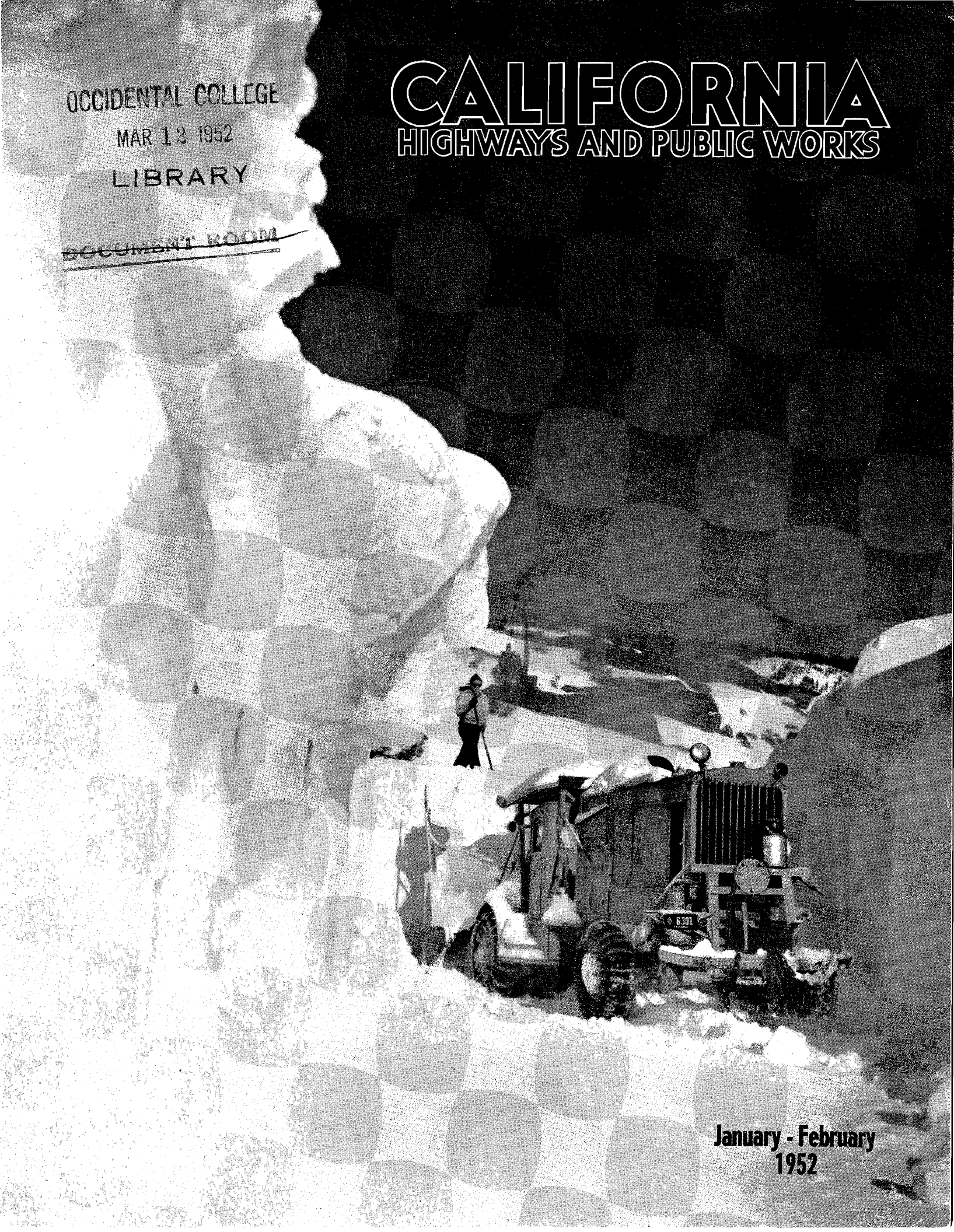
CALIFORNIA
HIGHWAYS AND PUBLIC WORKS



January - February
1952

California Highways and Public Works

Official Journal of the Division of Highways, Department of Public Works, State of California

FRANK B. DURKEE, *Director*
GEORGE T. McCOY, *State Highway Engineer*
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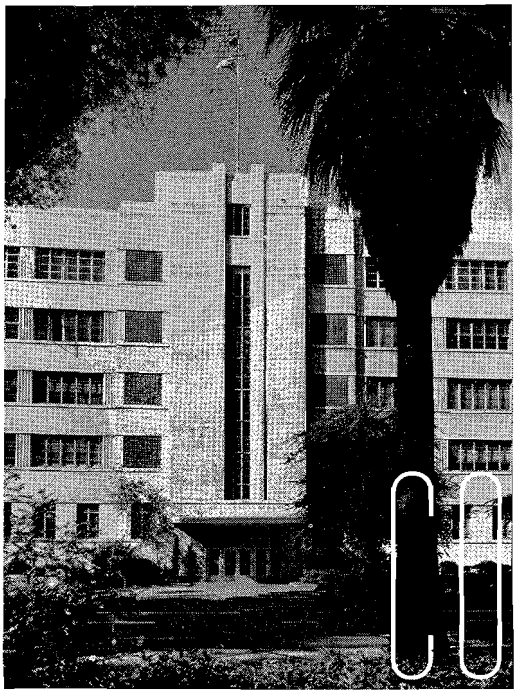


Public Works Building
Twelfth and N Streets
Sacramento

CONTENTS

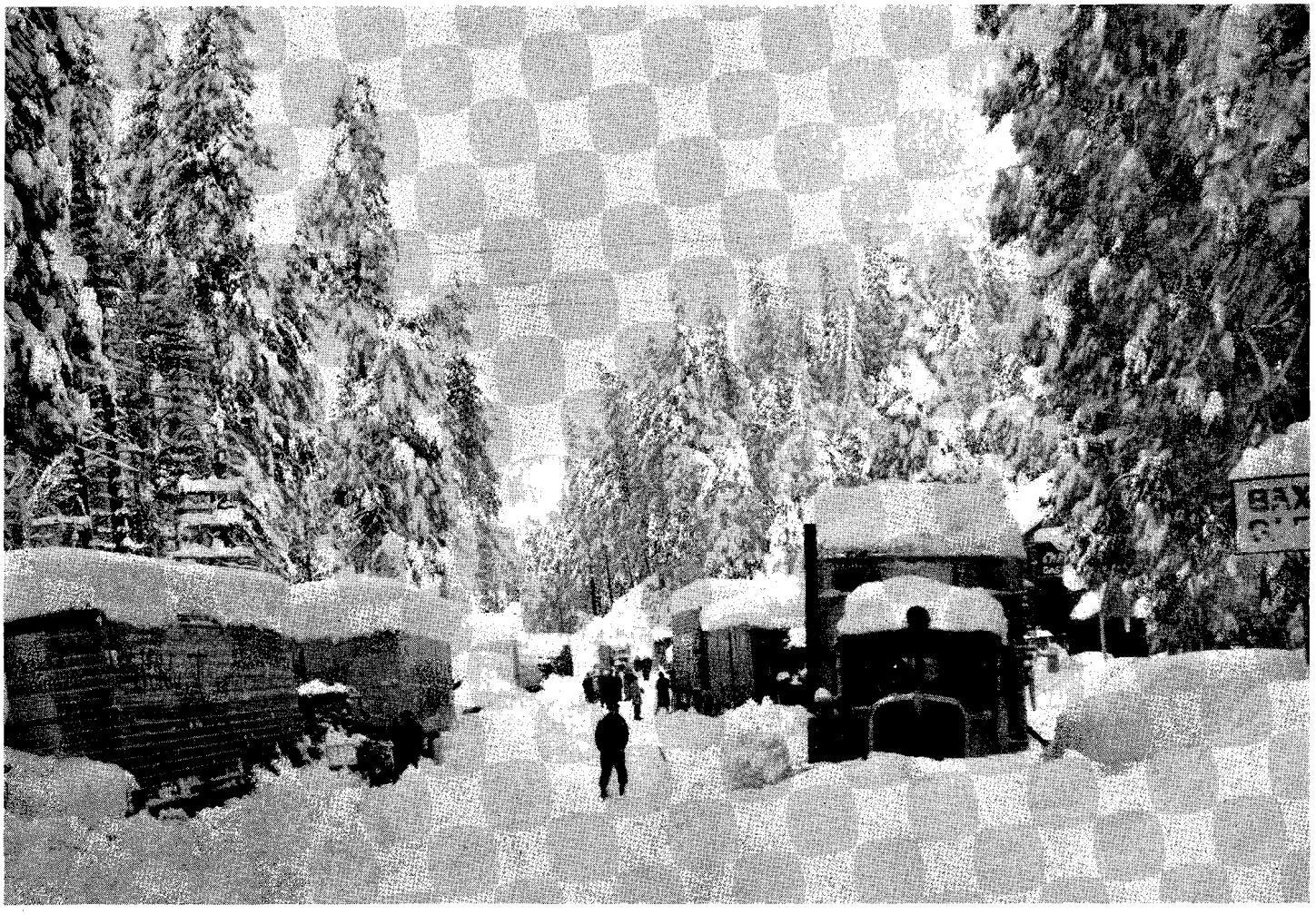
Epic Battle

Snow Removal Crews Wage Long Fight Against Record Storm

By N. R. BANGERT, Assistant Maintenance Engineer

THE GREATEST snowstorm in more than 50 years swept into Northern California on Thursday, January 10th, eventually bringing to a halt all transcontinental traffic on highways and railroads. Howling winds sweeping at velocities of 75 to 100 miles per hour drove freshly fallen snow into mountainous drifts, isolated many mountain communities for days, and set the stage for many courageous and dramatic rescue efforts, many of which probably remain unrecorded.

Storms during the month of December packed more than their normal punch through the Sierra Range between Bishop and the Feather River and several of the trans-Sierra routes, normally open to winter traffic, were closed for periods of a few hours to several days by blizzards and snowslides. During the latter part of the month, strong winds deposited great depths of snow on the steep east slopes. These deposits gave way without warning and swept across the highways.



The suddenness of the snowstorm trapped these trucks at Baxter on U. S. 40 on January 11th. Photo by San Francisco Chronicle.

One such avalanche, near the lower end of the Meyers Grade on U. S. 50, buried three maintenance men from the Echo Summit Station. One man, James S. Swafford, died before rescue workers were able to dig through the 10 feet of packed snow left on the road. Another avalanche, further down the grade, engulfed an unoccupied heavy push plow truck and carried it 300 feet down the slope.

Second Storm

Crews were barely getting roads in the mountain areas back to normal winter condition when the big January storm began to brew. This storm was preceded in the Sacramento Valley by several days of rain. On the east side of the Sierra, a preview of the storm to come took the form of high winds which swept the snow fields traversed by U. S. 395 on January 10th, and required the closing of this route until visibility improved. U. S. 50 was closed

east of the summit the night of January 10th as a precautionary measure since a new fall of snow threatened to precipitate fresh avalanches down the steep slopes above the Meyers Grade. U. S. 40, the main trans-mountain artery between San Francisco and Salt Lake City and the most popular truck route through the Sierra, remained open until 1.40 p.m., Friday, January 11th. Strong winds predicted for that day also materialized during the afternoon hours and made travel along the ridge near Airport slow and hazardous for traffic attempting to reach lower elevations.

Other Routes Closed

Eastbound traffic shut off by the closure of U. S. 40 and U. S. 50 sought passage over the more northern routes, such as the Feather River road, State Sign Route 24, and the Red Bluff-Susanville lateral, State Sign Route 36. These roads gave some relief during the early stages of the storm but finally closed on Sunday, January 13th, the first due to high winds and the latter because of drifts and traffic tieups.

U. S. 395, which skirts the eastern fringe of the Sierra, was closed by high winds on January 14th for three days and again on January 20th for an eight-day period.

As the area affected by the storm was so great and the road closures so complete, the first efforts of highway crews were directed to bringing relief to as many snowbound communities as possible in the shortest time with the equipment available. The opening of main roads for transcontinental traffic became secondary in importance.

Job for Communications

The severity of the storm was well-appreciated by Headquarters Office, as field conditions were forthcoming to that focal point by radio and teletype, day and night. The staff of the communications office at Sacramento, as well as informants in the district offices and at the superintendents' headquarters in the affected areas, worked "around the clock" for many days, gathering information on local conditions and relaying instructions concerning the deployment of men and equipment. The wisdom of expanding radio installations to include key equipment in virtually every foreman's territory was strongly confirmed during this storm.

As equipment on the high mountain roads became immobilized by breakdown or impassable drifts and as snow depths mounted in the foothill areas, the need for equipment capable of opening long sections of closed road became sharply apparent. Fortunately, at Headquarters Shop in Sacramento six new auger type rotary plows were awaiting assembly. An equal number were on hand at the North Hollywood Shop in Southern California. These new units had been obtained to replace worn-out and over-age equipment.

Reinforcements Rushed

At the first request for additional equipment, the equipment department threw its entire resources into the battle of plow assembly. Mechanics and shop foremen worked 16 to 20 hours a day to get the units out. The first of the six plows at Sacramento left the shop about 2 a.m. Monday, January 14th, the last on Friday, January 18th.

This equipment went into the field without the customary "shakedown" run and many of the "bugs" which developed during the first few days of operation under extreme conditions would normally have been discovered and corrected before the machines left the shop. The first auger plow from the southern shop was driven to Sacramento in an overnight drive, and immediately was sent on to the Truckee area by way of the Feather River road.

The shop men who delivered equipment into mountain areas often found it necessary to plow a road to their destination. Others, upon becoming snowbound, joined the regular crews in the "round-the-clock" operation of clearing slides and drifts. Mechanics at mountain stations spent countless hours at the grueling task of keeping the big machines rolling. Radio communication played a vital part in speeding the ordering of parts when breakdowns occurred.

Red Bluff-Susanville-Reno Lateral

State Sign Route 36 received some of the heaviest snowfall in its history, especially between Morgan Summit and Fredonyer Summit. During the first week of the storm, 80 mile an hour winds raged at times through this mountain area. A snow depth of 18 feet was recorded on the Morgan Summit gauge on January 22. Chester received a snowfall of about nine feet. Two heavy bulldozers working side by side were required to open the road between Chester and Susanville. This route received a second jolt on Friday, January 18th, when gale winds began to rage along the east slope of the mountains between Susanville and Reno. Fourteen-foot drifts piled over the road near Milford. Heavy tractor equipment was pressed into service to break the drifts and traffic was convoyed through the restricted portions between Susanville and the Nevada state line for a two-day period beginning Wednesday, January 23.

I. N. S. SENDS THANKS

Sacramento
January 28, 1952

MR. FRANK B. DURKEE
Director of Public Works
Sacramento

DEAR MR. DURKEE: As a veteran member of the press, and an employee of International News Service, I do wish sincerely to pay this tribute to you and your department and all its employees for their cooperation during the recent bitter high Sierra storms.

Especially, I am grateful for your prompt responses when the Southern Pacific streamliner City of San Francisco was snowbound in the mountains.

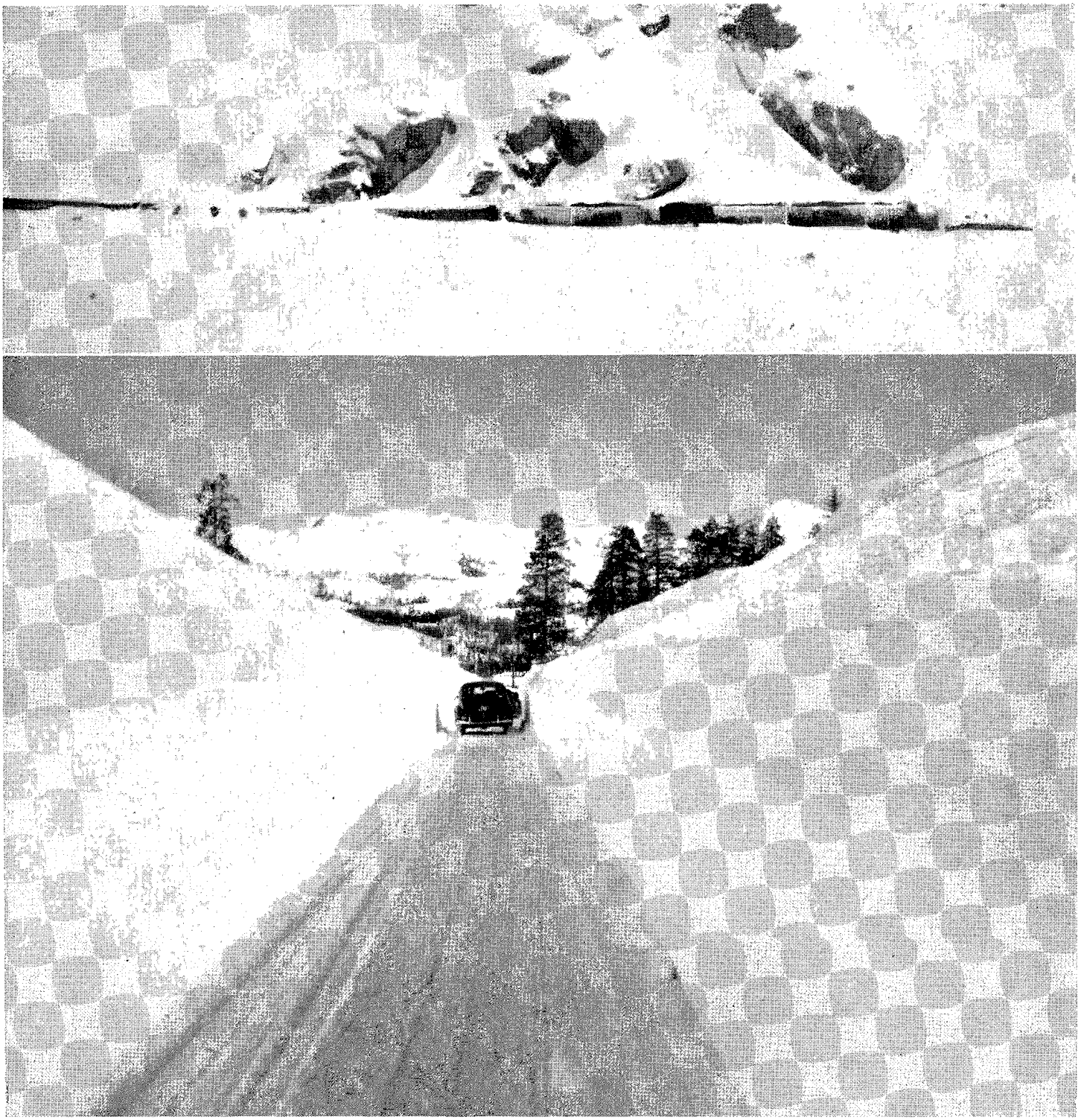
Had it not been for your very efficient communications system headed by your keen and alert Arnold H. Carver—coupled with the excellent work of Public Information Editor Kenneth C. Adams, we all would have been caught short.

It's a long serious story, but in a few words with which a newspaperman can express his deep appreciation of your operation, let me say: "You did a swell job—and a million thanks."

Best personal regards to you and your staff.

Sincerely,

A. NEIL SHAW
Bureau Manager
Room 224, State Capitol
Sacramento, California



UPPER—Stalled City of San Francisco and (BELOW) rescue road to train cut through by Division of Highways maintenance crew after many grueling hours of labor.

Feather River Route

Snow fell on State Sign Route 24 almost to the city limits of Oroville during the height of the storm. Rock slides in the lower Feather River Canyon and snow slides east of Rich Bar hampered the movement of traffic attempting to bypass the closures on U. S. 40 and U. S. 50. Snow fell to a depth of over two feet at Jarboe Gap, five feet at Quincy and seven feet at Spring Garden Summit. Extremely high winds buffeted the area from Blairsden to Hallelujah Junction and at times reduced visibility to zero. Mountainous drifts covered the road through the Sierra Valley between Portola and Chilcoot Pass. Snowplow units were

Plow clears path through deep drift on U S. 50

slowed or stalled by the excessive drifts and bulldozers were used on several occasions to break the road open. Portions of this road opened at intervals to restricted local traffic, and the entire route was declared open to all traffic on January 29th. During the height of the storm, three bulldozers were used to supplement plow equipment on State Route 83 between the Feather River Road and Greenville.

Grass Valley-Downieville Area

The Yuba Pass Road, State Sign Route 49, through Downieville and Sierra City, was closed early in the storm by rock slides and heavy snowfall. State Sign Route 20 east of Nevada City also closed due to snowfall and drifting. Records show the following maximum snow pack figures: Nevada City 26 inches, Downieville 72 inches and Sierra City 96 inches.

A rotary plow was brought north from the Stockton District to reopen the road towards the lumber town of Washington, 18 miles east of Nevada City. Going on this road was tough as snow depths up to eight feet were encountered, and eight days were required to plow to a point which could be reached by bulldozers working from the town. Rock slides hampered the efforts of a rotary brought in from U. S. 40 to open State Sign Route 24 through Downieville to Sierra City. An opening to the latter city, at many places through nine-foot drifts, was made by January 24th.

THANKS FROM UNITED PRESS

THE UNITED PRESS ASSOCIATIONS
SACRAMENTO

MR. FRANK DURKEE
Director of Public Works
Sacramento, California

MY DEAR MR. DURKEE: We should like to express our appreciation for the cooperation afforded by your department in aiding us in our coverage of the stalled southern Pacific streamliner.

Our thanks go particularly to your communications office headed by Mr. Arnold Carver and to Mr. Ken Adams.

Sincerely,

WALTER L. BARKDULL
Acting Manager

Far North

U. S. 299—Redding to Alturas—also received its share of snow and wind, with closures occurring at Big Valley Mountain and at Adin Mountain. Wind-drifted snow partly filled the upper end of Howard Gulch on the Canby-Tulelake Highway, and bulldozer operation was required to open the route. Heavy drifting also occurred on that portion of U. S. 395 between Johnsonville and New Pine Creek, especially north of Secret Valley and on Sage Hen Summit near Likely. The McCloud-Burney connection and the Mt. Lassen recreational stub likewise suffered the effects of high winds. Travel on U. S. 99 north into Oregon, by comparison, was not severely affected, as blizzard conditions and periods of heavy snowfall were of relatively short duration.

U. S. 395

The portion of U. S. 395 in Mono County north of Bishop suffered heavily from high winds for a two-weeks' period beginning January 14th. A wet snow condition, uncommon to the area, formed an extremely hard pack, and heavy tractor equipment, special snow units under test by the Navy at Crestview, and explosives were marshaled to break 10- to 15-foot drifts. Maximum snow readings for several of the stations follow: McGee Creek 52 inches, Crestview 72 inches, Conway Summit 54 inches, Sonora Junction 40 inches.

North Shore Area

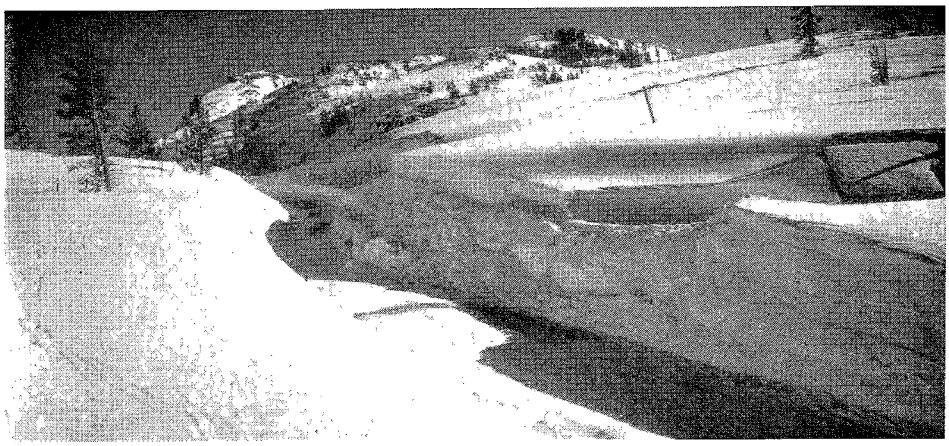
Snowfall of almost unprecedented proportions, accompanied at times by high winds, blanketed the area at the north end of Lake Tahoe. A pack in excess of seven feet developed in some areas. As roads radiating south and east of Tahoe City became impassable to even the heaviest snow trucks, efforts were concentrated on keeping open a life line along the Truckee River between Tahoe City and Truckee. This life line was broken many times by snowslides which developed on the east slope of the canyon, particularly in the vicinity of Deer Park. Swift moving avalanches overran the road in several places to depths of 17 feet and formed solid barriers, against which rotary plows made agonizingly slow progress.

Equipment breakdowns at points far from replacement centers slowed the efforts in this area. Efforts to cut emergency roads through to Brockway and to Homewood and Meeks Bay were frequently hampered by the necessity of returning equipment to new closures along the Truckee River. Aided by equipment brought in from the Sacramento side via northern routes, crews completed an emergency road to Brockway on January 30th. A similar road was pushed as far south as Bliss Park on the west side by February 3d.

U. S. 40

Under average winter conditions, sufficient plow equipment is assigned to U. S. 40 to handle the notoriously heavy falls of snow expected in the Donner Summit area. The storm which broke into full fury January 11th was not, however, an average storm and, as drifting and low visibility prevailed on all roads in the mountain area, equipment could not be spared from the side roads. Although assigned equipment on U. S. 40 remained in operation until broken beyond immediate repair or overwhelmed in impassable drifts, there came a time during the first weekend when virtually all efforts ground to a stop. Isolated crews concentrated on the digging out or repair of equipment and attempted to maintain contact with local sources of supply.

The stalling of the crack streamliner of the Southern Pacific near the Yuba Gap Maintenance Station spurred the road crew at that station to superhuman effort to break open the road which permitted the eventual rescue, without mishap, of all passengers and train crew. The story of this dramatic action is recounted elsewhere



This was a typical drift condition that prevailed on U. S. 40 at Donner Summit

CLEARING OF SIERRA ROADS WAS HERCULEAN TASK

Motor vehicles are proceeding over the Sierra on Highways 40 and 50 for the first time in nearly a month. Back of this announcement is the story of as hectic a battle as man ever waged against the elements in the West.

The roads went under early in January when the clouds dropped eight feet of snow on the Sierra in less than a week. As though that were not enough, the storm king threw some 100 miles an hour gales at the highway crews, making the task of clearing the highways an impossibility.

Thirty-foot drifts—almost as high as a three-story building—clogged the rights of way and the temptation must have been strong to let the thing lie until spring.

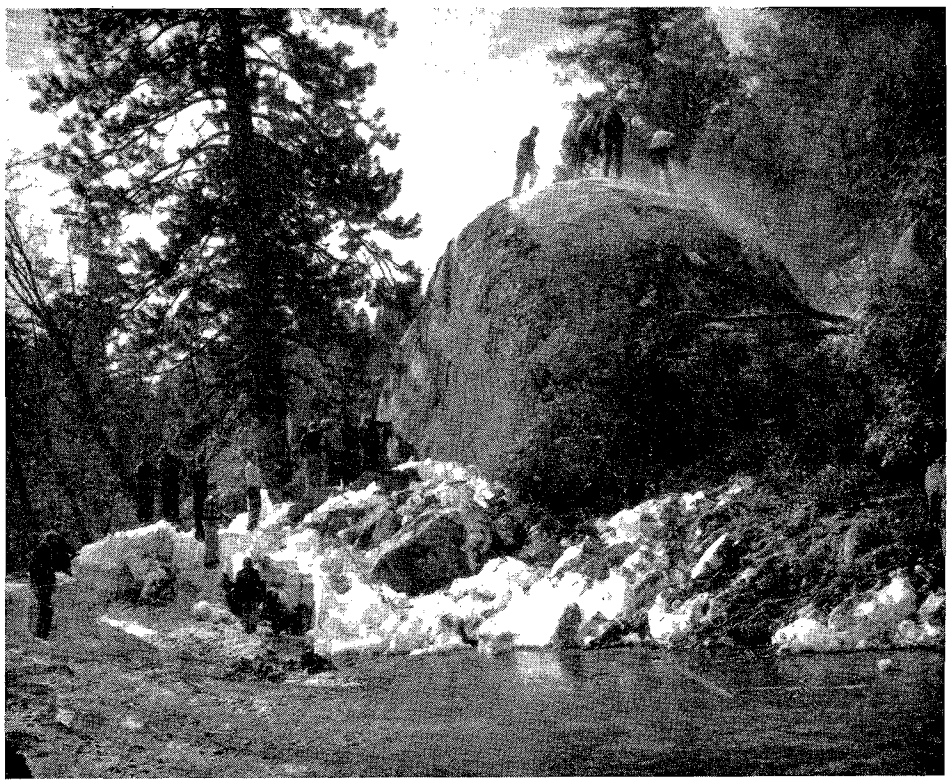
However, working around the clock, ofttimes in blizzards and always under the threat of snow and land slides, the crews finally carved passageways through the drifts to restore the traffic on these vital highway arteries.

It was a Herculean task when all the adverse factors are considered. The highway department, from State Highway Engineer G. T. McCoy down to the men with the shovels, deserves a lot of credit for its dogged efforts.

Only in that way was victory achieved on the Victory and Lincoln Highways.

—*Sacramento Bee*

On Saturday night, February 2d, this huge boulder weighing approximately 4,000 tons, blocked U S. 50 one mile and a half east of Kyburz



in this issue of *California Highways and Public Works.*

Drifts 10 Feet Deep

Even before the gale subsided, crews from the Colfax Station manned additional plows and began to open a narrow path uphill from Baxters toward Airport where drifts up to 20 feet in depth covered the road. Two rotary plows, working from the west, met "Old Faithful"—the lone survivor from Yuba Gap—as it "holed through" the biggest drift at Airport at 10 a.m., Thursday, January 17th.

Aided by clearing weather, and repaired equipment from Donner Station, reopening of the remaining 16 miles between the train rescue point and Donner Summit went rapidly. An emergency road sufficient to permit the bringing in of food and fuel supplies was established by Friday, January 18th. Unrestricted traffic was permitted as far as Donner Summit by Sunday, January 27th.

Work was immediately started on the opening of the road down the steep east slope. The progress was slow as the summit cut had drifted with snow to a depth of 16 to 20 feet.

Explosives Required

At first, large hand saws were used to cut through the upper portion of the drift to permit more rapid undercutting and disposal of the snow face by the rotary plows. Later, as the drifts consolidated, explosives were required to fracture and dislodge the snow. Progress through some of the deeply drifted cuts was very slow, less than 300 feet being made at times in 24 hours of operation. Similar operations were started at the lower end of Donner Grade as soon as plows could be released elsewhere from the task of driving roads to snow-bound communities. Snow depths of 40 feet were encountered in some spots and much of the work was undertaken under the threat of sudden engulfment by snowslides. A narrow service road was punched through by 6 a.m. February 5th, but much widening of the roadway, back sloping of the icy slopes, and shooting down of overhang was required before the road could be opened to traffic Friday, February 8th.

At one time during the blizzard, all roads out of Truckee were closed and in order to re-establish contact with the east, it was necessary to use large bulldozers to move mountainous drifts for several miles east of the town and to recut a trench to the state line. Snow pack in the Truckee area was exceptionally heavy, an estimated 10 feet being reported at one time.

Snow Depths

Listed below are a few of the recorded snow depths at Norden for December and January:

December 25, 1951	57 inches
January 1, 1952	121 inches
January 10, 1952	118 inches
January 17, 1952	218 inches

During the period January 10th to January 17th a snowfall of 138 inches was recorded.

U. S. 50

The storm dealt a somewhat different type of misery to the snow crews at Echo Summit and at Placerville on U. S. 50. Heavy wet snow accumulated to great depths on the canyon slopes west of the summit and began to slide across the road at a number of points. A bus load of students trapped by the rapid fall of snow on Friday night, January 11th, took shelter at the Echo Summit Maintenance Station. Several families from Audrain, Phillips and Echo Chalet also sought refuge at the Maintenance Station. Snowslides between Kyburz and Echo Summit prevented departure of the bus until Thursday, January 17th.

At Twin Bridges, on Monday, January 14th, a snowslide partly destroyed the store and resort building, killing two occupants of the structure. Highway radios played a prominent part in the rescue operations, as the Echo Summit foreman was able to summon a rotary plow to assist in digging to the crushed building and in enlisting all possible aid from Strawberry Lodge, to the west.

Saved by Radio

Radio communication was also largely responsible for the speedy rescue of the three men trapped under 10 feet of snow on lower Meyers Grade on the morning of December 30, 1951. As the crews were changing shift at that hour, one of the men going off shift was in the process of turning a radio-equipped express around while two other operators approached nearby on foot. As the slide struck, the men on foot were whisked to the side of the snow trench and the express was turned over on its side and buried under five feet of snow. During the first few moments that followed, the operator in the express heard his foreman at Echo Summit giving the road and weather report to Placerville. Chancing that he might be heard, he fumbled in the dark for the microphone and called the summit. The foreman answered immediately and rushed all available men in camp as well as men from nearby utility service crews to the rescue. The operator in the express was able to dig his way to the surface. The men who had been on foot were buried 1¼ hours; one was revived but the other failed to respond although artificial respiration was applied for 1½ hours.

A maximum snow pack of 170 inches was recorded at Echo Summit on January 26th.

A small resident crew stationed temporarily at Tahoe Valley worked doggedly through deep drifts to keep that portion of U. S. 50 open until heavy rotary equipment could be brought in through Nevada. Such equipment was sent from Yuba Gap, via Quincy and Carson City, as soon as Spooner Summit west of the latter city was opened on January 28th.

Breaking of the last barrier, the deep snowslides on Meyers Grade, permitted the opening of the entire route to through traffic on Saturday, February 9th.

At the south fringe of the storm, road crews on highways leading to the ski areas east of Stockton were likewise embroiled in a snow battle unequalled for many years.

The effort expended by maintenance crews, shop personnel, and other service units during such a storm cannot be fully comprehended or appreciated. The magnitude of the operation, however, can in some measure be realized by comparing the snow removal cost figures in the following table:

January Snow Removal Expenditure

	1950-51	*1951-52*
District II	$87,238	$298,279
District III	76,248	193,075
District IX	18,843	74,264
District X	13,815	39,968
	$196,144	$605,586

San Francisco Chronicle

THE CITY'S ONLY HOME-OWNED NEWSPAPER

Founded by M. H. de Young, Publisher 1865 to 1925

GEORGE T CAMERON, Publisher PAUL C. SMITH, Editor

EDITORIAL PAGE

The Blizzards Breed 'Em Tough

The Sierra train rescue called public attention to the mountain men who work along Route 40, fighting snow to keep the highways, rails, power lines and telephone circuits open. These particular maintenance crews of the Highway Division, the Southern Pacific and the Pacific Gas and Electric and the Telephone Company deserve all the praise and thanks they're getting from the City of San Francisco's passengers and the general public, but while the iron is hot we'd like to strike it for a mention of all the numerous mountain fraternity up and down the range.

On every Sierra road, from early fall till late spring, highway maintenance crews have snowdrifts to fight, power and phone company "cruisers" have their poles and lines to tend, and the millions down in the (occasionally) sunny lowlands never give them a thought. Skiers, perhaps, are the exception. The familiar week-end road-condition notice, "Chains advised on Route 108," usually means that on Friday a team of highway maintenance men has sweated a snowplow up the grade to make way for the Saturday sedans full of skiers. And, likely as not, the highway crew's Sunday dinner will be interrupted by a call to go to the rescue of a stranded party of big-city snow bunnies.

The blizzards breed 'em tough, and life above the snow line is hazardous. When a mountain man's pickup truck stalls, or his weasel or Sno-cat breaks down, he is thrown back onto his own hind legs, so to speak; back where the '49ers were, or the Indians before them, in a man-against-nature conflict.

A letter in the Forum from Vida M. Jones of Menlo Park suggesting that the first day of spring be set aside to honor these "valiant crews" is not the least appropriate idea we've heard expressed during this week of the Big Storm.

MAN vs. SNOW

By ART HOPPE
San Francisco Chronicle

The month is October.

Out in the North Pacific, air currents swirl and dance. They grow and swell and a storm is born—the first of the season.

Slowly the titanic forces begin to move. Ponderously they roll south.

In the State Highway Maintenance Station at Yuba Gap, 14 miles west of Donner Summit, the air still holds the warmth of late summer. The black asphalt of United States Highway 40 outside the door is warm to the touch —heated by the sun and the thousands of whirring automobile tires.

Inside the maintenance station, all is quiet. The beds in the dormitory are empty and the cribbage boards lie idle. The summer's work of oiling and patching the road is over. The winter's work has not yet begun.

The 14-foot red steel snow stakes have been spaced along the highway to guide the snowplows when the drifts get high. And in the "barn" next door to the station, the huge rotary snowplows stand ready—their augers sharp, their fans well-oiled.

The big dump trucks have been fitted with their concave, 10-foot blades in front, and their beds are filled with sand and gravel to give weight to their rear wheels in the snow.

The men are in their homes in Colfax and Auburn, Dutch Flat and Alta—having a Sunday with their families.

In the maintenance station, Pat Patchel, the cook, reads in his room.

"A new storm is bearing down on Northern California," says the slightly-bored voice of the radio announcer. "* * * possibility of snow in the high Sierra * * *."

Patchell sighs, gets to his feet and cranks the bell on the partyline telephone.

In homes in Colfax and Auburn, Dutch Flat and Alta, the phones begin to ring.

By nightfall, the men are back on the station, cursing good-humoredly. The sky now has darkened and gusts whip through the evergreens and stir the deep bed of pine needles that covers the Sierra. The first few flakes of the new winter flutter down, melting at first, but building up slowly—billions upon billions.

By early evening, the white line in the middle of the highway has disappeared and the two big push plows roll out of the barn. Just behind the push plows, Foreman Jack Snider dispatches his motor grader. Its narrow 12-foot blade bears down on the pavement with the full weight of the high-cabbed truck behind it and it can scrape the asphalt bare.

Yuba Gap's two big rotaries are kept in reserve in the barn. They are of no use until the snow gets deeper.

By morning, the skirmish is won. The highway is clear except for a jumbled three-foot pile on either side, pushed there by the diagonal blades on the plows. The snow has stopped falling.

"Better get the rotaries working on the pile," Snider radios the barn from his pickup truck in which he is patrolling the road. We'll need that space for the push plows if another storm hits."

The rotaries roll up the road, chewing away at the accumulation on the sides, spewing it far from the road.

On their fronts is a six by eight-foot opening like a shallow upright box. Inside the box three rows of augers, meat-grinder-like, send the snow into a two-foot hole in the middle of the box. There it is picked up by a whirling fan and shot out in a 100-foot plume through a funnel above and behind the augers.

When one has passed, the jumbled banks are neat and square as though some huge hand had sliced them with a knife.

"1162," comes the voice of the dispatcher at Yuba Gap to Snider over the Highway Department's modern FM radio system. "1162. He's got a broken short axle. Just this side of Tin Barn."

Snider swears softly. This is the headache. Breakdowns. Not so much now, but later in the year when the plows are working night and day * * *.

The month is January. January 10th —a Thursday.

The forecaster is talking about a new storm. But Highway 40, closed for four days over the New Year's holiday, is in good shape. The road has

LETTER OF APPRECIATION

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

DEAR MR. DURKEE: Now that the snow is cleared out of my hair—even though it might still be in yours—I would like to take this opportunity to thank your staff and road crews for their courtesy and intelligent cooperation during our coverage of the snowbound streamliner, City of San Francisco.

You have a grand gang and you can be proud of the job they are doing. I know you expect your men in the field to be up all night but I think you should know how many times I aroused Ken Adams to get a little bit more information. He was always more than willing.

Please feel free to call upon me for any help I might be able to give you.

Sincerely,

ABE MELLINKOFF
City Editor
San Francisco *Chronicle*

PRAISE FOR SNOW CREWS

MR. JACK SNIDER
Yuba Gap Highway Maintenance Station
Yuba Gap, California

DEAR MR. SNIDER: I know Art Hoppe and Ken McLaughlin have told you how much the *Chronicle* appreciated your unstinting cooperation during their coverage of the City of San Francisco. I have written Sacramento telling them what I think, but I would be remiss if I didn't send a personal word to you and your gang.

Your job in the snow has been—I hope—well recorded in this paper but I want to add a word of warm appreciation for your cooperation with our guys on the story.

Sincerely,

ABE MELLINKOFF
City Editor
San Francisco *Chronicle*

been widened out to maximum by the rotaries and there seems to be plenty of room for the push plows to shove aside any new snowfall.

There have been only five days since November 13 when it hasn't snowed. The pack along the road is six feet deep.

It begins to snow again in the morning and the push plows roll. By mid-afternoon the rotaries are out again. Shifts are changed at midnight. The men will work until noon the next day, eating sandwiches in the cabs of their equipment.

A howling wind sweeps across the mountains and into the canyons, carrying the snow before it. Visibility is cut to nothing.

At 1.20 p.m. Friday, Snider orders the road closed. He still has a narrow, two-way road, but the parking lots are filled with snow, and only emergency traffic can be allowed through.

The California Highway Patrol sets up a road block at Colfax and the cops are tough on motorists with excuses. They know from experience that some skiers will swear to anything—starving relatives, doctor needed—in order to get to resorts.

Then, finding no parking spaces off the road, they leave their cars on the highway and the snowplows can't get through.

Saturday—Still snowing; road still open to emergency traffic. A falling tree crashes through the windshield of one of Snider's two rotaries, putting it out of commission for a precious 90 minutes.

Snider orders it lubricated while being repaired. Lubricate all equipment every 48 hours. His other rotary is having trouble with its fuel pump, but it keeps going.

Both rotaries are having trouble with fallen trees and rocks that have slid down and been buried in the drifts. When the augurs on a rotary hit a rock, a small shearing pin breaks to save the heavier machinery and the crew must get out into the gale, take off their gloves and put in a new pin with their blue hands. Three times in an hour * * * ten times * * *.

Down in Marysville, R. I. (Nick) Nicholson, boss of snow removal on Highways 40, 50 and State Route 24, is generaling his forces by radio.

Brand New Rotary

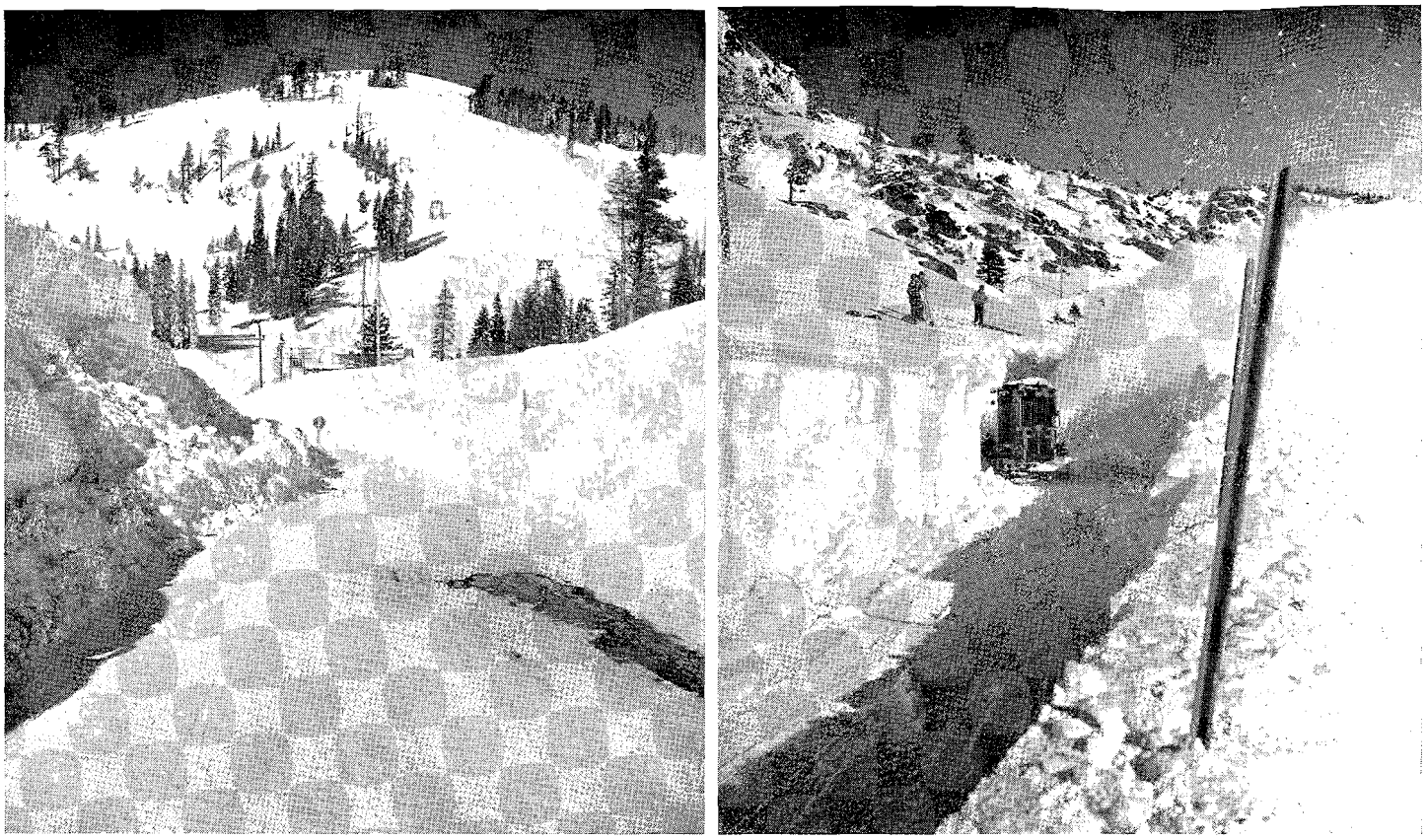
A brand new rotary is almost ready to go from the State's garage in Sacramento. "All it needs now is a coat of paint," he is told.

"You can forget the paint," Nicholson tells the radio. "Get it up to Snider as is."

Sunday—The snow is heavier. Five feet have fallen in the past three days. Snider is losing ground—even with the third rotary. He only has a one-way road open now. But the storm lets up in the afternoon and by late Sunday night, the road is again two-way, though narrow, in most stretches.

Monday—A new storm strikes. This one is a blizzard with 100-mile-per-hour winds. The drifts are soon over

Plows open road through deep drift at airport on U. S. 40



LEFT—Temporary end of road just west of the Donner Summit Maintenance Station. (Popular ski slope in background.) RIGHT—Auger type rotary plow cutting through drift just east of Donner Summit.

the snow markers along the highway and the plow operators steer by feel. It is a fine, powder snow falling and the wind picks it up and drops it into the 16-foot-deep trough that is Highway 40.

The two push plows are soon helpless. Their drivers take shelter in a roadside garage.

By midafternoon the word comes through from headquarters: "Abandon the road."

An hour earlier, the newscast had told of the snowbound City of San Francisco, only a mile and a half from Yuba Gap, with 226 passengers aboard. And though the Highway Department had not yet been asked for help, Snider wanted to get his equipment back to the barn in case of emergencies.

But the new rotary is cut off at Baxters, 10 miles west, by 25-foot drifts. Old 1162 has broken an axle again and is helpless until a truck can deliver the parts.

Snider, in his pickup, reaches the third rotary just six miles to the west about dark. "Let's get her home," he yells above the blizzard.

They reach the two snowbound push plows and the rotary digs them out. The caravan turns back toward Yuba Gap. But after only a mile, the windshield wiper on the rotary breaks. Struck blind, she goes up and over the bank.

Long, Long Mile

Without the rotary, the other vehicles are helpless and the men walk a long, long mile through the howling darkness to shelter.

It is the first time since 1938 that Highway 40 has been abandoned to the elements.

The story of how Snider and the seven men with him dug out their rotary by hand the next day and battled drifts for 24 hours to rescue the passengers on the streamliner has already been told.

The next night, with the passengers safe, the Yuba Gap crew returned to the job of clearing Highway 40—now just a faint depression in the wilderness of white. The night and day struggle of the big rotaries has to begin all over again. And the next day a new storm strikes.

The battle in which Snider and the 27 men at Yuba Gap took part was only an incidental action in the total war the State waged against The Storm.

In all, the State had 1,200 men and some 400 snow plows and trucks in its battle lines.

Just how many thousands of tons of snow they moved, no one will estimate. But department officials say that more than 35 feet of snow has fallen at Donner Summit since those first few flakes last October.

The goal of the 1,200 men is simple—two lanes of black asphalt, with plenty of parking spaces.

And for this, the department spends an average of $500,000 each year. This year the snow removal bill is expected to reach $1,000,000.

SIERRA CREWS FIGHT DRIFTS

By JACK WELTER
San Francisco Examiner Staff Writer

EXAMINER BUREAU, SACRAMENTO, Jan. 26.—Unheralded heroes still battled in the high Sierra today against the worst winter of the century.

They are the dog tired members of state highway crews, fighting in constant danger for the 17th straight day to dig clear the two main transcontinental routes.

Treacherous avalanches of snow have killed three persons along U. S. Highway 50 alone. But the highway maintenance men with their spewing rotary plows have struggled on to the flanks of the summits on both U. S. 40 and U. S. 50.

Save Stranded

Their work was largely responsible for rescue of the City of San Francisco train crew and passengers. Since then they have saved many another stranded person and bucked roads through for transport of food and medicine to buried communities.

Often, they have had to backtrack hurriedly to save themselves when snow threatened to close in behind them. But without rest they return to the attack against their icy white enemy.

When they can clear the highways completely is an unanswered question. It depends on fate and weather. The outlook is not bright. Crews had to work 40 hours on a single drift on Highway 40. There are uncountable snowblocks ahead of that.

Main Enemy

"I wouldn't attempt to say when we'll have them open," said George F. Hellesoe, Division of Highways maintenance engineer. "It depends entirely on the weather. Our biggest enemy is wind.

"And," Hellesoe added gloomily, "we're now entering our heavy snow season. Ordinarily, our worst snow and blizzard conditions in the Sierra occur from about now to the end of February.

"If it hadn't been for the hurricanes and gales, we could have handled a 200-inch snowfall without too much trouble. But when you get hurricane winds, they blot out visibility, drift the snow and fill the roadbed entirely. Then the pushplows are no good and you have to send the rotaries through, backing and banging, to open a single lane.

"We're faced with the added problem of snowslides. So far these conditions have been worse on U. S. 50."

But Hellesoe noted that the worst is yet to come on U. S. 40, where rotaries have gnawed their way into a tremendous drift a thousand yards eastward from the division maintenance station on Donner Summit.

Steep, Smooth

"On the east side of both summits," he said, "the rock formation is very steep and very smooth. We know there have been almost continuous slides and drifts on Donner, and the problem is what will happen when we get to the area subject to slide. In one place, the highway cut is 50 feet deep on the inside, and on the outside of the road we know there's a big tank truck stalled. There's no sign of it at all."

Hellesoe said a snowslide is a more sinister menace than the average rock or earth avalanche.

Road Closed

"With a landslide, there usually are some warning fragments. But a snowslide gives no warning whatsoever. You don't know how they'll react until you get to them."

Primarily because of this ever present danger, the division of highways has kept U. S. 40 closed above Colfax even though it has cleared a deeply-entrenched two-way road to Donner Summit. The road also is open from Truckee to the foot of the grade on the east side. Traffic similarly is banned beyond Kyburz on U. S. 50, although a good roadway has been opened to Echo Summit maintenance station.

Unpredictable weather conditions and inability of overworked equipment to take time to clear parking areas are other factors. Hellesoe said a snowplow began bucking the Echo Summit drifts then was forced to pull out when the latest storm refilled the roadway as fast as it was cleared. Such incidents have occurred repeatedly.

Expanding on the danger of slides, he said there have been two across a quarter mile stretch of U. S. 50 bordered by an innocent-appearing meadow. One avalanche broke loose high on a mountainside, swept across the meadow and highway and snapped off a two foot thick tree on the opposite slope. Another Echo slide engulfed a parked Cadillac.

Car Squashed

"When it was finally dug out it looked like it had been through a big press," Hellesoe said.

Slides have recurrently blocked the Tahoe City-Truckee highway. Only a rotary plow, slicing perpendicularly with its cutting bars and feeding snow into its powerful blower with its six-foot high horizontal augurs, can handle such slides. Hellesoe accordingly constantly shifts heavy equipment to areas of greatest need, but seldom without criticism from those deprived of it.

Highway 40 has been closed since January 11th, and U. S. 50 since January 10th. Only once before, during the 1937-38 blizzards, has Highway 40 been closed more than temporarily since the State began keeping it open the year round in 1931. On that occasion it was closed 10 days. Regular clearance of U. S. 50 was begun in 1940-41 and 1941-42, abandoned during the war years, and resumed in 1945-46.

Tales of heroism, ingenuity and backbreaking labor are common among the State's highway men.

One of the brightest is the story of the events that preceded release of the stormbound passengers of the Southern Pacific's City of San Francisco streamliner on January 18th. They were transferred from the stranded train to a relief train at Nyack via a roadway gouged out by a lone state highway plow.

Foreman Jack Snider of the Yuba Gap Maintenance Station fought blizzard conditions on Monday, January 14th, to rescue two men stranded in push plows above Pioneer Station on United States 40. With an "express" truck and a rescued pushplow truck trailing him, he wandered off the edge of the highway at 7 p.m., Monday, under conditions of zero visibility.

At midnight, exhaustion, cold and hunger forced suspension of efforts to extricate the plow. The men made their way to a small lodge near Butts Lake,

where they first learned of the Streamliner's plight.

Shovel Job

From daylight until 4 p.m., Tuesday, they labored with shovels to clear 135 feet of roadway and get the rotary back on the road. In the meantime the roadway back to the Yuba Gap station had plugged full again and the rotary's windshield wiper failed.

With weather conditions and the mechanical failure blinding the plow crew, Snider used his intimate knowledge of the highway alignment to direct the convoy home via two-way radio to the rotary from his place in the following express truck.

The rotary reached Yuba Gap at 4 a.m., Wednesday; a fresh crew took over under more favorable weather conditions, and four hours later had covered the 1.3 miles to the point where the Streamliner's passengers were picked up by auto from Nyack Lodge.

At 11 p.m. the plow completed the return trip to Nyack and the way was clear for one of the most dramatic mass rescues in the colorful history of the high country.

"The only other rotary in the area was broken down," Hellesoe said. "It's a funny thing, but equipment, like human beings, is sometimes naturally obstinate. Always before, that one had been a maverick."

FROM ASSOCIATED PRESS

THE ASSOCIATED PRESS
Sacramento, California

January 31, 1952

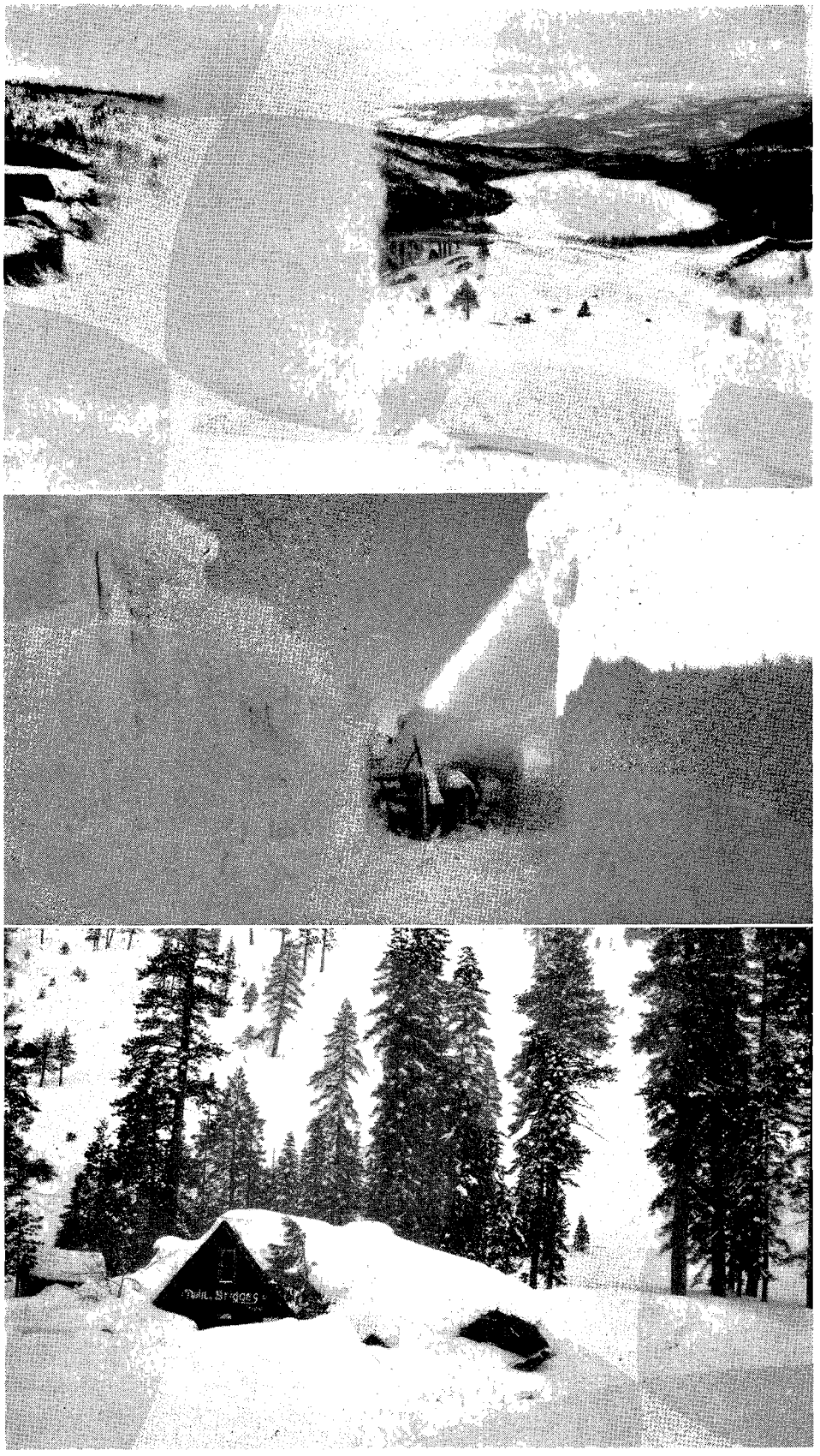
MR. FRANK B. DURKEE
Director of Public Works
Sacramento

DEAR MR. DURKEE: I must express our appreciation for the splendid cooperation by the Department of Public Works during the difficult days of California's big storm a few weeks back.

The department's ready help facilitated news coverage of the marooned City of San Francisco in the Sierra and of road conditions throughout the State.

This was public service at its finest.

Sincerely,
(Signed)
MORRIE LANDSBERG
Correspondent



UPPER—Auger plow working in a deep drift east of Donner Summit on U. S. 40, Donner Lake in distance. CENTER—Clearing a path through a deep drift at airport on U. S. 40. LOWER—Twin Bridges resort on U. S. 50 partly destroyed by snow avalanche which swept down from slope in background, killing two persons.

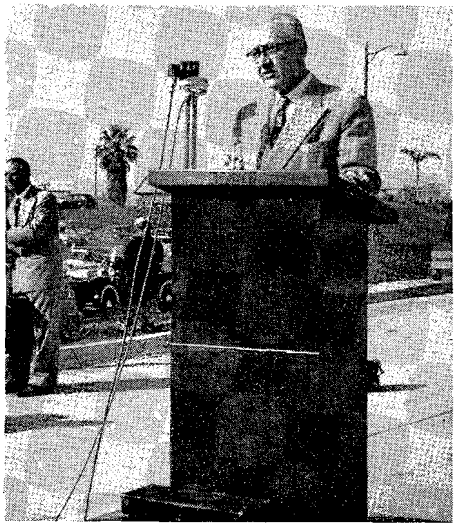
Christmas Gift

Hollywood Freeway Through Los Angeles Civic Center Open to Traffic

By R. C. KENNEDY, Secretary, California Highway Commission

THE CITY OF LOS ANGELES received a Christmas present from the California Highway Commission and the Division of Highways on December 20th, last, for on that day a half mile of the Hollywood Freeway, extending through the Civic Center, was open to traffic.

Sponsored jointly by the Downtown Business Men's Association, Central Business District Association and the Los Angeles Traffic Association, dedicatory ceremonies started at 11 a.m.



PAUL O. HARDING

Robert Mitchell, President of the Los Angeles Metropolitan Traffic Association, presided and the usual coteries of state, city and county officials all made appropriate remarks.

Among the speakers were: Robert Mitchell, President, Los Angeles Metropolitan Traffic Association; Mayor Fletcher Bowron, Roger Jessup, Chairman, Los Angeles Board of Supervisors; Postmaster M. D. Fanning, Harold Henry, President, Los Angeles City Council; City Engineer Lloyd Aldrich, Oscar Trippet, President, Los Angeles Chamber of Commerce; Harry Volk, Neil Petree and Felix Chappellet, Metropolitan Traffic and Transit Committee; City Traffic Engineer Ralph Dorsey, Chief of Police William Parker, Assistant City Engineer Lew Arnold, Bernard Caldwell, Howard Stites and Eugene P. Clark, President, Central Business District Association.

Paul Harding, Assistant State Highway Engineer in charge of District VII, called attention to a number of members of his department and the different contractors who had made the work possible. Harding lauded Spencer Cortelyou, who immediately preceded him in charge of District VII, and who is now retired.

Edward R. Valentine, president of the Downtown Business Men's Association, spoke on the importance of freeways and especially of this small section that was being opened, and complimented the Highway Commission and the Division of Highways on the job they were doing.

The final address was given by Highway Commissioner Harrison R. Baker.

"The opening of this relatively short portion of freeway today is important because it directly affects about 100,000 people daily, about a half a million people daily indirectly, and about four million people with a vision of things to come," Valentine said.

"It is important because it provides access roads for hundreds of thousands of people daily to come and go from their business, their jobs, and their shopping in the biggest destination center west of Chicago, Downtown Los Angeles.

"There was a time when the road builder thought, rightly, only of a straight road between two points. Yet we know that the State Division of Highways, and the City Engineer's office spent months of man-hours figuring the most important subject—how to get the cars where they want to go, from the freeway to office, job, or store.

"The opening of this portion of the freeway is important because 100,000 people will get relatively much more real good out of this little half-mile than they have so far from the six miles from Grand to Western. It is important because thousands of drivers now congesting downtown streets to get across town will use this freeway instead, and other thousands of our good citizens will get better use from downtown streets.

"It is important because we can begin to see the freeway picture start to develop. People are beginning to recognize the amazing savings in time.

CITY ENGINEER LLOYD ALDRICH

"People are beginning to be able to go from Hollywood to downtown, or from downtown to Hollywood in 15 minutes by automobile. They can go from Rosemead and Garvey to downtown (or vice versa) in 17 minutes. All this was *before* the opening of this half-mile. These access roads should take from 2 or 3, to 5 minutes off that time, depending on the time of day.

"The success of this freeway, where it's so sorely needed and can be so sorely tested, will insure the building of other freeways, *throughout* Los Angeles."

Baker Tells of Program

Commissioner Baker quoted figures to show the huge scope of the Freeway Program in Metropolitan Los Angeles. He said:

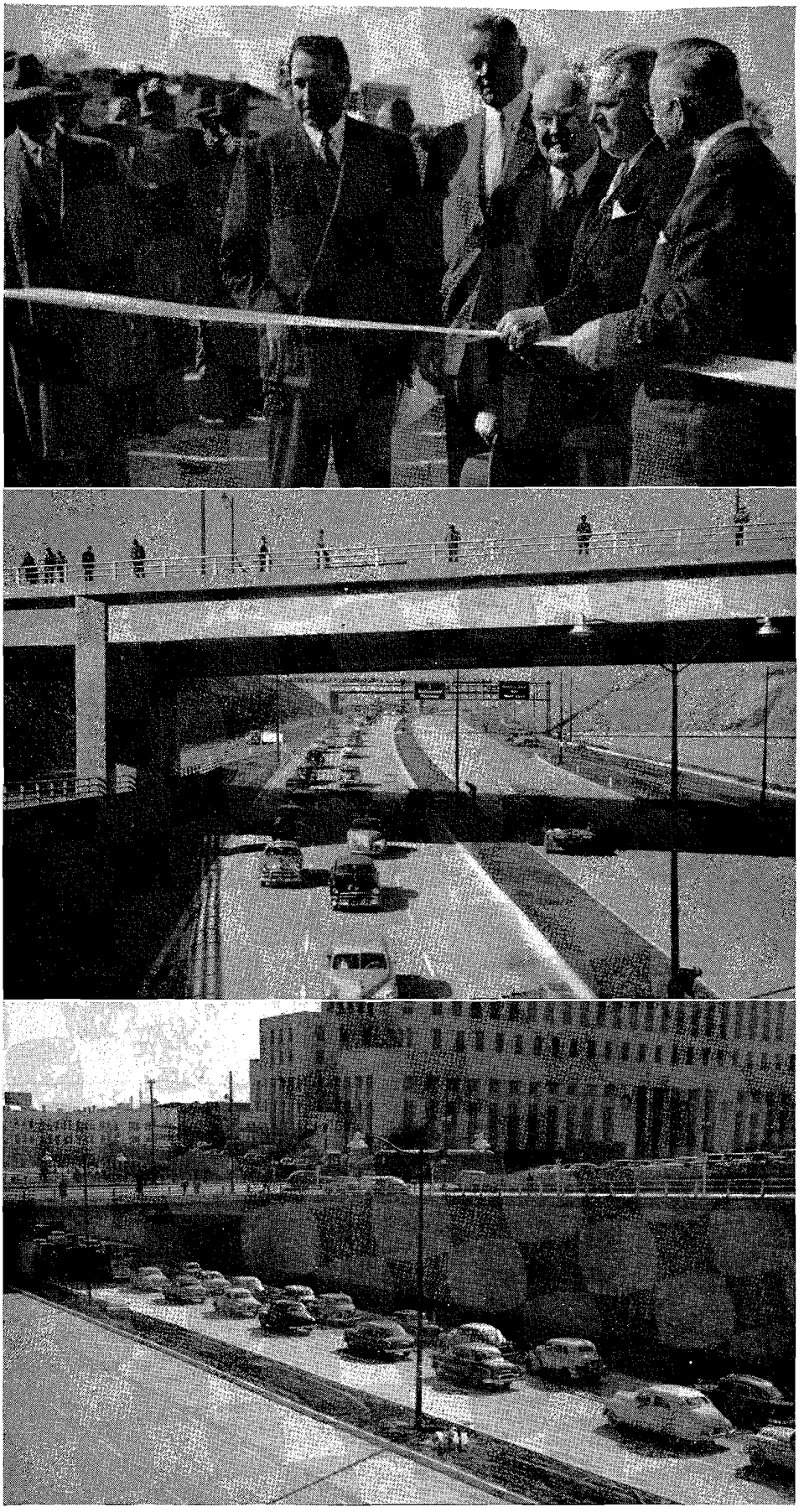
"As a member of the California Highway Commission it is my great pleasure to represent our Governor, Earl Warren and our Director of Public Works, Frank B. Durkee, on this occasion. Governor Earl Warren is vitally interested in the State of California and in the progress of the highway program that was initiated by him and incorporated in the Highway Act of 1947. Mr. Durkee, our new Director of Public Works, is also vitally interested in the highways of our State. Inasmuch as the Governor has called a meeting of his council to be held today, it is impossible for these two gentlemen to be with us. I know that both of these officials would be here if other state duties did not keep them away.

"There is another man who was vitally interested in the development of highways in our State who, if he were still alive, would be with us on this occasion. I am referring to the late beloved Charles H. Purcell who, as Director of Public Works, was largely instrumental in developing our present freeway system.

"This is a short but vital link of the Hollywood Freeway—in fact it is probably the most important link in the entire system of freeways. Not only does this link complete the five miles from Western Avenue but it gives a connection with the Ramona and Santa Ana Freeways. In addition, this link gives a good distribution of traffic from these three freeways into Downtown Los Angeles.

Historic Spot

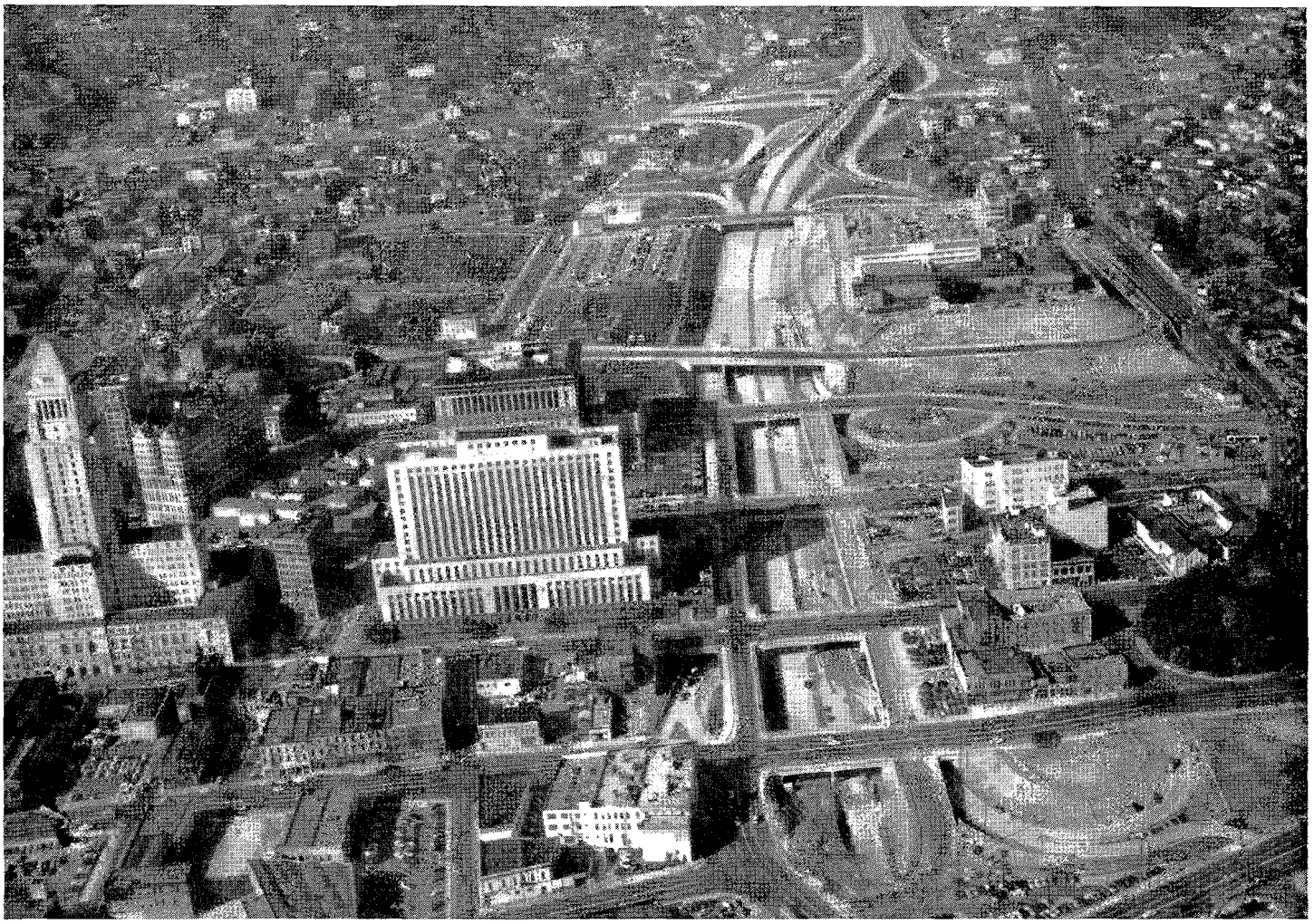
"This is an historic spot. We are bringing this great freeway into the heart of a city of 2,000,000 people almost adjacent to the original plaza where Los Angeles started as a sleepy pueblo in 1781.



UPPER—Ready for ribbon cutting (left to right), Senator Jack Tenney, Robert Mitchell, Ed Ainsworth, Mayor Fletcher Bowron, Commissioner Harrison R. Baker, Supervisor Ray V. Darby. CENTER AND LOWER—Official caravan of autos uses newly opened freeway section.

"This one-half mile of the Hollywood Freeway, which we are opening today, is the culmination of a spirit of cooperation rarely seen in state government. I am speaking of the cooperation of the city and county of Los Angeles with the Division of Highways in arriving at an equitable solution of the location of this particular piece of the Hollywood Freeway.

"Very few people know the amount of money that has been allotted, by the Highway Commission, and has been spent by the Division of Highways in the construction of this one freeway. Up to date, the commission has allotted and the Division of Highways has spent $49,100,000 on this freeway from Los Angeles Street to Vineland Avenue in the valley. On top of the $49,000,000 there is $5,140,000 in the 1951-52 Budget of which $3,900,000 is not yet under contract. In the 1952-53 Budget there has been allotted $650,000 to finish the job. That grand total will be somewhere in the neighborhood of $55,000,000 for the complete Hollywood Freeway from Los Angeles Street to Vineland. This section that is being opened today represents an expenditure of $4,212,600 for construction and $2,146,000 for right of way, making a total of $6,358,600 for this particular piece of highway. In that amount is $354,318 contributed by the City of Los Angeles and $271,516 by the County of Los Angeles. This money was turned over to the State for grading and rights of way in removing Fort Moore Hill. The Division of Highways made available to the city and county level land suitable for the expansion of the civic center.



Looking westerly, showing in foreground Los Angeles civic center buildings and Hollywood Freeway construction through civic center and westerly

More Work to Come

"There are several other contracts yet to be let and quite a little work yet to be done before the Hollywood Freeway will be a complete job. On the section from Western Avenue to Hollywood, the structures have all been completed. The bids for the grading and paving of this section were opened on December 13th and the award will probably be made within the next 10 days. This job is contemplated to be finished in the late fall of 1952. At the present time there is quite a little work being done in the way of structures between Hollywood Avenue and Cahuenga Pass. Award of a contract for construction of the last unit of Hollywood Freeway in the City of Los Angeles is pending. Bids for the project were opened in Los Angeles on January 31st.

The final section of the freeway will be between Mulholland Drive and Cahuenga Boulevard and between Gower Street and Hollywood Boulevard. This contract will complete the freeway

from Alameda Street near the Union Railroad station through Cahuenga Pass. When the award of contract is made, all major units of the Hollywood Freeway either will have been completed or placed under contract.

The low bidder on the final unit was Bongiovanni Construction Co., Los Angeles, $2,274,336.30.

The project involves the construction of three bridges, one pedestrian undercrossing, extensions to two existing pedestrian undercrossings and 11 retaining walls and the grading and surfacing of 1.4 miles to provide a six-lane divided highway.

Coming down to this end of the Hollywood Freeway the contract for the work to be done from the Alameda Street underpass to Lyon Street will be advertised sometime in the spring of 1952 and should be completed sometime the middle of 1953. From Lyon Street to the Aliso Street bridge the work will be advertised in the spring of 1953 and should be completed sometime the middle of 1954. In addition to this work on the ground, there is quite a little work to be done on the Aliso Street bridge, which we term as part of the Santa Ana and Ramona Freeways.

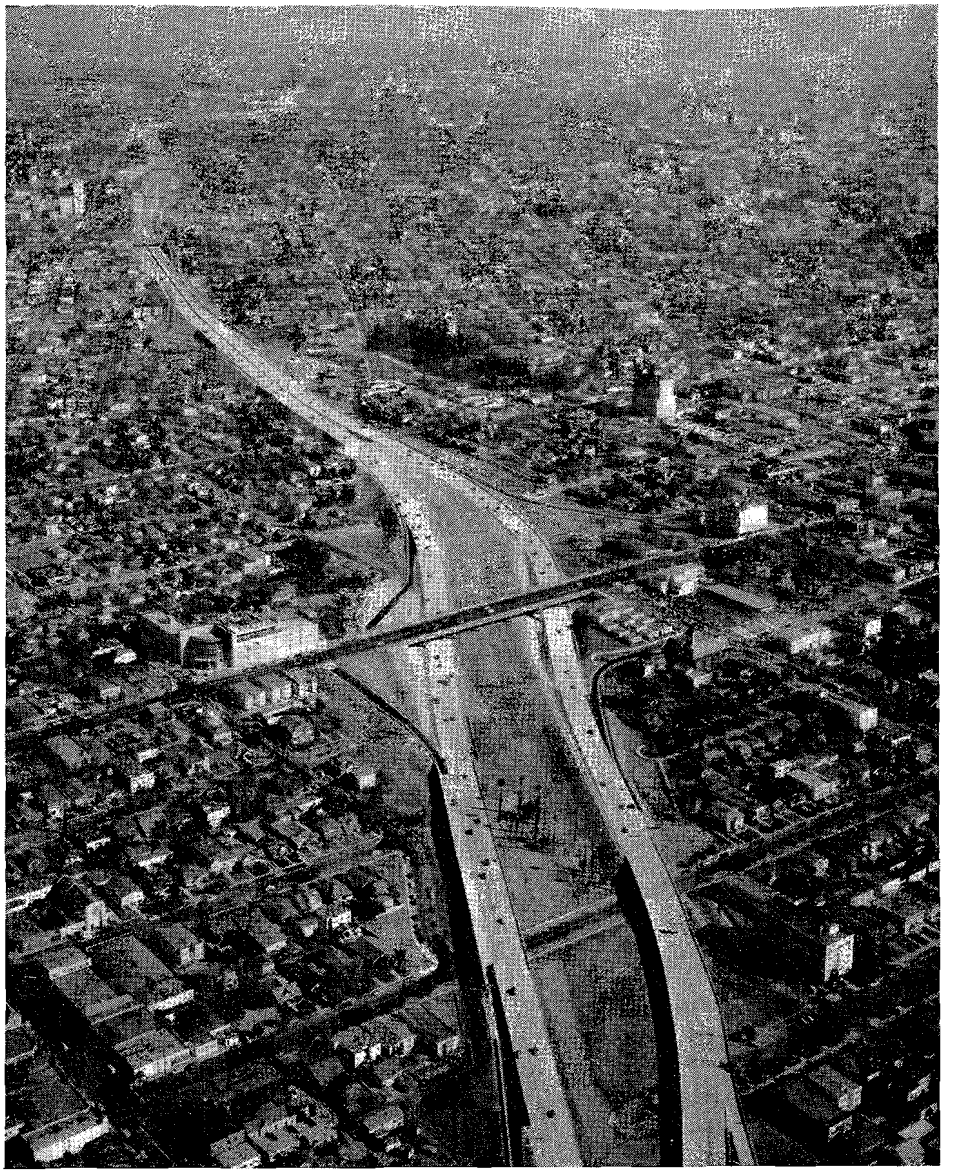
Harbor Freeway

"Many people are interested in the work being done on the Harbor Freeway. All the work necessary for this particular job, from Temple to Third Street, is under way and should be completed sometime next spring. The section from Third to Olympic Boulevard will be advertised late in 1952 and should be completed late in 1953.

"To make this section of the Harbor Freeway really do its job, it is going to be necessary to connect it with the Arroyo Seco Parkway. It is now contemplated that in the spring of 1952 the contract will be advertised for the work from Adobe Street to the four-level structure and this work should be completed late in 1952. When that is done there will be full and complete interchange provided for traffic between the Hollywood, Arroyo Seco and Harbor Freeways.

"We of the Highway Commission and the Division of Highways have found that when we open a section of a freeway the traffic somehow finds its way there. A year ago when we opened the section from Grand Avenue to Silver Lake Boulevard, we had an average of 30,000 cars a day using that section. When we first extended the Hollywood Freeway, last September, to Western Avenue we found that 45,300 cars were using that much of the Hollywood Freeway. Since that time the growth has been phenomenal and the Hollywood Freeway from Grand Avenue to Western is now carrying over 70,000 cars per day. Just what the total number of cars will be, after completion of the freeway, is problematical, but will, no doubt, approximate 100,000 cars per day.

"While these freeways cost millions of dollars they will more than repay their cost by direct savings to the motorists using them, in addition to the added convenience in their use and the savings in human lives due to the safety features built into them. While I am on my feet I would like to compliment both the city and the county of Los Angeles for the manner in which they have cooperated with our Division of Highways in arriving at a satisfactory conclusion to a lot of difficult questions."



Looking easterly along Hollywood Freeway, taken from above Melrose Avenue, showing in foreground the split between roadways to accommodate future connections with proposed Santa Monica Freeway

Ramona Freeway

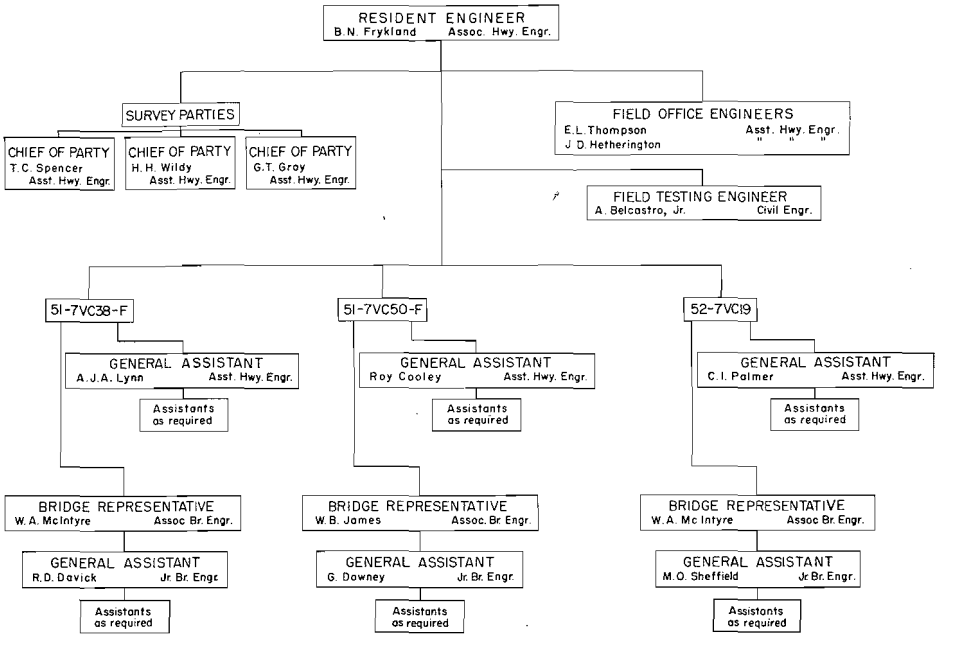
Engineering Personnel Is Organized Efficiently

By B. N. FRYKLAND, Resident Engineer

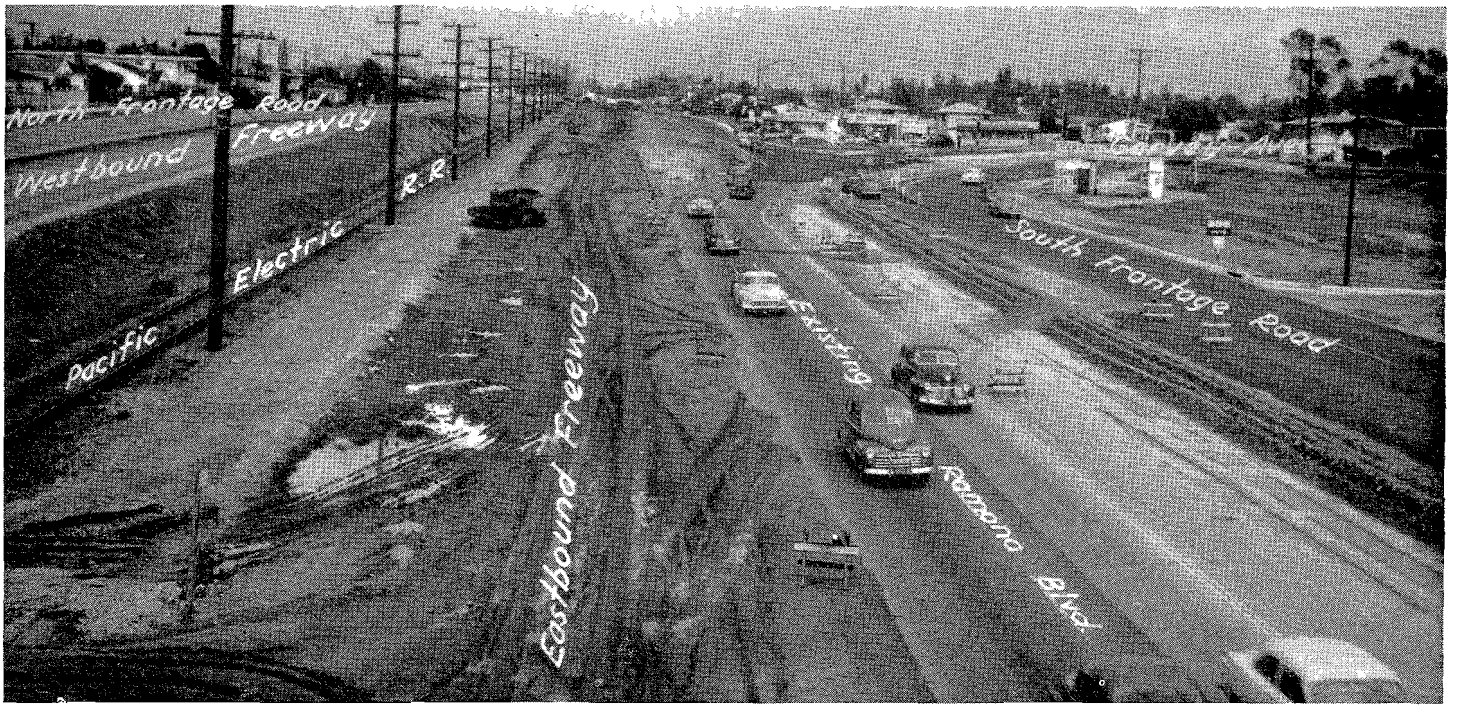
In September, 1949, work was started on the first postwar section of Ramona Freeway, from Evergreen Avenue to Helen Drive, a distance of 1.8 miles. This project was completed in April, 1951, at an approximate cost of $1,230,000. This work was described in a story by P. O. Harding, Assistant State Highway Engineer, in the September-October 1951 issue of the *California Highways* and *Public Works Magazine*.

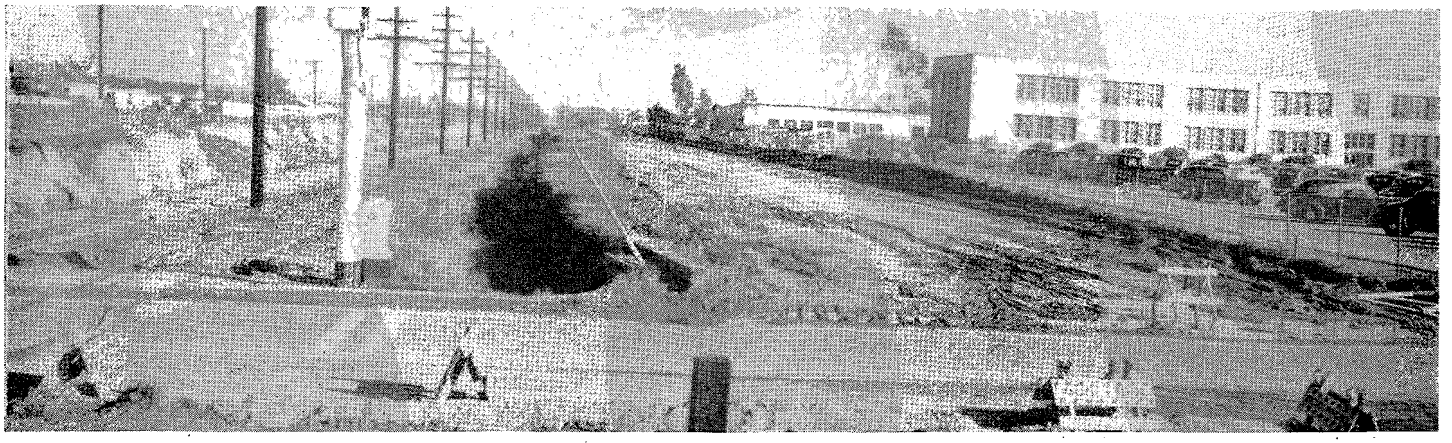
The second section, from Helen Drive to Hellman Avenue, Contract 51-7VC38-F, a distance of 1.5 miles, was approved in February, 1951, and is now approximately 60 percent complete. The estimated date of completion is November, 1952. The total cost will be approximately $1,950,000. J. E. Haddock, Ltd., is the contractor with Henry Ralston, the job superintendent.

The third section from Hellman Avenue to Eighth Street, Contract 51-7VC50-F, a distance of 0.9 miles, was approved August 4, 1951, and is now approximately 35 percent complete. The estimated date of completion is March, 1953. The estimated total cost is approximately $1,303,000. Griffith Company is the contractor with J. F. Porcher as job superintendent.



UPPER—Job organization chart. LOWER—Looking easterly from Warwick Avenue pedestrian overcrossing, showing construction in progress on Ramona Freeway.





Looking easterly from Almansor Avenue along eastbound roadway of Ramona Freeway, showing Mark Keppel High School in City of Monterey Park on right

The fourth section from Eighth Street to Jackson Avenue, Contract 52-7VC19, a distance of 1.7 miles, was approved on November 28, 1951, and is now approximately 15 percent complete. The estimated date of completion is July, 1953, and the total cost will be approximately $2,600,000. The Griffith Company, with J. F. Porcher as superintendent, is also the contractor for this construction.

The work in general on the three going contracts consists of grading and paving two 36-foot roadways of the freeway section, grading and surfacing of the necessary frontage roads, acceleration and deceleration lanes, off and on ramps, and construction of underpass and overpass bridges. Prior to the starting of grading operations a large amount of storm drain and sanitary sewer construction was necessary, as well as considerable work by the various utility companies in moving their facilities.

Bridges Total 29

The necessary grade separations for vehicular, railroad, and pedestrian traffic require the construction of 29 bridges and one pedestrian undercrossing. Proceeding from west to east over the three contracts the bridges are located as follows:

Floral Park Bridge carries the tracks of the Pacific Electric Railroad over the westbound freeway.

Floral Park On Ramp carries westbound South Frontage Road traffic over eastbound freeway to westbound freeway.

Warwick Road, Campbell Avenue, and Marguerita Avenue Pedestrian Overcrossings carry pedestrian traffic over two frontage roads, the Pacific Electric Railroad tracks, and both freeway roadways.

Fremont Avenue bridges carry both freeway roadways and the Pacific Electric Railroad tracks over Fremont Avenue. The work in this section results in a modified interchange which will permit traffic ingress and egress to both the westbound and eastbound freeways.

Raymond Avenue Bridge carries the westbound freeway over Raymond Avenue to provide access to the Pacific Electric Railroad substation and team track.

Atlantic Boulevard, Garfield Avenue, and New Avenue bridges carry the freeway roadways, the Pacific Electric Railroad tracks, and the frontage roads, or off and on ramps over these cross streets. These bridges, with the necessary connecting roadways, form complete traffic interchanges.

The Sixth Street bridges carry the above-noted tracks and roadways over Sixth Street.

Almansor Avenue Bridge carries Almansor traffic over the Pacific Electric tracks and all roadways.

The last mentioned grade separations are not of the interchange type.

The Jackson Avenue Pedestrian Undercrossing is an extension of an existing undercrossing under the Pacific Electric Railroad tracks, made necessary by the construction of freeway roadways on each side.

Traffic Major Problem

Due to the fact that the jobs lie within the limits of cities of Los Angeles, Monterey Park, and Alhambra, as well as being partly in unincorporated areas, the proper handling of the traffic on the first section, from Evergreen Avenue to Helen Drive, and on the second section, from Helen Drive to Hellman Avenue, was a major problem. It was necessary to provide for a free flow of traffic up to 40,000 vehicles per day through the construction zone at all times. The problem is not so acute on the third and fourth sections although Atlantic Boulevard, Garfield Avenue, Almansor Avenue, and New Avenue carry a considerable volume of traffic.

It is anticipated that the completion of the three going contracts, which

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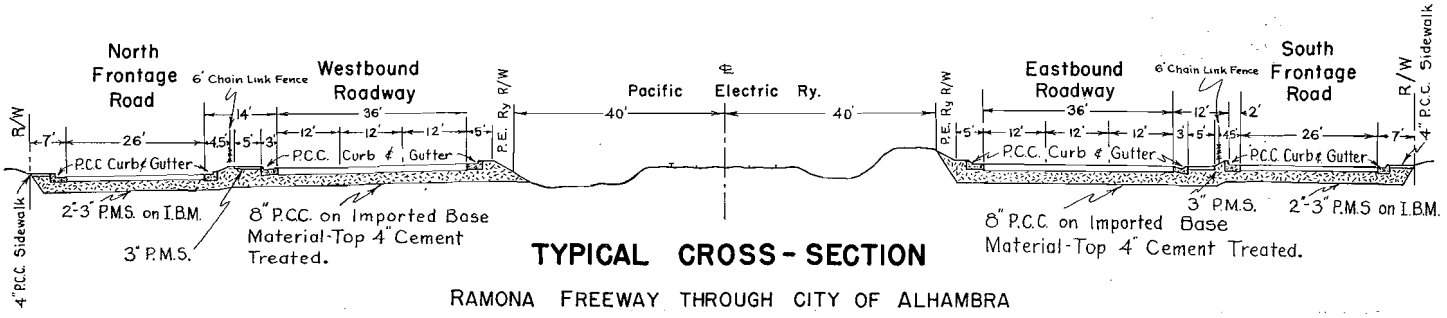
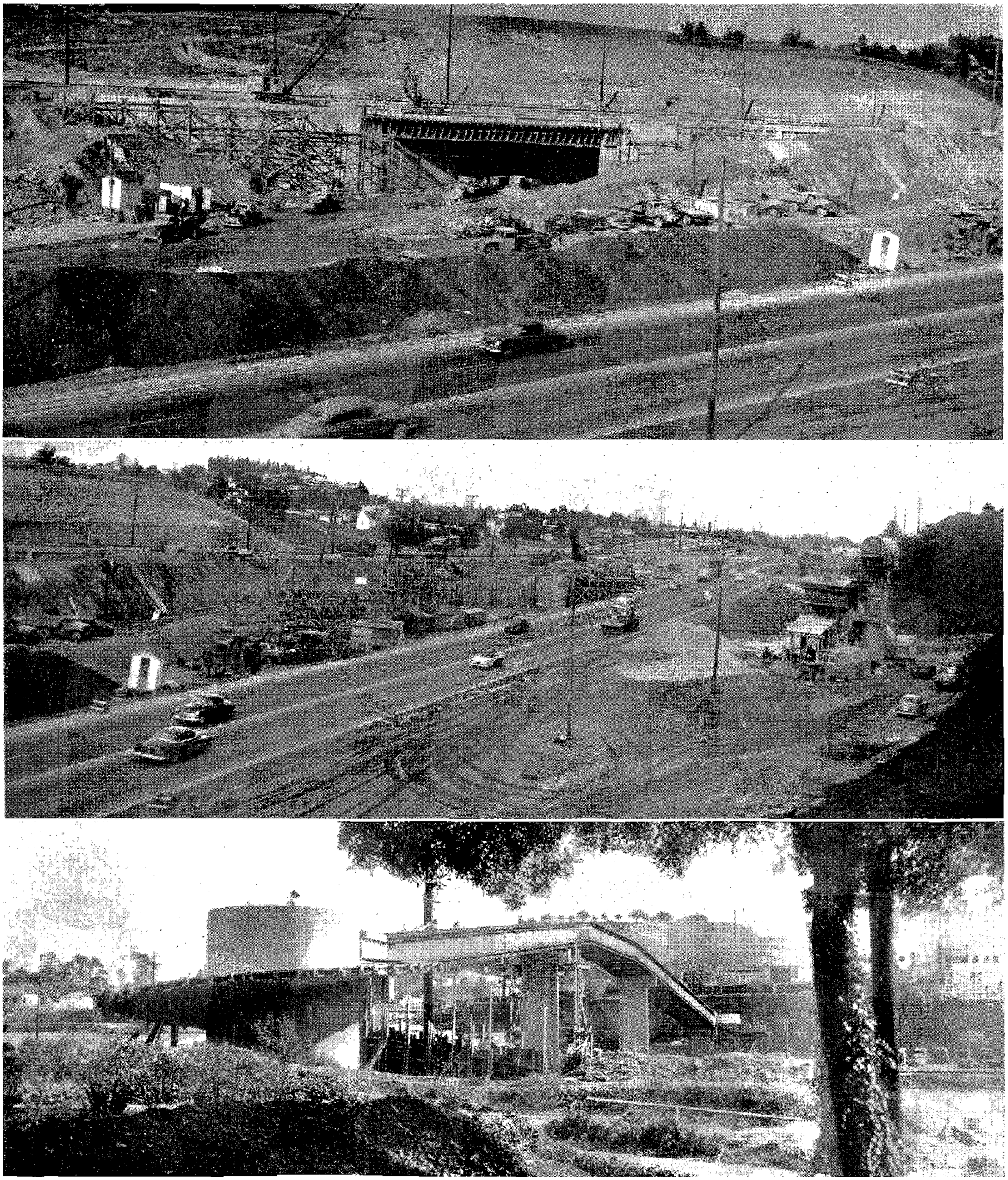


TYPICAL CROSS-SECTION

RAMONA FREEWAY THROUGH CITY OF ALHAMBRA



UPPER—Floral Park undercrossing that will carry westbound Ramona Freeway under tracks of Pacific Electric Railway. CENTER—Easterly along Ramona Freeway, Floral Park on ramp in foreground and Warwick Avenue pedestrian overcrossing in background. LOWER—Warwick Avenue pedestrian overcrossing, showing steel girders in place and spiral ramp construction at ends.

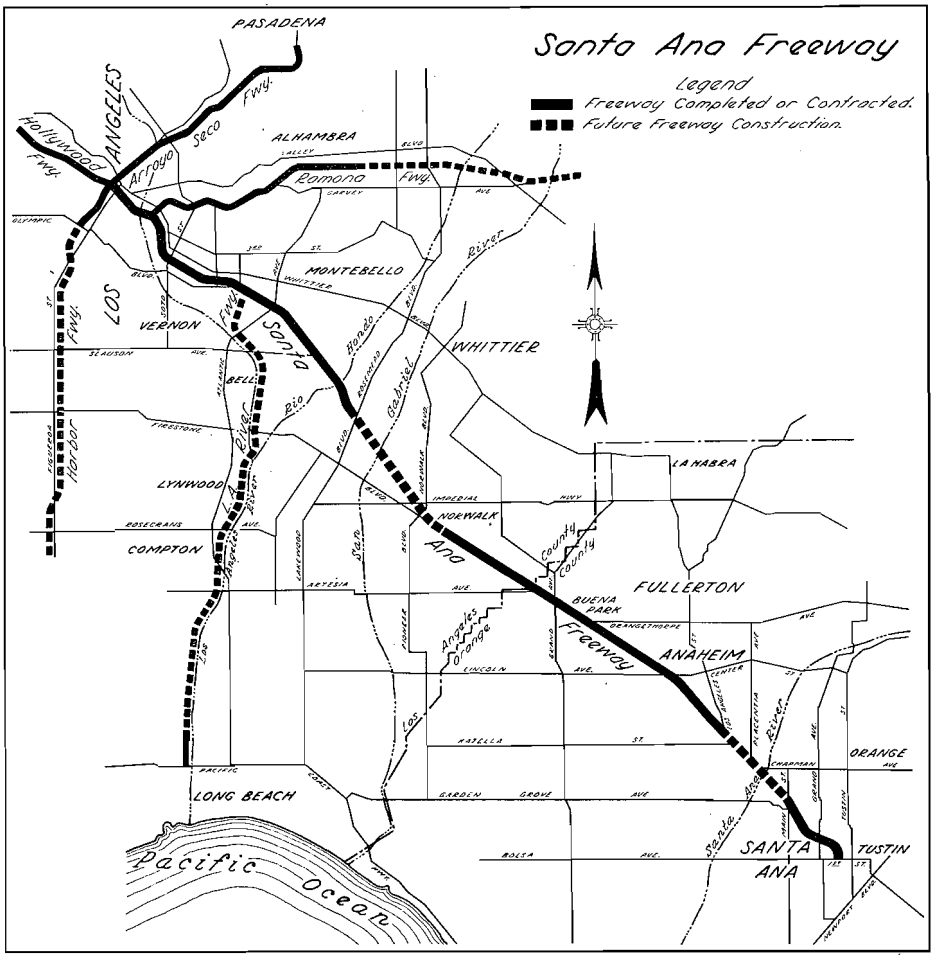
Santa Ana Freeway

Rapid Progress Is Being Made on Important Project

By W. L. FAHEY, District Engineer, District VII

SANTA ANA FREEWAY is one of the most important traffic arteries on the system of freeways now being constructed by the State Division of Highways to serve Southern California. It is perhaps of equal importance with the Hollywood Freeway because one freeway is a continuation of the other. From the standpoint of through traffic the two freeways will operate as a unit.

The Santa Ana Freeway extends from Spring Street in the Los Angeles Civic Center Area in a general southeasterly direction 34 miles to First Street in the City of Santa Ana. The inception of this freeway dates back about 12 years and during that interval, due to the wholehearted cooperation of county and city officials and organizations and the financing provided by the Collier-Burns Highway Act of 1947, Santa Ana Freeway is now well along toward completion.



Of Strategic Value

The fact that Santa Ana Freeway follows a northwesterly-southeasterly direction, generally paralleling the Pacific Ocean coast line, makes it of great strategic value because so many of the other important traffic arteries in this part of the state have been established in a general northerly-southerly or easterly-westerly direction.

Development of Santa Ana Freeway, bringing as it does Orange County closer to the Los Angeles Metropolitan Area, measured in travel time, will prove of immense benefit to both areas. The development of critically needed housing projects and large industrial manufacturing plants along the route of Santa Ana Freeway is an indication of the economic value of this freeway in land development to its highest and best use.

Three Sections Completed

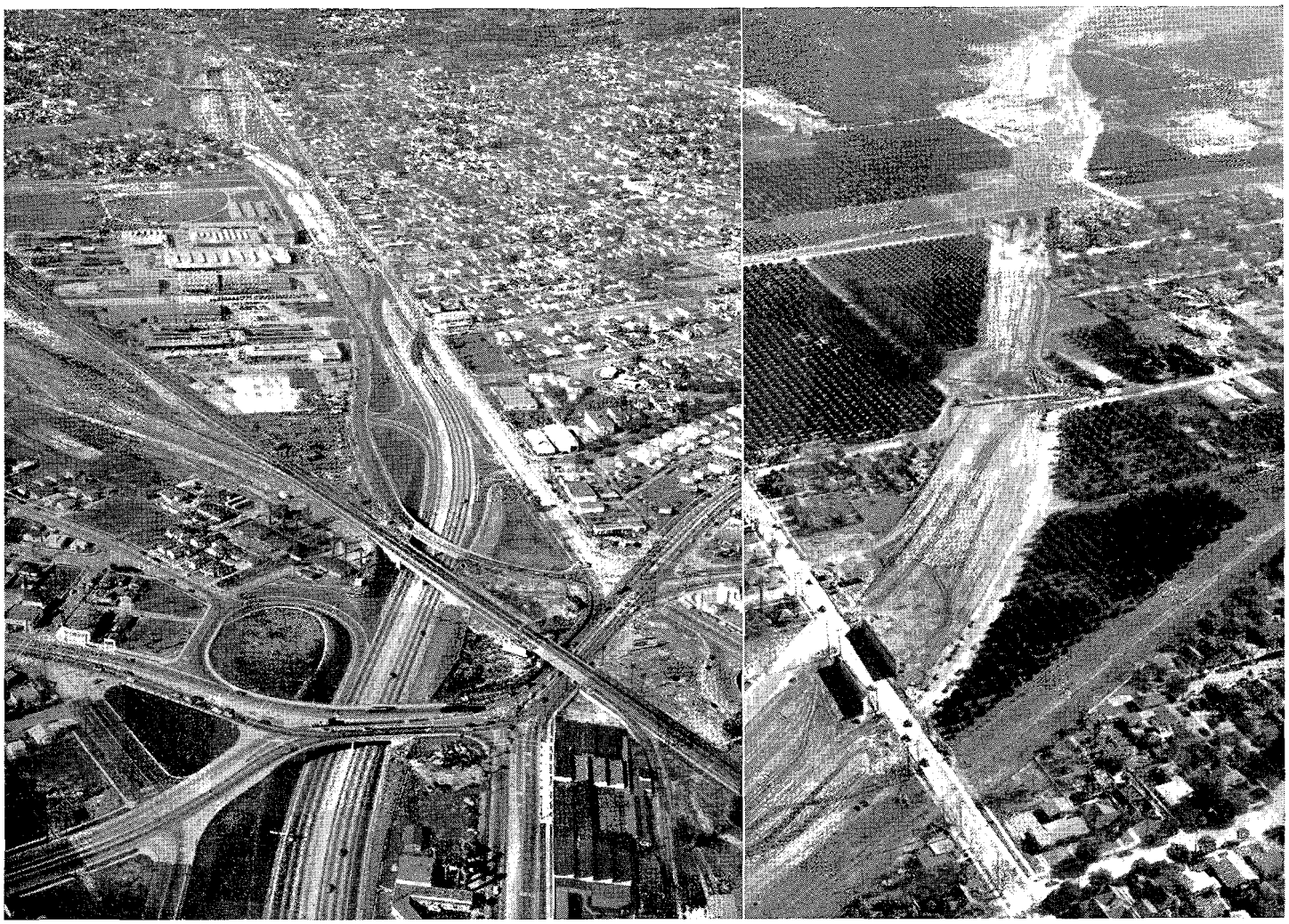
As of the present time we have three sections of Santa Ana Freeway which are completed and open to traffic, as follows:

(1) Aliso Street to Eastman Avenue, 3.6 miles; (2) Atlantic Boulevard to Union Pacific Railroad Crossing, 0.9 miles; and (3) Rosecrans Avenue east of Norwalk to Los Angeles Street south of Anaheim, 11.4 miles.

On the third unit listed above it should be noted that freeway construction has been completed except at the important cross streets. At these locations intersections at grade have been channelized and signalized so that traffic moves freely and safely. Due to the inadequacy of funds available for freeway construction, it appeared desirable on this section of Santa Ana Freeway to get the main roadway portion of the freeway completed and opened to traffic as quickly as possible, delaying the more expensive and time-consuming construction of grade-separation bridges to be carried out during future years when funds do become available.

Five Construction Projects

At the present time the State Division of Highways has five major construction contracts under way on Santa Ana Freeway, comprising a total length of 9.4 miles and representing an expenditure of almost $10,000,000. These contracts are as follows:



LEFT— Looking northwesterly along Santa Ana Freeway, showing 0.09-mile length of completed freeway under Atlantic Boulevard and under tracks of Union Pacific Railway. In foreground is Atlantic Boulevard overcrossing and in background, left, is construction in progress on Olympic Boulevard overcrossing. The interchange system in the foreground has been referred to as the "Mix-Master." RIGHT— Looking southeasterly along construction in progress in Santa Ana, showing in foreground erection of abutments for 17th Street undercrossing.

Description	Contractor	Resident engineer	Miles	Allotment
6-lane Freeway between Eastman Avenue and Atlantic Boulevard	Winston Bros. Co.	H. E. Belford N. G. Hallin	1.1	$1,184,300
6-lane Freeway from Augusta Avenue to Washington Boulevard	United Concrete Pipe Corp. & Ralph A. Bell	H. Ayanian J. M. Curran	2.3	1,742,100
6-lane Freeway from Washington Boulevard to Todd Avenue	United Concrete Pipe Corp. & Ralph A. Bell	H. Ayanian J. M. Curran	1.5	1,546,200
6-lane Freeway from Todd Avenue to Lakewood Boulevard	United Concrete Pipe Corp. & Ralph A. Bell	H. Ayanian J. M. Curran	2.0	2,701,200
4-lane Freeway from Broadway to First Street in Santa Ana	Winston Bros. Co.	C. C. Smith F. E. Sturgeon	2.5	2,656,300
Totals			9.4	$9,830,100

Completion Dates

By the end of 1952 or early in 1953 it is anticipated that all of these construction contracts will have been completed and that Santa Ana Freeway for the 10-mile length between the Los Angeles Civic Center and Rosemead Boulevard will be open to public traffic. However, Santa Ana Freeway traffic will not have the use at that time of the diagonal freeway routing shown on the map, from Rosemead Boulevard east of Rio Hondo to the town of Norwalk, for another year or two. This will not be a serious detriment because in the meantime traffic will have the use of a modern four-lane divided limited access highway as

now completed to the south on Rosemead and Lakewood Boulevards and to the east on Firestone Boulevard.

Another incomplete section of the Santa Ana Freeway, speaking as of the end of 1952, will be the short section in the vicinity of the Santa Ana River. The existing state highway at this location has a paved width of 56 feet, providing four lanes for moving traffic with side lanes for parking of vehicles. Thus traffic will not be greatly discommoded although it cannot move here as freely and safely as it will on the new freeway when completed.

Concerning the construction contracts now in progress, the resident engineers on these jobs make the following reports:

By H. E. BELFORD, Resident Engineer

On November 27, 1950, Contract 51-7VC23F in the amount of $1,112,-920.00 was awarded to Winston Brothers Company for constructing portions of Santa Ana Freeway, about 1.1 miles in net length, between Eastman Avenue and 0.1 mile westerly of Atlantic Boulevard, Road VII-LA-2,166-D,A.

The work included under this contract consists of clearing and grubbing, removing and disposing of portions of existing concrete pavements, curbs, gutters, sidewalks and structures; grading a roadbed to provide a six-lane divided freeway; surfacing with Portland cement concrete pavement on cement treated subgrade over imported base material; placing plant-mixed surfacing on shoulders; constructing accelerating and decelerating lanes, interchange roadways and outer highways, and surfacing them with plant-mixed surfacing on untreated rock base over imported base material. A reinforced concrete pedestrian undercrossing consisting of a box structure 122 feet in length and 10 feet in width with stairway entrances was provided at Eastman Avenue.

Bridge Structures

A reinforced concrete box girder overcrossing bridge consisting of four spans about 213 feet in total length, supported on reinforced concrete bents and abutments constructed on reinforced concrete cast-in-place piles and providing a clear roadway width of 40 feet, with two 5-foot sidewalks was provided at Downey Road. Also included in the contract was a reinforced concrete box girder overcrossing bridge for Olympic Boulevard, consisting of four spans and about 417 feet in total length supported on reinforced bents and abutments (no piles) and providing a clear roadway width of 70 feet with two 6-foot sidewalks. The bridge construction on this contract is under the supervision of N. G. Hallin, Resident Engineer for the Southern Section of the State Highway Bridge Department.

This contract also includes miscellaneous drainage structures, curbs, gutters and sidewalks, guard railing, chain link fence, reinforced concrete pipe culverts and siphons, vitrified clay pipe for sanitary sewers, drainage and electrical equipment and various other materials and items of work.

Rapid Progress

To date construction work on this project is about 58 percent complete. Construction of all north and south outer highways, the Eastman Avenue storm drain structure and pedestrian undercrossing, the Downey Road overcrossing bridge, the installation of sanitary sewers and storm drain siphon pipes has been entirely completed. Approximately 75 percent of all roadway excavation has been completed and the contractor is now concentrating on construction of the Olympic Boulevard bridge, which must be completed and traffic routed over it before any further road construction can be accomplished. This bridge should be completed sometime in April, 1952.

During construction of the Downey Road and Olympic Boulevard bridges, traffic is being carried around the bridge sites over the outer highways and specially constructed detour roadways connecting therewith that were all constructed as the first order of work on this project. Traffic has been operating over these detours for the past year with practically no hindrance or delays. In fact, westbound traffic into the City of Los Angeles has been faster over the detour than it was over the previous route.

Wells Are Replaced

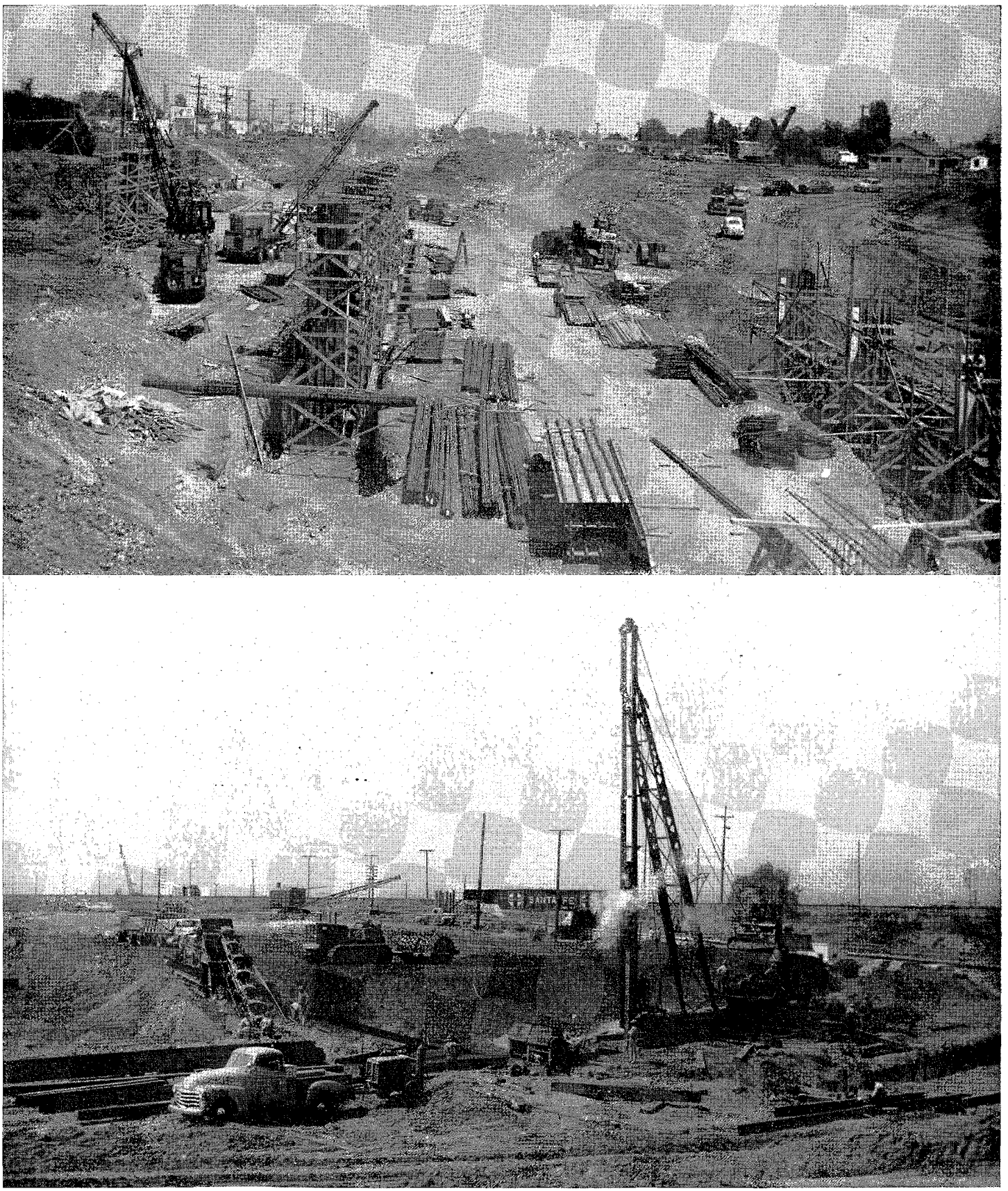
Five domestic water wells of the California Water Service Company, developing approximately 1,900 gallons per minute, which were in the right of way in the vicinity of the Downey Road and Olympic Boulevard bridges, had to be abandoned and new replacement wells drilled on new sites outside the right of way prior to construction of the highway.

All excess roadway excavation on the project was disposed of in embankment areas on the proposed Los Angeles River Freeway just southerly of the project, the material being placed and compacted in accordance with the Standard Specifications. The contractor used 15.5 cubic yard model 7-TDT Euclid scrapers for hauling roadway excavation to the Los Angeles River Freeway embankment area. The average haul distance was about 3,000 feet and each scraper hauled approximately 100 cubic yards per hour to the embankment area during peak operations.

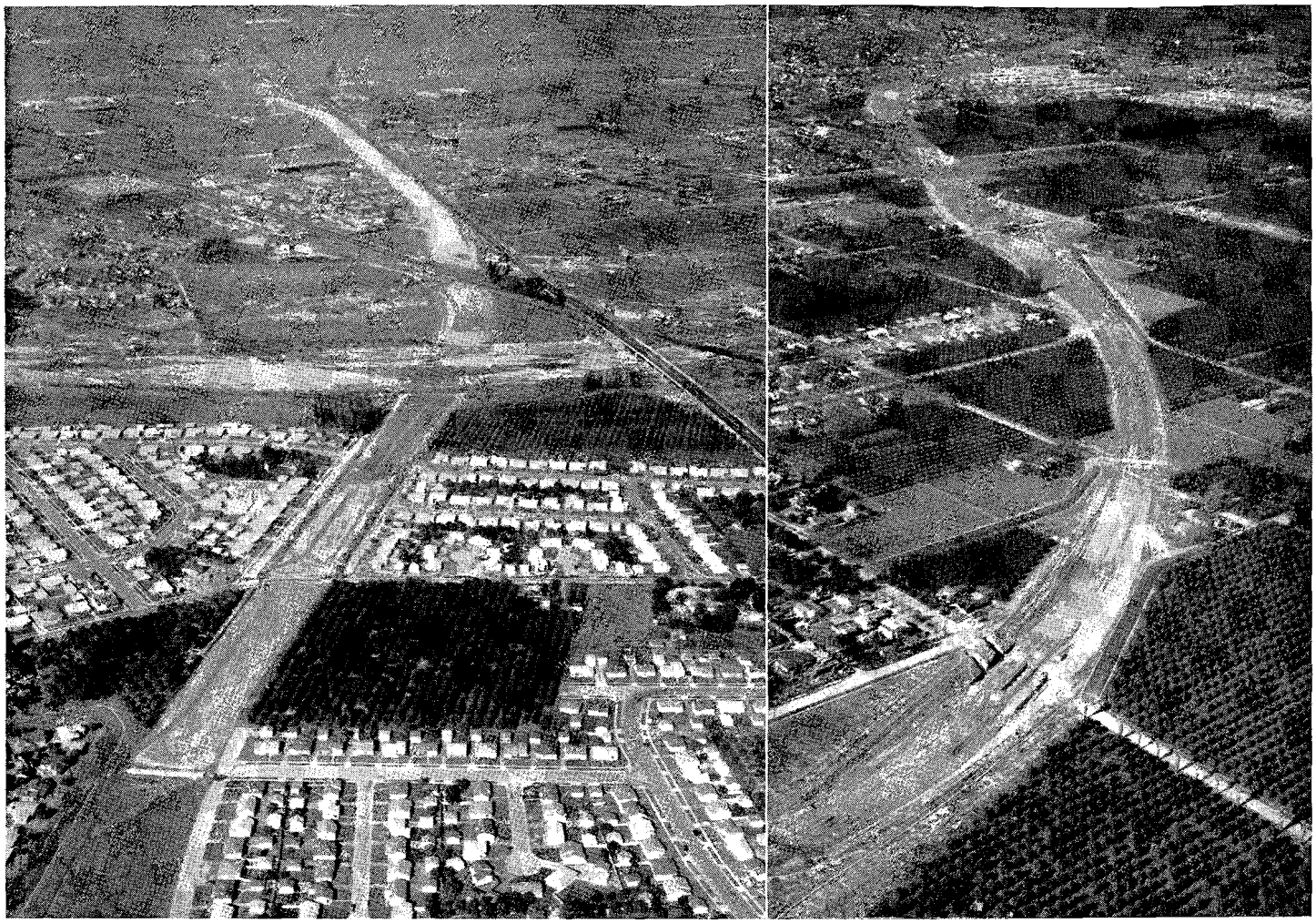
The span between bents No. 3 and No. 4 of the Olympic Boulevard bridge over the westbound roadway of the freeway is 145 feet, 6 inches. This is the longest box girder span constructed to date in the State and probably in the entire United States. Construction of the Olympic Boulevard bridge was delayed about four weeks due to curtailment of reinforcing steel by the Federal Government last fall. However, it is believed the contractor will complete this contract prior to August 19, 1952, the revised date of completion considering lost time for non-working days due to rain, at which time construction easterly to Washington Boulevard under another contract should be completed, making it possible to open to traffic an additional 3.2 miles of this important freeway from its present easterly terminus at Eastman Avenue.

By H. AYANIAN, Resident Engineer

The rapidly extending Santa Ana Freeway is being materially advanced by a series of three contracts being performed by the United Concrete Pipe Corporation and Ralph Bell under



UPPER—View looking southeasterly along Santa Ana Freeway, showing in foreground construction in progress on the Olympic Boulevard overpass. LOWER—View looking northwesterly along freeway, showing construction in progress on the Garfield Avenue undercrossing and Santa Fe Railroad grade separation.



LEFT—Looking northwesterly along Santa Ana Freeway construction, taken from just above Paramount Boulevard, showing in central portion of photograph approaches graded for the Rio Hondo crossing. RIGHT—Looking northwesterly along freeway construction in City of Santa Ana, showing in the foreground, left, present southerly terminus of the freeway at First Street and the excavation in progress for foundations for the Fourth Street overcrossing.

a joint venture. These three connecting contracts in one fell swoop will provide a six-lane divided freeway from near the junction of Olympic Boulevard and Anaheim-Telegraph Road to 0.2 miles beyond Lakewood Boulevard, including nine major structures, three pedestrian overcrossings, and a pedestrian undercrossing. The only exception in this stretch of six miles is the previously completed Griffith Company contract, 0.9 mile in length, at the Atlantic Avenue and Union Pacific Railroad grade separations.

The first contract, VII-LA-166-A, 51-7VC17-F, from Augusta Avenue to 0.2 miles southeasterly of Washington Boulevard, includes grading, PCC pavement, Marianna Avenue On-Ramp, Eastern Avenue Overcrossing, Kern Avenue Pedestrian Overcrossing, Gaspar Avenue Pedestrian Overcrossing, Washington Boulevard Undercrossing, and associated storm drains, sewers, and frontage roads.

Heavy Cut Section

The grading for this project consisted of a heavy cut section at the beginning of the job and the haul of this material, for distances of up to five miles, for embankments on the, at that time, future contracts. The overhaul was calculated in mile-yards and amounted to approximately 1,000,000 mile-yards. The material was all hauled in bottom dump truck and trailer units.

The sum of $1,748,000 was allotted for this first contract and work started on November 3, 1950, and is now about 60 percent completed. The estimated date for completion of all work is in June, 1952.

Second Contract

The second contract, VII-LA-166-A, 51-7VC41-F, covers the work from the end of the first contract to Todd Avenue. Included are the grading, PCC pavement, storm drains, sewers, the Simons Underpass at the mainline AT&SF R. R., the Garfield Avenue Undercrossing, the Greenwood Avenue Pedestrian Overcrossing, and frontage roads. In connection with the construction of the Simons Underpass, a shoofly was built with a temporary, timber pile supported, plate girder bridge to carry the rail traffic of over 40 trains daily over Anaheim-Telegraph Road.

This second contract was allotted $1,546,000 and work was started by the contractor on March 15, 1951. The estimated date for completion is in the

... Continued on page 46

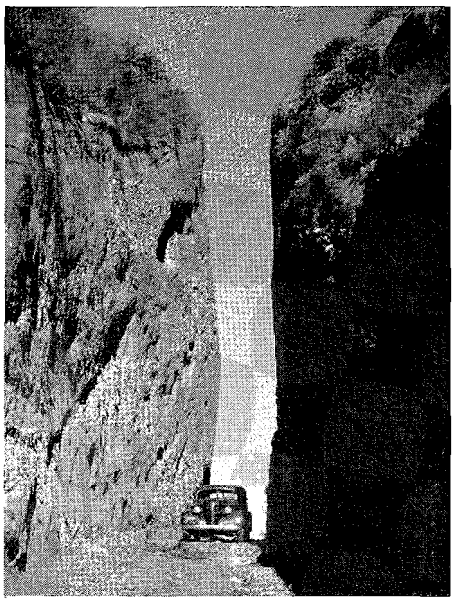
Ridge Route

Reconstruction as Freeway Now Is Nearing Completion

By C. P. MONTGOMERY, District Construction Engineer

FORTY YEARS ago the hardy soul driving from Los Angeles to San Francisco left the pavement shortly after crossing the Los Angeles River, followed the Southern Pacific through the sand and chaparral, past the railroad sidings of Burbank and Pacoima to the little village of San Fernando. From here his trip took on the nature of an adventure as the road veered away from the railroad through the historic Fremont Pass past Newhall to Saugus. From Saugus there was a choice of either the Bouquet Canyon or the San Francisquito Canyon roads past Elizabeth Lake, the abandoned almond orchards surrounding Neenach, the old Bailey Ranch Hotel at Quail Lake and over the Tejon grade, past old Fort Tejon and down the Grapevine grade to the floor of the San Joaquin Valley.

The venturesome motorist, having demonstrated the stamina of both himself and his car in crossing the mountains, now faced a test of endurance as he negotiated the remaining 350 miles of dusty unpaved roads through the length of the valley.



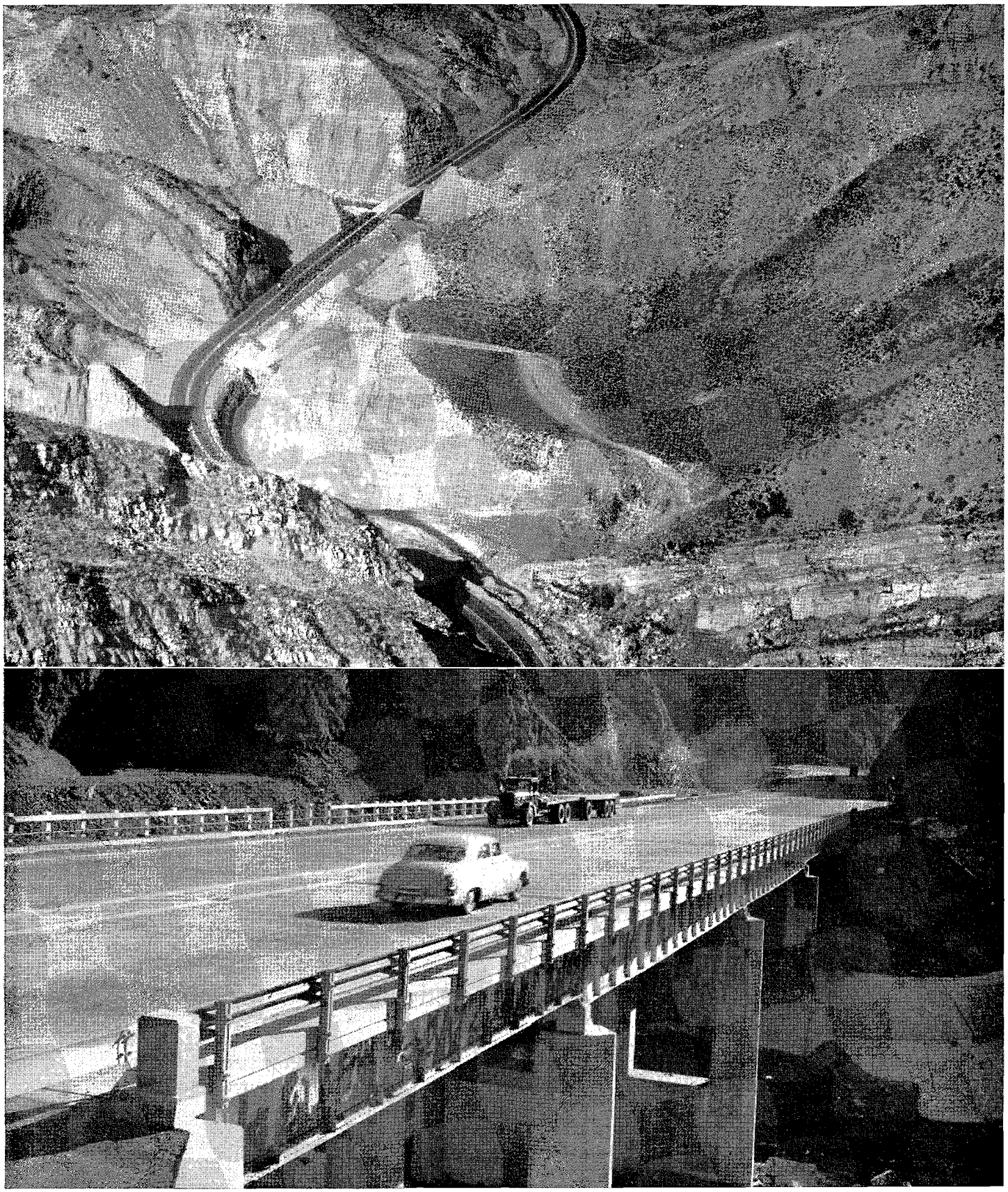
Fremont Pass, a slot through the mountains, 15 feet wide and 60 feet deep, constructed in stages by hand methods during pioneer days, was in service until 1910, at that time the most direct route from Los Angeles to the north

Challenge to Surveyors

Upon the formation of the California Highway Commission in 1911, a paved highway from the Mexican border through Los Angeles and San Francisco to the Oregon line, became the first order of business. Location surveys on this, the main north and south artery of the state highway system, were started in the early spring of 1912.

The mountains between Castaic in the Santa Clara River Valley and Ralphs Ranch, now Gorman, presented a challenge to the early location parties. The rugged terrain to be crossed was a primitive area with no trails, heavily covered with oak and

It is difficult for modern day motorists to believe that the present Ridge Route once looked like this



UPPER—Aerial view, looking northerly, showing completed Ridge Route in Piru Gorge with Pyramid Cut in left foreground. LOWER—Looking southerly, showing completed Ridge Route with Piru Creek Bridge in the foreground.

pine timber at the higher elevations and a dense growth of brush on the slopes. The survey parties in moving their camps and transporting water and supplies were dependent upon pack trains of burros. To bring the cost of construction within the limits of the funds available at that time, the original location followed a circuitous course over the mountain ridges from Castaic past Sandberg to Gorman.

First Contract in 1914

The first contract on the original Ridge Road was completed by the Lee More Construction Company of El Paso in June, 1914. Subsequent contracts and work by state forces under day labor, led to the completion of that portion within District VII, as a 15-foot concrete pavement on 24-foot roadbed in 1920. In spite of the 7 percent grades, many sharp curves, narrow pavement and traffic tie-ups during winter snows, this old road so stimulated motor traffic between Los Angeles and points north, that an alternate improved route lying westerly of the old original Ridge Route from Castaic junction to Lebec became a necessity and was built in the early thirties.

While still known as the Ridge Route this new location provided a greatly improved alignment with much less curvature. By following along the Alamo and Piru Creeks through Piru Gorge the gradient was reduced by 10 miles.

Highway Widening Necessary

Very soon the volume of traffic on the new Ridge Route had increased to such an extent that the three-lane road became critically inadequate. It was apparent that the only solution was to provide a four-lane highway with the opposing lines of traffic separated by a median strip. With funds made available by the Collier-Burns Highway Act of 1947, the early completion of the Ridge Route throughout as a four-lane divided limited access freeway is assured.

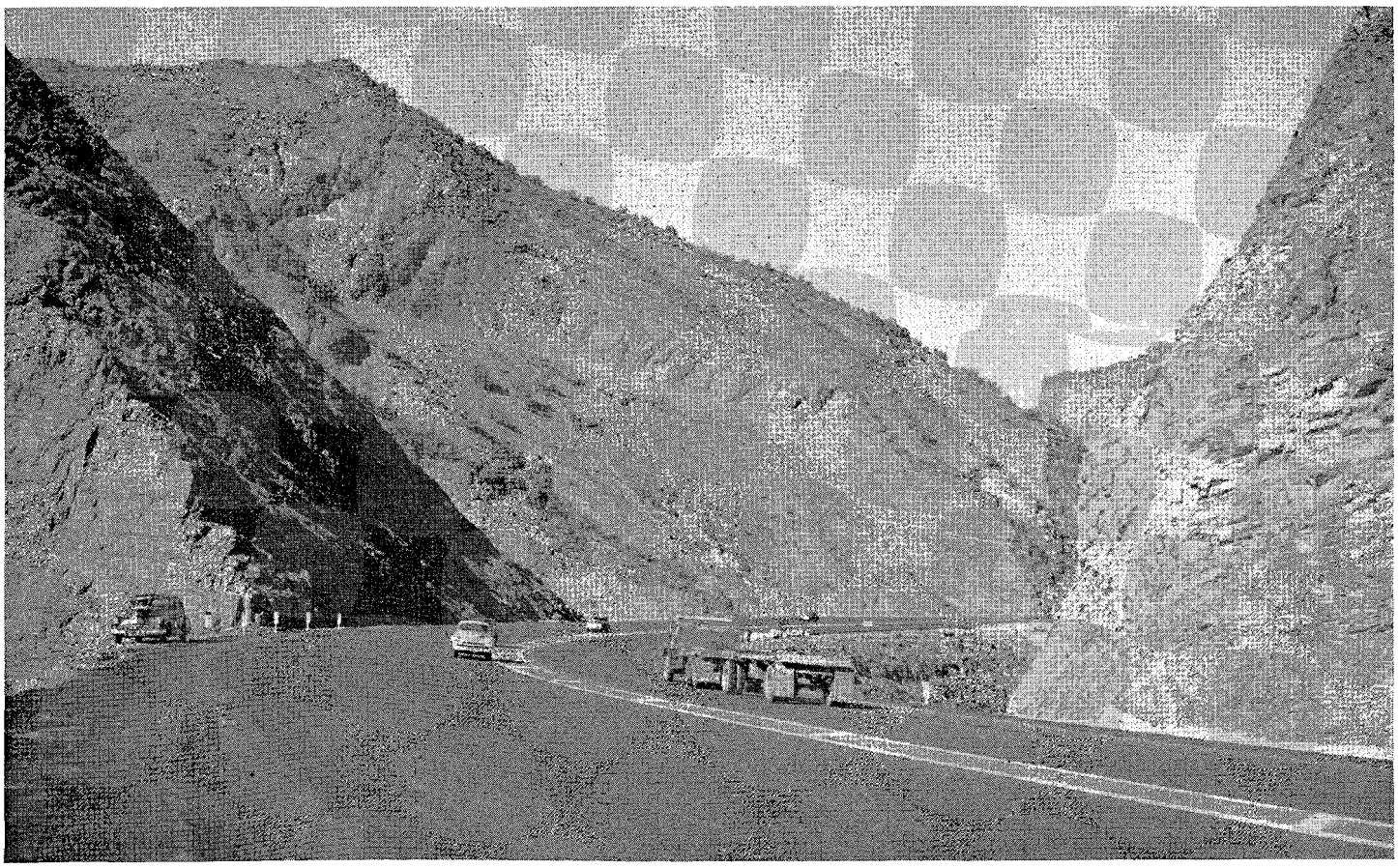
Piru Project Spectacular

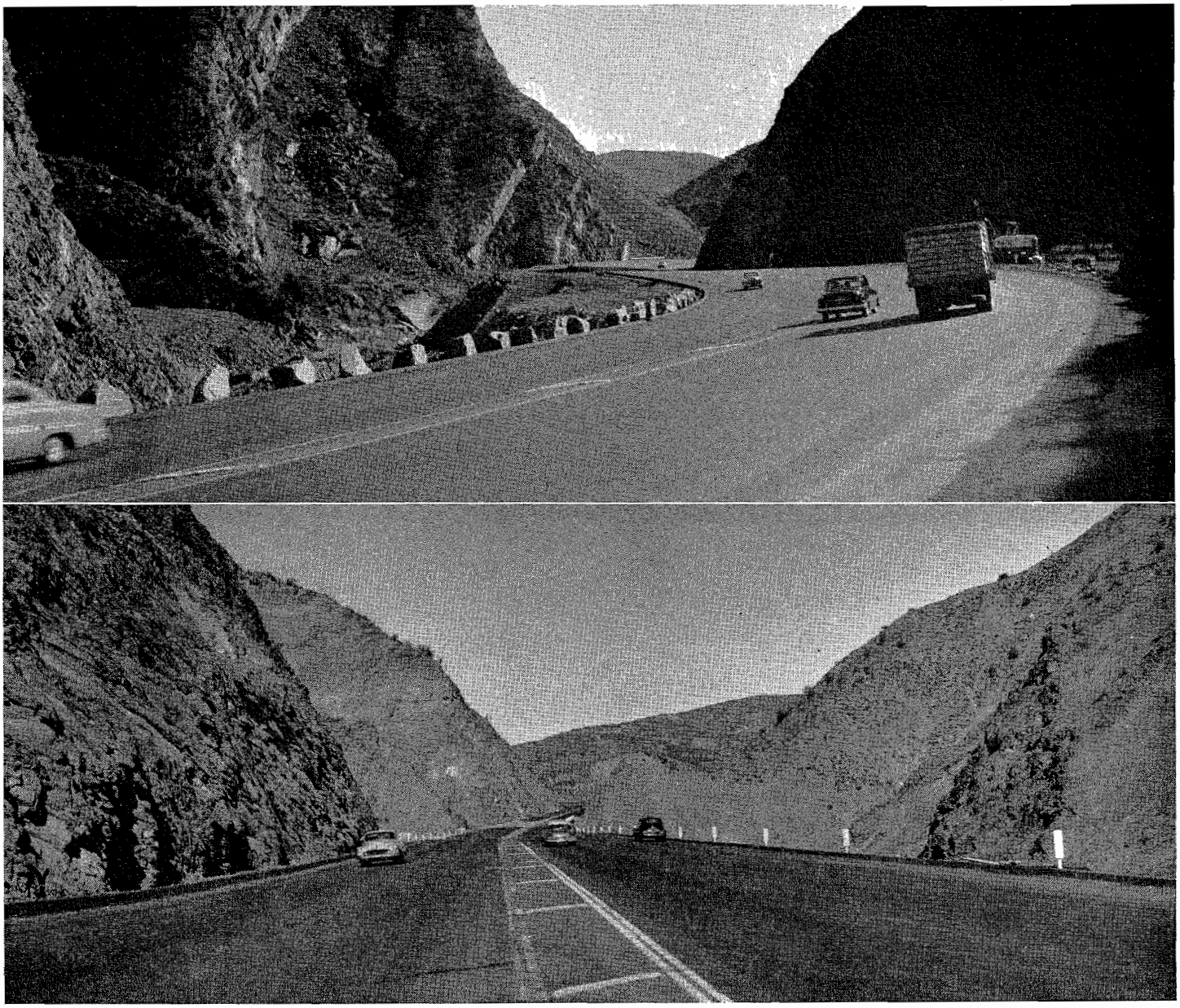
Probably the most difficult and spectacular section of this highway is the recently completed contract through Piru Gorge from Frenchman's Flat to the Alamos Creek Bridge.

Earth work quantities involved in the widening of this five-mile section of roadway amounted to 1,110,000 cubic yards and overhaul from cut to fill 15,000,000 station yards. The need for construction of two bridges over Piru Creek at each end of the Pyramid Cut was eliminated by the construction of a channel change to carry Piru Creek through the cut along the east side of the roadway. The widening of the Pyramid Cut alone, including the Piru channel, required the excavation of over half a million cubic yards of a very hard shale rock. The cut face rises to a height of 310 feet from the bottom of the channel or the height of a 25-story building.

The paving on the southerly three miles is four-inch plant-mixed surfacing 72 feet to 78 feet in width divided by raised bars. The northerly 2.3 miles consists of two parallel pavements 29

Looking northerly on completed section of Ridge Route through Piru Gorge, showing Pyramid Cut on left; channel change on right





UPPER—Looking south from Pyramid Cut, showing completed roadway with channel change on left.
LOWER—Looking northerly along completed Ridge Route in Piru Gorge.

feet in width with penetration treated shoulders and separated by an unpaved decision strip eight feet wide. All pavement is supported by a subgrade of untreated rock base over a subbase of eight inches of crushed granite. Subbase and subgrade material were produced by the contractor from a crushing plant set up at the state-owned granite quarry several miles above the northerly end of the contract. The contractor also installed an asphalt plant at this location for the production of the plant-mixed surfacing.

Traffic Carried Through

The outstanding and probably the most difficult feature of this work was the fact that traffic was carried through the contract during construction. It was necessary to control traffic while grading was in progress and the contractor conducted his operations to insure a maximum of safety and a minimum of delay to the traveling public. While working through cuts where there was danger from falling rocks, traffic was halted for periods of from 20 to 30 minutes, and then all work suspended until both lines of traffic had passed through grading operations. Longer though less frequent delays occurred during blasting operations, a DW10 scraper and bulldozers were always available at such times to clear the roadbed as quickly as possible. These unavoidable delays seldom lasted over 45 minutes. This contract was completed by A. Teichert and Son of Sacramento at a cost of slightly less than $2,000,000, under the able supervision of Adolph Baure, representing the contractor, and C. J. McCollough, Resident Engineer.

... Continued on page 46

U.S. 99 Job

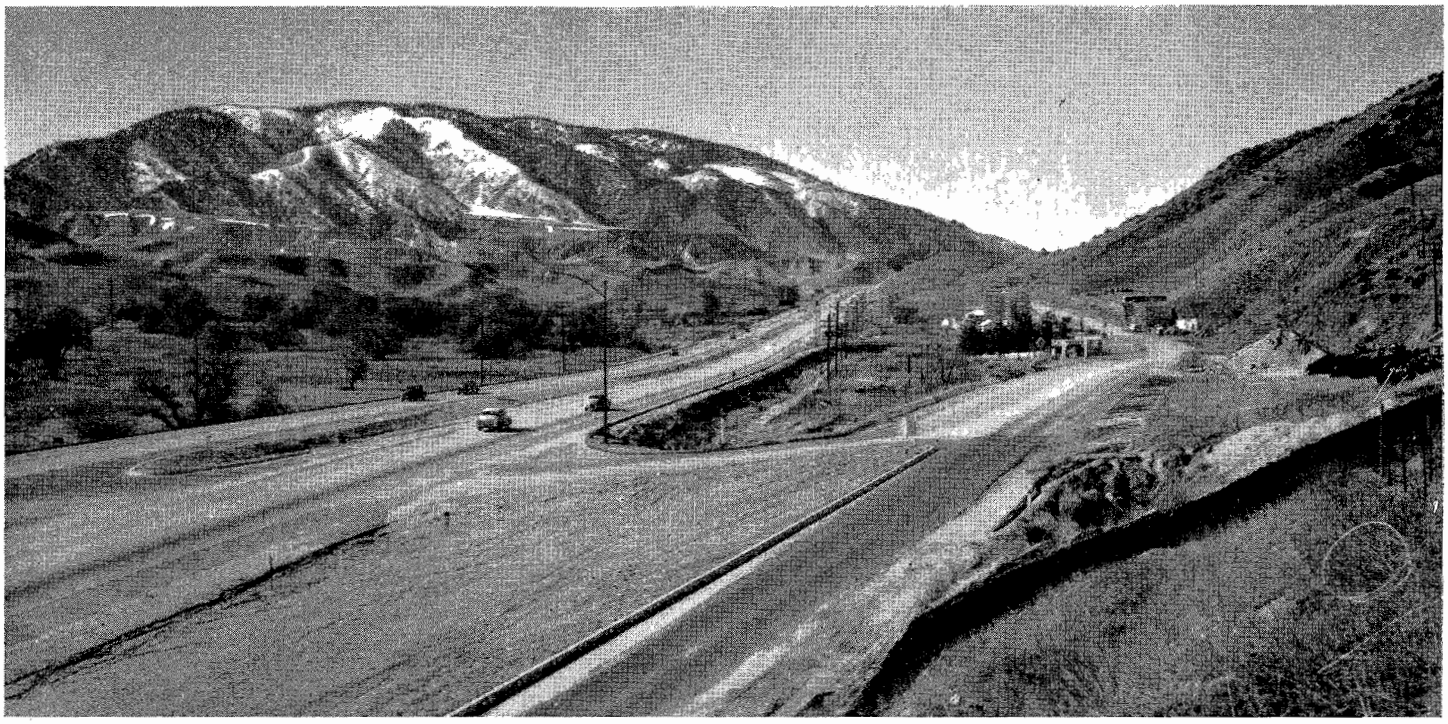
New Section of Four-lane Divided Highway Straddles Los Angeles-Kern County Line

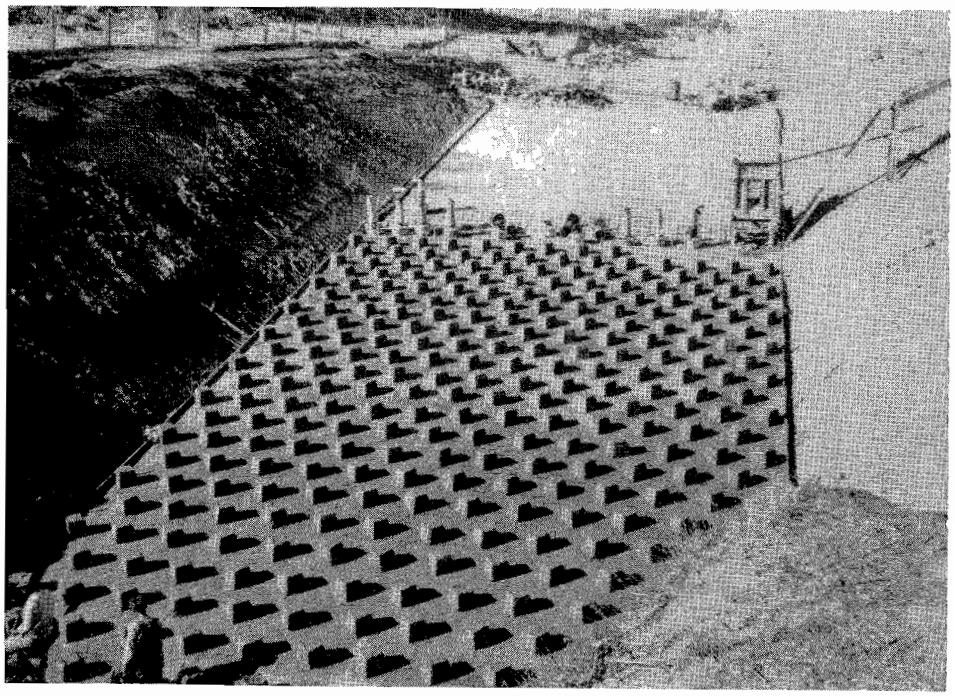
By W. M. NETT, Resident Engineer

CONSTRUCTION on an 11.4-mile section of U.S. Highway 99 known to the motorist as the Ridge Route was completed on November 8, 1951. This portion of highway forms the connecting link between two previously completed four-lane sections, the northern terminus being Fort Tejon, a United States Cavalry outpost which played an important part in early California history.

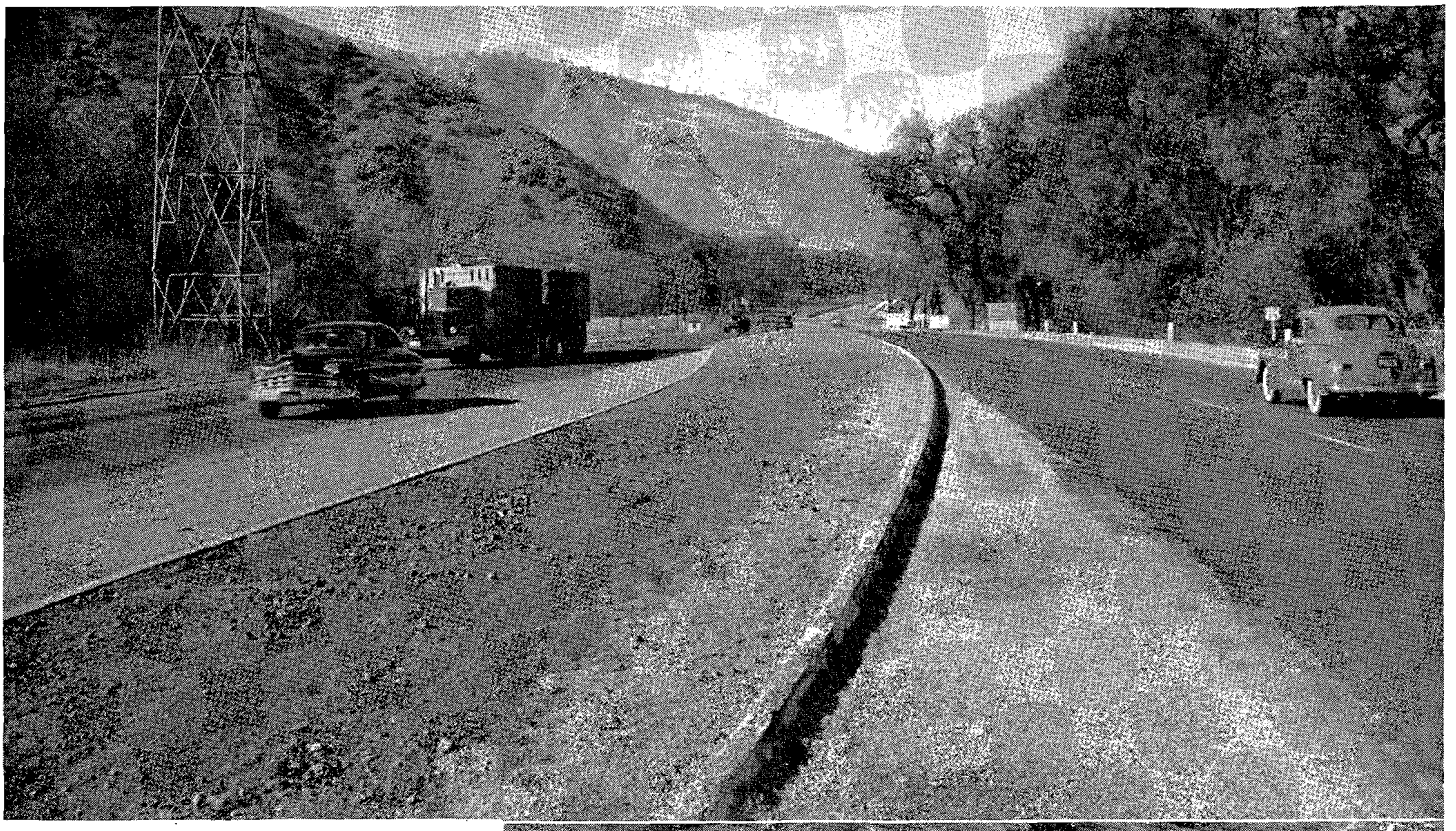
The southern terminus is 2½ miles south of the present Lancaster road, State Sign Route No. 138, which was part of the old original Ridge Route. This portion of the old highway from Gorman to Castaic via Sandberg which was by-passed by the three-lane construction in the mid 1930's, traversed terrain that inspired the name of Ridge Route, and which is still used to designate the entire route from the San Fernando Valley to the San Joaquin Valley.

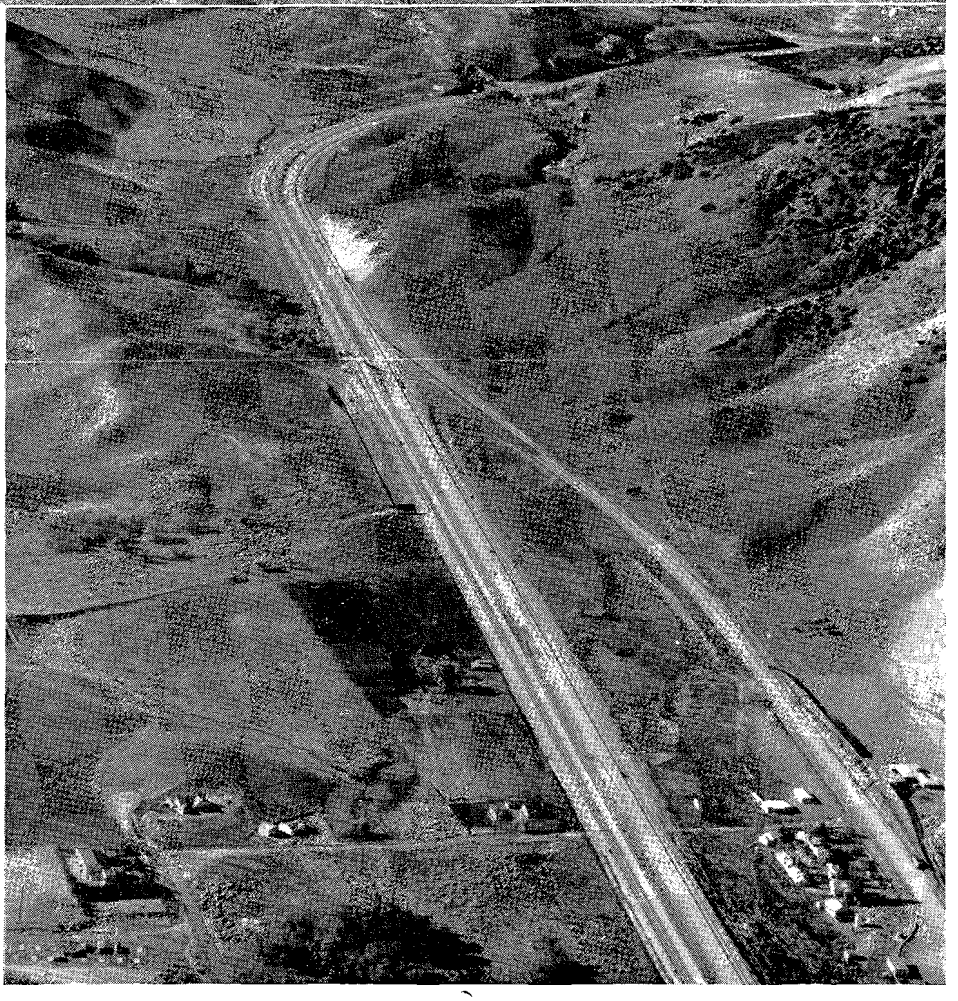
At various locations in the present work the old three-lane highway is used for one-way of travel. The new





UPPER—Completed construction on Ridge Route southerly from Gorman. LOWER—Special blocks on concrete apron to dissipate force of water at discharge of channel on west side of road just south of Gorman. Note smudge pots used to prevent freezing of concrete.





UPPER—Completed section of Gorman project in Kern County. LOWER—Looking northerly along completed section of Ridge Route. Community of Gorman is shown in foreground to right and Tejon Summit shown in background right.

lanes are of Portland cement concrete pavement 24 feet wide over cement treated subgrade with plant-mix shoulders.

Huge Excavation

The project was located in two state highway districts. District VII, Los Angeles, was responsible for the preliminary surveys, plans, specifications, and rights-of-way procurement, while District VI with headquarters in Fresno took over the construction engineering.

Something of the magnitude of the project can be seen in a few of the major items of work.

Well over a million cubic yards of roadway excavation was moved 28,000,000 station yards to reach its final location.

Sixty thousand tons of pervious material was used as a blanket over a wet meadow area at Gorman, and 237,000 tons of processed base material was used in subgrade construction.

Forty-nine thousand cubic yards of Portland cement concrete was poured and 41,000 tons of plant-mixed surfacing was used for shoulders and resurfacing of portions of the old highway.

Structures were constructed at 192 locations, varying in size from an eight-inch drain to a 133-foot reinforced concrete bridge across Cuddy Creek. There was also considerable amount of channel change work with various types of erosion fences and protection devices.

One of the highest 1951 production records for Portland cement concrete pavement was attained as 49,000 cubic yards of concrete were laid in 47 starts. The largest single day's output was 1,393 cubic yards, and the smallest was 555.

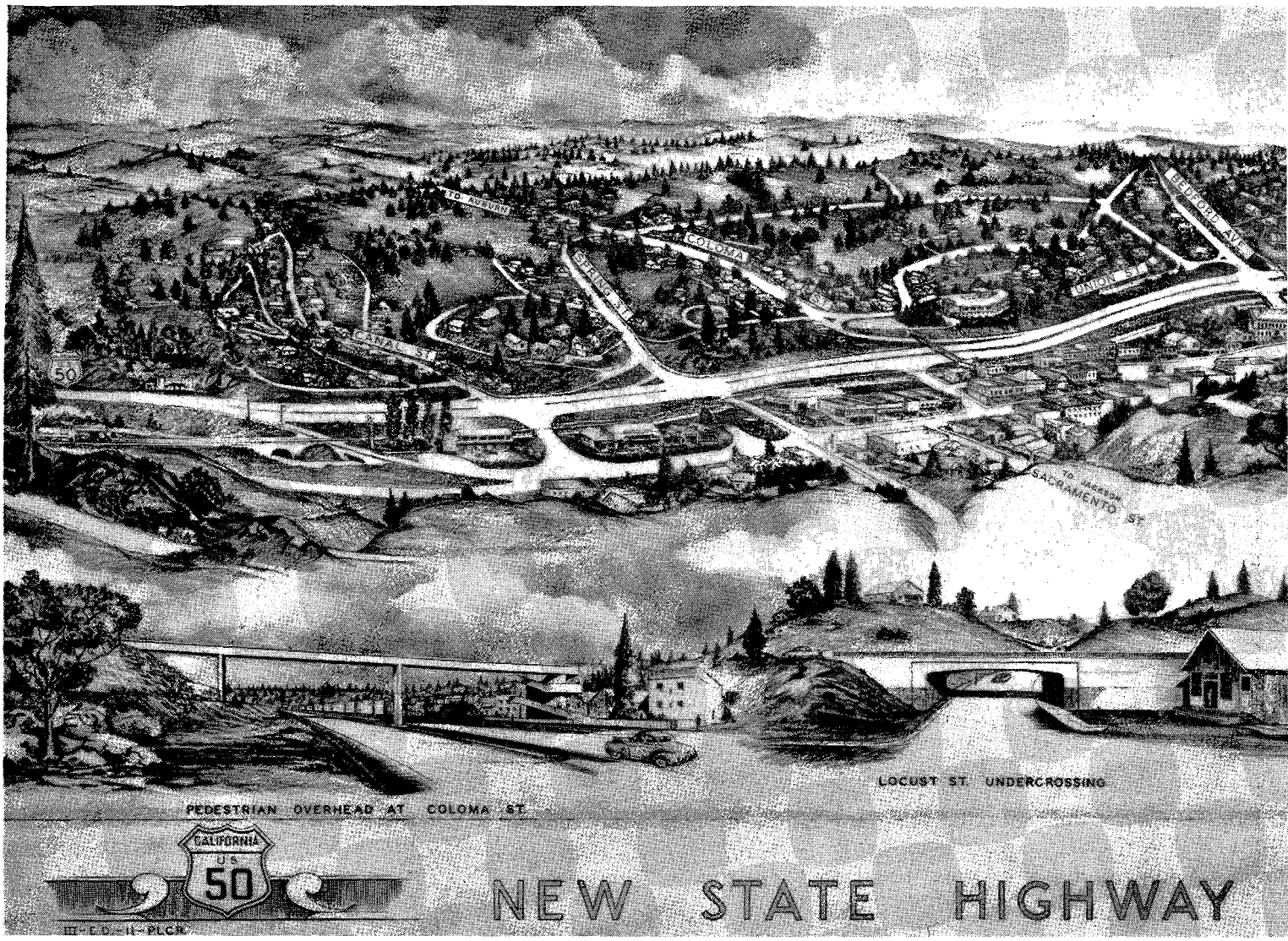
Other Projects

An experimental section of weakened-plane joints was put in the concrete pavement. These joints were formed by use of the standard mastic paper placed at variable spacings, ranging from the standard 15-foot panels to 60-foot panels at right angles to the direction of traffic. A section of variable spacings with the joint on a skew of three feet in the 12-foot lane width was also placed to study the effect of the impact caused by separate wheel load applications rather than by axle loads as in the standard right angled joint.

With the completion of this project and another in Los Angeles County, and with another project now under construction in Los Angeles County, U.S. 99 will be four lanes from McFarland to Los Angeles.

Mr. E. E. Frost was superintendent for N. M. Ball Sons, Contractor. W. M. Nett was resident engineer for the State.

LEFT—Looking southerly along completed section of Ridge Route. Lebec is shown in foreground. Tejon Summit is just off upper left corner of photograph.
RIGHT—Looking southerly along completed section of Ridge Route southerly of Gorman.



An artist's conception of what the new Placerville freeway will look like and how it will serve both through and local traffic is provided in this drawing prepared by Van der Goes of the Bridge Department, State Division of Highways. The freeway agreement has been signed by State Director of Public Works Frank B. Durkee.

By JEROME F. LIPP, Right of Way Agent, District III

THE PLACERVILLE City Council has been notified that the official agreement between the State and the city which clears the way for the early start of construction on the new freeway through Placerville has now been fully executed.

A copy of the document, signed by Director of Public Works Frank B. Durkee, was received from the office of District Highway Engineer C. H. Whitmore in Marysville. The agreement had previously been signed by the city.

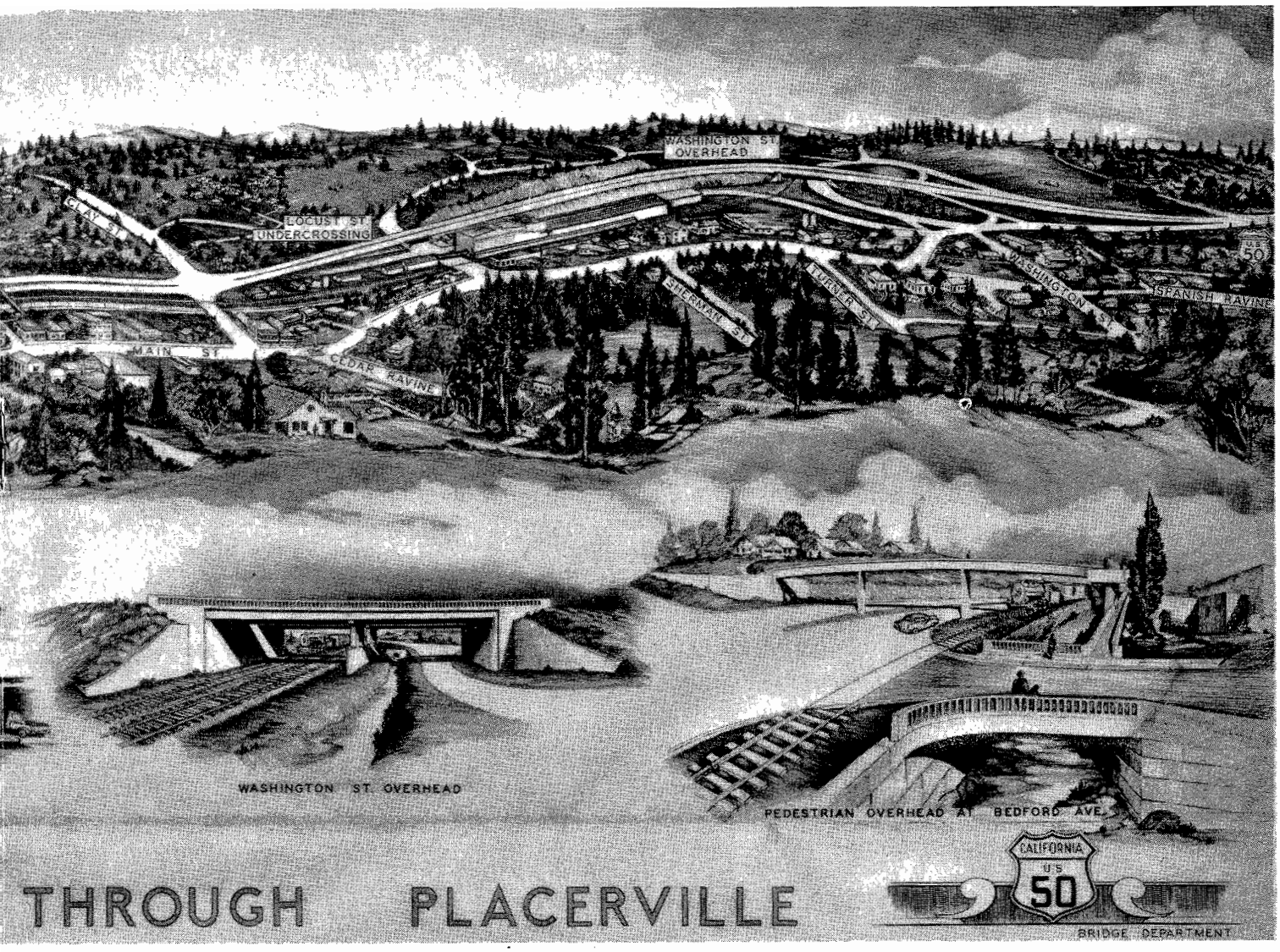
Funds in the amount of $300,000 were allocated to the Placerville freeway project in the 1952-53 construction budget of the California Highway Commission. The first call for bids is scheduled for early this summer, contingent on the completion of right of way negotiations. The work to be placed under contract in the coming season includes the Locust Street Undercrossing, the Washington Street Overhead, and the relocation and adjustment of the railroad facilities at the east end of the city.

Pedestrian Crossings

Pedestrian overhead crossings are planned just east of Coloma Street, to provide for the safety of elementary school pupils, and at Bedford Avenue, near the post office. Both these structures will have modern ramp approaches.

Generally, in California when it is impractical to relocate improvements on properties within the right of way needed for highway construction, the properties are just purchased outright at their fair market value.

However, special cases sometimes arise in which, despite the fact that moving buildings to a new location appears to be impractical, the outright



purchase of the property and subsequent disposal of the improvements for salvage value not only would have a severe adverse effect on public attitude towards the department, but would leave the affected property owners in an untenable position because of the impossibility of providing a substitute facility, short of long and tedious new construction.

Just such a situation confronted the Division of Highways in its right of way acquisition program for the Placerville Freeway. This freeway constitutes a realignment of a section of U. S. Highway 50, one of the Country's principal East-West routes, also used extensively by recreation enthusiasts en route to the Lake Tahoe area.

Buildings Moved

Among the improvements within the required right of way for the Placerville Freeway were the brick veneer church of the Christian Science Society, the clubhouse of the Placerville Women's Shakespeare Club, and a specially built private residence. The clubhouse, cultural center of the community, is owned by a corporation consisting of 150 members. This building, which houses a large auditorium, a dining room, a kitchen, a second-story all-metal projection room, two restrooms, a stage complete with footlights, and dressing rooms, contains approximately 6,500 square feet. Besides being used by its members, the club house is used as a regular meeting place for many of the city's service clubs.

In addition to the church and club house, the stucco home adjacent to the club house, required special attention because the wife of the owner, a semi-invalid confined to a wheel chair, required a specially built house on a level lot.

All buildings, while in excellent condition, were approximately 20 years old. They could not be duplicated under present building conditions for anywhere near their present value.

Agreement With Owners

In order to expedite the right of way acquisition by reaching some sort of an agreement with the affected parties, a meeting was held with the members of the Shakespeare Club at the beginning of our right of way acquisition on the project. The State's acquisition

procedure was carefully explained and the possibilities of moving the club house were thoroughly discussed. This same procedure was followed concurrently with the owners of the Christian Science Church and the owners of the private residence. It was determined in these meetings that all three buildings should be moved to another location so that the loss in usage to the owners and the community would be minimized.

Whether or not the complete transaction, based on moving improvements, would cost the state more than an outright purchase at the fair market value of the properties needed was the principal limiting factor in the decision concerning the economics of moving improvements which were within the right of way. Of course, in any event, the property acquired was to be paid for at its fair market value.

Shakespeare Club moved to new location

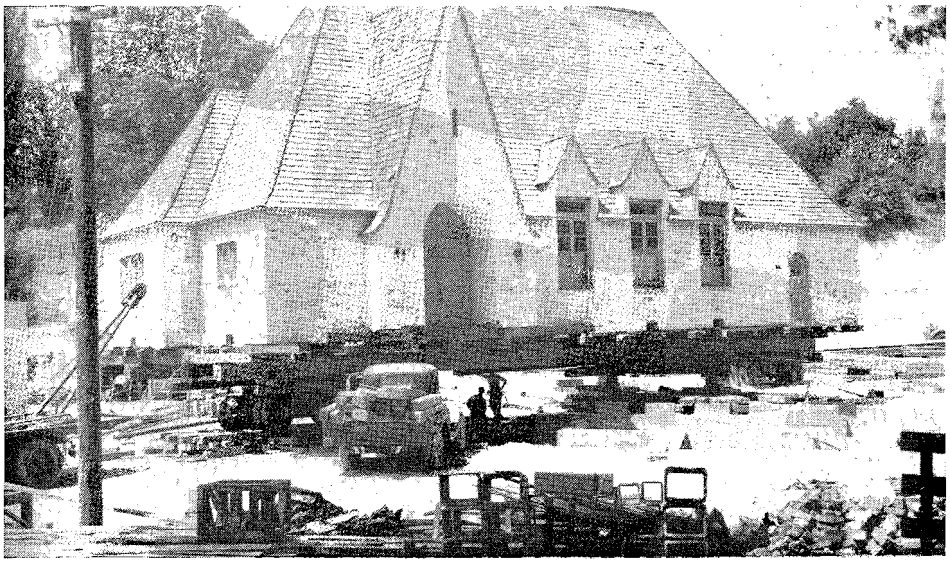
New Site Chosen

A site about one block up hill appeared to be the only practical one because almost all usable lots in the city's steep-sided narrow valley were in use. It was also most desirable for all three properties. However, the purchase of the site was complicated by the fact that it was owned by El Dorado County, which can sell land only by public sale. In order to avoid the many complications resulting from this requirement, the state finally purchased the entire parcel and subsequently deeded the land in three individual parcels to the parties involved.

The selected site was an average of 14 feet below street level; consequently, it was necessary to place 10,000 cubic yards of fill material to bring it to grade. Fortunately, a large vacant lot on a steep hillside, directly across Jackson Street from the site, provided a convenient material source.

The owner of the hillside lot gave the State permission to remove the needed fill material, free of charge. The removal of the fill dirt from this lot resulted in an improvement to the area generally, since enough material was excavated to leave level building sites where none had existed before.

Christian Science Church was moved without cost to owners



State Pays Moving Costs

Negotiations were conducted on the basis of the owners retaining all improvements, and the State's paying the estimated cost of moving them. The State, in conjunction with the building committee of the Shakespeare Club, the church officials, and the owner of the residence, secured bids for all phases of the relocation work, including filling the site, moving, rehabilitation, and landscaping. Wilkins Draying Company of Sacramento were the successful bidders for moving the clubhouse, while Nick Martinelli, also of Sacramento, was low bidder for moving the other two units.

While the moving of the brick veneer church intact, without losing a brick, was quite a feat in this steep area, the relocation of the Shakespeare Club presented the greatest problem. It was necessary to cut the building into three pieces and move each separately. Even then, the largest piece was wider than Jackson Street, over which the buildings had to be moved. Therefore, part of the moving operation included moving a residence on Jackson Street back 30 feet, destruction of a garage and several retaining walls, and removal and replacement of a front porch from another house. This additional work barely provided sufficient width for the moving operation.

. . . Continued on page 61

Bay Bridge Bonds

On FRIDAY MORNING, January 11, 1952, the sum of $21,000,000, plus accrued interest, was paid into the State Treasury in exchange for California Toll Bridge Authority revenue bonds in the amount of $21,000,000 to be delivered to their purchasers. The transaction involved the refinancing of the indebtedness of the San Francisco-Oakland Bay Bridge, including outstanding bonds and the amount due the State Highway Fund, and the providing of additional funds for improvements on the bridge to facilitate the movement of traffic.

It was necessary that the refunding be completed prior to January 15, 1952, in order to preserve the credit of the bridge looking ahead to the financing of future additional crossings of San Francisco Bay.

The sale of the bonds culminated proceedings which had their inception several years ago, when studies were made by the Division of San Francisco Bay Toll Crossings of improvements on the existing San Francisco-Oakland Bay Bridge and for approaches thereto which would fit in with any new crossing of San Francisco Bay.

Mayors Request Refinancing

On October 23, 1951, the mayors of the Cities of San Francisco and Oakland had joined in a recommendation to Governor Earl Warren, Chairman of the California Toll Bridge Authority, that the existing indebtedness of the San Francisco-Oakland Bay Bridge be refunded and that the new issue of bonds include sufficient funds to perform work on the present bridge, build additional approaches on each side of San Francisco Bay, and provide funds for a further study of an additional bay crossing.

At a meeting of the authority on November 27, 1951, a resolution creating an issue of bonds not exceeding $80,000,000, to be issued in series, was adopted. Only the sale of the first, or Series "A" bonds, was authorized, that series being in the amount of $21,000,000 for the purposes of refunding the presently outstanding bonds, repaying to the State Highway Fund the sum of approximately $6,600,000 appropriated in 1933 for construction of approaches, the appropriation providing for repayment after the original indebtedness of the bridge had been paid off; and approximately $7,000,000 for alterations and improvements on the existing bridge.

Other Series of Bonds

The resolution of the authority also provided for a Series "B" and Series "C" issue of $25,000,000 each, the proceeds to be used for the construction of approaches on the San Francisco side of San Francisco Bay, and for like purposes on the east side of the bay. Among the approaches designated on the east side of the bay is an additional tube under the Oakland Estuary which separates the Cities of Alameda and Oakland. Sale of the Series "B" and "C" bonds was not authorized at the November meeting.

A Series "D" bonds also authorized may not be issued until clarification of state and federal statutes affecting construction of new toll crossings of San Francisco Bay.

State Wins Decision

The OPINION of the district court of appeal in the case of *Chas. L. Harney, Inc.*, a corporation, v. *Frank B. Durkee*, as Director of Public Works of the State of California, reported in 107 A. C. A. 714, became final on January 15, 1952, by the refusal of the Supreme Court of California to grant a hearing in the case.

Following the opening of bids for the construction of the section of the Bayshore Freeway in San Francisco from Army Street to 17th Street, the Director of Public Works rejected all bids and ordered a readvertisement for new bids. Chas. L. Harney, Inc., the low bidder on the first call, brought the action in the Superior Court in San Francisco to nullify the rejection of all bids and to force award of the contract to it on the ground that no lower bid could reasonably be expected.

The opinion of the district court of appeal reversed the superior court and upheld the action of the Director of Public Works in rejecting the bids.

The project has now been readvertised and new bids are scheduled to be opened on March 12th.

Walter Sandelin Again Appointed Commissioner

On JANUARY 26TH, F. Walter Sandelin of Ukiah received from Governor Earl Warren his fourth appointment as a member of the California Highway Commission. His new term will end on January 15, 1956.

F. WALTER SANDELIN

When the new Highway Commission was created in 1943 Sandelin drew the short term and was reappointed by the Governor in January, 1944. He was reappointed January 15, 1948.

Commissioner Sandelin for many years has been active in highway development in the Redwood Empire counties. He is a veteran of World War I, past president of the Ukiah Rotary Club, past president of the Ukiah Chamber of Commerce and served as vice president and director of the Redwood Empire Association and as chairman of the transportation committee of the association.

Street Sweepers

Interesting Tests Made of Various Broom Fibres

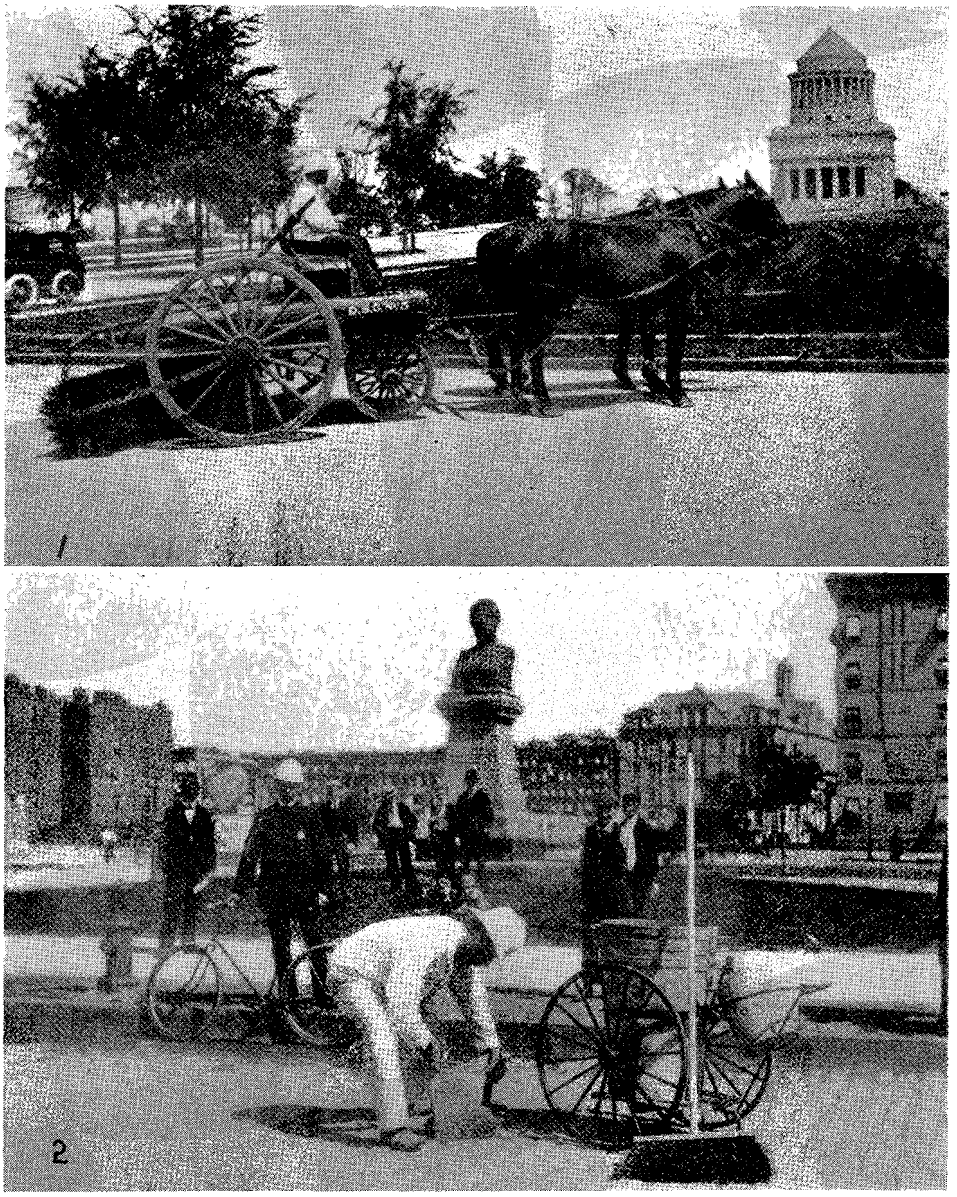
By NORMAN H. HEGGIE, Assistant Physical Testing Engineer
Service and Supply, Headquarters

"A NEW BROOM sweeps clean."

This old English expression was handed down by John Haywood in 1546, years before anyone ever dreamed of such a thing as a power broom. As a matter of fact, the first power broom was not invented for another 300 years. "Kanes Famous First Facts" gives the following description of the first power broom used in the United States. It was demonstrated on December 15, 1854, in Philadelphia and described in the *Philadelphia Public Ledger* in the following manner:

"A series of brooms on a cylinder about two feet by six inches wide attached to two endless chains running over an upper and lower set of pulleys which are suspended on a light frame of wrought iron behind a cart. As the cart wheels revolve, a rotary motion is given to the pulleys, conveying the endless chains and a series of brooms attached to them, which being made to bear on the ground, successively sweep the surface and carry the soil up an incline or carrier plate over the top of which it is dropped into the cart."

Figure 1 depicts an early model horse-drawn sweeper. Of course, prior to the advent of the horse-drawn sweeper, the personal attention of the individual "white wing" was required to sweep up refuse on city streets (*Figure 2*).



UPPER—Street sweeping machine, 1905 model. LOWER—Early day sweeper and his outfit.

Power Brooms

What a far cry this was from our modern powered brooms! But, of course, everything must have a beginning. *Figure 3* shows the modern power broom used to sweep the San Francisco-Oakland Bay Bridge.

The Division of Highways uses power brooms to sweep the road surface preparatory to applying armor coat and nonskid surface treatments, seal coats and resurfacing blankets besides keeping the roadway on bridges and state highways within city limits free of debris.

Up until recently, little attention was paid to the actual cost of broom fibre in relation to the sweeping job accomplished, it being considered that the fibre was a means to an end and, as it was sometimes difficult to purchase some fibres, those that were readily available on the open market were therefore used. It was observed in the field that the use of some fibres resulted in a more thorough and cleaner sweeping job, with better wearing qualities than others.

Test of Fibres

The extent of these differences were not known, so, in an endeavor to determine the relative characteristics and wearing qualities of the various broom fibres available for use, the Service and Supply Department solicited the cooperation of the Maintenance Department in Districts VIII, IV and on the Bay Bridge to conduct a series of tests on the following fibres wound on the brooms of their power street sweepers: bass, hickory, palmyra, split palm, synthetic.

The bass, palmyra and split palm are natural palm fibres. The hickory is split from the hickory wood. The synthetic fibre is a manufactured article.

Preparatory to winding the palm, hickory and natural palm fibres, they were soaked or boiled in water, or steamed. The plastic fibre was applied dry. Time of preparation was not included in the cost analysis.

Sweeping Data

The tests consisted of winding the broom cores, (*Figure 4*), noting the time required and obtaining the weight of fibre and length of bristle at completion of winding. (*Completed broom, Figure 6*). The broom was then used in its regular manner and run until normal wear was reached. *Figure 5* shows a badly worn broom. The mileage swept and type of surfacing was noted together with the weight of the fibre and length of bristles remaining on the core at the end of the test run. On basis of these data, the cost of the fibre per mile swept, including cost of winding, was obtained. A total of 3,824 miles of roadway surface was swept in obtaining this test data, with an average of 128 miles being swept by each broom. The minimum mileage swept by any one broom was 43 miles, the maximum 242.

We were primarily interested in determining which type of fibre was the most efficient and the most economical to use. The relative efficiency of the brooms was not determined as detailed comments and remarks by the operators were not generally obtained. However, the relative cost per mile of the fibre, including winding of the broom was obtained on basis of the individual fibre and over-all use compared with the fibres used on different machines, and also when used on different types of surfacing. *Table 1* summarizes these findings.

Percent Loss in Weight

A wide variation in percent loss in weight and fibre length was obtained. The fibres lost an average weight of 52 percent during their serviceable life on the broom, with a minimum of 32 percent, maximum of 76 percent. They were reduced an average of 48 percent in length with a minimum of 38 percent and maximum of 73 percent. These wide variations were reflected in the cost per mile shown in *Table 1* for any one fibre, especially for the palmyra where average values ranging from $0.099 to $0.269 per mile were obtained. A particular point in case can be taken from the analysis of fibre wound on the broom for sweeper "C."

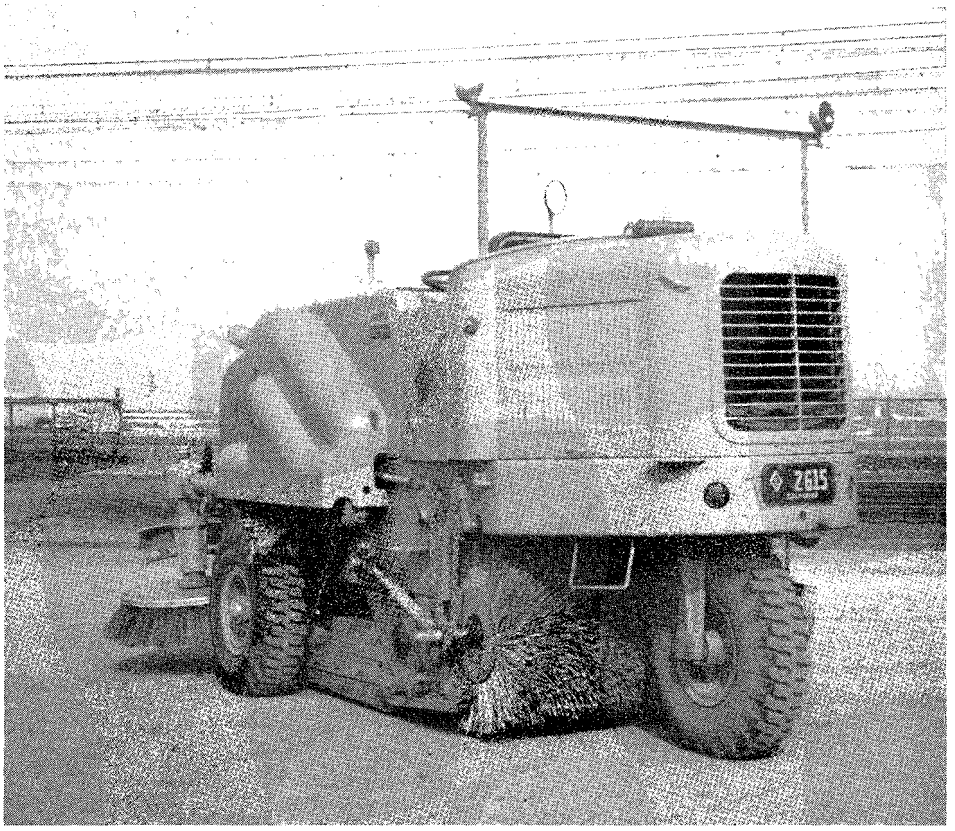
On the first winding with palmyra, the broom lasted for only 43 miles, with accompanying loss in weight of 65 percent, loss in length 66 percent and cost per mile of $0.472. On the second winding, the broom lasted for 179 miles with a loss in weight of 63 percent, loss in length of 59 percent, and a cost per mile of $0.112. Plant-mixed surfacing was swept in each case, using the same sweeper and operator. There was no particular notation by the operator to indicate factors contributing to such a difference. Whether this was due to a difference in the roughness factor of the surfacing or a difference in applied pressure, or possibly to a variation in the inherent quality of the fibre itself is unknown.

Comparisons

The cores wound with bass, palmyra and split palm all seemed to give comparable sweeping results, however, it was reported that the bass broom was less efficient than the other two in some instances, and the palmyra did not pick up sand too well, but did give an overall satisfactory sweeping job.

This is special power broom used on the San Francisco-Oakland Bay Bridge

On basis of the data presented in *Table 1*, it appears that the average cost per mile of all of the individual fibres is quite close, with the exception of the synthetic fibre, which is obviously excessive. In addition to this cost factor, this fibre was found to be very brittle and difficult to wind, and when used, broke off at the cable in bunches. This fibre appeared to lack sufficient stiffness to carry the sweepings up on to the belts, yet the tips of the fibre would break off when striking obstructions such as rocks, bottles and ends of median bars, and did not result in a good sweeping job. Results obtained with the use of this fibre were so adverse that subsequent tests were not considered advisable. Furthermore, upon inquiry to the City of Sacramento Street Department, we found that they had experienced the same results with synthetic fibre.



Modern power broom of Division of Highways

Winding of Fibres

No difficulty was encountered in winding the various palm fibres. The hickory, however, was found to be quite difficult to wind on the core without a long soaking period. Considerable breakage occurred when using the straight hickory fibres, due to their extreme brittleness. There did not seem to be sufficient spring in the fibre to throw the material on the conveyor belts, resulting in poor sweeping quality.

The cores wound with half hickory and half palmyra did, however, give far superior results, both from a mileage and an economic standpoint, besides resulting in the best sweeping job. The material was intermixed during the winding operation. Stiffness was supplied by the hickory, making the

TABLE 1. SUMMARY OF TEST DATA OBTAINED ON SWEEPER BROOM FIBRES

Overall cost/mile* on basis of 30 brooms regardless of sweeper or type of surfacing	Mean averages	Bass	Hickory	½ Hickory ½ Palmyra	Palmyra	Synthetic	"Split Palm"
	$0.264	$0.230	$0.222	$0.122	$0.241	$0.630	$0.223
Sweeper							
A	.202	-----	.232	.152	.099	-----	-----
B	.284	.375	-----	-----	.255	-----	.370
C	.250	.184	-----	-----	.258	-----	.199
D	.120	-----	-----	-----	.120	-----	-----
E	.252	-----	.170	.092	.117	.630	-----
Type of Surfacing							
P.C.C.	.375	-----	-----	-----	.120	.630	-----
A.C.	.165	-----	.178	.152	-----	-----	-----
A.C. and P.C.C.	.119	-----	.170	.092	.108	-----	-----
P.M.S. and R.M.A.	.242	.280	.246	-----	.257	-----	.223
Mileage Data—Regardless of Sweeper or Type of Surfacing							
Maximum	-----	141	160	242	240	115	190
Minimum	-----	108	96	167	43	115	59
Average	128	125	129	205	128	115	110

* Cost of fibre plus cost of winding.

broom capable of picking up the denser particles, while the suppleness of the palmyra provided a good "clean-up" quality. Little or no breakage of the broom was observed during its operation. The operators of the sweepers agreed that the brooms wound with half palmyra and half hickory fibres did a much better job than any other broom tested.

Cost Per Mile

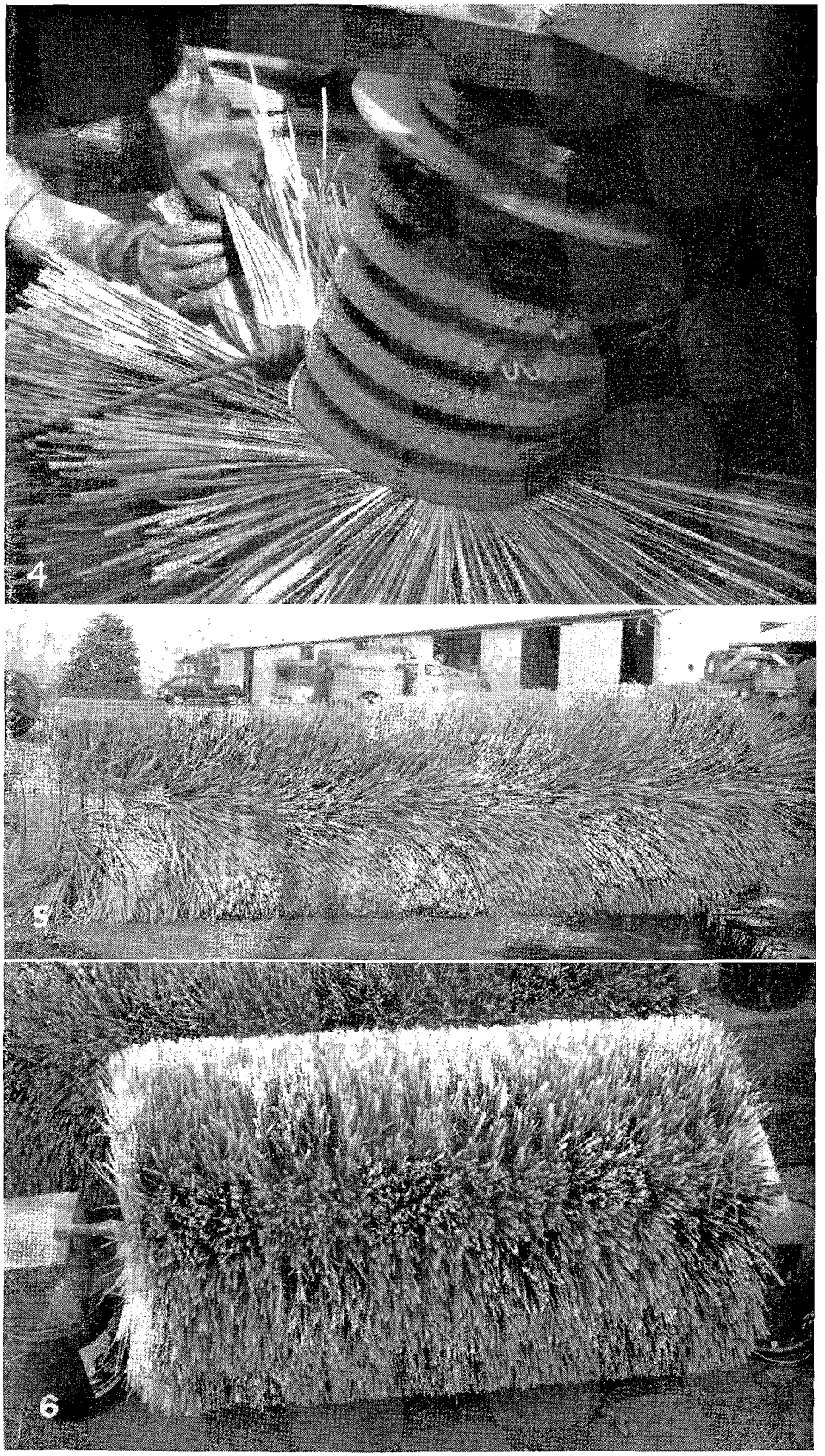
In substantiation of these observations, one of the brooms wound with half hickory and half palmyra swept 242 miles at a cost of $0.092 per mile for the fibre, including winding, on basis of the reported test data. This was the lowest cost per mile obtained on any of the brooms. A low average cost of $0.122 per mile was obtained on the complete series of tests made on this fibre. It was found that the City of Sacramento Street Department had also obtained successful results with palmyra and hickory fibres mixed and, in its opinion, these fibres proved the most satisfactory for their use of the fibres presently available.

CONCLUSION

Obviously, the results of this series of tests cannot be considered entirely conclusive, due to the many variable factors involved. Pressure exerted by the broom on the pavement, speed of broom rotation, roughness factor of the pavement swept and possible variation in inherent quality of the fibre are all important factors, variation in any one of which could be the basis for undue wear.

An analysis of the test data accumulated, together with an over-all picture of the results of the test series indicates that the most economic and thorough job of street sweeping which fulfills our normal requirements can be obtained by equipping our sweepers with broom cores wound with half hickory and half palmyra fibre intermixed.

On basis of the results obtained on this series of tests, the Maintenance Department of the Division of Highways is winding their sweeper broom cores with half hickory and half palmyra fibre whenever practicable. It is expected that our sweeping costs will be materially decreased and the efficiency of the brooms increased.



UPPER—Winding broom core. CENTER—Badly worn broom. LOWER—Completed broom ready for installation.

New Index

Highway Construction Costs Reach Record High Level

By RICHARD H. WILSON, Assistant State Highway Engineer
H. C. McCARTY, Office Engineer
R. R. NORTON, Assistant Office Engineer

DURING the fourth quarter of 1951 the California Highway Construction Cost Index rose 10.6 percent to reach an all-time high of 245.4 (1940=100). This fourth quarter rise confirms the statement made in October that the 6.9 percent drop in the third quarter was a temporary drop from a false peak and that the upward trend effective since the beginning of 1950 would continue during the fourth quarter of 1951.

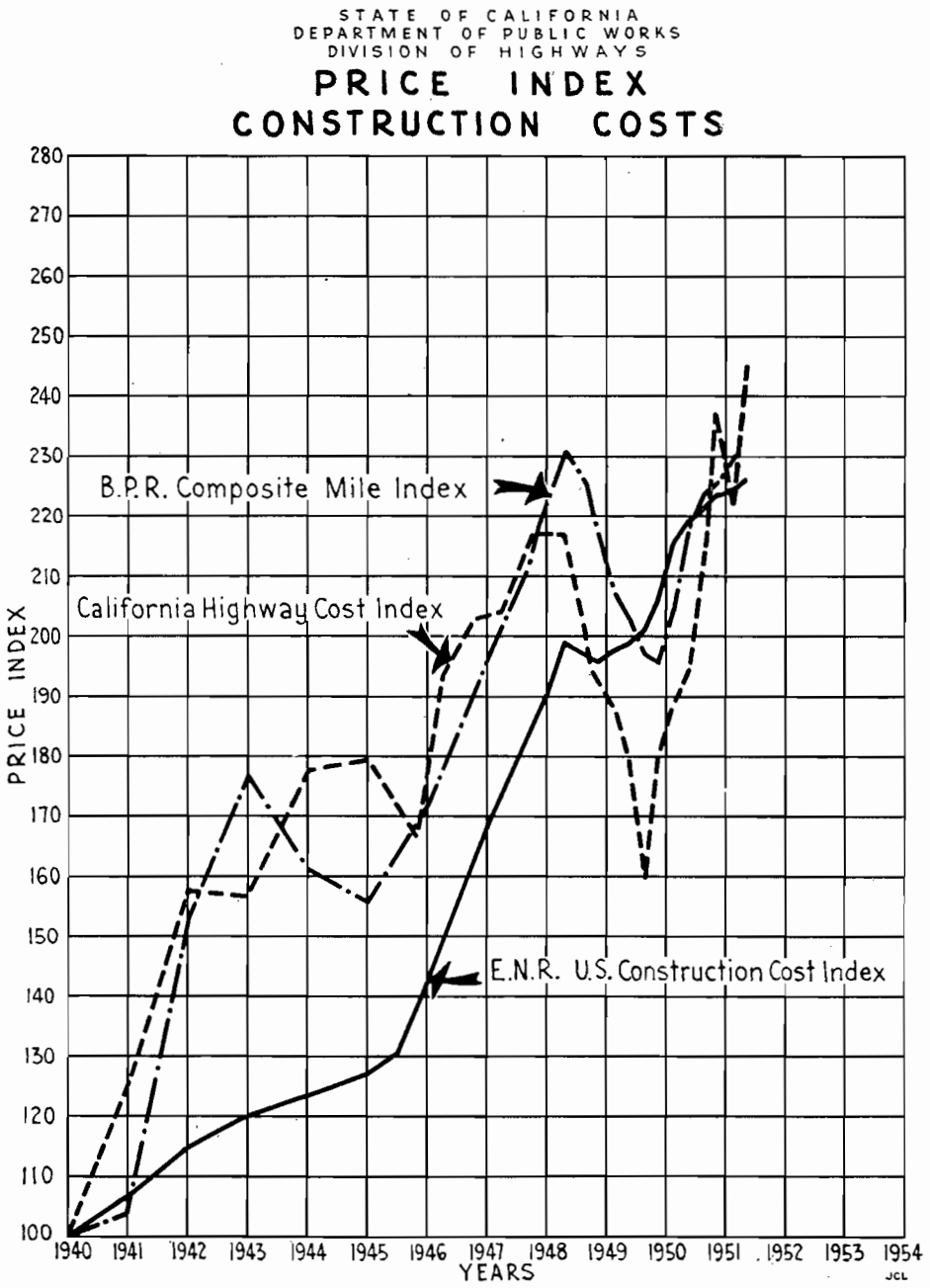
Beginning with 1940 as a base of 100 the California Highway Construction Cost Index shows the cost of highway construction rising steadily to 1948 when the index reached 216.6. This was a rise of 116.6 percent during those eight years. During the next two years costs declined; the index for the first quarter of 1950 was 160.0, a drop of 26.1 percent during those two years.

With the accelerated national defense program and the outbreak of the Korean war, highway construction costs began to rise in the second quarter of 1950, the index reaching 238.3 in the second quarter of 1951, an increase of 48.9 percent over the 160.0 low in the first quarter of 1950.

Upward Spiral

As previously stated, the third quarter of 1951 showed a drop of 6.9 percent, but the fourth quarter figure indicates that costs are back on the upward spiral, the index of 245.4 being 53.4 percent over the 160.0 low of the first quarter of 1950.

The U. S. Construction Cost Index of the *Engineering News-Record* rose 0.8 of 1 percent during the fourth quarter of 1951, which is a slight increase in the rate of rise of this index over the two previous quarters. Cost figures of the Bureau of Public Roads Composite Mile Index for the fourth quarter are not available at this writing,



but as that index rose nearly 6 percent during the first three quarters of the year it is thought that under current conditions its upward trend undoubtedly has continued during the last quarter of 1951.

The accompanying chart shows a comparison of the three indexes, all

with a base of 1940=100. Average contract prices for the items from which the California Index is prepared are shown in the accompanying tabulation.

Inflationary Tendencies

As long as inflationary tendencies continue, with the cost of living and taxes still on the increase, and while the short supply of steel and other essential materials with attendent uncertainties and delays persists, there appears no possibility of any drop in highway construction costs.

Our statement in the report for the third quarter of 1951, that the greater rate of rise of the California Highway Construction Cost Index over comparable indexes is influenced by local conditions, still holds as federal construction programs get under way for the Army, Navy and Air Force. This defense construction totals some 467 million dollars in California.

Considering these various economic factors of rising costs generally, limited supply and uncertainties of steel and other materials, and the large defense construction programs, it appears that the rise of highway construction costs in California will continue for some months.

Cost Index Tabulation

Following is a tabulation of the California Construction Cost Index from 1940 to and through the fourth quarter of 1951.

Period	Index 1940=100	Change from previous period	Change from 1948	Change from 1st qtr. 1950
1940	100	.....	.....	.....
1941	125.0	+25.0%	.....	.....
1942	157.5	+26.0%	.....	.....
1943	156.4	— 0.7%	.....	.....
1944	177.8	+13.7%	.....	.....
1945	179.5	+ 1.0%	.....	.....
1946	179.7	+ 0.1%	.....	.....
1947	203.3	+13.1%	.....	.....
1948	216.6	+ 6.5%	.....	.....
1949	190.7	—12.0%	.....	.....
1950 (1st qtr.)	160.0	—10.5%	—26.1%	.....
1950 (2d qtr.)	180.0	+12.5%	—16.9%	+12.5%
1950 (3d qtr.)	189.2	+ 5.1%	—12.7%	+18.3%
1950 (4th qtr.)	194.8	+ 3.0%	—10.1%	+21.8%
1951 (1st qtr.)	215.4	+10.6%	— 0.6%	+34.6%
1951 (2d qtr.)	238.3	+10.6%	+10.0%	+48.9%
1951 (3d qtr.)	221.9	— 6.9%	+ 2.4%	+38.7%
1951 (4th qtr.)	245.4	+10.6%	+13.3%	+53.4%

CALIFORNIA DIVISION OF HIGHWAYS
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	$7.69	$18.33	$0.040	$0.083	All projects
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	
1st Half, 1946	0.41	2.31	4.00	4.54	9.85	37.38	0.060	0.099	Federal aid projects only
2d Half, 1946	0.39	2.27	4.12	5.04	12.39	49.84	0.079	0.142	
1st Half, 1947	0.48	2.62	4.52	6.46	12.41	47.03	0.080	0.133	
2d Half, 1947	0.54	2.39	4.02	6.48	11.58	50.15	0.089	0.123	All projects
1st Half, 1948	0.56	2.45	4.42	4.91	13.37	49.51	0.094	0.145	
2d Half, 1948	0.52	2.64	4.80	7.00	14.01	49.08	0.103	0.131	
1st Quarter, 1949	0.49	2.48	4.54	5.70	11.84	48.11	0.089	0.113	
2d Quarter, 1949	0.43	2.91	4.63	4.06	11.74	48.63	0.083	0.110	
3d Quarter, 1949	0.41	2.40	5.05	4.60	11.53	45.35	0.080	0.093	
4th Quarter, 1949	0.43	2.55	3.78	3.50	12.66	44.54	0.078	0.092	
1st Quarter, 1950	0.34	2.22	3.65	3.74	.....	40.15	0.077	0.081	
2d Quarter, 1950	0.40	2.13	4.48	3.74	10.86	43.03	0.080	0.105	
3d Quarter, 1950	0.41	2.32	4.25	5.50	10.91	44.34	0.093	0.131	
4th Quarter, 1950	0.42	2.81	4.64	4.61	12.55	43.18	0.098	0.120	
1st Quarter, 1951	0.45	3.07	4.06	5.22	11.71	46.38	0.103	0.206	
2d Quarter, 1951	0.63	3.88	4.56	4.63	12.93	51.50	0.105	0.166	
3d Quarter, 1951	0.56	2.88	4.59	3.90	12.41	46.14	0.107	0.165	
4th Quarter, 1951	0.66	2.91	5.66	4.89	12.71	49.38	0.105	0.169	

Municipal Job

Improvement of Cherry Avenue In City of Tulare Is Described

By BERNARD P. WESTKAMPER, City Engineer, City of Tulare

THE PURPOSE of this article, in describing this small job, is to illustrate how one small city is using the funds allocated for construction under the Collier-Burns Highway Act. It might be interesting to public works officials in other similar political jurisdictions to compare their work with ours. If parts of this article appear facetious it should only serve to emphasis the complete seriousness with which we attempted to secure a good job.

Cherry Avenue is important in our community because it provides direct access northward to the district hospital and passes by one of the principal elementary schools. The job consisted of paving 1,280 feet of street. The work included roadway excavation, untreated rock base, plant-mix surfacing, curb and gutter, extensions to a box culvert, extension of storm drain and miscellaneous items.

Design

The design was prepared by the city with advice of Division of Highways personnel. Before initiating the design a complete and thorough field survey was made of the site. To this we attribute the fact that we did not have to make any changes in the plans during construction. The size of the job did not justify a rigorous analysis of pavement thickness. The section selected, based on judgment and past experience, was 2½ inches of plant-mix; over 5½ inches of untreated rock base, over a subgrade compacted to 90 percent, as determined by the Field Method Compaction Test, for a depth of six inches.

The engineer of city and cooperative projects of the Division of Highways reviewed our plans and objected to two items:

1. The reinforcing steel in the extensions to the box culvert at an irrigation ditch did not conform to the Division of Highways standard culvert plan.

2. The pavement width was wider than normal for two lanes plus parking and not wide enough for four lanes plus parking.

We changed our detail on the box culvert extensions. However, we did feel that the State's design was too conservative. In regard to street widths, we were able to show mitigating circumstances which warranted acceptance of a nonstandard width.

After the plans were approved the city asked for bids. One bid was received and it was for $29,360.40. This was above the engineer's estimate and the amount allocated. Two alternatives were open to the city; ask for a new bid and ask for an additional allocation from the city's share of gas tax funds. The city did both. At the next bid opening three bids were received. The low bid was $26,350.70, by Wells and Fields Constructors of Visalia, to whom the contract was awarded. The difference between the bids received at the first and second bid openings was possibly due to a paving plant being moved into the immediate area and to wider dissemination of the information that Tulare was accepting bids on paving.

Construction

We originally planned to utilize inspection by state personnel supplemented by our own men. Due to circumstances beyond our control this was impossible. Employees of the Division of Highways inspected at the hot-plant and taught our men how to make compaction tests. All street inspection was taken care of by city forces.

Excavation to subgrade was consummated quickly. In spite of having relocated the water mains, prior to the start of the work, we still had several broken service pipes. The contractor managed to sell the excavated material in a neighboring town for about enough to pay for the cost of excavating and hauling. Compaction of the subgrade to 90 percent to a depth of six inches was secured without ripping up and relaying it. This was fortunate, considering the maze of gas and water pipes just below the surface. One small spot which was overwatered during compaction quivered like a gelatin dessert when stepped on. Another overwatered spot was caused by a resident along the street watering his lawn and forgetting about it, thereby running the water all night and into the street.

Curbs and Gutters

Curb and gutter was constructed in conventional fashion. The concrete subcontractor started off with five-sack concrete whereas the specifications required six sacks of Portland cement per cubic yard. Of course this was instantly corrected. Curb forms were checked for elevation with an engineer's level at intervals of about 12 feet. This was in addition to setting grade stakes. During and after a recent rain there were no puddles in the gutter, in spite of the fact that part of the gutters were on a grade of about .0021.

The principal difficulty with the extensions to the 2-foot by 8-foot box culvert was in obtaining the four tons of reinforcing steel. Priorities had just come into effect.

There was considerable contrast between the reinforcing in the existing structure and the new extensions. The old culvert was reinforced with one-inch strap iron about 12 inches on center both ways. We hazarded a guess that it was excess tire iron stock left over when horse-drawn buggies went out of style.

The rock base and plant-mix was laid over the culvert to avoid the bump sometimes found when asphalt paving joins a structure. The contractor elected to backfill around the extensions with sand.

Untreated rock base was spread with a spreader box and a motor grader and compacted with a rubber-tired roller and a steel-wheel roller. Grade was checked against blue tops set at 50-foot intervals at the quarter points and center line. A penetration shot of one-fourth gallon per square yard of SC2 was placed on the rock base after compaction. It was two weeks later that we laid the plant mix. In the meantime we kept traffic off the street. As a consequence the SC2 penetrated a little over three-eighths inch setting up the base surface reasonably firm.

course, laid by means of a finishing machine adjacent to the gutters. The compacted surface next to the gutter was laid one-fourth inch higher than the gutter lip. Paving proceeded toward the center line. The last strip down the center was laid between two other strips. The contractor was careful on the width of his spreads so that the last one fit in the remaining space without too much difficulty.

The city had, in the past, some trouble with uncompacted joints. On this job emphasis was placed on obtaining good joints. One inspector

and paving was done over them. They were then raised to the pavement surface and patched around. This avoided the depressions and bumps sometimes found when manhole covers, etc., do not conform to finished grade.

There is one thing we may do different on the next job. That is, use one-half-inch maximum aggregate in the plant-mix instead of three-fourths inch. It might give a smoother textured surface, more suitable for a city street. However, they all look somewhat alike after they have been in use a year.

Cherry Avenue in City of Tulare after improvement

State Cooperation

The Division of Highways was completing a large project in our vicinity. Its contractors' plant production was available to our contractor as long as it did not interfere with state operations. Through the courtesy of the resident engineer, plant inspection was done by state personnel. Fortunately, the plant-mix used on the state project was made with the same grade of paving asphalt and the same gradation of aggregate as had been written into our specifications.

The plant-mix leveling course was laid with a motor grader. The contractor elected to start the finish stayed just behind the paving machine with a straight edge and rule and measured the height of the uncompacted plant-mix at the joint above the adjacent compacted strip. He signaled the screed operator if it was starting to get too high or too low. Maybe this helped because we do not have a poor joint on the street.

Some of the asphalt rakers could not understand English too well. Fortunately our principal engineering assistants speak Spanish fluently. As a consequence, the raking was well conducted.

The tops of manholes and valve boxes were lowered prior to paving

The characteristics of the street that is particularly pleasing to us is the drainage. During recent rains, no puddles formed. The water ran off the pavement to the gutters and then to the catchbasins leaving a dry nonskid surface.

Acknowledgements

The city is grateful to the personnel of District VI of the Division of Highways for aiding us on this project and particularly to the engineer of city and cooperative projects.

Dr. Thomas Drilling is Mayor and Robert E. Rounsaville is City Manager. The work was done under the writer's immediate supervision.

TRAFFIC ENGINEERING AND HIGHWAY PLANNING

By GEORGE M. WEBB, Acting Traffic Engineer, Division of Highways

"GET THE FACTS," a good slogan in any walk of life, is an indispensable creed for the highway planning engineer. He must predict future highway needs, and future development bearing on those needs. Fortunately, he is not restricted to the crystal ball as the basis for his predictions; he can make estimates, not guesses.

The data which must be studied and analyzed by the planning engineer in projecting the highway program far into the future come from many sources. Among the most important are those which tell the traffic and accident story. In fact, since the purpose of all highways is to provide for the safe and expeditious movement of vehicles, a complete traffic picture is one of the foundation stones of the sound planning which must precede sound highway improvements.

Traffic Data Required

Obviously, if a highway is to be located and designed so as to accomplish its purpose efficiently, the planning engineer must have at his disposal a good deal of information about the volume of traffic, both present and future: about the behavior of that traffic under various conditions; about where the traffic is going; about the accident situation, including type as well as frequency; and about the probable accident rate on the various types of highway improvements which are under consideration.

An incidental but important benefit gleaned from a study of traffic volume and trends is an estimate of the probable available revenue for highway purposes. A reliable estimate of future traffic will naturally indicate the volume of taxable motor fuel consumed.

How is all this information accumulated? From many sources, and in many ways.

Annual Traffic Counts

The cornerstone of the informational structure is the traffic count. We owe a great deal to the "get the facts" philosophy of our early-day highway engineers, who initiated the first traffic counts on a few mountain roads back in 1913.

At present, more than a thousand traffic counts are taken throughout California on a Sunday and Monday in mid-July. The tally starts at 6 a.m. and ends at 10 p.m. on both days, a total of 16 hours for each day. Actually, most counts represent two or three, since they are located at intersections, and each leg of the intersection is tallied.

In addition to the basic annual count, the Division of Highways takes other traffic counts to show the monthly variation in traffic throughout the year and the daily variation throughout the week. At 87 of the regular annual stations, a monthly count is taken. At 18 of them a count is taken for seven successive days in July.

How Traffic Is Estimated

Finally, when the annual mid-July count is taken state-wide, the Monday count at the 87 "monthly" stations is made not for 16, but for a full 24 hours (6 a.m. Monday to 6 a.m. Tuesday, to avoid Sunday night traffic). These 24-hour counts provide the mathematical factors which enable the traffic engineer to expand monthly counts and other 16-hour counts into 24-hour figures. Further computations, using all these counts, can convert the July Sunday-Monday tallies to the average daily traffic at any given point on the State Highway System. In special situations, a count can be taken at any time of the year and can be accurately expressed, through proper application of various factors and formulae, in terms of average daily traffic.

One purpose often served by a special traffic count is to indicate the need for improvements at intersections. In such cases, the count includes a record of turning movements and their volumes.

Standard Project Report

Another primary source of information on traffic conditions which the highway planner must consider is the traffic section of the standard Project Report compiled by the field offices of the Division of Highways prior to the design and construction of any major highway improvement.

The Project Report always includes, in considerable detail, not only such information as the average daily traffic on the existing facility, but also data on the composition of that traffic, on its speed, and on the turning movements at all intersections which may require special treatment. This information, taken in conjunction with economic studies of the area concerned and reviewed in the light of the past development of the area and its traffic provides the basis for an estimate of future traffic, generally projected 20 years ahead.

The Project Report also contains the accident history of the existing facility, by type as well as rate. The probable effect on accident rates of the proposed improvement is fully discussed.

Another type of information needed by the planning engineer is the answer to the question: "Where is the traffic going?" Just as the simplest way to find out how many cars are using a given road at a given point is to count them, the simplest way to find out where people are headed in their vehicles is to ask them. We "get the facts" under this heading through an Origin and Destination Survey.

Origin and Destination

An Origin and Destination Survey can be complicated and expensive, or it can be quite simple. The two large-scale ones we have made thus far, one in the San Francisco Bay area and one in Sacramento, have involved interviewing a predetermined percentage of residents in their homes to learn the number, origin and destination of their trips for a day. The simple type of survey is the roadside interview type: it can be accomplished in a day or two, since it is based principally on the two

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Orinda Slide

Installation of 95 Horizontal Drains Was Monumental Project

By E. W. HERLINGER, Associate Highway Engineer, District IV, and
GIFFORD STAFFORD, Assistant Highway Engineer, Materials and Research Department

THIS is the story of the Orinda slide on the Tunnel Road, State Highway 75, situated 1½ miles east of the Broadway Low Level Tunnel in Contra Costa County, and of the methods adopted to stabilize it against a repetition.

An old slide again became active on December 9, 1950, after several days of heavy rainfall. A huge mass of earth, 300 feet wide which extended up the hillside for 800 feet, together with its cover of trees and shrubs, started to flow across the highway at about 10.30 in the morning. Within 15 minutes the gradual movement of the slide had caused complete obstruction of the four-lane pavement and the flow continued on a diminishing scale for approximately two hours.

A major slide occurred at the same location during the reconstruction of this road 15 years ago, at which time a 30-foot high cutbank was removed on the south side of the road to provide a detour. When the more recent slide came to rest, the roadway was buried for a depth of 30 feet at centerline and the daylighted area also was completely covered.

Slide Congests Traffic

The closing of Tunnel Road immediately caused serious congestion of traffic on both sides of the slide. There are four alternate routes that may be used by traffic from the Bay area to Contra Costa County. The main detour required vehicles to be rerouted northerly to Richmond and thence over a narrow and winding two-lane county road known as San Pablo Dam Road, to Orinda. Other alternate routes which were pressed into service required traffic to travel to Berkeley and thence via Wildcat Canyon Road to Orinda, via the Redwood Canyon Road to Moraga and thence to Orinda, or south to Hayward and thence via Crow Canyon and State Highway Route 107.

Aerial photograph of Orinda Slide graphically shows its size. San Francisco Examiner photo.

The detour over the San Pablo Dam Road involved an increased distance of 15 miles while the remaining routes added as much as 25 miles to trips from the Bay area into Contra Costa County. Because of the distance involved and the circuitous routes, it was necessary to place over 200 detour signs.

Members of the Oakland Police Department, supplemented by officers from adjacent East Bay cities, worked for four hours to unsnarl the traffic jam that resulted from the closing of the road. The task of directing traffic to detours through the unincorporated

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Ridge Route

Continued from page 28 . . .

Last Section Under Contract

The last section of this freeway between Los Angeles and Bakersfield is now under contract to the Claude Fisher Company of Los Angeles. Extending from the Los Angeles City limits at Tunnel Station for a distance of slightly over five miles to Pico Canyon Road, this contract calls for the widening and realignment of the roadbed, lengthening of existing culverts and the installing of additional drainage structures.

The two roadways, separated by varying widths of division strips, are being paved over cement treated subgrade with eight-inch concrete, 24 feet in width. The pavement is to be lined with plant-mixed shoulders eight feet wide on the right and five feet wide on the left. The widening and realignment of the roadbed through Weldon Canyon involves roadway excavation amounting to over 700,000 cubic yards, most of which has been completed. Paving is now in progress as weather permits. This contract will be completed in the late Spring of 1952 at a cost of approximately $1,000,000.

When the Claude Fisher contract is completed, the 45-mile length of the Ridge Route in District VII between Tunnel Station and the City of Los Angeles and the Los Angeles-Kern County line, will be completed for its entire length as a 4-lane divided limited access freeway. A very important portion of the construction in District VII, in the vicinity of Gorman and Tejon Summit, was carried out under a contract supervised by District VI forces.

Aerial view of construction of divided highway in Weldon Canyon section of Ridge Route

Concerning this contract, which also comprised a considerable length of reconstruction in Kern County, in the vicinity of Lebec, a story appears elsewhere in this issue of *California Highways and Public Works.*

Santa Ana Freeway

Continued from page 24 . . .

latter part of October, 1952. At the present time this work is approximately 20 percent complete.

Third Contract

The third contract, VII-LA-166-A, 52-7VC17-F, carries the work to 0.2 miles beyond Lakewood Boulevard. The grading consists almost wholly of imported borrow for the embankments not previously constructed under contract 51-7VC17-F. The freeway is carried over Slauson Avenue and the Pacific Electric Railway on a reinforced concrete box girder overhead. A reinforced concrete and structural steel bridge about 635 feet in length carries the six-lane divided freeway across the Rio Hondo. Reinforced concrete is used for the Paramount Boulevard Undercrossing and for the Lakewood Boulevard Separation Structure. Portland Cement pavement is to be placed along with appurtenant storm drains, sewers, and a pedestrian undercrossing at Manzanar Avenue.

The third contract carries an allotment of $2,701,000 and is now about 10 percent completed. The contractor started work on August 20, 1951, and completion is scheduled for February, 1953.

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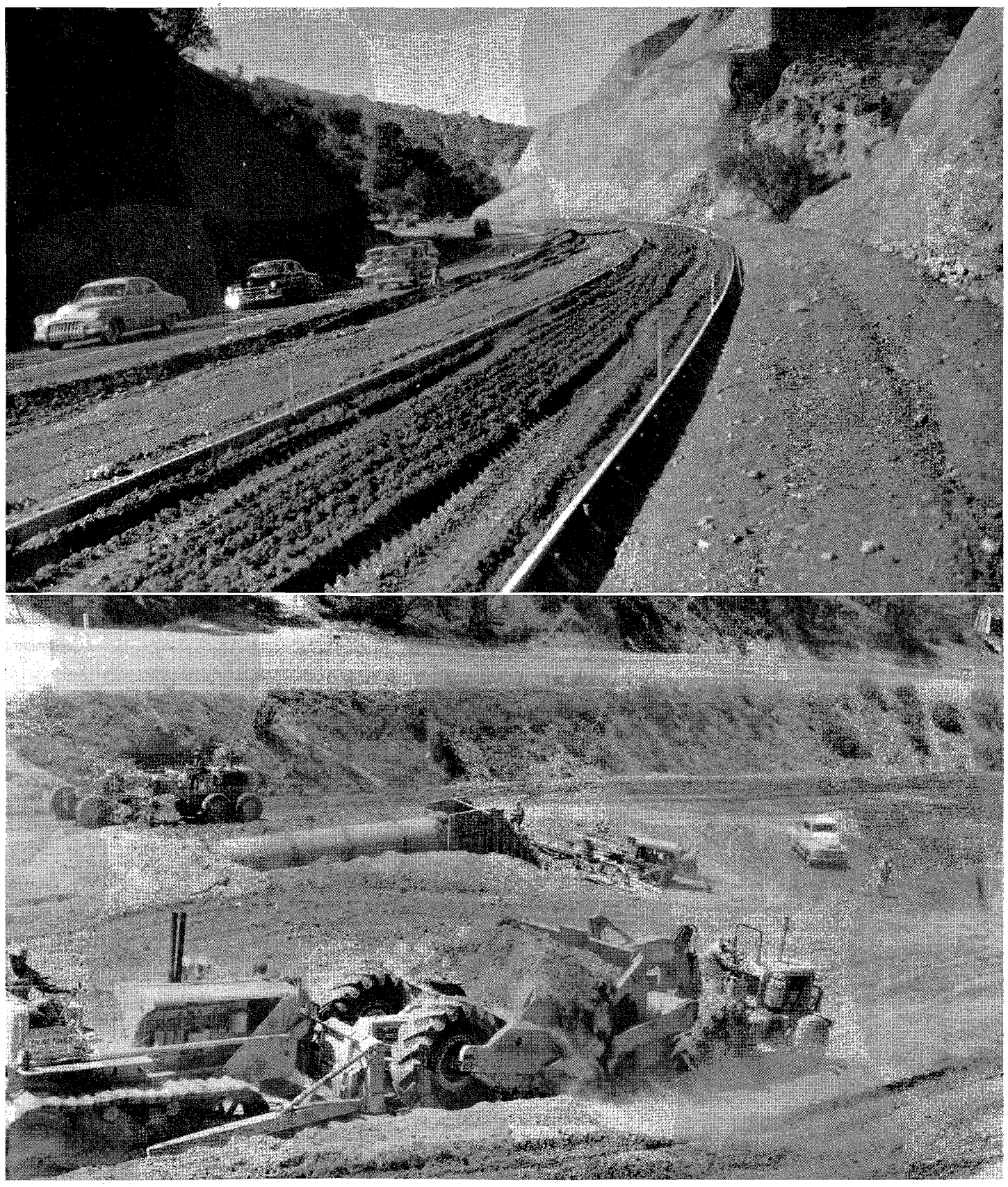
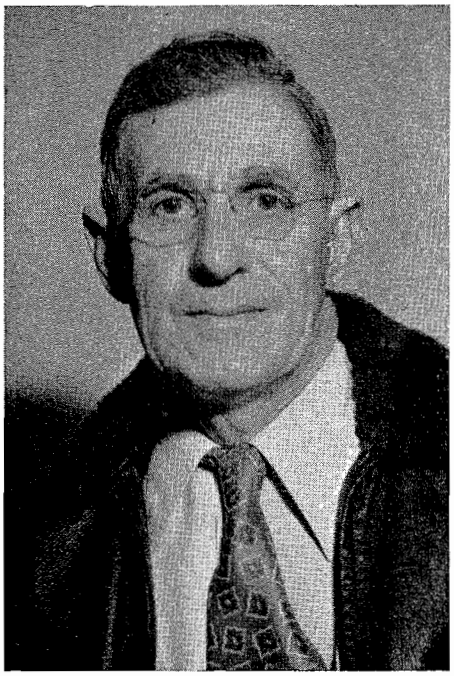


UPPER—Construction operations in Weldon Canyon section of Ridge Route, showing traffic being carried through construction on existing pavement. LOWER—Heavy equipment at work on construction in Weldon Canyon. Photo by Caterpillar Tractor Co.

STATE LOSES FOUR MAINTENANCE SUPERINTENDENTS

AMONG the more than 8,000 employees of the Division of Highways, no group has a more important role to play, year in and year out, than the superintendents in charge of the 61 maintenance territories into which the State Highway System is divided.

This winter the State lost the services of four of these key men through retirement. While other capable men have stepped up from the ranks of foremen, there is no ready replacement for the aggregate of nearly 120 years of state highway experience which these four men represent or for their accumulated maintenance "know-how."

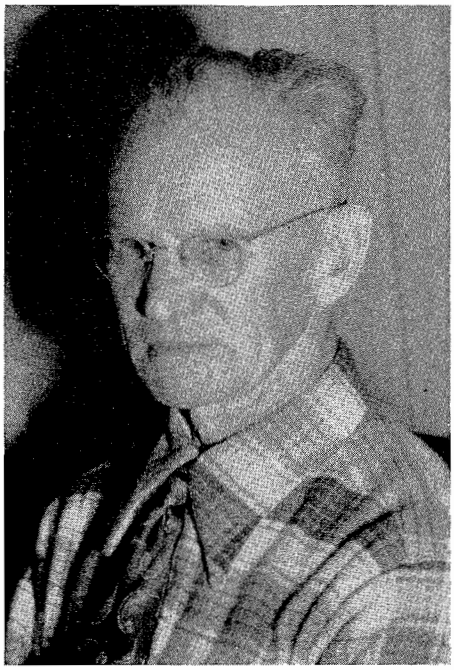


LEWIS W. SEYMOUR

Although he served briefly as a laborer in the old Sacramento headquarters shop of the Division of Highways in 1917, Lewis W. Seymour's actual career in highway work dates from May, 1919, when he joined the Division staff upon his discharge from World War I Army service. He worked as timekeeper in District III for several years.

In 1925 Mr. Seymour was appointed foreman, and was advanced to superintendent in April, 1931. In September, 1933, he was transferred to District VI, and made his headquarters at Hanford.

In 1942 Mr. Seymour was assigned to the Taft territory, and served as superintendent there until his retirement on January 1, 1952, after more than 31 years of service on the State Highway System.



CARL A. MILLER

Coming to California in 1907 from Kansas City, Missouri, where he was born June 14, 1888, Carl A. Miller held various lumber mill and bridge construction jobs and worked intermittently for the Division of Highways beginning in 1917. He entered state service on a regular basis in July, 1921, when he was employed as a foreman at Willits.

In March, 1924, Mr. Miller was promoted to superintendent and was assigned to the northern part of Humboldt County. He resigned from state employ in 1925, but returned in September, 1927, as superintendent in the southern part of District I, with headquarters eventually located at Garberville.

Mr. Miller continued as superintendent at Garberville until his retirement on December 4, 1951.

KENNETH MENDENHALL

After extensive experience in road construction work in Southern California, Kenneth Mendenhall, born in Los Angeles, June 13, 1884, joined the staff of District V, Division of Highways, in December, 1922, as sub-foreman.

Mr. Mendenhall was advanced to foreman in May, 1923, and served in the Santa Maria area. When the position of superintendent for the territory covering Santa Barbara County and the southern part of San Luis Obispo County was established in February, 1929, he was promoted to that post.

Mr. Mendenhall retired on January 1, 1952, after 29 years of continuous service in the Santa Maria area.

ROBERT L. HOLLIS

Born May 30, 1885, in Mitchell, South Dakota, Robert L. Hollis came to work for the Division of Highways as a laborer in the Chico area on May 28, 1924.

He was promoted to sub-foreman on May 1, 1926, and became a foreman on September 1, 1927.

On June 1, 1935, Mr. Hollis was advanced to Highway Superintendent and was assigned to the Alturas territory. In November, 1938, he was transferred to Susanville, and on December 16, 1941, to the Chico territory. He remained there until he relinquished his post on December 1, 1951.

Ramona Freeway

Continued from page 18 . . .

will cost approximately $5,850,000 and will add 4.1 miles to the existing freeway, will draw considerable traffic from Valley Boulevard in Alhambra, Garvey Avenue in Monterey Park, and other heavily traveled streets and highways. This will alleviate the peak hour congestion on these arterials with a resultant time saving for motorists traveling between the Metropolitan Los Angeles area and the many communities to the east.

Engineering Organization

In order to make the most efficient use of engineering personnel the organization as indicated on the accompanying chart has been developed. This relieves the resident engineer of a multitude of minor details and allows him to devote more time to matters of policy, public relations, major problems, right of way obligations, and discussions with utility companies and city officials regarding their problems during construction operations. It also provides the three general assistants, who are all potential associate highway engineers, an opportunity to gain valuable experience in supervising the work as a whole. The various other assistants on the jobs are transferred temporarily between the contracts as required, which results in more efficient use of the engineering personnel and broader experience for the men themselves.

The office work for the three contracts is handled from one field office by two field office engineers. This results in the elimination of duplicated effort.

Work of Survey Parties

Due to the complexity of freeway projects the services of survey parties are required for a large portion of the contract time. To make the best possible use of the parties while on the job, all survey work is coordinated through the field office engineers who keep priority lists of staking requirements. All requests for staking or other survey work, whether requested by the contractor or by state personnel, are made through E. L. Thompson, field office engineer, who being a former Chief of Survey Party is well qualified to coordinate this work.

The Bridge Department representatives, under the resident engineer for general administrative purposes, conduct their operations as independently as the mechanics of job control will permit.

With the job organization set-up that has been developed we find that the responsibilities of members of the engineering staff have been clarified, that duplication of effort has been eliminated, and that the various construction activities are coordinated and controlled for maximum efficiency.

Highway Division Is Commended by Road Commissioner

Commendation for the efficient job the Division of Highways has done in administering the Controlled Materials Plan is contained in a letter received by State Highway Engineer George T. McCoy from Sam R. Kennedy, Road Commissioner for the County of Los Angeles. Mr. Kennedy wrote:

"On behalf of the Road Department, County of Los Angeles, I would like to express our appreciation for the very commendable job that the State Division of Highways has performed in administering the Controlled Materials Plan. The efficient manner in which your organization has handled this complex and burdensome field of governmental controls reflects with merit upon those individuals who have administered this program.

"Mr. M. Harris, Engineer of Service and Supply, and Mr. R. H. Fulton, Assistant Engineer of Service and Supply, of your Sacramento office and Mr. R. W. Anderson, District VII Priorities Engineer have been particularly helpful and extremely capable in assisting and advising the Road Department of the County of Los Angeles in the various priority problems which have confronted us. It is my opinion that their excellent cooperation and direction has minimized the delay and confusion inherent in the inauguration of such a controlled program."

NICE CHRISTMAS GIFTS

Christmas gifts in the form of $50 checks from the State Merit Award Board were presented to William L. Van Sherman and Angelo A. Venturini of the Division of Highways by Director of Public Works Frank B. Durkee and Assistant State Highway Engineer Richard H. Wilson. Van Sherman and Venturini were awarded certificates of merit and the checks for inventing a rack for removing and replacing venetian blinds which will effect a considerable annual saving to the State.

Orinda Slide

Continued from page 45 . . .

areas to the east of the slide was handled by the California Highway Patrol.

Heavily Traveled Highway

The construction of the Broadway Low Level Tunnel, together with the accompanying improvement of the tunnel road, provided the main artery for travel through the barrier formed by the range of Berkeley hills between Alameda and Contra Costa Counties. The opening through the barrier resulted in a rapid development of the central portion of Contra Costa County into a residential area, and the tunnel road has subsequently become one of the Bay region's most heavily traveled four-lane highways. The 1951 annual traffic count indicates a 24-hour Monday volume of 35,000 vehicles with an increase of 7,000 vehicles over the preceding year.

A major volume of this traffic represents commuter traffic, with 44 percent of the total volume occurring between the hours of 7 a.m. to 10 a.m. and from 4 p.m. to 7 p.m. A recent survey of the Walnut Creek-Pleasant Hill district indicated that more than 55 percent of the workers living in the area commuted daily to jobs in San Francisco or the East Bay. As the highway provides the only direct route of transportation between the two areas, immediate relief was urged.

Detour Provided

While the seriousness of the situation was somewhat minimized by the fact that the slide had occurred on a Saturday morning, the first consideration was to promptly provide a reasonable detour for four lanes of traffic. The wet weather and large amount of moisture in the slide presented a difficult and uneconomical dirt moving problem with a serious hazard to traffic as well. The material in the slide was in such a liquid state that as it piled on the pavement the mass above caused material to move laterally across the roadway.

The loaf-shaped mound that was thus formed served as a strut that counteracted the downward thrust of the slide when a state of equilibrium was reached. The risk of disturbing the equilibrium of so large a mass of material by removing the volume of earth that would be required to clear the roadway was too great, as an additional movement of the slide could have readily caused as much as 100,000 to 200,000 cubic yards of material to slide. This condition dictated removing only the minimum quantity of material around the toe of the slide to provide a width of roadway sufficient for a four-lane detour and the necessary roadside drainage. State maintenance forces, supplemented by rented equipment, removed approximately 9,000 cubic yards of slide material to provide a bypass detour 50 feet in width and 600 feet in length on the following Sunday. The detour was surfaced on Sunday night and was opened to traffic at 5 a.m. on Monday in time to care for the commuter rush.

Drain at roadway level flowing 36,000 gallons per day

Horizontal Drains

The next phase of the work began on December 14, three days after the detour had been opened, when a drilling crew from the Materials and Research Department moved to the slide to start the installation of horizontal drains.

First consideration was given to draining the active portion of the slide

in order to arrest any further movement which might jeopardize the operation of the detour. It was also desired to drain the unstable mass in order to dry out the material to facilitate subsequent removal of the portion to be excavated.

The drilling crew was put on a seven-day work-week schedule for a short time and began installing drains on the western side of the slide at roadway level.

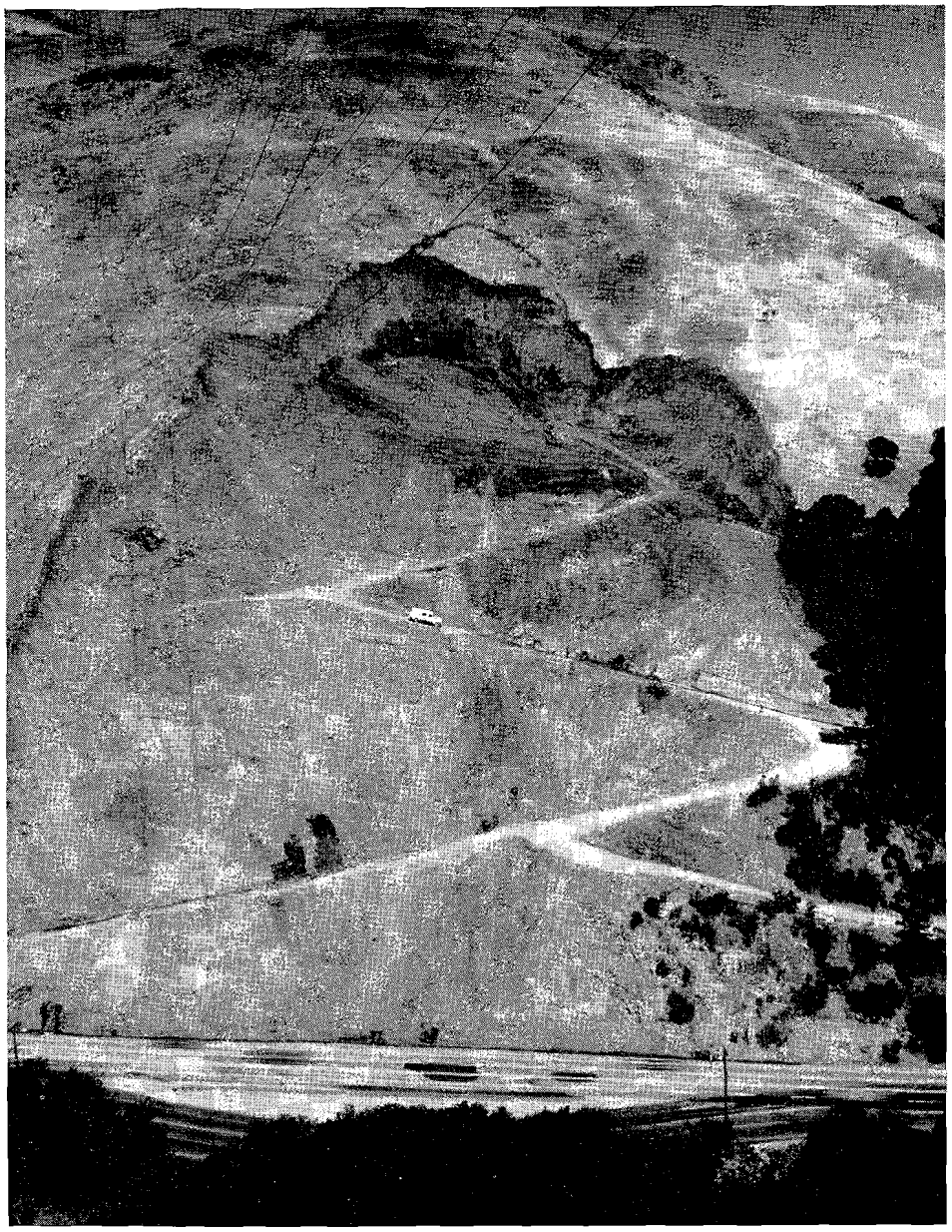
Fourteen drains for a total of some 2,000 lineal feet were completed during this first phase of the treatment. These drains were all placed at roadway level and below, and so located that they would form a part of the permanent installation. An aggregate maximum initial flow of 85,000 gallons per day was developed by these drains, attesting to their effectiveness.

Temporary Work

With these measures, the removal of the encroaching slide material and its overload was postponed until after the end of the rainy season, when the material could be handled more economically and without subjecting traffic to a hazard from mud on the surface that would result from working with wet material.

Preparations for the final correction immediately followed the temporary steps. A contour survey was made of the entire slide area and district laboratory forces started exploration of the area by sinking vertical holes with a one-inch soil tube. The investigation was subsequently supplemented with horizontal borings made by hydrauger equipment and five vertical wells were bored with a power drill at different levels in the central portion of the slide. Data concerning the soil conditions, together with ground water elevations and the depth of the loose broken slide material were obtained. The studies indicated that four and a half acres of ground, involving approximately 250,000 cubic yards, were involved in the movement.

The easterly half of the slide appeared to be a huge mud flow, while the westerly half was mainly composed of broken rock and shale. The test holes indicated a depth of from 30 to 50 feet of loose material in the slide area with an abundance of underground water. A record of ground water levels observed in these borings is being continued and will be helpful in determining the effectiveness of the slide treatment.



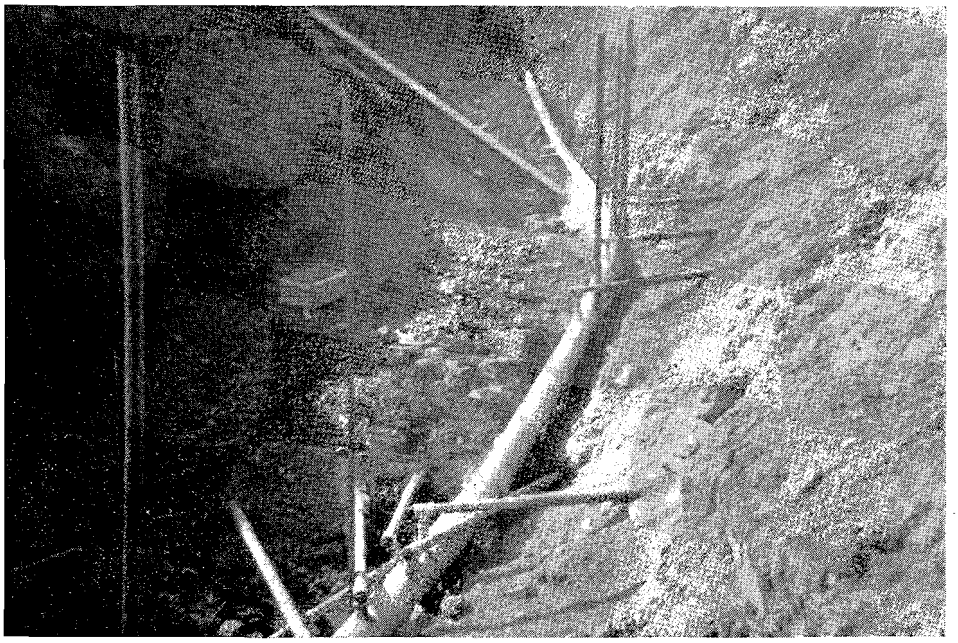
Slide after excavation, showing switchbacks on bench road

Unique Design

The plan adopted for the corrective treatment of the slide involved reducing the slope to an approximate 2:1 ratio and drying out the area of loose material by intercepting surface drainage and by providing subdrainage by means of horizontal borings at various levels. The problem of gaining access to the different levels of the slide where work was necessary was solved by a unique design which provided a 14-foot width of roadway on a 20 percent grade with three switchbacks. This layout provided dual purpose benches which served to collect surface water and afforded a location for the connecting pipes for the subsurface drainage system. In addition, the benches with the connecting switchbacks served as a haul road for materials and equipment and provided a working platform for the horizontal drilling equipment.

By April 1951, the slide material had dried out sufficiently to be handled

without difficulty. Material previously removed from the slide had filled all available dumping areas in the immediate vicinity and the nearest suitable disposal area was located on the San Pablo Dam Road at a distance of about one mile from the slide.



Drains connected to collecting pipe in interceptor trench

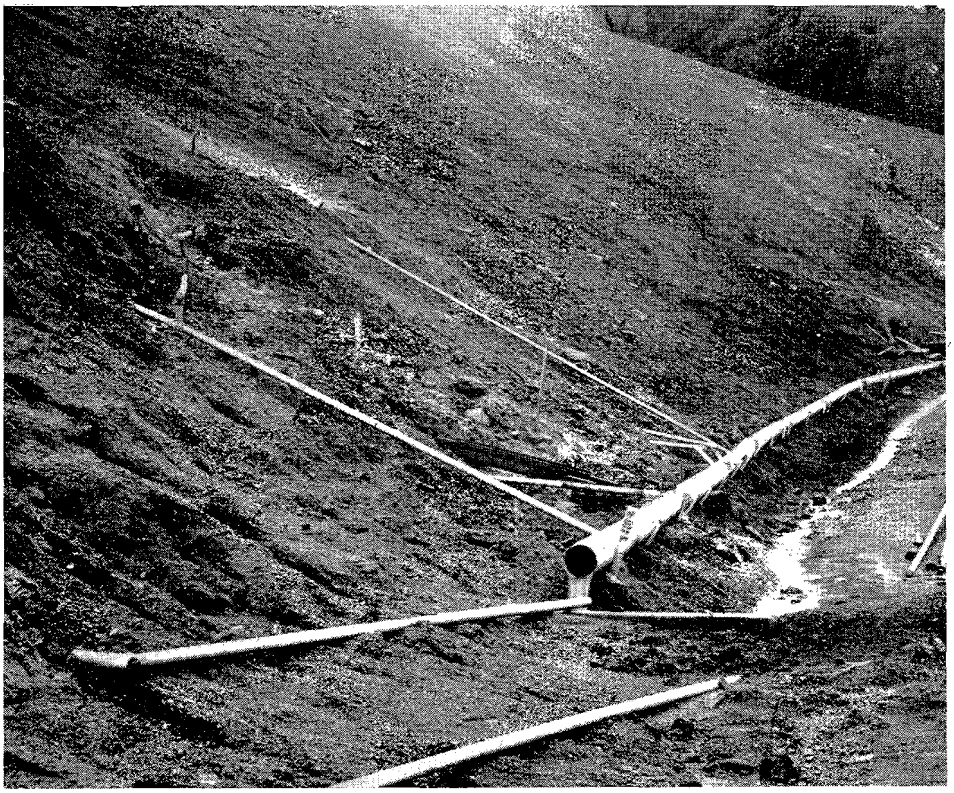
Traffic Problems

Since the slide was located on the northerly side of the highway it was decided to use the outer westbound traffic lane with the adjacent shoulder as a two-way haul road and westbound traffic was restricted to a single lane during hours that work was in progress. Conflict with traffic at the Orinda intersection was avoided by providing a section of temporary haul road that skirted the intersection for a short distance. Under normal conditions, the congestion at this location is acute during peak traffic hours, so in order to minimize the inconvenience and hazard to traffic, the work was performed by day labor and operations were scheduled during off-peak hours. Heavy traffic on the highway route and congested conditions at the signalized intersection a short distance to the east where the San Pablo Dam Road crosses the highway at Orinda complicated the haul problem.

The excavation operations included dressing down and removing loose and broken material which was overloading the slide; the system of benches and switchbacks previously described; a bulldozer trench approximately 200 feet long and 15 feet deep in the upper water bearing area to serve as an interceptor; and finally, the removal of the material that encroached upon the roadway.

When the excavation and construction work had reached the stage where the access and bench roads were passable, drilling work was started in the upper portion of the slide.

Collecting pipe and drains on lower bench



20 Drains Installed

The first drains in this area were located in the vicinity of a spring near the lower end of the interceptor trench. As soon as the trench was completed, drain installations were continued from its bottom. Large seepage areas appearing on the north side of the trench indicated a large amount of water entering the slide in this area.

Twenty drains were installed from the trench and vicinity. The seepage areas were dried up and a total initial flow from all 20 drains was over 200,000 gallons per day with one drain measuring 90,000 gallons per day, initial flow. Several of these drains were approximately 200 feet long; there was considerable difficulty in drilling and casing to such depth.

The drains installed from the trench were connected to an eight-inch perforated metal pipe covered with filter

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New Expressway

Another Unit of Coast Highway Open to Traffic Year in Advance

By GEORGE T. McCOY, Jr., District Construction Engineer

TRAFFIC between Chualar and Spence Underpass, in Monterey County, has been routed over a four-lane divided highway since November 30, 1951—more than a year ahead of previous scheduling. Work recently completed on the five-mile section south of Salinas was the first of a planned two-stage development which will result in an expressway to carry the heavy traffic volumes prevalent on this portion of the Coast Highway.

The first stage contract provided for the construction of new northbound lanes. It included provisions for placing base materials, Portland cement concrete pavement, and the temporary road approaches and crossovers required to provide access to adjacent properties. Shoulder construction was not provided, since it was not expected to be able to route traffic over the new lanes until the second stage of construction. Similarly, the transitions connecting the new lanes to the existing roadway were scheduled for construction as one of the first operations of the second stage contract.

More Work in Spring

Work to commence this spring under the second stage of the development provides for the shoulder and transition construction previously mentioned; routing traffic over the new work, followed by widening and reconstruction of the previously existing roadway, together with the permanent construction of crossovers, frontage roads, and road approaches to serve the local traffic. When completed, this project will provide the first section of highway south of Salinas in Monterey County constructed to expressway standards.

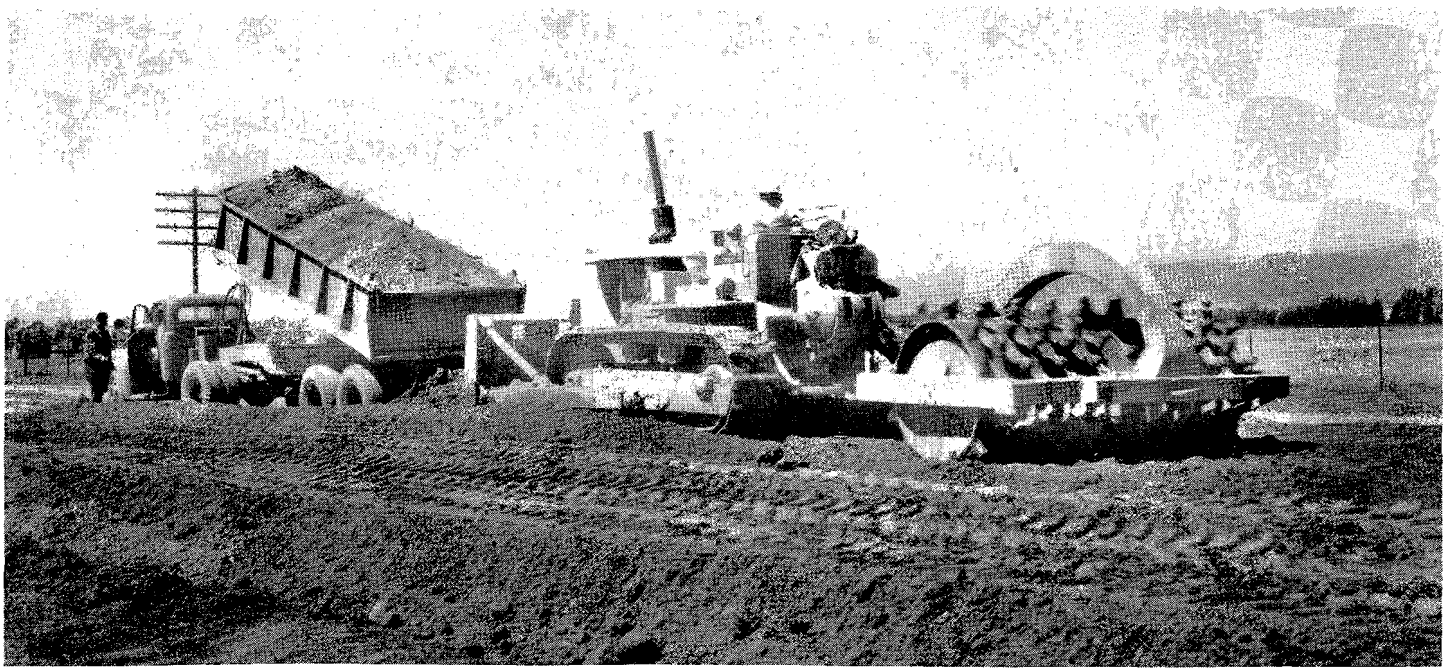
The northerly end of this expressway, Spence Underpass, is the point from which the Salinas Freeway will leave the existing highway to provide the modern highway service so urgently needed by the heavy traffic volumes common to this section. It is anticipated that work on the first unit of the Salinas project will start this spring and it is planned to proceed continuously on this project with succeeding units until it is completed.

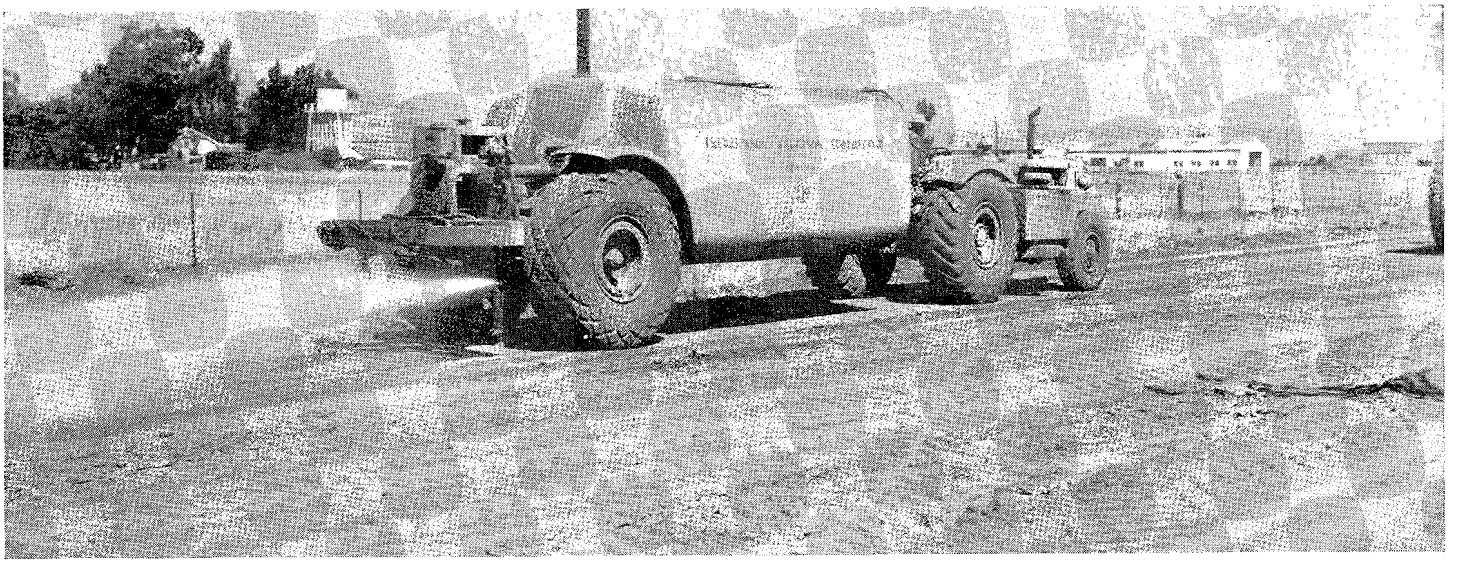
Chualar to Spence Project

The two stages of the Chualar to Spence project were planned to dovetail so that construction would be virtually continuous, although carried out on two separate contracts. However, vigorous prosecution of the work by the first contractor made it apparent that he would finish far ahead of schedule. Rather than leave the newly completed northbound lanes idle and unconnected during the winter months, particularly when the additional lane capacity is so badly needed in this area, slight changes in scheduling were made and the highway placed in service on a divided four-lane basis.

The transitions to the existing road were advanced into the first stage contract, the shoulders were shaped and given a temporary treatment to retard erosion until surfaced on the second

Construction between Chualar and Spence Underpass on U. S. 101. Photo by Caterpillar Tractor Co.





Applying water to base material by means of power sprays to obtain a more uniform spread than is possible by gravity feed

stage contract. Traffic will be routed over a divided highway, except for the necessary period next summer when reconstruction of the existing lanes will force the use of the new lanes as a two-lane highway for the duration of the construction period.

Historical Background

The history of this section is of interest because it is typical of the Coast Highway through most of this area.

The first improvement occurred in 1916, when, under standards very progressive for that era, a Portland cement concrete pavement 15 feet wide and four inches thick was constructed. The next significant improvement took place in 1930 when asphalt concrete pavement 20 feet wide and four inches thick was placed over the existing surface. This basic roadbed with shoulder improvement and surface repair has survived until now, when major reconstruction is required.

The highway serves an area that is as densely farmed as any portion of the world, in addition to carrying a main stream of coastal traffic. The surrounding land is excellent from an agricultural viewpoint, but has very poor properties when asked to support heavy truck loads. The poor structural value of the soil is accented by the nearly complete irrigation program in the adjacent fields, which results in saturation of the native materials under the roadway. Traffic volumes of from ten to fifteen thousand vehicles per day, many of which are heavy trucks, require extensive base construction to support the surfacing over the poor quality native soils.

Farm Vehicles Slow Traffic

Another feature related to farming which has caused much congestion on highways in the vicinity, is the specially developed vehicles which haul the produce from the fields to the packing houses, from where it is shipped to market. These vehicles generally consist of a tractor unit pulling two trailers in tandem. The trailer wheels are of a narrow gauge, approximately four feet, to fit the rows in the field; the body is of maximum width to permit carrying as much produce as possible. These vehicles operate at speeds much lower than those of the main volume of traffic and, of course, contribute greatly to congestion on the highway. Needless to say, additional lane capacity is extremely im-

. . . Continued on page 58

Completed section of U. S. 101 between Chualar and Spence Underpass

Highway Deficiencies: *How Defined—What Can Be Done*

By J. W. VICKREY, Assistant State Highway Engineer

The following article is based on an address delivered by Mr. Vickrey before the recent annual meeting of the Highway Section, California State Chamber of Commerce, in Los Angeles.

THE TERM "deficiency" in its application to highways probably was used first, in California at least, in 1944. During that year the Senate Committee on State Highway Revenue of the State Legislature propounded a set of questions to the California Division of Highways, requesting pertinent information with regard to the physical condition, financial status, and other matters with regard to the State Highway System of California.

Included in this questionnaire was the question, "What are the critical deficiencies of the State Highway System at this time, and why are they critical?" The answer to this question required both a discussion and a definition of highway deficiencies. It is immediately apparent, therefore, that the subject is not new, but having been presented again for discussion, seven years later, it is equally apparent that it has not been satisfactorily answered.

Subject of Great Interest

As a matter of actual fact, this subject of "Highway Deficiencies—How to Define Them," and the setting forth of a bill of particulars under selected definitions, has been a subject of considerable interest throughout this Country during the last seven years. There has been much written about it and just as much, or probably more, said about it in speeches and papers presented before highway-minded groups. The discussions, however, have been in the most part concerned with what to do with the deficiencies after they were defined rather than with the definitions themselves.

Included in the questionnaire that was propounded to the Division of Highways in 1944, there was another question. It preceded the question about deficiencies. The Senate committee asked: "Of what economic importance to California is motor transport?"

The first information the committee wanted for consideration, therefore, was a factual statement of the part that the highway represents in the economic scheme of things. In other words, what is the job that highways have to do here in California? The answer that was made to that question at that time by the Division of Highways is, of course, a matter of record and need not be repeated here in full.

Function of Highways

It would appear to be desirable, however, to again consider for a moment just what function highways do perform in our economy of today. In order to discuss intelligently the deficiencies of highways generally, or a specific system of highways, common sense dictates that there must be an acceptable understanding of the reasons for having highways. What do we expect them to do? What function do we want them to perform?

Back in 1944, the Division of Highways in its report to the Senate committee said this, in part:

"Transportation is a fundamental thing. It is, in fact, a thing so basic to our whole scheme of living that by the degree of its development we can closely measure the progress of civilization itself. All forms of transportation by whatever medium—water, rail, air, pipe line—make important contributions; but of all methods employed, road transport has always been and continues to be man's primary means of movement and intercommunication. For short trips the road has no competition. Even where for longer movements some other medium may be found advantageous for some intermediate portion, the road is again called upon at one or both ends to finally complete the job. To this important extent the road has always been and still remains indispensable."

Record Registration

A few months ago a large tire and rubber company, in a full-page statement in California daily newspapers, said this:

"The United States has more motor vehicles than all of the other countries of the world. Two-thirds of all freight is shipped by truck. Three-fourths of all passenger travel between cities, towns and farms goes by car and bus. More than 40,000 communities are completely dependent on car, truck and bus transportation. Therefore, it is vital that the automotive vehicles, on which we so largely depend, be kept moving quickly, economically and safely."

And recently in the daily press there appeared this statement:

"New statistics compiled by the Automobile Manufacturers Association show that during an average week 73 percent of the Nation's private cars are used for traveling to and from work and 53 percent for shopping. (The sum of these two percentages reflects to some extent at least multiple car use.) Twenty-two million passenger cars are used each week for earning a living, 16,000,000 for shopping. Some 2,500,000 persons in the United States use cars daily in earning a living. Forty-five percent of all employed persons use a passenger car in connection with their work."

Let us then for the moment and for the purpose of this discussion, at least, assume that highways are very necessary to our mode of life. Let us at least say we need them to implement our way of life. Then, to what extent or to what degree are they fulfilling the purpose for which we want them? Are they entirely satisfactory, or not? Do they do what we want them to do? Do they do too much or too little?

And so, with that particular thought in mind, let me do a little more quoting from the experts. In a statement before the Senate Fact-Finding Committee on State Highway Revenue in Sacramento on October 4, 1944, the Director of Public Works, the late Mr. Charles H. Purcell, made this statement, in part:

What Mr. Purcell Said

"The first income from gasoline tax in California became available in the 1923-1924 Fiscal Year, and the last of the bond issue money was expended the following year. Beginning with those years, the income per mile of road and per registered car began to rise, and with the increased income from gasoline tax, beginning in 1927, the annual income for highways reached approximately $10 per registered vehicle, or, in terms of miles of road in the State Highway System at that time, slightly in excess of $3,000 per mile. This level of income was maintained for a short period of time. In 1933 the Legislature allocated one-quarter cent of gasoline tax to state highways within incorporated cities, and in 1935 another quarter cent was allocated to major city streets. At this same time (1933) the State Highway System was increased by some 6,000 miles. This extending of the system over which the funds were to be expended, both on rural roads and city streets, quite naturally reduced the funds available per mile of road, and likewise per registered vehicle using those roads.

Wider Traffic Lanes

"During the intervening years, because of the increase in traffic volumes and speeds, and the increase in truck traffic—both in quantity and size of vehicles—it has been necessary to provide wider traffic lanes generally throughout the system, multiple lanes over a considerable mileage, longer radius curves, and to a considerable degree lesser grades. It has also been necessary to provide in many instances grade separations, extensive channelization schemes, traffic signals, and other necessary improved facilities.

"Thus, during the last 10 or 12 years prior to the war, the cost to traffic service over this extended system had increased very materially per vehicle unit; and while there had been an increase in total gasoline tax and registration fees, there had been a gradual losing of ground insofar as over-all improvement of the entire highway system was concerned."

Population Increase

That statement was made in 1944. There have been large sums of money invested in highways in California since that statement was made, but during the same period of time there has been an extraordinary increase in population and in motor vehicle registration. Even with the added expenditures the improvement of the road system has not kept pace with the traffic increase, with the result that in the over-all improvement there has still been a losing of ground.

Public Awareness

I might quote at considerable length from other sources and from other authorities on the sufficiency of the highway system to carry the present traffic load. I might even read at random from the great mass of correspondence, petitions and resolutions from persons from all walks of life that daily flow through the office of the Division of Highways at Sacramento.

The public awareness of the problem is evidenced in the State Chamber of Commerce annual listing of highway needs, based on discussion at local public meetings arranged by that organization.

For example, in July, 1951, the California State Chamber of Commerce presented to the California Highway Commission a state-wide program for state highway construction and improvement for consideration in the preparation of the 1952-53 Fiscal Year budget. This program was spelled out job by job, section by section, and county by county, and represented the assembled findings of all California communities on what constituted the most urgent highway needs. It totaled in dollar cost one billion, six hundred million dollars.

It is a generally accepted fact, I believe, that the State Highway System is not adequate for today's traffic. It is not satisfactorily doing the job the public wants it to do. It is deficient.

How can that deficiency be defined?

Highway deficiencies can be and have been defined in the following terms. These terms have been used in every state that has made an extensive study of the problem. Exactly the same words have not been used in each instance, but the words that have been used in every instance mean the same thing in the final definition.

1. *Structural Soundness*

Roadbeds and bridges which are structurally inadequate for the type of traffic they are called upon to carry are doubly deficient. Such weaknesses tend to restrict or to altogether preclude travel at normal speed and the movement of legal loads. When this occurs the highway has failed in the fundamental purpose for which it was created. A second critical condition unavoidably results, for in the constant endeavor to keep all restrictions on traffic to a minimum, excessive maintenance expenditures year after year cannot be escaped. Relief from this can be had only through major action for the permanent cure of these weak roadbeds and bridges.

On the State Highway System there are many miles of highways and literally hundreds of bridges that are structurally deficient; many of the bridges are posted for less than legal loads. This is particularly true in the outlying areas where freight traffic has increased by leaps and bounds to get forest products, mineral products, and agricultural products to an ever increasing market.

2. *Traffic Capacity*

Experience has taught us that highways carrying over 5,000 vehicles a day, particularly where the peak

movement exceeds 600 vehicles per hour, should provide more than two traffic lanes. This is especially true if there is included in this traffic volume more than the average freight traffic. This inadequate traffic capacity, lack of space in which to operate, is the outstanding deficiency on the State Highway System today. It is more apparent in the metropolitan areas and on the main line highways.

Traffic Capacity Lack

But lack of traffic capacity also exists to a marked degree on many miles of two-lane highways, particularly where too narrow width occurs in conjunction with obsolete alignment that allows insufficient sight distance for the present day traffic. Many sections of the Redwood Highway and the Interstate Route up the Sacramento Canyon near Dunsmuir are good examples of what I mean. Donner Pass (US 40) is another.

Inadequate traffic capacity is not limited just to those roads carrying 5,000 or more vehicles daily; it also exists on many roads carrying somewhat lesser volumes.

But the figure of 5,000 will shortly become even more significant. In 1940 on the 12,500 miles of state highway outside incorporated cities, the average daily traffic was 1,800 vehicles. In 1950 it was in excess of 3,000, of which 18 percent were trucks. We estimate that within about 10 years it will be 5,000, and that is all too short a time to do what should be done in order to accommodate this traffic safely and expeditiously.

Traffic seems to increase inexorably and at a faster rate than population. Coupled with the metropolitan situation, the lack of capacity in the rural highway system thus presents an alarming problem; first of giving service, and second of giving it in safety. This matter of traveling safely brings us to our third consideration.

3. *Traffic Safety*

The nationally accepted measure of highway safety is traffic fatalities in terms of vehicle miles of travel. Taken as a whole, California in these terms has made outstanding progress. Back in the years before the war—say in 1938 or 1939—the record shows for California about 13 fatalities per 100,000,000 vehicle miles on all highways, roads and streets. Measured in the same terms today, the record is down to about seven. That is heartening news and, if lives were not at stake, a record of which we could be proud. But when lives are at stake—and they are in traffic today—we cannot point to the record with anything but sorrow and shame; what we must have is not only a decline in the rate but an actual decrease in the number of people killed.

Looking at this situation from the highway standpoint alone, regardless of any other consideration, experience has taught us that the only type of highway that will contribute materially to the solution of the traffic accident problem is the freeway—divided roadways, access control, and separated grades.

Three Categories

These three categories—structural soundness, traffic capacity, and traffic safety—taken separately or in combination, are the terms generally accepted nation-wide for the purpose of defining highway deficiencies; and they have been used by most all states that have inventoried their highway systems within the past few years.

This discussion would not be complete, however, without mention of another term that has come into recent use—the Sufficiency Rating.

The Sufficiency Rating is a procedure under which an arbitrary numerical value is assigned to each of these categories of deficiency, structural soundness, traffic capacity and traffic safety, just discussed, and then, using the total assigned numerical value as par and comparing each section of highway against its predetermined standard by means of weighted point values for each category, deriving a score for each section; and finally arranging the sections for the entire highway system in order of adjusted ratings. Such a system was initiated in Arizona by an engineer who is now employed by the California Division of Highways.

This system has since been used in several states, including Colorado, Connecticut, Delaware, Louisiana, Oregon, Washington and others, amounting to 12 or 13 in all.

Sufficiency Rating Formula

From a discussion of the subject with representatives of the states at a meeting of the American Association of State Highway Officials at Omaha last October, it appears that this system has been applied by the great majority of states on rural low-traffic roads only. It has not been used on metropolitan freeways.

A report of the Highway Research Board, published in June of this year, gives a rather complete review and digest of the Sufficiency Rating Formula and procedures, setting forth the purposes for its use, and enumerating both strong points and weak points. It is apparent from a review of this report that no high degree of uniformity exists in the application of the formula in the several states where it has been used, and that uniform results have not been obtained.

From the preliminary study that we have given this subject with regard to its application in California, we have concluded that:

(1) it cannot be effectively used without extensive analysis and study over a period of at least two to three years;

(2) that as now developed it cannot be applied to metropolitan freeways, particularly in connection with a determination of metropolitan needs as compared with rural needs; and

(3) that it may even be of little value in application to main line freeways outside of metropolitan areas.

Symposium on Airfield Pavements for Jets

THE U. S. Naval Civil Engineering Research and Evaluation Laboratory of the Bureau of Yards and Docks is sponsoring a symposium on "Airfield Pavements For Jet Aircraft" to be held in Port Hueneme, California, on April 17-18, 1952.

The symposium is being held to encourage and facilitate the interchange of information and ideas among various groups engaged in research aimed toward the design or modernizing of airfield pavements to withstand the effects of jet powered aircraft.

New Expressway

Continued from page 54 . . .

portant in this agricultural section to minimize the effect of these slow-moving vehicles, as well as to carry the normal heavy flow of vehicles present on this important artery.

The benefit derived from early completion of the first contract on the section amounts to six month's service from a modern expressway, as opposed to service on a congested two-lane highway.

The contractor on the work took full advantage of materials found in one of the sources set up for the job. The material in the pit varied from a silty topsoil to a very high quality decomposed granite. Three grades of material varying from imported borrow with no quality specification to imported base with a rigid specification were required to construct the fills and base. All three materials, totaling 230,000 tons, were taken from this one source. Careful selection of materials and timing of operations enabled him to supply materials well inside the specification for each type of material.

Another interesting feature of the work was the installation of a 90-inch field assembled plate culvert which will house a belt conveyor under the roadway, between the railroad spur and loading platform and the warehouse of the Eckhart Seed Company. This provision will eliminate the extensive trucking across the highway that occurs in connection with the seed company's operations.

Other significant quantities of work performed in the first stage contract include 1,600 linear feet of reinforced concrete pipe, 16,000 cubic yards of Portland cement concrete pavement, 70,000 square yards of mixing and compacting of cement treated subgrade, 3,200 barrels of Portland cement, and the 230,000 tons of imported base materials.

The work was very capably performed by the Fredrickson and Watson Construction Company, who were represented on the job by Mr. Bernard Fredrickson and A. L. Pace. Richard H. Roberts was the resident engineer on the project, representing E. J. L. Peterson, District Engineer, District V, Division of Highways.

IMPORTANT APPEAL COURT RULING

IN A RECENT decision the District Court of Appeal in a unanimous opinion established the right of a city to contribute, and the right of the Department of Public Works to accept, city tax funds to assist in defraying the cost of projects for the improvement of state highways within cities.

The ruling was in the case of Dr. Eugene Perez of San Jose, owner of property fronting on The Alameda, who brought suit to enjoin the City of San Jose from expending $15,000 of city gas tax funds for street lighting on that section of US 101 in San Jose locally known as The Alameda. The trial court denied an injunction and dismissed the action, which Dr. Perez carried to the appellate court.

Applicable Statutes

Section 114 of the California Streets and Highways Code provides

"When the commission has allocated any funds for the construction, improvement or maintenance of any portion of a state highway within a city, the department may enter into a cooperative agreement with such city for the performance of any such work by the department or by such city, or for the apportionment of the expense of such work between the department and such city."

Section 113 of the code provides in part

"Any * * * city may aid in the construction, improvement or maintenance of any state highway within its boundaries by contributing any part of the expense thereof to the department out of any city funds available or to become available for construction, improvement or maintenance of streets within the city."

State and City Agreement

Pursuant to the authority of these sections, the California Department of Public Works and the City of San Jose, during the year 1947, entered into a cooperative agreement relating to the maintenance and improvement of state highways lying within the boundaries of San Jose, and providing for the performance of certain work by or under the supervision of the State and city, respectively. Among the projects covered by the terms of the agreement was one for the construction by the city of a center dividing strip, and the installation of certain traffic signals and street lighting, on State Route 2, which is locally known as The Alameda. The funds to be used for this project were primarily the city's allocated share of State gas tax funds earmarked for expenditure on State highways within cities, but since under Section 195 of the code, and under the department's previous policy, State gas tax funds cannot be used for street lighting other than safety lighting, the city agreed to contribute out of city funds the estimated cost of the street lighting, which was $15,000.

Lower Court Denies Injunction

Dr. Perez, a resident of San Jose and the owner of property fronting on The Alameda, brought suit to enjoin the city from expending city tax funds on this project, on several grounds. Because of the State's interest in the completion of the project and the settling of the legal points involved, the Department of Public Works intervened in the lawsuit, and presented its views to the trial court, as did, of course, the plaintiff and the city, in the hearing on plaintiff's application for a preliminary injunction. After hearing, the trial court denied the injunction and dismissed the action.

On the appeal, which was argued in the District Court of Appeal on October 22, 1951, the only points raised by the appellant, Dr. Perez, were:

First, that the improvement of a state highway within the city was not a municipal purpose within the meaning of certain provisions of the State Constitution which have been interpreted as prohibiting the expenditure of municipal funds for other than municipal purposes; and second, that in enacting Section 113 and other sections of the Streets and Highways Code, the Legislature intended to prohibit cities from using, in the improvement of state highways within their

. . . *Continued on page 64*

Orinda Slide

Continued from page 52 . . .

material to serve as an underdrain. This pipe also served in the collection of surface run-off during storms, as well as a collecting pipe to carry the horizontal drain water out of the slide area. During the dry summer months the flow in this collecting pipe tapered off to a flow of approximately 7,000 gallons per day, but has increased to 85,000 gallons per day at this writing which is in the middle of the wet season.

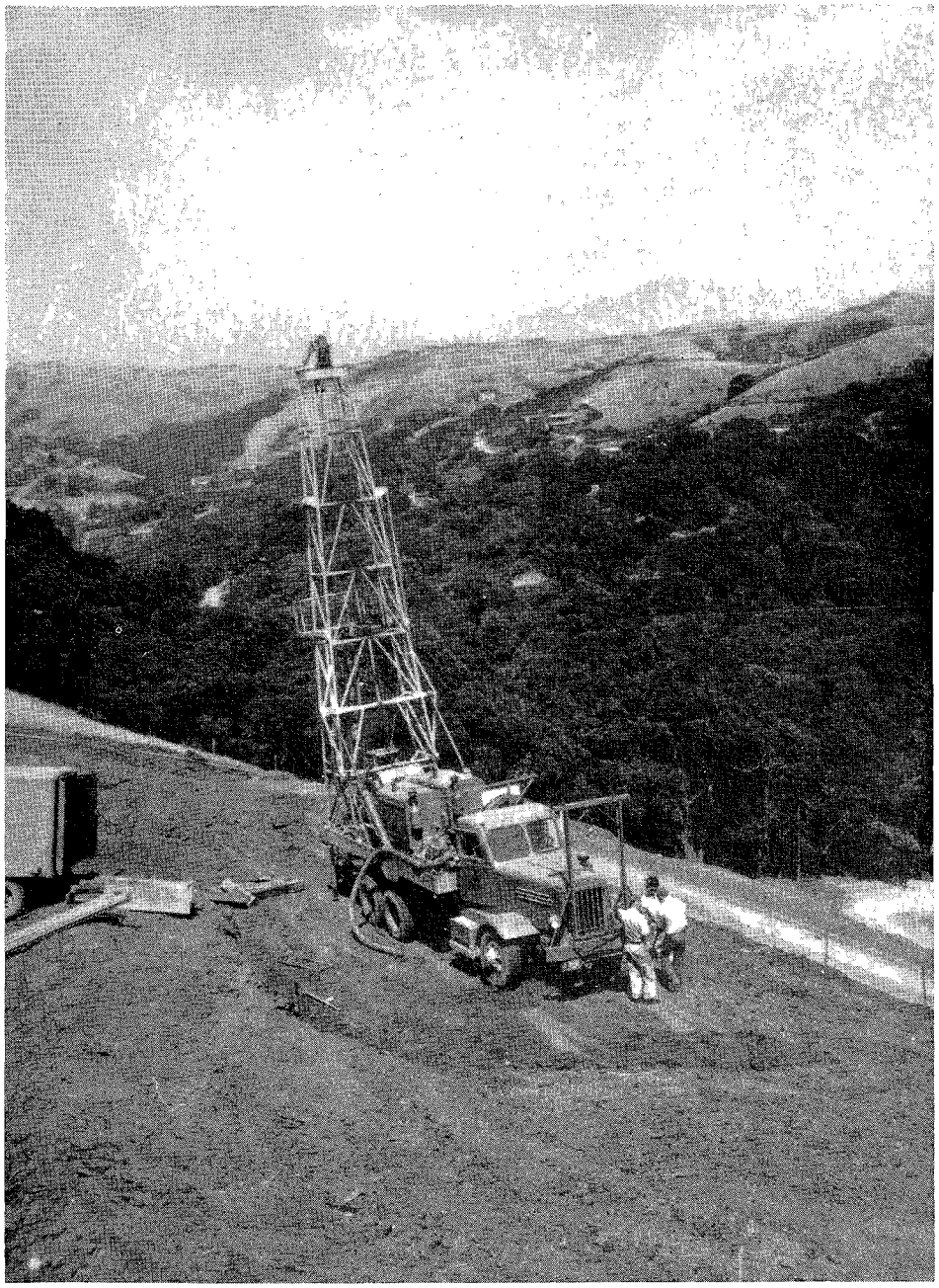
After completing the installation from the trench an attempt was made to install drains at the extreme upper portion of the slide. Due to the extremely broken condition of the formation, this proved impracticable and was discontinued; as a similar condition existed at the upper bench no drains were attempted at this level.

Drains Successful

Installation work was then begun in the main portion of the slide from the middle and lower benches formed by the access road. These drains appear to be quite successful, particularly those from the lower bench which developed a total initial flow of some 50,000 gallons per day, decreasing to about 3,000 gallons per day during the dry season; the rainfall in this locality during the last three months exceeded 20 inches, and the flow has increased to 40,000 gallons per day.

The installation of the horizontal drains was followed by construction of a system of collecting pipes and paved gutters that were constructed on the benches. The pipes serve to collect the water flowing from the drains and prevent its percolation into the slide mass. The paved gutters serve to catch the surface water during storms and minimize erosion by surface run-off. Both are designed to carry all the water that can be collected out of the slide area.

The excavation operations in connection with removal of the overload from the slide and the material encroaching upon the roadway continued for three months and a total quantity of 62,000 cubic yards of material was removed during this phase of the work. After the original roadway was restored, installation of horizontal drains was resumed at the roadway level. Drains were placed at locations which had been inaccessible to the drilling crew during the slide removal operation.



Vertical drilling equipment of Materials and Research Department

Largest Project of Kind

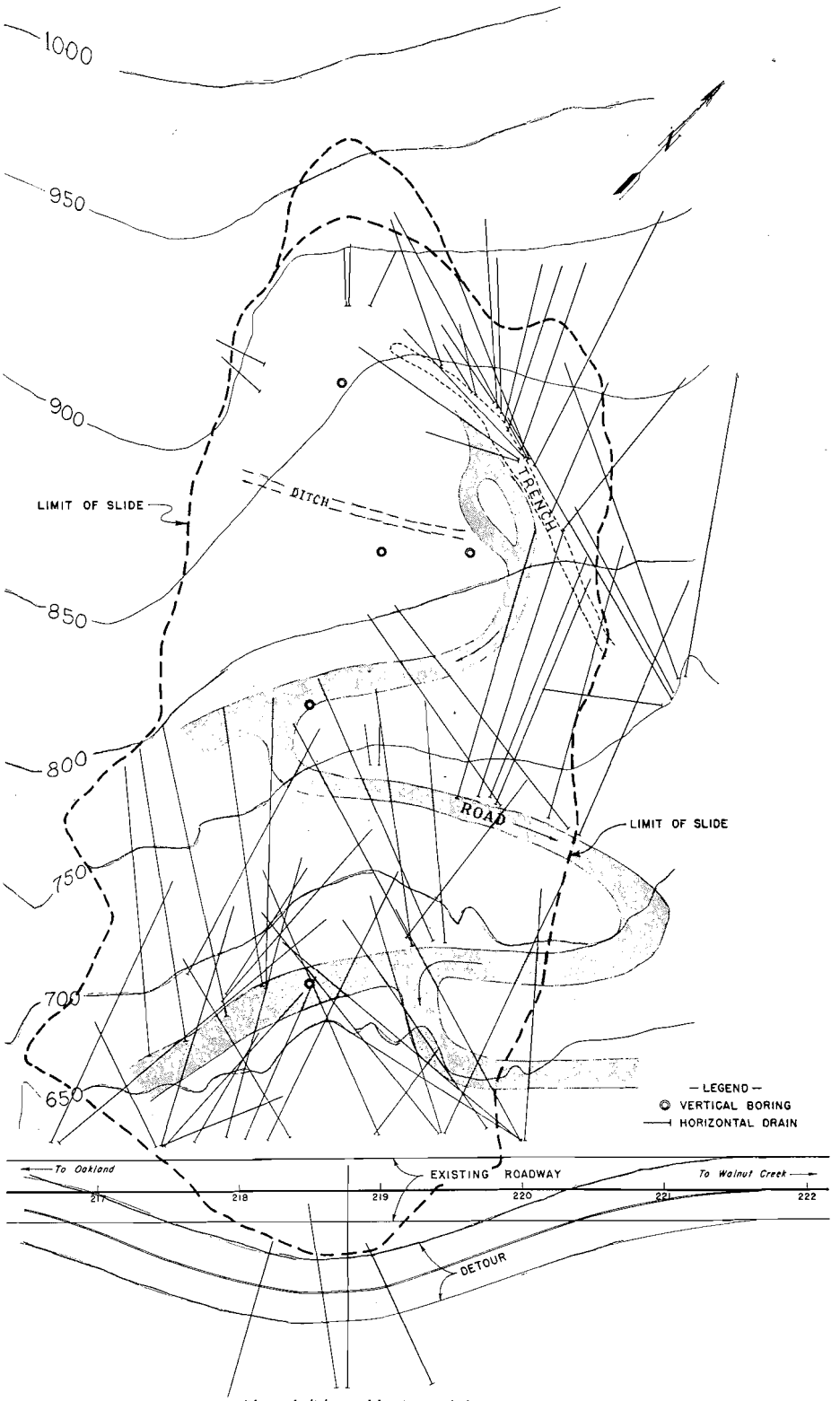
This installation of horizontal drains to aid in the stabilization of a slide area is the largest single project of its kind that has been undertaken to date by the Division of Highways. To date, a total of 95 horizontal drains has been installed for an aggregate length of 10,000 lineal feet of drain in 11,700 lineal feet of drilled hole. A total flow of 135,000 gallons per day is being recorded during the present rainy season from this horizontal drainage installation. The installation of drains is being continued and it is contemplated that this work will be completed early this year.

The drilling of holes and installation of horizontal drains as well as the work of making the exploratory borings and vertical wells was performed by personnel of the Materials and Research Department. These items represented

approximately one half of the cost of the work, which totaled $160,000. The other items of work, including the construction of the detour and access road, as well as providing for surface drainage, handling the excavation, and restoring the roadway, were performed by local maintenance crews supplemented by equipment rented on a fully operated basis from contractors and equipment vendors.

In addition to the degree of success attained in stabilizing this slide by the partial unloading of material in conjunction with the drainage installation, it is also gratifying to note the success that resulted from following the plan that was adopted for the scheduling and conduct of the work. In spite of the large amount of work and the volume of material that had to be handled over this congested portion of highway, not a single traffic accident occurred on the job during working hours and the corrective measures and restoration were carried out with a minimum amount of inconvenience to traffic.

The operations for moving the slide and restoring the road to traffic were under the direction of Assistant District Engineer R. D. Kinsey, and under the immediate supervision of Highway Superintendent J. C. Campbell and Highway Foreman Jack Peirano. Construction engineering on this project was handled by the senior author. Corrective treatment for slides and the horizontal drilling work were under the direction of A. W. Root, Supervising Materials and Research Engineer, and under the immediate supervision of the junior author.



Plan of slide and horizontal drainage system

Traffic Engineering

Continued from page 44 . . .

questions: "Where did your trip start?" and "Where will it end?"

These surveys, by showing where the traffic wants to go from the points where it originates, enable engineers to estimate how much of the traffic will use proposed alternate routes and which alternate route will serve the greatest number of highway users.

Accident Reports

Still another source of information is the accident reporting of the California Highway Patrol. Copies of all reports covering accidents on the rural state highway system are supplied to the Division of Highways for confidential use. These accident reports, combined with the traffic count data, are used in computing the accident rate for every section of the rural State Highway System.

The importance of accident rate figures is obvious. They have a bearing

. . . *Continued on page 64*

Placerville Freeway

Continued from page 34 . . .

Structures Returned to Owners

After the moving contracts were awarded, W. H. Rust of the Wilkins Draying Company took charge of the project as a whole. He retained a dirt moving firm to move the material required and also obtained the services of a local building contractor who had built the clubhouse and the church to serve as subcontractors. The basement of the clubhouse was first built and then the material to be deposited on the lot was moved in and compacted.

Following this work the foundations were built for the clubhouse and church upon the filled ground. Each of the three sections of the clubhouse was then moved to the new foundation that had been built.

After the placement of the three structures on their new foundations, the residences disrupted along Jackson Street, the path of the moving operations, were returned to their original situations at a cost of about $5,000.

Today, the three structures formerly within the right of way are again in service and the market value of each has been enhanced materially by the relocation. At the original site the buildings had no parking space and were close to the railroad running through the city. In addition to the elimination of the railroad disadvantage the new site provides parking space for approximately 50 cars. Furthermore, both the church and the residence have basements which they did not formerly possess. The necessary repainting of exteriors and the installation of more convenient walkways have further enhanced the value of all the properties.

Cost Estimates

It should be noted that accurate cost estimates on all phases of the relocation work, including substitute property acquisition, had to be made before any agreements were made in order that a comparison could be made between costs of the moving arrangement and outright purchase of the properties.

The completion of this project to the satisfaction of all parties concerned and at a cost somewhat less than the cost to the state would have been, based on a buy-out at market value, required the cooperation of not only the three owners involved, but also the property owners whose improvements were affected in the course of moving. While the over-all saving to the state, resulting from this rather complicated moving transaction, amounts to a relatively small amount, the beneficial effects on public attitudes and the subsequent aid to further right of way clearance is immeasureable.

IN MEMORIAM
Edwin (Sarge) Carlstad

The sudden death from a heart attack of Assistant Highway Engineer Edwin Carlstad was a severe shock to his many friends. A valuable and experienced employee was lost to the Division of Highways.

Mr. Carlstad was born in Wisconsin on March 24, 1890, and settled in California in 1910. He was employed in the Engineering Department of the Panama-Pacific International Exposition in San Francisco from 1912 to 1915, then by Miller and Lux in the Bakersfield area as a surveyor until he enlisted with the military forces in World War I in 1917. After military discharge Mr. Carlstad, or Sarge, as he was affectionately known by his many friends, reported for work with District IV of the Highway Division on November 13, 1919, and worked continuously on field surveys and contract construction for the more than 32 years of his state service.

During this period he handled many large construction projects as resident engineer, and was resident engineer on a large freeway contract at the time of his death.

Mr. Carlstad is survived by his widow, Emilie; two daughters, Mrs. Barbara Geitz of Hayward, and Mrs. Mildred Merrill of Concord; and a son, Mr. James Carlstad of Klamath Falls, Oregon.

THE GREEN LIGHT

The green traffic light doesn't always mean it's safe to speed across the intersection without looking both ways, says the California State Automobile Association. Protective driving calls for caution, even when the green light says "go." Watch the other fellow—handle your car skillfully.

Santa Ana Freeway

Continued from page 46 . . .

All bridge construction work is under the supervision of J. M. Curran, Resident Engineer for the Southern Section of the State Highway Bridge Department.

By G. C. SMITH, Resident Engineer

A CONTRACT was awarded June 22, 1951, to Winston Brothers Company, contractors, covering the construction of 2.5 miles of the Santa Ana Freeway within the city limits of Santa Ana, from Broadway on the north to First Street (U. S. Hwy. 101) on the south. This section of the freeway by-passes on the east the main business section of Santa Ana and passes through residential and agricultural land.

This contract, in addition to providing for grading and paving a four-lane divided freeway, also constructs the necessary grade separation overpasses and underpasses that are required with on and off ramps and outer highways.

The grade separation bridges are:

Main Street Overcrossing;
17th Street Undercrossing;
Lincoln Avenue Overcrossing;
Lincoln Avenue Underpass for the Atchison, Topeka & Santa Fe Railroad;
Grand Avenue Undercrossing;
Fourth Street Overcrossing;
Pedestrian Undercrossing at 20th Street.

The contractor has completed the clearing throughout and has made considerable progress on the grading. Work on all of the structures is now in progress except at the Main Street Overcrossing. Delay in getting this construction started is due to problems which have arisen in connection with detour construction.

The grading, paving, and incidental construction in connection with the road work is under the supervision of Resident Engineer F. E. Sturgeon.

The contract as a whole is 30 percent complete and the anticipated date for completion is February, 1953.

SIGNS FOR LIFE

Watch and obey traffic signs. They are not roadside decorations. They are there for your protection. Obeying such signs increases your life expectancy.

INDEX TO CALIFORNIA HIGHWAYS AND PUBLIC WORKS

January to December, 1951

Court Ruling

Continued from page 58 . . .

borders, any funds other than their allocated shares of state gas tax funds. The District Court of Appeal, in a unanimous opinion handed down on November 16, 1951 (reported in 107 A.C.A. 706), rejected appellant's arguments on both of these points, and affirmed the judgment of the trial court.

Appellate Court Decision

On the first point, the appellate court took the view that the improvement of a state highway within a city was a matter of city, as well as state, concern, from which inhabitants of the city received a special benefit, and was a proper municipal purpose for which city tax funds could be expended without violating any provision of the California Constitution. On the second point, the court held that there was no indication in any of the sections of the Streets and Highways Code cited by appellant of any legislative intention to limit cities, in improving state highways within their boundaries, to gas tax moneys received from the State. On the contrary, the court pointed out, Section 113 alone showed that the Legislature intended expressly to permit the use by cities, in aiding in the improvement and maintenance of state highways within their boundaries, of any funds which the city might properly use for the construction and maintenance of its own streets.

Traffic Engineering

Continued from page 60 . . .

not only on the need and the priority—relative need—of a proposed highway improvement, but on the type of highway design which can best be expected to reduce accidents under certain conditions.

The computation of accident rates in connection with freeways is an excellent example of the superiority of facts over theories. We all remember the dire predictions, when the first freeways were designed and built, that the higher speeds they would make possible would mean more accidents and particularly more fatalities.

Freeways Safer

The facts have proved just the opposite. Accidents on full freeways—those with no intersections at grade—are just about *one-half* the average for the rural State Highway System as a whole.

As for fatalities, the record is even more impressive. The term "fatality rate" when applied to accidents on highways means the number of persons killed per 100 million vehicle miles of travel. On the rural State Highway System the fatality rate averages just about 10. On all of the full freeways constructed and in operation to date, the fatality rate is 2. This reduction in highway deaths on freeways is even more remarkable when we consider that freeways do indeed accommodate higher speeds. The secret lies in the fact that they are designed to accommodate higher speeds with safety and have many built-in safety features.

EARL WARREN
Governor of California

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FRANK B. DURKEE
Director of Public Works

•

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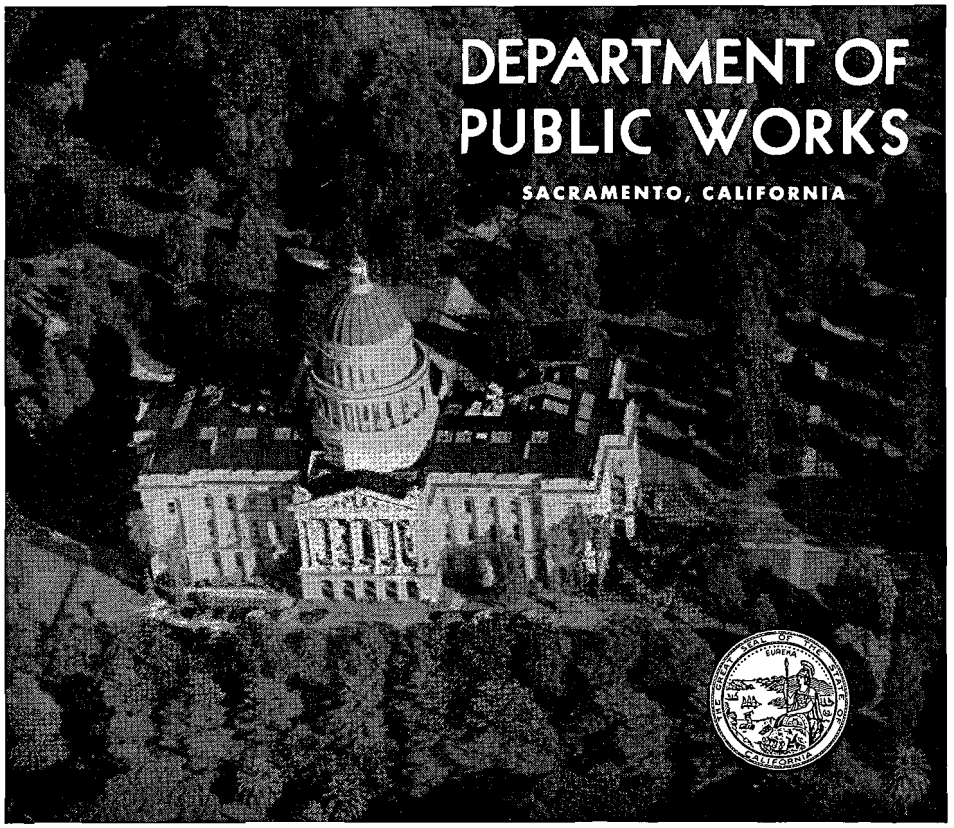

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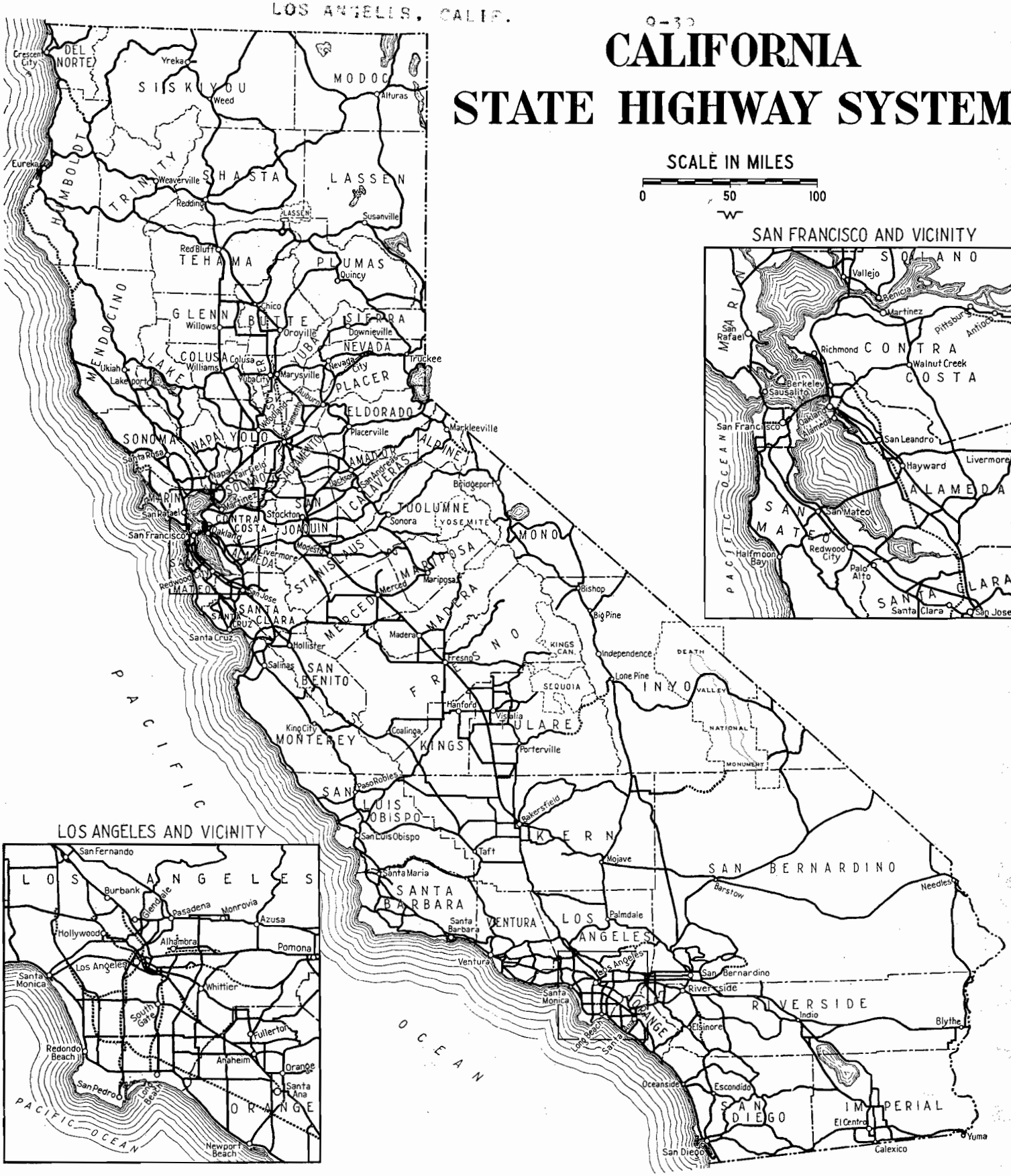

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