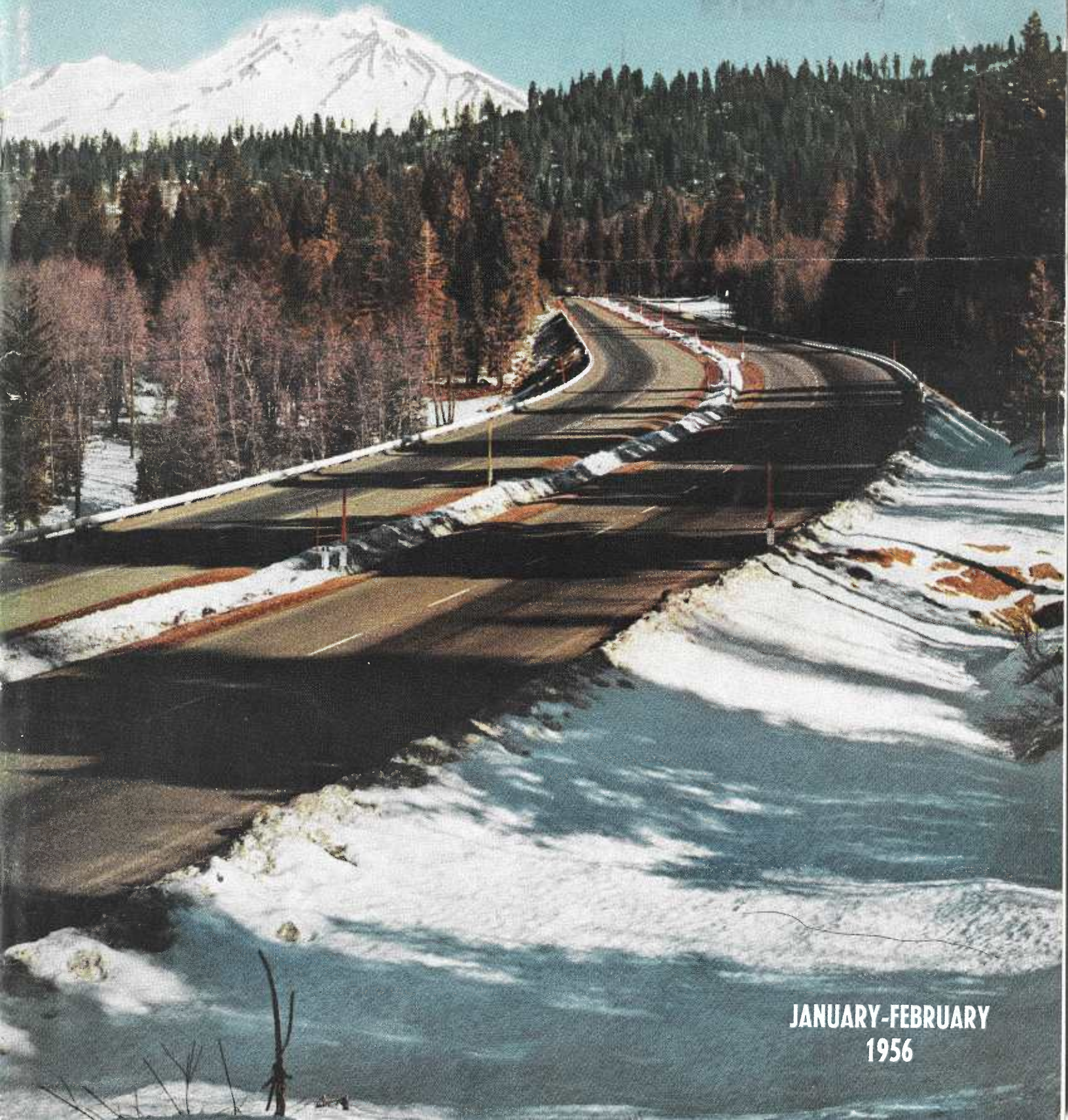


CALIFORNIA

HIGHWAYS AND PUBLIC WORKS



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California Highways and Public Works

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Address communications to

CALIFORNIA HIGHWAYS AND PUBLIC WORKS
P. O. Box 1499
Sacramento, California

Storm Damage

By GEORGE F. HELLESOE
Maintenance Engineer, Division of
Highways

*Repair of Highways Will
Cost Millions of Dollars*

Sets New Record

AN INTENSE, tropical type storm enveloped the northern and central portion of the state during the week prior to the Christmas holidays. Most of the major drainage systems as far south as the Tule River in Tulare County were deluged by abnormal amounts of rain, resulting in an unprecedented runoff and causing damage to the state highway system, as presently estimated, at over \$11,000,000.

In addition, damage to county roads has been estimated at approximately \$19,500,000 and to city streets at some \$700,000, for an over-all total of public road damage in excess of \$31,000,000. Approximately \$4,500,000 is required for emergency repairs—making it possible to reopen roads to traffic—while the balance is the estimated cost of rebuilding the damaged facilities for permanent use.

Practically all major north-south highways in the area were at one time or another closed by flooding, requiring the detouring of through traffic via circuitous routes which in some cases were later also engulfed by the spreading flood water. All transcontinental routes over the Sierra-Nevada Range, as well as major east-west laterals through the Coast Range north of San Francisco, were blocked for a time by slides, high water, washouts or bridge damage.

As the immediate functions of maintenance personnel under such conditions are the preservation of the highway structure wherever possible, the marking of dangerous locations or the barricading of impassable sections of road, and the establishment of detours, around-the-clock operation by all available personnel of the Maintenance Department assisted by representatives of the Bridge Department

By **FRANK B. DURKEE**
Director of Public Works

On behalf of Governor Goodwin J. Knight and myself, I desire to express our appreciation for the unselfish devotion to duty displayed by the engineers and personnel of the divisions of the Department of Public Works during the December and January floods.

Many of these employees worked around the clock during the critical period foregoing their Christmas and New Year's holidays. The tasks confronting State Highway Districts I, II, III, IV, V, and VI, were stupendous. Major efforts were required for emergency repairs to damaged roads to permit resumption of traffic.

Special commendation is due the maintenance personnel of the Division of Highways and engineers of the Division of Water Resources who labored ceaselessly during this period. The latter division worked with U. S. Army Engineers, the State Reclamation Board, military personnel from Camp Beale, and volunteer crews to save levees on the Sacramento, Feather, Yuba, San Joaquin rivers, and their tributaries, and to rescue persons trapped in the flood waters.

A word of appreciation is due the Communications Section and also photographers of the department who were out day and night compiling a pictorial record of the unprecedented floods.

To all who helped we extend our thanks and commendation.

and the Engineering and Supply sections were required for many days to carry out this responsibility.

At times the only direct means of communication between the field forces and their headquarters or between the districts and Sacramento was by means of the division's radio system.

Rainfall amounts for the storm which began at many points in Northern California on December 16th were exceptional at many locations. The Weather Bureau reports that at Hoberg's in the Coast Range south of Clear Lake 19 inches of rain fell in two days—December 19th and 20th. An equal amount was reported for a five-day period at Brush Creek in the Feather River basin. Camptonville on the Yuba River received more than 13 inches of rain on December 22d and 23d. Snow melted by warm rain which fell in some areas of the Sierras to above the 7,000-foot level added to the volume of flood waters which cascaded from the canyons.

As flood waters began to recede and the magnitude of the damage became apparent, outside equipment and labor were rapidly recruited from the construction and logging industries and other sources. Working under authority of the Declaration of Emergency declared by Governor Knight, heavy earth-moving equipment of every description was concentrated on the task of restoring travel on the highway network. A number of emergency contracts were let for the construction of temporary bridges where major bridge damage was sustained. At one location a Bailey type bridge was used to temporarily replace a lost bridge span.

Repair of road damage and the opening of transcontinental routes

across the Sierras to unrestricted traffic was further hampered early in January by exceptionally heavy snowfall and blizzard conditions which closed the Donner Summit and Echo Summit roads for short periods.

The rapidity with which severely damaged roads were made passable to traffic serves to indicate the perseverance, resourcefulness and stamina of the personnel of the division who are now faced with the gigantic task of restoration of the highway system following one of the most severe storms in the history of the state.

District I—\$2,950,850

By RUDOLPH BERGROTH
District Office Engineer

December 21, 1955, will long be remembered in a great portion of California and especially in Northern California. Unprecedented rainfall in the watersheds of all rivers and streams rapidly filled streams bankfull and, before the day passed into history, it was obvious that flood stages would be recorded; and, in most areas subject to floods and damage by high water, a major disaster was in the making.

The date to Humboldt County has double significance. The ironical coincidence is that December 21, 1955, was the anniversary of the 1954 earthquake that rocked the Humboldt Bay area, causing considerable damage and leaving Humboldt County with an uninhabited courthouse and the City of Eureka likewise without its city hall. It is further odd that the immediate Eureka area during the flood period received no considered abnormal rainfall—the amount being far less than surrounding areas and other stations throughout Northern California.

Floods Over Wide Area

In Northwestern California, however, the 1955 flood has shunted the earthquake with its seemingly disastrous damage into the background. The destructive flood and high water were prevalent over a wide area, affecting numerous communities and facilities and, at this writing, no firm estimate of the dollar value of the damage is yet available, but it is conceded by all that it will total many millions of dollars.

District I of the Division of Highways, with headquarters in Eureka, includes the Counties of Mendocino, Lake, Humboldt, Del Norte, and portions of Trinity and Siskiyou. The district contains 14 state highway routes totaling 853.61 miles of rural state highways.

To those familiar with California and its varied weather conditions, it will be noted that this district contains those counties well known for heavy rainfall.

Long History of Damage

The district's highway system has always been plagued by slides, slipouts, washouts, etc., as brought about by heavy rains. Hardly a highway project is designed in the district without considerable study entering into it involving drainage structures with adequate openings, embankment stabilization, flattening or benching cut slopes, placing horizontal drains, embankment protection along streams, and other features necessary to counteract the ravages of heavy rainfall with its resultant water-soaked earth and bankfull streams. Old-timers will recall the first constructed highways in the district that did not contain these modern design features to provide a stable, closure-free highway during winter months, and slides and slipouts were an accepted winter maintenance problem.

Along Route 1 (US 101, Redwood Highway) in years gone by, it was a foregone conclusion that road closures would probably occur at Lanes Flat, Bridges Creek Slide, Red Mountain Bluffs, Blue Slide, Hartsooks Slide, Garberville Bluffs, Redway Bluffs, Shively Bluffs, Greenlaw Bluffs, and other locations remembered by "old-timers." As old sections of highway were reconstructed or superseded, utilizing features to eliminate slides, slipouts, and washouts; and old slides became stabilized by the constant removal of material over the years, or corrective measures were applied, road closures during the winter became less common.

Stories and reminiscings of the trials and tribulations in keeping roads open in the old days, and the high waters of 1915 and 1937 were cast into the background by the Christmas week flood of 1955.

Every Route Damaged

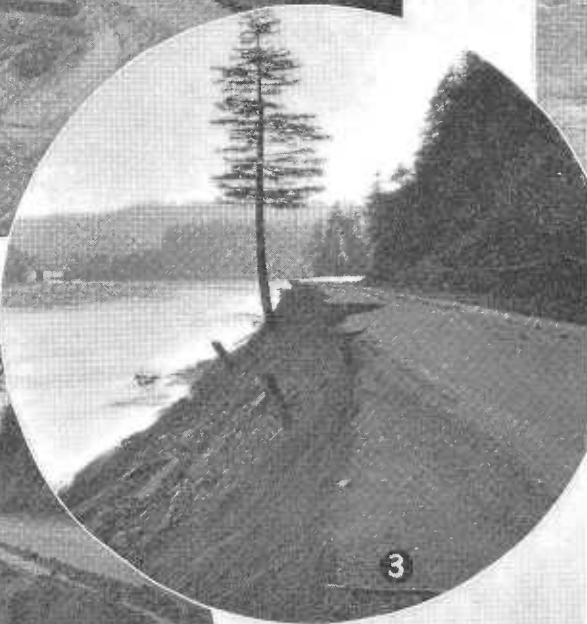
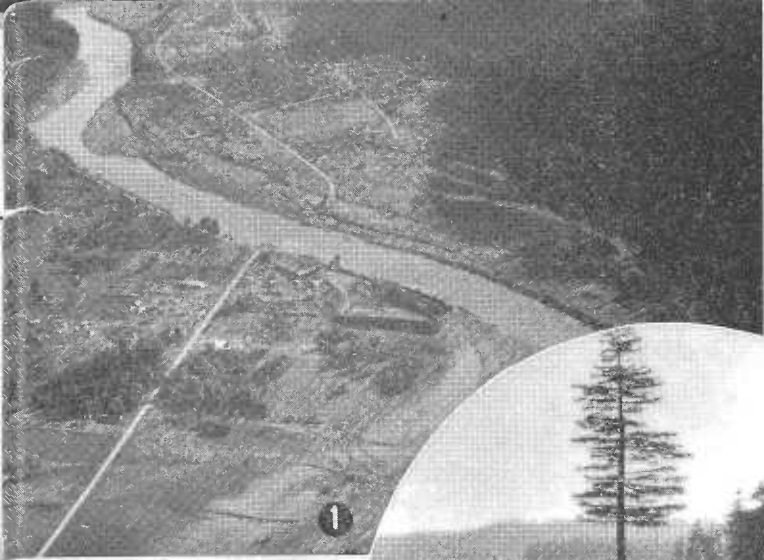
Every route in the district sustained damage ranging from comparatively inconsequential damage to destruction of catastrophic proportions. When the full details are summed up it will, in all probability, show that the District I highways suffered the most extensive and serious damage of the 11 highway districts in the State of California. Further, it will undoubtedly prove to be the most extensive and widespread damage ever sustained by portions of the California State Highway System at one time.

The major streams, which were generally in high-water stages in the early part of the week, and the increasing rainfall in all the major watersheds soon resulted in record-breaking gauge heights and discharges, and the devastating high water and inundation of contiguous areas. The highways utilizing the water level grades of the various streams to traverse the rugged terrain of the district were extremely vulnerable to damage. First reports of approximate high-water elevations at various locations were discounted and charged up to hysteria; however, a number proved to be essentially correct.

Astounding Discharges

Estimated discharges of some of the major streams during full flood conditions are rather astounding. The South Fork Eel River, near Miranda, was discharging 136,000 cfs., which is approximately twice as much as ever recorded. The Eel River at Scotia was discharging 470,000 cfs., establishing a record high. The Van Duzen River at Dinsmore recorded 21,500 cfs.; the Mad River at Forest Glen 33,000 cfs., and approximately one-half mile upstream from the US 299 crossing, 80,000 cfs. Redwood Creek at Orick 45,000 cfs., and the Klamath near Somes Bar was recording 180,000 cfs., and near Klamath Glen 400,000 cfs. The Smith River near the US 199 crossing recorded approximately 170,000 cfs. Rainfall such as that in Branscomb area of Mendocino County—which totaled 31.82 inches in 10 days prior to December 26th—accounts for these discharges.

The streams, having generally crooked courses, rugged beds and



1. Sign Route 96 in Hoopa Valley—Flood demolished bridge across Trinity River, center.
2. Portion of steel bridge at Hoopa washed 2,000 feet downstream.
3. On US 101 near Dyerville—Embankment washed out.
4. US 101 along Eel River at Shively—Bluffs washed out.
5. Pepperwood on US 101 flooded. Note pile-up of houses.
6. Weott on US 101 wrecked by Eel River.
7. Embankment washed out by Trinity River on Route 84 south of Hoopa.

shore lines, turbulence and eddies, together with high velocities, had an extremely damaging effect on the highway facilities subjected to inundation. To add to the damage caused by parallel creeks and rivers, cross streams and normally small water-courses became small raging torrents overtaking the capacities of drainage structures, with resultant flooding and washouts of roadbeds.

First Closure

The first closure in the district on Wednesday, December 21st, will probably never be known, but the first indication of trouble came from the southern portion of the district. The streams flowing southerly, with watersheds in the area receiving intense and continued rainfall, had comparatively short distances to travel to the lowlands subject to flooding. Possibly Route 16, the Hopland-Lakeport highway, was the first closure when it was closed at 5.30 p.m. on December 21st, due to high water in the Russian River. As rivers and streams continued to rise, reports came over the district's radio communication system and into the district office that evening in rapid sequence from all parts of the district, and the seriousness of the situation was made obvious.

By morning of December 22d, all routes were closed and any detailed information was impossible to obtain since telephone communications were out throughout the area and many portions of the highway system were inaccessible, with waters still rising to the crests in the lower basins of the streams. The reports received revealed that all the various damages causing road closures were present: slides, washouts, settlements, bridges and approaches damaged, and, although it was not realized at that time, even houses floating onto the traveled way at several locations impeded access into flooded areas when water receded.

In Southern Mendocino and Lake Counties, although road closures occurred by flooding the highway in these areas, the damage incurred was inconsequential in the over-all district picture, and all highways were opened as soon as waters receded.

On Route 15 (Sign Route 20), approaches at the easterly end of the North Fork of Cache Creek bridge were partially washed out and slope paving damaged.

On Route 70, Ukiah-Talmage Road, the high water of Russian River caused considerable pavement damage.

On Route 48 (Sign Route 128) some washouts occurred due to scour by high water in the Navarro River.

Mendocino Not Hard Hit

At Anderson Creek and Dry Creek, cross streams changed channels at crossings, but not to any irreparable or serious extent, and, in general, the highways under the Boonville maintenance territory jurisdiction were open to all traffic upon recession of high water. Route 56 (Sign Route 1), on the Mendocino Coast, gave no serious trouble.

On Route 1 (US 101) the first serious damage occurred at Longvale, where approaches to the bridge across Long Valley Creek Crossing No. 1 were washed out. As soon as waters receded approaches were restored. From this point to Laytonville, actual damage was relative nominal, generally consisting of some washouts, eroded shoulders, and minor slides.

The sector of Route 1 (US 101) from Laytonville to Scotia, a distance of approximately 105 miles, will, it is hoped, retain the record for all time as incurring the most extensive and serious damage ever inflicted upon such a length of state highway during a single storm. Within this section, the concentration of damage occurred between Leggett and South Scotia Bridge, a distance of approximately 68 miles. In this 68 miles, US 101 parallels the South Fork of Eel River at generally nominal elevations above streambed, and previously recorded high waters, and joins the main Eel River at Dyerville.

Slides and Slipouts

Damage to this section was of all descriptions: major and minor slipouts and slides, culvert blockage, undermined pavement, and washed out shoulders at discouraging intervals. The only major structure damage was the settlement of the box abutment at

the northerly end of the Smith Point Bridge, south of Benbow.

It should be noted that some of the "old-time" trouble spots previously mentioned herein again came into questionable prominence and persisted in giving trouble at this time. Slides at Greenlaw and Shively Bluffs continue to necessitate attention. The old Blue Slide washout south of Benbow was reactivated to a serious degree and is one of the major problems in restoration efforts.

The communities of Myers Flat, Weott, and Pepperwood were almost completely inundated, and receding waters left silt on the highway traveled way to depths of over two feet. Pioneering an emergency road through the Pepperwood area was further impeded by buildings that had floated onto the traveled way. Motel cottages, overturned and practically completely demolished, had floated onto the traveled way and become wedged between redwood trees in a jumbled mass, necessitating bulldozing to clear the way. In Pepperwood proper, two-story, story-and-a-half, and single-story houses reposed on the traveled way when waters receded. As they were, to a great extent, intact and single-lane traffic was able to shoofly around them, arrangements were made by the Division of Highways with professional house movers for the removal of these houses from the highway right of way in a repairable condition.

From South Scotia Bridge to Fortuna, where roadway grades were below this particular high water elevation, damage consisted mainly of erosive action on the generally low embankments and shoulders, and debris and drift on the highway.

Damage North of Arcata

From Fortuna to Arcata, the highway remained normal. Beyond Arcata, at what is known as Arcata Bottoms and where the Mad River traverses the flatlands at the northerly extremity, the damage to highway facilities by the overflow of Mad River was of major consequence. The approach spans and approaches to the Turner Draw Bridge were washed out and approaches to smaller structures across



8. Weott where high waters were to awning height.



9. Pepperwood inundated by Eel River.

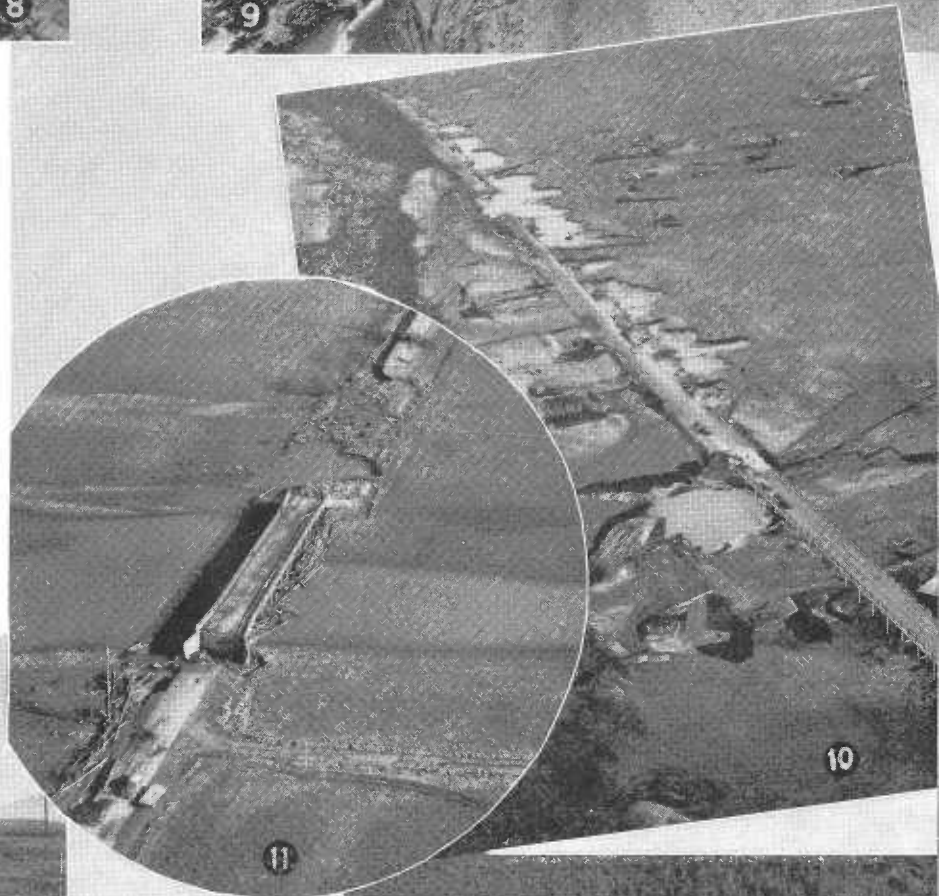
10. Sign Route 1 between Fernbridge and Ferndale—Water flowed over many square miles.

11. Sign Route 1 between Ferndale and Fernbridge—Embankments destroyed by Eel River.

12. Sign Route 1 near Ferndale—Box culvert washed out.

13. US 299 along Trinity River west of Del Loma—Masonry wall, left, topped by high waters.

14. US 101 at Dyerville on south fork Eel River. Note large slides blocking highway on left.



10

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overflow channels known as Moore Draw and Boyd Draw were washed out. At the major structure in the area, the bridge across Mad River, four spans of the timber approach at the north end of the structure were completely demolished.

From Arcata to Orick, Route 1 suffered what is considered negligible damage in this instance. At Orick, Redwood Creek overflowed its banks and damaged levees constructed after the Redwood Creek flood of 1953, and Orick was again flooded. Highway damage was not consequential.

Major Catastrophe

As we go into Del Norte County, the major catastrophe of the area occurred at the Town of Klamath, where almost complete destruction of the town resulted from the overflow of the Klamath River. The northerly approach to the Douglas Memorial Bridge, carrying US 101 across the Klamath River, was washed out.

From Klamath to Crescent City and on to the Oregon line, Routes 1 and 71 (US 101) suffered no extraordinary damage.

Although the Smith River registered record high water, Route 1 (US 199), from Crescent City to Grants Pass, Oregon, which follows the Smith River Canyon, the general damage consisted of no extraordinary slides and some washouts, but not of particularly serious nature. Route 81, North Bank Road connecting US 101 and US 199, did suffer some washout damage.

Mad River Bridge

On Route 20 (US 299) partial washout of approach fills of the Mad River Bridge occurred. On a series of forest highway projects under construction between Berry Summit and Willow Creek by the U. S. Bureau of Public Roads, major slides, slipouts, and washouts were prevalent, which made road opening a difficult process.

From Willow Creek to the district boundary, where the highway follows the Trinity River, dropping to "water grade" at Cedar Flat, washouts, slipouts, and slides were prevalent.

The Cedar Flat Maintenance Station, formerly located on a small flat

area between the highway and Trinity River, is a complete loss—not a sign of the foreman's cottage or truck shed with gas tank remains—and the former site is completely washed away. The Cedar Flat Bridge was in jeopardy for a period of time as the raging waters topped the deck of the bridge and threatened to demolish the structure. The easterly approach embankment, however, finally was penetrated by the river and pressure on the structure was relieved.

Hoopa Bridge Destroyed

Route 84, Sign Route from Willow Creek to Weitchpec, suffered major damage by slides, slipouts, and washouts, including complete loss of the steel truss bridge, together with center pier, that afforded crossing of the Trinity River at Hoopa. The main span of this steel structure was rolled downstream and finally came to rest approximately 2,000 feet from the bridge site.

Other serious damage in this area was incurred by Route 46, Martins Ferry to Weitchpec, and up the Klamath River through Orleans, on to the district boundary. Within these limits, the approaches to Bluff Creek Bridge were washed out, with Bluff Creek breaking a new channel at the location.

Route 56 (Sign Route 1) in Humboldt County, from Fernbridge to Ferndale, presented extensive damage when flood waters from the Eel River receded. The concrete bent approach at the south end of Fernbridge Bridge across the Eel River was seriously damaged. Bridge approaches were washed out at other structures and a large box culvert at Arlynda Corners was completely destroyed. Intervening roadway had shoulders completely washed out and the concrete pavement undermined for a distance of as much as six feet.

Van Duzen River

High waters in the Van Duzen River and Yager Creek resulted in damage and road closures on Route 35 (Sign Route 36). A pier on the Yager Creek Bridge at Carlotta was apparently undermined and jarred loose by

heavy drift, necessitating closing of the bridge.

Cooperation of the Northwestern Pacific Railroad resulted in an agreement between the Division of Highways and the railroad to temporarily plank the parallel railroad bridge so that light traffic could make the Yager Creek crossing.

Farther east, on Route 35, in the Grizzly Creek area, major washouts and slides seriously hampered road opening. Beyond Bridgeville no extraordinary damage was inflicted on Route 35.

Pioneering "trails" into stricken areas to bring in assistance and emergency vehicles was the first order of business by the maintenance crews. This also allowed some appraisal of the damage and immediately instigated restoration activities.

Extra Forces Employed

Field offices immediately hired privately owned equipment and additional manpower to supplement regular state maintenance equipment and personnel in an endeavor to open roads as soon as possible. Additional state forces were brought in from areas suffering lesser damage to the Laytonville-Scotia area where, as previously mentioned, the most lengthy section of highway was damaged severely.

Within this area, during the height of efforts to open the road, there were engaged in the work approximately 150 pieces of equipment of various kinds and in excess of 200 men. This was the greatest concentration of men and equipment ever assembled on a sector of state highway. Equipment belonging to approximately 70 different companies and individuals comprised this assemblage of equipment.

At this writing, full-scale restoration activities are still underway and many sections of highway are still in no condition to handle traffic in a normal manner. Men of the Bridge Department are in the district handling, in their usual able manner, the necessary bridge work.

Damage Almost \$3,000,000

At this time it is estimated that the dollar value of the damage to District

I state highways will approximate \$2,950,850. The greater portion of the damage occurred in Humboldt County, where it is expected that \$1,901,850 will have to be expended to restore highway facilities. The least amount of damage occurred in Lake County, where it is estimated to amount to approximately \$20,000.

It must be mentioned that companions to the state highways in land transportation facilities within the district; namely, the county roads and the Northwestern Pacific Railroad, also suffered severe and extensive damage.

Of the counties comprising the district, Humboldt's county roads incurred the greater portion of road damage. As an indication of the magnitude of the Humboldt County Road System damage, surveys of the situation have revealed that some 38 bridges have been damaged or completely lost, with indications that approximately 19 are completely out or will require complete replacement.

The Division of Highways is rendering Humboldt County emergency assistance at this time by arranging the financing and emergency contracting for the restoration of county roads and bridges on a priority basis to open roads into various areas to re-establish land transportation to communities.

The Northwestern Pacific Railroad has a major restoration job to contend with, including replacement of sidehill trestle along the precipitous Scotia Bluffs, along the Eel River just downstream from Scotia.

Story Incomplete

This would be only a very small part of a complete saga of the 1955 California flood, or even of the complete story of the floods within the area covered by this brief. All of the story will probably never be put together. Stories of destruction, tragedy, and despair, and probably humor as well, would have to be tracked down. We know there are innumerable factual stories of friend helping friend, neighbor helping neighbor, and stranger helping stranger, and stories of cooperation and extreme endeavor on the part of individuals, agencies,

and others throughout the area during the length of the emergency.

We have heard of stories wherein strangers, going in opposite directions and anxious to get to homes not too distant, were confronted with a wash-out who then and there traded pickups to continue in their desired direction, after making arrangements to return each others vehicles at a later date.

We also heard a story of a large bobcat seen hanging onto a log being carried down a swollen stream. He was snarling, but desperately hanging on. Possibly humorous, knowing that cats dislike water, but certainly a tragedy to the bobcat.

As for the Redwood Highway and other routes, they will be back in normal service and the vacationists and tourists from all parts of the Country will be traversing them in increasing numbers. They will marvel at beautiful vistas of placid, shimmering streams, snap pictures of these vistas unaware that these streams could show up the futility of man against the natural elements. They will look with askance and doubt at the "native" as he shows them where the water was in his house during Christmas week, 1955.

District II—\$2,586,145

By J. W. TRASK
District Engineer

The one predictable feature of California weather is that it is unpredictable. This was amply demonstrated in the Redding district this fall and early winter.

Normally, beginning in September, there are some fall rains. These continue intermittently, with some snow in the higher altitudes, until about mid-December. Then storms of greater intensity and duration occur and the snow blanket is built up in the mountains.

This year there were no fall rains. About the middle of November, a heavy snow fell over most of the district. This was followed by more or less continued intermittent storms that put rain in the valleys and snow in the highlands. Even this was at variance with the normal pattern. It was much heavier in the Trinity, Feather and Klamath watersheds than in the Pitt and Sacramento areas which usually have the heaviest snow cover.

Highway entirely destroyed at Chipps Creek on Feather River



Rain Creates Emergency

About the twentieth of December, the temperature rose and a warm rain began falling all over the district up to above the 5,000-foot level. The rain itself put down as much as five inches in 24 hours in some places. Coupled with the water from the melting snow, streams rose everywhere. Immediately messages began to pour into the Redding District Office from the Klamath River area in Siskiyou County, the Feather River area in Plumas County, and all along the Trinity River in Trinity County. The district radio went on almost a 24-hour shift. The district began lining up equipment which could be used as soon as more definite information about damages was available. Equipment, supplies, and personnel were dispatched and shifted to meet the emergencies as they materialized.

The pattern of the storm was developed by the twenty-fourth of December. Bridges were damaged and sections of highway washed out in all three of the watersheds.

As soon as it was possible to do so, a crew of engineers visited the damaged areas. They estimated costs of emergency repairs to put the high-

ways in operation and also amounts which will be required for restoration. Work began immediately on those of an emergency nature, and at the time this article goes to press will be largely accomplished.

SISKIYOU COUNTY

The major damage sustained was located in Scott Valley on Route 82, and along the Klamath River on Route 46.

On the highway between Etna and Fort Jones, the Scott River destroyed the bridge near Fort Jones. The bridge over Kidder Creek was also washed out. Patterson Creek bridge had the approaches damaged.

Along the Klamath River, the section between Walker and the junction of Route 3 received only nominal damage consisting of small slides and shoulder erosion.

The section between Walker and Seiad contains the bridge over the mouth of Scott River which was destroyed in its entirety. Washouts and erosion damages were also heavy.

Between Seiad and Happy Camp, damage was confined to slides and slipouts, with some damage to approaches to the Seiad Creek bridge.

Similar damage was sustained between Swillup Creek, the district boundary, and Happy Camp. However, due to the highway being narrower and not constructed to present standards, the cost of emergency repairs will represent almost half the total amount for full restoration.

Between Yreka and Weed, damage was sustained at Parks and Greenhorn Creeks.

TRINITY COUNTY

The Trinity River first strikes the highway near Vitzthum's and roughly parallels the location for about two miles until it reaches Douglas City where it is crossed by a bridge which takes the highway to Weaverville.

A section of heavy concrete riprap bank protection and the highway itself were washed out near Vitzthum's. About 170 feet of the Douglas City bridge over the Trinity was lost.

To catalog the highway damage along the Trinity River below Junction City would be a long recital of bank erosion and complete washouts. The approach of Canyon Creek bridge at Junction City was swept out. Damage was sustained at many other structures.

The road from Douglas City to Peanut received some scour. This was heavy near Redding's Creek.

SHASTA COUNTY

Route 3 in this county was protected from major damages by Shasta Dam. The only damage on this route was a slide near Antler in the Sacramento Canyon. Minor damages from erosion were suffered on Mount Lassen-Mount Shasta highway, south of the intersection with the road to Alturas. A mud slide occurred on Route 29 west of Platina.

TEHAMA COUNTY

Like Shasta County, Tehama received protection from Shasta Dam on the main routes. The highway west to Hayfork received minor damage by erosion. Route 47, the cutoff between Chico and Chester, had very minor damages. On the road to Susanville, damage was minor but rather widely spread. It consisted of shoulder scour, debris on the roadway, and some pavement restoration.

Slides and erosion east of Arch Rock Tunnel on US 40 Alternate, Butte County





UPPER—Temporary detour under construction on Trinity River two miles from Douglas City.
LOWER—Typical damage along Trinity River.

MODOC COUNTY

Only damage sustained by this county was a culvert washout on the road between Alturas and the Nevada state line.

LASSEN COUNTY

The Susan River flooded the highway in the vicinity of Litchfield on the road to Alturas and east of Susanville. Damages were minor. Largest item was requirement for placing rip-rap at Secret Valley Creek.

Very small damage occurred between Susanville and Doyle.

Beyond Doyle, Long Valley Creek washed out the highway where it crosses the Quincy-Reno route, and again where it crosses the Susanville-Reno connection. Culverts were overloaded at both places.

From Susanville to Reno, damage was relatively light. Major costs were in connection with one structure over Long Valley Creek which was wrecked and one which was damaged.

The southern end of Lassen County takes in a portion of the Quincy-Reno highway. A structure over Long Valley Creek was wrecked there.

PLUMAS COUNTY

There is no point in trying to list the damage to the Feather River Highway. Beginning just beyond Jarbo Gap, the amount of water was simply more than the channel could carry.

Highway slopes were washed out, the road undermined, and in some cases flooded and torn out in its entirety. Slides of huge boulders were dumped in the canyon completely obliterating the highway. One of these was estimated to contain 100,000 cubic yards.

At another place, a cut through "onion skin" rock broke loose. This is a stratified material sloping toward the highway. It is difficult to be certain just how much material will come in at this location.

At Bardee Creek, near Pulga, a slipout removed the entire roadway section to the extent of about 75,000 cubic yards.

The route from Blairsden to Sierra county line received some scour and damage to the bridge over the south fork of the Feather River; otherwise damage was minor.

The route from Lake Almanor to the Feather River was severely damaged in three places where it parallels Indian Creek. Scour at other locations was extensive.

TOTAL FLOOD DAMAGE IN DISTRICT II

County	Repairs	
	Emergency	Restoration
Siskiyou	\$113,565	\$503,835
Trinity	151,910	1,068,810
Shasta	16,060	7,150
Tehama	8,770	20,955
Modoc	1,760	2,100
Lassen	23,650	71,555
Plumas	260,945	335,080
	<u>\$576,660</u>	<u>\$2,009,485</u>

District III—\$925,000

By A. M. NASH
District Engineer

Rains in the latter part of November and the first of December had already saturated the soil in the mountains and valleys of Northern California so that the unprecedented heavy warm rains beginning December 18, 1955, did not disappear into the earth but caused a heavy run-off in all the mountain streams and rivers.

Damage to state highways in the district amounted to approximately \$925,000.

Rain at elevations up to 10,000 feet rapidly melted the snow pack which was about six feet deep at Yuba Pass, Donner, and Echo Summit.

On December 21st at 8 p.m. word was received from District II that US 40 Alternate was closed in the Feather River Canyon, and from then on there was very little sleep obtained among the highway personnel in District III.

On December 22d information began coming in from the different territories of road closures due to flooding and washouts along the Yuba, Feather and American Rivers.

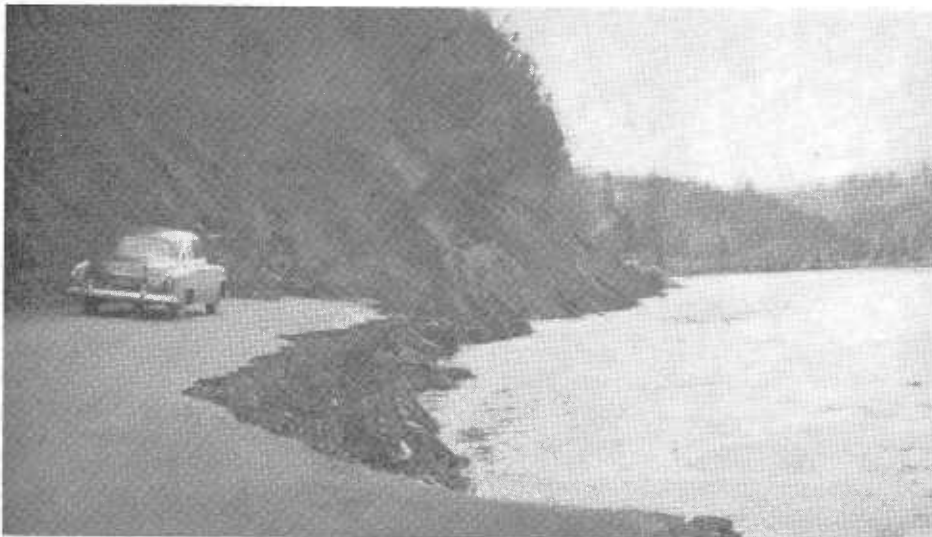
Considerable sections of road were washed out above Downieville on Sign Route 49, the Yuba Pass Highway. Sections of the road were washed out on US 50. There were serious fill slipouts on Sign Route 20 and US 40. There were also flooded sections of road on US 40 and US 50.

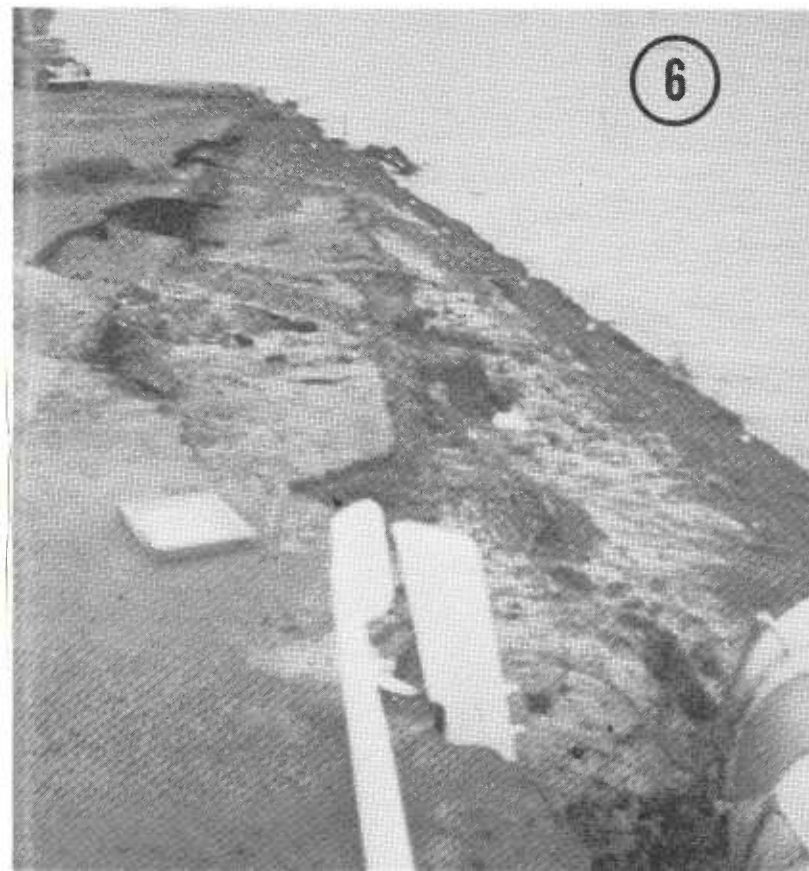
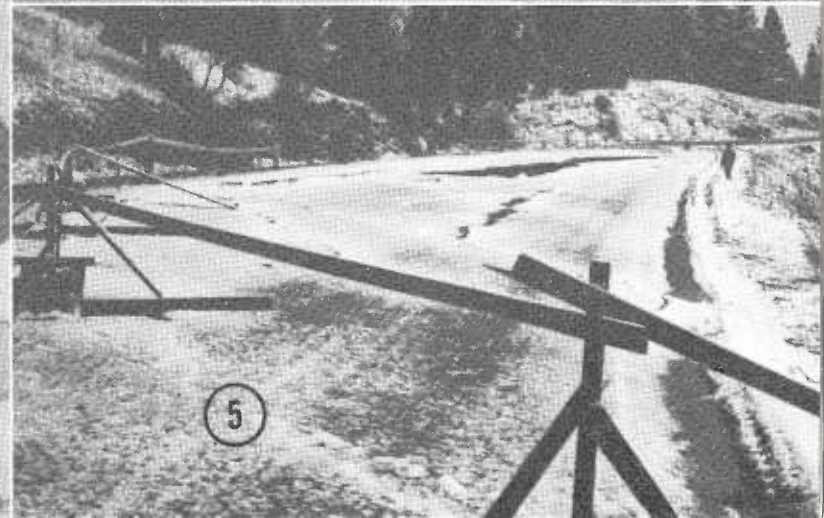
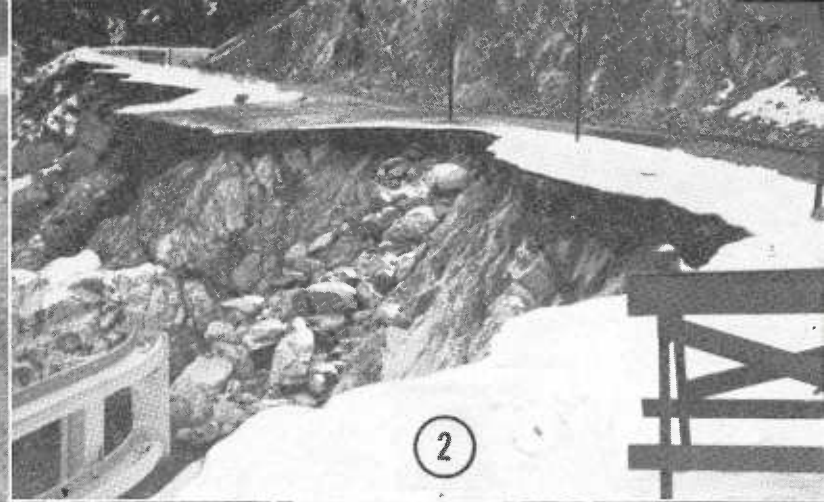
US 40 Alternate Closed

US 40 Alternate north of Marysville was closed between Marysville and Oroville by an overflowing of the Feather River flood crest into Simmerly Slough near Marysville, and from inundation of a considerable section of this road which lies on low ground adjacent to the Feather River between Union School and Oroville.

The Yuba River, in common with all other Sierra streams in this district, was rising rapidly, and in view of the unprecedented high flood stages reported from the upstream reaches, the Marysville Levee Commission alerted the District III highway authorities to the possible necessity of closing US 99E at the D Street Bridge so that a low gap in the levee at this point

Complete washout of sack rip-rap and highway near Vitzthum in Trinity County





1. Fill slipout on Sign Route 49 east of Nevada City
2. Erosion at Canyon Creek Bridge on Sign Route 49, Sierra County
3. Major fill slipout on US 40 west of Baxter, Placer County
4. Erosion of shoulders on Sign Route 49 through Coloma, El Dorado County
5. Fill slipout on US 50 east of Placerville in El Dorado County
6. Erosion around north end of Sutter Causeway on US 40, Alternete, Sutter County

could be closed. At 4 p.m. December 22d the bridge was closed to traffic to effect the placement of planks and sand bags, since the roadway forms about a four-foot depth gap in the levee at the bridge ends.

Our crews were working removing drift from the D Street Bridge throughout the afternoon and all through the night of Thursday, December 22d, and other men under the authority of the Levee Commission were strengthening the levees at the approach.

Marysville Evacuated

On Friday, December 23, 1955, the river stages began approaching record heights in the Marysville area, and soon after noon Marysville was ordered to be evacuated by 4 p.m. The only vehicle escape route by that time was over the 10th Street Bridge to Yuba City.

About midnight, Friday night, the west levee on the Feather River south of Yuba City broke and flooded a major portion of Yuba City and thousands of acres to the south—completely closing US 40 Alternate between Marysville and the Sutter Bypass.

After flood waters had subsided, work was immediately started on emergency restoration of the closed highways to permit one-way traffic on the sections that were closed by slides, slipouts and washouts.

All truck traffic was prohibited over US 40, and because of the condition of the road where there was a slipout at Steep Hollow, only trucks of an emergency nature were permitted to detour via State Sign Routes 49 and 20 between Auburn and Emigrant Gap. This detour was caused by a major slipout of a fill one-quarter mile east of Baxter.

Crews were sent out consisting of representatives of the district, Headquarters Office, and the Bureau of Public Roads to make an estimate of the storm damage including emergency restoration, complete restoration and/or improvements on all state highways. Similarly, road damage survey teams comprised of district, Bureau of Public Roads, Bridge Department representatives, and the county road commissioners were sent

out to estimate the emergency repair and restoration costs on city streets and county roads.

Work of Restoration

Work at present is going on restoring roads to two-way traffic throughout District III by day labor forces, by emergency contract, and by the use of rented equipment.

Continuous storms throughout the first of January, including heavy snow storms at times, have hampered the work considerably since it is necessary to stop repair work in many locations and go about the business of snow removal.

On US 99, south of Sacramento, the highways were in danger for a considerable time from the rising waters in the Cosumnes River and its overflow channels. However, when the height of the water reached the top of the stringers of the bridges over the Cosumnes overflow, a levee upstream broke and spread water over the lowlands of the area, relieved the condition, and saved the bridge from washing out.

The height of water in the Yolo Bypass was such that it was necessary to sandbag the approaches on the west end of the Yolo Causeway on US 40 west of Sacramento to prevent water from covering the highway in that area.

The "River Road" between Woodland and Sacramento was closed by waters from the Fremont Weir flowing into the Yolo Bypass and will, undoubtedly, remain closed for some time because of the continuing high stage of the Sacramento River.

The flooding of Yuba City and southern Sutter County was a major disaster in which many lives were lost, livestock killed by the thousands, and millions of dollars' damage done to property. One hundred and ten Division of Highways employees suffered damage ranging from minor flooding of garages to complete loss of houses and belongings. Fortunately, no division personnel or their families lost their lives, although there were narrow escapes.

The work of rehabilitating homes took employees, their families and friends up to two weeks away from work while co-workers carried on

with the problem of opening and restoring highways. Permanent repairs to homes, of course, will be continuing into the summer and fall.

The Marysville-Yuba City area will long remember the "Christmas" flood of 1955!

District IV—\$750,000

By D. C. RYMAN
District Maintenance Engineer

District IV, which comprises the nine Bay area counties of Sonoma, Marin, Napa, Contra Costa, Alameda, San Francisco, San Mateo, Santa Clara and Santa Cruz, was lashed by several hard gales and rainstorms from December 18th to 25th causing approximately three-quarters of a million dollars damage to the state highways.

Major arterial highways such as the Eastshore Freeway, Bayshore Freeway and US 101 south of Morgan Hill were flooded and closed during the height of the storm. Several other routes were closed by flooding, slides, slipouts, washouts, fallen trees, plugged culverts and one bridge failure. Nearly 500 men and 300 pieces of state-owned and rented equipment worked tirelessly around the clock to open the highways and restore safe public travel. All highways were opened to traffic on January 11, 1956, but there are many one-way sections which will require several months to restore to their original width.

First Storm December 18th-19th

The first heavy storm struck on December 18th and continued throughout December 19th. The Russian River in Sonoma County overflowed its banks east of Geyserville and adjacent to Guerneville where it reached a record flood stage of 47.8 feet and all highways in the area were closed until December 20th when the river receded.

The new highway in Napa County from Capell Valley to the uncompleted Monticello Dam on Putah Creek was damaged by slides and slipouts but remained open to one-way traffic. State Sign Route 1 on the coast south of San Francisco was closed due to hundreds of tons of mud sloughing from the bluffs above the highway.



1. Six-hundred-foot washout on Route 107 in Alameda County
2. Long washout on Sign Route 9 west of Saratoga in Santa Clara County
3. Slipout on Sign Route 5 south of La Honda in San Mateo County
4. Rock slide west of Junction 56, Route 6 on Sign Route 128, Napa County
5. Large slide which blocked highway from Waterman Gap to Big Basin State Park, Santa Cruz County
6. Small washout only one of many on Niles Canyon Highway, Alameda County
7. Slipout for full length of roadway, Sign Route 128, Napa County



Second Storm December 22d-23d

The second and most severe rains started early December 22d and continued through December 23d, raising the total rainfall for the storm to 10 inches in the immediate Bay area and a high of 30 inches in the Santa Cruz Mountains and Guerneville area.

North Bay Area

The Russian River again flooded, reaching the highest stage recorded with a flow of 90,000 second-feet. Portions of the communities of Geyserville, Healdsburg, Sebastopol and Guerneville were inundated and the highways were closed until December 27th. In Napa County, the Putah Creek flowed over the uncompleted Monticello Dam with a record flow of 90,000 second-feet and the new highway was shut tight with slides and slipouts. It required continuous work until January 6, 1956, to remove several thousand yards of slide material and to construct a detour to open the highway to one-way traffic. State Sign Route 128 between Rutherford and Monticello was also closed from slides and washouts until January 6th.

Santa Cruz Area

A large portion of the City of Santa Cruz business district was flooded to a depth of six feet by the high flow of the San Lorenzo River December 22d-24th, during which a record flow of 35,000 second-feet was reached. Two piers of a new bridge under construction were washed out.

State Sign Route 9 from Santa Cruz to Felton and the two highways leading into Big Basin State Park were closed by large slides and slipouts which destroyed many large redwood trees. The park area was isolated until December 26th.

Saratoga Creek went on a rampage washing out the entire highway for several hundred feet west of the town of Saratoga. Severe erosion along the creek, washouts, and slides damaged the entire route from Saratoga to Saratoga Gap.

The Los Gatos-Santa Cruz Highway, State Sign Route 17, was threatened by slides and plugged culverts several times. Recently placed concrete channel lining on the Los Gatos Creek which is under construction

HIGHWAY PERSONNEL COMMENDED

WHEREAS, Storms occurring during the latter part of December, 1955, caused unprecedented floods in streams and rivers throughout Northern and Central California, resulting in tragic loss of life and heavy damage to private as well as public property, including state highways; and

WHEREAS, Many state highway bridges were destroyed or damaged, and numerous sections of highway closed by slides and washouts, resulting in the isolation of many communities; and

WHEREAS, The engineers and employees of the Division of Highways of the Department of Public Works, in this grave situation, responded wholeheartedly to their duty, working long hours in adverse weather under extremely difficult and hazardous conditions; now therefore, be it Resolved by the California Highway Commission, that it hereby expresses to these engineers and employees its sincere appreciation and admiration for their outstanding service to the people of California in this emergency, and its further commendation to them for the rapidity with which damaged state highways were reopened to public travel.

was partially ripped out. The new Lexington Dam on Los Gatos Creek was completely filled and water

flowed over the spillway at the rate of 25,000 second-feet.

Gilroy-Watsonville Area

The Uvas, Llagas and Carnedero Creeks overflowed, closing all highways in the Gilroy area. US 101 was closed from Morgan Hill south to the county line. State Sign Route 52 was flooded at the Hollister Junction and the Hecker Pass portion west of Gilroy had slides, washouts, and a pier of the Uvas Creek bridge was undermined, dropping two spans of the deck. Slides also occurred at Pacheco Pass east of Gilroy.

These flood waters continued their ravaging damage throughout the Pajaro River channel, which caused erosion along Route 67, the Chittenden Pass Road, and flooded the Watsonville area December 24th and 25th.

East Bay Area

The Eastshore Freeway was closed on December 23d due to the overflow of San Lorenzo Creek. The Jackson Street Underpass on Route 105 in Hayward was flooded. The main arterial between Oakland and Walnut Creek State Sign Route 24 was kept open only by continuous work "around the clock" by both the Maintenance Department and a contractor. A heavy deluge of mud washed into the Broadway Tunnel ventilating equipment room.

Alameda Creek washed out several sections of the Niles Canyon Highway Route 107 between Niles and

Flooded Visalia Airport Interchange, Tulare County



Sunol. A protection wall 600 feet in length collapsed when topped by the creek. These flood waters continued downstream and flooded the Niles-Centerville-Alvarado area, closing State Sign Route 17. Damage in the Pittsburg and Livermore areas was light.

Bayshore-Alviso Area

The stream channels beginning with the San Francisquito Creek on the north to the Guadalupe River on the south overflowed, flooding several subdivisions, the Bayshore Highway, the Agnew Underpass, and isolating the town of Alviso. Highways leading to Alviso were closed until December 30th due to the combination of the flood waters and high tides.

District V—\$312,000

By L. E. ELDER
District Maintenance Engineer

On December 22, 1955, one of the heaviest holiday season storms recorded in recent years struck the Central Coast Counties of San Benito, Monterey, San Luis Obispo and Santa Barbara. Heavy rains continued throughout the Christmas week end with a final tapering off during the night of December 28th.

According to records compiled by the *Salinas Californian*, the Salinas Valley area, as of December 28th, had received a season's total rainfall totaling the fourth highest season's total in an 83-year record of rainfall. The rains during December have made it the fifth wettest December since 1872. Rainfall figures for the rest of the



UPPER—Flooded section of US 99 through Chowchilla, Madera County.
LOWER—US 99 flooded south of Chowchilla.

Central Coast Counties appear to indicate a record rainfall of about the same magnitude as that experienced in the Salinas Valley.

Heavy Rainfall

Many places throughout the four counties experienced exceptionally heavy rainfall during the second and

third day of the storm, in a few instances, attaining almost cloudburst proportions with the resultant run-off carrying debris and drift across the highways and causing extensive damage to existing highway facilities.

As an example, 8.45 inches of rain was recorded at the Big Sur Maintenance Station for the 24-hour period beginning at 8 a.m. on December 23d, and 6.45 inches at Willow Springs, 3.14 inches at Hollister, 2.77 inches at Seaside and 2.64 inches at Paso Robles all for the same period. During the following 24-hour period on December 24th, all areas except Buellton and Santa Barbara received rainfalls varying from 1.55 inches to 4.02 inches with Priest Valley receiving 3.42 inches, Atascadero 3.36 inches, Big Sur 3.75 inches, Willow Springs 3.35 and San Luis Obispo 4.02 inches. On December 25th, the storm reached its peak in the Santa Barbara area with a rainfall of 2.90 inches being recorded at Lompoc, 6.33 inches at San Marcos,

Pumping equipment set up in Chowchilla



2.94 inches at Buellton and 1.96 at Santa Barbara.

Main Roads Kept Open

In spite of the severity of the storm, District maintenance personnel, by working around the clock, managed to keep all the main line roads open for the heavy volume of holiday traffic. Only three main routes experienced closures. Route 117 was closed between Salinas and Monterey on December 24th for a period of 21 hours due to flooding at the Salinas River crossing west of Salinas. Sign Route 150 over San Marcos Pass was closed to all but local traffic for a period of about 10 days due to storm damaged embankments on a portion of the route now under construction.

Sign Route 1, between San Simeon and Carmel was closed early on December 23d. Historically, the highway between San Simeon and Carmel has always been considered a road highly susceptible to extensive damage during heavy storm periods due to slides, washouts and flooding by the numerous creeks and canyons throughout the area. The December storm proved to be no exception. Extensive damage was experienced to the existing bridges across San Carpojo Creek, White Creek and Mill Creek. Approximately 60,000 cubic yards of embankment will be required to replace a portion of the roadway at a point about 10 miles south of Big Sur where flash floods washed out the entire roadbed. Numerous minor and several major slides have completely blocked a 50-mile stretch of this road between San Carpojo Creek and the Big Sur River. However, several months will be required to complete repairs to damaged structures and to restore the existing traveled way to its original condition prior to the storm.

It has been estimated that it will cost about \$312,000 to repair the damaged structures and restore the roadbed to its original condition.

UPPER—Storm damage to roadway 10 miles south of Big Sur River at Redwood Canyon on Sign Route 1. LOWER—Damage to sacked concrete riprap at downstream side of Jungle Inn Bridge across San Benito River 20 miles south of Hollister on Route 119, San Benito County.

District VI—\$1,400,000

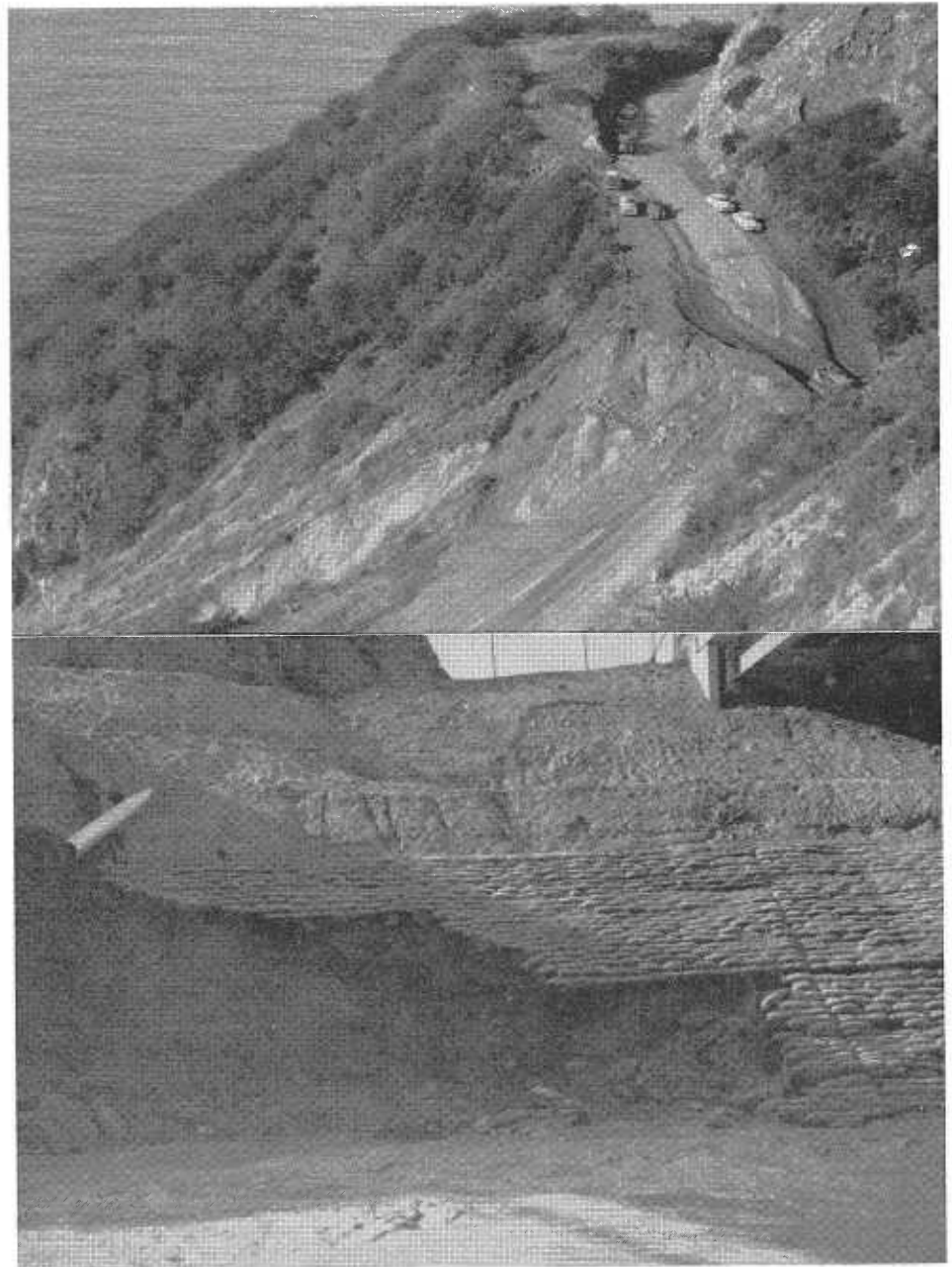
By T. M. WHITLEY

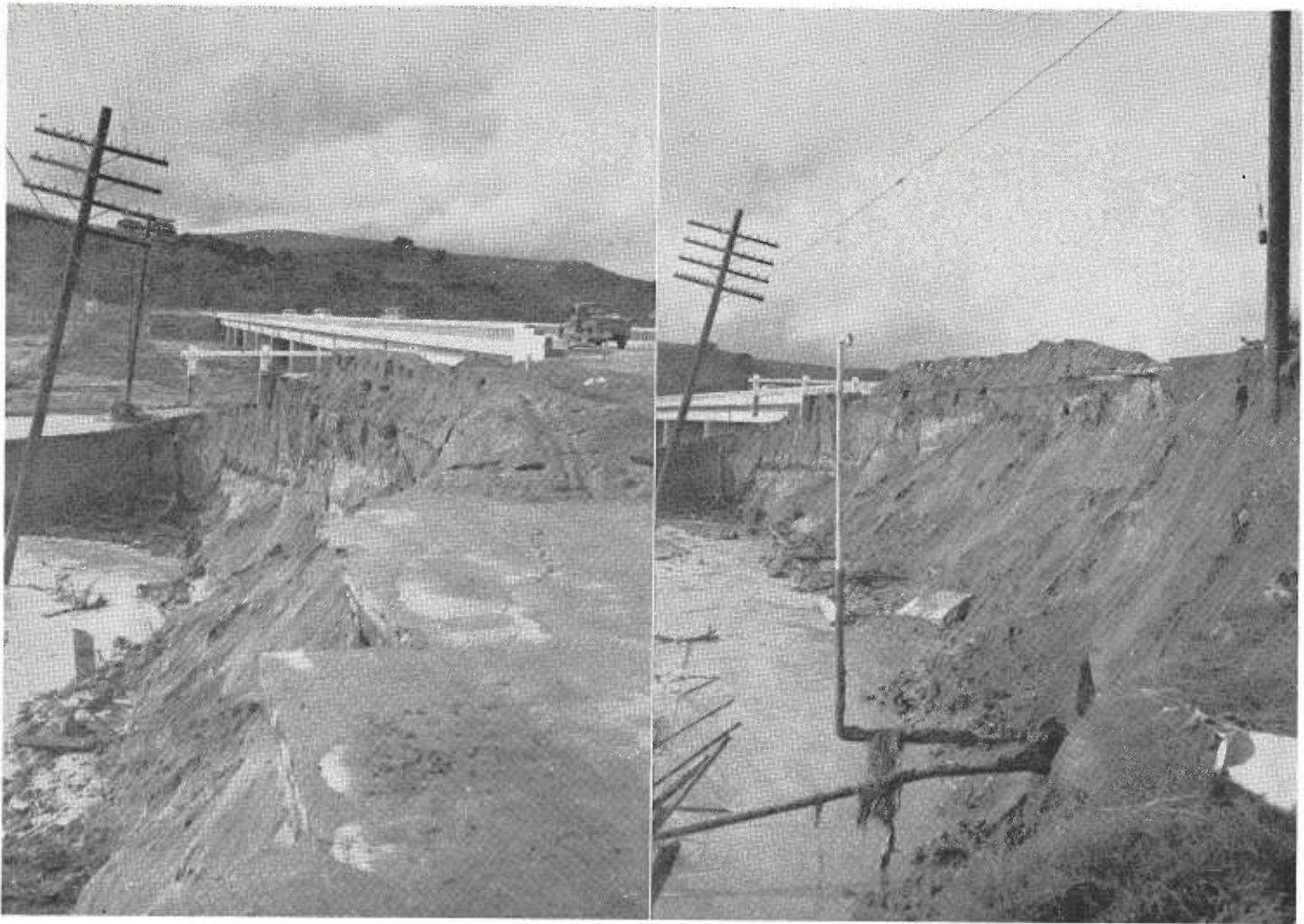
Assistant District Maintenance Engineer

The storm that struck Northern California during the Christmas holidays was first seriously felt in District VI on December 23d. During that day and through the ensuing week several sections of state highway were flooded by high water, numerous washouts occurred, and several bridges were damaged, some seriously. The total amount of damage to state highways in the

district is estimated at approximately \$1,400,000.

Perhaps the most serious loss occurred in the Kings River Canyon on Sign Route 180. In the vicinity of Boulder Creek, where the highway and the Kings River jointly occupy a steep, narrow canyon, approximately 4,000 feet of road was completely washed out. Because this particular stretch is impassable, an on-the-spot inspection of the flood damage has not been made. However, aerial observation and reports by employees of the





LEFT—Damage to roadway fill at east end of San Benito River Bridge, 0.9 mile west of Hollister, Route 22.
 RIGHT—Damage at same section.

View of downstream side of San Carpojo Creek Bridge 22 miles north of Cambria on Sign Route 1, San Luis Obispo County



national park indicate that there may be approximately seven or eight other washouts of a serious nature.

Three Rivers Damage

The next most seriously damaged sections are on Sign Route 198 in the vicinity of Three Rivers. Immediately east of the bridge across the south fork of the Kaweah River approximately 1,600 feet of road was lost and the Kaweah River, straightening its course, overtopped the highway and occupied an area approximately 1,000 feet south of the previous location of the route. Other washouts occurred in Pumpkin Hollow, approximately six miles east of Three Rivers, and at the gateway to Sequoia National Park, the easterly approach to the bridge across the Kaweah was destroyed.

Fortunately, the damage on Sign Route 180 occurred beyond the point

where that highway had previously been closed by snow through Kings Canyon National Park and no one has been inconvenienced to date by the loss of that section of the state highway. On Sign Route 180 it was necessary to restore service as soon as possible to the community of Three Rivers, to other residents along the highway easterly and for the employees of Sequoia National Park, whose headquarters are at Ash Mountain. This was done by using as a detour the former state highway around the large washout at the South Fork of the Kaweah and by immediate emergency repairs to other sections. Use of the former state highway as a detour required shoring up and re-decking a county bridge, which had partially failed.

Visalia Interchange Flooded

US 99, the principal artery of traffic through the district, was not seriously damaged although it was necessary to detour traffic from portions of it over various other routes for the better part of the week December 25th to 31st, inclusive. Portions of the interchange of US 99 and Sign Route 198 near the Visalia Airport were flooded when Mill Creek broke across the nearby airport and entered depressed areas of the interchange. With the failure of the pumps, it was necessary to dewater the underpass with whatever pumping equipment could be obtained.

Heavy flooding occurred in the vicinity of Chowchilla due to high water in Ash and Berenda Sloughs. Although no serious damage occurred to the highway itself, the flooded condition necessitated a long, tedious job of pumping the water into the Chowchilla River. This work required about one week's steady pumping, during which time it was necessary to detour US 99 traffic to other state highways to the west.

Visalia Hard Hit

Although damage to state highways in the community was negligible, the City of Visalia was hard hit when a diversion weir at McKays Point at the junction of the St. Johns and



UPPER—View of upstream side of El Capitan Creek showing debris at inlet end of structure. El Capitan Creek is located 16.5 miles north of Santa Barbara on US 101. LOWER—View of upstream side of San Carpojo Creek Bridge 22 miles north of Cambria on Sign Route 1, San Luis Obispo County.

Kaweah Rivers near Lemon Cove, carried way, permitting discharge of both streams through the bed of the Kaweah and flooding Visalia. This water eventually found an outlet to the southwest through Mill Creek, Packwood Creek and Cameron Creek. As previously stated, it was excess water in Mill Creek which flooded the Visalia Airport Interchange. High water in Packwood and Cameron

Creeks resulted in minor damage to state highways.

Loss of the diversion weir and resultant heavy flow in the Kaweah River, which carried tremendous amounts of debris, resulted in the deposition of approximately 2½ feet of silt and debris on State Sign Route 65 for about one-half mile each side of the Keweah River bridge. One of the concrete piles under the bridge



Flood damage vicinity El Portal—Excavating for footings for detour bridge to be constructed right of Station 198. Note rock foundation.



Flood damage vicinity El Portal—Inlet end of culvert plugged by tree Station 198.



Flood damage vicinity El Portal. Looking easterly over damaged 8' x 8' concrete box Station 198. Also shows temporary walkway constructed over tree blocking culvert.

was broken and knocked out of line. This, together with loss of the approaches, required closure of this section.

On State Route 131, one of the piers of the bridge across the Kaweah was undermined. The pier dropped approximately eight inches and this portion of the bridge was displaced downstream about two inches. Repairs to the pier are now under way and it is anticipated that the bridge will be restored to service in the near future.

District X—\$1,275,000

Flood damage to streets and highways in District X during the recent disaster was gratifyingly small, considering the large volume of precipitation and runoff. The estimated total damage to state highways was \$1,000,000 for restoration. In addition, it was estimated that the sum of \$275,000 would be required to restore county roads and city streets to pre-flood condition.

The greatest damage to state highways occurred on Route 18 in Mariposa County, the "All-Year" Highway to Yosemite, when the Merced River and its tributaries, Pigeon Creek and Crane Creek, overflowed their banks, destroying the entire roadbed in several locations. The total estimated damage for restoration of this route is \$550,000.

In Alpine County, the high water in the East and West Forks of the Carson River occasioned damage to Routes 23 and 24 in several locations, amounting to an estimated \$260,000 for restoration.

Of the nine counties comprising District X, Stanislaus County apparently suffered the greatest damage to roads and bridges in the amount of \$175,000 estimated for restoration. Damage to bridges constituted the greater portion of this loss.

C. M. (Max) Gilliss Permanent Deputy

Assistant Deputy Director of Public Works C. M. (Max) Gilliss has been given a permanent appointment as deputy director by Director of Public Works Frank B. Durkee. He has been acting as deputy director since last September. He passed a civil service examination for his new job.

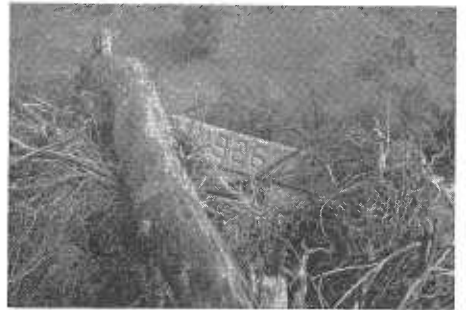
Gilliss assumed the duties of special representative of the Department of Public Works on December 1, 1952. In August, 1953, he was named assistant deputy director.



Flood damage vicinity El Portal—Excavating for footings for detour bridge upstream on Pigeon Creek.



Flood damage vicinity El Portal—Looking westerly from box culvert, showing pathway to temporary pedestrian bridge. Express parked on detour approach to Pigeon Creek temporary bridge.



Flood damage vicinity El Portal—Looking easterly over concrete box at Pigeon Creek.

FIND MAGAZINE USEFUL

MONTEREY

DEAR MR. ADAMS: For the past several years I have looked forward to the receipt of the next issue of your exceptional publication. I have found it a most informative and invaluable tool in my work. The research and technical articles have interested me the most although the others have been done equally well.

Thank you for another year of good reading.

Yours truly,

GEORGE L. WALTER
Leadingman Public Works
Naval Auxiliary Air Station

FLOODS DO PROPERTY DAMAGE ESTIMATED AT \$200,000,000

By R. R. REYNOLDS, Senior Hydraulic Engineer, and C. G. WOLFE,
Associate Hydraulic Engineer, Division of Water Resources

December, 1955, will be remembered in California as a record-breaking month whenever rainfall or floods are discussed. Heavy warm rains originating far out in the Pacific swept across Northern California during the five days just preceding Christmas. Another storm of major intensity occurred on December 26th and 27th. Together, these two storms produced sufficient rainfall to make the month one of the wettest, if not the wettest, Decembers since 1867. Heaviest rains were concentrated along the north coast, in the hills north of Santa Cruz, in the area south of Clear Lake, in the mountains above Shasta Dam, and in the Sierra Nevada watersheds of the Yuba and Bear Rivers. Over 30 inches of rain in less than 10 days were recorded at stations in these areas.

Frequent light rains followed, and during January 13th, 14th and 15th, 1956, another major storm brought new danger and renewed anxiety to the flood areas. Fortunately, no widespread flooding resulted from this storm. However, the prolonged wet period left tremendous amounts of water in the river channels, basins, and by-passes of Northern and Central California. The rate of drainage of this water from the Sacramento Valley will be very slow and cannot be accelerated, since it is controlled by the natural slope of the valley.

Tragic Results of Storms

Result of this intensive rain was spectacular and tragic. Peak flows on at least 18 major streams in the State exceeded previous flows. During December the Klamath River reached a peak of 400,000 cubic feet per second, which was about one-third greater than the previous recorded maximum flood on that stream. Likewise, the Russian River more than doubled its previous peak flow with a discharge of 47,000 cubic feet per second. Major floods in California were recorded on



TOP—Folsom Dam and Reservoir on December 24, 1955 (Corps of Engineers Photo).

BOTTOM—Town of Klamath with Klamath River at flood stage.



coastal streams from Nacimientto River on the south to the Klamath River on the north, and in Sierra streams from Kern River to the Sacramento River.

Damage Runs Into Many Millions

In the Sacramento Valley, Shasta and Folsom Dams effectively controlled the high flows of the upper Sacramento and American Rivers, while uncontrolled flows originating in the Feather River Basin caused damages in the order of \$65,000,000 within the flood plain of the Feather River between Yuba City and Verona. Friant Dam on the San Joaquin River and Pine Flat Dam on the Kings River effectively controlled the flows from the upper watersheds of these streams.

Streams causing severe flood damage were the Klamath, Eel, Van Duzen, Russian, Mad, Napa, San Lorenzo, Nacimientto, Tule, Kaweah, lower San Joaquin, Tuolumne, Stanislaus, Calaveras, Mokelumne, Cosumnes, Bear, Yuba, and Feather Rivers, and Petaluma, San Lorenzo, and Alameda Creeks.

Damage from these floods was staggering. Roads and bridges were washed out, homes flooded, valuable farm lands inundated, livestock drowned, and communications disrupted. At least 62 persons lost their lives. Total damage from the flood has not been fully determined, but present estimates indicate it may be as high as \$200,000,000.

Yuba City Bears Brunt

Hardest hit were Yuba City together with 100,000 acres of Sutter County's Peach Bowl, which were flooded as a result of a disastrous break in the levee on the west bank of the Feather River in the early morning hours of December 24th.

Early in the emergency, State Engineer Harvey O. Banks put the entire staff of the Division of Water Resources into the battle with the high waters.

The office of the flood control function of the division was fully staffed on a 24-hour basis, beginning at midnight December 21st. Hydrologic data and information regarding the high flows occurring on streams through-



TOP—Break in Feather River levee at Nicolaus. BOTTOM—Break in Feather River levee south of Yuba City, Sutter County.

out Northern and Central California were collected by means of the division's radio stream gage network, con-

stant telephone contact with various federal agencies and division personnel in the field, and communications with



Aerial view of City of Marysville at critical stage of flood on December 23, 1955 (Sacramento Bee photo)

numerous independent agencies and private individuals. These data were compiled by the staff to document the flood for future design studies, and, in addition, were made available to the general public and interested agencies. By use of these data, it was possible during to flood period to forecast and give warnings on peak stages some 48 hours in advance of their occurrence.

Water Resources Division Efficient

The Division of Water Resources dispatched equipment, supplies, and manpower, and supervised flood-fighting activities along the levee below Nicolaus, where a major break eventually occurred on December 23d. Subsequent flood-fighting activi-

ties by the division along the Natomas Cross Canal successfully averted the inundation of many thousand acres of rich agricultural lands, residences, and public utilities in Reclamation District 1000 just north of Sacramento. In addition, division personnel constantly patrolled over 200 miles of levee, made necessary repairs to weakened levee sections, and kept the Sacramento office informed of flood problems in the critical areas. Technical supervision by division personnel was furnished to many public districts during the flood period.

The levee on the left bank of the Feather River near Verona was breached December 24th by division forces to relieve the water pressure caused by the Nicolaus break. The

right bank levee of the Feather River opposite Nicolaus was breached Christmas day to drain the water from the area inundated by the break below Yuba City. Gates of the Sacramento Weir were opened to maintain the level of the Sacramento River below critical flood stage.

In addition, the division during the flood emergency secured and operated numerous pieces of heavy equipment, and dispatched to the critical areas many truckloads of burlap bags, canvas, tools, and other supplies necessary for the flood fighting. During the emergency period, about 900 men were employed in flood fighting.

During the flood emergency, valuable assistance, material, and equip-



Crews work to save north levee of Natomas Cross Canal. (US Air Force photo)

ment was furnished to the Division of Water Resources by the Division of Forestry, the California Highway

Patrol, the Office of Civil Defense, the Department of Employment, Mather and McClellan Air Force

Bases, the Sacramento Signal Depot, and the Arden-Carmichael School District.

COUNTIES GET INCREASED NATIONAL FOREST RECEIPTS

A check for \$2,994,976.12 has been sent to the State Treasurer as California's share in the cash revenues from the national forests, according to a statement by Chas. A. Connaughton, Regional Forester of the United States Forest Service.

This payment represents 25 percent of the gross receipts from the sales of timber, grazing fees, and other land uses of the national forests in California, for the year ended June 30th.

As provided by law, the State apportions the money received to the counties having national forest land within their boundaries. Thirty-nine of the State's 58 counties will thus receive funds for local school and road expenditures. The amount received by each county is proportional to the national forest acreage in the county.

Mr. Connaughton says that this year's receipts to the counties represent an 18 percent increase over last year.

FOR GOOD HIGHWAYS

LANCASTER

GENTLEMEN: For the past year I have been receiving your magazine. I have enjoyed every bit of it and I appreciate very much all of the good work you are doing.

I look forward each month to receiving the magazine. I have been a resident of California for over 40 years, and have owned a car since 1916, and I can see a wonderful change and improvements that have been made. I am 100 percent for good highways.

Yours truly,

Z. R. OXFORD
1655 E. Lancaster Blvd.

JACKSONVILLE

The town of Jacksonville, California, is named after Colonel Alden Jackson who settled there in the autumn of 1849.

THANK YOU

SANTA MONICA

DEAR MR. ADAMS AND HELEN HALSTED: I have received this magazine for some seven years. I have kept past copies for reference to past events in the highway system. I look forward for each new issue to arrive. The layout and photography are well done. Mr. Nickerson is to be congratulated along with you two.

Yours truly,

RICHARD BERK
1134 23d Street

FROM LOS ANGELES

LOS ANGELES

DEAR MR. ADAMS: I have been receiving and enjoying your interesting and educational journal for several years and wish right now to express my appreciation for the privilege of continuing to receive it.

Yours respectfully,

A. J. BORDEN
1616½ W. 12th Street

Carquinez Project

Revenue Bonds Sold and Major Contracts Awarded

By LEONARD C. HOLLISTER, Projects Engineer—Carquinez

ON JUNE 15, 1955, Governor Goodwin J. Knight signed Senate Bill 1450 authorizing the Department of Public Works to "lay out, acquire and construct" two new bridges across Carquinez Strait. One bridge was to be located adjacent to the existing Carquinez Bridge and the other to be located about six miles upstream, between Benicia and Martinez. The bill also authorized the California Toll Bridge Authority to issue revenue bonds and to reimpose tolls upon the existing Carquinez Bridge for the purpose of financing the construction of the two new bridges and their approaches.

Senate Bill 1450 was passed by the 1955 Session of the California State Legislature under the sponsorship of Senators Luther E. Gibson and George Miller, Jr., and Assemblymen Donald D. Doyle, Samuel R. Geddes and S. C. Masterson.

On June 16, 1955, Frank B. Durkee, Director of Public Works, assigned the work contemplated under this legislation to George T. McCoy, State

Highway Engineer. Exactly four months later four major contracts were advertised for bids involving a large portion of the construction work in connection with the new parallel Carquinez Bridge and its Contra Costa County approach.

Revenue Bonds Sold

On December 13, 1955, the California Toll Bridge Authority sold \$46,000,000 worth of Series A Bonds in accordance with the Resolution dated October 4, 1955, authorizing Carquinez Strait Bridges Toll Bridge Revenue Bonds. The interest rate called for is 3 3/4 percent payable semi-annually. Later, as plans progress, an additional issue of Series B Bonds can be sold for financing work on the Benicia-Martinez Bridge and the remaining freeway work through Vallejo.

Because these first four contracts were large and involved types of construction work not frequently encountered in the usual highway contracts, prospective bidders were given

a full six weeks' time to study the projects and make up their bids.

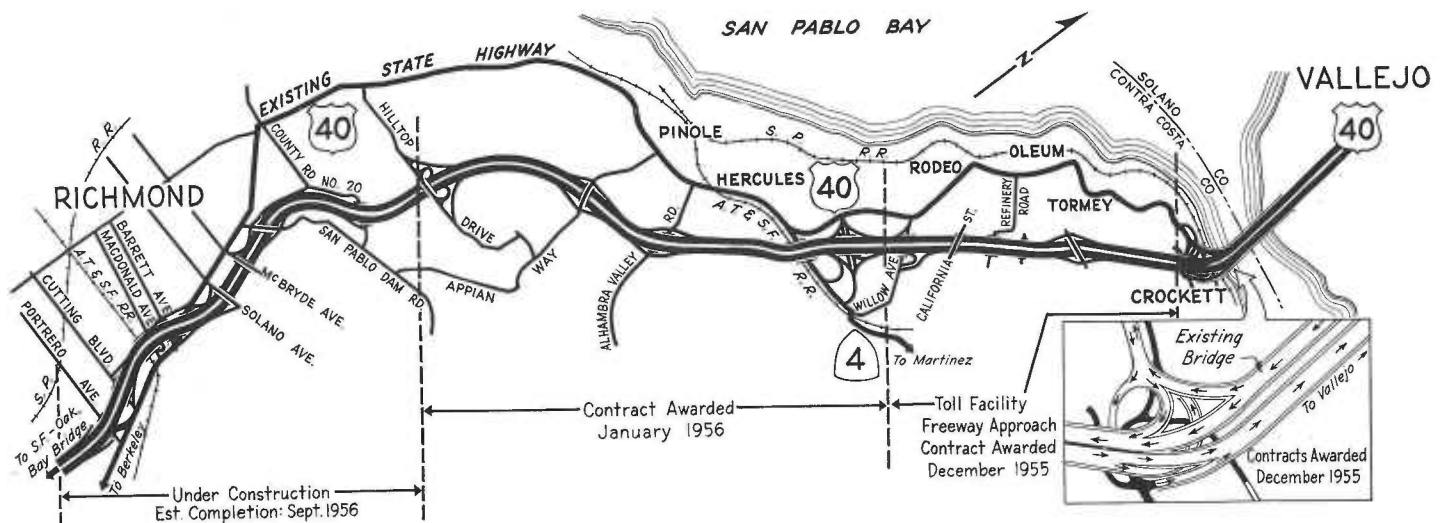
The first four contracts to be advertised and awarded include the following work: (1) Two and nine-tenths miles of freeway work in Contra Costa County extending from just north of the city limits of Hercules to the beginning of the bridge approach at Crockett; (2) The deep pier foundation work for the main bridge across Carquinez Strait; (3) The superstructure work, including the fabrication and erection of large steel double cantilever truss spans of the main bridge; and (4) The construction of the south approach and connecting interchange ramp spans through Crockett.

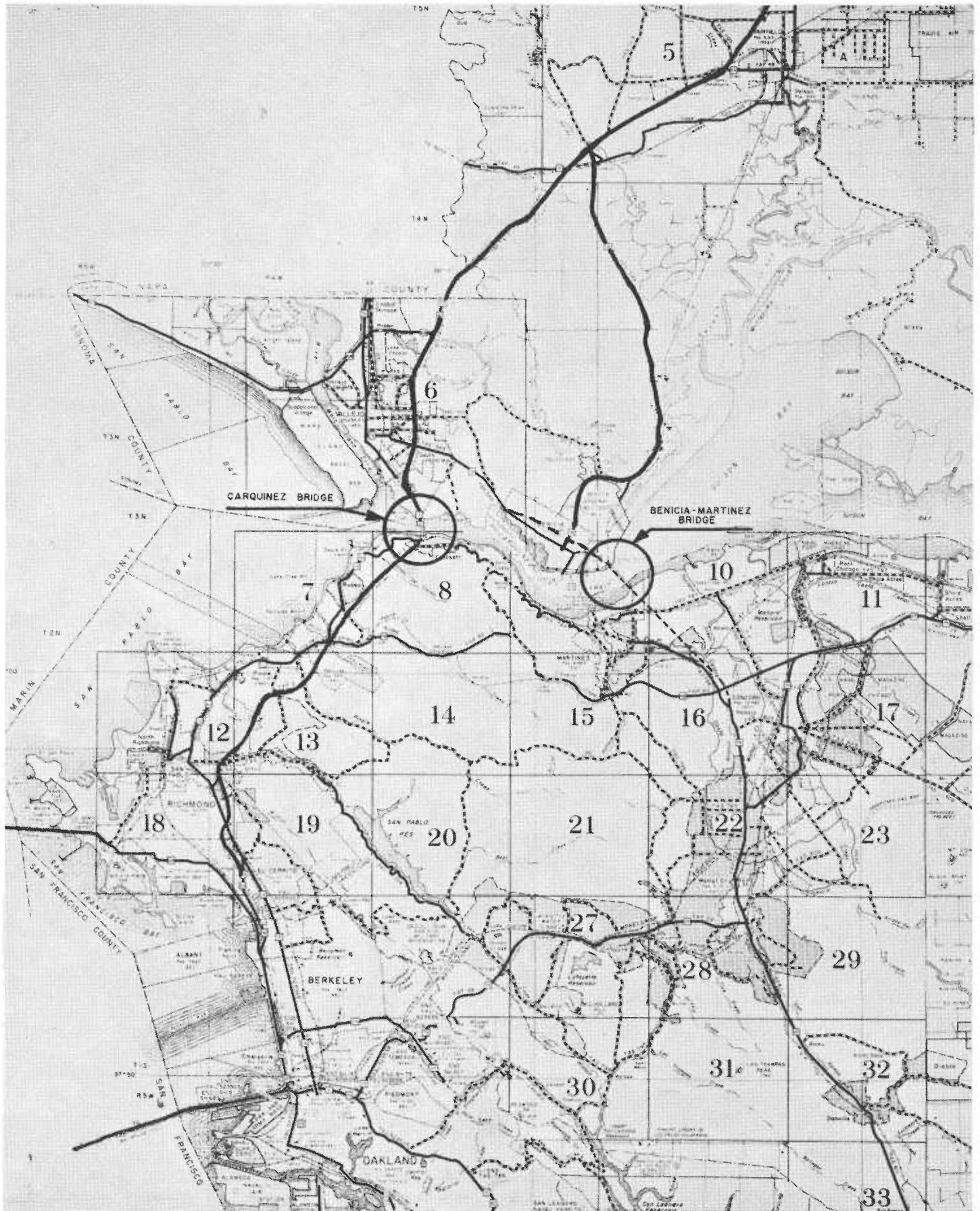
Contra Costa County Freeway Approach

The freeway project from Hercules to Crockett is exceptional not only because of the amount of money in-

Map showing the relation of the Carquinez Bridge and the Benicia-Martinez Bridge to the general San Francisco Bay area. →

This map shows how approximately 12 1/2 miles of US 40 between Richmond and the Carquinez Bridge will be relocated and constructed to full freeway standards by mid-1958 when the parallel Carquinez Bridge is expected to be completed. This section of US 40 now runs on congested San Pablo Avenue and takes a tortuous route through several communities of northern Contra Costa County. One contract is now under way and five others have been awarded. Now under construction and scheduled for completion in September, 1956, is a six-lane divided freeway between slightly south of Potrero Avenue in Richmond and south of Hilltop Drive, east of San Pablo, at a contract cost of \$5,107,922.





volved but because it includes the largest cut ever undertaken by the Division of Highways. The project includes 11,200,000 cubic yards of excavation and involves 455,000,000 station yards of overhaul.

Eight and one-half million cubic yards of this total excavation are to be taken from the big hill at the top of Crockett which has often been referred to as the "Big Cut." The depth at the largest section of this cut varies from 245 feet at the centerline of roadway to 350 feet at the high point to the side. The width at the top is 1,370 feet (about four average city blocks), and the total length is 3,000 feet.

Huge Excavation Job

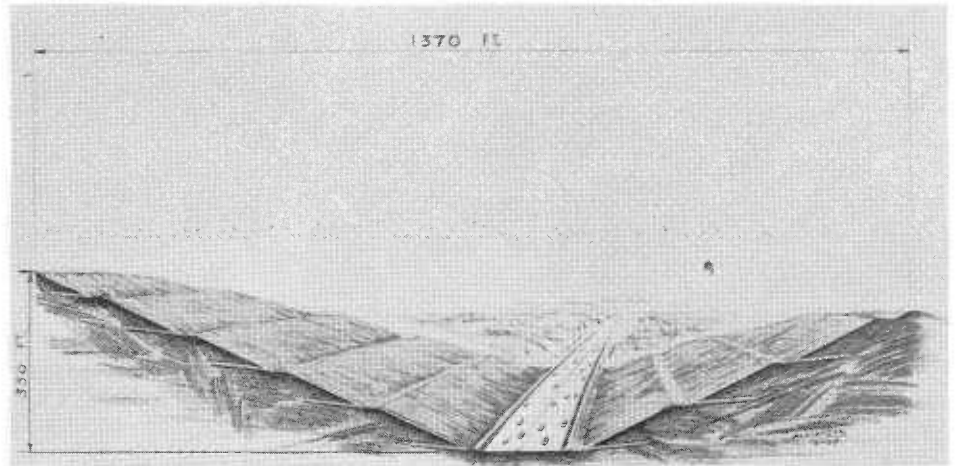
To complete this 11,200,000 cubic yards of excavation on schedule the contractor must plan to excavate, haul and place about 30,000 cubic yards of excavation each working day. This is at a faster rate than called for in any of the contracts so far let by the Division of Highways.

It will be interesting to watch the contractor move in with his many pieces of heavy earth-moving equipment. The clockwork efficiency of his organization and equipment will pay big dividends for as can be seen a reduction in cost of as little as one cent a cubic yard will net a total saving to him of \$112,000. The contractor's bid price for this roadway excavation was 25.6 cents per cubic yard.

Because of the size of this cut, preliminary studies included consideration of a tunnel. Geological conditions and economy of construction however, indicated considerable advantage to the open cut.

The "Big Cut"

To maintain structural stability the "Big Cut" will have two-to-one side slopes and horizontal benches 30 feet wide placed each 60 feet of depth. In addition, immediately following the excavation from top down to the first 30-foot wide bench, horizontal drains will be placed to drain underground water away and keep the sides of the cut dry, reducing the possibility of slides to a minimum. The drains will extend back into the sides of the cut for a distance of approximately 150



Architectural sketch of the "Big Cut" which helps to give one the feeling of immensity that will be gained on driving through

feet. This process of benching and draining will continue as excavation progresses from the top of cut on down to the final grade of the roadway. It is estimated that 20,000 lineal feet of these drains will be required.

Ten bids were received on this free-way job and Ferry Bros., John M. Ferry, Peter L. Ferry, L. A. and R. S. Crow, a joint venture of Glendale, California, contractors were the low bidders at \$7,098,690.20.

Substructure Contract

The construction of the foundations for the main bridge across Carquinez Strait just 200 feet upstream from the existing bridge will require special skills and equipment for the deep water piers not often encountered in the usual highway contract.

The most spectacular operation in the construction of these foundations will be the sinking of large concrete caissons to bed rock approximately 135 feet below the surface of the water.

The lower portion of these piers, which measure 53 feet wide by 102 feet 6 inches long (about the size of a good city lot), will be precast at some location not far from the site of the bridge, launched into the waters of the bay and floated to the bridge site. At the bottom of these precast caissons will be a heavy fabricated steel cutting edge made from thick steel plates.

Positioning of Caissons

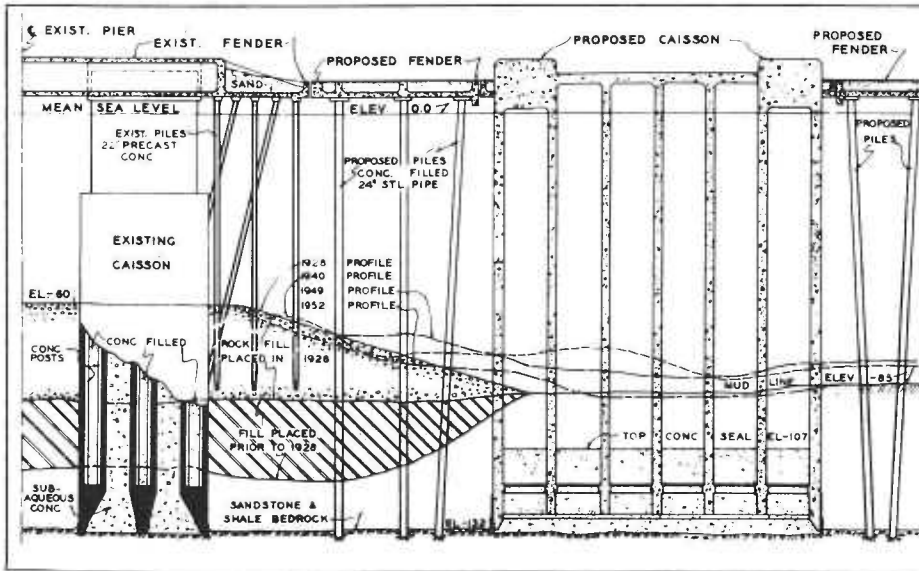
After being carefully positioned by heavy anchorages and guide towers,

additional sections will be added and the caissons will be lowered through the water and overburden to bedrock. The caissons will be lowered through the mud, sand and gravel by excavating material out from the bottom through 18 precast wells built into the caissons. In addition to excavation through these wells, provision will be made so that powerful streams of water can jet up from the sides of the cutting edges at the bottom if found necessary. These jets can cut away material from the sides and will reduce friction as the huge mass of concrete is gradually lowered to its final position on bedrock at the bottom.

During this sinking operation, which will take several months, great care must be exercised to keep the caisson from tipping or lowering too fast on one side or one corner. If it should get out of vertical then it must be righted by a carefully planned sequence of excavation and jetting.

Over half of the work in the foundation contract lies in these three caisson piers which will cost a little more than \$1,000,000 each. Other work will include the construction of two shore piers and one water pier 50 feet wide by 113 feet long founded on 260 steel bearing piles driven to bedrock.

As can be seen in the picture of the bridge, the center tower will have an extensive pier protection or fender system which will be founded on large steel pipe piles 24 inches in diam-



This sketch shows a section of the foundation work at the center tower of the bridge. To the right the section of the large concrete caisson is shown at its final resting place on bedrock at the bottom. To the left can be seen a half section of the existing caisson. The new and the old will be connected with one big fender protection system supported on the 24-inch-in-diameter 150-foot-long concrete-filled steel cylinder piles.

eter and 150 feet long, driven to bedrock and then filled with concrete. On top of these pipe piles will be placed large reinforced concrete girders and slabs surrounding the center tower and offering protection against navigation.

Five bids were received on the work involved in this contract. Mason and Hanger, Silas Mason Co., Inc. and F. S. Rolandi, Jr., Inc., a joint venture, were the low bidders at \$5,454,694.16.

Superstructure Contract

The fabrication and erection of the superstructure of the main bridge across Carquinez Strait will also require special skills and equipment not usually encountered in normal highway construction.

There will be approximately 14,000 tons of steel to be erected 146 feet above the waters of Carquinez Strait. Because of the height, the depth and current of the water, and navigation requirements, most of this steel will be erected by cantilevering out from the piers to avoid the use of falsework. Each of the main spans of the double cantilever construction will be 1,100 feet long, with two side spans each 500 feet long and a central tower 150 feet in width.

The design of the new parallel bridge will be similar in span length

and shape to the existing bridge but otherwise the two designs will be quite different because the new design will have a wider roadway and will incorporate several recent developments in modern bridge design.

Four Lanes of Traffic

The new structure will provide for four lanes of traffic on a 52-foot clear roadway supported by two trusses 60 feet apart. This will call for much heavier construction than the existing structure, which is 42 feet center to center of trusses and provides for only three lanes of traffic.

The new design features which make use of recent developments in bridge construction are: (1) the use of high strength bolts instead of rivets for field connections at the truss joints; (2) fabrication of the heavy truss members and floor beams by use of welding rather than riveting; and, (3) the use of a new high strength weldable steel nearly three times as strong as the ordinary structural steel used in bridge construction.

Bolted field connections were chosen in preference to rivets because the designers believe that field bolts will do their work with more assurance than the field driven rivets. In addition they feel that there is a good possibility that field bolts will show

economy over field rivets on truss connections of this magnitude. These bolts are $\frac{7}{8}$ inch, 1 inch and $1\frac{1}{4}$ inch in diameter. The smaller bolts are used for secondary bracing member connections, the 1-inch bolts are used in the main truss joints, and the large size bolts are used for the exceptionally heavy center tower joints. One average truss joint will require approximately 600 of these 1-inch bolts. The whole job will require 570,000 pounds of bolts or six freight car loads.

Welded Fabrication of Trusses

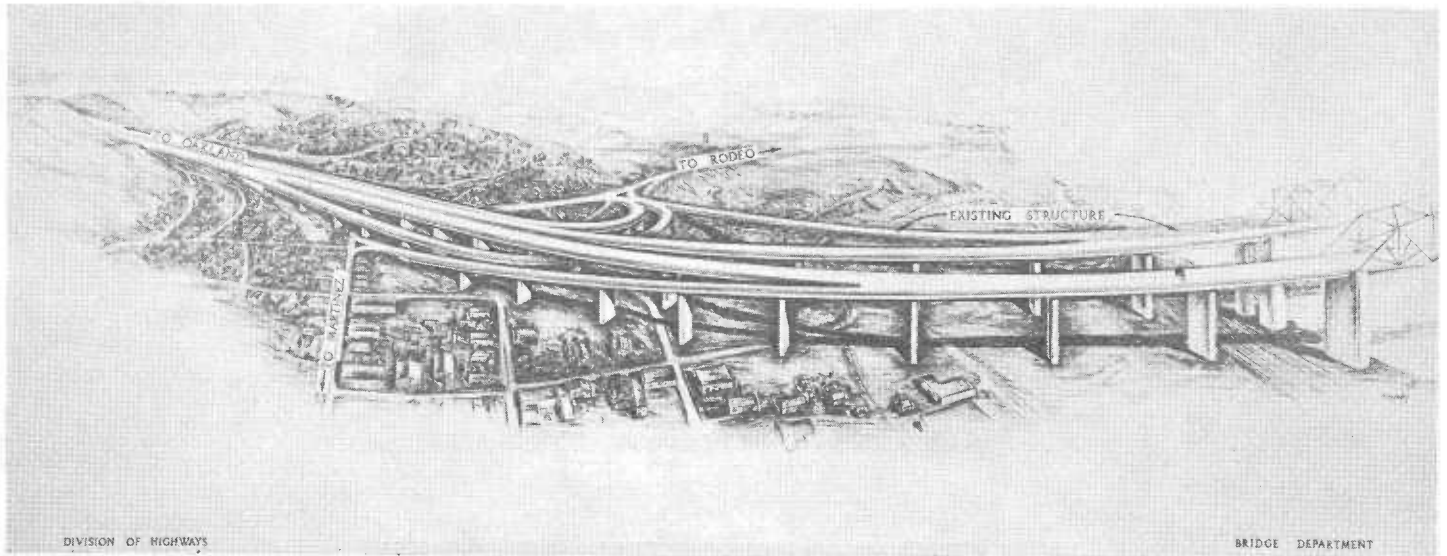
Welded fabrication of truss members is relatively new, and the great advances that welding has made in the past few years indicate that considerable economy can be realized by fabricating the heavy truss members by this method. It reduces the number of parts to be fastened together and simplifies and speeds up both design room time and shop work. As an example there are 29,440,000 pounds of steel to be fabricated and the low bid for this steel was \$8,091,776 which is an average of 27.49 cents per pound. If through simplified shop-work the fabricating costs can be reduced by as much as one-half cent per pound, it will result in a saving of \$147,000 for the superstructure contract.

Three types of steel were used in the design of these trusses, they were: (1) structural steel known as A7, (2) a somewhat higher strength low alloy steel known as A242, and (3) a recently developed extra high strength steel with good weldable qualities known as T1.

High Strength Steel

The use of this new extra high strength steel T1 capable of resisting 90,000 pounds per square inch when placed under tension, indicated a saving of approximately \$800,000 according to design computations. This large saving in cost was made in spite of the fact that the base price for the new steel was approximately 5.7 cents per pound more than regular structural steel.

This extra high strength steel was used in only the very heavily stressed members of the trusses. Because the heavily stressed members require such large sections of steel they become



Architectural sketch of the Crockett Interchange structure showing the approaches to the new and old bridge and the on and off ramps for use of traffic originating in the Crockett area

very stiff and when bent to conform to the large deflection of the 1,100 foot truss span, high internal bending stresses are set up. The vertical deflection of the trusses due to the dead weight of these long spans will be as much as 27 inches. The smaller these individual members are the less resistance they offer to the trusses conforming to this 27-inch deflection and therefore the smaller will be their stress due to bending. As an example the weight of one of these heavily stressed members would be 748 pounds per foot when designed of low alloy steel and only 400 pounds per foot when designed of this extra high strength steel. The high strength steels therefore made it possible to reduce the size of these heavily stressed members an appreciable amount and resulted in a considerable savings in the final cost.

Four bids were received on this project, which is the largest contract let to date by the Division of Highways. The low bidder was the United States Steel Corporation who submitted a bid of \$9,489,126. This is the same firm that fabricated and erected the steel superstructure for the existing Carquinez Bridge and the San Francisco-Oakland Bay Bridge.

Crockett Interchange Structure

The south end of the main bridge structure will connect to a series of

approach girder spans and ramp connections known as the Crockett Interchange Structure.

Traffic headed south from Sacramento and wishing to turn off at Crockett will use the existing bridge and the existing approach spans as an off ramp.

Traffic heading north from San Francisco and wishing to turn off at Crockett will be provided with a ramp taking off from the end of the "Big Cut" and swinging down under the approach spans and entering Crockett near the present intersection of Pomona Street and the existing highway. Crockett traffic headed for San Francisco will take off at this same intersection by use of a southbound on ramp. Crockett traffic headed toward Sacramento will take off from Pomona Street near Seventh Avenue and turn

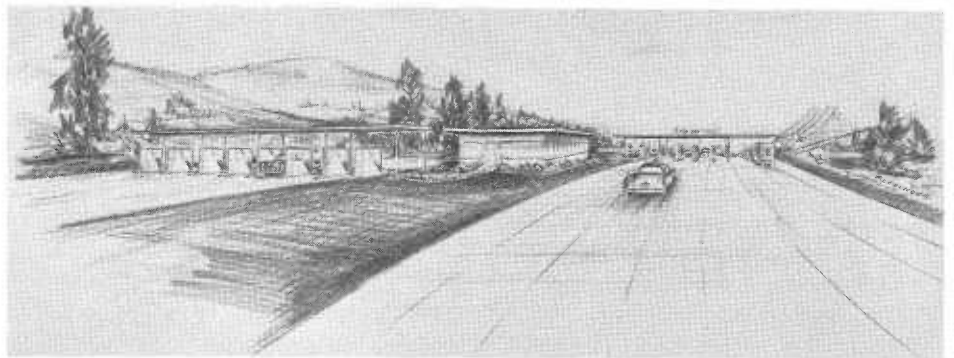
north by use of an on ramp. All of these connections will provide this area an easy access to the freeway and when completed will, figuratively speaking, place Crockett and vicinity at the front door to the San Francisco Bay area.

48 Girder Spans

The plans for this interchange structure call for the construction of approximately 48 girder spans ranging in length from 120 feet to 180 feet. These girder spans will require the fabrication of 4,250 tons of structural steel and the placing of 25,000 cubic yards of concrete.

In addition to this structural work there will be considerable grading and paving for the relocation of city streets. Approximately 300,000 square feet of new pavement will be placed in Crockett.

Architectural sketch showing how the Toll Plaza will appear on the Vallejo end approaching the bridge



Unfortunately the construction work in this area will make it necessary for more than 70 families living in the Crockett vicinity to find new dwellings. As is often the case with improvements that benefit all of the people, a few are sometimes temporarily inconvenienced.

Because of the sudden nature and rapid development of this Carquinez Bridge project since the last session of the State Legislature, families whose property is required for the construction of the interchange and the relocation of the city streets, have not had sufficient time to adequately provide for new homes. In order to relieve this situation, the State has provided that families may remain in their dwellings if necessary until July 1, 1956. In any event the relocation of this many families in a very small community like Crockett does involve hardships. The people of Crockett have faced this situation courageously and in a spirit of cooperation. We are sure that all who will benefit from this project appreciate this spirit of cooperation.

Eleven bids were received on the work involved in the construction of this interchange structure and local road improvements. Peter Kiewit Sons Company was the low bidder at \$4,661,462.

Future Contracts

In addition to these four contracts to be financed by Series A bonds there remains to be let a contract for the work from the north end of the bridge to a point about 0.2 miles north of the existing Vallejo Wye. This contract will include the construction of the Toll Plaza and Administration Building, and the widening of the Vallejo Wye. In order to adequately handle traffic with a minimum of delay it is planned to have 16 on-side toll booths for the initial construction with provision for four additional booths as traffic increases. This work is scheduled for advertisement in May of 1956.

A small mechanical and electrical contract is also to be advertised early in the spring of 1956. This work will provide for electrical power for beacon and navigation lights, and supply compressed air for maintenance operations of the two bridges.



Contractors and resident engineers gathered at the site of parallel Carquinez Bridge to discuss start of project.

TOP ROW, LEFT TO RIGHT: Russell G. Cone, Vice President, Mason and Hanger, and Project Manager for the substructure contract of the Main Bridge with Mason and Hanger, Silas Mason Co., Inc., and F. S. Rolandi, Jr., Inc.; E. E. McKeen, Erecting Manager for the steel work on the superstructure of the Main Bridge with United States Steel Corporation; F. S. Rolandi, Jr., Contractor on the substructure contract with Mason and Hanger, Silas Mason Co., Inc., and F. S. Rolandi, Jr., Inc., joint venture; Homer Olsen, Job Superintendent on the Crockett Interchange structure with Peter Kiewit Sons' Co.; L. G. "Bud" Waigand, Job Sponsor on the Crockett Interchange Structure with Peter Kiewit Sons' Co.; R. C. "Dick" Philbert, Superintendent of earth moving operations on the "big cut" job with Ferry Bros., John M. Ferry, Peter L. Ferry and Sons, and L. A. and R. S. Crow; Robert Hoyt, Superintendent of excavation on the Crockett Interchange structure with Peter Kiewit Sons' Co.; J. L. "Jim" Ferry, Contractor on the freeway contract including the "big cut" with Ferry Bros., John M. Ferry, Peter L. Ferry and Sons and L. A. and R. S. Crow, a joint venture; P. R. "Pat" Ferry, Contractor on the freeway contract including the "big cut"; Albert Lindquist, Superintendent bridge construction on the freeway contract.

LOWER ROW, LEFT TO RIGHT: Oscar Johnson, Senior Bridge Engineer, representative of the Division of Highways on the substructure and superstructure contracts for the Main Bridge and the Crockett Interchange contract; Wallace H. Ames, Associate Bridge Engineer, assistant resident engineer on the three-bridge structure contracts; Francis Donaldson, Vice President, Mason and Hanger Co. here from his New York office to look over the job on the foundation work for the Main Bridge; V. O. Smith, Senior Highway Engineer, representative of the Division of Highways on two large freeway contracts to the south of the bridge, one of which includes the contract for the "big cut" job; C. P. Sweet, Resident Engineer on the freeway contract including the "big cut."

Following the completion of the new bridge late in 1958 all traffic on the existing bridge will be stopped and routed temporarily over the new structure. This will be necessary in order to make the connections between the old bridge and the new approaches and ramps in Crockett. In addition the curbs on the old structure will be rebuilt and the roadway resurfaced to provide for 34 feet 4 inches between curbs, making the structure safer for the three lanes of traffic than is now provided by the 30-foot roadway width.

Completion in 1958

This work will be timed for advertisement in the summer of 1957 so that the contractor will have ample time to get his materials purchased and structural steel fabricated and be ready to start construction immediately after opening the new bridge to traffic. This will reduce to a minimum the period that traffic in both directions will be required to use the four lanes of the new bridge. Upon completion of this contract all southbound traffic will be switched back to the old bridge and

... Continued on page 66

Magazine Street Interchange on US 40 in Vallejo Area

By ROY M. CHALMERS, Project Design Engineer, District X

Independent of the Carquinez Toll Bridge Project but a future integral part of it in operation, an interchange at Magazine Street in Vallejo is now under construction as the first step toward conversion of US Highway 40 in and near Vallejo to full freeway standards.

A contract was awarded on December 5, 1955, for the construction of the interchange and an overcrossing at Magazine Street, a frontage road west of the existing highway between Sequoia and Alhambra Streets, and the realignment of the intersection at Magazine Street east of the existing highway.

The work is scheduled for completion in the summer of 1956, so that it will be of benefit to through and local traffic for two years before the scheduled operation of the over-all Carquinez Toll Bridge Project.

Traffic Volumes High

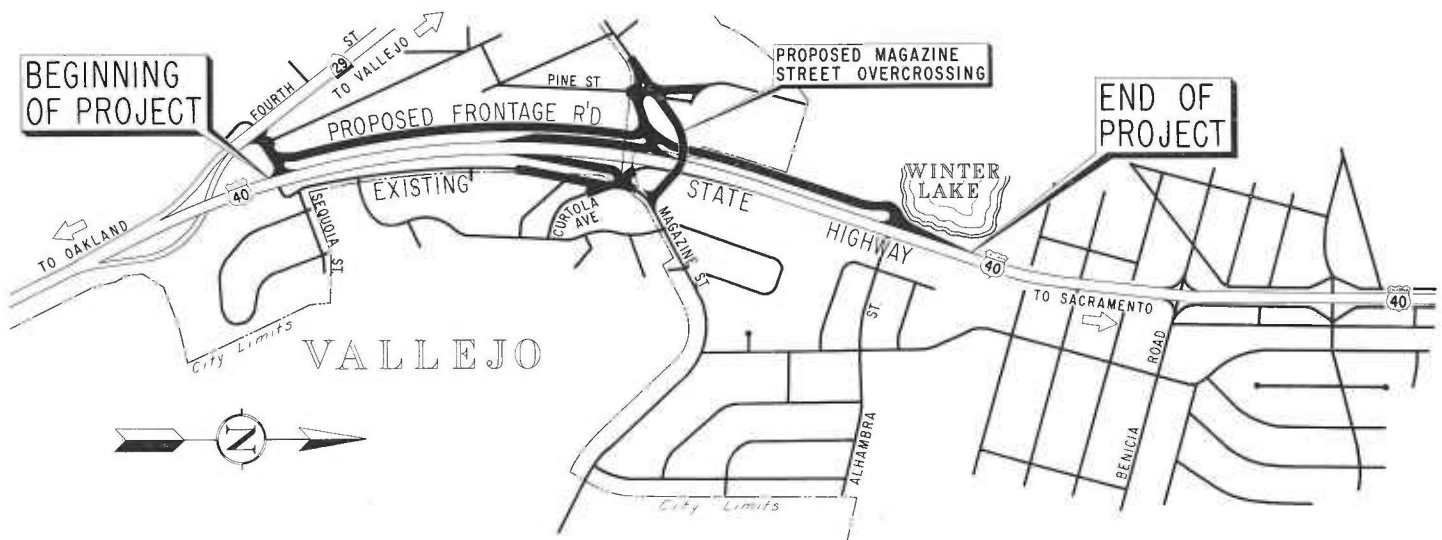
Since US 40 is the main highway between Sacramento and the San Francisco Bay area, traffic volumes are currently high and are expected to increase materially in the future. The construction of this overcrossing and interchange at Magazine Street will eliminate one of the undesirable connections at grade existing along this route. Traffic moving through this



Historic bid opening. First day of four successive days of bidding on four Carquinez Bridge projects. LEFT TO RIGHT: Morby Swanson, Richard H. Wilson, Assistant State Highway Engineer; Frank Palermo of Wilson's staff; State Highway Engineer Geo. T. McCoy.

intersection is presently delayed by traffic-actuated signals made necessary by the large volume of cross traffic. The 1954 average daily traffic count indicates that there are approximately

1,000 cars a day crossing the highway at this point and 20,000 cars a day traveling along the main highway. In addition, there are approximately 1,400 cars a day making left turns.



RETIREMENTS FROM SERVICE

Hans P. Williamson

A testimonial banquet and party at the Richmond Golf Club on the evening of December 16, 1955, attended by many friends and colleagues, honored the retirement of Hans P. Williamson, Senior Engineer of the Division of San Francisco Bay Toll Crossings.



HANS P. WILLIAMSON

Williamson was born on November 29, 1885, near Ludington, Michigan, and was educated in the Michigan public schools. In 1916 he graduated from the University of Michigan, receiving a bachelor of civil engineering degree. His first work after graduation was with Babcock & Wilcox and Carnegie Steel Company in Ohio and Pennsylvania, respectively, where he was employed in the design of plant buildings and maintenance engineering.

In 1920 Williamson went to Portland, Oregon, where he was married to Helen A. Cowles who had preceded him in the westward migration from Michigan. He worked in Portland for consulting engineers on building and industrial plant design and on steel fabricators.

The Williamsons moved to California in the spring of 1922, and after short engineering engagements with private concerns in Northern California, Williamson entered his first State service in the Division of Highways, Bridge Department, Sacramento, in November, 1923. For approximately two and one-half years he worked on design of steel and concrete spans for many of California's

valuable asset to the city by permitting uninterrupted transportation between the metropolitan section west of the main highway and one of its rapidly growing residential areas east of the freeway.

These large volumes of conflicting traffic movements are the principal contributing cause of a high accident frequency.

The construction of this overcrossing and accompanying interchange should markedly reduce these accidents in the future, when the traffic signals are removed and uninterrupted flow is permitted.

Frontage Road

The urban type frontage road planned for west of the highway, and terminating opposite Alhambra Street on this project, will ultimately be connected with a proposed frontage road from the north to become a part of the over-all development through Vallejo. This frontage road is to be constructed with two 12-foot lanes with an 8-foot paved shoulder on the outside and a barrier curb next to the outer separation between the freeway.

The existing east connection of Magazine Street will be improved by constructing a standard deceleration lane which in turn requires realigning the present frontage road east of the highway. A portion of the existing acceleration lane will be retained for use until the highway is widened to a six-lane freeway.

The approaches to the overcrossing have been designed with two 12-foot traveling lanes, and paved 5-foot shoulders, bordered with metal guard rail.

A considerable volume of pedestrian traffic across the freeway at this location is anticipated due to the rapidly growing urban development. Pedestrian crossings at grade are presently controlled by traffic signals. Provision will be made for pedestrians to use the overcrossing by construction of a sidewalk on the structure and a walk outside the guard rail on the approaches.

All features of these improvements have been positioned to accommodate the development of this highway into a divided six-lane freeway.

Vallejo, like many other California towns, has been growing rapidly in the past few years. One of the major present and future development areas lies east and southeast of the Magazine Street intersection. The elimination of this grade crossing will prove to be a

early highway bridges. He resigned this position in July, 1926, to return to Oakland to join the Pacific Coast Engineering Company.

In June of 1933 Williamson rejoined the state service in the Design Department of the San Francisco-Oakland Bay Bridge. Except for a short period of transfer to the Division of Architecture in 1938, Williamson remained with the San Francisco-Oakland Bay Bridge project until December, 1940.

In the following year Williamson returned to the Bridge Department of the Division of Highways in Sacramento, working on designs for many modern bridges in the state highway system until April, 1949, when he was transferred to the Division of San Francisco Bay Toll Crossings.

Since coming to Bay Toll Crossings and until his retirement on November 30, 1955, Williamson has been senior engineer (SFBTC) in direct charge of groups engaged in all aspects of superstructure design, including those for the proposed parallel crossing for the San Francisco-Oakland Bay Bridge and for the Richmond-San Rafael Bridge which is to be opened to traffic in October, 1956.

The Williamsons plan to travel to Michigan during 1956 but will return to their home at 3589 Fruitvale Avenue in Oakland. A son, Stanley C. Williamson, who is a teacher for the San Pablo School District, resides with them.

NO TRAFFIC PROBLEM

In 1895 there were only four passenger cars registered in the United States.

FIRST RACE

The first automobile race in America was held in Chicago on Thanksgiving Day, 1895.

LAKE ALMANOR

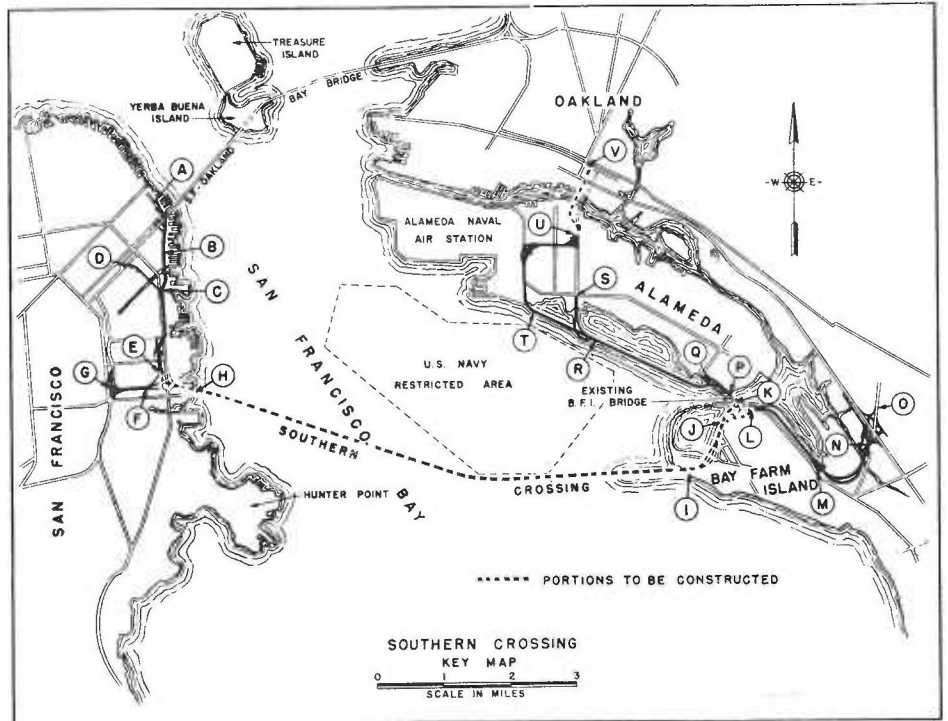
Lake Almanor, one of California's largest artificial lakes, is 45 miles in length.

Southern Crossing

By NORMAN C. RAAB
Projects Engineer

THE DIVISION of San Francisco Bay Toll Crossings, of the Department of Public Works, presented its report on the feasibility of financing and constructing a Southern Crossing of San Francisco Bay to the California Toll Bridge Authority at its meeting in Sacramento on December 13, 1955. An appropriation for the preparation of this report was authorized by the Legislature in the 1953 session.

The proposed Southern Crossing of San Francisco Bay will have its westerly terminus in the vicinity of Third and Army Streets in San Francisco, and its easterly terminus on Bay Farm Island in the City of Alameda.



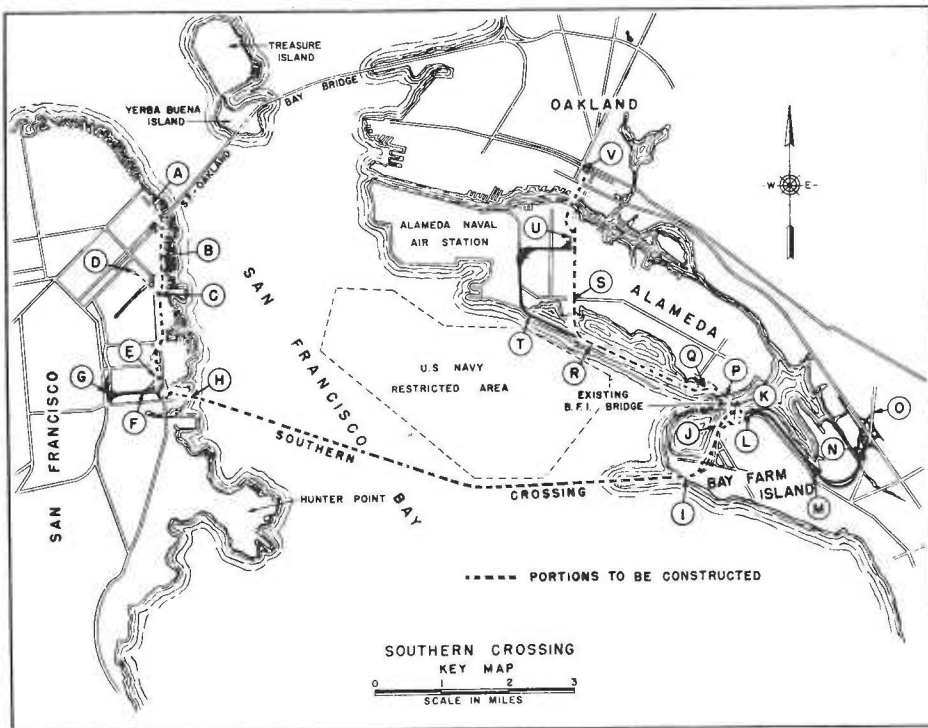
CONSTRUCTION BASED ON 25 CENT TOLL

Freeway connections from the bridge termini are to be made to the Bayshore and Eastshore Freeways on both sides of the Bay.

The Toll Bridge Authority has filed the report with the State Legislature for consideration of suggested amendments to the statutes pertaining to the approach system on both sides of the Bay, and for further policy determination. It is anticipated that the report will be before the Legislature at a special session in March of this year.

Numerous engineering, economic, and other factual matters relating to the construction of the Southern Crossing have been presented and discussed in the preceding parts of this report. The following conclusions can be made:

1. Although many difficult and unusual problems will be encountered, the entire project is feasible from an engineering and construction standpoint.
2. Contract plans and specifications for the largest single unit, the underwater crossing of the trans-bay section, will be completed and bids could be received by the early part of 1956. This procedure will indicate, prior to the sale of bonds, whether construc-



CONSTRUCTION BASED ON 30 CENT TOLL

R. L. Bishop New State Highway Commissioner

After 12 years of devoted service as a member of the California Highway Commission, F. Walter Sandelin of Ukiah tendered his resignation to Governor Knight in December. On



R. L. BISHOP

January 13th the Governor appointed Robert L. Bishop, auto dealer of Santa Rosa, to succeed him. Bishop was named for a four-year term. His appointment is subject to confirmation by the State Senate.

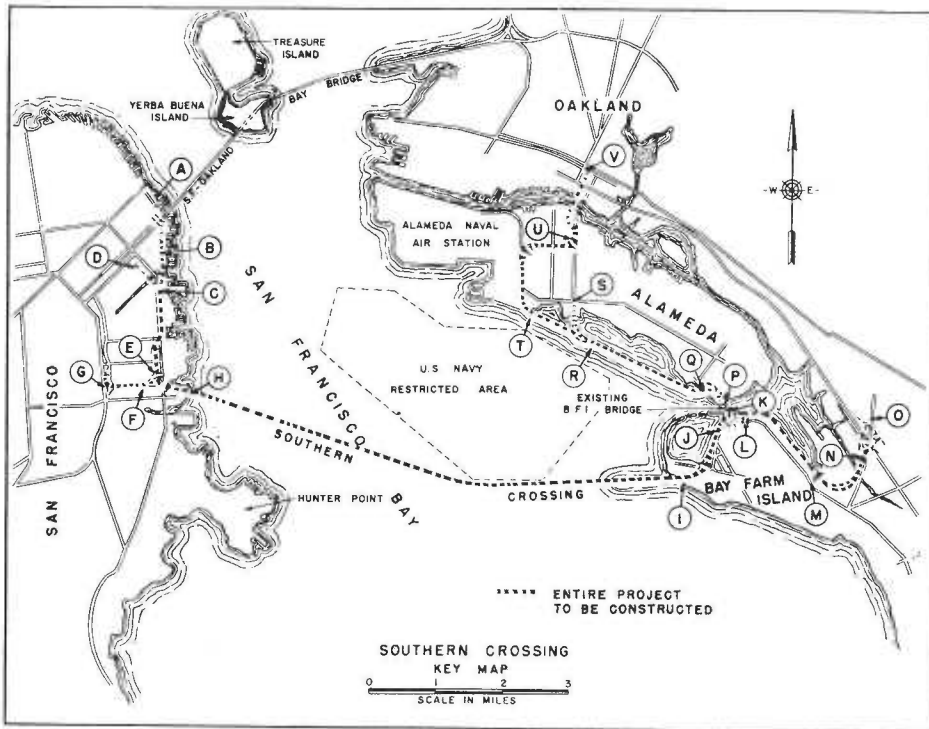
In a letter to Governor Knight, Sandelin said, "Serving as a member of the commission has been an esteemed privilege and an honor. I am grateful to have had the opportunity of participating in the California highway building program."

Sandelin was first appointed by Governor Earl Warren in 1943 and reappointed in 1944, 1948, and 1952.

The new commissioner was born in Springfield, Missouri, in 1897.

He is a member of the Santa Rosa City Board of Public Utilities and the citizens' advisory committee for the

... Continued on page 45



CONSTRUCTION BASED ON 35 CENT TOLL

tion costs are within financing limits.

3. Contingent upon receiving favorable bids on the underwater crossing work and the sale of revenue bonds, construction of the transbay crossing could start in the latter part of 1956.
4. It is estimated that the transbay crossing could be opened to traffic in 4½ years after the start of construction; the entire project including approaches could be completed in 5½ years.
5. The project as described by the statutes and reported on herein could be financed with an automobile toll of 35 cents on the Southern Crossing and a toll increase to 35 cents on the Bay Bridge at the time the Southern

Crossing is opened to traffic; however, this report does not take into consideration approach revisions as described and outlined in the *Assembly Journal* for March 23, 1955.

6. The entire project except the overwater crossing, with minimum approaches to street level, is adaptable to stage construction.
7. The accompanying Table IX-1 shows estimated length of the project that could be built together with the amounts of revenue bonds that could be redeemed by tolls obtained from users of the Bay Bridge and the Southern Crossing and put into effect at the time the latter is opened to traffic.

TABLE IX-1

Auto toll (cents)	Bond issue (\$1,000)	Repayment (years)	Project, miles			Total
			West Bay	Trans Bay	East Bay	
25	180,000	27	1.5	7.5	2.5	11.5
30	225,000	30	4.0	7.5	6.5	18.0
35	250,000	30	5.5	7.5	11.5	24.5

CHRISTMAS STORM TAKES HEAVY TOLL OF BRIDGES

By T. W. RODGERS, Senior Bridge Engineer

Bridges on state highways in Northern and Central California were struck a severe blow by the warm snow-melting storm of Christmas week 1955, which turned normally controllable streams into raging torrents. Five structures, three being classified as major bridges, were completely destroyed and 17 others were damaged to the extent that their use by vehicular traffic stopped. Countless others will require major to minor repairs but their use, for the time being, has not been restricted. An early estimate indicates that about \$2,000,000 will be required to return the destroyed and damaged structures to permanent standards; in addition, approximately a quarter of a million dollars has been spent to close the missing gaps on an emergency basis so that traffic service could be restored as soon as possible.

More Work to Be Done

In addition to the losses known at this time, subsiding waters in rivers and creeks are expected to reveal serious weakening of bridge pier foundations. Fortunately this weakening halted in time to keep spans from collapsing but the defects must be repaired before future high flows can complete the job of destruction. Cost of this work quite easily could reach a quarter of a million dollars due to large number of structures possibly affected.

Bridges under construction on routes not yet open to public travel also suffered flood damage estimated at this writing to amount to approximately \$100,000. Falsework was weakened and will have to be rebuilt. In some cases the progress of contractor's work had not reached the superstructure, thus leaving piers and abutments in less favorable position to withstand fast currents than if all members had been completed so as to tie them together.

Dangerous Debris Drift

While high water is often considered responsible for destruction of

bridges, this menace alone will quite often leave a structure virtually unscathed. Actually, the real villains are the accompanying threats, drift and scour. They pack the lethal punch, producing tremendous forces and excessive currents, that will send the stoutest of man-made works to oblivion. The story of the Christmas storm as it affected bridges again illustrates this fact. The urgency of drift removal explains the presence of state highway crews and equipment on bridges during the period of high flow.

Although the drift problem is usually associated with Northern California counties, where the natural litter of the forests and the residue of logging operations along streams creates an annual headache for highway maintenance forces, it also occurs in Central California. There the same trouble occurs from the local habit of dumping prunings, parts of fruit trees and other rubbish in normal dry creek beds. The huge mound of such debris which packed the channel entrance to the Saratoga Creek bridge and contributed to the lengthy overflow of the Bayshore Highway (US 101 Bypass) north of Santa Clara is a good example.

Although the cases of bridges submerged were well scattered throughout Northern and Central California, the most sizable damages and greatest monetary losses were concentrated in Humboldt, Siskiyou and Trinity Counties. The partial account that follows describes some of the most serious damage as well as other experiences of interest.

HUMBOLDT COUNTY

The major bridge over the Trinity River at Hoopa on State Sign Route 96 was the most serious loss of the storm due to its size and the isolating of towns to the north. The unprecedented flow, after rising above deck level, literally floated the smaller steel truss span out of sight, dumped the 225-foot main span into the channel, and toppled concrete piers. Crossing this large river immediately with a temporary structure was a difficult problem.

Farther north on this route between Orleans and Weitchpec all trestle spans and an abutment of the Bluff Creek bridge were washed away, completing the isolation of the latter community. Fortunately the main steel truss span was left intact so that returning the bridge to service will be made easier.

Debris removed from entrance of single span Saratoga Creek Bridge north of Santa Clara. Clogging flooded Bayshore Highway, US 101 Bypass.



North of Arcata on US 101 four timber trestle spans adjoining the main spans were carried away from the swollen Mad River and several nearby trestles were damaged sufficiently to interrupt traffic.

South of Eureka on State Highway Route 56 the big Eel River bridge at Fernbridge suffered the loss of the westerly concrete span and several connecting spans settled precariously.

Railroad Bridge Used

At Carlotta on State Sign Route 36 the undermining and partial toppling of a pier of the Yager Creek bridge left the continuous steel beam spans suspended in midair, closing the bridge to traffic. Although a project after the January, 1953, flood had deepened pier foundations, the massive collection of drift this time was too much to resist. Had not the Northwestern Pacific Railroad Company made its parallel bridge available for motor traffic, towns to the east would have been cut off for some time from the coastal area.

Several miles north of Garberville and just west of US 101 the joint county-state park bridge over the South Fork of Eel River in Whitmore

Grove State Park was weakened by high water and the battering of drift against truss members in the 300-foot main span. Until repaired, traffic was restricted to light cars only.

SISKIYOU COUNTY

Near Hamburg on State Sign Route 96 the two large steel truss spans of the Scott River bridge were carried away and the main pier destroyed, isolating Happy Camp and other Klamath River towns until a detour could be provided.

Another Scott River bridge, this one at Fort Jones on State Highway Route 82, was completely washed away although of modern concrete design. The center pier of the two-span bridge at nearby Kidder Creek dropped several feet due to undermining, seriously damaging it. The major forest fires in Siskiyou County late last summer, which permit quick concentrated runoffs from denuded hills and mountains, are believed mainly responsible for these losses.

On US 299 at Douglas City the concrete pier columns of the westerly spans of the Trinity River bridge were broken by the brutal pounding of giant logs and trees carried by the

extremely high water. These three concrete end spans after this loss of support collapsed completely. Traffic was restored to this main west-east Northern California route by the emergency installation of Army type Bailey bridge units that provided a one-lane temporary span so located to permit construction of permanent spans beneath later.

Further west on US 299, high water rose to deck level at the Trinity River bridge at Cedar Flat. Hard pressed maintenance men, foreseeing the danger, bulldozed away the top of the adjacent road fills, making more room for the raging river and relieving the pressure on the bridge. Even so, lower truss members suffered considerable damage. Their action undoubtedly saved the structure from the same fate experienced down-river at Hoopa.

PLUMAS COUNTY

Just south of Blairsden on State Sign Route 89 the recently completed bridge over the Middle Fork of the Feather River carried traffic without interruption while the former steel truss span several miles upstream which formerly served this route was closed due to high water. An accompanying shift in the main channel flow undermined a main pier of the old bridge, causing several feet of settlement. Supports under approach spans were swept away.

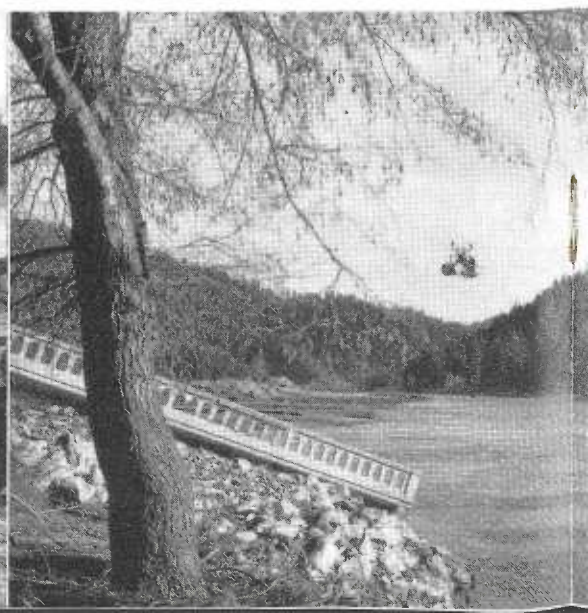
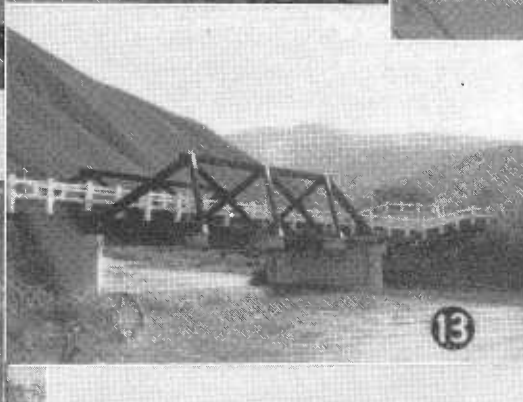
Several miles further south on Route 89 the oblique flow of meandering Sulphur Creek caused the undermining of all three bridge piers but the toughness of this continuous concrete slab design preserved it so that after peak flow subsided, light traffic was allowed to use the structure.

LASSEN COUNTY

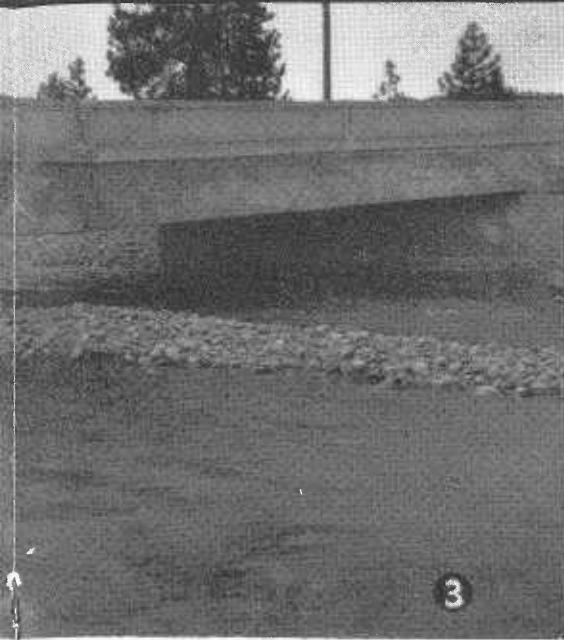
In the southeast corner of Lassen County Long Valley Creek burst its banks, harassing travelers who had chosen to use US 395 along California's eastern boundary to escape the closures on the other trans-Sierra highways. The bridge four miles south of Doyle was completely lost, causing the blocking of US 395. A detour 60 miles west over US 40 Alternate crossed another Long Valley Creek bridge. A partial washout here re-

Before and after views of completely destroyed 440-foot bridge over Trinity River at Hoopa, Sign Route 96





1. Scott River on Route 82 at Fort Jones, Siskiyou Co.
2. Kaweah River on Route 131 near Lemon Cove, Fresno Co.
3. Kidder Creek on Route 82 near Fort Jones, Siskiyou Co.
4. Eel River on Sign Route 1 near Fernbridge, Colusa Co.
5. Uvas Creek on State Route 152 near Gilroy, Santa Clara Co.
6. Crane Creek on Sign Route 140 near El Portal, Stanislaus Co.
7. Yager Creek on Sign Route 36 at Carlotta, Tehama Co.
8. Long Valley Creek on US 395 near Doyle, Colusa Co.
9. Trinity River on US 299 at Douglas City, Tehama Co.
10. Mad River on US 101 near Arcata, Humboldt Co.
11. Mill Creek on Sign Route 1—20 miles north of Arcata, Humboldt Co.
12. Old Middle Fork Feather River on Sign Route 1 near Fort Bidwell, Colusa Co.
13. San Carpojo Creek on Sign Route 1 near Fort Bidwell, Colusa Co.



Siskiyou County.

in Cove, Tulare County.

nes, Siskiyou County.

dge, Humboldt County.

Gilroy, Santa Clara County.

l Portal, Mariposa County.

ttta, Humboldt County.

yle, Lassen County.

r, Trinity County.

mboldt County.

north of San Simeon, San Luis Obispo County.

Route 89 near Blairsden, Plumas County.

ar San Simeon, San Luis Obispo County.

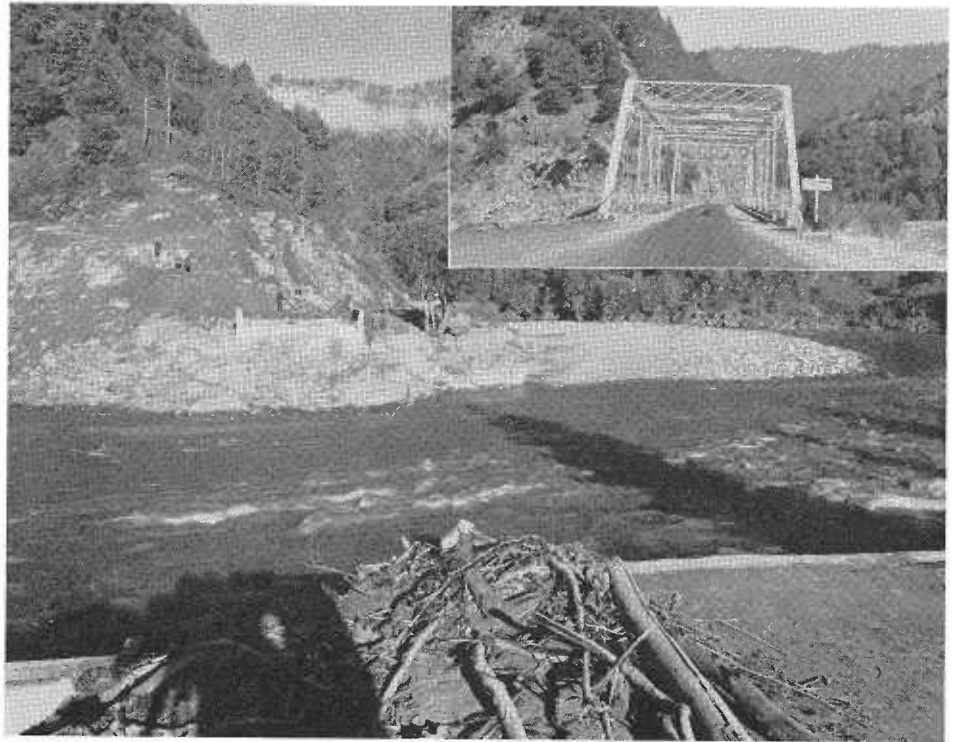


stricted traffic to one lane and for a time threatened to cut this last remaining trans-Sierra link.

SUTTER AND YUBA COUNTIES

State highway bridges in this area, the scene of the costly and tragic Feather River levee break which inundated Yuba City, remained intact and escaped serious injury although river levels were exceedingly high. The veteran concrete structure on US 99E over the Yuba River at Marysville, known locally as the D Street bridge, was overtopped and abandoned for a time as the river rose upward to tops of the main dikes. It was reopened to traffic after the water had receded, no serious structural defects being apparent.

North of Marysville on US 40 Alternate the timber trestle over Simmerly Slough was under 10 feet of water, the bridge deck being almost that distance below the nearby levee top. This relatively quiet backwater of the Feather River did not disturb the buoyant structure however, and it was returned to service as soon as minor road damage on this route could be repaired.



Before and after views of demolished 200-foot Scott River Bridge near Hamburg, Sign Route 96

A few miles east of Yuba County in Sierra County the North Fork Yuba River ran rough shod over the three steel truss spans on historic Highway

49. During the height of the storm they were submerged under several feet of fast water and pounded by giant timber. Miraculously the structure escaped destruction. Although damaged, its capacity was not impaired sufficiently to prevent its use afterwards.

Chippis Creek Bridge on US 40 Alternate near Belden buried in silt and rock carried by rampant stream. Insert shows digging out operation.



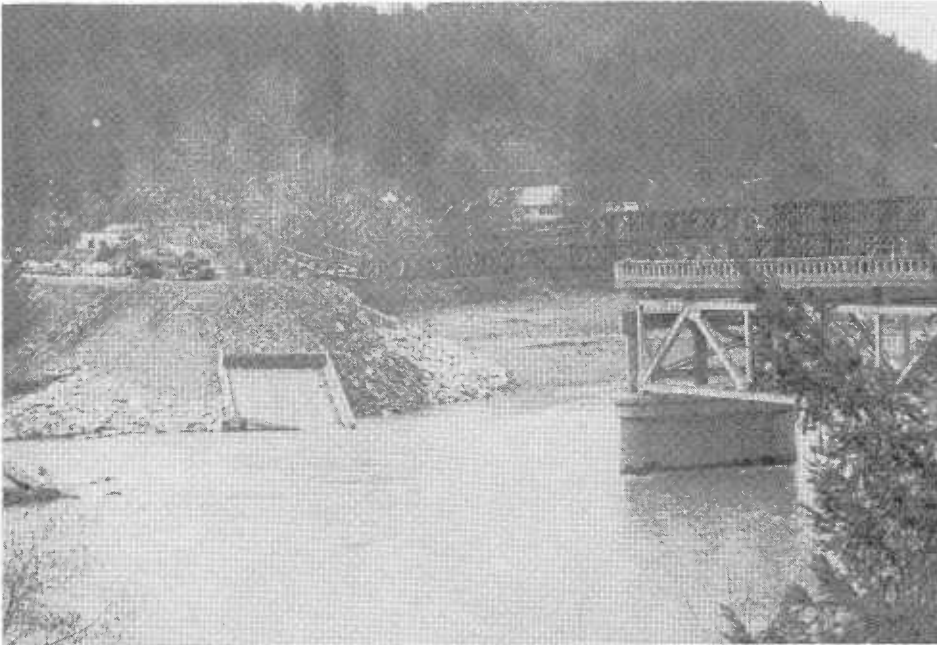
SANTA CLARA COUNTY

Uvas Creek rose to deck level on the bridge west of Gilroy on Hecker Pass Road, State Sign Route 152, causing the undermining and partial collapse of two concrete spans after a large tree lodged against a pier.

Heavy rainfall forced many streams over their banks and the Madrone Underpass and Agnew Underpass on US 101 and US 101 Alternate filled like giant bathtubs when this overland sweep of water become more than pumps could handle.

MARIPOSA COUNTY

Up State Sign Route 140, the Yosemite All-year Highway, road damages along the Merced River were heavy and a number of bridges were left standing alone like ghosts by washed gaps in road approaches. Only the all-concrete Crane Creek bridge



Emergency Bailey Bridge being pushed across gap in Trinity River Bridge at Douglas City, US 299

near El Portal was impassable with one abutment projecting into midair over a gaping cavity caused by stream erosion.

TULARE COUNTY

The Kaweah River, cresting at record heights, hammered successively at seven state highway structures down the rocky canyons of the Sierra and over the San Joaquin Valley, carrying the debris of decades. Near the entrance to Sequoia National Park on State Sign Route 198 the river was reported over the three concrete arch spans at Pumpkin Hollow, tearing away road approaches.

North of Lemon Cove the overflow onto lowlands kept water from overtopping the bridge on State Highway Route 131 but drift and scour nevertheless caused the settlement of one pier. North of Exeter on State Sign Route 65, the river running several feet over the deck, formed a dam of debris that forced the water through the road approaches beyond the ends of the bridge. Only one concrete piling was broken on the structure, however.

MONTEREY AND SAN LUIS OBISPO COUNTIES

The only major bridge damage in this area was along scenic State Sign Route 1 which follows the California coast line. Near San Simeon fast cur-

rents in San Carpojo Creek undermined a concrete pier under the main truss span and it settled several feet. Two other timber spans sagged when their underpinnings were carried away.

Large logs battered vital truss members of Trinity River structure at Cedar Flat, US 299. Bridge saved by diverting flow through gap bulldozed in road fill.



Ten miles north the log span which is located on the slide at White Creek and is accustomed to movement during heavy precipitation slid down the hill several feet at one end. At Mill Creek, 10 miles further north, both abutments of this three-span steel structure slid down the precipitous mountain side, leaving end span beams hanging precariously from the remaining piers.

While lack of space prevents telling of the emergency and other measures taken by various units of the Division of Highways to protect, restore and repair bridges, it must be said that the job was pushed through hectic, sometimes seemingly endless, days with an inspiring team spirit by all that helped make the task easier.

READER PLEASED

NEWPORT BEACH

DEAR SIR: I enjoy your publication very much. *California Highways and Public Works* as a publication carries a great deal of valuable, very useful information for a California resident and the material is very well presented.

Very truly yours,

MRS. C. A. BOWMAN
542 Catalina Drive

CLOSE FOLLOWING

Rear-end collisions are one of the most common traffic accidents and yet they're so easy to avoid. All you have to do is allow enough room between your car and the vehicle ahead. What's "enough room"? One car length for each 10 miles per hour of your speed is a fairly safe margin at speeds up to 50. Above that allow a little more.

WHEELS WERE INCLUDED

Back in 1906, fenders for automobiles were sold as extra equipment, notes the California State Automobile Association.

STANDING TIMBER

Oregon has more standing timber than any other state in the Union.

TURBO-JETS BURN FUEL FAST

A medium-power turbo-jet aircraft engine burns its own weight in petroleum fuel every 20 minutes.

Traffic Bar

*Durable Installation Is Developed
In Materials and Research Laboratory*

By HERBERT A. ROONEY, Associate Chemical Testing Engineer and
JAMES A. CECHETINI, Assistant Physical Testing Engineer

THE PROJECT described in this article was in response to a request from Headquarters Maintenance that the

On January 21, 1955, an experimental installation was made at the Fulton Avenue and U. S. 40 intersec-

tion east of Sacramento as shown in *Photograph No. 1*. Twelve of the longitudinal and transverse bars at the

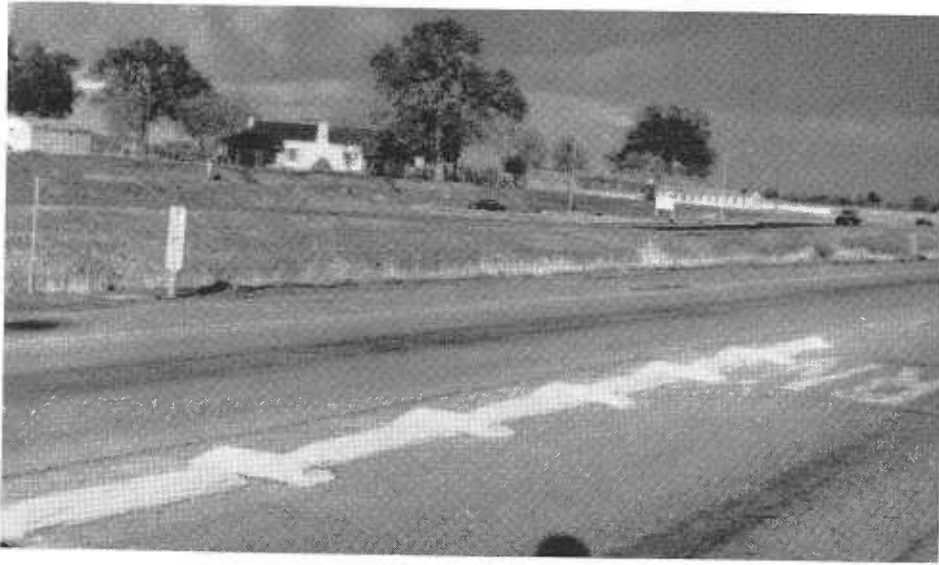


Materials and Research Department develop a durable adhesive for cementing concrete traffic bars in place. The object was to eliminate the steel dowels heretofore used in fastening concrete bars to a road surface.

Dowels remaining on a highway become a traffic hazard when a bar is knocked loose or shattered by impact. The asphalt emulsion type adhesive currently used with one type of traffic bar does not maintain its bond to a road surface when the bars are subjected to frequent impact. An epoxy-thiokol adhesive developed in the laboratory under the direction of E. D. Botts, Senior Chemical Testing Engineer, was used for bonding experimental concrete traffic bars to the concrete road surface on this project.



UPPER—Experimental traffic bars immediately after installation. LOWER—Traffic bars cemented with asphalt emulsion after two to three months.



Experimental bars after 11 months

east end of the dividing strip between the westbound and left turn lanes were removed and replaced by concrete bars made in the department and cemented in place with the epoxy-thiokol adhesive. The layer of asphalt emulsion remaining on the road surface after taking up the old traffic bars was removed and clean concrete exposed by the use of a concrete abrasion machine.

The epoxy-thiokol adhesive used in this installation has exceptional bonding power to clean portland cement or asphaltic concrete surfaces. For this reason it was deemed sufficient to apply the adhesive only to a zone one inch wide around the perimeter at the bottom of the bar. The location was ideal for the test in that the traffic bars dividing the two traffic lanes were hit frequently by trucks and many bars of the previous installation had been moved or broken.

Composition of Experimental Bars

The experimental concrete bars, designed by L. P. Kovanda and J. A. Cechetini of the Concrete Section, have the same cross section dimensions as illustrated in the 1949 Maintenance Manual, page 393, except they are recessed on the bottom to reduce weight and are cast in sections one foot long to reduce the difficulties in handling and in application to irregular road surfaces. The facing or outer portion of the bars to a depth of three-eighths of an inch is composed of white port-

land cement, titanium dioxide white pigment and glass spheres as an aggregate. The inner portion of the bars is composed of ordinary portland cement mortar. With this composition the bars are inherently reflective and do not require periodic painting and beading of the surface as any wear exposes new beads.

Results of Test

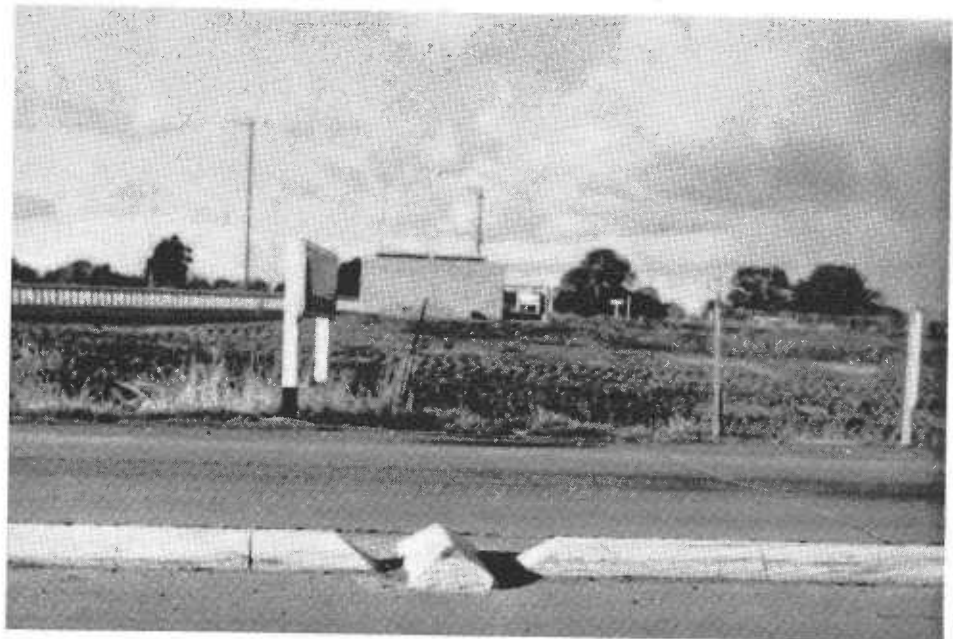
Prior to this test installation, it was necessary to replace several of the bars which were cemented with asphalt emulsion every few months. The bars

had either worked loose or were shattered by traffic, as shown in *Photograph No. 2*. Despite the constant impact of trucks in the past year, none of the experimental concrete bars cemented with epoxy-thiokol adhesive has worked loose. The bars have shown excellent resistance to the severe abrasion and impact to which they have been subjected. *Photograph No. 3* shows the condition of the experimental installation after approximately 11 months. *Photograph No. 4* is a closer view of part of the installation after 11 months.

Conclusion

Although this project was confined to a portland cement road surface, preliminary laboratory test data and results obtained from actual road tests in cementing traffic buttons to an asphalt plant-mixed surface indicate similar satisfactory results should be obtained by using the epoxy-thiokol adhesive for the installation of these concrete traffic bars on plant-mix highways. The epoxy-thiokol adhesive is more expensive than asphalt emulsion, but considering the fact that less of the former is used and a more permanent job obtained, the comparative over-all costs would appear to favor the type of installation described, especially in areas where traffic bars are subject to impact by traffic.

Experimental bars after 11 months, closeup



Public Hearings

Highway Commission Seeks Full Information on Freeway Routings

By FRANK B. DURKEE, Director of Public Works

WITH MORE than 10 percent of the motor vehicles in the entire Nation registered in California, this State has for years had a tremendous problem of providing adequate highways. The continued rapid increase in population and traffic during and since World War II has made the development of modern freeways along the principal state highway routes a matter of extreme urgency for the safety and welfare of our people.

Fortunately, California has had during this critical period the advantage of forward-looking legislation on which to base the steady expansion of its freeway network in accordance with sound long-range planning.

From the standpoint of future development, one of the gravest responsibilities delegated by the Legislature to any state agency is that of route adoption—the spelling out of highway locations between termini or control points established by Legislature when it designates a route as a state highway. Determination of routings, particularly freeway routings, is the keystone of the highway program in this State.

Commission Responsibility

Recognizing that state highway routings are matters of state-wide effect and interest, the Legislature has vested full authority for route determination in the California Highway Commission. The commission is by law a seven-man body which "shall represent the State at large * * *." (Sec. 70.2, Streets and Highways Code.)

Throughout the years the commission has sought to discharge most conscientiously the responsibility for route determination on the basis of the greatest good to the greatest number.

At the same time, the Highway Commission takes full cognizance of the needs and desires of the individual



Typical of the meetings called by the Division of Highways for public information and discussion of tentative freeway routing proposals is this session in the Mendocino County Courthouse in Ukiah on January 17, 1956. It was the second such meeting in the case of a proposed freeway route for US 101 in the vicinity of Ukiah, called by District Engineer A. S. Hart of District I. Hart is using a large aerial mosaic of the Ukiah area in his presentation.

communities, large and small, which the freeways must traverse. It is the commission's firmly established policy, originally stated in 1948 in a resolution which has since been revised and expanded, to give every possible consideration to local interest consistent with the solution of the over-all traffic problem.

Full Public Information

The commission's policy calls for full public information concerning the various alternative routings studied by the Division of Highways, public meetings at which the engineering and economic data can be explained and questioned, and, if desired or considered necessary by the local governmental authorities, a public hearing by the commission. As a part of this procedure, the commission may and some-

times does schedule public hearings on its own initiative.

Only after full opportunity has been provided for the presentation of all facts and arguments does the commission take final action to adopt a route and declare it a freeway.

The next major step before construction can begin involves a *freeway agreement* between the State and the city or county (or both) concerned. This freeway agreement spells out the necessary adjustments of local streets and roads as a result of the proposed freeway.

Section 100.2 of the Streets and Highways Code makes a freeway agreement mandatory before any local street or road can be closed by the State. The State may, legally, proceed with freeway construction without an agreement, as long as separation struc-



UPPER—Shows the front portion of the Chico State College auditorium on January 20, 1956. On the stage at the right of the picture are four members of the California Highway Commission, conducting the public hearing; at the two tables at the left are engineers of the Division of Highways, who used the maps in the background to explain their recommended and possible alternatives for a freeway location for US 99E in the Chico area. The speaker, standing in the first row with back to camera, is Mayor Theodore Meriam of Chico. LOWER—Shows the same auditorium on July 14, 1955, at a public meeting called by District Engineer A. M. Nash of District III to explain the results of freeway routing studies in the Chico area. The speaker in foreground is Dr. H. Thurston Hatch, Chico superintendent of schools. (Lower photo courtesy of Chico Enterprise-Record.)

tures are provided for every local road or street intersection; but in practice, this has never been seriously considered. Negotiations leading to freeway agreements have occasionally extended over a period of years.

Experience in many parts of California has shown properly located freeways to be beneficial to the local community as well as to traffic. The improved service thus provided to large volumes of vehicles also makes

for greater local traffic safety and relief of local congestion. The adoption of a freeway location also establishes the pattern and often provides the opportunity for sound, long-range planning of the community, for urban renewal, and other developments.

The engineers of the Division of Highways have had the full benefit of the thinking of engineers and planners of the respective cities and counties in solving freeway location problems in the public interest. This cooperative approach is undoubtedly another factor in California's nationally recognized leadership in freeway development, which has grown out of our sound structure of laws governing route determination and freeway agreements, supplemented by a Highway Commission policy of full consideration for local as well as statewide needs.

TEACHER USES MAGAZINE

THE UNIVERSITY OF NEW MEXICO
Albuquerque, New Mexico

California Highways and Public Works

GENTLEMEN: I would like to thank you for continuing to send me *California Highways and Public Works*. I have found this magazine to be of great value to me as a teacher and an excellent source of material for my classes in Highway Engineering. The articles on the effect of freeways on the economy of surrounding areas are of special interest.

Very truly yours,

MARVIN CLARK MAY
Associate Professor

RACING WASTES GAS

Don't race your engine while waiting for the light to turn green, advises the National Automobile Club. Let the other fellow get away first if he wants to, and waste his gas!

OLDEST FORMATIONS

The Alabama Hills, located to the west of Lone Pine in Inyo County, are reported by the National Automobile Club to be among the oldest geological formations on this continent.

JOE BEAVER vs. STATE OF CALIFORNIA

By H. CLYDE AMESBURY, District Traffic Engineer

Down on the South Fork of the Feather River they're a feudin'. It isn't a shootin' war but both parties are mighty determined.

The parties to the dispute are a small furry denizen named Joe Beaver and Cecil Koenig, the maintenance superintendent of the Division of Highways at Quincy.

To provide a little background for the argument, the following items are supplied:

Joe and his family lived in a small stream just south of Blairsden. This past year, the division awarded a contract to reroute the highway and crossed Joe's stream. The plans called for a fill which the contractor proceeded to place. This met with Joe's wholehearted approval; a dam was being constructed and a very substantial one just where he wanted it. However, he was horrified to note they left a hole in it containing a pipe 36 inches in diameter and it didn't hold water. With the best intentions in the world and in a spirit of helpfulness, he proceeded to plug the hole.

Joe Cost State Money

During the course of construction, the contractor spent about \$300 unplugging the pipe. Joe knew very well you couldn't have a dam with a hole in it! He busily plugged away and hoped the contractor would see the light.

Finally, the contractor completed his work and with the pipe all clean had it accepted by the State. Then in a few days before the maintenance department took over, Joe plugged the pipe tight.

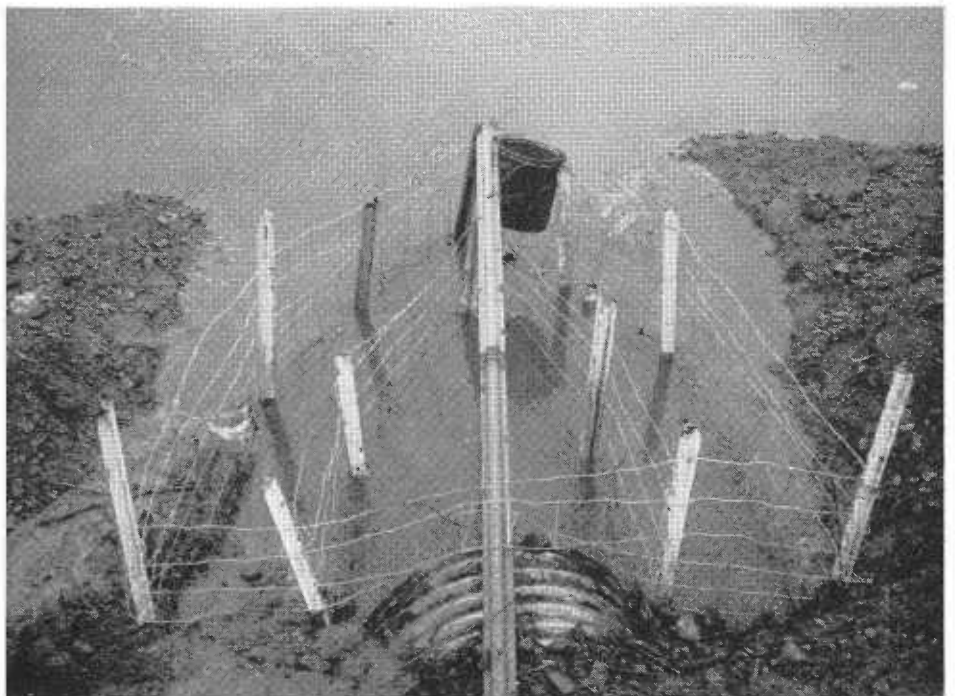
Now appears Cecil Koenig; he was horrified to find a pipe plugged on his new job. He sent a crew to clean it out. They worked from 8 until 3 o'clock and had it about completed. That night Joe assembled his family and next morning when the crew returned the pipe was plugged again. Looked like Joe won this round.

Then Cecil tore out the plug and built a contrivance of steel posts and



Creosote bucket still on fence. Joe had the water about two feet over the pipe.

Pictures of beaverproof barrier



mesh to keep Joe away from the upper end of the culvert. Cecil claimed he won that round.

Joe examined and investigated this addition to the landscape for about a week until he was certain it wasn't some kind of a trap to catch an unsuspecting and helpful beaver. Then he tunneled under the wire and plugged the pipe. That round he won.

What Next?

Cecil looked over the situation, cleaned out the culvert, spotted where Joe came under the wire, and hung a bucket of creosote with a small hole in the bottom where the liquid dripped out over the location. Joe apparently got some of this on his fur. Maybe he got some in his eyes. If there had been a referee he would have screamed "low blow" and "foul." He definitely had an odor such as no beaver ever had before and was probably ostracized by his family. Cecil claimed that round.

Joe waited about 10 days. The weather turned cold. The creosote stopped dripping and Joe and family happily restored the dam by plugging the culvert. Joe claimed the round.

Cecil then came out and unplugged the pipe and drove a series of steel stakes just below the mesh and close enough together so Joe couldn't get through. Cecil is claiming this round and tentatively claiming the contest.

As for Joe, he doesn't concede anything.

BISHOP MADE COMMISSIONER

Continued from page 33 . . .

Los Guilucos School for Girls. In addition he is a member of the Redwood Empire Association and chairman of the Industrial Committee of the North Coast Council of the State Chamber of Commerce.

Bishop is past president of the Santa Rosa Chamber of Commerce and the Santa Rosa Rotary Club. He was the first general chairman of the Santa Rosa United Crusade. Recently he became a member of the neighbors flood committee, which was organized to help flood victims in Northern California.

Harding Retiring, Telford Moves Up to Assistant State Highway Engineer

Paul O. Harding, Assistant State Highway Engineer in charge of state highway development and operation in Los Angeles, Orange, and Ventura Counties for the past six years, is retiring after 27 years of outstanding service with the California Division of Highways.

Appointment of Edward T. Telford to succeed Harding was announced by State Highway Engineer G. T. McCoy.

Harding has been closely identified with the world-famous metropolitan freeway network in the Los Angeles area since August, 1947, when he became a district engineer under S. V. Cortelyou. He succeeded Cortelyou as Assistant State Highway Engineer when the latter retired in October, 1949.

Freeways and expressways in the three counties comprising District VII of the Division of Highways now include 182 miles of completed projects and 45 additional miles under construction, costing a total of \$414,000,000 for construction and rights of way. For the 1956-57 Fiscal Year alone, the construction and right of way budget for District VII totals about \$86,000,000, covering additional projects planned and designed under Harding's supervision.

Harding was born in Garden City, Kansas, in 1893. From 1912 to 1915 he worked on location surveys in Oregon, after which he began his studies at the University of Nebraska. These studies were interrupted by service in World War I as a first lieutenant in the 27th Field Artillery, but were completed in 1922 when he received his B.S. degree in civil engineering.

Moving to California in 1923, Harding first worked for municipal and private engineering organizations. In 1929 he joined the Division of Highways as an inspector and instrumentman in District IV at San Francisco.

In 1931 he became assistant to the district construction engineer, and in 1933 he was placed in charge of the location and design of the approaches to the San Francisco-Oakland Bay Bridge, later supervising construction

of these approaches. In 1937 he was promoted to Assistant District Engineer of District IV.

In 1942 Harding was appointed District Engineer of District X, with headquarters at Stockton, where he remained for five years, until his transfer to District VII.

Harding is a member of the American Society of Civil Engineers and an honorary member of the American Right of Way Association. He was one of the founders of the California State Employees Association and was its second president, in 1932.

His responsibility for the planning and construction of the vast freeway network in the Los Angeles metropolitan area has made him a participant in many civic and governmental activities relating to the development of that region during the past eight years.

Telford will be promoted from the position of district engineer in charge of planning, a post he has held for the past three years. Telford's former duties are being assumed by District Engineer George Langsner, who has been in charge of operations for District VII. District VII includes Los Angeles, Orange and Ventura Counties.

To fill Langsner's position, McCoy announced the appointment of Lyman R. Gillis, presently Assistant District Engineer in District IV, with headquarters in San Francisco.

Harding who has spent 27 years in the state highway organization, the last six years in charge of District VII, is handing over to Telford the responsibility for a program involving more than \$100,000,000 a year in expenditures, including \$86,000,000 budgeted for the 1956-57 Fiscal Year for construction purposes, including rights of way. Freeways and expressways in District VII amount to 182 miles completed and 45 miles under construction, costing a total of \$414,000,000. Most of the work under the accelerated highway construction program has been accomplished during Harding's tenure in the district.

. . . Continued on page 67

Los Banos

City Finds a Solution for
Its Grave Parking Problem

By HARRY J. WEBB, District X

WHEN THE owners of commercial establishments catering to highway traffic ask that parking on the highway be prohibited, we think this is news.

This unusual situation developed on State Sign Route 152, Pacheco Pass Highway, through the southern portion of Los Banos a little over a year ago. At that time, the property owners along Pacheco Boulevard petitioned the city officials of Los Banos to enact the necessary ordinance for prohibiting all parking on the highway within the corporate limits.

The property owners and the city officials recognized the fact that the 58-foot city street section would not be adequate for four lanes of traffic without such action. Unless the free flow of traffic were assured, it was felt that public demand would result in an ultimate re-route around the town.

Off-street Parking

Pacheco Boulevard does not traverse the main business district and, as mentioned above, the majority of business establishments depend upon the motorist for revenue. The merchants have met this problem by providing off-street parking on practically a 100 percent basis.

A resurvey one year later found Pacheco Boulevard free of congestion with adequate capacity to handle the rapidly increasing traffic on Route 152.

The editor of the *Los Banos Enterprise*, F. A. Merrick, who is vitally interested in highway matters, particularly those affecting the community, is of the opinion that both the traveling public and the property owners are pleased with the results. Property values have remained firm and business has improved. Many local residents now patronize the establishments since congestion has been reduced and off-street parking provided.



UPPER—Medical Center parking. LOWER—Off-street parking at Restaurant.

No Accidents

Chief of Police R. H. McSwain states that the elimination of parking, especially truck parking, has improved visibility and safety. Since the ordi-

nance was enacted, he said, there have been no reported accidents on Pacheco Boulevard.

Enforcement of the ordinance has presented little difficulty inasmuch as



UPPER—No parking signs Pacheco Blvd. LOWER—City owned parking lot.

motorists generally prefer to park off the highway.

The city clerk, Michael Dambrosio, is enthusiastic about public reaction. Residents are pleased with the improved conditions and the attractiveness of Pacheco Boulevard. The city council of Los Banos is cognizant of the advantages of off-street parking and has provided public parking lots with no charge to the motorist.

Certainly, the City of Los Banos has lived up to its reputation as a progressive community and should be com-

mended for its action in furthering progress.

WEARINESS AND WORRY

Two enemies of safe driving are weariness and worry. Weariness slows down reaction time and worry affects concentration. You can't always stop worrying when you get behind the wheel of your car, says the California State Automobile Association, but you can take a rest if you're weary. Give yourself a break, don't drive when you're tired.

D. H. McMillan

D. H. McMillan, Senior Structural Designer for the State Division of Architecture, was honored by fellow employees at a farewell dinner December 15th in Sacramento. He retired December 28, 1955, after more than 39 years of state service.



D. H. McMILLAN

McMillan was born and reared on his father's stock farm in the hills of Yuba County where he also attended grammar school. Following graduation from the Sacramento High School, he worked for a time with his father. In June 1914, he quit the farm to work for the State as a messenger clerk with the Division of Architecture.

In a short time he was promoted to senior clerk and remained in that position until he resigned in 1919 to work for the 12th Naval District in San Francisco. As a junior draftsman in the Bureau of Construction and Repair, he worked on plans of U. S. Navy destroyers and submarines.

A year later McMillan returned to the Division of Architecture as a mechanical draftsman, inspecting steel shipments fabricated by the Palm Iron Works for the construction of the California State Building in San Francisco's Civic Center. By 1931 he had been promoted to associate structural engineering draftsman preparing drawings of schools, gymnasiums, hospitals, and other state facilities.

During World War II he worked for a short time with the U. S. Engineers and for Ellison & King, a structural engineering firm in San Francisco. At Ellison & King he detailed the plans of 26 concrete ships for the U. S. Maritime Commission.

In December 1943, he returned to Sacramento and the Division of Architecture.

McMillan plans to return to the Yuba County hill country of his childhood where with his wife, Jeanette, he expects to pursue his first and only avocation, livestock ranching.

Cost Index

Rises During Fourth Quarter of
1955 Highway Construction

By RICHARD H. WILSON, Assistant State Highway Engineer,
H. C. McCARTY, Office Engineer, and
JOHN D. GALLAGHER, Assistant Office Engineer

THE CALIFORNIA Highway Construction Cost Index stood at 212.6 (1940 = 100) for the fourth quarter of 1955, a rise of 1.9 percent over the 208.6 for the third quarter, and 12.3 percent over the first quarter of 1955.

For the entire calendar year of 1955 the Index stood at 203.8. This is an over-all increase of 5.3 percent over the 193.5 for the calendar year of 1954.

The computations for the fourth quarter Index were made excluding three large contracts awarded for construction of the new parallel bridge across the Carquinez Strait at Crockett. The total amount of these three contracts is nearly \$20,000,000 and the concentration of this amount of money and the large quantities of steel (12,880,000 pounds of structural steel, 10,740,000 pounds of high strength low-alloy structural steel and 5,820,000 pounds of high strength T-1 structural steel) were such that their inclusion would have unbalanced the entire Index for the quarter. While the poundage of high strength steel was much less than would have been required had the bridge been built entirely of ordinary structural steel, the cost per pound for the high strength steel was much higher than for straight structural steel. An unusually large structure such as the Carquinez Strait Bridge is not comparable from the cost standpoint to the normal highway project, even in this day of six, eight and ten million dollar free-way jobs.

However, as a matter of interest and comparison a separate computation of the Cost Index was made including the Carquinez Bridge. The result of including these bridge quantities and prices brought the Index to 228.8, which is approximately 7 per-

cent higher than the normal Index without the three Carquinez Bridge contracts.

Even though the rise in the California Highway Construction Cost Index during the fourth quarter of 1955 was only 1.9 percent it antici-

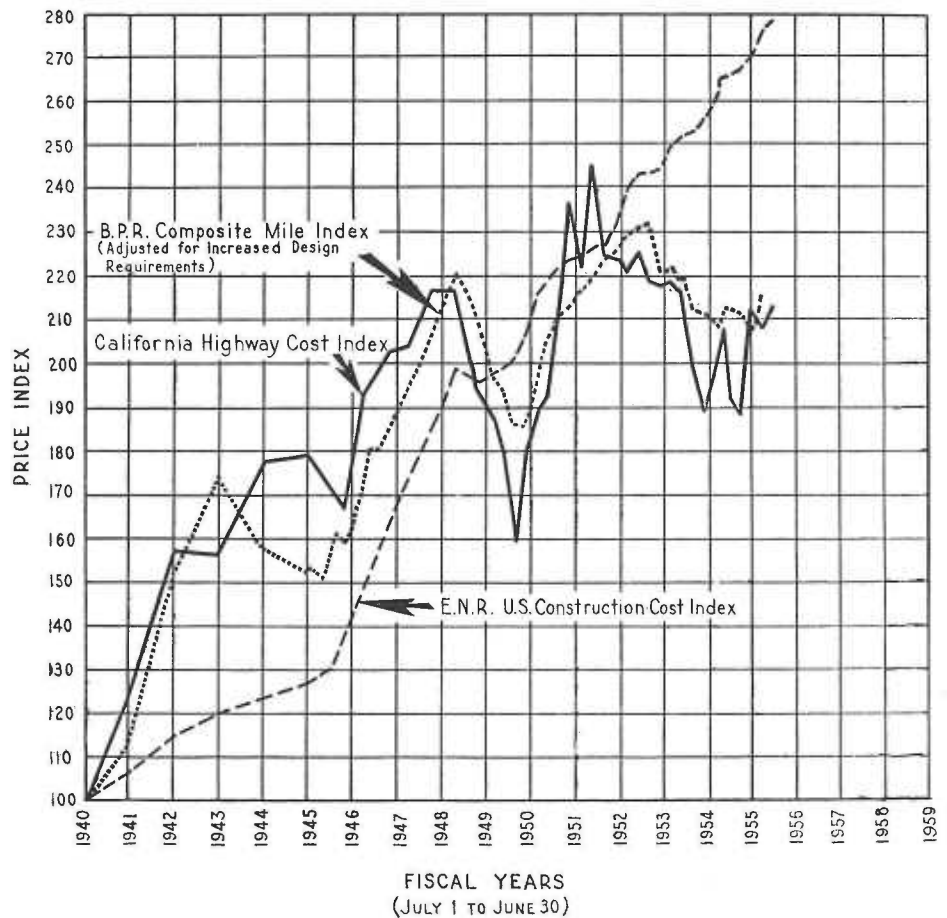
pates a continuation of the rise begun in the second quarter of 1955.

The accompanying tabulation shows the California Highway Construction Cost Index by years from 1940 through 1953 and by quarters for 1954 and 1955.

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

PRICE INDEX CONSTRUCTION COSTS

1940 = 100



THE CALIFORNIA HIGHWAY CONSTRUCTION COST INDEX

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

Projects awarded during the quarter included seven freeway jobs with large quantities and corresponding lower unit costs (the southerly approach to the Carquinez Bridge alone involves over 11,000,000 cubic yards of roadway excavation). In the face of the effect of these large projects in lowering unit prices the over-all result was a rise of nearly 2 percent.

As stated above it is the opinion of this department that this rise, small as it is, adds to the rise for the year as a whole and is an indication of further increases in the months ahead.

Another straw in the wind indicating increases in highway construction costs is the drop in the average number of bidders during 1955 as shown in the tabulation further on in this report.

Inspection of the average unit prices bid during the fourth quarter of 1955 for the eight items upon which the California Index is based (see accompanying tabulations) shows an increase in five items and a decrease in three. Roadway excavation dropped about 10 percent from 41 cents per cubic yard to 37 cents. This drop may be laid almost entirely to the 25.6 cents price on the 11,200,000 cubic yards of excavation on the Hercules to Crockett approach to the Carquinez Bridge. Untreated rock base was down from \$2.33 to \$2; this, however, is merely back to where it was in the second quarter of 1955. The average price of \$2.33 for rock during the third quarter was undoubtedly the direct result of the rock plants strike in Southern California during the summer. The only other decrease was

a drop of \$1.70 per ton in the price of asphalt concrete, but the total quantity of this item is so small as to have little effect on the Index.

Plant-mixed surfacing rose from \$5.43 per ton to \$5.52 per ton; portland cement concrete pavement was up from \$13.46 to \$15.05 per cubic yard; structural concrete rose from \$49.64 to \$52.72 per cubic yard; bar reinforcing steel rose from \$0.093 to \$0.099 per pound; and structural steel was up from \$0.132 to \$0.144 per pound.

In the computations made for the Index including the three Carquinez Bridge contracts the unit prices were more or less the same with the exception of bar reinforcing steel, which was up to an average of \$0.103 per pound; and for structural steel including the large quantities of high strength low-alloy and T-1 steels which go into the bridge the average unit price was \$0.223 per pound.

It is believed that a steady upward trend in highway construction costs is now established. The increases in labor and rising material costs have had their effect and competing bidders are no longer able to devise methods of cutting prices and trimming profits. The people of California have benefited during the past year by the efforts of the construction industry in creating devices to keep highway construction costs relatively stable in a period when general prices were rising; it is an excellent example of the benefits to the public of the contract system based upon competitive bidding.

The accompanying chart, showing the California Highway Construction Cost Index, the *Engineering News-Record* Construction Cost Index and the United States Bureau of Public Roads Composite Mile Index compares the three, all reduced to the 1940 = 100 base.

The *Engineering News-Record* Index, based upon materials and labor prices, comprises all types of construction and is nation-wide in scope. During the fourth quarter of 1955 this Index continued the steady rise begun in 1950 and reached 278.3 which was 0.76 percent higher than in the third quarter.

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	\$7.68	\$18.33	\$0.040	\$0.083
1941	0.26	2.31	2.84	3.18	7.54	23.31	0.053	0.107
1942	0.35	2.81	4.02	4.16	9.62	29.48	0.073	0.103
1943	0.42	2.26	3.71	4.76	11.48	31.76	0.059	0.080
1944	0.50	2.45	4.10	4.50	10.46	31.99	0.054	0.132
1945	0.51	2.42	4.20	4.88	10.90	37.20	0.059	0.102
1946	0.41	2.45	4.00	4.68	9.48	37.38	0.060	0.099
1947	0.46	2.42	4.32	5.38	12.38	48.44	0.080	0.138
1948	0.55	2.43	4.30	5.38	13.04	49.86	0.092	0.126
1949	0.49	2.67	4.67	4.64	12.28	48.67	0.096	0.117
1950	0.40	2.25	4.26	3.75	11.11	43.45	0.079	0.094
1951	0.49	2.62	4.34	5.00	12.21	47.22	0.102	0.159
1952	0.56	2.99	5.00	4.38	13.42	48.08	0.098	0.150
1953	0.51	2.14*	5.31	4.58	12.74	50.59	0.093	0.133
1st Quarter 1954	0.45	2.28	4.23	4.78	14.89	47.52	0.092	0.126
2d Quarter 1954	0.38	2.09	4.29	5.18	14.28	47.12	0.093	0.114
3d Quarter 1954	0.43	1.85	4.68	7.00	12.63	49.59	0.095	0.162
4th Quarter 1954	0.35	1.78	4.83	-----	13.13	46.08	0.094	0.135
1st Quarter 1955	0.39	1.69	4.59	-----	13.44	40.66	0.095	0.140
2d Quarter 1955	0.42	1.99	5.35	-----	14.46	51.36	0.098	0.136
3d Quarter 1955	0.41	2.33	5.43	5.70	13.46	49.64	0.093	0.132
4th Quarter 1955	0.37	2.00	5.52	4.00	15.05	52.72	0.099	0.144

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

... Continued on page 67

County Project

*Butte Completes Oroville By-pass
To Relieve Traffic Construction*

By E. H. WYMAN, Associate Highway Engineer, and
MARSHALL JONES, Butte County Director of Public Works

OPENING CEREMONIES for FAS Route 1169 in Butte County held October 31, 1955, marked completion of the project which has been under construction intermittently since 1947. The route was first proposed by former Supervisor Scott Lawton and Oroville City Councilman Bernard Richter in 1946 as a truck route to relieve congestion on Montgomery Street, US 40A, through Oroville.

As lumber is one of the main industries of the Oroville area, Montgomery Street, first laid out in early 1850 and little changed in width since that time, was literally alive with huge logging and lumber trucks. A steep grade at the east end of the street added to the traffic problem. The project was endorsed wholeheartedly by local residents after a lumber truck with faulty brakes ran wild through the business area causing considerable property damage.

Right of Way Donated

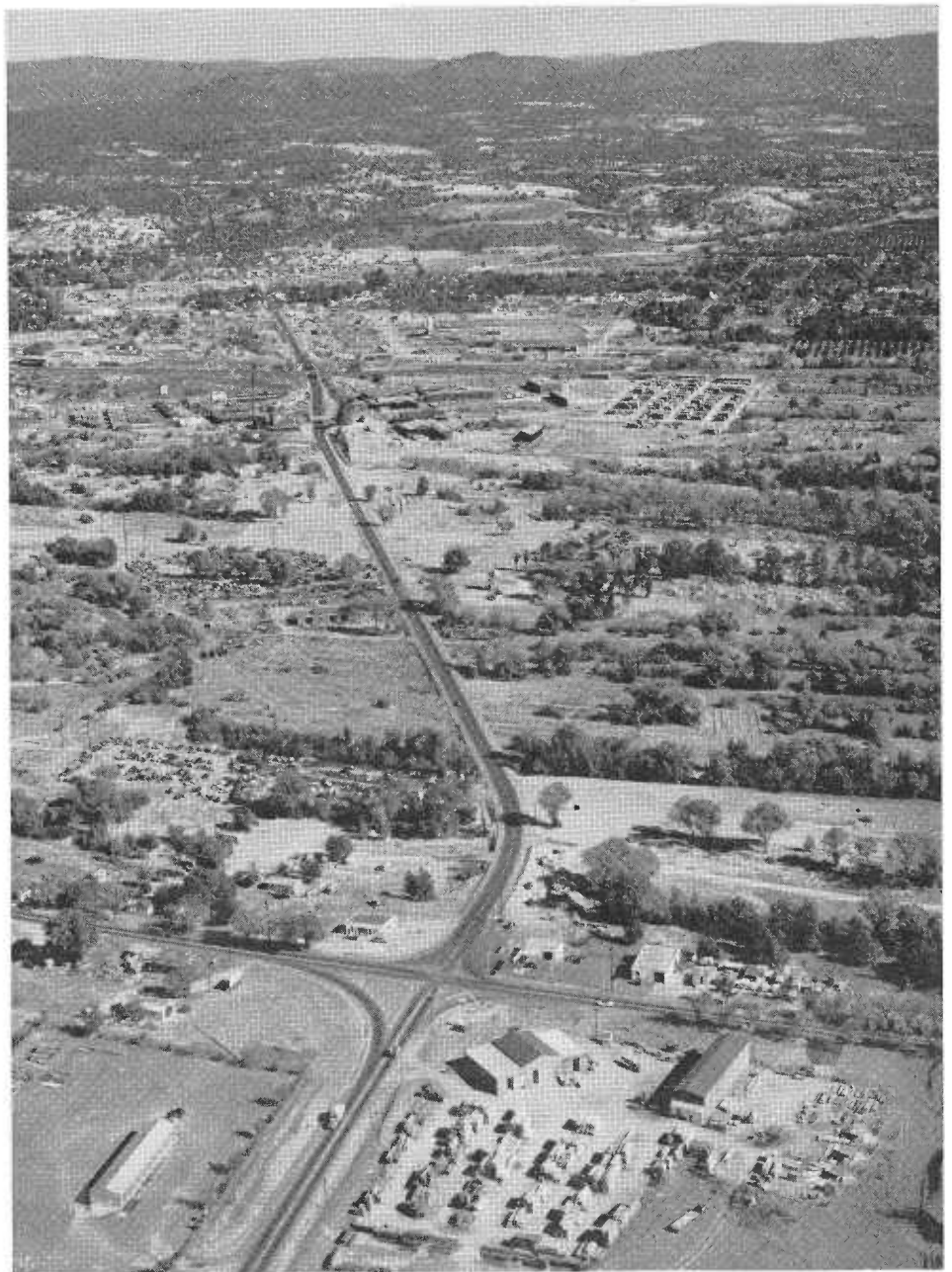
Right of way for a major portion of the route was donated, largely through the efforts of Mr. Richter, and the first portion of the project started. This consisted of the grading of various sections lying between connecting city streets and county roads both by small contract and county forces. The base and light surfacing were placed by county forces on various portions as funds were available. The route was not open to through traffic due to the necessity of constructing three underpasses and taking care of drainage on Dry Creek which the route follows for approximately one-half mile.

During 1950, through the efforts of Supervisor Dan Pellicciotti and the Oroville Chamber of Commerce, the road was established as an FAS route, and the first project, the construction of three underpasses and a new channel

for Dry Creek, was started under the direction of Bert Paxton, former road commissioner for Butte County. Con-

struction of this portion of the project was completed in 1953 by C. K. Moseman Construction Company of Bel-

Beginning of FAS Route 1169 looking easterly from junction of FAS Route 1169 with US 40 Alt. and Oroville-Richvale highway. End of FAS 1169 at its intersection with US 40 Alt. in the extreme upper left corner.





Looking easterly. Connection with US 40 Alt. at top of picture. Southern Pacific Railroad and Western Pacific Railroad underpasses in foreground. Lincoln Street, Meyers Street and Olive Highway intersections in center.

mont. This proved to be an extremely difficult operation due to the work lying in the bottom of Dry Creek and progressing through a winter which saw the heaviest rainfall in this area since 1890.

Upon completion of the structures, county forces graded and surfaced the roadway including additional base and light surfacing from the intersection at State Highway Routes 87 and 21A through to Oroville-Quincy county road (old state highway to Quincy

via Bucks Lake). This left approximately 0.7 of a mile to be constructed to open the route to state highway Route 21 east of Oroville. This project, FAS 1169(2), started in August, 1954, was completed in June, 1955. The project just completed, FAS 1169(3), covered the regrading of approximately one-quarter mile of an existing city street, the placing of additional base on approximately three-quarters of a mile and the placing of three inches of surfacing from

Route 87 south of Oroville to the old Oroville-Quincy highway. The last project was financed with state, federal, county and city funds.

Traffic Signals Planned

This route is now beginning to carry a large percentage of both through and local traffic. It is anticipated that a considerably larger volume will be carried upon completion of traffic signals at Myers Street intersection, one of the busiest in the county,

where traffic, particularly trucks, have difficulty crossing. The City of Oroville is now in the process of preparing plans for the signals.

The county day-labor and contract projects were completed at an ap-

proximate cost of \$150,000. The three FAS projects were constructed at a cost of \$429,000. The approximate total cost of the complete route was \$579,000. Marshall Jones, Butte County Director of Public Works, under

whose direction the last two projects were completed, has reported a great deal of satisfactory comment has been received from both local and outside highway users since the completion of this route.

Looking westerly along FAS 1169 on the left and US 40 Alt. diverging to the right, which intersect again in background near the Feather River Bridge south of Oroville. Bridge at right center is on S. H. Route 87 to Chico.



GLAD YOU LIKE IT

VALLEJO

DEAR MR. ADAMS: I wish to take this opportunity to congratulate you and your very capable staff for the

splendid job you are doing in compiling the information relative to the highways and their progress in this State and disseminating it to the public. I have learned many things about this great State of ours from

the *California Highways and Public Works* and would miss it very much if it were discontinued.

Sincerely yours,

ROBERT T. MONAGAN, SR.
1401 Rice Street

Whitton Succeeds General Merrill As A. A. S. H. O. Head

Less than two days after his election as President of the American Association of State Highway Officials, Major General Frank Dow Merrill, Commissioner of Public



FRANK D. MERRILL

REX M. WHITTON

Works in New Hampshire, died in Fernandina Beach, Florida, at the age of 52.

In accordance with the association's constitution, the new president for 1956 is Rex M. Whitton, Chief Engineer of the Missouri State Highway Department, who had been elected first vice president at the same New Orleans convention of A. A. S. H. O. at which General Merrill was chosen president to succeed G. T. McCoy, State Highway Engineer of California.

General Merrill's election to the presidency of A. A. S. H. O. climaxed the second of his two distinguished careers. He was graduated from the U. S. Military Academy in 1929 and from the Massachusetts Institute of Technology in 1932. He advanced through military ranks to brigadier general in 1943 and major general in 1944, when he was commander of United States forces in the India-Burma theater. Later he was chief of staff of the U. S. 10th Army.

During his far eastern service in World War II the bold and successful exploits of his troops earned them the nickname of "Merrill's Marauders."

Retired in 1947 for disability incurred in World War II, he was

A. A. S. H. O. POLICY STATEMENT ON FEDERAL LEGISLATION — 1956

The American Association of State Highway Officials urges the Congress to enact an expanded and adequate highway program early during the second session of the 84th Congress and to make funds authorized thereunder available for apportionment to the several states by July of 1956.

Further delay in taking action will cause additional critical traffic congestion and accidents, as well as create indecision at all levels of government in highway planning and construction and thereby materially retard the economy of the United States.

Any federal-aid program authorized by the Congress should be administered by the Bureau of Public Roads and constructed by the state highway departments—a working relationship

appointed New Hampshire Commissioner of Highways in 1949 by Governor Sherman Adams. He had been active in A. A. S. H. O. since that time, serving as a regional vice president in 1952 and as first vice president in 1955. During the past few years he had been closely identified with the planned A. A. S. H. O. Road Test Project soon to get under way in Illinois.

The new A. A. S. H. O. president, Rex Whitton, has been on the staff of the State Highway Department of Missouri since 1920, shortly after his graduation from the University of Missouri.

His first work was with a survey party, and he advanced through nearly every phase of highway engineering work, including 15 years as engineer of maintenance, to become the department's Chief Engineer in 1951.

Whitton has long been active in A. A. S. H. O., and has been chairman of its committee on maintenance and equipment. During the past year he served on the legislative committee, testifying before congressional committees on proposed Federal highway legislation.

that has proved so successful over the past years.

Federal Aid Increase Needed

An enlarged adequate highway program should indicate the intent of the Congress to construct the 40,000 mile Interstate System in not more than 15 years and to provide a progressive increase in the federal-aid to the secondary, urban, and primary systems. The initial authorization should be for a period of five years.

The matching of funds for the construction of the interstate system should be on a 90 percent federal and 10 percent state basis, with the matching on the other systems as now provided under existing legislation.

A 20 percent transfer provision should be allowed between secondary, urban, and primary allocations to make the highway program flexible enough to meet the most pressing needs of the individual states.

Funds for the construction of the interstate system should be initially apportioned on a basis of need as indicated by the Section 13 Study as reported by the Bureau of Public Roads, and as indicated by future successive needs estimates; such successive estimates to be made first in 1957 and in five-year intervals thereafter. The apportionment to the other systems should be on the present basis.

Moving of Utilities

The subjects of reimbursing for the moving of utilities from public highway rights of way, of labor relations and requirements, and of vehicle sizes and weights should not be included in federal statute but should be matters to be determined at the state level.

It is recommended that the Congress give consideration to the dedication of more of the general fund to road construction in view of the federal responsibility in the national defense system of highways.

... Continued on page 67

District VII

By PAUL O. HARDING
Assistant State Highway Engineer

Appraisal of Work
During Past Five Years

Freeways Report

FOUR YEARS ago I prepared a story for *California Highways and Public Works* on the role of the State Division of Highways in the development of a freeway system for the Los Angeles metropolitan area. Each year since then I have prepared a progress report, attempting to summarize what had been accomplished during the previous year. Since this present writeup is the fifth of the series it will perhaps be of interest to consider the accomplishments of the past five years.

Consideration of what has happened freeway-wise in District VII on the basis of the past five-year period is suggested because of the report just released by the California Taxpayers Association regarding population growth in this State. The figures made public by this association indicate that California's population has increased since the 1950 census, 27.2 percent—almost 3,000,000 persons additional—so that the population of California is now approximately 13,465,000. In Los Angeles County their records show a 31.8 percent increase since 1950 with the estimated population now 5,473,000. The California Taxpayers Association states that the greatest increase during the past five years in any one county has occurred in Orange county where the gain in population is 101.1 percent, with the estimated total now being 434,800.

Increase in Population

This tremendous increase in population within the area of District VII, which comprises the three counties of Los Angeles, Orange and Ventura, has brought to pass a corresponding increase in vehicular traffic on our highways. Mr. G. T. McCoy, State Highway Engineer, has just made public release of the 1955 state-wide



PAUL O. HARDING

traffic count figures. As Mr. McCoy says, on a state-wide basis the traffic volumes during the year 1955 have increased 8.79 percent. The rate of increase in traffic on the freeways in this district has considerably exceeded this figure. The increase in average daily traffic on the freeways of this area, comparing the traffic today with traffic one year ago, and also five years ago is shown by the following:

	1955	1954	1950
Hollywood (4-level westerly)	180,000	168,000	64,000
Pasadena (Elysian Park)	112,000	110,000	56,000
Santa Ana (Soto Street)	113,000	90,000	25,000
San Bernardino (Soto Street)	88,000	80,000	25,000
Harbor (4-level southerly)	160,000	125,000	—
Colorado (at Linda Vista)	27,000	30,000	—
Long Beach (Pacific Coast Highway)	31,000	10,000	—
Using 4-level interchange	250,000	200,000	—

From the above tabulation it will be recalled that five years ago there were only disconnected portions of the four major freeways in the Los Angeles area that were then open to public traffic and that these sections at that time had not come into full use.

Freeways Completed

The lengths of full freeways in District VII that were completed during 1955 are the following:

Santa Ana Freeway— From First Street, Santa Ana, to Browning Boulevard	2.4 miles
Golden State Freeway— From Sepulveda Boulevard to north city limits of Los Angeles	3.0 miles
Colorado Freeway— From Avenue 64 to Eagle Rock Boulevard	0.8 mile
Foothill Freeway— From Hampton Road to Montana Street in Flintridge area	1.8 miles
Total	8.0 miles

I find in reviewing my four previous articles that each one contains some reference to current and past legislative enactments that affected financing of highway and freeway construction. Therefore, it will perhaps be in order at this time to summarize briefly state highway financing.

Highway Financing

State highway construction was first started in California in 1912 from a bond issue of \$18,000,000 passed by the people in 1910. A second bond issue of \$15,000,000 was voted by the people at an election in 1916. Again in 1919 a \$40,000,000 bond issue was voted. Then the 1923 Legislature passed an enactment creating a 2-cents-per-gallon gasoline tax. This was the start of the pay-as-you-go financing. In 1928 this tax was increased to 3 cents per gallon, with 1 cent going to

counties and 2 cents reserved for maintenance and improvement of the state highway system.

In recognition of city problems, by legislative authority, Statutes of 1931, a policy of cooperation in construction was inaugurated for those portions of the highway routings within the cities, and in 1932 several miles within cities were improved by state and local cooperation. In further recognition of this problem Chapter 767, Statutes of 1933, provided that the Department of Public Works would annually expend from the state highway fund an amount equal to the net proceeds of one-fourth of 1 cent per gallon tax of motor vehicle fuel upon state highway routes within incorporated municipalities. Still further recognition of this problem was given by the Legislature in 1935 which provided an additional one-fourth cent of the gasoline tax for maintenance, rights of way, construction or improvement on streets of major importance within the cities, off the state highway system.

Gas Tax Increase

Both the 1933 one-fourth cent and 1935 one-fourth cent were taken from the state highway 2 cents of gas tax, thus reducing the expenditures upon the state rural system to 1½ cents. Coincident with the legislation reallocating these gas tax funds, the Legislature in 1933 and 1935 added some 6,800 miles of rural county roads to the state system, which, with the extended routes through the cities, resulted in a total state highway system of approximately 14,000 miles.

The Collier-Burns Highway Act of 1947 increased the gas tax to 4½ cents per gallon and supplemented this by other motor vehicle fees, which, however, were more than offset by a 2-cents-per-gallon allocation to cities and counties for roads and streets not on the highway system. The 1953 Legislature increased the state gasoline tax to 6 cents per gallon, also increasing supplemental taxes in proportion, but made this increase effective for only two years, after which both the gas tax and supplemental fees were to be decreased to the 5½-cent equivalent. The 1955 Legislature passed enactments to prevent the ½-cent-



What Does It Mean?

Over the length and breadth of California wherever the far-flung work of the Division of Highways, Department of Public Works, is in operation, this insignia will be found on automobiles, trucks, tractors, buildings, and other places too numerous to mention.

This familiar insignia attracts the casual attention of the public and the more or less added interest of the thousands of employees associated in the division, but the query of this article is directed to the meaning of the Latin phrase on the inner circle of the emblem: "Robur directum scientia est via fortunae."

Ask any number of officials or employees of the department what the sentence means and a negative answer is the reply. Here is the answer: "Labor directed by science is the way to fortune."

per-gallon decrease and make the 6-cents-per-gallon state gasoline tax and supplemental fees in continuing effect.

Right-of-Way Problem

In the metropolitan Los Angeles area those freeways of the system providing the greatest traffic service are, naturally, those which lie through the most densely settled areas where the right-of-way problem is extremely acute, and may entail expenditures of more than 50 percent of the total cost of the project. Planning for such freeways must be on the basis of providing sufficient right-of-way funds to permit construction for traffic relief at the earliest possible date. The advance purchase of rights of way while properties are still unimproved has become recognized as the most effective planning and cost control in the

protection of future freeways. By following this procedure, very considerable savings to the State have been effected, particularly where major highway improvements are involved such as freeways located on new alignment which require extensive widths of right of way through potential subdivision areas.

Legislation was adopted by the State Legislature in 1952 whereby the sum of \$10,000,000 was provided in a special fund known as the "Highway Right-of-Way Acquisition Fund," for the express purpose of acquiring rights of way on which development was imminent. This fund was later changed to a revolving fund and increased by \$20,000,000, making a total of \$30,000,000 available on a state-wide basis.

Summary of Savings

A brief summary of the advance acquisition of rights of way and the estimated savings realized in District VII, which has been accomplished to date through this fund, is as follows:

Fiscal year ending	No. parcels acquired	Am't paid from Hwy. Acq. Fund	Estimated savings
6-30-53	28	\$269,400	\$1,614,000
6-30-54	363	3,873,550	27,111,000
6-30-55	522	5,092,544	42,000,000
Total	913	\$9,235,494	\$70,725,000

In addition to the above, the California Highway Commission has authorized the acquisition of other properties amounting to \$14,000,000 with an anticipated additional saving of \$90,000,000. Acquisition is progressing rapidly on these other properties.

In this five-year period, 1950-55, the record of accomplishment reveals 11,629 parcels of land acquired at a total cost of \$137,466,464. Right-of-way clearance work has increased correspondingly, a total of 4,435 houses having been sold and removed from the right of way by the House Sales Section for a total return to the State of \$7,706,716. Tabulation showing this record year-by-year follows:

Fiscal year ending	No. of parcels acquired	Total cost	No. of houses sold	Am't received from house sales
6-30-51	1,733	\$16,538,846	599	\$1,200,347
6-30-52	1,415	15,244,133	343	746,747
6-30-53	1,616	19,051,707	334	699,568
6-30-54	3,390	40,971,476	1,508	2,252,396
6-30-55	3,475	45,660,302	1,651	2,807,658
Total	11,629	\$137,466,464	4,435	\$7,706,716

Removal of Houses

In connection with this sale and removal of houses from the right of way, it is of interest to note that notwithstanding the fact that certain areas of land acquired for rights of way are removed from the tax rolls, over 90 percent of the buildings which are sold and removed in the clearance of right of way are relocated to other locations and replaced on the tax rolls, rehabilitated and modernized in the relocation process to add years to their useful life. In this manner, what might appear to be a loss of taxable property assessed by the county is more than offset. Past experience has proven that

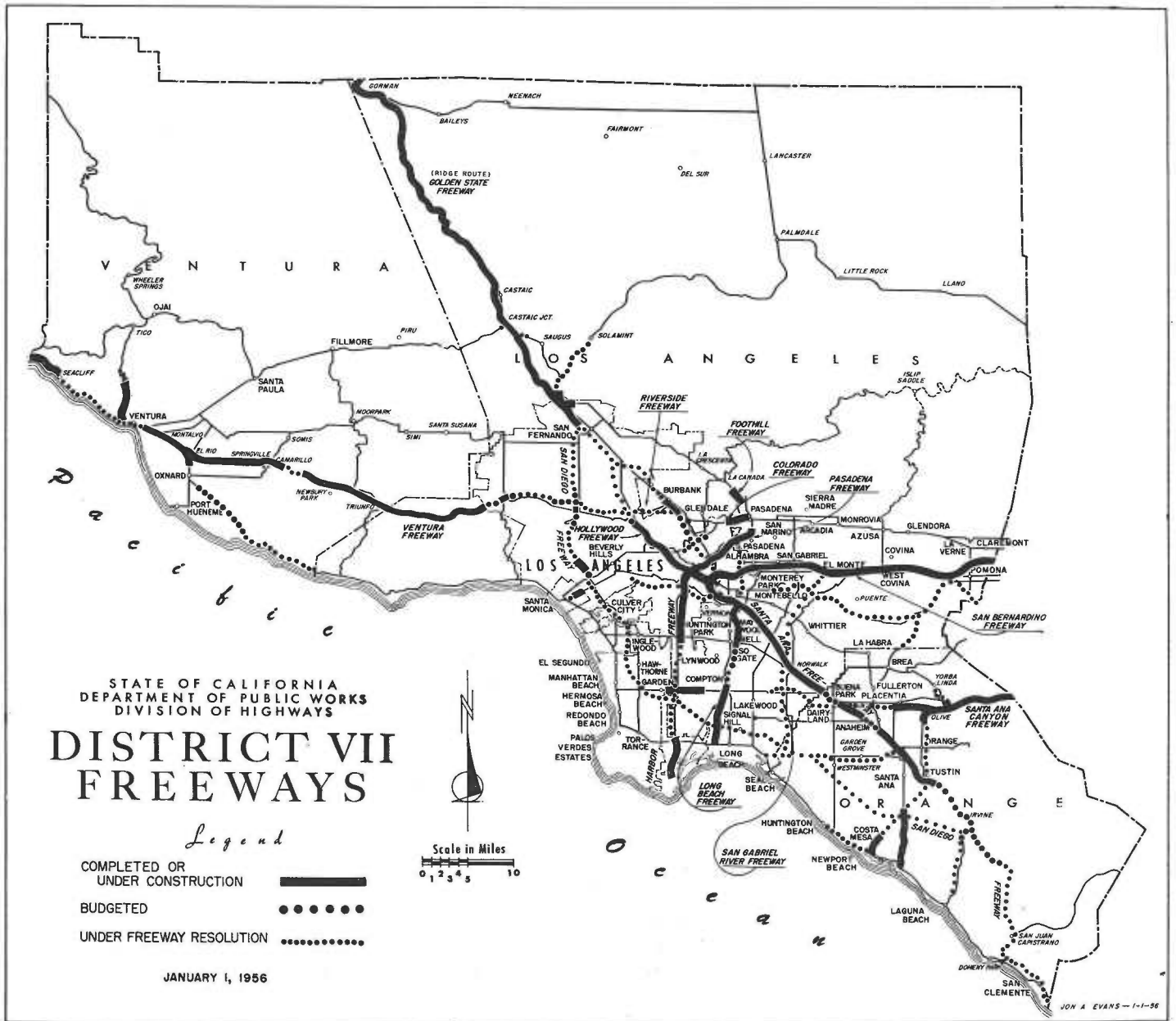
the appreciated value of properties abutting freeways, particularly in industrial areas due to improved accessibility, creates increased assessed values to such an extent that freeway right-of-way acquisition does not reduce the value of taxable property but decidedly increases it.

Another very important activity of the District Right-of-Way Department is the rental of buildings on lands acquired and held for future freeway construction. In such cases, all state-owned properties suitable for renting are rented or leased under rental agreement containing adequate cancellation clauses until shortly before

highway construction commences. A record of the income derived from the rentals of these properties is as follows:

<i>Fiscal year ending</i>	<i>Units</i>	<i>Yearly earnings</i>
6-30-51.....	332	\$180,680
6-30-52.....	587	304,532
6-30-53.....	1,090	418,290
6-30-54.....	1,305	597,731
6-30-55.....	1,742	888,252

The Division of Highways is forced to be in the rental business in order to keep houses occupied until the time arrives that the right of way has to be cleared for construction. This is the only effective way of preventing van-



dalism and keep a neighborhood from becoming rundown and deteriorated. While the rents received total substantial sums, the other considerations are of even greater importance.

Work of Legal Staff

As we have noted above, while every effort is made to secure rights of way by amicable negotiation with property owners, in some instances it is necessary for the State to resort to eminent domain proceedings and start condemnation of private properties. The number of parcels carried through condemnation is only about 2 percent of the total number acquired, the other 98 percent being consummated by negotiation and mutual agreement. The condemnation of rights of way for District VII and the other south-

ern counties is carried out by the legal department. During the five-year period 1950 to 1955 the district staff has carried out 248 condemnation suits for rights of way, totaling \$4,101,495.

Before right-of-way agents start negotiations with property owners for areas that are needed for rights of way for freeways and other state highways the fair market value of each parcel is determined. The appraisal of property is conducted in a detailed, comprehensive manner not only ascertaining all of the salient features of each particular piece of property but also making an extensive search of the records to determine the sale price of comparable or similar properties in that particular neighborhood. It is in this painstaking and careful manner, with the review

and approval of the Sacramento headquarters office, that the fair market value of each parcel is determined.

Condemnation Policy

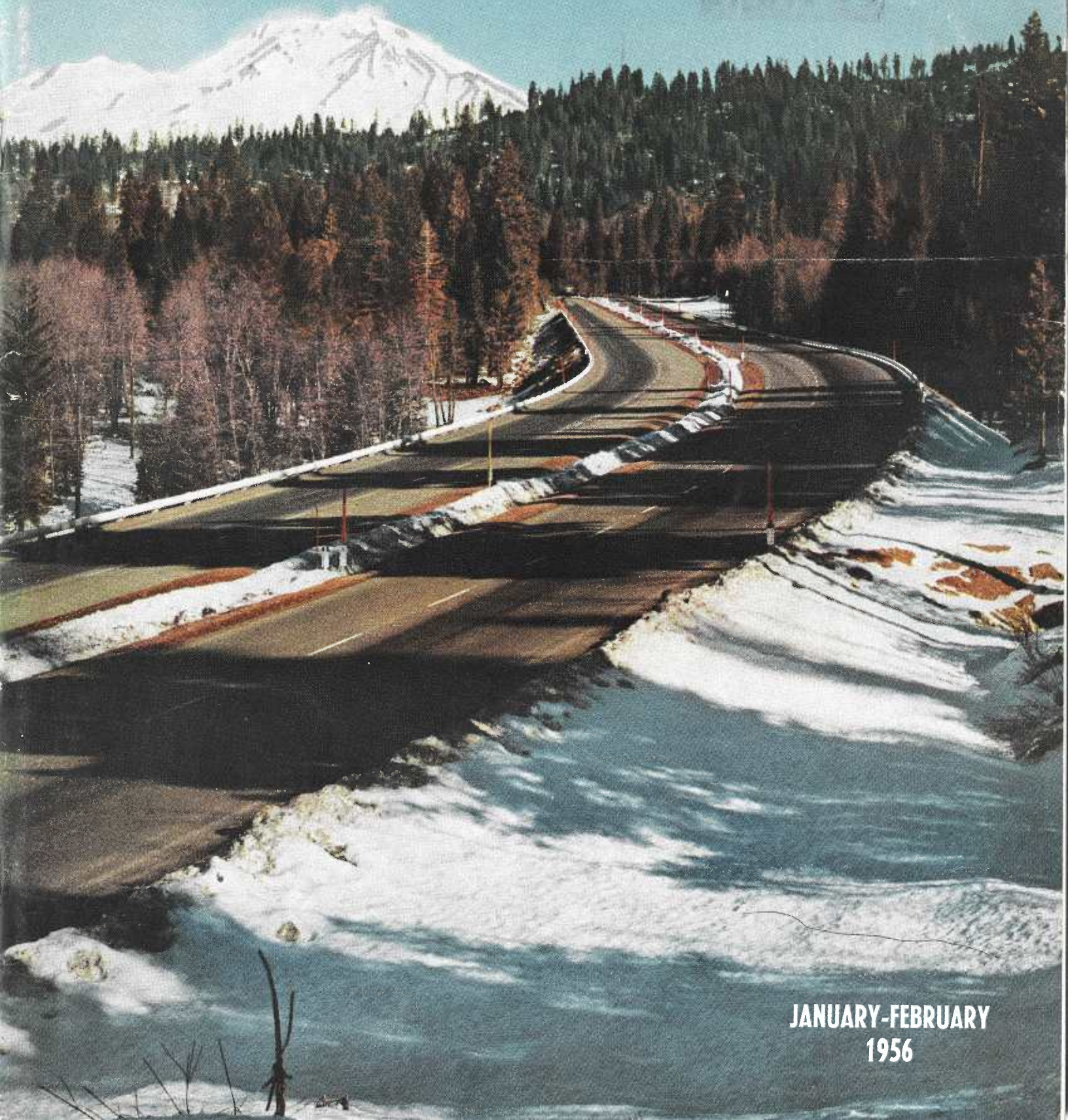
If the right-of-way agents, after opening negotiations with property owners, are unable to reach a satisfactory settlement with them, it is then necessary for the State to resort to condemnation proceedings. Were it not for the right of eminent domain, highway improvements would bog down and many times be impossible to carry out. The right of eminent domain is an important right of the people and its exercise is very necessary in order that state highway projects and freeway projects go forward, otherwise one recalcitrant property owner could hold up a project indefi-

STATUS OF DISTRICT VII FREEWAY PROJECTS—JANUARY 1, 1956

	Total miles	Completed projects		Under contract		Right of way costs	Total costs to date
		Miles	Constr. costs	Miles	Constr. est.		
Pasadena Freeway 4-Level Structure to Glenarm St., Pasadena.....	8.2	8.2	\$10,434,200			\$1,009,100	\$11,443,300
Hollywood Freeway Spring St. via Cahuenga Pass to Junction Golden State Freeway near Wentworth St.....	16.8	10.0	28,949,200		172,500	28,360,000	57,481,700
Santa Ana Freeway Spring St. (Los Angeles) to Junction of San Diego Freeway near El Toro.....	42.8	32.4	39,165,000	2.6	4,983,600	16,480,000	60,628,600
San Bernardino Freeway Santa Ana Freeway near Los Angeles River to San Bernardino County Line in Claremont.....	30.7	15.7	19,007,500	15.0	15,537,700	16,015,000	50,560,200
Harbor Freeway 4-Level Structure to San Pedro.....	22.4	2.9	11,221,800	8.4	18,556,500	48,600,000	78,378,300
Long Beach Freeway Pacific Coast Highway in Long Beach to Huntington Dr. in South Pasadena.....	21.5	7.9	10,891,100	4.8	8,671,200	18,435,000	37,997,300
Golden State Freeway Junction of Olympic and Santa Ana Freeway near Soto St. to Kern County Line.....	72.7	47.2	15,646,600	2.4	5,102,700	24,640,000	45,389,300
Ventura Freeway Vineland Ave. to S. County Line Ventura and N. County Line Ventura to Santa Barbara County Line.....	68.7	39.1	12,484,100		53,000	11,148,000	23,685,100
San Diego Freeway Golden State Freeway near San Fernando Reservoir to San Diego County Line.....	93.7		310,300	1.2	2,256,300	15,335,000	17,901,600
Colorado Freeway Eagle Vista Dr. in Eagle Rock to Holly St. in Pasadena.....	2.2	2.2	6,139,200			2,295,000	8,434,200
Foothill Freeway Hampton Rd. to Montana St. in Flintridge.....	2.0	2.0	2,107,200			624,000	2,731,200
Glendale Freeway Los Angeles River to Ave. 36, near Eagle Rock Blvd.....	1.6					3,005,000	3,005,000
Artesia Freeway Normandie Ave. to Santa Fe Ave. and Palo Verde Ave. to Santa Ana Canyon Freeway.....	21.7	1.9	1,010,900	6.2	2,877,600	2,140,000	6,028,500
Santa Ana Canyon Freeway Newport Beach to Riverside County Line.....	27.4	12.7	2,990,600			1,258,000	4,248,600
Ojai Freeway West Main St. in Ventura to 0.4 mi. north of Foster Park.....	5.7			4.1	2,100,000	1,000,000	3,100,000
Other Freeways Covered by Resolution of Adoption by Highway Commission.....	127.7					3,075,000	3,075,000
Total.....	565.8	182.2	\$160,357,700	44.7	\$60,311,100	\$193,419,100	\$414,087,900

CALIFORNIA

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1956

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Sacramento

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Address communications to

CALIFORNIA HIGHWAYS AND PUBLIC WORKS
P. O. Box 1499
Sacramento, California

Storm Damage

By GEORGE F. HELLESOE
Maintenance Engineer, Division of
Highways

*Repair of Highways Will
Cost Millions of Dollars*

Sets New Record

AN INTENSE, tropical type storm enveloped the northern and central portion of the state during the week prior to the Christmas holidays. Most of the major drainage systems as far south as the Tule River in Tulare County were deluged by abnormal amounts of rain, resulting in an unprecedented runoff and causing damage to the state highway system, as presently estimated, at over \$11,000,000.

In addition, damage to county roads has been estimated at approximately \$19,500,000 and to city streets at some \$700,000, for an over-all total of public road damage in excess of \$31,000,000. Approximately \$4,500,000 is required for emergency repairs—making it possible to reopen roads to traffic—while the balance is the estimated cost of rebuilding the damaged facilities for permanent use.

Practically all major north-south highways in the area were at one time or another closed by flooding, requiring the detouring of through traffic via circuitous routes which in some cases were later also engulfed by the spreading flood water. All transcontinental routes over the Sierra-Nevada Range, as well as major east-west laterals through the Coast Range north of San Francisco, were blocked for a time by slides, high water, washouts or bridge damage.

As the immediate functions of maintenance personnel under such conditions are the preservation of the highway structure wherever possible, the marking of dangerous locations or the barricading of impassable sections of road, and the establishment of detours, around-the-clock operation by all available personnel of the Maintenance Department assisted by representatives of the Bridge Department

By **FRANK B. DURKEE**
Director of Public Works

On behalf of Governor Goodwin J. Knight and myself, I desire to express our appreciation for the unselfish devotion to duty displayed by the engineers and personnel of the divisions of the Department of Public Works during the December and January floods.

Many of these employees worked around the clock during the critical period foregoing their Christmas and New Year's holidays. The tasks confronting State Highway Districts I, II, III, IV, V, and VI, were stupendous. Major efforts were required for emergency repairs to damaged roads to permit resumption of traffic.

Special commendation is due the maintenance personnel of the Division of Highways and engineers of the Division of Water Resources who labored ceaselessly during this period. The latter division worked with U. S. Army Engineers, the State Reclamation Board, military personnel from Camp Beale, and volunteer crews to save levees on the Sacramento, Feather, Yuba, San Joaquin rivers, and their tributaries, and to rescue persons trapped in the flood waters.

A word of appreciation is due the Communications Section and also photographers of the department who were out day and night compiling a pictorial record of the unprecedented floods.

To all who helped we extend our thanks and commendation.

and the Engineering and Supply sections were required for many days to carry out this responsibility.

At times the only direct means of communication between the field forces and their headquarters or between the districts and Sacramento was by means of the division's radio system.

Rainfall amounts for the storm which began at many points in Northern California on December 16th were exceptional at many locations. The Weather Bureau reports that at Hoberg's in the Coast Range south of Clear Lake 19 inches of rain fell in two days—December 19th and 20th. An equal amount was reported for a five-day period at Brush Creek in the Feather River basin. Camptonville on the Yuba River received more than 13 inches of rain on December 22d and 23d. Snow melted by warm rain which fell in some areas of the Sierras to above the 7,000-foot level added to the volume of flood waters which cascaded from the canyons.

As flood waters began to recede and the magnitude of the damage became apparent, outside equipment and labor were rapidly recruited from the construction and logging industries and other sources. Working under authority of the Declaration of Emergency declared by Governor Knight, heavy earth-moving equipment of every description was concentrated on the task of restoring travel on the highway network. A number of emergency contracts were let for the construction of temporary bridges where major bridge damage was sustained. At one location a Bailey type bridge was used to temporarily replace a lost bridge span.

Repair of road damage and the opening of transcontinental routes

across the Sierras to unrestricted traffic was further hampered early in January by exceptionally heavy snowfall and blizzard conditions which closed the Donner Summit and Echo Summit roads for short periods.

The rapidity with which severely damaged roads were made passable to traffic serves to indicate the perseverance, resourcefulness and stamina of the personnel of the division who are now faced with the gigantic task of restoration of the highway system following one of the most severe storms in the history of the state.

District I—\$2,950,850

By RUDOLPH BERGROTH
District Office Engineer

December 21, 1955, will long be remembered in a great portion of California and especially in Northern California. Unprecedented rainfall in the watersheds of all rivers and streams rapidly filled streams bankfull and, before the day passed into history, it was obvious that flood stages would be recorded; and, in most areas subject to floods and damage by high water, a major disaster was in the making.

The date to Humboldt County has double significance. The ironical coincidence is that December 21, 1955, was the anniversary of the 1954 earthquake that rocked the Humboldt Bay area, causing considerable damage and leaving Humboldt County with an uninhabited courthouse and the City of Eureka likewise without its city hall. It is further odd that the immediate Eureka area during the flood period received no considered abnormal rainfall—the amount being far less than surrounding areas and other stations throughout Northern California.

Floods Over Wide Area

In Northwestern California, however, the 1955 flood has shunted the earthquake with its seemingly disastrous damage into the background. The destructive flood and high water were prevalent over a wide area, affecting numerous communities and facilities and, at this writing, no firm estimate of the dollar value of the damage is yet available, but it is conceded by all that it will total many millions of dollars.

District I of the Division of Highways, with headquarters in Eureka, includes the Counties of Mendocino, Lake, Humboldt, Del Norte, and portions of Trinity and Siskiyou. The district contains 14 state highway routes totaling 853.61 miles of rural state highways.

To those familiar with California and its varied weather conditions, it will be noted that this district contains those counties well known for heavy rainfall.

Long History of Damage

The district's highway system has always been plagued by slides, slipouts, washouts, etc., as brought about by heavy rains. Hardly a highway project is designed in the district without considerable study entering into it involving drainage structures with adequate openings, embankment stabilization, flattening or benching cut slopes, placing horizontal drains, embankment protection along streams, and other features necessary to counteract the ravages of heavy rainfall with its resultant water-soaked earth and bankfull streams. Old-timers will recall the first constructed highways in the district that did not contain these modern design features to provide a stable, closure-free highway during winter months, and slides and slipouts were an accepted winter maintenance problem.

Along Route 1 (US 101, Redwood Highway) in years gone by, it was a foregone conclusion that road closures would probably occur at Lanes Flat, Bridges Creek Slide, Red Mountain Bluffs, Blue Slide, Hartsooks Slide, Garberville Bluffs, Redway Bluffs, Shively Bluffs, Greenlaw Bluffs, and other locations remembered by "old-timers." As old sections of highway were reconstructed or superseded, utilizing features to eliminate slides, slipouts, and washouts; and old slides became stabilized by the constant removal of material over the years, or corrective measures were applied, road closures during the winter became less common.

Stories and reminiscings of the trials and tribulations in keeping roads open in the old days, and the high waters of 1915 and 1937 were cast into the background by the Christmas week flood of 1955.

Every Route Damaged

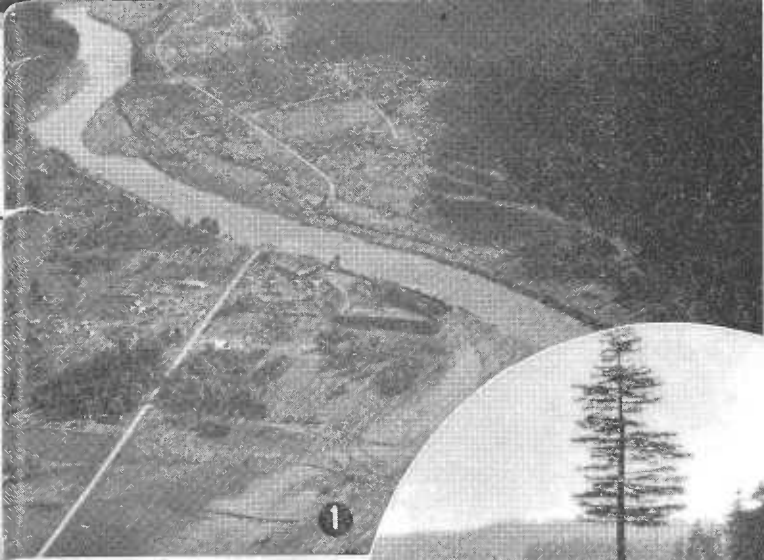
Every route in the district sustained damage ranging from comparatively inconsequential damage to destruction of catastrophic proportions. When the full details are summed up it will, in all probability, show that the District I highways suffered the most extensive and serious damage of the 11 highway districts in the State of California. Further, it will undoubtedly prove to be the most extensive and widespread damage ever sustained by portions of the California State Highway System at one time.

The major streams, which were generally in high-water stages in the early part of the week, and the increasing rainfall in all the major watersheds soon resulted in record-breaking gauge heights and discharges, and the devastating high water and inundation of contiguous areas. The highways utilizing the water level grades of the various streams to traverse the rugged terrain of the district were extremely vulnerable to damage. First reports of approximate high-water elevations at various locations were discounted and charged up to hysteria; however, a number proved to be essentially correct.

Astounding Discharges

Estimated discharges of some of the major streams during full flood conditions are rather astounding. The South Fork Eel River, near Miranda, was discharging 136,000 cfs., which is approximately twice as much as ever recorded. The Eel River at Scotia was discharging 470,000 cfs., establishing a record high. The Van Duzen River at Dinsmore recorded 21,500 cfs.; the Mad River at Forest Glen 33,000 cfs., and approximately one-half mile upstream from the US 299 crossing, 80,000 cfs. Redwood Creek at Orick 45,000 cfs., and the Klamath near Somes Bar was recording 180,000 cfs., and near Klamath Glen 400,000 cfs. The Smith River near the US 199 crossing recorded approximately 170,000 cfs. Rainfall such as that in Branscomb area of Mendocino County—which totaled 31.82 inches in 10 days prior to December 26th—accounts for these discharges.

The streams, having generally crooked courses, rugged beds and



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1. Sign Route 96 in Hoopa Valley—Flood demolished bridge across Trinity River, center.
2. Portion of steel bridge at Hoopa washed 2,000 feet downstream.
3. On US 101 near Dyerville—Embankment washed out.
4. US 101 along Eel River at Shively—Bluffs washed out.
5. Pepperwood on US 101 flooded. Note pile-up of houses.
6. Weott on US 101 wrecked by Eel River.
7. Embankment washed out by Trinity River on Route 84 south of Hoopa.

shore lines, turbulence and eddies, together with high velocities, had an extremely damaging effect on the highway facilities subjected to inundation. To add to the damage caused by parallel creeks and rivers, cross streams and normally small water-courses became small raging torrents overtaking the capacities of drainage structures, with resultant flooding and washouts of roadbeds.

First Closure

The first closure in the district on Wednesday, December 21st, will probably never be known, but the first indication of trouble came from the southern portion of the district. The streams flowing southerly, with watersheds in the area receiving intense and continued rainfall, had comparatively short distances to travel to the lowlands subject to flooding. Possibly Route 16, the Hopland-Lakeport highway, was the first closure when it was closed at 5.30 p.m. on December 21st, due to high water in the Russian River. As rivers and streams continued to rise, reports came over the district's radio communication system and into the district office that evening in rapid sequence from all parts of the district, and the seriousness of the situation was made obvious.

By morning of December 22d, all routes were closed and any detailed information was impossible to obtain since telephone communications were out throughout the area and many portions of the highway system were inaccessible, with waters still rising to the crests in the lower basins of the streams. The reports received revealed that all the various damages causing road closures were present: slides, washouts, settlements, bridges and approaches damaged, and, although it was not realized at that time, even houses floating onto the traveled way at several locations impeded access into flooded areas when water receded.

In Southern Mendocino and Lake Counties, although road closures occurred by flooding the highway in these areas, the damage incurred was inconsequential in the over-all district picture, and all highways were opened as soon as waters receded.

On Route 15 (Sign Route 20), approaches at the easterly end of the North Fork of Cache Creek bridge were partially washed out and slope paving damaged.

On Route 70, Ukiah-Talmage Road, the high water of Russian River caused considerable pavement damage.

On Route 48 (Sign Route 128) some washouts occurred due to scour by high water in the Navarro River.

Mendocino Not Hard Hit

At Anderson Creek and Dry Creek, cross streams changed channels at crossings, but not to any irreparable or serious extent, and, in general, the highways under the Boonville maintenance territory jurisdiction were open to all traffic upon recession of high water. Route 56 (Sign Route 1), on the Mendocino Coast, gave no serious trouble.

On Route 1 (US 101) the first serious damage occurred at Longvale, where approaches to the bridge across Long Valley Creek Crossing No. 1 were washed out. As soon as waters receded approaches were restored. From this point to Laytonville, actual damage was relative nominal, generally consisting of some washouts, eroded shoulders, and minor slides.

The sector of Route 1 (US 101) from Laytonville to Scotia, a distance of approximately 105 miles, will, it is hoped, retain the record for all time as incurring the most extensive and serious damage ever inflicted upon such a length of state highway during a single storm. Within this section, the concentration of damage occurred between Leggett and South Scotia Bridge, a distance of approximately 68 miles. In this 68 miles, US 101 parallels the South Fork of Eel River at generally nominal elevations above streambed, and previously recorded high waters, and joins the main Eel River at Dyerville.

Slides and Slipouts

Damage to this section was of all descriptions: major and minor slipouts and slides, culvert blockage, undermined pavement, and washed out shoulders at discouraging intervals. The only major structure damage was the settlement of the box abutment at

the northerly end of the Smith Point Bridge, south of Benbow.

It should be noted that some of the "old-time" trouble spots previously mentioned herein again came into questionable prominence and persisted in giving trouble at this time. Slides at Greenlaw and Shively Bluffs continue to necessitate attention. The old Blue Slide washout south of Benbow was reactivated to a serious degree and is one of the major problems in restoration efforts.

The communities of Myers Flat, Weott, and Pepperwood were almost completely inundated, and receding waters left silt on the highway traveled way to depths of over two feet. Pioneering an emergency road through the Pepperwood area was further impeded by buildings that had floated onto the traveled way. Motel cottages, overturned and practically completely demolished, had floated onto the traveled way and become wedged between redwood trees in a jumbled mass, necessitating bulldozing to clear the way. In Pepperwood proper, two-story, story-and-a-half, and single-story houses reposed on the traveled way when waters receded. As they were, to a great extent, intact and single-lane traffic was able to shoofly around them, arrangements were made by the Division of Highways with professional house movers for the removal of these houses from the highway right of way in a repairable condition.

From South Scotia Bridge to Fortuna, where roadway grades were below this particular high water elevation, damage consisted mainly of erosive action on the generally low embankments and shoulders, and debris and drift on the highway.

Damage North of Arcata

From Fortuna to Arcata, the highway remained normal. Beyond Arcata, at what is known as Arcata Bottoms and where the Mad River traverses the flatlands at the northerly extremity, the damage to highway facilities by the overflow of Mad River was of major consequence. The approach spans and approaches to the Turner Draw Bridge were washed out and approaches to smaller structures across



8. Weott where high waters were to awning height.



9. Pepperwood inundated by Eel River.

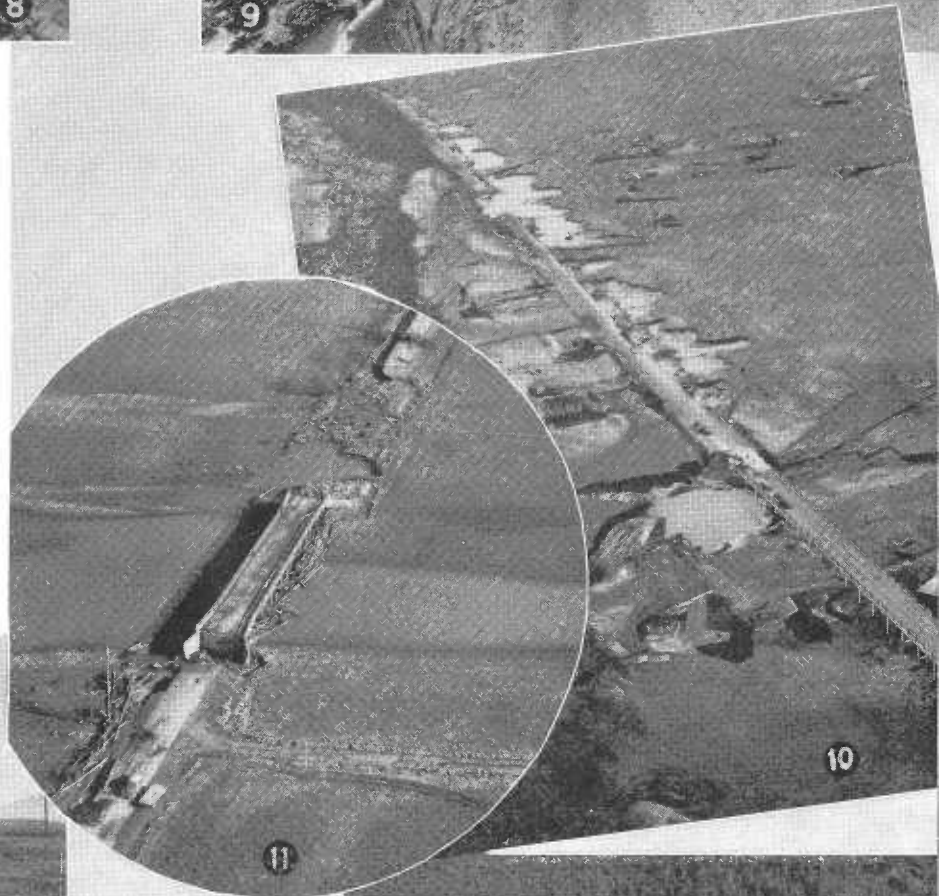
10. Sign Route 1 between Fernbridge and Ferndale—Water flowed over many square miles.

11. Sign Route 1 between Ferndale and Fernbridge—Embankments destroyed by Eel River.

12. Sign Route 1 near Ferndale—Box culvert washed out.

13. US 299 along Trinity River west of Del Loma—Masonry wall, left, topped by high waters.

14. US 101 at Dyerville on south fork Eel River. Note large slides blocking highway on left.



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overflow channels known as Moore Draw and Boyd Draw were washed out. At the major structure in the area, the bridge across Mad River, four spans of the timber approach at the north end of the structure were completely demolished.

From Arcata to Orick, Route 1 suffered what is considered negligible damage in this instance. At Orick, Redwood Creek overflowed its banks and damaged levees constructed after the Redwood Creek flood of 1953, and Orick was again flooded. Highway damage was not consequential.

Major Catastrophe

As we go into Del Norte County, the major catastrophe of the area occurred at the Town of Klamath, where almost complete destruction of the town resulted from the overflow of the Klamath River. The northerly approach to the Douglas Memorial Bridge, carrying US 101 across the Klamath River, was washed out.

From Klamath to Crescent City and on to the Oregon line, Routes 1 and 71 (US 101) suffered no extraordinary damage.

Although the Smith River registered record high water, Route 1 (US 199), from Crescent City to Grants Pass, Oregon, which follows the Smith River Canyon, the general damage consisted of no extraordinary slides and some washouts, but not of particularly serious nature. Route 81, North Bank Road connecting US 101 and US 199, did suffer some washout damage.

Mad River Bridge

On Route 20 (US 299) partial washout of approach fills of the Mad River Bridge occurred. On a series of forest highway projects under construction between Berry Summit and Willow Creek by the U. S. Bureau of Public Roads, major slides, slipouts, and washouts were prevalent, which made road opening a difficult process.

From Willow Creek to the district boundary, where the highway follows the Trinity River, dropping to "water grade" at Cedar Flat, washouts, slipouts, and slides were prevalent.

The Cedar Flat Maintenance Station, formerly located on a small flat

area between the highway and Trinity River, is a complete loss—not a sign of the foreman's cottage or truck shed with gas tank remains—and the former site is completely washed away. The Cedar Flat Bridge was in jeopardy for a period of time as the raging waters topped the deck of the bridge and threatened to demolish the structure. The easterly approach embankment, however, finally was penetrated by the river and pressure on the structure was relieved.

Hoopa Bridge Destroyed

Route 84, Sign Route from Willow Creek to Weitchpec, suffered major damage by slides, slipouts, and washouts, including complete loss of the steel truss bridge, together with center pier, that afforded crossing of the Trinity River at Hoopa. The main span of this steel structure was rolled downstream and finally came to rest approximately 2,000 feet from the bridge site.

Other serious damage in this area was incurred by Route 46, Martins Ferry to Weitchpec, and up the Klamath River through Orleans, on to the district boundary. Within these limits, the approaches to Bluff Creek Bridge were washed out, with Bluff Creek breaking a new channel at the location.

Route 56 (Sign Route 1) in Humboldt County, from Fernbridge to Ferndale, presented extensive damage when flood waters from the Eel River receded. The concrete bent approach at the south end of Fernbridge Bridge across the Eel River was seriously damaged. Bridge approaches were washed out at other structures and a large box culvert at Arlynda Corners was completely destroyed. Intervening roadway had shoulders completely washed out and the concrete pavement undermined for a distance of as much as six feet.

Van Duzen River

High waters in the Van Duzen River and Yager Creek resulted in damage and road closures on Route 35 (Sign Route 36). A pier on the Yager Creek Bridge at Carlotta was apparently undermined and jarred loose by

heavy drift, necessitating closing of the bridge.

Cooperation of the Northwestern Pacific Railroad resulted in an agreement between the Division of Highways and the railroad to temporarily plank the parallel railroad bridge so that light traffic could make the Yager Creek crossing.

Farther east, on Route 35, in the Grizzly Creek area, major washouts and slides seriously hampered road opening. Beyond Bridgeville no extraordinary damage was inflicted on Route 35.

Pioneering "trails" into stricken areas to bring in assistance and emergency vehicles was the first order of business by the maintenance crews. This also allowed some appraisal of the damage and immediately instigated restoration activities.

Extra Forces Employed

Field offices immediately hired privately owned equipment and additional manpower to supplement regular state maintenance equipment and personnel in an endeavor to open roads as soon as possible. Additional state forces were brought in from areas suffering lesser damage to the Laytonville-Scotia area where, as previously mentioned, the most lengthy section of highway was damaged severely.

Within this area, during the height of efforts to open the road, there were engaged in the work approximately 150 pieces of equipment of various kinds and in excess of 200 men. This was the greatest concentration of men and equipment ever assembled on a sector of state highway. Equipment belonging to approximately 70 different companies and individuals comprised this assemblage of equipment.

At this writing, full-scale restoration activities are still underway and many sections of highway are still in no condition to handle traffic in a normal manner. Men of the Bridge Department are in the district handling, in their usual able manner, the necessary bridge work.

Damage Almost \$3,000,000

At this time it is estimated that the dollar value of the damage to District

I state highways will approximate \$2,950,850. The greater portion of the damage occurred in Humboldt County, where it is expected that \$1,901,850 will have to be expended to restore highway facilities. The least amount of damage occurred in Lake County, where it is estimated to amount to approximately \$20,000.

It must be mentioned that companions to the state highways in land transportation facilities within the district; namely, the county roads and the Northwestern Pacific Railroad, also suffered severe and extensive damage.

Of the counties comprising the district, Humboldt's county roads incurred the greater portion of road damage. As an indication of the magnitude of the Humboldt County Road System damage, surveys of the situation have revealed that some 38 bridges have been damaged or completely lost, with indications that approximately 19 are completely out or will require complete replacement.

The Division of Highways is rendering Humboldt County emergency assistance at this time by arranging the financing and emergency contracting for the restoration of county roads and bridges on a priority basis to open roads into various areas to re-establish land transportation to communities.

The Northwestern Pacific Railroad has a major restoration job to contend with, including replacement of sidehill trestle along the precipitous Scotia Bluffs, along the Eel River just downstream from Scotia.

Story Incomplete

This would be only a very small part of a complete saga of the 1955 California flood, or even of the complete story of the floods within the area covered by this brief. All of the story will probably never be put together. Stories of destruction, tragedy, and despair, and probably humor as well, would have to be tracked down. We know there are innumerable factual stories of friend helping friend, neighbor helping neighbor, and stranger helping stranger, and stories of cooperation and extreme endeavor on the part of individuals, agencies,

and others throughout the area during the length of the emergency.

We have heard of stories wherein strangers, going in opposite directions and anxious to get to homes not too distant, were confronted with a wash-out who then and there traded pickups to continue in their desired direction, after making arrangements to return each others vehicles at a later date.

We also heard a story of a large bobcat seen hanging onto a log being carried down a swollen stream. He was snarling, but desperately hanging on. Possibly humorous, knowing that cats dislike water, but certainly a tragedy to the bobcat.

As for the Redwood Highway and other routes, they will be back in normal service and the vacationists and tourists from all parts of the Country will be traversing them in increasing numbers. They will marvel at beautiful vistas of placid, shimmering streams, snap pictures of these vistas unaware that these streams could show up the futility of man against the natural elements. They will look with askance and doubt at the "native" as he shows them where the water was in his house during Christmas week, 1955.

District II—\$2,586,145

By J. W. TRASK
District Engineer

The one predictable feature of California weather is that it is unpredictable. This was amply demonstrated in the Redding district this fall and early winter.

Normally, beginning in September, there are some fall rains. These continue intermittently, with some snow in the higher altitudes, until about mid-December. Then storms of greater intensity and duration occur and the snow blanket is built up in the mountains.

This year there were no fall rains. About the middle of November, a heavy snow fell over most of the district. This was followed by more or less continued intermittent storms that put rain in the valleys and snow in the highlands. Even this was at variance with the normal pattern. It was much heavier in the Trinity, Feather and Klamath watersheds than in the Pitt and Sacramento areas which usually have the heaviest snow cover.

Highway entirely destroyed at Chipps Creek on Feather River



Rain Creates Emergency

About the twentieth of December, the temperature rose and a warm rain began falling all over the district up to above the 5,000-foot level. The rain itself put down as much as five inches in 24 hours in some places. Coupled with the water from the melting snow, streams rose everywhere. Immediately messages began to pour into the Redding District Office from the Klamath River area in Siskiyou County, the Feather River area in Plumas County, and all along the Trinity River in Trinity County. The district radio went on almost a 24-hour shift. The district began lining up equipment which could be used as soon as more definite information about damages was available. Equipment, supplies, and personnel were dispatched and shifted to meet the emergencies as they materialized.

The pattern of the storm was developed by the twenty-fourth of December. Bridges were damaged and sections of highway washed out in all three of the watersheds.

As soon as it was possible to do so, a crew of engineers visited the damaged areas. They estimated costs of emergency repairs to put the high-

ways in operation and also amounts which will be required for restoration. Work began immediately on those of an emergency nature, and at the time this article goes to press will be largely accomplished.

SISKIYOU COUNTY

The major damage sustained was located in Scott Valley on Route 82, and along the Klamath River on Route 46.

On the highway between Etna and Fort Jones, the Scott River destroyed the bridge near Fort Jones. The bridge over Kidder Creek was also washed out. Patterson Creek bridge had the approaches damaged.

Along the Klamath River, the section between Walker and the junction of Route 3 received only nominal damage consisting of small slides and shoulder erosion.

The section between Walker and Seiad contains the bridge over the mouth of Scott River which was destroyed in its entirety. Washouts and erosion damages were also heavy.

Between Seiad and Happy Camp, damage was confined to slides and slipouts, with some damage to approaches to the Seiad Creek bridge.

Similar damage was sustained between Swillup Creek, the district boundary, and Happy Camp. However, due to the highway being narrower and not constructed to present standards, the cost of emergency repairs will represent almost half the total amount for full restoration.

Between Yreka and Weed, damage was sustained at Parks and Greenhorn Creeks.

TRINITY COUNTY

The Trinity River first strikes the highway near Vitzthum's and roughly parallels the location for about two miles until it reaches Douglas City where it is crossed by a bridge which takes the highway to Weaverville.

A section of heavy concrete riprap bank protection and the highway itself were washed out near Vitzthum's. About 170 feet of the Douglas City bridge over the Trinity was lost.

To catalog the highway damage along the Trinity River below Junction City would be a long recital of bank erosion and complete washouts. The approach of Canyon Creek bridge at Junction City was swept out. Damage was sustained at many other structures.

The road from Douglas City to Peanut received some scour. This was heavy near Redding's Creek.

SHASTA COUNTY

Route 3 in this county was protected from major damages by Shasta Dam. The only damage on this route was a slide near Antler in the Sacramento Canyon. Minor damages from erosion were suffered on Mount Lassen-Mount Shasta highway, south of the intersection with the road to Alturas. A mud slide occurred on Route 29 west of Platina.

TEHAMA COUNTY

Like Shasta County, Tehama received protection from Shasta Dam on the main routes. The highway west to Hayfork received minor damage by erosion. Route 47, the cutoff between Chico and Chester, had very minor damages. On the road to Susanville, damage was minor but rather widely spread. It consisted of shoulder scour, debris on the roadway, and some pavement restoration.

Slides and erosion east of Arch Rock Tunnel on US 40 Alternate, Butte County





UPPER—Temporary detour under construction on Trinity River two miles from Douglas City.
LOWER—Typical damage along Trinity River.

MODOC COUNTY

Only damage sustained by this county was a culvert washout on the road between Alturas and the Nevada state line.

LASSEN COUNTY

The Susan River flooded the highway in the vicinity of Litchfield on the road to Alturas and east of Susanville. Damages were minor. Largest item was requirement for placing rip-rap at Secret Valley Creek.

Very small damage occurred between Susanville and Doyle.

Beyond Doyle, Long Valley Creek washed out the highway where it crosses the Quincy-Reno route, and again where it crosses the Susanville-Reno connection. Culverts were overloaded at both places.

From Susanville to Reno, damage was relatively light. Major costs were in connection with one structure over Long Valley Creek which was wrecked and one which was damaged.

The southern end of Lassen County takes in a portion of the Quincy-Reno highway. A structure over Long Valley Creek was wrecked there.

PLUMAS COUNTY

There is no point in trying to list the damage to the Feather River Highway. Beginning just beyond Jarbo Gap, the amount of water was simply more than the channel could carry.

Highway slopes were washed out, the road undermined, and in some cases flooded and torn out in its entirety. Slides of huge boulders were dumped in the canyon completely obliterating the highway. One of these was estimated to contain 100,000 cubic yards.

At another place, a cut through "onion skin" rock broke loose. This is a stratified material sloping toward the highway. It is difficult to be certain just how much material will come in at this location.

At Bardee Creek, near Pulga, a slipout removed the entire roadway section to the extent of about 75,000 cubic yards.

The route from Blairsden to Sierra county line received some scour and damage to the bridge over the south fork of the Feather River; otherwise damage was minor.

The route from Lake Almanor to the Feather River was severely damaged in three places where it parallels Indian Creek. Scour at other locations was extensive.

TOTAL FLOOD DAMAGE IN DISTRICT II

County	Repairs	
	Emergency	Restoration
Siskiyou	\$113,565	\$503,835
Trinity	151,910	1,068,810
Shasta	16,060	7,150
Tehama	8,770	20,955
Modoc	1,760	2,100
Lassen	23,650	71,555
Plumas	260,945	335,080
	<u>\$576,660</u>	<u>\$2,009,485</u>

District III—\$925,000

By A. M. NASH
District Engineer

Rains in the latter part of November and the first of December had already saturated the soil in the mountains and valleys of Northern California so that the unprecedented heavy warm rains beginning December 18, 1955, did not disappear into the earth but caused a heavy run-off in all the mountain streams and rivers.

Damage to state highways in the district amounted to approximately \$925,000.

Rain at elevations up to 10,000 feet rapidly melted the snow pack which was about six feet deep at Yuba Pass, Donner, and Echo Summit.

On December 21st at 8 p.m. word was received from District II that US 40 Alternate was closed in the Feather River Canyon, and from then on there was very little sleep obtained among the highway personnel in District III.

On December 22d information began coming in from the different territories of road closures due to flooding and washouts along the Yuba, Feather and American Rivers.

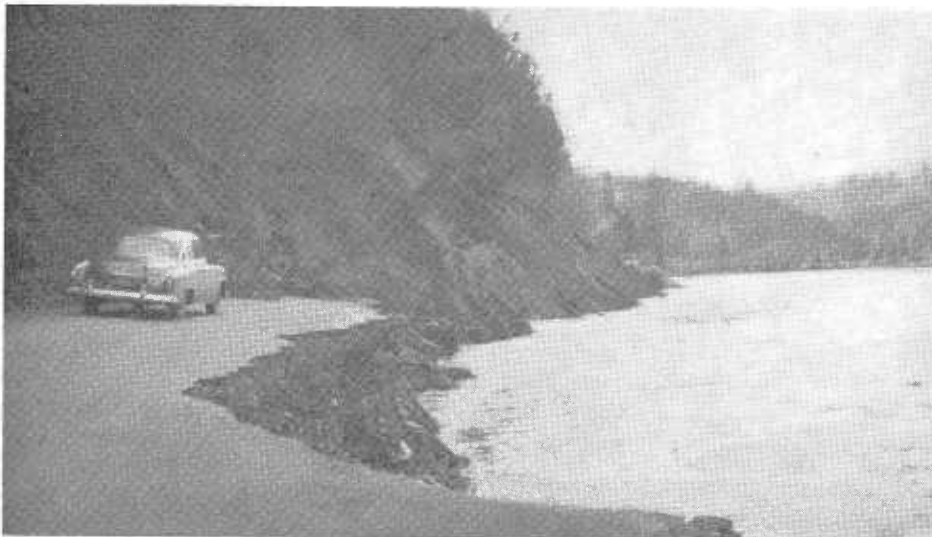
Considerable sections of road were washed out above Downieville on Sign Route 49, the Yuba Pass Highway. Sections of the road were washed out on US 50. There were serious fill slipouts on Sign Route 20 and US 40. There were also flooded sections of road on US 40 and US 50.

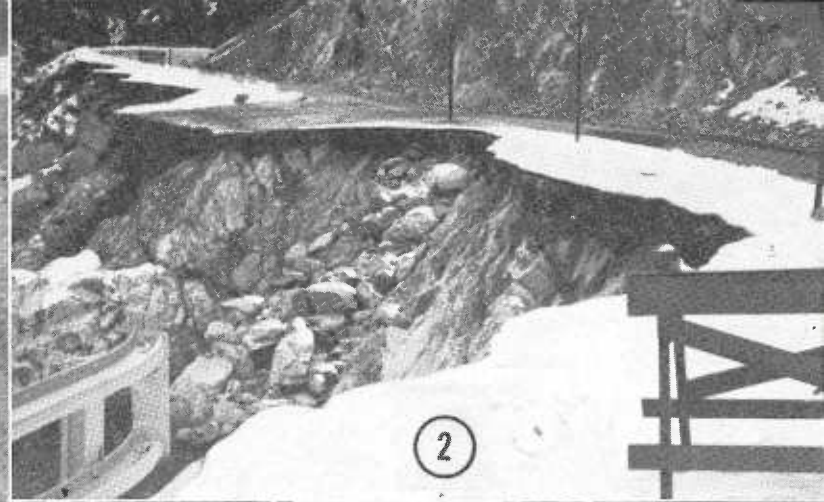
US 40 Alternate Closed

US 40 Alternate north of Marysville was closed between Marysville and Oroville by an overflowing of the Feather River flood crest into Simmerly Slough near Marysville, and from inundation of a considerable section of this road which lies on low ground adjacent to the Feather River between Union School and Oroville.

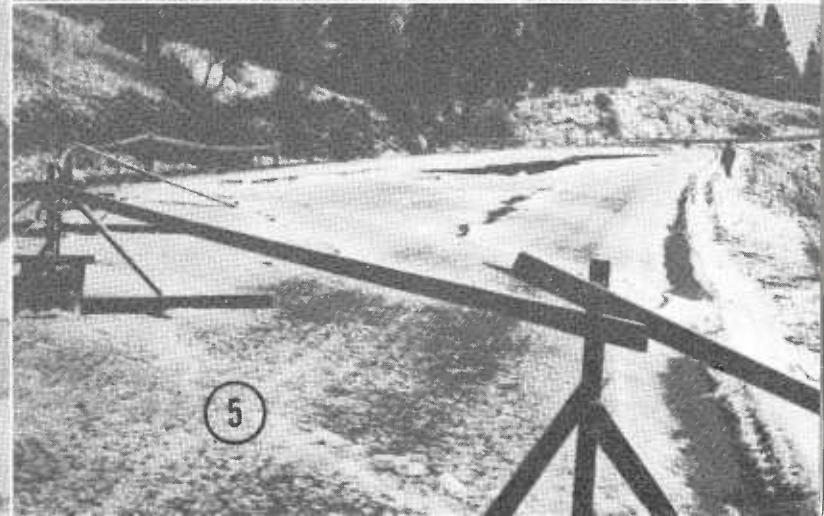
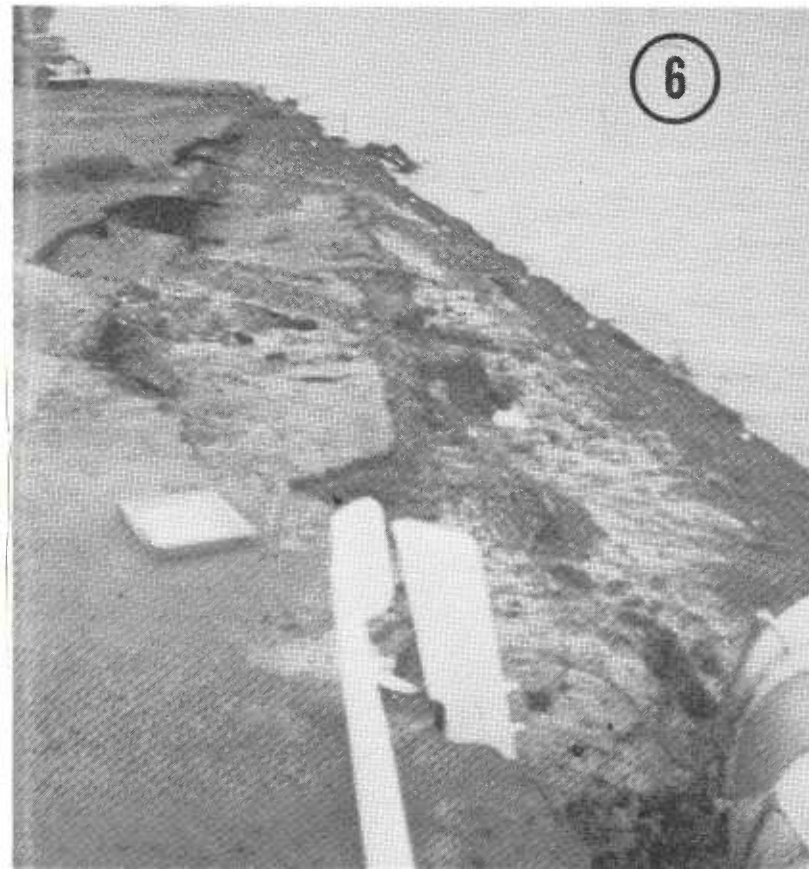
The Yuba River, in common with all other Sierra streams in this district, was rising rapidly, and in view of the unprecedented high flood stages reported from the upstream reaches, the Marysville Levee Commission alerted the District III highway authorities to the possible necessity of closing US 99E at the D Street Bridge so that a low gap in the levee at this point

Complete washout of sack rip-rap and highway near Vitzthum in Trinity County





1. Fill slipout on Sign Route 49 east of Nevada City
2. Erosion at Canyon Creek Bridge on Sign Route 49, Sierra County
3. Major fill slipout on US 40 west of Baxter, Placer County
4. Erosion of shoulders on Sign Route 49 through Coloma, El Dorado County
5. Fill slipout on US 50 east of Placerville in El Dorado County
6. Erosion around north end of Sutter Causeway on US 40, Alternated, Sutter County



could be closed. At 4 p.m. December 22d the bridge was closed to traffic to effect the placement of planks and sand bags, since the roadway forms about a four-foot depth gap in the levee at the bridge ends.

Our crews were working removing drift from the D Street Bridge throughout the afternoon and all through the night of Thursday, December 22d, and other men under the authority of the Levee Commission were strengthening the levees at the approach.

Marysville Evacuated

On Friday, December 23, 1955, the river stages began approaching record heights in the Marysville area, and soon after noon Marysville was ordered to be evacuated by 4 p.m. The only vehicle escape route by that time was over the 10th Street Bridge to Yuba City.

About midnight, Friday night, the west levee on the Feather River south of Yuba City broke and flooded a major portion of Yuba City and thousands of acres to the south—completely closing US 40 Alternate between Marysville and the Sutter Bypass.

After flood waters had subsided, work was immediately started on emergency restoration of the closed highways to permit one-way traffic on the sections that were closed by slides, slipouts and washouts.

All truck traffic was prohibited over US 40, and because of the condition of the road where there was a slipout at Steep Hollow, only trucks of an emergency nature were permitted to detour via State Sign Routes 49 and 20 between Auburn and Emigrant Gap. This detour was caused by a major slipout of a fill one-quarter mile east of Baxter.

Crews were sent out consisting of representatives of the district, Headquarters Office, and the Bureau of Public Roads to make an estimate of the storm damage including emergency restoration, complete restoration and/or improvements on all state highways. Similarly, road damage survey teams comprised of district, Bureau of Public Roads, Bridge Department representatives, and the county road commissioners were sent

out to estimate the emergency repair and restoration costs on city streets and county roads.

Work of Restoration

Work at present is going on restoring roads to two-way traffic throughout District III by day labor forces, by emergency contract, and by the use of rented equipment.

Continuous storms throughout the first of January, including heavy snow storms at times, have hampered the work considerably since it is necessary to stop repair work in many locations and go about the business of snow removal.

On US 99, south of Sacramento, the highways were in danger for a considerable time from the rising waters in the Cosumnes River and its overflow channels. However, when the height of the water reached the top of the stringers of the bridges over the Cosumnes overflow, a levee upstream broke and spread water over the lowlands of the area, relieved the condition, and saved the bridge from washing out.

The height of water in the Yolo Bypass was such that it was necessary to sandbag the approaches on the west end of the Yolo Causeway on US 40 west of Sacramento to prevent water from covering the highway in that area.

The "River Road" between Woodland and Sacramento was closed by waters from the Fremont Weir flowing into the Yolo Bypass and will, undoubtedly, remain closed for some time because of the continuing high stage of the Sacramento River.

The flooding of Yuba City and southern Sutter County was a major disaster in which many lives were lost, livestock killed by the thousands, and millions of dollars' damage done to property. One hundred and ten Division of Highways employees suffered damage ranging from minor flooding of garages to complete loss of houses and belongings. Fortunately, no division personnel or their families lost their lives, although there were narrow escapes.

The work of rehabilitating homes took employees, their families and friends up to two weeks away from work while co-workers carried on

with the problem of opening and restoring highways. Permanent repairs to homes, of course, will be continuing into the summer and fall.

The Marysville-Yuba City area will long remember the "Christmas" flood of 1955!

District IV—\$750,000

By D. C. RYMAN
District Maintenance Engineer

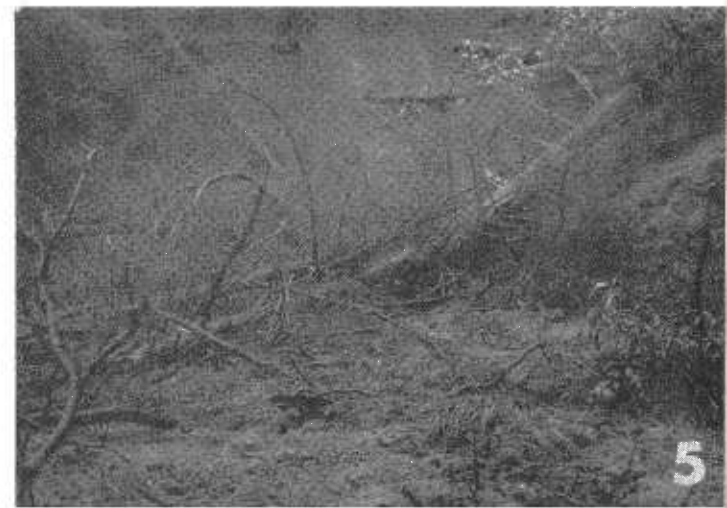
District IV, which comprises the nine Bay area counties of Sonoma, Marin, Napa, Contra Costa, Alameda, San Francisco, San Mateo, Santa Clara and Santa Cruz, was lashed by several hard gales and rainstorms from December 18th to 25th causing approximately three-quarters of a million dollars damage to the state highways.

Major arterial highways such as the Eastshore Freeway, Bayshore Freeway and US 101 south of Morgan Hill were flooded and closed during the height of the storm. Several other routes were closed by flooding, slides, slipouts, washouts, fallen trees, plugged culverts and one bridge failure. Nearly 500 men and 300 pieces of state-owned and rented equipment worked tirelessly around the clock to open the highways and restore safe public travel. All highways were opened to traffic on January 11, 1956, but there are many one-way sections which will require several months to restore to their original width.

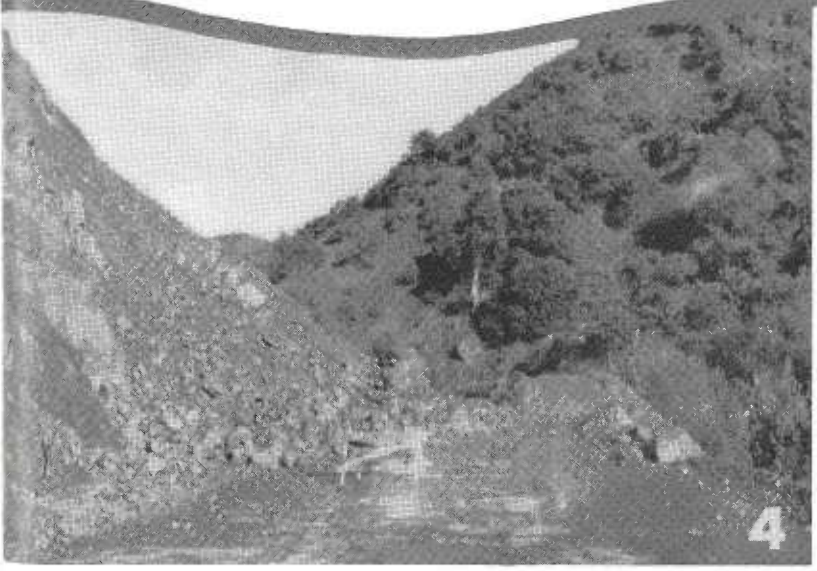
First Storm December 18th-19th

The first heavy storm struck on December 18th and continued throughout December 19th. The Russian River in Sonoma County overflowed its banks east of Geyserville and adjacent to Guerneville where it reached a record flood stage of 47.8 feet and all highways in the area were closed until December 20th when the river receded.

The new highway in Napa County from Capell Valley to the uncompleted Monticello Dam on Putah Creek was damaged by slides and slipouts but remained open to one-way traffic. State Sign Route 1 on the coast south of San Francisco was closed due to hundreds of tons of mud sloughing from the bluffs above the highway.



1. Six-hundred-foot washout on Route 107 in Alameda County
2. Long washout on Sign Route 9 west of Saratoga in Santa Clara County
3. Slipout on Sign Route 5 south of La Honda in San Mateo County
4. Rock slide west of Junction 56, Route 6 on Sign Route 128, Napa County
5. Large slide which blocked highway from Waterman Gap to Big Basin State Park, Santa Cruz County
6. Small washout only one of many on Niles Canyon Highway, Alameda County
7. Slipout for full length of roadway, Sign Route 128, Napa County



Second Storm December 22d-23d

The second and most severe rains started early December 22d and continued through December 23d, raising the total rainfall for the storm to 10 inches in the immediate Bay area and a high of 30 inches in the Santa Cruz Mountains and Guerneville area.

North Bay Area

The Russian River again flooded, reaching the highest stage recorded with a flow of 90,000 second-feet. Portions of the communities of Geyserville, Healdsburg, Sebastopol and Guerneville were inundated and the highways were closed until December 27th. In Napa County, the Putah Creek flowed over the uncompleted Monticello Dam with a record flow of 90,000 second-feet and the new highway was shut tight with slides and slipouts. It required continuous work until January 6, 1956, to remove several thousand yards of slide material and to construct a detour to open the highway to one-way traffic. State Sign Route 128 between Rutherford and Monticello was also closed from slides and washouts until January 6th.

Santa Cruz Area

A large portion of the City of Santa Cruz business district was flooded to a depth of six feet by the high flow of the San Lorenzo River December 22d-24th, during which a record flow of 35,000 second-feet was reached. Two piers of a new bridge under construction were washed out.

State Sign Route 9 from Santa Cruz to Felton and the two highways leading into Big Basin State Park were closed by large slides and slipouts which destroyed many large redwood trees. The park area was isolated until December 26th.

Saratoga Creek went on a rampage washing out the entire highway for several hundred feet west of the town of Saratoga. Severe erosion along the creek, washouts, and slides damaged the entire route from Saratoga to Saratoga Gap.

The Los Gatos-Santa Cruz Highway, State Sign Route 17, was threatened by slides and plugged culverts several times. Recently placed concrete channel lining on the Los Gatos Creek which is under construction

HIGHWAY PERSONNEL COMMENDED

WHEREAS, Storms occurring during the latter part of December, 1955, caused unprecedented floods in streams and rivers throughout Northern and Central California, resulting in tragic loss of life and heavy damage to private as well as public property, including state highways; and

WHEREAS, Many state highway bridges were destroyed or damaged, and numerous sections of highway closed by slides and washouts, resulting in the isolation of many communities; and

WHEREAS, The engineers and employees of the Division of Highways of the Department of Public Works, in this grave situation, responded wholeheartedly to their duty, working long hours in adverse weather under extremely difficult and hazardous conditions; now therefore, be it

Resolved by the California Highway Commission, that it hereby expresses to these engineers and employees its sincere appreciation and admiration for their outstanding service to the people of California in this emergency, and its further commendation to them for the rapidity with which damaged state highways were reopened to public travel.

was partially ripped out. The new Lexington Dam on Los Gatos Creek was completely filled and water

flowed over the spillway at the rate of 25,000 second-feet.

Gilroy-Watsonville Area

The Uvas, Llagas and Carnedero Creeks overflowed, closing all highways in the Gilroy area. US 101 was closed from Morgan Hill south to the county line. State Sign Route 52 was flooded at the Hollister Junction and the Hecker Pass portion west of Gilroy had slides, washouts, and a pier of the Uvas Creek bridge was undermined, dropping two spans of the deck. Slides also occurred at Pacheco Pass east of Gilroy.

These flood waters continued their ravaging damage throughout the Pajaro River channel, which caused erosion along Route 67, the Chittenden Pass Road, and flooded the Watsonville area December 24th and 25th.

East Bay Area

The Eastshore Freeway was closed on December 23d due to the overflow of San Lorenzo Creek. The Jackson Street Underpass on Route 105 in Hayward was flooded. The main arterial between Oakland and Walnut Creek State Sign Route 24 was kept open only by continuous work "around the clock" by both the Maintenance Department and a contractor. A heavy deluge of mud washed into the Broadway Tunnel ventilating equipment room.

Alameda Creek washed out several sections of the Niles Canyon Highway Route 107 between Niles and

Flooded Visalia Airport Interchange, Tulare County



Sunol. A protection wall 600 feet in length collapsed when topped by the creek. These flood waters continued downstream and flooded the Niles-Centerville-Alvarado area, closing State Sign Route 17. Damage in the Pittsburg and Livermore areas was light.

Bayshore-Alviso Area

The stream channels beginning with the San Francisquito Creek on the north to the Guadalupe River on the south overflowed, flooding several subdivisions, the Bayshore Highway, the Agnew Underpass, and isolating the town of Alviso. Highways leading to Alviso were closed until December 30th due to the combination of the flood waters and high tides.

District V—\$312,000

By L. E. ELDER
District Maintenance Engineer

On December 22, 1955, one of the heaviest holiday season storms recorded in recent years struck the Central Coast Counties of San Benito, Monterey, San Luis Obispo and Santa Barbara. Heavy rains continued throughout the Christmas week end with a final tapering off during the night of December 28th.

According to records compiled by the *Salinas Californian*, the Salinas Valley area, as of December 28th, had received a season's total rainfall totaling the fourth highest season's total in an 83-year record of rainfall. The rains during December have made it the fifth wettest December since 1872. Rainfall figures for the rest of the



UPPER—Flooded section of US 99 through Chowchilla, Madera County.
LOWER—US 99 flooded south of Chowchilla.

Central Coast Counties appear to indicate a record rainfall of about the same magnitude as that experienced in the Salinas Valley.

Heavy Rainfall

Many places throughout the four counties experienced exceptionally heavy rainfall during the second and

third day of the storm, in a few instances, attaining almost cloudburst proportions with the resultant run-off carrying debris and drift across the highways and causing extensive damage to existing highway facilities.

As an example, 8.45 inches of rain was recorded at the Big Sur Maintenance Station for the 24-hour period beginning at 8 a.m. on December 23d, and 6.45 inches at Willow Springs, 3.14 inches at Hollister, 2.77 inches at Seaside and 2.64 inches at Paso Robles all for the same period. During the following 24-hour period on December 24th, all areas except Buellton and Santa Barbara received rainfalls varying from 1.55 inches to 4.02 inches with Priest Valley receiving 3.42 inches, Atascadero 3.36 inches, Big Sur 3.75 inches, Willow Springs 3.35 and San Luis Obispo 4.02 inches. On December 25th, the storm reached its peak in the Santa Barbara area with a rainfall of 2.90 inches being recorded at Lompoc, 6.33 inches at San Marcos,

Pumping equipment set up in Chowchilla



2.94 inches at Buellton and 1.96 at Santa Barbara.

Main Roads Kept Open

In spite of the severity of the storm, District maintenance personnel, by working around the clock, managed to keep all the main line roads open for the heavy volume of holiday traffic. Only three main routes experienced closures. Route 117 was closed between Salinas and Monterey on December 24th for a period of 21 hours due to flooding at the Salinas River crossing west of Salinas. Sign Route 150 over San Marcos Pass was closed to all but local traffic for a period of about 10 days due to storm damaged embankments on a portion of the route now under construction.

Sign Route 1, between San Simeon and Carmel was closed early on December 23d. Historically, the highway between San Simeon and Carmel has always been considered a road highly susceptible to extensive damage during heavy storm periods due to slides, washouts and flooding by the numerous creeks and canyons throughout the area. The December storm proved to be no exception. Extensive damage was experienced to the existing bridges across San Carpojo Creek, White Creek and Mill Creek. Approximately 60,000 cubic yards of embankment will be required to replace a portion of the roadway at a point about 10 miles south of Big Sur where flash floods washed out the entire roadbed. Numerous minor and several major slides have completely blocked a 50-mile stretch of this road between San Carpojo Creek and the Big Sur River. However, several months will be required to complete repairs to damaged structures and to restore the existing traveled way to its original condition prior to the storm.

It has been estimated that it will cost about \$312,000 to repair the damaged structures and restore the roadbed to its original condition.

UPPER—Storm damage to roadway 10 miles south of Big Sur River at Redwood Canyon on Sign Route 1. LOWER—Damage to sacked concrete riprap at downstream side of Jungle Inn Bridge across San Benito River 20 miles south of Hollister on Route 119, San Benito County.

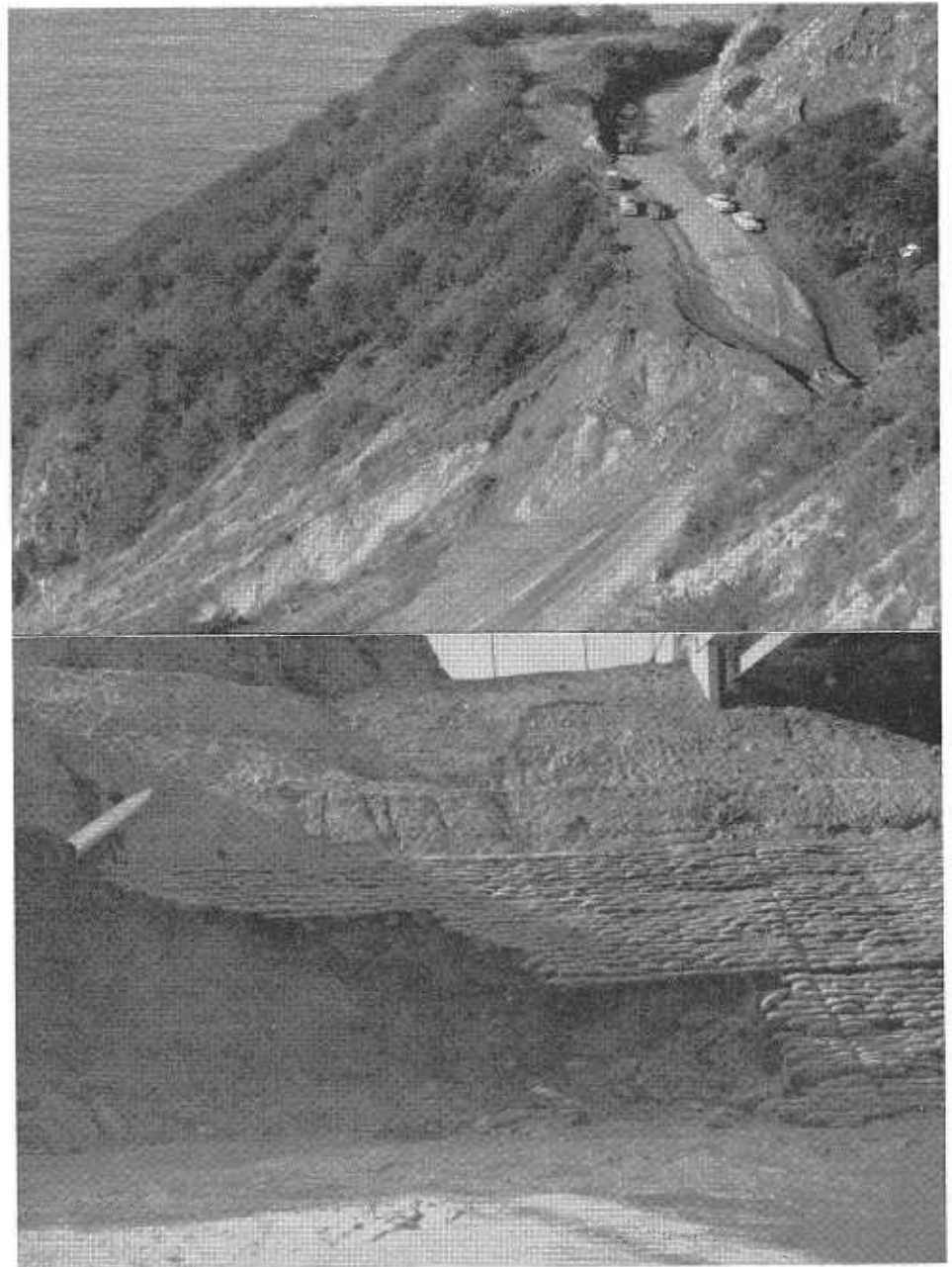
District VI—\$1,400,000

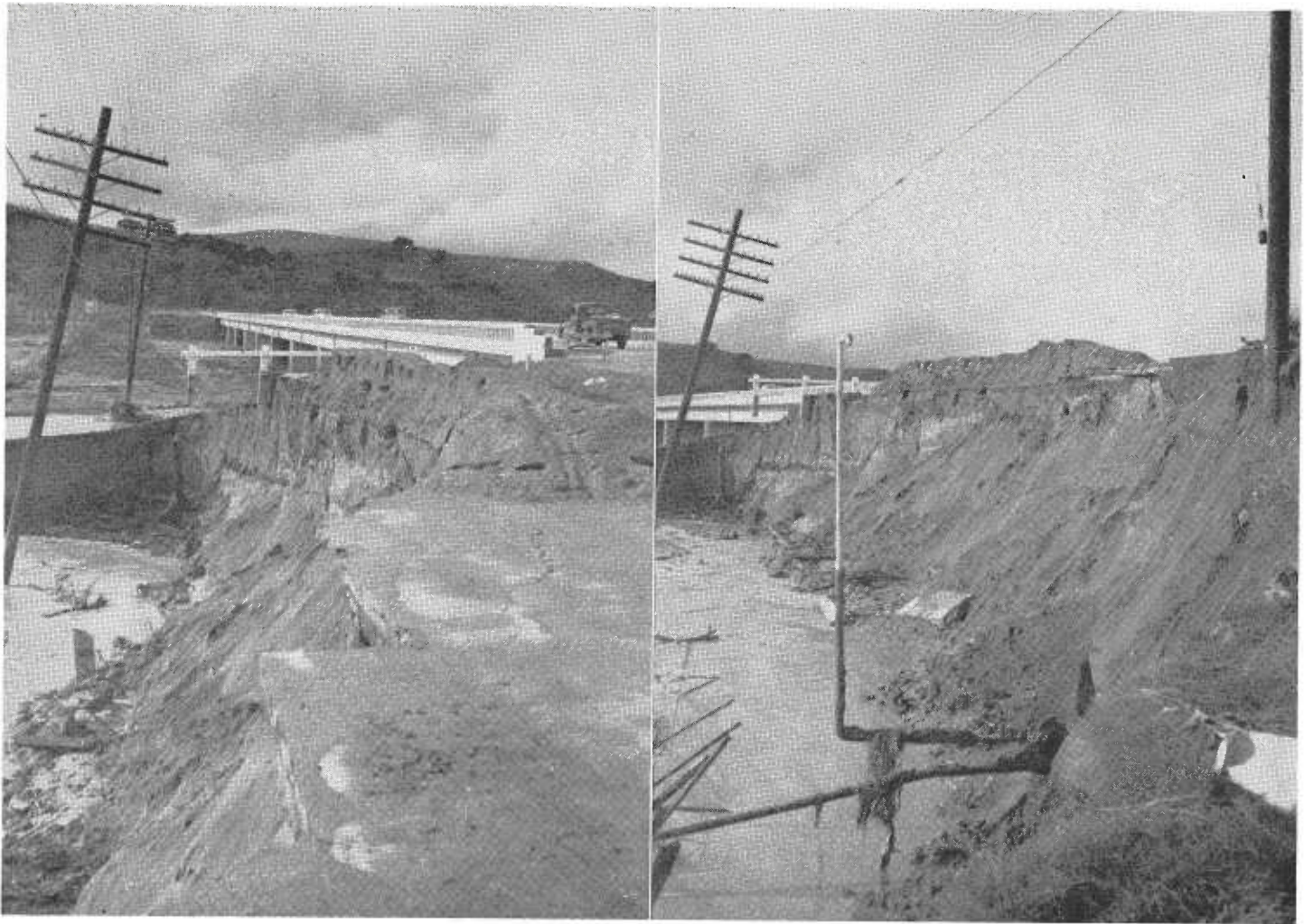
By T. M. WHITLEY
Assistant District Maintenance Engineer

The storm that struck Northern California during the Christmas holidays was first seriously felt in District VI on December 23d. During that day and through the ensuing week several sections of state highway were flooded by high water, numerous washouts occurred, and several bridges were damaged, some seriously. The total amount of damage to state highways in the

district is estimated at approximately \$1,400,000.

Perhaps the most serious loss occurred in the Kings River Canyon on Sign Route 180. In the vicinity of Boulder Creek, where the highway and the Kings River jointly occupy a steep, narrow canyon, approximately 4,000 feet of road was completely washed out. Because this particular stretch is impassable, an on-the-spot inspection of the flood damage has not been made. However, aerial observation and reports by employees of the





LEFT—Damage to roadway fill at east end of San Benito River Bridge, 0.9 mile west of Hollister, Route 22.
 RIGHT—Damage at same section.

View of downstream side of San Carpojo Creek Bridge 22 miles north of Cambria on Sign Route 1, San Luis Obispo County



national park indicate that there may be approximately seven or eight other washouts of a serious nature.

Three Rivers Damage

The next most seriously damaged sections are on Sign Route 198 in the vicinity of Three Rivers. Immediately east of the bridge across the south fork of the Kaweah River approximately 1,600 feet of road was lost and the Kaweah River, straightening its course, overtopped the highway and occupied an area approximately 1,000 feet south of the previous location of the route. Other washouts occurred in Pumpkin Hollow, approximately six miles east of Three Rivers, and at the gateway to Sequoia National Park, the easterly approach to the bridge across the Kaweah was destroyed.

Fortunately, the damage on Sign Route 180 occurred beyond the point

where that highway had previously been closed by snow through Kings Canyon National Park and no one has been inconvenienced to date by the loss of that section of the state highway. On Sign Route 180 it was necessary to restore service as soon as possible to the community of Three Rivers, to other residents along the highway easterly and for the employees of Sequoia National Park, whose headquarters are at Ash Mountain. This was done by using as a detour the former state highway around the large washout at the South Fork of the Kaweah and by immediate emergency repairs to other sections. Use of the former state highway as a detour required shoring up and re-decking a county bridge, which had partially failed.

Visalia Interchange Flooded

US 99, the principal artery of traffic through the district, was not seriously damaged although it was necessary to detour traffic from portions of it over various other routes for the better part of the week December 25th to 31st, inclusive. Portions of the interchange of US 99 and Sign Route 198 near the Visalia Airport were flooded when Mill Creek broke across the nearby airport and entered depressed areas of the interchange. With the failure of the pumps, it was necessary to dewater the underpass with whatever pumping equipment could be obtained.

Heavy flooding occurred in the vicinity of Chowchilla due to high water in Ash and Berenda Sloughs. Although no serious damage occurred to the highway itself, the flooded condition necessitated a long, tedious job of pumping the water into the Chowchilla River. This work required about one week's steady pumping, during which time it was necessary to detour US 99 traffic to other state highways to the west.

Visalia Hard Hit

Although damage to state highways in the community was negligible, the City of Visalia was hard hit when a diversion weir at McKays Point at the junction of the St. Johns and



UPPER—View of upstream side of El Capitan Creek showing debris at inlet end of structure. El Capitan Creek is located 16.5 miles north of Santa Barbara on US 101. LOWER—View of upstream side of San Carpojo Creek Bridge 22 miles north of Cambria on Sign Route 1, San Luis Obispo County.

Kaweah Rivers near Lemon Cove, carried way, permitting discharge of both streams through the bed of the Kaweah and flooding Visalia. This water eventually found an outlet to the southwest through Mill Creek, Packwood Creek and Cameron Creek. As previously stated, it was excess water in Mill Creek which flooded the Visalia Airport Interchange. High water in Packwood and Cameron

Creeks resulted in minor damage to state highways.

Loss of the diversion weir and resultant heavy flow in the Kaweah River, which carried tremendous amounts of debris, resulted in the deposition of approximately 2½ feet of silt and debris on State Sign Route 65 for about one-half mile each side of the Keweah River bridge. One of the concrete piles under the bridge



Flood damage vicinity El Portal—Excavating for footings for detour bridge to be constructed right of Station 198. Note rock foundation.



Flood damage vicinity El Portal—Inlet end of culvert plugged by tree Station 198.



Flood damage vicinity El Portal. Looking easterly over damaged 8' x 8' concrete box Station 198. Also shows temporary walkway constructed over tree blocking culvert.

was broken and knocked out of line. This, together with loss of the approaches, required closure of this section.

On State Route 131, one of the piers of the bridge across the Kaweah was undermined. The pier dropped approximately eight inches and this portion of the bridge was displaced downstream about two inches. Repairs to the pier are now under way and it is anticipated that the bridge will be restored to service in the near future.

District X—\$1,275,000

Flood damage to streets and highways in District X during the recent disaster was gratifyingly small, considering the large volume of precipitation and runoff. The estimated total damage to state highways was \$1,000,000 for restoration. In addition, it was estimated that the sum of \$275,000 would be required to restore county roads and city streets to pre-flood condition.

The greatest damage to state highways occurred on Route 18 in Mariposa County, the "All-Year" Highway to Yosemite, when the Merced River and its tributaries, Pigeon Creek and Crane Creek, overflowed their banks, destroying the entire roadbed in several locations. The total estimated damage for restoration of this route is \$550,000.

In Alpine County, the high water in the East and West Forks of the Carson River occasioned damage to Routes 23 and 24 in several locations, amounting to an estimated \$260,000 for restoration.

Of the nine counties comprising District X, Stanislaus County apparently suffered the greatest damage to roads and bridges in the amount of \$175,000 estimated for restoration. Damage to bridges constituted the greater portion of this loss.

C. M. (Max) Gilliss Permanent Deputy

Assistant Deputy Director of Public Works C. M. (Max) Gilliss has been given a permanent appointment as deputy director by Director of Public Works Frank B. Durkee. He has been acting as deputy director since last September. He passed a civil service examination for his new job.

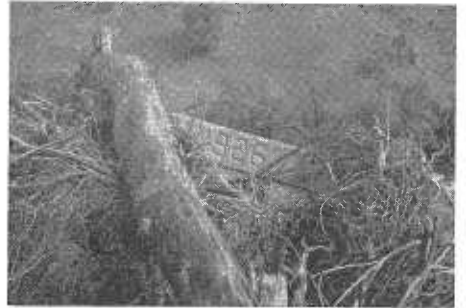
Gilliss assumed the duties of special representative of the Department of Public Works on December 1, 1952. In August, 1953, he was named assistant deputy director.



Flood damage vicinity El Portal—Excavating for footings for detour bridge upstream on Pigeon Creek.



Flood damage vicinity El Portal—Looking westerly from box culvert, showing pathway to temporary pedestrian bridge. Express parked on detour approach to Pigeon Creek temporary bridge.



Flood damage vicinity El Portal—Looking easterly over concrete box at Pigeon Creek.

FIND MAGAZINE USEFUL

MONTEREY

DEAR MR. ADAMS: For the past several years I have looked forward to the receipt of the next issue of your exceptional publication. I have found it a most informative and invaluable tool in my work. The research and technical articles have interested me the most although the others have been done equally well.

Thank you for another year of good reading.

Yours truly,

GEORGE L. WALTER
Leadingman Public Works
Naval Auxiliary Air Station

FLOODS DO PROPERTY DAMAGE ESTIMATED AT \$200,000,000

By R. R. REYNOLDS, Senior Hydraulic Engineer, and C. G. WOLFE,
Associate Hydraulic Engineer, Division of Water Resources

December, 1955, will be remembered in California as a record-breaking month whenever rainfall or floods are discussed. Heavy warm rains originating far out in the Pacific swept across Northern California during the five days just preceding Christmas. Another storm of major intensity occurred on December 26th and 27th. Together, these two storms produced sufficient rainfall to make the month one of the wettest, if not the wettest, Decembers since 1867. Heaviest rains were concentrated along the north coast, in the hills north of Santa Cruz, in the area south of Clear Lake, in the mountains above Shasta Dam, and in the Sierra Nevada watersheds of the Yuba and Bear Rivers. Over 30 inches of rain in less than 10 days were recorded at stations in these areas.

Frequent light rains followed, and during January 13th, 14th and 15th, 1956, another major storm brought new danger and renewed anxiety to the flood areas. Fortunately, no widespread flooding resulted from this storm. However, the prolonged wet period left tremendous amounts of water in the river channels, basins, and by-passes of Northern and Central California. The rate of drainage of this water from the Sacramento Valley will be very slow and cannot be accelerated, since it is controlled by the natural slope of the valley.

Tragic Results of Storms

Result of this intensive rain was spectacular and tragic. Peak flows on at least 18 major streams in the State exceeded previous flows. During December the Klamath River reached a peak of 400,000 cubic feet per second, which was about one-third greater than the previous recorded maximum flood on that stream. Likewise, the Russian River more than doubled its previous peak flow with a discharge of 47,000 cubic feet per second. Major floods in California were recorded on



TOP—Folsom Dam and Reservoir on December 24, 1955 (Corps of Engineers Photo).

BOTTOM—Town of Klamath with Klamath River at flood stage.



coastal streams from Nacimientto River on the south to the Klamath River on the north, and in Sierra streams from Kern River to the Sacramento River.

Damage Runs Into Many Millions

In the Sacramento Valley, Shasta and Folsom Dams effectively controlled the high flows of the upper Sacramento and American Rivers, while uncontrolled flows originating in the Feather River Basin caused damages in the order of \$65,000,000 within the flood plain of the Feather River between Yuba City and Verona. Friant Dam on the San Joaquin River and Pine Flat Dam on the Kings River effectively controlled the flows from the upper watersheds of these streams.

Streams causing severe flood damage were the Klamath, Eel, Van Duzen, Russian, Mad, Napa, San Lorenzo, Nacimientto, Tule, Kaweah, lower San Joaquin, Tuolumne, Stanislaus, Calaveras, Mokelumne, Cosumnes, Bear, Yuba, and Feather Rivers, and Petaluma, San Lorenzo, and Alameda Creeks.

Damage from these floods was staggering. Roads and bridges were washed out, homes flooded, valuable farm lands inundated, livestock drowned, and communications disrupted. At least 62 persons lost their lives. Total damage from the flood has not been fully determined, but present estimates indicate it may be as high as \$200,000,000.

Yuba City Bears Brunt

Hardest hit were Yuba City together with 100,000 acres of Sutter County's Peach Bowl, which were flooded as a result of a disastrous break in the levee on the west bank of the Feather River in the early morning hours of December 24th.

Early in the emergency, State Engineer Harvey O. Banks put the entire staff of the Division of Water Resources into the battle with the high waters.

The office of the flood control function of the division was fully staffed on a 24-hour basis, beginning at midnight December 21st. Hydrologic data and information regarding the high flows occurring on streams through-



TOP—Break in Feather River levee at Nicolaus. BOTTOM—Break in Feather River levee south of Yuba City, Sutter County.

out Northern and Central California were collected by means of the division's radio stream gage network, con-

stant telephone contact with various federal agencies and division personnel in the field, and communications with



Aerial view of City of Marysville at critical stage of flood on December 23, 1955 (Sacramento Bee photo)

numerous independent agencies and private individuals. These data were compiled by the staff to document the flood for future design studies, and, in addition, were made available to the general public and interested agencies. By use of these data, it was possible during to flood period to forecast and give warnings on peak stages some 48 hours in advance of their occurrence.

Water Resources Division Efficient

The Division of Water Resources dispatched equipment, supplies, and manpower, and supervised flood-fighting activities along the levee below Nicolaus, where a major break eventually occurred on December 23d. Subsequent flood-fighting activi-

ties by the division along the Natomas Cross Canal successfully averted the inundation of many thousand acres of rich agricultural lands, residences, and public utilities in Reclamation District 1000 just north of Sacramento. In addition, division personnel constantly patrolled over 200 miles of levee, made necessary repairs to weakened levee sections, and kept the Sacramento office informed of flood problems in the critical areas. Technical supervision by division personnel was furnished to many public districts during the flood period.

The levee on the left bank of the Feather River near Verona was breached December 24th by division forces to relieve the water pressure caused by the Nicolaus break. The

right bank levee of the Feather River opposite Nicolaus was breached Christmas day to drain the water from the area inundated by the break below Yuba City. Gates of the Sacramento Weir were opened to maintain the level of the Sacramento River below critical flood stage.

In addition, the division during the flood emergency secured and operated numerous pieces of heavy equipment, and dispatched to the critical areas many truckloads of burlap bags, canvas, tools, and other supplies necessary for the flood fighting. During the emergency period, about 900 men were employed in flood fighting.

During the flood emergency, valuable assistance, material, and equip-



Crews work to save north levee of Natomas Cross Canal. (US Air Force photo)

ment was furnished to the Division of Water Resources by the Division of Forestry, the California Highway

Patrol, the Office of Civil Defense, the Department of Employment, Mather and McClellan Air Force

Bases, the Sacramento Signal Depot, and the Arden-Carmichael School District.

COUNTIES GET INCREASED NATIONAL FOREST RECEIPTS

A check for \$2,994,976.12 has been sent to the State Treasurer as California's share in the cash revenues from the national forests, according to a statement by Chas. A. Connaughton, Regional Forester of the United States Forest Service.

This payment represents 25 percent of the gross receipts from the sales of timber, grazing fees, and other land uses of the national forests in California, for the year ended June 30th.

As provided by law, the State apportions the money received to the counties having national forest land within their boundaries. Thirty-nine of the State's 58 counties will thus receive funds for local school and road expenditures. The amount received by each county is proportional to the national forest acreage in the county.

Mr. Connaughton says that this year's receipts to the counties represent an 18 percent increase over last year.

FOR GOOD HIGHWAYS

LANCASTER

GENTLEMEN: For the past year I have been receiving your magazine. I have enjoyed every bit of it and I appreciate very much all of the good work you are doing.

I look forward each month to receiving the magazine. I have been a resident of California for over 40 years, and have owned a car since 1916, and I can see a wonderful change and improvements that have been made. I am 100 percent for good highways.

Yours truly,

Z. R. OXFORD
1655 E. Lancaster Blvd.

JACKSONVILLE

The town of Jacksonville, California, is named after Colonel Alden Jackson who settled there in the autumn of 1849.

THANK YOU

SANTA MONICA

DEAR MR. ADAMS AND HELEN HALSTED: I have received this magazine for some seven years. I have kept past copies for reference to past events in the highway system. I look forward for each new issue to arrive. The layout and photography are well done. Mr. Nickerson is to be congratulated along with you two.

Yours truly,

RICHARD BERK
1134 23d Street

FROM LOS ANGELES

LOS ANGELES

DEAR MR. ADAMS: I have been receiving and enjoying your interesting and educational journal for several years and wish right now to express my appreciation for the privilege of continuing to receive it.

Yours respectfully,

A. J. BORDEN
1616½ W. 12th Street

Carquinez Project

Revenue Bonds Sold and Major Contracts Awarded

By LEONARD C. HOLLISTER, Projects Engineer—Carquinez

ON JUNE 15, 1955, Governor Goodwin J. Knight signed Senate Bill 1450 authorizing the Department of Public Works to "lay out, acquire and construct" two new bridges across Carquinez Strait. One bridge was to be located adjacent to the existing Carquinez Bridge and the other to be located about six miles upstream, between Benicia and Martinez. The bill also authorized the California Toll Bridge Authority to issue revenue bonds and to reimpose tolls upon the existing Carquinez Bridge for the purpose of financing the construction of the two new bridges and their approaches.

Senate Bill 1450 was passed by the 1955 Session of the California State Legislature under the sponsorship of Senators Luther E. Gibson and George Miller, Jr., and Assemblymen Donald D. Doyle, Samuel R. Geddes and S. C. Masterson.

On June 16, 1955, Frank B. Durkee, Director of Public Works, assigned the work contemplated under this legislation to George T. McCoy, State

Highway Engineer. Exactly four months later four major contracts were advertised for bids involving a large portion of the construction work in connection with the new parallel Carquinez Bridge and its Contra Costa County approach.

Revenue Bonds Sold

On December 13, 1955, the California Toll Bridge Authority sold \$46,000,000 worth of Series A Bonds in accordance with the Resolution dated October 4, 1955, authorizing Carquinez Strait Bridges Toll Bridge Revenue Bonds. The interest rate called for is 3 3/4 percent payable semi-annually. Later, as plans progress, an additional issue of Series B Bonds can be sold for financing work on the Benicia-Martinez Bridge and the remaining freeway work through Vallejo.

Because these first four contracts were large and involved types of construction work not frequently encountered in the usual highway contracts, prospective bidders were given

a full six weeks' time to study the projects and make up their bids.

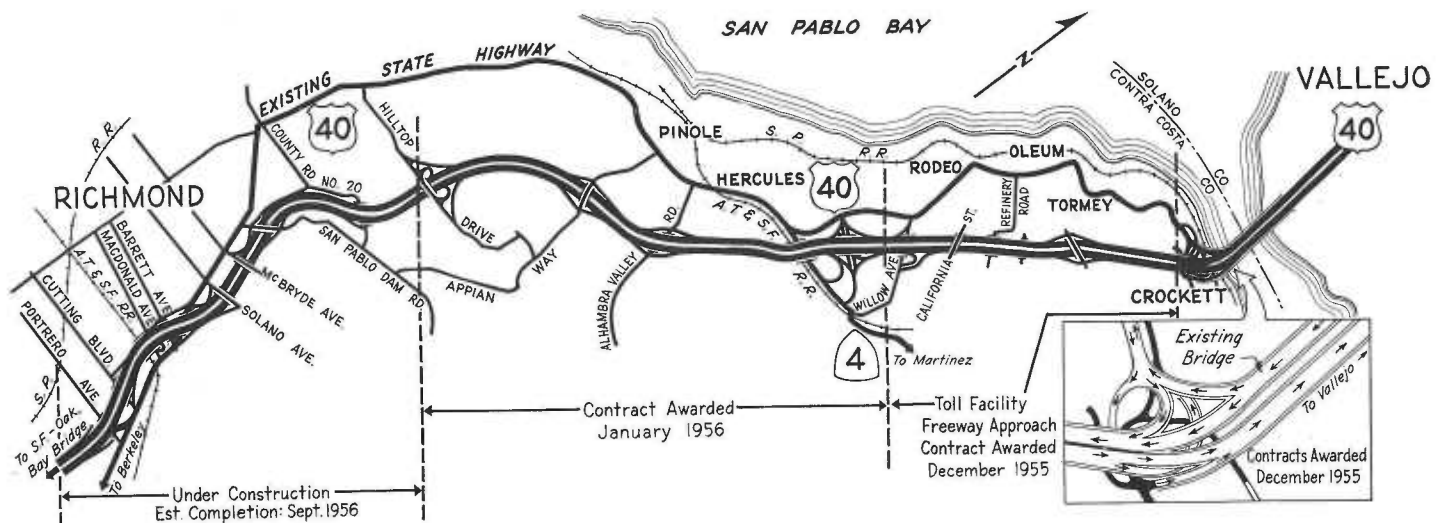
The first four contracts to be advertised and awarded include the following work: (1) Two and nine-tenths miles of freeway work in Contra Costa County extending from just north of the city limits of Hercules to the beginning of the bridge approach at Crockett; (2) The deep pier foundation work for the main bridge across Carquinez Strait; (3) The superstructure work, including the fabrication and erection of large steel double cantilever truss spans of the main bridge; and (4) The construction of the south approach and connecting interchange ramp spans through Crockett.

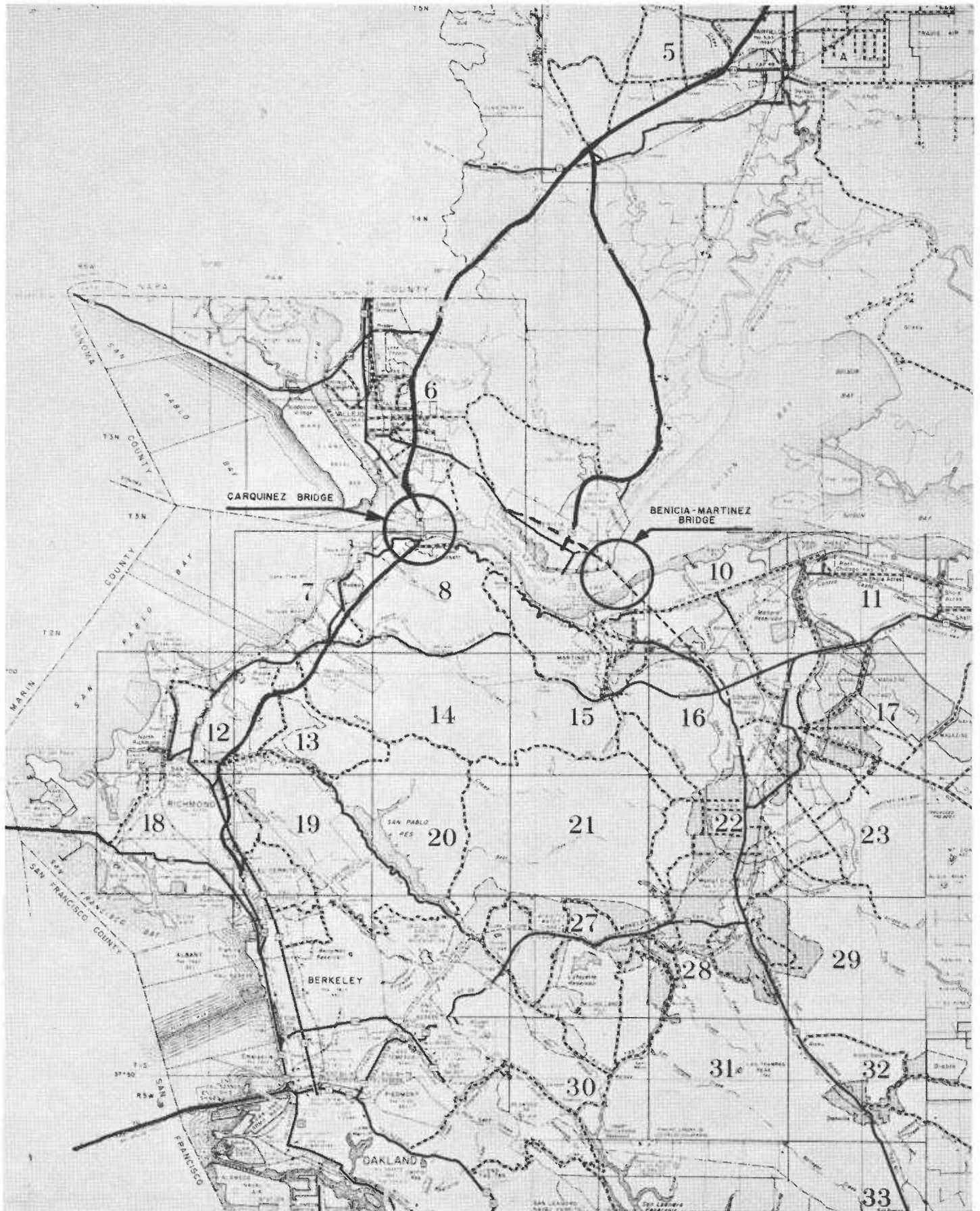
Contra Costa County Freeway Approach

The freeway project from Hercules to Crockett is exceptional not only because of the amount of money in-

Map showing the relation of the Carquinez Bridge and the Benicia-Martinez Bridge to the general San Francisco Bay area. →

This map shows how approximately 12 1/2 miles of US 40 between Richmond and the Carquinez Bridge will be relocated and constructed to full freeway standards by mid-1958 when the parallel Carquinez Bridge is expected to be completed. This section of US 40 now runs on congested San Pablo Avenue and takes a tortuous route through several communities of northern Contra Costa County. One contract is now under way and five others have been awarded. Now under construction and scheduled for completion in September, 1956, is a six-lane divided freeway between slightly south of Potrero Avenue in Richmond and south of Hilltop Drive, east of San Pablo, at a contract cost of \$5,107,922.





volved but because it includes the largest cut ever undertaken by the Division of Highways. The project includes 11,200,000 cubic yards of excavation and involves 455,000,000 station yards of overhaul.

Eight and one-half million cubic yards of this total excavation are to be taken from the big hill at the top of Crockett which has often been referred to as the "Big Cut." The depth at the largest section of this cut varies from 245 feet at the centerline of roadway to 350 feet at the high point to the side. The width at the top is 1,370 feet (about four average city blocks), and the total length is 3,000 feet.

Huge Excavation Job

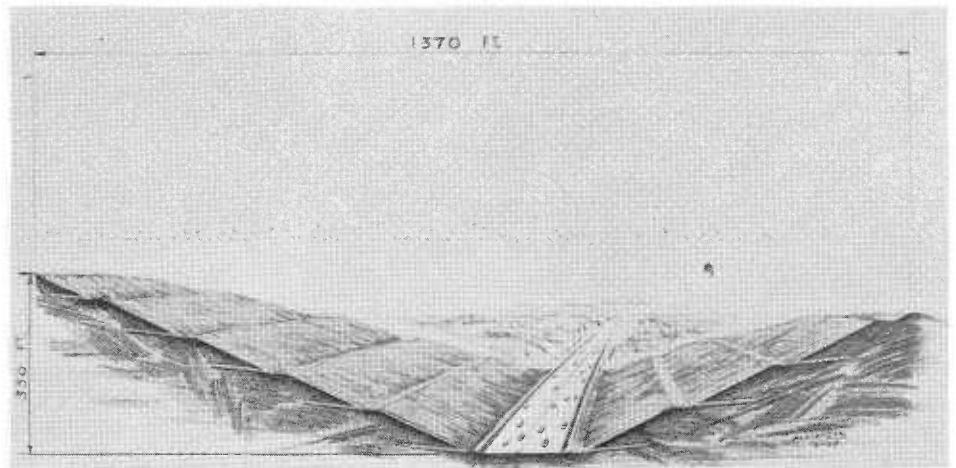
To complete this 11,200,000 cubic yards of excavation on schedule the contractor must plan to excavate, haul and place about 30,000 cubic yards of excavation each working day. This is at a faster rate than called for in any of the contracts so far let by the Division of Highways.

It will be interesting to watch the contractor move in with his many pieces of heavy earth-moving equipment. The clockwork efficiency of his organization and equipment will pay big dividends for as can be seen a reduction in cost of as little as one cent a cubic yard will net a total saving to him of \$112,000. The contractor's bid price for this roadway excavation was 25.6 cents per cubic yard.

Because of the size of this cut, preliminary studies included consideration of a tunnel. Geological conditions and economy of construction however, indicated considerable advantage to the open cut.

The "Big Cut"

To maintain structural stability the "Big Cut" will have two-to-one side slopes and horizontal benches 30 feet wide placed each 60 feet of depth. In addition, immediately following the excavation from top down to the first 30-foot wide bench, horizontal drains will be placed to drain underground water away and keep the sides of the cut dry, reducing the possibility of slides to a minimum. The drains will extend back into the sides of the cut for a distance of approximately 150



Architectural sketch of the "Big Cut" which helps to give one the feeling of immensity that will be gained on driving through

feet. This process of benching and draining will continue as excavation progresses from the top of cut on down to the final grade of the roadway. It is estimated that 20,000 lineal feet of these drains will be required.

Ten bids were received on this free-way job and Ferry Bros., John M. Ferry, Peter L. Ferry, L. A. and R. S. Crow, a joint venture of Glendale, California, contractors were the low bidders at \$7,098,690.20.

Substructure Contract

The construction of the foundations for the main bridge across Carquinez Strait just 200 feet upstream from the existing bridge will require special skills and equipment for the deep water piers not often encountered in the usual highway contract.

The most spectacular operation in the construction of these foundations will be the sinking of large concrete caissons to bed rock approximately 135 feet below the surface of the water.

The lower portion of these piers, which measure 53 feet wide by 102 feet 6 inches long (about the size of a good city lot), will be precast at some location not far from the site of the bridge, launched into the waters of the bay and floated to the bridge site. At the bottom of these precast caissons will be a heavy fabricated steel cutting edge made from thick steel plates.

Positioning of Caissons

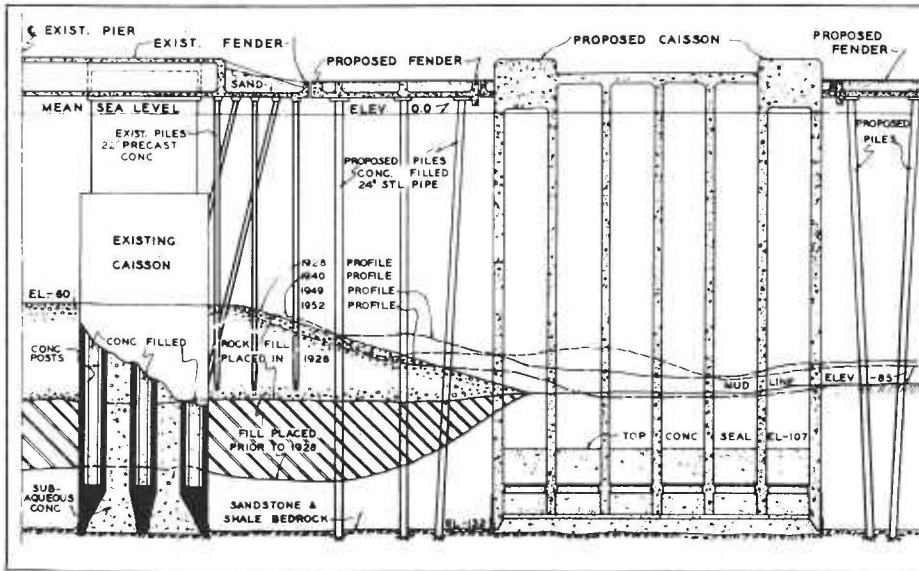
After being carefully positioned by heavy anchorages and guide towers,

additional sections will be added and the caissons will be lowered through the water and overburden to bedrock. The caissons will be lowered through the mud, sand and gravel by excavating material out from the bottom through 18 precast wells built into the caissons. In addition to excavation through these wells, provision will be made so that powerful streams of water can jet up from the sides of the cutting edges at the bottom if found necessary. These jets can cut away material from the sides and will reduce friction as the huge mass of concrete is gradually lowered to its final position on bedrock at the bottom.

During this sinking operation, which will take several months, great care must be exercised to keep the caisson from tipping or lowering too fast on one side or one corner. If it should get out of vertical then it must be righted by a carefully planned sequence of excavation and jetting.

Over half of the work in the foundation contract lies in these three caisson piers which will cost a little more than \$1,000,000 each. Other work will include the construction of two shore piers and one water pier 50 feet wide by 113 feet long founded on 260 steel bearing piles driven to bedrock.

As can be seen in the picture of the bridge, the center tower will have an extensive pier protection or fender system which will be founded on large steel pipe piles 24 inches in diam-



This sketch shows a section of the foundation work at the center tower of the bridge. To the right the section of the large concrete caisson is shown at its final resting place on bedrock at the bottom. To the left can be seen a half section of the existing caisson. The new and the old will be connected with one big fender protection system supported on the 24-inch-in-diameter 150-foot-long concrete-filled steel cylinder piles.

eter and 150 feet long, driven to bedrock and then filled with concrete. On top of these pipe piles will be placed large reinforced concrete girders and slabs surrounding the center tower and offering protection against navigation.

Five bids were received on the work involved in this contract. Mason and Hanger, Silas Mason Co., Inc. and F. S. Rolandi, Jr., Inc., a joint venture, were the low bidders at \$5,454,694.16.

Superstructure Contract

The fabrication and erection of the superstructure of the main bridge across Carquinez Strait will also require special skills and equipment not usually encountered in normal highway construction.

There will be approximately 14,000 tons of steel to be erected 146 feet above the waters of Carquinez Strait. Because of the height, the depth and current of the water, and navigation requirements, most of this steel will be erected by cantilevering out from the piers to avoid the use of falsework. Each of the main spans of the double cantilever construction will be 1,100 feet long, with two side spans each 500 feet long and a central tower 150 feet in width.

The design of the new parallel bridge will be similar in span length

and shape to the existing bridge but otherwise the two designs will be quite different because the new design will have a wider roadway and will incorporate several recent developments in modern bridge design.

Four Lanes of Traffic

The new structure will provide for four lanes of traffic on a 52-foot clear roadway supported by two trusses 60 feet apart. This will call for much heavier construction than the existing structure, which is 42 feet center to center of trusses and provides for only three lanes of traffic.

The new design features which make use of recent developments in bridge construction are: (1) the use of high strength bolts instead of rivets for field connections at the truss joints; (2) fabrication of the heavy truss members and floor beams by use of welding rather than riveting; and, (3) the use of a new high strength weldable steel nearly three times as strong as the ordinary structural steel used in bridge construction.

Bolted field connections were chosen in preference to rivets because the designers believe that field bolts will do their work with more assurance than the field driven rivets. In addition they feel that there is a good possibility that field bolts will show

economy over field rivets on truss connections of this magnitude. These bolts are $\frac{7}{8}$ inch, 1 inch and $1\frac{1}{4}$ inch in diameter. The smaller bolts are used for secondary bracing member connections, the 1-inch bolts are used in the main truss joints, and the large size bolts are used for the exceptionally heavy center tower joints. One average truss joint will require approximately 600 of these 1-inch bolts. The whole job will require 570,000 pounds of bolts or six freight car loads.

Welded Fabrication of Trusses

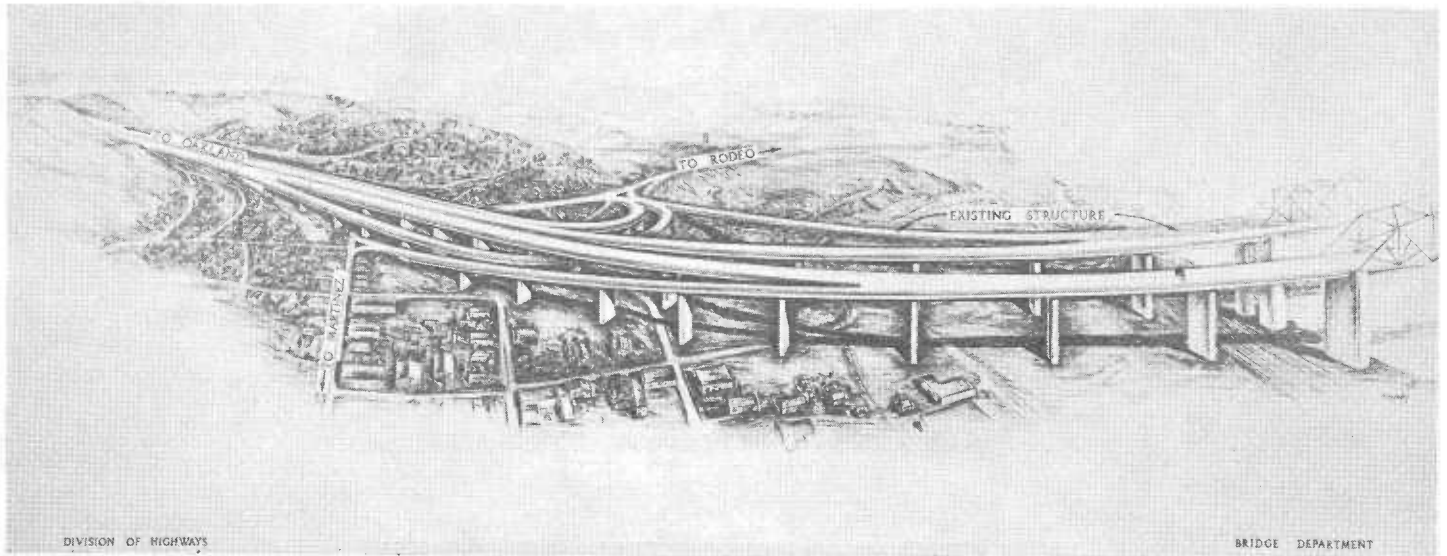
Welded fabrication of truss members is relatively new, and the great advances that welding has made in the past few years indicate that considerable economy can be realized by fabricating the heavy truss members by this method. It reduces the number of parts to be fastened together and simplifies and speeds up both design room time and shop work. As an example there are 29,440,000 pounds of steel to be fabricated and the low bid for this steel was \$8,091,776 which is an average of 27.49 cents per pound. If through simplified shop-work the fabricating costs can be reduced by as much as one-half cent per pound, it will result in a saving of \$147,000 for the superstructure contract.

Three types of steel were used in the design of these trusses, they were: (1) structural steel known as A7, (2) a somewhat higher strength low alloy steel known as A242, and (3) a recently developed extra high strength steel with good weldable qualities known as T1.

High Strength Steel

The use of this new extra high strength steel T1 capable of resisting 90,000 pounds per square inch when placed under tension, indicated a saving of approximately \$800,000 according to design computations. This large saving in cost was made in spite of the fact that the base price for the new steel was approximately 5.7 cents per pound more than regular structural steel.

This extra high strength steel was used in only the very heavily stressed members of the trusses. Because the heavily stressed members require such large sections of steel they become



Architectural sketch of the Crockett Interchange structure showing the approaches to the new and old bridge and the on and off ramps for use of traffic originating in the Crockett area

very stiff and when bent to conform to the large deflection of the 1,100 foot truss span, high internal bending stresses are set up. The vertical deflection of the trusses due to the dead weight of these long spans will be as much as 27 inches. The smaller these individual members are the less resistance they offer to the trusses conforming to this 27-inch deflection and therefore the smaller will be their stress due to bending. As an example the weight of one of these heavily stressed members would be 748 pounds per foot when designed of low alloy steel and only 400 pounds per foot when designed of this extra high strength steel. The high strength steels therefore made it possible to reduce the size of these heavily stressed members an appreciable amount and resulted in a considerable savings in the final cost.

Four bids were received on this project, which is the largest contract let to date by the Division of Highways. The low bidder was the United States Steel Corporation who submitted a bid of \$9,489,126. This is the same firm that fabricated and erected the steel superstructure for the existing Carquinez Bridge and the San Francisco-Oakland Bay Bridge.

Crockett Interchange Structure

The south end of the main bridge structure will connect to a series of

approach girder spans and ramp connections known as the Crockett Interchange Structure.

Traffic headed south from Sacramento and wishing to turn off at Crockett will use the existing bridge and the existing approach spans as an off ramp.

Traffic heading north from San Francisco and wishing to turn off at Crockett will be provided with a ramp taking off from the end of the "Big Cut" and swinging down under the approach spans and entering Crockett near the present intersection of Pomona Street and the existing highway. Crockett traffic headed for San Francisco will take off at this same intersection by use of a southbound on ramp. Crockett traffic headed toward Sacramento will take off from Pomona Street near Seventh Avenue and turn

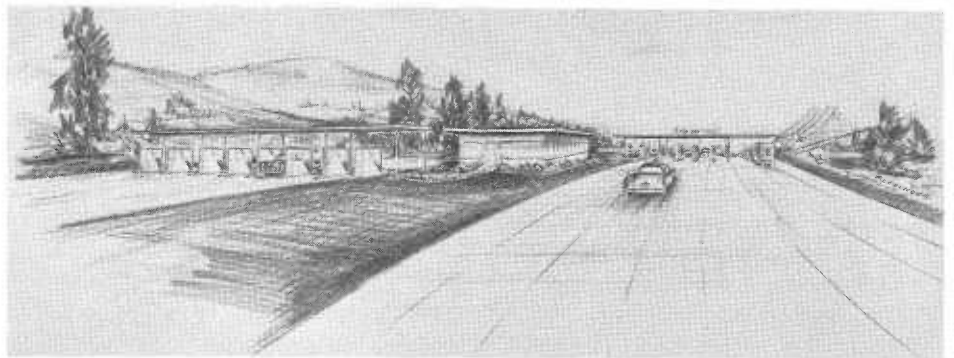
north by use of an on ramp. All of these connections will provide this area an easy access to the freeway and when completed will, figuratively speaking, place Crockett and vicinity at the front door to the San Francisco Bay area.

48 Girder Spans

The plans for this interchange structure call for the construction of approximately 48 girder spans ranging in length from 120 feet to 180 feet. These girder spans will require the fabrication of 4,250 tons of structural steel and the placing of 25,000 cubic yards of concrete.

In addition to this structural work there will be considerable grading and paving for the relocation of city streets. Approximately 300,000 square feet of new pavement will be placed in Crockett.

Architectural sketch showing how the Toll Plaza will appear on the Vallejo end approaching the bridge



Unfortunately the construction work in this area will make it necessary for more than 70 families living in the Crockett vicinity to find new dwellings. As is often the case with improvements that benefit all of the people, a few are sometimes temporarily inconvenienced.

Because of the sudden nature and rapid development of this Carquinez Bridge project since the last session of the State Legislature, families whose property is required for the construction of the interchange and the relocation of the city streets, have not had sufficient time to adequately provide for new homes. In order to relieve this situation, the State has provided that families may remain in their dwellings if necessary until July 1, 1956. In any event the relocation of this many families in a very small community like Crockett does involve hardships. The people of Crockett have faced this situation courageously and in a spirit of cooperation. We are sure that all who will benefit from this project appreciate this spirit of cooperation.

Eleven bids were received on the work involved in the construction of this interchange structure and local road improvements. Peter Kiewit Sons Company was the low bidder at \$4,661,462.

Future Contracts

In addition to these four contracts to be financed by Series A bonds there remains to be let a contract for the work from the north end of the bridge to a point about 0.2 miles north of the existing Vallejo Wye. This contract will include the construction of the Toll Plaza and Administration Building, and the widening of the Vallejo Wye. In order to adequately handle traffic with a minimum of delay it is planned to have 16 on-side toll booths for the initial construction with provision for four additional booths as traffic increases. This work is scheduled for advertisement in May of 1956.

A small mechanical and electrical contract is also to be advertised early in the spring of 1956. This work will provide for electrical power for beacon and navigation lights, and supply compressed air for maintenance operations of the two bridges.



Contractors and resident engineers gathered at the site of parallel Carquinez Bridge to discuss start of project.

TOP ROW, LEFT TO RIGHT: Russell G. Cone, Vice President, Mason and Hanger, and Project Manager for the substructure contract of the Main Bridge with Mason and Hanger, Silas Mason Co., Inc., and F. S. Rolandi, Jr., Inc.; E. E. McKeen, Erecting Manager for the steel work on the superstructure of the Main Bridge with United States Steel Corporation; F. S. Rolandi, Jr., Contractor on the substructure contract with Mason and Hanger, Silas Mason Co., Inc., and F. S. Rolandi, Jr., Inc., joint venture; Homer Olsen, Job Superintendent on the Crockett Interchange structure with Peter Kiewit Sons' Co.; L. G. "Bud" Waigand, Job Sponsor on the Crockett Interchange Structure with Peter Kiewit Sons' Co.; R. C. "Dick" Philbert, Superintendent of earth moving operations on the "big cut" job with Ferry Bros., John M. Ferry, Peter L. Ferry and Sons, and L. A. and R. S. Crow; Robert Hoyt, Superintendent of excavation on the Crockett Interchange structure with Peter Kiewit Sons' Co.; J. L. "Jim" Ferry, Contractor on the freeway contract including the "big cut" with Ferry Bros., John M. Ferry, Peter L. Ferry and Sons and L. A. and R. S. Crow, a joint venture; P. R. "Pat" Ferry, Contractor on the freeway contract including the "big cut"; Albert Lindquist, Superintendent bridge construction on the freeway contract.

LOWER ROW, LEFT TO RIGHT: Oscar Johnson, Senior Bridge Engineer, representative of the Division of Highways on the substructure and superstructure contracts for the Main Bridge and the Crockett Interchange contract; Wallace H. Ames, Associate Bridge Engineer, assistant resident engineer on the three-bridge structure contracts; Francis Donaldson, Vice President, Mason and Hanger Co. here from his New York office to look over the job on the foundation work for the Main Bridge; V. O. Smith, Senior Highway Engineer, representative of the Division of Highways on two large freeway contracts to the south of the bridge, one of which includes the contract for the "big cut" job; C. P. Sweet, Resident Engineer on the freeway contract including the "big cut."

Following the completion of the new bridge late in 1958 all traffic on the existing bridge will be stopped and routed temporarily over the new structure. This will be necessary in order to make the connections between the old bridge and the new approaches and ramps in Crockett. In addition the curbs on the old structure will be rebuilt and the roadway resurfaced to provide for 34 feet 4 inches between curbs, making the structure safer for the three lanes of traffic than is now provided by the 30-foot roadway width.

Completion in 1958

This work will be timed for advertisement in the summer of 1957 so that the contractor will have ample time to get his materials purchased and structural steel fabricated and be ready to start construction immediately after opening the new bridge to traffic. This will reduce to a minimum the period that traffic in both directions will be required to use the four lanes of the new bridge. Upon completion of this contract all southbound traffic will be switched back to the old bridge and

... Continued on page 66

Magazine Street Interchange on US 40 in Vallejo Area

By ROY M. CHALMERS, Project Design Engineer, District X

Independent of the Carquinez Toll Bridge Project but a future integral part of it in operation, an interchange at Magazine Street in Vallejo is now under construction as the first step toward conversion of US Highway 40 in and near Vallejo to full freeway standards.

A contract was awarded on December 5, 1955, for the construction of the interchange and an overcrossing at Magazine Street, a frontage road west of the existing highway between Sequoia and Alhambra Streets, and the realignment of the intersection at Magazine Street east of the existing highway.

The work is scheduled for completion in the summer of 1956, so that it will be of benefit to through and local traffic for two years before the scheduled operation of the over-all Carquinez Toll Bridge Project.

Traffic Volumes High

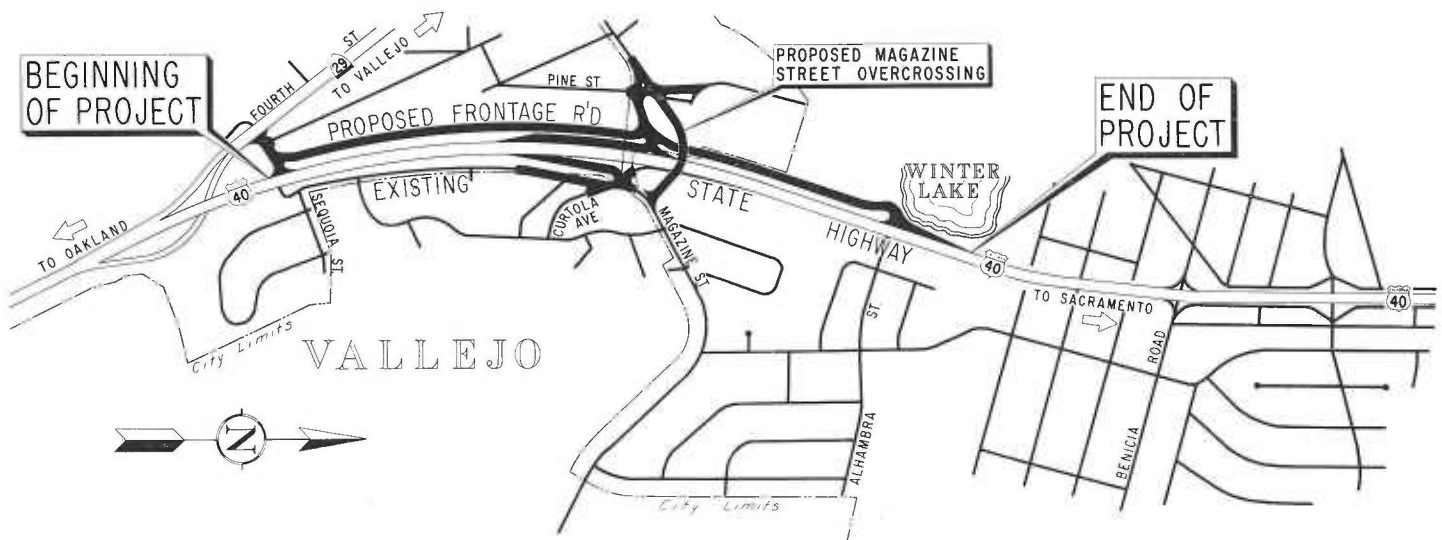
Since US 40 is the main highway between Sacramento and the San Francisco Bay area, traffic volumes are currently high and are expected to increase materially in the future. The construction of this overcrossing and interchange at Magazine Street will eliminate one of the undesirable connections at grade existing along this route. Traffic moving through this



Historic bid opening. First day of four successive days of bidding on four Carquinez Bridge projects. LEFT TO RIGHT: Morby Swanson, Richard H. Wilson, Assistant State Highway Engineer; Frank Palermo of Wilson's staff; State Highway Engineer Geo. T. McCoy.

intersection is presently delayed by traffic-actuated signals made necessary by the large volume of cross traffic. The 1954 average daily traffic count indicates that there are approximately

1,000 cars a day crossing the highway at this point and 20,000 cars a day traveling along the main highway. In addition, there are approximately 1,400 cars a day making left turns.



RETIREMENTS FROM SERVICE

Hans P. Williamson

A testimonial banquet and party at the Richmond Golf Club on the evening of December 16, 1955, attended by many friends and colleagues, honored the retirement of Hans P. Williamson, Senior Engineer of the Division of San Francisco Bay Toll Crossings.



HANS P. WILLIAMSON

Williamson was born on November 29, 1885, near Ludington, Michigan, and was educated in the Michigan public schools. In 1916 he graduated from the University of Michigan, receiving a bachelor of civil engineering degree. His first work after graduation was with Babcock & Wilcox and Carnegie Steel Company in Ohio and Pennsylvania, respectively, where he was employed in the design of plant buildings and maintenance engineering.

In 1920 Williamson went to Portland, Oregon, where he was married to Helen A. Cowles who had preceded him in the westward migration from Michigan. He worked in Portland for consulting engineers on building and industrial plant design and on steel fabricators.

The Williamsons moved to California in the spring of 1922, and after short engineering engagements with private concerns in Northern California, Williamson entered his first State service in the Division of Highways, Bridge Department, Sacramento, in November, 1923. For approximately two and one-half years he worked on design of steel and concrete spans for many of California's

valuable asset to the city by permitting uninterrupted transportation between the metropolitan section west of the main highway and one of its rapidly growing residential areas east of the freeway.

These large volumes of conflicting traffic movements are the principal contributing cause of a high accident frequency.

The construction of this overcrossing and accompanying interchange should markedly reduce these accidents in the future, when the traffic signals are removed and uninterrupted flow is permitted.

Frontage Road

The urban type frontage road planned for west of the highway, and terminating opposite Alhambra Street on this project, will ultimately be connected with a proposed frontage road from the north to become a part of the over-all development through Vallejo. This frontage road is to be constructed with two 12-foot lanes with an 8-foot paved shoulder on the outside and a barrier curb next to the outer separation between the freeway.

The existing east connection of Magazine Street will be improved by constructing a standard deceleration lane which in turn requires realigning the present frontage road east of the highway. A portion of the existing acceleration lane will be retained for use until the highway is widened to a six-lane freeway.

The approaches to the overcrossing have been designed with two 12-foot traveling lanes, and paved 5-foot shoulders, bordered with metal guard rail.

A considerable volume of pedestrian traffic across the freeway at this location is anticipated due to the rapidly growing urban development. Pedestrian crossings at grade are presently controlled by traffic signals. Provision will be made for pedestrians to use the overcrossing by construction of a sidewalk on the structure and a walk outside the guard rail on the approaches.

All features of these improvements have been positioned to accommodate the development of this highway into a divided six-lane freeway.

Vallejo, like many other California towns, has been growing rapidly in the past few years. One of the major present and future development areas lies east and southeast of the Magazine Street intersection. The elimination of this grade crossing will prove to be a

early highway bridges. He resigned this position in July, 1926, to return to Oakland to join the Pacific Coast Engineering Company.

In June of 1933 Williamson rejoined the state service in the Design Department of the San Francisco-Oakland Bay Bridge. Except for a short period of transfer to the Division of Architecture in 1938, Williamson remained with the San Francisco-Oakland Bay Bridge project until December, 1940.

In the following year Williamson returned to the Bridge Department of the Division of Highways in Sacramento, working on designs for many modern bridges in the state highway system until April, 1949, when he was transferred to the Division of San Francisco Bay Toll Crossings.

Since coming to Bay Toll Crossings and until his retirement on November 30, 1955, Williamson has been senior engineer (SFBTC) in direct charge of groups engaged in all aspects of superstructure design, including those for the proposed parallel crossing for the San Francisco-Oakland Bay Bridge and for the Richmond-San Rafael Bridge which is to be opened to traffic in October, 1956.

The Williamsons plan to travel to Michigan during 1956 but will return to their home at 3589 Fruitvale Avenue in Oakland. A son, Stanley C. Williamson, who is a teacher for the San Pablo School District, resides with them.

NO TRAFFIC PROBLEM

In 1895 there were only four passenger cars registered in the United States.

FIRST RACE

The first automobile race in America was held in Chicago on Thanksgiving Day, 1895.

LAKE ALMANOR

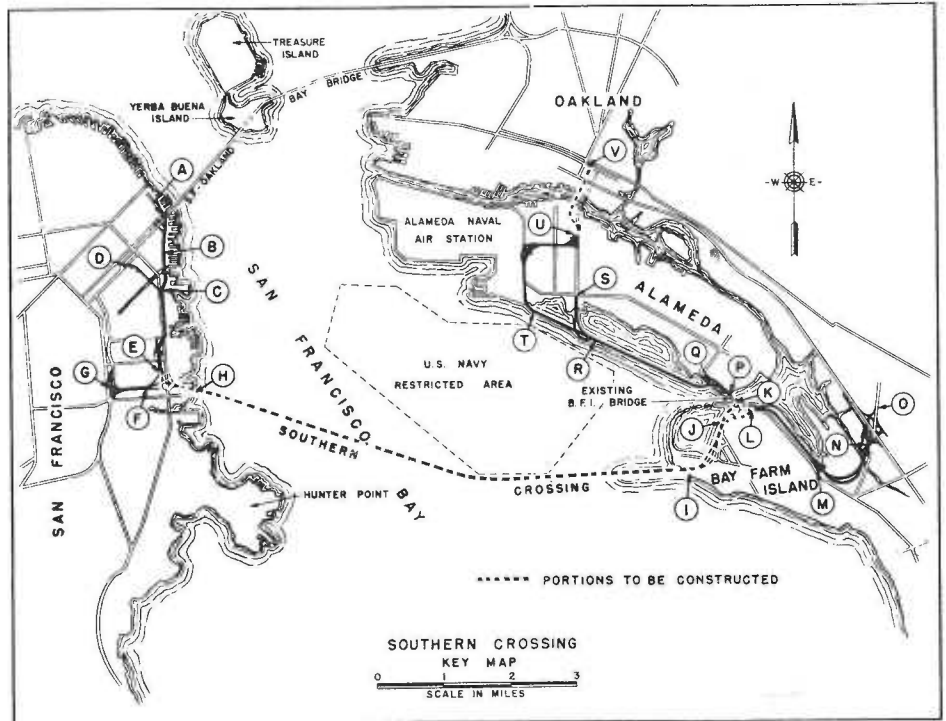
Lake Almanor, one of California's largest artificial lakes, is 45 miles in length.

Southern Crossing

By **NORMAN C. RAAB**
Projects Engineer

THE DIVISION of San Francisco Bay Toll Crossings, of the Department of Public Works, presented its report on the feasibility of financing and constructing a Southern Crossing of San Francisco Bay to the California Toll Bridge Authority at its meeting in Sacramento on December 13, 1955. An appropriation for the preparation of this report was authorized by the Legislature in the 1953 session.

The proposed Southern Crossing of San Francisco Bay will have its westerly terminus in the vicinity of Third and Army Streets in San Francisco, and its easterly terminus on Bay Farm Island in the City of Alameda.



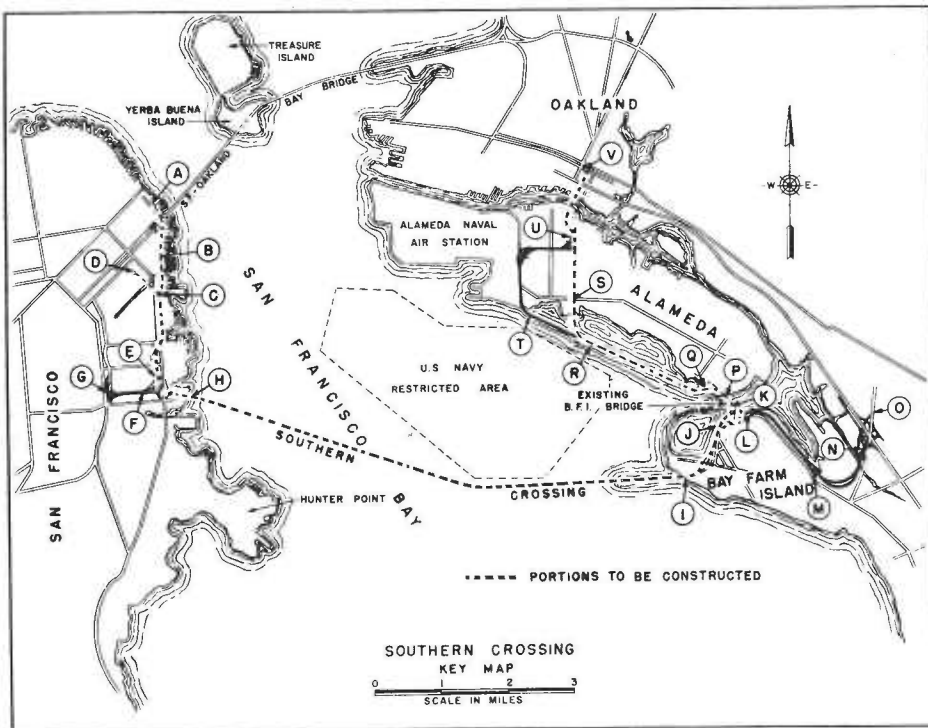
CONSTRUCTION BASED ON 25 CENT TOLL

Freeway connections from the bridge termini are to be made to the Bayshore and Eastshore Freeways on both sides of the Bay.

The Toll Bridge Authority has filed the report with the State Legislature for consideration of suggested amendments to the statutes pertaining to the approach system on both sides of the Bay, and for further policy determination. It is anticipated that the report will be before the Legislature at a special session in March of this year.

Numerous engineering, economic, and other factual matters relating to the construction of the Southern Crossing have been presented and discussed in the preceding parts of this report. The following conclusions can be made:

1. Although many difficult and unusual problems will be encountered, the entire project is feasible from an engineering and construction standpoint.
2. Contract plans and specifications for the largest single unit, the underwater crossing of the trans-bay section, will be completed and bids could be received by the early part of 1956. This procedure will indicate, prior to the sale of bonds, whether construc-



CONSTRUCTION BASED ON 30 CENT TOLL

R. L. Bishop New State Highway Commissioner

After 12 years of devoted service as a member of the California Highway Commission, F. Walter Sandelin of Ukiah tendered his resignation to Governor Knight in December. On



R. L. BISHOP

January 13th the Governor appointed Robert L. Bishop, auto dealer of Santa Rosa, to succeed him. Bishop was named for a four-year term. His appointment is subject to confirmation by the State Senate.

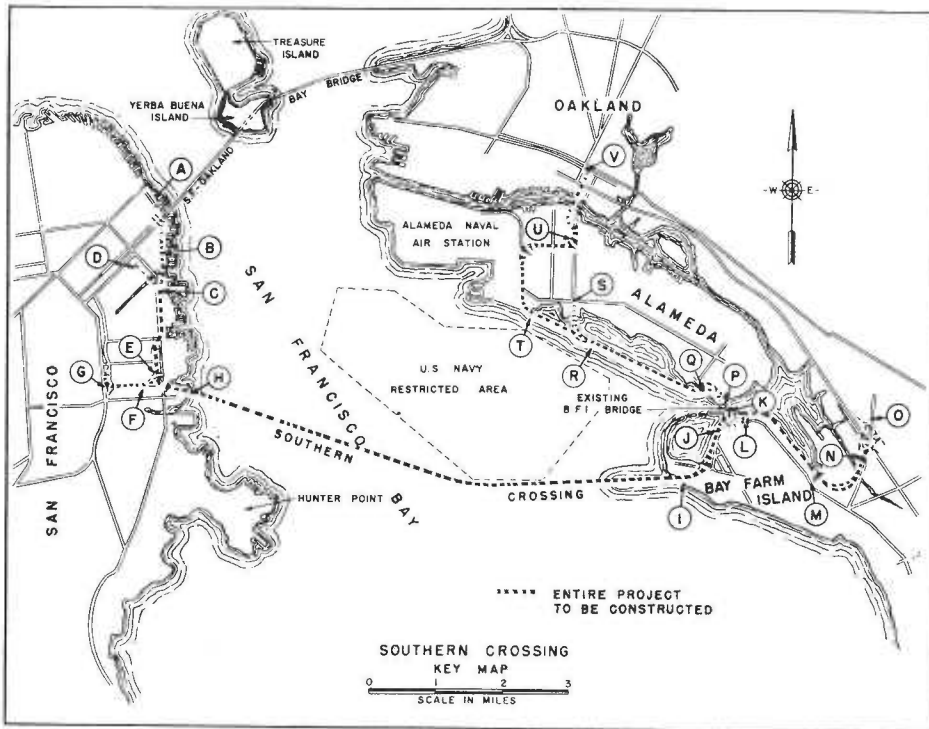
In a letter to Governor Knight, Sandelin said, "Serving as a member of the commission has been an esteemed privilege and an honor. I am grateful to have had the opportunity of participating in the California highway building program."

Sandelin was first appointed by Governor Earl Warren in 1943 and reappointed in 1944, 1948, and 1952.

The new commissioner was born in Springfield, Missouri, in 1897.

He is a member of the Santa Rosa City Board of Public Utilities and the citizens' advisory committee for the

... Continued on page 45



CONSTRUCTION BASED ON 35 CENT TOLL

tion costs are within financing limits.

3. Contingent upon receiving favorable bids on the underwater crossing work and the sale of revenue bonds, construction of the transbay crossing could start in the latter part of 1956.
4. It is estimated that the transbay crossing could be opened to traffic in 4½ years after the start of construction; the entire project including approaches could be completed in 5½ years.
5. The project as described by the statutes and reported on herein could be financed with an automobile toll of 35 cents on the Southern Crossing and a toll increase to 35 cents on the Bay Bridge at the time the Southern

Crossing is opened to traffic; however, this report does not take into consideration approach revisions as described and outlined in the *Assembly Journal* for March 23, 1955.

6. The entire project except the overwater crossing, with minimum approaches to street level, is adaptable to stage construction.
7. The accompanying Table IX-1 shows estimated length of the project that could be built together with the amounts of revenue bonds that could be redeemed by tolls obtained from users of the Bay Bridge and the Southern Crossing and put into effect at the time the latter is opened to traffic.

TABLE IX-1

Auto toll (cents)	Bond issue (\$1,000)	Repayment (years)	Project, miles			Total
			West Bay	Trans Bay	East Bay	
25	180,000	27	1.5	7.5	2.5	11.5
30	225,000	30	4.0	7.5	6.5	18.0
35	250,000	30	5.5	7.5	11.5	24.5

CHRISTMAS STORM TAKES HEAVY TOLL OF BRIDGES

By T. W. RODGERS, Senior Bridge Engineer

Bridges on state highways in Northern and Central California were struck a severe blow by the warm snow-melting storm of Christmas week 1955, which turned normally controllable streams into raging torrents. Five structures, three being classified as major bridges, were completely destroyed and 17 others were damaged to the extent that their use by vehicular traffic stopped. Countless others will require major to minor repairs but their use, for the time being, has not been restricted. An early estimate indicates that about \$2,000,000 will be required to return the destroyed and damaged structures to permanent standards; in addition, approximately a quarter of a million dollars has been spent to close the missing gaps on an emergency basis so that traffic service could be restored as soon as possible.

More Work to Be Done

In addition to the losses known at this time, subsiding waters in rivers and creeks are expected to reveal serious weakening of bridge pier foundations. Fortunately this weakening halted in time to keep spans from collapsing but the defects must be repaired before future high flows can complete the job of destruction. Cost of this work quite easily could reach a quarter of a million dollars due to large number of structures possibly affected.

Bridges under construction on routes not yet open to public travel also suffered flood damage estimated at this writing to amount to approximately \$100,000. Falsework was weakened and will have to be rebuilt. In some cases the progress of contractor's work had not reached the superstructure, thus leaving piers and abutments in less favorable position to withstand fast currents than if all members had been completed so as to tie them together.

Dangerous Debris Drift

While high water is often considered responsible for destruction of

bridges, this menace alone will quite often leave a structure virtually unscathed. Actually, the real villains are the accompanying threats, drift and scour. They pack the lethal punch, producing tremendous forces and excessive currents, that will send the stoutest of man-made works to oblivion. The story of the Christmas storm as it affected bridges again illustrates this fact. The urgency of drift removal explains the presence of state highway crews and equipment on bridges during the period of high flow.

Although the drift problem is usually associated with Northern California counties, where the natural litter of the forests and the residue of logging operations along streams creates an annual headache for highway maintenance forces, it also occurs in Central California. There the same trouble occurs from the local habit of dumping prunings, parts of fruit trees and other rubbish in normal dry creek beds. The huge mound of such debris which packed the channel entrance to the Saratoga Creek bridge and contributed to the lengthy overflow of the Bayshore Highway (US 101 Bypass) north of Santa Clara is a good example.

Although the cases of bridges submerged were well scattered throughout Northern and Central California, the most sizable damages and greatest monetary losses were concentrated in Humboldt, Siskiyou and Trinity Counties. The partial account that follows describes some of the most serious damage as well as other experiences of interest.

HUMBOLDT COUNTY

The major bridge over the Trinity River at Hoopa on State Sign Route 96 was the most serious loss of the storm due to its size and the isolating of towns to the north. The unprecedented flow, after rising above deck level, literally floated the smaller steel truss span out of sight, dumped the 225-foot main span into the channel, and toppled concrete piers. Crossing this large river immediately with a temporary structure was a difficult problem.

Farther north on this route between Orleans and Weitchpec all trestle spans and an abutment of the Bluff Creek bridge were washed away, completing the isolation of the latter community. Fortunately the main steel truss span was left intact so that returning the bridge to service will be made easier.

Debris removed from entrance of single span Saratoga Creek Bridge north of Santa Clara. Clogging flooded Bayshore Highway, US 101 Bypass.



North of Arcata on US 101 four timber trestle spans adjoining the main spans were carried away from the swollen Mad River and several nearby trestles were damaged sufficiently to interrupt traffic.

South of Eureka on State Highway Route 56 the big Eel River bridge at Fernbridge suffered the loss of the westerly concrete span and several connecting spans settled precariously.

Railroad Bridge Used

At Carlotta on State Sign Route 36 the undermining and partial toppling of a pier of the Yager Creek bridge left the continuous steel beam spans suspended in midair, closing the bridge to traffic. Although a project after the January, 1953, flood had deepened pier foundations, the massive collection of drift this time was too much to resist. Had not the Northwestern Pacific Railroad Company made its parallel bridge available for motor traffic, towns to the east would have been cut off for some time from the coastal area.

Several miles north of Garberville and just west of US 101 the joint county-state park bridge over the South Fork of Eel River in Whitmore

Grove State Park was weakened by high water and the battering of drift against truss members in the 300-foot main span. Until repaired, traffic was restricted to light cars only.

SISKIYOU COUNTY

Near Hamburg on State Sign Route 96 the two large steel truss spans of the Scott River bridge were carried away and the main pier destroyed, isolating Happy Camp and other Klamath River towns until a detour could be provided.

Another Scott River bridge, this one at Fort Jones on State Highway Route 82, was completely washed away although of modern concrete design. The center pier of the two-span bridge at nearby Kidder Creek dropped several feet due to undermining, seriously damaging it. The major forest fires in Siskiyou County late last summer, which permit quick concentrated runoffs from denuded hills and mountains, are believed mainly responsible for these losses.

On US 299 at Douglas City the concrete pier columns of the westerly spans of the Trinity River bridge were broken by the brutal pounding of giant logs and trees carried by the

extremely high water. These three concrete end spans after this loss of support collapsed completely. Traffic was restored to this main west-east Northern California route by the emergency installation of Army type Bailey bridge units that provided a one-lane temporary span so located to permit construction of permanent spans beneath later.

Further west on US 299, high water rose to deck level at the Trinity River bridge at Cedar Flat. Hard pressed maintenance men, foreseeing the danger, bulldozed away the top of the adjacent road fills, making more room for the raging river and relieving the pressure on the bridge. Even so, lower truss members suffered considerable damage. Their action undoubtedly saved the structure from the same fate experienced down-river at Hoopa.

PLUMAS COUNTY

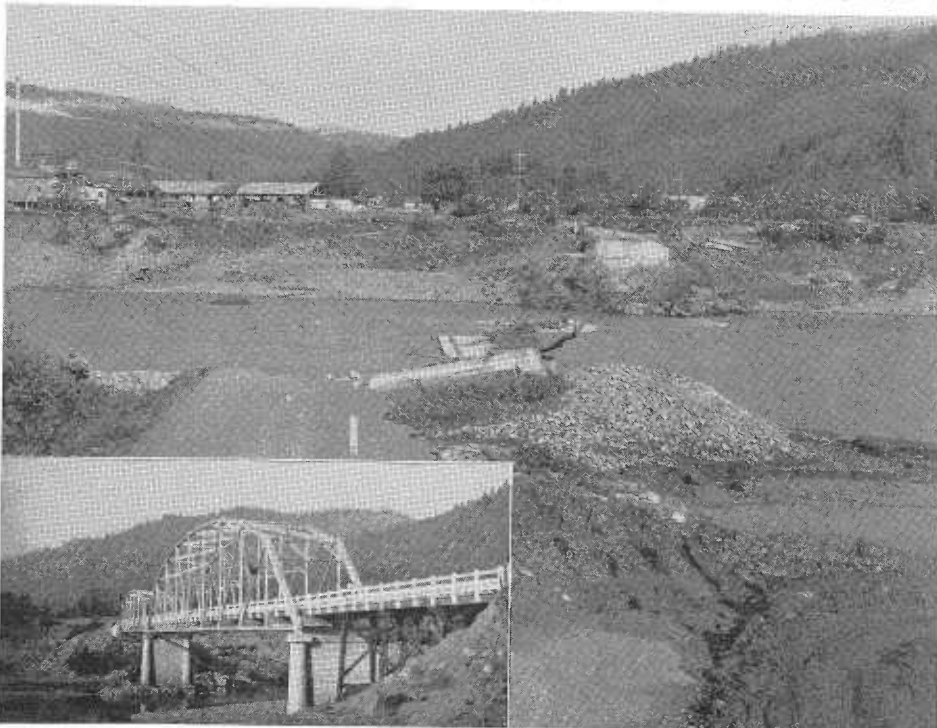
Just south of Blairsden on State Sign Route 89 the recently completed bridge over the Middle Fork of the Feather River carried traffic without interruption while the former steel truss span several miles upstream which formerly served this route was closed due to high water. An accompanying shift in the main channel flow undermined a main pier of the old bridge, causing several feet of settlement. Supports under approach spans were swept away.

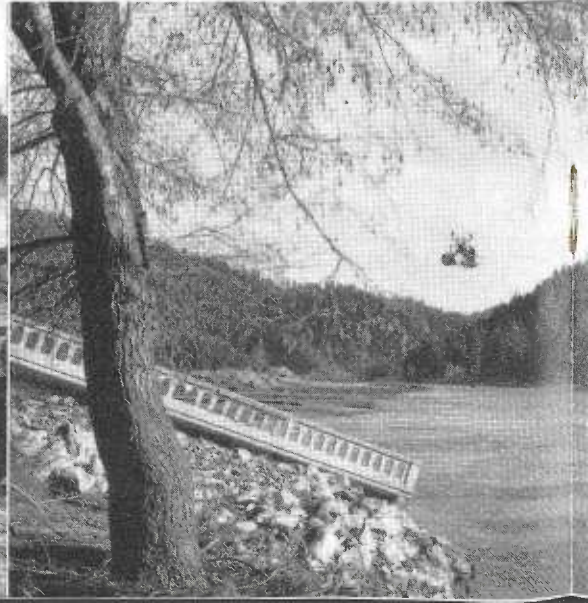
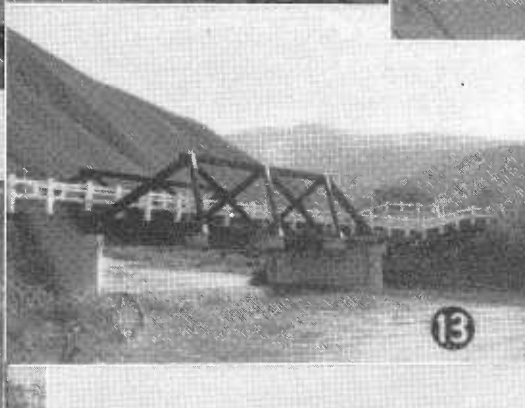
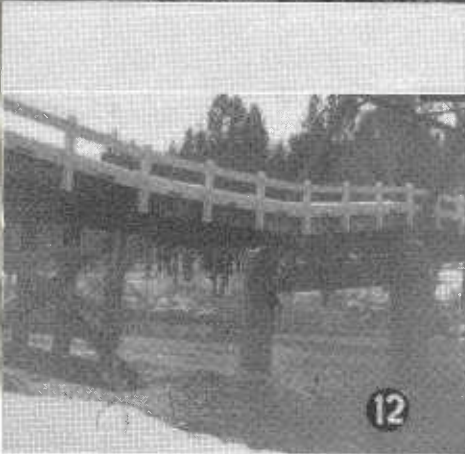
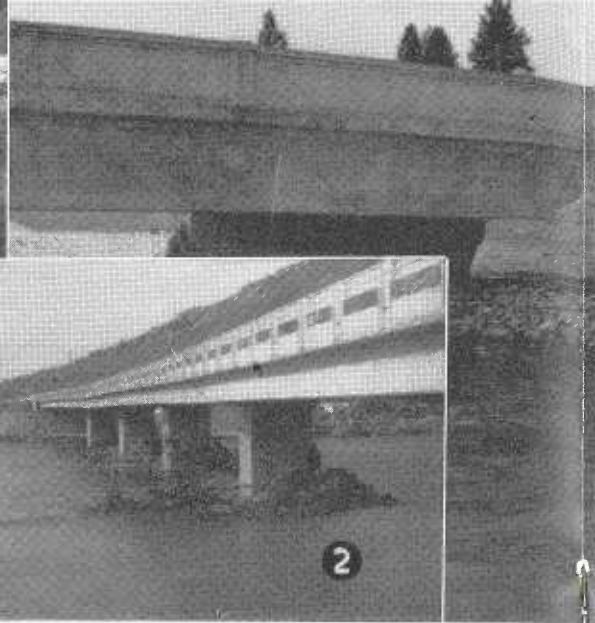
Several miles further south on Route 89 the oblique flow of meandering Sulphur Creek caused the undermining of all three bridge piers but the toughness of this continuous concrete slab design preserved it so that after peak flow subsided, light traffic was allowed to use the structure.

LASSEN COUNTY

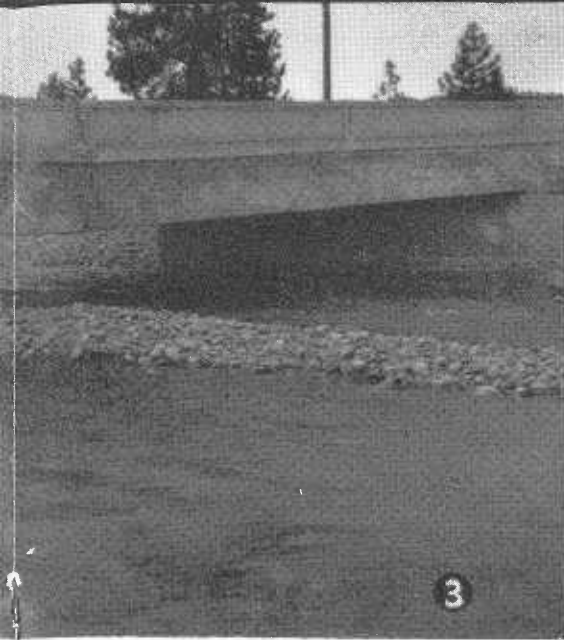
In the southeast corner of Lassen County Long Valley Creek burst its banks, harassing travelers who had chosen to use US 395 along California's eastern boundary to escape the closures on the other trans-Sierra highways. The bridge four miles south of Doyle was completely lost, causing the blocking of US 395. A detour 60 miles west over US 40 Alternate crossed another Long Valley Creek bridge. A partial washout here re-

Before and after views of completely destroyed 440-foot bridge over Trinity River at Hoopa, Sign Route 96





1. Scott River on Route 82 at Fort Jones, Siskiyou
2. Kaweah River on Route 131 near Lemon, Calaveras
3. Kidder Creek on Route 82 near Fort Jones, Siskiyou
4. Eel River on Sign Route 1 near Fernbridge, Glenn
5. Uvas Creek on State Route 152 near Gilman, Colusa
6. Crane Creek on Sign Route 140 near El Portal, Colusa
7. Yager Creek on Sign Route 36 at Carlotta, Tehama
8. Long Valley Creek on US 395 near Doyle, Tehama
9. Trinity River on US 299 at Douglas City, Tehama
10. Mad River on US 101 near Arcata, Humboldt
11. Mill Creek on Sign Route 1—20 miles north of Arcata, Humboldt
12. Old Middle Fork Feather River on Sign Route 1 near Arcata, Humboldt
13. San Carpojo Creek on Sign Route 1 near Arcata, Humboldt



3



4

Siskiyou County.

in Cove, Tulare County.

nes, Siskiyou County.

dge, Humboldt County.

Gilroy, Santa Clara County.

l Portal, Mariposa County.

ttta, Humboldt County.

yle, Lassen County.

r, Trinity County.

mboldt County.

north of San Simeon, San Luis Obispo County.

Route 89 near Blairsden, Plumas County.

ar San Simeon, San Luis Obispo County.



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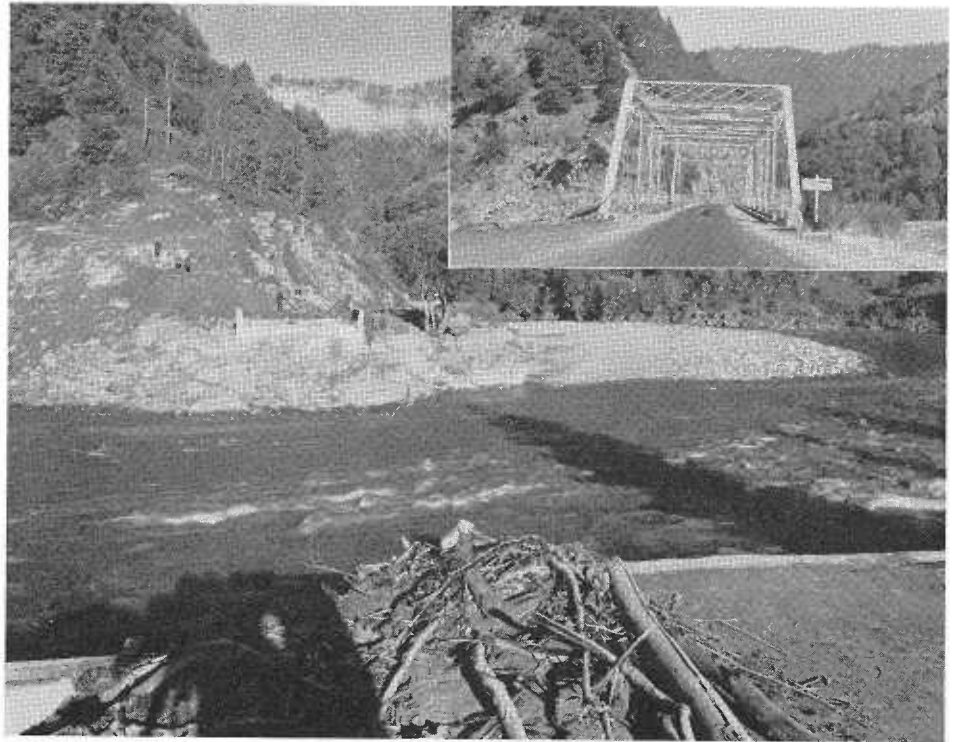
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stricted traffic to one lane and for a time threatened to cut this last remaining trans-Sierra link.

SUTTER AND YUBA COUNTIES

State highway bridges in this area, the scene of the costly and tragic Feather River levee break which inundated Yuba City, remained intact and escaped serious injury although river levels were exceedingly high. The veteran concrete structure on US 99E over the Yuba River at Marysville, known locally as the D Street bridge, was overtopped and abandoned for a time as the river rose upward to tops of the main dikes. It was reopened to traffic after the water had receded, no serious structural defects being apparent.

North of Marysville on US 40 Alternate the timber trestle over Simmerly Slough was under 10 feet of water, the bridge deck being almost that distance below the nearby levee top. This relatively quiet backwater of the Feather River did not disturb the buoyant structure however, and it was returned to service as soon as minor road damage on this route could be repaired.



Before and after views of demolished 200-foot Scott River Bridge near Hamburg, Sign Route 96

A few miles east of Yuba County in Sierra County the North Fork Yuba River ran rough shod over the three steel truss spans on historic Highway

49. During the height of the storm they were submerged under several feet of fast water and pounded by giant timber. Miraculously the structure escaped destruction. Although damaged, its capacity was not impaired sufficiently to prevent its use afterwards.

Chippis Creek Bridge on US 40 Alternate near Belden buried in silt and rock carried by rampant stream. Insert shows digging out operation.



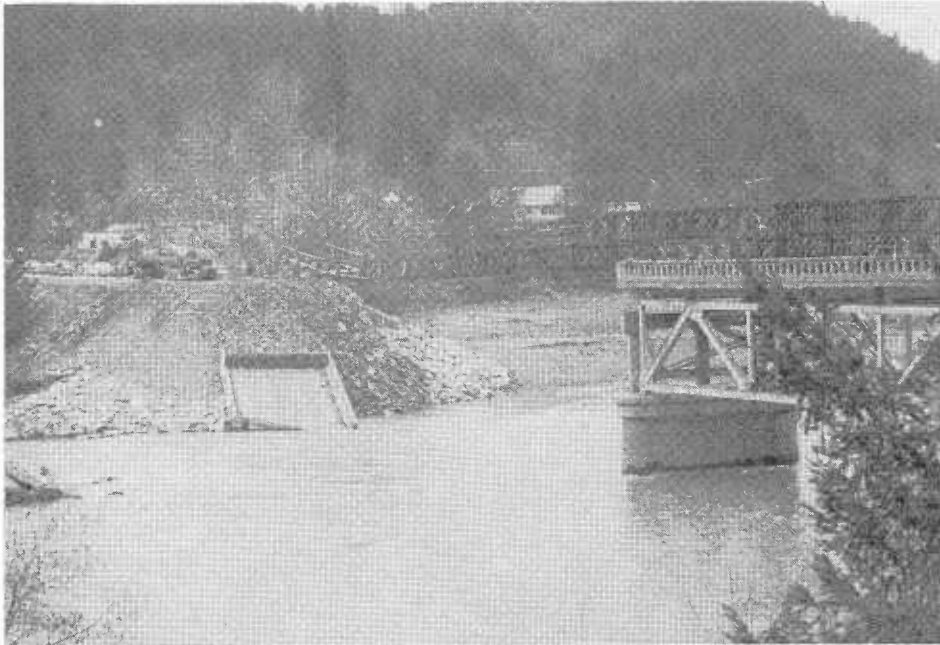
SANTA CLARA COUNTY

Uvas Creek rose to deck level on the bridge west of Gilroy on Hecker Pass Road, State Sign Route 152, causing the undermining and partial collapse of two concrete spans after a large tree lodged against a pier.

Heavy rainfall forced many streams over their banks and the Madrone Underpass and Agnew Underpass on US 101 and US 101 Alternate filled like giant bathtubs when this overland sweep of water become more than pumps could handle.

MARIPOSA COUNTY

Up State Sign Route 140, the Yosemite All-year Highway, road damages along the Merced River were heavy and a number of bridges were left standing alone like ghosts by washed gaps in road approaches. Only the all-concrete Crane Creek bridge



Emergency Bailey Bridge being pushed across gap in Trinity River Bridge at Douglas City, US 299

near El Portal was impassable with one abutment projecting into midair over a gaping cavity caused by stream erosion.

TULARE COUNTY

The Kaweah River, cresting at record heights, hammered successively at seven state highway structures down the rocky canyons of the Sierra and over the San Joaquin Valley, carrying the debris of decades. Near the entrance to Sequoia National Park on State Sign Route 198 the river was reported over the three concrete arch spans at Pumpkin Hollow, tearing away road approaches.

North of Lemon Cove the overflow onto lowlands kept water from overtopping the bridge on State Highway Route 131 but drift and scour nevertheless caused the settlement of one pier. North of Exeter on State Sign Route 65, the river running several feet over the deck, formed a dam of debris that forced the water through the road approaches beyond the ends of the bridge. Only one concrete piling was broken on the structure, however.

MONTEREY AND SAN LUIS OBISPO COUNTIES

The only major bridge damage in this area was along scenic State Sign Route 1 which follows the California coast line. Near San Simeon fast cur-

rents in San Carpojo Creek undermined a concrete pier under the main truss span and it settled several feet. Two other timber spans sagged when their underpinnings were carried away.

Large logs battered vital truss members of Trinity River structure at Cedar Flat, US 299. Bridge saved by diverting flow through gap bulldozed in road fill.



Ten miles north the log span which is located on the slide at White Creek and is accustomed to movement during heavy precipitation slid down the hill several feet at one end. At Mill Creek, 10 miles further north, both abutments of this three-span steel structure slid down the precipitous mountain side, leaving end span beams hanging precariously from the remaining piers.

While lack of space prevents telling of the emergency and other measures taken by various units of the Division of Highways to protect, restore and repair bridges, it must be said that the job was pushed through hectic, sometimes seemingly endless, days with an inspiring team spirit by all that helped make the task easier.

READER PLEASED

NEWPORT BEACH

DEAR SIR: I enjoy your publication very much. *California Highways and Public Works* as a publication carries a great deal of valuable, very useful information for a California resident and the material is very well presented.

Very truly yours,

MRS. C. A. BOWMAN
542 Catalina Drive

CLOSE FOLLOWING

Rear-end collisions are one of the most common traffic accidents and yet they're so easy to avoid. All you have to do is allow enough room between your car and the vehicle ahead. What's "enough room"? One car length for each 10 miles per hour of your speed is a fairly safe margin at speeds up to 50. Above that allow a little more.

WHEELS WERE INCLUDED

Back in 1906, fenders for automobiles were sold as extra equipment, notes the California State Automobile Association.

STANDING TIMBER

Oregon has more standing timber than any other state in the Union.

TURBO-JETS BURN FUEL FAST

A medium-power turbo-jet aircraft engine burns its own weight in petroleum fuel every 20 minutes.

Traffic Bar

*Durable Installation Is Developed
In Materials and Research Laboratory*

By HERBERT A. ROONEY, Associate Chemical Testing Engineer and
JAMES A. CECHEITINI, Assistant Physical Testing Engineer

THE PROJECT described in this article was in response to a request from Headquarters Maintenance that the

On January 21, 1955, an experimental installation was made at the Fulton Avenue and U. S. 40 intersec-

tion east of Sacramento as shown in *Photograph No. 1*. Twelve of the longitudinal and transverse bars at the

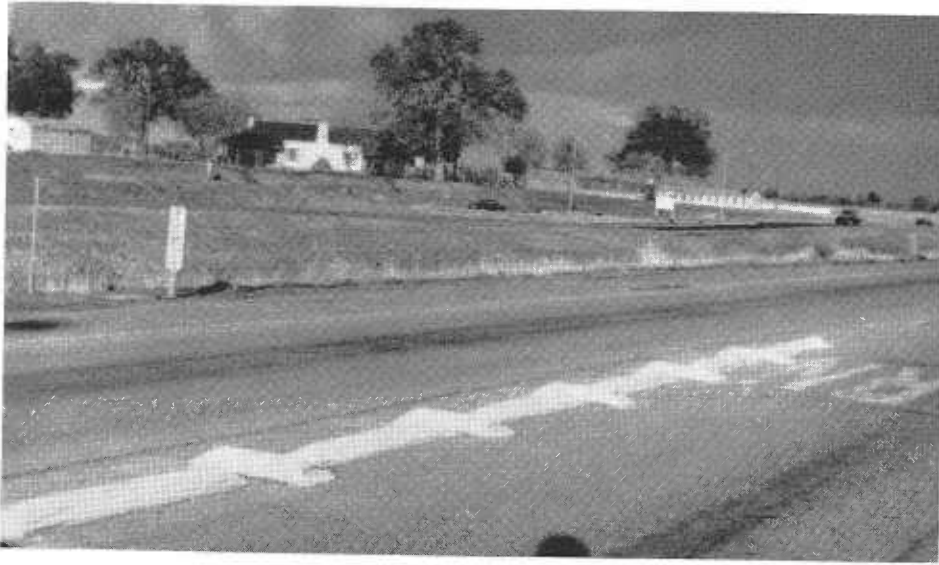


Materials and Research Department develop a durable adhesive for cementing concrete traffic bars in place. The object was to eliminate the steel dowels heretofore used in fastening concrete bars to a road surface.

Dowels remaining on a highway become a traffic hazard when a bar is knocked loose or shattered by impact. The asphalt emulsion type adhesive currently used with one type of traffic bar does not maintain its bond to a road surface when the bars are subjected to frequent impact. An epoxy-thiokol adhesive developed in the laboratory under the direction of E. D. Botts, Senior Chemical Testing Engineer, was used for bonding experimental concrete traffic bars to the concrete road surface on this project.



UPPER—Experimental traffic bars immediately after installation. LOWER—Traffic bars cemented with asphalt emulsion after two to three months.



Experimental bars after 11 months

east end of the dividing strip between the westbound and left turn lanes were removed and replaced by concrete bars made in the department and cemented in place with the epoxy-thiokol adhesive. The layer of asphalt emulsion remaining on the road surface after taking up the old traffic bars was removed and clean concrete exposed by the use of a concrete abrasion machine.

The epoxy-thiokol adhesive used in this installation has exceptional bonding power to clean portland cement or asphaltic concrete surfaces. For this reason it was deemed sufficient to apply the adhesive only to a zone one inch wide around the perimeter at the bottom of the bar. The location was ideal for the test in that the traffic bars dividing the two traffic lanes were hit frequently by trucks and many bars of the previous installation had been moved or broken.

Composition of Experimental Bars

The experimental concrete bars, designed by L. P. Kovanda and J. A. Cechetini of the Concrete Section, have the same cross section dimensions as illustrated in the 1949 Maintenance Manual, page 393, except they are recessed on the bottom to reduce weight and are cast in sections one foot long to reduce the difficulties in handling and in application to irregular road surfaces. The facing or outer portion of the bars to a depth of three-eighths of an inch is composed of white port-

land cement, titanium dioxide white pigment and glass spheres as an aggregate. The inner portion of the bars is composed of ordinary portland cement mortar. With this composition the bars are inherently reflective and do not require periodic painting and beading of the surface as any wear exposes new beads.

Results of Test

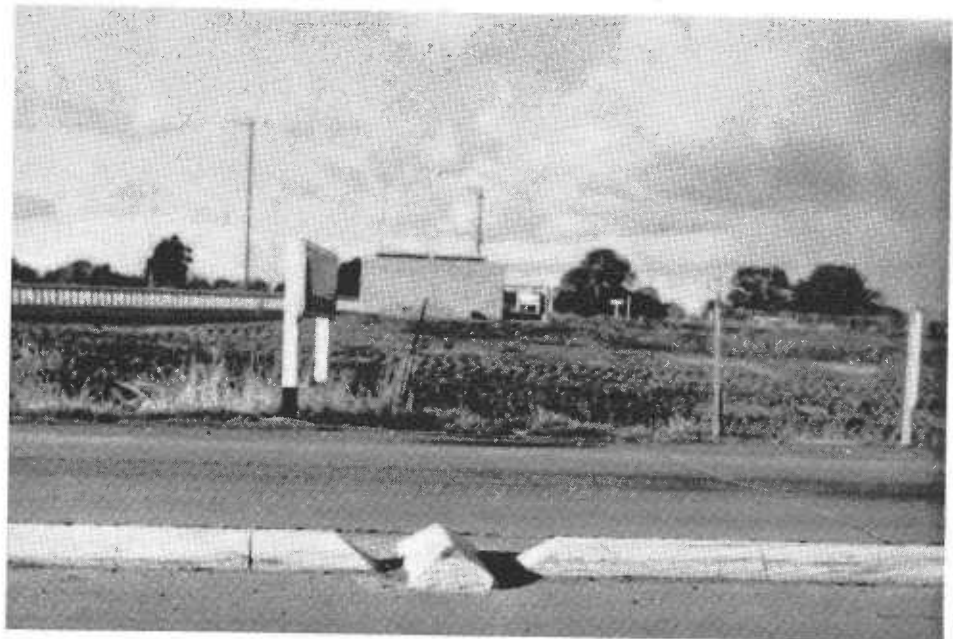
Prior to this test installation, it was necessary to replace several of the bars which were cemented with asphalt emulsion every few months. The bars

had either worked loose or were shattered by traffic, as shown in *Photograph No. 2*. Despite the constant impact of trucks in the past year, none of the experimental concrete bars cemented with epoxy-thiokol adhesive has worked loose. The bars have shown excellent resistance to the severe abrasion and impact to which they have been subjected. *Photograph No. 3* shows the condition of the experimental installation after approximately 11 months. *Photograph No. 4* is a closer view of part of the installation after 11 months.

Conclusion

Although this project was confined to a portland cement road surface, preliminary laboratory test data and results obtained from actual road tests in cementing traffic buttons to an asphalt plant-mixed surface indicate similar satisfactory results should be obtained by using the epoxy-thiokol adhesive for the installation of these concrete traffic bars on plant-mix highways. The epoxy-thiokol adhesive is more expensive than asphalt emulsion, but considering the fact that less of the former is used and a more permanent job obtained, the comparative over-all costs would appear to favor the type of installation described, especially in areas where traffic bars are subject to impact by traffic.

Experimental bars after 11 months, closeup



Public Hearings

Highway Commission Seeks Full Information on Freeway Routings

By FRANK B. DURKEE, Director of Public Works

WITH MORE than 10 percent of the motor vehicles in the entire Nation registered in California, this State has for years had a tremendous problem of providing adequate highways. The continued rapid increase in population and traffic during and since World War II has made the development of modern freeways along the principal state highway routes a matter of extreme urgency for the safety and welfare of our people.

Fortunately, California has had during this critical period the advantage of forward-looking legislation on which to base the steady expansion of its freeway network in accordance with sound long-range planning.

From the standpoint of future development, one of the gravest responsibilities delegated by the Legislature to any state agency is that of route adoption—the spelling out of highway locations between termini or control points established by Legislature when it designates a route as a state highway. Determination of routings, particularly freeway routings, is the keystone of the highway program in this State.

Commission Responsibility

Recognizing that state highway routings are matters of state-wide effect and interest, the Legislature has vested full authority for route determination in the California Highway Commission. The commission is by law a seven-man body which "shall represent the State at large * * *." (Sec. 70.2, Streets and Highways Code.)

Throughout the years the commission has sought to discharge most conscientiously the responsibility for route determination on the basis of the greatest good to the greatest number.

At the same time, the Highway Commission takes full cognizance of the needs and desires of the individual



Typical of the meetings called by the Division of Highways for public information and discussion of tentative freeway routing proposals is this session in the Mendocino County Courthouse in Ukiah on January 17, 1956. It was the second such meeting in the case of a proposed freeway route for US 101 in the vicinity of Ukiah, called by District Engineer A. S. Hart of District I. Hart is using a large aerial mosaic of the Ukiah area in his presentation.

communities, large and small, which the freeways must traverse. It is the commission's firmly established policy, originally stated in 1948 in a resolution which has since been revised and expanded, to give every possible consideration to local interest consistent with the solution of the over-all traffic problem.

Full Public Information

The commission's policy calls for full public information concerning the various alternative routings studied by the Division of Highways, public meetings at which the engineering and economic data can be explained and questioned, and, if desired or considered necessary by the local governmental authorities, a public hearing by the commission. As a part of this procedure, the commission may and some-

times does schedule public hearings on its own initiative.

Only after full opportunity has been provided for the presentation of all facts and arguments does the commission take final action to adopt a route and declare it a freeway.

The next major step before construction can begin involves a *freeway agreement* between the State and the city or county (or both) concerned. This freeway agreement spells out the necessary adjustments of local streets and roads as a result of the proposed freeway.

Section 100.2 of the Streets and Highways Code makes a freeway agreement mandatory before any local street or road can be closed by the State. The State may, legally, proceed with freeway construction without an agreement, as long as separation struc-



UPPER—Shows the front portion of the Chico State College auditorium on January 20, 1956. On the stage at the right of the picture are four members of the California Highway Commission, conducting the public hearing; at the two tables at the left are engineers of the Division of Highways, who used the maps in the background to explain their recommended and possible alternatives for a freeway location for US 99E in the Chico area. The speaker, standing in the first row with back to camera, is Mayor Theodore Meriam of Chico. LOWER—Shows the same auditorium on July 14, 1955, at a public meeting called by District Engineer A. M. Nash of District III to explain the results of freeway routing studies in the Chico area. The speaker in foreground is Dr. H. Thurston Hatch, Chico superintendent of schools. (Lower photo courtesy of Chico Enterprise-Record.)

tures are provided for every local road or street intersection; but in practice, this has never been seriously considered. Negotiations leading to freeway agreements have occasionally extended over a period of years.

Experience in many parts of California has shown properly located freeways to be beneficial to the local community as well as to traffic. The improved service thus provided to large volumes of vehicles also makes

for greater local traffic safety and relief of local congestion. The adoption of a freeway location also establishes the pattern and often provides the opportunity for sound, long-range planning of the community, for urban renewal, and other developments.

The engineers of the Division of Highways have had the full benefit of the thinking of engineers and planners of the respective cities and counties in solving freeway location problems in the public interest. This cooperative approach is undoubtedly another factor in California's nationally recognized leadership in freeway development, which has grown out of our sound structure of laws governing route determination and freeway agreements, supplemented by a Highway Commission policy of full consideration for local as well as statewide needs.

TEACHER USES MAGAZINE

THE UNIVERSITY OF NEW MEXICO
Albuquerque, New Mexico

California Highways and Public Works

GENTLEMEN: I would like to thank you for continuing to send me *California Highways and Public Works*. I have found this magazine to be of great value to me as a teacher and an excellent source of material for my classes in Highway Engineering. The articles on the effect of freeways on the economy of surrounding areas are of special interest.

Very truly yours,

MARVIN CLARK MAY
Associate Professor

RACING WASTES GAS

Don't race your engine while waiting for the light to turn green, advises the National Automobile Club. Let the other fellow get away first if he wants to, and waste his gas!

OLDEST FORMATIONS

The Alabama Hills, located to the west of Lone Pine in Inyo County, are reported by the National Automobile Club to be among the oldest geological formations on this continent.

JOE BEAVER vs. STATE OF CALIFORNIA

By H. CLYDE AMESBURY, District Traffic Engineer

Down on the South Fork of the Feather River they're a feudin'. It isn't a shootin' war but both parties are mighty determined.

The parties to the dispute are a small furry denizen named Joe Beaver and Cecil Koenig, the maintenance superintendent of the Division of Highways at Quincy.

To provide a little background for the argument, the following items are supplied:

Joe and his family lived in a small stream just south of Blairsdon. This past year, the division awarded a contract to reroute the highway and crossed Joe's stream. The plans called for a fill which the contractor proceeded to place. This met with Joe's wholehearted approval; a dam was being constructed and a very substantial one just where he wanted it. However, he was horrified to note they left a hole in it containing a pipe 36 inches in diameter and it didn't hold water. With the best intentions in the world and in a spirit of helpfulness, he proceeded to plug the hole.

Joe Cost State Money

During the course of construction, the contractor spent about \$300 unplugging the pipe. Joe knew very well you couldn't have a dam with a hole in it! He busily plugged away and hoped the contractor would see the light.

Finally, the contractor completed his work and with the pipe all clean had it accepted by the State. Then in a few days before the maintenance department took over, Joe plugged the pipe tight.

Now appears Cecil Koenig; he was horrified to find a pipe plugged on his new job. He sent a crew to clean it out. They worked from 8 until 3 o'clock and had it about completed. That night Joe assembled his family and next morning when the crew returned the pipe was plugged again. Looked like Joe won this round.

Then Cecil tore out the plug and built a contrivance of steel posts and



Creosote bucket still on fence. Joe had the water about two feet over the pipe.

Pictures of beaverproof barrier



mesh to keep Joe away from the upper end of the culvert. Cecil claimed he won that round.

Joe examined and investigated this addition to the landscape for about a week until he was certain it wasn't some kind of a trap to catch an unsuspecting and helpful beaver. Then he tunneled under the wire and plugged the pipe. That round he won.

What Next?

Cecil looked over the situation, cleaned out the culvert, spotted where Joe came under the wire, and hung a bucket of creosote with a small hole in the bottom where the liquid dripped out over the location. Joe apparently got some of this on his fur. Maybe he got some in his eyes. If there had been a referee he would have screamed "low blow" and "foul." He definitely had an odor such as no beaver ever had before and was probably ostracized by his family. Cecil claimed that round.

Joe waited about 10 days. The weather turned cold. The creosote stopped dripping and Joe and family happily restored the dam by plugging the culvert. Joe claimed the round.

Cecil then came out and unplugged the pipe and drove a series of steel stakes just below the mesh and close enough together so Joe couldn't get through. Cecil is claiming this round and tentatively claiming the contest.

As for Joe, he doesn't concede anything.

BISHOP MADE COMMISSIONER

Continued from page 33 . . .

Los Guilucos School for Girls. In addition he is a member of the Redwood Empire Association and chairman of the Industrial Committee of the North Coast Council of the State Chamber of Commerce.

Bishop is past president of the Santa Rosa Chamber of Commerce and the Santa Rosa Rotary Club. He was the first general chairman of the Santa Rosa United Crusade. Recently he became a member of the neighbors flood committee, which was organized to help flood victims in Northern California.

Harding Retiring, Telford Moves Up to Assistant State Highway Engineer

Paul O. Harding, Assistant State Highway Engineer in charge of state highway development and operation in Los Angeles, Orange, and Ventura Counties for the past six years, is retiring after 27 years of outstanding service with the California Division of Highways.

Appointment of Edward T. Telford to succeed Harding was announced by State Highway Engineer G. T. McCoy.

Harding has been closely identified with the world-famous metropolitan freeway network in the Los Angeles area since August, 1947, when he became a district engineer under S. V. Cortelyou. He succeeded Cortelyou as Assistant State Highway Engineer when the latter retired in October, 1949.

Freeways and expressways in the three counties comprising District VII of the Division of Highways now include 182 miles of completed projects and 45 additional miles under construction, costing a total of \$414,000,000 for construction and rights of way. For the 1956-57 Fiscal Year alone, the construction and right of way budget for District VII totals about \$86,000,000, covering additional projects planned and designed under Harding's supervision.

Harding was born in Garden City, Kansas, in 1893. From 1912 to 1915 he worked on location surveys in Oregon, after which he began his studies at the University of Nebraska. These studies were interrupted by service in World War I as a first lieutenant in the 27th Field Artillery, but were completed in 1922 when he received his B.S. degree in civil engineering.

Moving to California in 1923, Harding first worked for municipal and private engineering organizations. In 1929 he joined the Division of Highways as an inspector and instrumentman in District IV at San Francisco.

In 1931 he became assistant to the district construction engineer, and in 1933 he was placed in charge of the location and design of the approaches to the San Francisco-Oakland Bay Bridge, later supervising construction

of these approaches. In 1937 he was promoted to Assistant District Engineer of District IV.

In 1942 Harding was appointed District Engineer of District X, with headquarters at Stockton, where he remained for five years, until his transfer to District VII.

Harding is a member of the American Society of Civil Engineers and an honorary member of the American Right of Way Association. He was one of the founders of the California State Employees Association and was its second president, in 1932.

His responsibility for the planning and construction of the vast freeway network in the Los Angeles metropolitan area has made him a participant in many civic and governmental activities relating to the development of that region during the past eight years.

Telford will be promoted from the position of district engineer in charge of planning, a post he has held for the past three years. Telford's former duties are being assumed by District Engineer George Langsner, who has been in charge of operations for District VII. District VII includes Los Angeles, Orange and Ventura Counties.

To fill Langsner's position, McCoy announced the appointment of Lyman R. Gillis, presently Assistant District Engineer in District IV, with headquarters in San Francisco.

Harding who has spent 27 years in the state highway organization, the last six years in charge of District VII, is handing over to Telford the responsibility for a program involving more than \$100,000,000 a year in expenditures, including \$86,000,000 budgeted for the 1956-57 Fiscal Year for construction purposes, including rights of way. Freeways and expressways in District VII amount to 182 miles completed and 45 miles under construction, costing a total of \$414,000,000. Most of the work under the accelerated highway construction program has been accomplished during Harding's tenure in the district.

. . . Continued on page 67

Los Banos

City Finds a Solution for
Its Grave Parking Problem

By HARRY J. WEBB, District X

WHEN THE owners of commercial establishments catering to highway traffic ask that parking on the highway be prohibited, we think this is news.

This unusual situation developed on State Sign Route 152, Pacheco Pass Highway, through the southern portion of Los Banos a little over a year ago. At that time, the property owners along Pacheco Boulevard petitioned the city officials of Los Banos to enact the necessary ordinance for prohibiting all parking on the highway within the corporate limits.

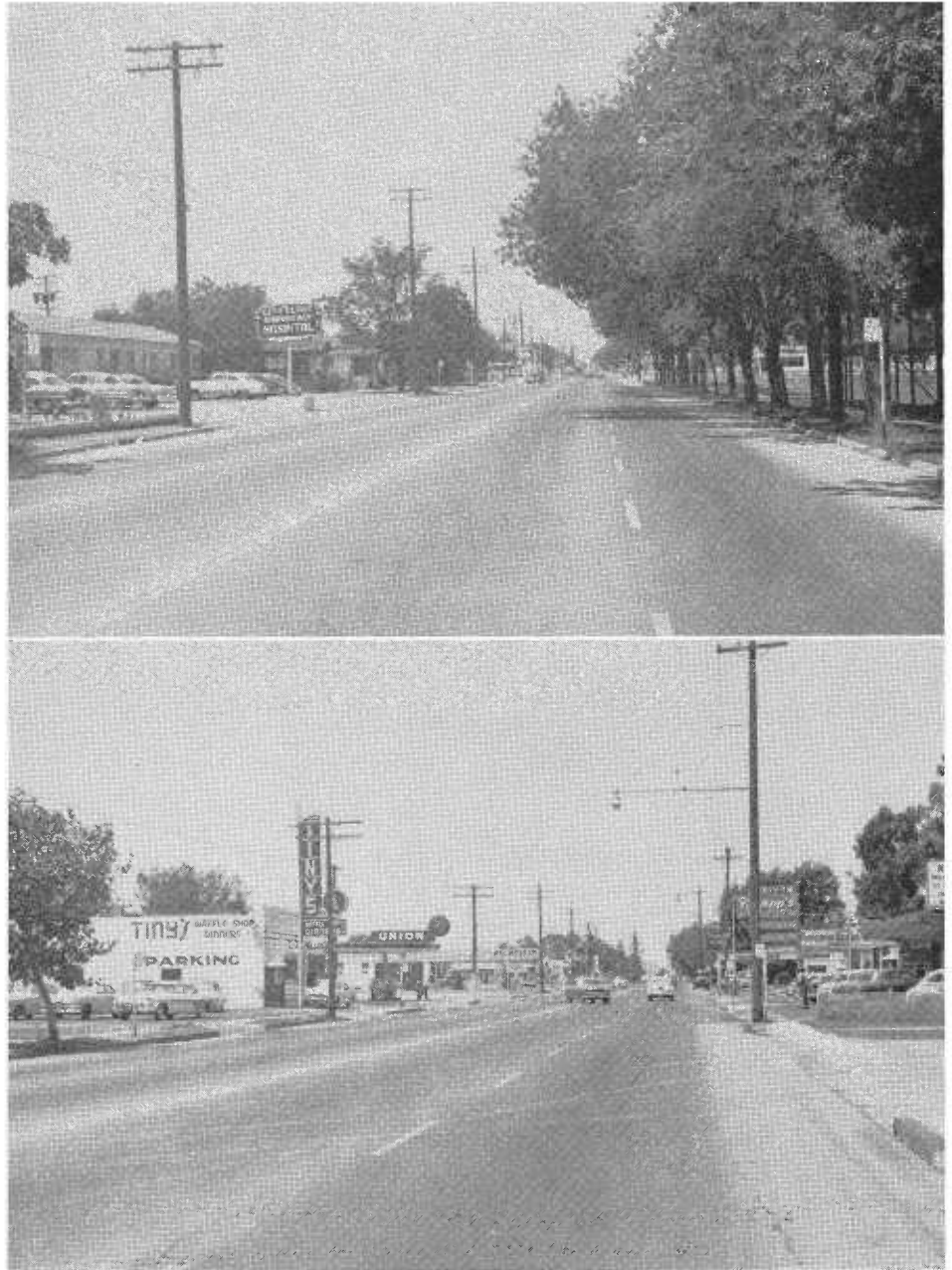
The property owners and the city officials recognized the fact that the 58-foot city street section would not be adequate for four lanes of traffic without such action. Unless the free flow of traffic were assured, it was felt that public demand would result in an ultimate re-route around the town.

Off-street Parking

Pacheco Boulevard does not traverse the main business district and, as mentioned above, the majority of business establishments depend upon the motorist for revenue. The merchants have met this problem by providing off-street parking on practically a 100 percent basis.

A resurvey one year later found Pacheco Boulevard free of congestion with adequate capacity to handle the rapidly increasing traffic on Route 152.

The editor of the *Los Banos Enterprise*, F. A. Merrick, who is vitally interested in highway matters, particularly those affecting the community, is of the opinion that both the traveling public and the property owners are pleased with the results. Property values have remained firm and business has improved. Many local residents now patronize the establishments since congestion has been reduced and off-street parking provided.



UPPER—Medical Center parking. LOWER—Off-street parking at Restaurant.

No Accidents

Chief of Police R. H. McSwain states that the elimination of parking, especially truck parking, has improved visibility and safety. Since the ordi-

nance was enacted, he said, there have been no reported accidents on Pacheco Boulevard.

Enforcement of the ordinance has presented little difficulty inasmuch as



UPPER—No parking signs Pacheco Blvd. LOWER—City owned parking lot.

motorists generally prefer to park off the highway.

The city clerk, Michael Dambrosio, is enthusiastic about public reaction. Residents are pleased with the improved conditions and the attractiveness of Pacheco Boulevard. The city council of Los Banos is cognizant of the advantages of off-street parking and has provided public parking lots with no charge to the motorist.

Certainly, the City of Los Banos has lived up to its reputation as a progressive community and should be com-

mended for its action in furthering progress.

WEARINESS AND WORRY

Two enemies of safe driving are weariness and worry. Weariness slows down reaction time and worry affects concentration. You can't always stop worrying when you get behind the wheel of your car, says the California State Automobile Association, but you can take a rest if you're weary. Give yourself a break, don't drive when you're tired.

D. H. McMillan

D. H. McMillan, Senior Structural Designer for the State Division of Architecture, was honored by fellow employees at a farewell dinner December 15th in Sacramento. He retired December 28, 1955, after more than 39 years of state service.



D. H. McMILLAN

McMillan was born and reared on his father's stock farm in the hills of Yuba County where he also attended grammar school. Following graduation from the Sacramento High School, he worked for a time with his father. In June 1914, he quit the farm to work for the State as a messenger clerk with the Division of Architecture.

In a short time he was promoted to senior clerk and remained in that position until he resigned in 1919 to work for the 12th Naval District in San Francisco. As a junior draftsman in the Bureau of Construction and Repair, he worked on plans of U. S. Navy destroyers and submarines.

A year later McMillan returned to the Division of Architecture as a mechanical draftsman, inspecting steel shipments fabricated by the Palm Iron Works for the construction of the California State Building in San Francisco's Civic Center. By 1931 he had been promoted to associate structural engineering draftsman preparing drawings of schools, gymnasiums, hospitals, and other state facilities.

During World War II he worked for a short time with the U. S. Engineers and for Ellison & King, a structural engineering firm in San Francisco. At Ellison & King he detailed the plans of 26 concrete ships for the U. S. Maritime Commission.

In December 1943, he returned to Sacramento and the Division of Architecture.

McMillan plans to return to the Yuba County hill country of his childhood where with his wife, Jeanette, he expects to pursue his first and only avocation, livestock ranching.

Cost Index

Rises During Fourth Quarter of
1955 Highway Construction

By RICHARD H. WILSON, Assistant State Highway Engineer,
H. C. McCARTY, Office Engineer, and
JOHN D. GALLAGHER, Assistant Office Engineer

THE CALIFORNIA Highway Construction Cost Index stood at 212.6 (1940 = 100) for the fourth quarter of 1955, a rise of 1.9 percent over the 208.6 for the third quarter, and 12.3 percent over the first quarter of 1955.

For the entire calendar year of 1955 the Index stood at 203.8. This is an over-all increase of 5.3 percent over the 193.5 for the calendar year of 1954.

The computations for the fourth quarter Index were made excluding three large contracts awarded for construction of the new parallel bridge across the Carquinez Strait at Crockett. The total amount of these three contracts is nearly \$20,000,000 and the concentration of this amount of money and the large quantities of steel (12,880,000 pounds of structural steel, 10,740,000 pounds of high strength low-alloy structural steel and 5,820,000 pounds of high strength T-1 structural steel) were such that their inclusion would have unbalanced the entire Index for the quarter. While the poundage of high strength steel was much less than would have been required had the bridge been built entirely of ordinary structural steel, the cost per pound for the high strength steel was much higher than for straight structural steel. An unusually large structure such as the Carquinez Strait Bridge is not comparable from the cost standpoint to the normal highway project, even in this day of six, eight and ten million dollar free-way jobs.

However, as a matter of interest and comparison a separate computation of the Cost Index was made including the Carquinez Bridge. The result of including these bridge quantities and prices brought the Index to 228.8, which is approximately 7 per-

cent higher than the normal Index without the three Carquinez Bridge contracts.

Even though the rise in the California Highway Construction Cost Index during the fourth quarter of 1955 was only 1.9 percent it antici-

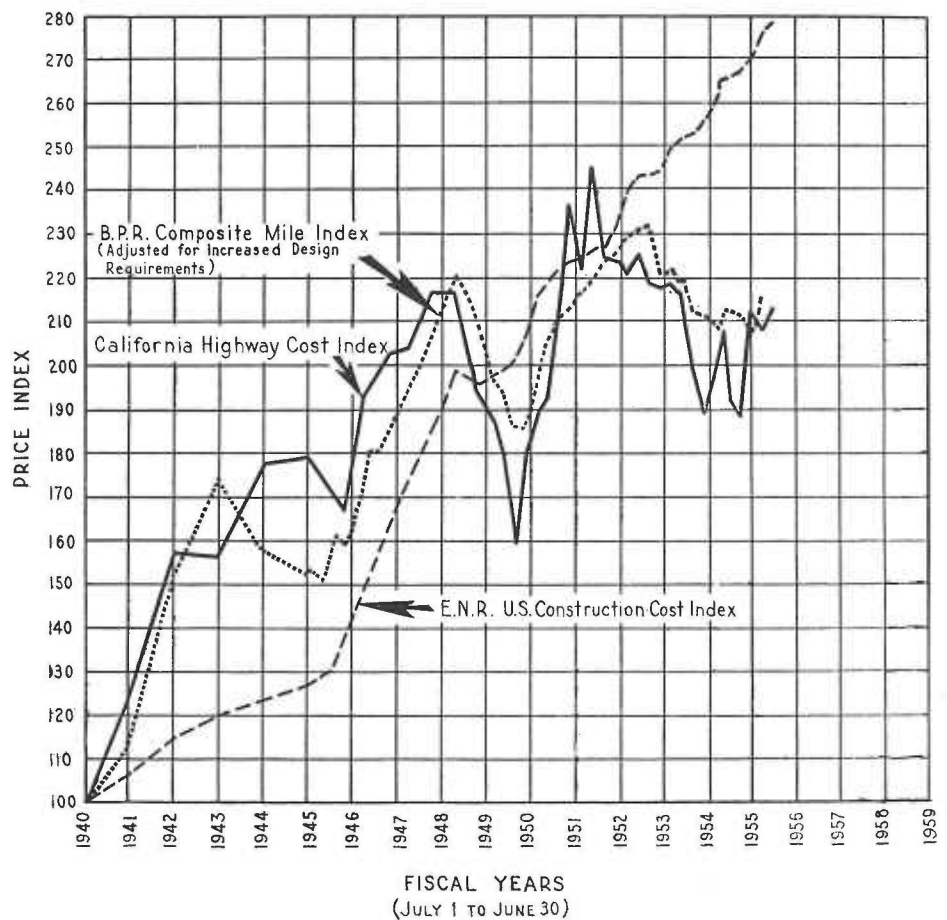
pates a continuation of the rise begun in the second quarter of 1955.

The accompanying tabulation shows the California Highway Construction Cost Index by years from 1940 through 1953 and by quarters for 1954 and 1955.

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

PRICE INDEX CONSTRUCTION COSTS

1940 = 100



THE CALIFORNIA HIGHWAY CONSTRUCTION COST INDEX

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

Projects awarded during the quarter included seven freeway jobs with large quantities and corresponding lower unit costs (the southerly approach to the Carquinez Bridge alone involves over 11,000,000 cubic yards of roadway excavation). In the face of the effect of these large projects in lowering unit prices the over-all result was a rise of nearly 2 percent.

As stated above it is the opinion of this department that this rise, small as it is, adds to the rise for the year as a whole and is an indication of further increases in the months ahead.

Another straw in the wind indicating increases in highway construction costs is the drop in the average number of bidders during 1955 as shown in the tabulation further on in this report.

Inspection of the average unit prices bid during the fourth quarter of 1955 for the eight items upon which the California Index is based (see accompanying tabulations) shows an increase in five items and a decrease in three. Roadway excavation dropped about 10 percent from 41 cents per cubic yard to 37 cents. This drop may be laid almost entirely to the 25.6 cents price on the 11,200,000 cubic yards of excavation on the Hercules to Crockett approach to the Carquinez Bridge. Untreated rock base was down from \$2.33 to \$2; this, however, is merely back to where it was in the second quarter of 1955. The average price of \$2.33 for rock during the third quarter was undoubtedly the direct result of the rock plants strike in Southern California during the summer. The only other decrease was

a drop of \$1.70 per ton in the price of asphalt concrete, but the total quantity of this item is so small as to have little effect on the Index.

Plant-mixed surfacing rose from \$5.43 per ton to \$5.52 per ton; portland cement concrete pavement was up from \$13.46 to \$15.05 per cubic yard; structural concrete rose from \$49.64 to \$52.72 per cubic yard; bar reinforcing steel rose from \$0.093 to \$0.099 per pound; and structural steel was up from \$0.132 to \$0.144 per pound.

In the computations made for the Index including the three Carquinez Bridge contracts the unit prices were more or less the same with the exception of bar reinforcing steel, which was up to an average of \$0.103 per pound; and for structural steel including the large quantities of high strength low-alloy and T-1 steels which go into the bridge the average unit price was \$0.223 per pound.

It is believed that a steady upward trend in highway construction costs is now established. The increases in labor and rising material costs have had their effect and competing bidders are no longer able to devise methods of cutting prices and trimming profits. The people of California have benefited during the past year by the efforts of the construction industry in creating devices to keep highway construction costs relatively stable in a period when general prices were rising; it is an excellent example of the benefits to the public of the contract system based upon competitive bidding.

The accompanying chart, showing the California Highway Construction Cost Index, the *Engineering News-Record* Construction Cost Index and the United States Bureau of Public Roads Composite Mile Index compares the three, all reduced to the 1940 = 100 base.

The *Engineering News-Record* Index, based upon materials and labor prices, comprises all types of construction and is nation-wide in scope. During the fourth quarter of 1955 this Index continued the steady rise begun in 1950 and reached 278.3 which was 0.76 percent higher than in the third quarter.

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	\$7.68	\$18.33	\$0.040	\$0.083
1941	0.26	2.31	2.84	3.18	7.54	23.31	0.053	0.107
1942	0.35	2.81	4.02	4.16	9.62	29.48	0.073	0.103
1943	0.42	2.26	3.71	4.76	11.48	31.76	0.059	0.080
1944	0.50	2.45	4.10	4.50	10.46	31.99	0.054	0.132
1945	0.51	2.42	4.20	4.88	10.90	37.20	0.059	0.102
1946	0.41	2.45	4.00	4.68	9.48	37.38	0.060	0.099
1947	0.46	2.42	4.32	5.38	12.38	48.44	0.080	0.138
1948	0.55	2.43	4.30	5.38	13.04	49.86	0.092	0.126
1949	0.49	2.67	4.67	4.64	12.28	48.67	0.096	0.117
1950	0.40	2.25	4.26	3.75	11.11	43.45	0.079	0.094
1951	0.49	2.62	4.34	5.00	12.21	47.22	0.102	0.159
1952	0.56	2.99	5.00	4.38	13.42	48.08	0.098	0.150
1953	0.51	2.14*	5.31	4.58	12.74	50.59	0.093	0.133
1st Quarter 1954	0.45	2.28	4.23	4.78	14.89	47.52	0.092	0.126
2d Quarter 1954	0.38	2.09	4.29	5.18	14.28	47.12	0.093	0.114
3d Quarter 1954	0.43	1.85	4.68	7.00	12.63	49.59	0.095	0.162
4th Quarter 1954	0.35	1.78	4.83	-----	13.13	46.08	0.094	0.135
1st Quarter 1955	0.39	1.69	4.59	-----	13.44	40.66	0.095	0.140
2d Quarter 1955	0.42	1.99	5.35	-----	14.46	51.36	0.098	0.136
3d Quarter 1955	0.41	2.33	5.43	5.70	13.46	49.64	0.093	0.132
4th Quarter 1955	0.37	2.00	5.52	4.00	15.05	52.72	0.099	0.144

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

... Continued on page 67

County Project

*Butte Completes Oroville By-pass
To Relieve Traffic Construction*

By E. H. WYMAN, Associate Highway Engineer, and
MARSHALL JONES, Butte County Director of Public Works

OPENING CEREMONIES for FAS Route 1169 in Butte County held October 31, 1955, marked completion of the project which has been under construction intermittently since 1947. The route was first proposed by former Supervisor Scott Lawton and Oroville City Councilman Bernard Richter in 1946 as a truck route to relieve congestion on Montgomery Street, US 40A, through Oroville.

As lumber is one of the main industries of the Oroville area, Montgomery Street, first laid out in early 1850 and little changed in width since that time, was literally alive with huge logging and lumber trucks. A steep grade at the east end of the street added to the traffic problem. The project was endorsed wholeheartedly by local residents after a lumber truck with faulty brakes ran wild through the business area causing considerable property damage.

Right of Way Donated

Right of way for a major portion of the route was donated, largely through the efforts of Mr. Richter, and the first portion of the project started. This consisted of the grading of various sections lying between connecting city streets and county roads both by small contract and county forces. The base and light surfacing were placed by county forces on various portions as funds were available. The route was not open to through traffic due to the necessity of constructing three underpasses and taking care of drainage on Dry Creek which the route follows for approximately one-half mile.

During 1950, through the efforts of Supervisor Dan Pellicciotti and the Oroville Chamber of Commerce, the road was established as an FAS route, and the first project, the construction of three underpasses and a new channel

for Dry Creek, was started under the direction of Bert Paxton, former road commissioner for Butte County. Con-

struction of this portion of the project was completed in 1953 by C. K. Moseman Construction Company of Bel-

Beginning of FAS Route 1169 looking easterly from junction of FAS Route 1169 with US 40 Alt. and Oroville-Richvale highway. End of FAS 1169 at its intersection with US 40 Alt. in the extreme upper left corner.





Looking easterly. Connection with US 40 Alt. at top of picture. Southern Pacific Railroad and Western Pacific Railroad underpasses in foreground. Lincoln Street, Meyers Street and Olive Highway intersections in center.

mont. This proved to be an extremely difficult operation due to the work lying in the bottom of Dry Creek and progressing through a winter which saw the heaviest rainfall in this area since 1890.

Upon completion of the structures, county forces graded and surfaced the roadway including additional base and light surfacing from the intersection at State Highway Routes 87 and 21A through to Oroville-Quincy county road (old state highway to Quincy

via Bucks Lake). This left approximately 0.7 of a mile to be constructed to open the route to state highway Route 21 east of Oroville. This project, FAS 1169(2), started in August, 1954, was completed in June, 1955. The project just completed, FAS 1169(3), covered the regrading of approximately one-quarter mile of an existing city street, the placing of additional base on approximately three-quarters of a mile and the placing of three inches of surfacing from

Route 87 south of Oroville to the old Oroville-Quincy highway. The last project was financed with state, federal, county and city funds.

Traffic Signals Planned

This route is now beginning to carry a large percentage of both through and local traffic. It is anticipated that a considerably larger volume will be carried upon completion of traffic signals at Myers Street intersection, one of the busiest in the county,

where traffic, particularly trucks, have difficulty crossing. The City of Oroville is now in the process of preparing plans for the signals.

The county day-labor and contract projects were completed at an ap-

proximate cost of \$150,000. The three FAS projects were constructed at a cost of \$429,000. The approximate total cost of the complete route was \$579,000. Marshall Jones, Butte County Director of Public Works, under

whose direction the last two projects were completed, has reported a great deal of satisfactory comment has been received from both local and outside highway users since the completion of this route.

Looking westerly along FAS 1169 on the left and US 40 Alt. diverging to the right, which intersect again in background near the Feather River Bridge south of Oroville. Bridge at right center is on S. H. Route 87 to Chico.



GLAD YOU LIKE IT

VALLEJO

DEAR MR. ADAMS: I wish to take this opportunity to congratulate you and your very capable staff for the

splendid job you are doing in compiling the information relative to the highways and their progress in this State and disseminating it to the public. I have learned many things about this great State of ours from

the *California Highways and Public Works* and would miss it very much if it were discontinued.

Sincerely yours,

ROBERT T. MONAGAN, SR.
1401 Rice Street

Whitton Succeeds General Merrill As A. A. S. H. O. Head

Less than two days after his election as President of the American Association of State Highway Officials, Major General Frank Dow Merrill, Commissioner of Public



FRANK D. MERRILL

REX M. WHITTON

Works in New Hampshire, died in Fernandina Beach, Florida, at the age of 52.

In accordance with the association's constitution, the new president for 1956 is Rex M. Whitton, Chief Engineer of the Missouri State Highway Department, who had been elected first vice president at the same New Orleans convention of A. A. S. H. O. at which General Merrill was chosen president to succeed G. T. McCoy, State Highway Engineer of California.

General Merrill's election to the presidency of A. A. S. H. O. climaxed the second of his two distinguished careers. He was graduated from the U. S. Military Academy in 1929 and from the Massachusetts Institute of Technology in 1932. He advanced through military ranks to brigadier general in 1943 and major general in 1944, when he was commander of United States forces in the India-Burma theater. Later he was chief of staff of the U. S. 10th Army.

During his far eastern service in World War II the bold and successful exploits of his troops earned them the nickname of "Merrill's Marauders."

Retired in 1947 for disability incurred in World War II, he was

A. A. S. H. O. POLICY STATEMENT ON FEDERAL LEGISLATION — 1956

The American Association of State Highway Officials urges the Congress to enact an expanded and adequate highway program early during the second session of the 84th Congress and to make funds authorized thereunder available for apportionment to the several states by July of 1956.

Further delay in taking action will cause additional critical traffic congestion and accidents, as well as create indecision at all levels of government in highway planning and construction and thereby materially retard the economy of the United States.

Any federal-aid program authorized by the Congress should be administered by the Bureau of Public Roads and constructed by the state highway departments—a working relationship

appointed New Hampshire Commissioner of Highways in 1949 by Governor Sherman Adams. He had been active in A. A. S. H. O. since that time, serving as a regional vice president in 1952 and as first vice president in 1955. During the past few years he had been closely identified with the planned A. A. S. H. O. Road Test Project soon to get under way in Illinois.

The new A. A. S. H. O. president, Rex Whitton, has been on the staff of the State Highway Department of Missouri since 1920, shortly after his graduation from the University of Missouri.

His first work was with a survey party, and he advanced through nearly every phase of highway engineering work, including 15 years as engineer of maintenance, to become the department's Chief Engineer in 1951.

Whitton has long been active in A. A. S. H. O., and has been chairman of its committee on maintenance and equipment. During the past year he served on the legislative committee, testifying before congressional committees on proposed Federal highway legislation.

that has proved so successful over the past years.

Federal Aid Increase Needed

An enlarged adequate highway program should indicate the intent of the Congress to construct the 40,000 mile Interstate System in not more than 15 years and to provide a progressive increase in the federal-aid to the secondary, urban, and primary systems. The initial authorization should be for a period of five years.

The matching of funds for the construction of the interstate system should be on a 90 percent federal and 10 percent state basis, with the matching on the other systems as now provided under existing legislation.

A 20 percent transfer provision should be allowed between secondary, urban, and primary allocations to make the highway program flexible enough to meet the most pressing needs of the individual states.

Funds for the construction of the interstate system should be initially apportioned on a basis of need as indicated by the Section 13 Study as reported by the Bureau of Public Roads, and as indicated by future successive needs estimates; such successive estimates to be made first in 1957 and in five-year intervals thereafter. The apportionment to the other systems should be on the present basis.

Moving of Utilities

The subjects of reimbursing for the moving of utilities from public highway rights of way, of labor relations and requirements, and of vehicle sizes and weights should not be included in federal statute but should be matters to be determined at the state level.

It is recommended that the Congress give consideration to the dedication of more of the general fund to road construction in view of the federal responsibility in the national defense system of highways.

... Continued on page 67

District VII

By PAUL O. HARDING
Assistant State Highway Engineer

Appraisal of Work
During Past Five Years

Freeways Report

FOUR YEARS ago I prepared a story for *California Highways and Public Works* on the role of the State Division of Highways in the development of a freeway system for the Los Angeles metropolitan area. Each year since then I have prepared a progress report, attempting to summarize what had been accomplished during the previous year. Since this present writeup is the fifth of the series it will perhaps be of interest to consider the accomplishments of the past five years.

Consideration of what has happened freeway-wise in District VII on the basis of the past five-year period is suggested because of the report just released by the California Taxpayers Association regarding population growth in this State. The figures made public by this association indicate that California's population has increased since the 1950 census, 27.2 percent—almost 3,000,000 persons additional—so that the population of California is now approximately 13,465,000. In Los Angeles County their records show a 31.8 percent increase since 1950 with the estimated population now 5,473,000. The California Taxpayers Association states that the greatest increase during the past five years in any one county has occurred in Orange county where the gain in population is 101.1 percent, with the estimated total now being 434,800.

Increase in Population

This tremendous increase in population within the area of District VII, which comprises the three counties of Los Angeles, Orange and Ventura, has brought to pass a corresponding increase in vehicular traffic on our highways. Mr. G. T. McCoy, State Highway Engineer, has just made public release of the 1955 state-wide



PAUL O. HARDING

traffic count figures. As Mr. McCoy says, on a state-wide basis the traffic volumes during the year 1955 have increased 8.79 percent. The rate of increase in traffic on the freeways in this district has considerably exceeded this figure. The increase in average daily traffic on the freeways of this area, comparing the traffic today with traffic one year ago, and also five years ago is shown by the following:

	1955	1954	1950
Hollywood (4-level westerly)	180,000	168,000	64,000
Pasadena (Elysian Park)	112,000	110,000	56,000
Santa Ana (Soto Street)	113,000	90,000	25,000
San Bernardino (Soto Street)	88,000	80,000	25,000
Harbor (4-level southerly)	160,000	125,000	—
Colorado (at Linda Vista)	27,000	30,000	—
Long Beach (Pacific Coast Highway)	31,000	10,000	—
Using 4-level interchange	250,000	200,000	—

From the above tabulation it will be recalled that five years ago there were only disconnected portions of the four major freeways in the Los Angeles area that were then open to public traffic and that these sections at that time had not come into full use.

Freeways Completed

The lengths of full freeways in District VII that were completed during 1955 are the following:

Santa Ana Freeway— From First Street, Santa Ana, to Browning Boulevard	2.4 miles
Golden State Freeway— From Sepulveda Boulevard to north city limits of Los Angeles	3.0 miles
Colorado Freeway— From Avenue 64 to Eagle Rock Boulevard	0.8 mile
Foothill Freeway— From Hampton Road to Montana Street in Flintridge area	1.8 miles
Total	8.0 miles

I find in reviewing my four previous articles that each one contains some reference to current and past legislative enactments that affected financing of highway and freeway construction. Therefore, it will perhaps be in order at this time to summarize briefly state highway financing.

Highway Financing

State highway construction was first started in California in 1912 from a bond issue of \$18,000,000 passed by the people in 1910. A second bond issue of \$15,000,000 was voted by the people at an election in 1916. Again in 1919 a \$40,000,000 bond issue was voted. Then the 1923 Legislature passed an enactment creating a 2-cents-per-gallon gasoline tax. This was the start of the pay-as-you-go financing. In 1928 this tax was increased to 3 cents per gallon, with 1 cent going to

counties and 2 cents reserved for maintenance and improvement of the state highway system.

In recognition of city problems, by legislative authority, Statutes of 1931, a policy of cooperation in construction was inaugurated for those portions of the highway routings within the cities, and in 1932 several miles within cities were improved by state and local cooperation. In further recognition of this problem Chapter 767, Statutes of 1933, provided that the Department of Public Works would annually expend from the state highway fund an amount equal to the net proceeds of one-fourth of 1 cent per gallon tax of motor vehicle fuel upon state highway routes within incorporated municipalities. Still further recognition of this problem was given by the Legislature in 1935 which provided an additional one-fourth cent of the gasoline tax for maintenance, rights of way, construction or improvement on streets of major importance within the cities, off the state highway system.

Gas Tax Increase

Both the 1933 one-fourth cent and 1935 one-fourth cent were taken from the state highway 2 cents of gas tax, thus reducing the expenditures upon the state rural system to 1½ cents. Coincident with the legislation reallocating these gas tax funds, the Legislature in 1933 and 1935 added some 6,800 miles of rural county roads to the state system, which, with the extended routes through the cities, resulted in a total state highway system of approximately 14,000 miles.

The Collier-Burns Highway Act of 1947 increased the gas tax to 4½ cents per gallon and supplemented this by other motor vehicle fees, which, however, were more than offset by a 2-cents-per-gallon allocation to cities and counties for roads and streets not on the highway system. The 1953 Legislature increased the state gasoline tax to 6 cents per gallon, also increasing supplemental taxes in proportion, but made this increase effective for only two years, after which both the gas tax and supplemental fees were to be decreased to the 5½-cent equivalent. The 1955 Legislature passed enactments to prevent the ½-cent-



What Does It Mean?

Over the length and breadth of California wherever the far-flung work of the Division of Highways, Department of Public Works, is in operation, this insignia will be found on automobiles, trucks, tractors, buildings, and other places too numerous to mention.

This familiar insignia attracts the casual attention of the public and the more or less added interest of the thousands of employees associated in the division, but the query of this article is directed to the meaning of the Latin phrase on the inner circle of the emblem: "Robur directum scientia est via fortunae."

Ask any number of officials or employees of the department what the sentence means and a negative answer is the reply. Here is the answer: "Labor directed by science is the way to fortune."

per-gallon decrease and make the 6-cents-per-gallon state gasoline tax and supplemental fees in continuing effect.

Right-of-Way Problem

In the metropolitan Los Angeles area those freeways of the system providing the greatest traffic service are, naturally, those which lie through the most densely settled areas where the right-of-way problem is extremely acute, and may entail expenditures of more than 50 percent of the total cost of the project. Planning for such freeways must be on the basis of providing sufficient right-of-way funds to permit construction for traffic relief at the earliest possible date. The advance purchase of rights of way while properties are still unimproved has become recognized as the most effective planning and cost control in the

protection of future freeways. By following this procedure, very considerable savings to the State have been effected, particularly where major highway improvements are involved such as freeways located on new alignment which require extensive widths of right of way through potential subdivision areas.

Legislation was adopted by the State Legislature in 1952 whereby the sum of \$10,000,000 was provided in a special fund known as the "Highway Right-of-Way Acquisition Fund," for the express purpose of acquiring rights of way on which development was imminent. This fund was later changed to a revolving fund and increased by \$20,000,000, making a total of \$30,000,000 available on a state-wide basis.

Summary of Savings

A brief summary of the advance acquisition of rights of way and the estimated savings realized in District VII, which has been accomplished to date through this fund, is as follows:

Fiscal year ending	No. parcels acquired	Am't paid from Hwy. Acq. Fund	Estimated savings
6-30-53	28	\$269,400	\$1,614,000
6-30-54	363	3,873,550	27,111,000
6-30-55	522	5,092,544	42,000,000
Total	913	\$9,235,494	\$70,725,000

In addition to the above, the California Highway Commission has authorized the acquisition of other properties amounting to \$14,000,000 with an anticipated additional saving of \$90,000,000. Acquisition is progressing rapidly on these other properties.

In this five-year period, 1950-55, the record of accomplishment reveals 11,629 parcels of land acquired at a total cost of \$137,466,464. Right-of-way clearance work has increased correspondingly, a total of 4,435 houses having been sold and removed from the right of way by the House Sales Section for a total return to the State of \$7,706,716. Tabulation showing this record year-by-year follows:

Fiscal year ending	No. of parcels acquired	Total cost	No. of houses sold	Am't received from house sales
6-30-51	1,733	\$16,538,846	599	\$1,200,347
6-30-52	1,415	15,244,133	343	746,747
6-30-53	1,616	19,051,707	334	699,568
6-30-54	3,390	40,971,476	1,508	2,252,396
6-30-55	3,475	45,660,302	1,651	2,807,658
Total	11,629	\$137,466,464	4,435	\$7,706,716

Removal of Houses

In connection with this sale and removal of houses from the right of way, it is of interest to note that notwithstanding the fact that certain areas of land acquired for rights of way are removed from the tax rolls, over 90 percent of the buildings which are sold and removed in the clearance of right of way are relocated to other locations and replaced on the tax rolls, rehabilitated and modernized in the relocation process to add years to their useful life. In this manner, what might appear to be a loss of taxable property assessed by the county is more than offset. Past experience has proven that

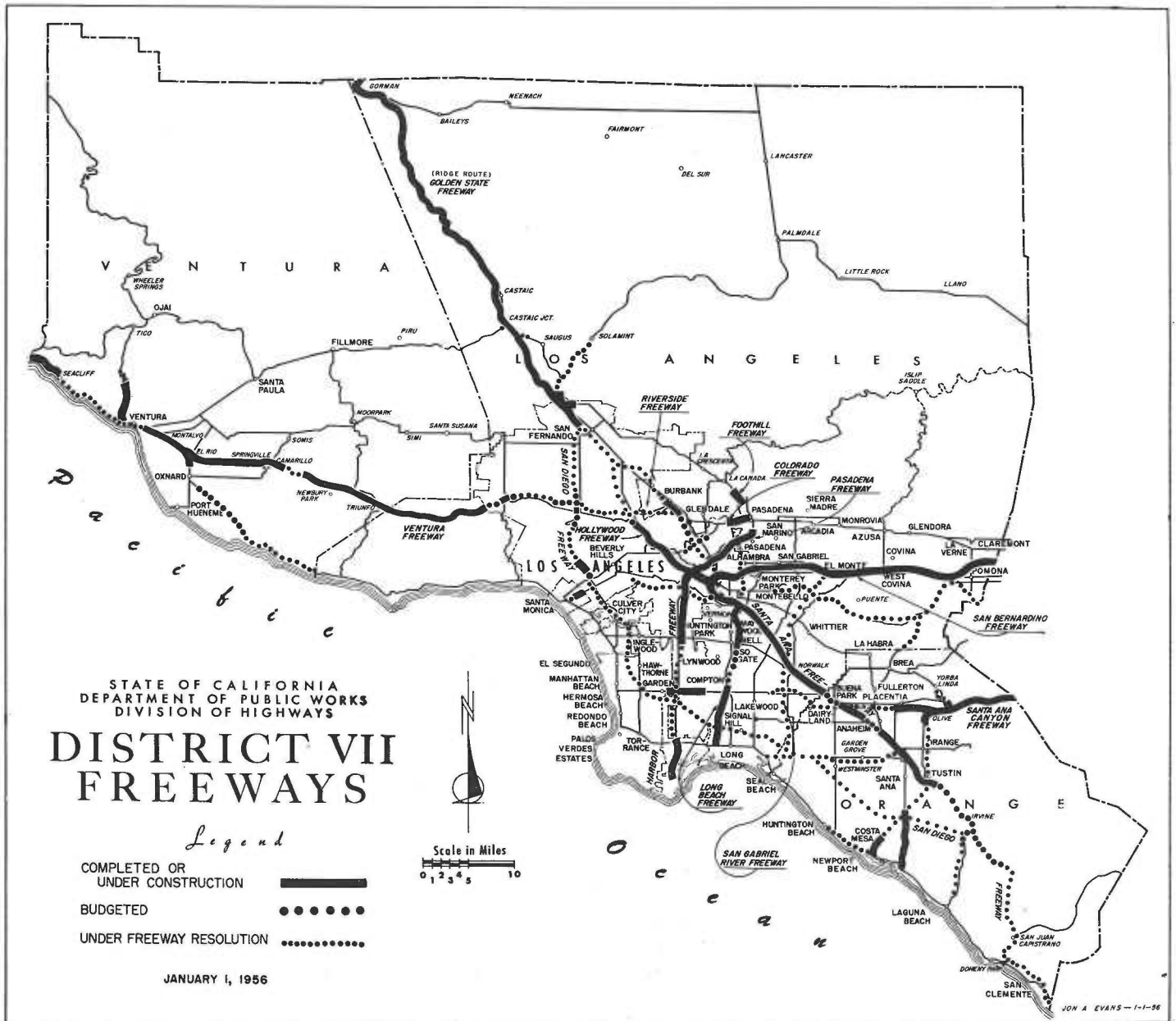
the appreciated value of properties abutting freeways, particularly in industrial areas due to improved accessibility, creates increased assessed values to such an extent that freeway right-of-way acquisition does not reduce the value of taxable property but decidedly increases it.

Another very important activity of the District Right-of-Way Department is the rental of buildings on lands acquired and held for future freeway construction. In such cases, all state-owned properties suitable for renting are rented or leased under rental agreement containing adequate cancellation clauses until shortly before

highway construction commences. A record of the income derived from the rentals of these properties is as follows:

Fiscal year ending	Units	Yearly earnings
6-30-51.....	332	\$180,680
6-30-52.....	587	304,532
6-30-53.....	1,090	418,290
6-30-54.....	1,305	597,731
6-30-55.....	1,742	888,252

The Division of Highways is forced to be in the rental business in order to keep houses occupied until the time arrives that the right of way has to be cleared for construction. This is the only effective way of preventing van-



dalism and keep a neighborhood from becoming rundown and deteriorated. While the rents received total substantial sums, the other considerations are of even greater importance.

Work of Legal Staff

As we have noted above, while every effort is made to secure rights of way by amicable negotiation with property owners, in some instances it is necessary for the State to resort to eminent domain proceedings and start condemnation of private properties. The number of parcels carried through condemnation is only about 2 percent of the total number acquired, the other 98 percent being consummated by negotiation and mutual agreement. The condemnation of rights of way for District VII and the other south-

ern counties is carried out by the legal department. During the five-year period 1950 to 1955 the district staff has carried out 248 condemnation suits for rights of way, totaling \$4,101,495.

Before right-of-way agents start negotiations with property owners for areas that are needed for rights of way for freeways and other state highways the fair market value of each parcel is determined. The appraisal of property is conducted in a detailed, comprehensive manner not only ascertaining all of the salient features of each particular piece of property but also making an extensive search of the records to determine the sale price of comparable or similar properties in that particular neighborhood. It is in this painstaking and careful manner, with the review

and approval of the Sacramento headquarters office, that the fair market value of each parcel is determined.

Condemnation Policy

If the right-of-way agents, after opening negotiations with property owners, are unable to reach a satisfactory settlement with them, it is then necessary for the State to resort to condemnation proceedings. Were it not for the right of eminent domain, highway improvements would bog down and many times be impossible to carry out. The right of eminent domain is an important right of the people and its exercise is very necessary in order that state highway projects and freeway projects go forward, otherwise one recalcitrant property owner could hold up a project indefi-

STATUS OF DISTRICT VII FREEWAY PROJECTS—JANUARY 1, 1956

	Total miles	Completed projects		Under contract		Right of way costs	Total costs to date
		Miles	Constr. costs	Miles	Constr. est.		
Pasadena Freeway 4-Level Structure to Glenarm St., Pasadena.....	8.2	8.2	\$10,434,200			\$1,009,100	\$11,443,300
Hollywood Freeway Spring St. via Cahuenga Pass to Junction Golden State Freeway near Wentworth St.....	16.8	10.0	28,949,200		172,500	28,360,000	57,481,700
Santa Ana Freeway Spring St. (Los Angeles) to Junction of San Diego Freeway near El Toro.....	42.8	32.4	39,165,000	2.6	4,983,600	16,480,000	60,628,600
San Bernardino Freeway Santa Ana Freeway near Los Angeles River to San Bernardino County Line in Claremont.....	30.7	15.7	19,007,500	15.0	15,537,700	16,015,000	50,560,200
Harbor Freeway 4-Level Structure to San Pedro.....	22.4	2.9	11,221,800	8.4	18,556,500	48,600,000	78,378,300
Long Beach Freeway Pacific Coast Highway in Long Beach to Huntington Dr. in South Pasadena.....	21.5	7.9	10,891,100	4.8	8,671,200	18,435,000	37,997,300
Golden State Freeway Junction of Olympic and Santa Ana Freeway near Soto St. to Kern County Line.....	72.7	47.2	15,646,600	2.4	5,102,700	24,640,000	45,389,300
Ventura Freeway Vineland Ave. to S. County Line Ventura and N. County Line Ventura to Santa Barbara County Line.....	68.7	39.1	12,484,100		53,000	11,148,000	23,685,100
San Diego Freeway Golden State Freeway near San Fernando Reservoir to San Diego County Line.....	93.7		310,300	1.2	2,256,300	15,335,000	17,901,600
Colorado Freeway Eagle Vista Dr. in Eagle Rock to Holly St. in Pasadena.....	2.2	2.2	6,139,200			2,295,000	8,434,200
Foothill Freeway Hampton Rd. to Montana St. in Flintridge.....	2.0	2.0	2,107,200			624,000	2,731,200
Glendale Freeway Los Angeles River to Ave. 36, near Eagle Rock Blvd.....	1.6					3,005,000	3,005,000
Artesia Freeway Normandie Ave. to Santa Fe Ave. and Palo Verde Ave. to Santa Ana Canyon Freeway.....	21.7	1.9	1,010,900	6.2	2,877,600	2,140,000	6,028,500
Santa Ana Canyon Freeway Newport Beach to Riverside County Line.....	27.4	12.7	2,990,600			1,258,000	4,248,600
Ojai Freeway West Main St. in Ventura to 0.4 mi. north of Foster Park.....	5.7			4.1	2,100,000	1,000,000	3,100,000
Other Freeways Covered by Resolution of Adoption by Highway Commission.....	127.7					3,075,000	3,075,000
Total.....	565.8	182.2	\$160,357,700	44.7	\$60,311,100	\$193,419,100	\$414,087,900

ately. When a condemnation suit is instituted, the issue is not to determine if the property shall be taken but only to determine how much shall the State pay for it. The necessity for the legal taking of private property by condemnation is authorized by the California Highway Commission in the passing of resolutions to that effect.

Bridge Department Accomplishments

One of the most important elements in freeway design and construction are the grade separation bridges. Without bridges to carry cross traffic, pedestrians, vehicles and railroad trains, either over or under freeway traffic, we would have no freeways as we know them today.

Following is a summary of completed and going contracts in District VII listed under the fiscal year in which budgeted:

Fiscal year	Number of structures	Value
1950-51	68 bridges	\$11,500,000
1951-52	47 bridges	7,000,000
1952-53	34 bridges	5,500,000
1953-54	117 bridges	19,900,000
1954-55	76 bridges	11,900,000
	342 bridges	\$55,800,000

Accompanying this story is a tabulation, Status of District VII Projects, January, 1956. This tabulation shows in convenient form the total miles of state highway over which the California Highway Commission has adopted freeway resolutions. With this authority given by the commission, the Division of Highways is authorized to proceed with development of freeway plans, right-of-way acquisition and construction. The first six freeways on this list within the limits of Los Angeles County have all been developed as full freeways. This means that all access rights of abutting property have been acquired and that grade separation bridges and subways have been built to carry all cross arterials either under or over the freeways.

Other freeways listed in this tabulation, planned for ultimate full freeways, have for the most part as a first stage been developed as expressways with access rights controlled and with central dividing strips to separate opposing traffic but without grade

separation structures. In the case of those freeways so developed as expressways where cross streets intersect at grade, this stage of design usually has the intersections channelized and signalized. In the case of the Santa Ana Freeway in Orange County some sections have already been constructed as full freeways while other sections presently on expressway basis are being rapidly converted to the full freeway status.

In order to determine the progress that has been made in the last five years in the District VII freeways, reference is made to the status as of January 1, 1951. As of that time the total length of state highways covered by freeway resolutions totaled 290.9 miles as compared with the total today of 565.8 miles. Completed freeway and expressway projects in 1950 totaled 65.1 miles whereas the total January 1, 1956, is 182.3 miles.

The full force and effect of the Collier-Burns Highway Act in 1947 and subsequent legislation on freeways for District VII, is shown by comparing the total costs to date on January 1, 1951, of \$136,346,200 with the January 1, 1956, total of \$414,087,900.

Pasadena Freeway

When the first six-mile unit of completed construction on the portion of this freeway from Avenue 26 in Los Angeles to Glenarm Street in Pasadena, then called "Arroyo Seco Freeway," was dedicated and opened to public traffic on December 30, 1940, it was acclaimed as the West's first freeway. Subsequently, extensions were made to this section of completed freeway to extend it southerly through Elysian Park to a connection with the Hollywood Freeway at the four-level structure.

The last unit of construction, one-half mile in length in the City of Los Angeles between College Street and the Hollywood Freeway, was completed and opened to traffic on September 22, 1953. This was the most important event on the Pasadena Freeway that occurred during the past five-year period. On that date for the first time all levels of the unique traffic interchange structure, comprising four levels with connecting roadways to take care of all necessary

traffic movements, was put into full operation. The Elysian Park section of the Pasadena Freeway is now carrying 112,000 vehicles per day and the estimated daily traffic utilizing the four-level interchange structure is 250,000 vehicles per day.

Harbor Freeway

The Harbor Freeway extends 22.4 miles from junction with the Hollywood Freeway in the four-level traffic interchange structure southerly to Battery Street in the San Pedro district of the Los Angeles Harbor.

From the standpoint of construction this is a new freeway since five years ago nothing had been completed and opened to traffic. Some construction on grade separation bridges was in progress at that time near the northerly end. Five years ago the record shows that \$10,500,000 had been expended for rights of way and \$3,000,000 on contracts to get construction under way. As of today the total expenditures on the Harbor Freeway total \$78,378,000. Two and nine-tenths miles of the Harbor Freeway have been completed between the Hollywood Freeway and 23d Street in Los Angeles. According to 1955 traffic counts this section of freeway is now carrying a total of 160,000 vehicles per day.

Four contracts are now in progress on the Harbor Freeway covering 8.4 miles and costing \$17,332,500. All the construction is scheduled for completion by spring of 1957.

Right-of-way acquisition is being carried on and nearly all the parcels have been acquired necessary to complete this freeway.

Long Beach Freeway

The Long Beach Freeway is also one of the newer freeway developments. The start of construction was heralded by groundbreaking ceremony at the southerly terminus of this freeway at Pacific Coast Highway, State Highway Route 60, in the City of Long Beach, on June 27, 1951, less than five years ago. Since that time there has been steady progress of construction on this important freeway in the East Los Angeles metropolitan area.



Looking east along recently completed Colorado Freeway. Eagle Rock, center left. Pasadena, center background.

The total length of the Long Beach Freeway from Pacific Coast Highway (Route 60) in Long Beach to Huntington Drive in East Los Angeles approaching the City of Alhambra is 21.5 miles. As of the present time, 7.9 miles of the Long Beach Freeway have been completed from Pacific Coast Highway northerly to the crossing with Atlantic Boulevard east of the City of Compton. Also completed in the East Los Angeles area during 1954 are two railroad grade separation bridges to carry the Long Beach Freeway over the Santa Fe Railroad freight yards and the Union Pacific Railroad freight yards. Both of these structures are about one-fourth mile long and the construction cost of these two is \$2,660,000.

On July 22, 1954, a contract was awarded for one mile of freeway construction and eight bridges between Sheila Street and Verona Street where junction is made with the Santa Ana Freeway. The contract allotment for this construction is \$2,692,000. The work is over 85 percent completed. It

is anticipated that this contract will be completed in March, 1956.

In addition to this nearly completed contract there are in progress three other construction contracts providing for an additional 3.8 miles of freeway construction for which the total of the construction allotments is approximately \$5,400,000. For continuing construction on the Long Beach Freeway the 1956-57 Fiscal Year budget carries an item of \$4,915,000.

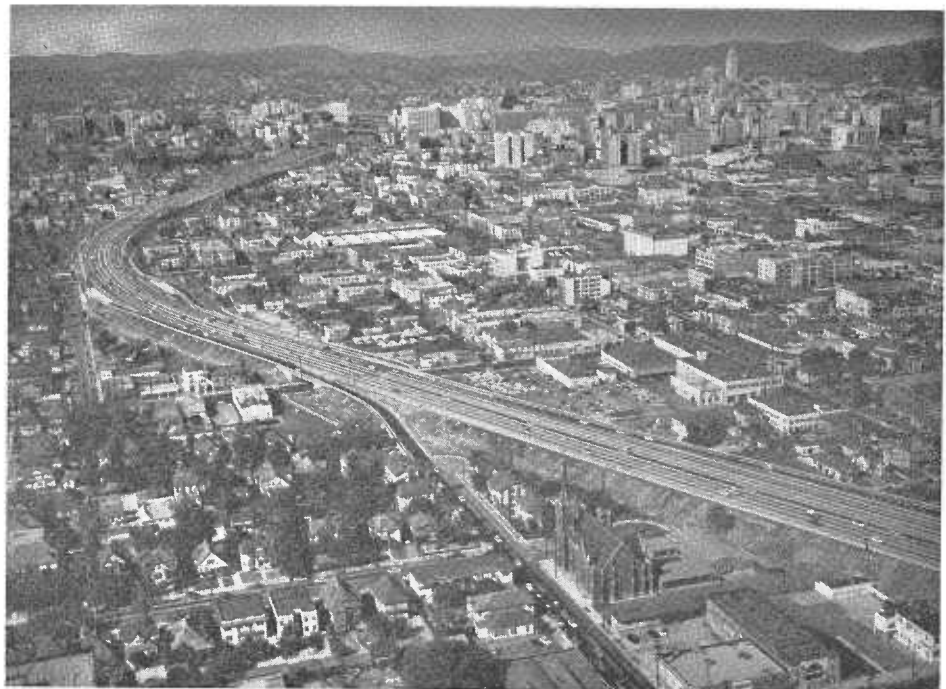
Hollywood Freeway

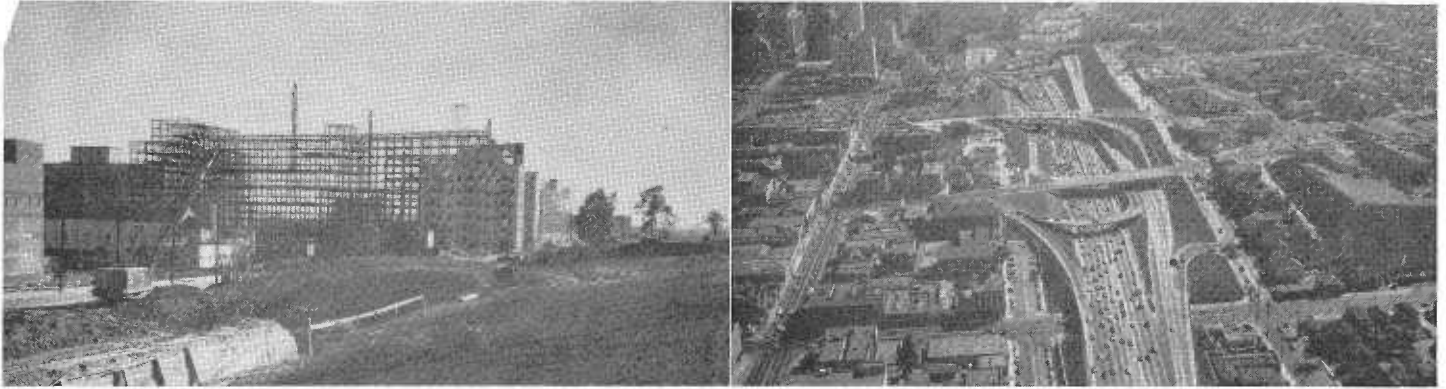
It is of interest to note that all construction units of the original 10-mile length of Hollywood Freeway from Vineland Avenue in the San Fernando Valley to Spring Street in the Los Angeles Civic Center, were completed and opened to public traffic during the past five-year period.

The first useable section of the Hollywood Freeway to be opened to public traffic was the three-mile section between Grand Avenue and Silver Lake Boulevard. This was opened to public traffic on December 27, 1950, with final completion and acceptance of the construction contracts being made on February 13 and 16, 1951.

The final construction contract to complete this 10-mile unit of the Hollywood Freeway was completed

Looking north along Harbor Freeway from above Washington Boulevard in Los Angeles





LEFT—Looking southerly along Harbor Freeway from Fourth Street in Los Angeles five years ago, when construction on Statler Hotel and Harbor Freeway were progressing simultaneously. RIGHT—Same location from air showing late afternoon full traffic load as of present.



Looking southeast along Santa Ana Freeway showing construction in progress now nearing completion on Long Beach Freeway. New construction provides traffic interchange between the two freeways.

and accepted by Director of Public Works Frank B. Durkee on August 5, 1954.

On basis of 1955 traffic counts, the average daily vehicular traffic on the Hollywood Freeway westerly of the four-level structure, is 180,000 vehicles per day. There have been individual counts that have exceeded this.

The Hollywood Freeway Extension joins the main Hollywood Freeway near the intersection with Lankershim Boulevard and extends northerly 6.8 miles to the proposed Golden State Freeway near Wentworth Avenue.

District VII right-of-way forces are concentrating on acquiring rights of

way for the Hollywood Freeway northerly extension for the 1.1-mile unit extending from Lankershim Boulevard to Moorpark Street where early construction is scheduled. On January 12, 1956, bids were opened for construction of two bridges on this section of freeway; one across the Los Angeles River, and the other at Vineland Avenue. This project, for which the contractor, Oberg Construction Corporation, submitted the low bid of \$910,694, is to be financed from items in the 1955-56 construction budget of \$1,100,000.

There is an item in the 1956-57 Fiscal Year budget in the amount of

\$2,350,000 for carrying out the additional structures and freeway construction necessary to complete this 1.1 miles of freeway. The construction schedule calls for advertising this important contract early this summer.

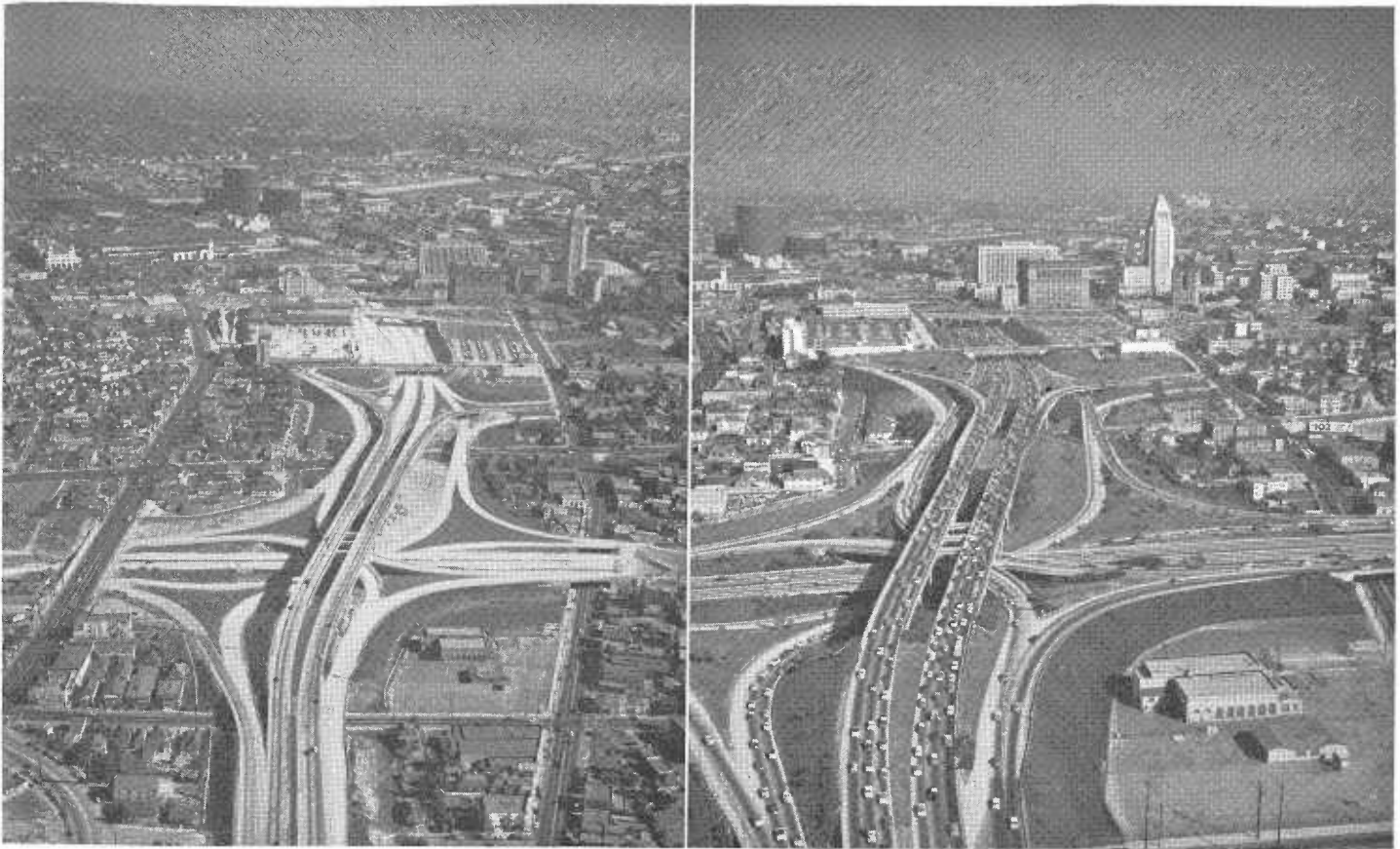
Santa Ana Freeway

California Highways and Public Works issue of September-October, 1955, carried a detailed illustrated story about the Santa Ana Freeway by W. L. Fahey, District Engineer, who retired from state service on December 1, 1955.

The progress of right-of-way acquisition and construction on this freeway during the past five years has been very extensive. Five years ago only 12.3 miles were completed and open to traffic, whereas today, a total of 32.4 miles are completed, at a total cost of \$61,000,000. 1955 traffic counts indicate that near Soto Street in the City of Los Angeles, the average daily traffic is 113,000 vehicles per day.

San Bernardino Freeway

The total length of the San Bernardino Freeway, formerly called "Ramona Freeway," between the junction with the Santa Ana Freeway at the Aliso Street bridge over the Los Angeles River to the San Bernardino county line, is 30.8 miles. The San Bernardino Freeway is now completed outbound from the junction with the Santa Ana Freeway in Los Angeles easterly to Rosemead Boulevard east of Alhambra, a distance of 9.3 miles. An additional 6.3 miles through the cities of Pomona and Claremont, from San Dimas Avenue to the San Ber-



LEFT—Looking east along Hollywood Freeway toward Los Angeles Civic Center as it looked five years ago, with traffic moving on top level only of four-level structure. RIGHT—Looking easterly along Hollywood Freeway toward Civic Center with heavy traffic on four-level interchange structure.

nardino county line, was opened to public traffic December 1, 1954. On this same date 7.2 miles of completed construction adjoining in District VIII, extending through Upland and Ontario to Archibald Avenue in San Bernardino County, was also opened to traffic.

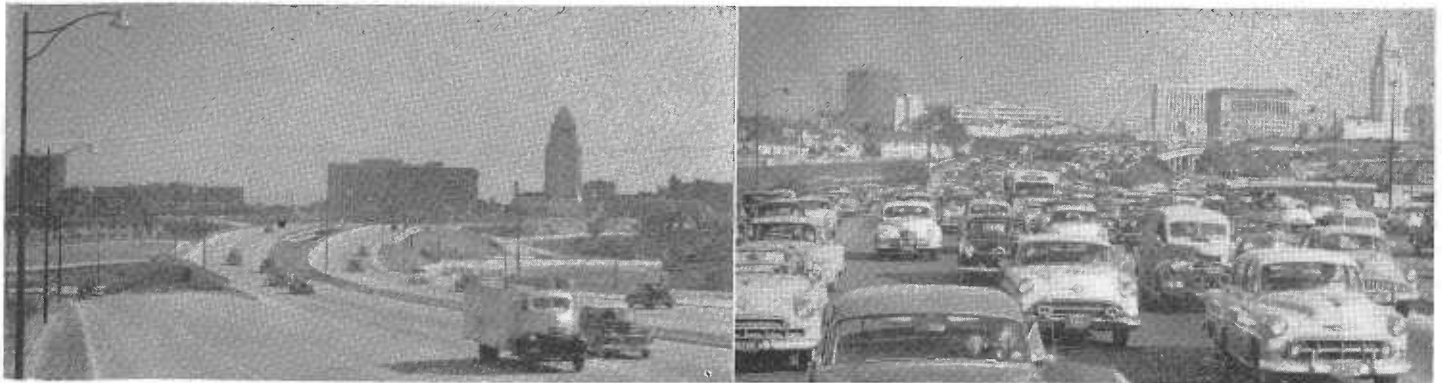
Four contracts are now in progress on the San Bernardino Freeway, ex-

tending for 15.3 miles. These construction allotments total \$16,466,500. When these four construction contracts are completed late next summer, the entire length of the San Bernardino Freeway in Los Angeles County from the Los Angeles River at Aliso Street junction with the Santa Ana Freeway to the San Bernardino County line will be completed. This indicates

the extent of the accomplishments that have been carried out during the past five years.

Five years ago there were only six miles of the San Bernardino Freeway that were completed and opened to traffic. This was the most westerly section extending from the Los Angeles River bridge to Helen Drive in the City Terrace area just easterly of

LEFT—Looking east along Hollywood Freeway, showing late afternoon traffic near four-level structure as of five years ago. RIGHT—Same location showing late afternoon traffic as of now. This is a typical condition that produces an average daily traffic count of 180,000 vehicles.





LEFT—Five years ago the Santa Ana Freeway looked like this when viewed from Los Angeles Civic Center looking east. RIGHT—Same location. Photo taken in January, 1956.

the Los Angeles city limits. The total expenditures to date on the San Bernardino Freeway for the 30.8 miles, including moneys spent and obligated for rights of way and construction, is approximately \$50,000,000. The traffic on the completed portions of the San

Bernardino Freeway has been steadily increasing. The average daily traffic in 1950 was 25,000 vehicles per day whereas recent counts taken at Soto Street show 88,000 vehicles per day. This tremendous increase in traffic is to a considerable extent due to the

unprecedented building program in the areas passed through. As one example of this, information has come to us that the City of West Covina in 1950 had a population of 2,667 whereas recently the estimated population is 28,631.

LEFT—Looking northeast, showing junction of Santa Ana Freeway with San Bernardino Freeway. Little traffic in evidence when first opened to public. RIGHT—Same location showing heavy traffic in July, 1955, when new interchange structure and bridge widening over Los Angeles River was nearing completion.





Looking northeasterly, showing completed San Bernardino Freeway over Garfield Avenue

Ventura Freeway

The Ventura Freeway extends from the Hollywood Freeway near Vineland Avenue in the San Fernando Valley to the Santa Barbara county line, a distance of 65.1 miles. Of this mileage, 39.1 miles have been completed at a construction cost of \$12,484,000 to four-lane divided highway or expressway standards. This completed construction is all westerly of the west city limits of Los Angeles at Calabasas. Seventy-five percent of this construction was carried out during the past five years.

The California Highway Commission on May 18, 1955, adopted a freeway routing to carry the Coast Highway (U. S. Highway 101) through the City of Ventura. Plans are now in progress so that construction can go forward whenever financing can be arranged for this entire 5.5 miles through the City of Ventura.

Within the City of Los Angeles, the Highway Commission has adopted freeway resolutions covering 16 miles of the Ventura Freeway from the westerly city limits of Los Angeles near Calabasas to the existing terminus of the Hollywood Freeway. District right-of-way forces are now actively engaged in acquiring rights of way throughout the entire length of the

bridges is now under way. One of these bridges is to carry the Ventura Freeway over Topanga Canyon Road and the other is to carry the freeway over existing Ventura Boulevard. Funds in the amount of \$6,270,000 for completion of the construction within this area for 3.8 miles between Kelvin Avenue and Calabasas and for 2.6 miles from Sepulveda Boulevard to Encino Avenue are included in the 1956-57 Fiscal Year budget.

San Diego Freeway

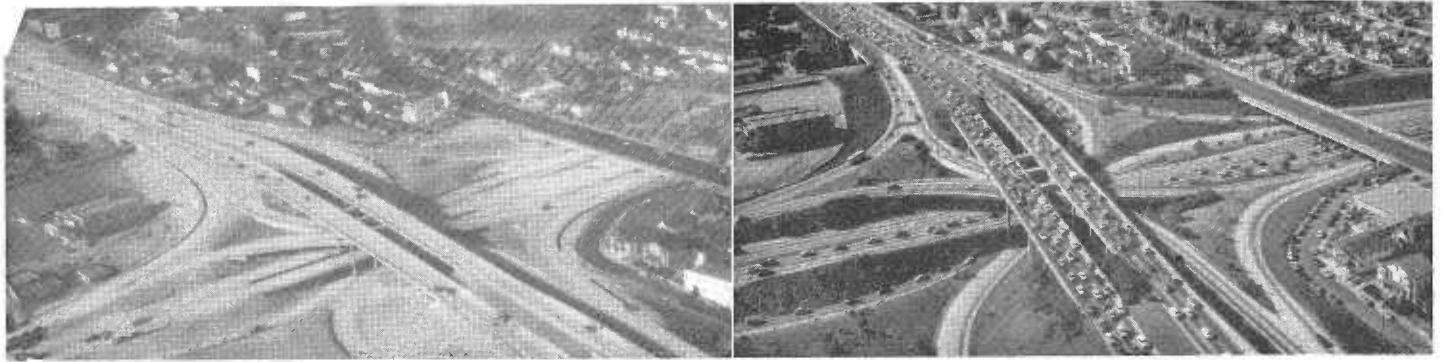
Much has been accomplished on the San Diego Freeway, formerly called "Sepulveda Freeway," within the last five-year period. The right-of-way expenditures to date of January 1, 1956, total almost \$18,000,000.

The first unit of construction on this freeway was for structures between Waterford Street and Casiano Road, and bids were opened on August 26, 1954. This construction includes the large grade separation bridge to carry Sunset Boulevard over San Diego Freeway and three other smaller bridges. This bridge construction is expected to be completed by the time this story is published.

Ventura Freeway in Los Angeles from Hollywood Freeway Extension to Calabasas at the west city limits. Much right of way has already been cleared from Sepulveda Boulevard westerly and a construction contract for two

Looking east along San Bernardino Freeway, showing construction progress through City of El Monte





LEFT—Looking west toward Hollywood, showing traffic five years ago at four-level structure. RIGHT—Looking west toward Hollywood, showing traffic today at four-level structure.

Present construction of the freeway proper on this portion of the San Diego Freeway between Waterford Street and Casiano Road is 40 percent completed, and will be finished next fall.

The section immediately to the south between Waterford Street and Ohio Street was let to contract in January. The low bid was \$2,465,402.50. Upon the completion of this contract, scheduled for early in 1958, 3.3 miles of freeway in the West Los Angeles area will be available to the traveling public. In the San Fernando Valley the construction of a bridge structure to carry the San Diego Freeway over Ventura Boulevard is now under way. Funds in the amount of \$4,565,000 for the construction of the traffic interchange layout between the San Diego and the Ventura Freeways have been budgeted in the 1956-57 fiscal year, and this work will be combined with the construction of the Ventura Freeway between Sepulveda Boulevard and Encino Avenue, and advertised later this year.

The Newer Freeways

The remaining freeways on the accompanying tabulation are newer freeways as compared with those higher on the list, and all might be called products of the past five years because five years ago construction had not been started on them. All that had been accomplished five years ago were route adoptions by the California Highway Commission, allocation of funds for right-of-way acquisition and preparation of designs and plans for construction.

The Colorado Freeway, extending from Eagle Vista Drive in Eagle Rock to Holly Street in Pasadena, being entirely complete with the new Pasadena Pioneer's Bridge over the Arroyo Seco, is of vital importance to the people of Pasadena and this area. The last unit of construction on the Colorado Freeway from Eagle Vista Drive to Avenue 64 was completed July 28, 1955.

The portion of the Foothill Freeway from Hampton Road to Montana Street in the Flintridge area, 1.8 miles in length, was reported in detail in the September-October, 1955, issue of *California Highways and Public*

Works. This important project, completed October 28, 1955, was also welcomed by the people of Pasadena, Flintridge and Altadena because it corrected an exasperating traffic congestion at Devil's Gate Dam.

Golden State Freeway

During the past five years, the portion of the Golden State Freeway, U. S. Highway 99, locally known as the "Ridge Route" between Tunnel Station and the Kern county line, 45.2 miles in District VII, has been converted to a four-lane expressway. The total cost of this reconstruction, completed February, 1953, was \$13,-

Looking east along Ventura Freeway through Camarillo



500,000. Southerly from Tunnel Station for 27.5 miles the Golden State Freeway is to be carried out to full freeway standards to its southerly terminus at junction with the Santa Ana Freeway. Of this portion the northerly three miles from Tunnel Station southerly to Sepulveda Boulevard was completed at a cost of \$3,200,000 on August 25, 1955.

On the Golden State Freeway two very important contracts have been started that affect the Griffith Park area. The first of these was awarded on August 15, 1955, carrying an allotment of \$748,000, provides for the construction of two grade separation bridges at Los Feliz Boulevard in the City of Los Angeles. The anticipated date of completion is in the summer of 1956. The second contract, awarded October 3, 1955, called for grading and paving 4.2 miles of the Golden State Freeway in the Cities of Los Angeles, Glendale, and Burbank, extending from 0.9 mile south of the Los Angeles River in the City of Los Angeles to Ash Avenue in the City of Burbank. Included in this construction are six bridges and three pedestrian undercrossings.

Continuing Construction

For continuing construction on the Golden State Freeway within the City of Los Angeles there are two construction items in the 1956-57 Fiscal Year budget that provide for building 2.7 miles of this freeway extending it southerly from near the Rodger Young Village to Glendale Boulevard for which the budgeted funds total \$4,890,000. It is expected that this unit of construction will be advertised this spring. Combining this sum with the allowance set up for acquisition for rights of way on the Golden State Freeway the funds available in the 1956-57 Fiscal Year budget total \$17,890,000.

Right-of-way activities are under way for acquiring all rights-of-way needed for the Golden State Freeway in the City of Los Angeles between Glendale Boulevard and junction with the Santa Ana Freeway. Right-of-way funds for the complete acquisition of right of way for project to be constructed in East Los Angeles between Sixth Street near the Santa Ana Free-



Looking southerly along Golden State Freeway, showing grade separation between Golden State Freeway and Southern Pacific Railroad, center left, and traffic interchange connection with Sepulveda Boulevard-San Fernando Road and Foothill Boulevard. San Fernando Reservoirs in background.

way and Mission Street northerly of the San Bernardino Freeway are included in the 1955-56 Fiscal Year right-of-way budget, and efforts are being made to concentrate on clearing this right of way. Completion of the Golden State Freeway through the City of Los Angeles, connecting it with the Santa Ana Freeway, the San Bernardino Freeway and the Pasadena Freeway, is of vital importance in clearing up traffic congestion on present freeways serving the Los Angeles Civic Center and business district.

Glendale Freeway

On the Glendale Freeway for the 1.6-mile section between the Los Angeles River and Avenue 36 near Eagle Rock Boulevard, plans are now completed and construction funds are included in the 1956-57 Fiscal Year budget in the amount of \$3,270,000. This includes grade separation over Taylor Yard tracks of the Southern Pacific Railroad. Advertising of this contract is expected later this year. The 1.5-mile section of this freeway from the Los Angeles River extending it southerly to Glendale Boulevard

was adopted by the Highway Commission on December 14, 1955.

The Artesia Freeway which is a part of State Highway Route 175 extends from Coast Highway Route 60 in Redondo Beach to a junction with the Santa Ana Canyon Freeway in Orange County near Olive. Of this total length of 34 miles, 21.7 miles have been adopted by the California Highway Commission as freeway routing. These two sections of freeway in Los Angeles County extend from Normandie Avenue to Santa Fe Avenue, and in Orange County from Palo Verde Avenue to the Santa Ana Canyon Freeway. On these freeway sections during the past five years, 1.9 miles between Normandie Avenue and Main Street were completed at a cost of \$1,000,000. We have under construction at the present time between Central Avenue and Santa Fe Avenue a unit 2.2 miles in length, having a construction allotment of \$1,700,000, which will be completed this spring. We also have under construction in Orange County a section four miles long extending from Cypress Avenue to the Santa Ana Canyon Freeway, having a construction allotment of

1,200,000, that is also scheduled for completion this spring. Plans are in progress for the remaining portions of this important east-west freeway.

The Santa Ana Canyon Freeway for which total expenditures now are \$4,248,000, including the improvement of Route 43 through Costa Mesa in Orange County, is largely a development of the last five-year period.

The Ojai Freeway in Ventura County is one of the most recent freeway developments. Construction to freeway standards from West Main Street in the City of Ventura northwesterly for 4.1 miles is now under construction, with completion date set for midsummer of 1956.

Other Freeways

In addition to the above described freeways, the California Highway Commission has adopted freeway routings during the past five years for 127.7 miles of additional freeways upon which as yet no construction has been started.

Limitation of space prevents further detailed description of these very important freeway projects that are so badly needed in this area. Designing of these freeways is being pushed as fast as other commitments will permit, and good use of advance right-of-way funds is being made whenever critical situations arise where action must be taken now to protect future rights of way from impending private developments which if permitted to go forward would cause great increase in future costs of rights of way. However, there are some of these freeways of such great importance they should be briefly mentioned.

The Riverside Freeway was adopted by the California Highway Commission on November 18, 1954. This freeway resolution covered 10.9 miles extending from junction with the Golden Gate Freeway, State Highway Route 4, in Griffith Park westerly to Sepulveda Boulevard, State Route 158, which included the last remaining section of Ventura Freeway that had not previously been adopted as a freeway.

San Gabriel River Freeway

The California Highway Commission adopted the route for the San

Gabriel River Freeway on December 15, 1954. This freeway extends from the junction with the Garden Grove Freeway near Long Beach to a junction with the San Bernardino Freeway near El Monte, a distance of 23 miles. Design is now under way in order to acquire vacant property subject to industrial and residential development under the advance right-of-way acquisition program.

The portion of the Pomona Freeway between Potrero Grande Drive and the junction of Route 19, a length of 18 miles, was adopted by the Highway Commission on April 2, 1954. Notwithstanding the intense subdivision activity in the Puente area, right-of-way needs for the freeway have been established ahead of the numerous subdivisions, and acquisition of vacant property is under way.

On June 21, 1955, the Highway Commission declared that portion of existing Route 23 (US 6) between Route 4 (US 99) and Solamint, a distance of seven miles, to be a freeway. The commission has announced their intention to hold a public hearing on February 9, 1956, for a proposed freeway route between Vincent Y and junction of Route 59, a distance of 19.6 miles. The latter section passes through the Palmdale-Lancaster area where there is considerable activity in new industry and subdivisions.

The California Highway Commission adopted the route for the Olympic Freeway between La Cienega Boulevard and the Santa Ana Freeway on May 21, 1954. Funds for right-of-way acquisition are available between the Harbor Freeway and the Santa Ana Freeway, and design studies are now in progress. Due to the heavy industrial development in the area between Harbor Freeway and the Santa Ana Freeway it has proven economically feasible to design and construct a continuous viaduct so as to hold to a minimum the cost of rights of way required for this freeway and secure other advantages.

Outlook for the Future

There is good reason to believe that the next five years will see fully as much if not more freeway development in this area than has been ob-

tained during the past five-year period because great advantage will be had of previously made right-of-way purchases. Also, it may be anticipated that with increasing vehicle registration, increasing moneys will become available. It is, however, obvious that this area is not getting the freeways which it needs quickly enough to meet the expanding requirements of growing population. The present hope is that Congress may this year pass legislation increasing federal aid, particularly for use on interstate highway routes. This would be a substantial help but when population growth is as explosive as is now being experienced in this area, it would appear that still other additional funds must be provided if the people are to have all the freeways and other highway facilities that are so badly needed.

As has been stressed in this and previous articles, close cooperation among all governmental and civic organizations is the basic key to success in providing a tangible freeway system which must represent the greatest good to the greatest number of people in this great State of ours.

CARQUINEZ PROJECT

Continued from page 29 . . .

northbound traffic will continue to use the new four-lane structure.

This project along with the freeway work into Richmond, Berkeley and Oakland are scheduled for completion late in 1958. At this time the last remaining traffic bottleneck will have been broken between the two great areas of the San Francisco Bay and the Sacramento Valley.

Plans are underway for the remaining work contemplated by the legislation such as the freeway through Vallejo and the Benicia-Martinez Bridge and approaches. This work is tentatively scheduled for advertisement in the latter part of 1956.

DEATH VALLEY

Death Valley is approximately 140 miles long and covers 2,981 square miles, reports the California State Automobile Association.

COST INDEX

Continued from page 49 . . .

During the third quarter the U. S. Bureau of Public Roads Composite Mile Index rose 3.1 percent reaching 215.1. This Index is based on actual highway contract prices, as is the California Index, but on a nation-wide scale. It will be noted that the trends

of this Index follow those of the California Index. Figures for the Composite Mile Index during the fourth quarter of 1955 are not available at this writing.

In view of the highway construction cost trends, as indicated by the Index, it is our belief that 1956 will see an accelerating upward spiral in bid prices.

HARDING RETIRING

Continued from page 45 . . .

Telford's duties during the past three years have included supervision not only of the planning phase of metropolitan freeway projects but also of the traffic engineering and design functions of the district.

The new Assistant State Highway Engineer is a native of Santa Barbara. After service in World War I in the infantry, he worked successively on highway surveys, railroad location and mining operations. He joined the staff of the Division of Highways in 1927 as a civil engineer in the Fresno district, and in succeeding years served in district offices in Bishop, and Eureka, and at Sacramento headquarters. He was a resident engineer on construction projects in the Los Angeles area from 1932 to 1936.

In 1950 Telford was appointed Engineer of Design for the Division of Highways, and subsequently Traffic Engineer. It was the latter position which he left to become District Engineer in District VII in February, 1953.

Telford also served in World War II, much of the time in North Africa and the India-Burma Theater.

District Engineer Langsner, in transferring from operations to planning, is returning to a field in which he has specialized for the past several years. He has been on the staff of District VII since his graduation from California Institute of Technology in 1931, and from 1949 to 1955 was responsible for the design of many of the metropolitan freeways in the Los Angeles area. Last year he was promoted to the post of district engineer to succeed W. L. Fahey upon the latter's retirement.

Gillis, the new district engineer—operations, has been on the Division of Highways staff since his graduation from the University of California in 1938. He has served in various capacities in District IV since 1941, except for military service with the Navy Civil Engineers Corps in World War II and the Korean conflict. Last year he was appointed assistant district engineer in charge of construction for District IV, which includes nine counties in the San Francisco Bay area.

NUMBER AND SIZE OF PROJECTS, TOTAL BID VALUES AND AVERAGE NUMBER OF BIDDERS (July 1, 1955, to December 31, 1955)

Project volume	Up to \$50,000	\$50,000 to \$100,000	\$100,000 to \$250,000	\$250,000 to \$500,000	\$500,000 to \$1,000,000	Over \$1,000,000	All Projects
Road Projects							
No. of Projects	143	50	39	13	5	2	252
Total value*	\$2,575,806	\$3,768,008	\$6,917,593	\$4,853,857	\$3,528,132	\$2,612,921	\$24,256,317
Ave. No. Bidders:	4.0	4.7	6.2	5.5	7.0	9.0	4.7
Structure Projects							
No. of Projects	21	7	4	2	3	4	41
Total Value*	\$329,294	\$462,596	\$531,699	\$845,215	\$1,792,939	\$19,049,288	\$23,011,031
Ave. No. Bidders:	4.4	8.0	4.5	5.5	9.3	5.5	5.5
Combination Projects							
No. of Projects					4	17	21
Total Value*					\$3,402,122	\$61,590,662	\$64,992,784
Ave. No. Bidders:					9.0	7.2	7.5
Summary							
No. of Projects	164	57	43	15	12	23	314
Total Value*	\$2,905,100	\$4,230,604	\$7,449,292	\$5,699,072	\$8,723,193	\$83,252,871	\$112,260,132
Ave. No. Bidders:	4.1	5.1	6.1	5.5	8.3	7.0	5.0

* Bid items only.

Total Average Bidders by Months by Calendar Years

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Avg. yr.
1955	8.5	5.8	6.7	5.5	5.0	4.4	4.9	4.2	4.4	5.4	6.2	5.4	5.3
1954	7.6	8.4	8.8	6.9	5.7	6.3	6.7	6.0	6.5	7.9	7.0	6.4	6.9

A. A. S. H. O. STATEMENT

Continued from page 53 . . .

Such additional revenues as may be needed in the judgment of Congress for financing an enlarged highway program could be obtained by using one or more of the following, and it is suggested that the Congress explore these possibilities:

- A reasonable increase in the present federal motor fuel tax.
- A reasonable tax or an increase in tax on items not now taxed by the states but that will serve as a measure of highway use.
- The reasonable use of short term credit financing with due consideration to its effect upon the national debt limitation.

GOOD GUIDE

HUNTINGTON PARK

California Highways and Public Works

DEAR SIRS: We have enjoyed your magazine very much and when we take trips through the State we use it as a guide to find the best routes to travel. This past summer we covered a great deal of the country in Northern California and plan to go more places this coming year so we do not want to miss a single copy of your journal for the next year or so, as we save each copy and loan them to our friends too.

Thanking you so much,

MR. AND MRS. O. H. WILLIAMS
3123 Walnut Street

State Highway Contracts Awarded

NOVEMBER, 1955

Alpine County—FAS 960—On Diamond Valley Road, between State Highway Route 23 near Woodfords and Springmeyer Ranch, 4.5 miles. Construct graded roadbed and surface with road-mixed surfacing on imported base material. Contract awarded to Lee Const. Co., San Leandro, \$78,606.

Calaveras County—Sign Route 4—At Avery, 0.2 mile. Construct cement treated base and surface with plant-mixed surfacing, drainage correction. Contract awarded to Rice Brother's, Inc., Lodi, \$26,851.80.

Calaveras and Tuolumne Counties—Portions between 3.8 miles south of Angels Camp and 1.6 miles south of Stanislaus River, 2.7 miles. Grade and surface with road-mixed surfacing on untreated base. Contract awarded to H. Earl Parker Inc., Marysville, \$244,119.70.

Fresno County—FAS 1230—Across Fresno Slough By-pass at James Road. Two reinforced concrete slab bridges to be constructed and 24-inch reinforced concrete pipe culvert. Contract awarded to Thomas Construction Company, Fresno, \$59,908.89.

Imperial County—State Route 201—Near Alamo, between Route 187 and 0.5 mile north, 0.5 mile. Grade and surface with road-mixed surfacing on untreated base. Contract awarded to N. L. Basich, South San Gabriel, \$57,739.50.

Kern County—State Route 139—Between Rio Bravo School and Jackson Avenue (portions), 0.3 mile. Raising grade at three locations and surface with road-mixed surfacing, furnish and install corrugated metal pipe and pipe-arch culverts. Contract awarded to Irv. Guinn, Contractor, Bakersfield, \$5,083.50.

Kern and Inyo Counties—At various locations. Producing and stockpiling sand. Contract awarded to John M. Ferry, Glendale, \$14,925.

Los Angeles County—US 99—In Los Angeles between Edward Avenue and Delay Drive, 0.2 mile. Widen the existing roadbed by grading, placing plant-mixed surfacing on untreated base and on existing portland cement concrete, apply seal coat and construct concrete curbs and sidewalks. Contract awarded to Jesse S. Smith, Glendale, \$24,869.50.

Los Angeles County—US 99—In San Fernando, on San Fernando Road between Fox Street and Hubbard Avenue, 1.1 miles. Heating, mixing and relaying the existing surfacing and then surfacing with plant-mixed surfacing. Contract awarded to G. J. Payne Co., Los Angeles, \$12,316.28.

Los Angeles County—On US 6, 99, SR 134, in Los Angeles, Glendale and Burbank, between 0.9 mile south of Los Angeles River and Ash Avenue, 2.4 miles. Construct graded roadbeds and surface with portland cement concrete pavement and plant-mixed surfacing on cement treated base, seven undercrossings, one overcrossing, one bridge and separation completion of which provides an eight-lane divided freeway with frontage roads and connections. Contract awarded to Vinnell Co., Inc. & Vinnell Constructors, Alhambra, \$4,040,782.

Los Angeles County—On Foothill Boulevard at San Dimas Avenue, 0.2 mile. Constructing a graded roadbed and surfacing with plant-mixed surfacing on untreated base, construct drainage facilities. Contract awarded to Ralph J. Laird, La Verne, \$20,110.75.

Los Angeles County—In the City of San Fernando, on Maclay Avenue at Fourth Street, Fifth Street, Glenoaks Boulevard and Seventh Street. Traffic signal systems and highway lighting at four locations. Contract awarded to Galland Electric Co., South Gate, \$14,576.76.

Los Angeles County—Between three miles and 3.6 miles north of Pacific Coast Highway, on Topanga Canyon Road, 0.6 mile. Construct a graded

roadbed and place plant-mixed surfacing on untreated base, completion of which provides a roadway on new alignment, eliminating many curves. Contract awarded to Lowe & Watson, San Bernardino, \$202,178.95.

Los Angeles County—Between Melrose Avenue and Linda Vista Avenue Off-ramp on Colorado Freeway. Roadside development. Contract awarded to K. E. C. Co., Artesia, \$61,573.66.

Los Angeles County—In Hawthorne, at the intersections of Hawthorne Boulevard with 138th Street, with 135th Street and with 132d Street. Traffic signal systems to be furnished and installed or modified. Contract awarded to Sherwin Electric Service, Los Angeles, \$9,576.

Los Angeles County—On US 66, 101, at the Santa Ana Freeway-Lakewood Boulevard Interchange. Construct drainage facilities on divided freeway. Contract awarded to Angeles Construction Co., Downey, \$3,602.

Los Angeles County—In the vicinity of Long Beach and Lakewood, at the intersections of Carson Street with Palo Verde Avenue and with Los Coyotes Diagonal-Studebaker Road. Furnish and install traffic signal and highway lighting systems. Contract awarded to Fishback & Moore, Inc., Los Angeles, \$34,466.

Madera County—Sign Route 145—On Madera Avenue between Cottonwood Creek and 0.5 mile north, 0.5 mile. Furnish and place imported borrow, two corrugated metal pipe arches and plant-mixed surfacing. Contract awarded to Stewart & Nuss Inc., Fresno, \$10,063.

Riverside County—At Keen Camp Maintenance Station. Constructing a cottage and a pump house (with pump and pressure tank), furnishing and installing a water supply system, sewer system and discharge line to be constructed. Contract awarded to Loren B. Smith, Covina, \$20,982.50.

Riverside County—At various locations across Perris Valley Storm Drain and San Jacinto River, on Nuevo Road and Martin Street between about two and seven miles northeasterly of Perris. Four reinforced concrete slab bridges. Contract awarded to C. B. Tuttle, Los Alamitos, \$98,134.40.

San Bernardino County—In San Bernardino, at District VIII office and laboratory buildings. Intercommunication system to be furnished and installed. Contract awarded to Fairfax Radio Electric Co., Los Angeles, \$3,955.

San Bernardino County—US 91, 466—Between two miles east of Yermo and 10 miles east of Baker, 0.3 mile. Place plant-mixed surfacing on existing bridges and approaches. Contract awarded to G. W. Ellis Construction Co., North Hollywood, \$10,500.

San Bernardino County—In the City of San Bernardino, at Highland Avenue and Mt. Vernon Avenue, 0.5 mile. Grade and surface with plant-mixed surfacing on untreated base interchange roadways and approaches, girder bridge, signals, lighting and illuminated signs. Contract awarded to R. M. Price Co., Altadena, \$784,876.05.

San Diego County—US 80—Between 0.2 mile east of Maryland Avenue and 0.2 mile east of Baltimore Drive, near La Mesa, 0.8 mile. Grading and paving with plant-mixed surfacing on untreated base and imported subbase and constructing frontage roads, ramps and connections, and a steel girder overcrossing. Contract awarded to V. R. Dennis Const. Co., Hillcrest Sta., \$410,913.

San Diego County—US 395—At the intersection with Sign Route 76, 0.3 mile. Grade and channelize an intersection, surface traffic lanes with plant-mixed surfacing on untreated base. Contract awarded to E. L. Yeager Co., Riverside, \$19,073.10.

San Diego County—US 395—In San Diego, between Fulton Street and Aero Drive, 2.0 miles. Constructing a graded roadbed for a frontage road and surfacing with plant-mixed surfacing, a rein-

forced concrete box girder bridge undercrossing and a welded steel plate girder bridge overcrossing with reinforced concrete deck. Contract awarded to Griffith Co., Los Angeles, \$668,472.

San Diego County—Sign Route 76—In the City of Oceanside, between Santa Barbara Street and Mesa Drive, 0.8 mile. Grade and surface with plant-mixed surfacing on untreated base, widen to four-lane divided highway. Contract awarded to R. E. Hazard Const. Co., San Diego, \$93,599.

San Diego County—Sign Route 94—Between College Avenue and Campo Road, 2.5 miles. Grading and paving with portland cement concrete on cement treated subgrade and plant-mixed surfacing on cement treated base, for constructing a six-lane divided freeway together with the necessary ramps and interchange lanes and street connections, four undercrossings, two overcrossings, one underpass and one separation. Contract awarded to Guy F. Atkinson, Long Beach, \$2,863,722.50.

Stanislaus County—Sign Route 132—Across San Joaquin River, about 13 miles west of Modesto. Repair an existing bridge. Contract awarded to C. C. Gildersleeve, Grass Valley, \$2,888.88.

Tulare County—Sign Route 134—Between 0.3 mile east of Ash Avenue and Route 132 near Tulare. Storm sewer system and electrically operated drainage pumping plant to be constructed. Contract awarded to W. M. Lyles Co., Avenal, \$35,538.76.

DECEMBER, 1955

Alameda County—Eastshore Freeway—At Centerville Elementary School and at Irvington Elementary School. Flashing beacon systems to be furnished and installed. Contract awarded to Manning and Whitaker, San Francisco, \$2,389.96.

Alameda County—State Routes 228 and 105—Between Route 69 and Mattox Road. Resurfacing with plant-mixed surfacing, constructing cement treated base, median curbs and island surfacing and repairing failed areas, 1.5 miles. Contract awarded to Clements Const. Co., Centerville, \$39,050.50.

Calaveras County—FAS 1150—Between 1.0 mile and 3.3 miles northeast of Altaville, 2.3 miles. Constructing a graded roadbed, placing imported subbase material and untreated base and surfacing with road-mixed surfacing, drainage structures to be furnished and installed. Contract awarded to Beerman & Jones, Sonora, \$131,912.40.

Colusa County—Sign Route 20—Between Southern Pacific Railroad in Williams and 5 miles east. Construct new fence and drainage facilities. Contract awarded to E. H. Thomas Co., Sacramento, \$33,430.75.

Fresno County—Sign Route 180—Between 0.5 mile south of Mendota and 0.3 mile east of Panchoche Road, 0.6 mile, constructing a graded roadway and surfacing with road-mixed surfacing on imported borrow. Contract awarded to Paul E. Woolf, Fresno, \$20,964.80.

Fresno County—Sign Route 145—Between Kernman and 2.1 miles north (portions), constructing a graded roadbed and surfacing with plant-mixed surfacing, 0.4 mile. Contract awarded to C. E. Ruberts & Son, Coalinga, \$9,012.50.

Fresno County—FAS 1211—On Belmont Avenue, between Clovis Avenue and Academy Avenue, construct a graded roadbed placing imported base material, constructing a cement treated base and surfacing with plant-mixed surfacing, a reinforced concrete girder bridge to be constructed, 8.0 miles. Contract awarded to Baun Const. Co., Inc., Fresno, \$323,255.30.

Humboldt County—US 101—At Rohnerville Road. Reinforced concrete pipe culvert to be installed. Contract awarded to Mercer Fraser Co., Inc. and Mercer Fraser Gas Co., Inc., Eureka, \$9,247.75.

Imperial County—FAS 649—Between State Highway Route 12 and New River near El Centro. Constructing a graded roadbed, surfacing with plant-mixed surfacing on imported base material and applying fog seal coat, 5.6 miles. Contract awarded to Basich Bros. Const. Co. & N. L. Basich, South San Gabriel, \$259,903.95.

Imperial County—US 80—Between Alamo River and 0.1 mile east of Holtville. Constructing a graded roadbed, placing imported subbase material and surfacing with plant-mixed surfacing on cement treated base and existing pavement, clearing and grubbing to be performed, a special reinforced concrete drop inlet and concrete curbs, sidewalks and driveways to be constructed, right of way monuments and raised traffic bars, completion of which will provide a four-lane divided highway, 1.3 miles. Contract awarded to N. L. Basich, South San Gabriel, \$157,547.00.

Kings County—Sign Route 41—Through Pyramid Hills, about 15 miles southwest of Kettleman City, constructing a two-lane highway by grading, placing plant-mixed surfacing on cement treated imported subbase material and constructing plant-mixed surfacing dikes, and roadway to be finished, 2.0 miles. Contract awarded to Valley Paving & Const. Co., Inc., Pismo Beach, \$150,390.50.

Kings and Fresno Counties—FAS 623 and 945—On 6th Avenue, between Fargo Avenue and Excelsior Avenue; and on Excelsior Avenue between 19th Avenue and Kings River. Constructing a graded roadbed and surfacing with plant-mixed surfacing on cement treated base, clearing and grubbing to be performed and the roadway to be finished, 5.7 miles. Contract awarded to Granite Const. Co., Watsonville, \$160,420.00.

Lake County—I-LAK-1044—On Butts Canyon Road between Napa County line and 1.8 miles northwesterly. Grading a two-lane roadbed, placing untreated base, applying penetration treatment and drainage facilities, 1.8 miles. Contract awarded to Lange Bros. & Hastings, Lakeport, \$98,629.05.

Los Angeles County—In the city of Los Angeles, San Diego Freeway at Ventura Boulevard. Construct embankments, widening existing streets and placing plant-mixed surfacing on untreated base, construct undercrossing, channelization, curbs, sidewalks, drainage facilities, sewers, highway lighting and signal system for freeway, 0.1 mile. Contract awarded to Oberg Bros. Const. Co., Inglewood, \$460,861.50.

Los Angeles County—State Route 161—Between Orange Grove Avenue and Vernon Avenue, install a watering system and a chain link fence. Contract awarded to D & M Sprinkler Co., Long Beach, \$2,971.65.

Los Angeles County—State Route 166—Between Camfield Avenue and Pioneer Boulevard, roadside areas to be developed and planted, 7.5 miles. Contract awarded to K E C Company, Artesia, \$30,990.92.

Los Angeles County—State Route 167—Between 0.3 mile south of Southern Avenue and Atlantic Boulevard. Construct graded roadbeds and surface with portland cement concrete pavement on cement treated subgrade and plant-mixed surfacing on untreated base and cement treated base and install highway lighting and directional sign system, and construct eight structures and three pumping plants, completion of which provides a new six-lane divided freeway with bridges at: Florence Avenue Overcrossing, Gage Avenue Overcrossing, East Walker Underpass, Standard Oil Co. Pipe Line Overcrossing, Slauson Avenue Overcrossing, Retaining Wall No. 180, Cheli Depot Overhead, Cheli Depot Storm Drain, and Florence Avenue Overcrossing Pumping Plant, Gage Avenue Overcrossing Pump Plant and Slauson Avenue, 3.4 miles. Contract awarded to Ukropina, Polich, Steve Kral & John R. Ukropina, San Gabriel, \$3,188,422.10.

Los Angeles County—State Route 178—In the City of Long Beach over Route 178 at Long Beach City College. Construct a combination welded plate girder and concrete slab bridge, sidewalks and chain fence to be constructed and a highway lighting system to be furnished and installed, providing a pedestrian overcrossing. Contract awarded to N. M. Saliba Co., Gardena, \$52,827.00.

Los Angeles County—FAS 852—On Valley Boulevard, between Ferrero Lane and 0.1 mile east of

Turnbull Canyon Road. Construct a graded roadbed and surfacing with asphalt concrete on untreated base, constructing a steel beam bridge with reinforced concrete deck, drainage facilities and roadway to be finished, 1.9 miles. Contract awarded to Clifford C. Bong & Co., Arcadia, \$686,047.30.

Madera County—Sign Route 152—At Berenda Slough, about 3.3 miles west of Califa, reinforced concrete bridge to be constructed and approaches to be graded and surfaced with plant-mixed surfacing on untreated base, 0.6 mile. Contract awarded to R. E. Hertel, Sacramento, \$181,409.70.

Marin County—State Route 1—Between 2.0 miles north of Dolan's Corner and 2.5 miles south of Tomales, at various locations. Culverts to be re-constructed and underdrain to be constructed. Contract awarded to Ghilotti Bros., Inc., San Rafael, \$15,812.80.

Monterey County—State Route 118—At Blanco-Cooper Road, 3.2 miles northwest of Salinas construct a graded roadbed, place imported subbase material and untreated base, surfacing with plant-mixed surfacing and applying seal coats, 0.4 mile. Contract awarded to Valley Paving & Const. Co., Inc., Pismo Beach, \$36,212.00.

Monterey County—FAS 660—On Los Laureles Grade Road, between 0.7 mile north of Carmel Valley Road and Summit, constructing a graded roadbed by grading and placing selected material on a portion of the roadbed, 2.3 miles. Contract awarded to Jess H. Harrison, San Ardo, \$167,104.00.

Orange County—US 101—Between Browning Avenue and Fourth Street. Furnishing and placing plant-mixed surfacing, preparing planting areas and planting, 2.1 miles. Contract awarded to K E C Company, Artesia, \$23,401.72.

Orange County—US 101 Alternate—At the intersection of Coast Highway with Los Patos Avenue, approximately one-half mile southeasterly from Sunset Beach. Constructing channelization, furnishing and installing a three-phase full traffic-actuated signal system and highway lighting, 0.3 mile. Contract awarded to Cox Bros. Const. Co., Stanton, \$38,276.95.

Orange County—FAS 826—On Katella Avenue, between Stanton Avenue and Santa Ana Freeway. Constructing a graded roadbed and placing plant-mixed surfacing on untreated base, drainage facilities to be furnished and installed, 5.1 miles. Contract awarded to Sully-Miller Contracting Co., Long Beach, \$316,471.90.

Riverside County—FAS 734—On 56th Avenue between Monroe Street and Coachella Valley Storm Drain at Thermal. Grading and surfacing with plant-mixed surfacing on imported base material, 5.5 miles. Contract awarded to Baun Const. Co., Inc., Fresno, \$197,396.20.

San Benito County—FAS 670—On Fairview Road and Shore Road, between Fallon Road and Bolsa Road, construct graded roadbed, place imported subbase material and untreated base, apply penetration treatment and seal coat, 7.5 miles. Contract awarded to Valley Paving & Const. Co., Inc., Pismo Beach, \$140,014.00.

San Diego County—At various locations. Sealing pavement joints, 21.2 miles. Contract awarded to James M. Pope, Downey, \$58,498.75.

San Joaquin County—In Manteca, on Main Street at Yosemite Street. Traffic signal system to be furnished and installed. Contract awarded to Collins Electrical Co., Inc., Stockton, \$10,277.00.

San Mateo County—Bayshore Freeway—Between 1.5 miles south of San Francisco County line and 0.4 mile north of Butler Road Overcrossing. Construct graded roadbeds and railroad embankments, a welded steel girder bridge with reinforced concrete deck slab and a reinforced concrete box girder bridge, for six-lane divided highway on new alignment, 3.5 miles. Contract awarded to Guy F. Atkinson Co., South San Francisco, \$2,039,702.00.

Santa Clara County—US 101—About 6 miles north of Morgan Hill, at Encinal Elementary School. Install a flashing beacon system. Contract awarded to Progress Electric, Palo Alto, \$1,897.00.

Santa Clara County—Sign Route 17—At the intersection with Trimble Road, near south city limit of Milpitas. Install a span-wire mounted flash-

In Memoriam

MARTIN C. POLK

Martin C. Polk, 83, former Butte County Assessor, city and county engineer and political leader, died in Chico, January 26th.

Polk, who opened an engineering office in Chico in 1901, became city engineer the following year during the installation of the city's sewer system. He was named county surveyor in 1903 and served on a per diem basis until 1918, when the position of road engineer was written into the county charter. He was city engineer simultaneously from 1908 until 1918, when he resigned to take over the county position full time.

He retired in 1954 after selling his engineering firm.

Polk liked to recall he turned the first dirt on what now is California's elaborate highway network. He explained that in 1912 or 1913 one of the first state highway jobs was in Yuba County and was awarded to the Chico Construction Company, for which Polk was the engineer. He said he and a crew went to the site ahead of the official start of construction and he held the mule-drawn plow which turned the first earth.

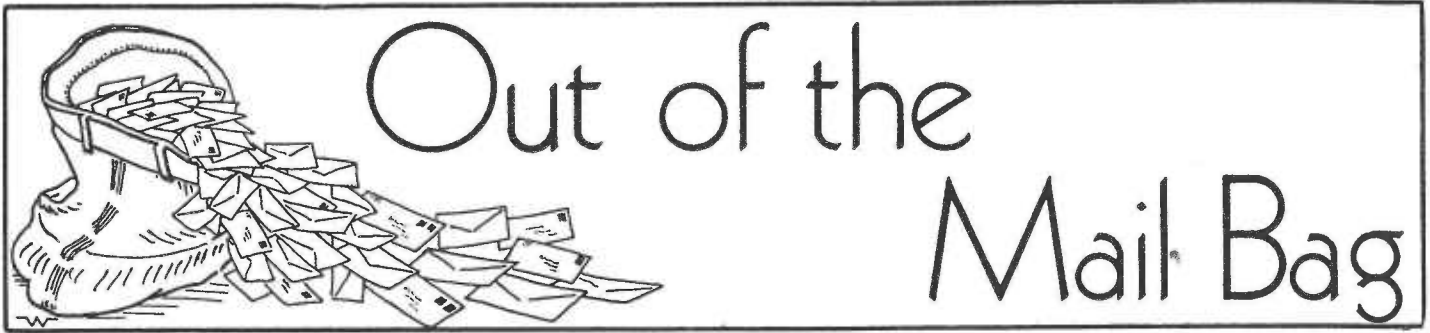
ing beacon system and highway lighting. Contract awarded to Ets-Hokin and Galvan, Oakland, \$1,888.00.

Santa Clara County—Sign Route 17—At intersections of San Jose-Los Gatos Road with Union Avenue and with Campbell Avenue, in and near Campbell. Install traffic signal and highway lighting and construct channelization. Contract awarded to Leo F. Piazza Paving Co., San Jose, \$70,449.00.

Santa Clara County—Bayshore Highway—Between Sign Route 17 and Santa Clara Street. Constructing graded roadbeds, paving with portland cement concrete on cement treated subgrade, placing plant-mixed surfacing on existing pavement, frontage roads, ramps and connecting roads and surfacing with plant-mixed surfacing on cement treated base, three bridges, one overcrossing and one underpass, 1.6 miles. Contract awarded to Lew Jones Const. Co. and Leo F. Piazza Paving Co., San Jose, \$1,535,052.80.

Santa Clara County—FAS 996—On Santa Clara-Los Gatos Road, between Vasona Junction and Shelburne Way. Constructing a graded roadbed and surfacing with plant-mixed surfacing on untreated base, reinforced concrete drainage structures to be constructed, 10.0 miles. Contract awarded to Edward Keeble, San Jose, \$218,393.90.

Shasta County—US 99—II-SHA-3-C—Between Crespos and Vollmers. Grading and surfacing with plant-mixed surfacing on cement treated base and untreated base, completion of which will provide a four-lane divided highway, 2.0 miles. Contract awarded to Guy F. Atkinson Co., South San Francisco, \$1,294,763.70.



SHARES MAGAZINE

SOUTH PASADENA

MR. K. C. ADAMS, *Editor*

DEAR MR. ADAMS: I am very happy to know that I will continue to receive *California Highways and Public Works* magazine.

You perhaps might be interested in knowing that this magazine is forwarded to four different offices, all of which are very interested and get a great amount of pleasure from the reading of this magazine.

I expect to increase this recirculation to at least six offices within the near future.

Again thanking you for your courtesies, I am

Yours very truly,

G. B. FOSTER
701 Brent Ave.

CONGRATULATIONS

PACIFIC ROAD BUILDER AND
ENGINEERING REVIEW

MR. KENNETH C. ADAMS, *Editor*

DEAR KEN: Congratulations on another fine magazine—the November-December issue of *California Highways and Public Works*. Every article is closely read by me as part of my constant search to uncover a new development in highway construction. I now find that I am personally acquainted with more and more of your staff of resident engineer writers and this increases my interest in the articles.

Belated season's greeting to you and your staff.

Yours very truly,

HAROLD SHAW, *Editor*
Pacific Road Builder and
Engineering Review

FROM T. V. A.

TENNESSEE VALLEY AUTHORITY
Chattanooga, Tennessee

MR. KENNETH C. ADAMS, *Editor*

DEAR MR. ADAMS: I have received two copies of your magazine which I have certainly enjoyed. Though I am a sanitary engineer in the field of water supply and sewage treatment, my first love was highway construction, having worked summers during high school and college days in Mississippi when that state's construction progress was just getting underway.

You are doing a good job in presenting the problems of financing, design, right-of-way acquisition, and construction. The people of California should be proud of their active and progressive highway department.

Sincerely yours,

WILLIAM WARD FILGO
Public Health Engineer

FROM PENNSYLVANIA

PITTSBURGH, PA.

DEAR MR. ADAMS: Thanks very much for enabling me to receive copies of your wonderful magazine.

I want you to know I have thoroughly enjoyed the past issues I have received.

You will understand this by reason of the fact that I am employed as a construction inspector (highways) and of course have had considerable experience along these lines.

I can see you have a wonderful highway construction program on out there and it's certainly interesting to see what is going on out in your wonderful state.

Respectfully,

CHARLES E. PFEIL

FROM ALBION COLLEGE

ALBION COLLEGE
Albion, Michigan

MR. K. C. ADAMS, *Editor*

I would like to say "thank you" and to let you know that I appreciate receiving your magazine.

The issues are made available to our engineering students on the combined plan. Those interested in civil engineering receive stimulus and knowledge from the issues. In many cases they can see where the fundamentals of mathematics and physics are used. Which helps.

Many of us wish that our state highway department had the fine public relations which yours seems to have.

Yours truly,

EDMUND E. INGALLS
Professor Mathematics
In charge of students on the
Combined Plan in Engineering

KEEP BACK COPIES

FELTON

MR. K. C. ADAMS, *Editor*

DEAR MR. ADAMS: We cannot express our sincere appreciation enough for this wonderful educational and enlightening magazine.

The well written articles and illustrations, the detailed costs of construction, causes us to read your magazine from cover to cover.

We have all copies sent us for years and very often refer back to old copies, and note the profound advancement in our highway building.

We wish to thank you again.

Sincerely,

MR. AND MRS. J. F. SCHUTTE
614 Highway 9 South

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GOODWIN J. KNIGHT
Governor of California

CALIFORNIA HIGHWAY COMMISSION

FRANK B. DURKEE . . . Director of Public Works
and Chairman
H. STEPHEN CHASE . . . San Francisco
JAMES A. GUTHRIE . . . San Bernardino
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State Highway Engineer, Chief of Division

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CHAS. E. WAITE . . . Deputy State Highway Engineer
EARL WITCOMBE . . . Assistant State Highway Engineer
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J. C. WOMACK . . . Assistant State Highway Engineer
R. H. WILSON . . . Assistant State Highway Engineer
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GEORGE F. HELLESOE . . . Maintenance Engineer
J. C. YOUNG . . . Engineer of Design
G. M. WEBB . . . Traffic Engineer
MILTON HARRIS . . . Construction Engineer
H. B. LA FORGE . . . Engineer of Federal Secondary Roads
C. E. BOVEY . . . Engineer of City and Cooperative Projects
EARL E. SORENSON . . . Equipment Engineer
H. C. McCARTY . . . Office Engineer
J. A. LEGARRA . . . Planning Engineer
J. P. MURPHY . . . Principal Highway Engineer
F. M. REYNOLDS . . . Principal Highway Engineer
E. J. SALDINE . . . Principal Highway Engineer
A. L. ELLIOTT . . . Bridge Engineer—Planning
I. O. JAHNSTROM . . . Bridge Engineer—Operations
J. E. McMAHON . . . Bridge Engineer—Southern Area
L. C. HOLLISTER . . . Projects Engineer—Carquinez
E. R. HIGGINS . . . Comptroller

Right of Way Department

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E. F. WAGNER . . . Deputy Chief Right of Way Agent
GEORGE S. PINGRY . . . Assistant Chief
R. S. J. PIANEZZI . . . Assistant Chief
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District IV

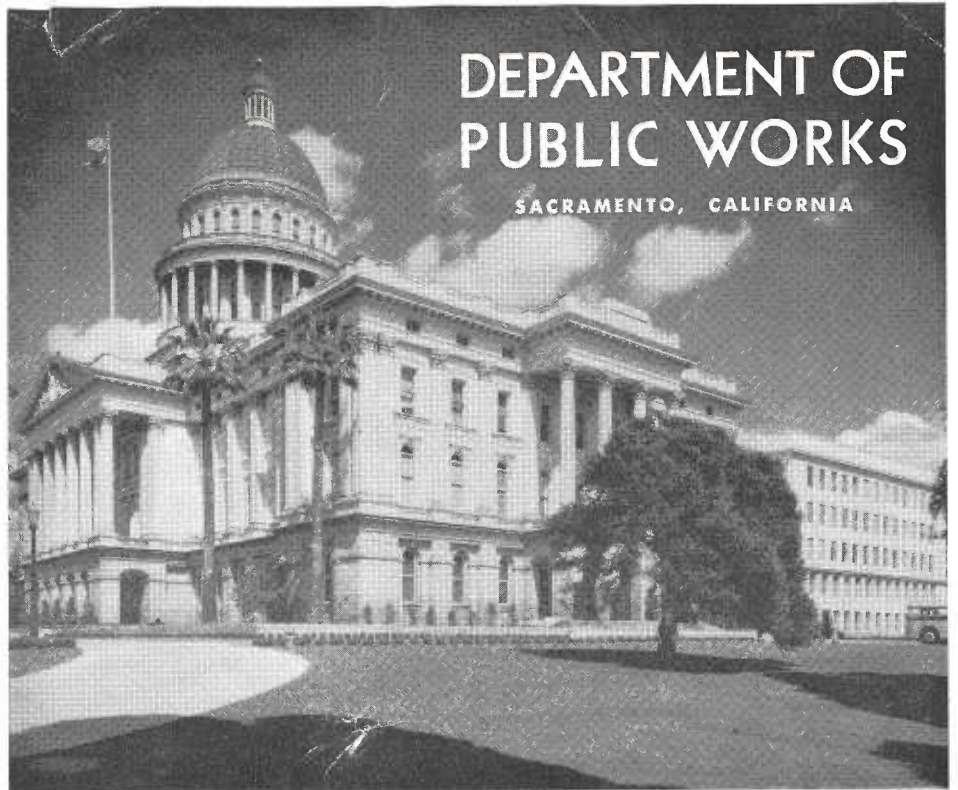
B. W. BOOKER . . . Assistant State Highway Engineer

District VII

P. O. HARDING . . . Assistant State Highway Engineer

District Engineers

ALAN S. HART . . . District I, Eureka
J. W. TRASK . . . District II, Redding
A. M. NASH . . . District III, Marysville
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L. A. WEYMOUTH . . . District IV, San Francisco
L. L. FUNK (Acting) . . . District V, San Luis Obispo
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J. DEKEMA . . . District XI, San Diego
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State-owned Toll Bridges



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Water Resources Investigations, Central Valley
Project, Irrigation Districts
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Sacramento River Flood Control Project, Su-
pervision of Safety of Dams, Sacramento-San
Joaquin Water Supervision
L. C. JOPSON . . . Assistant State Engineer,
Water Rights and Water Quality Investigations
MAX BOOKMAN
Principal Hydraulic Engineer, Los Angeles Office
HENRY HOLSINGER . . . Principal Attorney
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HUBERT S. HUNTER . . . Deputy Chief of Division
ROBERT W. FORMHALS
Administrative Assistant to State Architect

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HENRY R. CROWLE . . . Fiscal Assistant
THOMAS MERET . . . Construction Budgets Architect
WADE O. HALSTEAD
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STANTON WILLARD . . . Principal Architect, Standards

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JAMES A. GILLEM . . . Principal Architect, Los Angeles
CHARLES PETERSON
Principal Structural Engineer, Los Angeles
CARL A. HENDERLONG
Principal Mechanical and Electrical Engineer
CLIFFORD L. IVERSON . . . Chief Architectural Draftsman
GUSTAV B. VEHN . . . Supervising Specifications Writer
JOHN S. MOORE . . . Supervisor of Special Projects

Construction Service

CHARLES M. HERD . . . Chief Construction Engineer
CHARLES H. BOCKMAN
Assistant to Chief Construction Engineer

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CALIFORNIA STATE HIGHWAY SYSTEM

SCALE IN MILES

