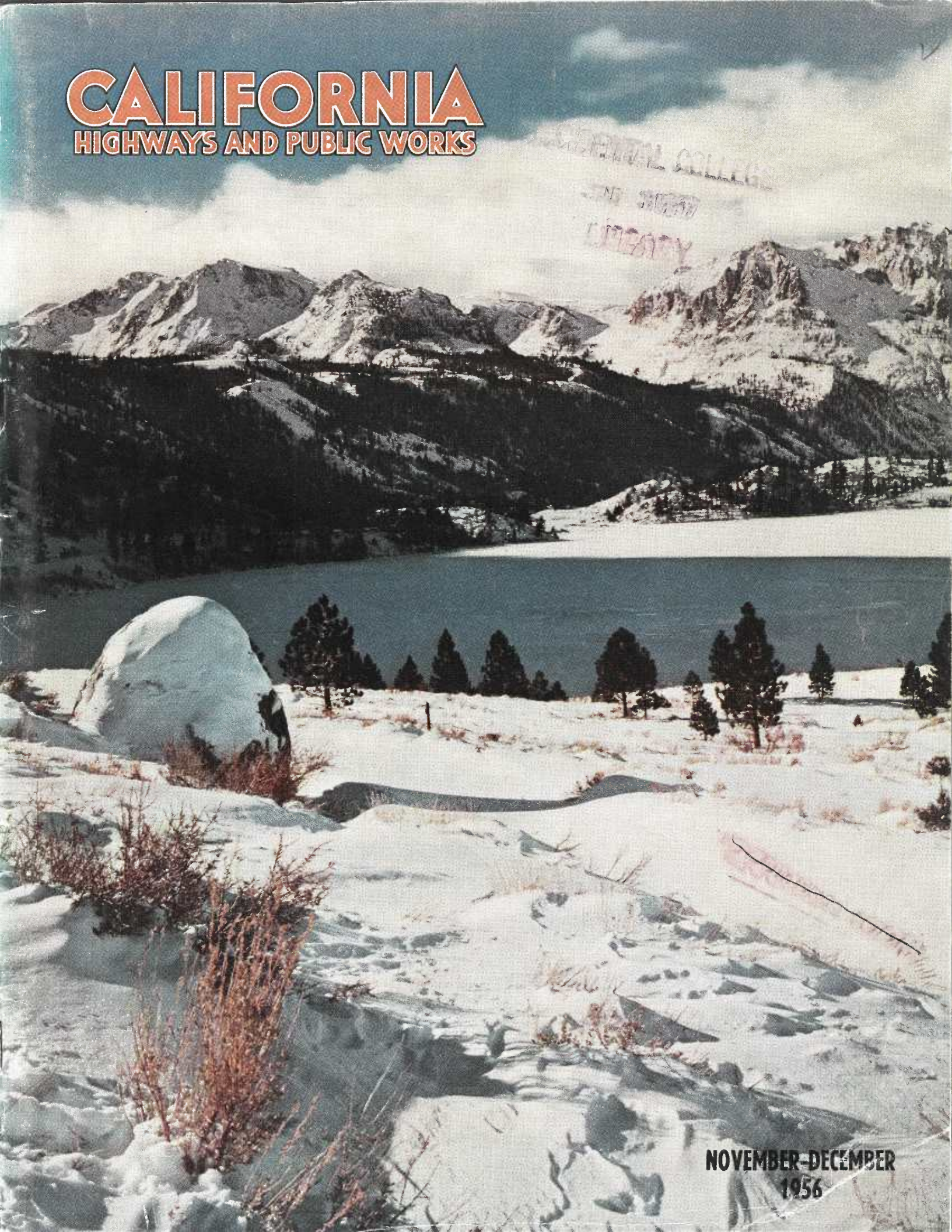
CALIFORNIA
HIGHWAYS AND PUBLIC WORKS



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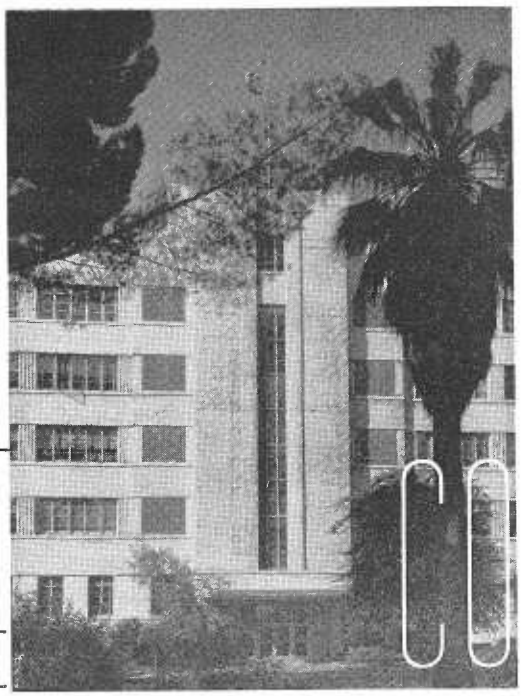

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COVER

June Lake on Route 111 in Mono County receives first blanket of winter snow—*Photo by Robert Munroe, Photographic Section, Department of Public Works, M. R. Nickerson, Chief*

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Angeles Crest Highway Opened

Half Century Dream of Engineers Realized

By GEORGE LANGSNER,
District Engineer

AFTER NEARLY a half century of cooperative effort and expenditures totaling some $10,000,000, the Angeles Crest Highway across the San Gabriel Mountains has been completed, and after dedication ceremonies on November 8, 1956, was opened to public use.

The Angeles Crest Highway, having its westerly terminus at the intersection of Haskell Avenue with Foothill Boulevard in La Canada, extends easterly for 55 miles to the Big Pines recreational area in the Angeles National Forest.

This new highway saves motorists between Los Angeles and Big Pines, 42 miles of travel when compared with the best route previously available. It makes the summer and winter recreational areas of the U. S. Forest Service much more accessible than formerly.

Great Cooperative Effort

The inception of the Angeles Crest Highway dates back some 50 years when the people of Southern California began to recognize the need for additional access to the recreational facilities in the Angeles National Forest. While many organizations and individuals had a part in taking the original steps toward consummation, special mention should be made of the important parts played by the Pasadena Board of Trade, the predecessor of the present Pasadena Chamber of Commerce; the U. S. Bureau of Public Roads, the National Forest Service, and by the Automobile Club of Southern California.

The first engineering work of record that was done on the Angeles Crest Highway was sponsored and financed by the Automobile Club of Southern California. In 1919, Henry W. Keller, as chairman of the Roads and Highways Committee of the Automobile Club of Southern California, authorized an expenditure of $2,200 to the engineering firm headed by J. B. Lippincott for a reconnaissance survey to be used as a basis for later location studies for the Angeles Crest Highway. Ernest E. East, in his capacity as Chief Engineer of the Automobile Club of Southern California, and Harold F. Holley, as Assistant Chief Engineer (recently retired), both made many reconnaissance trips with Lippincott and others dating back as far as 1919. These two engineers did much to keep alive public interest in the Angeles Crest Highway project until the State Division of Highways started the location surveys in 1928 and initiated construction in 1929. Thereafter, East and Holley maintained a lively interest in the project and made frequent trips over the project consulting with State Highway and U. S. Public Roads representatives.

GEORGE LANGSNER

Taken Into State Highway System

The Angeles Crest Highway, as Legislative Route 61, was taken into the State Highway System in three parts. The westerly section from Foothill Boulevard in La Canada to the Mt. Wilson Road at Red Box Divide was brought into the State Highway System by the Bond Amendment of 1919. The middle section from the Mt. Wilson Road at Red Box to Pine Flats became a part of the State Highway System by Statutes of 1931. The easterly section from Pine Flats to the Los Angeles-San Bernardino county line was taken into the State Highway System by the Statutes of 1933.

Allocations of state highway funds for construction on the Angeles Crest Highway were first made in 1929 by the California Highway Commission. In subsequent budgets the commission provided funds for this project so that essential work could go forward.

Among the former members of the California Highway Commission having their homes in Southern California who have maintained, through the years they so faithfully served the people of California, a lively interest in furtherance of the Angeles Crest Highway, where Philip A. Stanton, Amerigo Bozzani, Harrison R. Baker, as well as present commissioners James A. Guthrie and Robert E. McClure.

Top-level Decisions

In carrying the Angeles Crest Highway project through to final completion there have been, from time to time, many top-level decisions that had to be made by the Sacramento staff. State Highway Engineer G. T. McCoy and Director of Public Works Frank B. Durkee are, and have always

been, most enthusiastic in their support of action to advance the Angeles Crest Highway.

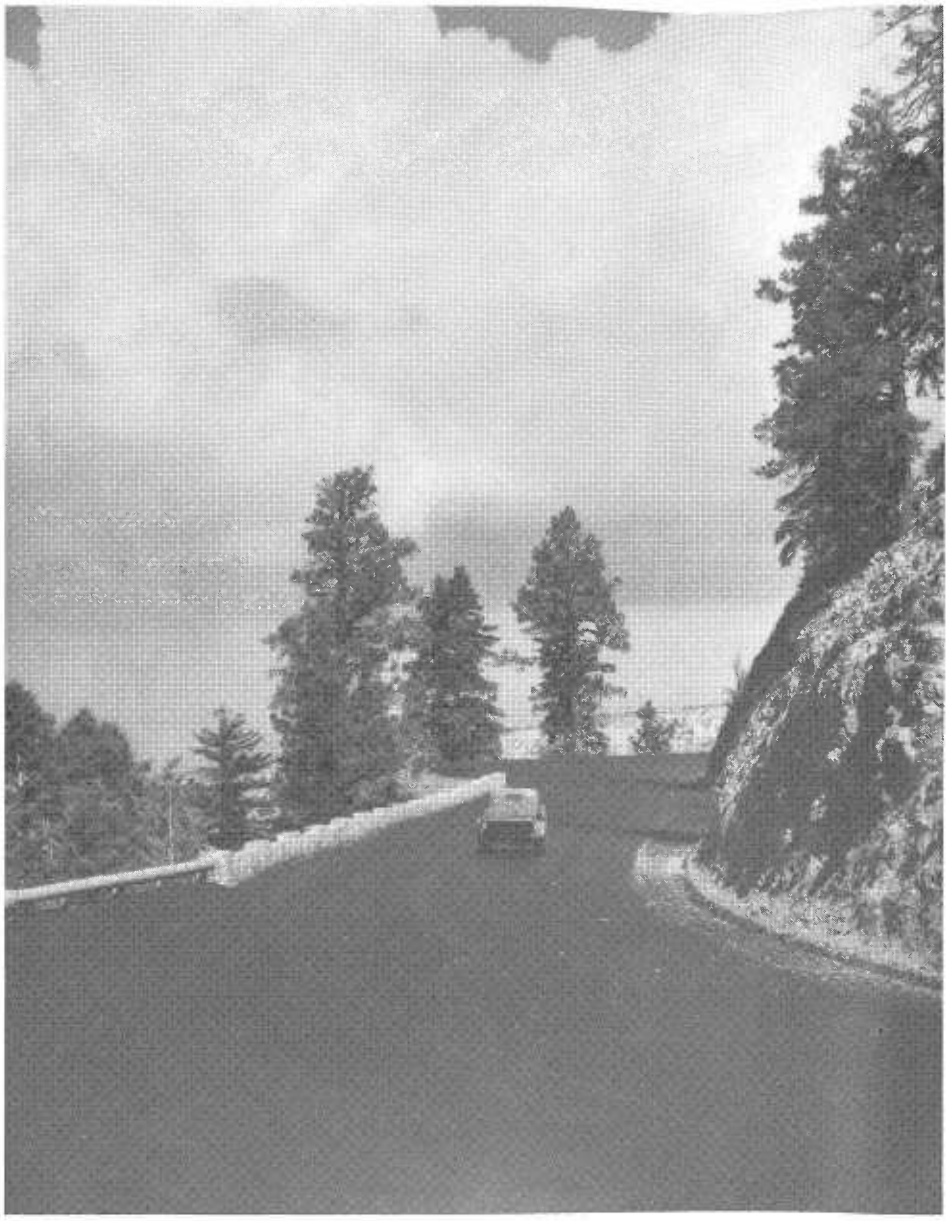
In order to assist in the prisoner rehabilitation program as provided by laws, the decision was made that as much as possible of the construction on the Angeles Crest Highway be done with prison labor working out of honor camps.

Many top-level conferences have been necessary between the Sacramento headquarters staff of the State Division of Highways and the State Department of Corrections. Between these two state departments a most cooperative spirit has always existed relative to the many difficult problems that have arisen in connection with the utilization of prison labor for state highway construction on the Angeles Crest Highway.

These Men Worked Hard

The first camp was first opened under the jurisdiction of the California State Prison at San Quentin where J. B. Holohan was then warden. Work continued under wardens Court Smith and Clinton P. Duffy. Throughout the period correctional officer H. A. Hinshaw was in charge of the camp. Working with him were correctional officers George Lessick, James Rodden, S. Knutson, W. Garrett, W. Ballard, L. McGinnis, H. Johnson, R. Doggett, H. E. Breakbill, Gus Opitz, A. L. Jewett, John Madigan, Bert Gothic, Frank Trip, James Ledden, John Butler, Lester Higgins, Ralph Shera, A. P. Lambdin.

Honor camps were closed shortly after the United States entered World War II and reopened in June, 1946, at the direction of Richard A. McGee, Director of Institutions. It was then a unit of the California Institution for Men at Chino, under Superintendent Kenyon J. Scudder, and continued under Superintendent F. R. Dickson. Chief camp supervisors during the period were George Winter, now field representative of the department; Malcolm Harris, now Deputy Director of the Department of Alcoholic Beverage Control; William Beckley and Johnnie Breen. Supervisor in charge of the opening of the camp was Harry Hoop. Subsequent supervisors were Beckley, now retired, Joe Hendrix,



Looking easterly along Angeles Crest Highway near Dawson's Saddle, showing attractive rock masonry retaining wall on left

Holly Weeks, Walter Slead, John Tisdale, now retired, Walter Stone, Charles Hamilton, and the late Paul Brockmeir.

Louis W. Baugh is presently in charge of the camps.

Federal and State Agencies Cooperate

The location and preliminary engineering on the Angeles Crest Highway, extending over a period of several years, was carried out by personnel of the U. S. Bureau of Public Roads and of the State Division of Highways. There was continual cooperation and harmonious liaison between these two groups of highway engineers. Generally speaking, the State took care of surveys for the westerly section between La Canada and Red Box, whereas, the U. S. Bureau of Public Roads handled the easterly section from Red Box to Big Pines.

In January, 1928, Assistant Engineer J. H. Obermuller, on the staff of Sacramento Headquarters Surveys and Plans Department, made a report to his chief, Fred J. Grumm, Engineer of Surveys and Plans, in which he outlined the preliminary reconnaissance survey of the Angeles Crest Highway

that he had made in company with Robert L. Thomas, Locating Engineer for District VII. (All three of these men have since retired from state service.) In his report, Obermuller makes these significant comments:

Obermuller Report

"The country from the mouth of the Arroyo Seco to Red Box was studied for determination of a routing on which final survey of the project should be started. The two routes surveyed in 1923 by preliminary lines by Frank Waller, U. S. Bureau of Public Roads, the one previously in 1919, by A. N. George for the State, the routing via the existing Edison Company Road, and the possibilities for alternative positions in location, were viewed in the field from the roads and trails and from advantageous peaks. No representative idea of routing can be secured in this brush-covered canyon except from such vantage points. The conclusions reached on that reconnaissance were that hand-level scout lines should be run over a considerable portion of routings approximating the position of the high lines surveyed by Waller and George. This would furnish information regarding doubtful grade connections on advanced alignment standards and permit more reliable recommendation for preferable routing."

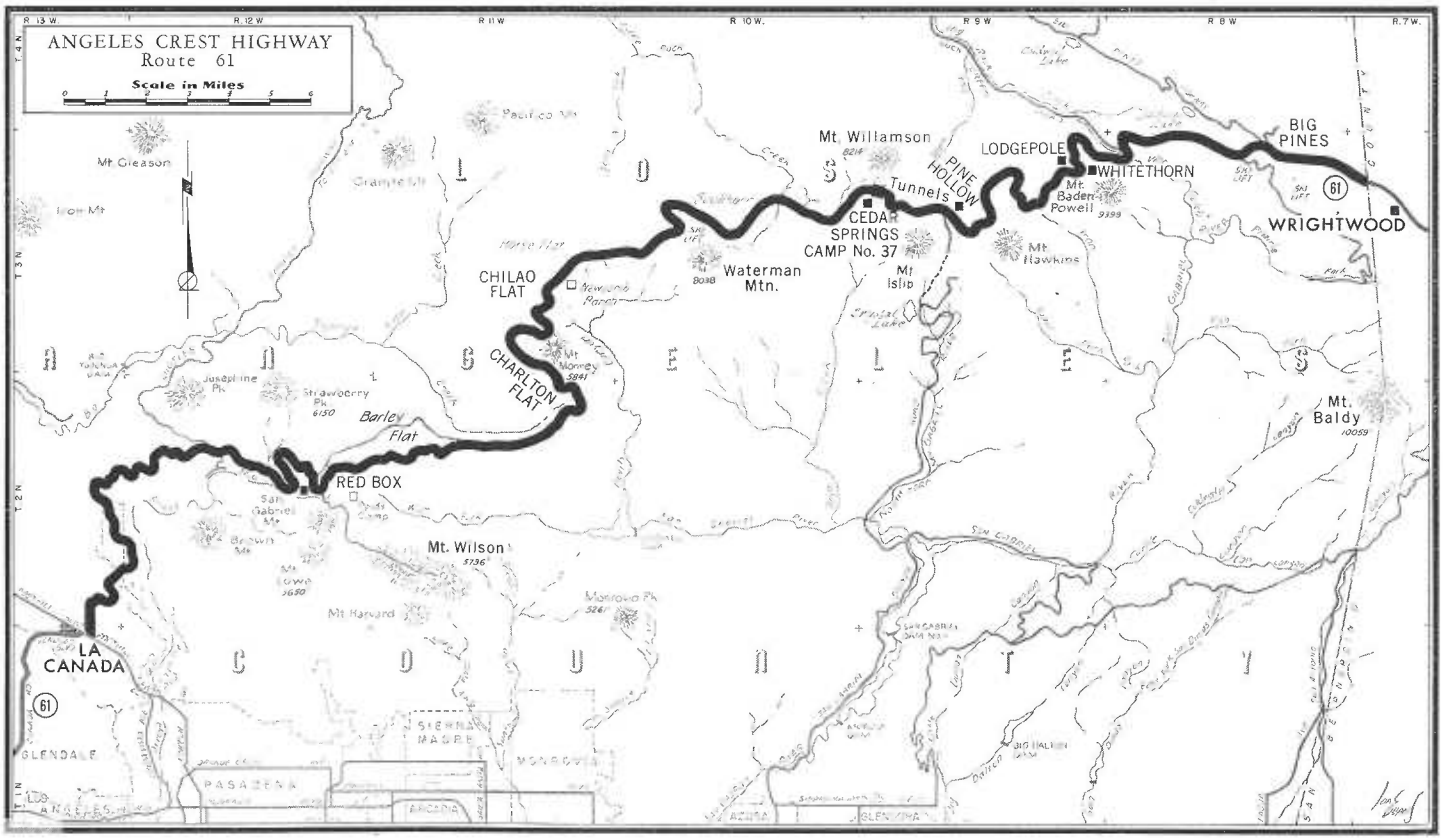
Purcell Starts Surveys

Shortly after Obermuller made his report to Grumm, State Highway Engineer Charles H. Purcell authorized Spencer V. Cortelyou, then district engineer of District VII, to start location surveys for the Angeles Crest Highway with Division of Highways forces. A start was made later in 1928 with a survey party of which W. H. Irish was chief. About the same time came a second survey party under Donald G. Evans, who recently retired from the position of Construction Engineer on the Sacramento headquarters staff. These two survey parties worked under the supervision of Robert L. Thomas, then Location Engineer for District VII (now retired). Henry Hawthorne was the field office engineer on the job assisting "Bob" Thomas. These two survey parties were supplemented by additional survey party personnel during the years 1929 and 1930. Among the District VII engineering employees (in addition to those mentioned above) who made a very considerable contribution to the original location surveys on the Angeles Crest Highway, were: R. L. Adkins, C. T. Berry, E. F. Burge, W. P. Devine, C. Fox, C. C. French, A. L. Hawkins, B. E. Hooper, A. W. Hoy, R. M. Haverstick, Henry Hawthorne, V. B. Kolks, J. Q. McAndrew, B. F. Morris, A. E. Newton, L. F. Phillips, T. T. Peasnall, C. R. Smith, N. D. Soderblom, W. H. Suverkrubbe, and Harry H. Wildy.

Problem of Steep Slopes

The Angeles Crest Highway was designed and constructed to provide a 30-foot roadway with 200-foot radius curves as minimum standard for alignment and as maximum standard for rate of grade. Considering the rough mountainous country passed through these are considered as of sufficiently

Index map of Angeles Crest Highway



high standard. Actually, only a few 200-foot curves were put in at the start and later the minimum was established at 300 feet. Over two of the steep canyons it was found more economical to construct bridges than to build retaining walls to hold back roadway embankments, and in one instance of the location being along very steep side hill, a half bridge was constructed. In many other locations the slopes of the mountain sides were so steep that fill slopes would not catch and masonry retaining walls, reinforced concrete cribbing or metal bin-type cribbing had to be used.

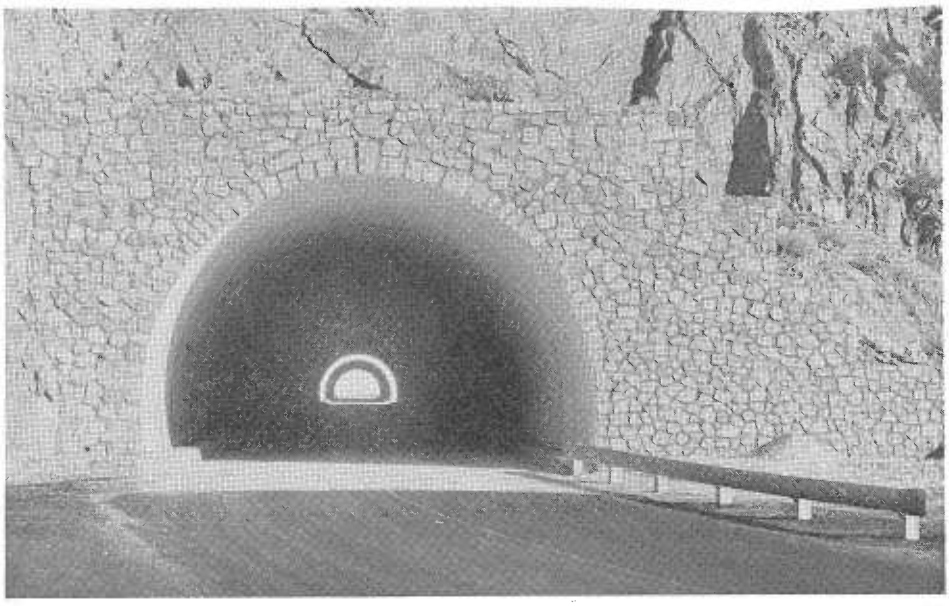
Two Tunnels Built

The most spectacular construction on the Angeles Crest was the building of two tunnels and these were handled by Camp 37 forces from the present location at Cedar Springs. Near West Islip Saddle, the topography is very rugged and precipitous. Two steeply sloping ridges projecting out from the face of Mt. Williamson proved to be too steep for construction of even narrow pioneer roads. At this location, two tunnels had to be constructed. The first tunnel is 680 feet in length and the second tunnel is 470 feet in length. The two tunnels are separated by 87 feet of open-cut roadway. The tunnels were constructed to a section 32 feet wide x 21½ feet high, and the portals have been faced with very appropriate and picturesque rough stone masonry.

On the section of the Angeles Crest Highway between Cedar Springs and West Islip Saddle the excavation is for the most part through hard solid rock requiring that 80 percent of the excavation must be blasted.

The story of the Angeles Crest Highway is one of cooperative effort on the part of several organizations and of many people, women and children as well as men. The loyalty of the wives and children of State Division of Highways regular civil service employees working in Honor Camp 37, who gave up the conveniences and pleasures of urban life to live in small cottages adjoining the day labor camp, certainly was a big factor contributing toward the success of the project.

The children in camp of school age, numbering from 6 to 12, attended the "little red school house" right there in Camp 37, and were instructed in all elementary grades by competent teachers furnished by the Pasadena City School District. Bringing the school to the children saved the 74 miles of round trip travel that would have been incurred had the children been required to go to school in La Canada.



View of westerly portal of Tunnel No. 1 near Camp 37 Honor Camp on Angeles Crest Highway, with Tunnel No. 2 visible through Tunnel No. 1

U. S. Forest Service Aid

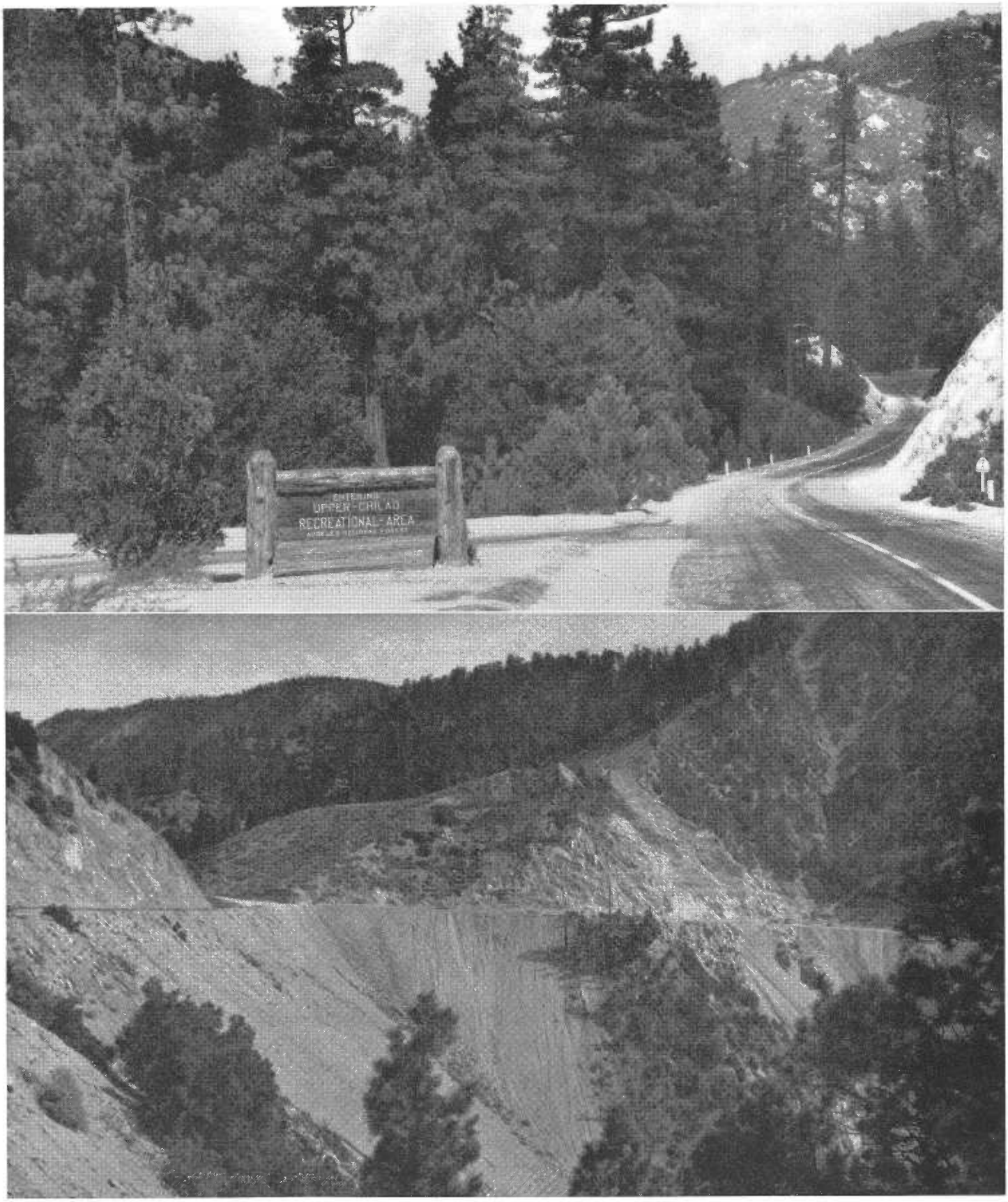
The story of the Angeles Crest Highway is also a story of the Angeles National Forest which it traverses. Had it not been for the active interest of the U. S. Forest Service in leaving no stone unturned to get a high standard road constructed within the Angeles National Forest from La Canada to Big Pines, this project might have been much longer delayed in the building.

Great credit is due to William V. Mendenhall, the forest supervisor for the Angeles National Forest for his enthusiastic support in furtherance of the Angeles Crest Highway and his energetic drive for U. S. Forest Road Funds to be allocated for 16 miles of construction that was carried out by the U. S. Bureau of Public Roads. Mendenhall is most emphatic as to the great benefit that the Angeles Crest Highway has been to the Angeles National Forest. He unequivocably states that this new highway facility has improved the management, the development and the forest fire fighting ability of his staff by 100 percent.

In 1933 there was a very destructive forest fire which denuded of vegetation the mountain sides and canyons above Montrose. At that time only a short section of the new Angeles Crest Highway was traversible. Mendenhall says that in his opinion the fact that forest service fire fighting equipment and personnel had the use of a portion of the Angeles Crest Highway to get back into the mountains and fight this fire, reduced to a very considerable extent the great damage caused by this fire. It will be recalled that early in 1934 the heavy rains falling on the burned-off areas of the Angeles National Forest caused, what has been referred to as the "Montrose Flood," that resulted in many persons losing their lives and millions of dollars of property damage. In Mendenhall's opinion, had it not been for the Angeles Crest Highway this catastrophe would have been much worse than it was.

Made National Forest

Bill Mendenhall well knows this area. He was born and reared in Pasadena. He became a forest ranger in the Angeles National Forest Lopez Canyon District, in 1911, and was stationed there for many years. For a



UPPER—Completed Angeles Crest Highway at entrance to Upper Chilao recreational area in the Angeles National Forest. LOWER—Looking easterly showing long embankment slopes where junction occurs between Crystal Lake Highway and Angeles Crest Highway. Completed Angeles Highway to left. Crystal Lake Road under construction, to right.

short time he served in the Santa Barbara National Forest, and then in 1929 was appointed forest supervisor for the Angeles National Forest. In this capacity he has watched the Angeles Crest Highway grow and develop since initial construction was first started.

The creation of Angeles National Forest dates back to congressional action in 1891, followed by official proclamation of President Benjamin Harrison in 1892. The area was first called "San Gabriel Timberland Reserve." Then in 1908 the name was changed to Angeles National Forest.

One of the points of interest on the Angeles Crest Highway is Newcomb's Ranch located just beyond Chilao Camp grounds about midway between La Canada and Big Pines. This ranch is 160 acres in extent, homesteaded in 1878 by Louis Newcomb. This is the only privately owned land on the Angeles Crest Highway within the forest boundary. Newcomb was one of the pioneers whose knowledge of the back country was officially recognized by his appointment in 1898 as one of the first forest rangers by the newly organized National Timberland Reserve.

Story of Forest

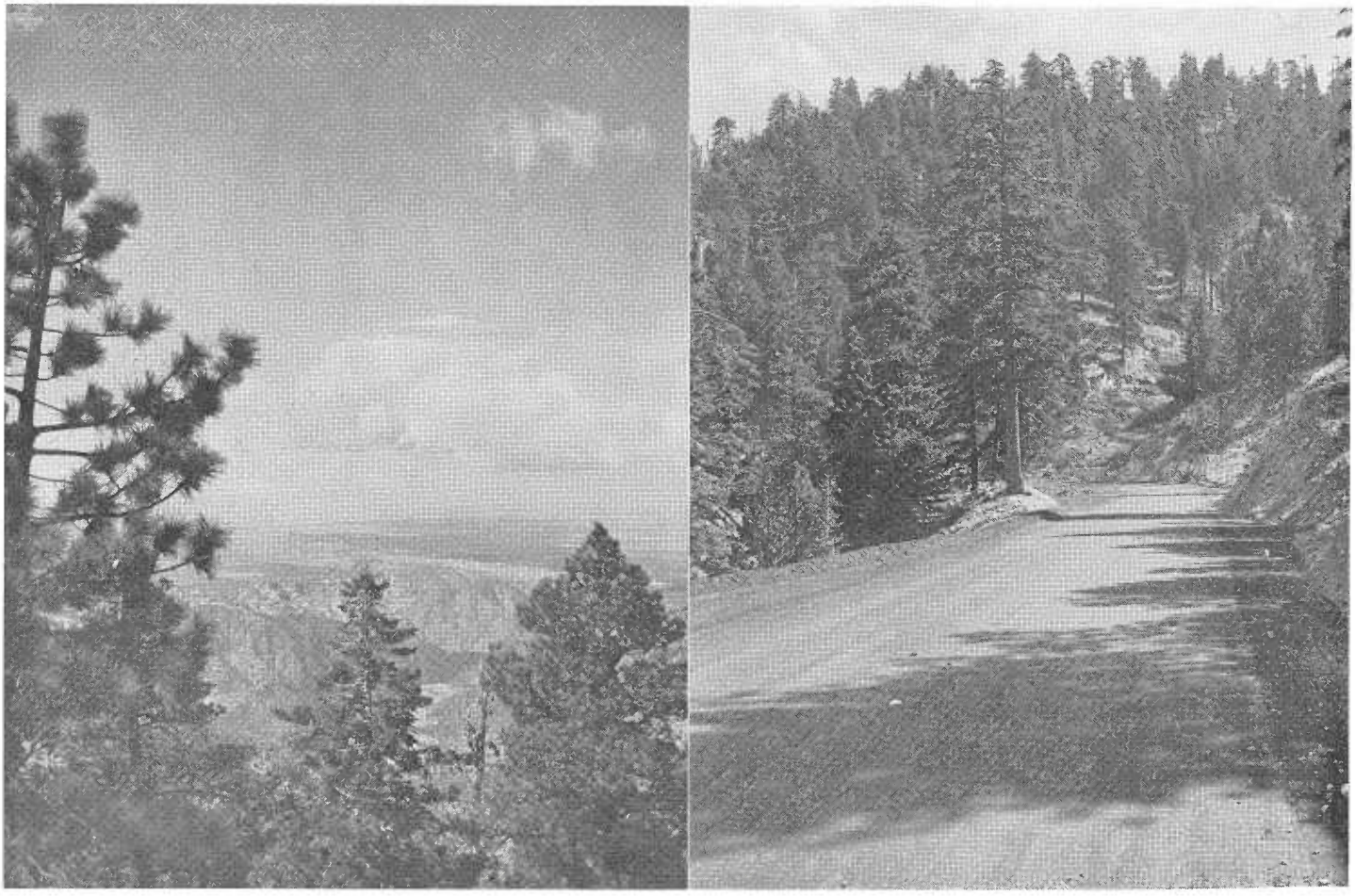
The Angeles National Forest consists of some 700,000 acres of mountains, canyons and forest lands. The people of this area have always been very appreciative of the recreational facilities offered by the U. S. Forest Service. W. W. Robinson, in his "The Story of the Angeles National Forest," as published in 1946 by the Title Insurance and Trust Company of Los Angeles, described the situation as follows:

"The people of the towns and valleys of Los Angeles County have always gone to the San Gabriel Mountains for recreation.

"Before the creation of the forest reserve, however, they got little farther than the ferny dells and the paddle pools at the mouths of canyons. With the building of trails and dirt roads under ranger supervision, the people began to learn more about the playground that lay beyond the western fringes.

"Today, paved highways and automobiles carry 'the people'—thousands of them—into the vast interior of the Angeles National Forest and make them acquainted with its endless miles of deep canyons, its sharp peaks, its chaparral-covered or pine-studded slopes and its rolling, timbered areas. They introduce them to a world of spectacular vistas, swiftly changing views, mountainsides smoking in mist or shimmering in the sun, valleys of dark shadow or hilltops tapestried in

LEFT—Looking northwesterly from Angeles Crest Highway near Buckhorn Campground showing Antelope Valley in background. RIGHT—Looking northeasterly along Angeles Crest Highway spotted for traffic striping in the vicinity of Cortelyou Springs, shown in center. These springs were named to honor Spencer V. Cortelyou, Assistant State Highway Engineer, Retired.



green. During 1945, visitors to the forest numbered 1,310,000. The forest caters to the people. There is a supervisor of recreation on the forest supervisor's staff, and every ranger has 'recreational' activities second in importance only to fire prevention.

Camping Grounds

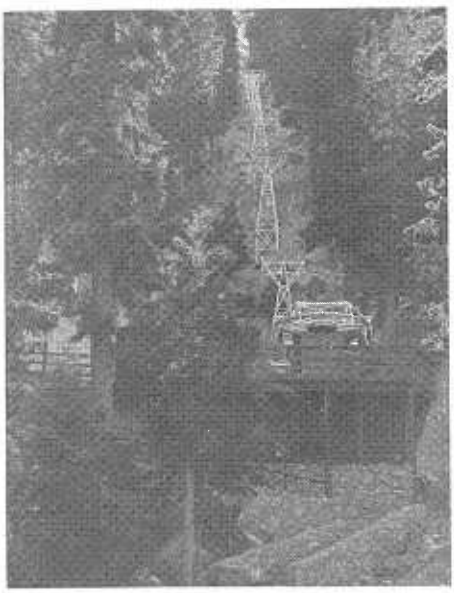
"Charlton Flats, with its stand of ponderosa pine, incense cedar and bigcone spruce, is, under forest supervision, a paradise for the Sunday picnicker. This place was once the goal of the sweating three-day hiker. Now it is the end of a quick drive from Los Angeles for father, mother and the children, who arrive spick and span with twice too much lunch. The ground is soft with pine needles and the air is fresh with pine scent.

"At Chilao, a little farther on, are camping grounds for those who like to go to sleep with the whisper of the pines in their ears. There are trailer units, too, as well as a corral for the horses of those who ride through on the old Sturtevant Trail from Sierra Madre. Chilao, when snow covered, has slopes that are good for safe and sane sledding.

"The same Angeles Crest Highway that introduces the people of Southern California to the beauties and pleasures of Charlton Flats, Chilao and other play areas, carries them on to Mt. Waterman and the joys of winter toboganning and skiing. A chair lift takes the skier from the highway level at 7,000 feet to near the summit at 8,000 feet, giving him a thrilling view and a tug at the pit of his stomach. On the mountain top are a thousand acres of open, rolling slopes and two supplementary tow ropes. To this land of shining snow comes the parade of those wearing ski pants, windbreakers and many-hued shirts, the people who use strange words like 'slalom' and 'crouch' and 'telemark.'

Scope of Work Increased

"In due time this same highway will be extended to the Big Pines recreational area which is under the jurisdiction of the Valyermo Ranger Station. Big Pines is now reached from the desert side of the Angeles Forest by way of Mint Canyon, or by way of Cajon Pass and Wrightwood. In winter it has been visited on Sundays by 20,000 people—devotees of skating, sledding and skiing. The ski tow on Table Mountain, overlooking the area, has a vertical rise of 500 feet. Skiers get a startling desert view from Table Mountain and also of Mt. Baden-Powell—black pines against blue-white. Blue Ridge, also of this area, has ski-heaven slopes."



Mt. Waterman Ski Lift on Angeles Crest Highway

Since Mr. Robinson wrote about the Angeles National Forest in 1946, the U. S. Forest Service has greatly increased the scope of its activities. As of 1955, Mendenhall reports that the number of yearly visitors has increased to 1,700,000. There are also now in use at Holiday Hill and Kratka Ridge, additional areas where winter visitors can enjoy the sport of skiing. Additional camp ground facilities along the Angeles Crest Highway are being provided. There will soon be in operation on the newly opened section between Cedar Springs and Blue Ridge, three additional picnic areas with tables and cooking facilities located at Pine Hollow, White Thom, and Lodgepole.

Beautiful Country

In 1934, Spencer V. Cortelyou, then District Engineer and later Assistant State Highway Engineer, in charge of District VII until his retirement in 1949, in describing the Angeles Crest Highway, wrote in *California Highways and Public Works:*

"As the ascent is made, a beautiful vista is unfolded. From certain prominent points a view can be had of Los Angeles, Pasadena, Glendale and many other cities and small towns in the flatter country below. On exceptionally clear days the ocean and Catalina Island can also be seen.

"Care was used in planning the construction of this road to avoid making high cut or fill slopes which could be seen from the valley. The beauty of the mountain slopes in the vicinity of Los Angeles (particularly north of Hollywood and Beverly Hills) has been destroyed in many cases by the construction of subdivision streets and roads making unsightly gashes in the forest cover. To avoid these long fill slopes at exposed places, the excess material was hauled farther into the mountains and deposited out of view to make parking places and picnic grounds.

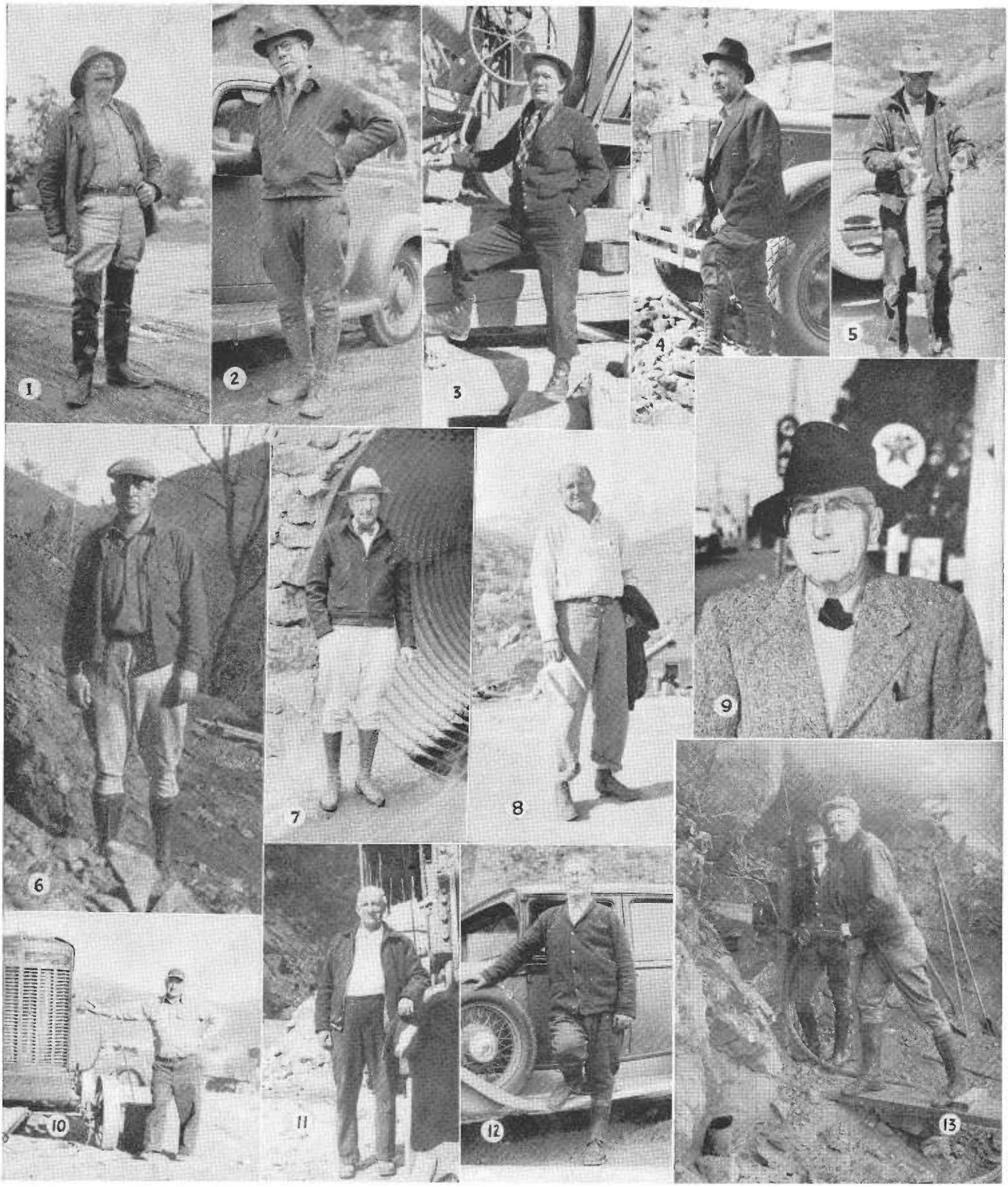
Striking Scenic Views

"Wherever possible, in the construction of this highway, the scenic points have been graded so as to form areas where cars can park overlooking the valley below."

In addition to the scenes mentioned by Cortelyou, of the Los Angeles coastal plain, there are many striking views of the San Gabriel Mountains, Mohave Desert, and the distant Sierra Nevada Mountains as one crosses Cloudburst Summit at 7,000 feet, and Dawson Saddle nearly 8,000 feet in elevation.

The construction on the Angeles Crest Highway was handled as four separate and distinct operations which however often overlapped each other, both as to sections of the Angeles Crest Highway being worked on, and with respect to the time element. The first construction by regular state highway contracts was in 1929 and extended from La Canada four miles northerly. Then, two day labor camps, Camp D and Camp K, were established during 1930-33 as a relief measure to alleviate the unemployment situation, especially for transient homeless men in the City of Los Angeles and vicinity. This work consisted of grading pioneer roads, clearing and grubbing, and erosion control. Then in 1930 to 1934, state highway contracts completed the construction from La Canada to Red Box.

The next phase of construction was a group of eight contracts, from 1934 to 1950, carried out by the U. S. Bureau of Public Roads and financed from National Forest Highway Funds.



*Pioneers of Angeles Crest project—***1.** *L. A. McCandless (1928-1942);* **2.** *H. L. Waste (1930-1945);* **3.** *H. D. Johnson (1947-);* **4.** *W. B. Stout (1929-);* **5.** *H. L. Leventon (1928-1937);* **6.** *A. N. Lund (1922-1931);* **7.** *B. H. Henry (1930-1947);* **8.** *R. C. McFarland (1930-);* **9.** *G. D. Grant (1921-1925);* **10.** *H. F. Caton (1947-);* **11.** *Ed Rawson (1919-1947);* **12.** *W. B. Albertson (1915-1947);* **13.** *R. W. Brown (in foreground) (1918-1926)*

These expenditures, according to Bureau of Public Roads records, totaled $1,308,381 and the construction work was on various sections of the Angeles Crest Highway between Red Box and Big Pines.

State and U. S. Funds

Simultaneously with this work being carried on by the U. S. Bureau of Public Roads, the State Division of Highways through day labor work orders financed from funds budgeted by the California Highway Commission extending over the years 1935 through 1956, excepting during the war years, carried out construction work utilizing honor camp labor. This was done in cooperation with the State Department of Corrections. The work conducted by Honor Camp 31, Honor Camp 35, and Honor Camp 37, completed all the remaining construction between Red Box and Big Pines that was not completed by the U. S. Bureau of Public Roads contracts.

During the years 1930 through 1956, the California Highway Commission has made 22 allocations of funds totaling $6,336,205 for day labor work on the Angeles Crest Highway.

The earlier camps, Camp "D" and Camp "K," were operated during the years 1930-33 on the section of the Angeles Crest Highway between La Canada and Red Box, and were largely for the purpose of providing worthwhile work to relieve the unemployment then existing in the Los Angeles area. The superintendent in charge of Camp "D" was A. N. George, and the resident engineer was M. L. Bauders. For Camp "K," C. C. Rossi was superintendent, William Axtman was his assistant, and M. L. Bauders was resident engineer.

Operations of Camps

Later the three honor camps previously referred to were established to utilize prison labor as supplied by the State Department of Corrections. Camp 31, located three miles east of Red Box, was put into operation in August of 1935 with Benjamin H. Henry as superintendent and M. L. Bauders as resident engineer. In 1937, this camp was moved to a new location near Newcomb's Ranch and called Camp 35. The location was again changed in 1939 to Cedar Springs and was known as Camp 37. Honor Camp 37 remained in operation until it was closed down in September 1942 when the World War II situation became acute and shortages of critical material developed. Operations were resumed in June, 1946, the camp being reopened with William E. Melcher and Frank B. Cressy, who had just returned from a tour of duty with the U. S. Navy, in charge. Ben Henry resumed his old post as superintendent, taking over from Frank Cressy when the latter was promoted to the position of district construction engineer for District VII. In 1948, when Ben Henry accepted an assignment in the District VII office, Harry D. Johnson became superintendent of Camp 37, and has been continuously in charge up to the present time.

During the periods of day labor camp operation many engineers on the District VII staff had assignments as resident engineers on this work. Among these were: M. L. Bauders, Eugene Burge, W. J. Calvin, Ralph Chase, Ray De Groff, W. D. Eaton, G. E. Farnsworth, E. W. Fehsenfeld, K. M. Fenwick, J. M. Lackey, W. E. Melcher, F. A. Read, P. R. Reed, L. F. Phillips, and H. A. Wildy.

During the period of construction on the Angeles Crest Highway the work was successively under supervision of District VII Construction Engineers L. M. Ransom, A. N. George, F. B. Cressy, E. G. Bower, and Bruce A. Gentry. During the construction period, general supervision was the responsibility of District Engineers S. V. Cortelyou (later promoted to Assistant State Highway Engineer), P. O. Harding (later promoted to Assistant State Highway Engineer), M. E. Cessna, W. L. Fahey, George Langsner, and Lyman R. Gillis. General supervision is now exercised by Assistant State Highway Engineer Edward T. Telford, District VII.

Rehabilitation Program

During the year 1948 the *San Francisco News* reprinted a series of articles on California state prisons and the problems of organization and operation that faced the State Department of Corrections. In this reprint edition the editor of the *San Francisco News* prefaced the issue as follows:

"What happens after sentence? Where does the prisoner go? What kind of treatment does he get? What kind of food does he eat? Where does he sleep? What work, if any, does he do? What interest have you, the taxpayer, 'the people of California,' in this prisoner? Do you care, for that matter, whether he comes back alive to the responsibilities of citizenship or with senses deadened to anything but crime?

"You should care, because he is an expensive 'guest' while in prison; and potentially an expensive ex-criminal, unregenerate and bent upon more expensive crimes upon release; or, having served his term in custody, is a new person, with a new outlook upon life, with new determination to become a useful member of society.

"It was to inquire into these alternatives, this cost of custody, confirmation in crime, or rehabilitation of the prisoners of the State, that Al Ostrow, reporter, and Herman C. Bryant, head photographer for *The News*, toured the prisons of California, examined every cell, every shop, every yard, every infirmary. They saw everything.

S. F. News Articles

"What they found is that California is conducting the most extensive and progressive experiment in reclaiming human beings, in straightening out distorted minds, in rehabilitating men and women to become useful citizens ever attempted in the history of penology.

"The story was told in a series of articles, with pictures, and is reprinted here. The story is entitled, 'Send 'Em Back Alive!'"

In his story Ostrow has considerable to say about State Highway Honor Camps. In discussing the operation and accomplishments of Camp 37 on the Angeles Crest Highway, he said:

"There was enough dynamite in the cache to rip open the seams of both Folsom and San Quentin Prisons, and the men handling it were convicts.

"But Harry Johnson, the rugged State Highway Department Engineer in charge of the Angeles Crest road camp at Cedar Springs, was not apprehensive.

"'We're too busy building a highway through mighty rough country to worry about such things,' he confided.

"The camp is 6,800 feet above sea level, amid the scenic splendor of Angeles National Forest, not far from the famous Mt. Wilson Observatory. This is the type of upland grandeur that inspired the inscription on the State Office Building in Sacramento: 'Bring me men to match my mountains.'

Few Escapes From Camps

"Freedom seems particularly precious in the wide open vistas of the Coast Range, where bald rocks tower boldly above the timber line and great trees sway gently in the embrace of pine-flavored breezes. A man with a number who has spent several years

These old photos show snow conditions at Angeles Crest Road Camp No. 37 in Los Angeles County. UPPER LEFT AND RIGHT—A 12-foot depth of snow is indicated by views of tank in center of each photograph. LEFT—Before heavy snowfall. RIGHT—After heavy snowfall with top of tank just visible. CENTER LEFT—Free family quarters near Camp 37. CENTER RIGHT—Camp equipment shop. LOWER LEFT—Removing snow from road through camp. LOWER RIGHT—Clearing snow to office entrance.

behind prison bars might easily become intoxicated by the fresh atmosphere and decide to take a deep draught of liberty.

"It's easy to escape from Angeles Crest—but few men do. They have too much to lose by running away, and a lot to gain by staying.

"There are no armed guards and no guns at Angeles Crest. The custodial force consists of two officers whose job, aside from the nose counting, is about the same as that of policemen in any isolated construction camp. Their job is made easier—or perhaps harder—by the fact that intoxicating liquor and gambling are banned.

"The prisoners work side by side with 25 foremen employed by the Highway Department. They blast tunnels through the mountains, crush rocks, build culverts, pour concrete, clear underbrush, cut timber, and scale the crags to knock loose projections which might eventually fall and block the highway.

"The prisoners expect to stay only six months to two years each. All of them are that close to parole.

Careful Selection of Workers

"Carefully selected from the inmate population of the California Institution for Men at Chino, most are volunteers eager to get out of confinement and into the bodybuilding outdoors, as well as to save up some money before their release.

"The punishment for breaking the rules at Angeles Crest is immediate return to Chino. Men who violate the confidence of the classification committee which assigned them to the camp by running away lose their parole dates and face an additional penalty of a year to life at San Quentin or Folsom for escaping from a state prison.

"The road camps are part of the program of the State Department of Corrections designed to send men out of prison better prepared for normal social life than when the gates closed behind them; to 'send them back alive.'

"The number of men who can be sent to the camps is rigidly limited by security considerations. There wouldn't be much point in sending a lot of prisoners whose records indicate they would very likely attempt to escape from the camps as they are presently run. That would only make trouble for the camp officials, and also for the men—since statistics show that close to 99 percent of America's escaped convicts are recaptured."

Legislation in 1915

For many years while he was assistant construction engineer on the Sacramento headquarters staff, George A. Tilton, Jr. had the responsibility of general supervision over all honor camps operated by the State Department of Corrections and the State Division of Highways. Published shortly after his death, George Tilton's book, *Prison Road Camps*, based on a series of articles he had written in *California Highways and Public Works*, fully covered the history and legislation behind this activity as well as detailing the accomplishments.

The employment of prison labor for the construction of state highways in California was first advocated in a bill introduced in the 1915 Legislature by Assemblyman B. B. Meek of Butte County, who later held the office of Director of Public Works from 1927 to 1931. This bill was enacted into law and became the basis for establishment during that year of honor camps in various locations throughout the State.

As honor camp operations employing prisoners on highway work proceeded, the need for changes in the law was recognized, and the original legislation was modified by statutes of 1923, 1935, 1941 and 1947. The law now provides that inmates shall be paid a daily wage of $3.50, from which are deducted necessary expenses. The law also provides that nonconvict personnel be assigned to supervisory positions and to all jobs requiring skilled labor, such as shovel operators and truck drivers. Prisoners are not automatically assigned to highway work in the honor camps; they must first make a voluntary request and meet certain minimum requirements to become eligible. There are far more applicants for service in the honor camps than there are jobs to be filled. As George Tilton expressed it:

Eligibles Eager to Work

"There is probably no greater pleasurable anticipation in the gamut of human emotions than the prospect of departing prison environment after years of close confinement. Having once reached the eligible list, the inmate eagerly awaits the time he is to be sent to a camp. Immediately prior to prison departure, he is interviewed personally by a prison official and told that he is being placed on his honor to obey all camp rules, and that he is expected to work at any tasks assigned to him.

"Upon arrival in camp, new inmates are promptly assigned to comfortable quarters and acquainted with camp routine and rules by the senior camp supervisor responsible for their custody. The day following arrival in camp, the prisoner comes in active contact with state highway personnel for the first time, and the relative freedom of an outdoor life."

Honor Camp 37, with respect to responsibility for the inmates, is under the jurisdiction of the Superintendent of the California Institute for Men near Chino, that is operated by the State Department of Corrections. One of the main duties of the honor camp superintendent is to maintain close contact and harmonious cooperative relations with the camp supervisors and correctional officers of the State Department of Corrections. The operations of Honor Camp No. 37 on the Angeles Crest Highway work have proven over the years that the productiveness of inmate labor is comparable to that of free labor.

Withycombe Report

Assistant State Highway Engineer Earl Withycombe, in submitting his annual progress report on honor camp projects as of June 30, 1956, comments as follows:

"The Department of Corrections is responsible for inmate welfare in the camps. The Department of Public Works pays to the Department of Corrections $3.50 per inmate day on a day's worked basis. The Department of Corrections in turn feeds, clothes and pays the inmate $15 per month on a six-day week basis, or $18 per month on a seven-day week basis.

"During the last fiscal year all major grading operations were completed on the final 16 miles of the Angeles Crest Highway, Road VII-LA-61-C,D between the camp and Blue Ridge, 2.1 miles westerly of Big Pines.

"Activities during the spring of 1956 were concentrated on the cleanup of minor slides and sloughs into the gutter which was performed with rented equipment. The power shovel was utilized in removing a major slide which had occurred during the winter and completing some rock excavation.

"Fine grading operations were completed and selected material was placed on the roadbed for bituminous surfacing operations to be performed by contract during the summer.

"Unusually good weather conditions also permitted continuation of grading operations on the Crystal Lake Road, VII-LA-62-B for 1.2 miles southerly from the intersection with Route 61 at Islip Saddle. This section requires extensive drilling and blasting operations as the location is generally in rock formation.

"A total of 452,658 cubic yards of excavation were moved this year at an average cost of $1.09 per cubic yard. To date a total of 4,179,929 cubic yards have been moved at an average cost of $0.76 per cubic yard.

"The inmate quota of this camp is 100 men, but population varies during the year depending on the weather. The average inmate population was 79 for the year, the lower figures during the winter months pulling down the average. This spring the district requested an increase to 114 men because of favorable working conditions.

"During the year H. D. Johnson was superintendent, W. E. Wescott, Sr., was field office assistant and E. F. Burge was resident engineer."

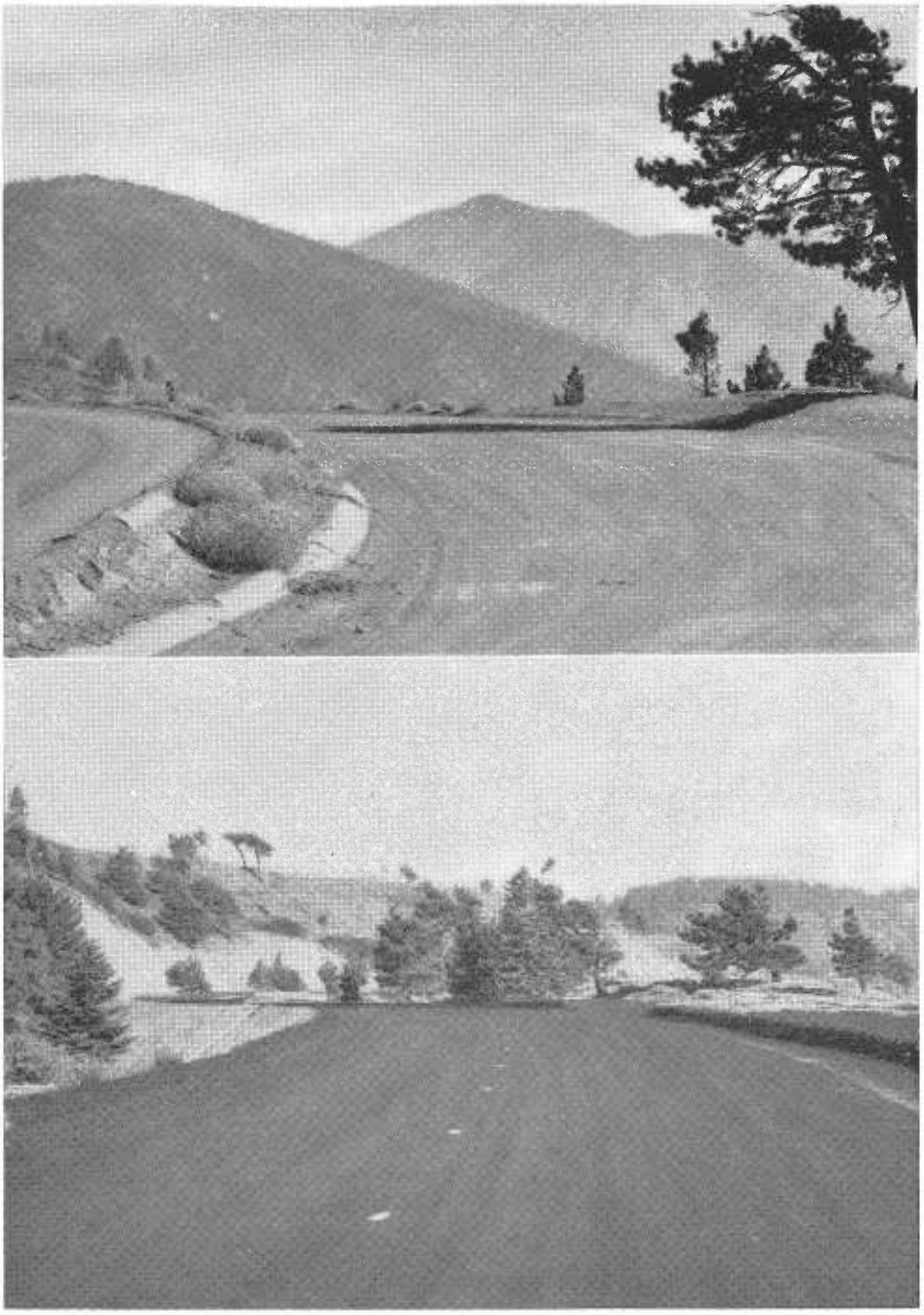
Erosion Control

Meldon L. Bauders, now District VII City and County Cooperative Projects Engineer, was resident engineer at various times on Angeles Crest Highway construction between 1929 and 1939. During this period, one of the chief problems was erosion control. Mel Bauders states that during the Angeles Crest construction Charles J. Kraebel, senior silviculturist for the U. S. Department of Agriculture, Forest Service, spent considerable time on the job, to the end that adequate erosion control features could be worked out during construction, explaining the whys and wherefores of erosion control, and personally put on practical demonstrations to show how the work should be done, even to seeding of slopes. In 1935 Kraebel's handbook was published, entitled *Erosion Control on Mountain Roads*. In this book many references are made to the Angeles Crest Highway, and Kraebel's grasp of his subject is well shown by the following excerpts:

"The rapid increase of motor traffic into the mountainous parts of California during recent years has compelled the building of many new high-standard roads and the reconstruction of old roads along modern lines. Much of this traffic is pleasure bent, and the new roads are devoted largely to the opening of recreational areas, particularly in the national forests and national parks. That these roads often disfigure the very charms they are intended to reveal is one of the unfortunate results of the high standards on which they are built and the rugged topography which they necessarily traverse. Another result, even more serious from the economic viewpoint, is the long train of damages from erosion beyond the rights of way for which the new roads are almost invariably though by no means unavoidably responsible.

Battle With Nature

"No sooner is a new road constructed than the forces of nature are at work to destroy it. Water and wind, cold and heat, and the constant pull of gravity, all combine to break up the road surface, tear down the fills, and round off the squared edges of shoulder berms and back slopes—in short, to eradicate the entire road and cause the area occupied by it to revert to the wild state. On newly improved roads the wear by traffic is unimportant compared with the work of these natural forces, and of these forces the most powerful by far is water.



UPPER—Looking easterly along Angeles Crest Highway approaching Big Pines recreational area, showing side of road development for motorists who wish to park off the highway. LOWER—Completed Angeles Crest Highway with centerline marking for traffic striping at Blue Ridge Summit, three miles westerly of Big Pines recreational area.

"The direct cause of all this damage is, of course, the movement of enormous quantities of soil and rock which are loosened during construction and started on a suddenly accelerated descent to the sea. In most sections of California a great part of this displaced material finds its way almost immediately into stream channels, reservoirs, water-spreading grounds, and irrigation works. The damage to water supplies created by such deposits has in some localities reached serious proportions. Recreational values are similarly hard hit, in the extermination of fish in pools filled by the eroded silt and sand, in the destruction of camp grounds, in the despoliation of streamside beauty by mud and boulder flows, and in damage to roads and bridges."

Erosion Work Important

H. Dana Bowers, supervising Landscape Architect for the State Division of Highways, and Kraebel conferred

innumerable times in working out the erosion control features to incorporate in the Angeles Crest Highway construction work, to the end that damage from storm water flow would be kept to a minimum. Regarding this feature of the Angeles Crest Highway construction, Dana Bowers has this to say:

"Erosion control methods have been considerably simplified and perfected since the 'early' days of 1935. At that time we were just becoming erosion conscious, a consciousness that was accelerated by the ever-increasing soil losses occurring on higher cut slopes resulting from the demand for improved alignment and grades.

"For many years erosion control was a period of trial and error, and almost anybody's idea was given a trial. In retrospect it is now somewhat amusing to review the many approaches to the problem. Practically everything was done in an effort to protect the raw slope surfaces, except the single natural method—the use of grass. Barriers of every kind and description, from steel to fish netting, were employed, all of which required hand labor to install. In those days hand labor was plentiful and cheap, but as the depression eased off and good times and high prices arrived, it became the popular thought of the day to avail ourselves of more economical methods.

"Consequently, because of economics, plus observation and analysis of the various erosion control methods that had been installed, we finally arrived at the present method we are using which involves the use of straw, cereal grain and other seeds, fertilizer, and for compaction a modified type of sheep's foot roller. We call this method our Type "C" stabilization. We also found that compaction of the slope surface into which straw had been incorporated was of paramount importance. Water more slowly penetrates a hard surface, therefore reducing saturation and slump. The straw imbedded into the surface serves the same purpose as the grass root mat that would form as the season progressed. In short, we are now merely imitating, on a speeded up schedule, nature's age-old method that can be observed on every hillside, but it took us years to see it!"

U. S. Bureau of Public Roads

Many passing references have been made in this story to the U. S. Bureau of Public Roads and the part its personnel played in bringing to consum-

Easterly end of Angeles Crest Highway where it joins existing road at Big Pines recreational area

mation the completed Angeles Crest Highway. As shown on the accompanying tabulation, the U. S. Bureau of Public Roads carried out eight separate construction contracts, building 16 miles of the Angeles Crest Highway at a cost of approximately $1,300,000.

The location engineering for the Angeles Crest Highway between Red Box and Big Pines was carried out by H. A. Alderton and Henry A. Garber, location engineers for the U. S. Bureau of Public Roads. H. A. Alderton is now Principal Highway Engineer in the U. S. Bureau of Public Roads District Office in Sacramento.

The operations by the U. S. Bureau of Public Roads were under the general direction of the Division Engineer in San Francisco, Charles C. Morris, until 1946. Since 1946 and to date, the operations have been under the general direction of the District Engineer in Sacramento, E. C. Brown.

Los Angeles County has a big stake in the Angeles Crest Highway. Until a few years ago, the Los Angeles County Department of Parks and Recreation operated the Big Pines County Park at the easterly end of the Angeles Crest Highway. This area has now been returned to the jurisdiction of the U. S. Forest Service as a part of its recreational activities in the Angeles National Forest.

In Mt. Wilson Area

In 1934 the U. S. Bureau of Public Roads with some $500,000 of U. S. Forest Road money completed a contract for five miles of scenic highway connecting Mt. Wilson with the Angeles Crest Highway at Red Box. This was a very important highway because it gave the people of California easy access by automobile, via the already completed portion of Angeles Crest Highway to Red Box, to the hotel and Carnegie Institute Observatories on top of Mt. Wilson. It superseded an old single-lane steep and curving wagon road on the south slope of Mt. Wilson, known as "The Toll Road." During later years the top of Mt. Wilson has taken on an industrial aspect due to the installation of television transmission towers atop the mountain. Had there not been the Angeles Crest Highway and the Los Angeles County maintained road from Red Box to Mt. Wilson, the problems of making and maintaining these television transmitting installations might have proven insurmountable.

Another important project developed by the Los Angeles County Road Department is the Angeles Forest Highway northerly to Vincent that connects with the Angeles Crest Highway at Clear Water Canyon about four miles from La Canada. This has proven to be a very important additional highway facility for motorists traveling between the Palmdale area of Antelope Valley and the Pasadena-Los Angeles area.

New Recreation Areas

In the April 9, 1956, issue of the *Los Angeles Mirror-News*, Staff Writer Charles Ridgway, in describing construction work on the Angeles Crest Highway, in part writes as follows:

"No wide freeway this—just a two-lane rock-littered trail not quite ready for a coat of asphalt. But when the State Highway Commission recently appropriated a final $180,000 for paving this most rugged of mountain roads, the realization of a 30-year dream was in sight. The highway will open vast new recreation areas. Exciting ski slopes will bring Wrightwood and Big Pines Park 27 miles closer to Los Angeles and provide a new outlet to the desert.

"Resident Engineer Eugene Burge can remember back to 1928 when he helped survey for the beginning of Angeles Crest Highway at La Canada. During the 1930's the road construction wound its way past Lookout Mountain, through Red Box Gap around Mt. Wilson, across Barley Flat to Mt. Waterman and Kratka Ridge. Except for a turnoff over Angeles Forest Highway to Palmdale, it was a 40-mile road to nowhere.

"It was in 1946 before engineers returned to open a construction camp at Cedar Springs and begin picking away at those last 16 miles. With them came 'trusties' from Chino Prison, men who thought they had it tough for a few years until they came up against the mountains.

" 'Just put a man on a jackhammer for about a week if you want to see the meanness leave him,' advises one supervisor. Through the years the prisoners—50 to 100 at a time—have scraped away at the rocks under the supervision of 30 Division of Highway employees. Almost without exception, the Chino men have come away better citizens because of their experience.

Camp Has Own School

"And the men who watch over them wouldn't trade their job for any other. About 15 families of supervisors and other 'free' workers live in a separate camp about a mile from the prisoners' barracks. The camp's one-room school has eight students. Camp Superintendent Harry Johnson has been on the job since it started in 1946. Johnson is eligible for retirement but is waiting until the job is finished. Why does it take so long? Take a look back over what has already been done. There are two tunnels through Mt. Williamson totaling more than 1,000 feet in length. There's a huge cut across the face of sheer cliffs near Islip Saddle. It's only one of many as the road winds up to a summit of nearly 8,000 feet at Mt. Baden-Powell.

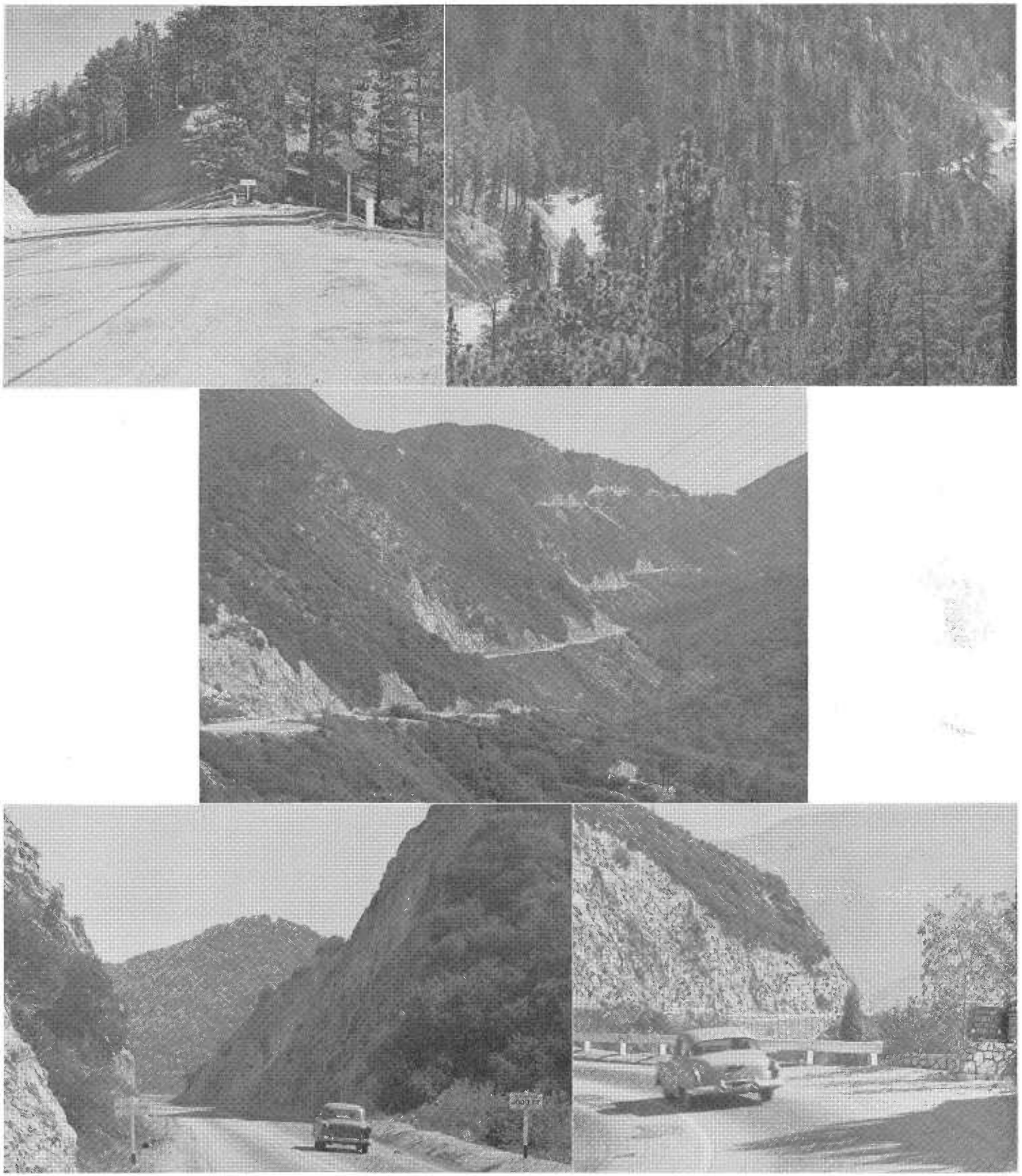
" 'At first,' explains Frank Cressy, superintendent of construction for Division of Highways District VII, 'it's almost all hard work. When the path is wide enough, bulldozers move in to help, but every yard of the way has to be blasted with dynamite. You begin at the top, blow the rocks loose, then roll the debris down into the canyon 400 or 500 feet below. The camp uses nearly 1,000 pounds of dynamite every day.'

"Cressy this week conducted a tour over the road for L. R. Gillis, new district engineer for construction in Los Angeles, Orange and Ventura Counties. Even for Gillis, it was hard to believe the huge rock piles leaning against the mountain sides were man-made. It looks like dangerous work and it is. Workers must constantly watch for rocks tumbling from above. Bulldozers crawl along the edge tipping dangerously as they push still more dirt and rocks into the canyons. And there is a sense of pioneering adventure, breaking through a wilderness to bring it within reach of civilization."

As fast as sections of the Angeles Crest Highway have been completed and the traveled way oil-treated, these sections were opened to public traffic, and from that time forth became the responsibility of the District Maintenance Department.

Maintenance Department

The first section that was opened was 2½ miles, extending from La Canada into the Angeles National Forest. This occurred in the latter part of 1931 when I. S. Voorhees was the district maintenance Engineer. Subsequently, other units as completed were turned over to the Maintenance Department, until 38 miles were in use, taking traffic as far as Cedar Springs. Succeeding Voorhees as maintenance engineer was W. L. Fahey, who was promoted to district engineer in 1950 and who retired from state service November, 1955. W. D. Sedgwick succeeded Fahey as assistant district engineer, and maintenance work on



UPPER LEFT—Looking northeasterly along Angeles Crest Highway at Cloudburst Summit, entering the Mt. Waterman winter sports area. UPPER RIGHT—View looking westerly from Cloudburst Summit, elevation 7,000 feet, showing Angeles Crest Highway winding through the forest.
CENTER—View from location 10 miles northeasterly of La Canada showing the Angeles Crest Highway along the side of the mountains approaching Red Box, background right. Road to Switzer's Camp showing in foreground. LOWER LEFT—View of completed Angeles Crest Highway six miles northeast from La Canada at the 3,000-foot elevation. LOWER RIGHT—Angeles Crest Highway where it enters south boundary of Angeles National Forest. Note crib wall supporting roadbed, center left.

UPPER—Ribbon cutting by Director of Public Works Frank B. Durkee. ***Left to right:*** *Roger Jessup, Supervisor, Los Angeles County; Victor Jory, Master of Ceremonies; Fred Dickson, Superintendent, California Institute for Men, Chino; Durkee; G. T. McCoy, State Highway Engineer; Harrison R. Baker, former member of California Highway Commission; S. Wesley Break, Chairman, Board of Supervisors, San Bernardino County; Elmer Wilson, Chairman, Convention and Tourist Committee, Pasadena Chamber of Commerce; John Anson Ford, Supervisor, Los Angeles County. LOWER—Honor Camp 37 cottages for State Division of Highways employees. The building at left is the schoolhouse operated by the Pasadena City School District.*

the Angeles Crest Highway is now part of his responsibilities.

The maintenance crews who presently maintain the road from the junction of Foothill Boulevard in La Canada to its temporary terminus at Cedar Springs, work out of the La Crescenta and Chilao Maintenance Stations.

During the summer months of May to September, the maintenance of the roadway is of a general nature typical of many mountain roads. The traveled way surfacing is patched where necessary to maintain a smooth, hazard-free surface. The shoulders and ditches are graded and kept clean of slough and other debris. Guard rails, sight posts and culvert markers are painted, restenciled and replaced as necessary.

A large part of the Angeles Crest Highway is constructed along steep side hills and through ridges where slopes are acted upon by wind, rain and snow. To keep the road safe during heavy rains, maintenance trucks equipped with rock plows patrol the Angeles Crest Highway constantly. Frequently between storms crews gather up slide material with skip loaders, and trucks haul it to disposal areas. Unlike many other locations in the State, slide material and rocks cannot be bladed or dumped in any convenient gully or canyon. Every effort must be exercised to avoid unsightly spoil banks, and slide material must be hauled to specifically designated locations where the disposal will not be unsightly.

For many winters the Angeles Crest Highway has been kept open from La Canada to Cedar Springs. This is the nearest snow country for winter sports in the Los Angeles area.

One of the big problems without ready solution is traffic control during snow removal operations. Several times in the past, the number of vehicles attempting to reach winter sports resorts has been so great that the snow plows could not operate and motorists at the resorts could not leave. On some of these occasions it became necessary to close the highway temporarily to incoming traffic until the roadway could be cleared.

The California Highway Patrol renders splendid cooperation, assigning extra men and patrol cars to the area on weekends when the snow sport travel is the heaviest.

CONSTRUCTION CONTRACTS CARRIED OUT BY STATE

Description	Date	Contractor	Total cost	Resident engineer
La Canada to 2½ mi. north—grading	8-14-29	H. W. Rohl Co.	$270,063	A. N. George
Bridge across La Canada Canyon	12- 9-29	Whipple Eng. Co.	35,167	R. W. Van Stan
2½ mi. north La Canada to 4 mi. north—grading	1-27-30	T. M. Morgan Paving Co.	309,712	A. N. George
La Canada to 2½ mi. north—oiling	12- 1-30	Chas. A. Ladeveze	6,366	A. N. George
4 mi. north La Canada to Colby C.—grading	4-15-31	T. M. Morgan Paving Co.	452,747	M. L. Bauders
Bridge across Fern Canyon	8-13-31	Houghton and Anderson	31,470	R. W. Van Stan
At La Canada—oiling	10- 6-31	Square Oil Co.	2,248	A. I. Bird
Between Colby and Mt. Wilson road—grading	9-20-33	Jahn and Bressi Const. Co.	357,122	C. P. Montgomery
Between Cedar Springs and Blue Ridge—oiling	7-12-56	E. C. Young	135,219	F. W. Luchsinger
			$1,600,114	

CONSTRUCTION CONTRACTS BY U. S. BUREAU OF PUBLIC ROADS

Location	Cost	Type of work	Dates	Res. Engr.
Red Box to 1.367 miles east	$131,359	Grading and drainage	1-27-37 7- 3-37	E. E. Hopson
4.272 miles to 9.243 miles east of Red Box	300,463	Grading and drainage	9-12-35 7- 3-37	H. Booth
9.243 miles to 12.5 miles east of Red Box	142,700	Grading and drainage	5-17-37 10-11-37	E. E. Hopson
18.96 miles to 21.02 miles east of Red Box	133,861	Grading and drainage	5- 1-39 12- 8-39	B. H. McCain
21.02 miles to 22.75 miles east of Red Box	142,841	Grading and drainage	9- 8-39 8-22-40	B. H. McCain
Red Box to 12½ miles east	36,346	Road mix surfacing	6-15-39 10-17-39	B. H. McCain
9.15 miles to 10.72 miles east of Islip Saddle	145,716	Grading and drainage	5-14-34 7-12-35	Roy Schmidt
13.79 miles to 15.90 miles east of Islip Saddle	275,095	Grading, drainage and road mix surfacing	1950	C. F. Storm
	$1,308,381			

DRIVER ALERTNESS

Motorists should be aware that the most frequent type of accidents on freeways are rear-end and sideswipe collisions, warns the California State Automobile Association.

The AAA motorists' organization points out that freeways could be made even safer than they are if the number of rear-end and same-direction accidents on these controlled access traffic ways could be reduced. Alertness by drivers can do much toward accomplishing this reduction.

Freeway drivers, therefore, should be particularly heedful of sudden changes in speed, following too close, passing, lane-changing, and cutting in.

FATALITIES ON CALIFORNIA FREEWAYS 1955

During the calendar year of 1955 there was a total of 65 fatal accidents, resulting in 81 fatalities, on the 208.22 miles of operating full freeways. Based on 3,061,722,000 vehicle miles of operation, the 1955 fatality rate, full freeway, rural and urban, was 2.65 fatalities per 100 million vehicle miles. This represents a sharp increase from the very favorable rate of 1.92 fatalities per 100 million vehicle miles experienced in 1954.

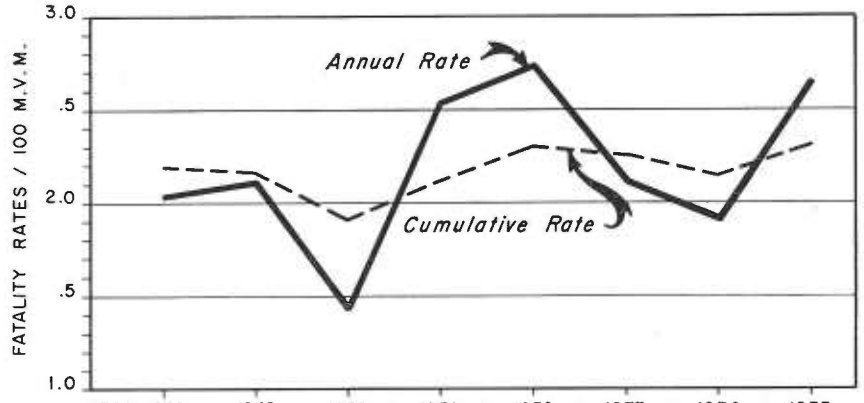
(The over-all fatality rate for rural state highways in California in 1955 was 8.36 per 100 million vehicle miles.)

Chart No. 1 shows the fatality rates on California full freeways, by years, 1941 through 1955. It may be noted that, although this graph centers about the area representing rates of 2.0 to 2.5, there has been considerable fluctuation in the rate for the individual years. In this respect it may be noted that the 2.65 is not the highest rate of record, nor is the 1954 rate of 1.92 the lowest rate. A study of cyclic fluctuation in this graph indicates a reasonable chance for the rate to again drop in the future.

CHART NO. 1

CALIFORNIA FREEWAYS

Fatality Rates by Years 1941 through 1955



YEAR	1948	1949	1950	1951	1952	1953	1954	1955
Annual M.V.M.	294	378	491	708	986	1274	2034	3062
Cumulative M.V.M. 1941 to Date	548	925	1415	2124	3112	4386	6420	9481

Expanding Fatalities

The year 1955 was a year of expanding fatalities nationwide. Since March of 1955, each month has shown an increase over the numbers killed for the corresponding month of the prior year on a national basis. It may well be noted that the two major facilities which most closely approached California freeways' fatality rate for 1954 experienced substantial increase in 1955. The fatality rate on the New York State Throughway increased from 2.44 in 1954 to 2.83 in 1955, and the New Jersey Turnpike increased from 2.47 in 1954 to 2.76 in 1955. In spite of the substantial increase in the California rates, it is noted that California's 1955 freeway fatality rate is again lower than these two comparable type eastern facilities.

In addition to the nationwide upswing, there is another important factor involved in California's increased rate. This factor is the expanding mileage of rural full freeways. Whereas, prior records represented primarily urban freeways, the 1955 record is based on 109 miles of rural as compared to 99 miles of urban freeways. The effects of higher speed on rural freeways and their inclusion in mileage subjected to a higher percentage of long-distance travel, resulted in a fatality rate (rural only) of 3.13 fatalities per 100 million vehicle miles as compared to a rate of 2.41 for the urban portion of the system. The building of rural freeways, which is currently progressing at a faster rate than the construction of urban freeways, is expected to exert an increasing upward influence on the basic composite fatality rate.

Details of 1955 Freeway Fatal Accidents

Table I, showing basic data on 1955 freeway fatalities, is significant primarily in the fact that 12 of the 65 fatal accidents were pedestrian accidents involving 13 of the 81 persons killed. This percentage is unduly high considering freeways are fenced and posted for "Motor Vehicles Only." It also represents an extreme increase from 1954 when there were only two pedestrian fatalities on full freeways. In 11 of these accidents causing 11 deaths the pedestrians were on the freeway in violation of the law. Keeping hitchhikers and other pedestrians off the full freeways is an enforcement problem. The increase in number of pedestrian fatalities in 1955 is responsible for a substantial part of the increase in the fatality rate over 1954.

Lighting

Table I also shows light conditions under which freeway fatal accidents occurred in 1955. It may be noted that only 28 percent of the fatal accidents occurred during daylight hours with 72 percent occurring during the hours of darkness. Pedestrian accidents were similarly distributed with 75 percent of pedestrian accidents occurring during darkness. The period from 11 p.m. to 3 a.m., which involved only 5 percent of the vehicle miles, accounted for 34 percent of the fatal accidents on freeways.

TABLE I

BASIC DATA ON 1955 STATE-WIDE RURAL AND URBAN FULL FREEWAY FATALITIES

Number of fatal accidents	65
Persons killed	81
Persons injured in fatal accidents	61
Number of pedestrian accidents	12
Pedestrians killed	13
Total million vehicle miles	3,061.722
Fatalities/100 MVM	2.65

Item	No.	Percent of total
LIGHTING		
Daylight	18	28
Darkness	47	72
No artificial lighting	18	28
From 11 p.m. to 3 a.m.	22	34
Pedestrian accidents:		
Daylight	3	25
Darkness	9	75
No artificial lighting	6	50
WEATHER		
Cloudy or clear	60	92
Raining (1 foggy)	5	8
ELEMENT TYPES		
Single car accidents	40	62
Two or more car accidents	25	38
VEHICLE CONDITION		
No defects	52	80
Defects	2	3
Unknown	11	17
ROADWAY FEATURES		
Curved road	21	32
43 percent of single car accidents are on curved sections		
17 percent of two or more car accidents are on curved sections		
Straight road	43	66
Unclassified	1	2
Level grade	46	71
Up-grade	5	8
Down-grade	8	12
Unknown	7	11

TABLE II

TABULATION OF 1955 FREEWAY FATAL ACCIDENTS BY TYPE AND SEVERITY

Items studied	Approaching No.	Approaching Percent of total	Overtaking No.	Overtaking Percent of total	Single vehicle No.	Single vehicle Percent of total	Total vehicles No.	Total vehicles Percent of all accidents
Accidents	9	14	16	24	40	62	65	100
Persons killed	18	22	20	25	43	53	81	100
Persons killed/accidents	2.0	....	1.25	....	1.1	....	1.2	....
Persons injured	28	46	19	31	21	34	61	100
Persons injured/accidents	3.11	....	1.2	....	0.5	....	0.9	....
Pedestrians killed	0	0	4	31	9	69	13	100

TABLE III

DRIVER CONDITION AND VIOLATIONS INVOLVED IN 1955 FREEWAY FATALITIES

Items studied	Approaching No.	Approaching Percent of type	Overtaking No.	Overtaking Percent of type	Single vehicle No.	Single vehicle Percent of type	Total vehicles No.	Total vehicles Percent of all accidents
Driver condition								
H. B. D.	3	33	2	11	10	38	15	23
Normal	3	33	6	33	9	23	17	26
Sleepy	0	0	2	11	5	13	7	11
Unknown *	3	33	7	39	16	40	24	37
Epileptic	0	0	1	6	0	0	1	2
Causes								
Speed	4	40	4	22	22	55	30	46
Following too closely	0	0	3	17	0	0	3	5
Turning	0	0	4	22	2	5	6	9
Parking	0	0	1	67	0	0	1	2
Changing lanes	6	60	4	22	1	3	10	8

* Eleven additional accidents could reasonably be also H. B. D. due to statements of witnesses, time of accident and facts surrounding the accident.

Table I shows that 62 percent of the accidents involved a single car, as compared to 38 percent two or more car accidents. Vehicle condition is not an important factor and is specifically noted on only 3 percent of the fatal accidents.

Roadway Features

Under roadway features, also shown in Table I, the majority of accidents as expected occurred on straight road (66 percent) and level grade (71 percent). More significant perhaps is that 32 percent of all fatal accidents and 43 percent of the single car fatal accidents occurred on curves. These percentages of fatal accidents on the relatively small percentage of curve alignment on California freeways should well refute the argument of those who advocate deliberate curvature to reduce monotony.

Fatalities by Type of Accident

Table II shows a breakdown of accidents and fatalities by basic accident types. It may again be seen that single vehicles accounted for 62 percent of the fatal accidents but only 53 percent of the number killed. Overtaking accidents accounted for 24 percent of the fatal accidents and 25 percent of the persons killed. Head-on type accidents, as might be expected, had by far the highest severity with 14 percent of the accidents involving 22 percent of the fatalities and 46 percent of the persons injured in fatal accidents. Although the percentage of head-on fatalities shows a drop from 1954 when one-third of freeway fatalities were due to head-on collisions, the 18 persons killed in such type accidents leaves no room for complacency.

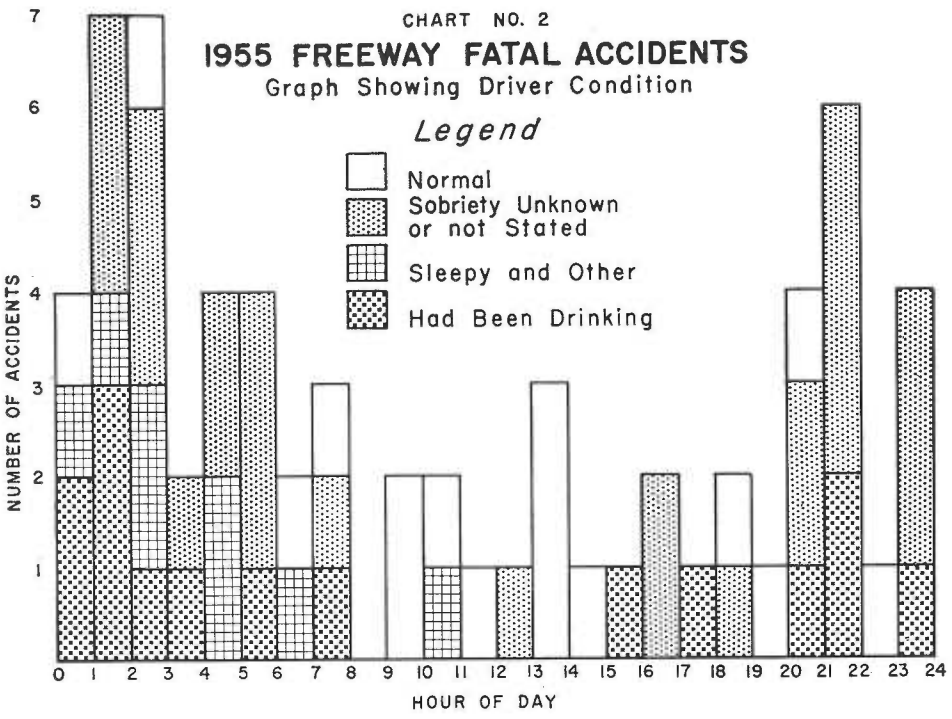
Traffic density on California's highest traffic freeways makes it probable that a crossed median accident will be a head-on and probably fatal. Median guard rails on the heavy volume freeways could probably have prevented the majority of these cross median head-ons. In this respect, it would also have prevented a deliberate attempt to U-turn across the median of the San Bernardino Freeway in the Pomona area which resulted in the death of three young people. This accident is not classed as a head-on since they were run down by a truck in the near inside lane before completing their maneuver.

Driver Condition

Table III shows driver condition and basic causes by type of accident. It may be noted that had-been-drink-

ing drivers were involved in 23 percent of the fatal accidents. Drinking was most significant in the single vehicle and head-on type accidents involving 38 percent and 33 percent of such accidents respectively. Sleepy and asleep drivers involved 11 percent of fatal accidents. More significant was the fact that driver condition was checked as "unknown" or not stated on 37 percent of the accident reports. Of the 24 accidents in which driver condition was not stated by the reporting officer, 11 accidents could probably be classed as involving drinking drivers due to the statements of witnesses and facts surrounding the accident.

Chart No. 2 sets forth graphically the relation between driver condition and hours of occurrence of 1955 fatal accidents on California's freeways. The high rate of fatal accidents during the lightest traffic period between 1 a.m. and 3 a.m. is again apparent together with the high percentage of drinking and fall-asleep accidents during the early morning hours. This chart again graphically points out incomplete information with the large areas of unknown or not stated.



Violations

Table III also notes violations by type of accident. Speed is the primary cause of freeway fatalities involving 46 percent of the fatal accidents, with 55 percent of the single vehicle accidents and 40 percent of the head-ons being primarily due to the excessive speed. Speed does not appear as the major factor in total highway accidents and ranks third as a causative violation on total freeway accidents; but for the restrictive class of freeway fatal accidents, a high percentage of which occur in light traffic hours, speed is by far the major violation involved.

Improper turning is involved in 9 percent of the total accidents and 22 percent of the overtaking type accidents. Improper lane changes are involved in only 8 percent of the accidents but are a basic cause of the vehicle going out of control and crossing the median as shown in 60 percent of the head-on accidents.

CONCLUSIONS

1. Past experience would indicate that the fatality rate on full freeways may well experience a drop in the next year or two, but the expanding of rural freeways at a faster rate than urban will exert a continuing upward influence on freeway fatality rates.

2. Serious violations are the primary cause of the following two fatal accident categories which contribute very substantially to the freeway fatality rate.

   a. Pedestrian fatalities which involve pedestrians illegally on full freeways.
   b. The high percentage of fatal accidents in the lowest traffic night and early morning hours in which drinking and excessive speed are the predominate causative factors.

3. The number and extreme severity of cross median accidents may indicate a need for a more positive divider on those freeways carrying such high volumes that a median crossing will most probably result in a head-on accident. Further study has been initiated to relate median types to high volume roads.

AMPHITHEATER BEING ENLARGED FOR 1957 ROAD SHOW

The Chicago International Amphitheater, already the largest exposition hall in the United States, will be enlarged even more to hold the upcoming 1957 ARBA Road Show, Road Show Chairman Julien R. Steelman, President of the Koehring Company, announced.

A new addition, 410 feet by 270 feet, has been put under construction and is expected to be completed by Road Show time, January 28-February 2, 1957. The amphitheater will then have as much display area as 12 football fields under one roof.

The 1957 Road Show will be the largest indoor industrial show of any kind ever to be staged in this Country. Nearly 250 equipment manufacturers will have thousands of pieces of machinery on display and 50 manufacturers of highway materials and supplies have reserved space for a central exhibit of their products.

Redwood Empire

Association Holds 36th Annual Convention

STATE and federal officials played prominent parts in the Thirty-sixth Annual Convention of the Redwood Empire Association at Boyes Hot Springs, Sonoma County, October 18th through 20th.

At the closing banquet, Robert L. Bishop, Santa Rosa, a member of the California Highway Commission, extended greetings on behalf of Governor Goodwin J. Knight.

The final meeting was opened by Reed W. Robinson, president of the association, who turned the gavel over to the organization's new president, Ben A. Cober, Ukiah newspaper publisher, after thanking the retiring executive board and introducing the new members.

Distinguished Guests

State, federal and other officials were extended a welcome by James F. Lyttle, Sonoma County Supervisor. Among the distinguished guests pres-

Ben A. Cober, Ukiah newspaper publisher, new president of the Redwood Empire Association, left, and Reed W. Robinson, retiring president

Newly elected Executive Board of Redwood Empire Association, left to right: Past President C. H. Demmary, Grants Pass, Oregon; Chester S. Bush, Napa County, Vice President; James A. Nealis, Humboldt County, Vice President; Judge Raymond A. Lathrop, Grants Pass, Oregon; Attorney Elliot M. Epsteen, San Francisco; Don Emerson, Lake County, Vice President; Frank K. Runyan, San Francisco, Vice President; Elias S. Day, Marin County; Reed W. Robinson, San Francisco, Immediate Past President; Ben A. Cober, Ukiah, President; George G. Hoberg, Lake County, Past President; Arthur J. Schilder, Ukiah, Past President; Thomas P. Ludcke, Santa Rosa, Member at Large; Clyde Edmondson, General Manager; E. R. Freyer, Piercy, Unit President; L. J. Guglielmetti, Santa Rosa, Unit President; J. M. Reinarz, Del Norte County, Vice President; Edwin S. Heydenburck, Josephine County, Oregon, Vice President; Martin M. Mulford, Sonoma, Unit Vice President.

ent were U. S. Congressman Hubert B. Scudder, Frank B. Durkee, State Public Works Director and Chairman of the California Highway Commission; State Senators A. W. Way and F. Presley Abshire, Assemblymen Frank P. Belotti and Samuel R. Geddes;

Justus F. Craemer and Ray E. Untereiner, State Public Utilities Commissioners; Paul Leake, member of the State Board of Equalization; George T. McCoy, State Highway Engineer; F. W. Panhorst, Assistant State Highway Engineer; T. Fred Bagshaw, Assistant State Director of Public Works; E. R. Bonnickson, Acting Division Engineer, U. S. Bureau of Public Roads; Barney W. Booker, Assistant State Highway Engineer, and District Engineers L. A. Weymouth and J. P. Sinclair, San Francisco; and John H. Skeggs, former Assistant State Highway Engineer.

During the convention, Clyde Edmondson, general manager of the association, said that a spot check made by his organization showed that improved highways held the key to the tourist-vacationist business not only in the Redwood Empire, but elsewhere. He said this conclusion was reached after a survey of the volume of travel over the Redwood Highway (US 101), interior roads and border check points.

Increased Tourist Travel

Edmondson reported that tourist-vacationist business showed an increase in the northern and southern parts of the Empire during the past season. However, he added, business fell off somewhat in the central areas. This indicated, he said, that highway conditions are a vital factor when tourists and vacationists plan their itineraries.

Commenting on controversies developing over the construction of freeways, Bishop, who officially represented Governor Knight at the convention, stressed the need of greater understanding of expressway problems at the local level. He said that too many differences of opinion have resulted in unnecessary delays in carrying out these projects.

Bishop also made a plea that highways be kept apart from politics. He said the Division of Highways was solely interested in the construction of the best highways at the lowest cost to the taxpayers.

Delegates to the convention heard with interest the announcement by Bagshaw that the highway budget for the eight California Redwood Empire counties for 1957-58 was $38,000,000, up $10,000,000 over the 1956-57 budget.

Highway Beautification

Supervisor William C. Blake, San Francisco, also suggested that freeways in metropolitan areas should be made more pleasing to the eye.

DIVISION OF BEACHES AND PARKS RELEASES ROADSIDE REST DEVELOPMENT SCHEDULE

A schedule of proposed developments for the initial phase of the new state-wide roadside rest program for 41 counties has been released by Newton B. Drury, Chief, Division of Beaches and Parks. The 1956 Legislature appropriated $450,000 for getting this program under way. The total program proposed in the five-year master plan of the Division of Beaches and Parks anticipates expenditure of $2,600,000 for establishment and operation of the entire roadside rest system.

Drury stated that, with approval by the California State Park Commission, the Division of Beaches and Parks is now working full speed to accomplish this needed program along California state highways. The projected initial development is divided into 20 priorities and anticipates in the first three years the construction of approximately 200 rest stations along the major highways.

"Given first priority in the preliminary list is a section of highway in San Bernardino County from Barstow to the eastern state line along US 466 and US 66. This unit, together with priority No. 2, along US 40 Alternate, in Plumas, Butte and Lassen Counties will constitute the first completion of roadside rest units expected by January, 1957," Drury stated. Already working in these two units are engineers, who are surveying property lines, and the land staff is negotiating for a relatively small amount of land necessary for purchase.

In Memoriam

THOMAS H. IVES

Thomas H. Ives, Supervising Highway Engineer and Assistant District Engineer, Materials and Surveys, received his final call on the evening of Wednesday, November 7, 1956. On his way home from Sonoma and a visit to his grandchildren, death came with startling and and shocking suddenness in an automobile accident on Waldo Grade.

Thomas began his career with Highways in 1929, two years after his graduation from Oregon State College. While his interest through the years has largely been in materials, his outstanding qualifications in that field lead him through a wide range of activity. Starting as a Test Laboratory Aid in the Headquarters Office, he progressed through the materials testing classes until called to the San Francisco-Oakland Bay Bridge as an Assistant Bridge Construction Engineer. There as engineer in charge of the concrete plant he supervised the plant and designed the mixes for much of the bridge.

After a short leave of absence he came to District IV in early 1939 as District Materials Engineer. Later, location surveys were added to his department and Tom guided these activities through the growth of the forties and the fifties.

While Thomas Ives was a native of Washington he received his engineering degree from the Oregon College and practiced his profession largely in California. Prior to his college work he spent two years in France during World War I and was awarded the Purple Heart. On separation from the Army Engineer Corps he became a construction foreman in private industry and his experience, both military and civil, brought into focus the desirability of an engineering education.

It is the experience of many that the good they do finds appreciation only upon departure. Thomas Ives was more fortunate. A host of friends were his throughout his life, articulate friends both in state service and private, who voiced so many times the qualities of friendship, loyalty and competence which were his.

IMPROVED METHODS IN HIGHWAY LOCATION AND DESIGN

By L. L. FUNK, Supervising Highway Engineer

Federal financing of an accelerated highway program has increased the interest of highway engineers everywhere in improved methods such as photogrammetry and electronic computations that will increase engineering productivity. Here in California we have been making increasing use of photogrammetry during the past five years and have now had over a year's experience in the use of electronic computations for earthwork quantities and traverse. This is an appropriate time to review our current practice and ask ourselves if we are making the maximum use of these improved methods.

In discussing photogrammetry for highway engineering uses, it is convenient to divide the various products which can be obtained into three classifications:

(1) Aerial photography
(2) Reconnaissance mapping
(3) Design mapping

(This article is based on a talk by Mr. Funk at the District Engineers' meeting, August 10, 1956)

Aerial Photographs

The first classification, aerial photographs, may be either contact prints, enlargements, or mosaics, with the latter two available on either paper or transparent film. Contact prints are the basic product of the aerial photography, being direct prints from the aerial negatives. They are generally nine inches by nine inches in size. The Division of Highways obtains such photography in a wide variety of scales, ranging from as small as one inch = 2,000 feet to as large as one inch = 200 feet. Several of the various scales being used at the present time are shown in *Figure 1*. The scale selected for a particular project depends on the purpose for which the photography is to be used, the land use or development of the area, and the size of the project. The larger scales are used for detailed studies of a single route and in areas of intensive development, while the smaller scales are used for preliminary studies covering several possible routes and in rural or mountainous areas where there is little development.

Contact prints are used for advanced planning and location studies, for materials and foundations investigations, for determining drainage areas, supplementing topographic maps, and various other purposes. When the overlap area of two contact prints is viewed under a stereoscope, the experienced observer can gain a knowledge of the topographic and cultural features of the terrain that could not be obtained in any other way. A day spent in stereoscopic study of the contact prints, supplemented by a brief field review, will provide the location engineer with more information than days spent in detailed field reconnaissance without benefit of aerial photographs.

Enlargement of Photographs

Enlargements of aerial photographs are generally limited to three or four times the size of contact prints, although with good quality photography fairly satisfactory enlargements up to six diameters can be obtained. For some purposes enlargements have advantages over contact prints, as they provide more working room and can be made more nearly to scale. Enlargements are frequently used for right of way estimates, interchange studies, and the establishment of setbacks where future widening is planned. Enlargements made on film provide positive transparencies from which ozalid prints can be made in any desired quantity. Such ozalid prints provide satisfactory working copies at low cost.

Mosaics are assemblies of individual photos, usually made at the approximate scale of the contact prints. They are then copied at the same scale and enlarged up to as much as three diameters on either photographic paper or film. Mosaics have become almost indispensable in planning studies, as they provide the best possible over-all project maps for use in project reports and in public meetings. For the latter various alternate routes are generally shown in colored ink or tape on the mosaic. Such a mosaic, on which several possible routes have been shown, is illustrated in *Figure 2*.

Scale Is Important

In selecting the scale to be used in obtaining aerial photography, it is important to remember that enlargement does not add detail and that the amount of detail on the photographs is dependent on the scale of the original photography. For example, a four-diameter enlargement at one inch = 400 feet will not have as much detail as a contact print of the same area at one inch = 400 feet. Also a mosaic copy will generally have less detail than an enlargement at the same scale due to the extra copying process involved in making the mosaic.

Aerial photography of one or all of the types described has a very definite place in the location, planning, and design of practically every highway project. While it is difficult to evaluate the exact benefits, aerial photography provides a definite saving in manpower, time, and cost. A still more important advantage is the certainty that in almost all cases a better location will result from the use of aerial photographs, because of the wealth of detail and wide coverage provided.

The second classification of photogrammetric products, reconnaissance mapping, is used for location studies where more than one possible route must be considered and where the terrain is such that excavation quantities are an important factor in the location or where grade controls might govern. The important difference between aerial photographs and either reconnaissance or design mapping is that the latter are accurate in scale and are based on an actual field survey, with this survey being used to control the

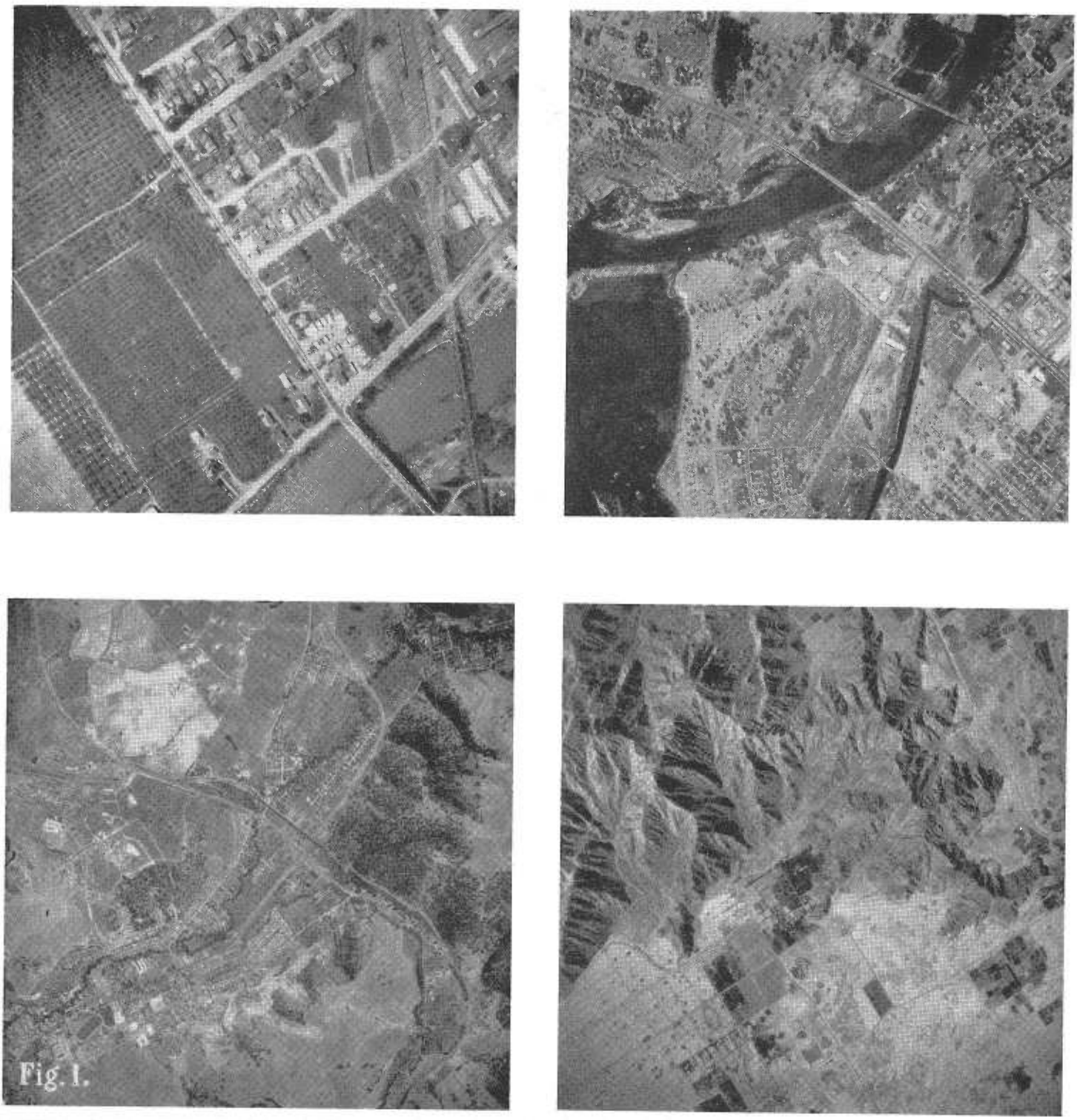


FIGURE 1—Contact prints at some of the scales being used for planning and location studies. Scales of original photographs: ***upper left,*** *1 inch = 200 feet;* ***upper right,*** *1 inch = 500 feet;* ***lower left,*** *1 inch = 1,000 feet;* ***lower right,*** *1 inch = 2,000 feet.*

scale of mapping and the differences in elevation it shows.

Reconnaissance Work

For reconnaissance work, the highway engineer planning to use photogrammetric mapping again has a choice of several types of products. In areas where they are available, U. S. Geological Survey quadrangle sheets at a scale of one inch = 2,000 feet with contour intervals of 10, 20, or 40 feet are one of the most effective tools of the location engineer. When used in conjunction with stereoscopic study of contact prints, the maps will provide the answer to many location problems.

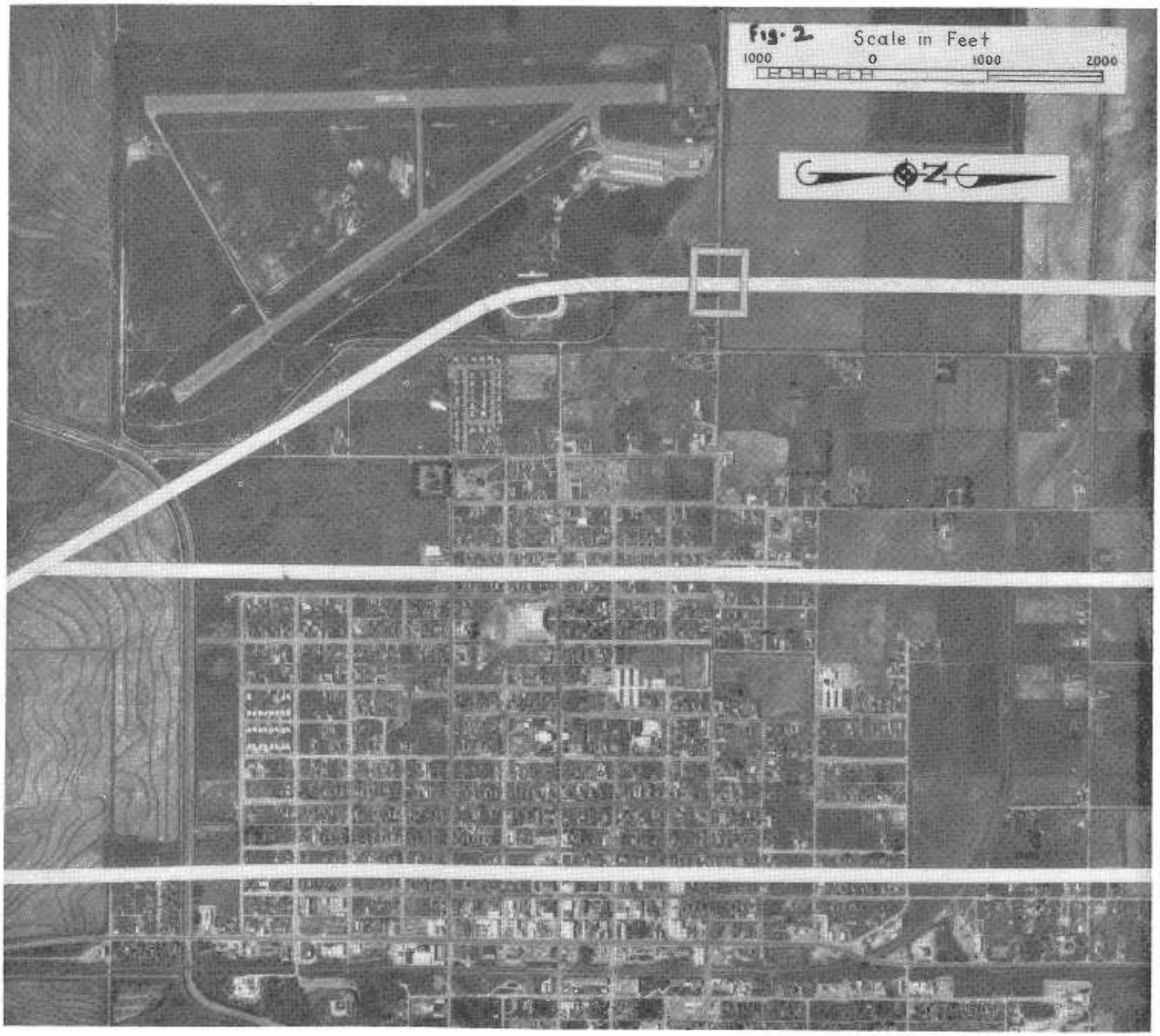
Where conditions require a larger scale, or where U. S. Geological Survey mapping is not available, we frequently use form line mapping from either existing or new photography. A reasonably accurate map at one inch = 200 feet with 10-foot or even 5-foot contours can be obtained from photography taken with a 8¼-inch lens at a scale of one inch = 800 feet supplemented by a minor amount of ground control. In some cases existing road surveys or U. S. Geological Survey data will provide sufficient control. Such mapping is generally obtained on a force account or plotter rental basis from mapping contractors and is usually confined to relatively small areas.

In Rugged Terrain

Where it is necessary to study several alternate routes covering a wide band of rugged terrain, we usually contract for reconnaissance mapping in the same manner as for design mapping, using slightly different specifications. Scales used have ranged from one inch = 200 feet to one inch = 500 feet, with contour intervals of 5, 10, and 20 feet. Here again the larger scales are associated with intensive land use and the smaller scales are used in rural areas. Mapping of this type is illustrated by *Figure 3*. Such a map at one inch = 400 feet with 20-foot contours will cover an area over two miles in width with a single strip of photography.

The use of reconnaissance mapping has practically eliminated the necessity for making preliminary field surveys

FIGURE 2—Several possible locations have been shown on this mosaic for a public presentation of route studies. Scales of the mosaic was 1 inch = 400 feet.



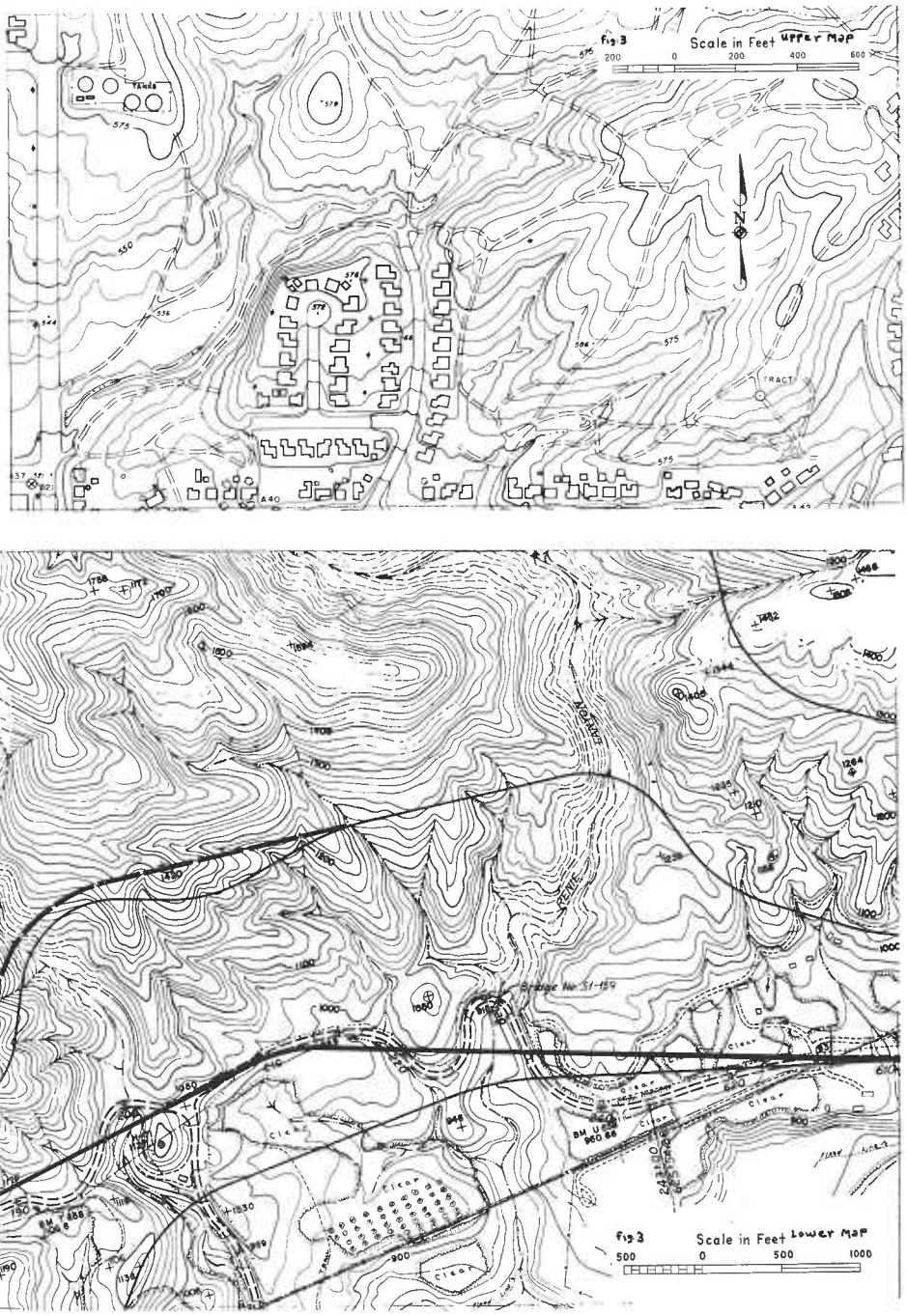


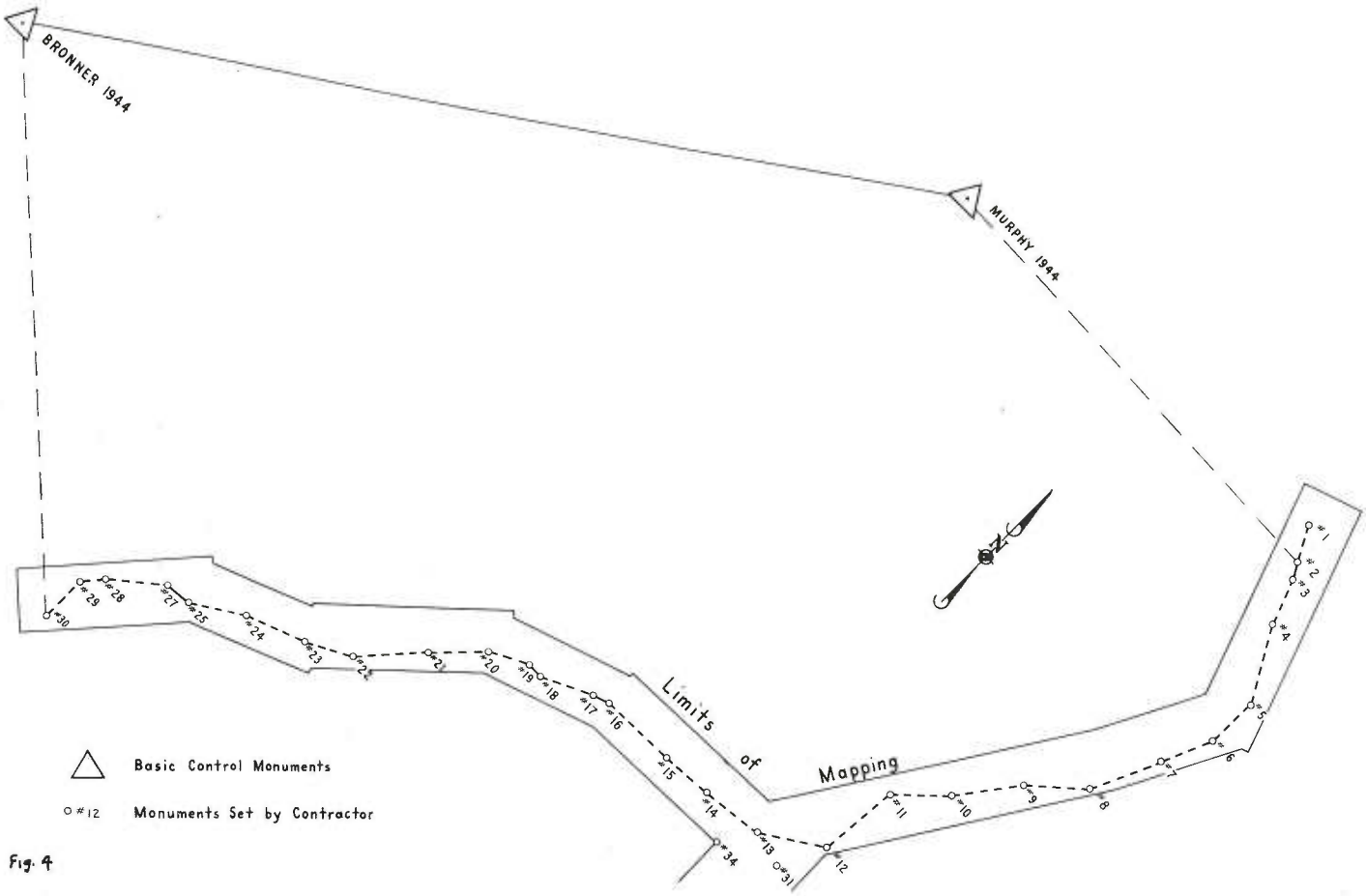
FIGURE 3—The upper map as delivered by the mapping contractor was at a scale of 1 inch = 200 feet with a contour interval of five feet. The lower map at a scale of 1 inch = 400 feet with 10-foot contours covered a wide band of rugged terrain. Several routes which were studied in detail are shown on this map.

of several alternate routes in order to determine the best location. Here again photogrammetry has provided the highway engineer with a tool which will effect major savings in manpower, time, and cost on many projects.

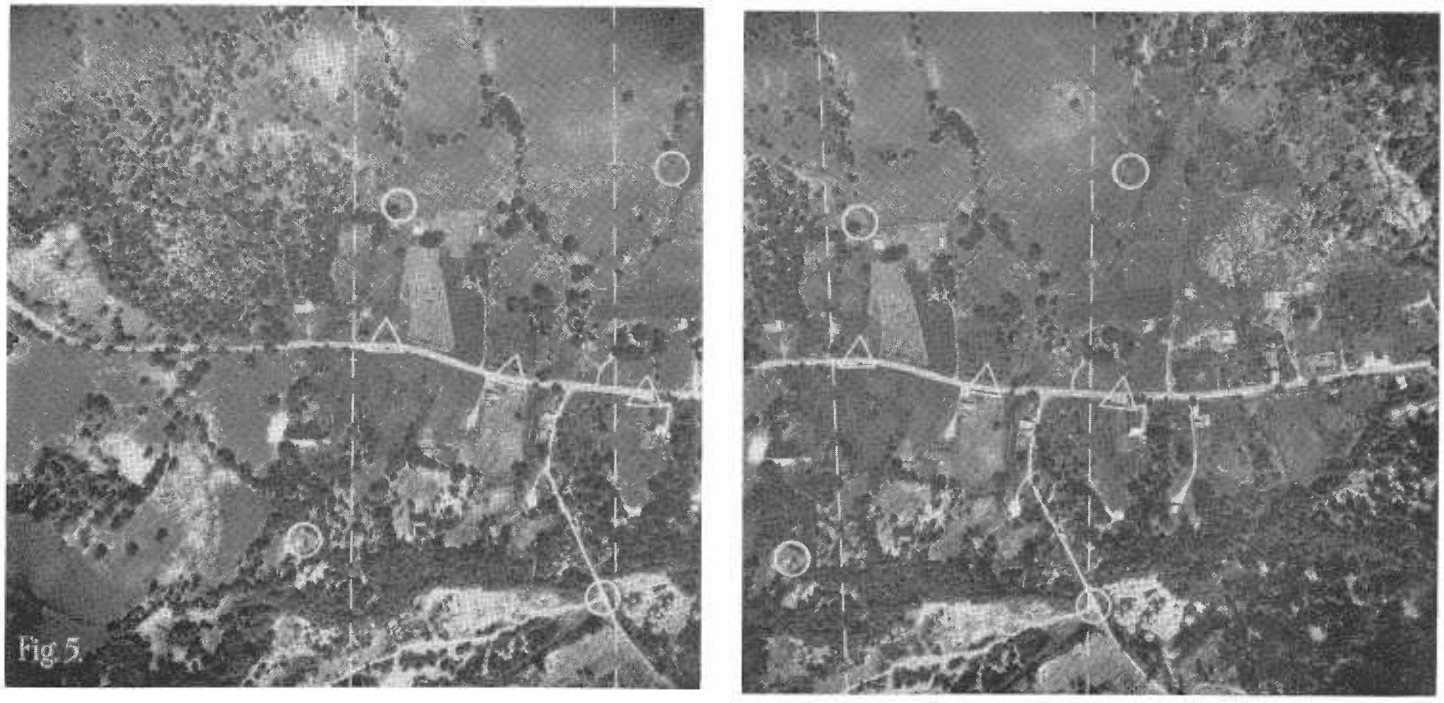
Design Mapping

Design mapping, the third classification of photogrammetric products, is now being used on many highway projects as an almost complete substitute for the final location survey of the selected route. Complete construction plans are being prepared and rights of way acquired through the use of these maps, supplemented by a minor amount of field surveying. This procedure makes it unnecessary to stake the final line in the field until the construction contract is ready for advertising.

Design mapping is based on a control survey generally made by the mapping contractor to second-order accuracy. Succeeding steps in the mapping process are the photography, picture point control, and map compilation. *Figure 4* illustrates a typical control survey with two existing control monuments which the mapping contractor has used as the basis for the traverse he has run through the area to be mapped. This traverse includes monuments set at locations designated by the State which will subsequently be used for supplemental surveys such



UPPER—FIGURE 4—This control diagram shows the primary ground control survey for an eight-mile design mapping project. LOWER—FIGURE 5—A single pair of the overlapping, vertical aerial photographs used for mapping a portion of the project in Figure 4 are shown here. Points for photo control were premarked on the ground prior to taking the photographs.



as property ties, bridge sites, and for staking the final line.

Picture Point Control

The next step in design mapping, the photography and picture point control, are illustrated in *Figure 5*. The aerial photographs were taken at a scale of one inch = 250 feet from an altitude of 1,500 feet above the terrain, with 60 percent forward lap. The mapping contractor then selected five points appearing in the overlapping areas of each pair of photographs, called the models, for vertical picture point control. He also selected three points in each model for horizontal control. The elevations of the vertical control points and the position of the horizontal points were determined by field survey methods.

Positive glass plates, called diapositives, made from the aerial negatives were then placed in the stereoplotter and oriented to the horizontal and vertical picture point controls, after which the plotter operator was able to proceed with the compilation or drawing of the portion of the map covered by this particular model. *Figure 6* illustrates the portion of the finished map at one inch = 50 feet corresponding to the model shown in *Figure 5*. We have found that the one inch = 50 feet scale with two-foot contour interval is well suited for design on most projects.

Spot Elevations

Until recently the value of photogrammetric mapping in level terrain, except for planimetric details, was questionable, as even one-foot contour intervals are generally not satisfactory for design purposes in such areas. We are now taking advantage of the fact that spot elevations can be read directly in the plotter more accurately than contours can be drawn and are specifying a grid of spot elevations in lieu of contours where the contours would be more than 100 feet apart. Such a map is shown in Figure 7. In this case the spot elevations were expressed to the nearest 0.2 foot with the specifications requiring that 70 percent be within 0.5 foot of their true elevation. In most cases this accuracy will be sufficient for final design purposes.

A third type or scale of mapping for design purposes is at one inch = 100 feet with 5-foot contours. This scale is used on projects where the terrain is quite rugged or is obscured by brush to the extent that 2-foot contour mapping by photogrammetric methods would be extremely difficult. Even in rugged terrain there are frequently small valleys or plateaus so level that 5-foot contours will not depict them accurately. By supplementing the contours with spot elevations, accurate to one foot, in such areas we have greatly increased the usefulness of this type of mapping.

Maps Are Accurate

There is no longer any doubt that design maps of these types are sufficiently accurate for the computation of earthwork quantities. Our present practice is to re-cross-section immediately prior to construction for determination of final pay quantities. On several projects a comparison of preliminary quantities from photogrammetric maps and final quantities from field cross sections shows a difference of less than 1 percent. Very few projects have been reported where the difference was greater than 2½ percent.

The actual savings effected by the use of design mapping are much easier to measure than those obtained from the use of aerial photos or reconnaissance mapping. Data reported by several districts indicate a saving of 40 percent in cost and 70 to 80 percent in manpower as compared to conventional field survey methods. A further saving of between 20 and 40 percent is achieved in design where photogrammetric mapping is used.

The use of photogrammetric mapping for design purposes has become standard practice in at least four of the eleven districts and is rapidly increasing in the others. In the period from April, 1952, to July, 1956, the Division of Highways contracted for 1,090 miles of design mapping or an average of approximately 270 miles per year. (Between July 1st and October 15th of this year requests have been received for an additional 275 miles of this type of mapping, indicating that the effect of the federal highway program is already being felt.)

Great Help to Engineers

Photogrammetry has provided the highway engineer with tools to increase his productivity in the fields of advance planning, location, and design. The use of electronic computers is logical as the next step to relieve him of some of his more tedious tasks. Computation of earthwork quantities has always been one of the longest and most tedious of the various steps in the design of a highway project. It is therefore not surprising that a method to minimize this work has been well received.

The method used in California involves the submission of terrain and roadbed notes to the tabulating section for computation. The terrain notes, in the conventional form of field cross section notes, are taken from the contour maps. Roadbed notes, prepared in similar form, show the various breaks in the templet which may include ditches, benches, etc., and rates of cut and fill slopes. Data furnished the designer by machine computation include cut and fill quantities, mass diagram ordinates, and distances out to catch points of cut and fill slopes. After the results of the machine calculation are received and studied for balance and other factors, adjustments of line and grade are made by the designer if necessary. New roadbed notes, or instructions to use the original notes with designated horizontal and/or vertical shifts, are then submitted and combined with the previously submitted terrain notes for machine computation. By this method any number of variations of line and grade can be investigated in a fraction of the time formerly required. Machine computation of earthwork quantities is rapidly superseding both the contour grading or horizontal slice method and the conventional cross section and planimeter method.

Machine Computation

Machine computation (*California Highways and Public Works*, July-August, 1955) is now available for adjustment of traverses, as well as for the solution of any traverse up to 98

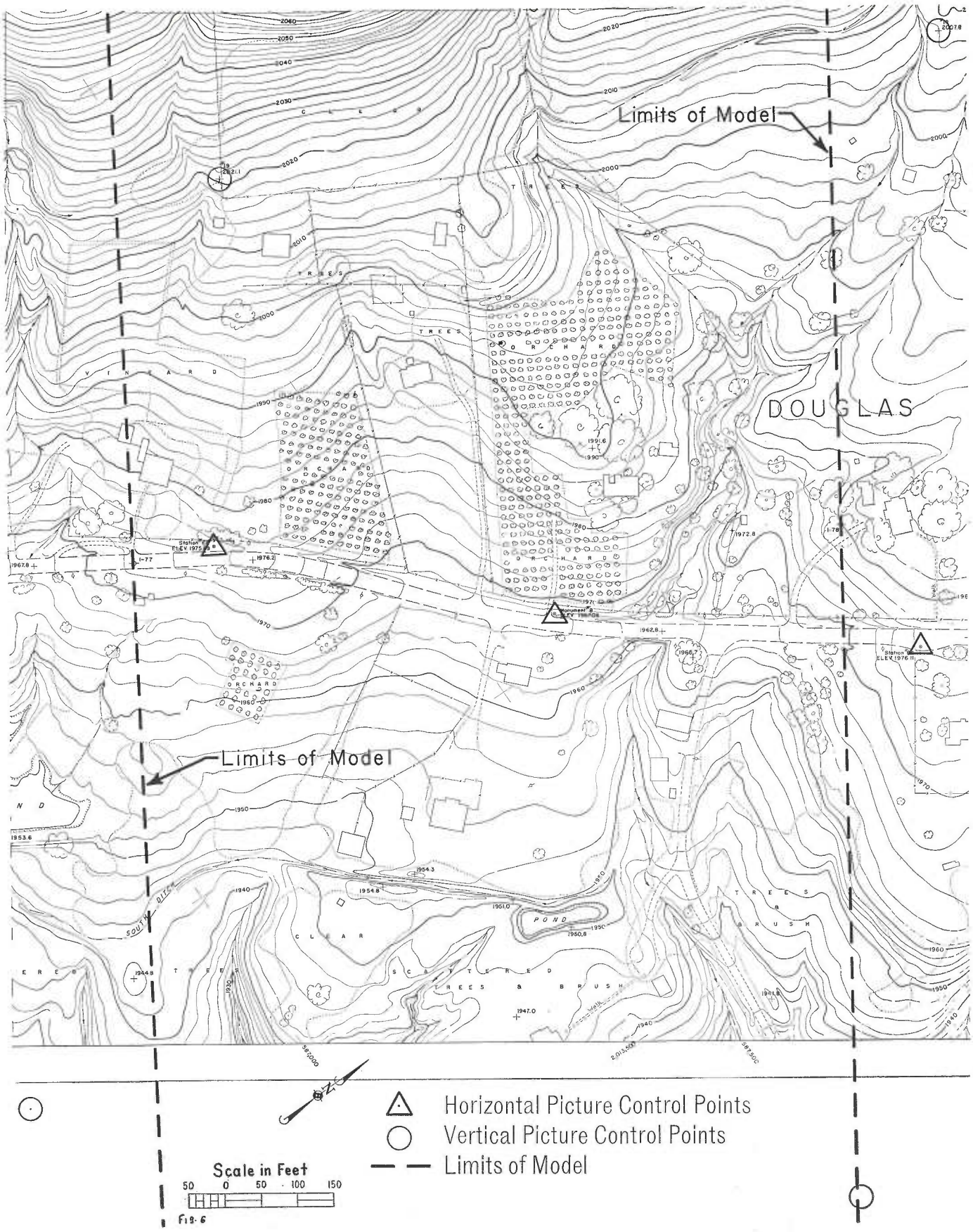


FIGURE 6—This portion of the final map at a scale of 1 inch = 50 feet with two-foot contours was compiled from the photographs shown in Figure 5

courses in length which may include two unknowns. The tabulating section is now processing over 2,000 traverse courses per day.

Availability of such a wide variety of photogrammetric products and machine computations gives rise to a new type of problem—which of these new tools should the engineer use in a particular situation? To make full use of these new methods in a rapidly changing field, we must provide the necessary training; and we must also have wider dissemination and exchange of information, both between Headquarters Office and the districts and within the individual districts. A program aimed at better communication of this type has recently been undertaken.

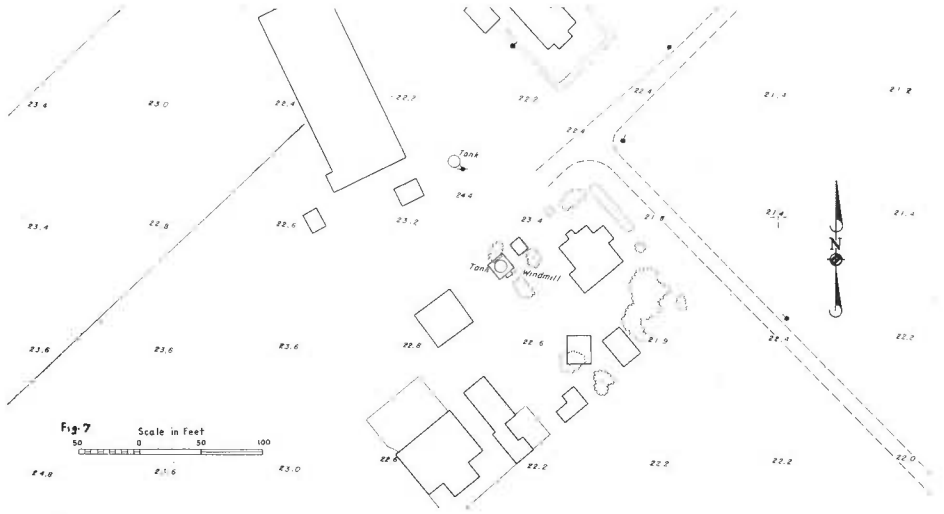
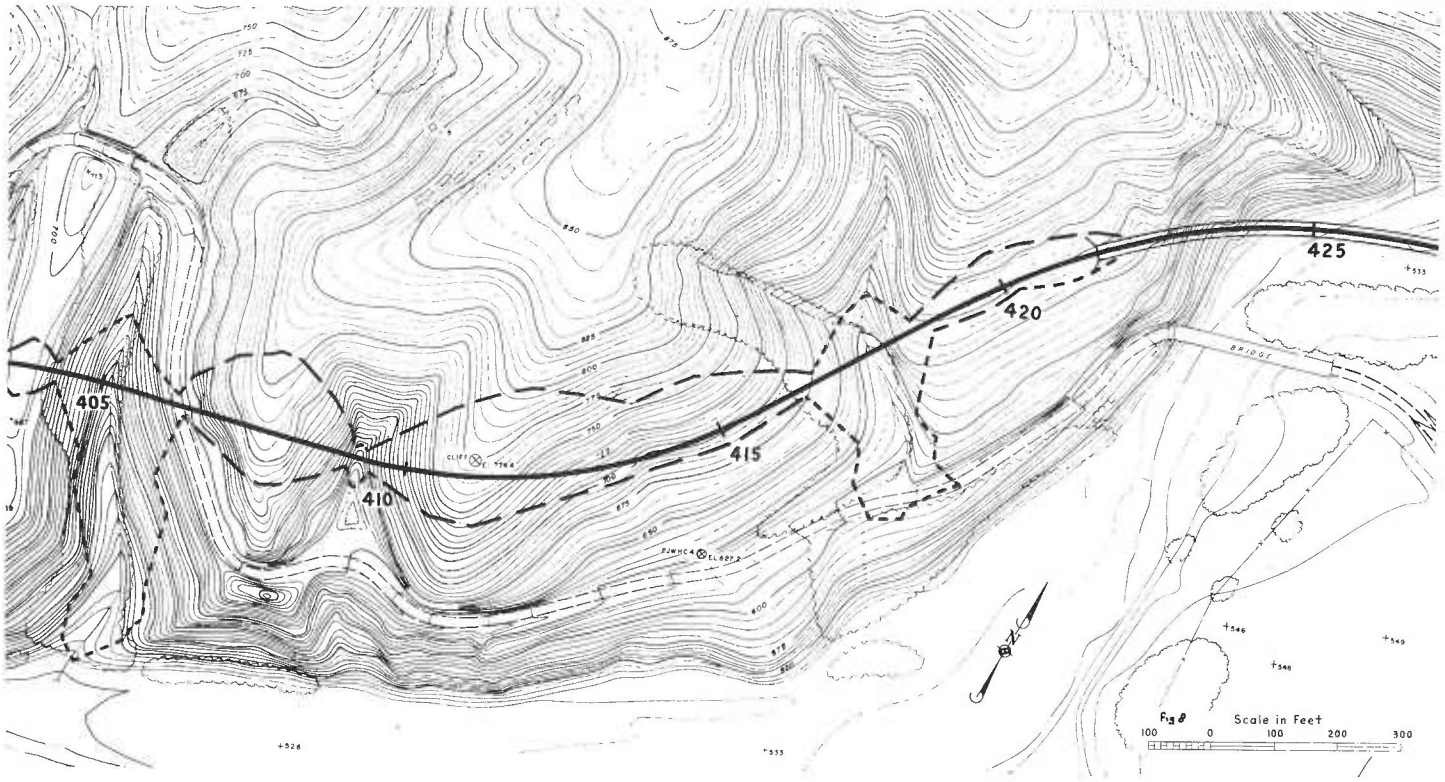


FIGURE 7—Spot elevations are used in lieu of contours where photogrammetric maps are obtained for the design of highways in comparatively level terrain. Scale of the original map was 1 inch = 50 feet.

FIGURE 8—Where the terrain is extremely rugged, photogrammetric maps at a scale of 1 inch = 100 feet with five-foot contours are frequently used for design purposes. The designer has developed the proposed alignment and has shown the trace of cut and fill slopes.



SLOW DOWN

It doesn't pay to hurry through city traffic. Experiments show that a car driven recklessly through town with little regard for traffic regulations arrives only a minute or two ahead of one driven safely and in observance of all traffic rules.

BOTH HANDS

Sleight-of-hand tricks may be all right for the magician but they are out of order when you're driving a car. Don't make your right hand guess what your left hand is doing. Keep *both* hands on the steering wheel where they belong.

AUTOMOTIVE DEVELOPMENT

The turbine powered passenger car still is a long way from the family garage, although recent developments in automotive research and testing laboratories have brought the turbo-car a little closer to reality, reports the National Automobile Club.

Record Budget

Highway Commission Votes $350,000,000 for Construction

An all-time record state highway budget providing more than $350,000,000 for major construction purposes for the 1957-58 Fiscal Year—an increase of more than $100,000,000 over the budget adopted a year ago—was adopted by the California Highway Commission on October 18th.

The construction items in the new budget include $220,439,000 for major projects, including construction engineering; $127,623,057 for rights of way; and $6,000,000 for contingencies, which normally is allocated later for construction purposes.

For comparison, the budget for the 1956-57 Fiscal Year as adopted in October, 1955, contained approximately $250,000,000 for major construction purposes, including rights of way. That budget was augmented in August, 1956, by approximately $63,000,000 as a result of additional federal aid.

Total Budget $464,247,288

The over-all total budget adopted by the commission amounts to $464,247,288, of which $421,062,057 is for state highway purposes.

In addition to the $354,062,057 for construction, rights of way and contingencies, the state highway allocations in the budget include $25,000,000 for maintenance, $25,500,000 for preliminary engineering, $2,000,000 for the state-wide highway planning survey, $7,500,000 for administration, $4,500,000 for buildings and plants and $1,750,000 for honor camp projects.

The nonstate highway items in the budget include $30,187,000 for major city streets (⅜ cent per gallon of the gasoline tax); $7,920,000 in federal aid secondary funds for county roads; $4,087,854 in state highway matching funds to assist counties in the required matching of federal funds on F. A. S. projects; and $904,000 to cities for engineering work.

Federal Aid Increased

Federal aid, still further increased, accounted for most of the additional funds in the 1957-58 budget, along with a normal rise in highway user tax revenues collected by the State. For 1956-58, California will receive approximately $134,000,000 in federal aid for state highways, plus nearly $8,000,000 in federal funds for county roads on the Federal Aid Secondary System. Prior to the 1956 federal highway legislation, California's largest federal apportionment had been $40,000,000 for state highways and $7,000,000 for county F. A. S. roads.

State Director of Public Works Frank B. Durkee, Chairman of the Highway Commission, pointed out that the 1957-58 state highway budget is the first in history to contain one or more construction projects in every one of California's 58 counties.

"This fact bears out," Durkee said, "what we announced last June when the federal program was enacted into law. Although the bulk of the additional federal funds is earmarked for the National System of Interstate Highways, the effect of the added money here in California has been to release state funds for expenditure all over the State, wherever the needs are greatest."

Early Advertising

The Division of Highways has already advertised $3,500,000 worth of projects in the 1957-58 budget for bids. State law permits the awarding of state highway contracts as early as January 1st, six months before the start of the fiscal year. This provision enables the Division of Highways to make maximum use of favorable construction weather, which means earlier opening of road improvements to traffic.

In addition to extension of freeway systems in the State's metropolitan areas, the new budget provides for many miles of intercity freeways, and expressways, and numerous sections of modern two-lane highways. Nearly 70 miles of two-lane highway projects in the budget are to be built as initial units of ultimate four-lane freeways or expressways, with access control already provided an enough right of way for the remaining two lanes and a median strip to be added later. One of these two-lane projects on an ultimate freeway basis consists of nearly 18 miles, on State Route 90 (Vacaville-Dunnigan cutoff) in Solano and Yolo Counties.

Significant Features

Significant features of the 1957-58 state highway budget include:

San Francisco Bay Area—The final unit, in Oakland, of the 38-mile Eastshore Freeway from the Bay Bridge to San Jose; in San Francisco, extension of the Central Freeway (US 101); the Walnut Creek Bypass Freeway in Contra Costa County; and further construction of the Bayshore Freeway in Santa Clara County. Funds are provided to round out acquisition of rights of way for completion of the US 40 freeway in the Albany-Richmond area.

Los Angeles Metropolitan Area—Completion of the Long Beach Freeway from the Santa Ana Freeway to Pacific Coast Highway; a start on the Olympic Freeway (two projects in downtown Los Angeles); first downtown Los Angeles unit of the Golden State Freeway; continuation of the Golden State Freeway in the Burbank area; widening of portions of the Hollywood and Santa Ana Freeways; further extension of the Hollywood Freeway into the San Fernando Valley; extension of the San Diego Freeway in the Culver City area.

Various Projects

In Orange County, the San Diego Freeway (US 101) is being extended southeastward by two projects in the San Juan Capistrano and San Clemente areas.

In the San Diego area, current emphasis is on conversion of express-

Major Construction Projects in State Highway Buc

County	Route	Description	Approximate mileage	Estimated cost
Alameda	69 (SR 17)	Eastshore Freeway—0.25 mile east of Fallon Street to 0.22 mile west of Market Street; grade, pave and structures for 8-lane freeway (completes Eastshore Freeway between Bay Bridge and San Jose)	0.9	$6,400,000
Alameda	105	San Mateo-Hayward Bridge to Eden Landing Road; shoulders	1.8	100,000
Alameda	105	East 14th Street in Oakland between 77th and 74th Avenues at Arroyo Viejo Creek; reconstruct storm drains		250,000
Alameda	226	East 14th Street in San Leandro to 0.1 mile west of Southern Pacific R.R. Crossing; reconstruct and widen	0.5	165,000
Alameda	227	Mountain Boulevard in Oakland, between US 50 near Calaveras Avenue and SR 24 (portions); grade and surface (continuing cooperative freeway project with City of Oakland and Alameda County)		300,000
Alameda	Various	Rights of way on state highway routes (including $12,000,000 for US 50 freeway in Oakland)		13,757,000
Alpine	34 (SR 88)	Red Lake Dam to 1.5 miles east of Blue Lakes Road; grade and surface realignment)	5.8	800,000
Amador	34, 65 (SR 88, 49)	Lancha Plana Road to 0.5 mile east of Martell; grade surface and structures (realignment)	7.4	1,010,000
Amador	34 (SR 88)	Silver Lake to Alpine County Line (portions); grade and surface (reconstruction and realignment)	3.8	400,000
Amador	Various	Rights of way on state highway routes		45,000
Butte	21 (US 40 Alt)	Bear Creek Bridge; reconstruct		25,000
Butte, Plumas	21 (US 40 Alt)	Arch Rock, Elephant Butte and Grizzly Dome Tunnels (portions); line tunnels		60,000
Butte	47 (SR 32)	Glenn County Line to 2½ miles west of Chico; grade surface and structures (initial 2 lanes of ultimate 4-lane expressway) (See Glenn Co.)	5.9	475,000
Butte	47 (SR 32)	Junction US 99E via 8th and 9th Streets to Fir Street east of Chico; grade, surface and drainage (to provide one-way couplet)	1.1	230,000
Butte	87, 21 (US 40 Alt)	Union School to Montgomery Street in Oroville; grade, surface and structures (initial 2 lanes of ultimate 4-lane expressway)	5.4	750,000
Butte	Various	Rights of way on state highway routes		360,000
Calaveras	24 (SR 4)	Murphys to Big Trees (portions); grade and surface (widening and realignment)	6.6	550,000
Calaveras	65 (SR 49)	Through Mokelumne Hill; grade and surface (relocation)	2.0	340,000
Calaveras	Various	Rights of way on state highway routes		90,000
Colusa	15 (SR 20)	Williams to Sacramento River Bridge (portions); base and surface (reconstruct), and widen structure (Steer Ditch Bridge)	8.9	350,000
Colusa	Various	Rights of way on state highway routes		50,000
Contra Costa	75, 107 (SR 24, 21)	East of Pleasant Hill Road to west of Walden Road, with connection to SR 21 at Crest Avenue; grade, pave and structures for 6-lane freeway in vicinity of Walnut Creek (Walnut Creek Bypass)	4.2	7,500,000
Contra Costa	75 (SR 4)	SR 24 to Brentwood; reconstruct	6.6	305,000
Contra Costa	Various	Rights of way on state highway routes		1,991,000
Del Norte	1 (US 101)	Minot Creek and High Prairie Creek; new bridges and approaches		235,000
Del Norte	Various	Rights of way on state highway routes		75,000
El Dorado	11 (US 50)	Mays to Nevada State Line; grade, surface and structures for 2-lane and 4-lane highway	5.2	350,000
El Dorado	93	Georgetown to 2.4 miles west; grade and surface (reconstruction and some realignment)	2.4	145,000
El Dorado	Various	Rights of way on state highway routes		245,000
Fresno	41 (SR 180)	Ventura Avenue, from R Street to Chestnut Avenue; grade and surface (widen to full 4-lane divided highway)	2.3	750,000
Fresno	41 (SR 180)	0.7 mile east of Reed Avenue to 2.3 miles east of Friant-Kern Canal (portions); grade, surface and structure (relocation)	1.4	230,000
Fresno	125 (SR 41)	Shaw Avenue to 0.8 mile north of Herndon Avenue, grade and surface (extending 6-lane divided highway)	2.6	400,000
Fresno	125 (SR 41)	Ventura Avenue from C Street to Broadway; grade and surface (reconstruct)	0.4	28,000
Fresno	Various	Rights of way on state highway routes		485,000
Glenn	7 (US 99W)	3.6 miles south of Willows to Willows; surface	3.6	100,000
Glenn	47 (SR 32)	US 99W to Butte county line; grade, surface and structure (initial 2 lanes of ultimate 4-lane expressway, including new bridge at Stony Creek) (see Butte County)	11.1	965,000
Glenn	Various	Rights of way on state highway routes		220,000
Humboldt	1 (US 101)	1 mile south of Dyerville to Englewood; grade, surface and structures for 4-lane freeway (first unit of relocation in Humboldt Redwood State Park area)	4.2	2,605,000
Humboldt	1 (US 101)	0.2 mile north of Fortuna to 0.4 mile north of Fernbridge; structures and approaches for 4-lane expressway		515,000
Humboldt	1 (US 101)	0.4 mile north of Fernbridge to 0.7 mile north of Hookton Road; grade and surface to complete sections of 4-lane expressway	4.6	750,000
Humboldt	1 (US 101)	Mad River; structure (additional Mad River bridge)		500,000
Humboldt	1 (US 101)	Patricks Point to 0.3 mile north of Big Lagoon; grade for future 4-lane expressway	3.5	1,300,000
Humboldt	Various	Rights of way on state highway routes		490,000
Imperial	187 (SR 115)	Sandia to Alamorio; grade and surface (widen)	10.3	1,480,000
Imperial	201 (SR 115)	0.5 mile north of Route 187 to Standard Canal; grade and pave (widen)	6.3	725,000
Imperial	Various	Rights of way on state highway routes		465,000
Inyo	23 (US 6-395)	Black Rock to 4.4 miles south of Big Pine; grade and surface (widen)	6.4	350,000
Inyo	(US 395) 23, 76	Texaco Corners to Birchim Canyon; grade and surface (widen)	11.5	260,000

SR=State Sign Route.

dget for 1957-58 Fiscal Year Total $350,000,000

County	Route	Description	Approximate mileage	Estimated cost
Inyo	Various	Rights of way on state highway routes		$175,000
Kern	(4 US 99)	Fort Tejon to 2 miles north of Grapevine Station; grade, pave and structures to provide 8-lane freeway (additional 4-lane northbound roadway)	7.2	6,935,000
Kern	4 (US 99)	Route 129 to Delano (portions); grade and pave (reconstruct)	10.2	450,000
Kern	23 (US 6)	Ittners to one mile north; grade and surface (realignment)	1.0	600,000
Kern	57 (SR 178)	2.0 miles east to 4.0 miles east of Weldon; grade and surface (realignment)	2.0	100,000
Kern	58 (US 466)	0.3 mile west of east city limit of Bakersfield to Route 143; grade and surface (widen)	4.2	270,000
Kern	58 (SR 178)	Buena Vista Slough Bridge; widen bridge and approaches		45,000
Kern	140	5.3 miles east of Arvin to 2.2 miles west of US 466, grade and surface (realignment—White Wolf Grade)	3.3	625,000
Kern	145 (US 395)	0.4 mile north of Inyokern to US 6; grade and surface (relocation)	5.0	160,000
Kern	Various	Rights of way on state highway routes (including $2,100,000 for US 99 freeway in Bakersfield area)		3,131,000
Kings	125 (SR 41)	1.9 miles north of Stratford to Jersey Avenue; grade and surface (widen)	1.9	190,000
Kings	135	Kansas Avenue to SR 198; grade and surface (widen)	8.0	770,000
Kings	Various	Rights of way on state highway routes		615,000
Lake	49 (SR 53)	Cache Creek to SR 20; grade and surface for 2-lane highway on relocation (expressway basis)	6.3	950,000
Lake	Various	Rights of way on State highway routes		35,000
Lassen	73 (US 395)	North of Ravendale to Madeline (portions); grade and surface (reconstruct)	6.7	750,000
Los Angeles	2 (US 101)	Hollywood Freeway—Highland Avenue to Lankershim Boulevard; grade and pave additional lanes	2.6	775,000
Los Angeles	2, 159 (US 101)	Hollywood Freeway Extension—0.2 mile south of Moorpark Street to Kling Street on Route 159 and to 0.1 mile west of Laurel Canyon Boulevard on US 101; grade, pave and structures for 8-lane freeway	1.7	5,900,000
Los Angeles	2 (US 101)	0.2 mile south of Cheeseboro Road (west of Calabasas) to 0.15 mile north of Lindero Creek; reconstruct	3.5	250,000
Los Angeles	4, 26 (US 6-99) (US 60-70-99)	Golden State Freeway—0.1 mile south of Sixth Street to 0.2 mile north of Mission Road; and on US 60-70-99-Fickett Street to Macy Street; grade, pave and structures for 8-lane freeway	3.1	8,900,000
Los Angeles	4 (US 6-99)	Golden State Freeway—Alameda Avenue to Burbank Boulevard in Burbank; grade, pave and structures for 8-lane freeway	1.3	3,150,000
Los Angeles	60 (US 101 Alt)	Vermont Avenue to Reed Street; reconstruct	1.3	120,000
Los Angeles	62 (SR 39)	San Bernardino Freeway to Paramount Avenue in Azusa; grade, pave and structures for 4-lane divided higway	3.3	1,235,000
Los Angeles, San Bernardino	77 (SR 71)	0.3 mile south of Riverside Drive to US 60 at Butterfield Road; grade, pave and structures for 4-lane expressway	3.2	900,000
Los Angeles	77	0.2 mile east of San Bernardino Road in El Monte to Rio Hondo Wash; grade, pave and structures (widen)	0.8 0.8	270,000 270,000
Los Angeles	158 (SR 7)	San Diego Freeway—0.2 mile south of Venice Boulevard to 0.2 mile north of Ohio Avenue; grade, pave and structures for 8-lane freeway	3.5	6,025,000
Los Angeles	162 (US 66)	On Santa Monica Blvd. from Wilshire Blvd. to Sierra Dr. in Beverly Hills; reconstruct	1.4	100,000
Los Angeles	164 (SR 107)	Broadway (Hawthorne) to Hillcrest Blvd. (Inglewood); grade and surface for 6-lane divided highway	2.6	315,000
Los Angeles	164 (SR 107)	0.2 mile south to 0.3 mile north of 190th Street (Torrance); grade, surface and structure (widen R.R. underpass) for 6-lane divided highway	0.5	145,000
Los Angeles	166 (US 101)	Santa Ana Freeway—Lakewood-Rosemead Blvd. to Rosecrans Avenue; grade, pave and structures (widen 4-lane freeway to 6 lanes)	5.2	1,200,000
Los Angeles	167 (SR 15)	Long Beach Freeway—0.1 mile south of South Junction of Atlantic Boulevard to 0.3 mile south of Rosecrans Ave.; grade, pave and structures for 6-lane freeway (completes Long Beach Freeway from Santa Ana Freeway to Pacific Coast Highway)	1.1	1,750,000
Los Angeles	168 (SR 19)	On Lakewood Blvd., from Gardendale Street to Hall road; reconstruct	1.7	180,000
Los Angeles	173 (SR 26)	Olympic Freeway—Harbor Freeway Interchange (portions); structure and approaches		1,400,000
Los Angeles	173 (SR 26)	Olympic Freeway—West right of way line of Santa Fe Railroad Yard to 8th Street; structure (L.A. River and Santa Fe R.R. yard) for future 8-lane freeway	0.3	7,000,000
Los Angeles	175 (SR 14)	On Artesia Boulevard, from Gramercy Place to Western Avenue; grade, surface and structure (Dominguez Flood Control Channel)	0.3	115,000
Los Angeles	179 (SR 22)	US 101 Alt. in Long Beach to Los Cerritos Channel; grade, surface and structures (widen to 4 lanes)	1.1	175,000
Los Angeles	Various	Rights of way on state highway routes, including $12,000,000 for Olympic Freeway, $12,000,000 for Golden State Freeway, $9,000,000 for San Diego Freeway, $3,500,000 for Glendale Freeway and $3,000,000 for Hollywood Freeway Extension		53,270,000
Madera	4 (US 99)	0.5 mile south to 1.5 miles north of Madera; grade, pave and structures for 4-lane freeway	3.9	3,400,000
Madera	Various	Rights of way on state highway routes		150,000
Marin	1 (US 101)	0.2 mile north of Richardson Bay Bridge; pedestrian overcrossing		60,000
Marin	1 (US 101)	Greenbrae Intersection to 0.5 mile north of California Park Overhead; grade, pave and structure for 6-lane freeway	1.4	1,325,000
Marin, Sonoma	8 (SR 37)	Petaluma Creek Bridge; new 4-lane bridge and approach embankments		2,300,000
Marin	Various	Rights of way on state highway routes		457,000
Mariposa	18 (SR 140)	Acorn Inn to King Solomon Mine; grade, surface and structures (widening and realignment)	4.6	1,200,000
Mariposa	65 (SR 49)	2.0 miles north of SR 140 to Coulterville (portions); grade and surface (some realignment)		200,000
Mariposa	Various	Rights of way on state highway routes		65,000

SR=State Sign Route.

County	Route	Description	Approximate mileage	Estimated cost
Mendocino	1 (US 101)	0.5 mile north of Hilvilla to 0.9 mile south of Irvine Lodge; grade and surface for 4-lane expressway	3.8	$2,000,000
Mendocino	48 (SR 128)	Robinson Creek to Maple Creek; base and surface	4.6	250,000
Mendocino, Sonoma	56 (SR 1)	Gualala River; new bridge and approaches	0.9	625,000
Mendocino	Various	Rights of way on state highway routes		325,000
Merced	4 (US 99)	G Street to Bear Creek (portions); reconstruct existing highway	1.4	300,000
Merced	122 (SR 140)	0.5 mile east to 4.0 miles east of Gustine; grade and surface (widen)	3.5	150,000
Merced	122 (SR 140)	West of Lincoln Road to west city limits of Merced (portions); grade and surface (widen)		550,000
Merced	Various	Rights of way on state highway routes (including $750,000 for US 99 freeway in Merced area)		1,600,000
Modoc	28, 73 (US 395)	Alturas to Oregon State Line (portions); surface		725,000
Modoc	Various	Rights of way on state highway routes		40,000
Mono	40	US 395 to Nevada State Line; surface	21.7	275,000
Mono	96	Bridgeport to Walker River Reservoir; grade and surface (reconstruct)	4.8	200,000
Mono	Various	Rights of way on state highway routes		40,000
Monterey	2 (US 101)	Through Chualar; grade, surface and structures for 4-lane freeway	1.3	620,000
Monterey	2 (US 101)	1 mile north of Greenfield to Salinas River near Soledad; grade, surface and structures for 4-lane expressway	5.6	1,090,000
Monterey	2 (US 101)	1.8 miles north of Salinas River to 2 miles south of Greenfield; grade, surface and structures for 4-lane expressway	7.9	1,600,000
Monterey	56 (SR 1)	San Luis Obispo county line to Rocky Creek (portions); cribbing (reconstruct retaining walls)		230,000
Monterey	119 (SR 25)	SR 198 to San Benito county line (portions); surface		70,000
Monterey	Various	Rights of way on state highway routes		370,000
Napa	49 (SR 29)	Union Station to Orchard Avenue; grade and surface (additional 2 lanes for 4-lane expressway)	2.3	525,000
Napa	102 (SR 128)	Sage Creek Bridge; superstructure		15,000
Napa	Various	Rights of way on state highway routes		285,000
Nevada	38 (US 40)	Boca to Floriston (portions); detour for future 4-lane freeway construction		350,000
Nevada, Placer	38 (SR 89)	0.2 mile south of Squaw Valley Road to Truckee Wye; grade, surface and structures (widening)	9.4	1,450,000
Nevada	Various	Rights of way on state highway routes (including $600,000 for US 40 freeway in Truckee area)		895,000
Orange, San Diego	2 (US 101)	San Diego Freeway—San Mateo Creek to 0.1 mile south of Avenida Cadiz (San Clemente); grade, pave and structures for 6-lane freeway	2.4	2,725,000
Orange	2 (US 101)	San Diego Freeway—1.9 miles south of SR 74 (at San Juan Capistrano) to 0.1 mile south of Trabuco Creek; grade, pave and structures for 4-lane freeway	3.6	3,470,000
Orange	175 (SR 14)	From Santa Ana Freeway to 0.2 mile east of Spadra Road in Fullerton; grade, pave and structures for 4-lane freeway	3.8	2,900,000
Orange	179 (SR 22)	Knott Street to Century Boulevard; grade and surface (widen existing highway to 4 lanes)	3.8	400,000
Orange	Various	Rights of way on state highway routes (includes $1,500,000 for SR 55 freeway and $1,750,000 for San Diego Freeway)		4,140,000
Placer	37 (US 40)	Near Magra to 0.1 mile west of Alta Road (portions); detour for future 4-lane freeway construction		300,000
Placer, Nevada	37 (US 40)	Hampshire Rocks to Soda Springs; grade, surface and structure for 4-lane freeway	5.7	3,100,000
Placer	Various	Rights of way on state highway routes		885,000
Plumas	21 (US 40 Alt)	0.7 mile west of Spring Garden to Sloat; grade and surface (initial 2 lanes of ultimate 4-lane expressway)	5.2	1,300,000
Riverside	19, 78 (US 60, 395)	US 60-395 separation; lighting, signing and speed change lanes		50,000
Riverside	19 (US 60)	4.0 miles west of US 70-99 to US 70-99 (near Beaumont); grade, surface and structures for 4-lane freeway	4.3	1,150,000
Riverside	43 (US 91) (SR 18)	Van Buren Street to Arlington Avenue; grade, surface and structures for 4-lane freeway	3.7	2,850,000
Riverside	64 (US 60-70)	Colorado River; new bridge (near Blythe); cooperative project with Arizona		600,000 (California share)
Riverside	64 (SR 74)	Antsell Rock Creek, Servo Creek and South Fork San Jacinto River; bridges and approaches	0.3	220,000
Riverside, San Bernardino	187	US 60-70-99 to Morongo Valley; grade and surface (widen)	11.3	270,000
Riverside	Various	Rights of way on state highway routes (including $1,000,000 for US 60-70-99 freeway in Beaumont area)		2,731,000
Sacramento, Solano	53 (SR 12)	Sacramento River Bridge at Rio Vista; sub-structure		1,150,000
Sacramento	Various	Rights of way on state highway routes (including $1,500,000 for north-south freeway in and south of Sacramento)		1,985,000
San Benito	2 (US 101)	San Benito River; reconstruct bridge and approaches	0.1	185,000
San Benito	119 (SR 25)	5 miles north of San Benito River to Paicines; grade and surface (realignment)	4.6	450,000
San Benito	Various	Rights of way on State highway routes		135,000
San Bernardino	31, 58 (US 66-91)	Victorville to Barstow; grade, surface and structures for 4-lane freeway	29.4	5,200,000
San Bernardino	43 (SR 18)	1.0 mile south of Forest Boundary to Apple Valley; grade and surface (widening and some realignment)	23.9	440,000
San Bernardino	43, 31 (US66-91-395)	6th Street to Devore; grade, surface and structures (to complete 4-lane freeway through San Bernardino to Devore)	11.6	7,300,000
San Bernardino	58 (US 466)	Kern County line to Hinkley (portions); grade and surface (widen)	28.2	420,000

SR=State Sign Route.

County	Route	Description	Approximate mileage	Estimated cost
San Bernardino	Various	Rights of way on state highway routes (Including $1,160,000 for US 91-395-SR 18 freeway in and south of San Bernardino)		$3,596,000
San Diego	2 (US 101)	0.7 mile south of Dairy Mart Road to south city limits of Chula Vista (portions); grade, pave and structures (convert 4-lane expressway to full freeway)	5.2	910,000
San Diego	2 (US 101)	0.4 mile south of Washington Street to Barnett Avenue; grade, pave and structures (Washington Street Interchange)	1.1	1,340,000
San Diego	12, 77 (US 80, 395)	1.2 miles east of Taylor Street to 0.2 mile east of US 395; grade, pave and structures (convert 4-lane expressway to full freeway, including revision of Mission Valley Interchange)	2.4	3,100,000
San Diego	12 (US 80)	0.3 mile west to 0.6 mile east of Fairmount Avenue; grade, pave and structures (Fairmount Avenue Interchange)	0.9	1,700,000
San Diego	77 (US 395)	Caliremont Mesa Boulevard Interchange; structure and approaches	1.0	800,000
San Diego	195 (SR 76)	Fry Creek Bridge and Big Fry Creek Bridge; new bridges and approaches	1.2	200,000
San Diego	200 (SR 94)	17th Street to Home Avenue; grade, pave and structures for 6-lane freeway	1.7	4,065,000
San Diego	Various	Rights of way on state highway routes (including $6,600,000 for US 101 freeway in San Diego and $1,250,000 for US 80 freeway in San Diego-La Mesa-El Cajon area)		8,825,000
San Francisco	2 (US 101)	Central Freeway—South Van Ness Avenue to Turk Street; grade, pave and structure for 6-lane freeway	1.0	5,200,000
San Francisco	2 (US 101)	Lyon Street to SR 1 connection; grade, pave and structures for 8-lane freeway	1.3	3,900,000
San Francisco	Various	Rights of way on state highway routes (including $10,000,000 for Southern Freeway)		12,932,000
San Joaquin	5 (US 50)	East city limits of Tracy to Grant Line Road; grade, surface and structures (widen existing highway to 4-lanes, including East Tracy Overhead and channelization at Chrisman Road)	3.9	1,100,000
San Joaquin	5 (US 50)	Richards Avenue to Charter Way; grade, surface and structures (widen existing highway to 4-lanes)	5.0	1,100,000
San Joaquin	75 (SR 4)	US 99 to Knights Ferry Road (portions); reconstruct		20,000
San Joaquin	Various	Rights of way on state highway routes		265,000
San Luis Obispo	2 (US 101)	0.2 mile south of Camp Fremont to Cuesta Overhead; resurface	3.2	500,000
San Luis Obispo Santa Barbara	57 (SR 166)	1.0 mile west of Huasna River to 0.7 mile west of Buckhorn Creek; grade, surface and structures (relocation around Vaquero Reservoir)	7.8	1,165,000
San Luis Obispo	Various	Rights of way on state highway routes (including $900,000 for US 101 freeway in Pismo Beach area)		1,900,000
San Mateo	2 (US 101)	El Camino Real—31st Avenue to Poplar Avenue in San Mateo; grade and surface (widen)	2.9	375,000
San Mateo	56, 55 (SR 1,5)	Edgemar to Junction Skyline Boulevard (SR 5) and Edgemar Road; grade, surface and structures for 4-lane expressway	1.5	1,300,000
San Mateo	Various	Rights of way on state highway routes		1,949,000
Santa Barbara	2 (US 101)	Wigmore to 1.7 miles north of Los Alamos; grade, surface and structures for 4-lane expressway	5.9	1,900,000
Santa Barbara	2 (US 101)	0.5 mile west of Refugio to Tajiguas; grade, surface and structures for 4-lane expressway	2.3	769,000
Santa Barbara	Various	Rights of way on state highway routes (including $1,000,000 for US 101 freeway in Santa Barbara)		2,475,000
Santa Clara	2 (US 101)	El Camino Real—San Tomas Aquino Creek in Santa Clara to Route 114 (Saratoga Road) in Sunnyvale; grade and surface (widen to 4 lanes)	3.8	945,000
Santa Clara	5, 42 (SR 17)	Route 42 (Santa Cruz Avenue) in Los Gatos to Bascom Avenue in San Jose on SR 17 and Tait Avenue to new SR 17 in Los Gatos; grade, pave and structures for 4-lane freeway	8.8	5,770,000
Santa Clara	32 (SR 152)	San Felipe Road to Hollister Wye; reconstruct and resurface	2.3	90,000
Santa Clara	68 (US 101 Bypass)	Bayshore Freeway—Stevens Creek to Ellis Street; grade, pave and structures for 6-lane freeway	1.1	1,100,000
Santa Clara	Various	Rights of way on state highway routes (including $750,000 for Bayshore Freeway)		1,929,000
Santa Cruz	56, 5 (SR 1, 17)	0.3 mile east of Morrissey Avenue to 0.6 mile north of SR 1-SR 17 Junction; grade, pave and structures for 4-lane freeway	2.2	1,600,000
Santa Cruz	56 (SR 1)	0.2 mile east of Swift Street to Wildre Creek; grade and surface (2 lanes of ultimate 4-lane expressway; portion cooperative project with Joint Highway District No. 9)	2.6	415,000
Santa Cruz	116 (SR 9)	Felton to Boulder Creek (portions); grade, surface and structures (widening)	5.9	400,000
Santa Cruz	Various	Rights of way on state highway routes		360,000
Shasta	3 (US 99)	Clear Creek to Redding Underpass; grade, surface and structures (frontage road)	3.3	365,000
Shasta	3 (US 99)	0.5 mile north of Lamoine to 0.8 mile north fo Shotgun Creek; grade, surface and structures (extension of 4-lane freeway in Sacramento Canyon)	6.9	4,520,000
Shasta	3 (US 99)	Cypress Avenue to Sulphur Creek in Redding; grade and surface (for one-way street couplet and widening)	2.0	190,000
Shasta	Various	Rights of way on state highway routes		272,000
Sierra	25 (SR 49)	North Fork Yuba River to 0.25 mile east of Ramshorn Creek (portions); grade and surface (widen)		200,000
Sierra	Various	Rights of way on state highway routes		95,000
Siskiyou	3 (US 99)	Shasta River to Gazelle; surface	7.6	160,000
Siskiyou	46 (SR 96)	4.5 miles to 5.4 miles east of Hamburg; grade and surface (realignment)	0.9	125,000
Siskiyou	Various	Rights of way on state highway routes		570,000
Solano	7 (US 40)	Interchange at SR 12; structure and approaches (west of Fairfield)		1,100,000
Solano	7 (US 40)	0.2 mile north of Vallejo Wye to 0.4 mile north of Redwood Street; grade, pave and structures for 6-lane freeway	3.5	4,300,000
Solano	74 (SR 21)	New SR 21 to 1.25 miles north of Benicia Arsenal; structure and approaches (Benicia Arsenal Interchange)		375,000
Solano	90	Vacaville-Dunnigan Cutoff—0.3 mile north of Sweeney Creek to Yolo County line; grade, surface and structures (initial 2-lanes of ultimate 4-lane freeway) (See Yolo County)	5.0	1,070,000
Solano	Various	Rights of way on state highway routes (including $750,000 for new freeway route in Benicia area)		1,565,000

SR=State Sign Route.

County	Route	Description	Approximate mileage	Estimated cost
Sonoma	51 (SR 12)	US 101 to 0.17 mile east of Farmer's Lane; widen and channelize	2.3	$435,000
Sonoma	Various	Rights of way on state highway routes (including $800,000 for US 101 freeway in Santa Rosa-Healdsburg area)		908,000
Stanislaus	4 (US 99)	Modesto Freeway-Whitmore Road to Pecos Avenue; grade, pave and structures for 4-lane freeway	2.2	1,300,000
Stanislaus	Various	Rights of way on state highway routes (including $1,100,000 for U.S. 99 freeway in Ceres-Modesto area)		1,300,000
Sutter	15 (SR 20)	East and Sutter Bypass to US 40 Alt. (portions); surface		235,000
Sutter	87 (US 40 Alt)	Knights Landing to Onstott Road (portions); surface and widen structures		700,000
Sutter	Various	Rights of way on state highway routes		300,000
Tehama	29 (SR 36)	1.5 miles east of Lassen Camp to Mineral; grade surface and structure (initial 2 lanes of ultimate 4-lane expressway)	5.2	980,000
Tehama	29 (SR 36)	3 miles east of Tedoc Road to Dry Creek; grade and surface (realignment)	6.2	775,000
Tehama	Various	Rights of way on state highway routes		38,000
Trinity	29 (SR 36)	Salt Creek Bridge; repair bridge		18,000
Trinity	Various	Rights of way on state highway routes		30,000
Tulare	4 (US 99)	6th Street Overcrossing at Tipton; structure and approaches		165,000
Tulare	10 (SR 198)	County Road 80 to Mooney Boulevard; grade and surface for 4-lane divided highway	4.3	1,100,000
Tulare	Various	Rights of way on state highway routes		1,350,000
Tuolumne	13 (SR 49, 108, 120)	7.0 miles east of Stanislaus County line to Montezuma Road; grade and surface (initial 2 lanes of ultimate 4-lane expressway	8.1	1,500,000
Ventura	2 (US 101)	Ventura Freeway—Conejo Grade Summit to 5th Street in Camarillo; grade, pave and structures for 4 and 6-lane freeway	4.8	3,400,000
Ventura	2 (US 101)	Ventura Freeway—Rose Road Interchange; structure and approaches		250,000
Ventura	9 (SR 118)	Arroyo Simi Bridge; new bridge and approaches	0.1	179,000
Ventura	151 (SR 150)	0.1 mile west of Sisar Creek to 0.1 mile east of Santa Paula Creek; grade, surface and structures (realignment)	0.4	215,000
Ventura	Various	Rights of way on state highway routes (including $3.000,000 for US 101 freeway in and near Ventura		4,669,000
Yolo	6 (SR 128)	Solano County line to Route 90 at Winters (portions); reconstruct	9.1	250,000
Yolo	6 (US 40)	Solano County line to Swingle; structure (Davis Interchange)		320,000
Yolo	50 (SR 16, 24)	East side of Yolo Bypass to near Kiesel; grade and surface (widening and some realignment)	3.0	300,000
Yolo	50 (SR 16, 24)	Bryte to Broderick; grade and surface (widening)	2.2	110,000
Yolo	90, 6	Vacaville-Dunnigan Cutoff—Solano County line to 2.75 miles north of Madison; grade, surface and structures (initial 2 lanes of ultimate 4-lane freeway) (see Solano County)	13.9	3,000,000
Yolo	Various	Rights of way on state highway routes		160,000
Yuba	15 (SR 20)	Westerly approach to Parks Bar Bridge; grade and surface (realignment)	1.0	100,000
Yuba	Various	Rights of way on state highway routes		200,000

SR = State Sign Route.

way sections of US 101, US 80 and US 395 to full freeways by construction of interchanges. The Highway 94 freeway is being extended further into the San Diego downtown area.

In the Sacramento metropolitan area, Durkee pointed out that construction will begin soon on two previously budgeted projects, one a $2,250,000 six-mile freeway job on US 50-99 south of Elk Grove Road and the other a $1,400,000 14-mile widening of US 50 east of Sacramento. He added that the findings of a cooperative state-city-county trafficways survey, now in progress, will be a major factor in future freeway plans for the entire Sacramento metropolitan area.

The longest single full freeway project in state highway history—29.4 miles on US 66-91 from Victorville to Barstow—is included in the new budget. Together with a new 11.1-mile freeway project in and north of San Bernardino, this will provide 70 miles of continuous freeway and expressway from San Bernardino to Barstow. Extension of the north-south freeway through Riverside is also included.

On US 99 South

On US 99 between Los Angeles and Sacramento, the major projects budgeted include the conversion of the Grapevine Grade in Kern County to an eight-lane full freeway; freeway construction through Madera; and the first unit of the freeway through Modesto. Nearer the Oregon line, an additional 6.9 miles of freeway are scheduled for construction on US 99 north of Shasta Lake in the Sacramento River Canyon.

The major gap in freeway and expressway construction on US 101 between San Francisco and Los Angeles has been in southern Monterey County. The new budget provides for three projects, totaling 14.8 miles, which will close much of this gap between King City and the completed freeway south of Salinas. Two additional expressway projects are budgeted on the Santa Barbara County portion of US 101 along with freeway development in Ventura County from the Conejo Grade to Camarillo. On the Redwood Highway (US 101) in Humboldt County, the first unit of the freeway bypassing the State Park Redwood Groves is included.

More US 40 Improvement

The long-range effort to multilane US 40 over the Sierra is continued in the new budget, with one 5.7-mile freeway project in the high country west of Soda Springs and two projects for major detour construction preparatory to future freeway work on the same route.

There are several major bridge projects in the budget. Among those in the half-million-dollar or more class

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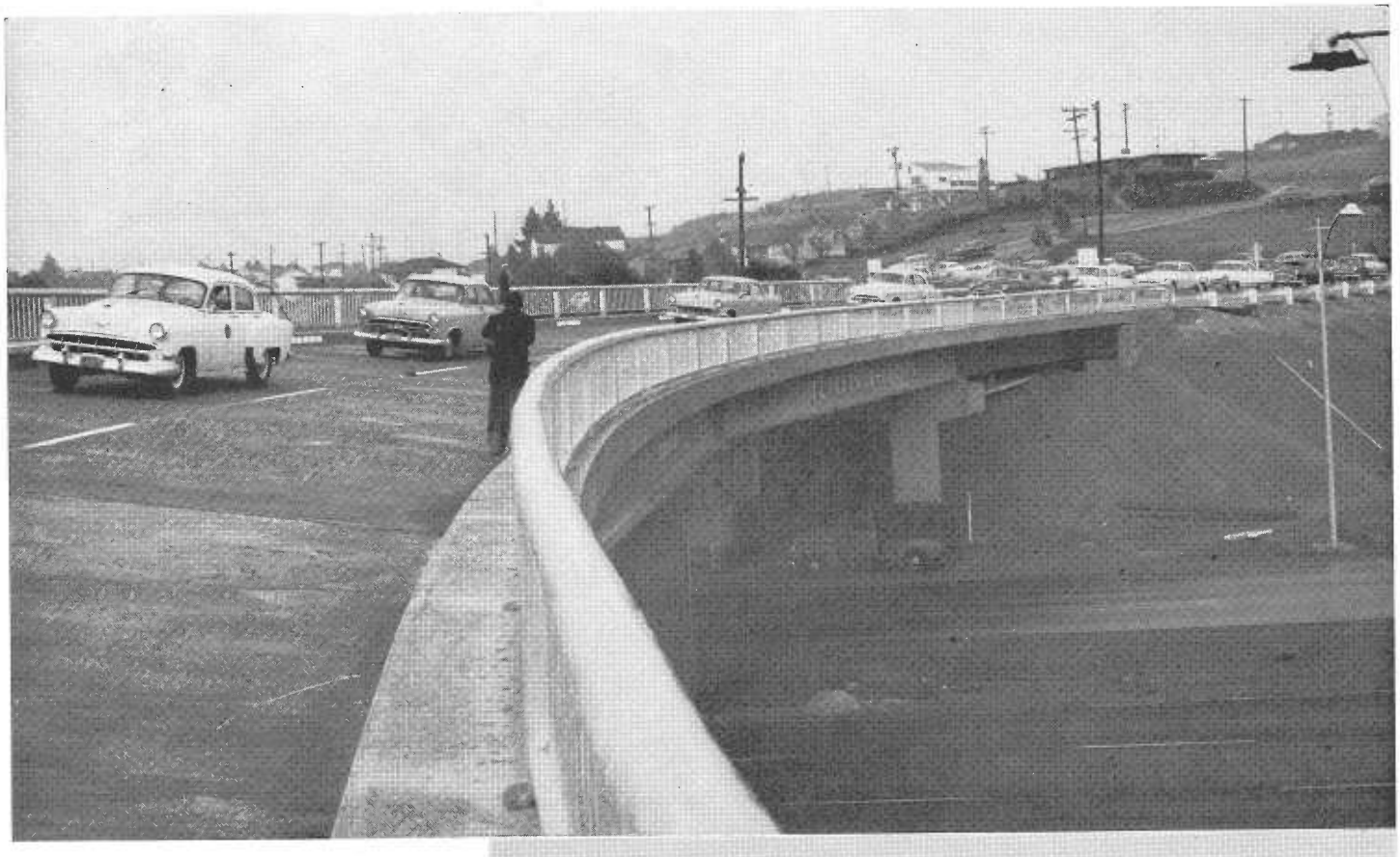
MAGAZINE STREET OVERPASS IN VALLEJO IS COMPLETED



Crosstown traffic was made considerably safer and quicker in Vallejo when the $460,000 overpass, approaches and frontage roads were opened to public use at Magazine Street on Friday, October 27, 1956. The new structure eliminates a dangerous crossing over busy US 40, main artery over the Sierra Mountains to the East Coast.

Threatening skies withheld rain long enough to permit a giant size pair of scissors to snip the ribbon and allow the free flow of traffic from one side of the city to the other.

Gathered to celebrate the event were numerous city, county, and state officials, including a large number of interested residents of the area.

The Magazine Street Overpass is the first of six to be constructed in the City of Vallejo. When completed the heavy traffic in both directions will then flow without the delay of the present signal lights.

UPPER—Newly completed Magazine Street Overhead. LOWER—Scene at ribbon cutting. Left to right: Colon O. Kilby, Supervisor; G. E. Derr, Councilman; John Baldwin, Congressman; William F. Goheen, Supervisor; Chelso A. Maghetti, Secretary, California Highway Commission.

Southern Crossing

Experts Report on Financial Feasibility of Proposed Span

As California Highways and Public Works goes to press the California Toll Bridge Authority was preparing for a meeting in Sacramento on December 12th, to consider the report on "The Financial Feasibility of the Proposed Southern Crossing of San Francisco Bay," submitted by the firm of Smith, Barney and Co. of New York.

On June 1, 1956, the Department of Public Works entered into an agreement with Smith Barney and Co., to make a study and submit a report on the financial feasibility of the proposed new crossing.

Governor Knight ordered the report made public as soon as completed and on October 23, 1956, it was released at a press conference in San Francisco. Copies of the report were made available to members of the Legislature, public officials and others interested in this project.

The report includes the following conclusions and recommendations:

The complete Southern Crossing is not financially feasible as presently authorized at a basic toll rate of 25 cents for both the Bay Bridge and the Southern Crossing.

Although the minimum Southern Crossing appears to meet the requirements for a self-liquidating project in combination with the Bay Bridge at a 25-cent basic rate of toll for both facilities, the projected $180,000,000 of revenue bond financing necessary to finance its construction would not comply with all of the generally accepted investment standards for such securities and the minimum Southern Crossing must, therefore, be considered marginal as to financial feasibility on that basis, particularly in view of the unfavorable money market conditions which exist today. In this connection, it should be noted that under the suggested conditions governing the issuance of additional bonds contained in the appended financial studies, in the event of the initial financing of the minimum Southern Crossing it would not be possible to finance the construction of the remaining portions of the complete Southern Crossing at a basic toll rate of 25 cents for the Bay Bridge and the Southern Crossing unless the applicable revenues as estimated by the traffic engineers are substantially exceeded. These suggested conditions prerequisite to the issuance of additional bonds conform in general with standard practice in comparable revenue bond issues and, in our opinion, represent the minimum restrictions which would be acceptable to investors. In any event it would be necessary, in our opinion, that the authority enter into a covenant with the purchasers of any bonds issued to finance the costs of the minimum Southern Crossing that it would put into effect promptly such adjustment in the rates of toll applicable to the Bay Bridge and the Southern Crossing as may be necessary to maintain net revenues available for debt service equivalent to the interest, amortization and reserve requirements of the proposed revenue bonds to be issued to finance construction of the minimum

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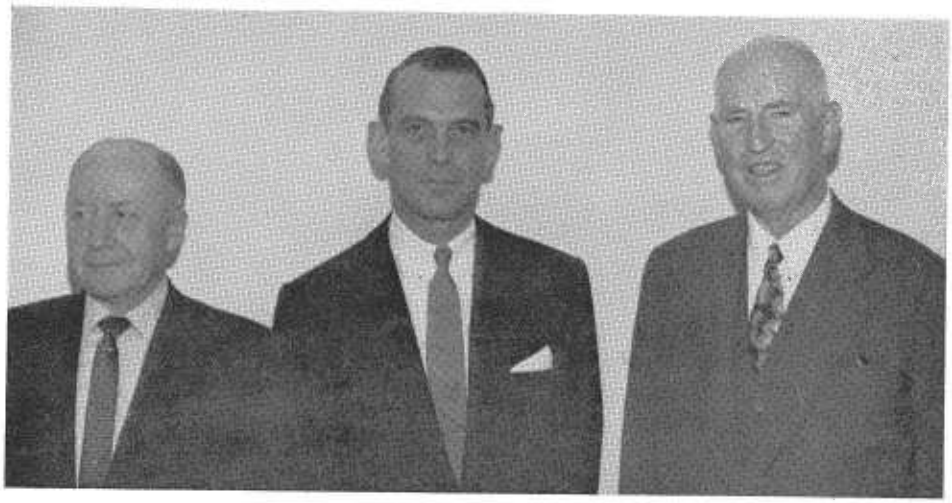


Southern Crossing experts. Left to right: Norman C. Raab, Chief, Division of San Francisco Bay Toll Crossings; C. Cheever Hardwick of Smith, Barney & Co.; George W. Burpee, Coverdale and Colpitts.

Representatives of the Department of Public Works at press briefing. Left to right: Robert E. Reed, Chief Counsel; T. Fred Bagshaw, Assistant Public Works Director; E. R. Higgins, Comptroller of the Department.

Sherwin Grade

New Highway Completed Far Ahead of Scheduled Date

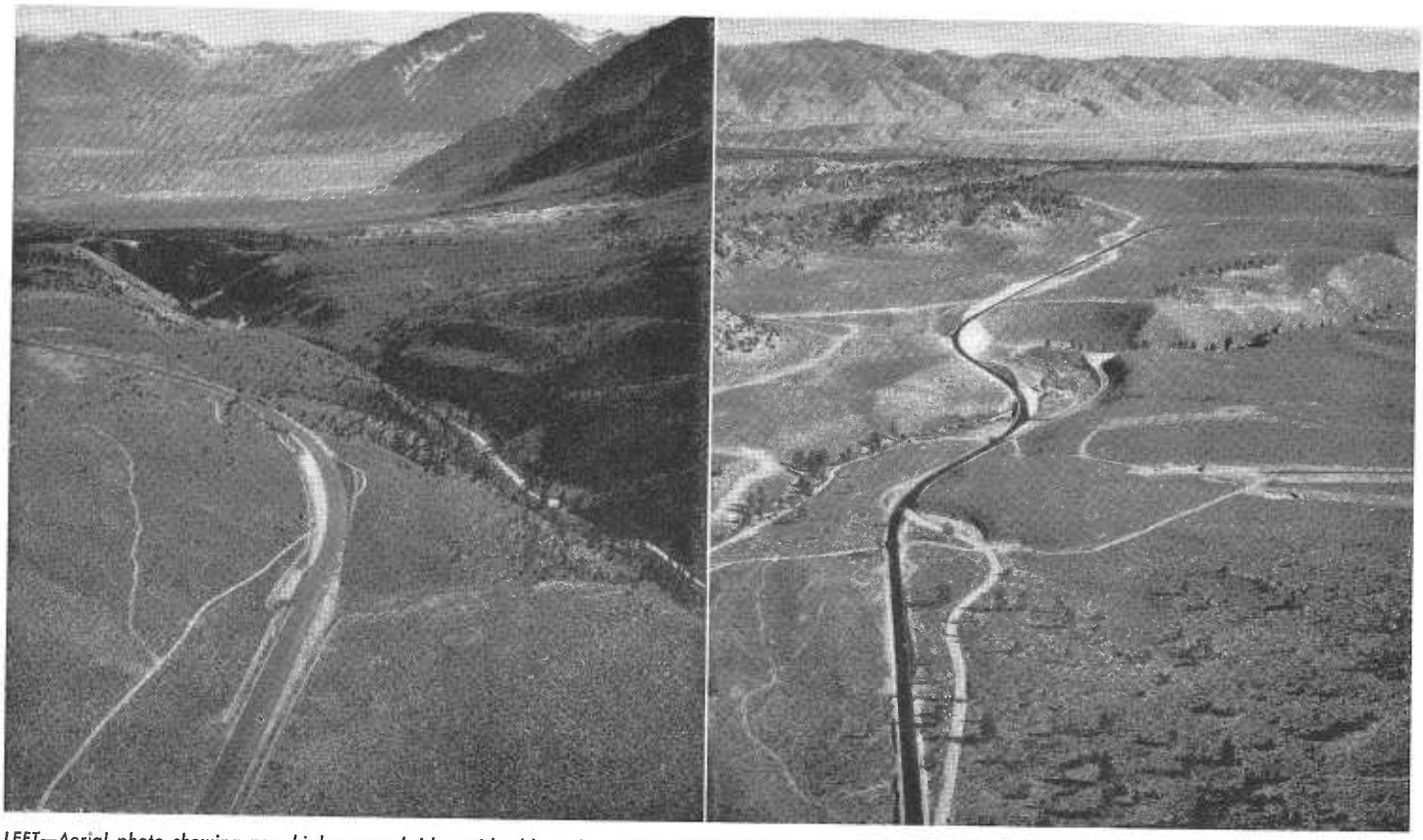
By J. R. JARVIS, District Construction Engineer

NOVEMBER 10, 1956, became another red letter day in the long history of Sherwin Grade, a portion of the Three Flags Highway (US 395) north of Bishop, in State Highway District IX. On this date public traffic was routed over the new realignment of approximately 12 miles of state highway nearly a year earlier than was contemplated when the contract for its construction was awarded on January 3d of this year. R. A. Westbrook, Inc., and Morrison-Knudsen Co., Inc., submitted the low bid on this project for which 270 working days were allowed for completion.

When the time schedule was set up it was contemplated that two summers would be required to complete the job, one to accomplish grading operations with a shutdown over the winter, and a second to place the base and surfacing. However, despite additions and changes during construction for which an additional 12 days were allowed and 27 days which were unworkable due to weather conditions, the contractor completed all phases of the work in 175 working days, between January 17 and November 14 of this year, which was about 62 percent of the time allowed. This was accomplished by subcontracting portions of the work to specialists so that several operations were done concurrently, and by fitting the equipment to the job rather than trying to make the job fit the equipment. Much new, modern equipment was purchased specifically for this job and when it had served its purpose was moved to other projects or sold again.

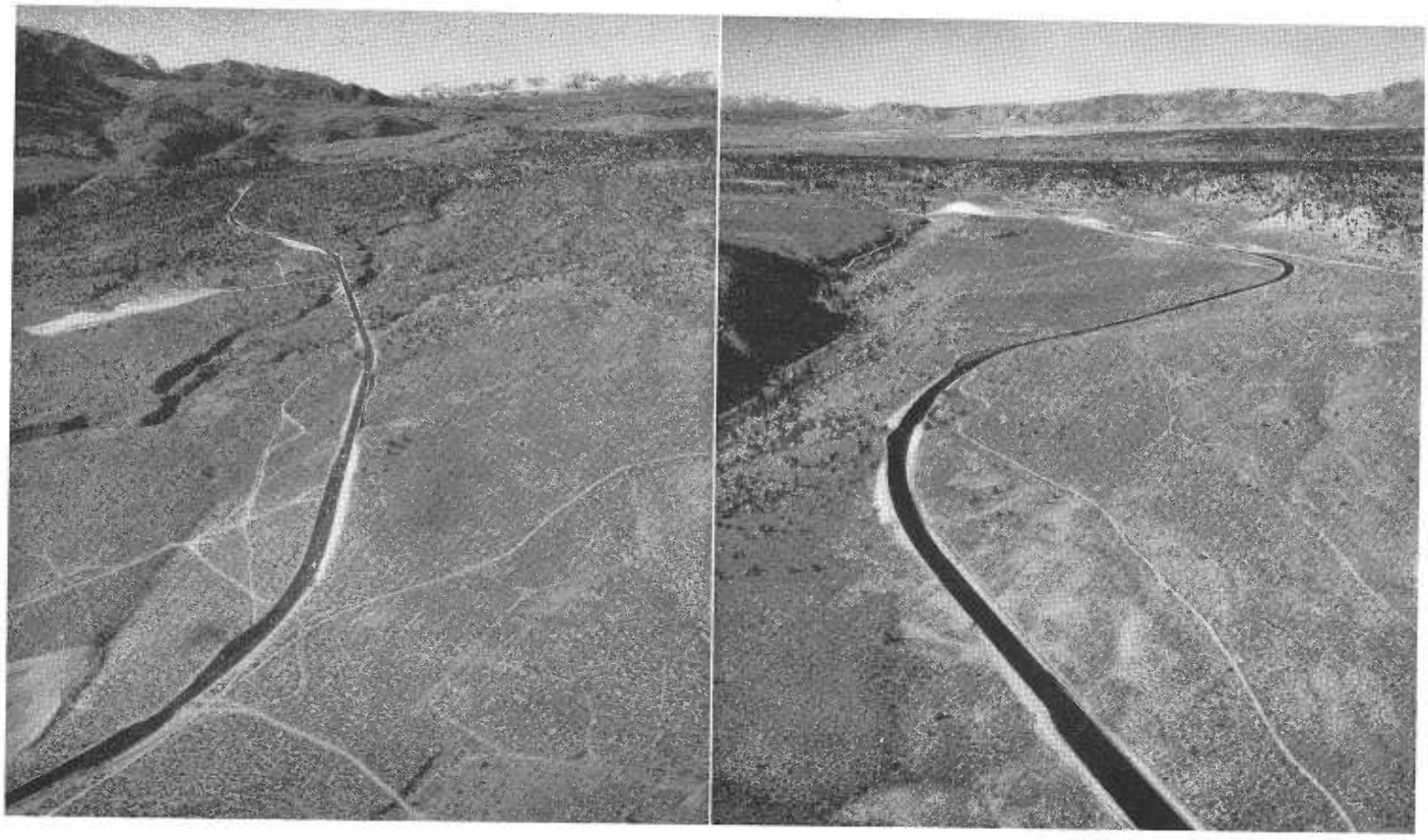
The old Sherwin Grade was originally built about the year 1874 by pioneer James L. C. Sherwin to serve his sawmill on Rock Creek and he later extended the road to another sawmill at Mammoth. It was for many years a private toll road. The first construction on this road as a part of the State Highway System was done in 1915-16 when some realignment was accomplished, drainage was installed and a penetration oil surface was

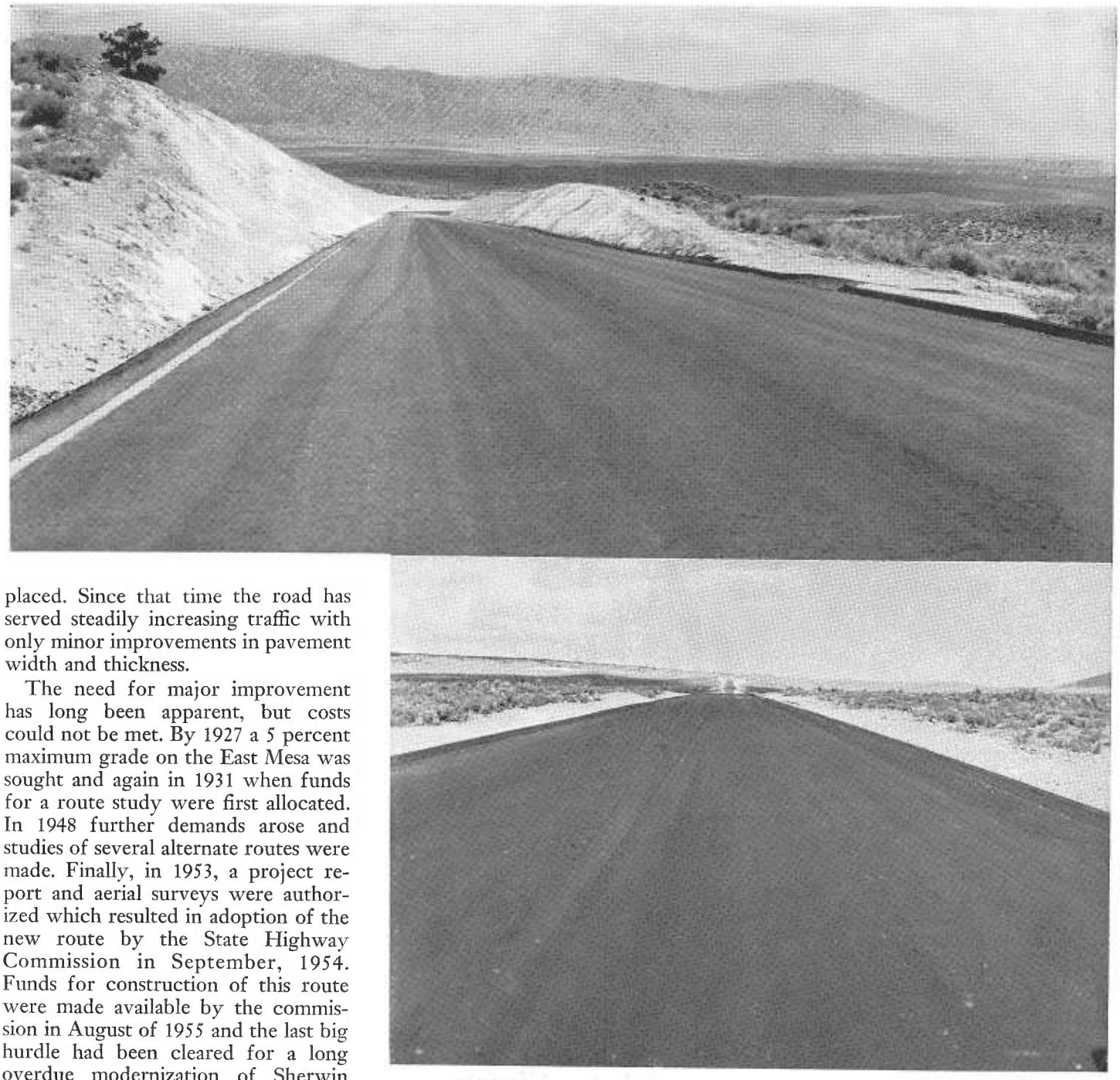
Showing typical lava rock cut and junction with old highway at foot of grade



LEFT—Aerial photo showing new highway on bridge with old road on right. RIGHT—Looking southerly towards Bishop and White Mountains from north end of project. Note heavy cuts and fill on new road and treacherous "Cadillac Curve" on old road in right center of picture.

LEFT—Looking north from middle of project with two of borrow areas on left. RIGHT—Looking north with four-lane section in foreground and end of project in distance. Old road in Rock Creek Canyon at left.





UPPER—Showing volcanic pumice cut with Bishop and White Mountains in background.
LOWER—Showing typical long tangent on new highway.

placed. Since that time the road has served steadily increasing traffic with only minor improvements in pavement width and thickness.

The need for major improvement has long been apparent, but costs could not be met. By 1927 a 5 percent maximum grade on the East Mesa was sought and again in 1931 when funds for a route study were first allocated. In 1948 further demands arose and studies of several alternate routes were made. Finally, in 1953, a project report and aerial surveys were authorized which resulted in adoption of the new route by the State Highway Commission in September, 1954. Funds for construction of this route were made available by the commission in August of 1955 and the last big hurdle had been cleared for a long overdue modernization of Sherwin Grade.

Many striking contrasts can be marked between the old and the new. The old, tortuous grade had some 84 curves which could not be negotiated safely at over 30 to 35 miles per hour and the average grade was 8 percent with some pitches up to 10 percent. The new highway has only 16 easy curves which are designed for travel at 60 m.p.h. and the maximum grade has been held down to 6 percent on a climb from an elevation of 4,470 feet to the new summit at 7,000 feet. First state construction on the old road was done at a cost of approximately $64,000 while the completely new road cost approximately $1,304,000 exclusive of rights of way and engineering.

Quantities for the original construction are not available for comparison but methods of mule teams and scrapers, wheelbarrows and stoneboats held them to a minimum. With modern power shovels and carryalls, tractors and trucks, air drills and paving machines the following quantities were taken in stride to build the new highway. Approximately one quarter million cubic yards of volcanic rhyolite rock were excavated and placed in fills; some 400,000 yards of earth,

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1956 ANNUAL TRAFFIC COUNT

By G. T. McCOY, State Highway Engineer

The annual state-wide traffic count, taken on Sunday and Monday, July 15 and 16, 1956, shows an increase of 7.71 percent over the previous annual count of July, 1955. Gains were generally well distributed over all routes and regions although greatest increases were registered on the "Interstate Connections," primarily those highways which connect with Arizona and Nevada highways along California's eastern border.

For the fourth consecutive year, monthly traffic counts show freight vehicles increasing at a substantially faster rate than passenger vehicles. Also, for the fifth time in the last six years, Sunday traffic shows appreciably less gain than Monday traffic. These factors, together with the fact that the "Recreational Routes" as a group shows the lowest traffic increases, all point to the continued diminishing of recreational travel in relation to the total traffic picture.

No change was made from the regular procedure of previous years in the manner of taking the count. However, more directional counts have been included because of expanding traffic volumes on multi-lane facilities. Actual recording covers the 16-hour period from 6 a.m. to 10 p.m. for both Sunday and Monday, totals being shown for each hour. At selected representative stations, counts are also continued for the entire 24-hour period and are extended to record each of the seven days of the week. Traffic is segregated into the following vehicle classifications: California passenger cars, out-of-state passenger cars, buses, pickups, two-axle commercial units, three-axle units, four-axle units, five-axle units, and six-or-more-axle units.

Each year some minor changes in the census become necessary, such as the relocation, addition, or discontinuance of individual stations; but in every instance these are excluded in determining comparison with the previous year, only those stations that were identical during both years being taken into consideration.

These comparisons for the various route groups are as follows:

PERCENT GAIN OR LOSS FOR 1956 COUNT AS COMPARED WITH 1955

	Sunday	Monday
All routes	**+5.74**	**+8.04**
Main north and south routes	**+6.04**	**+7.76**
Interstate connections	**+9.34**	**+9.44**
Laterals between inland and coast	**+5.71**	**+8.60**
Recreational routes	**+1.27**	**+6.22**

The gain or loss of traffic volume for State Highway Routes 1 to 80, inclusive, which constitute the basis for the foregoing summary is shown in the following tabulation:

	1956 Percent gain or loss			
	Sunday		Monday	
Route Termini	Gain	Loss	Gain	Loss
1. Sausalito-Oregon Line	1.26		6.84	
2. Mexico Line-San Francisco	6.24		7.01	
3. Sacramento-Oregon Line	9.42		19.45	
4. Los Angeles-Sacramento	9.79		7.56	
5. Santa Cruz-Junction Route 65 near Mokelumne Hill	2.32		8.14	
6. Napa-Sacramento via Winters	12.20		11.34	
7. Crockett-Red Bluff	5.31		7.84	
8. Ignacio-Cordelia via Napa	2.43		9.19	
9. Route 2 near Montalvo-San Bernardino	3.66		7.55	
10. Route 2 at San Lucas-Sequoia National Park	3.83		4.86	
11. Route 75 near Antioch-Nevada Line via Placerville	14.60		14.26	
12. San Diego-El Centro	4.53		5.99	
13. Route 4 at Salida-Route 23 at Sonora Junction	4.92		4.95	
14. Oakland to Route 7 near Crockett	3.22		8.69	
15. Route 1 near Calpella-Route 37 near Cisco	8.74		7.42	
16. Hopland-Lakeport	17.15		15.73	
17. Route 3 at Roseville-Route 15, Nevada City	8.11		9.08	
18. Route 4 at Merced-Yosemite National Park	10.11		7.41	
19. Route 2 at Fullerton-Route 26 at Beaumont	12.50		13.71	
20. Route 1 near Arcata-Route 83 at Park Boundary	4.99		13.38	
21. Route 3 near Richvale-Route 29 near Chilcoot via Quincy	3.31		3.19	
22. Route 56, Castroville-Route 32 via Hollister	29.33		10.42	
23. Route 4 at Tunnel Station-Route 11, Alpine Junction	9.42		10.49	
24. Route 4 near Lodi-Nevada State Line	8.84		16.67	
25. Route 37 at Colfax-Route 83 near Sattley	6.34		10.79	
26. Los Angeles-Mexico via San Bernardino	9.95		11.32	
27. El Centro-Yuma		5.92		0.01
28. Redding-Nevada Line via Alturas	1.91		7.78	
29. Peanut-Nevada Line near Purdy's	3.44		9.00	
31. Colton-Nevada State Line	10.13		9.65	
32. Route 56, Watsonville-Route 4 near Califa	5.25		1.55	
33. Route 56 near Cambria-Route 4 near Famosa	17.82		1.37	
34. Route 4 at Galt-Route 23 at Pickett's Junction	1.61		0.80	
35. Route 1 at Alton-Route 20 at Douglas City		18.91		10.79
37. Auburn-Truckee	13.03		16.60	
38. Route 11 at Mays-Nevada Line via Truckee River		5.79		2.10
39. Route 38 at Tahoe City-Nevada State Line	2.31			16.17
40. Route 13 near Montezuma-Route 76 at Benton	24.14		16.05	
41. Route 5 near Tracy-Kings River Canyon via Fesno	1.93			0.70
42. Redwood Park-Los Gatos		10.23		6.68
43. Route 60 at Newport Beach-Route 31 near Victorville	1.30		5.04	
44. Boulder Creek-Redwood Park		11.77		7.92
45. Route 7, Willows-Route 3 near Biggs		19.71		18.36
46. Route 1 near Klamath-Route 3 near Cray	7.17		20.96	
47. Route 7, Orland-Route 29 near Morgan	7.22		9.38	
48. Route 1 north of Cloverdale-Route 56 near Albion	17.84			3.91
49. Napa-Route 15 near Sweet Hollow Summit	10.00		8.11	
50. Sacramento-Route 15 near Wilbur Springs	6.58		11.86	
51. Route 8 at Shellville-Sebastopol	4.73		4.38	
52. Alto-Tiburon	5.62		5.75	
53. Route 7 at Fairfield-Route 4 near Lodi via Rio Vista	12.96		15.40	
54. Route 11 at Perkins-Route 65 at Central House	6.59		9.51	

Route	Termini	1956 Percent gain or loss Sunday Gain	Sunday Loss	Monday Gain	Monday Loss
55.	Route 5 near Glenwood-San Francisco		12.18	14.32	
56.	Route 2 at Las Cruces-Route 1 near Fernbridge		1.94	6.25	
57.	Route 2 near Santa Maria-Route 23 near Freeman via Bakersfield	11.49		8.43	
58.	Route 2 near Santa Margarita-Arizona Line near Topock via Mojave and Barstow	6.71		7.46	
59.	Route 4 at Gorman-Route 43 at Lake Arrowhead	9.20		7.91	
60.	Route 2 at Serra-Route 2 at El Rio		1.58	3.02	
61.	Route 4 south of Glendale-Route 59 near Phelan	11.48		6.38	
62.	Route 171 near Buena Park-Route 61 near Crystal Lake	7.70		13.01	
63.	Big Pine-Nevada State Line		9.06	14.71	
64.	Route 2 at San Juan Capistrano-Blythe	2.05		1.85	
65.	Route 18 near Mariposa-Auburn		1.20		0.54
66.	Route 5 near Mossdale-Route 13 near Oakdale	14.04		10.81	
67.	Pajaro River-Route 2 near San Benito River Bridge	23.85		1.08	
68.	San Jose-San Francisco	10.06		10.55	
69.	Route 5 at Warm Springs-Route 1, San Rafael	1.15		7.72	
70.	Ukiah-Talmage	11.60		14.13	
71.	Crescent City-Oregon Line		31.17		6.68
72.	Weed-Oregon Line	2.73		5.75	
73.	Route 29 near Johnstonville-Oregon Line	11.68		14.33	
74.	Napa Wye-Cordelia via Vallejo and Benicia	3.15		2.65	
75.	Oakland-Junction 65 at Altaville		0.92	10.01	
76.	Route 125 at Shaw Ave.-Nevada State Line near Benton	16.43		16.32	
77.	San Diego-Los Angeles via Pomona	9.47		7.66	
78.	Route 12 near Descanso-Route 19 near March Field	10.59		3.13	
79.	Route 2, Ventura-Route 4 at Castaic	9.80		7.77	
80.	Route 151, Rincon Creek-Route 2 near Zaca	21.12		16.33	

Justus F. Craemer Retires From Public Service

Nationally known as a newspaperman and public official, Justus F. Craemer retired from state service as member of the California Public Utilities Commission on November 1st.

Craemer was co-owner of the *Orange Daily News* from November, 1909, through 1946. He has been associated in the ownership of the *San Rafael Independent-Journal* since 1937. Craemer was President of the California Newspaper Publishers Association for the period of 1929-30. He was also President of the National Editorial Association for 1932-33 and he has been President of the California Press Association since 1943. Before that period he was CPA vice president for 20 years.

His long life in public service includes such activities as being a member of the California State Board of Agriculture (State Fair Board), 1923-1928; private Secretary to Governor Frank F. Merriam during 1934; Assistant Director of the California State Department of Public Works, 1935-1937; Building and Loan Commissioner, State of California, 1937-1939; and member of the California Public Utilities Commission since January 1, 1939. He served as president of the commission in 1942.

His other activities as a public servant has included acting as Chairman of the Mountain Pacific States Conference of Public Service Commissions from 1942 to 1946 and being President of the National Association of Railroad and Utilities Commissioners from November 18, 1948, to August 11, 1949.

Craemer's other business activities include an interest in the ownership of an orange grove in Orange County for many years. He is presently serving as a director of the First National Bank of Orange. In the past he has served as a Director of the Orange Building and Loan Association, Director of the Federal Finance Company of Santa Ana, Director of the California State Chamber of Commerce and from 1936 through 1938 Craemer was the Chairman of the Republican State Central Committee.

His social and service affiliations include memberships in the Rotary Club, Orange; the Press-Union League Club, San Francisco; Pacific Railway Club, San Francisco; the Jonathan Club, Los Angeles; the Family Club, San Francisco, and the Commonwealth Club in San Francisco.

SHERWIN GRADE

Continued from page 41 . . .

gravel and boulders were moved; 342,000 tons of imported borrow material were hauled to complete the fills; 47,000 tons of crushed rock base and 46,000 tons of plant-mixed surfacing were placed to complete the pavement. The old pavement was 18 to 20 feet wide while the new is 32 feet minimum with one four-lane portion that is 60 feet wide. Although the new route saves only 0.43 mile in distance, savings in time, tempers and traffic congestion will multiply through the years to come and the savings in cost to the motorist will soon repay the initial investment in this modern highway.

One feature that may puzzle those traveling the new road is the series of small lateral dams in many of the cut sections. These were placed to prevent erosion and undermining of the pavement by storm water runoff on the long grades and will be filled by nature during the first storms to form a series of gentle gutter slopes.

State supervision on this major project, which is the largest ever undertaken in the Inyo-Mono Counties area, was the responsibility of Resident Engineer Gene Snyder and his assistants. Don Westbrook was general superintendent for the contractor. The many hours these men devoted to the job assured the quality of the finished product.

TEMPER

A person with a temper often gets into trouble. If a person with a temper loses it when he drives a car, he may also lose his life, says the California State Automobile Association. Many accidents are caused by one motorist trying to get revenge on another. When you drive, leave your temper at home or you may not get home.

During the 1955-56 Fiscal Year 21 grade crossings on state highways were closed or abandoned by changes in highway alignment, by construction of grade separations or by abandonment of railroad tracks, and three new crossings were opened, leaving a total of 814 such crossings on state highways as of June 30, 1956.

Arcata Project

Intersection Improvement On US 101 and US 299

By E. B. THOMAS, Resident Engineer

RECENTLY COMPLETED in District I is the project in Humboldt County on US 101 between 0.6 mile north of Plaza Avenue in Arcata and 1.0 mile south of Mad River, and on US 299 between US 101 and the Mad River.

Of primary concern in the inception of this project was the improvement of the substandard intersection of US 101 and US 299.

The existing intersection was a right-angle abutment of US 299 against US 101 about 550 feet north of an overhead structure to a railroad and county road. All westbound traffic on Route 20 (US 299) was required to stop, then enter the almost continuous flow of north-south traffic on US 101. No traffic lights, turning lanes, or channelization for this conflicting traffic movement was practical because of the proximity of the existing overhead structure. To further aggravate the situation, all traffic turning southerly towards Arcata had to accelerate from the stop sign, cross the northbound traffic flow and travel up a 6 percent grade to the old overhead approach, a difficult feat for heavily loaded trucks.

Timber Land Area

US 299, extending easterly from Arcata to Redding, taps an immense area of timber land which has been heavily logged in post-war years. This highway provides the only outlet for the timber products, both logs and finished lumber, which must be trucked easterly to Redding or westerly to the Arcata-Eureka area where many mills are located and where facilities are available for transhipment by truck, rail, or ship.

The logging industry has consequently brought about a large increase in heavy trucking over this route during the past few years. A comparison of the 16-hour July Monday traffic counts for 1947 and 1956 shows the following:

	1947	*1956*	*Increase (percent)*
Total traffic	2,800	6,000	214
3-axle trucks	54	400	741
5-axle trucks	80	290	363

The normal increase of total traffic combined with the great increase of heavy truck traffic made a revision of the US 299 intersection essential.

Constructed In Two Stages

The new facility consists of a four-lane divided highway, with a 22-foot median strip. The structural section provided for 0.20 feet of Type B and 0.05 feet of open-graded plant-mix surfacing on 0.67 feet of road-mixed cement-treated base and 0.75 feet to 1.08 feet of imported subbase material. The project was developed on a limited access basis with frontage roads provided where required by local conditions.

The improvement was constructed in two stages. The first contract, for structures, was let in April, 1955, and required an expenditure of approximately $360,000. This structure contract provided a two-lane separation structure for the new US 101-US 299 intersection and twin overhead structures on US 101 over the Northwestern Pacific Railroad and a county road.

The southbound lanes of US 101 are entirely new construction lying westerly of the existing road, and therefore required a new overhead structure. However, the northbound lanes utilize the original roadbed location and the existing overhead was incorporated into the improvement. Timber trestle approach spans were removed and replaced with reinforced concrete girder spans, and the existing steel girder main span was widened with reinforced concrete to provide a 28-foot clear roadbed width.

Trumpet-type Interchange

The new intersection, about 1,500 feet north of the existing connection, features a trumpet-type interchange. The free flow of traffic over this new construction will be a welcome relief to all concerned. As an interesting sidelight this intersection is the first interchange structure ever built in the geographical limits of District I.

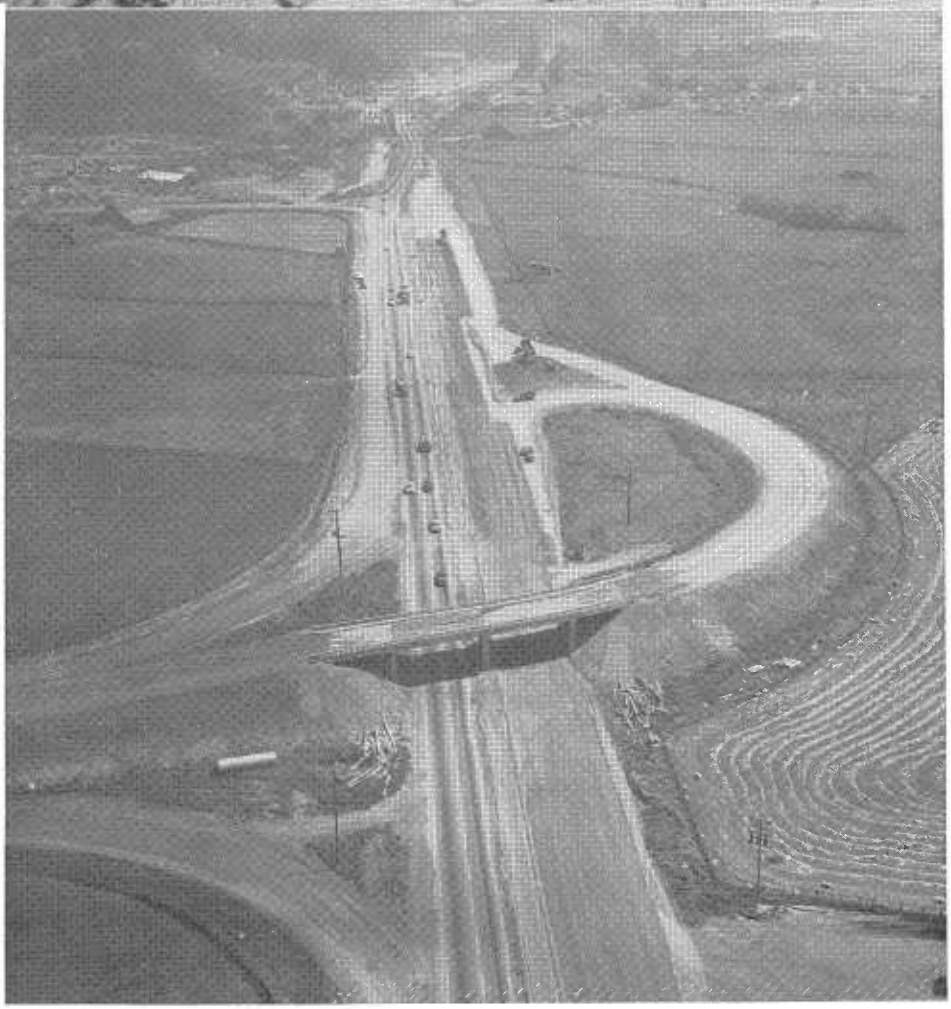
From the interchange structure US 299 heads northeasterly on new alignment for about 0.6 mile where it joins the existing road. From this point to the end of the project the existing alignment is followed.

The new alignment mentioned above supersedes about one mile of existing US 299, which will eventually be reverted to the County of Humboldt. A connection between this road and the new construction has been provided about 0.8 mile easterly of the new US 101-US 299 intersection. A cul-de-sac has been constructed at the end of the abandoned state highway at the site of the old intersection.

Heavy Logging Traffic

It is interesting to note that the above-mentioned connection to the existing road, although only a county road connection, has the same structural section as the freeway. This requirement is imposed by the fact that a high percentage of all traffic over the road will be logging trucks serving the seven lumber mills and one plywood mill along the superseded portion of US 299, in addition to various mills west of Arcata which are reached via the county road under the overhead structure.

Three-fifths of the construction lies predominately in the flood plain of the Mad River Valley. The grade was held somewhat above the surrounding ground throughout this section of the project to provide structural support and assure adequate drainage. This resulted in a "borrow job" with 150,000 cubic yards of imported borrow being set up against only 29,000 cubic yards of roadway excavation.



Borrow Work

A hillside borrow site near the middle of the job, about 1.1 miles east of the existing US 101-US 299 intersection, was set up under a materials agreement and was used by the contractor. This material, a marine deposit of brown sandy clay and gravel, proved to be excellent borrow with R-values ranging from 30 to 74 and averaging 55. The native moisture in the pit was almost perfect, and the material compacted very readily just as spread from the trucks.

Two 1½-cubic-yard shovels and one 1½-cubic-yard dragline were used to load a fleet of twenty 8 to 10 cubic yard trucks for the major part of the borrow work. A daily production rate of 4,575 cubic yards in 10 hours was attained. Compaction was obtained using tractor towed sheepsfoot rollers and a self-propelled 4-wheel roller the wheels of which are faced with steel pads.

Because the fills are nominal in height and overlay river bottom land which had been under cultivation for many years, compaction of the natural ground was required under all fills and roadway trenching was required to 2½ feet below profile grade in lieu of the standard 2 feet.

UPPER—Construction on US 101-US 299 interchange north of Arcata. LOWER—Looking southerly at US 101-US 299 interchange north of Arcata.

Big Clearing Job

Development of the borrow pit entailed clearing off second growth redwood trees and brush and the removal of old redwood stumps up to 15 feet in diameter. Small debris was burned at the site; but, because of the difficulty of burning the large stumps, the contractor split them, by blasting, down to a size that could be loaded into trucks and hauled them to a disposal site. It is probable that more effort was expended in clearing the borrow site and removing the stumps than was required to clear the entire roadway construction area.

Unsuitable material developed in several areas of the roadway section where the templated excavation penetrated into the wet, blue-black organic soils underlying much of this area. It was necessary to remove this material to an average depth of 2 feet below subgrade with imported borrow or, in cases where standing water was encountered, with river-run gravel. All unsuitable material was disposed of in an old excavation near the end of the work on US 101. This pit was set up in the Special Provisions as a mandatory disposal site in conformance with a right of way agreement.

Series of Projects

This is the latest in a series of projects which began in 1952 to provide a four-lane divided highway from the north city limit of Eureka, through Arcata to this point, a total distance of 8.8 miles along US 101 and 1.7 miles on US 299.

Plans for extension of freeway construction north on US 101 are under way with studies well advanced for rerouting on a freeway basis from the end of this contract to 0.7 mile north of Trinidad, a distance of 13½ miles. The next stage of construction actually scheduled is for the reconstruction of the existing Mad River Bridge and construction of a parallel span and approaches in the 1957-58 Fiscal Year.

No further construction in this vicinity on US 299 is presently scheduled; however, preliminary studies of the section from Mad River Bridge to Preston Ranch, a distance of 15 miles, are now under way.

The current contract, covering grading and surfacing was awarded in April of this year and was completed in November. The bid for this contract was $629,285. Mercer, Fraser Company, Inc., of Eureka was the contractor on both the structure and grading contracts. The work was under the direction of Alan S. Hart, District Engineer, and the author, for the Division of Highways. The contracting firm was represented by R. W. Brown, president, and Harley Stevenson, superintendent.

MERIT AWARD BOARD WINNERS

Employees of the Department of Public Works receiving certificates of award and commendation during September and October, 1956, are:

Frank Brunner, Highways, San Diego, $150, for proposing a modification of the minor movement control. This control is used with a three-phase timer to add a fourth phase to the traffic pattern at signalized intersections. This enables the timing on the fourth phase of fluctuate directly with traffic demand and increases the possibility of a smooth traffic flow. In other words, the modification makes possible a variable time feature which means the length of a green light on a special turning movement will vary in accordance with the demands of traffic making a movement.

Francis Fisk, Architecture, San Francisco, $25 for recommending that column numbers (and pile cap numbers) be shown on mechanical and electrical drawings. This suggestion will be adopted as a general policy on all future drawings, including mechanical, electrical and architectural, as well as all other drawings, outlining work which must be orientated and correlated with the structural plans.

Lucy M. Enriquez, Architecture, Los Angeles, $25 for recommending that the printed tracing paper sheets used by project architects, etc., for preliminary budget plans be cut to one-fourth inch from the inside black border line so they will fit in the standard flat drawer file cases and that all future printed drawing paper be printed either the correct size or be trimmed to fit these files.

Eleanor L. Lenau, Highways, Sacramento, $20 for recommending the elimination of posting estimates in vendor's index; the filing of all water bill postings alphabetically under W; and making of a posting for each city or county on one card with a distinctive symbol to designate the city or county department.

Oleg J. Devorn, Los Angeles, and *Henry W. Remitz,* Sacramento, Highways, $15 each for recommending draftsmen be supplied with parallel edges instead of T-squares in the structural drafting section.

Dale H. Kuiper, Highways, San Bernardino, certificate of commendation for recommending that highway district safety engineers design safety routes to be used in case of fire or other disasters in a District VIII office building. While his suggestion was not used, it brought to the attention of the administration the existence of a problem and proper steps were taken to alleviate the situation.

Bruce F. Hockman, Highways, San Diego, certificate of commendation for recommending that the "Earthwork Data Sheet" be made in two distinct colors, one for terrain notes and the other for roadbed notes.

John E. Gere, Highways, Los Angeles, $100 for recommending the use of a slurry seal coat for highway surfaces, and the spraying of the pavement with water before applying the mix. Slurry seal coat is an asphalt emulsion mixed with rock dust and plaster sand. This mixture can be economically and rapidly applied to badly cracked and shattered portions of highway pavements. While it is not a cure for all problems it can and does act as a protecting overlay and will in some places be substituted for the conventional screening seal.

Isadore Goldberg, Hayward; *Neil V. Mahoney,* Sacramento; and *John R. Christian,* Buellton; Division of Highway employees, $25 a piece for suggesting a revision of Form M-31, Cost Distribution Sheet.

Robert Miller, Placerville, Highways, $50 for suggesting the use of an attachment for the "Tarco" salt spreader which permits operation of the sand control lever from the driver's seat. This procedure allows one man to operate the truck and spreader rather than having one man for each operation. It also permits safer operation by eliminating the need of a man on the rear of the truck.

John A. Brown, Eureka, Highways, $20 for suggesting a revision in the accounting procedure regarding the collection of the cost of repairing damages to state property.

Benjamin L. Potter, San Luis Obispo, Highways (four-time winner), $25 for recommending the use of a firm steel foundation for raised traffic signals rubber contact units. Instead of using sand, asphalt, cement and similar materials for fill-ins, this employee used steel bars and discarded steel salvage from the maintenance yard, as the basis for setting the contact units on.

Cherie Mae Carroll, Sacramento, Architecture, certificate of commendation for calling the attention of management to an unnecessary procedure, which resulted in a revision of Administrative Notice No. 17.

A total of $1,726,919 was expended by the Division of Highways for snow removal and icy pavement sanding during the 1955-56 Fiscal Year.

Dust Palliatives

Highway Engineers Keep Abreast of New Methods

By BERNDT NELSON, Assistant Construction Engineer, Division of Highways

WHEREVER highway construction is in progress there is the potential of dust nuisance. The ordinary inconveniences to the traveling public during construction periods such as delays during necessary traffic control, detours bypassing construction, additional distances, rougher temporary surfaces, etc., are accepted by the average motorist without complaint. The effect of dust when uncontrolled, however, is a major irritant, not only to the motorist, but to all within reach of it—adjacent property owners whose crops, animals and homes suffer, businesses—and to those who must handle the just complaints of those affected.

Because of its far-reaching effect, dust control is accentuated during the construction of state highways in order to minimize the nuisance that can be caused by lack of control.

Dust Control Methods

Often in our highway construction program, it is necessary to route traffic from existing nondusting traveled ways to other existing roads, or to detours constructed for the purpose to permit uninterrupted passage of traffic during construction of the new grade. It may be even necessary to route the traffic through the construction. At times it is not feasible because of the time element, stage construction or high cost, et cetera, to provide a dust-free surfaced roadway for a short period. Control of dust from this source and from the contractor's hauling operations is generally done by sprinkling with water. This type of dust control is used where a more permanent method, such as paving, is not considered economical or feasible.

The results obtained are often temporary, ranging at times from an overly wet condition shortly after application through the drying stage until dust conditions again demand a repetition of the cycle and so on. Obviously, any economical, easy, practical method of prevention of dust nuisance that will be more lasting than our present method would be welcome.

Wetting Agents

One method of improving results accomplished by using water is by use of wetting agents. Some materials naturally resist wetting, even when dry, and the surface of other areas may acquire this characteristic by deposition of slight amounts of air-borne hydrophobic substances of unknown origin. Where this condition exists, untreated water runs off to low areas and accumulates in puddles, the other areas remaining unaffected by the treatment. Wetting agents lower the surface tension of water surfaces, causing quick penetration on contact with road material and longer lasting treatment because of uniform and deeper penetration.

Wetting agents are generally added at the rate of approximately one part of agent to four or five thousand parts of water for the first application, and about one part of agent to eight or ten thousand parts of water for subsequent applications. The cost of wetting agents of this nature is generally between $2.50 and $3 per gallon, in 55-gallon drums.

Calcium Chloride Effective

Where economical, calcium chloride is used to alleviate dust nuisance. This product which can be obtained in flake or pellet form is effective because it has a strong affinity for water. It attracts and absorbs moisture from the air and is dissolved in the moisture it collects. When added to a dust area, calcium chloride, because of the above action, keeps the surface slightly moist. The resulting solution resists evaporation and lasts longer than an application of water penetrating to the same depth.

When used as a dust preventive it is spread at the rate of approximately one to one and one-half pounds per square yard for the first treatment, subsequent treatments requiring about one-half pound per square yard. Water must be available for it; therefore in dry areas the area to be treated should be dampened just prior to application. The material is ideal for use where air temperature and moisture conditions are such that loss by evaporation during the day can be regained during the nighttime hours of relatively higher humidity.

Mixed With Rock Salt

Calcium chloride is in general use as a dust preventive in the Midwest, as that area is close to the source of supply. Freight costs represent approximately 50 percent of the total cost of $70 to $75 per ton to the user on the West Coast.

Sodium chloride is also used as a dust preventive. Rock salt is the form in which it is generally used. The dust prevention obtained is from a different action from that of calcium chloride which prevents dust by keeping the surface moist. Because sodium chloride is not deliquescent, water must be added to it to form a solution. For this reason rock salt is generally mixed with the road surfacing materials and water to the desired depth. The water dissolves the salt and the resultant solution binds together the dust-forming materials when recrystallization takes place at the surface during the periods of dry weather. About one and one-half pounds of rock salt is used per square yard per inch of depth desired. The material is produced on the West Coast and can be obtained at a cost of $14 to $15 per ton f.o.b. the plant. This is approximately one-half the cost of calcium chloride f.o.b. the plants in the Middle West.

Some Products on Market

There are a few proprietary products on the market sold primarily for dust control purposes. Although the

exact formulations of each are held confidential by the manufacturers, the information given is that in the manufacture of the products, waste materials from asphalt and lubricating oil refining, used lubricating oil, petroleum resins, water and chemical additives are used and combined, further refined, emulsified or cut back to create a product with dust-preventing characteristics when applied to untreated road surfaces.

They are available to the user at approximately $24 per ton at the refineries. Recommended application by the manufacturers is one-half gallon per square yard.

Gaining in popularity because of excellent results, cost and relative permanency, and in which increased interest is being shown, is another method of dust laying that has been tried with success in several locations in California and elsewhere.

Briefly, the method is the use of a greatly diluted solution of asphaltic mixing emulsion and water—or to put it more simply, the continued use of water but containing a small percentage of mixing emulsion.

Materials—The mixing emulsion is that conforming to Section 56(a) of the Standard Specifications quoted in part as follows:

"(2) Mixing Type Emulsion.—The bituminous base used in manufacturing mixing type emulsion shall be paving asphalt, Grade 120-150 * * * .

"When tested in accordance with the standard method of tests of the AASHO Designation: T59 * * * mixing type emulsion shall conform to the following requirements:

"No separation within	30 days
"Viscosity, S. F., seconds	20-100
"Residue at 163° C., percent	57- 62
"Sieve test, max. percent	0.10
"Cement mixing test not more than	2%
"Modified miscibility with water—difference of asphalt residue not more than	4.5%"

Although various proportions have been experimented with, a 10 percent mixing emulsion–90 percent water solution seems to be the most practical from the standpoint of ease of application, good penetration and the characteristics of being able to be placed without pickup, splattering, staining or interference with traffic. Travel on the roadway is possible to the same degree as if just water alone had been applied.

Equipment—Application by asphalt spreader truck is not necessary as the mixture can be applied with the same equipment used for applying water, whether the water spreading equipment is equipped with regular nozzles, a drilled pipe header or a spreading pan. A separate operation of mixing the water and the mixing emulsion is not necessary either. Generally, the mixing emulsion is placed in the spreading tank first and because of its complete miscibility with water, the water added to fill the tank creates all the action necessary for uniform mixing.

Methods. Best results are obtained if the material to be treated is previously wetted. This prevents quick drying and promotes penetration of the diluted emulsion mixture. This is especially true in hot weather when quick drying will prevent penetration and cause a decrease in the effective depth of treatment.

Application rates vary, depending on the type of surface to be treated and on the ability of the surface to absorb the application without runoff. A total application of 0.75 gallon per square yard is considered about the minimum for the first treatment. Using 90 percent–10 percent mixture, this means a net of about 0.04 gallon asphalt per square yard. To avoid excessive runoff from tightly consolidated materials, it may be necessary to make more than one application to obtain the total desired spread.

The mixture has an initial appearance similar to muddy irrigation water, the black color usually associated with asphalt being only in evidence after application when an area has chanced to dry without being subjected to traffic. This, too, disappears within a short period, the only color evidence visible being a slight darkening of the treated material. Some who have used the method claim a secondary advantage. In fact the primary purpose for the use of the method has been in cases to promote cohesiveness whereby the road surface is held together without "whip-off" of the road material. The shape of the road is maintained and surfaces that once required intermittent watering and blading throughout the dry period of the year can be treated with the expectation that the treatment would last three to five times longer than without the use of the added emulsion. This varies, of course, with the depth of treatment, some going to the extent of blade-mixing material because of the ease of doing so to obtain greater depth. Another advantage is that cold, wet weather is not a deterrent; the increased mixing season can be measured in months.

The success of the method as a dust palliative lies in the fact that although the water used has performed a temporary task of settling the dust, it has also acted as a carrier of asphalt which remains in a thin film on the treated material after the water has disappeared by evaporation or percolation. The dust particles are caused to cohere or are made heavier by the asphalt film which accumulates after each application, resulting in a successively longer lasting treatment.

RECORD BUDGET

Continued from page 36 . . .

are: a new Colorado River Bridge at Blythe, in cooperation with the State of Arizona; a structure to carry the Olympic Freeway over the Los Angeles River and the Santa Fe yards in Los Angeles; a new bridge over Petaluma Creek on State Sign Route 37; the substructure for a new Sacramento River Bridge at Rio Vista; and new bridges over the Mad River in Humboldt County (US 101) and the Gualala River, at the Mendocino-Sonoma county line (State Sign Route 1).

The substantial allocations for rights of way in the 1957-58 state highway budget will be used to clear the path for still more new construction in succeeding fiscal years, when even larger federal apportionments are expected.

Fire hazard and noxious weed control on state highways cost $549,480, and $1,249,500 was expended by the Division of Highways for erosion control and care of trees during the Fiscal Year 1955-56.

Old A.C. Pavement

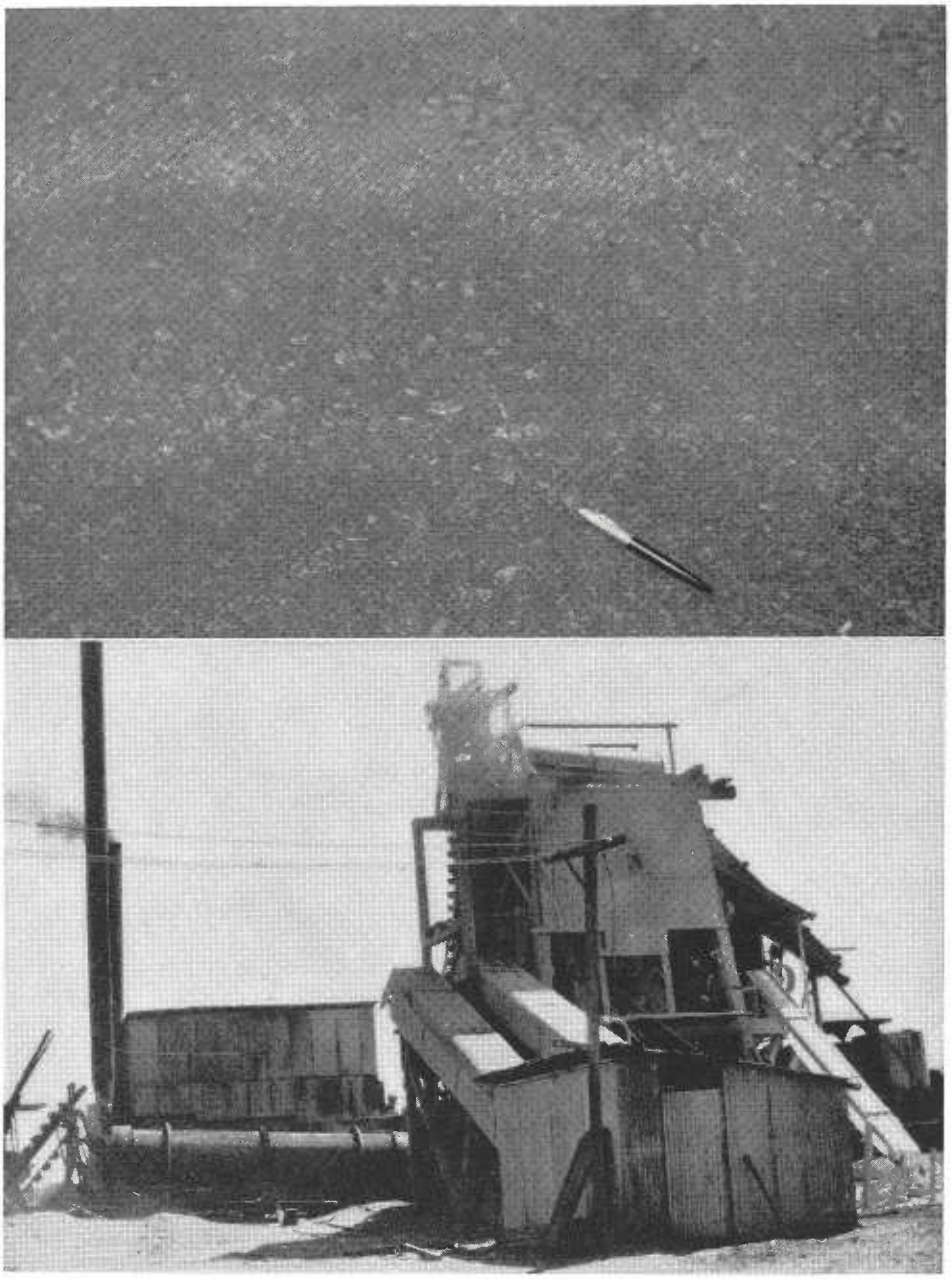
Completes 30 Years of Satisfactory Service

By E. G. BOWER, Assistant District Engineer

UNDER the recent District VIII blanket resurfacing contract, a portion of Mission Boulevard (U.S. 60) between the Riverside county line and Mira Loma has received its first real "assist" in 30 years of continuous duty as a traffic carrier.

The original construction consisted of an 18-foot Portland cement concrete pavement four inches thick, constructed in 1914 by the M. R. Company, Inc. of Los Angeles. This job extended from the Riverside county line to the Santa Ana River—a total length of 10.34 miles.

By 1926 reconstruction was necessary. Under another contract, four inches of asphalt concrete were placed over the old pavement and six inches (in places) where a sand blanket was placed to raise the grade. It is this pavement which has given 30 years of "unassisted" service. Perhaps a look at the method of placing or the materials used will give us a clue to its long life.

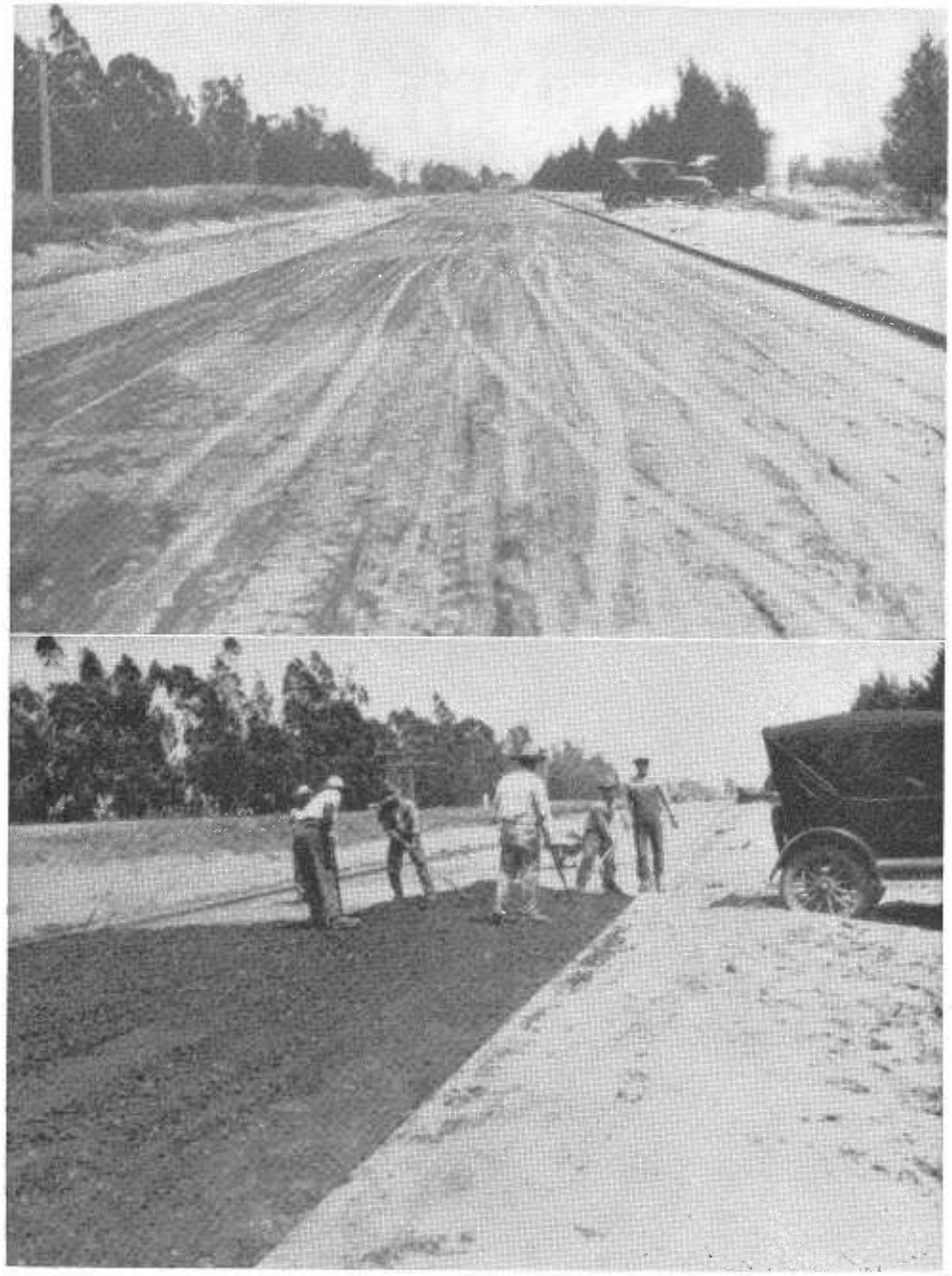


UPPER—Texture of old pavement as it looked before resurfacing. LOWER—Portable batch plant at Champagne Siding.

Problems Encountered

The final report for this project, written by Resident Engineer H. O. Ragan, gives a graphic account of the problems encountered and the nature of the work:

"The old Portland cement concrete pavement 18 feet in width and four inches thick had become badly fractured—particularly that part between Ontario and the San Pedro, Los Angeles, and Salt Lake Railroad crossing. The adjacent soil along this portion is extremely sandy; in fact, during windstorms no little trouble has been experienced in keeping the highway clear of drifting sand. The most severe condition in this respect existed just west of the railroad crossing and extending for a distance of about 4,400 feet, where the highway parallels the tracks of the railroad. The grade line of the highway on this section was much lower than that of the railroad and also lower than the original ground. This condition consequently created a pocket in which the sand collected during windstorms and necessitated being removed after the storms had subsided in order to make the highway safe for traffic. Thus, to avoid future trouble in this respect, the grade line of the new improvement was raised one to two feet. In



UPPER—Old sand subgrade, looking east. Raking old base course.

this connection, the contractor was given the choice of building up a new grade on the old pavement by means of imported earth borrow or utilizing the available surplus sand along the sides of the highway. After studying the condition closely from all angles, it was decided to make use of the sand. Grade was constructed and headers placed just previous to paving operations. Fortunately, standpipes of an irrigation pipeline were just off the right of way line to the right and the grade was well-ponded with water for settlement. The resultant condition and appearance of the finished highway on this particular section is favorable.* * * "

Work Begun in 1925

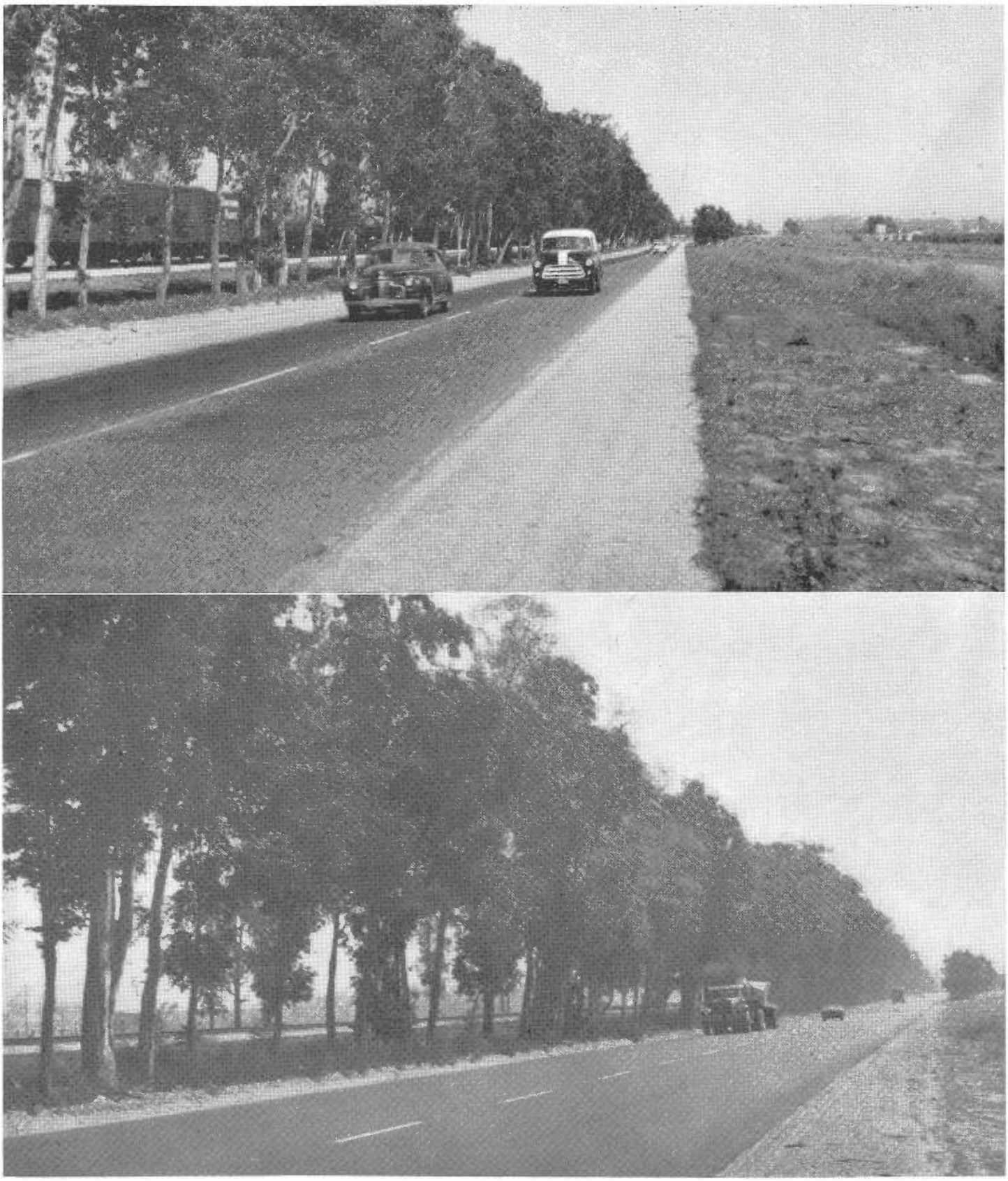
"Setting of wooden headers in preparation for asphalt concrete pavement was begun on December 20, 1925. As stated previously, the old pavement was 18 feet wide, and the two feet of widening was placed on the right, or south, side only. The headers used on the right side were three inches by six inches and the top set to grade of asphalt concrete shoulder widening. The headers on the left side were three inches by four inches and set to grade of leading course. Strips one and one-half inches by two inches were nailed on the large headers for pavement courses that followed. Much of the ground encountered east of Wineville was very dry and hard, making it difficult to drive header stakes. The contractor overcame this hindrance by employing * * * an air compressor and drill for opening up the holes for the stakes, and a hammer of his own design for driving them. He estimated that such an arrangement resulted in the saving of five to six laborers per day. * * * "

Asphalt Concrete Surface

"Before laying of asphalt concrete surface, the old concrete base, from which the loose oil cake had been removed, was well cleaned by sweeping with stiff push brooms and then painted with an asphalt paint binder mixture consisting of 40 percent asphalt and 60 percent gasoline. Painting was done well enough in advance of paving operations to allow for evaporation of the gasoline. The mixture was formed by first heating the asphalt to a safe temperature and placing in drums to which the required amount of gasoline was added. It was then deposited on the base by buckets and swept as thinly as possible with light push brooms over the full 20-foot width."

Materials for construction of asphalt concrete pavement consisted of crushed rock from Reliance Rock Company, Covina, and Blue Diamond Company, Corona, shipped to the plant by rail; sand from a local sand dune area hauled in by truck; and rock dust from the Riverside Portland Cement Company delivered into the contractor's trucks at Crestmore. Paving asphalt, Grade "D" (50-60 penetration), was supplied by the Standard Oil Company from its El Segundo refinery. The combined mix conformed with the requirements of the Standard Specifications of June, 1925, for base course, leveling course, and surface course.

. . . Continued on page 54



UPPER—View of road just before resurfacing. Note new eastbound roadway on right. LOWER—View of new road as it looks today.

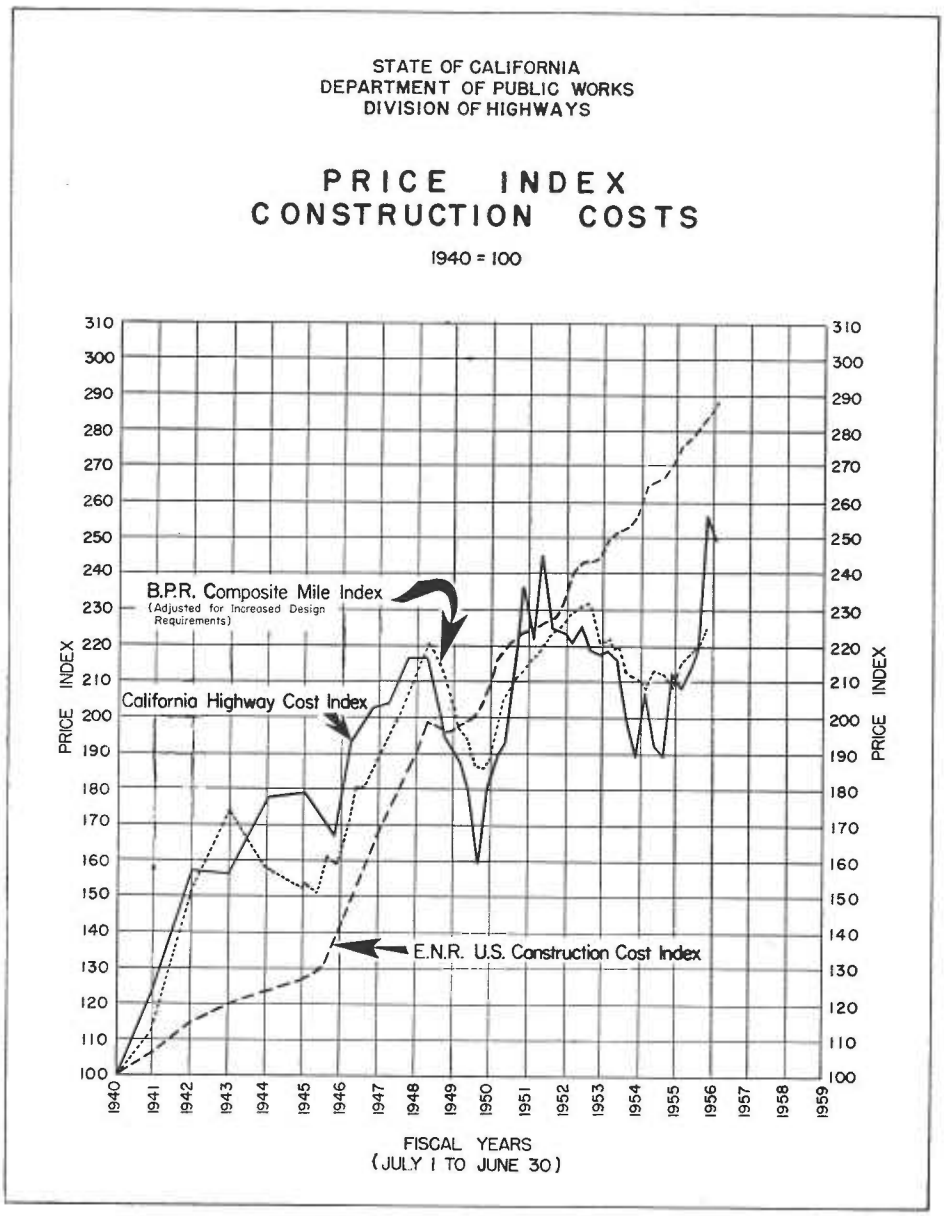
Cost Index

Declines Noted During Third Quarter of 1956

By RICHARD H. WILSON, Assistant State Highway Engineer;
H. C. McCARTY, Office Engineer, and
LLOYD B. REYNOLDS, Assistant Office Engineer

THE CALIFORNIA Highway Construction Cost Index for the third quarter of 1956, counter to the forecast made at the end of the second quarter, stood at 249.1 index points (1940=100), a decline of 2.7 percent from the previous quarter. It exceeds the first quarter of 1956 by 13.5 percent and the high established in the fourth quarter of 1951 by 1.5 percent. It is believed that the current sag is temporary and that the upward trend will be resumed in the fourth quarter of this year.

The present decline in the index was influenced by three of the eight construction items upon which the index is based. Primary effect was caused by favorable steel prices obtained on six large freeway projects situated close to fabricating centers. Settlement of the steel strike in July which resulted in a three-year agreement between labor and industry has effectively stabilized the price of steel to the extent that bidding against future deliveries can be made with reasonable assurance. It is reasonable to believe that during the second quarter, considerable of the advance in bid prices received on items involving the use of steel can be attributed to inclusion of contingencies on the part of contractors for their protection in view of uncertainties connected with renewal of labor agreements and a possible strike which materialized.



Bidder Competition Low

Competition among bidders continues at a low average. The average number of bidders per contract during the third quarter of 1956 stood at 3.7 compared to 3.8 in the second quarter and 4.5 in the third quarter of 1955. While there is a marked decrease in the number of bidders showing interest in projects valued in excess of $1,000,000, its weighted effect on the average is not pronounced but the mainstay in holding to a high average is the class usually evident in bidding below $500,000 which has apparently vanished. The number of contractors prequalified by the department to bid in the various brackets of project value remains in agreement with former years which indicates that a decline in available bidders is not the underlying reason for the low average obtained.

THE CALIFORNIA HIGHWAY CONSTRUCTION COST INDEX

Year	Cost Index
1940	100.0
1941	125.0
1942	157.5
1943	156.4
1944	177.8
1945	179.5
1946	179.7
1947	203.3
1948	216.6
1949	190.7
1950	176.7
(1st Quarter 1950—160.6)	
1951	210.8
(4th Quarter 1951—245.4)	
1952	224.5
1953	216.2
1954 (1st Quarter)	199.4
1954 (2d Quarter)	189.0
1954 (3d Quarter)	207.8
1954 (4th Quarter)	192.2
1955 (1st Quarter)	189.3
1955 (2d Quarter)	212.4
1955 (3d Quarter)	208.6
1955 (4th Quarter)	212.6
1956 (1st Quarter)	219.5
1956 (2d Quarter)	255.9
1956 (3d Quarter)	249.1

The first projects included in the federal interstate highway program have recently "rolled off the assembly line" and bids will shortly be received on these projects. This program will continue at a uniform rate but considered in the over all, the number will not be large during the ensuing year for reasons explained in the release of the second quarter index.

Four of the eight items used in computing the construction cost index showed an increase during the third quarter and three items were below the average costs in the previous quarter. The tabulation of average contract prices contained in this report furnishes a comparison of the eight contract items in previous periods.

Roadway Excavation

Roadway excavation advanced 1 cent to $0.52 in this quarter. The fluctuation is minor although it is a new high since 1952. The increase of $0.21 to $2.27 in the price of untreated rock base is no doubt occasioned by the availability of supply source with respect to project locations. The current cost is still below

NUMBER AND SIZE OF PROJECTS, TOTAL BID VALUES AND AVERAGE NUMBER OF BIDDERS

(July 1, 1956, to September 30, 1956)

Project Volume	Up to $50,000	$50,000 to $100,000	$100,000 to $250,000	$250,000 to $500,000	$500,000 to $1,000,000	Over $1,000,000	All Projects
Road Projects							
No. of projects	135	28	21	14	6	----	204
Total value*	$2,217,167	$1,992,687	$3,193,860	$4,707,232	$4,604,604	----	$16,715,550
Ave. No. bidders	3.3	4.0	5.1	4.4	3.8	----	3.7
Structure Projects							
No. of projects	12	1	6	2	----	1	22
Total value*	$221,051	$85,496	$928,044	$766,923	----	$1,098,618	$3,100,132
Ave. No. bidders	3.6	2.0	5.0	2.5	----	5.0	3.9
Combination Projects							
No. of projects	----	----	----	----	2	8	10
Total value*	----	----	----	----	$1,341,234	$21,048,258	$22,389,492
Ave. No. bidders	----	----	----	----	3.0	5.4	4.9
Summary							
No of projects	147	29	27	16	8	9	236
Total value*	$2,438,218	$2,078,183	$4,121,904	$5,474,155	$5,945,838	$22,146,876	$42,205,174
Ave. No. bidders	3.3	3.9	5.1	4.2	3.6	5.3	3.7

* Bid items only.

Total Average Bidders by Months

	July	August	September	Average for third quarter
1956	3.8	3.7	3.7	3.7
1955	4.9	4.2	4.4	4.5

AVERAGE CONTRACT PRICES

	Roadway excavation, per cu. yd.	Crusher run base, per ton	Plant mix surfacing per ton	Asphalt concrete pavement, per ton	PCC pavement, per cu. yd.	PCC structures, per cu. yd.	Bar reinforcing steel, per lb.	Structural steel, per lb.
1940	$0.22	$1.54	$2.19	$2.97	$7.68	$18.33	$0.040	$0.083
1941	0.26	2.31	2.84	3.18	7.54	23.31	0.053	0.107
1942	0.35	2.81	4.02	4.16	9.62	29.48	0.073	0.103
1943	0.42	2.26	3.71	4.76	11.48	31.76	0.059	0.080
1944	0.50	2.45	4.10	4.50	10.46	31.99	0.054	0.132
1945	0.51	2.42	4.20	4.88	10.90	37.20	0.059	0.102
1946	0.41	2.45	4.00	4.68	9.48	37.38	0.060	0.099
1947	0.46	2.42	4.32	5.38	12.38	48.44	0.080	0.138
1948	0.55	2.43	4.30	5.38	13.04	49.86	0.092	0.126
1949	0.49	2.67	4.67	4.64	12.28	48.67	0.096	0.117
1950	0.40	2.25	4.26	3.75	11.11	43.45	0.079	0.094
1951	0.49	2.62	4.34	5.00	12.21	47.22	0.102	0.159
1952	0.56	2.99	5.00	4.38	13.42	48.08	0.098	0.150
1953	0.51	2.14*	5.31	4.58	12.74	50.59	0.093	0.133
1st Quarter 1954	0.45	2.28	4.23	4.78	14.89	47.52	0.092	0.126
2nd Quarter 1954	0.38	2.09	4.29	5.18	14.28	47.12	0.093	0.114
3d Quarter 1954	0.43	1.85	4.68	7.00	12.63	49.59	0.095	0.162
4th Quarter 1954	0.35	1.78	4.83	--	13.13	46.08	0.094	0.135
1st Quarter 1955	0.39	1.69	4.55	--	13.44	40.66	0.095	0.140
2d Quarter 1955	0.42	1.99	5.39	--	14.46	51.36	0.098	0.136
3d Quarter 1955	0.41	2.33	5.43	5.70	13.46	49.64	0.093	0.132
4th Quarter 1955	0.37	2.00	5.52	4.00	15.05	52.72	0.099	0.144
1st Quarter 1956	0.40	2.08	5.40	6.50	14.05	52.51	0.105	0.166
2d Quarter 1956	0.51	2.06	6.27	--	14.64	57.13	0.113	0.219
3d Quarter 1956	0.52	2.27	6.12	--	15.57	56.32	0.121	0.178

* Untreated rock base substituted for crusher run base at this point.

average in the corresponding period last year. Prices for portland cement concrete pavement averaged $15.57 as against $14.64 last quarter. The current quarter established a new high for this item. Project conditions during the quarter were not sufficiently varied during the quarter to offset the effect of a few highly weighted contracts. Bar reinforcing steel prices

reached the new high of $0.121 in this period. This increase is no doubt attributable to the rise in steel prices. Use of reinforcing steel was sufficiently widespread in the quarter to obtain a fairly true average. Unbalance due to proximity or remoteness of projects to supply sources was therefore not evident.

Decreases Reflected

Plant-mixed surfacing reflected a decrease of 15 cents per ton in this period to $6.12. The extensive resurfacing program was carried on statewide and representative projects involved fairly large quantities. The sources of supply being equally widespread contributed to maintaining an unbiased average. Class A portland cement concrete structures dropped to $56.32 from $57.13 in the previous quarter. The 81 cent drop in this item no doubt reflects the stabilizing effect brought about by settlement of the steel situation existing in the last quarter. Delays in steel deliveries would in turn, cause equal delays in completing structures particularly in those structures involving steel shapes in their construction. The decline in structural steel prices in this period from $0.219 to $0.178 was commented on in the beginning of this release.

The accompanying graph shows a comparison of the California Construction cost Index, the Engineering News-Record Construction Cost Index and the United States Bureau of Public Roads Composite Mile Index all of which are reduced to the base, 1940=100. The last two mentioned indexes are nationwide in scope.

The Engineering News-Record Index continues its upward course without interruption. Its steady climb indicates that adverse influence in any spotted locations is not sufficiently felt to overcome the general trend. The E. N. R. Index is up 4.4 points or 1.53 percent over the second quarter.

Belief was expressed last quarter that the United States Bureau of Public Roads Composite Mile Index would follow the course of the California and E. N. R. Indexes. This assumption was substantiated when results of the computations became available. It remains to be seen whether the third quarter position will follow the national trend of E. N. R. or the flattening trend developed in California. Figures for the second quarter show the B. P. R. Index to be up five points or 2.27 percent over the first quarter of 1956.

OLD A. C. PAVEMENT

Continued from page 50 . . .

Portable Batch Plant

These materials were mixed in a 2,000-pound portable batch plant set up in two different locations during the life of the job. The portion of the roadway now remaining in its original form was paved from the second plant set up at Champagne Siding at the county line. Referring again to the final report, we read that "mineral aggregates for the asphalt concrete mixture were fed to the cold elevator at the drier by clam shell. This did not prove entirely satisfactory as far as control of material grading in the different bins; consequently, a two-compartment bunker was installed over the cold elevator of the Champagne plant and much better results secured. * * * Multiple beam scales of the Warren Brother's type were employed. * * *"

"Distribution and handling of asphalt concrete mixture at the place of laying on the highway was done with shovels, six shovelers and four rakers handling the plant output. A pair of patented mechanical asphalt spreaders were given a trial, but as manipulated by the contractor's crew did not produce satisfactory results and after using them for part of two days, they were abandoned by the contractor, since he could not foresee their practicability and saving in labor. The greater part of the pavement laying on the Riverside County section of the job was done during cold and windy weather, making it difficult to place the mixture and roll at a suitable working temperature."

Tests of Interest

On June 27, 1956, just prior to resurfacing this 30-year-old asphalt concrete pavement, a sample was cut through the full 4½-inch depth on the Riverside County portion. Although a grading analysis was made, the results have no particular significance, since they represent a combination of leveling and surface courses, each of which met a different grading specification; however, the other test results may be of interest:

Moisture content	0.1%
Bitumen ratio	5.7%
Specific gravity	2.31
Stability	59
Swell	0.000"
Permeability	0

Indications are that the long service life of this pavement was due to a combination of factors. The low moisture content is indicative of dry subgrade, which results in part from the fact that the grade was raised one to two feet with blow sand in this area. The high stability undoubtedly contributed its share also, and probably resulted from the interlocking of the crushed rock used in the mix and the relatively low penetration of the paving asphalt. (The 1949 Standard Specifications, latest edition covering asphalt concrete pavement, require a minimum stabilometer value of 35 and provide for the use of paving asphalts having a range of penetration of 60-70, 85-100, or 120-150.) It is estimated that the pavement has been subjected to 16,700,000 equivalent 5,000-pound wheel loads, even though the first 10 years of its life contributed only about one-eighth of the total.

Under a contract with Matich Constructors, a one-inch blanket of plant-mixed surfacing was applied to the roadway last summer, and it is anticipated that the road will serve future traffic requirements for many more years. According to the traffic count made last July, the highway is now carrying an average daily traffic of 9,600 vehicles, or about 4,800 per day on the north roadway.

GOOD DRIVER

One difference between a good and a bad driver is that the good driver rarely gets himself into situations where he needs to react swiftly to avoid trouble. A bad driver, says the California State Automobile Association, has several close calls almost every time he drives.

Anniversary

San Francisco-Oakland Bay Bridge Is Twenty Years Old

By HOWARD C. WOOD, Bridge Engineer

On November 12, 1936, President Franklin D. Roosevelt pressed a gold telegraph key in Washington, D. C., and set off one of the noisiest celebrations in the history of the San Francisco Bay area.

Factory whistles shrilled and aerial bombs exploded while thousands of people cheered. Hundreds of crowded, gaily-decorated fishing boats and private pleasure craft churned the waters of the bay. Overhead, 250 fighter planes roared through the sky while high above a lone aircraft traced the words: "The bridge is open."

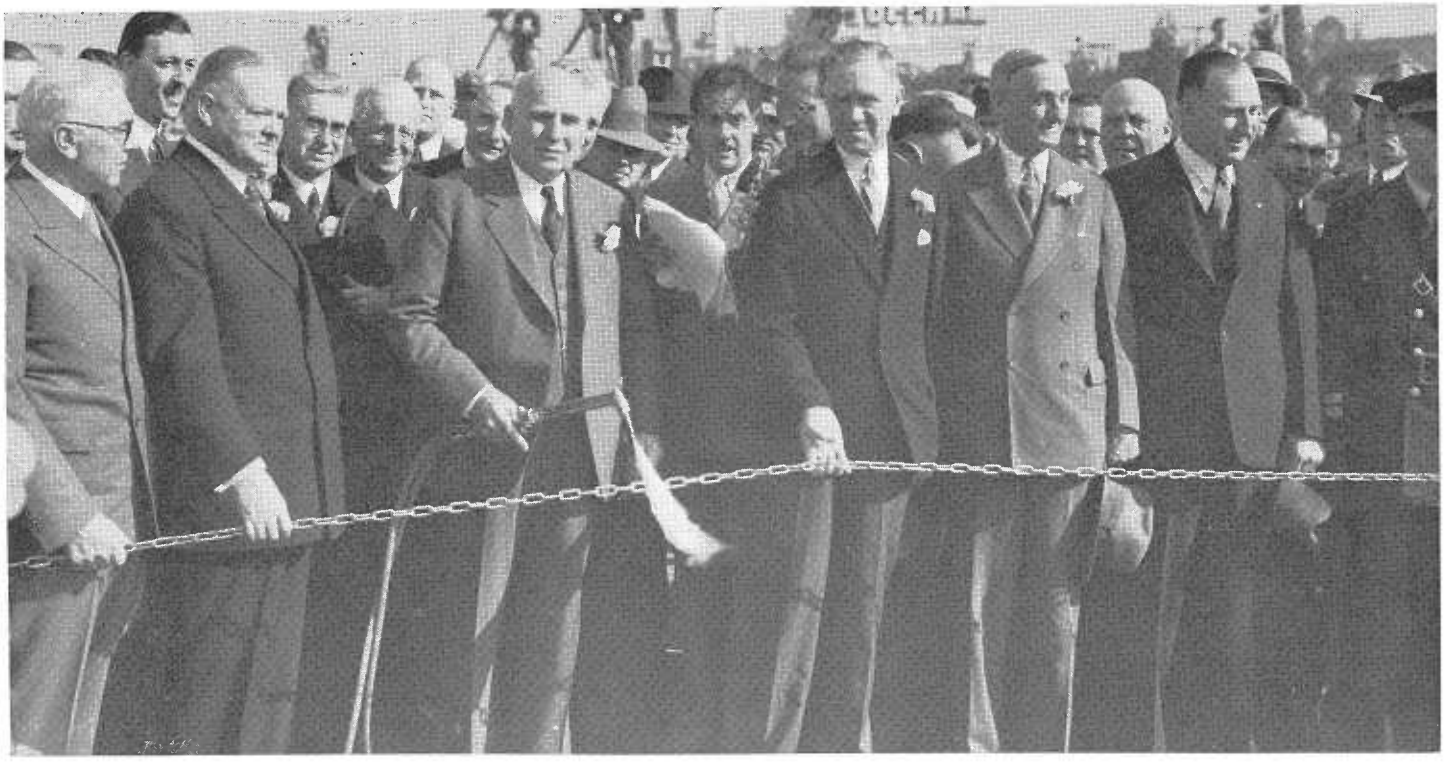
The telegraph key pressed by the President 3,000 miles away had blinked on green lights marking the formal opening to the public of the San Francisco-Oakland Bay Bridge, the largest structure of its kind planned and erected by man.

Dream Comes True

Its completion marked the realization of a long-standing dream of cities and communities on both sides of the bay. By midnight of that first day more than 200,000 eager, happy people had flooded across the new bridge. Opening celebrations in San Francisco and Oakland lasted four days.

The impact of so imposing a structure upon the citizens of the Bay area was strong and, in some cases, overwhelming as exemplified by the story of the little farmer from an East Bay community who, shortly after the opening of the bridge, decided to see it for himself. Accompanied by his wife, he headed his small truck west, joined the flow of cars making for the toll gates and soon found himself on the bridge rolling along toward San Francisco. But the quiet-living man soon found the spectacle overpowering. Everywhere around him cars flashed by, horns blared, and, to make things worse, the shrill, frightened comments and admonitions of his wife were added to the cacophony. All this amidst a tangle of cables and struts and gleaming towers that seemed to reach to the sky. Finally, the little man could stand it no longer. Pulling over into the right lane he stopped his truck and, while the horns and cries of frustrated motorists sounded behind him, walked up to the nearest emergency call box and pressed the button. As he explained to the emergency crew who answered his call, he had had all he could take and would they please get him out of there, a plea, it may be added, that many a modern day motorist admits to feeling when

Governor Frank F. Merriam uses blow torch to sever chain signalizing opening of San Francisco-Oakland Bay Bridge to traffic. Dignitaries, left to right: State Highway Engineer Charles H. Purcell, who built the span; former President Herbert C. Hoover; Governor Merriam; Charles Henderson, Director of RFC; U. S. Senator William G. McAdoo; Director of Public Works Earl Lee Kelly.



entering on to a heavily trafficked urban freeway for the first time.

One of World's Wonders

It was hard for anyone, and especially a Californian, to repress a feeling of pride when he gazed upon the mighty structure across the bay, which immediately claimed and has held a place among the wonders of the modern world. The statistics of the new bridge were impressive and often record-shattering.

To begin with, it was the longest high level bridge in the world (a record it still holds) with 4¼ miles of structure and another four miles of approaches at the San Francisco and Oakland ends, for a total length of 8¼ miles.

The towers of the suspension section across the West Bay were more than 500 feet high and from them hung 28-inch-thick cables supporting a two-level roadbed with six lanes for autos on the upper deck and three lanes for busses and trucks plus two tracks for electric interurban trains on the lower deck. Each cable had 17,464 separate wires in it and there was enough wire in all the cables to stretch nearly three times around the world.

Record Depth Below Water

The bridge piers had established new engineering records for depth below water, the base of one pier having been sunk to a maximum depth of 242 feet. The concrete and reinforcing steel in the bridge were enough to rebuild all the large office buildings in downtown San Francisco. The timber used to put up the structure would build 3,000 five-room dwellings, enough for a town of 15,000 people. The tunnel through Yerba Buena Island connecting the West Bay suspension crossing with the East Bay cantilever crossing was the largest bore vehicular tunnel in existence.

From the time of its opening the bridge assumed a vital role in the transportation picture of the Bay area. After the first influx of sightseers following its completion the traffic count steadied at an average daily figure of 25,000 vehicles. The count fell off slightly in 1938, rose markedly during 1939 with the opening of the San Francisco World's Fair on Treasure Island. It rose rapidly during the war years when it handled heavy military and war industry traffic between San Francisco and Oakland and the military establishments on Treasure Island.

Expert divers were used extensively in laying the foundations for the bridge caissons

90,000 Vehicles per Day

In addition to bearing the brunt of commuter traffic across the bay it was also designated as the western terminus of two transcontinental highways, US 40 and 50. Now carrying an average of 90,000 vehicles a day and well over 100,000 on peak days, it is often referred to as the "Main Street of the Bay Area."

From the beginning, the maintenance and operation of the bridge was a task of major proportions. At the present time bridge personnel, under the direction of the author and his assistant, Carl Hamilton, number some 300 for the Bay Bridge itself. Another 150 persons, also under their direction, are assigned to the other State-owned toll bridges in the area, the Dumbarton, San Mateo-Hayward, and the recently-completed Richmond-San Rafael Bridge as well as the Carquinez Bridge near Vallejo.

Maintenance against the elements is an ever present problem. A permanent crew of 60 painters is kept constantly busy painting and repainting the bridge to protect it from the ravages of corrosion by spray and salt-laden winds and the exhaust fumes from thousands of autos and trucks.

Safest Stretch of Highway

Even though on the basis of comparative accident statistics (per mile of vehicle travel) the Bay Bridge can claim to be the safest stretch of highway anwhere in the State, traffic tie-ups, the universal headache of all heavy traffic roads, are one of the chief concerns of the bridge staff. A traffic accident with the consequent blocking of one or more lanes, especially during rush hours, can cause a chain reaction jam-up that extends for miles. It also causes frayed tempers which tend to bring about more accident-prone conditions.

Service crews are always standing by to man the emergency fleet of six tow trucks, one fire truck and four special bridge service pickup trucks or "cruisers." During the peak traffic hours from 7 to 9 o'clock in the morning and 4.30 to 6.30 in the evening the four radio-equipped "cruisers" are constantly patroling back and forth

with the traffic on the bridge to spot any trouble or to be closer at hand when trouble on a particular section of the bridge is reported to them.

Emergency Service

Speaking in terms of averages, these crews can look forward each day to changing six flat tires, bringing gas or oil to 11 stalled cars and towing another 11 off the bridge due to engine trouble or some other reason. One out of every 20 of the tow-offs is the result of an accident. Once every seven days they can expect a fire of some sort on the bridge. Putting it another way, since the bridge was opened to the public in 1936 these crews have changed nearly 47,000 flat tires, towed 76,500 stalled vehicles off the bridge, brought gas or oil to 78,000 more and put out just over 1,000 fires.

Handling the tolls claims the largest portion of bridge employees. In addition to their duties of collecting and guarding an average of $26,000 in tolls each day, the more than 100 toll officers, sergeants and lieutenants under Captain M. L. Silvey find themselves faced with a variety of extra problems all the way from detecting and apprehending a drunk driver to rendering assistance to some solid citizen who finds that he has come away from home without any money in his pockets.

Radio Broadcasts

In spite of what an average motorist might think when he happens to be caught in a traffic jam, his safety and convenience are the constant concern of the bridge staff. One recent inovation was to allow a local Bay area radio station to beam a week day program direct from the bridge itself. Known as "Car Tunes," the program originates from the central dispatcher's office at the toll plaza where all the latest information about traffic conditions on the bridge is available. Emceed by one of the radio station staff, the broadcast is aimed primarily at the tired commuter wending his weary way homeward over the bridge between 4 and 6 p.m. The show supplies him with information on bridge traffic conditions along with music and news, and is apparently having some effect on driving habits. Statistics indicate that during the time the show was on the air accident reduction on the upper deck was 25 percent.

For 20 years, now, the bridge has existed as a reality, a magnificent spectacle of proportioned towers, cables, girders and piers spanning the bay. It has become so much a part of the scenery that it is easy to forget that for a long time it was only a dream in the minds of men.

Dream 100 Years Old

Just how or when this dream first took form it is not easy to say. Perhaps, first, only as a thought in the mind of an Indian or a Spaniard as he stood looking out over the gray-green waters of the bay.

The first formal expression of the idea seems to have occurred just 100 years ago when an article in the now defunct newspaper *Alta Californian* reported the State Legislature as debating, rather perfunctorily as it turned out, the feasibility of attempting a transbay bridge.

Some say that the idea really began in 1868 when an editorial entitled "A Bridge Across The Bay" appeared in the *San Francisco Bulletin*. It began:

"What do our readers think of a bridge from Hunters Point to the Alameda shore? Is that not considerable of a bridge?"

The editorial went on to say that the Central Pacific Railroad Company had the matter under consideration and only awaited a franchise from the State to enable it to commence work.

Some Wide Bridge

The bridge was to be 125 feet wide (the roadway of the present bridge is 58 feet), would cost 5¼ million dollars according to engineering estimates of the time, and would be between four and five miles long. It would be erected on stone piers "after the most approved and substantial method" and have several "draws" to let light and heavy vessels through. The deck was to provide room for a double railroad track, a double thoroughfare for vehicles and a double walk for pedestrians.

The editorial admitted that it would be much cheaper to build a road around the bay unless the Central Pacific could "kill two birds with one stone" and install some types of facilities to derive extra income which should pay at least some return on the immense outlay. Therefore, it was proposed to "erect booths and saloons on the remaining space on the deck and to make the bridge a place of popular resort for moonlight promenades."

Needless to say, the bridge was never constructed.

In the years that followed, innumerable private enterprises for the construction of a bridge over the bay were launched by always enthusiastic and sometimes capable men, but none of these ever became anything more than schemes on paper.

San Francisco's Supervisors Act

The San Francisco Board of Supervisors might claim some credit for getting the bridge on the road to reality when it declared a transbay bridge to be a commercial and economic necessity for the area, but that it must not be a private enterprise, thereby laying the problem in the lap of the State of California.

The first concrete aid came in July, 1921, when the San Francisco Motor Car Dealers appropriated $12,000 for preliminary borings by Ralph Modjeski and John Vipond Davies. The next hard cash was not forthcoming until eight years later when the City of San Francisco supplemented the amount with $40,000. But the tenuous dreams of the earlier decades were taking on form and even a little substance. In May, 1929, the California Legislature created the California Toll Bridge Authority. Five months later the Hoover-Young Commission was formed with Mark L. Requa as chairman. The commission was charged with the task of recommending a solution to the San Francisco-Oakland Bay Bridge problem.

Purcell Built Bridge

Secretary of the commission was the late Charles H. Purcell, then State Highway Engineer, and later State Director of Public Works, who was to play such a vital part in financing, designing and constructing the bridge.

On February 20, 1931, the Congress of the United States passed an

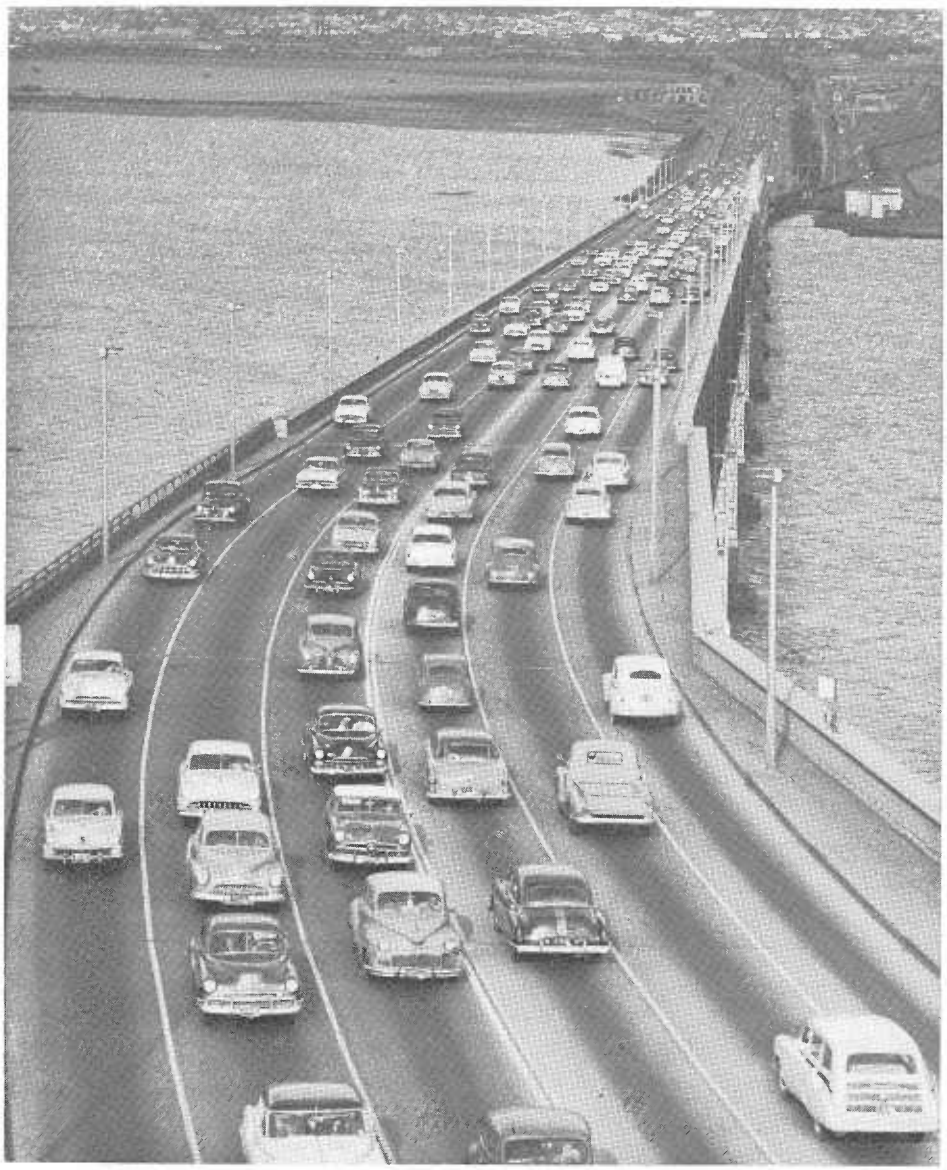
act "granting to the State of California the right to construct, maintain and operate a bridge across the Bay of San Francisco from Rincon Hill in San Francisco by way of Goat Island (Yerba Buena) to Oakland."

On May 25th, Governor Rolph signed Chapter 400, Statutes of 1931, which appropriated $650,000 for the completion of plans and specifications of the San Francisco-Oakland Bay Bridge. In August, Purcell was appointed Chief Engineer of the California Toll Bridge Authority with Glenn B. Woodruff as Engineer of Design. On September 15th the San Francisco-Oakland Bay Bridge offices were officially opened at 500 Sansome Street in San Francisco and the San Francisco-Oakland Bay Bridge Division of the Department of Public Works was created with Charles E. Andrew as Bridge Engineer.

Financial Hurdle

Plans for the bridge were well on their way at last, but the biggest hurdle of all still remained: the financing of the structure itself. With the country in the grips of a depression, money was not easy to come by. It was hoped to finance the bridge through the recently instituted Reconstruction Finance Corporation. However, to do so it would be necessary to amend the act as it then stood so that it would include such self-liquidating projects as the San Francisco-Oakland Bay Bridge which, though financially sound, could, according to state law, only raise the initial loan by pledging state credit and not by putting up collateral.

Purcell was appointed chief representative for California in this matter and from May to July of 1932 he was in Washington, D. C., appearing before congressional committees and other groups stressing the importance of the bridge and other similar projects around the country. He pointed out their financial soundness, their employment potential, and advocated the inclusion of necessary clauses in the Wagner Bill to enlarge the scope of the Reconstruction Finance Corporation to enable it to buy bonds from political subdivisions of public bodies so as to start construction of self-liquidating projects.



Looking east from east portal of cantilever section of Bay Bridge

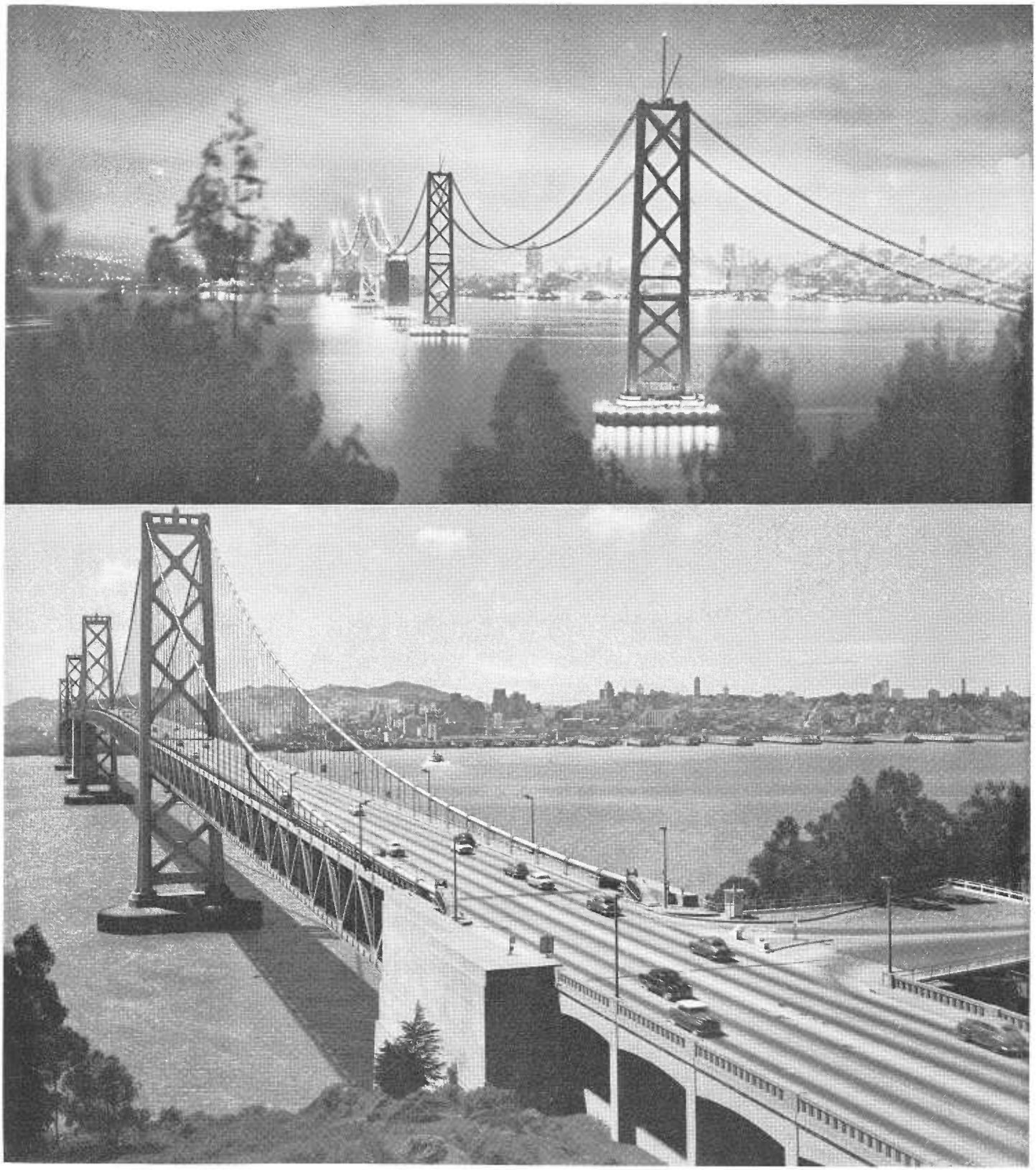
Loan Applied For

On June 20th he telegraphed that the desired changes in the financing provisions seemed assured. On July 22d the Department of Public Works made formal application to the Reconstruction Finance Corporation for $75,000,000 to build the San Francisco-Oakland Bay Bridge. On August 31st, Purcell, accompanied by Engineer Andrew, returned to Washington, D. C., to present the engineering facts concerning the bridge to the Reconstruction Finance Corporation. They were later joined by Joseph R. Knowland and Harrison S. Robinson of Oakland and Leland W. Cutler and George T. Cameron of San Francisco who, as personal representatives of Governor James Rolph, went back to urge favorable consideration by the R. F. C.

On September 16th the R. F. C. announced its approval of the design of the bridge. On September 27th Cutler obtained a personal interview with President Hoover and reported the Chief Executive as favoring the financing of the bridge. On October 10th the R. F. C. agreed to purchase $61,400,000 of California Toll Bridge Authority bonds, enough to insure construction of the bridge.

Money Not Easy

In light of present-day traffic it has often been argued that the bridge



UPPER—Night scene of Bay Bridge during spinning of gigantic cables for the suspension section. LOWER—View of Bay Bridge just after its opening to traffic.

planners were not generous or far-seeing enough in their designs. Few people realize that from the beginning Purcell and his staff were well aware of possible future demands on the bridge and that some of their original ideas, based on this premise, called for greater deck width on the bridge. But what is often forgotten in these pros-

perous days of 1956 is the dearth of ready cash back in the early 1930's and the consequent restrictions that the R. F. C. found necessary to place on all projects coming before it for consideration. The original hopes for a wider bridge had to be modified down to the present 58-foot roadway if the structure was to meet R. F. C. financing requirements. Otherwise, it could not have been financed.

When Earl Lee Kelly was appointed Director of Public Works (on October 13, 1932) he immediately announced that he was retaining Purcell as State Highway Engineer and Chief Engineer of the Toll Bridge Authority. "In my opinion," Kelly said, "C. H. Purcell is one of the outstanding engineers of the United States and I think that I am indeed fortunate to have in my department a man like him upon whose shoulders will fall the responsibility for the engineering skill and the building of the great San Francisco-Oakland Bay Bridge."

On February 28, 1933, bids were opened on the West Bay substructure by Governor Rolph before 500 persons from all over California in the Senate Chambers of the State Capitol. The opening of bids on the East Bay substructure and the superstructure bids for both crossings plus the tunnel had to be postponed a few days because of the bank holiday declared by the President.

Contracts Awarded

On April 28th the Director of Public Works awarded contracts to the successful bidders.

Ground-breaking ceremonies took place on Yerba Buena Island on July 9th. Governor Rolph turned the first shovelful of earth. President Roosevelt in the White House at Washington tapped a telegraph key which set off three blasts, one on Yerba Buena Island, and the other two on Rincon Hill in San Francisco and at the foot of 14th Street in Oakland where overflow ground-breaking celebrations were taking place.

Actually, construction had already begun a month earlier when work was started on laying the piers for the West Bay substructure. A few days after the ground-breaking ceremonies work was started on boring the tunnel through Yerba Buena Island, and on July 27th the first caisson was launched. Within a few months work on the East and West Bay crossings was in full swing.

A look at the compendious "Log of the San Francisco-Oakland Bay Bridge" shows that although the work proceeded steadily and even ahead of schedule during the next three years it was not without its occasional setbacks.

For example, on January 16, 1934, we note:

"Caisson No. 6 * * * standing at about elevation minus 138 feet, suddenly, a little after 6 p.m., tilted toward the east and settled out of level eight feet in about 10 seconds. Dredging was immediately started on the west cylinders. * * *"

Minor Problems

The following morning commuters crossing the bay on the ferries were alarmed by the obviously tilted position of Caisson No. 6 and Bay area newspapers were deluged with phone calls. Editors began to contact bridge officials to find out what had happened. Purcell and his staff conferred and in order to avoid any sensationalizing of the story issued a statement to all papers explaining that although the caisson was tipped it presented no unusual engineering difficulty and that no danger to the pier was involved. The newspapers not only cooperated by not overplaying the story but actually attempted to outdo each other in minimizing the risks and quieting the concern of commuters.

As if this were not enough for one day the "Log" also records that a shale slide started on the south side of the west approach on Yerba Buena Island and continued throughout the 18th, 19th and 20th.

And on April 23d of the same year:

"At 5.30 a.m. the roof and north side of the north anchorage tunnel on Yerba Buena Island caved in."

No lives were lost but more than a month was needed to complete the work of mucking out the thousand tons of fallen debris.

Inevitable Accidents

Nor could a project of such magnitude and duration be completed without its share of tragedy.

On August 4, 1933, only two months after major construction work had begun on the bridge, we read:

"The first fatality in the construction of the bridge occurred today when Harry V. Hill, pile driver, age 50, fell 20 feet into the bay while working on a material dock on Yerba Buena Island."

And again, on November 25th:

"Louis R. Knight, rigger, lost his balance and fell from Pier E-4 into the bay at 10.15 a.m. His body was recovered at 1.45 a.m. the following day."

And on December 14th:

"Lloyd J. Evans, diver, died of caisson disease. He had been working at a depth of 112 feet. After being brought to the surface he collapsed and was rushed to the decompression chamber at Harbor Pier 24 where attempts to save his life failed."

In all, 20 persons lost their lives in the construction of the bridge.

Work Progress Good

In addition, there were strikes which, on several occasions, slowed up work or even brought it to a standstill for a few days. In spite of this, the general work progress was good. The spinning of the huge cables for the suspension section, which required the setting up of special machinery on the San Francisco side, was completed in January, 1936. When the bridge was opened to the public in November it was six months ahead of schedule, a tribute to Purcell and his staff as well as the contractors and their men who had performed the actual construction work.

What of the future of the bridge? Physically speaking, there is no reason, engineers say, why it could not last for several centuries if properly maintained. Or as the man in charge of the bridge, Howard Wood, puts it, it should last long enough into the future until other modes of transportation render it and the automobile obsolete and make it nothing more than a museum piece spanning the bay to remind future generations of the glories of the past.

Queen of Bridges

But what about the immediate future of the bridge and its place in the transportation picture of the Bay area? It has been recognized for some time now that it cannot handle all of the expanding traffic in the region it serves and that additional bridges will be necessary. Surveys are now under

Forgotten Street Finds Business Better

NEWPORT BEACH – The "forgotten street" – old Newport Boulevard – never had it so good.

Three years ago its existence as a thriving business district appeared doomed by the State Division of Highways' project of fencing it off and rerouting traffic over a ditch-type freeway.

Merchants, hostelry owners and residents fought the freeway. The two-lane boulevard had for years been the main route from Santa Ana and Costa Mesa into resort Newport Beach, and to change this would be a disaster.

The business district had developed and seemed to be flourishing because this route was heavily traveled * * * people said "the ditch" would make it a "forgotten place" and property owners looked for the worse.

But a strange turn of events saved the business district and three years later a survey of some establishments shows "business is better than ever."

Gambled and Won

Some merchants, such as Claude L. Blood, gambled on the boulevard and won. Blood bought a former real estate office that had been abandoned when the freeway opened. His friends, he said, called him "nuts." But today Blood has one of the busiest pet shops in the coastal area.

He claims the less traveled street has helped the parking problem and allows local residents to use his store without the frantic problem of fighting heavy boulevard traffic.

Motels–there are two of them, the Mesa and Newport Harbor hostelrys, faced the most serious threat. These establishments depend on the tourist trade and main travel routes for business. Both proprietors fought the freeway, but inevitably lost.

Now, Mrs. Adeline Jackson, owner of the Mesa Motel, considers the result a boon to business.

"Business has never been better," she says. "The first year we lost badly, but now we have more to offer because it is quieter and easier to get in and out of. Of course, to hold the trade longer we opened kitchenette apartments. Now people are freeway conscious and motel seekers are beginning to look off the main routes for a place to stay."

It Paid Off

Mrs. L. E. Woodward, proprietor of the neighboring Newport Harbor Motel, said the freeway paid off in the end by bringing more people into the area.

"We depend on visitors and, the more visitors the better the business," she explains. Like Mrs. Jackson she felt being off the "main line" is an advantage and safer for children visitors.

"Then–I wouldn't have believed our business would be better than than ever," Mrs. Woodward stated, "but it is."

Some other apartment and motel owners said they changed their style of advertising to meet the problem of being shifted away from traffic. "We left cards at big recreation spots * * * impressing the fact that we are on a quiet street," one businessman explained.

Store owner Mike, Santa Cruz, of Boulevard Liquor Market, 449 North Newport Boulevard, admitted he had some worrisome moments at first.

"Better Than Ever"

"But now business is better than ever. On Sundays before the bumper-to-bumper traffic kept trade down. People couldn't stop or get in. We now do more local business and have better accommodations for parking, etc. My business dropped badly for eight months. * * * I remember arguing with the State, but it was like talking to a blank wall."

And the Beacon Auto Parts management Floyd E. Hubbard, one of the few merchants who did not oppose the freeway, claims he saw the "better business picture then."

Hubbard, who has been in business for eight years, claims trade has tripled since the freeway opened in early summer, 1953.

"Before people were afraid to stop * * * now it is easy and comfortable," he explained, "and parking, the life source of a good business, is tremendously better."

It appears from other observations of the one time "main drag" that prospective merchants are taking an interest in this quiet route too.

At its south terminus a multibusiness shopping center has been built * * * with its store backs significantly turned on the freeway.

From Santa Ana Register

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way to determine the feasibility of financing and constructing a southern crossing of the bay, and most engineers and civic planners see a time in the not too distant future when the mushrooming population will require even a second new bridge somewhere near the present one.

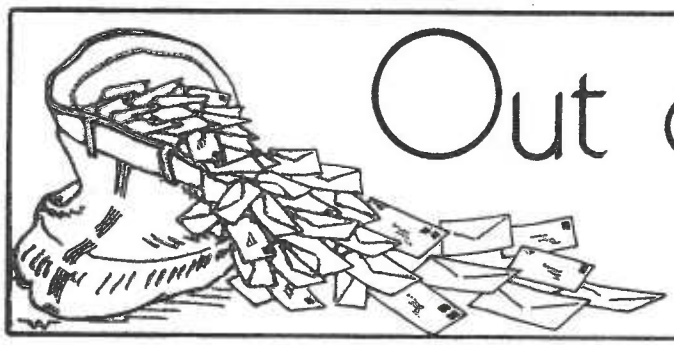
But one thing is certain. Whether she is ever equaled or bettered in size the present Bay bridge will always be assured a place in the hearts of the people of the Bay area who have seen her stand alone and unchallenged as queen of them all for 20 years.

SOUTHERN CROSSING

Continued from page 38 . . .

Southern Crossing, plus a reasonable margin of safety therefor, similar to the toll covenants relative to the authority's financing of the San Mateo-Alameda, Richmond-San Rafael and Carquinez Strait bridges.

If the authority determines to proceed with such further steps as may be necessary to finance the construction of the minimum Southern Crossing, we strongly recommend that provision be made in the authorizing bond resolution for financing the costs of paving the railway portion of the Bay Bridge in the event that such action appears to be necessary or desirable, even though an increase in tolls may be required for that purpose. Furthermore, although it is perhaps somewhat beyond the immediate scope of our assignment, we recommend that at the same time serious consideration be given to the advisability of imposing basic rates of toll in excess of 25 cents on the Bay Bridge and the Southern Crossing coincidentally with the financing of the latter in order to assure the success of that financing and also the authority's ability to meet the future requirements of transbay traffic in an economically sound and businesslike manner.



Out of the Mail Bag

GLAD YOU LIKE IT

San Lorenzo, California

Kenneth C. Adams, *Editor*

Dear Sir: I thank you for again having the opportunity of receiving *California Highways and Public Works* magazine for another year.

The copy that I receive passes through the hands of many of my friends and business associates in the telephone company district office in the East Oakland area. Its arrival is always cause for attention and discussion.

Further use of its contents is made when it is forwarded to a member of the Alameda City Council.

Again I thank you.

Yours truly,

Richard D. Carroll

A WELDER WRITES

WESTERN WELDING WORKS
Carmichael, California

Kenneth C. Adams, *Editor*

Dear Mr. Adams: I want to express my appreciation for your fine magazine which I have been reading for some 10 or 12 years. Being in the welding business, I have been especially interested in the development of the new Carquinez Crossing, because of the gaining acceptance of welding in all types of structures, particularly bridges.

I have also enjoyed the articles concerning prestressed concrete girders and piles. Of course I enjoy the whole publication, but the above in particular.

Yours very truly,

Randolph K. Sullivan

AN EXPERT WRITES

Paramount, California

Kenneth C. Adams, *Editor*

Dear Sir: I would like to take this opportunity to thank you and the State of California for the privilege of receiving the *California Highways and Public Works* magazine.

In my work as a bus driver and tour conductor for Pacific Greyhound Lines, I travel many miles of our Country's highways annually, with passengers from all walks of life, from many parts of the Country, some frequent travelers, others for the first time in California. I am sure it would be gratifying if you could hear the general reaction of so many of my passengers concerning our highways in California. A typical comment—"California highways in general are the best in the Country."

I personally obtain much of my information and facts from *California Highways and Public Works.*

Yours very truly,

L. A. Prey

THANKS

Mr. Kenneth C. Adams, *Editor*

Dear Sir: I wish to express my appreciation of *California Highways and Public Works,* which my family and I enjoy very much, particularly the informative manner in which each subject is presented. We definitely admire your department's contribution towards the progress of our great State.

Very sincerely,

Joaquin Vergara
4701 Yosemite Way
Los Angeles, California

AN APPRECIATION

Napa, California

Kenneth C. Adams, *Editor*

We have received your magazine for almost a year. We appreciate and enjoy each copy and look forward to the next.

Being in the sales and service business end of automotive transportation we appreciate your report on the highway development and progress that is being made for safer transportation.

Sincerely yours,

Wesley Cobb

FROM A BANKER

Bank of America
Sacramento, California

Mr. Kenneth C. Adams

Dear Mr. Adams: *California Highways and Public Works* is one of the finest publications that I have been privileged to read each month; in fact, just as soon as it is received it is read carefully from cover to cover since the contents are so interesting and well prepared.

Cordially,

G. K. Cunningham
Vice President

YOUR THANKS APPRECIATED

Rodeo, California

Mr. Kenneth C. Adams, *Editor*

Dear Mr. Adams: I wish to thank you for *California Highways and Public Works.* Each copy we receive tells us a new story of a new highway or bridge, etc. We enjoy reading it very much and we pass them on to our friends so they may read them.

Yours truly,

Mrs. Dorothy Vaughan

WILL DO

EARP, CALIFORNIA

DEAR MR. ADAMS: We have now received your wonderful publication for 19 years. We enjoy it immensely and look forward to receiving every issue. It is very informative and interesting. It gives the "inside" story of every project that is undertaken and completed.

Just keep up the good work.

Yours truly,

FRANK BRITTON

HOLLISTER THANKS YOU

HOTEL DEL CORONADO
Coronado, California

DEAR MR. ADAMS: Congratulations on the September-October issue. It brings me much pleasure and knowledge. The illustrations help me to know what is going on.

The article by Mr. Leonard C. Hollister, Project Engineer on the Carquinez Bridge, is most wonderful. Keep that type of reading up, please.

WALTER STANLEY

MAINTENANCE CREWS ON JOB

COMMUNITY WELFARE AND TAXPAYERS ASSOCIATION, INC.
Eureka, California

MR. K. C. ADAMS, *Editor*

It is a pleasure to get your very excellent magazine, the *California Highways and Public Works*, and it is also a pleasure to congratulate you for the fine editing and usual good pattern you always come up with in each issue.

The occasions I have to travel over the highways in Northern California are very frequent and from your magazine it is with enthusiastic anticipation I look forward to trips over roads not frequently traveled by me; the changes are always there.

May I say a word for the men that keep the highways open during the winter months. They are always on the job, rain or snow. In fact I have always gotten through on any highway traveled during bad weather. The maintenance crew sees to that. May I say congratulations to maintenance.

Very truly yours,

JAMES T. HAMMONS

A BOW TO GOOD SAMARITANS

MR. FRANK B. DURKEE
Director of Public Works
Sacramento, California

DEAR MR. DURKEE: On Wednesday, October 24th, I was hopelessly snowbound at Gold Lake away from the county road, Bassets to Graeagle, in Plumas and Sierra Counties. There was no communication for miles; my car was stalled. It looked as if my wife and I were in for a very bad time. I was about to walk 12 miles through the snow to Graeagle for help, when Guy Robinson, Nevada County Supervisor, and Chester Butz of Downieville, recently retired from the Division of Highways, came along.

They not only got me out of the snowdrift, but returned later to help me get my boat loaded on the trailer and gave me time to close my cabin on the lake before they would leave me.

Seeing Mr. Robinson and Mr. Butz operate was an education to me. They were so efficient in getting my car out and started, and thoughtful in returning to see that I actually got on my way.

My comment is that, though retired, Mr. Butz still has that fine spirit of service which will always reflect credit on the California Highway Department and will always make me a strong champion of the department.

Sincerely yours,

W. J. GILFILLAN

HIGH PRAISE INDEED

UNIVERSITY OF CALIFORNIA
Department of Engineering

MR. KENNETH C. ADAMS, *Editor*

DEAR MR. ADAMS: I enclose the required postal card to continue *California Highways and Public Works* for another year. Permit me to take this opportunity to commend you on the excellence of the publication which you produce. I find considerable personal enjoyment from the articles and repeatedly apply the data thus provided to problem material in our course in highway engineering.

Respectfully,

JOHN HUGH JONES
Assistant Professor of
Civil Engineering

MAGAZINE IS USEFUL

MISSOURI STATE HIGHWAY COMMISSION
Jefferson City, Missouri

MR. KENNETH C. ADAMS, *Editor*

I note it is time again to make a request for continuation of my name on the mailing list to receive *California Highways and Public Works*. I desire very much to be retained on your mailing list. This magazine is not only read and studied by myself, but is also circulated among my senior engineers, assistants, locators, and designers here in the main office. It is retained and used as a reference and is considered almost invaluable to us.

Very truly yours,

C. P. OWENS
Engineer of Surveys
and Plans

JUDGE LIKES MAGAZINE

MUNICIPAL COURT
Oakland-Piedmont Judicial District
Oakland, California

MR. KENNETH C. ADAMS

DEAR MR. ADAMS: *California Highways and Public Works* is an extremely interesting magazine, and by reason of my interest in traffic enforcement, I have found it very informative.

Very truly yours,

JOSEPH A. MURPHY, Judge

WE LIKE THESE LETTERS

KENNETH C. ADAMS, *Editor*

DEAR SIR: It isn't often that I write a fan letter, but your magazine is so deserving for its fine work, that I've decided to add my word of praise.

We've received the publication for the past few years, and the information and pure pleasure it has given us are unparalled. We travel this good old State whenever possible. Your valuable magazine with its wide variety of information on highways, is a real boon to the motorist. We want to thank you for making it available to us.

Sincerely,

MRS. NORMANN HIXON
P. O. Box 36
Chino, California

In Memoriam

CHARLES H. WHITMORE

An engineering career covering more than half a century was brought to an end on November 10th with the death of Charles H. Whitmore, retired engineer of the Division of Highways.

At the time of his retirement from state service in 1952, Whitmore was District Engineer of District III (Marysville), a post he had held for 23 years. Prior to that time he was Construction Engineer for District IV (San Francisco) and District Engineer of District I (Eureka). Before coming to California, he was a district highway engineer for the State of Oregon.

His early career was spent in location and construction work for various railroad companies and in land and water development. He was county engineer of El Paso County, Texas, from 1908 to 1911.

Both in Texas and Oregon, Whitmore had charge of constructing some of the first hard-surface highways to be built outside of cities. He was also one of those who helped in formulating and encouraging the tax on gasoline for road construction purposes which Oregon pioneered in 1919, the first gas tax measure in the Country.

Whitmore was born in Emporia, Kansas, and studied engineering at Oberlin College in Ohio. He is survived by his wife, Florence, his daughter, Mrs. May Louise Hillebrand, and two grandchildren, all of Marysville, a brother in Oregon and three sisters in Illinois.

AUTO PRODUCTION

France produced 553,300 units of the total world production of 13,000,000 automobiles in 1955, reports the National Automobile Club.

During the 1955-56 Fiscal Year, the total number of contractors prequalified to bid on the various types of state highway construction increased from 800 to 812. The combined bidding capacity of these contractors is estimated to be $1,601,255,500.

Employees Receive Twenty-five-year Awards

Employees of the Division of Highways who became eligible for 25-year awards prior to July 31, August 31, September 30 and October 31, 1956, are:

Name	Total service Yrs.	Mos.	Days
District I			
Hemenway, Bernard A.	25	0	10
Rivers, Harvey J.	25	0	04
Schuler, Donald K.	25	0	12
District II			
Chapman, Wilbur C.	25	0	14
Grant, William	25	0	12
Hayes, William	25	0	26
Hogan, Wendell W.	25	0	27
Keefer, Lloyd V.	25	0	06
Peterson, Bessie	25	0	10
District III			
Dorris, Wilma E.	25	0	28
Haines, Ellis A.	25	0	20
Hamma, Clarence D.	25	0	01
McDonough, David E.	25	0	21
Rhud, Hanlon E.	25	0	15
Sawyer, Jesse E.	25	0	06
Sheridan, Paul C.	25	0	20
White, Albert C.	25	0	09
District IV			
Deasy, John G.	25	0	02
Elder, Drury	25	0	11
Lange, H. C.	25	0	25
Lucas, Frank C.	25	0	06
Weber, Charles A.	25	0	20
District V			
Bunce, Charles Lee	25	0	17
Moon, Ralph J.	25	0	24
Skanse, Andrew T.	25	0	22
District VI			
Cowan, Walker R.	25	0	13
Johnson, Roy F.	25	0	06
Van Patten, Ellsworth I.	25	0	09
District VII			
Farmer, Rex C.	25	0	18
Fisher, Leland W.	25	0	02
Hon, Richard	25	0	21
Langsner, George	25	0	18
Nigh, Donald T.	25	0	02
Reingold, Samuel	25	0	24
Reynolds, Jesse M.	25	0	02
Smith, Le Roy, Jr.	25	0	14
District VIII			
Backus, Lawrence N.	25	0	11
Beckett, Orville A.	25	0	14
Brouse, Fred R.	25	0	01
Wieman, Donald S.	25	0	01
District X			
Oneto, John L.	25	0	08
Parker, Herbert M.	25	0	25
Spradling, Richard E.	25	0	13
District XI			
Hansen, Frank E.	25	0	12
Mullins, Grace L.	25	0	14
Patterson, Ben	25	0	13
Pearce, Franklin D., Sr.	25	0	21
Talbot, Dale J.	25	0	29
Young, Randolph R.	25	0	20
Central Office			
Boyer, Oliver D., Jr.	25	0	12
Everitt, Fred L.	25	0	18
Lathrop, Scott H.	25	0	12
MacDonald, Ernest M.	25	0	20
Shouse, Jo.	25	0	23
Sloan, George W.	25	0	28
Winter, Pascal	25	0	01
Zazzi, Evelyn A.	25	0	00
Bridge Department			
Dunn, Thomas J.	25	0	01
Kiedaisch, W. C.	25	0	17
McMahon, James E.	25	0	28
Winter, Carroll C.	25	0	29
Yeager, Arlos M.	25	0	20
Bay Bridge			
Corbett, Mary M.	25	0	00
Warne, J. R.	25	0	19
Central Office			
Joynes, Harold L.	25	0	16
Headquarters Shop			
Green, Frank F.	25	0	03
McCormack, Jack F.	25	0	08
Shop 6			
Campbell, Charles H.	25	0	05
Public Works—Administration			
Catching, Alpha	25	0	26
Contracts and Rights of Way			
Jones, Holloway	25	0	10

Employees of the Division of Architecture receiving 25-year awards:

	25 years on	Location
Andrew Petersen	July 27, 1956	Area II, Folsom
Arthur F. Dudman	August 4, 1956	Headquarters, Sacramento
Willace E. Manhart	October 11, 1956	Headquarters, Sacramento

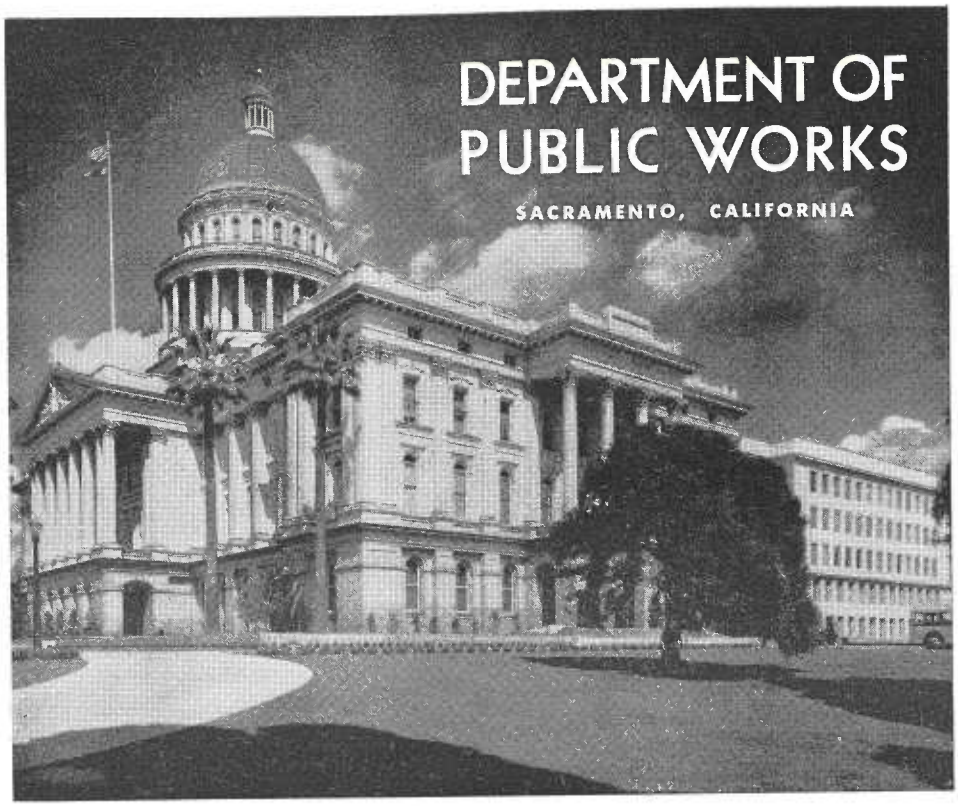
MISSING PLATES

If you lose one or both of the license plates on your car, the law requires that you must obtain substitute plates, says the California State Automobile Association. Take your registration card and the one remaining plate (if only one has been lost) to an office of the Department of Motor Vehicles. Substitute plates will be issued for a $2 fee. If the plates have been stolen, notify the police.

MORE MOTOR VEHICLES ENTER CALIFORNIA

A total of 467,574 automobiles, trucks, and busses entered California during September of this year. This was 55,122 more motor vehicles than entered during September, 1955.

GOODWIN J. KNIGHT
Governor of California



CALIFORNIA HIGHWAY COMMISSION

FRANK B. DURKEE . . Director of Public Works and Chairman
H. STEPHEN CHASE . . . . . San Francisco
JAMES A. GUTHRIE . . . . . San Bernardino
ROBERT E. McCLURE . . . . Santa Monica
ROBERT L. BISHOP . . . . . Santa Rosa
FRED W. SPEERS . . . . . Escondido
CHESTER H. WARLOW, Vice Chairman . Fresno
C. A. MAGHETTI, Secretary . . . . . Davis
T. FRED BAGSHAW . . . . . Assistant Director
A. H. HENDERSON . . . . . Deputy Director
C. M. "MAX" GILLISS . . . . . Deputy Director

DIVISION OF HIGHWAYS

GEO. T. McCOY
State Highway Engineer, Chief of Division
J. W. VICKREY . . . Deputy State Highway Engineer
CHAS. E. WAITE . . Deputy State Highway Engineer
EARL WITHYCOMBE . Assistant State Highway Engineer
F. W. PANHORST . . Assistant State Highway Engineer
J. C. WOMACK . . Assistant State Highway Engineer
R. H. WILSON . . . Assistant State Highway Engineer
F. N. HVEEM . . . Materials and Research Engineer
FRANK E. BAXTER . . . . Maintenance Engineer
J. C. YOUNG . . . . . Engineer of Design
G. M. WEBB . . . . . Traffic Engineer
MILTON HARRIS . . . . . Construction Engineer
H. B. LA FORGE . Engineer of Federal Secondary Roads
C. E. BOVEY . Engineer of City and Cooperative Projects
EARL E. SORENSON . . . . . Equipment Engineer
H. C. McCARTY . . . . . Office Engineer
J. A. LEGARRA . . . . . Planning Engineer
J. P. MURPHY . . . . Principal Highway Engineer
F. M. REYNOLDS . . . Principal Highway Engineer
E. J. SALDINE . . . . Principal Highway Engineer
A. L. ELLIOTT . . . . Bridge Engineer—Planning
I. O. JAHLSTROM . . . Bridge Engineer—Operations
J. E. McMAHON . . Bridge Engineer—Southern Area
L. C. HOLLISTER . . . Projects Engineer—Carquinez
E. R. HIGGINS . . . . . Comptroller

Right of Way Department

FRANK C. BALFOUR . Chief Right of Way Agent
E. F. WAGNER . . . Deputy Chief Right of Way Agent
RUDOLPH HESS . . . . . Assistant Chief
R. S. J. PIANEZZI . . . . . Assistant Chief
E. M. MacDONALD . . . . . Assistant Chief

District IV

B. W. BOOKER . . Assistant State Highway Engineer

District VII

E. T. TELFORD . . Assistant State Highway Engineer

District Engineers

ALAN S. HART . . . . . District I, Eureka
H. S. MILES . . . . . District II, Redding
J. W. TRASK . . . . . District III, Marysville
J. P. SINCLAIR . . . . . District IV, San Francisco
L. A. WEYMOUTH . . . . District IV, San Francisco
A. M. NASH . . . . . District V, San Luis Obispo
W. L. WELSH . . . . . District VI, Fresno
GEORGE LANGSNER . . . . District VII, Los Angeles
LYMAN R. GILLIS . . . . District VII, Los Angeles
C. V. KANE . . . . . District VIII, San Bernardino
E. R. FOLEY . . . . . District IX, Bishop
JOHN G. MEYER . . . . . District X, Stockton
J. DEKEMA . . . . . District XI, San Diego
HOWARD C. WOOD . . . . . Bridge Engineer
State-owned Toll Bridges

DIVISION OF CONTRACTS AND RIGHTS OF WAY

Legal

ROBERT E. REED . . . . . Chief Counsel
GEORGE C. HADLEY . . . . . Assistant Chief
HOLLOWAY JONES . . . . . Assistant Chief
HARRY S. FENTON . . . . . Assistant Chief

DIVISION OF SAN FRANCISCO BAY TOLL CROSSINGS

NORMAN C. RAAB . . . . Chief of Division
BEN BALALA . . . . . Principal Bridge Engineer

DIVISION OF ARCHITECTURE

ANSON BOYD . State Architect, Chief of Division
HUBERT S. HUNTER . . . . Deputy Chief of Division
ROBERT W. FORMHALS
Administrative Assistant to State Architect

Administrative and Fiscal Service

EARL W. HAMPTON
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Headlights of automobiles create spectacular light pattern at night on Harbor Freeway in Los Angeles. Photo by L. Clay Dudley, Photographic Section, Department of Public Works, Merritt R. Nickerson, Chief.