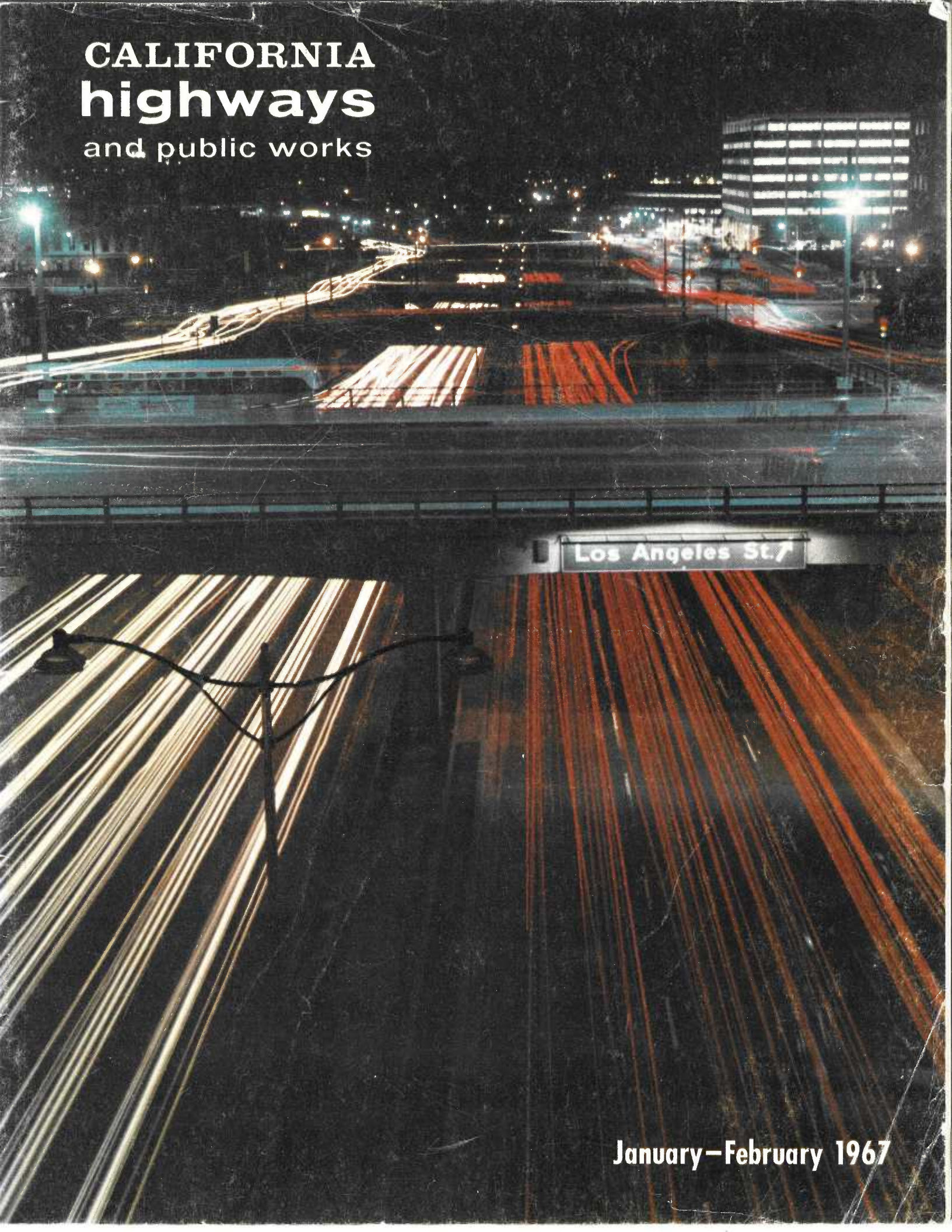
CALIFORNIA highways and public works



January–February 1967

The complaints about the problem of getting through Sacramento are rapidly becoming a thing of the past, as the city's freeway system comes on apace. Construction on Interstate 80 is seen in lower portion of high altitude photo above, and its junction with US 50 at lower right. Here Interstate 80 turns north, and US 50 turns east. Interstate 5 will come down left-hand side of photo, along edge of downtown section. River across center is the American; larger one looping into lower left of photo is the Sacramento. Nine highway and railroad bridges can be seen, including the new Interstate 80 Pioneer Memorial Bridge at lower left. Two additional highway bridges are under construction, including Interstate 5 crossing seen at left center.

CALIFORNIA highways and public works

VOLUME 46 JANUARY–FEBRUARY 1967 NOS. 1–2

TABLE OF CONTENTS 3

FREEWAY BEAUTY 4
By Valley Knudsen

SOUTHLAND FREEWAY PROGRESS 8

BRIDGE STEEL WELDS 11
By Art German

CHANGES IN HIGHWAY COMMISSION 12

STORM HAVOC IN DISTRICT 6 14
By Ed Tiedemann

CALIFORNIA HIGHWAY NEEDS 17
By J. C. Womack

HIGHWAY TO SPACE BASE 33
By Richard R. Crandall

BARTLETT AWARD FOR J. C. WOMACK 36

GOVERNOR'S DESIGN AWARD 37

MINIMUM SPEED LIMITS 38
By Norman Wingerd

TRAVEL TIME STUDY 41
By Peter G. Koltnow

RIO VISTA BRIDGE 44

BYLINES 46

john c. robinson, *Editor*

stewart mitchell, *Managing Editor*

william r. chaney, *Chief Photographer*

Editors are invited to use information contained herein.

Address communications to:
BOB NANCE, INFORMATION OFFICER
CALIFORNIA HIGHWAYS AND PUBLIC WORKS
P.O. BOX 1499
SACRAMENTO, CALIFORNIA 95807

Layouts by Bob Enos and Judith Dong

The yearly index is no longer printed as part of the magazine but on separate pages punched so that they can be inserted into a three-ring binder. Readers who want copies of the index covering the issues for 1966 should send their requests to the editor.

Freeway Beauty

BY MRS. VALLEY KNUDSEN, PRESIDENT
LOS ANGELES BEAUTIFUL

Our landscaped freeways of today are forerunners of green belts through our cities of tomorrow—and they may be virtually the only ones we have. Thanks to our progressive California Highway Commission much of our freeway system is newly planted, and in a few years we will enjoy some of the most beautiful roadways in the country.

"Beauty is good business," as Los Angeles Beautiful has consistently maintained for the past 17 years. This is particularly applicable to our park-like freeways. To the multimillion-dollar tourist trade, it is important whether our visitors drive down concrete canyons, or whether they travel avenues of flowering ground cover and blossoming trees and shrubs.

To us who live and work here, the freeways are more than just an efficient way to get from one place to another. They are not only the fastest, safest route of travel but they are also the most enjoyable because of the beautifully landscaped surroundings.

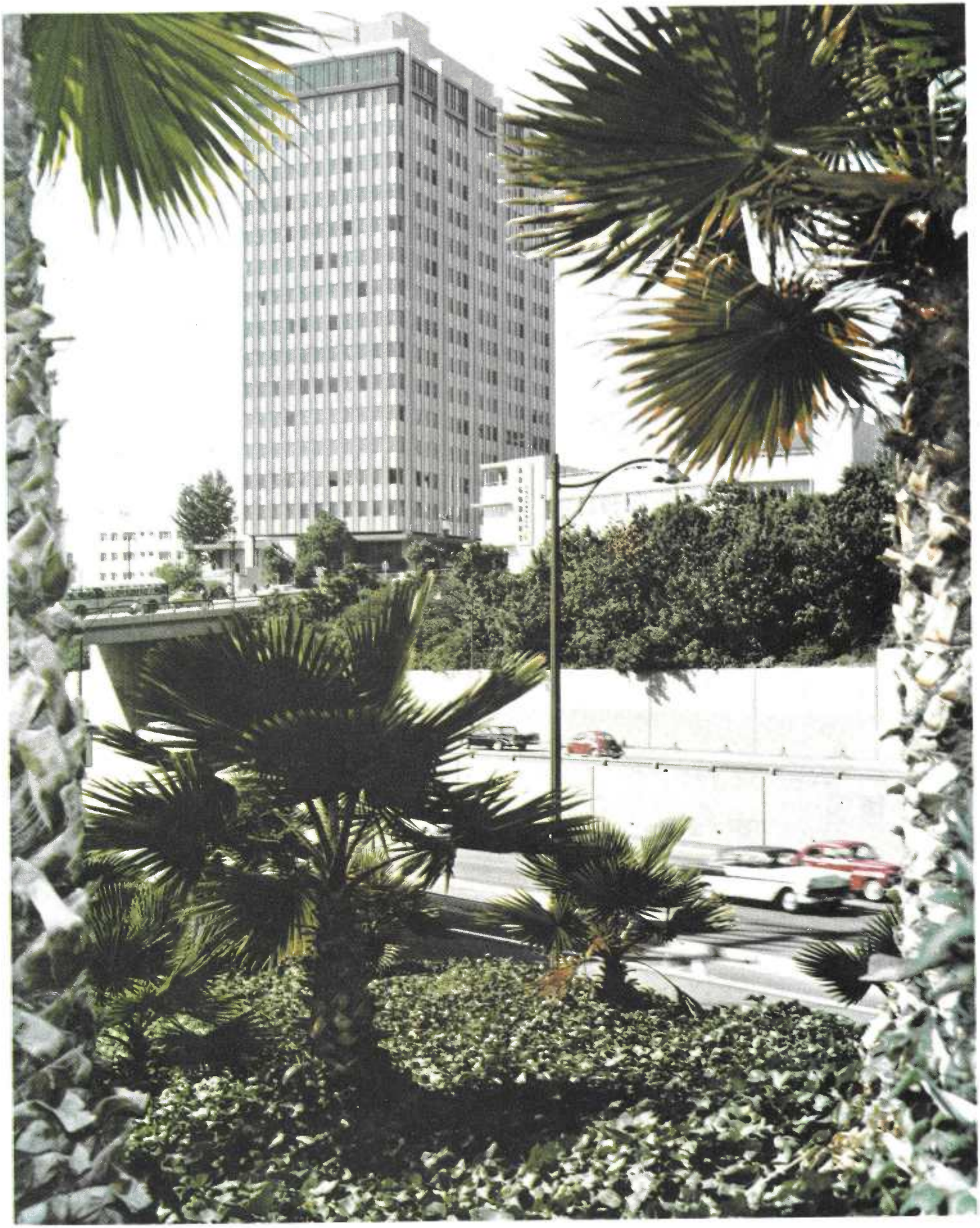
We would be more readily reminded of this fact if we had retained the original designation of these modern highways, namely, "parkways." This is by far a more apt description of what we hope is achieved in maintaining our highway system.

Our sensitivity to beauty can be dulled unless we jealously guard our policy of landscaping freeways. We believe the motoring public prefers to travel highways that are surrounded by ivy, shrubs, flowers, trees and a variety of plants, rather than to be visually trapped by barren concrete embankments, garish billboards and unsightly junkyards.

Los Angeles Beautiful believes that in addition to all of its other advantages the freeway should provide in all of our daily motoring an interlude of natural beauty.

"Automobility," a word coined to describe our utter dependence upon wheels, will be with us for many years to come. The growing public demand for ever increasing flexibility of movement would seem to create imponderable problems of engineering. And yet, the freeways continue to stretch across the landscape in ribbons of concrete and asphalt. To the extent that they are designed and maintained as areas of beauty for enjoyment as well as utility, our purpose is well served.

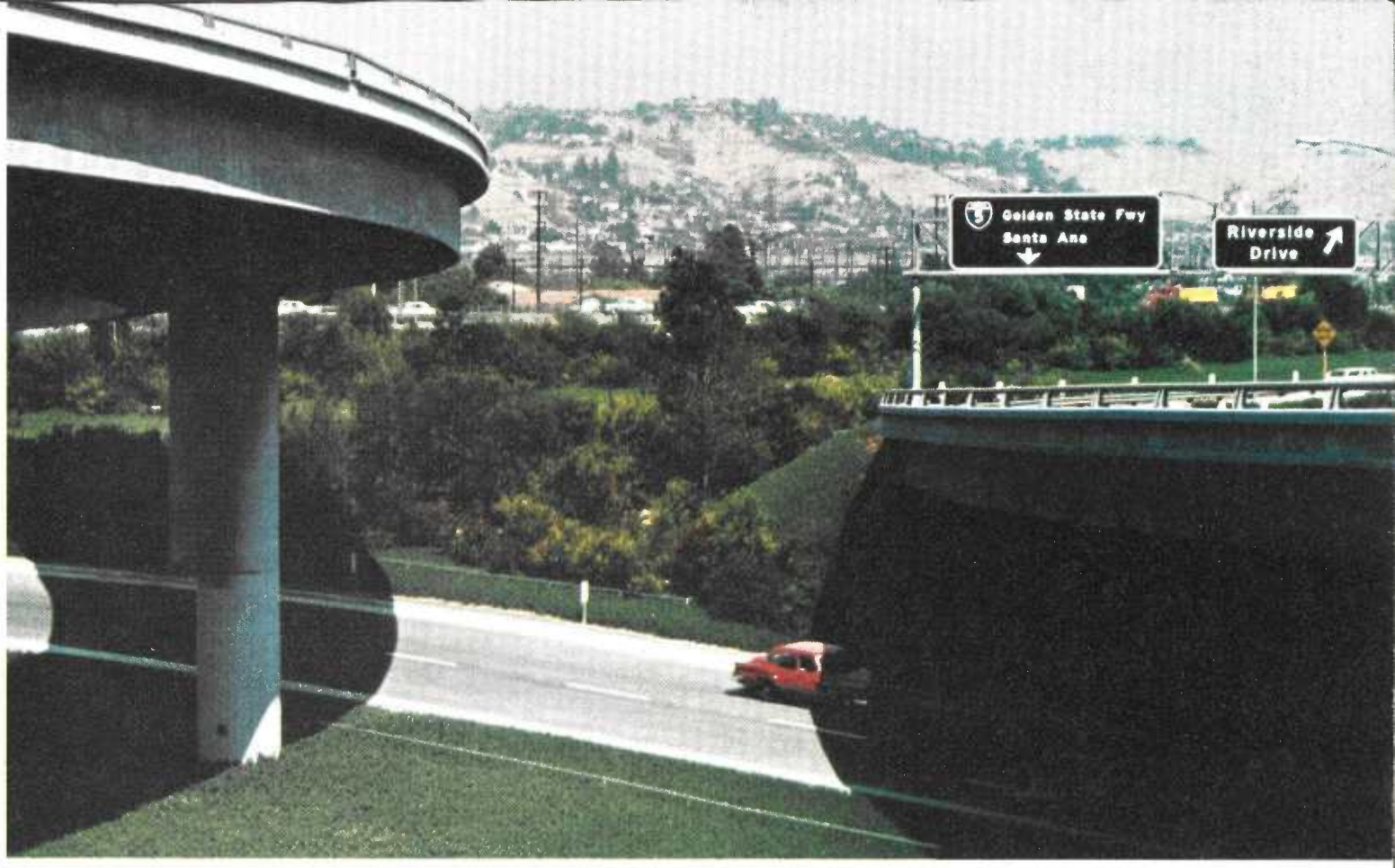
BELOW: This recently completed landscaping near the approach to the Vincent Thomas Bridge in San Pedro features broad expanses of yellow hymenocyclus and white pelargonium against a backdrop of myoporum, phormium and pines.

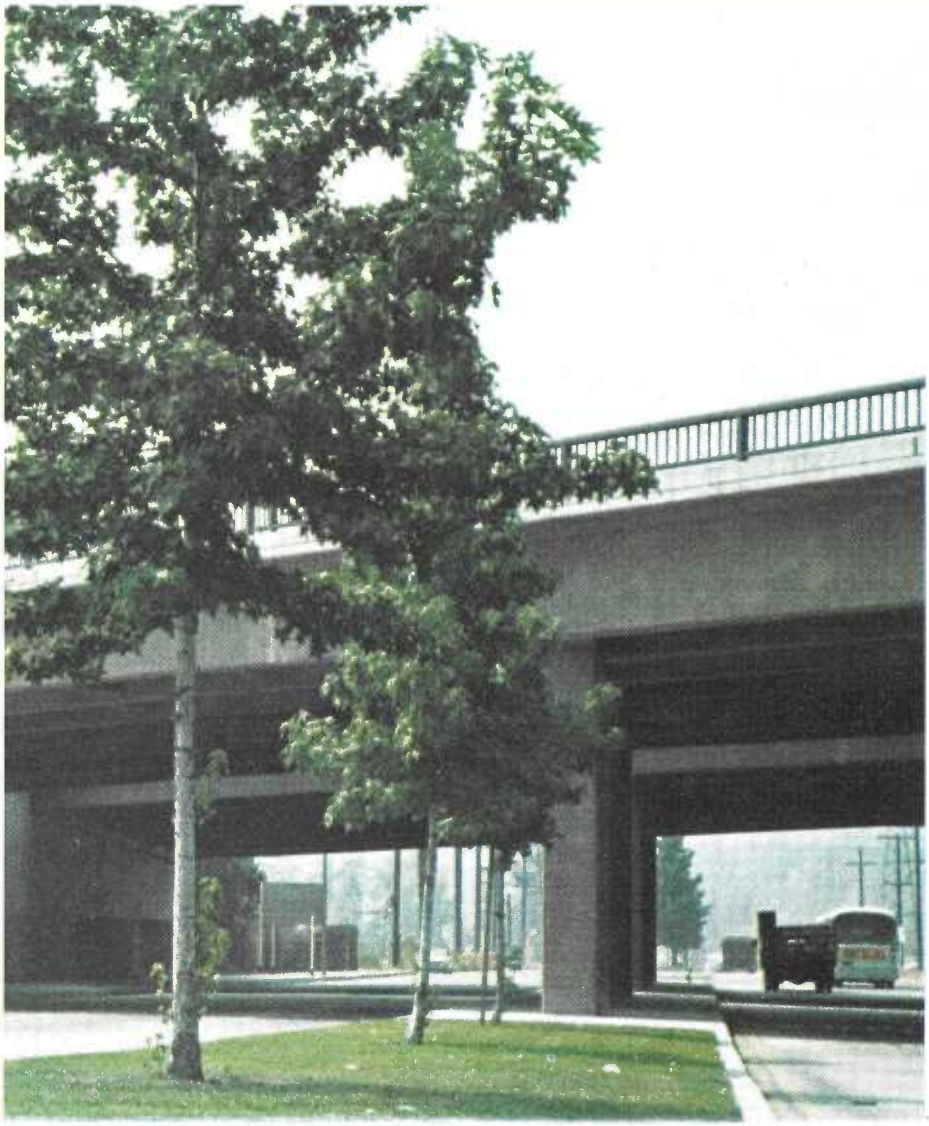


A view of the Harbor Freeway in downtown Los Angeles, which was planted in the mid-1950's. Ivy used as ground cover sets off the Mexican fan palms.

ABOVE: A section of the Harbor Freeway-Santa Monica Freeway Interchange in downtown Los Angeles, planted in 1962. An unusually high cut created a condition of dense shade on the south side. Ivy was used as ground cover. Shrubs and trees included eucalyptus, tipuana, oleander and callistemon.

BELOW: The four-level structure in Los Angeles, landscaped in the early 1950's, is probably the first multi-level freeway interchange to receive such treatment. The mixed shrubs included leptospermum, pittosporum and sycamores, with ailanthus added later.





ABOVE: Landscaping on the Glendale-Golden State Freeway Interchange features a ground cover of mesembryanthemum edule and eucalyptus trees. Mixed shrubs included acacia melaleuca, pittosporum and callistemon.

BELOW: A landscaped section along the Hollywood Freeway near Glendale Boulevard. It stresses a simple but effective use of lawn and liquidambar trees.

Southland Freeway Progress

Traffic separation at airport eliminates congestion.

WORLD'S GREATEST RAPID TRANSIT SYSTEM

By Marcia J. Mickelsen

During the latter half of 1966, 31.5 miles were added to the District 7 freeway network. In the three counties of Los Angeles, Orange, and Ventura this makes a total of 526 freeway and expressway miles at year's end, or roughly one-third of the mileage called for by the master plan adopted in 1959.

The most important accomplishment was the simultaneous opening of 10.6 miles of the San Gabriel River Freeway (Interstate 605) on July 1. This work involved four individual contracts and the expenditure of $24,610,000, and brought to completion the San Gabriel River Freeway between the Santa Ana Freeway in Norwalk and the San Diego Freeway (Interstate 405) in and near Los Alamitos and Long Beach.

With the opening of this lengthy section, it is possible for the motorist to travel for 22 miles on an eastern bypass of the Los Angeles metropolitan area from the San Bernardino Freeway (Interstate 10) on the north to the San Diego Freeway on the south.

A host of communities—from Rossmoor to Santa Fe Springs—received direct benefit from the new freeway as people of these communities are now able to make unhindered connections with three major Interstate Routes—405, 5 and 10. Also, travel from the Long Beach area to the northeast part of Los Angeles County (and beyond) is no longer dependent upon the Long Beach Freeway.

Eventually, noninterstate extensions of the San Gabriel River Freeway will provide continuous travel for 30 miles from the Foothill Freeway (Interstate 210) on the north via Route 243 to the Pacific Ocean on the south via Route 240.

Aside from freeway construction, but tantamount to the total transportation picture in the Los Angeles area,

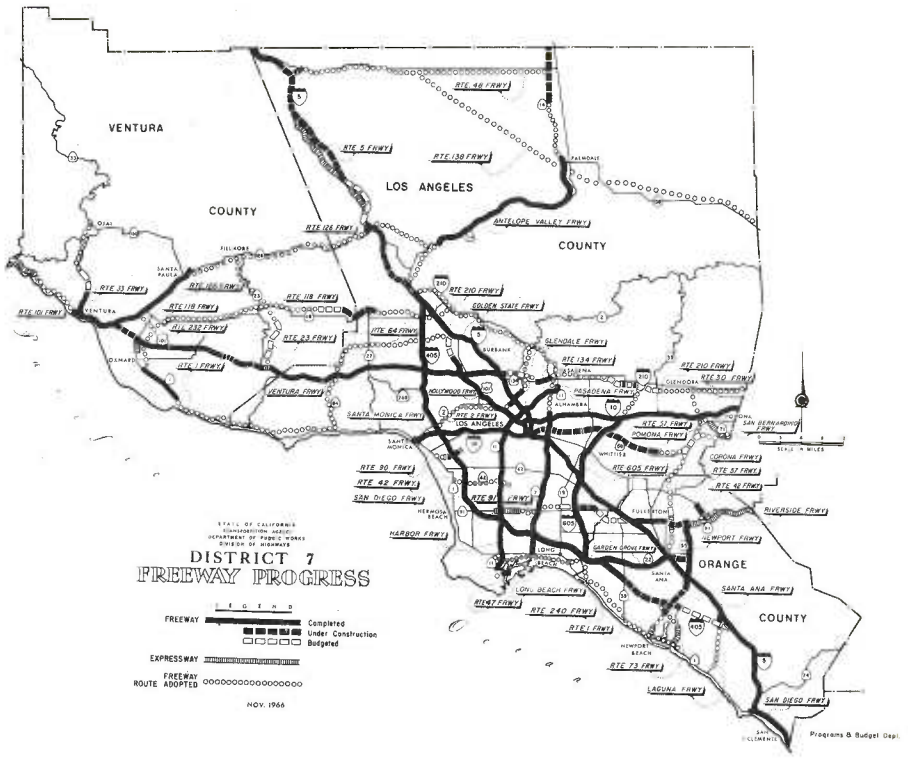
31.5 MORE MILES ADDED SINCE JUNE

especially in terms of air-ground destination travel, was the summertime completion of a traffic separation project at Century and Sepulveda Boulevards near the passenger entrance to International Airport. A joint project of the City of Los Angeles and the state, this improvement cost about $1 million.

On the Ridge Route the task of converting this important highway to interstate standards continued, with the completion in September of the second of 12 projects planned to provide 45 miles of eight-lane freeway through the mountains between the Los Angeles city limits and the Kern County line. Cost of the 12 Los Angeles County projects will total $86 millions. The September opening added nearly four miles of freeway, including three bridges, to Interstate 5 along the top of the ridge from near Gorman to Cuddy Creek in Kern County, at a cost of $5.9 millions.

An extension of the Hollywood Freeway, a two-mile section from Magnolia Boulevard to Victory Boulevard in North Hollywood, was completed in September. Known numerically as Route 170, the Hollywood Freeway extension provides access to and from the San Fernando Valley, midway between Interstate Routes 405 and 5. The $5.9 million contract for this job was carried out in time for the section to be dedicated as a major feature of National Highway Week

Early in October, a six-mile extension of the Antelope Valley Freeway (Route 14) between the Angeles Forest Highway at Vincent and Avenue P-8 in Palmdale was opened to traffic. This construction, performed at a cost of $5.4 million, completes 28 continuous miles of four- and six-lane



"District 7 Freeway Progress" map as of November 1966 shows status of system at approximate time of writing of article. Note various alternate routes now available, which have siphoned off considerable traffic load from older freeways.

Below left: Section of new Hollywood Freeway extension, with new businesses which have sprung up beside it. Below right: San Gabriel River Freeway (Interstate 605) at the Willow Street-Katella Avenue Interchange in Long Beach.

Miss Orange County aided District Engineer E. T. Telford in dedicating Riverside Freeway.

Above: A formal parade of cars opened a 10.6-mile stretch of the San Gabriel River Freeway following dedication July 1st.

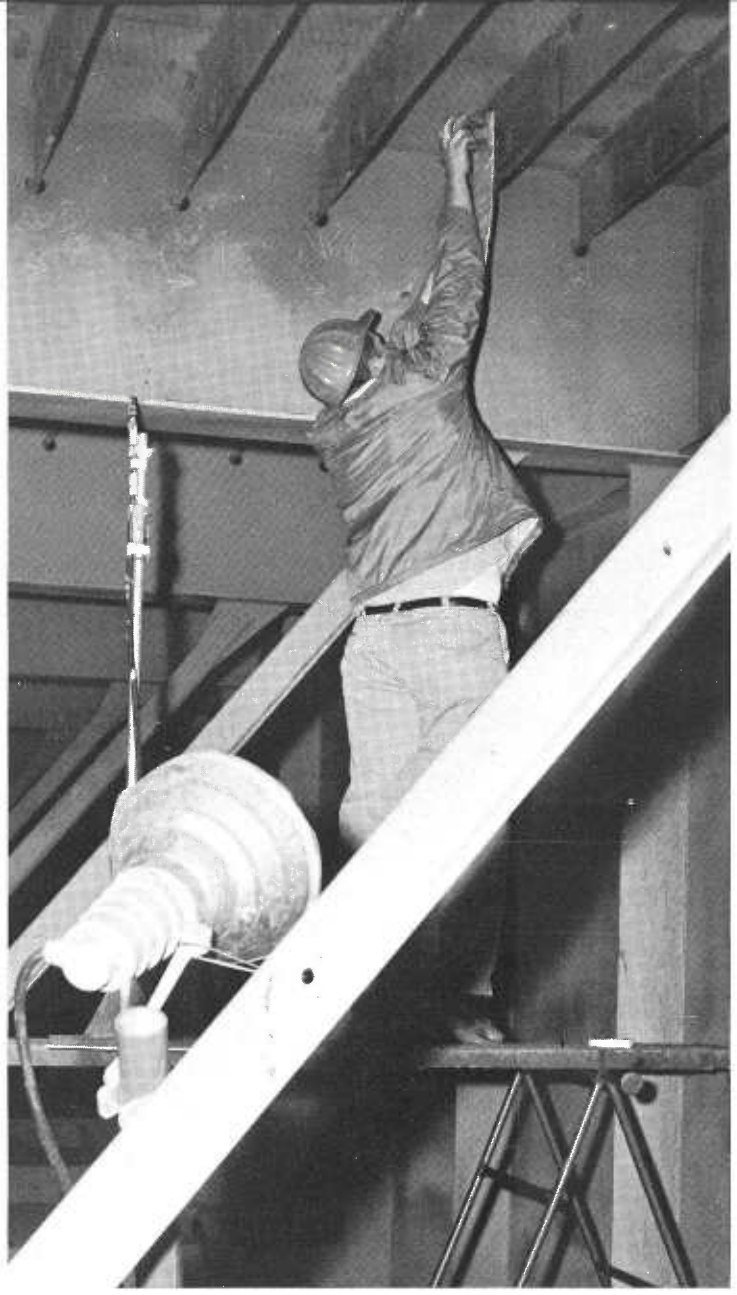
Below: The Santa Monica Freeway (Interstate 10), now open all the way to its junction with Route 1 at the coast, is carrying its share of traffic load.

freeway for the motorist in the Antelope Valley region, from a point near Solemint to the north city limit of Palmdale. Included in this work was a Route 14/Route 138 separation structure and a bridge to span the California Aqueduct. Since then, work has been started on a nine-mile segment from Lancaster north to the Kern county line, a $7.8 million job.

In Orange County, six miles of the San Diego Freeway (Interstate 405) were dedicated on November 18. Cost of construction between Beach Boulevard and Harbor Boulevard in Costa Mesa was $10.7 million. With the opening of this section on December 8, the traveler can follow Interstate 405 continuously for more than 61 miles in two counties, bypassing the Los Angeles metropolitan area on the western side.

On the Newport Freeway (Route 55), construction was finished in mid-December on a portion between Warner Avenue in the Santa Ana-Tustin area, and Bristol Street-Palisades Road in Costa Mesa. This 3.9-mile, $5.3 million project included parts of the interchange with the future San Diego Freeway (Interstate 405). Now, the motorist may drive uninterruptedly for more than 13 miles on the Newport Freeway—between the Riverside Freeway (Route 91) and Bristol Street-Palisades Road.

A project to convert the Riverside Freeway from expressway to six-lane freeway for 5.8 miles between Lemon Street in Fullerton and the Newport Freeway in Anaheim was also completed in December. Cost of this project was $5.6 million.



An inspector applies film to a welded area before making a radiographic check for hidden flaws.

BRIDGE STEEL WELDS

FASTER THAN THE EYE

By Art German

Both radiography with gamma rays, and ultrasonic waves, are being used to test the many miles of steel welds inside the girders on the new San Mateo-Hayward Bridge now under construction. Only 17 inches of weld can be tested with each exposure.

E. R. Foley, Chief Engineer of Bay Toll Crossings, explained the unusual techniques in this way:

"A bridge is a major investment which must serve the public for a long time. The testing program is an important device to assure that the structure meets the required standards."

In radiography with gamma rays, radioactive isotopes are used, which require a much shorter exposure time than the cathode rays used in the more common X-rays used in the medical profession. Any imperfections in the welds are shown immediately. These may be porosity (bubbles of gas) inside the weld, slag (entrapped residue), lack of fusion with the metal, cracks, and lack of complete penetration.

Although the radiographic tests are being made at all six fabrication yards working on the bridge—Richmond, Oakland, Lockeford, Napa, Maywood, and Fontana—the major testing is at Richmond. Here the work proceeds virtually around the clock, and more than 10,000 "pictures" will be made at this one yard alone before the structure is completed.

The ultrasonic process is cheaper and faster, but the radiography yields a permanent record on film, much like a medical X-ray. Both processes are superior to visual inspection.

Gordon C. Luce

Fred C. Jennings

Changes In

NEW AGENCY ADMINISTRATOR,

Gordon C. Luce, 41, of La Jolla, has been named the new Administrator of the State Transportation Agency by Governor Ronald Reagan.

Prior to his appointment Luce was senior vice president of a savings and loan association in San Diego with which he had been associated for 12 years.

A specialist in business management and administration, Luce holds bachelor and master of arts degrees from Stanford University and is a graduate of the Indiana University School of Savings and Loan.

He served in the U.S. Infantry in Europe and the occupation of Japan from 1946 to 1948. He was awarded a Bronze Star.

Luce, a native San Diegan, is past president of the San Diego Downtown Association and the University Club of San Diego, and a member of the American Savings and Loan Institute. He is presently a director of the San Diego Symphony Association.

He and his wife, Karen, have two sons and a daughter.

The first of recent new appointments to the California Highway Commission is **Fred C. Jennings,** 58, of Riverside, appointed to replace the late James A. Guthrie.

Jennings has been president of a real estate firm in Riverside since 1958 and for 12 years before that was owner of an automobile agency.

He is a member of the board of directors of Security First National Bank in Los Angeles and the Southern California Water Coordinating Committee.

He has been a member of the board of directors of both Riverside Community Hospital and the Riverside Board of Public Utilities, and served as chairman of the Citizens Advisory Committee to March Air Force Base.

Jennings is married and has two children.

Jennings was appointed to fill the unexpired term of James A. Guthrie, editor emeritus of the San Bernardino *Sun-Telegram*, who died last August.

Moon Lim Lee

Vernon J. Cristina

Highway Commission

THREE OTHER NEW MEMBERS

Another recent appointee to the California Highway Commission is **Moon Lim Lee,** 63, a businessman who long has been active in civic and highway association affairs in Weaverville, Trinity County. He replaces Roger Woolley of Rancho Santa Fe.

Lee operated a grocery business in Weaverville from 1922 to 1948 and since 1949 has been owner of an appliance firm.

He attended school in his native Trinity County and has been active in civic affairs in that area including the Weaverville Chamber of Commerce. He is a director of the Highway 299 Association, the Trinity County Recreation Park and Parkway District and the Weaverville Sanitary District.

Lee is past president of the Trinity County Historical Society, a member of the Chinese Historical Society of America and serves on the Advisory Committee of the California National Highway Week Committee.

Lee is married and has one daughter.

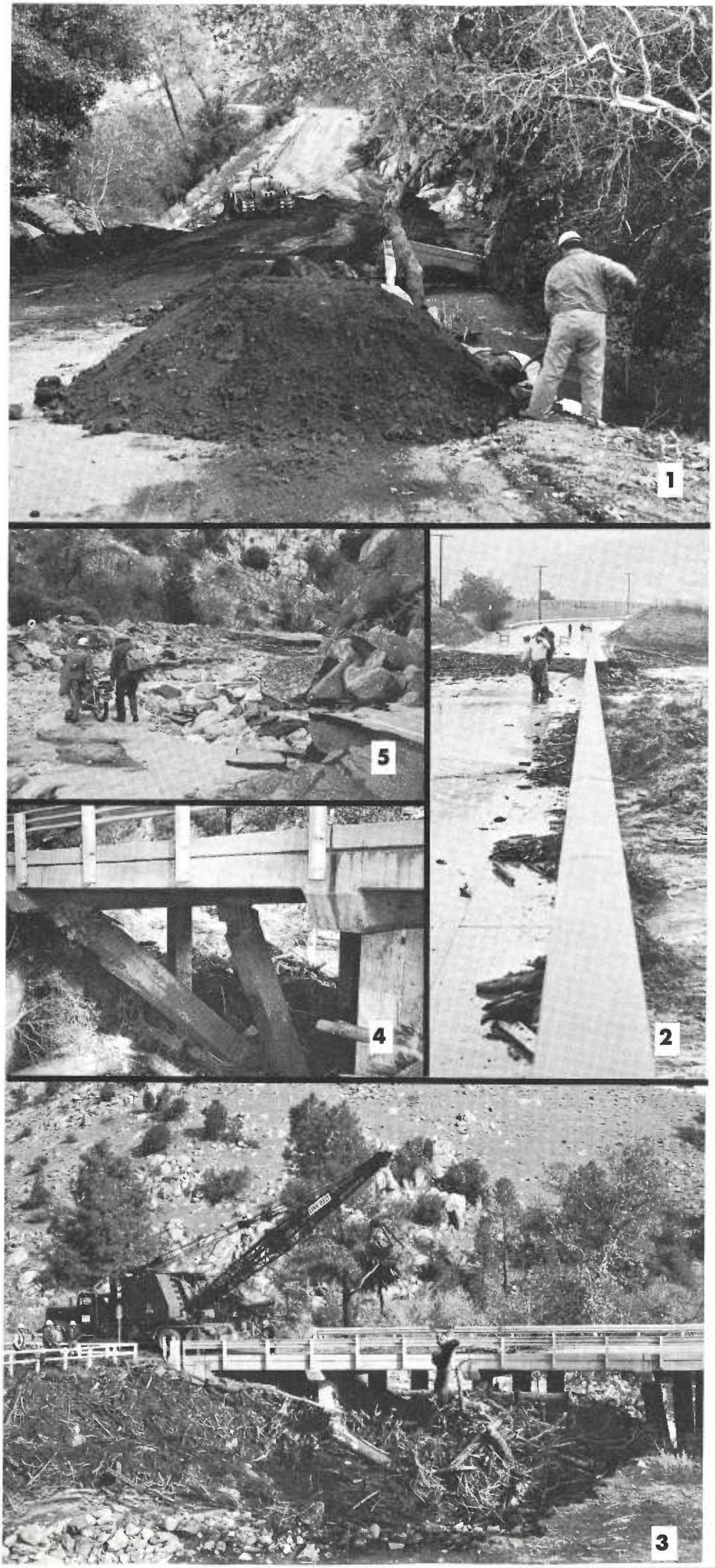
Appointed to the Highway Commission at the same time as Lee, was **Vernon J. Cristina,** 51, of San Jose, head of a warehouse company and active for many years in the transportation field. He succeeds Joseph Houghteling of Atherton.

From 1937 to 1948 he operated and managed orchard properties and a general store in San Benito County.

Cristina attended San Jose High School and graduated from the University of Santa Clara with a major in political science.

He has been active in numerous civic activities. He is past president of both the Santa Clara County Transportation Club and the Santa Clara County Truck Owners Association. He is also a member of the Board of Governors of the California Truck Owners Association.

Cristina is married and has three sons.



STORM HAVOC IN Dist. 6

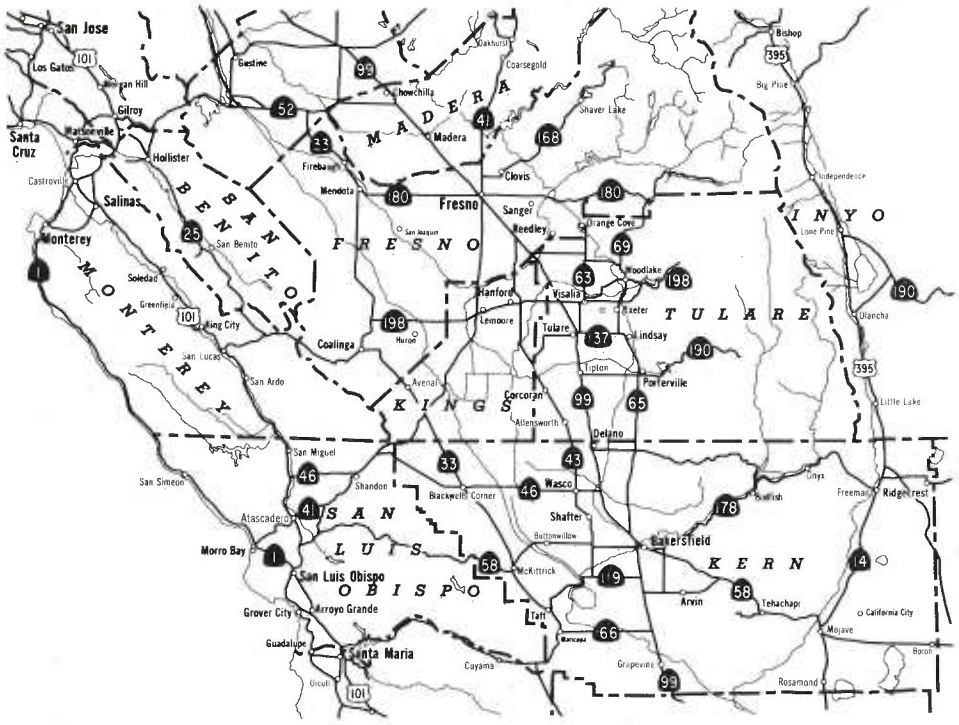
By
Ed Tiedemann

Photos clockwise from top: (1) Widespread clogged culvert damage is typical of such storms. Pipe becomes clogged by debris and water rushes across paving, washing out road. (2) Although water rose over deck, this bridge over Tule River on Route 190 east of Porterville did not fail. (Photo courtesy of **Tulare Advance Register**) (3) Crane removing debris backed up against Clear Creek Bridge, Route 178, Kern County. (4) Typical damage to bridge understructure. (5) Destroyed section of Route 180 in Kings River Canyon, near national park boundary. Engineers used motorbike to travel road to assess damage, "mule hauling" it over washed out places.

Record flood—5,000 acre-feet per hour—80,000 second-feet—peaking at 100,000 second-feet—these and other terms filled the San Joaquin Valley newspapers during the first week in December. They were used to try to describe the torrential rains and devastating floods that occurred during that period.

To engineers, these terms are meaningful for use in formulas for determining sizes of dams, reservoirs, channels and bridges to handle quantities of water. To the layman who has never seen water in those quantities—even to those who have had the absolutely helpless feeling of being exposed to floods—it is very nearly impossible to relate these figures to known quantities.

STATE ROUTES SUFFER, COUNTIES MORE SO



Orientation map shows location of highways and counties hardest hit.

An acre-foot of water, the common unit of measure of water in a lake or reservoir, is the volume of water contained in an area of one acre one foot deep. Thus, when the water in the Success Reservoir in Tulare County was rising at the rate of 5,000 acre-feet per hour, one can think of a column of water covering an acre of ground and about a mile high being dumped into the reservoir every hour.

A flow of 80,000 second-feet means that 80,000 cubic feet, or about 600,000 gallons, of water passes a given point every second. The Kern River flowed at that rate above the Isabella Reservoir during the height of the storm. At this rate of flow, it would take a minute and a half to supply the 54 million gallons required daily by the City of Fresno.

The Counties of Tulare and Kern were hardest hit of the five counties making up District 6. Fresno and Kings Counties suffered more moderate damage, while Madera County experienced very little trouble.

Kern County

State Routes 178 and 155 were hit by flooding which caused rock slides and mud slides, washed out sections of roadway and severely damaged the Clear Creek Bridge. Pilings have been shored up as a temporary measure. Mud flows, a foot or more in depth, were troublesome for maintenance forces trying to clear the roads. However, they eased the removal of large boulders which almost floated in the mud.

State highways in Kern County suffered relatively minor damage. Preliminary cost estimates of repairs total about $83,000.

County roads were harder hit, with early estimates of over two million dollars for repairs and restoration of roads and bridges. Property damage estimates are in the area of four million dollars and expected to rise.

Three bridges were completely wiped out by the raging waters, including the bridge at Kernville which linked the two parts of town. A Bailey bridge—the type that was used so successfully after the 1964 floods in the northern part of the state—was installed as a temporary replacement for this vital structure. Among the county roads that had sections completely washed out was the important Kernville-Johnsondale Road. Kernville was completely isolated for several days, without telephones, electricity and drinking water except for that which was brought in.

Tulare County

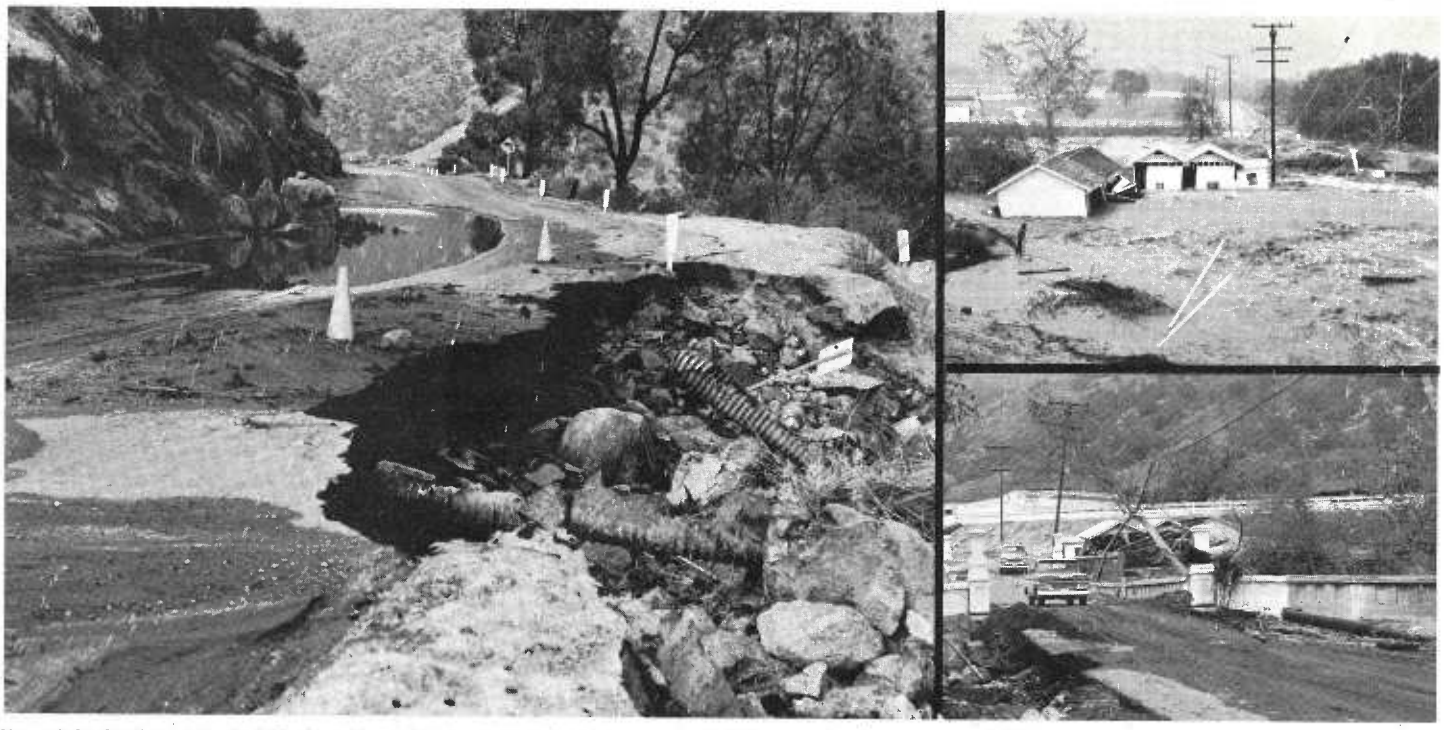
State Route 190 lost a 40-year-old bridge just east of Springville, at the north fork of the Tule River. At Boulder Creek, a complete washout was repaired about three weeks later with a temporary road.

The Kaweah River, flowing a mile wide and 15 feet deeper than normal for this time of year, chewed away at the town of Three Rivers, knocked out bridges and washed out sections of roadway. The section just above the junction with the Mineral King road will be restricted to one-way traffic for three or four months.

The raging Tule River poured so much water so fast into Success Reservoir that it went over the spillway and raced on downstream into the valley. For a time, it was feared that Route 99 might have to be closed at the Tule River Bridge between Tipton and Tulare. Water was bubbling up through the weep holes in the bridge deck, and, with the high-water mark about six inches below the surface of the deck, pressure was building up against the side of the structure. Fortunately, the flow subsided in time.

Early estimates place state highway damage in Tulare County at $337,000.

Again, it was the county road system and property that suffered most. Preliminary estimates place road damage at about 2½ million dollars and property damage at nearly 10 million dollars.



Above left: Section of Route 178 along Kern River west of Bodfish shows culvert failure, rock slide, water and debris on pavement, all problems for the maintenance crews. Two photos above right: "During" and "after" views of North Fork Tule River Bridge on Route 190, at Springville (upper right courtesy of **Porterville Evening Recorder).**

The county lost 13 bridges and damage to and loss of miles and miles of roads. Johnsondale suffered isolation for days, and, with the drinking water supply limited to that which could be brought in from the outside and sanitation facilities destroyed, there was fear of epidemics. County health officials were flown in and the threat curtailed. Springville, and as noted earlier, Three Rivers were the other communities hit hardest in Tulare County.

The town of Woodlake was almost isolated when State Routes 216 east and 69 were closed. Route 216 west was kept open under control. The town of Exeter was threatened when Yokohl Creek broke over its banks, flooding the nearby orchards. No one could remember this happening before.

Fresno County

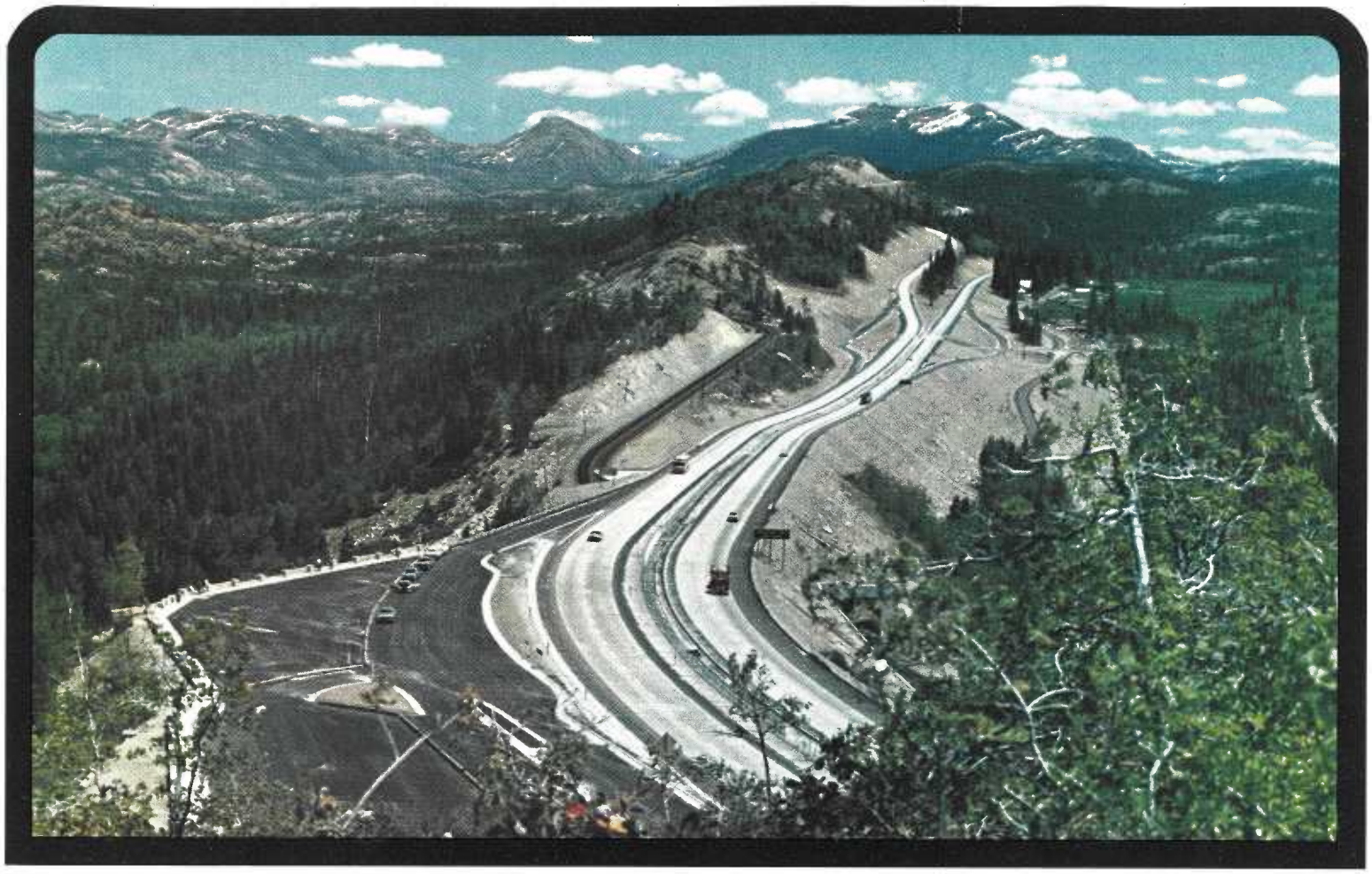
Major damage to state highways in Fresno County was concentrated on Route 180 through the Sequoia National Forest. East of General Grant Grove, the bridge at Ten Mile Creek was damaged so severely that the 35-year-old structure will probably be replaced. The Kings River preempted the highway alignment in this area and will have to be brought back into its normal channel. Four clamshells were kept busy during the storm at various locations clearing debris away from bridges.

Estimates of cost of restoring this route range to $550,000, depending on the amount of bank protection work required on the river banks.

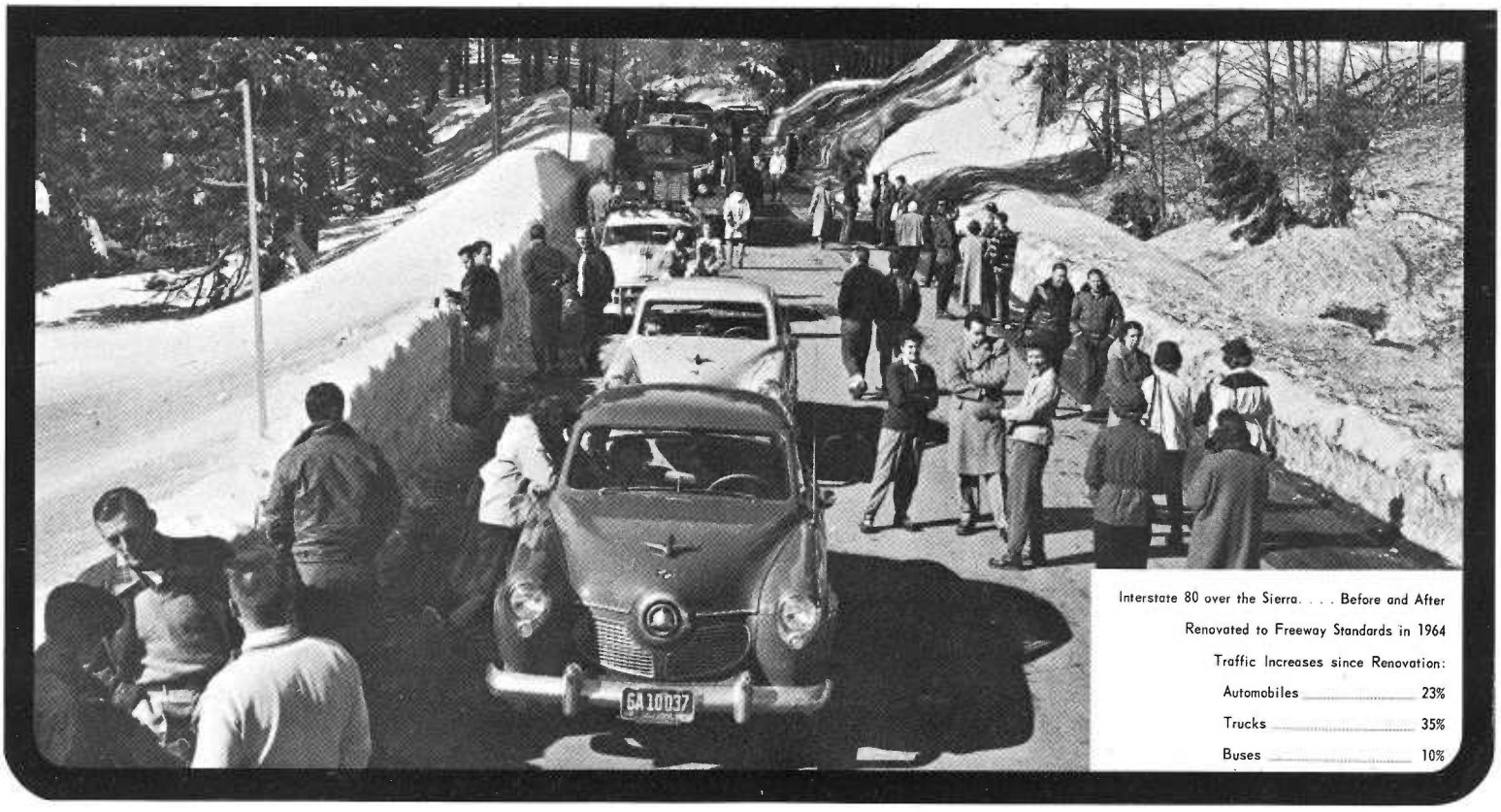
In the valley west of Route 99, Route 43 in Tulare County was closed for about a week when the Tule River spilled over its banks; Routes 33 and 41 were blocked by mud flows for a couple of days near Kettleman City. A rancher, a veteran of 70 years in this area, said this was the heaviest rainfall he had ever seen there. Route 198 west of Coalinga was closed for two days because of mud and rocks on the highway.

The lower areas of Kern, Tulare and Fresno Counties would have been subjected to far greater flooding and very extensive property damage had it not been for the Isabella, Success and Terminus, and Pine Flat Dams and Reservoirs. It is estimated that $150,000,000 damages in Kern and Tulare Counties alone were averted by the first three of the dams listed above. The communities above the dams took the brunt of the storm. Water systems and wells were either washed away or contaminated by the rampaging floodwaters; warnings were issued to boil drinking water. Houses and mobilehomes were swept from their foundations and parking places. Kernville alone lost 115 mobilehomes, with another 110 damaged.

Sequoia National Forest suffered over two million dollars in damage to roads, trails, bridges and campgrounds. Rainfall measurements for the storm included 19.45 inches at PG&E Forks on the Tule River, 30.49 inches at Johnsondale, and 35 inches at Wishon Station. Fortunately, damage to natural resources was relatively moderate. Although high winds toppled trees which will total some 14 million board feet of lumber, the Forest Service estimates that about two-thirds of this timber may be salvaged next spring. Pending approval of requests for funds to repair damaged areas presently available funds will be used to remedy situations affecting health and safety.



CALIFORNIA highway needs



Interstate 80 over the Sierra. . . . Before and After Renovated to Freeway Standards in 1964

Traffic Increases since Renovation:

Automobiles	23%
Trucks	35%
Buses	10%

TO SAVE MANY LIVES:

Speed Highway Building

CALIFORNIA, MORE THAN any area in the world, lives on wheels. The length of the state and its complex metropolitan developments are factors that continually build the volume of highway traffic.

Strong Support For Freeways

The County Supervisors Association of California, through its board of di-

Chamber Fears Fund Tieup to Delay Freeways

Full Development of Routes Pushed Despite San Francisco Problem

Full development of the San Diego, Riverside and Orange Freeways has been urged by directors of the Orange County Chamber of Commerce despite the possibility of tieup of federal interstate funds.

Simi Valley Residents to Fight Freeway Delay

Morgan Hill Joins The Campaign

Road Funds Dim Disney Prospects

Question Is not to Build Freeways but to Get Them Built in Time

Cutback seen in county road building funds

By MARTIN SALDITCH
Enterprise Capitol Bureau

SACRAMENTO — Riverside County faces a cutback in state road construction as an indirect result of

'Hazardous Route'

Highway 104 Funds Urged

Fight For Sierra Road Is Pledged

Contra Costa Asks Freeway Start on Route 17

Gilroy 101 Bypass Needed Now

Monterey County Road Costs Rise $1 Million Last Fiscal Year

BH Freeway Badly Needed

U.S. Cutback On Highway Funds Hit

Get Show on Road!

Council Urges Haste on Devore Freeway

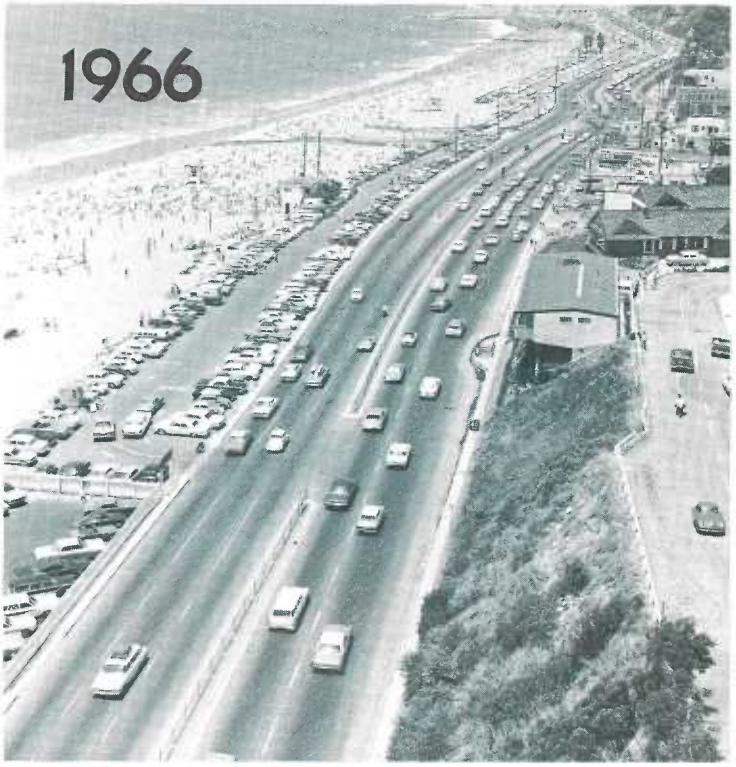
ONTARIO — The City of Ontario wants the California Highway Commission to hurry and build the Devore Freeway.

The City Council

ber 1
expec
speed
secti

Drivers Will Have Long Wait For Improvements On US50

California's Continuing Problem



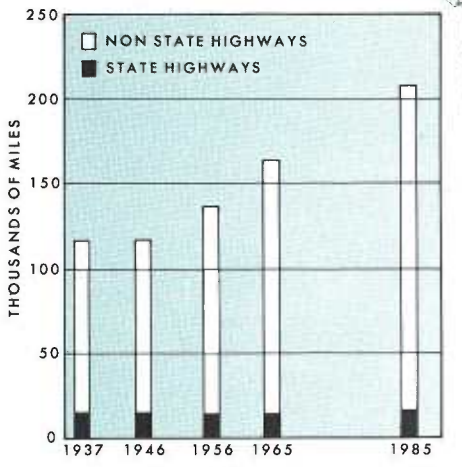
Although the overall situation changes, some traffic patterns remain constant. These two photos of the same location on the Pacific Coast Highway, near Santa Monica, were taken 36 years apart. During that period, the conventional two-lane highway was renovated by the addition of more lanes and today's traffic flows smoothly but the thoroughfare still is inadequate. A freeway is needed now and this increases each year. The various alternate plans under consideration for freeway construction will all require the expenditure of several million dollars per mile.

The Situation Today

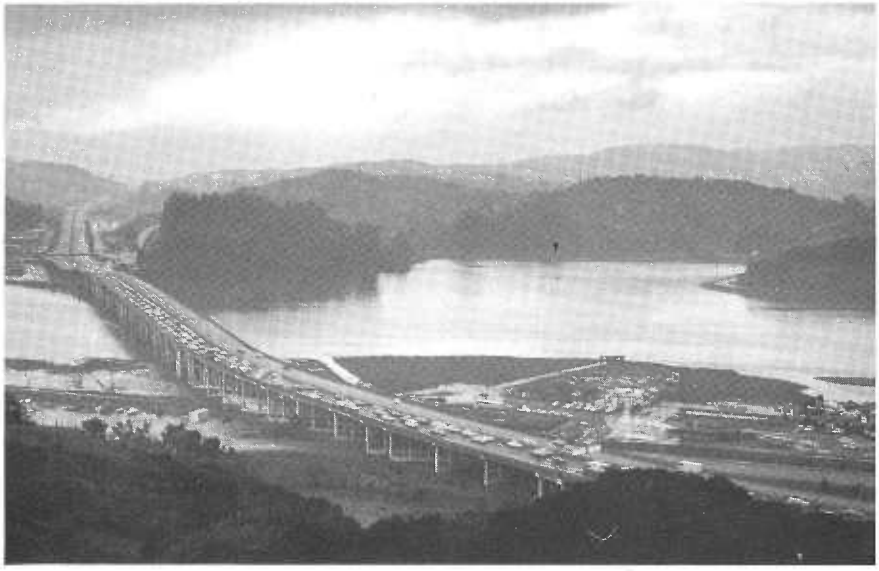
During the 1966 Christmas weekend, the people in California traveled more than 662,000,000 miles on California's total road network. Approximately 10,000,000 vehicles were in operation and they traveled upon 2,700 miles of multilane freeways or expressways, 11,500 miles of conventional state highway and 150,000 miles of county roads and city streets and national roads.

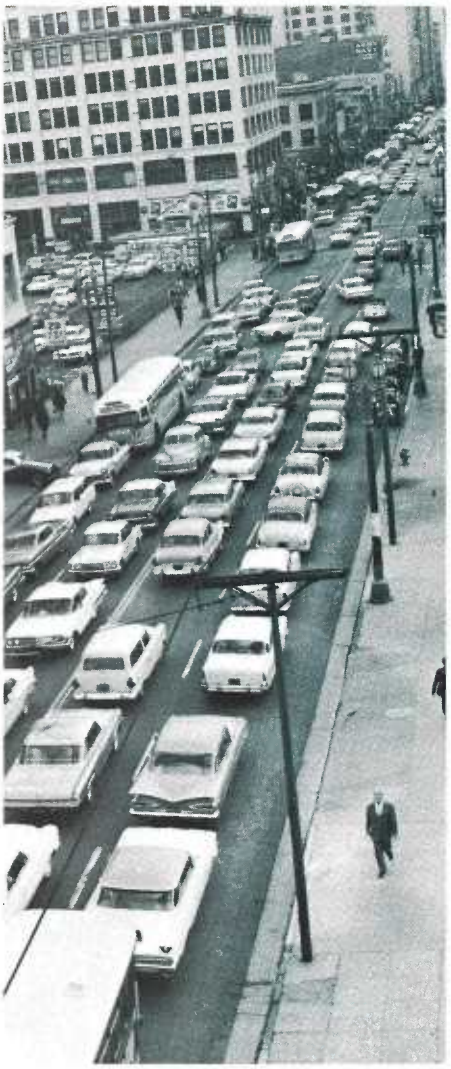
The 2,700 miles of freeway at times verged on reaching the saturation point for they accounted for 223,000,000 of the vehicle-miles. The conventional state highways accounted for 115,000,000 vehicle-miles and the other roads the remaining 324,000,000.

Next Christmas, the number of miles driven and the number of vehicles that will travel in California will be even more impressive, for the state's vehicle population at that time will have been increased by a substantial number of trucks, buses and automobiles. If highway construction fails to keep pace with this gain during the next 12 months, it will result in a loss of time and money to California drivers and more important, some will lose their lives because of increased congestion and traffic hazards brought about by the greater number of vehicles that will be using the system.

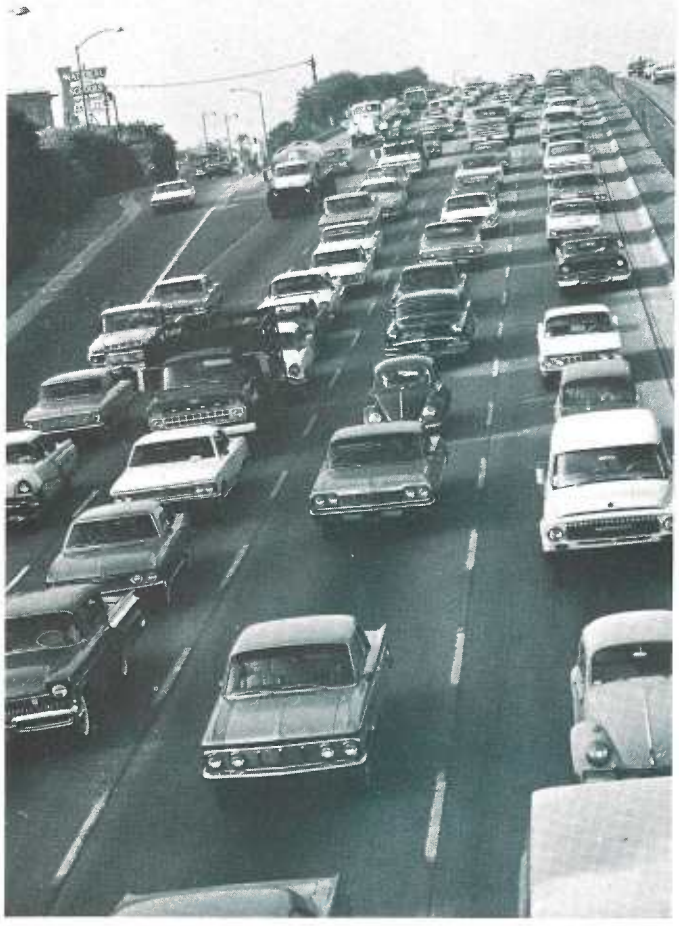


TOTAL TRAVERSABLE ROAD MILEAGE





The continuing phenomenal growth of California's population, quadrupled since the 1930's, with an even faster rate of growth in numbers of automobiles, is creating problems on urban and interurban freeways, as well as on city streets. Compounding the problems is the arrival in the state every day of several thousand new automobiles.



Above: East approach to San Francisco-Oakland Bay Bridge. Left: Harbor Freeway, Los Angeles. Below: In addition to traffic congestion, deficiencies on major routes exist all over the state. This sidehill viaduct, built in 1927, is still in use on US 101, the Redwood Highway. In summer this portion of this popular route carries approximately 5,000 vehicles daily; a mixture of California vacationists, tourists from out of state, lumber and logging trucks, and traffic serving the needs of the local communities. To bring the Redwood Highway alone up to modern standards, between San Francisco and the Oregon line, about $500 million will be needed. Dozens of other mountain and recreation highways in the state are as badly in need of modernization.

The Californian and His Automobile

HE IS ALMOST TOTALLY DEPENDENT ON IT

Granted, Californians drive more miles during a holiday weekend than at any other time, but, nevertheless, its economy is almost totally dependent upon rubber-tired vehicles so far as the transportation of people and goods are concerned.

A deep and lasting affinity has existed between the average California citizen and the automobile for many years. He seems to demand the independent mobility—the ability to go where he wants at his pleasure—that driving his own car provides, and he is more than willing to pay for it. He refuses to live in an environment that groups his home, place of work and shopping facilities all within easy walking distance of each other. He turns away from the use of mass transportation as a means of getting to work and even is reluctant to join in a car pool with fellow workers. He prefers to own at least two automobiles and for good reason. While he has one at work, the other is used by the rest of the family to transport the children to school and to permit his wife easy access to the thousand and one advantages and services that exist within the community—if she has convenient access to them.

Above: Hundreds of thousands of Los Angeles County workers travel daily up to 40 and 50 miles each way between their homes and their jobs. Below: The freeway seen crossing the upper part of the photo, combined with the expressway which passes over it, serve a portion of San Jose which two decades ago was a quiet scattering of residences. Greater San Jose, with its growing industrial complex, will soon rival San Francisco in population.

Rush hour at the San Francisco-Oakland Bay Bridge Toll Plaza

HE LIVES IN A BIG STATE

With few exceptions, California's metropolitan areas are attuned to individual transportation facilities, for rather than being a land where the environment is a vertical one such as that found in the larger cities of the eastern United States and where many people live in high rise apartments, in the Golden State there has been vast horizontal expansion with an accompanying very low density of population within a particular vicinity. Expressed differently, in California there are very few living in the same neighborhood who follow common traffic patterns. Therefore, until technology can provide a substitute that Californians will accept, the motor vehicle will remain the state's basic means of transportation.

One out of every 10 persons in the United States lives in California, and its 19,300,000 population continues to grow. It is basically an urban state, for research conducted in 1965 showed that 88 percent of its people live in urban areas. This was not always true, for at the turn of the century 47 percent of the people lived in the country. Since that time, there has been a gradual influx into cities, and by 1985 this trend will have reduced the rural population to only 11 percent of an estimated total population of 32,600,000 persons.

There were 9,900,000 motor vehicles registered with the California Department of Motor Vehicles at the end of 1965, or slightly more than 11 percent of all within the United States. No figures are available for the estimated national number in 1985, but in California research indicates that registrations will then approximate 20,000,000 vehicles.

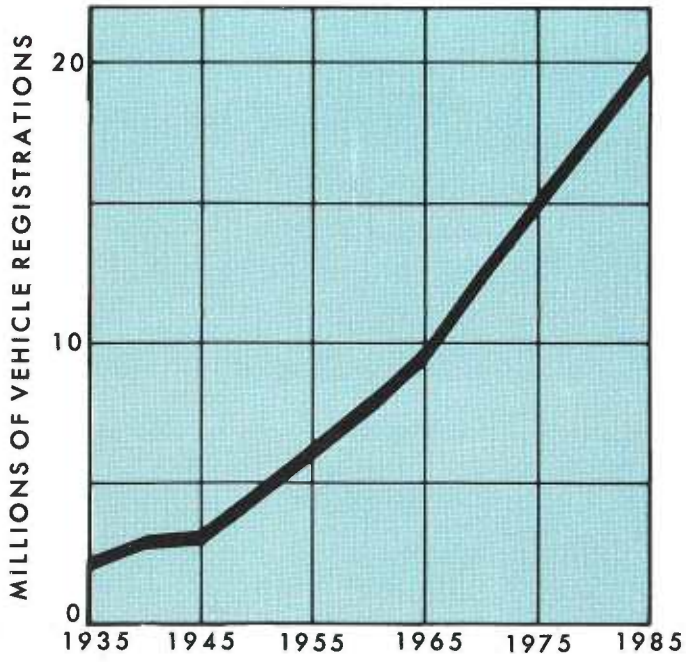
In 1965, 96,100,000,000 vehicle-miles were driven in California, approximately 11 percent of the national total. No national estimate is available for the year 1985, but the very conservative estimate for California in 1985 is 199,000,000,000 vehicle-miles.

Although this increase in people and vehicles will concentrate in urban areas, California ranked sixth nationally in rural population in the last federal census and, therefore, it is imperative that highway planning follow a balanced program concept that takes into consideration all elements of the population and provides total highway service to all California highway users.

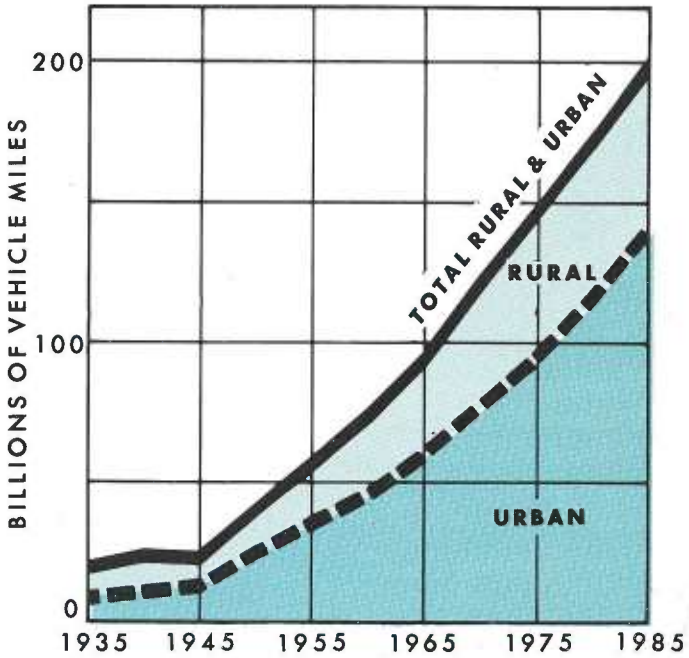
Recreation is a case in point. A recent study shows that recreation facilities in the vicinities of California's 14 metropolitan areas are now inadequate. The bulk of new ones that will be developed to meet current and future needs will be at an appreciable distance from the cities and the logical means of transportation between these sites and the cities is the motor vehicle. In this regard too, the State Department of Parks and Recreation as

(Photograph by Jon Wells, courtesy of Gross, Roberts and Rockey)

WITH MANY AUTOMOBILES



VEHICLE REGISTRATION



VEHICLE MILES TRAVELED

Highway Needs Are Immense

a part of its study noted that, with the exception of walking, driving for pleasure is by far the most popular form of California outdoor recreation.

The vehicle transportation needs of California have been and are continuing to be carefully evaluated under a comprehensive planning process.

The State Legislature has established the California freeway and expressway system, which is a master plan of development for meeting transportation needs over the major State highway routes. The plan established in 1959 is designed to serve and promote both the present and future economy of the state and the welfare of the people. The now partially completed system will eventually consist of 12,500 miles of controlled-access highways and is intended to connect and serve major areas of population, provide appropriate access to the various regions of the state and facilitate the enjoyment of the state's many scenic and recreational facilities.

Because of the many needs and the ever-present funding limitations in the total highway program, most careful evaluation is given to the type of development to be afforded each route and the priority or importance of the particular project.

Where traffic volumes and other factors warrant, freeway facilities are provided because they have clearly been shown to be the safest and most effective form of roadway facility. In many other situations, conventional highways are reconstructed or partial access control highways are provided. Through careful coordination with local officials and a system of meetings and discussions with interested groups throughout the state, all construction needs and priorities are systematically examined.

An extensive spot improvement program is carried out in situations where financing is not available for total reconstruction.

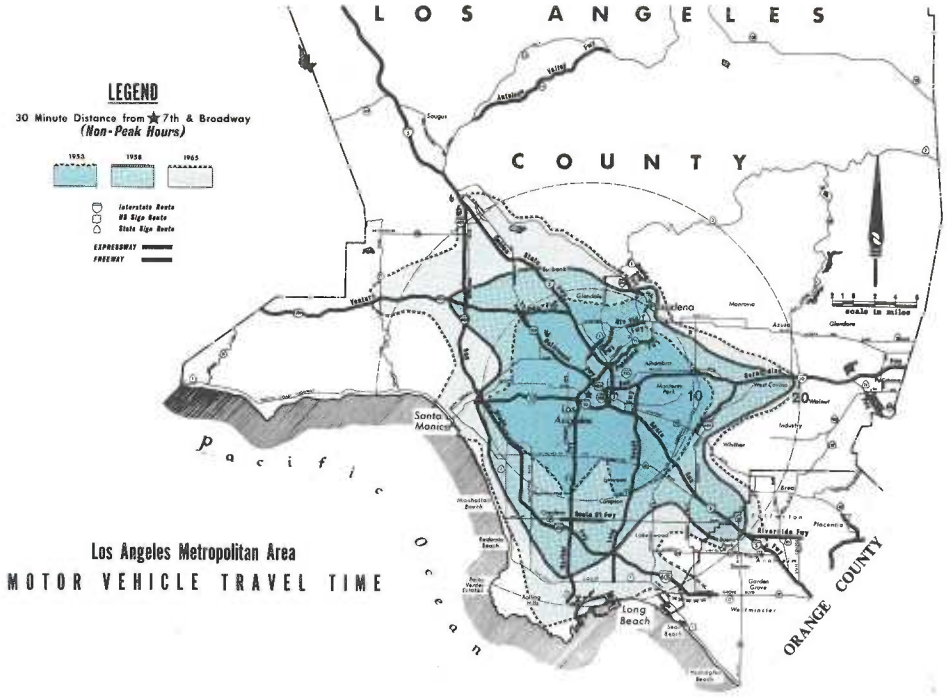
Under this program, accident concentration locations are readily determined and necessary remedial action taken. Considerable emphasis is placed on minor improvements such as curve corrections, widening of pavement, and the installation of guardrail, channelization and signal lights.

Safety roadside rests and provisions for a special scenic highway system round out the state program.

A "select system" of county roads and city streets has been established to serve the needs of local jurisdictions. This system consists of 38,500 miles of heavily traveled local roads and streets. Financing is provided by a share of the state gas tax and local funds. The state maintains general control of the system by approval authority as to additions, deletions, roadway design and actual expenditure of funds.

The federal aid secondary and urban extension programs further assist in the vast job of providing an adequate local road system to meet ever increasing needs.

MUCH HAS BEEN DONE . . .



Although the Greater Los Angeles freeway system is still incomplete, it is gradually cutting down travel times in the area. Note how each freeway now in service greatly extends the distance a driver can travel in a set period of time, versus the distance he can travel in the same time on conventional highways and city streets.

Comprehensive urban transportation studies are now underway or definitely planned for the state's 13 major urban areas (50,000 population or more). These studies are being carried out under the provisions of the Federal Aid Highway Act of 1962 and will provide a continuing evaluation of overall transportation needs and will develop guidelines as to means of fulfilling these needs. These comprehensive studies take into consideration all facets of community and transportation planning and because of the high degree of local participation, will be of great assistance in the development of feasible, practical solutions.

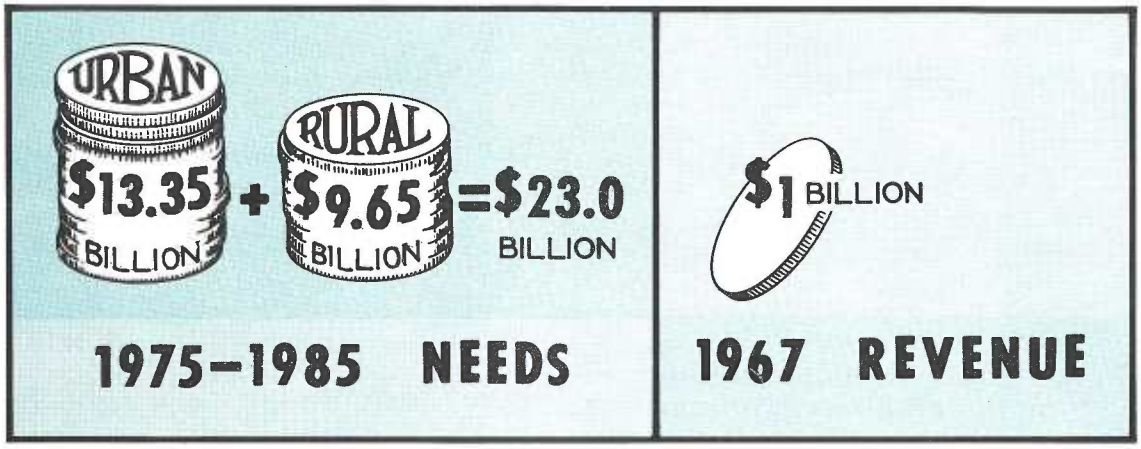
The Los Angeles freeway system, although only partially completed, is at the present time the largest and most effective rapid transit system ever devised. The San Diego Freeway, which is only a 50-mile segment of the system, carries over three-quarter million people on an average day. The Harbor, Santa Ana, and Golden State Freeways within the metropolitan area each carry well over half a million persons. Other segments also carry high volumes.

The system too has the dual role of providing the means of transporting the predominance of freight originating or terminating in the vast Los Angeles metropolitan area. An analysis made in 1962 showed that the San Bernardino Freeway, for example, carried an average of 110,000 tons per day, or the equivalent of over 1,800 box cars or 11 Liberty ships. The Santa Ana, Hollywood and Harbor Freeways were also high-volume carriers. On an overall basis the Los Angeles system volume is now estimated at 3,300,000,000 ton-miles per year.

The need for additional freeway miles is increasingly important. Social scientists declare that by 1985 there will be a single urban area extending from north of Los Angeles past San Diego and on to the Mexican border. The people who will reside there probably will be like the ones who live there today—members of an automobile-oriented society who depend mainly on rubber-tired vehicles.

While the southern California area provides the most striking illustration of urban growth and consequent needs, this same general theme of growth and needs is true for the many other urban areas of the state.

1975 - 1985 $23,000,000,000



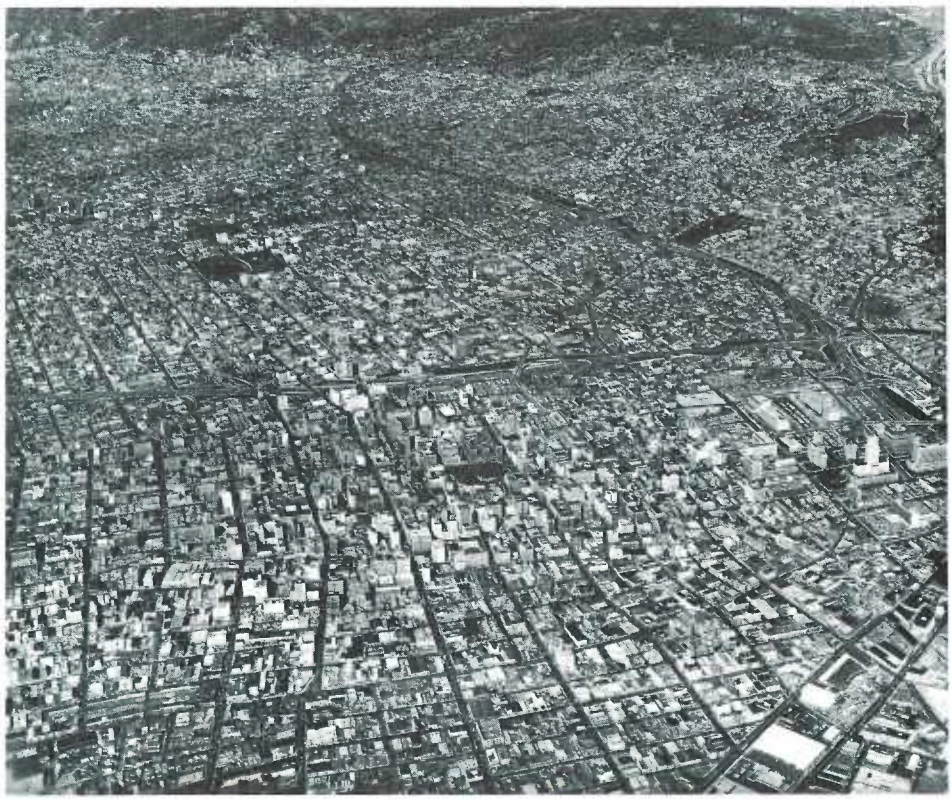
TO SOLVE MANY PROBLEMS

The needs both state and local for the 10-year period between 1975 and 1985 are of particular concern at this time. Based on today's prices, it will cost approximately $16,000,000,000 to pay for construction, rights-of-way and engineering during that decade. However, land values in California are going up and the general cost of construction is keeping pace. Cost projections, based on statistics compiled over many years, indicate that today's figure will be approximately $23,000,000,000 when the bills actually are paid. This is based on the assumption that the present program level will continue up to 1975.

Future needs in California are determined in a conservative manner and they include only those factors that must be considered to ensure a system that can provide basic service to the traffic flow of the future. Only those additions that this future traffic will require are included in the 1975–1985 period.

In making the estimates of roadway deficiencies due conideration has been given the fact that other forms of transportation will be carrying their predicted share of the load.

Below: Although commonly thought of as a single city, Los Angeles is only the heart metropolis of a complex of some 120 cities covering 9,000 square miles, with a population of 9 million people. Here, where almost all the usable land in these 9,000 square miles has been built upon, is also the world's greatest concentration of motor vehicles. Because almost all of California's urban areas have been developed in modern times since the automobile came into popular use, private cars are used virtually exclusively for transportation, and trucks for the movement of freight. Los Angeles County alone has more than 4 million registered motor vehicles.



SOME OF THE PROBLEMS . . .

This narrow section and bad alignment on US 299 in the northwestern part of the state is typical of the bottlenecks or deficiencies which still exist not only on secondary state routes but on major federal aid routes similar to US 299.

Typical congested street on a major through route in a major Central Valley city.

An older freeway section in Los Angeles now carrying more than 150,000 vehicles daily.

Many Californians today have vacation or retirement homes in the desert, the mountains, and along the seacoast. Trip travel between urban areas and these new developments is heavy, particularly on weekends and in season. Shown is a typical such development which offers 3,500 building lots, but is 23 miles from the nearest state highway. It is currently serviced by a substandard county road.

A major federal aid route. Its substandard two lanes clogged in summer with trucks, vacationers, and locals.

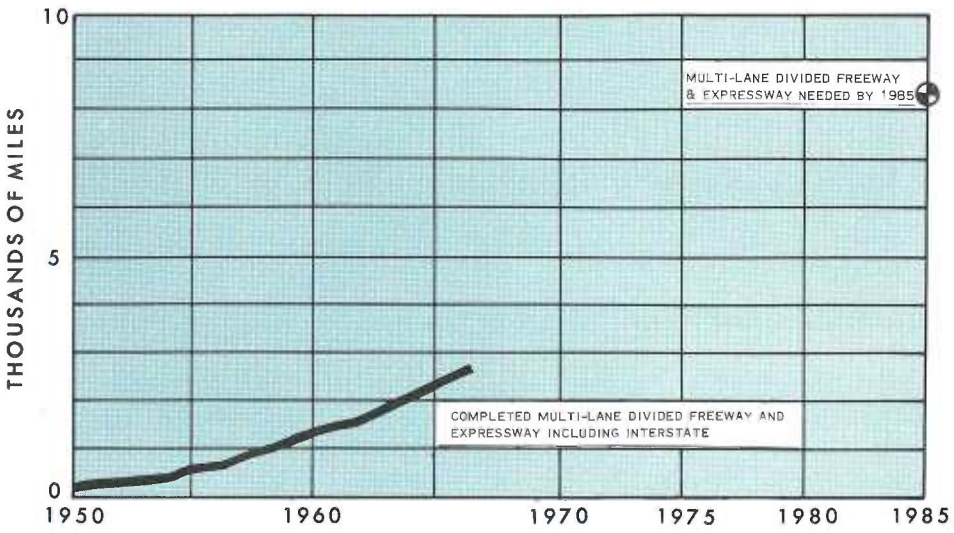
Many of California's state and county routes pass through exceedingly difficult terrain and have dangerous sections such as this which must be brought up to date.

The Future

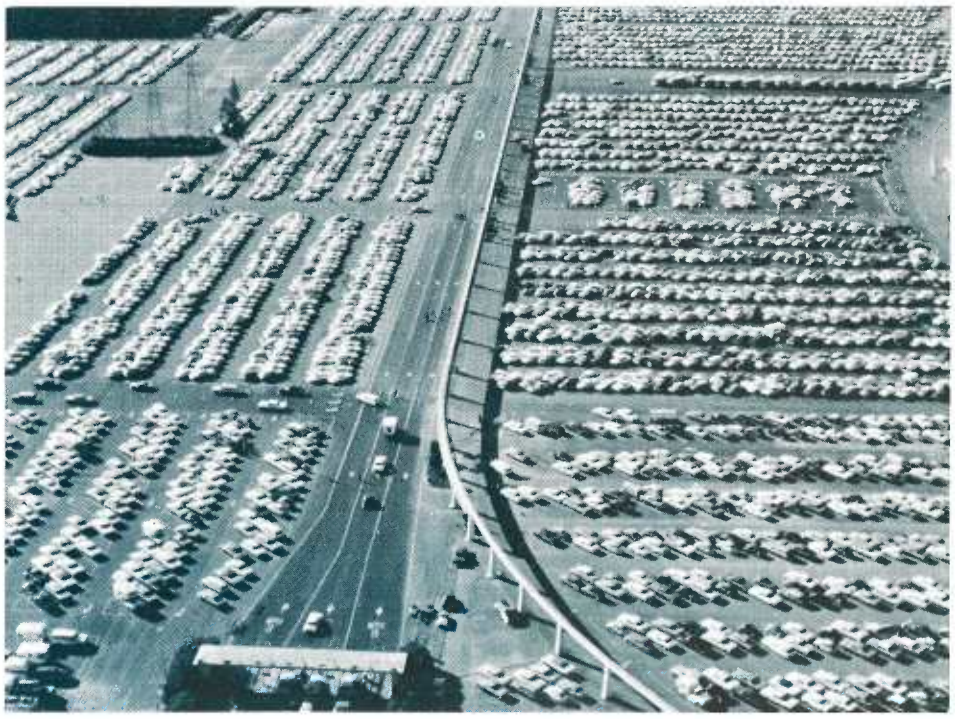
Much of the specific planning required to accomplish the work that should be done during the 10-year period under discussion has been accomplished and other phases are now underway. The State Legislature has identified the termini of all state highways, and the locations of the routes that many of them will follow have been formally adopted. Like the state, each city and county has a competent engineering staff that is charged with identifying and correcting their needs.

California now spends almost one billion dollars per year in improving roadway facilities with about two-thirds of this amount devoted to state highway development. The amount available for state highways alone provides for nearly 250 miles of new freeways each year plus a substantial mileage of new and improved conventional roadway facilities. Additionally hundreds of miles of roads and streets are constructed or improved each year with funds available at the local level. This improved roadway mileage barely takes care of increasing needs. Deficiencies exist in almost all areas of the state, and because of financial limitations some highly desirable projects must be put off for future years. In this regard, it is estimated that even if spending continues at the present level until 1975 an additional $23,000,000,000 will be required to meet needs in the 1975–1985 period.

If the California highway system is to continue to operate effectively, other *planned* segments must be added to handle increasing demands. Any significant decrease in the construction of the freeways, expressways, conventional highways, or county roads and city streets will immediately handicap the movement of people and the things they need. If such a slowdown were to continue over an appreciable period of time, it could result in stifling their economy and stagnating the most mobile society in the world.



FREEWAY PROGRESS



The parking area at Disneyland on a holiday weekend. This attraction handles 1½ million cars annually in its lots. In recent years amusement parks similar to Disneyland, baseball and football stadiums and cultural centers are generating new transportation problems. Also included in the recreation travel problem is the Californian's tendency to travel hundreds of miles for beach enjoyment, mountain scenery, camping in state and national parks and forests, skiing, and boating. Privately owned boats which are carried on trailers, of which the state now has more than a quarter million, present particularly difficult traffic problems.

California Highway Facts

MILEAGE—ROADS, STREETS, HIGHWAYS

Present	164,248 miles
Rural	124,701 miles
Urban	39,547 miles
Comprised of	14,215 miles state highways
	36,980 miles city streets
	70,089 miles county roads (maintained)
	11,258 miles county roads (not maintained)
	31,706 miles national roads
Estimated 1985	207,500 miles (16,200 miles state highways)
Rural	127,051 miles
Urban	80,449 miles

MOTOR VEHICLE REGISTRATION (ALL VEHICLES)

1966—California—10.9 million—Rank, first
(Percent of nation—approximately 11%)

1985—(Estimated) California—20.0 million

MOTOR VEHICLE TRAVEL—VEHICLE-MILES

1965—California—96,100,000,000 vehicle-miles
Rural—36,100,000,000
Urban—60,000,000,000
(Percent of nation—approximately 11%)

1985—(Estimated) California—199,000,000,000 vehicle-miles
Rural—60,400,000,000
Urban—138,600,000,000

Of the 1985 total, 86 billion vehicle-miles will be traveled on state highways annually. Of this, 37.9 billion will be on the Interstate system alone.

TOTAL NEEDS ALL HIGHWAYS, ROADS AND STREETS—$23 BILLION

Rural—$9.65 billion
Urban—$13.35 billion

POPULATION

1966—California—19.3 million—Rank, first
(Percent of nation—approximately 10%)

1985—(Estimated) California—32.6 million

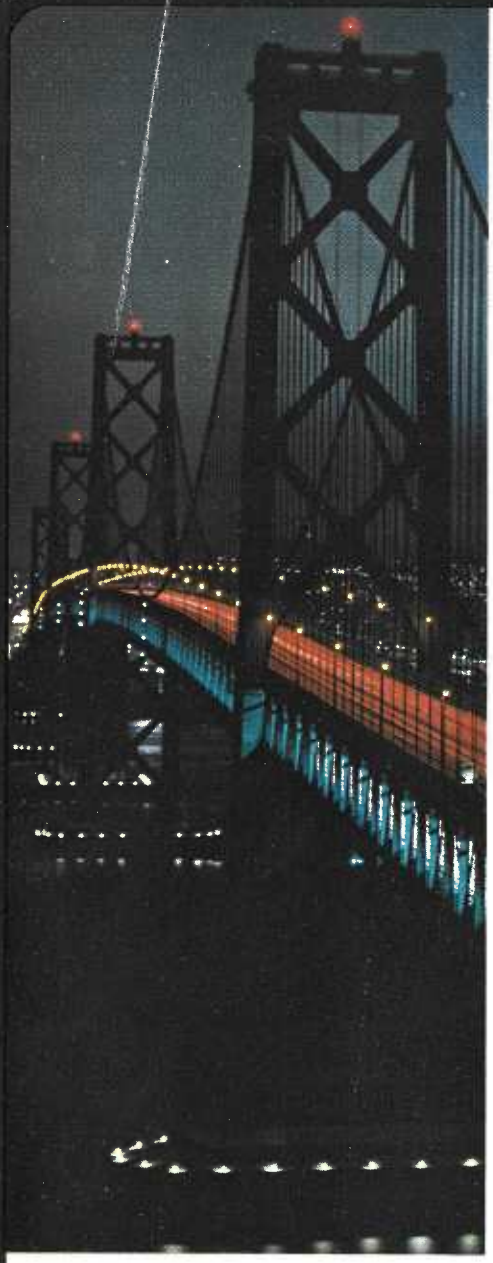
Eighty-eight percent of the population of California lives in urban areas. In 1985 it is estimated that 29 million people or 89 percent will live in urban areas.

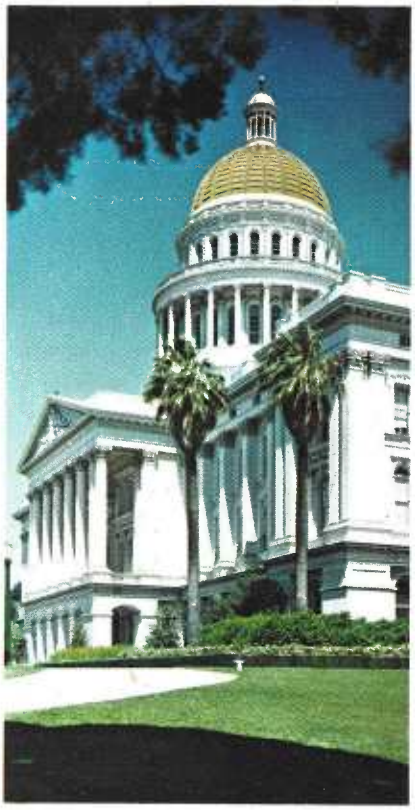
MILEAGE—FEDERAL AID SYSTEMS

Interstate highway system		2,165 miles authorized
Completed	1,087 miles	
Under construction or budgeted	579 miles	
Total	1,666 miles	
Other federal-aid primary		7,623 miles authorized
Federal-aid secondary		12,667 miles
(State, 3,554 miles; local, 9,113 miles)		

PROGRESS ON CALIFORNIA FREEWAYS AND EXPRESSWAYS

Completed multilane divided state highway		
Freeway	2,046 miles	
Expressway	661 miles	
	2,707	2,707
Multilane divided state highway under construction or budgeted		
Freeway	720 miles	
Expressway	64 miles	
	784	784
		Total 3,491





View of new highway, south end looking north.

Highway to the Space Base

By R. R. Crandall

COOPERATIVE EFFORT CREATES A BEAUTIFUL ROAD

The general said, "We must be able to evacuate this base in nine minutes."

This remark initiated a system of expressways for the great Vandenberg Air Force Base, located on the shores of the Pacific Ocean, north of Lompoc and southwest of Santa Maria, in Santa Barbara County.

Until recently, only two narrow, winding ribbons of asphalt passed through the old Camp Cooke area, but today's growing space center is now served by the best in modern highway facilities. With the opening of the Vandenberg Shortcut Number Two modern highway service is now completed to the space age center, where recently a new two-million-dollar contract was awarded to initiate a space probe program.

Lompoc, once a quiet nearby village of 4,000 souls, has become a thriving, growing city of 24,000, and Santa Maria has expanded until homes are springing up on pastureland miles from the city center. Most of the base's 20,000 workers travel from these two cities early in the morning and return late in the evening. The scramble at the base gate at these times resembles an exodus from a Dodger baseball game at Chavez Ravine.

An exchange of ideas from the Santa Maria Chamber of Commerce, the Bureau of Public Roads, the county road department, the VAFB engineering and personnel staff, and personnel from the District 5 engineering department cleared the way for the production of contract plans. This was a complicated project, financed by the federal government, administered by the U.S. Bureau of Public Roads, designed and constructed under the supervision of the State Division of Highways, reviewed by the staff of VAFB, and maintained by the County of Santa Barbara, but everything evolved in excellent form.

Photos left to right clockwise: (1) Where cuts were necessary slopes were made 4 to 1 to blend into terrain. (2) Section through swamp area. Beneath surface ground was almost all water, with material about of consistency of thin gruel to depth of 40 feet. More than 50,000 yards of sand were required to establish road foundation on this half-mile stretch. (3) Loop connection with recently realigned Route 1. (4) At this low pass, a new view spreads before the traveler's eye. (5) Across the road, believe it or not, was one of the borrow sites. Now, smoothed and graded to fit into the surrounding slopes, and seeded with ryegrass, it becomes a part of the natural landscape. (6) Map of area shows new route to Vandenberg and superseded San Antonio Road. Almost simultaneously, the new section of Highway 1 shown was opened.

Last October, at eight in the morning, it was not uncommon to see cars lined up bumper to bumper for five miles, the hundreds of occupants waiting impatiently to get to work at the base. Several times when fog was present, a series of telescopic rear-end collisions occurred.

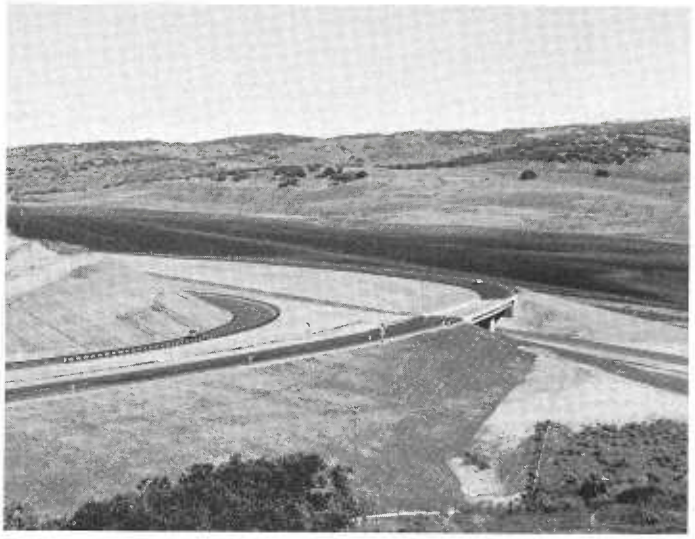
Today, since dedication of the new expressway on November 2, 1966, a worker from Santa Maria can leave 15 to 20 minutes later in the morning and still arrive on time for work. The 6.5 miles he doesn't have to drive, plus the better entry conditions all go to make for a safer drive and a happier and more relaxed traveler.

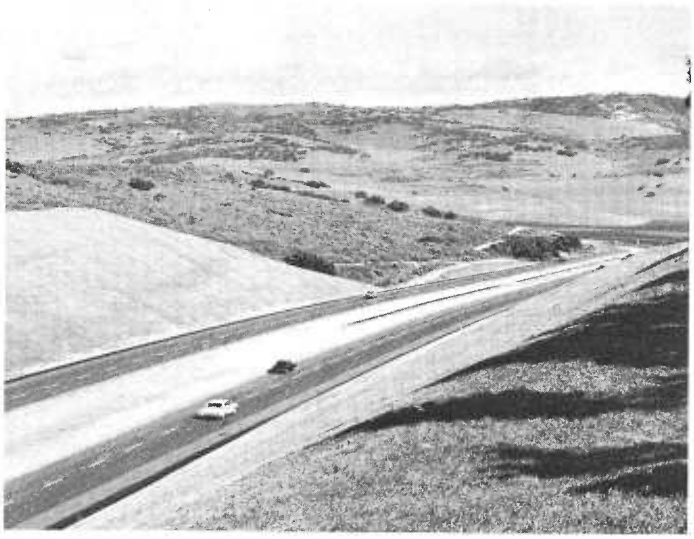
In addition, in line with today's practices, the aesthetic values of the highway were protected by shaping tops of cuts to look like natural hills, by flattening slopes to resemble original terrain, by concealing ditches from the driver's view, by using rounded earth-colored poles for a camouflaged fence, and by saving as many beautiful oak trees as possible. To restore beauty where new construction made unavoidable scars, an extra heavy application of straw and seed on the sandy slopes was used and then to further enhance the beauty of the terrain, Texas bluebonnet seeds were scattered. (For those who would question the use of an out-of-state "native," it should be explained the Texas bluebonnet is almost identical with one of California's lupines, is as well adapted to the California climate, germinates better, is a more vigorous plant, and has the added advantage that seeds are available in quantity).

Not forgetting the requirements of the *Planning Manual*, a "built-in" maintenance department was constructed. To give the maintenance men a chance to clean up sand that might trickle down the cut slopes, a six-foot bench at dike level to act as a catch all was provided on each side of the highway. Ditches, where subject to erosion, were lined with tinted air-blown mortar. Distracting markers, signs and guardrails were kept to a minimum. All pipes were placed so as to maintain a self-cleaning condition.

Not everything was "peaches and cream." There were a few problems in design. A swamp area of about a half-mile in length gave some trouble when headquarters reported that the material in this area was undoubtedly the worst that had ever come to the lab for testing. It was so bad that it had to be moved during construction, and it was.

It was a challenge to design the Vandenberg Overcrossing with a graceful loop meeting the Route 1 Freeway at a design speed of over 50 miles an hour, and to endow a merging connection with a feeling of security. Even though the driver rises to some 30 feet above natural ground, the shape of the loop area, the flatter-than-normal slopes, the wide-open view and wide medians afford the feel-



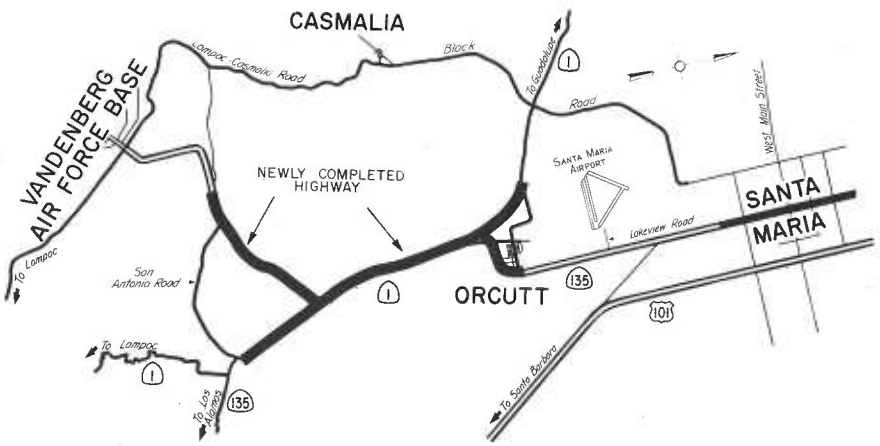


ing of security essential for a well-designed highway.

Construction personnel did an excellent job of putting the plans "on the ground" and then adding touches here and there to dress up the countryside so that it is now especially beautiful. Particularly, they were remarkably successful in leaving two borrow sites in a natural-looking condition.

Ground water was encountered in the largest cut. The problem was solved by the use of perforated metal pipe underdrains which still conduct a large quantity of water.

If the reader would like to see some of the finest stately oak groves of California, wildflowers of many colors and forms, and experience a truly pleasurable tour, a drive over this new highway is strongly recommended. As a bonus, it is possible that one may even see a mighty missile rise from the earth and soar grandly down the Pacific range.



Bartlett Award for J. C. Womack

The "George S. Bartlett Award," one of engineering's highest, has been awarded to J. C. Womack, State Highway Engineer and Chief of the California Division of Highways. The award is given annually to the person who has made the most outstanding contribution to highway progress.

In presentation ceremonies at the national conference of the American Association of State Highway Officials in Wichita, Kansas, on November 29, A. E. Johnson, executive secretary of AASHO cited Womack's achievements in leading California's highway and freeway program, terming it "the most advanced in the nation."

Johnson pointed to the State Highway Engineer's successful efforts to beautify America's roadways, paying particular attention to Womack's example in promoting highway aesthetics.

The George S. Bartlett Award, named for the individual who first advocated paved roads in the United States, was instituted in 1931. It is presented annually to a member of the American Association of State Highway Officials, the American Road Builders' Association or the Highway Research Board.

A native of Emmett, Idaho, Womack was educated in Seattle and attended the University of Washington. He served as a second lieutenant of field artillery in World War I. His engineering career began in Oregon and Washington in 1922 on location and construction work for the U.S. Bureau of Public Roads.

Joining the California Division of Highways in 1929, he was assigned to the Marysville office, where he served successively as resident engineer, district maintenance engineer, engineer of surveys and plans, district construction engineer, and assistant district engineer. In 1948 he moved to Headquarters Office in Sacramento as planning engineer for the division.

In 1955, Womack was promoted to Assistant State Highway Engineer—Planning, and in October 1959 was advanced to Deputy State Highway Engineer—Engineering. In December 1959, he was appointed State Highway Engineer.

Womack is past president of both the American Association of State Highway Officials and the Western Association of State Highway Officials. He is a member of the American Public Works Association, the American Society of Civil Engineers, the American Concrete Institute, the American Society of Photogrammetry, the Commonwealth Club of San Francisco, and the Elks.

He is currently serving on the executive committee of the Highway Research Board, National Academy of Sciences; and as vice president of the American Road Builders Association.

As State Highway Engineer for California, Womack is responsible for administration, planning, improvement, construction and maintenance of about 15,000 miles of state highways plus some related functions in connection with local roads and streets. The State Division of Highways has about 18,000 employees, with an annual budget of almost a billion dollars.

For the past 17 years, and especially since his appointment as planning engineer in 1948, Womack has been closely identified with California's long-range highway improvement programs, with emphasis on freeway development. California now has about 2,100 miles of full freeway in operation or under construction. California's adopted routings for freeways come to more than 7,300 miles, or well over half of the mileage for the state's 12,500-mile freeway and expressway system designated by the Legislature in 1959 after a two-year pioneering study by the Division of Highways.

In addition to his California work, Womack has served as consultant to two foreign governments. He assisted with a study of highway deficiencies for Haiti, and with a route study between Tokyo and Kobe in Japan. He has also served as special consultant on construction problems in Indonesia.

In 1963 Womack was selected by the American Public Works Association as one of the nation's "top 10 public works men of the year."

Governor's Design Award

THREE OUT OF FOUR IN TRANSPORTATION FIELD

In the Governor's Design Awards contest for 1966, the California Division of Highways won three of the four certificates given for "significant design in the field of transportation." One was for a bridge, the Cold Spring Canyon steel arch in Santa Barbara County; another was for the design of the San Diego-Santa Monica Freeway Interchange in Los Angeles; and the third was for the design of the Interstate 80 Freeway over the Sierra Nevada.

The presentations were made by the Governor on December 28 in Pasadena. Nathaniel A. Owings, chairman of the awards jury, acted as master of ceremonies. Other members of the jury were Mrs. Helen Reynolds, president, California Roadside Council; Allan Temko, Center for Planning and Development Research, University of California, Berkeley; Sam T. Hurst, dean, School of Architecture and Fine Arts, University of Southern California; Dr. Harry Ashmore, Center for the Study of Democratic Institutions; Cesar Pelli, director of design, Daniel, Mann, Johnson and Mendenhall; and Professor T. Y. Lin, Department of Civil Engineering, University of California, Berkeley.

Awards were given in the categories of urban buildings; public buildings; educational, cultural and religious buildings; industrial projects; commercial service facilities; planned community; transportation facilities; rehabilitation (of buildings or neighborhoods); conservation; social improvement; landscape; and leadership (environmental).

Attending for the Division of Highways were J. E. McMahon, state bridge engineer, representing J. C. Womack, State Highway Engineer; and Tom Lammers, representing District 7, accompanied by Prescott Reed and Marilyn Reese. District Engineer Robert J. Datel represented District 5, and H. F. Sherwood District 3. Marvin Shulman and George Hood of Headquarters Bridge Department also attended.

Photos, top to bottom: The three certificates. Split section of Interstate 80 in the Sierra Nevada. San Diego-Santa Monica Freeway Interchange, Los Angeles. Cold Spring Canyon Bridge, Santa Barbara County.

STUDY
SHOWS DRIVERS ARE NOT
EASILY REGIMENTED

Installing a tape-switch indicator for recording speeds and time of day. More than 85,000 recordings were used in compiling data for study.

Minimum Speed Limits

By
Norman Wingerd

When the Legislature in April 1965, by House Resolution No. 133, directed the Division of Highways to undertake a study of the value of establishing minimum speed limits for each lane on state freeways, it seemed an interesting project, which might offer considerable benefit to California drivers.

The report on the results of the carefully documented tests at four locations in the state shows that quite the opposite result might be expected. The motorist reacts to such close regimentation, but not in the intended fashion.

Where the signs indicating minimum lane speeds were posted, drivers who normally would travel at middle-range speeds in the slower lanes, apparently said to themselves, "Oh boy! I can make better time if I get over in the fast lane," and they would move over but continue to drive at the same middle-range speed. Apparently, just as everyone thinks he is a good driver, so everyone thinks it is the other guy who is holding up traffic. (Actually, the traffic engineers say that almost everyone in California is a reasonably good driver, for which they are thankful, but, as also every driver knows, everyone does not like to drive at the same speed.)

Actually, when traffic reaches a certain rate of flow, the midrange drivers are reluctant to move back and forth between the outside lane and the "passing" (left) lane every time they catch up with a slow vehicle. In other words, they don't like to "keep right, pass left," since it causes them to change lanes so often. Yet the fast drivers, who comprise a minority, expect the midrange drivers to do just this in order to avoid having to change lanes themselves (by passing on the right).

At the outset of the tests, the engineers conducting them were interested in exploring the following possibilities which from a logical viewpoint might have been expected:

- 1. Variations in speed of vehicles in each lane should be less. In other words, the lane controls would separate the traffic so each driver would be moving at a speed comparable with others in his lane. He would then be

content to stay in the lane, rather than change back and forth, a cause of many accidents. There would also be less "tailgating" by drivers discontented with the speed of those ahead of them.

- 2. Traffic should tend to increase in the right lane, and decrease in the left lanes. This would make better use of the right lanes, while leaving the left lanes free for faster moving vehicles, with once again less motivation toward lane changing.
- 3. Passing on the right should be lessened. Although passing on the right is legal where there are adequate lanes to permit it, and allows freer movement of traffic on multilane highways, it does make some drivers nervous to be so passed, and it irritates the fast drivers who have to change lanes in order to get around the slow ones.

Four study sites were selected for the tests: one four-lane, one six-lane, one eight-lane, and one where an eight-lane freeway narrows to six lanes. The latter actually served as two study sites.

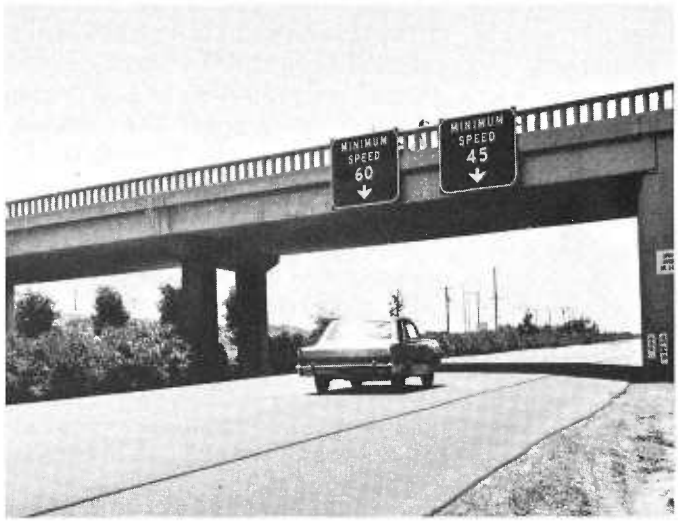
The four-lane section was on Interstate 80 (Roseville Freeway) near Roseville. The six-lane section was on Interstate 80 near Dixon. The eight-lane section was on Route 11 (Harbor Freeway) in Los Angeles. The combined section was on Route 101 (Bayshore Freeway) in San Mateo County.

These sites were selected for the following reasons:

- (1) They have nearly straight alignment;
- (2) They have no sustained grades which would significantly affect truck speeds;
- (3) They have no high volume on- or off-ramps which would induce an excessive amount of lane changing, passing on the right, and below-normal speeds, and;
- (4) All study sites had overcrossings on which signs could be mounted.

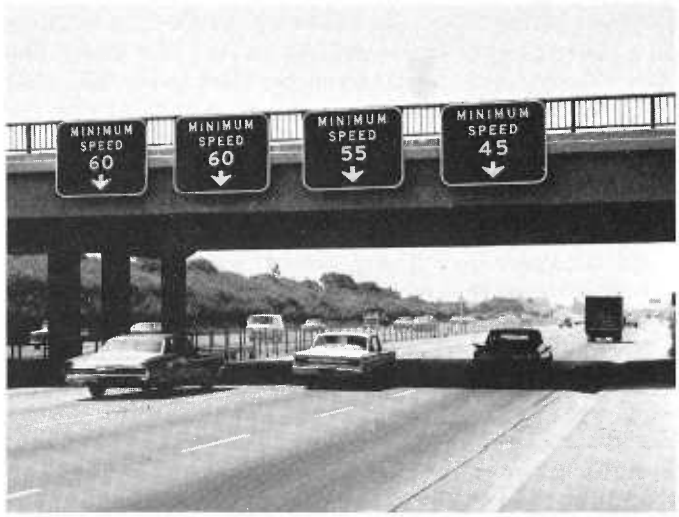
The first three considerations create an atmosphere for high speeds. This was necessary for the validity of the tests, as design features which affected speeds would introduce an artificial element.

"Before" and "after" data was gathered at each of the study sites, with "after" data taken when the signs had



Two-lane test site, Roseville Freeway.

Three-lane test site, Bayshore Freeway.



Four-lane test site, Harbor Freeway.

Two photos below: Traffic analyzer vehicle, and interior view showing operator at recording machine.

been in place a minimum of two weeks. Speed, volume, and headway information was obtained with the use of the Bureau of Public Roads' "traffic analyzer," a recording device which prints numbers on a paper tape showing the speed of each vehicle, as well as the time of day when it passed, to the nearest one-third of a second.

Observations of more than 85,000 vehicles were made with this equipment for the purpose of the study. The timing device of the analyzer was frequently checked and calibrated by numerous comparisons with the calibrated speedometers of Highway Patrol cars through the trap. Stopwatch observations over a longer section were also used for comparison.

The lane-changing incidence and the incidence of passing on the right was obtained by a visual count and also from an analysis of time-lapse photography using 16-mm movie film taken at one frame per second.

It was learned early in the study that the minimum speeds used on the higher speed lanes would have to be very close to the maximum speed limit if they were to have any effect, because the so-called "slow drivers" were already traveling nearly at the maximum speed limit. The minimum lane speeds used were 60 mph for the left (median) lane and 45 mph for the right (shoulder) lane. At the three-lane study sites, the central lane was posted for a minimum speed of 55 mph, and at four-lane sites the minimum speeds used were 60 mph for the two left lanes and 55 mph and 45 mph for the two right lanes.

From the analysis of individual vehicle speeds several things were learned.

- (1) There was little evidence of increased average speeds due to signing. In fact, most study sites showed a decrease.
- (2) With the average speed in the range of 67 mph for the left lane of high speed rural freeways, and the variation in speeds only four to six mph, it was found that a vehicle traveling at the posted minimum speed (60 mph) would often be impeding traffic.

At all of the sites studied, approximately 95 percent of the traffic in the left lane traveled faster than 60 mph, both before and after the installation of the signs. The posted minimum speed of 60 mph would make it difficult to cite a driver for impeding normal traffic flow even when he actually is impeding traffic that is going faster than 60 mph. (This could lead to the conclusion that, to be effective, minimum speed limits should be higher than those tested, and perhaps the minimum speed limit should be even higher than the maximum speed limit!)

The most unexpected result of the minimum speed signing was a shift of traffic to the left. This shift caused the reduction in mean speeds, because it built up congestion in the high speed lanes. It also resulted in increased violation of the minimum speeds; increased passing on the right; and increased, instead of reduced, travel time.

It would appear that there may be subconscious psychological factors involved with many slow drivers who drive about 60 mph, but who do not realize, or do not admit to themselves, that they are "slow drivers." When they see signs implying that the slower traffic should keep right, they assume that faster traffic (namely themselves) should keep left.

From an operational point of view, it must be concluded that imposing minimum speeds by lane showed little or no positive advantages, and showed some definite disadvantages.

Furthermore, since the average speed on the mainline of a freeway running at capacity is approximately 35–45 mph, minimum speed signing would not be a factor in the relief of congestion which occurs when a freeway reaches capacity.

Nor would there be any advantage in safety, for if minimum lane speed signs were posted on all freeways throughout the state, it would mean the construction of many sign bridges. As determined by previous research, fixed-object accidents constitute 25 percent of all freeway accidents and have a much higher fatality rate than other accidents. The overall safety of freeways would, therefore, be decreased.

Also, additional overhead signs would not be consonant with current efforts to enhance the aesthetic quality of highways.

Finally, costs would be heavy. At a spacing of two miles, the cost of sign bridge installation would be approximately $7,000 per mile on a four-lane facility, $8,200 per mile on a six-lane facility and $10,000 per mile on an eight-lane facility. There are approximately 2,000 miles of existing freeway in California, so the expense would be somewhere between $15 and $20 million. Annual maintenance costs would be in addition.

"With evidence of operational and safety disadvantages, and little or no positive improvement, the placement of minimum speed signs by lane cannot be recommended," the report concluded.

(The above is a summary of a 1966 report entitled "The Feasibility of Minimum Speed Limits by Lane Number on Multiple Lane Highways." This project was accomplished by the California Division of Highways in cooperation with U.S. Bureau of Public Roads.)

Travel Time Study

By Peter G. Koltnow

AS FREEWAY SYSTEM GROWS TRAVEL TIMES SHRINK

It has been said that there are three stages in transportation development. In the first stage the emphasis is on a minimum facility that will somehow permit movement to take place. Roads and bridges are built where it is easiest and cheapest to construct them. Travel time and distance are secondary and human time is cheap.

In the second stage the emphasis is upon acceptable standards of transport service. People are willing to pay for more convenience. There is increased interest in raising the levels of efficiency in the movement of traffic and of comfort and amenity for the traveler. An effort is made to minimize the highway user's total transportation cost.

The third stage of transportation development would reflect the needs of an affluent urban society. In this third stage there is concern about how the highway facility improves or detracts from community values.

In the United States we are still largely in the second stage of highway transportation development, although the third stage may well be near at hand. For the last 10 years or so there has been an increasing concern with the quality of highway service as measured by the driver. Experts in this field are in disagreement about what elements of a highway trip contribute most importantly to "good service." Travel time, consistency of speed, frequency of stops, smoothness of pavement, freedom from distractions, relative safety, simplicity of route and attractiveness of surroundings are some of the many ingredients that go together to form trip quality.

To different drivers and at different times one or another of the ingredients may change in importance. If one must select a single trip element which best characterizes the quality of a commuting trip, however, there is little argument that travel time would be the one chosen. When a commuter describes his trip to work as "good" or "bad" he usually means that he was able to reach his destination more or less quickly than usual.

Even in general discussions of highway transportation we usually describe quality of traffic service in terms of travel time. We say that traffic is "strangling" or that it takes longer to travel from one end of town than it did years ago or that we can "get around better" now that freeway systems are generally available to us. Since vast sums of money are spent each year with the purpose of improving the quality of traffic service, it is important that some periodic measurement be made of this quality so that we can tell whether we are making progress and how much improvement we are getting for our money.

Travel time studies have been conducted in almost every major city in the United States. In the Los Angeles metropolitan area the Automobile Club of Southern California has made such studies since 1927. The usual procedure is to select a downtown starting point and record location and time periodically during a series of typical commuter trips. Studies usually use employees who keep track of their morning and evening commute trips for a period of a week or so. In the Los Angeles area these travel time studies have been helpful in demonstrating the progress brought about by the Los Angeles freeway system and by improvement of major arterial streets.

Measurements of travel time have been instrumental in countering the frequently vague and usually gloomy predictions of imminent traffic stagnation which continue to make popular reading in the daily press. In the Los Angeles area, for instance, it has been possible to measure a 30-percent increase in commuting speed in the years between 1957 and 1965. During the same period urban area population increased from 6 million to 8 million and motor vehicle registrations climbed from 3.3 to 4.3 million. Periodic travel time studies have helped the public and its representatives appreciate the improvements made as the result of a planned program of highway construction.

Two years ago it became apparent that the traditional method of measuring travel times was no longer suitable in an area as large and complex as the Los Angeles basin. The central business district is only one of many important centers for employment. As a matter of fact, only slightly more than 5 percent of the jobs in the Los Angeles metropolitan area are in the

downtown district. Many major freeway improvements on the fringes of the metropolitan area cannot be measured by a downtown-oriented travel time study. To expand the scope of these studies and provide a basis for future measurements of travel times throughout the metropolitan area, the auto club joined the Los Angeles Area of the Western Section of the Institute of Traffic Engineers in a massive travel time study as a local technical project. The Los Angeles Junior Chamber of Commerce also agreed to lend its aid to an enlarged study.

Early in 1965 a two-part program of travel time measurement was organized. In the first part employees working in a dozen major employment centers throughout the metropolitan area kept track of their commuting experiences for one week. In the second part of the study local traffic engineers made off-peak studies of travel time between major employment centers. The latter information was collected for use by businessmen and commercial interests who are involved with midday deliveries of supplies and equipment.

The Los Angeles Junior Chamber of Commerce helped contact many employers who agreed to distribute travel time study forms to their employees. The auto club prepared and distributed the forms and provided data processing and computing services for the reduction and analysis of the vast quantities of information collected. The data processing facilities of the California Division of Highways, through the Los Angeles Regional Transportation Study, were also made available. The Division of Highways hopes to make use of the travel time study information to test future travel time projections as a part of studies throughout the Los Angeles metropolitan area.

The peak hour study was conducted in May 1965 and involved over 30,000 workers in Los Angeles and Orange Counties. More than 7,000 usable returns were received from these workers. In addition to giving information on the distance traveled to and from work and the time involved, workers also described the amount of freeway driving they did and listed any unusual events which affected their travel. Almost one-half million miles of automobile commuting experience were logged by participants in the peak hour part of the study.

The off-peak part of the survey was conducted during July and August 1965 and represented over 5,000 miles of travel between major employment centers. Speeds and travel time were recorded separately for freeway travel and travel on surface streets.

Some of the study results are in the form of travel time "contour maps", showing the distances one can travel during the commuting hours to and from a dozen of the largest employment centers in the metropolitan area.

East Los Angeles Interchange, where Pomona, Santa Ana, Santa Monica, and Golden State Freeways cross, has total average daily traffic count of more than 350,000 vehicles.

These contour maps represent average conditions over the entire commuting period either in the morning or the evening. For each of the employment centers, a breakdown was made of the average speed and average distances traveled in 15-minute increments during the entire morning and afternoon commuting period. The so-called "peak hour" extends for a considerably longer period than one hour and in some cases was actually over two hours long.

The breakdown of the commuting period into 15-minute increments has been helpful to a number of businesses and government offices which have considered the possibility of staggering or shifting their work hours. The information contained in the report shows how much they are likely to gain or lose by changing their normal working hours.

The report pointed out differences in commuting habits and experiences among the various employment centers. The average morning speeds among all centers ranged from 23 to 31 mph and in the evening from 20 to 28 mph. Common to all employment areas, however, was support for the often noted statement that Friday afternoons are the worst time to travel. Differences were also noted in the distance typically traveled by employees in various centers. Workers to downtown Los Angeles, for instance, traveled about 50 minutes to get to and from work. In more distant communities, such as Santa Ana, the acceptable commuting distance was closer to 30 minutes. The greater travel times to some centers reflected greater distances of commuting, rather than slower travel service, however.

Survey results were also organized to give a picture of relative commuting ease in seven general areas of the Los Angeles basin. This information showed that the San Fernando Valley, which is currently the area of greatest growth in Los Angeles, enjoys the best commuting speeds.

The breakdown of information relating to use of freeways showed some interesting characteristics. Use of freeways in different areas is largely related to length of trip. Within any one area commuters who travel farthest make the most use of freeways and have higher travel speeds. Workers in the central area of Los Angeles, for example, who used freeways for most of their trip, lived twice as far from downtown as those who made no use of freeways, and their average speed was 50 percent greater. Long-distance freeway-driving commuters to the central area of Los Angeles lived nine miles farther from work than nonfreeway users on the average, but at the cost of only 9½ minutes more driving each way. In comparison with nonfreeway users the frequent users of freeways experienced almost mile-a-minute service for the extra miles they traveled.

Study participants were asked to record any accidents, radio "sigalerts" or other unusual occurrences that might have affected their trip. Anal-

ysis of the returns showed that it was difficult to assign any time value to the occurrences noted. In some cases an unusual event such as an accident or a sigalert was actually associated with a faster trip than normal. The experiences of commuters suggest that some motorist advisory broadcasts do not describe the most important traffic blockages and that such messages may "age" quickly. The report suggests that efforts be made to improve motorist advisory broadcast services.

Although the question was not included in the survey form, motorists offered many unsolicited comments on the causes of delay. The most common motorist complaint concerned inefficient traffic signal operation and the adverse effects of roadway construction, illegal parking or loading, stalled cars and occasionally, policemen issuing citations. In the San Fernando Valley there were frequent references to delays caused by trains.

San Diego Freeway, shown here at south edge of San Fernando Valley near Ventura Freeway interchange, at this point carries 130,000 vehicles daily.

The off-peak part of the study was conducted between the hours of 9 a.m. and 3 p.m. It analyzed speeds, travel times and distances along 43 different routes.

This portion of the study was valuable in pinpointing corridors of deficient travel service and in showing the relative value of freeway driving. There were substantial differences between the fastest and slowest routes. The fastest route, from downtown Los Angeles to Woodland Hills, was traveled at an average speed of 57 mph. The slowest, from Vernon to Downey, had an average speed of only 23 mph. Generally, lowest speeds were found in the travel corridor connecting the Los Angeles International Airport and the Vernon-Downey industrial complex. High speeds were always associated with trips making extensive use of freeways. Lowest speeds were found where no freeways were available to motorists.

This part of the study showed some interesting differences in directional speeds and travel times. For example, motorists traveling east from the Los Angeles International Airport to West Covina aways traveled more slowly than those driving west.

It was also found that there is a consistent amount of surface street traveled in any off-peak trip. Over three-fourths of the trips that included both freeway and surface street travel showed motorists using surface streets for five miles or less of their total trip, regardless of the length of the total trip. As more freeways are made available typical off-peak trips will include about four to five miles of surface street travel with the rest on freeways, regardless of the length of the trip. This finding conforms to a generally held theory of urban freeway spacing.

Average freeway speed in the metropolitan area during the off-peak hour was 57 mph and on surface streets 24 mph. Travel time between any two points was very consistent. Ninety percent of trip times were within two minutes of average trip times, suggesting that barring an unforeseen event that might severely affect highway capacity, a person can pretty well count on his off-peak trip taking a predictable length of time.

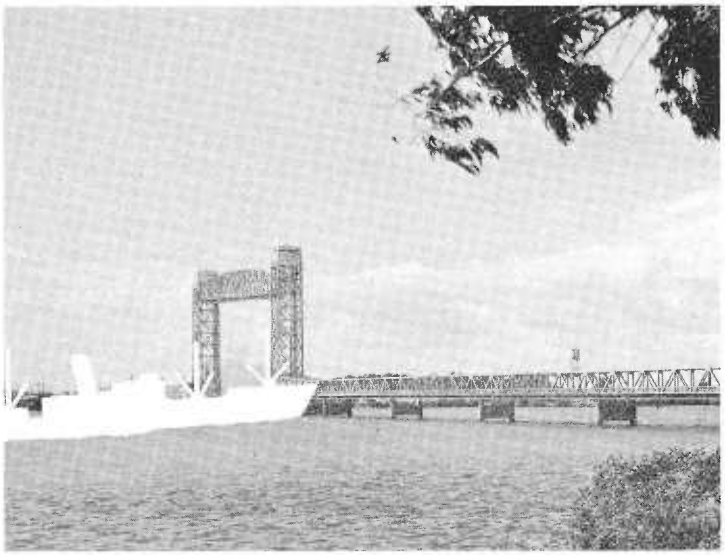
The 1965 metropolitan travel time study in the Los Angeles area clearly points out the need to proceed with the area's planned freeway system without delay. Poor travel service was uniformly associated with those corridors of travel where no freeway routes were available. The study also emphasizes the need to apply well-known traffic engineering techniques to improve the surface street system, which in the Los Angeles area handles about 70 percent of all travel. It is also apparent that there are serious conflicts between the needs of the traveling public and those whose work requires street openings or excavation.

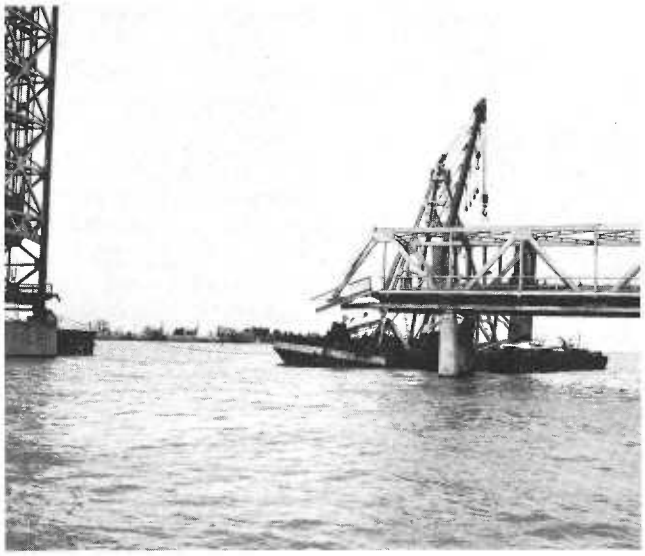
The 1965 travel time study was a pioneering effort in many respects. It examined the subject of travel time on a new, metropolitan scale. It brought together a number of groups with different skills and melded their efforts in a productive investigation of an important part of our daily lives. It was based on the combined experiences of large numbers of motorists whose help had not previously been used for studies of this kind.

Travel time studies in large metropolitan areas could well imitate the scope of the Los Angeles study. To insure that highway services in these large communities are being measured adequately, it is especially important that there be periodic repetition of these studies so that highway officials, transportation planners, legislators and the general public have a clear and accurate picture of changes in highway transportation service. While pioneering efforts such as the Los Angeles study can well be taken up by informal cooperative arrangements among interested groups, over the long haul it is important that the responsibility for these studies be considered a routine part of the urban transportation planning programs carried on by organizations such as the Transportation Association of Southern California, South Coast Transportation Study, and San Diego Metropolitan Area Transportation Study.

Busiest spot in the Los Angeles Freeway system is the Harbor-Santa Monica Freeway Interchange, used each day by 400,000 vehicles.

Copies of the *1965 Los Angeles Metropolitan Travel Time Study* are available from the secretary-treasurer, Western Section ITE, Terminal Annex Box 2890, Los Angeles 90054.

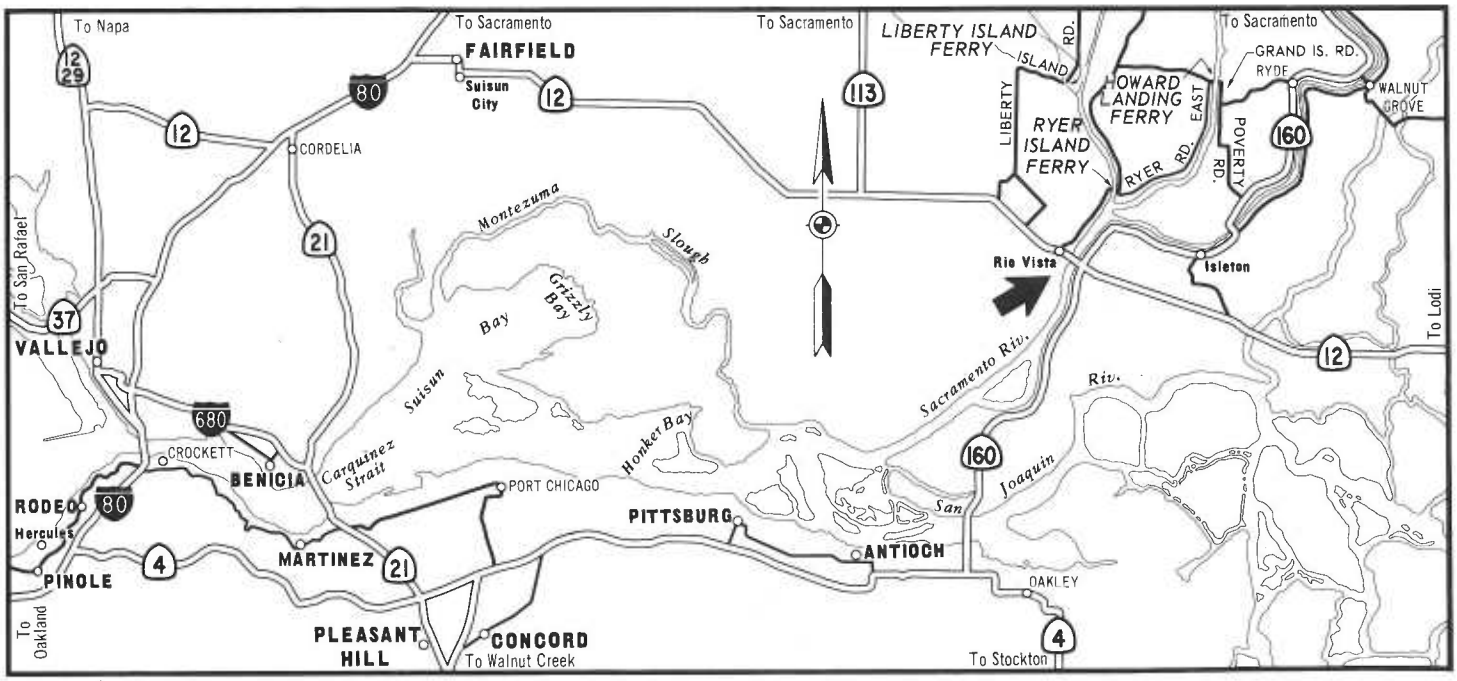




Rio Vista

MERCHANT VESSEL CARRIES AWAY ENTIRE TRUSS SPAN IN FOG

Map shows area served by Rio Vista Bridge (arrow, right center). Due to many sloughs and channels in Sacramento-San Joaquin River Delta, road connections are limited, and loss of bridge necessitated detour either via Fairfield and Benicia-Martinez Bridge or over county routes with two limited-capacity ferry crossings.



Far left: Artist's concept of how merchant vessel struck bridge in fog. Center left: Opening in crossing after missing span carried away, with barge mounted derrick removing damaged members. Left: Closeup view of damage. Although adjacent truss span remained in place, it also suffered considerably.

Bridge

In dense fog late Sunday afternoon, January 15, the Italian freighter *Ilice* missed the open draw on the Rio Vista Bridge across the Sacramento River and carried away an entire truss span. Damage is estimated at more than $500,000.

There were no injuries, although two teenage boys, Mark Ackerman and Jamie Cove, both of Stockton, had parked their car at the barrier and were standing at the open draw to see the ship go through. When the vessel struck behind them, both ended up in the river, but they were quickly rescued.

Bridge tender Clyde Spencer of Rio Vista was at his control station a hundred yards away at the time of the crash, across the open span. He could hear the commotion, but because of the poor visibility was not sure what had happened and had a few anxious moments.

Although the engines of the 10,000-ton vessel were backing at the time of impact, her momentum and weight carried away the roughly 400-ton span as though it were made of matchsticks. *Ilice* was trapped in the wreckage for about four hours until tugs could pull her free, but she suffered only minor damage and proceeded to the Port of Sacramento under her own power to take on a load of rice for Japan.

The break in the bridge interrupted the use of State Route 12 at the river, and the structure was out of service for about three weeks until a temporary span across the gap could be completed. Damage was extensive, in addition to the lost span. Concrete pier pedestals were cracked and broken, an additional 36 feet of the adjacent span must be replaced, and paving for some distance from the point of impact was disturbed. Possible damage to the structure's alignment and underwater construction had to be investigated under tedious and difficult conditions.

Emergency repairs were effected by constructing a steel pile bent and crossing the gap with two 72-foot spans of steel girders from the Division of Highways stock. The temporary structure provides for two lanes of legal loads.

In the meantime, a new truss span is being fabricated in the San Francisco Bay area. When it is completed, it will be floated upriver on the huge barge and crane combination which is intermittently used to place the girders for the new San Mateo Bridge. The crane will then remove the temporary structure, and drop the new span into place. Hopefully, the permanent repairs will be completed about June 15.

Since the bridge was handling about 5,000 cars daily at the time its service to the public was interrupted, there was considerable inconvenience to the local residents. This was complicated by the lack of a suitable bypass route. Immediate water taxi service was furnished by the proprietor of Uncle Bobby's Resort, and by a Sixth Army landing barge which carried school children.

As soon as Department of Public Works lawyers could arrange for liability insurance, a service agreement between the Division of Highways and the Sixth Army was effected, with the Sixth Army operating a landing barge on a regular schedule to handle pedestrians.

State Highway Engineer J. C. Womack praised all agencies involved in working out the prompt arrangement, saying "We were worried more about the movement of people—workers, businessmen and hospital cases—than we were about vehicles. Although an awkward situation, the transportation system in the two affected counties could continue to function during the emergency by pooling vehicles at both ends of the ferry."

Bylines

FREEWAY BEAUTY Mrs. Valley M. Knudsen (1), founder and chairman of Los Angeles Beautiful, was born in Chicago but lived most of her life in southern California.

Long prominent in civic and cultural affairs, she has been listed in *Who's Who in America* since 1947. Honors bestowed on her include the King Christian Liberty Medal and the Royal Service Medal in Gold with Crown presented by the King of Denmark for work done during World War II, the Times Woman of the Year Award in 1952, and the Distinguished Service Award of the California Council of the American Institute of Architects and U.S.O. Service Award, both in 1961. She also holds a doctor of laws degree from Loyola University of California.

Her travels during the past 35 years have taken her all over the world, including four trips to the Soviet Union and satellite countries.

1

BRIDGE STEEL WELDS Art German (2) is a native of Brooklyn, New York, who received his B.A. degree from Brooklyn College and M.A. from Stanford University. During his career as a newspaperman before joining the state in 1965, German won Associated Press spot news reporting awards for three consecutive years (1958–60) and was cited by the American Political Science Association in 1960 for distinguished reporting of municipal affairs. He is now information officer for the Division of Bay Toll Crossings.

2

3

HIGHWAY TO SPACE BASE Richard R. Crandall (3), a native of Springville, Utah, and graduate of Utah State University, is now an associate highway engineer with the Division of Highways San Luis Obispo office. He joined the division 17 years ago. For the past nine years he has been doing design work. This has included large freeway projects in District 5, which contains a large portion of the central coastal area of California.

4

STORM HAVOC IN DISTRICT 6 Edwin L. Tiedemann (4), administrative officer in the Division of Highways Fresno office, started work with the division in Los Angeles in 1951. Prior to his present appointment he served as an engineer in design and as an administrative assistant in the Sacramento headquarters construction department. Tiedemann was born in Silver Creek, New York, and attended the University of Illinois.

MINIMUM SPEED LIMITS Norman Wingerd (5), associate highway engineer, was born near Abilene, Kansas, and graduated from Los Angeles State College. He joined the Division of Highways Los Angeles office in 1956. Prior to his transfer to Sacramento in 1966 to do traffic flow research, he was resident engineer on a section of the Pomona Freeway through Monterey Park.

5

TRAVEL TIME STUDY Peter G. Koltnow (6) is traffic engineer for the Automobile Club of Southern California. He was study director of the 1965 Metropolitan Travel Time Study for the Western Section of the Institute of Traffic Engineers and has also directed similar previous studies for the auto club. Before coming to work for the auto club Koltnow served as traffic engineer of Fresno County for six years.

6

STATE OF CALIFORNIA

RONALD REAGAN, *Governor*

TRANSPORTATION AGENCY

GORDON C. LUCE . . . . . Administrator
JAMES C. SCHMIDT . . Assistant to the Administrator

DEPARTMENT OF PUBLIC WORKS . . . JOHN ERRECA, Director

RUSSELL J. COONEY . . Deputy Director (Management)
JAMES A. MOE . . . . Deputy Director (Planning)
T. F. BAGSHAW . . . . . Assistant Director
JOHN STANFORD . . . . . Assistant Director
JUSTIN DuCRAY . Departmental Management Analyst
S. ALAN WHITE . . Departmental Personnel Officer

DIVISION OF HIGHWAYS

J. C. WOMACK . . . State Highway Engineer, Chief of Division

J. P. MURPHY . . . Deputy State Highway Engineer
J. A. LEGARRA . . Deputy State Highway Engineer
GEO. LANGSNER . . Deputy State Highway Engineer
LYMAN R. GILLIS . Assistant State Highway Engineer
J. E. McMAHON . . Assistant State Highway Engineer
FRANK E. BAXTER . Assistant State Highway Engineer
GEORGE A. HILL . Assistant State Highway Engineer
J. C. BURRILL . . . . . Comptroller
NEAL E. ANDERSEN . . . . . Equipment Engineer
JOHN L. BEATON . . Materials and Research Engineer
C. G. BEER . . . . . Urban Planner
A. N. DUNHAM . . . Computer Systems Engineer
ALVORD C. ESTEP . . . . . Engineer of Design
J. F. JORGENSEN . . . . . Construction Engineer
SCOTT H. LATHROP . Personnel and Public Information
C. T. LEDDEN . . City and County Projects Engineer
JACK E. PEDDY . . . Program and Budget Engineer
DANA G. PENGILLY . . . . . Planning Engineer
R. V. POTTER . . . . Systems Research Engineer
PAUL C. SHERIDAN . . . . . Office Engineer
E. L. TINNEY . . . . . Maintenance Engineer
DONALD P. VAN RIPER . Principal Landscape Architect
J. E. WILSON . . . . . Traffic Engineer
A. L. ELLIOTT . . . . Bridge Engineer—Planning
H. R. HINEMAN . . . Bridge Engineer—Operations
R. J. IVY . . . Bridge Engineer—Administration
DALE DOWNING . . Bridge Engineer—Southern Area

Right of Way

RUDOLF HESS . . . . . Chief Right of Way Agent
HARRY L. KAGAN . . . . . Assistant Chief
DEXTER D. MacBRIDE . . . . . Assistant Chief
R. S. J. PIANEZZI . . . . . Assistant Chief

District 1, Eureka

SAM HELWER . . . . . District Engineer

District 2, Redding

H. S. MILES . . . . . District Engineer

District 3, Marysville

W. L. WARREN . . . . . District Engineer

District 4, San Francisco

ALAN S. HART . . . . . District Engineer
R. A. HAYLER . . . . . Deputy District Engineer
HAIG AYANIAN . . . . . Deputy District Engineer
C. F. GREENE . . . . . Deputy District Engineer

District 5, San Luis Obispo

R. J. DATEL . . . . . District Engineer

District 6, Fresno

R. E. DEFFEBACH . . . . . District Engineer

District 7, Los Angeles

E. T. TELFORD . . . . . District Engineer
A. L. HIMELHOCH . . . . Deputy District Engineer
A. C. BIRNIE . . . . . Deputy District Engineer
A. W. HOY . . . . . Deputy District Engineer
T. G. LAMMERS . . . . . Deputy District Engineer

CALIFORNIA HIGHWAY COMMISSION

GORDON C. LUCE . . . Chairman and Administrator, Transportation Agency
WILLIAM S. WHITEHURST . Vice Chairman Fresno
ABRAHAM KOFMAN . . . Alameda
ALEXANDER H. POPE . . . Los Angeles
FRED C. JENNINGS . . . . Riverside
MOON LIM LEE . . . Weaverville
VERNON J. CRISTINA . . . San Jose

JOHN ERRECA . Administrative Officer and Director of Public Works
JACK COOPER, Secretary . . . Sacramento

District 8, San Bernardino

C. V. KANE . . . . . District Engineer

District 9, Bishop

C. A. SHERVINGTON . . . . . District Engineer

District 10, Stockton

JOHN G. MEYER . . . . . District Engineer

District 11, San Diego

JACOB DEKEMA . . . . . District Engineer

DIVISION OF CONTRACTS AND RIGHTS OF WAY

HARRY S. FENTON . . . . . Chief Counsel

EMERSON RHYNER . . . Deputy Chief (Sacramento)
HOLLOWAY JONES . . . Deputy Chief (San Francisco)
REGINALD B. PEGRAM Deputy Chief (Los Angeles)

DIVISION OF BAY TOLL CROSSINGS

E. R. FOLEY . . . . . Chief Engineer, Chief of Division

J. J. KOZAK . . . . . Deputy Chief Engineer
THOMAS G. BERTKEN . . . . . Planning Engineer
BEN BALALA . . . . . Construction Engineer
VERNON J. RICHEY . . . . . Design Engineer
CHARLES L. SWEET . . . . . Operations Engineer
GEORGE F. ANDERSON . . . Administrative Officer

DIVISION OF AERONAUTICS

CLYDE P. BARNETT . . . . . Director, Chief of Division

△85522—500 12-66 82M

printed in CALIFORNIA OFFICE OF STATE PRINTING

California Highways and Public Works
DIVISION OF HIGHWAYS
P. O. BOX 1499
SACRAMENTO, CALIFORNIA

RETURN REQUESTED