Highways (now the California Depart-

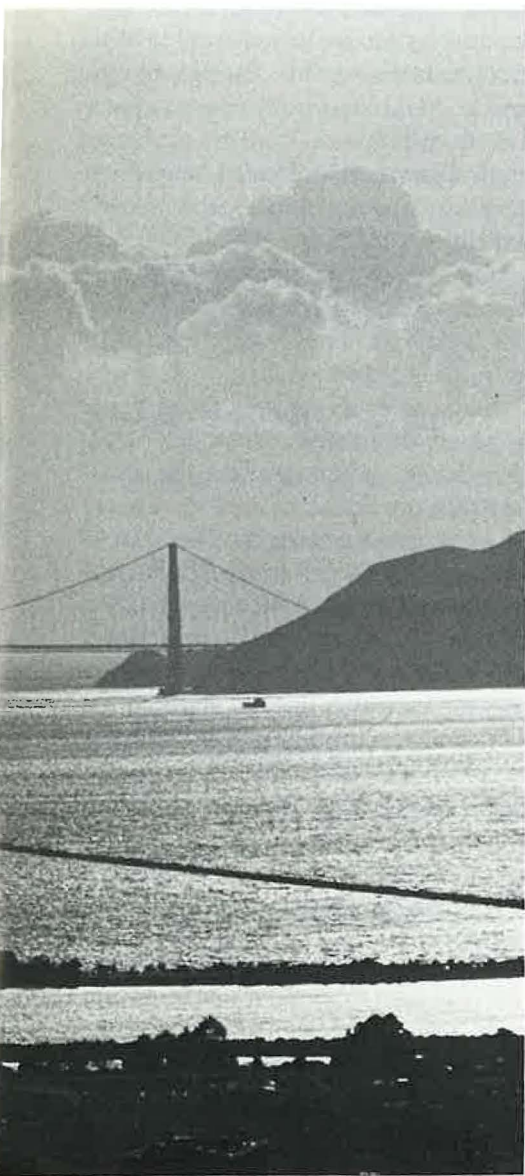


ITS Library serves students, faculty, university researchers, public agencies, private industry, and the general public.

ment of Transportation, or Caltrans) estimated the state's future transportation needs and presented the results to the California legislature. California's population was forecast to be more than 11 million by 1960 and to reach almost 15 million by 1980. At the time, some critics considered these to be wild overestimates, but the numbers actually fell short by 40 and 60 percent, respectively. Mid-1940 projections for vehicle registration were even less accurate. They missed the mark by 50 percent for 1960 and by a startling 150 percent for 1980.

Despite the cloudy crystal ball, the legislature could see that something had to be done to ensure adequate transportation services in the future. Together, state senators and UC administrators developed a plan for a university-based program in transportation engineering. In 1947, the legislature passed a bill establishing the Institute of Transportation and Traffic Engineering, as ITS was first called, as part of the Department of Engineering at UC Berkeley.

The legislature established a broad charter for the institute, charging it to "carry on instruction and research related to the design, construction, operation, and maintenance of highways, airports, and related facilities for public transporta-



Campanile on the UC Berkeley campus is well-known landmark in the San Francisco Bay Area.

tion" and to "give attention to the interrelated problems of highway design, traffic control, and highway safety." The institute was also mandated to cooperate in research with and to provide training for state and local transportation agencies. Within a year of the institute's inception, a library, a publications division, and extension services were established.

In all the administrative hustle and bustle of the early years, there was still time left to embark on an ambitious schedule of research. Most of the first research projects, in keeping with the nature of the institute, focused on engineering issues in transportation. Harmer E. Davis, the first director and a former chairman of the Highway Research Board (predecessor to TRB), recalls that the biggest early projects involved soils and bituminous materials, traffic engineering, vehicle-pavement interaction and skid resistance, and airport runway lighting. (Airport studies were still unique at the time.)

The institute's founders soon realized that any comprehensive program of transportation studies would have to include other branches of study. "From the outset it was recognized that trans-

portation is not an end in itself, and is not a closed system," says Davis. "As the needs of an economy, the values of a society, and technology change, changes in transportation follow. It is important, then, that those who work in the transportation field understand the interaction between transportation and the societal and economic environment in which it operates."

While ITS research expanded into other fields, it also expanded onto other UC campuses. In 1974, ITS-Irvine was established to focus initially on transit. A transportation research group at Davis, which is on its way to becoming a third ITS organization, has paid special attention to alternative transportation fuels and energy issues. The Berkeley, Irvine, and Davis institutes function independently but cooperatively.

In the past, Berkeley and Irvine functioned as branches of a statewide institute, and ITS policy and programs were guided by an advisory council and an executive committee. Following a university restructuring of systemwide organizations, the branches now operate as separate entities, but the spirit of inter-campus cooperation remains unchanged. A committee with representatives from the three campuses and the Region Nine University Transportation Center has been formed to coordinate research and joint projects.

New PATH at ITS

The Program on Advanced Technology for the Highway (PATH) is a premier example of the collaborative, interdisciplinary work that takes place today under ITS leadership. One of ITS's largest projects, PATH has a lofty goal: to shape the way urban dwellers of the future commute. In PATH, ITS-Berkeley, together with Davis and Irvine, is working with Caltrans, a long-standing sponsor and collaborator, to devise a more efficient highway system that could decrease traffic congestion, air pollution, accident rates, and fuel consumption. More than \$10 million has already been invested in

PATH by Caltrans, FHWA, UMTA, and private industry.

PATH researchers from several departments, including mechanical engineering, electrical engineering, computer sciences, and civil engineering, are applying advanced telecommunications, computing, sensor and actuator, and electronic technologies to traffic management and vehicle control. The aim is to develop more effective highways by making vehicles and roadways "smarter."

Roadway guidance systems, using sensors and radar, are being developed to allow more cars at a time on freeways. Sensors in the road will guide cars laterally, allowing for narrower freeway lanes, while radar or similar technology and on-board computers will equip cars to automatically maintain a constant distance from vehicles ahead. Another integral part of PATH involves testing an electric vehicle that has its batteries recharged from a power source buried beneath the road's surface. A 400-foot section of electrified track has been built at UC's Richmond Field Station, a large-scale laboratory facility located six miles from the Berkeley campus, where most PATH research is conducted.

While some researchers develop and refine advanced technologies, other PATH participants are studying the impacts of applying the new technology. In one ongoing project, for example, a broad overview is being developed of the economic and social conditions in which PATH technology will be found. Researchers are anticipating potential markets, economic barriers, and competition, and are identifying social and economic issues that will require further attention.

Engineering to Ease Congestion

PATH is not ITS's only response to rampant traffic congestion. ITS researchers are using traffic engineering tools to enhance roadway performance. Investigators have studied everything from freeway surveillance and ramp metering to



Air traffic controller trainee uses equipment simulating real air traffic conditions.

high-occupancy vehicle lanes and park-and-ride lots. The majority of ITS studies on traffic operations and management take place under the guidance of Adolf D. May, a long-time ITS researcher and professor of civil engineering. He works closely with Caltrans in many of his projects, and he teaches courses on freeway operations and simulation for Caltrans personnel.

In recent years, traffic engineering research has included projects to develop an accident prediction model for unsignalized intersections, to test new detector strategies and technologies, and to evaluate the methods of estimating demand for HOV lanes. Much of the work goes beyond the study of isolated ramps or intersections to include evaluations of the performance of large sections of roadway, such as freeway weaving sections or entire freeway corridors. Computer specialists have developed and refined simulation models for traffic engineering applications, and are currently investigating the feasibility of using computer-based expert systems to solve urban roadway operational problems.

Asphalt Research Paves the Way

Traffic engineering studies have taken place at ITS since its formation, and so have studies of transportation materials. Over the years, civil engineering professor Carl L. Monismith has directed work on such topics as pavement response to dynamic truckloads and the implementation of road surface management packages. A major new research project focuses on a basic building block of highways—**asphalt**. Monismith was selected in 1988 to head a \$9.5 million study at ITS on asphalt mixtures as part of the Strategic Highway Research Program, a five-year, \$150 million program

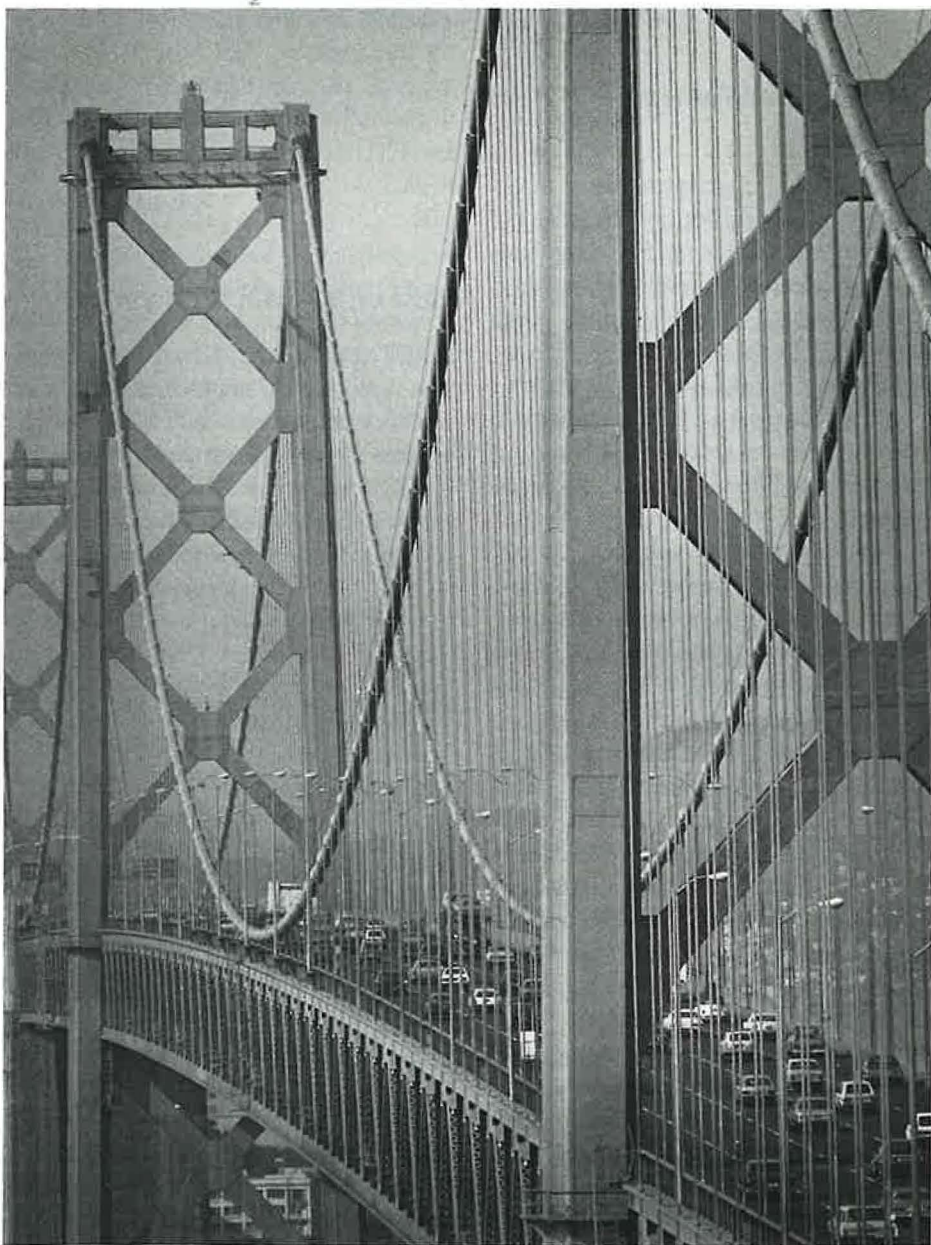
administered as a unit of the National Research Council to accelerate innovation in highway design and maintenance.

Monismith and a team of international experts will improve tests to measure the performance of asphalt-aggregate mixtures, enabling users to preview how well their prospective roads will hold up. By simulating various factors found in the field that affect pavement performance, such as traffic, aging, temperature, and moisture, the new tests will help users predict in-service mixture performance and will reflect sensitivity of the mixtures to asphalt and aggregate properties.

ITS in the Air

Air transportation research has also remained constant throughout the institute's four decades, at first led by the late Robert Horonjeff and now by ITS-Berkeley director Adib Kanafani. Research topics have greatly expanded since the first study on airport runway lighting, however. Today's projects analyze in-depth such topics as the transpacific airline network, economic deregulation and safety, and air traffic control operations.

As in all other fields of inquiry, ITS



San Francisco-Oakland Bay Bridge, one of the most heavily traveled transportation corridors in the state, is frequent subject of ITS management and operations studies to ease traffic flow.

research goes beyond studies of airport infrastructure and air traffic. In one study, an ITS researcher is examining the role of air transportation in Pacific Rim trade. In another, wide-ranging study, Caltrans and ITS are working together to explore the potential of new technology in the development of the California aviation system. In November 1988, ITS held a conference in Los Angeles where participants identified a program of initiatives that could help the state foster the development of promising new technologies. This project may lead to the establishment of a center for air transportation technology research at UC Berkeley.

Outreach Complements Research

Research may attract most of the attention, but it is by no means the only ITS activity. Researchers publish their findings through the ITS publications office, which also produces two quarterly newsletters, the *ITS Review* and *Tech Transfer*. The institute boasts one of the nation's oldest transportation libraries, which has provided free reference services to students and California agencies since its inception in 1948. The library collection consists of 130,000 volumes, 75,000 microfiche, 2,800 current serial titles, and collections of manuscripts, archives, maps, and other materials. The library circulated more than 24,000 items in fiscal year 1988-1989.

As one of its most important functions, ITS also provides courses, conferences, and technical assistance to California's transportation and public works community. The multimillion-dollar Fuel-Efficient Traffic Signal Management program has helped almost 200 local agencies retune their traffic signals to keep traffic flowing more smoothly, thereby promoting fuel conservation and improving air quality. A traffic engineering specialist and an enforcement expert travel the state to evaluate the traffic engineering and enforcement programs of cities and counties. For 10 years a special

course in construction and maintenance zone safety has been held all over the state several times a month. ITS Extension also sponsors several conferences each year; the two oldest annual gatherings are the California Transportation and Public Works Conference, which has been held for 42 years, and the Airport Management Conference, which has been held for 29 years.

ITS strives to reach as many agency personnel as possible through its extensive schedule of continuing education courses, ranging in length from one to five days, which also are held throughout the state. More than 2,000 students attended 26 different courses offered in 55 locations in fiscal year 1988-1989. Two of the courses were presented through the Rural Technical Assistance and Technology Transfer programs of FHWA.

Partnership with Caltrans

Under contract with Caltrans, ITS Extension has recently embarked on a new schedule of classes called the Cooperation Training Assistance Program (C-TAP). Funded at a half-million dollars per year, C-TAP was initiated by a statewide group of city and county public works department directors. It is designed to provide low-cost, hands-on technical training to local government employees in order to fill the gap between their technical skills and their agencies' everyday needs.

C-TAP is only the latest in a series of joint ITS-Caltrans projects that dates back to the institute's original charter in 1948. For many years, Caltrans has funded other ITS extension programs, such as training sessions for local agencies in the retiming of traffic signals, and an annual course on freeway operations for senior Caltrans personnel.

The ITS-Caltrans relationship functions on many levels. Some research is conducted jointly, especially for PATH. Some ITS researchers work closely with Caltrans operations units and laboratory

staff, developing one-on-one relationships that transcend individual projects.

Caltrans and ITS are both involved in the new U.S. Department of Transportation Region Nine University Transportation Center, one of the 10 University Transportation centers established nationwide in the fall of 1988. The center, which is based at Berkeley, works closely with ITS, drawing on its research and administration capabilities and resources. To aid the center in its efforts to increase university collaboration with government agencies, Caltrans has named the chief of its Office of Research and Development, John West, to be coordinator of all the projects conducted with both the center and ITS, and he spends one day a week on campus.

ITS and the Future

Cooperative relationships with state and local agencies, other departments, and other UC campuses all enrich ITS research, maintaining the free flow of information and ideas crucial to the ITS mission—to create a program that both addresses immediate transportation problems and provides a strong conceptual framework for anticipating and understanding transportation issues of the future.

"As we move into the institute's fifth decade, we aim to renew the commitments that brought ITS to this point," wrote ITS-Berkeley director Kanafani on the occasion of the institute's fortieth birthday. "At the same time, we aim to look forward and continue to make our programs and contributions relevant to their times. . . . As we move into the coming decade, we must be able to distinguish between the meaningful and the faddish, between the relevant and the trivial. We must be ready to relinquish the comfort of doing what we now know how to do best in order to learn to do what we must."