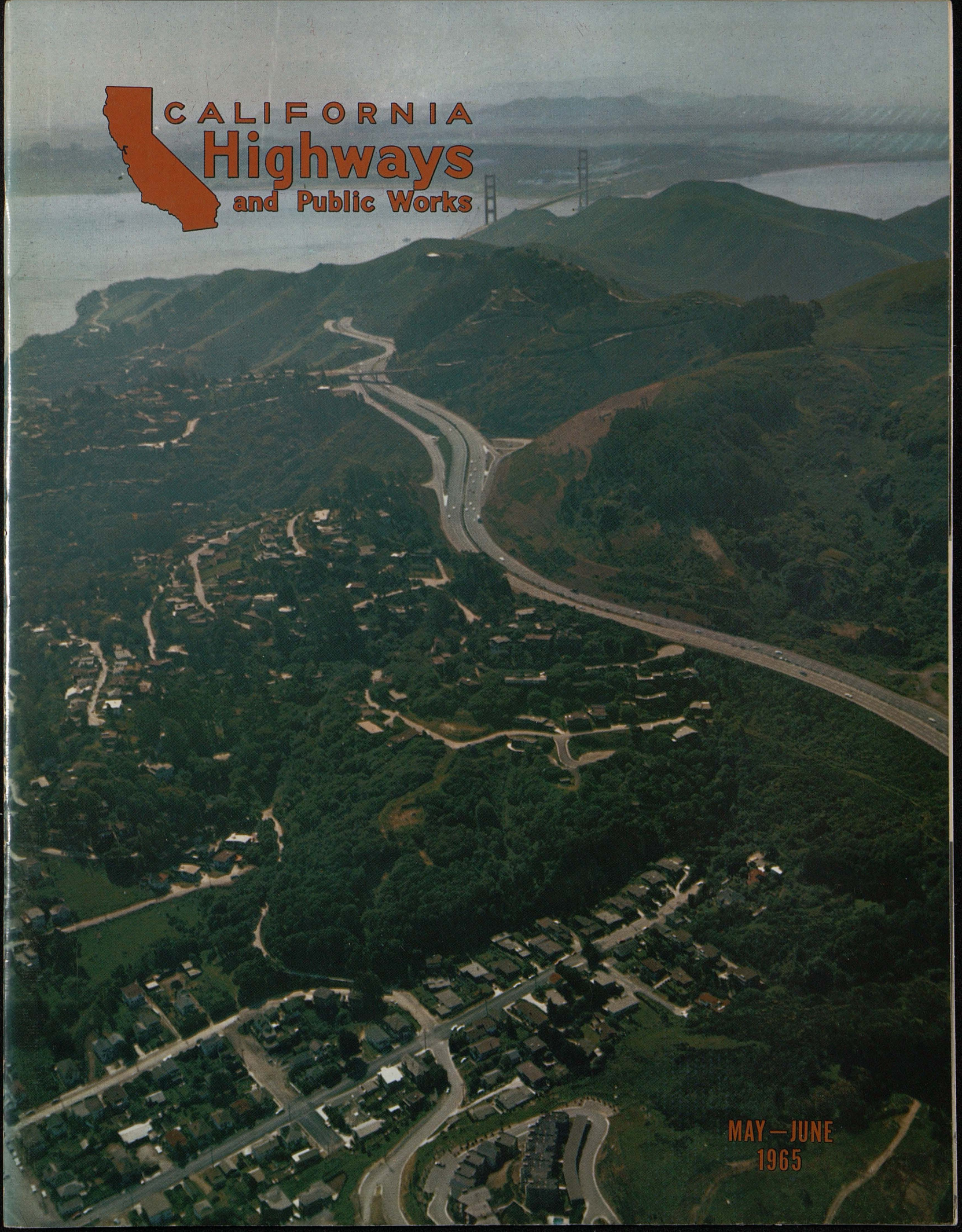
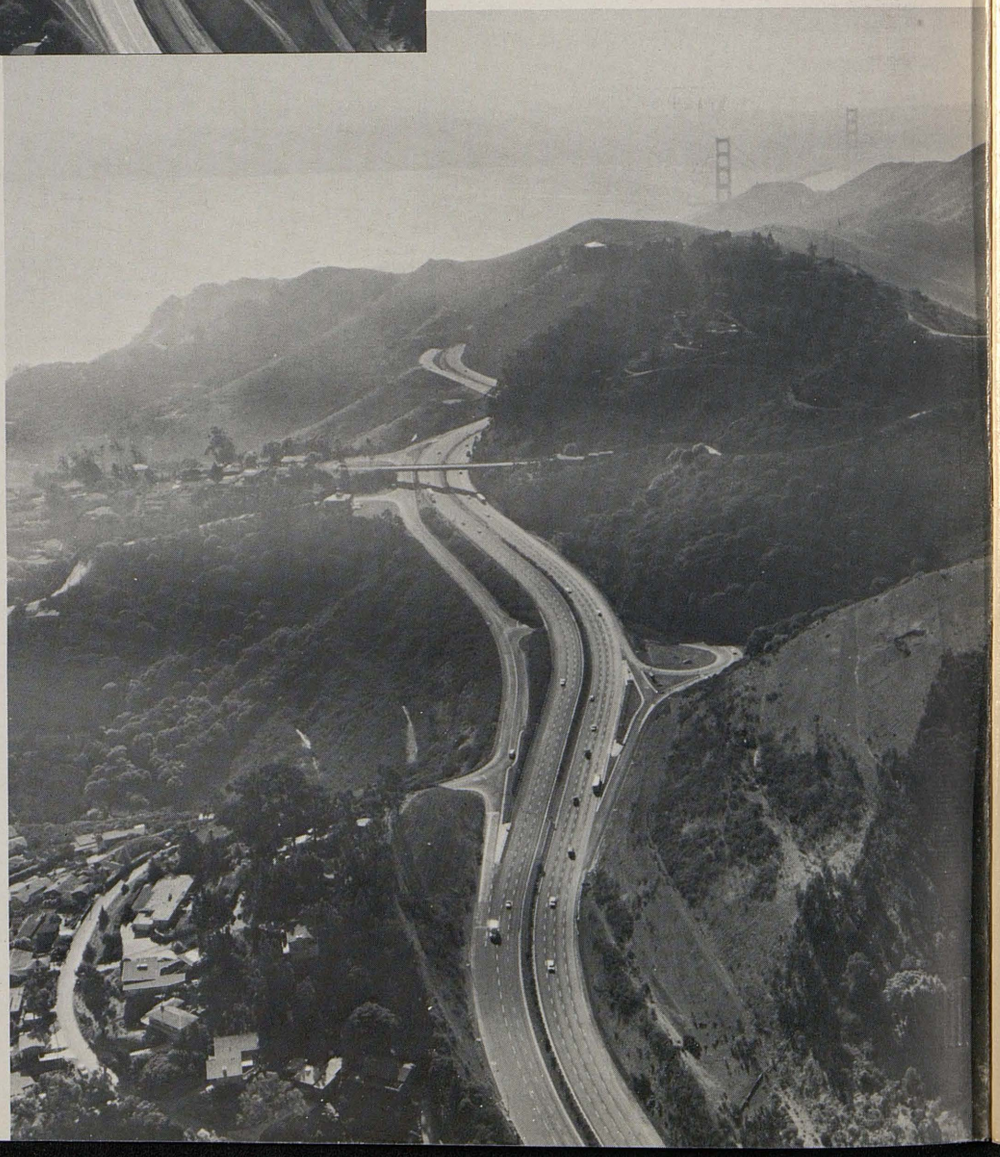

CALIFORNIA
Highways
and Public Works
MAY—JUNE
1965

The extensive cuts and fills involved in widening Waldo Grade on US 101 north of the Golden Gate Bridge a decade ago were so impressive that the Museum of Modern Art in New York City was prompted to include this project in an exhibition on 20th Century engineering feats. Although it was difficult to realize at the time, the handiwork of nature was to play an important part in the final appearance of the slopes. Native shrubs and grasses seeded during construction have now mingled with other natural growth to provide greenery which unifies engineering and aesthetics.

The Natural Restoration of Waldo Grade



California Highways and Public Works

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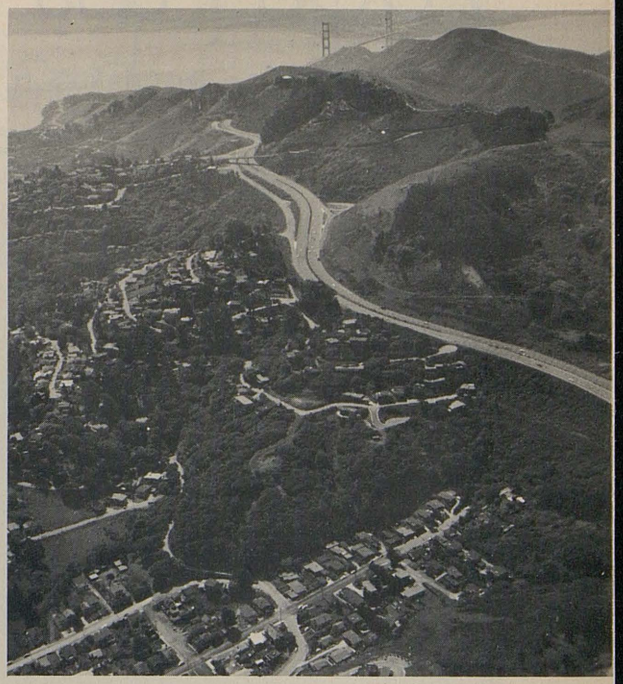
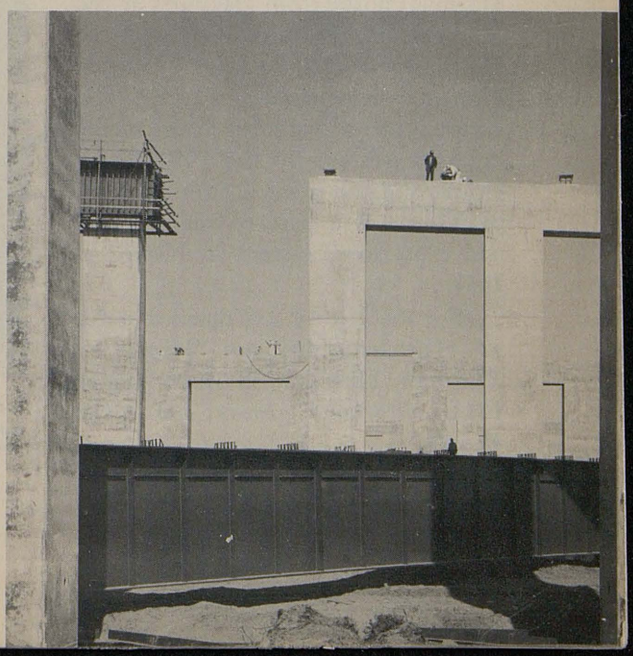


FRONT COVER: The verdant hills found on US 101 immediately north of the Golden Gate Bridge are the subject for the picture feature on the inside front cover. A full roundup of highway progress in District 4 which contains this route begins on page 24. *(Photo by Jack Meyerpeter.)*

BACK COVER: The abstract pattern of steel and concrete was photographed during construction of the W-X Street Bridge being built over the Sacramento River to carry Interstate 80 through the state capital. Completion of the bridge and freeway approaches is scheduled for late in 1966. *(Photo by Peter Asano.)*



Yuba Pass Highway

Four Miles of Highway 49 Improved in Sierra County

By CHARLES H. CHAPPELLE, Highway Engineering Associate

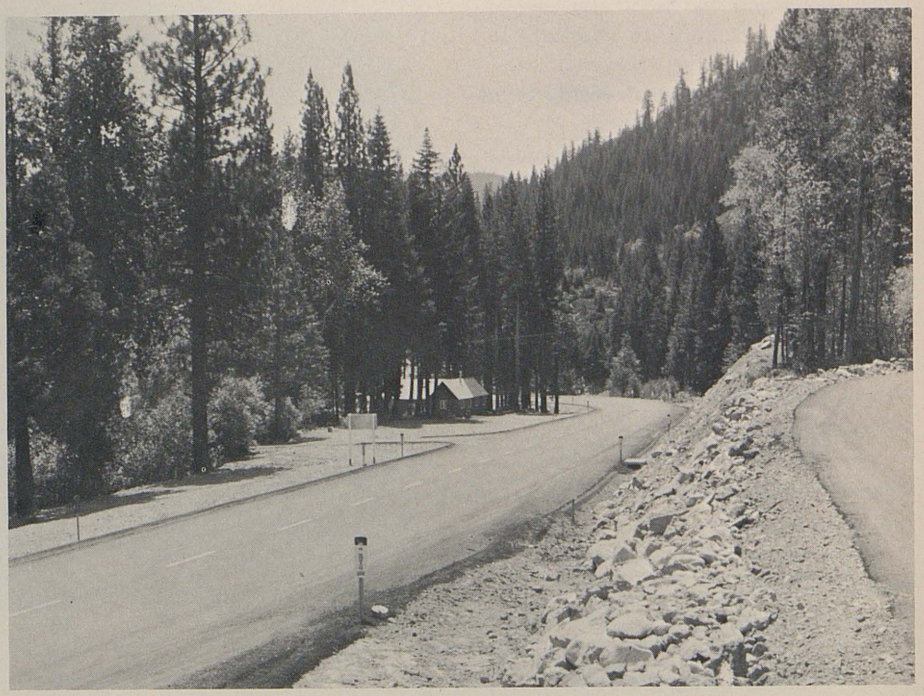
Four miles of widened and realigned State Highway 49, built to two-lane expressway standards, were completed last summer in mountainous central Sierra County through some of the most scenic country in the state.

The project is a classic example of the careful planning and design of a rural two-lane mountain highway which is a part of both the California freeway and expressway system and the scenic highway system—where the natural scenic beauty and unspoiled atmosphere were protected and in fact enhanced.

Recreational areas and points of historical interest were not only preserved, but actually made easier to get to. Access to the highway is controlled by limited driveways and public road approaches, and there is no conflict with the highway's duty to provide an adequate trafficway, and, at the same time, insure availability to the wide range of fishing, hunting and vacation spots.

Historic Highway 49, promoted as the Mother Lode Highway by the Golden Chain Council, extends some 315 miles north from Oakhurst at the junction of Highway 41, south of Yosemite National Park, to Vinton in Plumas County at Highway 70. The entire road was included in the scenic highway system by the 1963 Legislature, and the portion from Auburn to Vinton is a part of the freeway and expressway system established in 1959.

(For the history and detailed status of Highway 49, see "Highway Through History" in July–August 1963 *California Highways and Public Works.*)



A section of the new Yuba Pass highway through a densely wooded area. Road at right is private.

A typical section of the old highway before widening and improvement. Slope cuts (right) were through old glacial material of round, loosely packed rocks which presented a tough maintenance problem of constant sloughing and falling rock resulting from the freeze-thaw cycle in winter and spring.

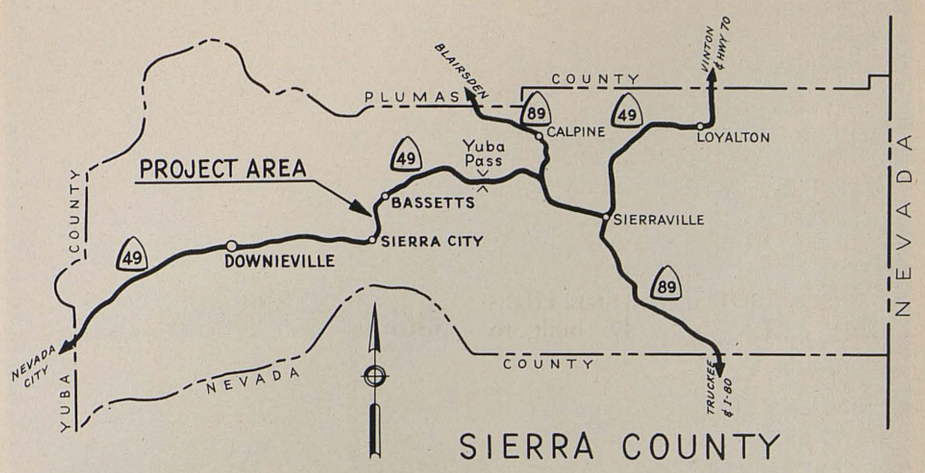
Canyon Often Steep, Narrow

There are 65 miles of the route in Sierra County—from Yuba County on the west to Plumas County north of Loyalton in the northeast. Most of Highway 49 in western and central Sierra County, between the Yuba County line and west of Yuba Pass, shares a narrow and often steep canyon with the North Fork of the Yuba River through both the Tahoe National Forest and private land.

The section which is the main topic of this article reaches from a point beginning 0.7 mile east of Sierra City to old Bassetts Station, and is known locally as the Yuba Pass Highway. Sierra City, an unincorporated community of about 225 persons, is 12½ miles east of Downieville, the county seat. Yuba Pass is seven miles east of Bassetts (see maps).

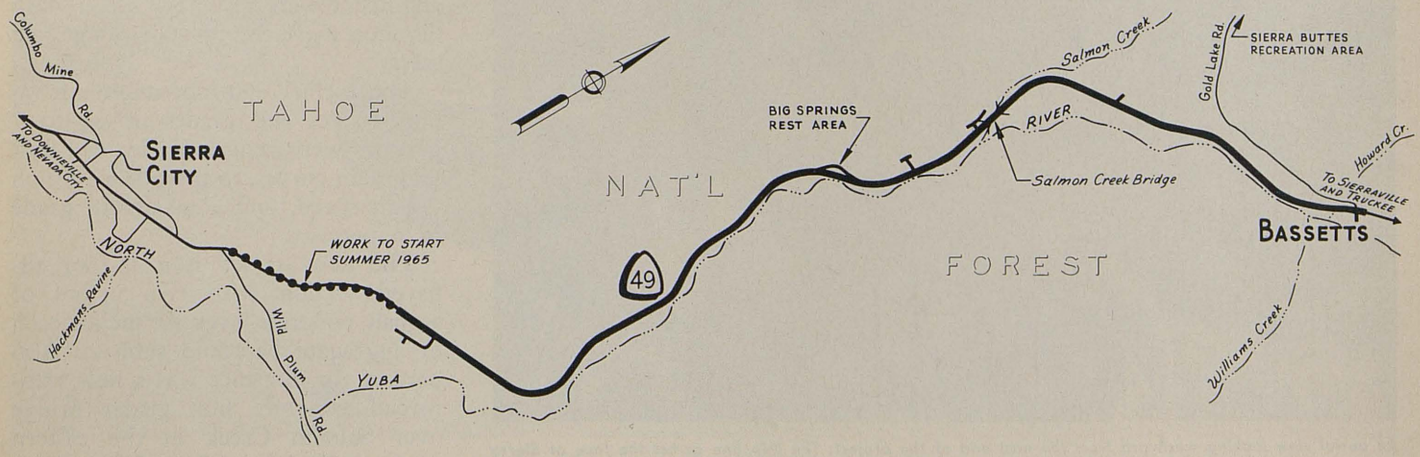
Elevation at the beginning of the project is 4,575 feet above sea level, and at Bassetts, 5,378. Yuba Pass, over the top of the Sierra Nevada range, is at elevation 6,708.

The Yuba Pass Highway passes through an increasingly popular tourist and vacation area due to its natural scenic grandeur and recreational opportunities. Best known, and perhaps most frequented, is the Sierra Buttes recreation area north of Bassetts via Gold Lake Road—a region of 29 high-altitude lakes and 400 miles of streams, draining mostly into Salmon Creek which flows into the North Yuba River. Among the most popular are Sardine Lake and Gold Lake. The latter drains into the Feather River

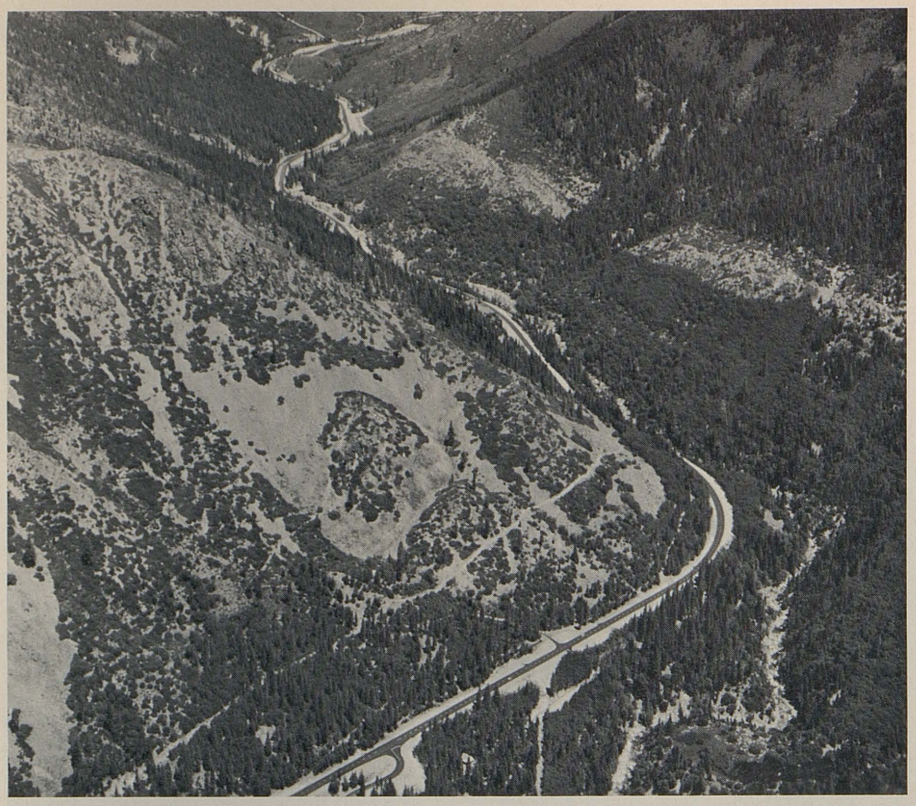


Map showing the general location of the project between Bassetts and Sierra City in Sierra County.

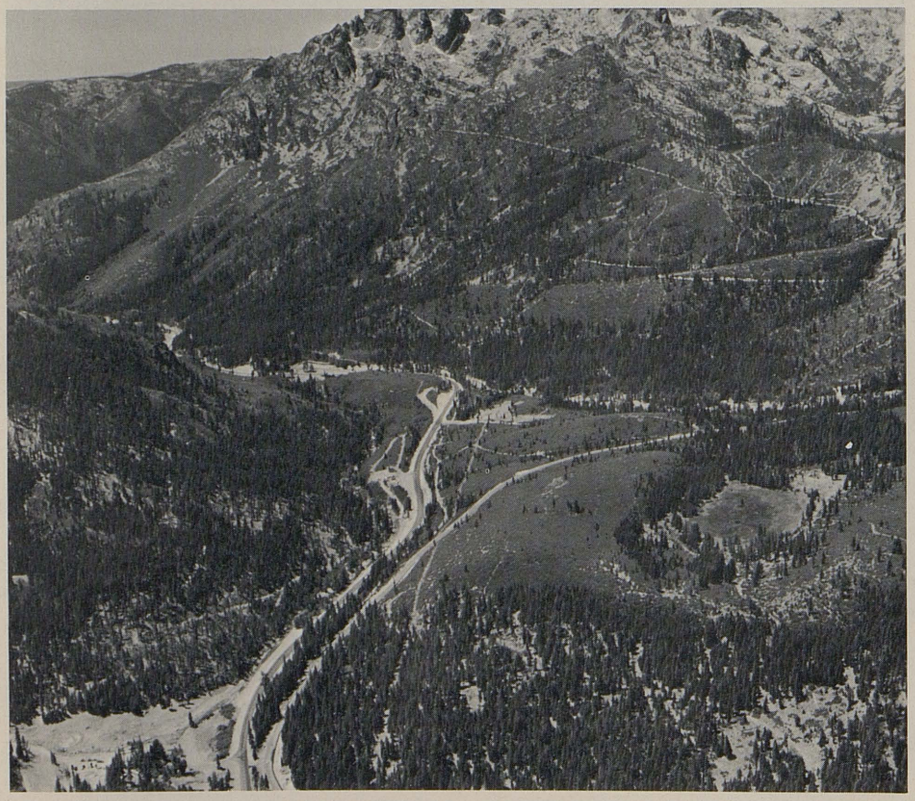
The Sierra Buttes provide an imposing backdrop for a section of the widened roadway at Manzanita, near the east end of the job.



Map showing the limits of the highway construction discussed in this article.



An aerial view looking eastward up the North Yuba River canyon near the eastern end of the project.



An aerial view looking westward from the east end of the project. The thin line across the face of Sierra Buttes (background) is a road to a mine built in 1878.

in Plumas County by way of Frazier Creek.

Good Fishing, Campgrounds

The region is an area of excellent fishing and features numerous public campgrounds under U.S. Forest Service supervision, and many private resorts.

In fact, the county itself was named after the Sierra Buttes (peak elevation 8,752)—the majestic, towering landmark visible from this stretch of highway. They are strikingly dramatic when capped with snow against a crystal blue sky.

Of historical interest is that gold was discovered in the North Yuba country in 1849, and in 1869 the "Monumental Nugget," weighing 141 pounds, was found at Sierra City. It was one of the world's largest.

In gold rush times some of the roads, little more than widened trails in some cases, were subject to tolls and located on the south side of the river. The present route, on the north side of the Yuba, was first graded in 1924–25 as a forest highway project. In 1937 two inches of gravel base and two inches of road-mixed gravel was placed by the Division of Highways.

Little improvement has been made since then. State maintenance forces have continued to reprocess and patch to keep it traversable. Some widening was done in places.

Improved Alignment

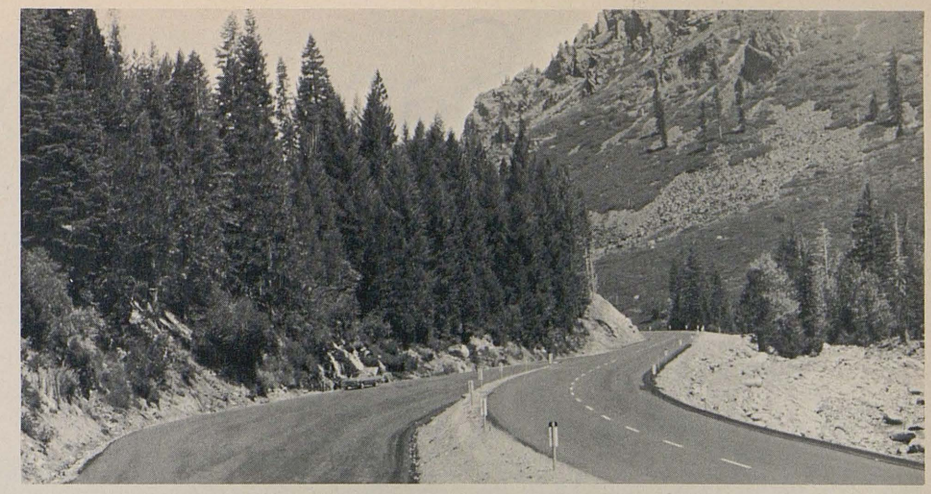
Prior to the recent contract, roadway width was from 16 to 20 feet and, although the new section generally follows the old—crossing and recrossing it—many improvements in alignment were made for better sight distance, more comfortable riding, and safety.

The former 300-foot minimum radius curves and grades of up to 7 percent were replaced with 850-foot minimum curves, to provide a 50-mph design speed, and a maximum grade of 6 percent.

The new stretch is a 32-foot all-paved section with two inches of asphalt concrete over six inches each of aggregate base and subbase. Also part of the contract was a new reinforced concrete box girder bridge over Salmon Creek in the eastern quarter of the project. Built about

400 feet downstream from the old bridge, completed in 1932, it is a three-span structure, 252 feet in length and 32 feet wide.

At picturesque Big Springs, about midway in the job, a paved safety rest area was provided for off-highway parking. Big Springs is in effect a group of small, sparkling waterfalls coursing over moss-covered rocks through wild fern and azaleas at the side of the road. The water is delicious—the overflow from two springs higher above the highway on the mountainside—a favorite stopping and watering place for generations of motorists and the pioneers before them. The runoff is carried beneath the parking pad and roadway into the Yuba River by a culvert.



The Big Springs safety rest area looking east. The paved parking area is actually a reconstructed portion of the old highway.

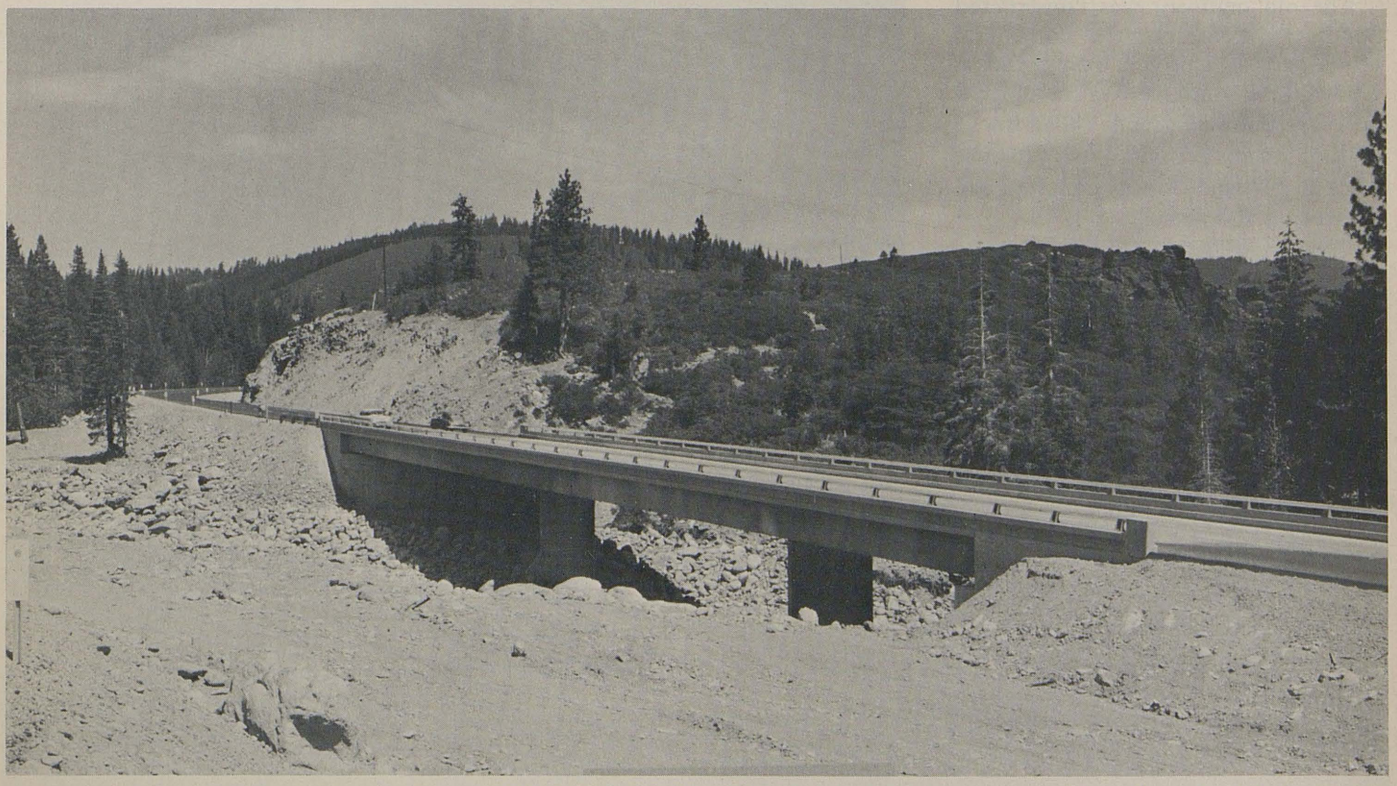
Flood Danger

Although usually peaceful, the North Yuba can become one of the wildest and swiftest rivers in the north Sierra area under flood conditions. And, since the highway is alongside at many points, it was a challenging design problem to provide protection against this river which, when raging, can move 80-ton boulders with ease. In addition, the river had to be realigned at three places to accommodate line changes in the roadway.

Contractor for the $1,450,000 job was McNamara Corporation Limited of Burlingame, a Canadian firm of Toronto, Ontario. General manager was C. A. Peterson, and superintendent at completion was Red Reusser.

Construction engineer for the state was Don Young. Kenneth R. Bailey was State Bridge Department representative and the author was resident engineer.

For an additional three-quarters of a mile, as the second phase of work in this area, construction is expected to start later in the year on the piece from Sierra City to the beginning of the completed unit (see map). It, too, will be a 32-foot section. $190,000 has been budgeted.

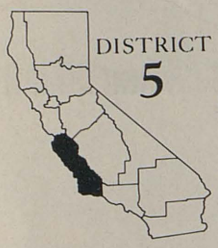


The new Salmon Creek Bridge, looking east. The old bridge, built in 1932, was about 400 feet upstream (left) and was demolished.

Bradley-San Ardo

Monterey County Gets 12 Miles of New Freeway

By ROY E. ALDERMAN, District Construction Engineer



Completion of 12 miles of new freeway between Bradley and San Ardo in Monterey County last year reduced by approximately one-fourth the remaining two-lane highway on US 101 in District 5.

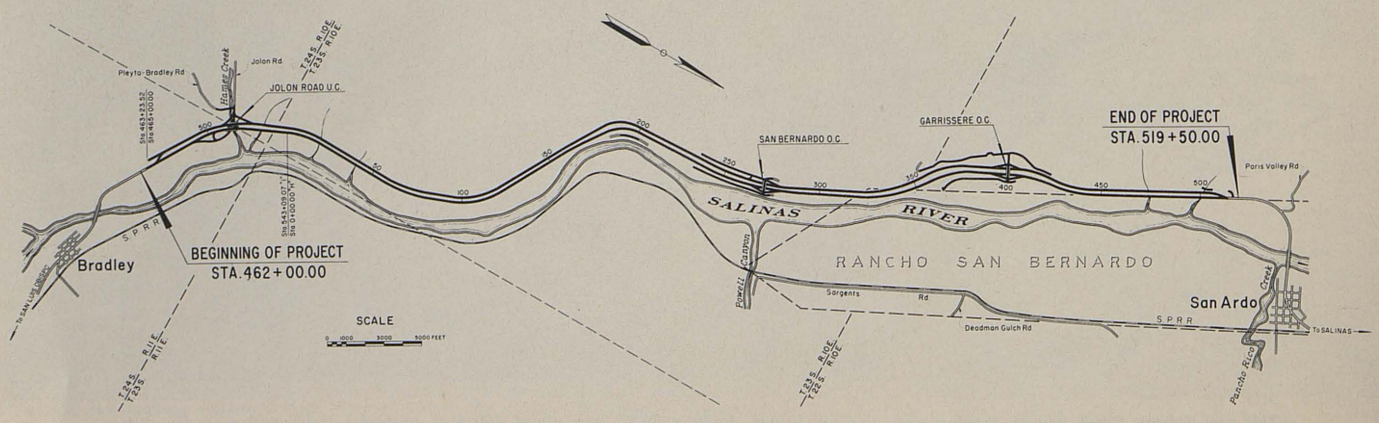
The area surrounding this section of US 101 is devoted to grain farming and grazing. Individual land holdings are generally large, consequently, the population density is quite low. The only land use other than agricultural is the San Ardo Oil Field. The oil field is located in the northern third of the project, with oil wells on both sides of the highway. This field has been operating for many years and appears to be fully exploited.

The old highway was constructed under two contracts; the north half was a part of a project completed in 1933 and the south half was completed in 1937. Both contracts called for a 36-foot roadway with two 10-foot lanes of portland cement concrete and oil treated shoulders.

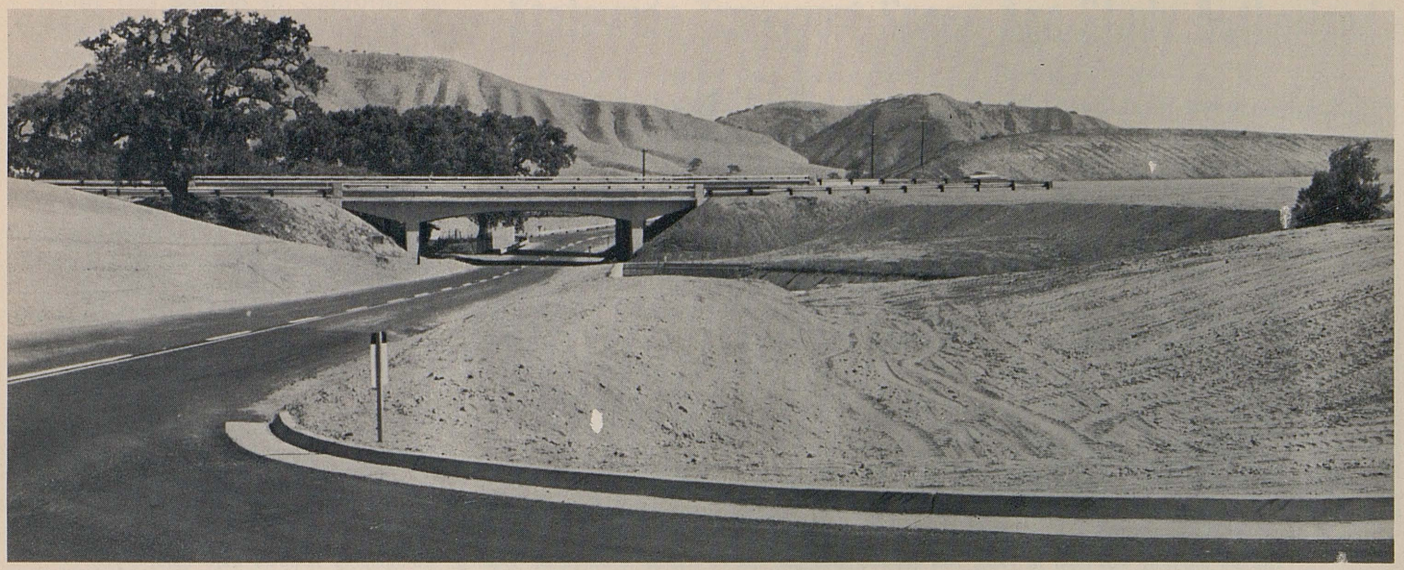
First Self-loading Scrapers

The 1933 contract is believed to have been the first contract in this dis-

The new Bradley-San Ardo US 101 freeway looking southward from above the San Bernardo Overcrossing. Salinas River at left.



Limits of the freeway project were from 1.2 miles north of Bradley to 1.7 miles south of San Ardo in Monterey County.



Looking eastward along Jolon Road toward the new freeway which crosses over on the bridge.

trict where self-loading, self-dumping scrapers were used. The contractor, M. J. Bevanda, used two Le Tourneau nine-cubic-yard scrapers towed by 60-horsepower tractors. The cutting edge and ejector was powered by electric motors mounted above the scraper bowl.

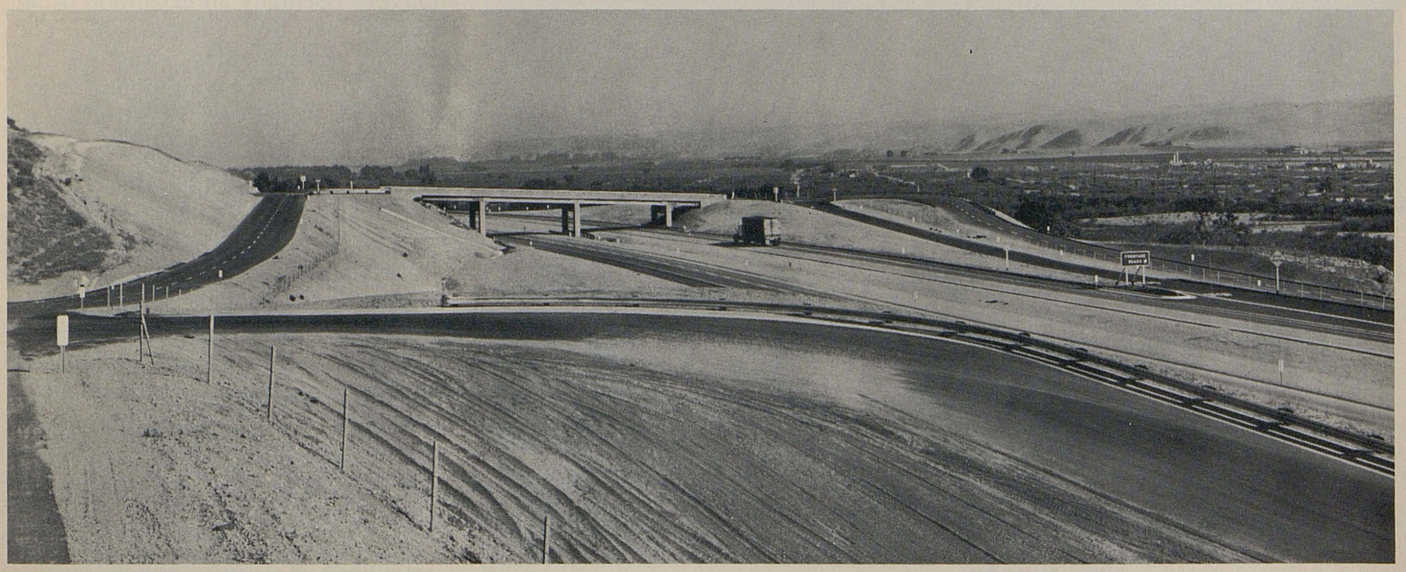
The old two-lane highway was on good alignment, but narrow lane widths and the rolling grade contributed to a fairly high accident rate. Although the passing sight distance on the old road was substandard for a two-lane facility, it was satisfactory for a four-lane divided highway. Consequently, since alignment and location were good, much of the existing highway could be salvaged.

Salvaging was accomplished by widening to current standards and strengthening the structural section. The widening and conversion to a four-lane facility should eliminate the causes of most of the accidents. The structural elements of the widened area consisted of 0.67-foot cement-treated base over 0.17 foot of aggregate base and 0.50 foot of aggregate subbase. The entire traveled way was then covered by 0.33 foot of asphaltic concrete.

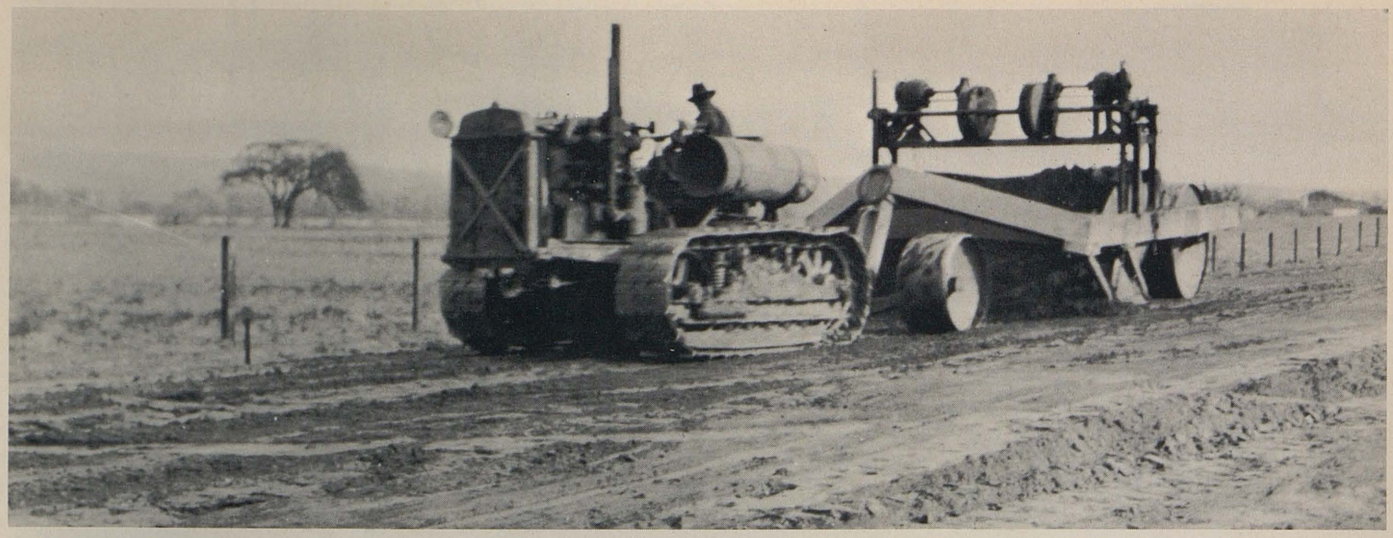
Two Lanes Constructed

The new lanes were constructed of 0.67 foot of portland cement concrete, 0.33 foot cement-treated base over 0.17 foot of aggregate base and 0.50 foot aggregate subbase. The 0.17 foot of aggregate base is standard practice in this district and is used to provide a working table over a generally cohesionless sand subbase material.

The contractor elected to place the portland cement concrete pavement in two 12-foot lanes using sideform



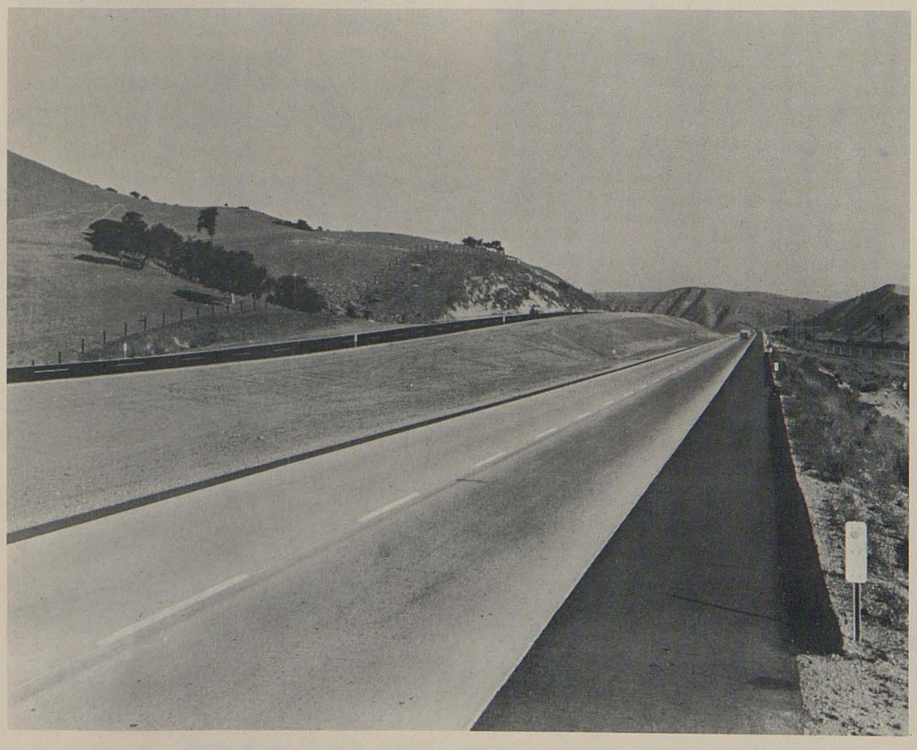
A ground view of the San Bernardo overcrossing shortly after its completion. The view is north.



The old highway was built in 1933. This contract was the first in District 5 where self-loading, self-dumping scrapers were used.

construction. Although this method is no longer in general use, the equipment and methods have been thoroughly refined through the years and the resultant pavement has excellent riding qualities. There were no local aggregates which met our specifications for portland cement concrete, and these aggregates were hauled from a commercial source near Watsonville, approximately 90 miles away. The concrete was dry batched in 1½-cubic-yard batches and hauled to a 34E mixer from a batch plant located on private property near the center of the project.

The general plan for traffic handling was to leave traffic on the existing lanes while completing as much of the new lanes as possible. Traffic was then shifted to the new lanes and the existing roadway was widened and strengthened. Through most of the project the new lanes were constructed as a separate roadway with the grade differential between the two roadways between 5 and 15 feet.



A typical section of the completed freeway between Bradley and San Ardo on US 101.

Interchanges Also Constructed

Three interchanges were constructed as a part of this project. The most southerly is at the Jolon Road intersection, where Jolon Road, the only public road intersecting this project, makes a "T" intersection with Highway 101. Jolon Road extends to the west serving an extensive agricultural area and the Hunter Liggett Military Reservation.

The new interchange at this location was essentialy an expansion of an existing two-lane interchange. The existing undercrossing structure became a part of the southbound lanes. A parallel bridge was constructed to carry northbound traffic. Most of the existing ramps were salvaged and incorporated into the interchange by resurfacing and adding curbs.

Two additional interchanges were constructed as the least expensive way to provide access for local property owners. Both of these interchanges were constructed as elevated overcrossings and diamond-type ramps. The overcrossing structures were both four-span with the two center spans being on precast, prestressed concrete girders. The short end spans were cast in place.

While this section of California is regarded as relatively dry, considerable ground water was encountered between Stations 190 and 250. During grading operations it was necessary to remove a large amount of saturated material below the grading plane. The subexcavation was then backfilled with river sand, one-foot layer of permeable material and a system of perforated metal pipes, side ditches and sand drains.

Extensive contour grading was done each interchange and in the area of separate roadways. The resident engineer used surplus roadway excavation and a small amount of additional grading to flatten slopes and blend the fills into the surrounding terrain.

This project was the first of six projects planned to complete the freeway between San Miguel and just north of King City. Two of the remaining five projects are presently underway and will close the gap between the existing freeway at San Miguel and the south end of this project. The first of these, from San Miguel to north of the main gate at Camp Roberts, is expected to be completed by summer of 1965. The second unit, which lies between these two projects, is expected to be open to traffic by spring of 1966. The three projects to the north will fill the gap between the existing four-lane section north of King City and the north end of this project. The first of these will be a three-mile project in the vicinity of King City. Design and right-of-way acquisition are nearly completed on this unit. The second unit will extend the freeway to the south to a point just north of Route 198 at San Lucas. Design is under way and right-of-way acquisition will begin this year. The last unit—between San Lucas and San Ardo—will complete the four-laning of this 46-mile section. It is in the early stages of design.

The estimated cost for the 46 miles between San Miguel and north of King City is $24,000,000.

The recently completed freeway was started in April 1962 and was completed in August 1964. Cost of the completed project was approximately $3,540,000. The Contractor was Madonna Construction Company. The resident engineer was D. E. Connolly.

Statewide Transport Space Age Study Authorized

Governor Brown has announced that the Los Angeles Division of the North American Aviation, Inc., has been awarded a $100,000 contract to make a space age study for a statewide transportation system.

The contract is the fourth in a series of studies being undertaken by the aerospace industries to apply advanced systems engineering methods to state and local problems.

The study will encompass these major objectives, Governor Brown said:

1. Identifying major patterns of movement of people, merchandise, materials, and food within and between the major metropolitan areas as well as in the rural and smaller urban environment.

2. A consideration of road, rail, water, and airborne vehicles, private and commercial carriers, and any novel means of transport justified for evaluation.

3. A definition of 30- to 50-year objectives toward which the state should strive in terms of the composition, layout and control of the network.

Some 18 nationally famous aerospace companies bid on the transportation study contract. The Governor said that to evaluate the proposals, a committee consisting of urban planners, highway economists and traffic engineers was selected. The three finalists were subsequently interviewed by the State Highway Engineer, the Office of Planning in the Department of Finance and members of the committee.

The Governor pointed out that this year there are 9.5 million vehicles in California and that by 1990 there will be 24.5 million.

"We estimate that vehicle travel alone in 1990 will total 245 billion miles," Governor Brown said. "And by the same year we will have had to spend $25 billion on city, county and state roads and highways to keep up with the growth of automobile and truck traffic."

Equally important, he said, are other transportation needs: mass rapid transit for the cities, and air, sea, and rail travel.

Previous contracts for aerospace studies have been awarded to Space General Corp., of El Monte, for a study leading to more effective methods of combating crime and delinquency; Lockheed Missiles and Space Co., of Sunnyvale, for a state information system; and Aerojet-General Corp., of El Monte, for a study of waste management.

The aerospace companies are being asked to employ the new scientific principles of problem solving, discovered in space, missile and defense work, in studying state problems. In addition to providing the state with new insights and ideas, it is anticipated that the companies may develop programs for converting some of their engineering, scientific and technical resources to civilian purposes, the Governor said.

In its proposal for the contract, North American took this futuristic view of the transportation needs of California:

"Rockets taking Californians to New York in minutes; tube trains with San Francisco to Los Angeles times similar to today's jets; individual air cars from home to office; hands-off control of all vehicles on throughways; automated pipeline movement of produce from farm to home in hours; continuous flow of mail from dropbox to destination; easy access to areas of recreation without destroying natural beauty; smog-free cities with tree-lined walkways—all and more are feasible within California in the next 50 years."

L. L. Waite, senior vice president in charge of contracts and programs for North American, said in a letter of transmittal with the company's bid proposal that the "systems approach" to problem solving could be applied to an integrated study of transportation in the state.

"A study group of specialists representing scientific, engineering, social, and other disciplines drawn from throughout the corporation will be designated to perform this work," the company said.

Wrong-way Drivers

Cooperative Study Outlines Problems, Possible Solutions

This article was originally prepared by Information Officer Robert E. Nance as a series of four write-ups for newspapers on wrong-way driving, corrective signing and spike barriers.—Editor.

Beware of sober 47-year-old men driving in moderate traffic on unfamiliar freeways or expressways during daylight hours on Saturdays when the weather is clear—statistically, this is the person most likely to be a wrong-way driver.

He is not, however, the driver most likely to kill you, himself or others as a result of his misguided sense of direction. This composite prospective killer is a man 10 years younger who departs a bar after its legal 2 a.m. closing hour, crawls into his car and then can't find the right way home.

That overly maligned female—the woman driver—emerges almost blameless when compared to her masculine counterpart, for she is the cause of only one out of five of California's wrong-way driving incidents.

These facts, along with many other pertinent details, are contained in a research project report, "Wrong-way Driving," recently released by the California Division of Highways. The study was conducted in cooperation with the U.S. Bureau of Public Roads. Assistance was provided by the California Highway Patrol and the city police of Los Angeles, San Diego, Long Beach and Riverside.

The report examines 1,214 wrong-way incidents and accidents and is aimed at gathering facts as a basis for stepping up the attack on the wrong-way driving menace. More important, researchers hope it will assist them in decreasing the number of accidents caused by such traffic violations.

Chance of Survival Poor

The study shows that your chances of surviving a wrong-way accident are so poor that they would discourage a professional gambler. In 1963, the ratio of persons killed in all freeway accidents was 2.4 per 100, but when only wrong-way mishaps were considered, it soared to 14 dead per 100 accidents.

During the total four-year period considered, 126 people died and another 150 suffered serious injuries in the 83 fatal wrong-way accidents that happened on freeways. Traffic engineers, still analyzing last year's statistics, predict that 1964 will prove to be even worse.

Tests showed that phrase "WRONG WAY" was best understood by erring drivers.

Fortunately, wrong-way accidents account for a minor percentage of the total traffic accidents which occur each year on freeways.

But the severity of this type of collision is made obvious by an extract from the 1963 California traffic accident reports which show that 39 victims died in 30 fatal crashes included in the total 279 wrong-way accidents that occurred on freeways and expressways that year.

On 23 of these deadly occasions, law enforcement officers were able to ascertain the physical condition of the offending driver and 15 proved to have been drinking to the degree that their driving ability was obviously impaired; 5 had been drinking to a lesser degree; and 2 were suffering from obvious physical defects. Only the remaining two were apparently fit to drive.

The percentage of unfit drivers (78.1 percent) whose wrong-way driving resulted in somebody's death during the years 1961–1964 was deplorable. Of 83 such violators, officials discovered that 50 had been drinking, one had suffered a diabetic attack, only 13 were sober, and the physical condition of the remaining 19 could not be determined.

Drunk Drivers Favor Off-ramps

Although less than half of all wrong-way drivers get that way by entering a controlled access highway via an off-ramp, almost two-thirds of the drinking drivers embark on their illegal trips from such a point. Apparently a drunk believes in following the shortest route possible when driving between two points.

And it is the same stubborn drunk who is primarily responsible for the 6 percent of all wrong-way driving incidents occurring at about 2 a.m.—when only 1 percent of the total miles of vehicle travel takes place. The rate drops very rapidly after that hour.

The age of drivers developed into a significant factor during the course of the study and a pattern correlating age and the use of alcohol emerged.

Slightly more than a third (36.7 percent) of the 1,214 wrong-way drivers stopped by police had been drinking.

Of the total number apprehended, 137 were more than 70 years old but only 8 (5.8 percent) of this group had been drinking.

An increase was noted among the 60–69 age group, for 22 (12.7 percent) of 173 persons had been drinking.

The trend continued to rise as the age bracket lowered, for among the 50–59-year-olds, 82 (39.1 percent) of the 210 drivers involved were in the "had been drinking" category.

In the 40–49-year-old group, out of 237 persons stopped, 118 (49.8 percent) showed the influence of alcohol.

The 30–39 age group was the peak unit. Of 226 such wrong-way drivers observed by law enforcement officers, 133 (58.9 percent) had been drinking. However, the rate plummeted sharply when the youngest group, 16–29 years old, was considered. There were 65 (34.6 percent) drinkers among the 187 wrong-way offenders.

The mean age of all drinking wrong-way drivers was 41.8 years and that of sober wrong-way drivers was 50.9 years.

How Drivers Go Wrong

Freeways and expressways save hundreds of lives in traffic each year; but they are also the spawning ground of wrong-way drivers who all too often die, along with innocent victims, in the locale that gave them birth. An occasional one is found on a conventional road, but the vast bulk begin and end their illegal trips on the freeway.

Warning messages, traffic islands, directional arrow signs and pavement markings all combined can fail to penetrate an alcohol-soddened brain, the mind of a person suffering a mental

At on-ramps, a white-on-green sign reading "FREEWAY ENTRANCE" will be placed at the point of entry.

defect, or even the reveries of a daydreamer. The result? Another vehicle rolling head-on into the opposing flow of traffic.

Reports from the California Highway Patrol regarding 388 specific wrong-way drivers apprehended on freeways revealed that the circumstances through which 88 of them become traffic offenders couldn't be determined. Of the remaining 300, 137 (45.6 percent) entered the freeway via an off-ramp. An even dozen (4 percent) made a U-turn from an off-ramp and thereby headed in the right direction once on the freeway, but 37 others (12.3 percent) completed U-turns on off-ramps that had them bucking traffic flow once they were back on the freeway.

The U-turn was also popular with 25 (8.3 percent) who made them into on-ramps; 9 (3 percent) who made "hard - to - classify" types involving ramps; and 67 (22.3 percent) who made them on the freeway's traffic lanes.

Thirteen rugged individualists (4.3 percent) simply drove across the median divider to become wrong-way drivers under other circumstances.

Drinking drivers are far more prone to originate their wrong-way trip at an off-ramp than are those who are sober. The unintoxicated make U-turns to head the wrong way as often as they enter traffic by means of an off-ramp.

Not Easy to Get Facts

The engineers who design freeways could benefit immeasurably in their attempts to build more nearly foolproof interchanges if definite information could be developed regarding the type of off-ramp most commonly used by wrong-way drivers. If the geometric features or combinations of

TOP TWENTY COUNTIES

All Incidents

	Total incidents*	1964 Fwy. travel (MVM)†	Percent entered via off-ramp	Percent over 70 age	Percent H.B.D.‡
1. San Bernardino	133	972	36.1	16.5	27.9
2. Los Angeles	132	8,236	32.6	6.0	42.5
3. Riverside	114	480	20.2	17.5	21.9
4. Tulare	55	305	14.5	12.7	40.0
5. Ventura	54	238	16.7	13.0	29.6
6. Solano	52	282	25.0	7.7	40.4
7. Santa Barbara	51	200	11.7	3.9	25.5
8. Santa Clara	39	665	18.0	18.0	28.2
9. Sacramento	38	494	60.5	10.5	63.2
10. Contra Costa	38	535	39.5	10.5	55.2
11. San Diego	35	1,102	48.5	8.6	54.3
12. Kern	34	300	11.8	5.9	26.5
13. San Luis Obispo	33	118	18.2	27.2	18.2
14. Fresno	32	202	31.2	6.3	40.6
15. Alameda	32	1,503	21.9	18.7	43.8
16. Sonoma	30	197	30.0	13.3	53.3
17. Monterey	27	78	0	25.9	14.8
18. San Mateo	26	926	42.3	0	73.0
19. Merced	24	87	16.7	8.3	37.5
20. Orange	23	999	34.8	8.7	34.8
Average			27.0	11.9	36.2

* Includes freeway, expressway and conventional roads of both incident studies.
† Millions of vehicle-miles.
‡ H.B.D. = Had been drinking.

same that are conducive to illegal entry could be identified, then steps could be taken to modify those in existence at present and revise construction design in the future.

For these reasons, intensive efforts were made to learn the point of origin of each wrong-way trip. But it was a difficult task, for many of the older drivers and those who had been drinking had no idea as to where they had gone astray, let alone why. Even when they could locate the interchange they had used to enter the freeway, there were alternate paths they might have followed.

This confusion is not difficult to understand, for even sober, normally alert drivers who offended must have been in something of a mental fog or they would not have been apprehended unknowingly headed in the wrong direction.

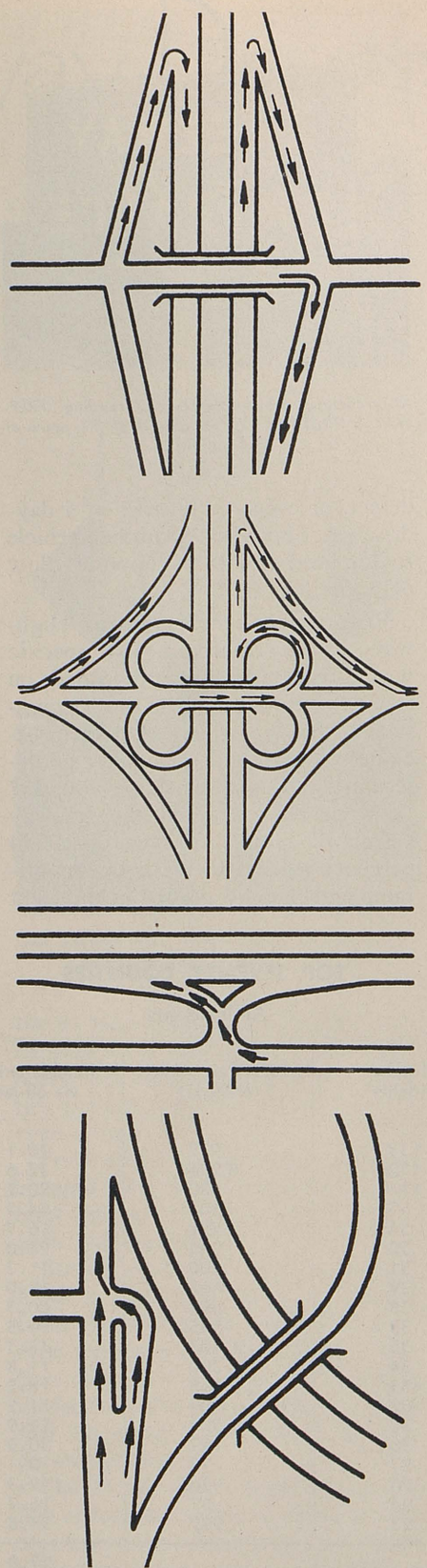
Only when the arresting officer actually witnessed the entry was an exact determination made of the origin of the incident. Sometimes geography and geometry combined to identify a particular ramp. In other cases, a researcher was able to pinpoint a ramp as the highly probable location. When sufficient clues were not available, the point of entry was classified as "unknown."

Intentional wrong-way driving was confined mostly to taking shortcuts. A typical example is the driver who misses the off-ramp at an interchange and then makes a U-turn into the on-ramp to reach his desired connection.

Both Urban and Rural Freeways

Offenders were found on both high-traffic-volume urban freeways and on low-volume rural freeways and expressways. In the urban setting, a driver can usually see that he is doing something wrong simply by observing other vehicles. However, he is often unable to take corrective action because of heavy traffic and because median barriers thwart his desire to cross over to the side where traffic is flowing in his direction.

Out in the country, large gaps in the traffic flow make it easy for wrong-way entries and provide fewer clues by moving vehicles as to the correct direction in which to travel; but far greater opportunities exist for corrective measures on the part of the offending driver once he realizes his mistake.



Typical wrong-way movements at various types of interchanges are (top to bottom): diamond; cloverleaf; buttonhook; and cul-de-sac (design of channelization variable).

The report contains a chart that shows the number of wrong-way driving incidents by counties. Also listed is the number of freeway vehicle-miles traveled per year; the percentage of offenders who entered freeways from off-ramps; the number of offenders over 70 years of age; and the percentage that had been drinking.

Because almost one-third of the mileage driven on freeways occurs in Los Angeles County, it would seem safe to assume that most wrong-way drivers would be apprehended there—but it isn't so. Neighboring San Bernardino County, with its long stretches of desert as well as urban freeways, holds that dubious distinction with 133 incidents, although Los Angeles comes in a close second with 132. Riverside is third, but Tulare County—which is almost entirely rural and has considerably less travel than highly urbanized Contra Costa, Alameda, or San Mateo Counties—ranks fourth on the list and has considerably more wrong-way driving incidents than the latter three counties.

San Luis Obispo County, which ranked 13th in overall standings, led the top 20 in elderly offenders with 27.2 percent. San Mateo County ranked 18th, but led the top 20 in drivers who had been drinking with 73 percent.

Sacramento County, in ninth place overall, was first with 60.5 percent in the "entered via off-ramp" category, and second in percentage of "had been drinking" cases, 63.2 percent.

Corrective Signing

A traffic sign can save your life, but it is only a worthless piece of metal cluttering the side of the highway when drivers fail to read and heed it.

Those who don't bother about signs are lucky if they live to regret it, for some signs provide the instructions necessary to keep persons from becoming wrong-way drivers on freeways.

That fact was borne out in experiments conducted by the Driving Simulation Laboratory, Institute of Trans-

SOBRIETY BY AGE GROUPS

All Incidents

Age group	Drunk or ability impaired		All groups of H.B.D.*		Sober		Percent of group that H.B.D.*
	Number	Percent	Number	Percent	Number	Percent	
16–29	31	12.7	65	15.2	122	16.4	34.6
30–39	77	31.6	133	31.0	93	12.5	58.9
40–49	72	29.5	118	27.6	119	16.0	49.8
50–59	50	20.5	82	19.2	128	17.3	39.1
60–69	11	4.5	22	5.1	151	20.4	12.7
70 and over	3	1.2	8	1.9	129	17.4	5.8
	244	100	428	100	742	100	36.7
Not stated	9		16		28		
	253		444		770		

* H.B.D. = Had been drinking.

portation and Traffic Engineering at the University of California, Los Angeles and the California Division of Highways.

First, the laboratory tested different words and color combinations and discovered that white letters on red background are quick to draw attention.

Once the colors were decided upon, highway engineers started work to discover the message that would best get through to potential wrong-way drivers. Three signs were developed for testing. All were five feet high and three feet wide. On one the message read "WRONG - WAY – GO BACK"; the second said, "STOP–GO BACK"; and the third, "GO BACK – YOU ARE GOING – WRONG WAY."

The signs, augmented by a five-foot-long white-on-red sign reading "DANGER," were installed at an on-ramp in Sacramento. Then 18 unsuspecting drivers were asked to follow an itinerary that included that particular on-ramp.

Four of the drivers didn't notice the signs. Five saw them but failed to react. The remaining nine not only saw the signs but slowed down and then stopped.

As a partial explanation as to why some drivers didn't see (or heed) a sign that obviously warned of danger ahead, traffic engineers point out that the signs were purposely placed on the driver's right at a place where normally they should focus their attention to the left because they should be preparing to merge into freeway traffic.

Phrase 'Wrong Way' Best Understood

Interviews with the 18 drivers plus a myriad of other facts resulted in the conclusion that the phrase "WRONG-WAY" was the best understood and that the sign, "GO BACK – YOU ARE GOING – WRONG WAY" best indicated what was wrong and the proper corrective action that should be taken. This sign, therefore, will be further tested in one geographic area to see if it adds further benefits to those that will be derived from the following statewide sign installations now in progress:

1. The black-on-white "DO NOT ENTER" signs now in place at off-ramps will be augmented with an accompanying "WRONG-WAY" white-on-red sign. This sign is the result of joint findings by ITTE and the Division of Highways.

2. White arrows now painted on pavements at all off-ramps have been redesigned and lengthened so they appear as arrows—not only to the persons following them—but to wrong-way drivers as well. The present arrows are not easily identified as directional markings by wrong-way drivers. This refinement is another result of ITTE and Division of Highways joint efforts.

3. At on-ramps, a white-on-green sign reading "FREEWAY ENTRANCE" will be emplaced at the point of entry. The color green suggests "go conditions" and complements the red "no-go situation" at exit points of off-ramps. Once again, ITTE experts and Division of Highways engineers cooperated in developing this sign.

4. At transitions from undivided sections to freeways, the 24-inch by 30-inch "KEEP RIGHT" signs will be replaced with 48-inch by 72-inch ones where median widths permit. In advance of this sign, another will be installed that reads "DIVIDED ROAD" and 100 feet past the "KEEP RIGHT" message will be still another that reads "DO NOT ENTER." This message will be in 12-inch black letters on a white background and will be supplemented with another white-on-red reading "WRONG-WAY." White arrows of the new design will be painted at 100-foot intervals in each lane and in both directions of travel. This system was designed by the Division of Highways.

5. At all transitions from freeways to expressways, the first median crossover or intersection at road level will be safeguarded by "DO NOT ENTER" signs visible only to drivers proceeding in the wrong direction. The new pavement arrows will also be installed at road level intersections on expressways. Once again, this is a Division of Highways project.

State highway engineers and psychologists of the ITTE staff agree the signs should have a great favorable impact on the wrong-way driving rate in California.

The State Highway Commission has allocated $500,000 for the entire project and the signs will be installed at more than 5,000 locations by the year's end.

Spike Barrier

Like that old show business complaint about everybody wanting to get into the act, just mention the wrong-way driver problem to some people and they sit down, write a letter to their favorite state official and tell him the answer.

All the letters end up with the California Division of Highways, and a handful each day (about 90 percent) laud the abilities of the spike barrier. The writers are understandably anxious to keep wrong-way vehicles from entering the freeway, but they seldom consider the ramifications of this "solution." Traffic officials shudder at the thought of an immobilized vehicle facing fast-moving right-way traffic on a freeway off-ramp and backing traffic up on the freeway lanes themselves.

Spike barriers seem to be the ideal solution for a commercial parking lot operator who has a problem in keeping his customers headed in the right direction—but they could create mass havoc if installed at freeway ramps.

For the past several years, the California Division of Highways has been seeking a physical barrier that would keep vehicles from entering freeways via off-ramps and departing them from on-ramps. Their success in parking lot operations concerned made it inevitable that the search would one day turn to spike barriers.

Effectiveness Tested

The barrier tests were designed to determine just how effective the spikes would be in disabling all types of wrong-way vehicles; whether they would cause drivers to lose control of their vehicle; and if they would stand up under heavy freeway traffic.

Only simple binding tests were needed to determine that metals used in spikes now being manufactured could not stand the constant pounding of heavy traffic.

This, however, was a problem that could possibly be overcome by making spikes from tougher metals (if other aspects made it worth while), so traffic engineers, technicians from the Division of Highways Materials and Research Laboratory, and test drivers moved to an outdoor driving range to check the spikes' abilities in disabling an automobile and to see what would happen to a driver when he suddenly found himself rolling along on from one to four punctured tires.

A compact foreign car and a standard American-built passenger auto used in the experiments were driven in a series of passes over the barrier at speeds varying from 15 to 60 miles per hour. They were equipped with four-ply and two-ply tubeless tires. Cars were driven both the right way and the wrong way across the spikes.

From the outset the compact car proved that a narrow tire could beat the barrier a substantial part of the time by crossing between spikes. And both the compact and the standard-size auto suffered no immediate appreciable damage when spikes penetrated their tires.

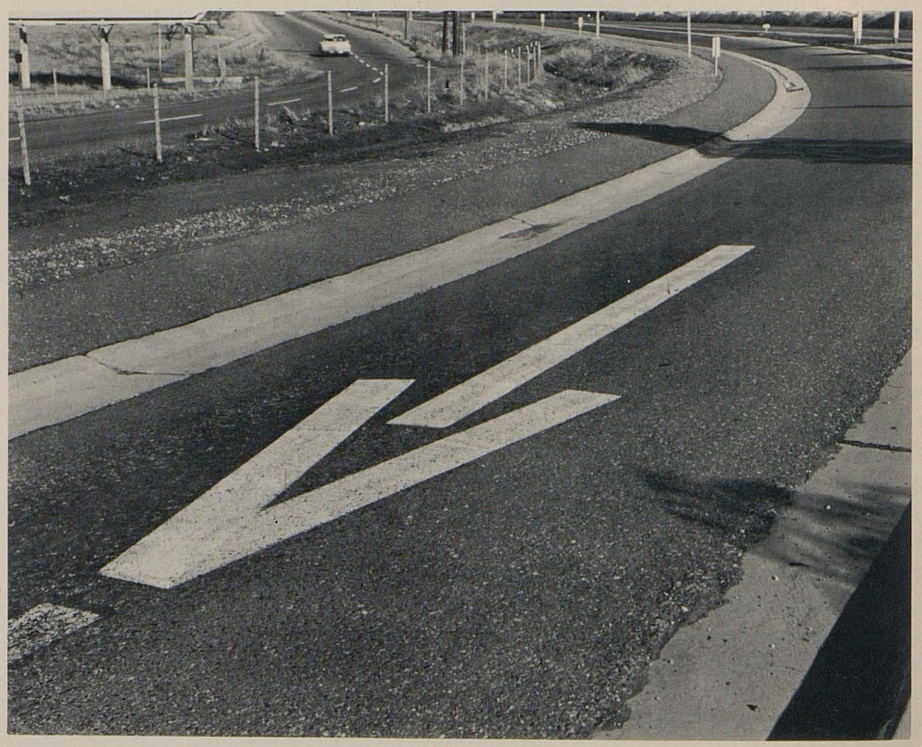
Complete Failure in One Series

In one series of seven runs where punctures were encountered, the barriers were miserable failures. On six runs the driver wasn't able to detect a loss of air pressure from affected tires within 5 minutes. On the other occasion, the driver realized he had a tire going flat after only 10 seconds —but at 60 miles per hour, 10 seconds is the equivalent of 880 feet of travel.

Still not convinced they weren't on the right track, the engineers designed fish hook barbs big enough to hold a fair-sized shark and replaced the blunt ends of spikes with them. The barbs did just exactly as hoped—they ripped chunks of rubber and fabric from the tires—but it still took a minimum of 10 seconds before a damaged tire deflated and quite often 30 seconds went by before the flat occurred.

The barbs proved to have an unhappy side effect, too. The momentum of car and the strength of the tire combined with the gripping power of the barbed spike caused a permanent deformation of the spike so as to point the spike straight up. In this position, it would damage right-way as well as wrong-way vehicles.

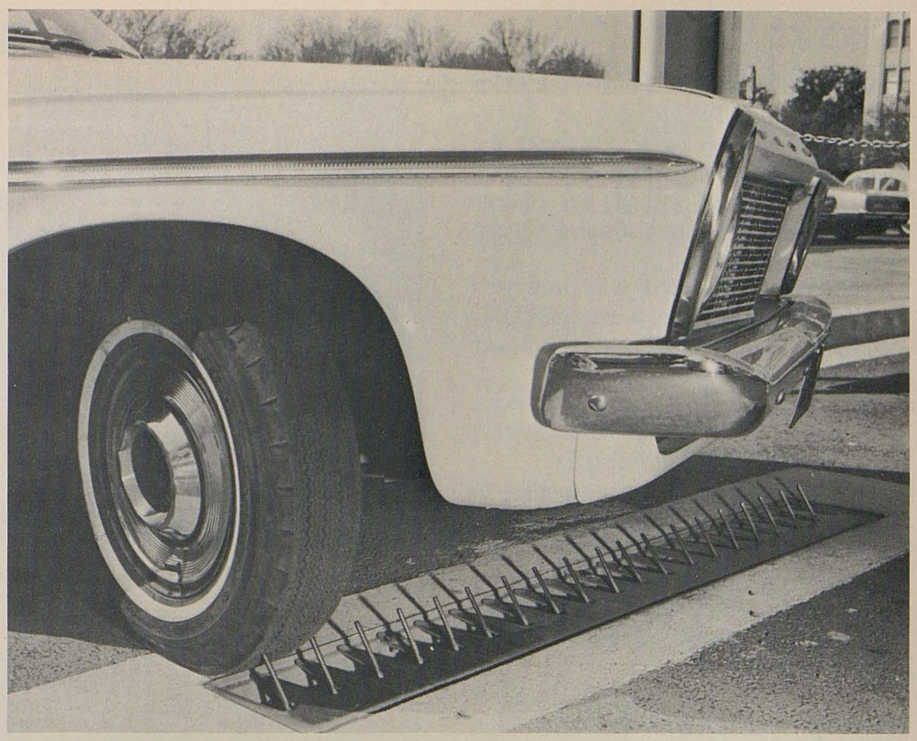
Not one test run resulted in the driver losing control or the vehicle



Redesigned pavement arrows will be painted at 100-foot intervals in each lane and in both directions of travel.

showing a tendency to roll. But the engineers refuse to rule out either factor.

They point out that in the interests of safety, no tests were made of vehicles equipped with worn tires or tube-type tires that lack the facility to at least partly seal themselves. Nor were runs made in excess of 60 miles per hour. Instead, they were content to stop after making certain that the spike barrier could not be incorporated into the freeway system without creating hazardous conditions that would threaten the safety of inexperienced drivers.



Although spike barriers seem an ideal solution to the wrong-way driving problem, tests show that they would only create havoc if installed at freeway ramps.

Bids Invited on Big Interstate Projects

The State Division of Highways called for bids early in June on three projects involving multimillion-dollar construction on two interstate highways in San Mateo, Stanislaus, and San Joaquin Counties.

The San Mateo County project involves grading and paving to construct 3.4 miles of the eight-lane Interstate 280 Freeway, between a half-mile south of Arroyo Drive in South San Francisco and Eastmoor Avenue in Daly City.

Interchanges will be constructed at Westborough Boulevard, the future Hickey Boulevard Extension, at Collins Avenue, and the future Route 1 Freeway. Undercrossings will be provided at King Drive, Hickey Boulevard, Collins Avenue and the Chinese Cemetery Road; and an overcrossing at the Sullivan Avenue ramp.

Bids will be opened July 28 in Sacramento. Approximately $10,425,000 is available for the project.

At its northerly limits this project will connect to a 2.6-mile segment of Interstate 280 freeway construction currently in progress between Eastmoor Avenue in Daly City and Orizaba Avenue in San Francisco, which is scheduled for completion in late summer of 1966.

The Stanislaus County project consists of grading and paving to construct 9.2 miles of four-lane Interstate Route 5 (Westside) Freeway between 0.4 mile north of Stuhr Road and 0.7 mile south of Del Puerto Canyon Road.

An interchange will be constructed at Fink Road, undercrossings at Covell, Oak Flat, and Niels-Hansen Roads, and overcrossings at Simon-Newman and Davis Roads. Bridges will be provided across the California Aqueduct and Crow and Salado Creeks.

Bids will be opened July 21 in Sacramento. Approximately $4,667,900 is available for the project, including an estimated $397,900 to be paid by the Department of Water Resources.

Construction is just beginning on jobs at either end of this 9.2-mile project. On the north, a 13.1-mile segment extends from 0.9 mile south of Del Puerto Canyon Road to the San Joaquin county line. On the south, a 13.8-mile segment begins 0.4 mile north of Stuhr Road and extends to 2.8 miles north of Route 33 in Merced County.

The project in San Joaquin County calls for constructing twin two-lane parallel bridges on Interstate 5 (Westside) Freeway across the California Aqueduct, two miles north of the Stanislaus county line, about 12 miles southeast of Tracy. Bids will be opened July 7 in Sacramento. Approximately $338,400 is available for the project, including an estimated $148,400 to be paid by the Department of Water Resources.

Another San Joaquin County project provides for grading and paving road approaches and ramps, and grading for just over two miles of four-lane freeway, as the first stage of extending Route 132 westerly from its present terminus in Vernalis, to connect with the Interstate 580 (Westside) Freeway construction now in progress and scheduled for completion late this year.

This first stage includes construction of twin bridges across the California Aqueduct and an interchange with Chrisman Road. The project extends slightly more than a mile, beginning just east of Interstate 580. It is anticipated that the second completing stage will be advertised later this year.

Bid opening was to be June 30. Approximately $3,550,000 is available for the total project, including an estimated $190,000 to be paid by the Department of Water Resources.

District 3 Wins 6th Top Award in 7 Years

The Marysville Division of Highways District has again received the California Division of Highways statewide first place award for safety achievement, the sixth time in seven years.

The award for 1964 was presented during ceremonies in Sacramento by Deputy State Highway Engineer George Langsner.

W. L. Warren, district engineer, accepted the certificate of achievement on behalf of the district.

The citation is given annually to the 1 of 11 state highway districts which has the lowest number of hours lost from work as a result of on the job injuries. In 1963 the Marysville District tied for top honors with District 10, Stockton.

In addition, the Marysville office has won two plaques in recognition of over one million continuous working hours without a lost-time accident.

In the history of this Highway Division only three such awards have been made.

Since the inauguration of the district's safety program in 1952 lost-time accidents have been decreased from 49.60 per million man hours to 2.27 accidents per million hours.

There are 1,400 employees in District 3 with work assignments in 11 Sacramento Valley and Sierra mountain counties.

More than 1,000 pieces of automotive and maintenance equipment are in use by the districts including 400 units assigned to the snow belt to help keep highways open.

Don Wieman Retires In San Bernardino

Don S. Wieman, highway superintendent with District 8 in San Bernardino, retired last month (May) after a 34-year career with the Division of Highways.

Wieman's career—which dates back to September 1931, when he started working for District 8—advanced through positions as stone mason, construction foreman, maintenance foreman and superintendent to superintendent of districtwide crews.

Wieman grew up on a small fruit farm in San Joaquin Valley. His background includes working as a building contractor and a millwright in an oil tool shop.

Scenic Highways Committee Inspects I-280 Model

Members of the Advisory Committee on a Master Plan for Scenic Highways, currently engaged in compiling a set of scenic highway standards intended for state and local use in accordance with 1964 legislation, devoted part of their agenda at a recent meeting to studying a Division of Highways scale model of a scenic treatment of Interstate 280 in San Mateo County.

Committee members and others grouped around the model are (clockwise): Charles Perry Walker, City Councilman and former Mayor of Manhattan Beach; Richard Leonard, San Francisco attorney and conservationist; Bridge Planning Engineer A. L. Elliott, Division of Highways; Edwin S. Moore, San Francisco, executive vice president of the California State Automobile Association; Robert Grunwald of Hanford, city and regional planning consultant; Harry P. Schmidt of Gustine, Merced County Supervisor and chairman of the advisory committee; Assistant State Highway Engineer G. A. Hill; Dee W. McKenzie, chief of the highways and bridges division of the Sacramento County Department of Public Works; and State Deputy Director of Public Works Harry D. Freeman. Not present for the picture was Committee Member Nathaniel Owings of Big Sur, noted architect.

The committee has been meeting monthly since February 1964, in conjunction with state personnel engaged in planning and highway design.

San Diego-Coronado Bridge Test Borings Started

Work has begun on foundation borings—the first contract to be awarded by the State Division of Bay Toll Crossings in connection with the San Diego-Coronado Bridge.

The J. N. Pitcher Co. of San Francisco will take 465 soil samples during the coming month from the land approaches on either side and from beneath the waters of San Diego Bay. The company has been awarded a contract for $34,580 to do the work.

A portable rotary drill will be used and will work from a barge for the overwater borings.

The 465 soil samples to a 300-foot depth will be taken from approximately 15 test holes at intervals along the route of the bridge, which will cross the bay via a curving arc from San Diego to Coronado.

The bridge is scheduled to be completed in 1969.

The bridge will be 10,000 feet long and will provide 200 feet of overwater clearance--ample for the largest naval and commercial vessels.

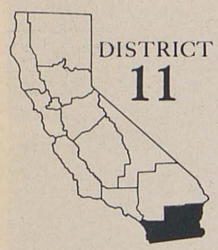
There will be three main spans. Two will cross parallel 600-foot channels for ship traffic and a third will span a 500-foot channel near the San Diego bulkhead line. This additional feature was requested by San Diego port authorities.

The bridge will carry four lanes of traffic on a single level and will provide maximum traffic benefits by linking Route 5 near Crosby Street in San Diego with Glorietta and Fourth in Coronado. It will carry traffic from Coronado directly into the San Diego freeway system.

Construction will cost over $30 million and will be financed by bonds which will be retired by a basic 50-cent automobile toll, with graduated tolls for other vehicle types.

Mission Gorge Road

6 Miles of Key Highway Constructed in San Diego



November 20, 1964, marked the completion of construction of Mission Gorge Road. The area where this project is located has long been considered of historical significance as the Padre Dam, the source of water for the first San Diego Mission. This federal aid urban extension project was a joint San Diego County, San Diego City, State of California and Bureau of Public Roads effort. Studies prepared under the direction of D. K. Speer, county surveyor and road commissioner, had for some time indicated that relief for the Carlton Hills, Santee, Lakeside and east county traffic was in order. During commuter hours, traffic had been extremely congested and hazardous on the old meandering two-lane highway.

Several materials and asphalt plants contributed truck traffic to aggravate the situation further. Public traffic can now flow smoothly and safely at the 65-mile-per-hour design speed on multilane construction. Three miles of the existing alignment was improved, with 2.6 miles of the northeasterly end being entirely new construction, for a total of 5.6 miles. The project beginning is in the City of San Diego at Zion Street and terminates at Simeon Drive in the County of San Diego. Two and two-tenths miles of the alignment is in the City and 3.4 miles in the county.

Preliminary Design

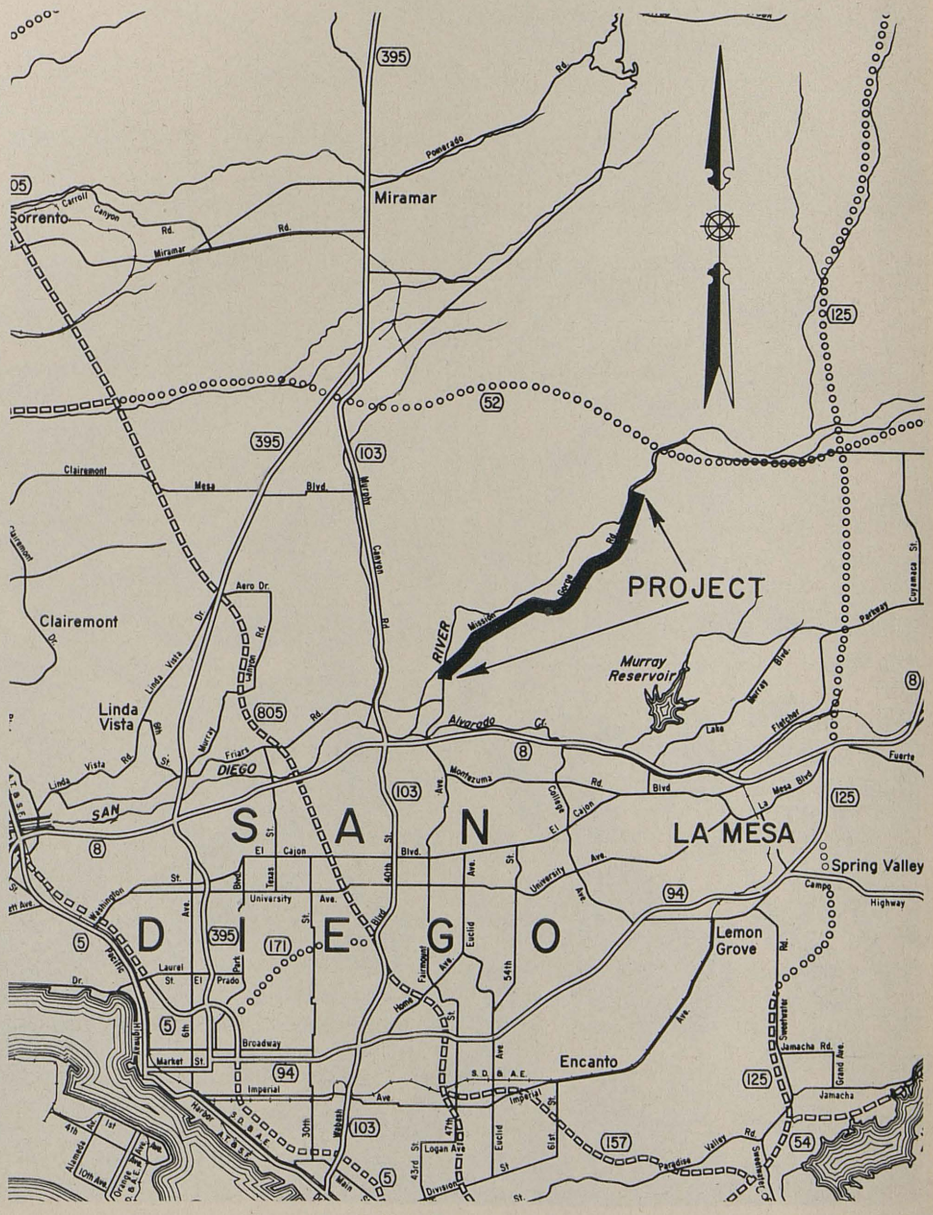
Preliminary design work made full use of aerial photography methods in alternate route comparison, final alignment placement and plotting of elevations used in earthwork calculations. Earthwork computations were performed by the data-processing section of the California Division of Highways using punched cards and magnetic tape data-processing equipment.

Drainage appurtenances include reinforced concrete culvert pipe, precast and cast-in-place concrete drop inlets and both lined and unlined ditches. All ditch lining was air-blown mortar.

Federal aid urban funds provided for 50 percent of the financing of the project, with the remaining 50 percent shared by the County of San Diego and the City of San Diego.

Design

Geometric design was based on an average daily traffic in 1981 of 11,000 cars with a design speed of 65 miles per hour. Minimum curve radius is



The project, which begins at Zion Street in the City of San Diego and terminates at Simeon Drive in the county, involved widening and realignment of the roadway.

This aerial looking northeast shows the realignment. Part of the old road can be seen in the upper left corner of photo. The old road will be retained for access into a proposed city park.

950 feet and maximum gradient is 7 percent. Typical cross-section of the road is four-lane divided either by an 18-foot unpaved median or a 4-foot raised and paved island. The shoulder area will be eight feet paved on the right and two feet paved on the left. The maximum uphill grades have an added lane for slower moving traffic.

The structural section consists of one foot of subbase, an eight-inch base and three inches of asphalt concrete. Subbase was deleted through rock cut areas.

Contractor

The contract was awarded on December 12, 1963, to C. W. McGrath, Inc., of San Diego. The contract allowed 350 working days to complete the contract, the contractor actually used 223 working days, attesting to excellent progress. The final construction cost exclusive of engineering was $1,779,000.

Construction

Generally, the contractor used conventional methods to complete the work. One of the major items of work was the moving of slightly in excess of one million cubic yards of roadway excavation, of which an estimated 250,000 cubic yards consisted of rock, concentrated mainly in a large 84-foot cut at the north end of the project. South of this deep cut is an 85-foot-high embankment containing approximately 325,000 cubic yards. The rock excavation was variable as to type, blue granite and disintegrated granite, intermixed, with many seams, which made it difficult to analyze for drilling and blasting.

First Use

One of the first uses in southern California of compressible backfill material over a reinforced concrete pipe culvert took place on this job. This consisted of a layer of baled straw placed over a 424-foot 78-inch reinforced concrete pipe to be covered by approximately 85 feet of embankment.

Soils

Site and soils investigation was handled by the County of San Diego,

An aerial looking northward showing the 84-foot rock cut and the 85-foot embankment involved in the highway reconstruction.

Surveyor Department Soils Laboratory. Extensive soil core borings and seismic studies of possible rock formations within the right-of-way were used to compile a comprehensive materials report.

The materials report was made available to prospective bidders in hope of obtaining more realistic earthwork prices and it is believed the report did influence the construction costs.

An evaluation of seismic data of the materials report during construction indicated the results were accurate within practical limits. The materials report was reviewed by District 11 California Division of Highways Materials Laboratory under the direction of Paul Ruplinger.

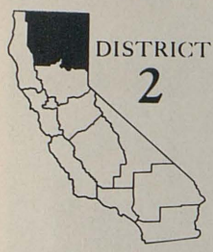
Personnel

Project design was under the immediate supervision of Alton S. Hamm of the County of San Diego. He and the writer were the resident engineers. State project construction representative was James V. Bell.

The City of San Diego furnished some of the inspectors for the project. The inspection force used handie-talkie citizen band radios to communicate on the site. Jack Crabtree and Ray Johnson acted as superintendents for the contractor.

Route 44 Expressway

By FRANK P. BERNARD, Resident Engineer



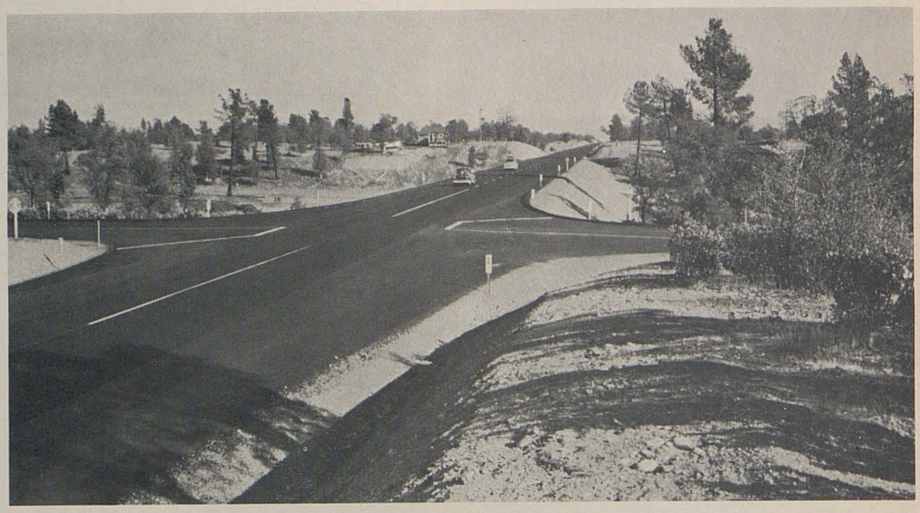
During October and November 1964, a section of State Sign Route 44 —between Airport Road about six miles east of Redding and 0.9 mile east of Millville— was retired in favor of a two-lane expressway on new alignment.

The roadbed is positioned to become the westbound lanes of a future four-lane facility. Fencing has been placed to establish access control throughout, including future needs for three interchanges and two overcrossings. Construction of these 7.8 miles was performed under two separate contracts purposely scheduled for nearly simultaneous opening to traffic.

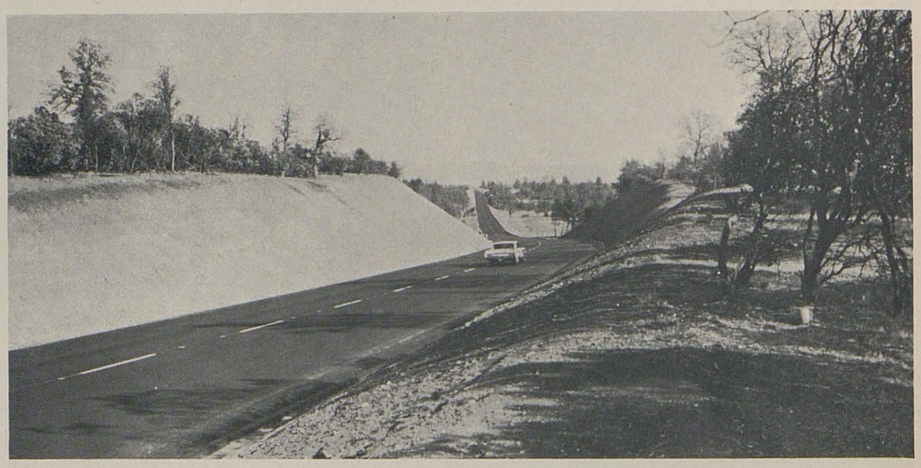
The justification for reconstruction was obvious, considering that the last extensive improvements were made more than 40 years ago.

The first section—Airport Road to Cow Creek—was completed on October 14, 1964, by J. F. Shea Company, Inc., of Redding.

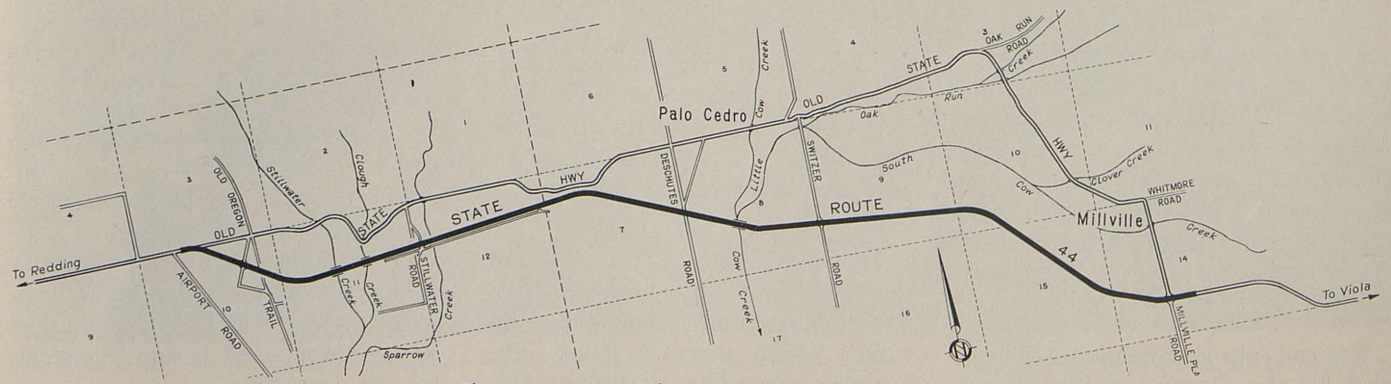
The benefits of modern highway design are evident in the 60-mph design speed, 40-foot typical section, and maximum grade of 4.85 percent. Two curves with 2,000-foot radii now serve in lieu of 20 short-radius curves on relinquished alignment. Many of



A section of the new Route 44 expressway at Stillwater Road.



The new Route 44 expressway one mile east of Cow Creek.



The new expressway is located on Route 44 east of Redding.

the latter were coupled as reversing curves. A climbing lane was added during construction to relieve truck traffic at the one location with maximum grade.

Concrete girder bridges 40 feet wide provide unobstructed shoulder width across both Stillwater and Clough Creeks. Stanley D. Newell and Robert Tucker were bridge representatives on this work.

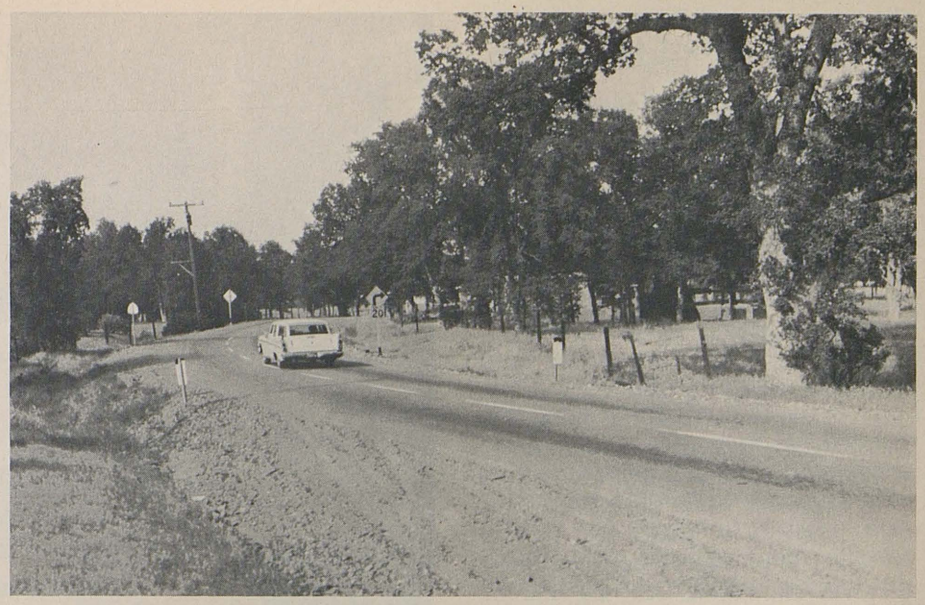
Unusual Protective Treatment

Unusual protective treatment was necessary at the four reinforced concrete box culverts constructed on this project. Protective coatings of coal tar primer followed by coal tar enamel were applied to concrete surfaces in contact with earth to prevent acidic deterioration. Polyethylene sheeting was placed beneath invert slabs, and coal tar primer only was utilized on interior surfaces. Corrugated metal culvert pipes were bituminous coated with paved inverts through these areas. For the last half of this project, uncoated concrete pipe culverts were satisfactory because of less acidic soils.

The old highway was extremely circuitous, had rolling ground level grades, and was structurally inadequate for present-day traffic. The Shasta County improvements of the early 1920's were undoubtedly more than adequate for that era; however, the numerous 20–30-mph curves and two 16-foot-wide bridges constructed at that time have long since been outmoded. Normal traffic growth, coupled with rapid residential expansion both adjacent to and beyond the existing facility, hastened its demise as the principal traffic artery. However, the existing 20-foot-wide roadway and one-way bridges at Stillwater and Clough Creeks should be adequate to handle local traffic for many years to come.

Second Section Completed

The second section, between Cow Creek and 0.9 mile east of Millville, was completed on November 17, 1964, by Ransome Company and Hughes and Ladd. This two-lane expressway has 70-mph design speed, a 40-foot typical section, and maximum grade of 1.05 percent. The grade line is generally well above the original ground, thereby providing headroom for drainage facilities and avoiding water problems associated with the flat terrain. The new alignment utilizes three 2,000-foot-radius curves, as compared to 24 substandard curves on the existing facility.



A typical hazardous curve on the old highway.

A hairpin curve and one-way bridge at Clough Creek on the old highway.

The excellence of this location is emphasized by the elimination of circuity, shortening the route by nearly one mile and the elimination of several major drainage structures. A single 444-foot concrete girder bridge now spans Cow Creek in lieu of five bridges on the old alignment. This was accomplished by positioning the new alignment to cross Cow Creek below the confluence of its several tributaries. William H. Schooler was the bridge representative on this work.

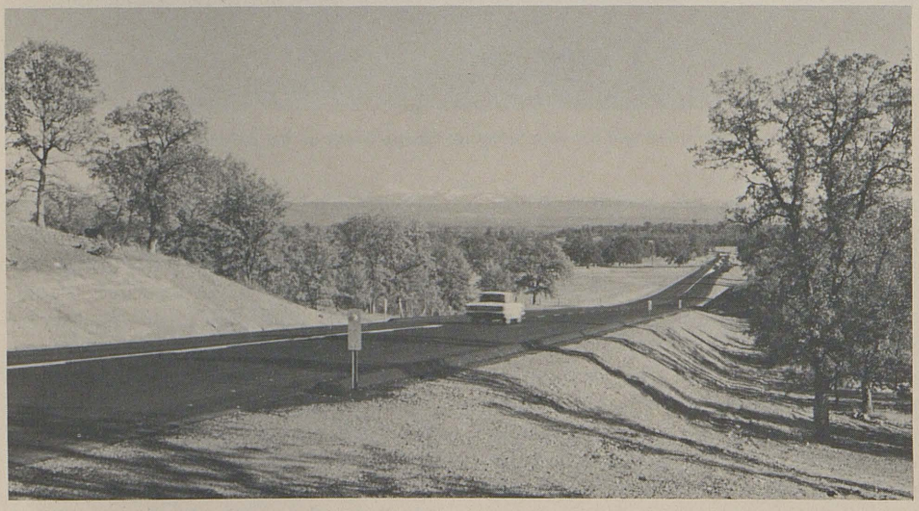
The original highway was narrow and had numerous sharp-radius reversing curves in addition to three right-angle turns. The grade line was relatively flat, and closely paralleled

the natural ground. This condition aggravates the deficient structural section due to proximity of moisture. New concrete bridges and approaches have been constructed at Oak Run Creek, Clover Creek, and South Cow Creek in recent years, but little else has been changed since the early 1920's. The steam tractors, pictured in this article, used this route around the turn of the century. Two-wheel trailers, coupled in series and hauling 16-foot lengths of rough-sawn lumber, were towed by these tractors between Shingletown and the railhead at Bella Vista. According to old timers the biggest traffic problem was to hold onto the team while these "new-fangled contraptions" passed by. Anyone traveling Highway 44 between Shingletown and Viola can see one of these steam tractors at the Big Wheels Resort.

A steam tractor used at the turn of the century to tow trailers transporting lumber from Shingletown to the railhead at Bella Vista.

Route History

The exploration and development of the western territory is closely tied into the country traversed by these projects. The Old Oregon Trail runs northward near the beginning (see sketch). Less known, perhaps, is the "Walla Walla Trail" established by Alexander McLeod in 1829. At that time Hudson Bay Company sent McLeod south to explore the Sacramento Valley. His travels took him via the present town of McCloud, down the Pit River, and along the Cow Creek Basin to its confluence with the Sacramento River. Joseph Chiles, who established the "Yellowstone Cutoff" between Boise and Fall River Mills, used this route in 1843. John Fremont's northward travels in 1846 proceeded via the Millville Plains and continued along this trail. It is interesting to note that of all the United States territories, northern California was the last challenge to these pathfinders. One pioneer said, "It was too far away and too difficult of access."



The new Route 44 expressway looking toward the intersection with Deschutes Road.

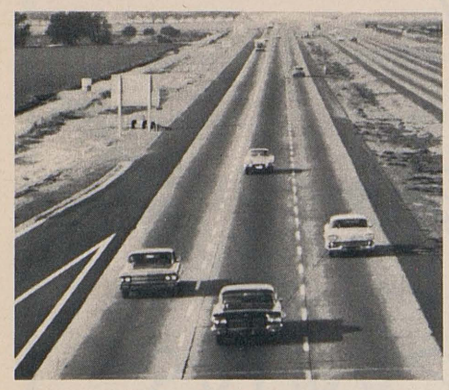
A 1.5-mile section of Route 44 at its western end is currently under construction in conjunction with Interstate Route 5 east of Redding. The intervening link, Interstate Route 5 to the beginning of the projects discussed in this article, is next scheduled for construction, with projects east of Milville to follow.

Even though these projects are only the beginning of planned improvements, the motorist will benefit by the added safety, increased comfort, and the knowledge that additional expressways are forthcoming. The day is not too distant when travelers to Lassen National Park and points beyond will enjoy the full blessings of a modern highway on Route 44.

NEW AMERICAN RIVER BRIDGE

The State Department of Public Works has announced the award of a $1,550,677 contract for constructing a four-lane bridge with sidewalk and horse trail across the American River in Sacramento County southwest of Folsom. Upon completion of the bridge, the county plans to complete construction of Hazel Avenue from Nimbus Interchange to Madison Avenue.

Senate Resolution Orders Fog Study; Fog Abstains



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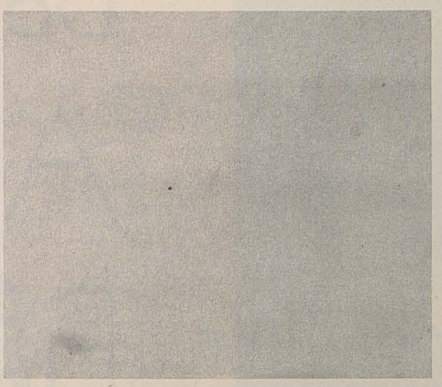


WITH

Senate Resolution No. 33 ordered a fog study, but it didn't order the fog —at least not thick enough for study purposes. This may have been fine with California motorists, but it threw a curve to the Highway Transportation Agency, which was to report its findings and recommendations to the Legislature before March 15, 1965.

Since the beginning of the SR 33 study there have been very few days with ground fog sufficiently dense to reduce visibility below a sight-distance of 500 feet—the environment in which most multiple vehicle accidents occur, according to traffic engineers.

Submitting an interim report, Agency Administrator Robert B. Bradford has recommended continuation of the study for another year.

The resolution, introduced at the 1963 regular session of the Legislature by the late Senator L. M. Backstrand of Riverside and Senator Randolph Collier of Yreka, requested a study to determine possible means of giving advance warning to drivers of the need for greater alertness and caution during periods of reduced visibility, and to explore the use of warning devices or other means to inform drivers of existing hazardous conditions.

Although the number of fog accidents involving more than four vehicles comprise less than 0.2 percent of all accidents on the state highway system, the number of these accidents has fluctuated widely from year to year, seemingly in relation to the number of "foggy" days.

Testing methods being used in the study involve four general categories: roadway and signing, patrol activity, public information, and vehicle equipment.

Roadway and signing devices being tested include illuminated variable speed limit signs, shoulder striping, colored edge and gore striping at off-ramps, and raised lane markers and other warning devices.

Along with increased patrol activity, it is proposed to use the rear amber flashing lamps both on moving patrol cars, and patrol units parked off the roadway.

Public information testing will consist of broadcasting advisory warnings to motorists over AM radio.

As to vehicles and equipment, the study group is determining the best means of rear lighting to enable motorists to signal that their vehicle is proceeding normally, is rapidly slowing down and stopping, *is* stopped, or is about to change direction.

Except for partial testing of the variable speed limit signs, virtually no testing of other devices has been possible because of lack of ground fog at test sites. Tentative results indicate that with low to moderate traffic volume in daylight fog conditions, motorists voluntarily reduce their speeds by about five miles per hour, and that the illuminated speed limit signs cause an additional 5-mph reduction. But these speeds were still generally higher than those considered safe with the limited visibility. The posted speeds did, however, produce more uniform speeds, and also reduced the number of short headways, or tailgating.

Plans for the continued year of study, if the Legislature extends the time limit, are to determine the effect of posted illuminated speed limits under high-volume traffic and nighttime conditions, as well as the effectiveness of devices and methods already under consideration.

September Date Set For Highway Week

The 1965 observance of National Highway Week will take place during the week beginning September 19.

In California the observance will again be a cooperative affair involving various highway-oriented organizations and the State Division of Highways. Its purpose will be to focus public attention on the progress being made and the problems involved in providing safe, adequate highway transportation throughout California.

Among the organizations most active in the event will be Californians for Modern Highways, Inc., the Automobile Club of Southern California, the California State Automobile Association, the California State Chamber of Commerce and various industrial groups.

As in recent years, the district offices of the Division of Highways will provide informational material and exhibits on regional and local highway development in cooperation with local highway organizations. Events such as highway "ribbon cuttings," groundbreaking for new projects, etc., are expected to be numerous.

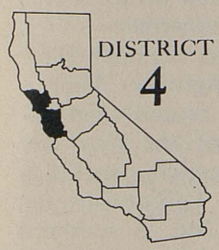
Northern California regional chairman for National Highway Week is Sherman P. Duckel, retired chief administrative officer of the City and County of San Francisco. Duckel is a vice president of Californians for Modern Highways, Inc. A southern California regional chairman was to be designated later in June.

The American Association of State Highway Officials, through its subcommittee on public information, is coordinating plans for the observance nationwide.

Bay Area Freeways

By ALAN S. HART
District Engineer

The new stretch of eight-lane freeway on Route 24 looking toward the east portal of the Caldecott Tunnel. Gateway Boulevard interchange is in the foreground.



District 4, headquartered in San Francisco and responsible for the administration of more than 1,600 miles of state highway in the nine bay area counties, reports substantial progress during the past year, with major emphasis on completion of the federal system of interstate and defense highways.

There are a total of 192 miles within the district, and almost 76 miles of these interstate system routes have been completed to date. More than $90,000,000 is currently allocated towards going construction or budgeted projects which, when completed, will provide an additional 53 miles of modern interstate freeways.

Right-of-way costs already expended and budgeted for the interstate system amount to over $205,000,000. Plans are proceeding rapidly on the balance of the system, looking toward early construction on the remaining 63 miles of interstate highways in the bay area.

Tremendous Undertaking

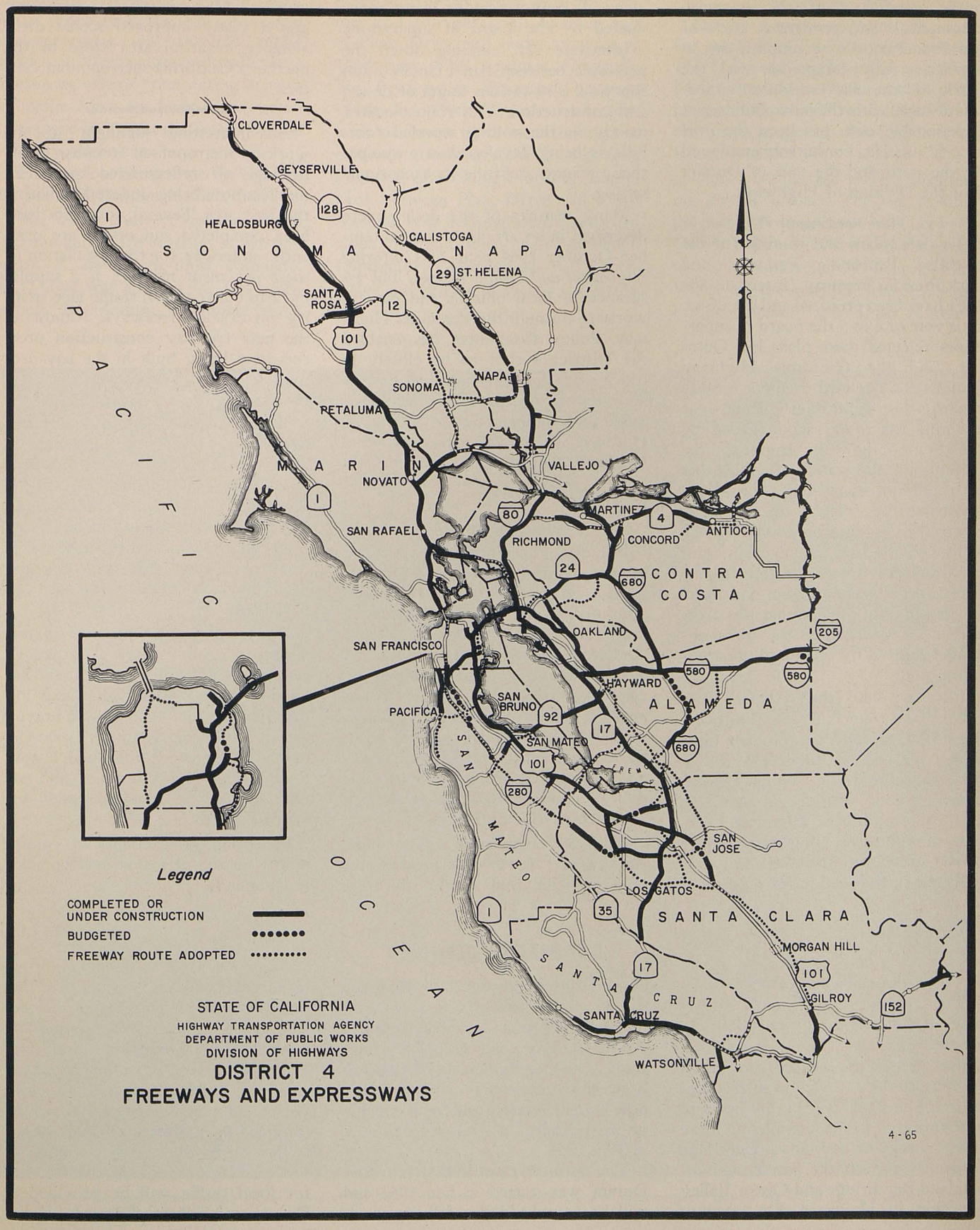
While development of the interstate highway system in the bay area is a tremendous undertaking, it has become even more of a challenge to the district and its staff with the approval by federal authorities on October 12, 1964 for a new routing for Interstate 680 in Santa Clara and southern Alameda Counties. This new interstate route, extending for about 15 miles between Interstate 280 in San Jose and Warm Springs, supersedes the previously approved routing along the already constructed Nimitz Freeway through San Jose and north to Fremont. It will provide a new parallel corridor for traffic around central San Jose and the easterly side of the Santa Clara Valley.

Designation of this new route as an interstate highway to be completed by 1972 will mean that plans must be prepared and right-of-way acquired over a very short period of time for construction estimated to cost about $56,000,000 and right-of-way acquisition estimated at $50,000,000.

Seeks Satisfactory Plan

In San Francisco the district has been seeking to provide a satisfactory freeway plan to meet the increasing need to relieve traffic congestion. San Francisco, because of its intensive development and exceptional character, provides a real challenge to engineers, planners, and architects working as a team. The designated interstate system includes 21 miles within the limits of the City and County of San Francisco. This limited mileage is expected to accommodate one-third (33 percent) of all vehicular traffic in the city upon its completion.

The interstate system provides a loop around San Francisco Bay, but also includes an inner loop in San Francisco connecting the three exterior corridors—Golden Gate Bridge, San Francisco-Oakland Bay Bridge, and the peninsula—with the heavy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M A R I N
NOVATO
VALLEJO
SAN RAFAEL
MARTINEZ
CONCORD
ANTIOCH
RICHMOND
CONTRA COSTA
OAKLAND
SAN FRANCISCO
HAYWARD
ALAMEDA
SAN BRUNO
PACIFICA
SAN MATEO
SAN JOSE
LOS GATOS
SANTA CLARA
MORGAN HILL
GILROY
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FREEWAY ROUTE ADOPTED
STATE OF CALIFORNIA
HIGHWAY TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS
DISTRICT 4
FREEWAYS AND EXPRESSWAYS
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traffic generators of the financial, commercial, and residential areas of San Francisco. To accomplish this in a manner fully compatible with the fabric of "the city" and in an appropriate scale with the surroundings, at a reasonable cost, has been the goal of city officials, consultants employed by the state, and the staff of District 4 of the Division of Highways.

Plans Need Approval

To date, plans and routing for the so-called Panhandle Parkway and Park Presidio Freeway (Interstate 80–280) have been prepared and discussed. By a vote of 6 to 5 the board of supervisors rejected these plans last October, and the California Highway Commission declined to adopt a route against this opposition. While not adopting the route recommended by the State Highway Engineer, the commission also stated its policy that it would not approve a proposal to construct the freeway in a tunnel, referred to as the Crosstown Tunnel. Whatever the final outcome is for this needed freeway, the district is prepared to commence design and make an all-out effort to see that this freeway is constructed, in the event approval is given by the board of supervisors.

Interstate 480 (the "Golden Gate Freeway") connecting the Embarcadero Freeway and the Golden Gate Bridge has been the subject of a similar exhaustive study, culminating in a district public hearing on April 9, 1965. The California Highway Commission took this routing matter under consideration on April 28, 1965, but deferred further action for 60 days in view of routing studies being conducted by the board of supervisors.

Interstate 280, running down the peninsula between San Francisco and San Jose, is in various stages of design and construction. This route, located mainly in the rolling wooded foothills, is being developed in a sympathetic manner befitting its exceptional setting.

Many features of the design were described in an article in the September–October 1964 issue of *California Highways and Public Works*. The assistance of local officials and citizens working through the Peninsula Highway Policy Committee has enabled the District 4 staff to be closely in touch with local feeling and desires. This means of channeling local proposals and communicating Division of Highways design features and studies has been helpful in reaching a satisfactory solution to knotty design problems.

Interest in Aesthetics

In line with the generally expanded interest in aesthetics, many unusual features in location, roadway layout, structure design, and other facets of the freeway plan have been developed. The first major contract utilizing curved-edge box girder bridges developed particularly for this area is now in progress. Contour grading, special design of slopes to fit the natural terrain, and curvilinear alignments on independent levels of grade line will all combine to improve the appearance of this highway.

Just a few years more will complete Route 280 freeway and provide not only a major traffic relief to overcrowded 101 Freeway (Bayshore) but also a vastly improved scenic drive along a beautiful area close to the northern California metropolitan centers.

Reflectorized Buttons

An interesting highlight of the work on metropolitan freeways is the placing of reflectorized pavement markers now being undertaken within the bay area. Several contracts have been completed and others are presently underway for the installation of these pavement markers as a supplement to conventional traffic lane striping on existing freeways. Almost all the new freeway construction projects now being built in the bay area will incorporate the use of these buttons.

The use of these reflectorized raised buttons was approved following exhaustive studies of alternate means of providing a visible traffic stripe during the rainy weather. The reflectorized stripe previously used as standard lane markers, while of excellent visibility for dry weather both day and night, was almost completely lost on wet pavement.

The raised buttons not only provide improved visibility but also give an audible or physical warning if the vehicle strays out of its lane. This improvement in lane markings on heavily traveled freeways is almost as important as the median barriers which were developed a few years ago and are now accepted as standard design for major freeways.

Following is a county-by-county report on recent major developments in District 4:

ALAMEDA COUNTY

Interstate Route 580

Two contracts are currently underway on Interstate 580—one between Buell Street and Durant Avenue in Oakland and the other from Sybil Avenue to 173rd Avenue in San Leandro. The latter will be finished late in the spring of 1966, completing more than 15 miles of continuous eight-lane freeway between the San Francisco-Oakland Bay Bridge and Castro Valley Junction in Hayward. Six previous contracts were required to complete the 8½ miles presently in service on this route in Oakland and San Leandro.

The most recently completed contract, covering two miles of freeway between the easterly limits of Oakland near Durant Avenue and Sybil Avenue in San Leandro, was opened to traffic in July 1964.

The project between Buell and Durant was started in late 1962 and will be completed this fall. Approximately $12,000,000 was allotted for the construction of 4.5 miles of freeway adjoining Calaveras Avenue and portions of Mountain Boulevard. Freeway-to-freeway traffic service between Warren Boulevard Freeway (Route 13) and Interstate 580 will be provided by a directional interchange being constructed in the vicinity of Mills College. Access to the freeway for local traffic will be provided at Davenport, Kuhnle, Edwards, Keller

and 106th Avenues and at Golf Links Road. Four overcrossings and seven undercrossings will provide traffic service at interchanges and traffic separation at several intersecting streets. Frontage roads are being constructed to replace local access affected by the freeway alignment.

The work is being done by Gordon H. Ball and Gordon H. Ball, Inc.

The other contract between Sybil Avenue and 173rd Avenue in San Leandro is about one-third complete. $5,571,000 was allotted for this work which, in addition to almost three miles of freeway, includes overcrossings at 150th and 159th Avenues and at Plaza Drive and undercrossings at 164th and 167th Avenues. Generally the freeway is depressed between 150th and 159th Avenues and split-level roadways have been designed to conform to the terrain in this area. Portions of existing Foothill Boulevard, between Plaza Drive and 173rd Avenue, will become a frontage road when the freeway has been completed. Contractor is Gordon H. Ball Enterprises and Price and Harris Construction Co.

173rd to Castro Valley

Design studies are well advanced for one mile of Interstate 580 between 173rd Avenue in Hayward and Strobridge Avenue in Castro Valley. This project will include reconstruction of the interchange at the junction of Routes 238 and 580.

Design studies are also in progress on several projects for the 11-mile portion of Interstate 580 between Castro Valley Junction and the junction with Interstate 680 near Dublin. Work on the portion between Strobridge Avenue and Crow Canyon

Looking toward the west portal through the new bore of the Caldecott Tunnel. To the right is one of the emergency stations spotted at 250-foot intervals within the tunnel. They contain fire extinguishers, a hydrant and public address system. Slots in the ceiling are ventilation ports.

Road includes a channel change and interim grading along Don Castro Regional Park. The latter work is to be expedited to fit improvement plans and construction schedule for the park and a revised freeway agreement for this project was signed by Alameda County in February.

The existing 20 miles of expressway between the intersection of Interstate Routes 580 and 680 and the San Joaquin county line will be converted to six- and eight-lane freeway and design studies for these projects are well advanced. Safety roadside rests and truck stops have been approved for the portion between Vasco Road and west of the San Joaquin county line.

Construction of interchanges within the above limits at Tassajara-Santa Rita Roads near the north city limits of Pleasanton and First Street (Route 84) near Livermore was started in January. The contractor is Gallagher & Burke, Inc. Funds in the amount of $1,367,000 are allotted for this work which should be completed by the end of this year.

Landscaping

Landscaping on Interstate 580 projects has followed closely behind completion of the freeway and this work has been completed to Park Boulevard in Oakland. One such contract is presently in progress between Park Boulevard and Birdsall Avenue.

In addition, $200,000 has been budgeted for landscaping almost two miles of freeway between Gabriel Court and 108th Avenue. Studies are in progress for landscaping the 4½-mile portion between Birdsall Avenue and 108th Avenue and the 2.7-mile section between 173rd Avenue and Gabriel Court.

Interstate Route 680

Approximately 60 percent of the construction on Interstate 680 between Route 580 and one mile north of the Alameda-Contra Costa county line has been completed. Slightly over three miles of freeway is being constructed with interchange facilities at the intersection of Routes 580 and 680 and at Alcosta Boulevard and separation structures at Amador Valley and Dublin Boulevards.

As a part of this project, Interstate 580 is being widened from four to eight lanes within the limits of the Route 580/680 interchange. Frontage roads are being constructed in the vicinity of Alcosta Boulevard and bridges over the Alamo Canal are included in the project. This work, which is completely on new alignment, is expected to be completed late this fall. $5,312,000 has been allotted for this work, which is being performed by the joint venture of Green Construction Co. and Winston Bros. Co.

Design studies are in progress on Route 17 (future Interstate 680) between Alum Rock Avenue in San Jose and near Prune Avenue in Fremont. This routing for Interstate 680 was approved last year in lieu of the former location along Nimitz Freeway.

Plans are nearing completion for almost nine miles of Interstate 680 between Scott's Corner and Interstate 580. This work is expected to be advertised shortly. Interchanges will be provided at Route 84, Sunol Road, Pleasanton-Sunol Road and Bernal Avenue, and twin structures will be constructed across Arroya de la Laguna. A total of $8,450,000 is required to construct this project. Extensive relocation of the Arroya de la Laguna between Arroyo Mocho and Arroyo del Valle is required, and this work is presently underway through cooperative agreement with the Alameda County Flood Control District.

Design studies are in progress for nearly five miles of Route 680 in Fremont between Mission Boulevard near the Warm Springs district and the junction of Routes 238 and 680 in the Mission San Jose district.

Route 13 (Warren Boulevard Freeway)

One and three-tenths miles of four-lane freeway is being constructed on Route 13 between Atlas Avenue and Interstate 580 as a part of a $1,728,000 contract. Access to Route 13 for local traffic will be provided by interchange facilities at Redwood Road and Carson Street. Five reinforced concrete cantilever retaining walls and a pedestrian overcrossing at Leona Heights Park are included in the work. Construction is by the L. C. Smith Co.; the section is expected to be opened to traffic early next year.

The rough grading for this portion of Warren Boulevard Freeway was completed as a part of the project presently under construction on Interstate 580 between Buell Street and Durant Avenue in Oakland. This is the final unit of construction on Route 13 between Route 24 and Route 580. Initial construction on this route between these limits was initiated with Joint Highway District funds contributed by the City of Oakland, County of Alameda and State Highway Fund. Local jurisdictions contributed $150,000 each to this final project.

The $45,000 landscape project at Moraga Avenue Interchange was accepted in March.

A $54,000 project for the revision of drainage facilities and the installation of a pump at Folger Avenue Underpass at the northerly terminus of Route 13 at Ashby Avenue was completed in late April. Prior to this work, the underpass was subject to closure by flooding during periods of heavy rainfall. This work should eliminate that condition.

Route 17 (Nimitz Freeway)

Funds in the amount of $1,300,000 have been budgeted for widening slightly over four miles of Nimitz Freeway to six lanes between Jackson Street in Hayward (Route 92) and Washington Avenue in San Leandro. Provision for widening within the existing median was made in the original construction and this work is expected to be advertised this summer.

Five structures will be widened within these limits: the "A" Street Undercrossing, San Leandro Creek Bridge, Hesperian and Lewelling Boulevard Undercrossings and the Route 17/238 Separation. A double metal beam median barrier will be installed as a part of this project.

A contract for resurfacing Route 17 between Davis Street and 0.3 mile north of Hegenberger Road is in progress. Night paving operations on the southbound lanes were begun late in February but a labor dispute delayed these operations for a while during March. There is $353,000 allotted for this 1.5-mile project.

Funds in the amount of $300,000 have been budgeted for a similar project between 1.1 miles north of Washington Avenue and 0.3 mile north of Davis Street (Route 112) in San Leandro. This contract will include grinding some pavement joints. The contract is expected to be advertised before summer.

Studies by the division and the City of Oakland for new connections to the Nimitz Freeway between 98th Avenue and High Street, to serve the Oakland Coliseum, are well advanced. Interchange design at 66th Avenue is in progress anticipating construction in the next few years. Right-of-way for the 66th Avenue Interchange will be furnished by the City of Oakland.

Projects for additional widening of Nimitz Freeway between Davis Street and Hegenberger Road and between Washington Avenue and Davis Street are being designed.

The contract for landscaping the Marina Boulevard Interchange (First Street) in San Leandro was completed in March, with $11,500 allotted for this work.

Plans have been completed for the erection of 6.8 miles of median barrier on Route 17 between Jarvis Avenue and Jackson Street (Route 92). Design studies for the enlargement of Winton Avenue Interchange in Hayward are currently in progress.

Revisions to the plans for the Industrial Parkway Interchange to provide for future eight lanes on the freeway are being studied. This project includes a scale installation south of Tennyson Road. Rights-of-way for the interchange ramps will be financed by the city.

Design studies are in progress for the construction of an initial two-quadrant cloverleaf interchange at Stevenson Boulevard (formerly P.G. & E. Road). Rights-of-way for this project will be furnished by the City of Fremont under cooperative agreement.

Caldecott Tunnel

Work has been completed on two projects for the renovation of the old Caldecott Tunnel bores, and a third project to provide for four-lane peak hour traffic flow in each direction is in progress. The first of the two contracts called for mechanical and electrical renovation of the old bores, including painting and installing new lights. This work cost approximately $851,000. The other contract included the construction of struts and the installation of a drainage system in the old tunnels at a cost of $310,500. Both projects were completed in March.

Funds in the amount of $339,000 are allotted for the third project which provides for the installation of lane control devices and necessary signing. The devices, which function by use of compressed air, should be fully operative this summer, concurrent with the completion of the freeway project discussed below.

Construction on the new bore for the Caldecott Tunnel was completed, and it was placed in operation in October. This project, which cost approximately $10,897,000, provides a two-lane, 28-foot roadway with a 4-foot sidewalk on one side and a 2½-foot emergency walk on the other. The length of the bore is 3,371 feet. The contract included tiling and lighting the interior, ventilating equipment, fire-protection facilities and a closed-circuit TV system for traffic surveillance.

Route 24

West of the tunnel, a $4,404,000 contract has been in progress since early last year on portions of Route 24 between 0.4 mile west of Warren Boulevard Freeway (Route 13) and the west portal. This work includes the 260-foot-long Kay Overcrossing; a partial interchange, approximately one-half mile east of Lake Temescal on Route 24 and a signalized intersection at Tunnel Road and Route 13, just north of Lake Temescal.

The eastbound traffic lanes are expected to be opened to traffic this summer. At that time it will be possible to operate the central tunnel in reversible direction by use of the new lane control system.

Detailed design studies for Route 24 between Golden Gate Avenue in Oakland and Warren Boulevard Freeway(Route 13) are continuing. These studies include alternate plans for embankment utilizing a variety of short walls to reduce the effect on the adjoining property at the control points. The City of Oakland approved the parallel off-ramp at Patton Street on

Caldecott Tunnel construction. After the walls were painted, new fluorescent strip lighting fixtures were installed. Here a workman inspects the ballast wiring for a strip section.

the portion between Interstate 580 and Golden Gate Avenue in January.

Design studies for the freeway-to-freeway connector ramps between Route 24 and Interstate 580 are well advanced.

The design work east of Golden Gate Avenue to the Nimitz Freeway is being coordinated and scheduled to accommodate both rapid transit and City of Oakland redevelopment. Additional rights-of-way required because of rapid transit between 27th Street and Golden Gate Avenue are being acquired.

Route 92

A contract for the construction of three miles of Route 92 between the San Mateo-Hayward Bridge and Hesperian Boulevard in Hayward was started in February by Ivaldi Bros. & Associates and Andell, Inc. This project will provide a full freeway facility between the bridge and west of Hesperian Boulevard at a cost of approximately $3,111,000. The existing grade crossing of the Southern Pacific Railroad at Mt. Eden will be eliminated by a separation, and access to the freeway will be provided by interchanges at Industrial Boulevard and at the intersection of Clawiter and Eden Landing Roads. Frontage roads will be provided for access to properties west of Clawiter Road. Completion of this project is expected by the summer of 1966.

Design studies for the portion of Route 92 between Route 17 and Interstate 580 near Castro are proceeding, looking toward a freeway agreement with the city.

Other Projects

The landscaping project for the approaches to the Posey and Webster Street Tubes is nearing completion, with some $29,600 allotted. It should be completed this summer.

The contract for the rehabilitation of the Posey Tube Portal buildings was completed in February. This project included steam cleaning, concrete removal and painting at a cost of $32,600.

CONTRA COSTA COUNTY

Interstate Route 680

Construction was completed recently on 6.7 miles of four-lane freeway on Interstate 680 between Danville and Walnut Creek. This project has been open to traffic and Interstate 680 has functioned as a full freeway from Danville to the Benicia-Martinez Bridge since early December. Southerly of Danville, two projects are currently under construction which will complete Interstate 680 within Contra Costa County and Alameda County as far as Interstate 580 (see Alameda County section).

The Danville to Walnut Creek contract is the largest single roadway contract let to date in the bay area and required about two and three-quarters years to complete. The total cost of the work was $13,750,000, including participation by local jurisdictions. Separation structures for interchanges and local traffic are provided at Sycamore Valley, Diablo, El Pintado, El Alamo, El Monte, Stone Valley, Rudgear and Livorna Roads. Four bridges were constructed over San Ramon Creek and overheads were built over the Southern Pacific Railroad at Danville and at South Walnut Creek.

South of Danville, 5½ miles of Route 680 between 1 mile north of the Alameda county line and Sycamore Valley Road is currently under contract. Work was started February 4, 1965, on this $7,700,000 project. The contractor is Fredrickson & Watson Construction Co.

Access to the freeway will be provided at Crow Canyon Road and bridges will be constructed across San Ramon Creek. Other structures include undercrossings at Pine Valley Road and Donegal Avenue and overcrossings at Bollinger Canyon and Norris Canyon Roads and County Road "D" (North San Ramon) to provide for local traffic separation.

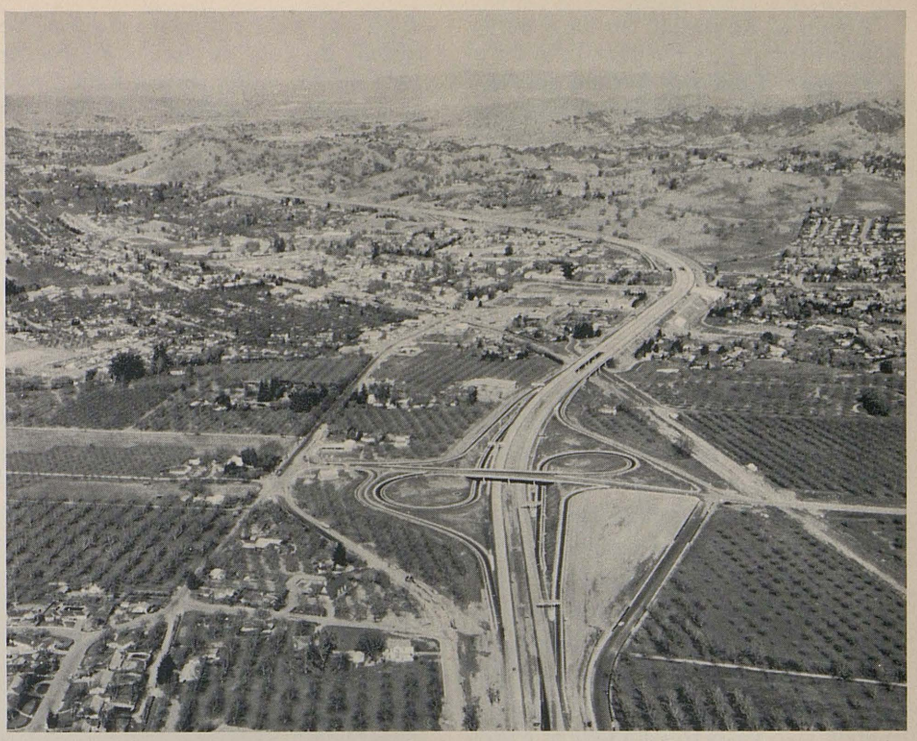
Technically, work was not completed until March on a contract on Route 680 between Monument Boule-

The Monument Boulevard project involved improvement of a heavily traveled two-lane road to a modern four-lane arterial. The new Walnut Creek Bridge is visible in the middle of the photo.

vard in Concord and Willow Pass Road, although the freeway lanes and traffic separations on this portion were opened to traffic in January of last year. Construction on Route 680 consisted of completing the Monument Boulevard Interchange and constructing a Y interchange at the intersection of Routes 242 and 680, in addition to grading and surfacing four lanes on Route 680. The remainder of the contract consisted of the construction of nearly four miles of freeway on Route 242 between Monument Boulevard and Olivera Road (see Route 242 below).

Plans are complete for adding two lanes to slightly over six miles of Route 680 between South Walnut Creek Overhead and Route 242 north of Monument Boulevard and design studies are in progress for the future project to add two lanes in the median between Sycamore Valley Road and South Walnut Creek Overhead.

Design studies are in progress for landscaping approximately 3.2 miles of the completed freeway between Walden Road in Walnut Creek and the south city limits of Concord. Studies are also in progress for 6.5 miles of tree and functional planting on portions of Interstate 680 between one mile south of Danville and Crest Avenue in Walnut Creek. One hundred fifty thousand dollars has been budgeted for this work, which will be started this fall.



Looking north from the Sycamore Valley Road interchange south of Danville along the recently completed freeway between Walnut Creek and Danville on Interstate 680.

Route 4

Work was started in the middle of February on the construction of 4.7 miles of four-lane freeway between 0.2 mile west of Cummings Skyway and 0.1 mile west of Howe Road in Martinez. Nine million two hundred fifty-nine thousand dollars has been allotted for this contract, which is expected to be complete in late 1966 or early 1967.

The project is generally on new alignment replacing the tortuous Franklin Canyon route. Gordon H. Ball Enterprises and Syar & Harms are the contractors.

Design studies are being continued for four miles of the future Route 4 freeway between A Street and the Route 4/84 interchange near Neroly Road. This project includes that portion of future Route 84 freeway between Route 4 and the Antioch Bridge.

Route 24

Construction on almost two miles of eight-lane freeway between the east portal of Caldecott Tunnel and Orinda was completed in February. This work, which requires almost 2½ years to complete, cost approximately $6,974,000. Interchanges were constructed at the east portal of the tunnels and at Gateway Boulevard. Cable chain link median barrier was installed throughout the majority of the project and blocked-out metal beam barrier was used in interchange areas.

Work has been completed on two projects for the renovation of the old Caldecott Tunnel bores and a third project to provide for lane-changing devices to accommodate four-lane directional flow is in progress (see Alameda County section).

Preliminary approval has been given to a plan to locate a six-mile portion of the Bay Area Rapid Transit District net-work within the freeway median strip on Route 24 between Orinda and Walnut Creek—subject to negotiation of a satisfactory financing agreement. This location will reduce right of way requirements for the transit facility as well as provide improved aesthetics, but will require reconstruction of the westbound freeway lanes and interchanges.

Interstate Route 80

Funds in the amount of $300,000 have been budgeted for the construction of ramps at County Road 20 on Interstate 80 near San Pablo, and this work is expected to be advertised this fall.

Work was completed in April on a cooperative project for ramp widening at the nothbound off-ramp to San Pablo Dam Road. This work cost approximately $43,500, of which $9,000 was contributed by the City of San Pablo.

Route 242

Although the freeway lanes have been in service for several months, the contract for the construction of the four-lane freeway on Route 242 between Monument Boulevard and Olivera Road was not completed until early March. This work included the construction of Route 680 between Monument Boulevard and Willow Pass Road, which is discussed in connection with that route.

Access to Route 242 for local traffic is provided at interchanges at Willow Pass Road, Concord Avenue and Solano Way. The total allotment for the contract, including work on Interstate 680, was $5,480,000.

A contract for widening Monument Boulevard, the former Route 242 facility, was completed in March. Rights-of-way for this project, between Buskirk Avenue in Pleasant Hill and 0.2 mile west of Oak Grove in Concord, together with $148,000 of construction costs were furnished under cooperative agreements with local jurisdictions. The total cost of the work was $298,000. This facility was constructed to a four-lane conventional highway, including a modern four-lane structure with sidewalks over Walnut Creek.

Work was also completed recently on former State Sign Route 24 (Monument Boulevard and Galindo Street) between Oak Grove Road and Salvio Street in and near Concord. Total cost of this project was $30,800.

MARIN COUNTY

Route 101

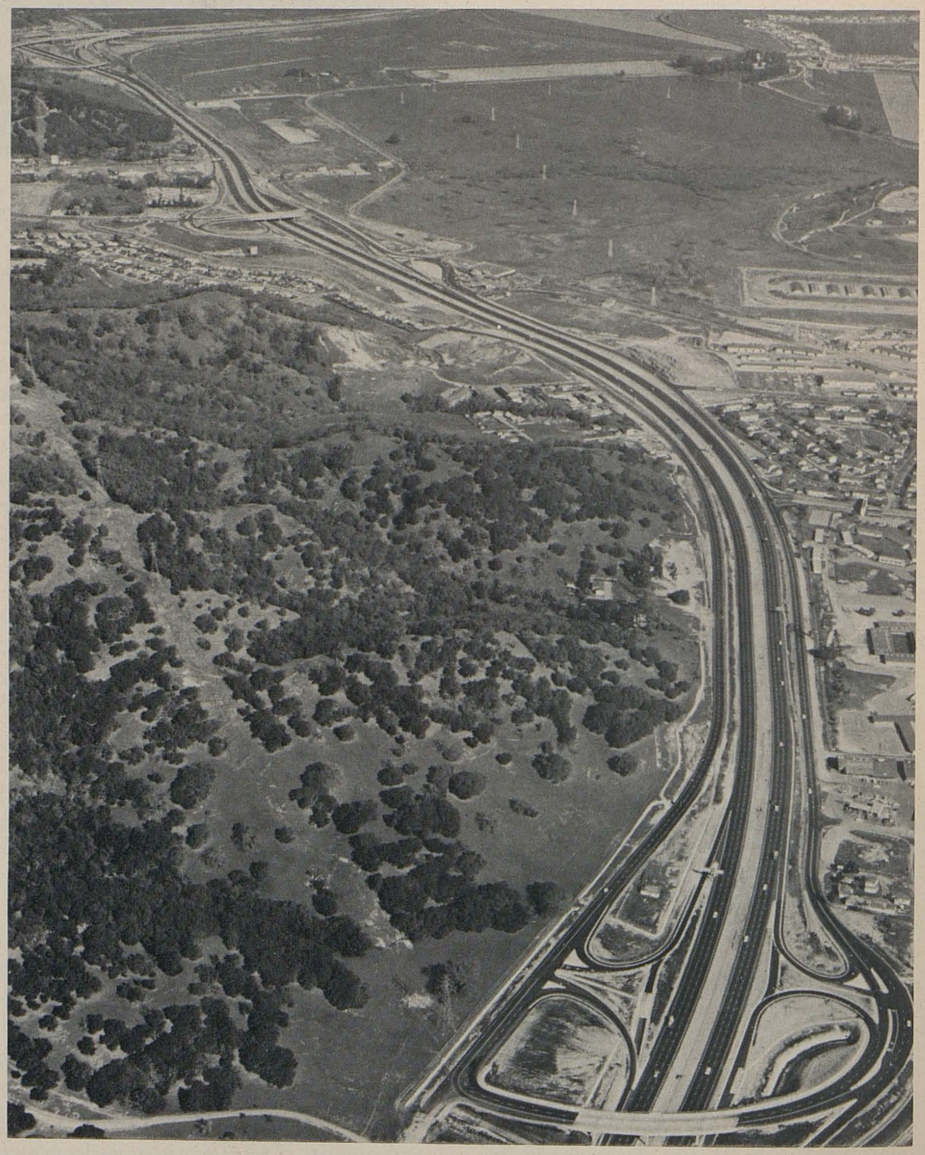
Another step toward the conversion of Route 101 to full freeway between the Golden Gate Bridge and central Novato—a distance of nearly 21 miles —was recently completed.

The last segment of this job, 2.7 miles of six- (ultimately eight-) lane freeway between Miller Creek Road and Entrada Drive, took approximately two years to complete at a cost of $4,241,000. The contract was performed by a joint venture of Syar & Harms, Gordon H. Ball and Gordon H. Ball, Inc.

The project, which was completed in the middle of December, included climbing lanes in both directions over St. Vincent's Hill. Interchanges were constructed at Ignacio (San Jose) Boulevard and at Bolling Drive in the Vicinity of Pacheco Creek. Access to Hamilton Air Force Base is provided by a frontage road between these interchanges.

Work was started in February on the first of several projects for the eventual reconstruction of six miles of Route 101 to eight-lane freeway between San Quentin Wye and Miller Creek Road interchange. This contract, between Irwin Street and Third Street in San Rafael, will realign streets and off-ramps and provide improved local service on the frontage roads by eliminating points of severe conflict. Funds in the amount of $616,000 have been allotted for this work.

The construction of a freeway-to-freeway interchange at the intersection of Routes 37 and 101 was completed on July 13, 1964. This project, which was started in February of 1963, cost approximately $4,278,000. Five major structures, including separations over the Northwestern Pacific Railroad tracks, were constructed on this contract. The contractor was Peter Kiewit Sons Company.



A six-lane freeway section was constructed opposite Hamilton Air Force Base near Novato. View is north.

Smaller Projects

The contract for landscaping and construction of restroom facilities at the Vista Point area at the north end of the Golden Gate Bridge will be completed shortly. Some $65,600 is allotted for this work. Design studies for the west side parking lot and a freeway connection at this location are suspended pending clarification of Golden Gate Bridge expansion plans.

Work began in March to construct approximately 0.8 of a mile of Route 131 as a four-lane divided conventional highway. This work, along Tiburon Boulevard between Blackfield Drive and beyond Reed Ranch Road, will cost approximately $610,000 and take about seven months to complete.

Portions of existing Tiburon Boulevard will be utilized as a frontage road on the southerly side of Route 131 in conjunction with Greenwood Cove Drive. The contract includes grading 0.4 of a mile between Reed's Underpass at Trestle Glen Drive and west of San Rafael Avenue in Tiburon and placing rock slope protection along Richardson Bay.

A $151,000 contract for resurfacing, reconstruction of shoulders, and the installation of underdrains was completed in February north of Atherton Avenue in Novato on the Redwood Highway (US 101). This work is similar to a project completed in this area last year.

Minor widening has been completed on 0.4 mile of Route 1 between Stinson Beach and three miles southerly. Design studies are also in progress for the replacement of the Stemple Creek Bridge and for drainage improvements between Stinson Beach and Marshall.

Median Barrier

Installation of 5½ miles of median barrier between approximately ½ mile south of Waldo Undercrossing and Corte Madera Creek was recently completed. Several types of experimental glare shields were installed as a part of the project. These included vertical and diagonal plastic strips and expanded metal mesh screen. Almost $187,000 was allotted for this project, of which $39,000 was for the experimental installation of glare shields.

A contract for the installation of median barrier between the north end of the San Rafael Viaduct and the south end of Corte Madera Creek Bridge was started in February. Funds in the amount of $137,000 have been allotted for this 2½-mile project.

Landscaping

The landscaping contract at Tierra Linda Interchange (Manuel T. Freitas Parkway) was completed in August, an $88,500 project. Installation of an irrigation system was included.

Design studies are in progress for 1.1 miles of landscaping south and north of Corte Madera Creek, and for additional planting at Spencer Avenue interchange.

NAPA COUNTY

Route 29

A $955,000 contract to build a 1.2-mile section of four-lane divided freeway in the City of Napa between Old Sonoma Road and Trancas Street (Redwood Road), was completed last May.

Frontage roads were provided on the westerly side between Old Sonoma Road and Laurel Street and in the vicinity of First Street. Major structures were constructed at Napa Creek Bridge and First Street Overcrossing.

An interim project on Route 29 was also completed last May. This project, from two miles north of Trancas Street to 2.7 miles south of Yountville, consisted of increasing skid resistance by resurfacing portions of the existing pavement with open-graded asphalt concrete and replacing raised traffic bars.

Bids were opened on March 24, 1965, for signals, lighting, and widening at Imola West and Jefferson Street in Napa. Some $35,000 is budgeted from State funds. Both the City and County are contributing $5,800.

Other Routes

Construction was completed last September on a 26-foot all-paved section on Route 121 about two miles northeast of Vichy Avenue. Approximately 1.2 miles of widening and minor improvements in alignment were included in the work. This project cost nearly $83,300. On November 6, 1964, the $35,000 contract to realign Route 128 to ease a curve approximately ten miles east of Rutherford was completed.

Future Projects

Plans are being revised for a project on Route 29 between Napa Creek and Trancas Street to include a northbound off-ramp at Lincoln Avenue interchange.

This project will complete Route 29 to a four-lane freeway from south of Imola Avenue to south of Trancas Street.

Design studies are in progress for completing the development of the four-lane expressway north of Trancas Street to two miles north of Yountville, and for an ultimate four-lane freeway between north of Yountville and Ritchie Creek. This project is planned initially as a two-lane expressway bypassing St. Helena.

Design studies are underway for nearly one mile of reconstruction on Route 128 east of Pope Valley Road as a part of the continuing improvement of the existing facility. Funds in the amount of $50,000 have been budgeted for this project. It is the fourth of several contracts of a similar nature, and design studies for another 1.3 miles on Route 128 are in progress.

SAN FRANCISCO COUNTY

Within the past year the most significant developments in San Francisco have been the completion and presentation of two of the most extensive and imaginative studies for urban freeway routes ever undertaken by the Division of Highways.

These involved the development of the Panhandle Parkway extension of Interstate Route 80 from the San Francisco Civic Center to the Golden Gate Bridge and the recently completed studies for Interstate Route 480 from the Embarcadero Freeway, along the north waterfront area to the Golden Gate Bridge.

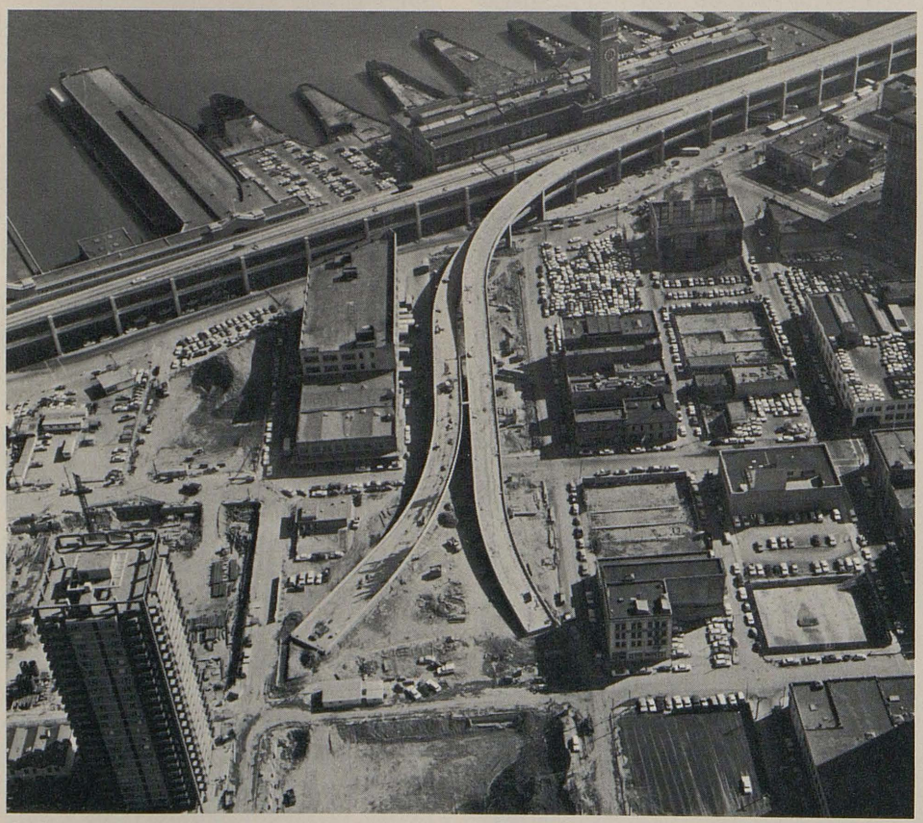
Route 82

When the section of Route 82 (known locally as the Southern Freeway) from Orizaba Avenue to Mission Street opened to traffic in August, motorists were provided with a safer, signal-free ride from the southwesterly corner of San Francisco to the Bay Bridge and downtown San Francisco via this new route and the James Lick Freeway (US 101).

Construction costs on this new six-lane freeway totaled more than $22,000,000. More than six years and four major construction projects were required to complete the approximately four miles between Orizaba Avenue and the Route 82/101 interchange. The Guy F. Atkinson Company built the interchange, while the firm of Charles L. Harney, Inc., performed the other three contracts.

Many traffic separation structures, major street connections, retaining walls and pedestrian overcrossings were constructed on these projects.

Approximately one-third of the work has been completed on the portion of Route 82 between Newcomb Avenue and Army Street. The project includes construction of a double-deck viaduct transitioning to a single-deck viaduct in the vicinity of Evans Avenue and the construction of ramp connections in the vicinity of Army and Pennsylvania Streets. The latter facilities are an integral part of the future Islais Creek Interchange, to be constructed at the junction of Routes 82 and 87. Some $5,380,000 has been allotted for this contract which is expected to be completed in the spring of 1966.



Structure work on the Clay-Washington ramps to the "Embarcadero" Freeway, shown as it neared completion. The ramps were integrated with the overall plan for the Golden Gateway Redevelopment Project. One of the completed apartment towers appears at lower left. The excavation at the bottom of the photo is the site for a large parking facility.

Route 87

The first unit of Route 87, the future north-south freeway intended to relieve congestion on Route 101, has been budgeted. A total of $9,500,000 has been approved which will cover the construction of nearly 1.5 miles of this eight-lane freeway between Evans Avenue and 18th Street.

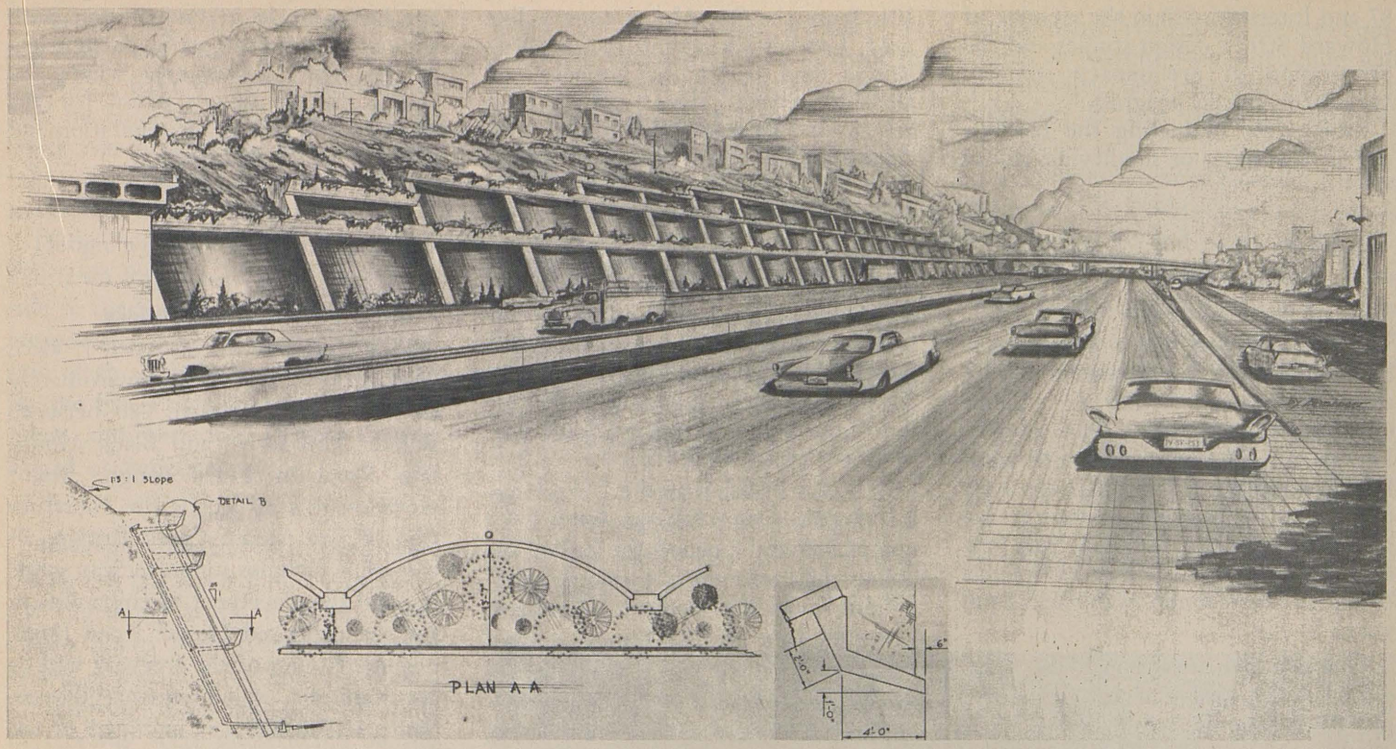
Interchanges to provide access to the freeway will be constructed at 18th and 25th Streets and overcrossings for local traffic separation will be constructed at 18th and 20th Streets.

An unusual feature of this project will be the precast concrete retaining wall in the Potrero Hill area. Planting balconies will be provided in this wall for landscaping intended to enhance the finished appearance of the wall.

Interstate Route 480

The contract for the construction of the Clay and Washington Street ramps has been completed by Stolte, Inc., and these facilities are now open to traffic. The ramps connect Interstate 480 (locally known as the Embarcadero Freeway) with the Golden Gateway redevelopment project in the City of San Francisco and should relieve some of the congestion due to lack of access northerly of Market Street. This project, which included sign structures, signs and lighting, cost approximately $1,422,000.

Location studies on extending Interstate 480 northerly have been completed and a wide range of alternative routings for the proposed location were present to the board of supervisors on March 8, 1965. They include a variety of proposals to extend Interstate 480 from the vicinity of Broad-



An unusual feature of the future eight-lane freeway between Evans Avenue and 18th Street will be the precast retaining wall in the Potrero Hill area. Planting balconies will be provided in this wall for landscaping intended to enhance the finished appearance of the wall.

way and the Embarcadero through the north waterfront area of San Francisco to a connection with the Golden Gate Bridge.

The studies were undertaken at the request of the board of supervisors and were made in cooperation with the city technical staffs, and in association with the architectural form of Eckbo, Dean, Austin and Williams. Among the proposals are a variety of engineering forms, including tunnels under Telegraph and Russian Hills, depressed and elevated designs, and structure along the edge of the bay.

On April 28, 1965, the California Highway Commission took this routing under consideration, after receiving a recommendation from State Highway Engineer J. C. Womack, but deferred further action for 60 days in view of routing studies being conducted by the board of supervisors.

Other Routes

Other current construction within San Francisco is being performed on Route 1 as a part of a contract on Interstate 280 between Eastmoor Avenue in Daly City and north of Alemany Boulevard Overcrossing (see San Mateo County). Route 1 within San Francisco is a connection between Route 82 at San Jose Avenue and Interstate 280 in the vicinity of Alemany Boulevard-Knowles Avenue in Daly City. Within San Francisco, traffic separations are being constructed at Alemany Boulevard and in the vicinity of St. Charles Avenue in addition to the freeway connection. The San Pedro Overcrossing on the Daly City portion of Interstate 280 was opened to traffic in March.

A contract was completed in February for the placing of reflective markers on 4.2 miles of Route 101 (James Lick Freeway) between the San Mateo county line and 17th Street to improve night visibility of traffic striping particularly in rainy weather.

Landscaping

Bids were opened on March 10, 1965, for a project to landscape 2.2 miles of Route 82 between Route 101 and Havelock Street, westerly of James Lick Freeway. There is $267-000 allotted for this work, which will take about nine months to complete.

Plans are being prepared for two additional landscaping projects on Route 82 on portions of the freeway which were completed last fall. Funds in the amount of $135,000 are available for landscaping 1.3 miles of divided freeway between Ocean and San Jose Avenues and $60,000 has been budgeted for landscaping the one-half mile of viaduct between James Lick Freeway (Route 101) and Revere Avenue.

Future Projects

The route was adopted for Routes 87 and 230 between Army Street near Islais Creke and Route 101 near the San Mateo county line last year. Design studies for this portion including interchange studies at both ends are underway.

Design studies are also underway for the extension of Route 87 between 18th Street and Sixth and Brannan Streets. Freeway agreements for this portion have been executed. From Sixth Street to the junction of Routes

87 and Interstate 480 in the vicinity of Howard Street, design studies and the preparation of preliminary freeway agreements are in progress.

Studies for evaluating the feasibility of expanding or modifying Route 101, from the San Mateo county line near Candlestick Point to the Bay Bridge, and Route 80, between the Division Street Wye and Mission Street, to increase operational efficiency are in progress. These studies are being made in cooperation with the city technical staff, particularly in the Army Street area where the city is in the design phase for the construction of a grade separation and new ramps to the freeway.

SAN MATEO COUNTY

Interstate Route 280

A total of five major projects are currently under construction, advertised or financed within San Mateo County on Interstate 280, locally known as the Junipero Serra Freeway. Design studies are being expedited on the remaining portions to insure that this entire facility between San Jose and San Francisco is either completed or under construction in the next four years.

Considerable attention has been given in the design of Interstate 280 to the preservation and, when possible, the enhancement of the natural beauty of the area through which the freeway is located. To assist in these aims, medians of varying width and roadways separated by as much as 40 feet in height are provided, opening up unrestricted vistas of scenic views to both directions of traffic. In addition, the improved architectural treatment of structures and designed configuration of slopes is intended to integrate the roadway with the natural terrain bordering it.

The portion between one-half mile south of Eastmoor Avenue in Daly City and Orizaba Avenue in San Francisco should be opened to traffic in the summer of 1966. Funds in the amount of $9,978,000 are allotted from state highway funds for this work, with additional moneys being provided by the City of Daly City and the San Mateo County Sanitary District.

Interchange facilities are being constructed in the vicinity of Market Street, Washington Street and Alemany Boulevard-Knowles Avenue, all in Daly City, with an on-ramp from San Francisco being provided by modification of the existing Alemany Boulevard Overcrossing at the northerly end of project. Separations for local traffic are provided at San Pedro Road, Washington Street, School Street, Knowles Avenue and at two locations on Junipero Serra Boulevard, which is being realigned.

The San Pedro Road and Washington Street Overcrossings have been completed and opened to traffic, enabling the contractor to resume excavation along the freeway alignment.

Preliminary to the above project was a contract for relocation of storm drains on Junipero Serra Boulevard, approximately one-quarter mile south of Knowles Avenue in Daly City which was completed last May.

In addition to construction on Route 280, the contract includes work on portions of Route 1 which intersect the interstate facility in this vicinity. In San Francisco, traffic separations are being constructed at Alemany Boulevard and in the vicinity of St. Charles Avenue. Other work on Route 1 in Daly City consists of rough grading, drainage and frontage road facilities for a future freeway connection on that route between Routes 1 and 280.

Plans are completed for extension of this interstate facility southerly through Daly City. More than $10,000,000 is budgeted for the 3.3-mile portion of Route 280 from Arroyo Drive in South San Francisco to Eastmoor Avenue in Daly City.

Access to the freeway will be provided through interchanges at Westborough Boulevard, Hickey Boulevard Extension and Collins Avenue Extension. Separations for local traffic will be built at Chinese Cemetery Road and King Drive Extension. All of the proposed extensions will be constructed by other jurisdictions.

San Mateo Creek Bridge

Bids were opened on April 7, 1965, for the construction of approximately two miles of Interstate 280 between Bunker Hill Drive and Black Mountain Road in Hillsborough. Major work on this project is the construction of San Mateo Creek Bridge, although it includes some freeway grading and the placement of embankment for the proposed Hayne Road Interchange. Paving of the freeway will be accomplished on subsequent projects. Some $2,500,000 was included in the 1964–65 budget to partly finance this work, with an additional $4,785,000 being provided in the 1965–66 budget.

The final design of the San Mateo Creek Bridge by the Division of Highways Bridge Department is the result of many studies. The studies and a model of the design were reviewed with the Peninsula Highway Policy Committee last year.

Bids were opened May 19, 1965, for another major project on Interstate 280 between Summit Drive and San Bruno Avenue in San Bruno. This construction includes 1.7 miles of freeway and the placement of four embankments between Summit Drive and Larkspur Drive, as well as additional embankment construction on Route 1 on the portion between Route 280 and St. Francis Boulevard.

Excess Material

Material for these embankments will come from the section of the route between Larkspur Drive and Route 186 in San Bruno. The rest of the excess material will be hauled to the San Francisco Airport or some other optional disposal site. Some $8,500,000 is available for this project.

Farther south, the structure carrying Route 280 over the Stanford University two-mile linear accelerator will be completed this summer. The work was undertaken early to maintain coordination with work being preformed on the accelerator.

Design work on a unit of Interstate 280 from Raymundo Drive in Woodside to the San Mateo Creek Bridge is temporarily delayed due to consideration of an alternate location requested by the San Francisco Water Department and the San Mateo County Board of Supervisors.

Route 1

Although the freeway lanes were opened to traffic on January 29, 1965, the remaining work on Route 1 between Sharp Park Road and Manor Drive in Pacifica was not completed until spring. Two and one-half miles of freeway were constructed on this $4,364,000 project by McNamara Corporation, Ltd. Interchanges were constructed at Sharp Park Road, Brighton Road-Paloma Avenue and Manor Drive, plus a pedestrian overcrossing at Milagra Drive and a similar undercrossing at Sharp Park Golf Course.

As an interim improvement a contract for the widening of Route 1 to four 10-foot traffic lanes, without shoulders, between Linda Mar Boulevard and one mile south of Sharp Park Road was completed in February. A six-foot-wide pedestrian walkway was built along the westerly side of the reconstructed highway. The City of Pacifica obtained the necessary rights of entry and slope easements.

The development of Route 1 in Daly City between Route 35 and Interstate 280 is being handled in connection with construction of three separate projects. The earthwork and frontage road construction is discussed herein in connection with two projects on Interstate 280. Design studies for structure construction and paving the portion between Routes 35 and 280 are in progress.

A resurfacing and channelization contract on Route 82 (El Camino Real) between Finger Avenue in Redwood City and Central Avenue in San Carlos was completed in February. Also completed in February was a project for drainage improvements at Watkins Avenue. This work is intended to alleviate flooding at Atherton Creek.

Numerous signal and channelization revisions are being designed on El Camino Real in the cities of San Mateo, Burlingame and Redwood City, and a similar project is underway in Belmont.

Other Routes

The contract for the placing of approach embankments for structures on Route 92 near the west end of the San Mateo-Hayward Bridge was completed in March. This scheduling will permit settlement prior to bridge construction in this relatively unstable area.

The superstructure contract for the new San Mateo-Hayward Bridge is well underway and many of the column bents have been poured. This work is administered by the Division of Bay Toll Crossings and is expected to be completed in the summer of 1967.

Bids were opened on March 24, 1965, for a project to widen the 4.8-mile section of Bayshore Freeway (Route 101) between 19th Avenue in San Mateo (Route 92) and Broadway in Burlingame to eight lanes. The

Traffic has more direct and convenient access to Woodside Road, bypassing downtown Redwood City, since completion of the new expressway.

The new freeway through Pacifica looking north along the coast from above the Sharp Park Golf Course.

work includes rough grading for the Whipple Avenue Interchange, construction of median barrier, and the updating of signing and lighting. Funds in the amount of $1,100,000 are budgeted.

Other Routes

The Route 82/114 separation on the project on Route 114 between Cypress Avenue, south of El Camino Real and Bayshore Freeway, was opened to traffic March 27, 1965. This facility replaces the former "Five Points" signalized intersection on El Camino Real. The remaining structure work at Redwood Junction Overhead over the Southern Pacific Railroad is nearly completed, with the entire contract to be finished late this summer.

In addition to the structures, a four-lane expressway is being built on 1.1 miles of this route. The sum of $2,329,000 was allotted for construction of the project, of which $1,040,000 was contributed by the City of Redwood City and County of San Mateo.

Landscaping

The plant-establishment period ended in March on the landscaping contract for the completed portion of Route 92 freeway between north of West Hillsdale Boulevard Extension and Grant Street. Additional oak tree planting was made possible as a part of the project by the contribution of $1,000 received from owners of the Borel Estate, adjacent to the freeway.

SANTA CLARA COUNTY

Interstate Route 280

Completion of one major contract and the anticipated completion of another on Interstate Route 280 by June will provide full freeway service to the rapidly growing areas in the heart of the Santa Clara Valley.

Almost five miles of six-lane freeway between Saratoga Avenue in San Jose and Stelling Road in Cupertino was completed and opened to traffic in March of this year. Access to the freeway is provided by interchanges at Lawrence Expressway-Stevens Creek Boulevard, Wolfe Road and Saratoga-Sunnyvale Road with a separation for local traffic having been constructed at Blaney Avenue. Generally the freeway is elevated in the vicinity of Lawrence Expressway-Stevens Creek Boulevard and depressed from Saratoga-Sunnyvale Road to Stelling Road. This $4,432,000 job was done by Fredrickson & Watson Construction Company.

North of this portion, one mile of six-lane construction is in progress on Route 280 between Saratoga-Sunnyvale Road and the vicinity of the future Route 280/85 interchange. This $1,000,000 contract, which includes an interim four-lane connection to future Route 85 just south of Homestead Road, should be opened to traffic this summer.

The only major structure included in this project is the construction of Stelling Road Overcrossing.

A contract was awarded in March and work is underway for constructing six lanes of Route 280 freeway between northwest of Foothill Boule-

vard and Magdalena Avenue and eight lanes of freeway between Magdalena Avenue and Page Mill Road. The median area varies from a minimum width of 36 feet to 100 feet, and the profiles of the roadways are separated to adapt the freeway to the natural terrain. Contractor is Green Construction Co. & Winston Bros. Co.

Interchanges are to be constructed at Magdalena and El Monte Avenues and ramp connections will be provided at Page Mill Road. Undercrossings will be built at St. Joseph Avenue, Robleda Road, La Barranca Way, Elena Road and Arastradero Road. Additional structures will be constructed at Maryknoll Overhead and Mora Drive Overcrossing. The "new look" in structure design on this project was the result of many studies to provide an architectural treatment which will both enhance their aesthetic appearance and blend with the natural beauty of the area through which the route passes.

Funds in the amount of $8,725,000 are included in the budget for construction of this seven-mile facility.

The project for the portion between 0.3 mile west of Stelling Road and 0.6 mile west of Foothill Boulevard is expected to be advertised in the next few months, with $3,600,000 available. Portions of the county's Foothill Expressway will be constructed as a part of this two-mile project.

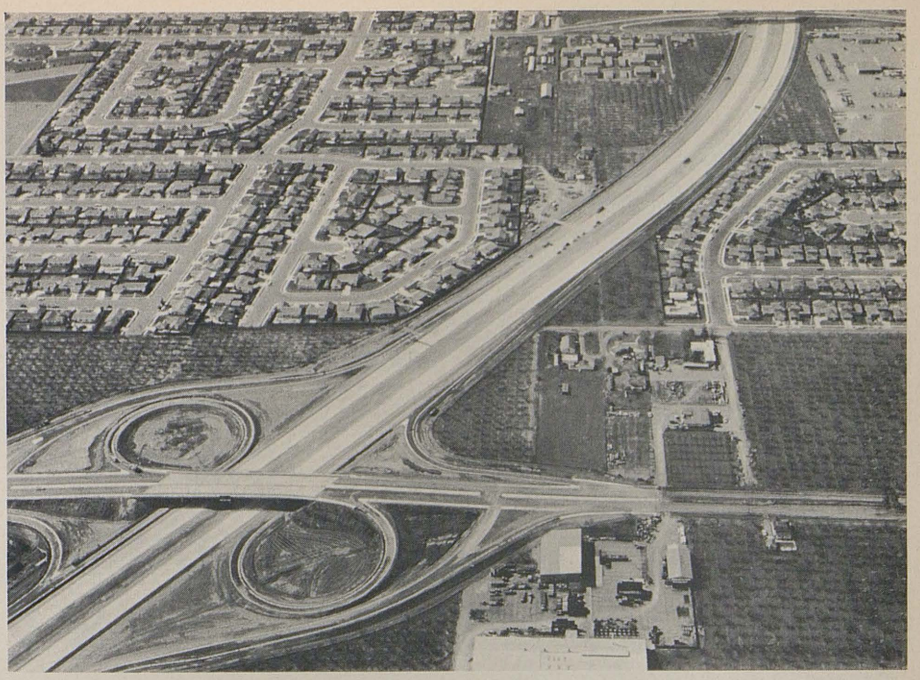
Route 82

Work was completed in March on the four-lane divided widening project on Monterey Road (Route 82) between Ford Road and Curtner Avenue in San Jose. This construction eliminates the former three-lane facility, which had been in use for many years.

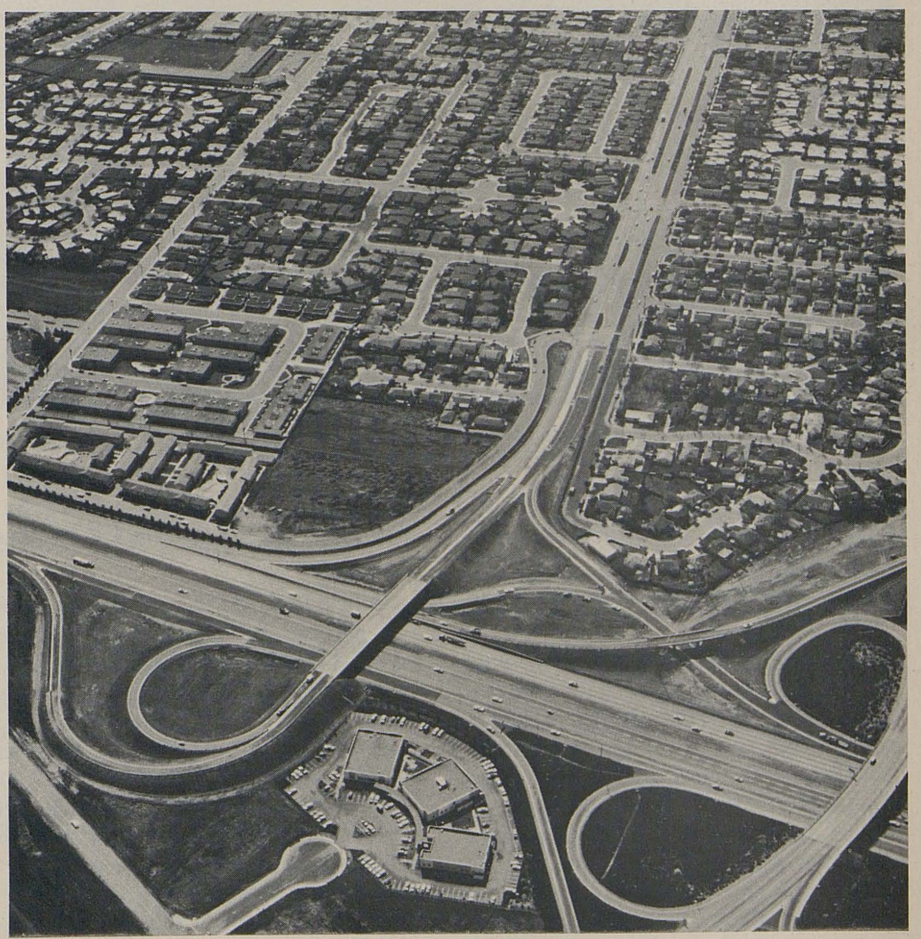
Total cost was $1,142,000, of which a portion was contributed by Santa Clara County.

Route 85

Construction is approximately two-thirds complete on Route 85 between Homestead Road in Cupertino and Route 101 in Mountain View. The facility should be opened to traffic this winter. In combination with the aforementioned construction on Inter-



The new section of Interstate 280 west of San Jose was completed in March. At lower left is Wolfe Road interchange.



The Oregon Expressway interchange on the Bayshore Freeway was completed in February. The interchange at lower right is with Embarcadero Road.

Looking north along Route 85 construction from above the El Camino Real interchange. Route 85 crosses over Route 237 near the center of the photo.

state 280 in this vicinity, a freeway loop is provided for traffic generated within the fast growing suburban areas.

Five and one-half miles of four-lane freeway are being constructed on this $6,600,000 contract. Access for local traffic will be provided by interchanges at Fremont and Evelyn Avenues, Homestead Road, Routes 82 (El Camino Real), 101 (Bayshore Freeway), and 237; Moffett Boulevard, and the proposed County of Santa Clara Central Expressway. Other structures include an overhead at the Southern Pacific Railroad and bridges across Stevens Creek at three locations.

Work has just started on a widening project on Routes 9 and 85 between Oak Place in Saratoga and 0.1 mile north of the Southern Pacific Railroad at Azule. This project, 2.3 miles in length, will cost approximately $706,000, of which $125,000 will be contributed by the County of Santa Clara. Approximately six months will be required to complete it.

Route 101

A project for the construction of nearly 19 miles of median barrier on Bayshore Freeway between Redwood Creek in Redwood City and Route 87 in San Jose was recently completed. The contract also included the installation of sign lighting systems between University Avenue in Palo Alto and Redwood Creek Bridge.

Construction of the Oregon Avenue Interchange on Bayshore Freeway was completed in March. This trumpet-type interchange serves the County of Santa Clara's newly constructed Oregon Avenue expressway. The structure and ramp connections augment the Embarcadero Road Interchange.

Currently, a contract is underway for the construction of interchanges on Route 101 between south of Tully Road and Coyote Creek. Traffic separation and access will be provided at the Capitol Expressway and Hellyer Avenue.

Work on connecting roads to the interchanges, being done under the jurisdiction of Santa Clara County, will be completed at the time the structures on this $1,277,000 project area ready to be opened to traffic.

Route 101 Freeway

Bids will be opened June 23, 1965, for converting the remaining 4½ miles of the present expressway on Route 101 between McKee Road in San Jose and Ford Road to an initial four-lane freeway. Major construction on this $1,900,000 project will be an interchange at Story Road and a separation structure at San Antonio Street.

Route 237

One and one-half miles of improved facilities on Route 237 between El Camino Real and Bernardo Avenue in Mountain View was opened to traffic last May. A four-lane divided expressway was constructed between El Camino Real and Church Street and a four-lane freeway from Church Street to Sylvan Avenue. This project, which cost approximately $1,568,000 and included the construction of the East Mountain View Overhead over the Southern Pacific tracks, was performed by a joint venture of L. C. Smith Company and Concar Ranch & Enterprises, Inc.

SANTA CRUZ COUNTY

Route 1

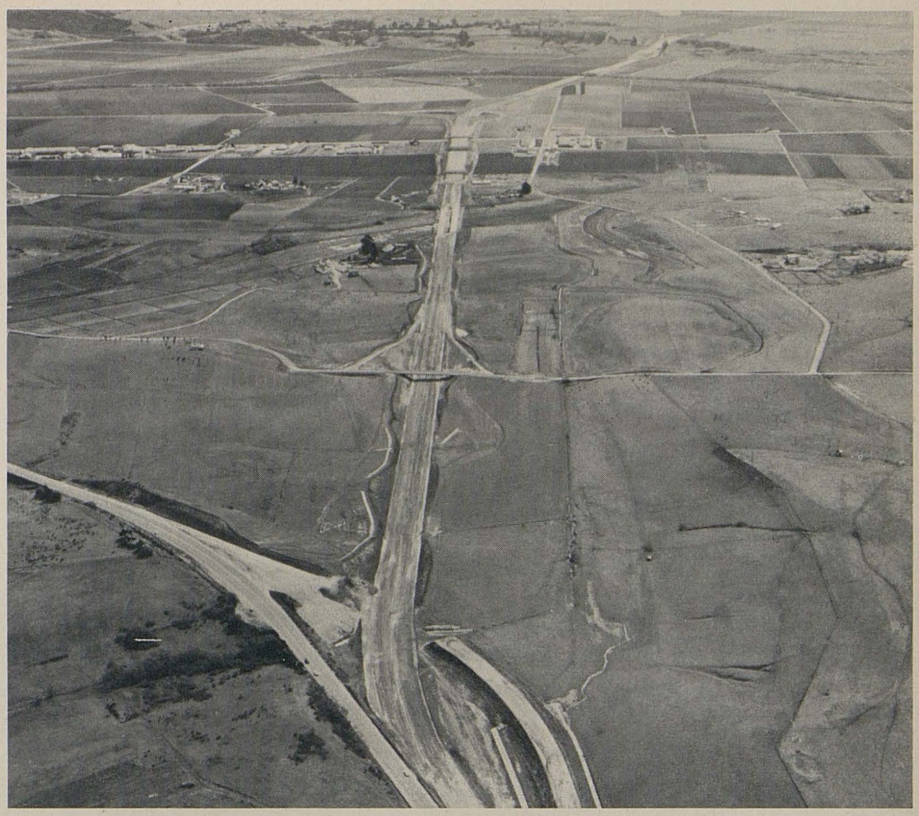
Adverse weather conditions slowed completion of the grading project on Cabrillo Highway (Route 1) near Watsonville. This five-mile project, between the Pajaro River and northwest of Watsonville, is completely on new alignment bypassing Watsonville to the west. Cost will be approximately $2,063,000.

Also included as part of this contract are an overcrossing at Harkins Slough Road and a bridge across Struve Slough, as well as rough grading of portions of Route 129 connecting the bypass to Main Street in Watsonville.

Surfacing is not part of the present contract because a surcharge is required on fills to expedite settlement and to stabilize freeway embankment through the marshy terrain. The budget, however, includes $3,000,000 for completing this project.

Construction on this phase will not begin until the surcharge has had sufficient time to accomplish its purpose. At that time the work will include removal of the surcharge and completion of the separation structures at the junctions of Route 1 with Route 129 and Route 152.

In addition to the paving of 3.6 miles of four-lane highway on Cabrillo Highway, 1.6 miles will be paved on Route 129 between Route 1 and Main Street in Watsonville. An interchange facility will be constructed at the junction of Route 1 and 152. It is anticipated that advertising for bids will be submitted in November 1965.



The first phase of construction on the Watsonville Bypass has been completed. For the next year the work will be allowed to stand while foundation materials settle; then the final phase of the work will be started. The view is southeast, toward Monterey County.

Projects in Santa Cruz

A project for the construction of left-turn storage lanes and modifications to the existing signal system at the Route 1 freeway terminus and Mission Street in Santa Cruz was recently completed. This work was administered by the City of Santa Cruz, in connection with their improvement of Chestnut Street. The state contributed $18,000.

The sum of $110,000 has been budgeted for 0.5 mile of reconstruction and resurfacing on Route 1 between Green Street and Rigg Street in Santa Cruz.

SONOMA COUNTY

Route 101

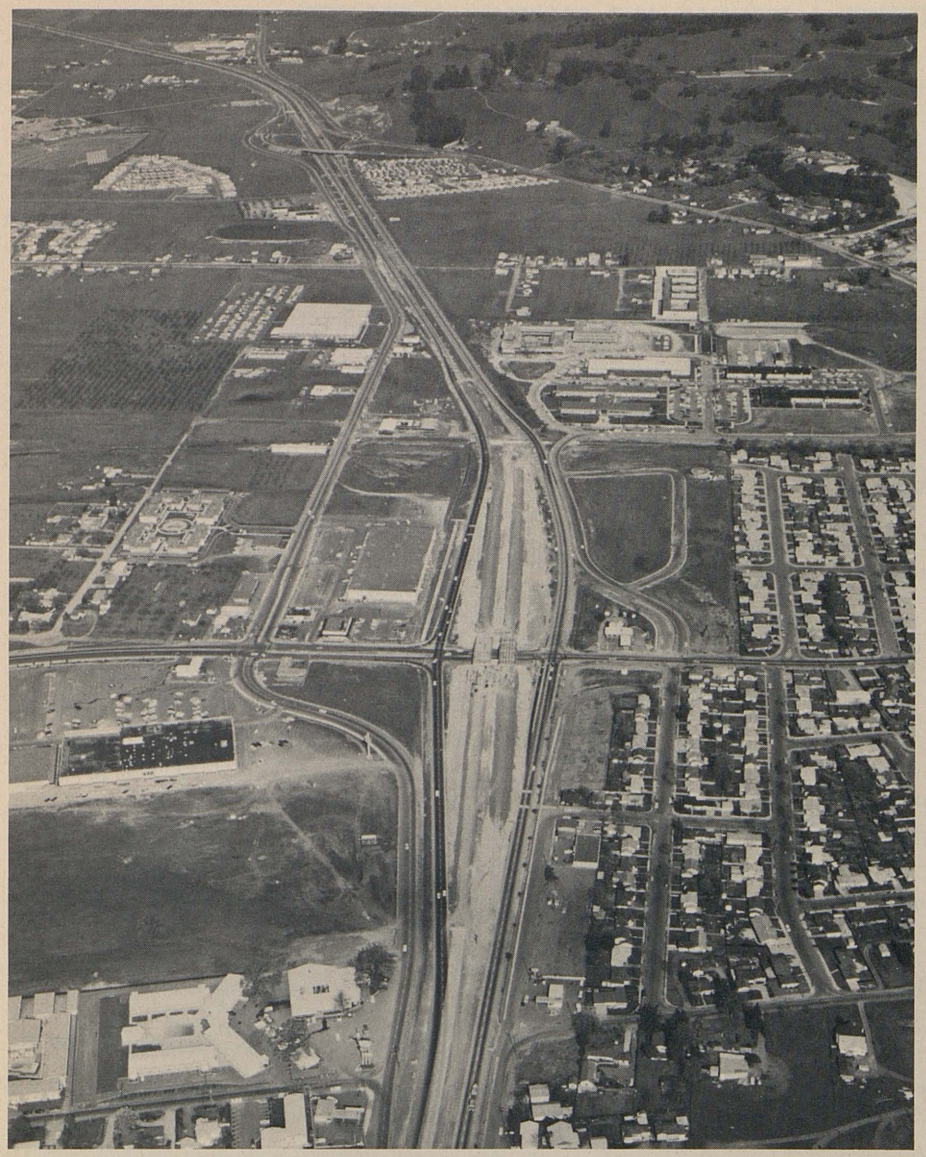
The completion and opening to traffic of two major adjoining projects on the Redwood Highway late last year, totaling almost $3,500,000 in construction costs, now provides the motorists of Sonoma County with more than five miles of four-lane freeway between Lytton and Cloverdale, as a part of the conversion of the Redwood Highway to a modern freeway facility.

One $2,297,000 contract between Washington School Road and Hiatt Road was completed on August 17, 1964. This work, known locally as the "Asti Bypass," included undercrossing and access ramps at Dutcher Creek Road and Asti Post Office Road, in addition to 3.5 miles of four-lane freeway. It was performed by McNamara Corp.

Cleanup and minor installations were completed in March on the relocated portion of the Redwood Highway immediately to the south between Canyon Road and Washington School Road. It was opened to traffic on December 9, 1964.

This new 1.7-mile section of four-lane freeway includes the Chianti un-

A panorama of the new US 101 freeway north of Geyserville in Sonoma County. The view is north, showing the Russian River (right).



Construction continues on US 101 near Santa Rosa. Interchange in the foreground is Steele Lane.

dercrossing, which provides a connection between the frontage roads which were constructed on both sides of the freeway. This work, done by Fredrickson Brothers, bypasses the former sharp alignment at Zanzi's Corner.

Routes have been adopted for the remainder of Route 101 within Sonoma County.

Route 12/101 Interchange

The project for the four-lane freeway and expressway on Route 12 between Occidental Road and east of South E Street in Santa Rosa was completed in December. The freeway lanes constructed under this $4,900,000 contract by Peter Kiewit Sons' Company have been open to traffic since June of last year.

This job was basically on Route 101. Work on Route 12 was necessary to make the new three-level interchange at the intersection of Routes 12 and 101 operational.

Separation structures for local traffic were built at Olive Street, Santa Rosa Avenue and Dutton Avenue. Other structures include an overhead over the Northwestern Pacific Railroad tracks in the vicinity of Roberts Avenue and the Earle Street Pedestrian Overcrossing on Route 101.

Steele Lane

With design completed in the vicinity of Santa Rosa for the conversion of the present expressway through the city to a full freeway, construction is presently underway between Edwards Avenue and Russell Avenue. Work on this project, which includes the Steele Lane Interchange, is approximately two-thirds complete, even though construction has been delayed somewhat by inclement weather. Completion of this contract is scheduled for this summer.

In addition to the diamond-type interchange at Steele Lane, frontage roads are being constructed to serve local traffic to the adjacent shopping center and the county administration center.

Route 1

Bids were opened March 31, 1965, for the reconstruction of 1.6 miles of two-lane, all-paved highway on Route 1 approximately 11 miles north of Fort Ross. The project calls for improved alignment and drainage.

Work was completed last spring on a project between three miles north of Bodega Bay and 0.2 mile south of Bridgehaven for the replacement of inadequate culverts. Culvert pipe was jacked under the roadway during the construction of this project.

Other Routes

Bids were opened April 7, 1965, to reconstruct Route 116 between 0.5 mile and 2.1 miles east of Austin Creek near Big Bend, west of Monte Rio. The 1.2 miles of two-lane conventional highway has been budgeted at $320,000. Design studies for the remaining portions of this route between Austin Creek and Monte Rio are in progress. Bids were opened in March for landscaping and tree planting on Route 12 between Roseland and Brookwood Avenue, east of South E Street. Funds amounting to $200,000 have been budgeted for the project.

STATUS OF DISTRICT 4—FREEWAY AND EXPRESSWAY PROJECTS

April 1965

New route	Description	Total miles	Completed projects		Under contract		Budgeted construction		Right-of-way expended and budgeted
			Miles	Construction cost	Miles	Construction cost	Miles	Construction cost	
I-80	Central Freeway	1.8	1.8	$11,653,000					$8,533,099
I-80	San Francisco to Carquinez Bridge (portions)	18.2	18.2	[d]63,506,000		$64,000		$300,000	14,418,676
I-280	Junipero Serra Freeway, from Route 17 at Moorpark Avenue in San Jose to San Francisco county line	43.9	4.7	6,161,000	17.6	32,572,000	10.2	[a]16,042,000	52,617,576
	Park Presidio Freeway, from Golden Gate Bridge to Fulton Avenue	2.1	1.2	1,448,000					2,582
I-480	Golden Gate Freeway, from Embarcadero Freeway to Golden Gate Bridge	3.3							957,581
	Embarcadero Freeway	1.5	1.5	14,842,000		1,531,000			12,432,864
I-580	MacArthur Freeway, distribution structure to Castro Valley	15.3	8.7	28,283,000	6.6	17,937,000		200,000	73,054,376
	Castro Valley to San Joaquin county line	31.8	31.4	11,647,000	0.9	2,850,000	0.4	1,350,000	6,448,942
I-680	From I-280 at Moorpark Avenue to Warm Springs via Alum Rock Avenue	18.3							4,566,347
	Warm Springs to I-580 (US 50)	21.1	4.7	6,200,000			8.7	4,115,000	7,340,256
	I-580 (US 50) to Walnut Creek	16.0	10.3	16,389,000	8.3	13,020,000		163,000	13,520,934
	Walnut Creek to Monument	3.4	3.4	9,322,000				235,000	6,413,323
	Monument to Solano county line	7.4	7.4	[e]17,545,000					4,141,959
1	Cabrillo Highway, from south of Watsonville to 4 miles south of Davenport (portions)	22.8	21.8	[g]11,578,000			1.0	2,100,000	3,145,137
	Moss Beach to San Jose Avenue at Route 82 (portions)	17.8	9.0	7,604,000	0.4	950,000			10,330,716
4	Arnold Industrial Freeway, from Hercules to Antioch Bridge	34.1	14.7	4,737,000	5.0	8,800,000			3,422,502
12	Sebastopol to Kenwood	17.7	4.1	5,200,000		200,000			6,165,837
	Kenwood to south of Sonoma at Route 121	14.0							
	From Route 29 to Solano county line	3.3							
13	Warren Boulevard Freeway, from Route 24 near Lake Temescal to MacArthur Freeway	5.6	4.1	[f]7,018,000	1.5	2,439,000		45,000	2,273,509
17	From Santa Cruz to Route 101 in San Jose	19.9	19.9	19,068,000					12,308,443
	Nimitz Freeway, from Route 101 at Bayshore Freeway to Warm Springs	8.9	8.9	4,435,000					883,608
	Connection from 17 to 680	1.0							284,814
	Nimitz Freeway, from Warm Springs to distribution structure	33.8	32.4	56,495,000		300,000		1,658,000	20,947,126
	From I-80 near Albany to Route 101 near San Rafael	9.9	2.2	1,992,000					2,814,971
24	Grove Shafter Freeway, from Nimitz Freeway (Route 17) to Warren Boulevard Freeway	4.8							28,518,735
	From Warren Boulevard Freeway to Walnut Creek	11.0	9.5	28,944,000	1.5	5,255,000		45,000	1,521,198
29	From Solano county line to Calistoga (portions)	36.9	25.4	6,350,000				[a]1,305,000	5,193,327
35	From south of Route 1/35 interchange to San Matio-San Francisco county line	2.9	2.9	829,000					1,231,782
37	From Route 101 at Ignacio to Solano county line	9.7	6.3	4,872,000					697,082
61	Bay Farm Island Bridge and approaches	0.6	0.6	2,062,000					165,033
	Webster Street and Posey Tubes	1.1	1.1	18,716,000					2,643,072
77	Shepherd Canyon Freeway, from Warren Boulevard Freeway to Route 24 in Lafayette	10.3							663,027
82	Southern and Southern Embarcadero Extension Freeway, from Route 1 at San Jose Avenue to Route 87 near Army Street (portions)	5.4	4.4	[b]27,326,000	0.7	6,367,000	0.3	1,200,000	26,647,258

STATUS OF DISTRICT 4—FREEWAY AND EXPRESSWAY PROJECTS—Continued

April 1965

New route	Description	Total miles	Completed projects		Under contract		Budgeted construction		Right-of-way expended and budgeted
			Miles	Construction cost	Miles	Construction cost	Miles	Construction cost	
84	From east of I-280 to west end of Dumbarton Bridge	6.4							$445,847
	From 2.6 miles east of Dumbarton Bridge to Route 238 at Niles	5.7							
	From I-680 near Sunol to I-580 near Livermore	9.7							
85	West Valley Freeway, from Route 101 south of San Jose to Route 17	10.0							867,866
	From Route 17 to Bayshore Freeway Route 101 at Mountain View	13.6			5.5	$6,669,000		$[a]400,000	6,464,183
87	Guadalupe Freeway, from Bayshore Freeway Route 101 to West Valley Freeway Route 85	9.5							
	From Routes 82/87 interchange near Army Street to I-480	3.0					0.8	5,695,000	4,000,000
92	19th Avenue Freeway, from Junipero Serra Freeway I-280 to Alameda county line at San Mateo Bridge (portions)	8.0	2.3	$5,235,000					7,618,529
	From San Mateo county line to Nimitz Freeway (Route 17)	6.8			3.1	3,500,000			1,363,075
101	San Benito county line to Ford Road south of San Jose	27.9	5.8	1,093,000					545,839
	Bayshore Freeway, from Ford Road to Southern Freeway in San Francisco	52.9	52.4	[a]62,901,000	(7.4)	2,287,000	(4.6)	2,029,000	28,353,099
	James Lick Memorial Freeway	3.0	3.0	11,445,000					12,870,844
	Redwood Freeway, Golden Gate Bridge to Mendocino county line	84.3	78.0	[c]64,439,000	1.1	1,911,000		72,000	21,641,742
114	West of Route 82 to Bayshore Freeway Route 101 in Redwood City	1.1			1.1	[h]2,250,000			2,875,709
121	From Route 37 near Sears Point to Route 29 in Napa at Imola Avenue	16.8	1.1	1,124,000					123,885
152	Pacheco Pass, from 1 mile east of Bells Station to Merced county line	5.3	5.3	1,702,000					12,393
186	Sweeney Ridge, west of Route 35 to Bayshore Freeway (Route 101)	4.0							1,011,373
237	Mountain View-Alviso Freeway, from El Camino Real (Route 82) to Nimitz Freeway (I-680)	10.5	7.7	[a]3,803,000			2.0	[a]2,905,000	2,772,319
238	Freeway Connection from Nimitz Freeway to MacArthur Freeway (I-580)	2.2	2.2	2,803,000					2,236,852
242	North of Monument in Pleasant Hill to Route 4, Concord	3.4		226,000	3.2	3,150,000			1,879,232
		739.7	414.9	$547,964,000	56.5	$112,052,000	23.4	$41,059,000	$430,033,529

[a] Includes some funds contributed by cooperating agencies.
[b] Includes total of $1,600,000 by City of San Francisco.
[c] Includes total of $5,000,000 by Golden Gate Bridge and Highway District.
[d] $29,117,000 Toll Bridge Funds in this amount.
[e] $6,833,000 from Toll Bridge Funds.
[f] City of Oakland and Alameda County contributions included in this figure.
[g] Includes $690,000 by District 4.
[h] Includes total of $1,051,000 by City of Redwood City.
[i] County of Alameda contribution included in this figure.

Temporary low-level bridge at Orleans to carry traffic while new bridge over Klamath is being constructed. This will be a major project.

Northwest Roads

Back to Normal—Almost

At noon on May 12, 1965, the last detour on storm-damaged northwest state highways was eliminated when, with appropriate ceremony, the Robinson Ferry Bridge, which carries US 101 over the lower Eel River, was reopened. This crossing, also known as the Paul E. Mudgett Memorial Bridge, suffered the loss of more than 600 feet of its structure in the December 1964 floods, and was made famous throughout the United States by Neil Hulbert of the *Humboldt Times*, in his widely reprinted aerial photo which showed the broken spans with the floodwaters rushing through the gap.

Present at the reopening ceremonies were mayors of several Humboldt County towns, the chairman of the county board of supervisors, the president of the Redwood Empire Association, and various other dignitaries. It was an important occasion to these northwest residents, because it assured them their timber products would flow more smoothly to market, and that the tourists so important to their economy would be able to travel through the redwood country the same as they had in previous years.

Reopening of the bridge eliminated use of Humboldt County's Blue Slide Road as a detour. This is a section of county road which follows along the south side of the Eel and rejoins US 101 at Fernbridge. Although very little longer in miles, the detour road was designed neither for high speed nor heavy traffic loads, and its retirement from heavy duty represents considerable saving in time.

Prior to the completion of the bridge repair project, that section of freeway in the Fortuna-Alton area damaged by the flood had already been repaired.

US 101 and US 199 (the Redwood Highway), and US 299 which crosses the mountains from Eureka to Redding and the Sacramento Valley, have now been resurfaced and striped for their entire lengths. On the Redwood Highway travelers may experience short delays until approximately August 15 along the Eel River just south of Pepperwood, where a major repair contract is in progress, and there will be signal-controlled one-way traffic across the Scotia-Rio Dell Bridge until completion of repairs there in August.

A temporary low level bridge is in use on Route 96 at Orleans, to replace the structure destroyed by the Klamath River. Traffic can now move over this route freely, although it will be some months before all the damaged sections on this route are completely back to normal.

Since so many of the road fills and bridges were temporary, any substantial rises in the river levels would have been disastrous, undoing the work of weeks, but nature was cooperative. There were no heavy rains of sustained duration during the spring, and although there were occasional rises in the rivers, the temporary installations have not been damaged. During the summer months most of these temporary repairs will be consolidated or replaced by permanent structures.

Repairs have been made or contracts have been let for permanent bridge repair or replacements in all cases of bridge destruction by the 1964 floods, except the Orleans crossing, which is under study. When design is completed, it is to be 14 feet higher than the previous bridge, but construction cannot be completed until some time in 1966. The other permanent bridges now under construction on the Van Duzen and Smith Rivers have urgency provisions in their contracts requiring their completion by December 1, 1965.

Due to the additional funds released by the temporary gasoline tax provisions, new construction also can go forward on the Redwood Highway. A contract was let in June for a multimillion-dollar project extending the Redwood Freeway northward seven miles to a few miles south of Scotia. The old route will be retained for tourist travel as has been done in the past in creating the Avenue of the Giants.

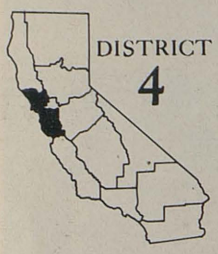
Looking north from Rio Dell side of Eel River, along repaired Robinson's Ferry Bridge, reopened in mid-May.

View along Route 96 which follows the Trinity-Klamath system. This popular sportsman's route is passable, but requires care in places.

Nonskid Deck

18,000 Studs Used to 'Rough Up' Surface on Napa River Bridge

By CHARLES P. CARTER, Senior Highway Superintendent

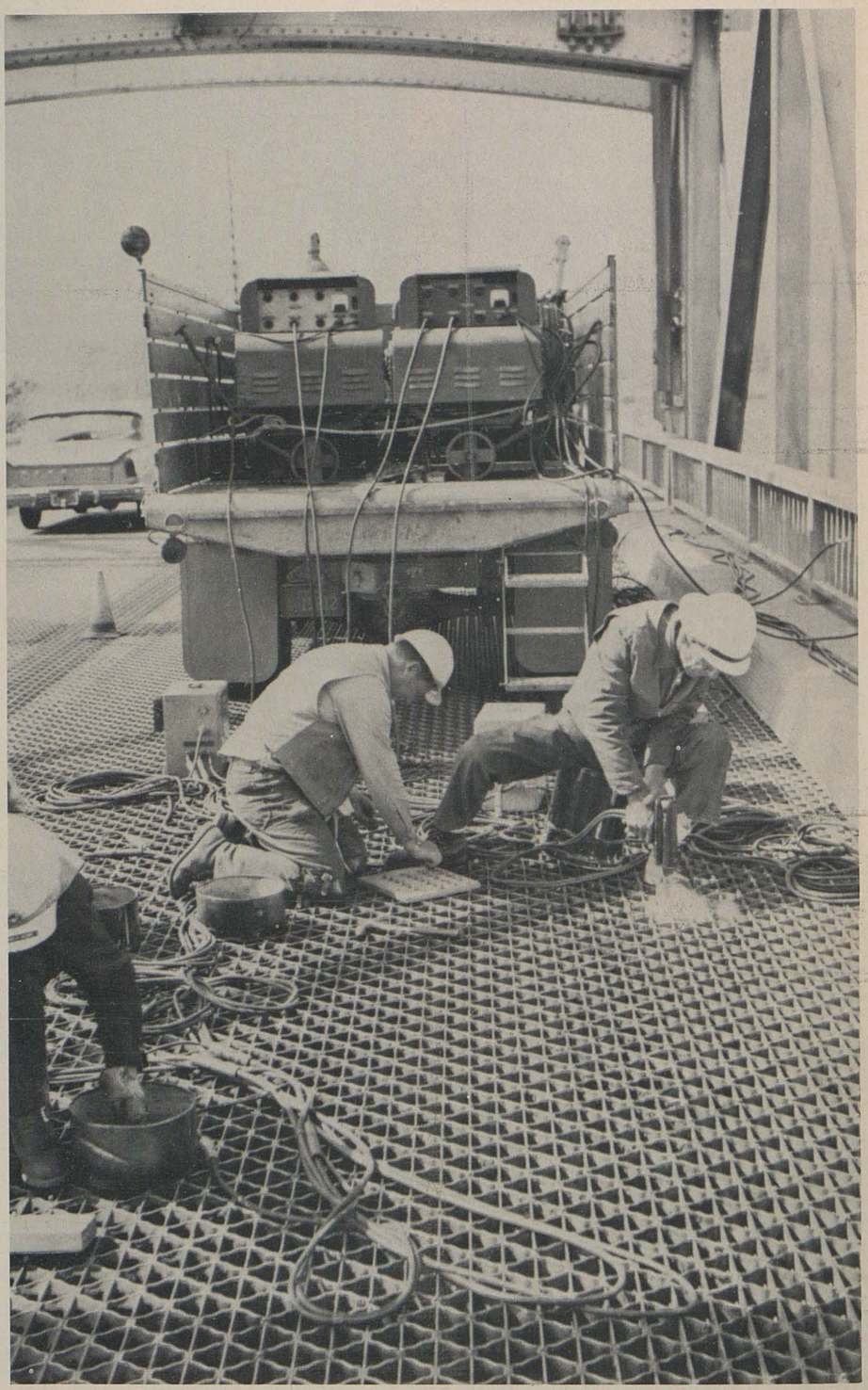


A "roughing-up" job was recently done on the open grid deck of the Maxwell Bridge over the Napa River on State Route 29 at the southerly edge of the City of Napa. This 132-foot two-lane lift span presented a skid problem in damp weather. The process consisted of welding over 18,000 studs to the deck, leaving a "hobnail" effect. The deck is a steel grid type consisting of longitudinal bars on edge 2½ inches apart with zigzag bars for spacers.

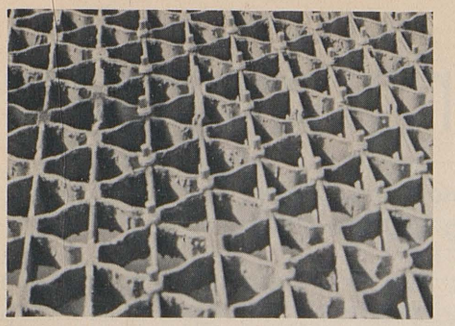
In recent years as traffic volume increased and skidding accidents were occurring, the deck was treated with an epoxy adhesive covered with aluminum oxide grits. This process cost about $2,500, and it was necesary to repeat the treatment 18 months later at a cost of $2,000. With the continued increase in traffic a yearly treatment would be necessary. The same areas were covered with welded studs at a cost of $3,800, and the treatment is estimated to last 10 years or longer.

The work was performed by state forces under the supervision of Highway Superintendent Paul Loeffler of Napa and his senior foreman, George Henderson. The ⅜-inch steel studs were purchased. Welding guns and the battery-powered welding units were rented by service contract.

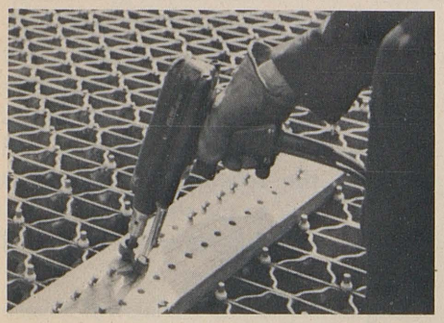
Studs were welded at the bar intersections of the grid deck resulting in a pattern 5 inches apart in longitudinal and transverse directions. The intermediate longitudinal bars were spotted with studs at 15-inch centers to break up any sway pattern. The studs as welded on are 1 inch high to fit the gun. They are grooved, and a single hammer tap breaks them off at the groove leaving a welded button ⅜



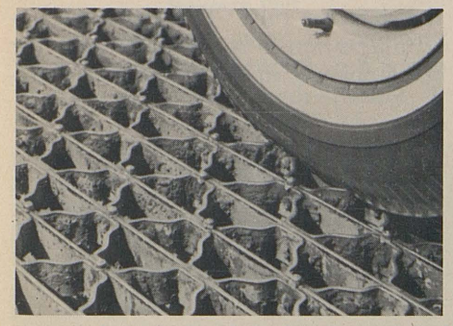
A state crew welds studs into the deck grid with battery-powered units set on truck.



This photo shows the studs in place before being knocked off. The white collar around each one is an insulating ferrule used in the welding process. It breaks off with the stud.



Studs were inserted in the gun from a holding board made by the crew to speed the operation.



A view of the bridge deck after the studs had been welded giving a hobnail effect which greatly reduces skidding accidents.

inch in diameter and ¼ inch high. The crew consisted of seven men welding the studs in addition to two flagmen.

The state maintenance crew were unfamiliar with the operation of the stud guns, but after a short time they were placing studs at the rate of four to six a minute per man. This resulted in the job being completed in 3½ days against the estimated time of 6 days. The previous treatments of epoxy and abrasives had taken over a week each time. As the traffic must be controlled in one lane, this inconvenience of several days' duration will no longer be necessary.

This is the first state highway bridge in California treated with this process. As there are a number of bridges on the state highway system with the open grid decks, the effectiveness of this treatment may prompt its use in other locations having a skid problem. The only other location in the state where this treatment has been used is on the Admiral Heim Bridge in the City of Long Beach.

FLOOD VICTIMS GET HELP FROM FELLOW EMPLOYEES

Division of Highways employees throughout the state raised more than $8,200 through donations to aid fellow workers in Districts 1 and 2 who suffered loss of homes and household goods during the Christmas flood.

Presentation of the money in the form of checks to the individual employees was made by Deputy State Highway Engineer George Langsner on April 15 at the District 1 office in Eureka.

Flood losses suffered by the employees ranged from $14,000 to $200 and totaled more than $52,000. One employee had his house and its furnishings swept away. Several others had their houses flooded, with total or nearly total loss to furnishings and other possessions.

Distribution of the aid fund was made on a prorated scale to the recipients. Amounts of the 12 checks presented ranged from $2,190 to $30.

The division committee which handled the collection and distribution of the fund included Paul C. Sheridan, division office engineer, and William Z. Hegy and Everett Thomas, assistant district engineers of District 1 at Eureka.

John L. Piper

John L. Piper, former construction engineer for District 3 in Marysville, who retired in 1947, died at Menlo Park on April 9. He was 82.

A native of Kentucky, Piper joined the Division of Highways in 1912.

He directed the pioneer snow removal program on Highway 40 (now Interstate 80) over Donner Summit in 1932 and played an important role in the road's subsequent development as an all-weather highway.

He also aided in the development of concrete and asphaltic highway construction methods in California.

Prior to his state service, he was construction superintendent on a portion of the original Los Angeles aqueduct system through Mojave from Owens Valley.

He is survived by his wife, Agnes, and two sons, Donald B., of Atherton, and Lacy, of Santa Monica.

Compaction Control

Nuclear Unit Measures Soil Moisture, Density

By WILLIAM G. WEBER, JR., Senior Materials and Research Engineer
and ROBERT E. SMITH, Assistant Physical Testing Engineer

The art of compaction control of embankments is in a state of change from hand methods to automation. From August 20, 1964, to November 20 of this year, a new nuclear device for measuring the in-place moisture and density of compacted soils was evaluated by Headquarters Construction Department and the Materials and Research Department. The device is a mobile truck and trailer mounted instrument called the road logger developed by the Lane-Wells Company, of Houston, Texas.

This traveling nuclear gauge makes a continuous recording or trace of moisture and density as it is driven over the soil surface. Figure 1 shows the truck and trailer ready to begin logging, and Figure 2 is an illustration of the permanent and continuous record of field data. It differs from conventional practice in that density is presented as wet density and moisture in pounds per cubic foot rather than percent. This graph may be studied to determine the effectiveness of a contractor's effort, variation in moistures, uniformity of compaction, and other factors.

Density Probe

The density probe is mounted in the trailer shown in Figure 3. When traveling the probe is secured within the body of the trailer, and in the logging position it is lowered hydraulically to within an inch of the ground. The density probe then rolls on its own wheels to maintain this one-inch air gap between the soil and the unit.

A 0.43-curie source of cobalt 60 is used in the density probe. This is a considerably stronger source than those used in the more familiar portable units. However, it is more than amply shielded by a tungsten-lead-steel carrier. This shield is of the "collimating" type, which means that the gamma radiation emerges principally straight downward. The radiation is then scattered within the soil, and some of the secondary radiation is bounced back to the shielded scintillation detector which is mounted a fixed distance from the source.

Higher density material will absorb more of the radiation than low density soil, and this difference is sensed by the detector tube. The electronic instrumentation is so calibrated so that these changes in the amount of radia-

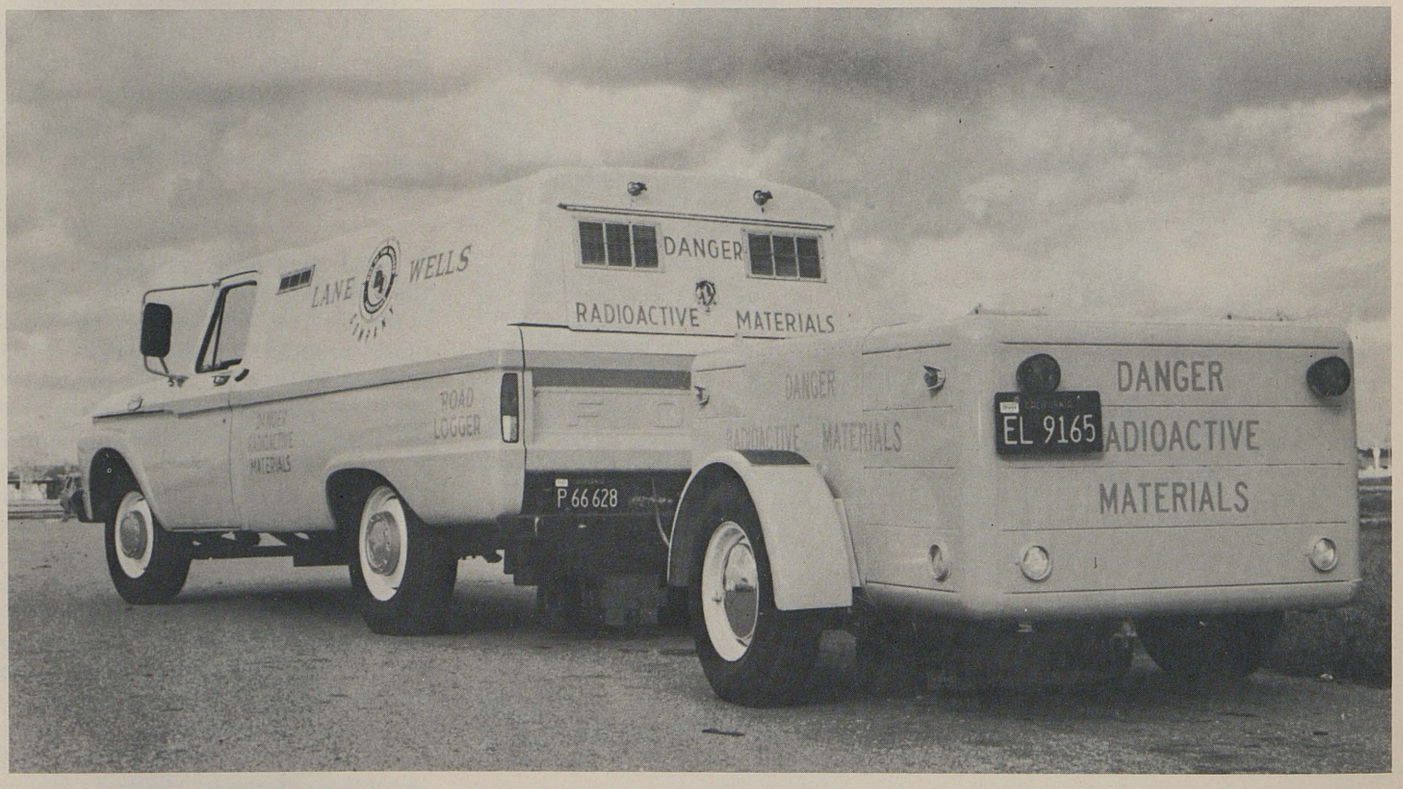


FIGURE 1—The moisture and density units in traveling position under the truck and trailer of the road logger.

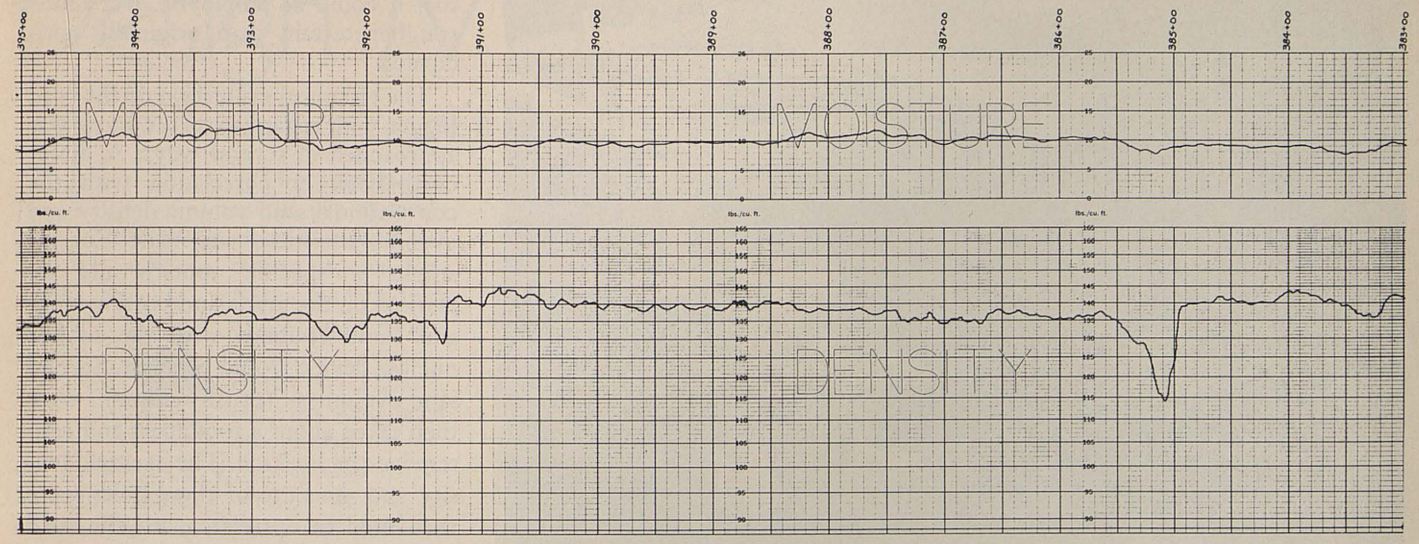


FIGURE 2—Continuous road logger graph of moisture (top) and density (bottom) from Wells Road in Santa Paula.

tion returned are directly interpreted in terms of wet density.

Moisture Unit

The moisture unit is mounted within the truck, Figure 4, and is also raised and lowered hydraulically; it too has a separate set of wheels to maintain a constant one-inch air gap when traveling in the logging position. A five-curie source of plutonium mixed with beryllium is used in the moisture-sensing unit. This source emits principally high energy neutrons with a minimum of gamma radiation. The high energy neutrons are moderated by the water in the soil, and on return are detected by a boron trifluoride pickup tube.

The moisture and density-sensing units measure a volume of material 12 to 15 inches wide, by 6 to 8 inches deep, by approximately 5 to 10 feet long. The 5- to 10-foot dimension depends on the speed of travel and on the choice of time constant of integration on the rate meter. Thus, any point on the graphs represent an integral value for 5 to 10 feet of roadway. These factors can be changed at will by the operator to suit local requirements. Figure 5 shows the recorder and electronic equipment which is located in the cab of the truck.

An approximate total of 180 miles of embankment and structural section was logged throughout the state, in various districts. Several factors that might affect the results from the road logger were given careful attention by the attendant personnel. For example, the effect of logging speed was studied by going over the same course at various speeds. Reproducibility of results was investigated by making duplicate runs over a controlled course. A close check was made of the instrument it-

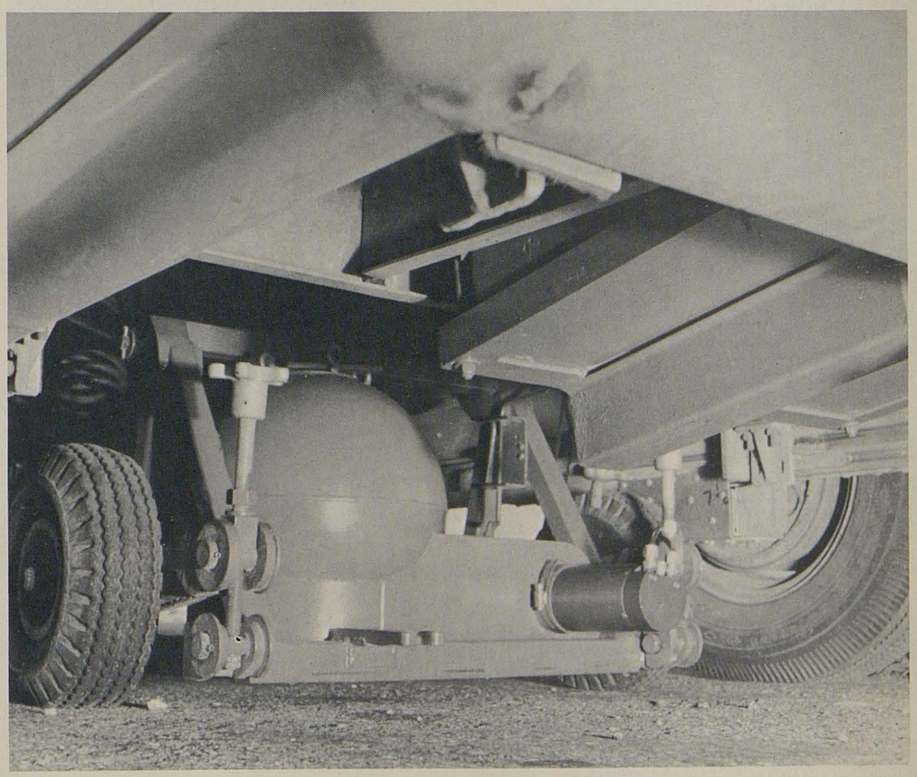


FIGURE 3—The density unit lowered into logging position.

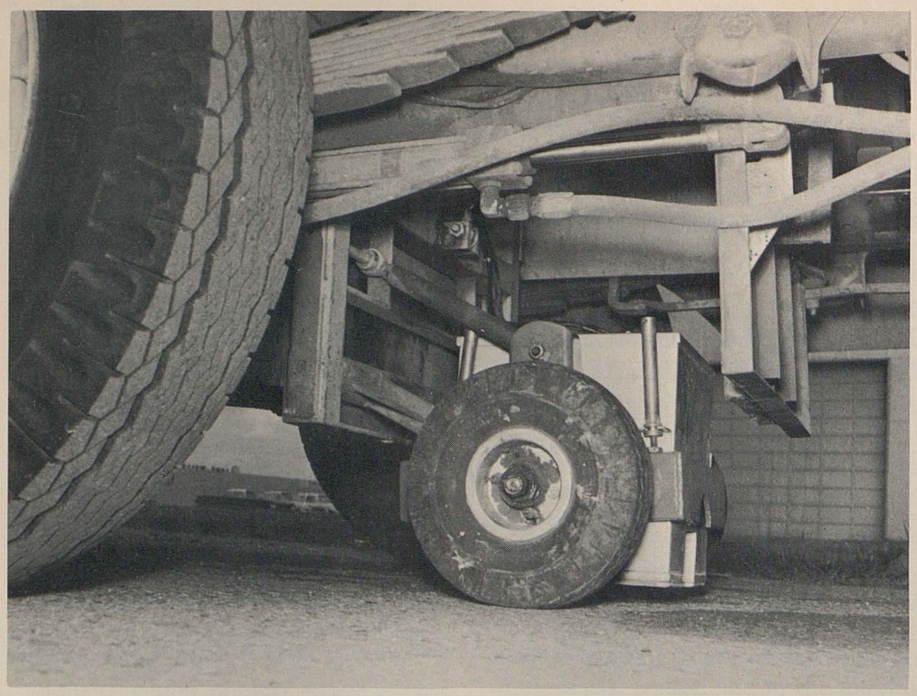


FIGURE 4—The moisture unit lowered into logging position.

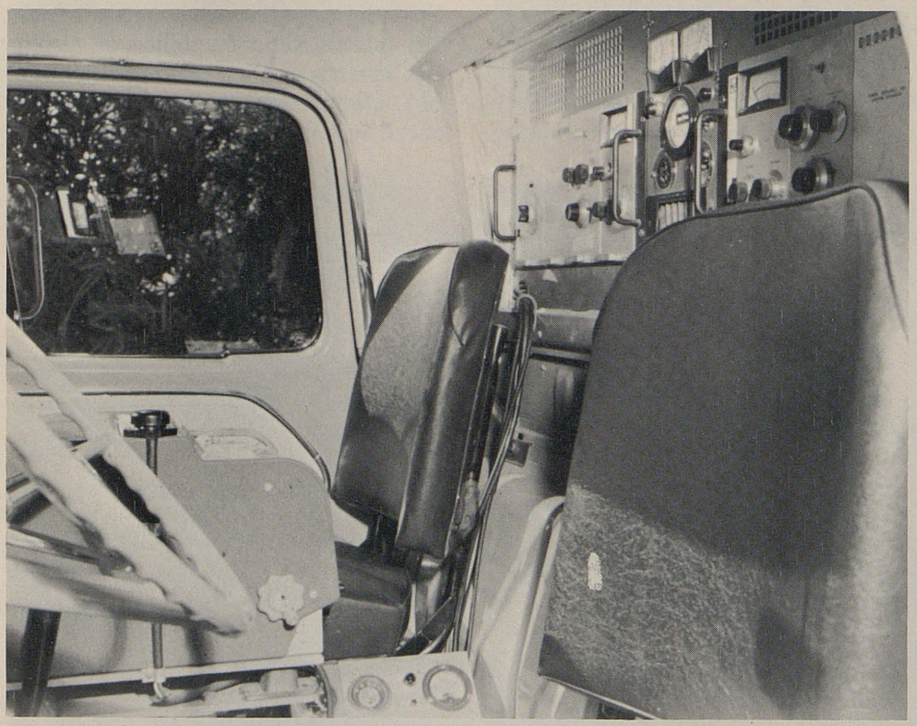


FIGURE 5—The recording unit and electronic equipment may be regulated by the driver or his assistant.

self with regard to stability and durability.

Roughness a Problem

An item of particular importance was the determination of the roughness of a surface upon which the unit could be used. Many of our embankments do not have what could be called a smooth surface at any time during construction; and there was some doubt that such a device could be used on these embankments. The men in charge of the road logger were told to "give it a try." It was found that it could be employed over much rougher terrain than originally anticipated.

The technical evaluation of the road logger with regard to its accuracy was approached in several ways. A direct comparison or correlation with the conventional sand volume density and ovendry moistures was made. For example, a specific spot would be marked on the grade and both moving and static readings with the mobile nuclear device would be made. Several sand volumes (usually four) were then taken about a foot apart and centered at the location. The average density and moisture of these holes were then used to correlate with the road logger data.

Statistical Method Also Used

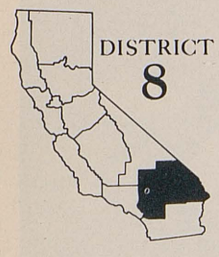
There is some difficulty with the above comparison because, at best, there are differences in the volumes measured by the two methods. In other words, each may be equally right and not exactly agree. Therefore, a statistical approach will also be used to check on the accuracy of the road logger. The approach is roundabout, whereby the overall picture of density variation for a given job as portrayed by the logger is tabulated. This is then compared with the equivalent information obtained by the conventional sand volume tests which were used in the density control for the job. These two independent methods of measurement should reflect the same overall distribution of density variation for that project.

The cooperation and active participation by the districts in this program is playing a very important part in finding the possible practical applications of the Lane-Wells road logger. Part of the time the unit was in the field it was placed under their direction for scheduling, and they were requested to simulate actual use. Their comments will strongly influence the final consensus as to the possible uses of the mobile moisture-density apparatus.

Design Models

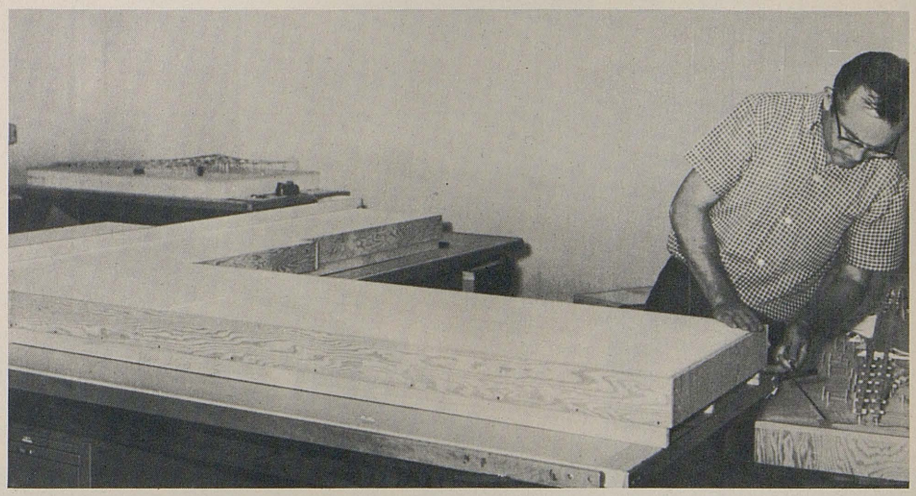
New Techniques Result In Greater Versatility

By R. M. COLLINS, District Design Engineer



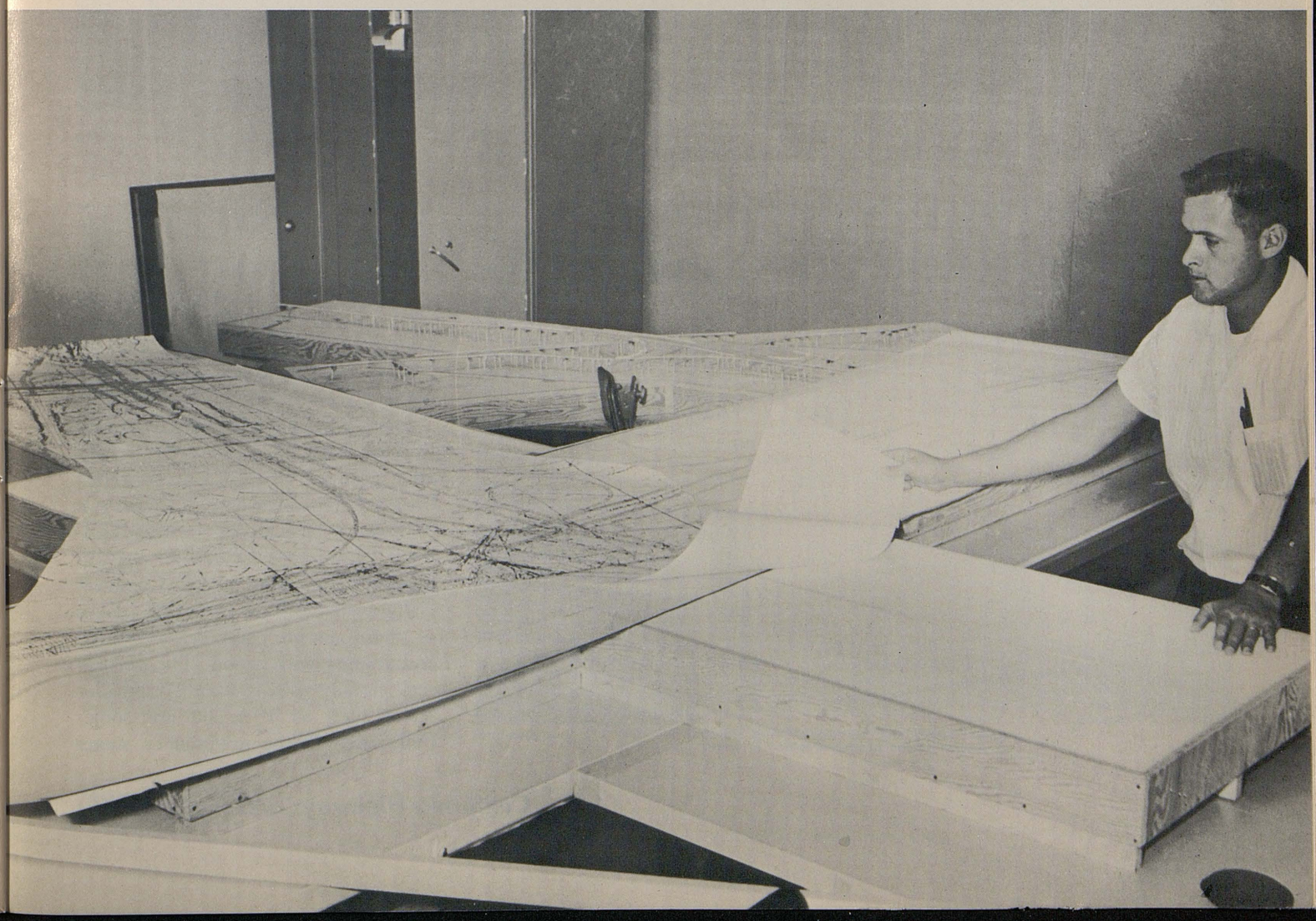
The importance of the use of models as a tool in the design of such features as undercrossings, overcrossings, separations, overheads, etc., has long been recognized. In order to qualify as an acceptable working tool, such a model should be accurate as to scale, easy and quick to assemble, and fully adjustable so that revisions can be made to the model as design progresses.

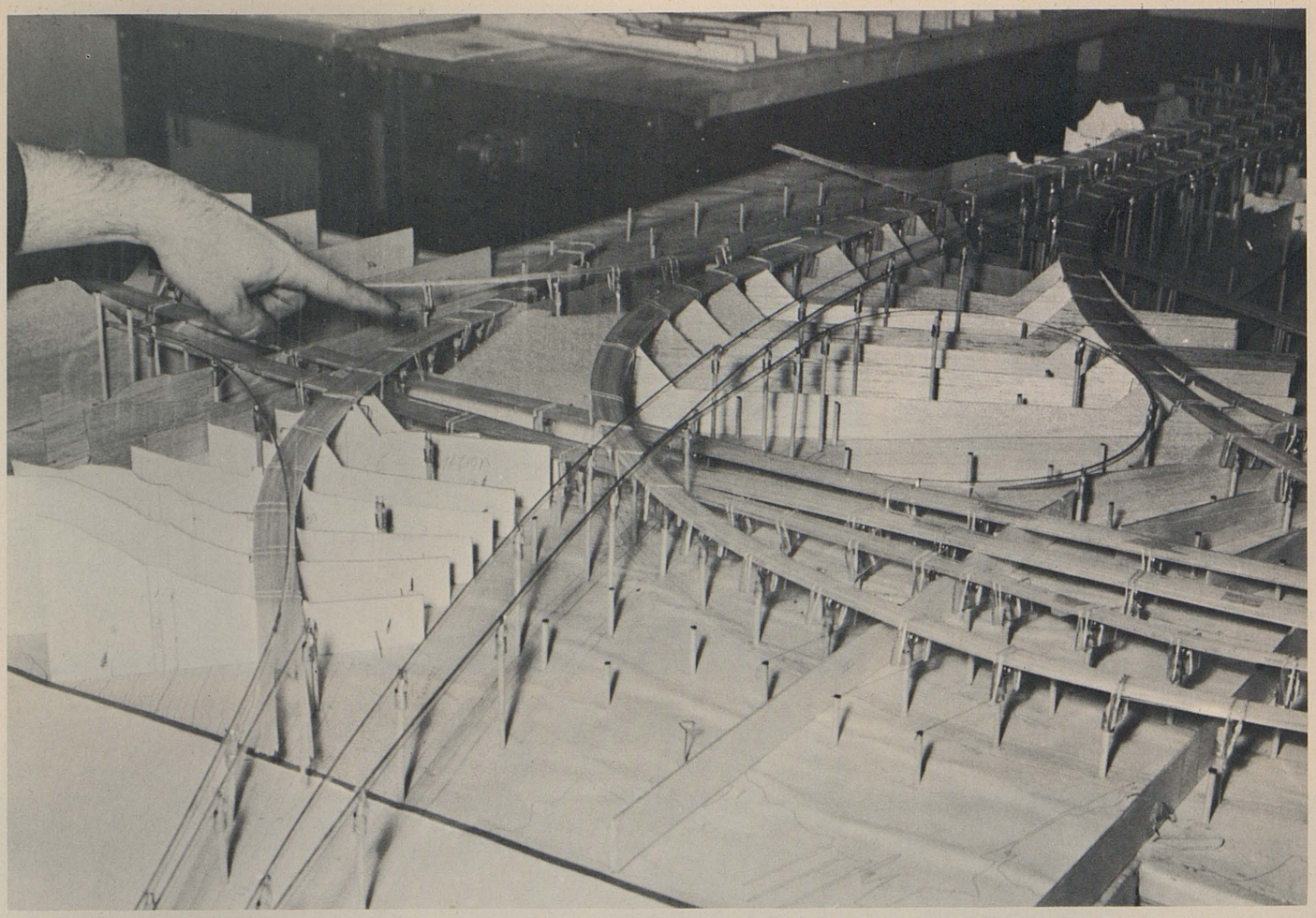
After a great deal of experimentation, District 8 has developed a model



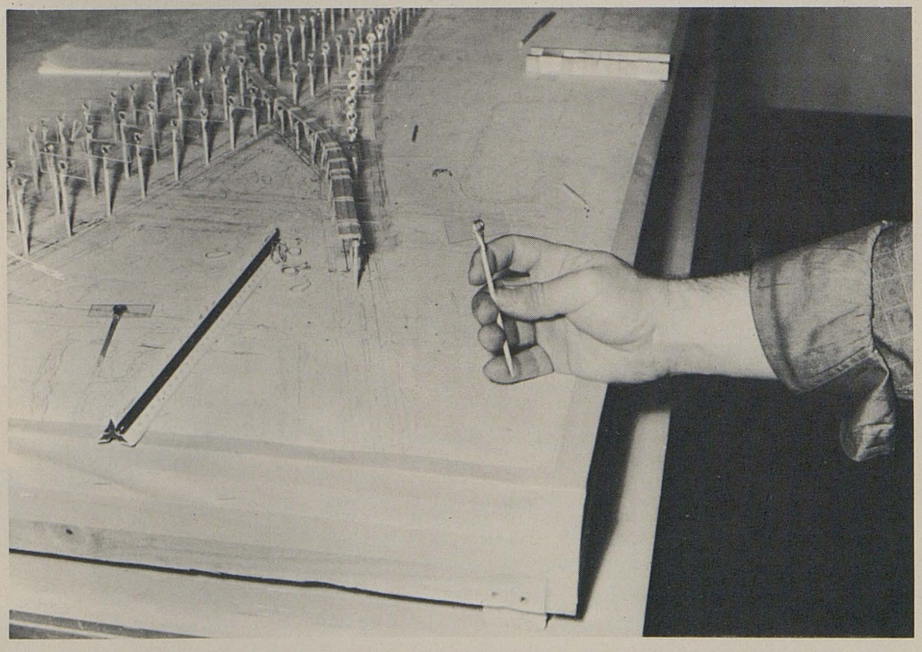
As a base for the models, blocks of styrofoam are combined as desired and framed with wood.

An aerial contour map of the area is stretched over the styrofoam base.





Ground elevation "shots" are represented by single black-topped dowels. Note the roadway construction of plastic strips and "T" pegs for support. In this particular model, balsa wood templates were used in an experimental fashion to show the shape of a finished interchange.



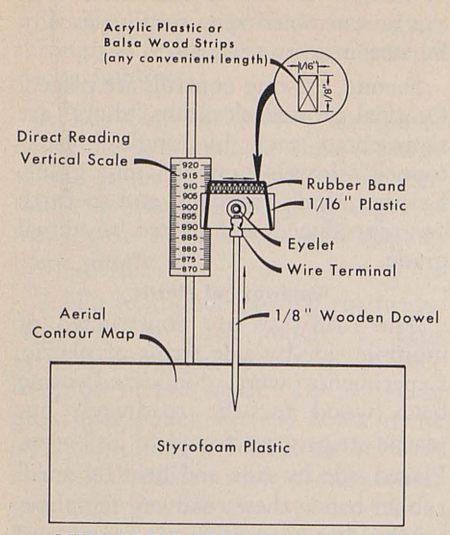
A closeup of one of the versatile "T" pegs.

that embodies, to a great degree, the above-mentioned features.

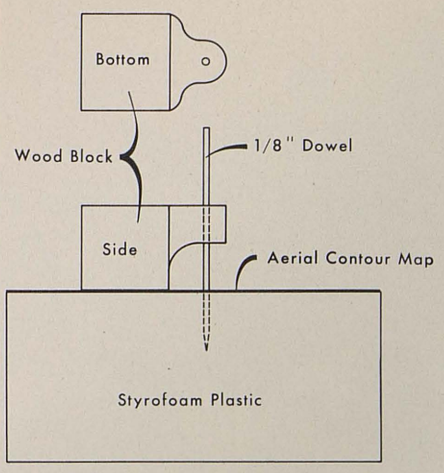
Procedure

Following is a general outline of methods and materials being used by District 8 in the construction of engineering models, which are called, for obvious reasons, "stick" models.

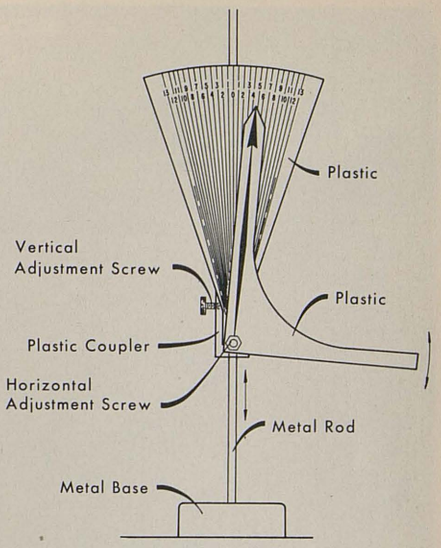
First, a print of an aerial contour map of the area concerned (usually at a scale of $1'' = 50'$) is stretched over a 3-inch thick base of styrofoam to form a surface which is an arbitrary datum from which all vertical measurements are taken. Commercially available 3″ x 12″ x 36″ blocks of styrofoam are combined as desired and framed with wood. The vertical scale usually used is $1'' = 25'$. Smaller scales such as $1'' = 200'$ are sometimes used in the preliminary stages



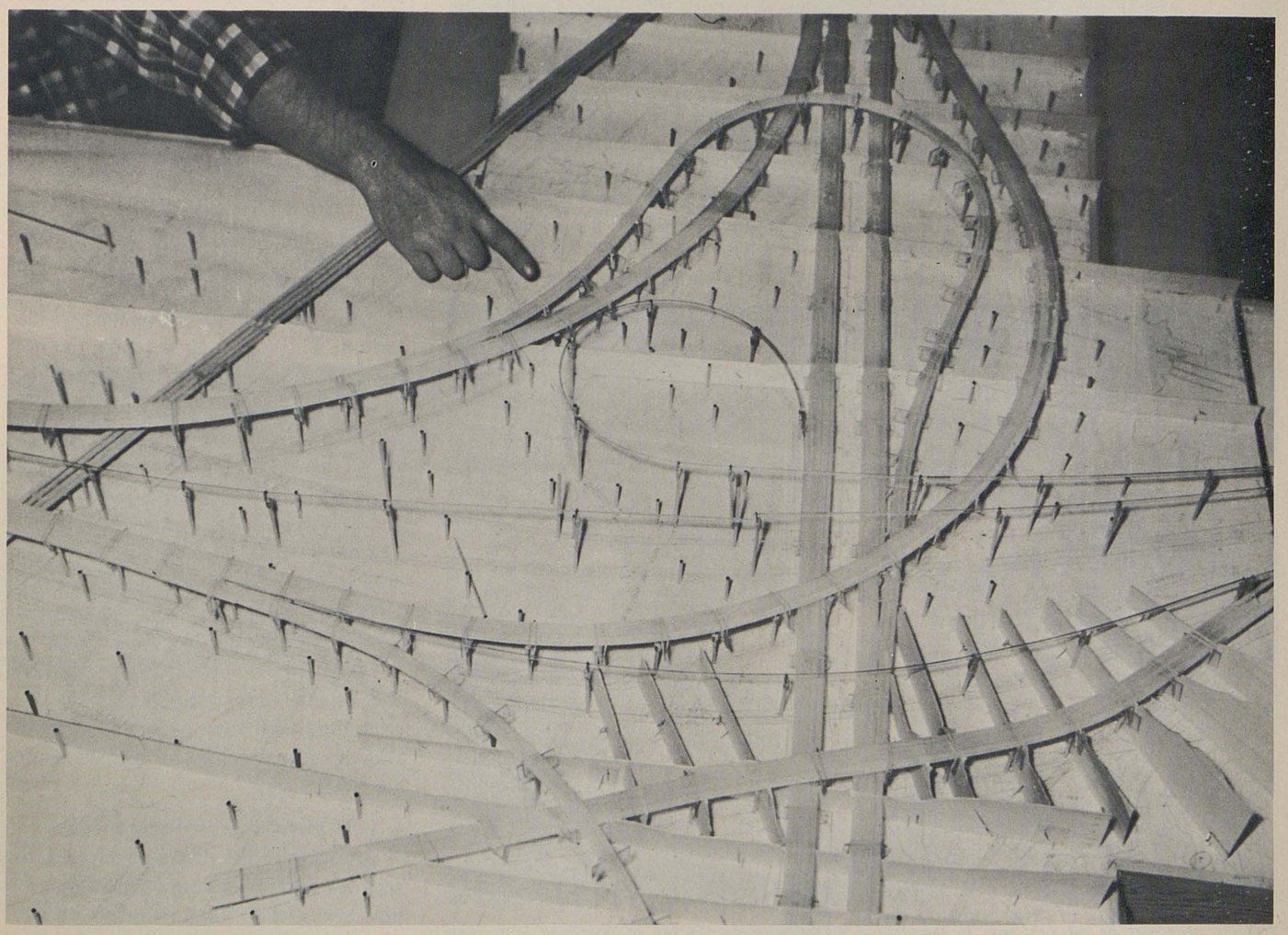
DETAIL OF THE VERSATILE "T" PEG AND THE TOOL FOR MEASURING VERTICAL ELEVATIONS



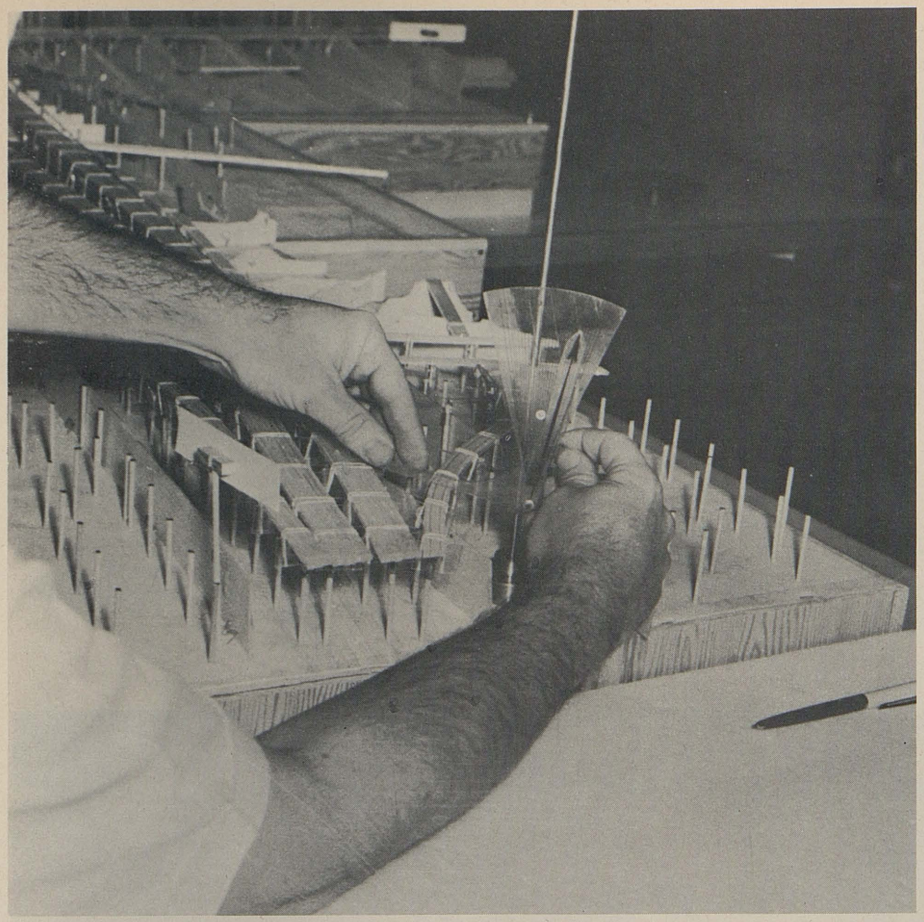
DETAIL OF TOOL USED IN PUNCHING VERTICAL HOLES IN THE STYROFOAM BASE



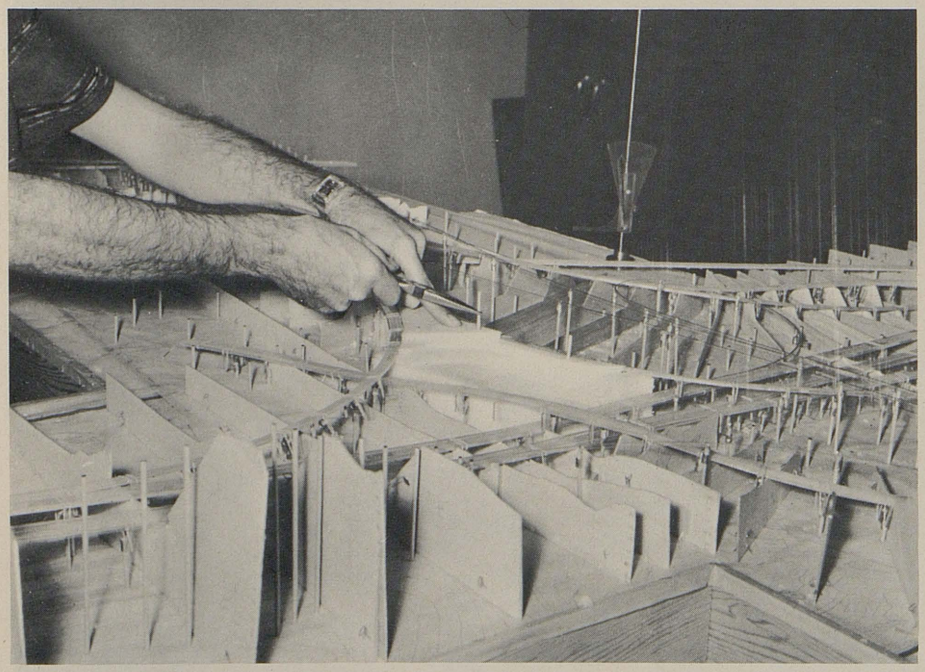
DETAIL OF TOOL USED IN SETTING AND CHECKING SUPERELEVATION



Use of plastic strips for roadways and "T" pegs for supports permits extreme flexibility of design.



Tool developed for setting and checking superelevation being used to check one of the roadways on a model (see drawing on previous page).



Wooden pegs may be set with ease to the desired elevation. Note the use of styrofoam in forming contour graded areas and the use of wooden templates for ground elevations.

of design. Models of this latter type can be assembled very readily, usually by one man in one day.

Second, existing controls are placed. Original ground elevation "shots" are represented each by single "black-topped" dowels punched into grade. Existing roads, railroads, and so forth are reproduced and placed to actual grade.

Roadways of Plastic

The roadways are constructed of multiple side-by-side strips of plastic. Experiments were conducted using balsa wood for the roadways, but plastic strips were found to be better. Placed side by side and held by small rubber bands, these roadway templates readily bend to permit vertical and horizontal curvature. One-eighth-inch by one-sixteenth-inch plastic strips are used. The strips are placed on edge with the 1/16″ dimension horizontal. The plastic that is currently being used is acrylic plastic, sawed 1/8″ wide from 1/16″ thick sheets. Butyrate plastic could be used, although it is softer and does not have as much "memory" or spring as acrylic plastic.

The roadways are fastened with rubber bands to "T" pegs. The pegs can be readily punched into the styrofoam base and adjusted to desired elevation. This "T" peg is really the key to the versatility of the models, since it may be adjusted readily both vertically and horizontal, and with the adjustable cross member, superelevation may be set or adjusted as desired.

The dowels used in the "T" pegs and grade pegs are made of wood. Experiments were made using metal dowels, but wood dowels were found to remain more firmly in position in the styrofoam base, even after repeated adjustments. Metal dowels will slip if adjustments in elevation are attempted.

Tool Checks Superelevation

A tool has also been developed for setting and checking superelevation and also a tool for measuring vertical elevations. (*See attached sketches.*)

Briefly, the steps that are gone through in order to construct a model are as follows:

1. Lay out blocks of styrofoam to cover the area involved. Bind together with a frame or box and mount contour map thereon, bringing edges of map down sides of box and stapling them snugly.

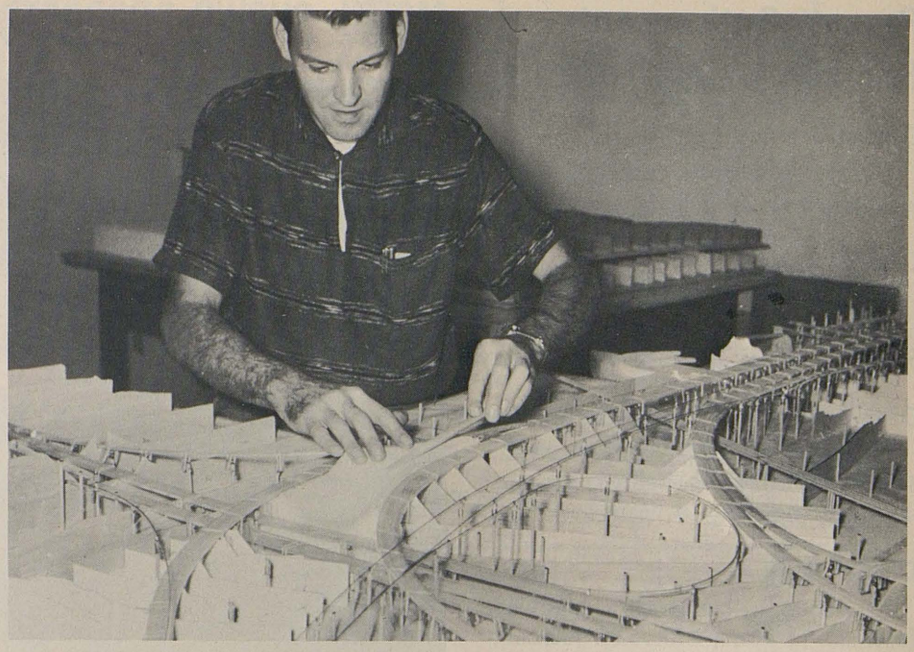
2. To reproduce existing roadways, ramps, and so forth, punch "T" pegs in along centerline spaced about three or four inches apart. To set these pegs, first punch vertical holes in the styrofoam using a pointed dowel with a vertical guide, such as a vertical groove in the side of a wooden block. Next, push the "T" pegs into grade.

3. Assemble roadways to widths and lengths desired and fasten to the "T" pegs with rubber bands. Merge of ramps with main line is smoothly affected by bringing outside strips around continuously, then staggering added strips into the "V."

4. Punch "grade" pegs in surrounding terrain as desired.

5. Designer then studies and physically tries any scheme desired.

6. When a solution is reached, results are scaled, plotted, and then precised by conventional methods.



Shaping the styrofoam to the desired contours.

Applications

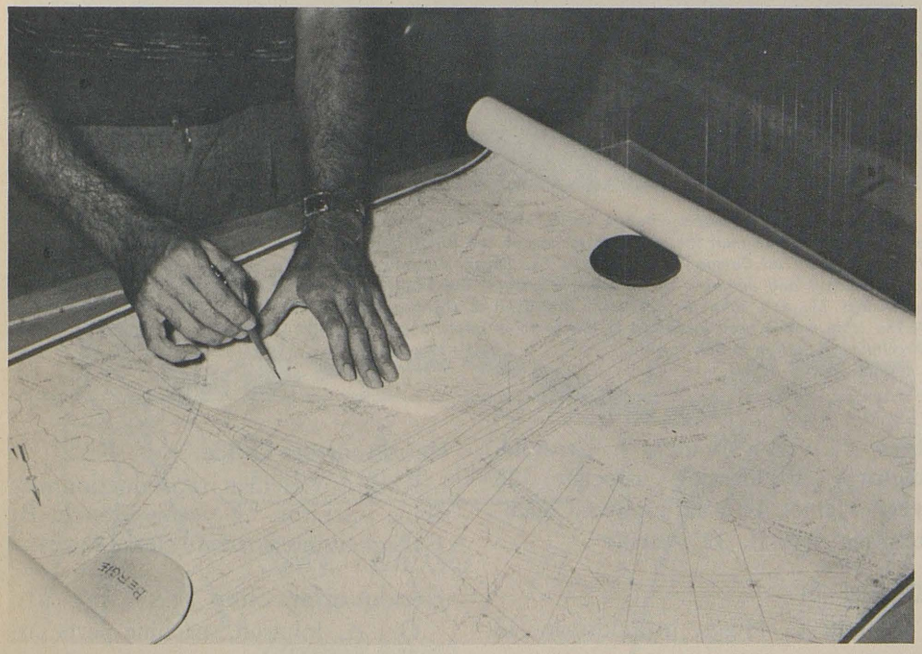
While our basic purpose has been to facilitate preliminary design, we are also able to become aware sooner of vertical mismatched features.

Design of freeway signing also benefits from a check with the model.

By the use of the models, it is possible to determine the most aesthetic and useful contour grading. This is done by shaping styrofoam to the desired form, using 0.2-inch-thick (for a vertical scale of $1'' = 25'$) styrofoam sheets. The styrofoam sheets are of two colors, green and beige. The colors are used alternately, each sheet representing a 5-foot vertical distance. When the designer has arrived at the most desirable contour grading by use of the model, the shape of each layer of styrofoam, each of which would represent a five-foot contour interval, is duplicated on a plan sheet. Difficult drainage problems can be easily studied and solved by this method of preparing contour grading plans.

Other benefits, obviously, are that such models are valuable in presenting ideas to local agencies and in assisting the resident engineer and the contractor in visualizing the work in early construction.

District 8 developed the use of the "stick" models about two years ago. Since then the results of the developments have been disseminated throughout the state, and it is gratifying to note that the use of such models is becoming widespread throughout the other districts.



Transferring a shaped contour interval to a drawing.

Recent Retirements For Highways Listed

District 1

Vivien A. Gutsch, associate highway engineer, 35 years.

District 2

Randall A. Gay, highway maintenance man II, 19 years; George W. Sorsoli, highway foreman, 38 years.

District 3

Cecil R. Harden, highway foreman, 36 years; Henry N. Wallace, assistant highway engineer, 10 years.

District 4

Lawrence D. Bigelow, highway foreman, 31 years; Albert H. Jackson, assistant highway engineer, 13 years; Edmund W. Silverfoote, highway landscape specialist I, 33 years; Lucile Stephens, drafting aid II, 11 years.

District 5

Benjamin L. Potter, senior highway traffic signal technician, 16 years.

District 6

Lloyd Allen, Jr., assistant highway engineer, 18 years; Leslie Tresidder, assistant highway engineer, 42 years.

District 7

Otis Bray, highway maintenance man II, 33 years; John A. Parenti, senior delineator, 42 years; William J. Simmons, highway maintenance man III, 29 years; Lena M. Smith, intermediate clerk, 8 years.

District 8

Maynard L. Goode, assistant highway engineer, 34 years.

District 9

Daisy M. Powers, highway field office assistant, 17 years.

District 10

Walter S. Arneson, drawbridge operator, 11 years; Earl D. Freeman, drawbridge operator 23 years; Clinton D. Greenwook, office building engineer, 32 years; Francis J. Leithold, highway engineering associate, 28 years; James T. Sola, highway maintenance man II, 32 years.

District 11

Milton C. Higgs, groundsman, 16 years.

Headquarters Office

Ruth A. Coleman, reproduction machine operator, 12 years; Frances R. Gallagher, intermediate clerk, 19 years.

Headquarters Shop

Ora A. Johnson, machine parts coordinator, 41 years.

MODEL SHOWS PROPOSED SAN DIEGO INTERCHANGE

A preview of the major interchange which, within a few years, will connect Interstate Highways 5 and 8 and State Route 109 near the old town section of San Diego has been on display in the lobby of the Title Insurance and Trust Company in downtown San Diego. Viewing the model are, left to right: R. F. Bachman, vice president and manager of the Title Insurance and Trust Company; District Engineer Jacob Dekema of District 11; and John M. Robinson, president of the San Diego Highway Development Association.

The scale model, used in design of the complex interchange, was built by Division of Highways Bridge Architectural Section in Sacramento.

New Routings Adopted

At its March and April meetings, the California Highway Commission adopted the location for 66.5 miles of freeways on five routes; revised 3.6 miles of a previously adopted freeway routing; and adopted new alignments for 1¼ miles on two conventional highways.

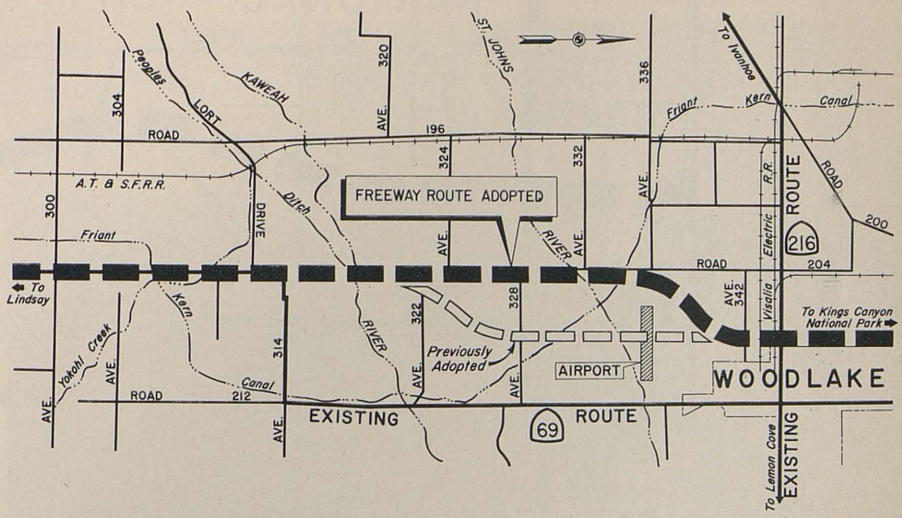
Although all of the route adoptions were preceded by public hearings conducted by the Division of Highways, only one generated sufficient local interest to require a public hearing by the commission itself.

The adoption of a freeway routing for approximately 30 miles of Route 152 in Merced County, between its junction with Route 207 and the Madera county line, was the subject of a commission hearing in Los Banos on March 25.

The new routing generally follows the alignment of the existing highway except for a section of about five miles in and near Los Banos where it curves southeasterly near Los Banos Creek to cross Ortagalita Road, then swings easterly to pass south of the cemetery at Center Avenue.

It continues easterly to the Main Canal, then turns northeasterly to merge with the existing highway about one-half mile east of Ward Road.

In San Diego County, the commission adopted freeway routings for 17 miles of Route 56, between Interstate 5 Freeway, now under construction north of La Jolla, and Route 67, northwest of San Vicente Lake; and for 2.3 miles of Route 54 between Interstate 5, just north of Chula Vista, and just east of Sweetwater Road.

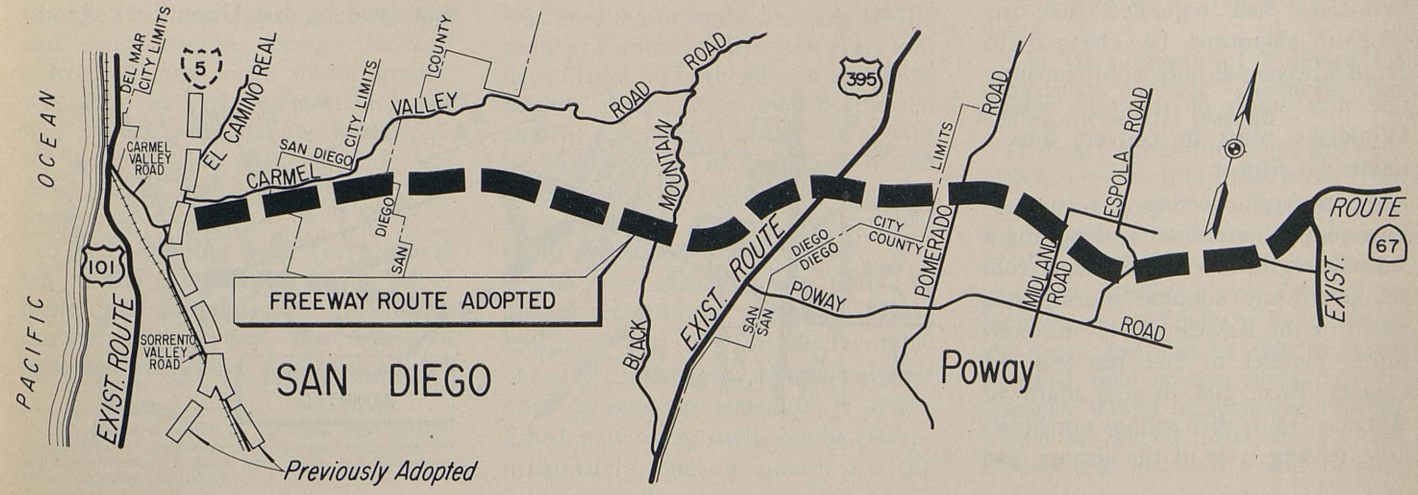


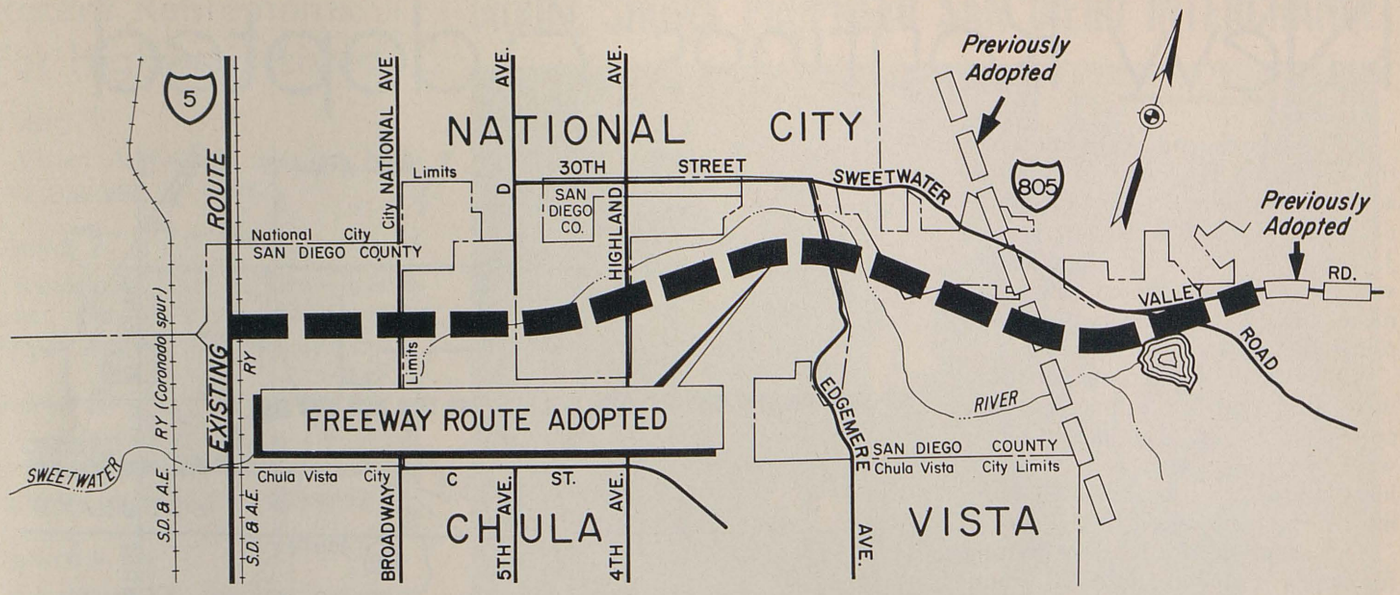
The Route 56 Freeway is planned as an integral part of the future San Diego metropolitan area freeway system, and is intended to serve the anticipated development between the coastal communities of Del Mar and La Jolla, and the inland communities of Poway, Ramona and Julian.

The Route 56 Freeway will run easterly from Interstate 5, just south of Carmel Valley Road, will cross US 395 about 1.5 miles north of Poway Road, and will intersect Route 67 about 0.8 mile north of Poway Road.

Route 54 will follow the center of the Sweetwater Valley easterly from Interstate 5 past Sweetwater Road to Valley Road, with a slight swing to the north in the vicinity of Edgemore Avenue. Near its easterly end the adopted route will intersect with the adopted routing for the Interstate 805 Freeway.

The commission adopted freeway locations in Santa Barbara County for 11.7 miles of Route 246 and 5.5 miles of Route 1.





The new alignment for Route 246 extends between Cebada Canyon Road, about three miles northeast of Lompoc, and 1.7 miles west of US 101 at Buellton. It generally follows the alignment of the existing highway except for a 2.6-mile section through the Santa Rita Hills east of Drum Canyon Road, where it will eliminate some curves.

The Route 1 Freeway will follow the alignment of the existing highway between 1.4 miles northwest of Orcutt and 3.5 miles south of Guadalupe.

The commission had adopted a 20.4-mile combined routing for Routes 65 and 69 in the Lindsay-Exeter-Woodlake area of Tulare County in January 1962. However, the City of Woodlake had requested that the adopted alignment be changed to avoid a private airport, approximately one mile south of the city, which Woodlake plans to convert into a municipal airport.

At its April meeting, the commission adopted a revised routing for a 3.6-mile segment which diverges from the previously adopted routing just north of the Kaweah River and continues parallel to and just east of County Road 204 to just south of Avenue 336. It then swings northeasterly, passing west of the airport, and rejoins the adopted routing at Avenue 342.

The commission also adopted new routings for short sections of two conventional highways.

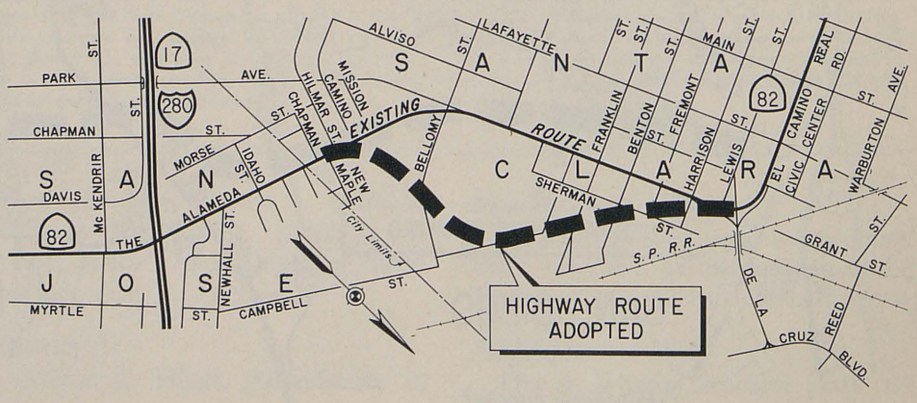
In Santa Clara County, it relocated one mile of Route 82 (El Camino Real) in the City of Santa Clara between De La Cruz Boulevard and New Maple Street.

The new route leaves the existing highway at De La Cruz Boulevard and runs southeasterly to Campbell Avenue at Franklin Street. It follows along Campbell Avenue to approximately 600 feet northwest of Bellomy Street, then turns southerly to rejoin the existing highway at The Alameda near the junction of New Maple Street.

Both the city and the University of Santa Clara had asked that the highway between these limits be rerouted, as it passed through the center of the university's property and the school's planned building expansion would increase the number of pedestrians crossing the highway. The city also stated that the rerouting would benefit a planned urban renewal area by removing through traffic.

In Humboldt County, the commission adopted a new routing for three-fourths of a mile of Route 36, about nine miles east of Carlotta.

The new routing straightens a curve along the north bank of the Van Duzen River around the low-lying flat known as "Stretter Ranch." The former highway was nearly completely destroyed by last December's floods.



Roadside Vegetation Control

Finding ways to maintain California's more than 14,000 miles of state highways efficiently, economically, and safely involves the design and construction of special equipment when items to fit these needs cannot be purchased commercially.

Recent innovations designed by the Equipment Department of the Division of Highways have resulted in two improved machines for roadside vegetation control.

The newly developed ice plant cutter, with blade encased for safety, trims vegetation with a minimum of manpower and traffic disturbance.

Cutter

One is a cutter which is similar to a lawn edger in purpose. The job of the cutter is to trim vegetation that has begun to creep over curbing and thus present an accident hazard. With more freeways featuring attractively planted medians and roadsides, efficient control of overgrowth has become an area of increasing concern.

A plant frequently used for ground cover is ice plant. Although its vines are thick and pulpy, have a high water content, and develop tough fibers, ice plant is one of the few carpeting plants suitable for use as ground cover in California. Over 90 percent of the world's plants have been ruled out for landscaping because all of the state, in terms of nature, experiences an annual summer drought.

The toughness of ice plant makes roadside cutting a difficult chore. Employees on foot were used for the job but hand cutting was time consuming and dangerous. A rotary disk-type cutter, mounted on a motor grader, was tried in early experiments, but was discarded because the round cutter did not trim well; its blade was easily dulled, and it was slow and expensive to operate.

The continuing need for a cutter led to the development of an edger using the principle of the rotary mower except that the blade is mounted vertically. The blade, a ⅜" x 2½" x 24" double-edged alloy cutter equipped with a safety guard, is powered by a hydraulic motor driven from the vehicle's engine. Mounted on a mower chassis, the machine can clear from three to five miles of roadside per hour, a considerable improvement over the one-mile-per-day accomplished by a man on foot.

On the test unit, the cutter blade was installed on only one side of the mower. Future models, however, will have blades on both sides so that both sides of the roadway may be cleared and the direction of travel will always be with traffic. The blade arm of the machine is retractable so that the vehicle need not impede traffic when being moved from job to job.

The first machine was tested in coastal areas where vegetation grows at a rapid rate. Even in this favorable climate, it has been determined that once a mowing schedule is established, new overgrowth can be cut approximately once a month by the machines, and the trimmings easily swept away with gutter brooms.

Spray Proportioner

A second unit, also developed for vegetation control, is used for roadside spraying of both herbicides and insecticides. Retarding growth is preferable to killing vegetation because of the undesirable appearance produced when growth is completely eliminated.

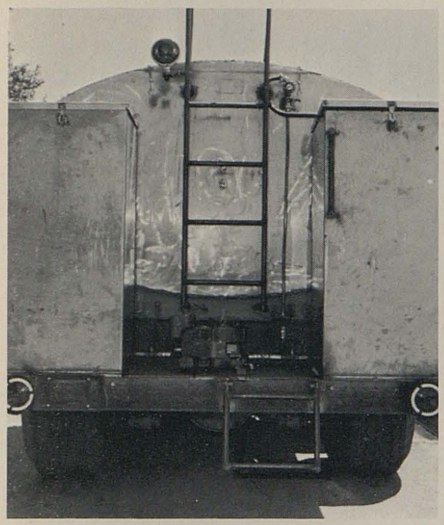
The development of a device for dispensing roadside chemicals was vexing for several reasons.

Ordinary agricultural type sprayers, which work well in fields away from traffic and close to a source of spray supply and water, did not fit the needs of the roadside vegetation control program. Ideally, a unit for use on highways would have a rapid working speed and also be able to travel at usual road speeds when enroute. Capacity would be such that refilling would be needed infrequently. Also, a successful machine would be able

This article appeared in the April 1965 issue of *Public Works* magazine and is reprinted here for the convenience of those who might not have seen it as originally published.

to cover 24 feet of roadside with one application, and could be operated by one man.

In the first experiment, a one-tank truck was used, but certain obstacles were encountered. Quantities of mixture which would be needed for a specific job were hard to estimate. Mixing the chemicals beforehand and loading them into the truck tank

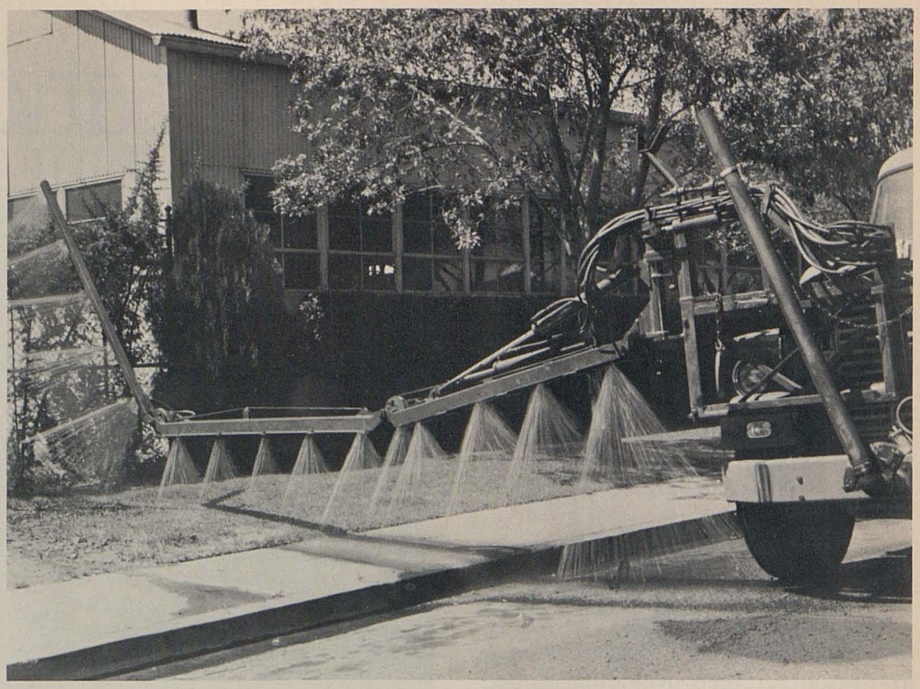


A rear view of the spray proportioner truck shows the two oblong chemical tanks and the oval water tank. The rear steps are retractable.

proved slow and wasteful. Maintenance employees were often at a loss at how to dispose of excess material. Often, long trips were necessary to find a "safe" place to dump a potentially toxic mixture.

Moreover, many of the chemical additives caused the interior of the tank to scale and rust. The rust particles would then flow into the spraying apparatus, causing plugged filters and spray jets. Experiments with types of paints and lining materials to eliminate corrosion of the tank interior were ineffective. Steam cleaning of the tanks was often necessary when different chemicals were used.

A solution to the roadside spraying problem has been found in a recently developed machine called the "spray proportioner." Designed by the Equipment Department, the new sprayer has three tanks on one truck bed. The main tank, of oval configuration, holds a 2,000-gallon supply of water. (One hundred gallons of mixture are usually adequate for spraying one acre.) The



The versatility of the spray proportioner is demonstrated by this positioning of the three eight-foot hinged booms. The irrigation pipe, attached at the center of the truck bumper, is in its travel position.

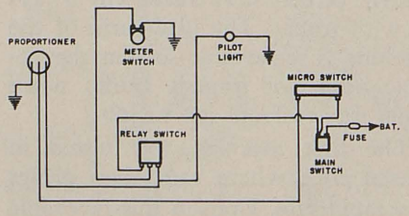
other two 60-gallon stainless steel tanks can be filled with chemicals to be mixed in any desired ratio. The new machine is also capable of varying flow rate and pumping pressure.

The spray proportioner can be used for irrigation as well as for spraying. A water delivery boom is attached to the main tank, enabling the operator to release pure water for trees and other vegetation. A power lift on the boom makes it possible to bypass signs and other obstacles which formerly slowed down operations.

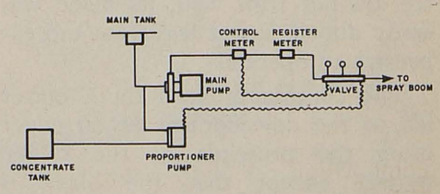
Clogging of jets does not seem to occur with the new method. On-the-spot mixing of chemicals reduces the potential for rusting, and pure water from the main tank can be used to flush the spray jets at the end of a job. Unused chemicals can be drawn off and stored, or left in the tanks for future use.

During vegetation and insect control operations, a second man is required to control the rate of application and manipulate the spray boom from the cab. The spray boom consists of three eight-foot sections, all individually actuated by electronic controls in the cab. When the equipment is in full use, the operator can spray a 24-foot-wide section.

The spray proportioner makes finite control of the spraying operation possible. This is highly desirable in cutting maintenance costs and keeping roadsides attractive.



WIRING DIAGRAM
PROPORTIONER



FLOW SYSTEM
PROPORTIONER

JAPANESE ENGINEERS VISIT HEADQUARTERS OFFICE

A group of Japanese engineers, contractors and highway officials visited California in late April to observe construction methods and confer with staff members of the Division of Highways. Those seated at the table in the Public Works Building conference room in Sacramento are members of the visiting delegation, as are the two men on the left of the group standing at the rear. The other five men standing are from the Division of Highways staff: left to right, James K. Okimura, structural draftsman; George W. Smith, senior bridge engineer; George Langsner, Deputy State Highway Engineer; J. C. Womack, State Highway Engineer; and H. Frank Hiyama, associate bridge engineer. The young lady is Miss Reiko Yabuno, tour coordinator.

Maintenance Chief Ralph Kinsey Retires

Ralph D. Kinsey, assistant district engineer, maintenance, in District 4, retired May 31, completing more than 41 years of service with the Division of Highways.

RALPH D. KINSEY

A native of Los Angeles, Kinsey attended school there, Fullerton and Monrovia. He joined the Division of Highways in 1924 as an instrumentman, grade 2, in Ventura County, at the start of the Coast Highway construction below Point Mugu.

After a short time on surveys, he transferred to construction in 1925, holding residences in the Los Angeles and San Diego areas until 1933. During that year Kinsey was assigned as design engineer in District 7, performing engineering duties in design and right-of-way engineering. In 1940, he was appointed assistant district maintenance engineer in Los Angeles. He held that post until 1945, when he came to San Francisco as maintenance engineer for District 4. He has been in that post since then.

Kinsey is a member of the American Society of Civil Engineers and the American Association of Public Works. He is also a Mason and a member of the Commonwealth Club.

He and his wife, Margaret, have two sons, William R. of Middletown, Ohio, and John of Temple City, and seven grandchildren.

Construction Costs Drop 6.9 Percent

The California Highway Construction Cost Index for the first quarter of 1965 dropped to 249.6 (1940 = 100), which is 18.5 points or 6.9 percent under the fourth quarter of 1964.

The number of bidders for this quarter averages 5.8 per project, an increase of 0.5 over the previous quarter.

District Eight's Wayne Crawford Retires

Wayne H. Crawford, construction engineer for District 8 in San Bernardino, retired in April after 35 years with the Division of Highways.

Except for short periods when he was on loan to the Bridge Department and District 3 in Marysville, all of Crawford's service was with District 8.

WAYNE H. CRAWFORD

He was resident engineer on many major highway projects including the units of the San Bernardino Freeway which included the 60-acre Route 26/43 interchange. He later held the posts of district materials engineer and district design engineer.

A native of Fort Wayne, Indiana, Crawford attended schools there and in Grants Pass, Oregon.

He began his engineering career as assistant to the city engineer of Covina and Glendora, California. Before joining the state in 1930 he was employed by the City of Los Angeles Colorado River Survey.

Crawford is a Mason and a member of the Al Malaikah Shrine.

He and his wife, Emagene, have a son, Wayne, Jr., who is a commander in the U.S. Naval Air Force.

IN MEMORIAM

District 5

Arthur F. Durrant, highway foreman.

District 7

Francis G. Parsons, associate right-of-way agent.

District 8

Curtis Lakes, highway maintenance man II.

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EDMUND G. BROWN, *Governor*

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T. F. BAGSHAW . . . . . Assistant Director
C. RAY VARLEY . . . . . Assistant Director
JUSTIN DuCRAY . Departmental Management Analyst
S. ALAN WHITE . . Departmental Personnel Officer

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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
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C. G. BEER . . . . . Urban Planner
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E. J. L. PETERSON . . Program and Budget 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
R. J. IVY . . . Bridge Engineer—Administration
I. O. JAHLSTROM . . . Bridge Engineer—Operations
DALE DOWNING . . Bridge Engineer—Southern Area

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HARRY L. KAGAN . . . . . Assistant Chief
DEXTER D. MacBRIDE . . . . . Assistant Chief
R. S. J. PIANEZZI . . . . . Assistant Chief

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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

W. L. WELCH . . . . . 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
R. E. DEFFEBACH . . . . Deputy District Engineer

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JAMES A. GUTHRIE . . San Bernardino
ABRAHAM KOFMAN . . . Alameda
FRANKLIN S. PAYNE . . Los Angeles
WILLIAM S. WHITEHURST . . . Fresno
JOSEPH C. HOUGHTELING . . Sunnyvale

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

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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

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HOWARD F. TOPPING . . . . Planning Engineer
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California Highway Commission—1965

This portrait of the California Highway Commission was taken during the April meeting in the conference room in Sacramento.

Chairman Robert B. Bradford, Administrator of the Highway Transportation Agency, is at the left. Continuing clockwise around the table: State Director of Public Works John Erreca, the commission's administrative officer; Roger S. Woolley, vice chairman; Franklin S. Payne; Joseph C. Houghteling; Commission Secretary A. J. Cooper; Assistant Secretary Robert T. Martin; State Highway Engineer J. C. Womack; William S. Whitehurst; Abraham Kofman; and James A. Guthrie.

The large aerial mosaic on the wall shows a portion of San Francisco, in connection with the commission's consideration of a routing for Interstate 480 in that city.