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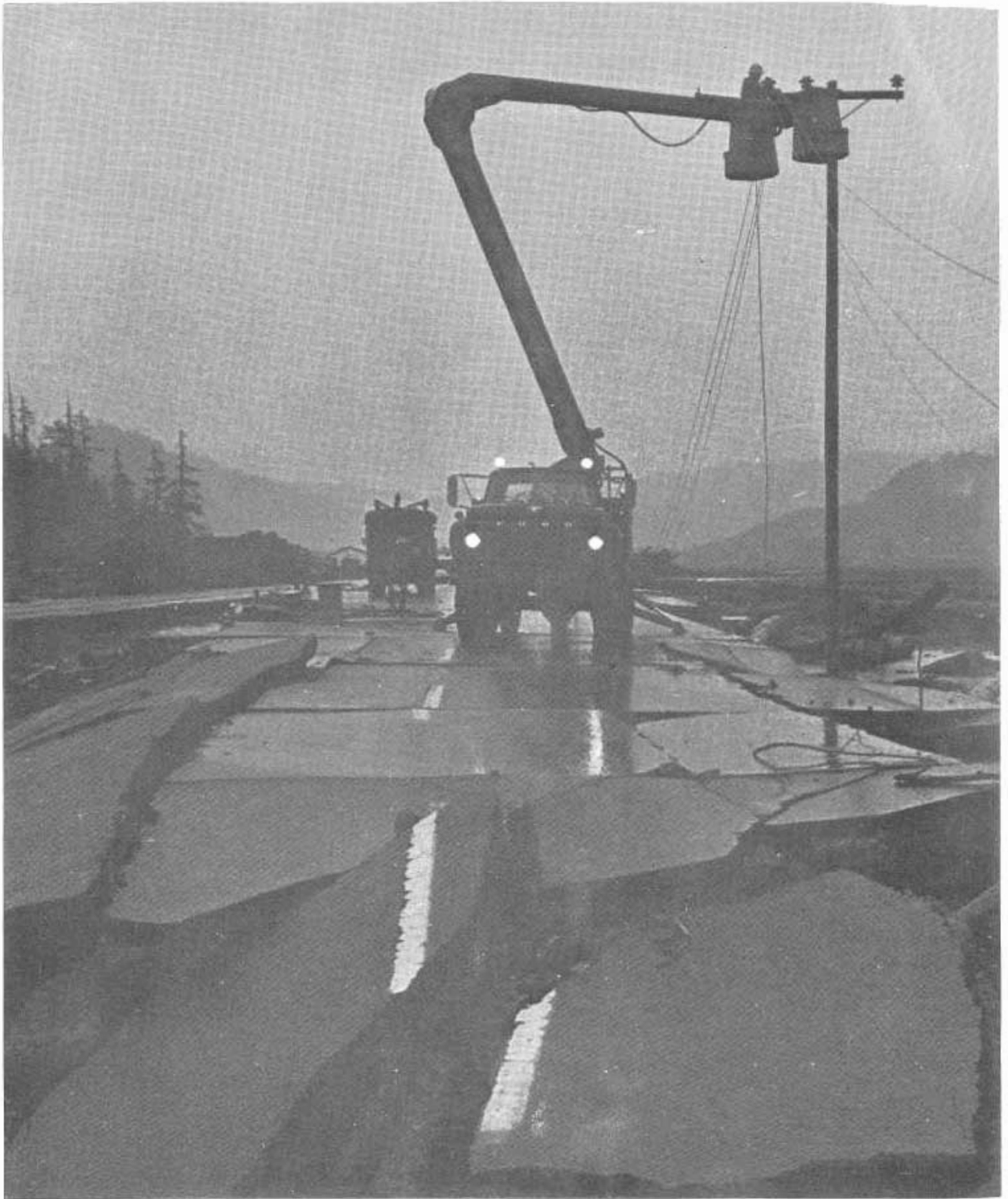
CALIFORNIA  
**Highways**  
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JANUARY-FEBRUARY  
1965





*In drumming rain, beneath low-hanging clouds, public utility crews labor at restoring electrical power in flood-stricken Humboldt County on Christmas Day, 1964. Photo was made on US 101 between Alton and Fortuna, where rampant Eel River cut new channel and tore up the highway. See flood articles beginning on page 2. (Photo courtesy of Humboldt Beacon, Fortuna.)*

# California Highways and Public Works

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

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January-February

Nos. 1-2

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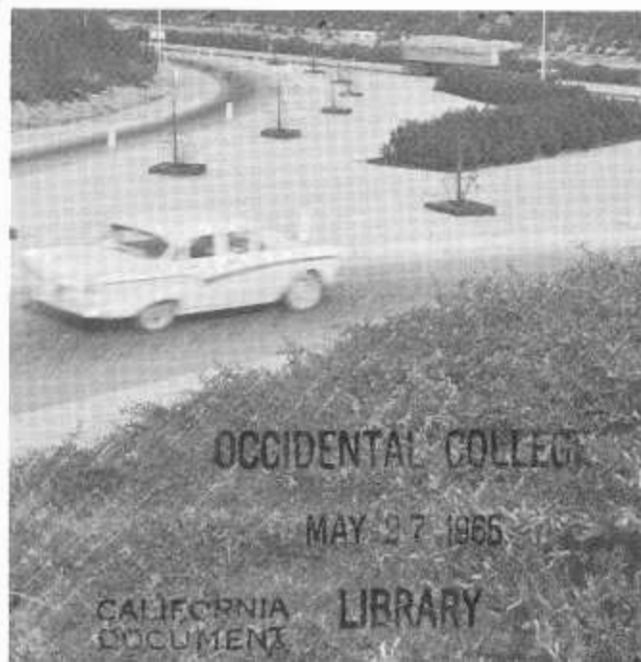
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FRONT COVER: The first glimpse of the Pacific Ocean on US 101, after the motorist leaves the Golden Gate Bridge in the northerly direction, occurs 300 miles later on this new stretch of four-lane highway which bypasses McKinleyville. Here he is afforded unrestricted access to the magnificent beach for a distance of one and a half miles via frontage roads. The roadside rest features a wooden plaque dedicated to this area "Where the Majesty of the Redwoods Meets the Beauty of the Sea" and an exceptional view of Trinidad Head. See "McKinleyville Freeway," page 31. (Photo by Robert Mulno.)

BACK COVER: The crisp redness of the firethorn berries brought a touch of color to the US 99 freeway at Tulare during the holiday season. See "12,000 Shrubs and Trees," inside back cover. (Photo by Bill F. Ruland.)



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# CHRISTMAS FLOODS 1964

## PART 1: *The Redwood Highway*

By JOHN ROBINSON

*Robinson Ferry (Paul Mudgett Memorial) Bridge, on US 101, at height of Christmas, 1964, flood. Eel River overflow in foreground tore great gaps in the roadway, while debris piled behind center spans caused structure failure at main stream. Note houses in debris. Town in background is Rio Dell. Redwood Highway traffic is now using county "Blue Slide" road which travels along flat at upper right. Contract for repair of bridge is well underway, and bridge is expected to be back in service by about May 1. (Photo courtesy of Eureka Newspapers, Inc.)*

In the northwestern sector of California, where winter storms sweep in from the Pacific and drop rainfall approaching rain forest conditions, the narrow valleys between the ridges of the Coast Range, running north and south parallel to the coastline, are a series of troughs which collect the water. One of area's most important rivers, the Eel, and its major tributary, the South Fork, flow northward 150 miles while only 30 miles or so from the coast. Running longitudinally through a strip subject to heavy rains, phenomenal rises and floodings

are common to the river system, as would be expected.

Most of the north coast rivers follow this same pattern, except for the powerful Klamath, which cuts deeply through the Klamath Range, but the topography of its drainage is very similar to that of the Eel. Periodically, a series of fierce winter storms, spread over a broad area, drop heavy rains over the combined watersheds of these several rivers, and widespread flooding occurs.

Nine years ago, in December 1955, just before Christmas, such a series of

storms struck the coast, and the resultant floods, particularly along the Eel, were the worst on record. There was considerable loss of life, and very heavy property damage.

History in the north coast counties of California seemed to be repeating itself in the last half of December 1964, when continuous rainfall saturated the Coast Range and the Klamath Mountains. Just as in the record floods of 1955, the rivers draining these ranges began to rise within their banks a few days before Christmas. Those who dwelt near the flood mark



paused in decorating their trees to listen with special attention to the weather forecasts on their radios.

On Monday, the 21st of December, a great mass of tropical air, supersaturated with water, was driven in from the Pacific over these northern ranges. The watersodden air, cooled rapidly as it was deflected upward by the mountains, dropped its load like liquid squeezed from a sponge. On the 21st and 22nd of December torrential rainfall approaching cloudburst proportions was common over most of the north coastal counties.

On the 22nd Garberville, on the South Fork of the Eel, recorded 8.29 inches. In the 1955 flood period its highest one-day fall was 3.23 inches. Grizzly Creek State Park on the Van Duzen River recorded 6.52 inches on the 22nd, against a record 4.43 inches in 1955. Klamath Glen recorded 4.02 on the 22nd and 4.01 on the 23rd. The report from this station noted that "the gauge is near the river mouth and does not reflect rainfall in the upper regions" (where it was much higher). Likewise, Jediah Smith State Park, near the mouth of the Smith River, reported 4.08 inches, compared to a 1955 higher figure of 2.74.

Highest one-day fall on record in the area was at Richardson Grove, well up on the South Fork of the Eel, with 11.30 inches on the 22nd, and 7.23 on the 23rd. Still farther up the Eel drainage, Laytonville recorded 10.75 inches on the 21st, and 11.75 on the 22nd. The heavy December 21st rains here had already started downstream when the widespread downpours of the 22nd struck.

The water falling on the saturated ridges ran off almost as fast as it fell, and the resultant rise in the river canyons was frightening. On the 22nd all the major river systems of the north California coast were flooding heavily and still rising—primarily the Eel, but also the Van Duzen, the Mad, Redwood Creek, the Klamath-Trinity system, and the Smith.

In places, the rise was several feet an hour but actual recordings of water depths are spotty. Before the rivers crested many gauges were swept away or topped by the raging floods.

January-February 1965



Eel River in full flood, site of town of Pepperwood in foreground. Highway 101 passes across photo about quarter of the way up. Town was destroyed, with many buildings caught in groves of trees amidst debris seen in picture. (Photo courtesy of Eureka Newspapers, Inc.)



ABOVE: Debris deposited by flood on US 101 in redwood groves just upstream from Pepperwood. Barn with cupolas came from site across river and several miles upstream. BELOW: Downstream bridge of pair on Redwood Highway at South Scotia was also flood victim. Older bridge at left of through-truss design, survived flood because it was high enough to avoid debris which collected on truss below deck of newer bridge now missing at right. (Photo courtesy of Eureka Newspapers, Inc.)







George Leatherwood Memorial Bridge, on US 101 Freeway near Dyerville on South Fork of Eel, withstood flood after blasting of debris by a highway maintenance man. Stubs visible just downstream are approaches to old through-truss bridge on Route 254, Avenue of the Giants. This bridge failed at height of flood, when water was somewhat higher, although it had stood through many previous floods. (Photo courtesy of Eureka Newspapers, Inc.)



ABOVE: Destroyed Northwestern Pacific Railroad Bridge at South Fork. One of the wrecked spans may be seen in foreground. BELOW: View of railroad right-of-way in main Eel canyon at Alderpoint, where river rose about 95 feet. Note earth deposited on tracks. (Photo courtesy of Northwestern Pacific Railroad.)

An observer at Alderpoint, on the main Eel River above its confluence with the South Fork, estimated a record crest between 95 and 105 feet. This was at least 15 feet above the Eel's highest crest here in 1955.

With the streams already running bank full, such a rise was inevitable. In the 36 hours of heaviest rainfall on the 21st and 22nd, the Eel drainage received additional precipitation about equal to dumping into it the 3½ million acre-feet of Shasta Reservoir when filled to capacity. As these torrents of water roared down the river, the people of Humboldt County began to realize they were experiencing the most disastrous flood on record—a "thousand-year flood," as one engineer called it.

Virtually every structure on the flats along the lower Eel Canyon was swept away, and in many cases residents escaped with little more than

their lives and the clothes they wore. On some 20 miles of the lower South Fork, town after town was devastated. Upstream on the main Eel those towns that were located near the flood level also suffered heavily.

Below the junction of the two streams, the Towns of Holmes, Shively and Alton were virtually wiped out. Pepperwood, a small town of about 400 people on US Highway 101, had only two or three ruined buildings left standing when the waters receded, and the townsite is now a debris-cluttered plain with the houses piled in a helter-skelter heap against a grove of trees downstream.

Although the rise at many points was 15 to 20 feet above the highest flood of record on the Eel, the loss of life was low, presumably because modern communications warned most people in time. Nevertheless, few saved any personal property, as none believed the crest would be so much higher than in 1955.

Actually, the amount of water flow was incredible for such relatively small river systems. Below Alton, the Eel is joined by the Van Duzen River, which crested simultaneously. At the height of the flood, stream velocity at this point is estimated to have approached one million cubic feet of water per second. This flow would fill Shasta Reservoir in two days, so the analogy used above, comparing the rainfall with dumping Shasta Reservoir into the river is not farfetched.

If a flow of around 900,000 cfs is accepted, this can be compared to the 1,100,000-cfs flow of the Columbia during the same floods in the northwest. The average flow of the Mississippi at Vicksburg, near its mouth, is less than 600,000 cfs, and even in its great floods is only about 3,000,000 cfs, so it can be said the Eel in flood was carrying almost a third of the amount of water the Mississippi does in its worst floods!

In this comparison, it should be noted the Mississippi has a vast area over which to spread, with a very gentle gradient. The flow in the Eel, traveling in a narrow canyon with a steeper gradient, was much faster, and hence more destructive. Houses were not gently lifted off their foundations





and floated away, they were tossed along almost as before a fire hose.

A complicating problem of this flood and its extraordinary rainfall was the tremendous amount of "drift." On the slopes above the rivers, broken tree branches, ancient windfalls, and partly uprooted stumps were loosened and carried down into the streams. This material, some of which had lain undisturbed for decades, moved into the center of the stream where it was carried along at 15 to 20 miles an hour.

Many lumber mills in the canyons had "cold decks," that is, their winter supply of logs, stacked close to the river bank, but at levels where they were believed safe from flooding. As the water rose, these logs, weighing up to 30 tons each, were picked up and carried out into the stream to become deadly missiles shooting along in the other debris.

At Pacific Lumber Company in Scotia, where a tract for the cold deck had been especially raised by filling to above the 1955 flood level, several thousand logs totaling 18,000,000 board feet were swept away. In addition, some 15,000,000 board feet of stored lumber went downstream, and railroad boxcars on a siding were tossed around like dice thrown from

a cup. The flood losses of this company alone were about \$8,000,000.

North of Eureka, in southern Del Norte County, the Klamath, always a strong, deep stream, rose rapidly and swept away the entire business section and many private homes in the town of Klamath and nearby communities. The beautiful old concrete arch bridge here, famous for its statues of California Bears on either end, was a casualty.

An eyewitness of the bridge's death told Sam Helwer, district engineer, that before the structure failed, debris was backed upstream several hundred feet, although the river level was still several feet from the top of the arches. At times small logs would come hurtling downstream, hit the floating debris, and shoot into the air completely over the structure. The pressure of the river against the debris finally pushed 400 feet of the bridge out of the way, and the debris shot downstream with a roar.

Altogether, District 1 lost 18 state highway bridges, 7 of these on the Redwood Highway, but the full extent of the loss was not clear until some days after the flood because of the disrupted communications. In many cases the bridges carried the utility lines, and when the bridges



ABOVE: Squaw Creek, cascading down the steep slopes at Cummings on the Redwood Highway, tore this gap in the road. BELOW: This concrete arch bridge on US 199 above Crescent City withstood the flood, despite obvious pounding. Note debris lodged in every opening, and battered conditions of railing.







ABOVE: North abutment of North Scotia Bridge at Rio Dell torn out by force of Eel, here shown partly in flood. Building at left of broken bridge end is now gone. (Photo courtesy of Eureka Newspapers, Inc.) BELOW: Looking south along US 101, the Redwood Highway, with the town of Klamath in the foreground, and washed-out bridge in background. (Photo courtesy of Eureka Newspapers, Inc.)



went out, electrical and telephone lines also were broken. In some places, the rushing water literally washed utility poles out of the ground.

Mostly by radio, the information trickled into district headquarters. The first reports came in on US 101, as much of the damage here was close to the settlements. Here, too, was the most serious bridge damage.

South of Fortuna, where the Eel begins to emerge from its canyon, the river makes a big reversed S, which the highway crosses like the bar in a \$ sign, and each crossing of the river needs a big bridge.

At the first crossing just south of Fortuna, more than 600 feet was gone from the 1,613-foot Robinson Ferry Bridge. One large through-truss span, and  $5\frac{3}{4}$  concrete approach spans were missing. This effectively stopped all traffic on US 101 south of Eureka.

Just beyond this bridge, within the curve of the bottom half of the Eel's reverse S, lies the flourishing town of Rio Dell, with US 101 its main street. Here at the south end of town, another bridge crosses the Eel, the North Scotia Bridge, giving access to Pacific Lumber Company's town of Scotia, and accommodates traffic heading south on the Redwood Highway.

At the Rio Dell end of this bridge, also a large through-truss structure, the river washed out  $62\frac{1}{2}$  feet, including the abutment. The river bed is narrow and deep here, and readings at Scotia indicate the flood may have reached its greatest velocity in this canyon.

After the wide swing around Scotia, this tremendous flow was concentrated against the Rio Dell side, and it cut deeply into the steep bluffs. Several houses and stores tumbled into the river, and the current tore out the bridge's northern anchorage, leaving an open gap.

Rio Dell was isolated. The only other entry is via a county route, the Blue Slide Road, which connects the town with Ferndale along the south side of the Eel. Several miles of this road which lay close to the river were gone completely, including the several feet of fill used for base, and the river was running over it many feet deep.

Across the Eel to the south lies Scotia, with Pacific Lumber Company bereft of all its stored logs, and a big portion of its inventory of lumber. Although there was some flooding of the road here, damage was negligible. A few miles farther on, at the top of the reverse S, a pair of bridges crossed the river, carrying northbound and southbound traffic on separate structures. The older structure, a through-truss type which stands upstream and carried the northbound lanes, survived the flood.

A new bridge, opened to traffic in the winter of 1960-61 and which carried the southbound lanes, was swept away. Although it stood higher than its companion, it was a deck truss type, its truss extending down below the deck 18 feet. Drift collecting in the steel truss finally created such a dam the bridge was pushed off its piers.

Beyond these bridges the road follows the south bank of the river for a few miles, including the portion through Pepperwood. On the sections close to the river, undercutting and slides were severe up to the point where the road veers away from the main canyon and starts up the South Fork.

At the southern end of the Avenue of the Giants—the old Redwood Highway which has been retained for tourists—the road crosses the South Fork. Here for many years stood an old fashioned through-truss steel bridge, and when the freeway was built it was retained as a connection from the main road into the avenue.

This fine old relic is gone, an early casualty to the flood. It stood much lower than the new freeway bridge, and no doubt its trusses collected great masses of debris before it gave way, for in this section of the canyon the water boiled through 20 feet deeper than ever before recorded.

Its younger companion upstream, a simple steel girder type, offered less resistance to the combination of debris and water, but nevertheless almost became a casualty also. At the height of the flood, when debris was piled against the structure in great depth, and the deck portion was actually visibly lifting and shifting on its supports,



Division of Highways maintenance man William F. Wilson, Jr., climbed out on the debris and at the risk of his life planted charges which broke up the jam and saved the bridge.

The freeway sections between Dyerville and Phillipsville, totaling 23.4 miles, withstood the flood well. In one place underground water filtered out some of the subgrade, allowing two lanes of the paving to drop several feet. At another place a culvert was plugged by debris and the resultant stream over the paving undercut the two outside lanes so that they dropped away. Near Dyerville and at one or two other points the river washed out the outer edge of the fill so that a total of several hundred yards of guardrail was lost.

At no time was the freeway closed to traffic, and such repairs as were necessary represented commitment of a small group of men and equipment for only a few days at the most. With such minor damage, despite the fact the river came over the paving many feet deep in places, the superiority of modern engineering and construction was demonstrated. Cut slopes showed little or no tendency to move, fills remained stable, there was no bridge damage, and, in general, drainage functioned perfectly.

On the old, obsolete sections between Phillipsville and Laytonville destruction was so severe it will take at least a year to complete repairs. Slides involving half a million yards of earth were not uncommon, and washouts cut great ravines across the highway. On the precipitous portions between Garberville and Leggett, where the road clings to a narrow ledge hundreds of feet above the river, undercutting eliminated at least half of the highway in many places, leaving a one-lane road with no outside shoulder, and two- and three-hundred-foot drops alongside.

Where the damage in the lower Eel mostly resulted from tremendous flows and heavy debris in the main stream, much of the damage in the upper canyon was caused by side water. The canyon walls are very steep here, and vegetation is sparse.

The amount of debris loosened by the pelting rains and washed down the



Logs from mills' storage and other debris carried down by rivers and washed into Crescent City harbor. Cut logs are worth about \$100 apiece.



ABOVE: US 199 in the Smith River Canyon, the section of the Redwood Highway which connects Crescent City and Grants Pass, Oregon, is here seen completely washed away without vestige. (Photo courtesy of Six Rivers National Forest, U.S. Forest Service.) BELOW: This photo at Weott gives an inkling of how high water was. (Photo courtesy of Eureka Newspapers, Inc.)







Road destruction may be from several causes. This photo on US 101 in Mendocino County shows the effect of undercutting by a parallel stream.



ABOVE: In this photo of roadbed destruction on Northwestern Pacific Railroad debris washed down the slope has filled the culvert and the stream has cut a new bed. (Photo courtesy of Northwestern Pacific Railroad.) BELOW: Destruction here is by slipout, or, in other words, a slide of the supporting slope below the roadbed.



slopes was very heavy, and culverts and small bridges choked quickly. Tiny streams and normally dry gullies became raging torrents which the established drainage facilities could not accommodate, particularly since they rapidly clogged with debris. Water rushing across the roadway washed out fills and foundations, often "eating back" across the paving until there was sometimes a cut a hundred feet deep where the road had been.

In places the river cut away the toes of slopes hundreds of feet high, and the entire slope slumped, bringing long stretches of highway with it. In other places slopes above the road, sometimes rock, sometimes gravel, slid down to cover hundreds of feet of highway. Except for those located on the freeway, every town along the upper Eel was isolated from its neighbors. The freeway was isolated from Eureka by the damaged bridges.

North of Eureka most of the Redwood Highway is on high ground, or is modern expressway or freeway. Except for the destruction of the Klamath River Bridge, damage between Eureka and Crescent City was slight. Heavy flooding by Redwood Creek in Orick left a layer of silt several feet thick on the roadway, but this was quickly cleaned up.

But it was another story on US 199, which carried the Redwood Highway

into Grants Pass, Oregon, via the Smith River Canyon. Above Gasquet, damage was severe. Three concrete arch bridges were carried away, and several miles of roadway lost. In places the roadway destruction here was so complete the canyon looked as though it had never had a road through it.

So extreme was the damage in this canyon, it was days before it could be assessed adequately. Crews were sent up through Oregon to begin working on the northern end of the damaged area, and others started working from the south. The only way the damage could be surveyed properly over the 20 miles or so of worst devastation was by sending young engineers in on foot to hike through with backpacks. In this canyon, and in many other places in Highway Districts 1 and 2, where road communications were completely destroyed, this meant miles of travel on foot through knee-deep mud, steep climbs high above the river through trackless forest to get around wash-outs, and sleeping and eating wherever local hospitality was available.

When the floods receded, the Redwood Highway was closed to all traffic in dozens of places. Damage to east-west routes connecting Humboldt County with the Sacramento Valley was equally severe. All highways in and out of the area were closed.

BELOW: This photo shows one of the few places where damage occurred on the Redwood Parks Freeway, resulting in the loss of two lanes. Culvert became plugged and stream went over pavement, "eating back" by washing out slope on outside.





Crescent City had a roundabout route open north over 101 through Oregon. Eureka and the Humboldt lowland were isolated, except by sea through a debris-cluttered harbor, and by air through small and often weather-closed airports, for the railroad was also hard hit.

The Northwestern Pacific had suspended service indefinitely. Its tracks down the Eel Canyon were devastated. When the flood subsided, railroad men found on a 100-mile stretch more than 50 miles of track twisted and uprooted, millions of yards of rock riprap washed away with fills gone, three steel bridges destroyed, over 70 pieces of rolling stock missing, and debris and silt piled everywhere the right-of-way was not destroyed. Cost of repairs was estimated at \$10 million.

Since the Humboldt-Del Norte economy is about 75 percent based on forest products, and since normally the railroad hauls about 75 percent of these products, this made the flood a doubly severe blow at the region. Not only had the floods caused tremendous damage to property, but the region's ability to recover was crippled.

The value of modern transport was once again demonstrated, for with the destruction of its transportation, the area's economy was brought to an immediate halt, and many thousands of people were affected in addition to those whose property was in the direct path of the flood. This put tremendous pressure on state highway personnel to reopen the roads as soon as possible, to alleviate in part the economic distress.

Although it is being said the storm was "one in a thousand years," there is no guarantee this is so. Certainly new records are now established which must be taken into account in future design, which means more expensive construction. It should be kept in mind that both the 1955 and 1964 storms struck exactly on the winter solstice, when the northern hemisphere storm track is at its most southern point. The same set of circumstances could repeat next year!



Another kind of damage occurred when underground waters, seeping through fill, washed out part of road foundation.



ABOVE: This paving damage was caused by pressure of sliding material on slope at right, forcing its way between road surface and foundation. BELOW: Man in photo has right hand at high-water mark which South Fork of Eel reached here near Phillippsville. This stretch of freeway, recently completed, was constructed five feet above high-water line of 1955 flood.







Overflow water from Sacramento River passing over weirs into Yolo Bypass during week of Christmas Flood makes Interstate 80 look like causeway to Key West. (Photo courtesy of Vernon Giles, Carmichael Times.)

# CHRISTMAS FLOODS

## PART 2: Elsewhere in the State

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**Editor's Note:** Because of space and time considerations, the two flood articles in this issue of the magazine cover only the actual damage caused by the December storms. Followup articles on action taken to reopen the roads will appear in succeeding issues.

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The storms which devastated the north coastal counties in December 1964 spread eastward and southward across much of northern California.

Before they subsided more than a score of counties had been designated as disaster areas, with some of them suffering very heavy damage to both private and public property. Included was bridge and highway destruction running into many millions of dollars.

Damage to state routes was also heavy, particularly in the northwestern quadrant of the state. Not only was the Redwood Highway rendered completely unusable, but so were several other routes such as US 299

between Arcata and Redding, Sign Route 36 between Fortuna and Red Bluff, and Sign Route 96 up the Klamath River.

On most routes there were many temporary interruptions. At one time all trans-Sierra routes were closed by high water, snow or blizzard conditions, except a northerly route via State Sign Route 44 and Susanville.

Along the north coast the heaviest rainfall seemed to strike Mendocino County first, then gradually spread





Engineers surveying damage on county road in Humboldt County, seeking route into Rio Dell, struggle through knee-deep mud along banks of the Eel River. This route is now being used temporarily as part of the Redwood Highway.



Typical damage to county road, Humboldt County.

northward and eastward. While several stations near the headwaters of the Eel recorded more than 20 inches for a two-day period, this intensity was not equaled in other parts of the state. Probably there was somewhere around 12 to 16 inches in many parts of the Klamath and Trinity Ranges on these two worst days, which had its effect not only on westward flowing streams, but also on those streams draining eastward into the Sacramento Valley.

Farther to the east, Blue Canyon, west of Donner Pass and on the headwaters of the American River, recorded more than 23 inches of rain for the four days of the worst storm. Most places in the Sierra, however, got only about 12 inches during these four days, but it was over ground already saturated by a series of lighter storms.

The effect of these earlier storms had already been felt by the 21st, when several counties reported road closures from slides and flooding. On the state system, Highway 101 was closed by slides and flooding at Benbow, and State Route 1 was closed at the Garcia River by flooding.

On the 22nd, reports of damage over a wide area were coming in. All roads into Eureka were closed indefinitely. Interstate Highway 80 was closed at Cisco due to flooding. The

Southern Pacific Railroad suspended service over the Sierra and north into Oregon where the road was closed at

Crescent Lake. Humboldt, Del Norte, Shasta, and Mendocino Counties were declared disaster areas.

*The washout at Bluff Creek, across State Route 96 along the Klamath River. Original streambed passes along ledge and out of left center of picture, but flow of water was so great stream broke through solid rock many feet higher than bed and cut new channel across highway. Note detritus carried down into river.*







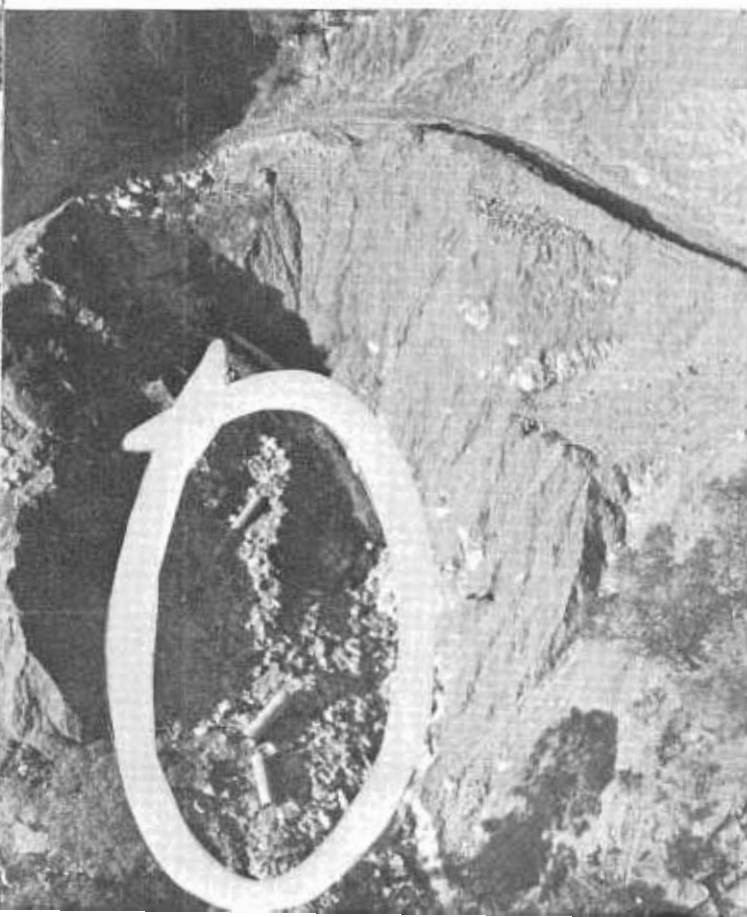
*Hospital Creek on Trinity River near Hoopa brought down so much debris it filled channel, and covered highway with gravel several feet thick. This was a common type of damage in this storm, and required reestablishment of the channel in each case. Note creek "delta" in river.*

By the 23rd, water had to be released from some dams. Almost every northern county was reporting closures, flooding, and bridge losses. Schools were closed. In many places in the Sacramento Valley the roads on fill were like causeways across inland seas. A contractor working on a highway job near Orland watched one of his pickups as it was swept end over end down Stony Creek. Yuba County lost its new 155-foot Oregon House Creek Bridge, which was under construction and just ready for its final pour.

All the Sacramento River bypasses had to be opened, which flooded many low-level roads. As the storm spread southward, the Tuolumne River flooded State Sign Route 120, and there were slides and flooding on Sign Route 108 in Sonora County. Sign Route 70 in the Feather River Canyon was closed, as was Sign Route 20 east of Nevada City.

All routes connecting California and Oregon were closed. Interstate 5 was closed near the Oregon line by flooding, reduced to one lane at Dunsmuir by a slide, closed on US 99W south

*BELOW: Destruction of culvert and road on State Route 96. Trail across top of picture is emergency road. Washed-out culvert can be seen in circled area.*



*BELOW: Slides and slipouts on State Route 96 left this government equipment (seen in circle) trapped, unable to get out. (Both photos courtesy of Six Rivers National Forest, U.S. Forest Service.)*







On December 27 this cable carrier was being used to carry people and small quantities of supplies across Canyon Creek at Junction City. Road in background is US 299. (Photo courtesy of United Press International.)

of Red Bluff, and US 99E between Roseville and Lincoln.

Sign Route 49, traveling through the foothills across dozens of streams, had many closures. Hell Hole Dam, under construction on the Rubicon River in the Sierra, failed and loosed a wall of water which three hours later wiped out the State Sign Route 49 bridge near Auburn. A few miles farther north the fine old covered bridge on the county road at Bridgeport barely missed destruction when the Yuba River rose to the bottom of its housing.

Siskiyou County reported 15 bridges destroyed, and 15 more with damaged approaches. This was later modified, after the water went down, and several bridges thought lost reappeared. All roads in the county were impassable, with heavy flooding on the Klamath, and along the lower Trinity.

Governor Brown telegraphed the President names of 10 more counties nominated as disaster areas. Humboldt County reported nine county bridges destroyed, and the first loss of life in the storm when a road collapsed beneath a jeep, and vehicle and driver were swept away in the Klamath River.

January-February 1965



In many places travel by air was the only means of access. A Division of Highways photographer caught here an Army Caribou plane over a destroyed bridge on US 299.



ABOVE: Visible in this photo at the Arcata airport are Air Force, Navy, and private aircraft which provided food and other supplies for the isolated areas for weeks, and made countless rescue and reconnaissance missions. (Photo courtesy of Eureka Newspapers, Inc.) BELOW: Big, two-rotor Marine helicopter lands on street of isolated Willow Creek. A machine like this carried fuel for equipment to many isolated emergency road contracts. Aircraft even brought in hundreds of tons of feed for Humboldt County's dairy cattle.







*This special congressional subcommittee of the U.S. House of Representatives Public Works Committee toured the flood-ravaged areas of the several stricken western states to get firsthand knowledge of the extent of the disaster. Here photographed at Redding Airport, January 12, 1965, they are, left to right: Congressmen Harold T. (Bizz) Johnson of California; Jim Wright, Texas; Robert E. Jones, Alabama (chairman of subcommittee); California Division of Highways Senior Highway Superintendent Henry Pickrell, District 2; Congressman Don H. Clausen, California; and William H. Harsha, Ohio.*

In Shasta County a hole 70 feet deep and 100 feet wide developed across the four lanes of Interstate 5 at Meers Creek north of Redding, when water undermined the fill. The district engineer commended temporary employees M. D. Crowe and J. C. Garrigus for noticing the pavement beginning to sag at 2 a.m. and standing by to stop traffic.

On the 24th, El Dorado County reported 12 to 20 inches of rain in the Tahoe area during the storm, which delivered 1.2 million acre-feet of water into the lake. Plumas County reported the loss at Chester of the main bridge over the North Fork of the Feather, and heavy flooding across Sign Route 70 below Pulga. Closures on Interstate 5 near the Oregon state line were repaired, and hundreds of cars, plus 14 Greyhound buses, all stalled there for hours, streamed northward.

Storm damage and flooding was widespread over the entire northwestern United States. In California many

roads had to be patrolled by sheriff's deputies and California Highway Patrolmen to screen travel over dangerous sections.

Traffic on Interstate 5 north of Yreka was still one-way on the 27th, and US 50 was closed by slides between Placerville and Meyers. Sign Route 70, the Feather River route, was closed by slides 12 miles east of Jarbo Gap. Also closed were Sign Routes 1, 16, 20, 36, 41, 96, 140, 169, and US Routes 199 and 299.

By the 28th the snow level had dropped to the 2,500-foot level in the mountains, with heavy falls in the coast ranges, the Klamaths, the Siskiyou, and the Trinitys, adding to the misery of those isolated, and hampering emergency reconstruction. However, the rainfall at lower elevations slowed, and streamflows subsided, allowing many minor road closures to be repaired. In the north dozens of highway crews were still cut off by bridge and road destruction, but the radio-equipped cars kept a steady flow

of information coming into headquarters at Eureka and Redding.

The damage to highways was extensive but generally speaking, the older the road the more closures there were. The narrow, winding roadways are very vulnerable to slides and washouts. Maintenance is difficult in any winter on these older sections. The cut slopes are unledged and steep, and when they become saturated with water, they slide, either covering the road or carrying the road with them.

On US 299, running from Arcata to Redding, this type of damage was common west of Weaverville. There were few bridges in this vicinity to go out, but the failure of the Canyon Creek Bridge at Junction City effectively prevented repair work west of it until a temporary crossing could be built. Between Junction City and Willow Creek there were many slides, slipouts, and washouts. Two washouts were so great they had to be bridged.

From the town of Willow Creek, the road heads west up Willow Creek. When the normally peaceful creek rose to become a roaring torrent, it closed six miles of the highway by undercutting. With the Redwood Highway hopelessly destroyed in dozens of places, repairs in this section between Berry Summit and Junction City were vital to reestablish road communications to Eureka.

Sign Route 36, west of Red Bluff suffered some damage on its eastern sections, and along about 20 miles of its western end there were bad washouts and slides. Three sizable bridges were destroyed on this route, also.

Possibly the worst slide damage in the entire state was on State Highway 96, which leaves US 299 at Willow Creek, then travels down the Trinity Canyon and up the Klamath from the junction of the rivers at Weitchpec. This is very rugged country, with the few settlements directly on the roads.

On the Siskiyou County road along the Salmon River, a slice of mountain half a mile high and three-fourths of a mile wide slid down into the stream, erasing three-fourths of a mile of road and damming the river. When the dam broke, a 90-foot-high wall of water roared downstream. On this



route, 17 miles of road was virtually wiped out.

From Weitchpec, at the confluence of the Trinity and Klamath, uncompleted Route 169 goes part way down the Klamath, to the Town of Pecwan. Over two-thirds of this road was destroyed.

Bridge damage in the Klamath-Trinity drainage area was heavy. The bridge at Willow Creek, connecting Route 96 with US 299 was completely destroyed, as were several other state bridges on this route. In the Weitchpec-Orleans-Somes Bar vicinity, every bridge was destroyed, both state and county.

Included was the state bridge at Somes Bar and the beautiful prize-winning suspension span at Orleans, the fine county bridge at Martin's Ferry which gave access to the county road to Orrick and US 101 and the jewel-like little Forest Service suspension bridge at Ishi Pishi. Upstream there was further bridge damage, and all along the canyon terrible road damage. When the flood subsided, people who lived in these communities could be provided with food and supplies only by helicopter.



Gaping washout from what is normally an insignificant trickle of a stream is typical of damage throughout the several northwestern counties in the December 1964 floods. This is State Route 208 in Mendocino County, west of Leggett.

Mendocino County suffered very heavily, both from the Russian and Eel Rivers. Damage was particularly heavy in the vicinity of Covelo and Dos Rios around the main Eel and its North Fork. Here also the railroad

suffered heavily. These are examples of some of the worst hit areas. Many other counties suffered damage, some of them substantially. The photos herewith tell the story better than words.

Guerneville in Sonoma County from the air on December 24, 1964, while Russian River was in flood. State Route 116 travels across photo about one-third the distance from the top. (Photo courtesy of Santa Rosa Press Democrat.)



County losses alone, ignoring state losses, totaled 340 miles of roadway, and 104 bridges. The table below lists these losses; and their dollar value:

County	Cost	Miles road	Bridges
Butte	\$112,000	2	
Colusa	166,000	10	
Del Norte	1,940,000	25	5
El Dorado	142,000	5	4
Glenn	258,000	2	1
Humboldt	6,200,000	20	21
Lake	550,000	6	9
Lassen	17,000	3	
Mendocino	6,650,000	110(?)	14
Modoc	23,000	3	1
Napa	113,000	2.8	1
Nevada	52,000	.1	1
Placer	293,000	2	1
Plumas	217,000	5	2
Shasta	327,000	7	4
Sierra	200,000	10	3
Siskiyou	2,368,000	60	20
Sonoma	566,000	6.1	2
Tehama	335,000	8	5
Trinity	2,030,000	50	10
Yuba	124,000	2.5	1
<b>Total</b>	<b>\$22,683,000</b>	<b>339.5</b>	<b>104</b>





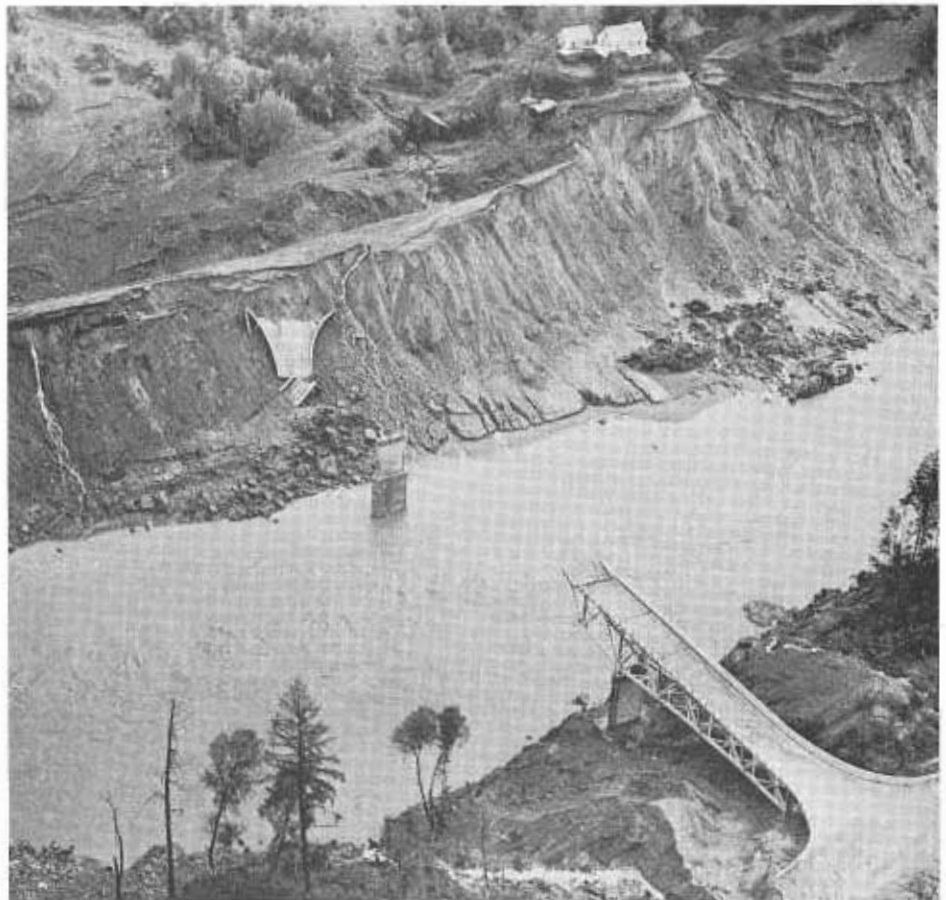
ABOVE: One of the more than 100 county bridges damaged. This is Trinity County's Carrville Bridge over the Trinity River. BELOW: The damaged Feather River Bridge, Chester, Plumas County. (Photo courtesy of Feather River Bulletin.)



ABOVE: "Before" photo of the Forest Service Bridge across the Klamath River at Ishi Pishi, on the Humboldt-Siskiyou county line. BELOW: "After" photo of same bridge, showing only abutment remaining, indicates height and power of flood in Klamath Canyon.



ABOVE: Whittemore Bridge on Federal Aid Secondary Route 977 in Humboldt County. BELOW: This Mendocino County bridge across the upper Eel River on road to Covelo withstood flood despite debris. (Photo courtesy of Santa Rosa Press Democrat.)



This photo of destroyed Martin's Ferry Bridge, on Humboldt County route between US 101 and Klamath River towns, clearly shows power of the Klamath in flood. Top of pier on other side of stream is 95 feet above normal river flow and subsiding waters left driftwood on it. River height here is estimated to have reached somewhere between 110 and 115 feet. Note also washouts and undercutting of cliffs in upper right which previously supported the road. (Photo courtesy of Eureka Newspapers, Inc.)

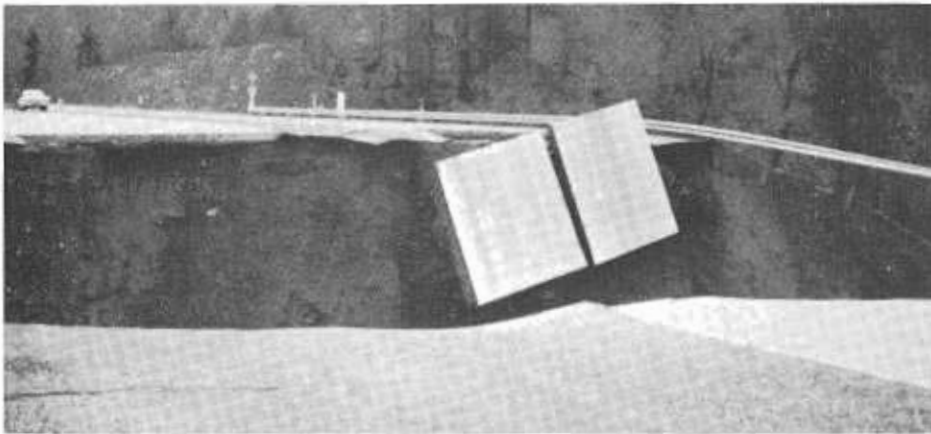
BELOW: Until December, this was the beautiful State suspension bridge at Orleans, which won an award for design in 1940. Flood topped deck before bridge gave way. (Photo courtesy Six Rivers Forest, U.S. Forest Service.)







ABOVE: Damage on Humboldt County road from flooding Sprawl Creek, December, 1964. BELOW: Mears Creek washout, Shasta County, on Interstate Route 5, December 23, 1964. Highway foreman happened to have camera focused and cocked when two-lane piece of paving broke off and fell.



BELOW: Collapsed bridge at Willow Creek, on State Route 96, near junction with US 299.



ABOVE: Washed-out Cold Creek Bridge, State Sign Route 20, Mendocino County, east of Calpella. BELOW: Thomas Creek Bridge on county F.A.S. Route 1078 near Paskenta, Tehama County.



ABOVE: Pier settlement, county bridge over South Fork of Cottonwood Creek, Evergreen Road, Tehama County. BELOW: Partly destroyed Oregon Creek bridge, Celestial Valley Road, five miles south of Camptonville, Yuba County.



ABOVE: Looking across gap of fallen North Fork of Russian River Bridge at Calpella. Severance of utility lines disrupted telephone service for entire area. (Schroll Studio photo courtesy of Santa Rosa Press Democrat.) BELOW: Stephens Bridge over Cache Creek, Yolo County, 5½ miles west of Woodland.





# US 99-Kingsburg

Last Unit of 21-Mile  
Relocation Completed

By JAMES M. McDOWELL, District Construction Engineer



DISTRICT  
6

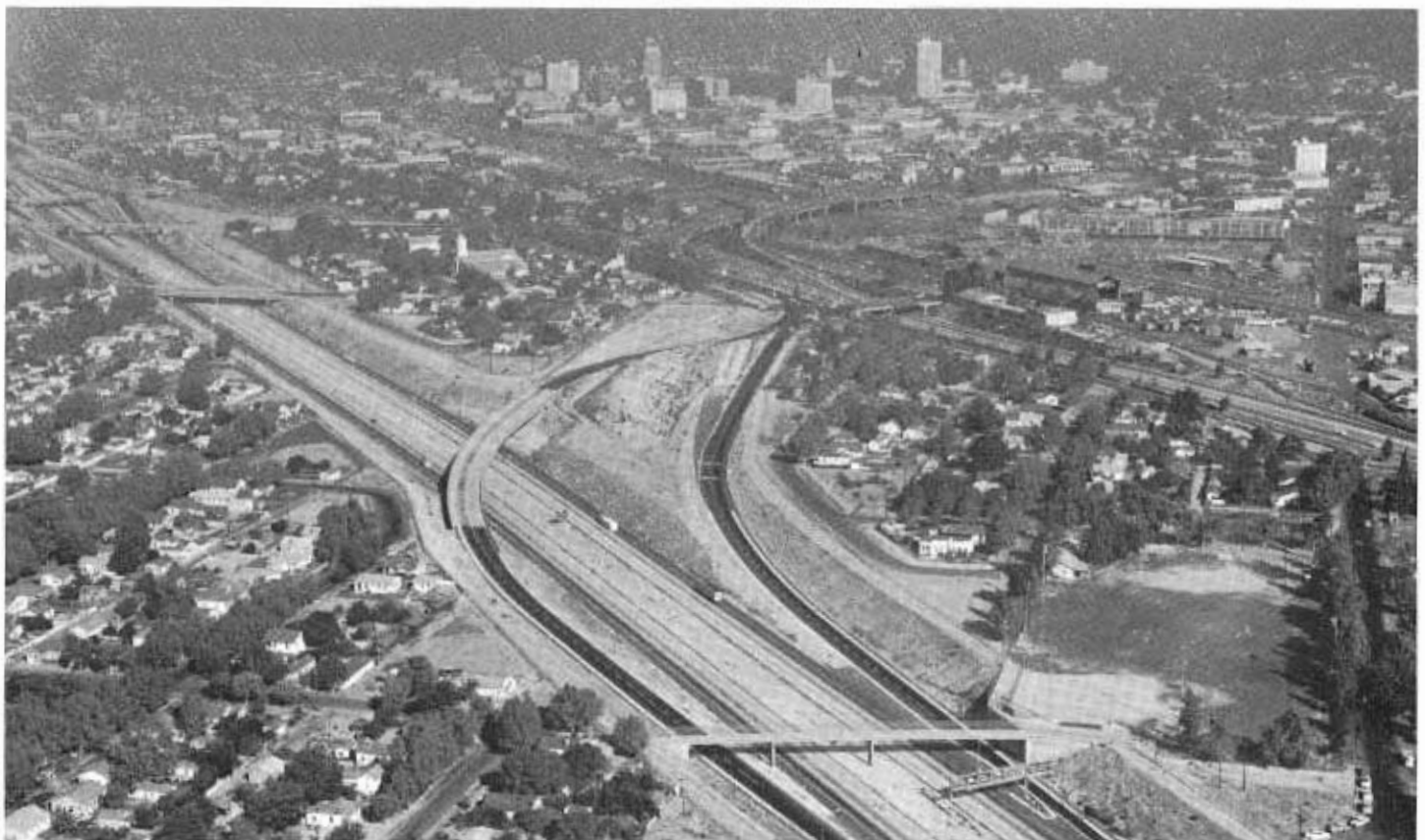
A dramatic wave-through by a perspiring, red-coated flagman was the only ceremony in evidence as the third and final section of the Kings River to Fresno relocation of the

Golden State Freeway was opened to traffic in early August, eliminating the last two traffic signals on US 99 in District 6.

The entire relocation lies approximately a quarter-mile west of the old route, which will continue in use as a local service road for the southern portion of Fresno and the Cities of Kingsburg, Selma, and Fowler.



The north (Fresno) end of overall project, showing the direct connection to Golden State Boulevard, the superseded highway.



Ramps with temporary connections to California Avenue indicate the diagonal alignment of future Route 41 Freeway into downtown Fresno.



Recently completed Unit Three is from south of Kingsburg to a connection north of Selma with Unit One, which was described in the September-October 1962 issue of this magazine. Unit Two, completed in October 1963, extended the central project to the north and made connection with the Fresno Freeway at the intersection with Highway 41.

#### Part of Important Route

This 21 miles of San Joaquin Valley highway is part of the most important and heaviest traveled route in central California, serving a large portion of traffic between the richest agricultural area in the nation and the major metropolitan areas of the state. It also carries a considerable amount of recreational traffic between these areas and mountain or coastal resorts.

With provision for future widening to six and eight lanes, the southerly nine miles were constructed with four lanes, the remainder with six. Thirty-seven major structures were included in the work; 18 interchange facilities, 11 street separations, 3 railroad separations; a pedestrian overcrossing, and 4 drainage pumping plants.

#### Construction Costs

Construction costs for the three projects amounted to nearly 17 million dollars, and included:

- ... enough concrete to build a three-foot-wide sidewalk half-way across the United States
- ... excavation sufficient for 30,000 family-size swimming pools
- ... asphalt surfacing adequate for a driveway 350 miles long
- ... an amount of steel equivalent to that in 7,000 automobiles

Right-of-way requirements were also extensive: a total of 842 parcels of land were acquired involving expenditure of 9½ million dollars.

#### Rapid Acceptance

As evidence of the rapid acceptance of slip-form paving in California since its introduction in late 1959, all 187,000 cubic yards of concrete pavement were placed in this manner. Roughly three-quarters was done with the Lewis machine. The remainder was placed by the Guntert-Zimmer-

man machine, controlled by an electronic guidance system receiving instructions for line and grade from a preset, tensioned piano wire.

Hand in hand with new placing methods were new ideas in concrete manufacture. Where mixing was formerly accomplished by one or more movable mixers with their stretched-out supply trains of water trailers and dry-batch trucks, two of these projects utilize central-mixed concrete from jobsite batch plants. Mixing was done in eight-cubic-yard batches and hauled in nonagitating dump trucks for distances of several miles to the paving spread. The concrete was merely dumped ahead of the paver which spread, consolidated, and extruded the slab to required dimensions while the trucks returned for another load.

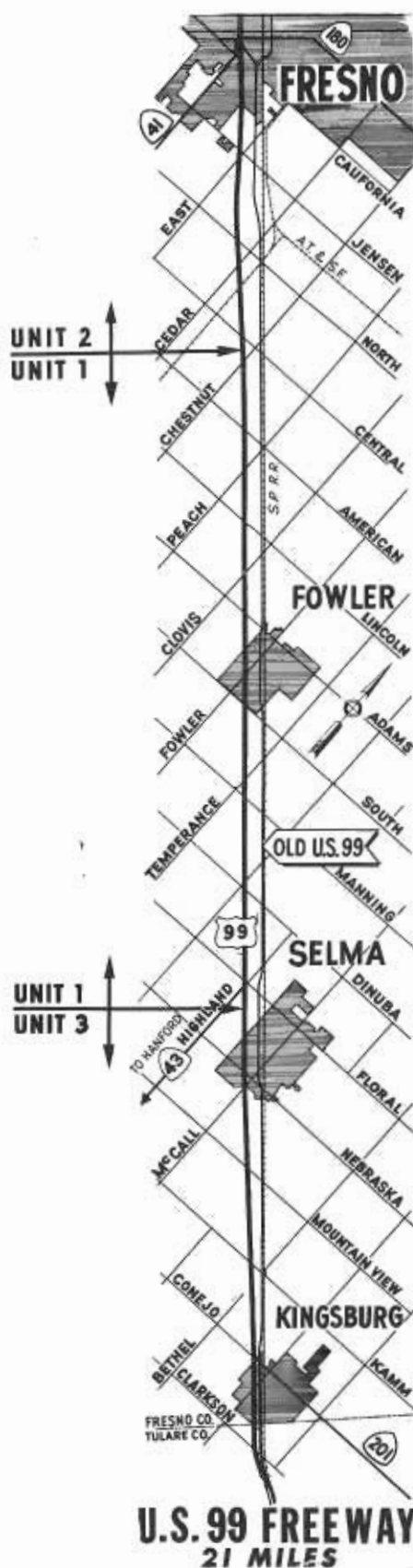
#### Old Style Equipment Replaced

Fast being relegated to the past along with other old-fashioned practices are the numerous teams of blade operators and "guinea hoppers" once relied upon to smooth the subgrade. Often being accused of "being right once every 50 feet," they are being replaced with machines capable of spreading the structural layers to tolerances once thought impossible. Both the Lewis subgrader—a machine similar in appearance to the paver—and the Gurries roadbuilder—a wire-controlled spreader—gave excellent results at considerable savings in equipment costs and manpower.

An innovation in dirt moving on the Unit Three section achieved the amazing production rate of 2,500 tons of imported borrow per hour. A fleet of scrapers making high-speed shallow cuts passed over a set of specially built elevated scales, were weighed, and then dropped their loads into a large hopper. The material was then dropped through hydraulic gates into waiting double trailer rigs capable of a 100-ton fast haul to the embankment area.

#### Pipe Cast in Place

Long lengths of concrete irrigation pipeline were cast in place with a Fullerform machine, which does away with laborious hand placing and mortaring of section after section of



MAP ABOVE: The 21-mile freeway relocation from Kingsburg to Fresno was completed in three units. Unit 1 was opened to traffic in November 1962, Unit 2 in October 1963 and Unit 3 in August 1964.



heavy pipe. In this process fresh concrete from transit-mix trucks is deposited into a hopper of the movable machine, which straddles a long, inflatable neoprene "sausage." This tube, which determines the inside diameter of the pipe, is placed in a carefully built trench, anchored, and "swallowed up" by the moving pipe maker as the concrete is packed around it. When the concrete hardens, the tube is deflated and repositioned for the next pour.

Yet another development in modern highway construction was used extensively on these projects. Bridge deck finishing has always required a keen eye for detecting, and strong back muscle for correcting, surface irregularities. The Bidwell Finisher, a combination strikeoff and longitudinal float, rides on screed rails outside the pour and produces excellent results. Even with reduced crews, finishing time was lessened by hours from old "grunt and groan" methods.

#### Work Started in 1961

Work on Unit One was begun by R. A. Westbrook, Inc., and Morrison-Knudsen Co., Inc., in March of 1961 and completed in November of the



Mendocino Avenue Overcrossing and Overhead south of Kingsburg. The Tulare-Fresno county line is just beyond the structures.

following year. This 9.7-mile project between Highland Avenue (Route 43) in Selma and Chestnut Avenue in Malaga is of initial six-lane width and provides traffic interchange facilities at Highland-Floral Avenues, Manning

Avenue, Merced Street in Fowler, Adams Avenue, Clovis Avenue, American Avenue, and Chestnut Avenue.

Unit Two got underway in November 1961, with R. A. Westbrook, Inc., Morrison-Knudsen Co., Inc., and Richard N. Moseman as contractor. Of six-lane width, this 5.5-mile contract ties to the existing Fresno Freeway on the north and has connecting ramps at Central Avenue, Cedar Avenue, North Avenue, Jensen Avenue, the future Route 99/41 interchange, and at Ventura Street.

The joint venture of Fredrickson and Watson, Kenneth H. Golden Co., and Hess and Dubach commenced work on the final section in April of 1963. Interchange ramps for the four-lane freeway are provided at Mendocino Avenue in Kingsburg, Conejo Avenue (Route 201), Bethel Avenue, Mountain View Avenue, and at Second Street in Selma.

Project manager for Westbrook, Morrison-Knudsen on Units One and Two was Oliver Pope; for the Fredrickson and Watson, Golden, Hess and Dubach combine on Unit Three the superintendent was William Brewer. Resident engineer on Units One and Three was Nelson Humiston; on Unit Two, Tom Conley.



Mountain View Avenue, an important east-west county road.



# Lebec Project

Modernizing of Interstate 5 Continues  
Over Ridge Route

By D. L. McKENZIE, Resident Engineer



It is August 1772, DISTRICT and Don Pedro Fages is leading his weary band of Spanish militia on the arduous trek from San Diego to the new mission at San Luis Obispo.

The troops have trudged up and over the Cajon Pass, across a portion of the Mojave Desert, through the Lake Hughes area, continued on over the Tejon Pass, and are rounding the toe of a peak which will soon reveal the beautiful sight of a lush green meadow some half-mile wide by three miles long bordering Castaic Lake. The assemblage will soon push on down Cajon de las Uvas (Grapevine Canyon), across the southwesterly corner of the San Joaquin Valley, by Buena Vista Lake, and on to San Luis Obispo. Here in this mountain meadow location only a dim trail leads ahead.

If time could be instantaneously advanced for Don Pedro and his troops, and the year were suddenly changed from 1772 to the year 1915, our group would see a 20-foot-wide pavement winding around the edge of the meadow which could, if the vehicles were available, easily be traversed at speeds of 25 to 35 mph. If the year were 1936, the group would see a 30-foot ribbon of PCC pavement that crosses the meadow, rather than skirting it, on an alignment that is nearly the same as that in use today. If the year were 1952, the road would be a four-lane expressway. If the year were 1964, an eight-lane full freeway would be seen stretching toward the top of Grapevine Canyon.

#### Road Work Begins

Work began on April 29, 1963, converting a 4.7 mile length of four-lane expressway to an eight-lane full freeway from one-half mile north of the Los Angeles county line to Fort

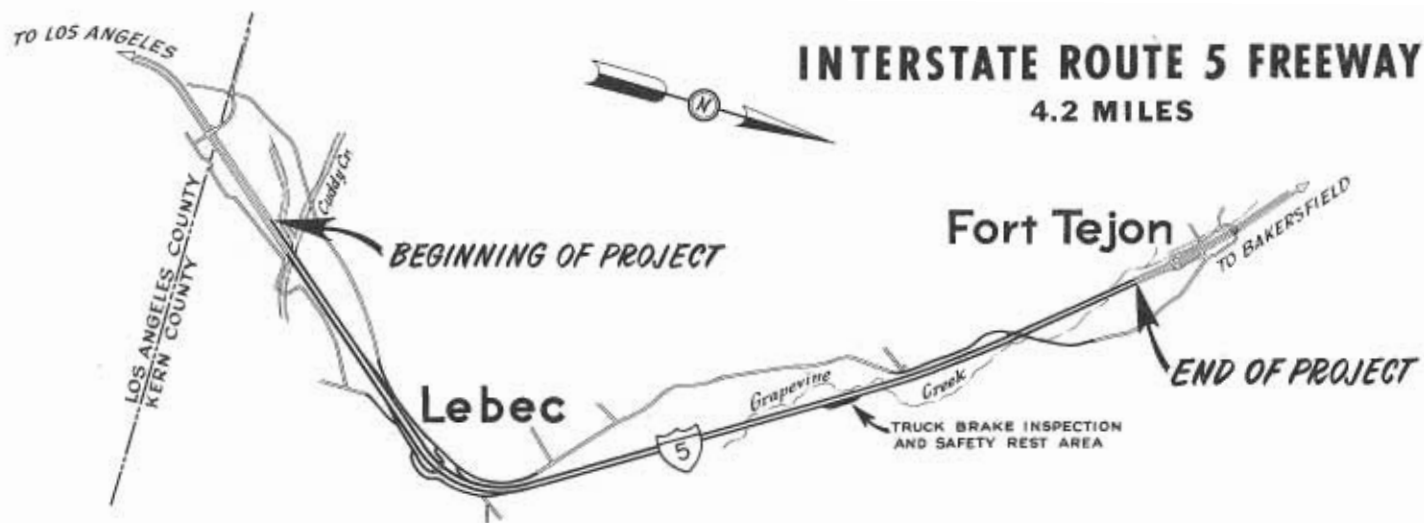


A view northward along the new eight-lane Interstate 5 Freeway between Lebec and Fort Tejon on the Ridge Route.



Northbound truckers will be able to check out their rigs at this location off the freeway before beginning an eight-mile descent to the San Joaquin Valley floor. Weary travelers will also find this a convenient rest stop.





This map shows the location of the new freeway section which extends from Fort Tejon to south of Lebec, a distance of more than four miles.



The combination truck brake inspection area and safety rest stop can be seen in the lower center of this aerial photo.

## INTERSTATE ROUTE 5 FREEWAY 4.2 MILES

Tejon on Interstate Route 5, known to most people as the "Ridge Route". It was completed on September 18, 1964. Previously, a 6.6-mile section just north of this project was completed in July 1960 at a construction cost of \$7,430,000. Work on a contract in District 7 has recently been started to continue an eight-lane freeway development another 5.4 miles to the south.

For the most part, the project completed in 1964 was a standard highway construction effort. The feature that set it apart was the attempt to salvage as much as possible of the inherent value of the existing highway pavements, and the resulting necessity for carefully staging the traffic handling in order to accomplish this salvaging without delay or danger to the traveling public.

### Terrain Relatively Level

The project terrain looks relatively level, but only because of 6-percent grades near each end of the job—Grapevine grade to the north and Tejon Pass grade (over Holland Summit) to the south. Grades on the project varied from 2 percent to 4¾ percent, uphill to southbound traffic.

The existing southbound roadway consisted of two lanes of PCC pavement constructed in 1951. Approximately 20 percent of the outer lane needed replacing. To accomplish this replacement, a series of southbound traffic moves were made. First, the southbound traffic was channeled into



a two-lane pattern using the existing outer AC shoulder. During this time the new eight-foot-wide inner shoulder of AC was constructed. Then the southbound traffic was channeled into a two-lane pattern near the median using the newly constructed inner shoulder as a part of the traveled way.

#### Outer Lanes Reconstructed

Next order of work was the reconstructing of portions of the outer lane of the existing PCC pavement. To provide room for work, traffic was merged into a single lane nearest the median, using the shoulder and a portion of the inner lane.

The Special Provisions required that only 1,000 feet of one-lane road could be in use at one time so that the slow-moving uphill trucks would not bottle up the traffic flow. A traffic flow study indicated that if 3,000 feet of two-lane roadway were available between the one-lane segments there was no noticeable traffic delay. This course was pursued to completion of the slab replacement program. Replacement was for the full lane width (12 feet) at lengths varying from 6 feet to 690 feet. As each 1,000-foot increment was completed, traffic was restored to two-lane usage by continuing to use the inner shoulder and portions of the PCC pavement.

When the slab replacement work was complete, construction of the additional two lanes of southbound pavement was begun. A six-foot "buffer" area was barricaded off along the edge of the existing lanes to keep vehicles clear of the dropoff during subgrading operations. Using a Lewis slipform paver and a fleet of 15 transit paving mixers, the southbound paving was completed.

#### Traffic Uses Southbound Lanes

When the outer AC shoulder was in place, all traffic was routed onto the southbound pavement. A 1-inch by 4-foot AC pad was placed along the center of the southbound four-lane pavement, and a double-double yellow stripe was placed on the pad, to serve as a divider between the two directions of traffic. This provided two lanes for each direction of traffic while the northbound roadway construction was in progress.



A down-canyon (northward) view toward the San Joaquin Valley. Lebec is at lower left.



A southward view from approximately the same location as the above photo with Lebec visible in right foreground.

The inner two lanes of the northbound lanes were constructed as a PCC blanket overlay on the existing pavement. Some planing of high spots was necessary, and the subgrade was brought to the proper grade by placing an AC leveling course. The outer two lanes were fully subgraded. Prior to beginning the northbound paving operations, the contractor changed his transit paving mixers from the fixed drum type to the tilt-drum type. The average daily production soared because of the reduced discharge time. As is usually the case with slipform paving, a better Profilograph daily average was obtained when the higher production rate was sustained.

#### Inspection Area Constructed

A combination truck brake inspection area and safety rest stop was constructed along the northbound roadway near the middle of the job. Located in a picturesque setting alongside the green meadow under some stately old oak trees, the rest stop is being used by a large number of travelers. A future project, now in the planning stage, will add restrooms and picnicking facilities.

Prime contractor for the work was Matich Constructors of Colton. Resident engineer for the state was D. L. McKenzie. Subcontractor for bridge construction was W. F. Maxwell Company of Fontana. The state's bridge engineer was C. W. Purkiss.

## Woolley Is Elected CHC Vice Chairman

The California Highway Commission has elected Roger S. Woolley of Rancho Santa Fe as its vice chairman. He succeeds Abraham Kofman of Alameda.

Woolley, a San Diego attorney, was appointed a member of the commission by Governor Edmund G. Brown in March 1959 and reappointed in 1963.

The commission elects a new vice chairman from among its members each year.

## Womack Appointed to Research Committee

State Highway Engineer J. C. Womack has been appointed to membership on the executive committee of the Highway Research Board, National Academy of Sciences, for a three-year term beginning in January 1965.

Womack was notified in December 1964 by Chairman Richard C. Jordan of the academy's Division of Engineering and Industrial Research that the appointment was made upon nomination of the Highway Research Board and with the approval of the president of the National Academy of Sciences.

The academy is a private, nonprofit organization of scientists, dedicated to the furtherance of science and to its use for the general welfare. It was established in 1863 under a congressional charter, signed by President Lincoln, which required it to act as an adviser to the federal government in scientific matters.

In 1916 the academy established the National Research Council, at the request of President Wilson, to broaden its base of scientist participation. And in 1920 the Highway Research Board was organized as an agency of the Division of Engineering and Industrial Research, one of the NRC's eight functional divisions.

The Highway Research Board is a cooperative organization of the highway technologists of America operating under the support of the Academy-Research Council and with support of the various state highway departments, the U.S. Bureau of Public Roads, and other interested organizations.

Its purposes are to encourage research and provide a national clearing house and correlation service for research activities and information on highway administration, transportation and technology. It conducts an annual meeting at which many research papers are presented; disseminates and correlates research information; and works extensively through specialized committees.

## Houghteling Named to Highway Commission

Governor Edmund G. Brown has announced the appointment of Joseph C. Houghteling, 39, of Sunnyvale, to the California Highway Commission. He will fill the vacancy created by the resignation of Alfred Heller.



JOSEPH C. HOUGHTELING

Houghteling publishes the *Daily Standard-Register Leader* of Sunnyvale; he is president of the Los Gatos *Times-Saratoga Observer* and Gilroy *Evening Dispatch* publishing companies, and vice president of the Pleasanton *Times* firm.

"By the inherent nature of his profession, Joseph Houghteling has always had a real and vital interest in the matters of state, and has served it well in various capacities," the Governor said in making the appointment. "I know he will bring this same imagination and energetic interest to the Highway Commission."

A native of San Francisco, Houghteling is a graduate of Yale University. He is vice chairman of the San Francisco Bay Study Commission, is on the advisory board of California Tomorrow, and is trustee of the World Affairs Council of Northern California. He serves as director of the Western Newspapers Industrial Relations Bureau. From 1959 to 1963 Houghteling served on the State Park Commission, the last 1½ years as chairman.



# US 99—San Joaquin Co.

By GEORGE AVERY, Assistant Design Engineer



DISTRICT  
**10**

Throughout the length of California, motorists on US 99 have long dreamed of the time when they would travel this highway with the safety and comfort we now associate

with our modern freeway system. After many years of concentrated effort, these hopes have become a near reality in San Joaquin County. The recent conversion of an eight-mile expressway between Stockton and Lodi completed nearly 37 miles of full freeway in the county. The two remaining miles of expressway are scheduled for conversion to a freeway in the near future and will end a long range reconstruction program which began many years ago.

US 99 is a part of the California freeway and expressway system. Its central location has throughout the years been very important to the economy of the flat, fertile San Joaquin County—ranked fifth in the agriculture producing counties of the nation. Convenient access to and from this highway contributes to the efficient and orderly movement of the agriculture and manufactured prod-



BEFORE: The intersection of Linden Road (Highway 26) and US 99 east of Stockton before conversion from expressway to full freeway.



AFTER: The Linden Road Overcrossing after reconstruction of this section of US 99 to full freeway.





*A frontage road bordering the new freeway in the vicinity of Morada Lane on US 99.*

ucts, which include livestock, a variety of fruits, vegetables, and nuts as well as durable and nondurable manufactured goods. All are moved quickly and safely to the nearby canneries, the Port of Stockton, and the numerous local and distant markets.

#### **Two-lane Roadways**

Prior to 1930, US 99 was, in most areas, a narrow, two-lane roadway of poor alignment, but the traveling lanes were generally paved or treated with some type of oiled surface. Flooding often occurred in the vicinity of the larger waterways.

One of the earlier reconstruction projects was started in 1931. The existing roadway was completely rebuilt from Turner Station south of

Stockton to the intersection of Charter Way in the City of Stockton, a total distance of slightly over seven miles. The work consisted primarily of replacing the narrow, rough riding surface with two lanes of concrete pavement and oiled shoulders. The total cost was about \$250,000. Incidentally, a large portion of this concrete pavement between Lone Tree Creek and Mariposa Road near Stockton was resurfaced with one inch of asphaltic concrete in 1956 and is still in use today carrying traffic as part of the existing divided highway.

#### **Construction Completed**

In 1938, construction work was completed on a \$230,000 five-mile project from Jahant Road north of

Lodi to about two miles north of the San Joaquin-Sacramento county line. At that time, two lanes of concrete pavement and paved shoulders were built, with provisions for expansion to a future divided highway. This later conversion was made in 1955. Here, again, the old pavement has been resurfaced and is now being used as the southbound lanes for the freeway in that area.

With the exception of necessary maintenance work to keep the existing pavements in good condition, very little work was done on US 99 between 1938 and the end of World War II. In 1945 and 1946, the great surge in automobile and truck traffic started. The two-lane pavements became inadequate to handle the in-



creased traffic volumes, and traffic analysts were predicting even greater volumes in the future. Efforts were soon started to rebuild this major highway to at least a four-lane expressway.

#### Four-lane Expressways

Construction projects for the next several years were directed toward converting the existing two-lane pavements to four-lane expressways. This would provide four lanes of divided highway for through traffic with partial control of access. Grade crossings were permitted only where considered necessary.

The first expressway on US 99 was started in 1945. Eight miles of two-lane pavement north of Stockton between the Calaveras River and Lodi were rebuilt at a cost of \$600,000. Shortly thereafter, the first stage of a two-stage project on the easterly fringe of Stockton was started. This work consisted of grading and structures for a six-mile expressway on a new alignment. Bids for the second stage were received in 1949, and the work consisted of paving the previously constructed roadbed. At a combined cost of \$2,500,000, these two projects provided a new expressway from Mariposa Road, south of Stockton, to the Calaveras River where it joined the previously completed expressway to Lodi. A continuous 14-mile stretch of divided highway was now open to motorists, and a major delay for through traffic was eliminated since the highway was no longer routed through one of Stockton's major business districts.

#### Freeways

As funds became available, some of the older two-lane pavements were reconstructed to full freeways in the early 1950's. These were also divided highways but differed from expressways since full access control was acquired and crossings at grade were eliminated. The first project of this type on US 99 was completed in 1954 between the north city limit of Ripon and just north of Austin Road at a cost of \$1,300,000. Four lanes of concrete pavement were built, as well as overcrossing structures at Jack Tone and Austin Roads.



This photo taken in the early 1930's shows US 99 flooded south of the Mokelumne River bridge.

One of the biggest delays to the motorist was the intersection of US 99 and State Highway 120 in the center of Manteca. The conflict of highway traffic and city traffic was nearly intolerable and construction of a freeway around Manteca was started in 1954. This freeway was completed in 1956 at a cost of \$1,800,000 and was located easterly of Manteca between Austin and Lathrop Roads. Several miles' of two-lane highway passing through the Manteca residential and business areas were superseded for US 99 traffic as well as three railroad grade crossings and a four-way-stop intersection.

Shortly thereafter, three miles of two-lane pavement south of Stockton

between Turner Station and Weber Road were converted to a freeway. Frontage roads were constructed on both sides of the highway on the northerly half of the project. The mainline was constructed with concrete pavements, and the cost of the completed work was nearly \$800,000.

#### Projects Started Simultaneously

In the latter part of 1955, several projects were started almost simultaneously. A troublesome grade crossing of the Tidewater Railroad Company tracks at Turner Station was eliminated by construction of the freeway between the north end of the Manteca Freeway and Turner Station. Four lanes of concrete pave-



The US 99 crossing of the Tidewater Southern Railroad tracks near Turner Station in 1929, looking north.



The intersection of US 99 and Highway 120 (Yosemite Avenue) east of Manteca as it looks now (see two photos at bottom of page). Note how the functional planting complements the structure.

ment and frontage roads were built for about \$1,000,000. At the same time, two projects from the northerly city limits of Lodi to north of the San Joaquin-Sacramento county line near Galt were underway to convert the existing pavement to a freeway with frontage roads. These latter projects totalled almost 10 miles in length and cost more than \$3,000,000. Interchanges were built at Woodbridge, Acampo, Peltier, Jahant, Collier, and Liberty Roads. An 800-foot concrete slab-type bridge was con-

structed over the Mokelumne River for southbound traffic. The existing bridge was widened to accommodate northbound traffic.

This completed the conversion of the old two-lane roadways on US 99 in San Joaquin County to either full freeway or four-lane expressway standards except for a portion of the highway in the City of Lodi. There also remained, however, several at-grade intersections and railroad crossings along isolated sections of the

highway, and studies were continued toward their elimination.

#### Conversion of Expressways

In 1958, bids were opened on an \$800,000 project to construct ramps, frontage roads, and structures at Mariposa and Farmington Roads east of Stockton. The heavy farm-to-market cross traffic was separated from the through traffic on US 99, thus eliminating the hazardous intersections. A 60 percent reduction in the number of accidents within the immediate vicinity of these crossings was recorded during the two-year period following their reconstruction.

Two additional projects, totaling a length of almost five miles, were started in 1961. These converted the expressway easterly of Stockton to freeway standards at a combined cost of \$2,000,000. Interchanges were built at Linden (State Highway 26), Waterloo (State Highway 88), and Cherokee Roads. In addition, an underpass at the Stockton Terminal and Eastern Railroad crossing north of Linden Road was constructed to eliminate the railroad grade crossing.

The remaining expressway sections on US 99 are located east of Stockton and consist of a Southern Pacific Railroad crossing and the Washington Street connection south of Linden Road. Future construction will eliminate these expressway sections.

The photo below shows traffic congestion in Manteca at the Highway 120 (Yosemite Avenue)-US 99 intersection prior to construction of the freeway. (See photo at top of page.)





In February 1964, a five-mile project was completed through Lodi, the second largest city in San Joaquin County. This work extended from Armstrong Road south of Lodi to the Mokelumne River. Four complete interchanges, frontage roads, crossings for several city streets, and four lanes of concrete pavement were built for nearly \$3,000,000. An interesting feature was the construction of almost one mile of a depressed freeway section in relatively flat terrain. Engineering studies during the design stage determined that the depressed section was superior to and more economical than an embankment section in that area.

Next, the four-lane expressway between Stockton and Lodi was converted to a six-lane freeway with frontage roads at a cost in excess of \$3,500,000. Interchanges were constructed at the Calaveras River, Hammer and Morada Lanes, Eight Mile and Armstrong Roads, and Harney Lane. This project, which was completed in December 1964, has eliminated the conflicts with the heavy cross-traffic going into and out of the



*BEFORE: The Cherokee Road intersection looking northward prior to reconstruction of US 99 to full freeway east of Stockton.*



*AFTER: Looking south towards the Cherokee Road Overcrossing following the freeway construction.*

Morada district east of the freeway. In the past few years, this cross traffic had been steadily increasing due to new developments and subdivisions in the area.

#### **Current Projects**

Several projects are now being scheduled for the completion of US 99 to full freeway standards in the county. Currently included in the 1965-66 fiscal year construction program is a \$200,000 project for an overcrossing structure which will permit closing the Section Avenue access opening north of Farmington Road in Stockton. The same program also includes over \$2,000,000 to reconstruct US 99 from a four-lane expressway to a six-lane freeway from the San Joaquin-Stanislaus county line to just north of Ripon. An additional \$300,000 is allocated to widen the existing freeway and reconstruct portions of the shoulders between Turner Station and Mariposa Road.

#### **Beautification Is Aim**

Continuous efforts have been made in recent years to beautify and improve the aesthetics of the highway by means of landscape projects wherever feasible. The 1965-66 program includes \$200,000 for a planting project between Armstrong Road south of Lodi and the Mokelumne River. Additional landscaping projects of this type will be undertaken from time to time as funds become available.



*An aerial of the Mariposa Road (foreground) and Farmington Road Interchanges during conversion of this section of US 99 to full freeway in 1958.*



Excluding minor signalization, lighting, and landscaping projects, more than \$20,000,000 has been invested in the long-range program to reconstruct US 99 to freeway standards within San Joaquin County. It has been a long, hard effort to rebuild the old narrow, two-lane roads to four-lane expressways and again convert these to the modern four- and six-lane freeways as we know them today. But it is considered money and effort well spent, because the accident rate on a typical section of highway south of Stockton has decreased from 2.80 accidents per million vehicle miles in 1946 to 0.50 in 1964. As a result, the traveling public, as well as the commercial truck carrier, can now drive the entire length of the county with increased safety and convenience on one of the best highways in the nation.

## Bids Called for Big Interstate 5 Project

The State Division of Highways has called for bids on a multimillion-dollar project in Merced and Stanislaus Counties.

The project consists of grading and paving to extend the four-lane Interstate 5 (Westside) Freeway construction now in progress (between Route 152, west of Los Banos, and 2.8 miles north of Route 33 in Merced County) another 13.8 miles north to four-tenths mile north of Stuhr Road in Stanislaus County.

The project includes interchanges at Sullivan Road in Merced County and at Stuhr Road in Stanislaus. Undercrossings will be constructed at West Bank and Allen Roads in Merced County, and at Poverty Flat, Shiells and Orestimba Roads in Stanislaus.

A vista point will be constructed for southbound traffic approximately a mile and a half south of Orestimba Creek.

Bids will be opened April 28 in Sacramento. A total of \$7,290,000 is available for the project.

## San Mateo-Hayward Spans Are for Sale

Want to buy a bridge?

The State Division of Bay Toll Crossings will stage its version of the "You wanna buy the Brooklyn Bridge?" game—only this time it will be for real.

In a month or two, the division will advertise for bids to buy the five central spans of the San Mateo-Hayward Bridge, which is being replaced by a new high-level \$70 million span.

E. R. Foley, chief engineer of the division, said it may well be feasible to transport the bridge to almost any point in the world.

And it could be far less expensive, he said, to transplant the San Mateo-Hayward Bridge in this fashion over, say, the Mekong River, than to build a new bridge from scratch.

Foley announced plans to reach an international audience of potential bridge buyers by advertising in engineering journals and foreign publications.

The bridge can be transported either of two ways. It can be dismantled and reconstructed. Or entire trusses can be placed on seagoing barges and transported whole to their destination.

The five 300-foot-long bridge spans can be used as one 1,500-foot bridge or as five smaller bridges, Foley said. In fact, any combination of the sections can be used—such as combining two sections to make a 600-foot bridge and the remaining three sections as a 900-foot bridge at another location.

One restriction, however, is that one buyer must buy all five sections, Foley said.

The buyer must agree to remove the bridge soon after the new span is completed in 1967.

The new bridge will have a unique, orthotropic design, with no overhead steel supports and cables which are common on most long span steel bridges. It will be supported between the concrete piers by box girders below the roadway, which will itself be fashioned of steel and will be part of the support structure.

The result will be a modern, streamlined and uncluttered silhouette.

## Jethro J. Cravens

Jethro J. Cravens, highway maintenance man II in District 10, was struck by a car and killed instantly on December 15 as he and a coworker were spreading tar on cracked portions of US 99 near Modesto.

Cravens, 44, and Harvey Eugene Smith, 35, were both struck when an automobile driver failed to heed flag warning signals, veered into the two men, and went on to hit a trailer-heater filled with boiling road tar.

A native of Arkansas, Cravens had been employed by the Division of Highways since 1953. He is survived by his wife, two daughters, and one son, all of Modesto.

Smith, who was hospitalized with extensive burns, is expected to return to work soon. The two occupants of the automobile were also injured.

## District 4 Cafeteria Has 'Sinclair Room'

A small dining room included in the remodeled basement cafeteria in the District 4 office building in San Francisco has been named the "Sinclair Room" in memory of Joseph P. Sinclair, former district engineer, who died in May 1964.

The dining room, finished in somewhat more formal style than the main dining area of the cafeteria, is used for special group events organized by district employees.

The "Sinclair Room" is identified by a bronze name plaque above the entrance door, a larger commemorative bronze plaque on one of the inner walls, and a framed photograph of Mr. Sinclair on another wall. These items were financed from a fund contributed by district employees; a balance of \$40.96 remaining after the purchase of the plaques and frame was sent to the Heart Fund in memory of Mr. Sinclair.

A \$27,146,000 contract—a record for the State Department of Public Works—has been awarded to Murphy Pacific Bridge Builders of Oakland to erect the steel superstructure.



# McKinleyville Freeway

By KARL W. KAMPE, Resident Engineer



DISTRICT  
**1**

On October 3, 1964, dedication ceremonies sponsored by the local chamber of commerce were held at a scenic vista site overlooking the Pacific Ocean to commemorate

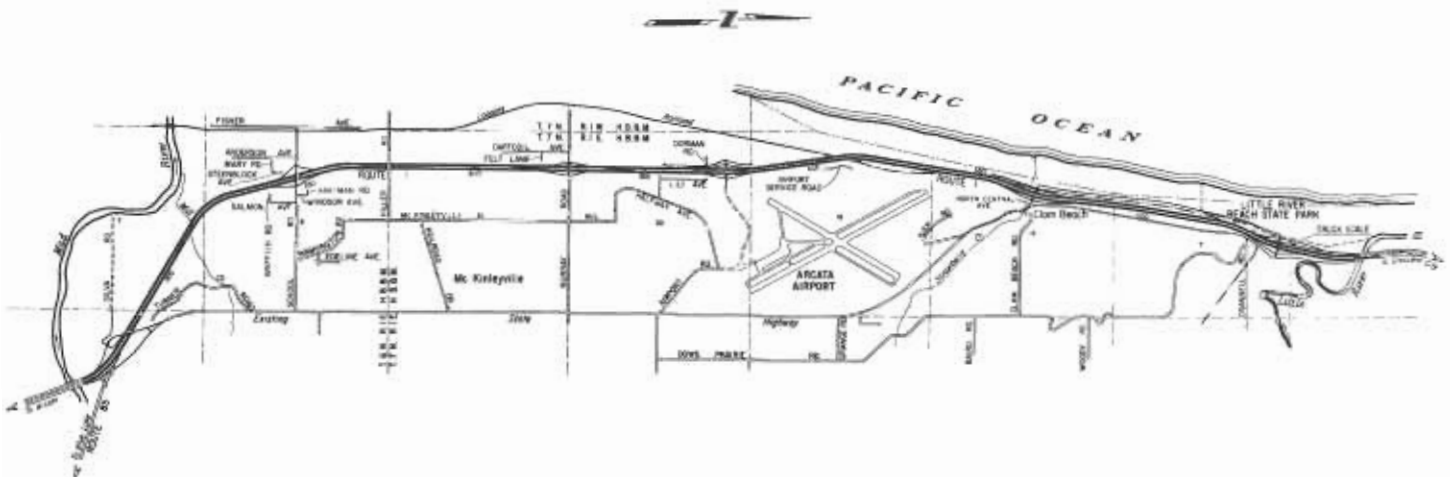
completion of the McKinleyville freeway project. This latest improvement on U.S. 101 Redwood Highway was opened to public traffic on October 8, culminating almost two years of construction activity.

By action of a supervisor of former Klamath County,\* "any trail wide enough for a bear to travel over is declared to be an open highway." This was historically the first apparent official effort to improve the present Redwood Highway from Mad River to Little River. The declaration did not produce much improvement, since the only resources for road building in 1855 was a levy of three days' labor per year against the able-bodied men in the county. Nevertheless, by 1876

\* Klamath County, formed in 1851 and dissolved in 1874, included the general area now in Del Norte, Trinity and Siskiyou Counties.



Looking north along the new McKinleyville Freeway section of US 101 in Humboldt County.



Map of the recently completed freeway project which extends from the Mad to Little River on the Humboldt Coast.



An aerial of the McKinleyville Freeway looking south. Clam Beach Interchange is in the foreground. The old highway through McKinleyville is to the left and Arcata Airport center. Frontage road right of freeway in foreground provides parking for 350 cars and unrestricted access to the beach for 1½ miles. Photo by David Swanlund.

the trail, or road, was fit for pleasure travel since the early settlers used it to go on camping expeditions to a spot now called Little River Beach State Park.

#### First Improvements in 1921

The first in a series of improvements by the state in this area began in 1921 with the grading and graveling of a road 18 feet wide. This project on new alignment now provides eight miles of full freeway consisting of four lanes on divided roadways with six full interchanges and one overcrossing facility to serve the area.

The freeway bypasses the community of McKinleyville, an unincorporated area with a population of approximately 10,000. The community is largely residential with some farmland. In the normal course of development, businesses started along the main traffic artery of the community, which was the existing highway. As the community grew, traffic volume increased and accident frequencies increased proportionately along the old highway due to the large number of left-turn movements entering and leaving developments along the highway. With

the opening of the freeway the community is now free to develop with greater safety to the residents.

#### Offers Contrasting Scenery

The new alignment offers the traveler contrasting scenery. The southerly half of the project consists of gently rolling terrain. At the midpoint of the project the road leaves an elevated plateau, dropping approximately 100 feet in elevation to a sandy beach. The motorist is suddenly afforded a spectacular view of the ocean, beach and Trinidad Head. At this point the northbound motorist on Highway 101 is able to see the ocean for the first time since leaving the Golden Gate, approximately 300 miles to the south. Appropriately, the scenic value of this panorama was recognized and a roadside vista point was constructed under the contract to permit the traveler to park, rest and enjoy the view.

The local chamber of commerce, impressed by the vista site, erected a large plaque commemorating the opening of the freeway which is the lifeline of the north coastal area. The plaque itself is a segment of a redwood log, six feet in diameter, on which is carved "Where the Majesty of the Redwoods Meets the Beauty of the Sea."

In the central portion of the project, the freeway is bounded on the east by the Arcata Airport. An interchange permits direct access to the airport, and during the time the freeway was under construction the County of Humboldt was engaged in constructing a new four-lane road from the freeway to the airport.

#### Parallels Public Beach

From the vista site northerly for four miles the freeway parallels a beautiful public beach that is owned by the County of Humboldt and the California Division of Beaches and Parks (Little River Beach State Park). Unrestricted access to this beach is provided for 1½ miles by a frontage road which parallels the freeway. The frontage road includes a paved shoulder for parking throughout its entire length, capable of handling 350 cars. This phase of the project has been of interest to sportsmen since this beach



yields an abundant supply of razor clams. During favorable clam tides the beach is used by hundreds of clam diggers.

Liberal use has been made of native plants to insure revegetation throughout the project. Extensive plantings of beach grass, native lupine and willows have been made to date in addition to normal seeding with rye grass and barley.

**Freeway Blends With Terrain**

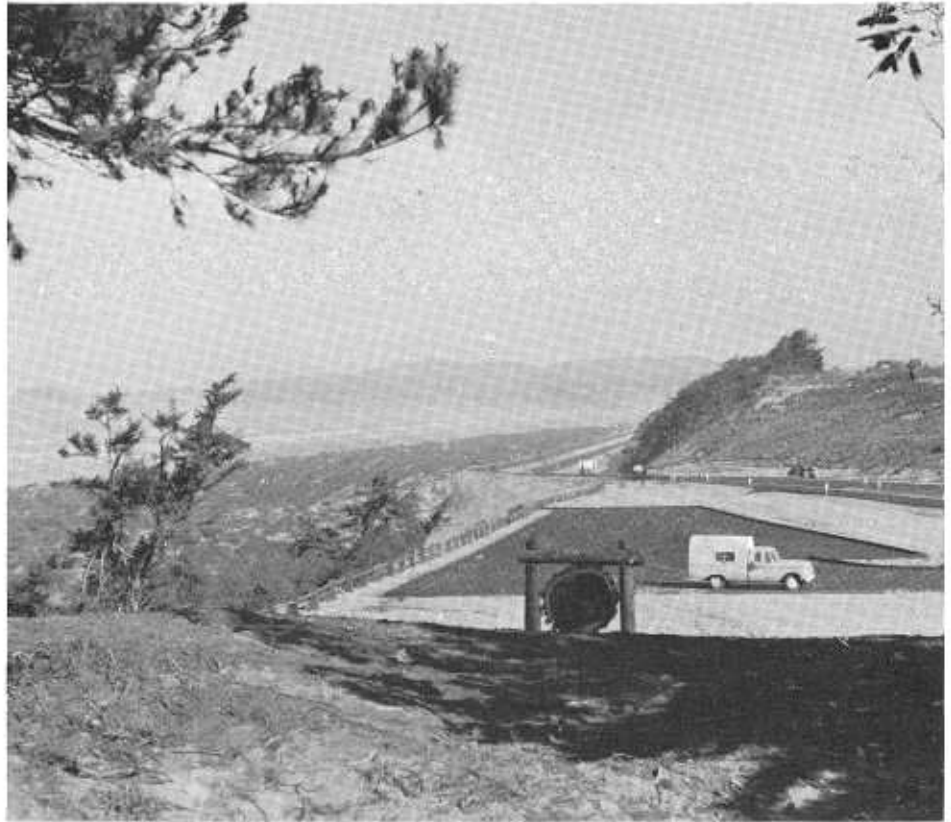
Contour grading was performed in interchange areas and variable flattened slopes were used throughout the project where possible to insure that the freeway would blend in with the surrounding terrain.

The project officially started on April 11, 1963, and was completed on October 29, 1964, at a construction cost of \$4,700,000. Although situated in an area of the state where construction seasons are short due to extensive winter rains, the project was completed and opened to traffic within two construction seasons because of the short time limit of 190 working days specified in the contract and because of the efficient use by the contractor of materials and manpower resources.

**Some Construction Problems**

The project was not without its share of construction problems. Extensive stripping and stabilization work was required at the southern end of the project where the new facility tied into the old highway on Bella Vista Hill. The old highway at this location had a notorious history of slipouts and accidents. The work in this area was complicated in that it was necessary to excavate and back-fill the active slipout area directly below the existing highway without disrupting the normal flow of traffic.

The new roadbed also crossed Mill Creek Swamp, which preliminary borings penetrated over 60 feet in depth without encountering firm material. The swamp consisted of organic material and mud that was interlaced with ancient logs. The fill across this swamp was approximately 15 feet in height with 40-foot strut fills on each side. No stripping or stabilization



*The Vista Point parking area on the McKinleyville Freeway, looking north. The log-framed dedication plaque erected by the chamber of commerce is in the center foreground.*



*A view of the Vista Point area (photo above) looking to the southwest.*





*The Crannell Interchange, looking north, showing typical lumber industry truck traffic. Planting of beach grass in foreground prevents drifting sand in the dune areas.*

work was involved in this crossing; however, it was required that the fill be allowed to settle for one year before base and surfacing could be placed.

Granite Construction Company of Watsonville was the prime contractor with Richard A. Lewis as project superintendent. C. K. Moseman Company was the structures subcontractor with Bill Milot as superintendent.

James W. Beck was Bridge Department representative and Karl W. Kampe was resident engineer for District 1.

## UNIQUE LIGHTING PLAN FOR NEW SAN MATEO BRIDGE

A continuous white ribbon of light extending almost  $7\frac{1}{2}$  miles across San Francisco Bay—that is the unique plan for illuminating the \$70 million San Mateo-Hayward Bridge, which will be completed in 1967.

Plans for lighting the span—one of the longest in the United States—with twin fluorescent lights mounted atop a center concrete road divider have been announced by E. R. Foley, Chief

Engineer for the State Division of Bay Toll Crossings.

It will be the first time in northern California that such lighting will have been used on a major bridge, Foley said.

The concrete divider on which the continuous fluorescent lights will rest will be about  $2\frac{1}{2}$  feet high. From a distance, the lighting will have the appearance of a solid white ribbon across the bay.



# Red Bluff-Cottonwood

By B. L. MELTON and R. W. WENHAM, Resident Engineers



Ribbon-cutting ceremonies on July 8, 1964, officially opened a 15.2-mile section of Interstate Route 5, extending from Red Bluff to north of Cottonwood. There were two separate

contracts involved in the construction, at a combined cost of approximately \$7.2 million. The two contracts were programmed to permit a simultaneous completion date. A detailed description of each project follows:

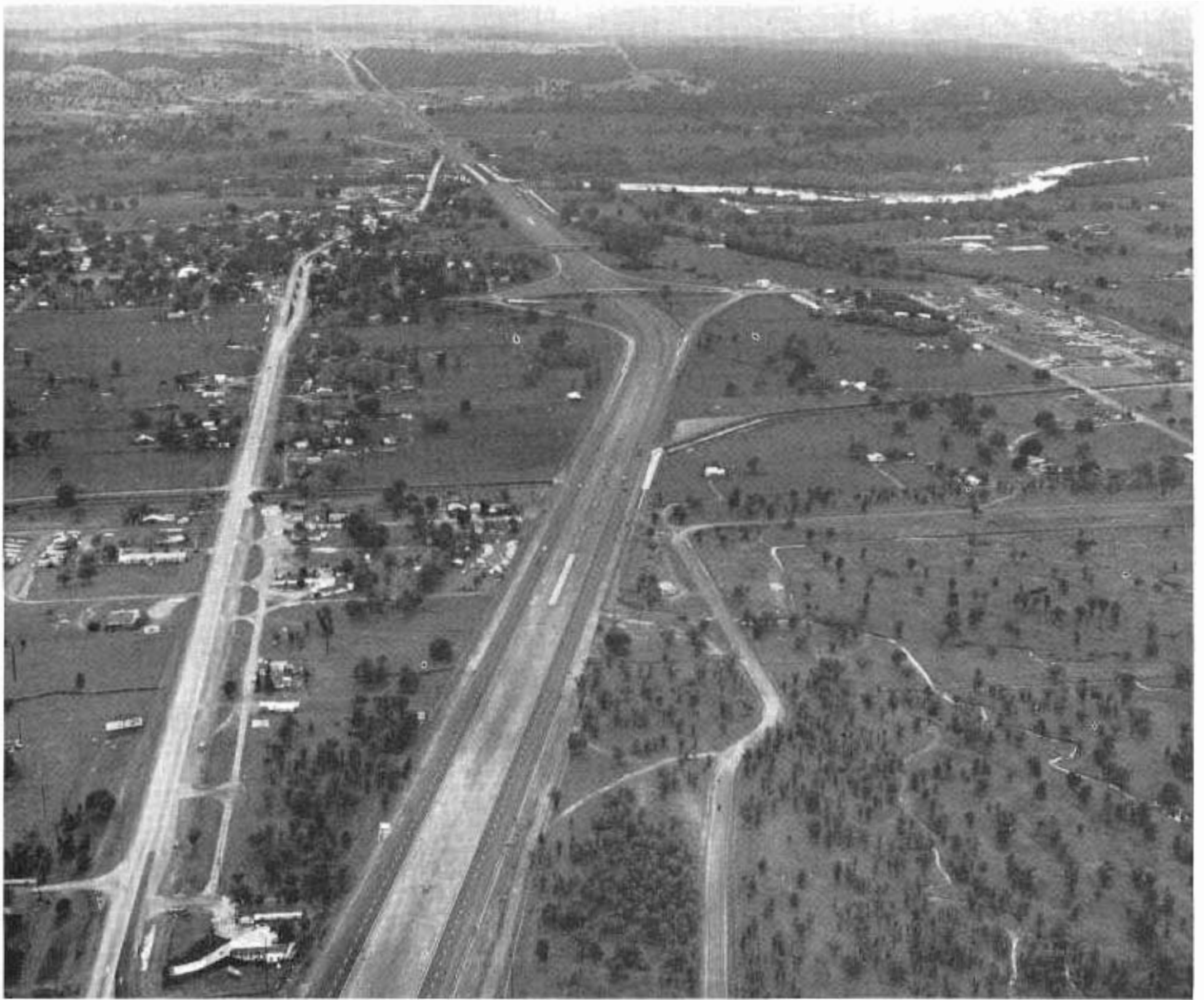
#### **United No. 1—Red Bluff to Cottonwood**

The first contract, awarded in September 1961, covered the section from

0.2 mile north of Red Bluff city limits, in Tehama County, to the Shasta county line, just south of Cottonwood. Frederickson & Watson Construction Company, Lew Jones Construction Company, and Ransome Company were the successful bidders, with a joint venture bid of \$3,950,236. Basically, the project involved a typical rural freeway development. The



A section of the new Interstate 5 freeway near Cottonwood in Shasta County. Note the wide, contoured grading of side slopes and median with split-level roadways and trees preserved and made part of the highway picture in the wide median separator.



Looking south along Interstate 5 toward the 4th Street Interchange, First Street Overcrossing, Cottonwood Creek Bridge and Overhead. Beyond the bridge is Bowman Road Interchange. The old highway and the town of Cottonwood are to the left.

old highway was incorporated into the new routing wherever feasible. In these locations the new lanes were generally constructed on independent grades and alignment.

Except for a short section of totally new construction near the center of the project, existing US 99 was reconstructed to function as the northbound lanes up to Nine Mile Hill, and as the southbound lanes from there northward. The reconstruction principally amounted to placing a varying thickness of asphalt concrete cover and shaping shoulders.

Included in the contract was the construction of a new truck-weighing

station near the north end of the project. Two safety rest areas and erosion control treatment were added during the project.

A drainage feature, unusual for District 2, was the construction of a series of spillway checks near the southerly project limit. These were utilized as energy dissipators in a 12-foot bottom channel to minimize the tendency of channel material to erode.

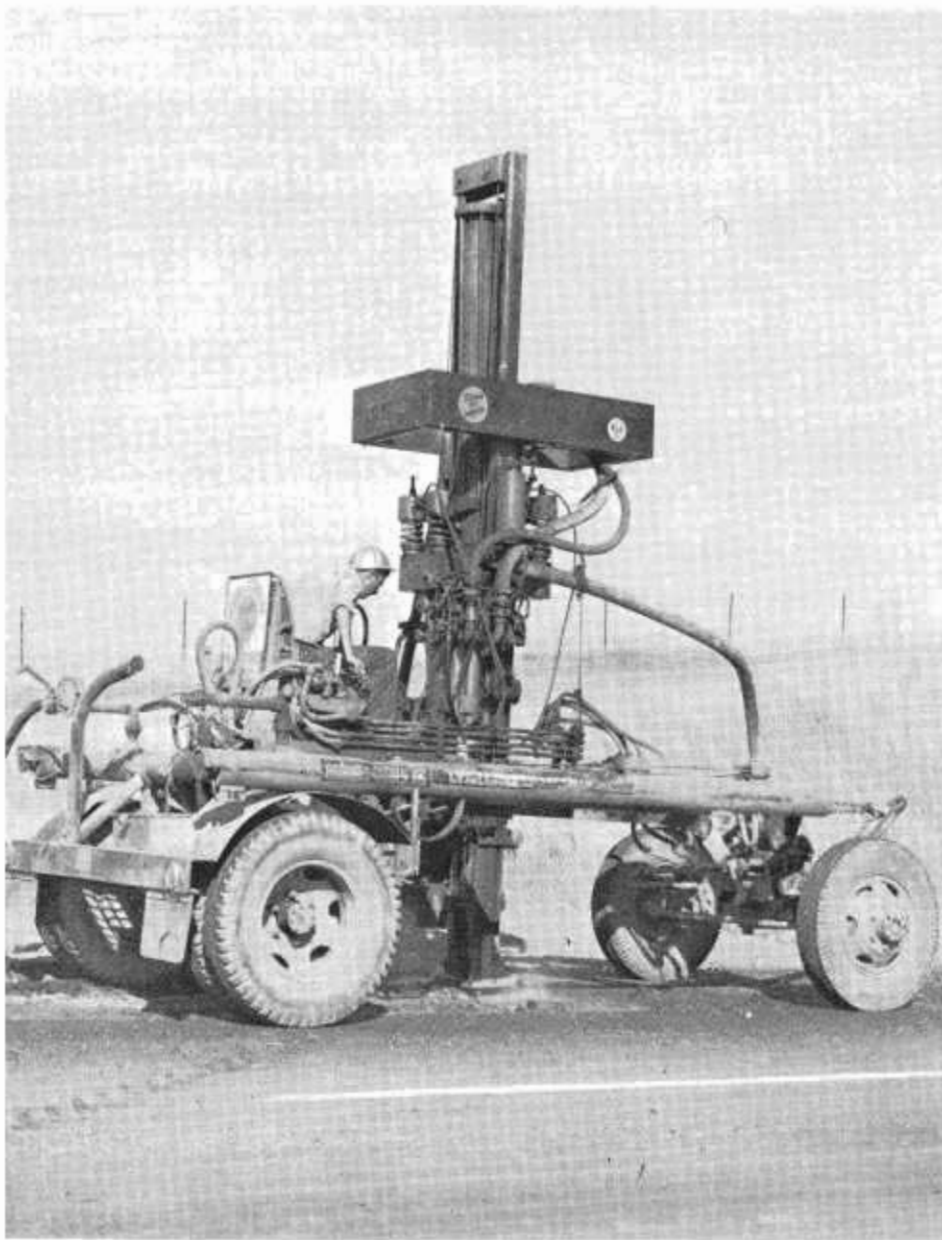
#### **Prestressed Bridge Girders**

Because this project incorporated existing US 99 into the interstate freeway, it was necessary to provide for traffic at each of the six overcrossing

structures. Special efforts were made to hold traffic delay to an absolute minimum. To comply with these conditions, bridge designers were faced with the alternative of using either steel girders or precast and prestressed concrete girders for the overhead structures. On this job economy dictated use of the concrete girders.

Each overhead structure consisted of two center spans, varying in length from 80 to 97 feet, with shorter approach spans. Only the girders in center spans were prestressed; the remaining girders were precast with conventional reinforcement. The girders were manufactured and trans-





A heavy-duty pavement breaker pulverizes a section of existing highway to eliminate slabbing action.

ported to the job site by truck. The advantage of these construction methods became apparent when traffic delays were held to less than 20 minutes for each installation.

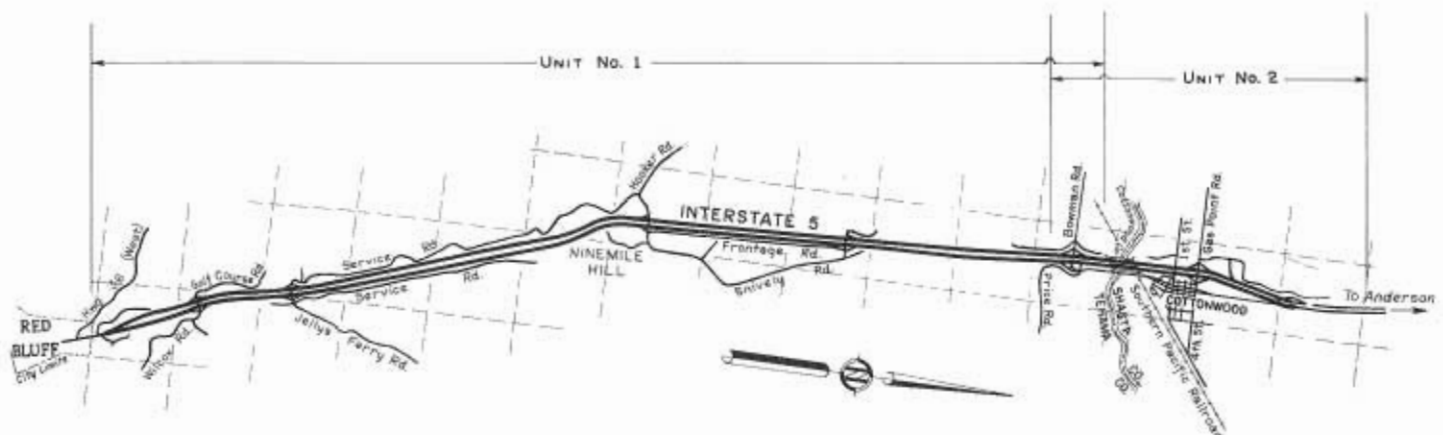
#### Special Equipment and Techniques

One piece of equipment that was used, which generated interest on both a district and statewide basis, was a cement-treated base spreader. Affectionately dubbed "The Monster," this machine spread the mix in lifts 26 feet in width, while operating at a rate of 400 tons per hour. When operated with care, it was capable of turning out good results. Of 32 Headquarters' audit samples taken, only one was outside the allowable tolerances, which gives favorable indication of the machine's performance capabilities.

#### Safety Rest Areas

As a result of a statewide program initiated for the purpose of providing pleasant travel conditions and greater highway safety, two roadside rest areas were constructed on this project. These were placed at staggered locations on both the north and south-bound lanes. Each rest area can accommodate in excess of 20 vehicles and was located so as to take full advantage of the plant life indigenous to this area. A contract is currently underway which will provide sanitary facilities, picnic tables and other miscellaneous facilities at each location.

The contract was completed on May 1, 1964. R. P. Brodie of Fredrickson & Watson Construction Company was project superintendent; Mark E. Cessna, Jr., and Bill L. Melton were resident engineers; and N. E. Spickle-



Location of the new 15-mile freeway section on Interstate 5 between Red Bluff and Cottonwood is shown in the above map.



A 30-ton precast prestressed concrete girder is installed at Bowman Road Interchange, south of Cottonwood.

mire was the Bridge Department representative.

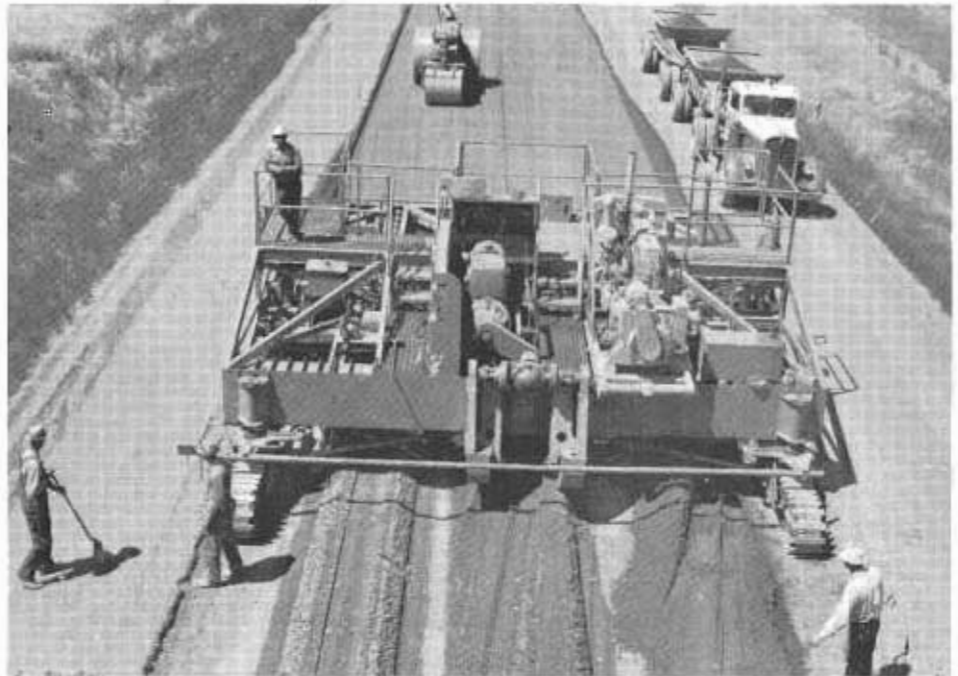
#### Unit No. 2—Cottonwood Freeway

On July 8, 1964, 3 miles of modern freeway were opened to traffic. This project extends from 0.5 mile south to 2.5 miles north of the Tehama-Shasta county line, skirting the westerly edge of the Town of Cottonwood.

The Town of Cottonwood and the surrounding area have excellent access to the freeway. Immediately south of town is the Bowman Road Interchange, the major portion of which was constructed under the previously described Unit No. 1 project. Just west of town is the Fourth Street Interchange and to the north, the North Cottonwood Connection. There is also an overcrossing at First Street.

The cost of this project was approximately \$2,900,000, nearly half of which was for structures. These consist of the First and Fourth Street Overcrossings, the North Cottonwood Undercrossing, and the Cottonwood Creek Bridge and Overhead. The Cottonwood Creek Bridge and Overhead consists of two parallel structures. The bridge for northbound traffic is 1,492 feet long and the southbound struc-

ture 1,339 feet long. Each of these two structures has three steel girder spans, which bridge the Southern Pacific Railroad right-of-way, and 15 and 13 reinforced concrete box girder spans respectively over the creek bed.



A machine spreads the first of two four-inch lifts of cement treated base on northbound lanes of Interstate 5 north of Nine Mile Hill.

This is the third creek crossing to be built in this area. The first, built about 1920, was a concrete arch structure about 600 feet long located adjacent to the railroad bridge and partly under the new structures. This bridge was removed as a part of this contract. The second structure, on the former state highway and just downstream from the new crossing, will remain in service as part of the county road system.

#### Future Lanes

The new highway has an 84-foot median which makes it possible to add lanes in the future. The structural section is composed of selected material, aggregate subbase, eight inches of cement-treated base and five inches of asphalt concrete. Earthwork consisted of 460,000 cubic yards of roadway excavation and 300,000 tons of imported borrow. Few serious problems were encountered, although about 15,000 cubic yards of unsuitable material had to be removed from swampy areas within the Fourth Street Interchange. This was replaced with selected material from Cottonwood Creek to provide a firm foundation for the structural section.

The majority of the project was constructed without serious inconven-





*A series of these spillway checks were constructed in a 12-foot bottom channel near the south end of the project. Southbound lanes of the freeway are to the right.*

ience to the traveling public. A series of temporary median crossings were used to carry traffic through the work at the south end of the project. Detours were provided for local traffic at First and Fourth Streets while the overcrossing structures were being built, and southbound traffic used the southbound off-ramp of the North Cottonwood connection while the main line was under construction in this area.

In order to maintain existing irrigation systems, several irrigation facilities were constructed. These included a 24-inch reinforced concrete pipe "siphon" in the vicinity of First Street and a 12'x7'x334' box culvert in the Anderson-Cottonwood Irrigation Dis-

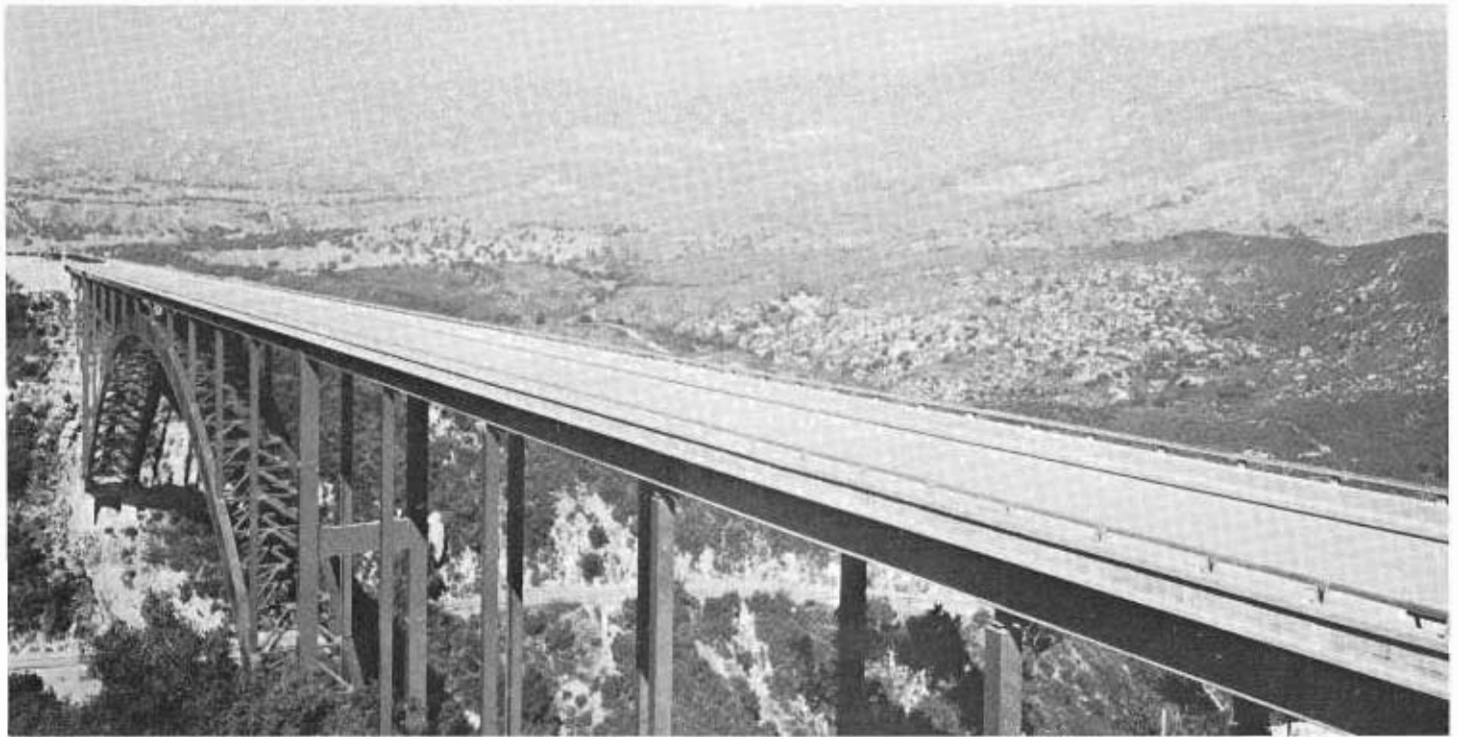
trict Canal. In other utility work, an eight-inch water line and a three-inch gas main were placed in the Fourth Street Overcrossing to continue service to both sides of the freeway. Conduit for future water and sewer lines was placed under the freeway in the vicinity of Crowley Gulch by the Cottonwood Water District to provide for anticipated growth in the area.

Work was started on the project on August 2, 1962, with major emphasis on the Cottonwood Creek structures. By the time high water began to hamper the work, the majority of the footings and piers were in place. Also about 80 percent of the grading had

been completed when operations were halted by bad weather.

The structures were completed in 1963. Paving was completed in the spring of 1964 and other items were completed by midsummer.

The contract was awarded to Stolte, Inc., and Lee Stephens, a joint venture, on August 2, 1962, and work was completed on August 6, 1964. Base and surfacing were done by Morgan Construction Company and by Ransome Company, subcontractors. Paul Gatschet, of Stolte, Inc., was project manager; E. B. Delano and R. W. Wenham were resident engineers; and N. E. Spicklemire was Bridge Department representative.



ABOVE: Long Span Prize Winner—COLD SPRING CANYON BRIDGE near Santa Barbara . . . Jurors' Comment: "A steel arch. Very simply and directly handled. The integration of the arch and approaches is very well done. There is a beautiful use of steel: integrated, lightweight, but still a long span. It fits beautifully into the site and is an economical bridge."

# AWARD WINNING

## California Steel Structures Take Four A.I.S.C. Prizes

California bridges took two of the top prizes in the annual prize bridge competition sponsored by the American Institute of Steel Construction for steel bridges opened to traffic between January 1, 1963, and October 10, 1964. Two others, also designed by the Division of Highways Bridge Department, were among 16 steel bridges receiving "Awards of Merit" in the national competition which drew 135 entries.

Cold Spring Canyon Bridge on Route 154 in Santa Barbara County was named the most beautiful long span bridge. Entries in this class were bridges with one or more spans of over 400 feet. This bridge, and its designer Marvin A. Schulman, associate bridge engineer, had been honored previously by the James F. Lincoln

Foundation for progress in welded steel design (see September-October 1964 issue).

Winner in the short span prize bridge classification was Devil's Canyon Bridge No. 2, located five miles east of the San Diego county line on

US 80 (Interstate 8). This bridge, designed by W. A. Behrens, senior bridge engineer (now with the Division of Bay Toll Crossings), was judged most beautiful of steel bridges with fixed spans and costing less than \$500,000.



AT RIGHT: Short Span Prize Winner—DEVIL'S CANYON BRIDGE NO. 2 east of San Diego . . . Jurors' Comment: "Done in rather complete, harsh simplicity, fitting in with the country around it. It is a graceful structure using straight cantilever beams. The approaches are nice and look solid. We particularly like the proportionate simplicity of the piers holding the spans of this fine bridge."



## CONTEST JURORS

WALDO G. BOWMAN, President, American Society of Civil Engineers, 1963-64; Publisher, *Engineering News-Record*

J. ROY CARROLL, JR., President, American Institute of Architects, 1963-64; Partner, Carroll, Grisdale and Van Alen, Architects

ROBERT L. DURHAM, Director, American Institute of Architects, 1963-64; a principal in the firm of Durham, Anderson and Freed

JON W. HAUSER, President, Industrial Designers Institute, 1963-64; President, Jon W. Hauser, Inc.

HENRY L. KAMPHOFNER, President, Association of Collegiate Schools of Architecture, 1964-65; Dean, School of Design, North Carolina State College of Agriculture and Engineering

WILLIAM C. RENWICK, President, American Society of Industrial Designers, 1963-64; Design Director, Dow Corning Corporation

RONALD B. SMITH, President, American Society of Mechanical Engineers, 1963-64; Senior Vice President, M. W. Kellogg Company

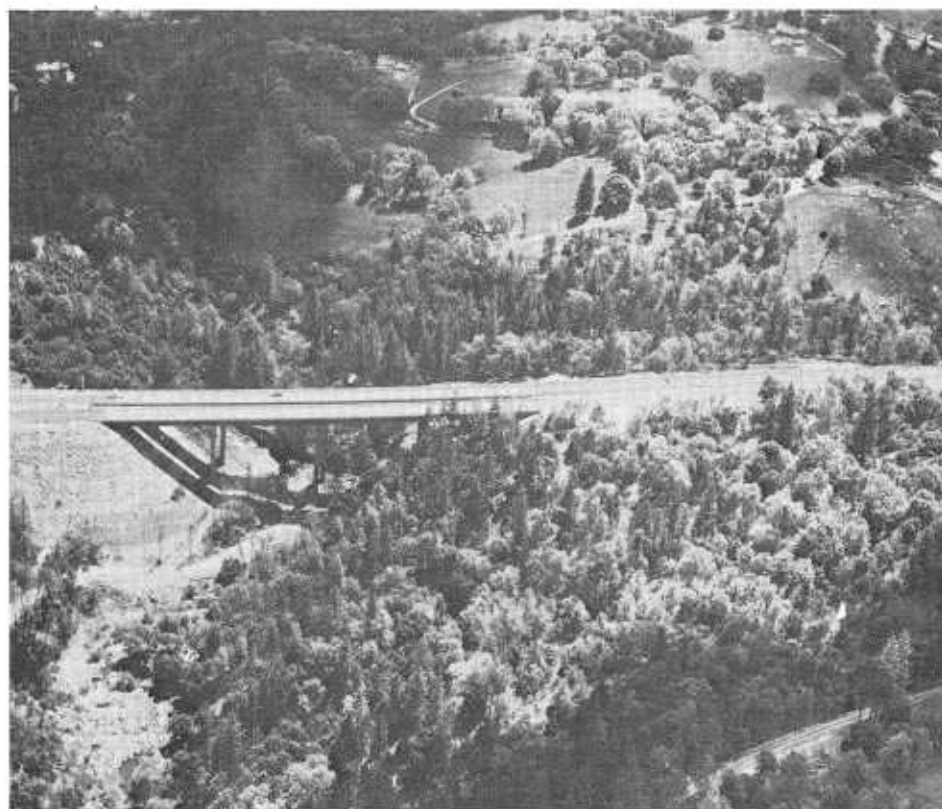
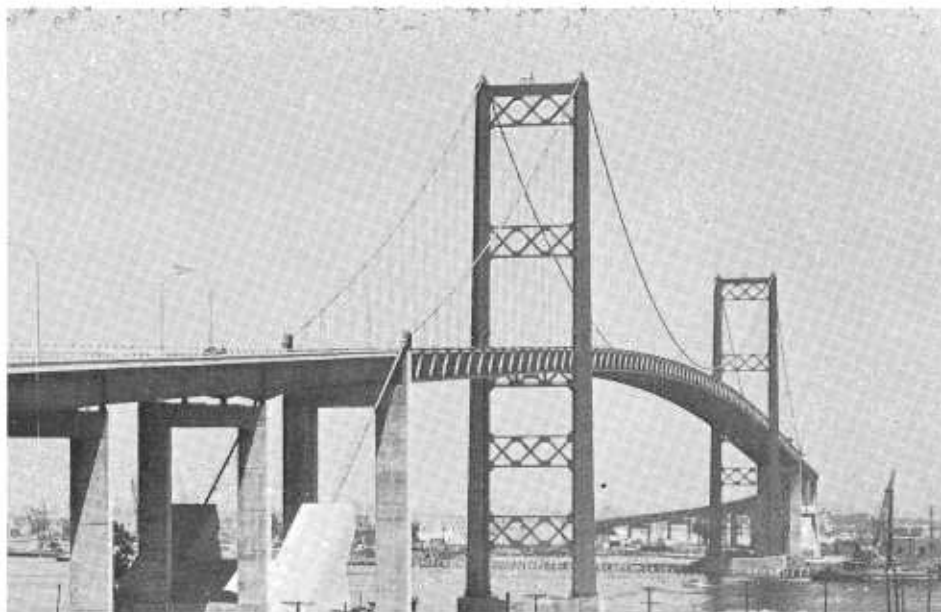
KURT F. WENDT, President, American Society for Engineering Education, 1963-64; Dean of the College of Engineering, University of Wisconsin

EDWARD J. ZAGORSKI, President, Industrial Design Education Association, 1964-65; professor in charge of design program, University of Illinois

# BRIDGES

The Vincent Thomas Bridge, linking San Pedro and Terminal Island, was one of four long span bridges receiving an "Award of Merit" from A.I.S.C. this year. And, the bridge across Webber Creek on US 50 near

*The Vincent Thomas Bridge, which links San Pedro and Terminal Island, was one of four long span bridges chosen for an Award of Merit in the 1963-64 contest. There were 135 entries from all parts of the country.*



*Webber Creek Bridge on US 50 about 16 miles east of the Sacramento county line was one of five bridges in the medium span class receiving an Award of Merit from A.I.S.C.*

Placerville was one of five bridges in the medium span class which were selected for an "Award of Merit."

W. J. Jurkovich, senior bridge engineer, designed the Vincent Thomas Bridge, and A. P. Bezzone, senior

bridge engineer, designed the Webber Creek Bridge.

In appraising the winners, the jurors agreed that bridge designers are taking advantage of the new steels as they are brought out by industry. "The current quality of bridge design," the jury said, "is very good. Bridges are getting better looking, as well as more economical. There is an obvious attempt on the part of the designers in this competition to do something about appearance. The winners all show that a great many types of bridges can be designed beautifully and harmoniously in steel."

The jury announced that "they are streamlining bridges more than they have before." In their criticism, they said that in some cases "the main part of the bridge often ends abruptly before the road has reached land again. The extremities are thinly or lightly done and don't seem to integrate as a total design."

Stainless steel plaques will be affixed to the winning bridges as a permanent tribute to their designers for combining aesthetics and utility, and award certificates will be distributed.

# I-80 Over Donner Summit

By H. F. SHERWOOD, Assistant District Engineer



DISTRICT  
3

*(Editor's note: The author, "Bill" Sherwood, headed both the planning and design of the high Sierra sections of Interstate 80 described in this article, and "walked the line in '52.")*

When the final three sections of Interstate 80 freeway in the upper reaches of the Sierra Nevada Range were opened to traffic October and November 1964, the last of the 40-year-old, narrow, two-lane road was bypassed on this historic 115-mile route between Sacramento and the Nevada state line.

Formerly US 40, this heavily traveled portion of one of the nation's best-known intercontinental highways has been under construction since 1956 as part of the interstate system, financed mainly by federal tax funds. However, conversion to freeway standards began as early as 1947 in the Sacramento area.

*This aerial taken from above Donner Summit looks northeastward across the old highway (foreground) to the new section of I-80 freeway. The old bridge and vista point can be seen in left foreground.*





The opening of the 10½-mile climb over the formidable Sierra wraps up more than \$100,000,000 in construction.

For the future, several projects remain to convert a section of expressway to freeway and to widen the existing freeway to six and eight lanes in the valley and foothill region between Sacramento and northeast of Auburn.

#### Earlier Reports

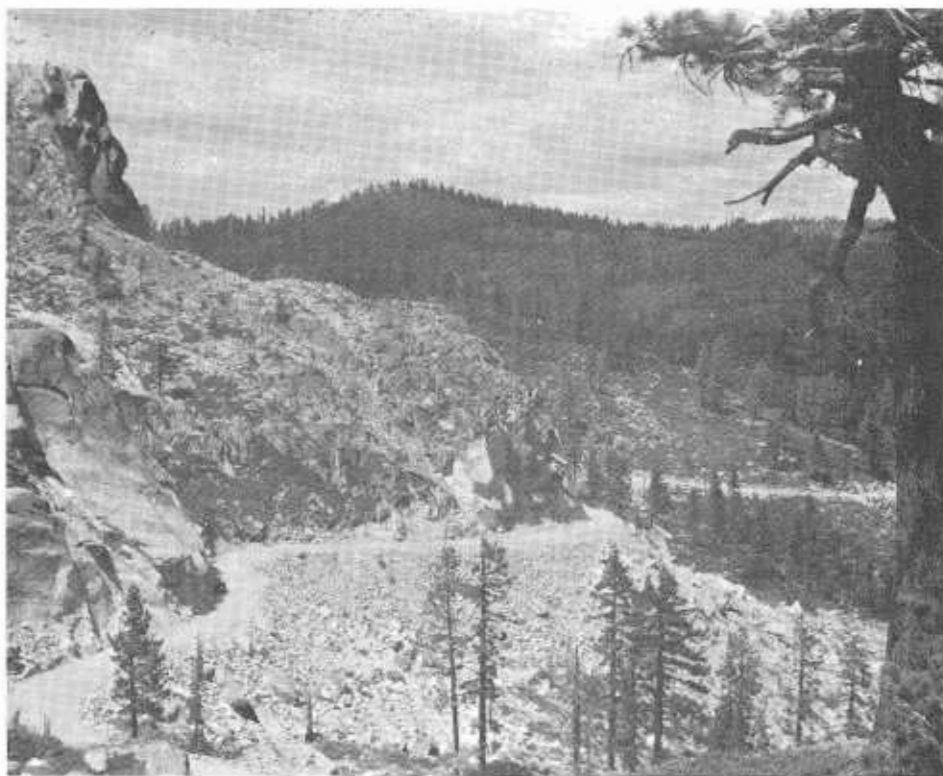
Detailed reports on earlier Interstate 80 construction were published in *California Highways and Public Works* for May–June 1955; May–June and September–October 1956; May–June, July–August, and November–December 1957; November–December 1959; January–February 1962; and March–April 1963.

This route, in use for 120 years, has often been a fierce challenge to the traveler. Its awesome grandeur and natural beauty are offset by a rigorous climate and rugged terrain.

The Donner Pass, if it can be called a pass—for the eastern face of the Sierra Nevada Range is really an escarpment formed by an ancient geological upheaval—was first penetrated by white men in 1844–45. The Indians wouldn't have much to do with it.

Excerpts from one historical account give a brief sketch of what these pioneers surmounted:

"The main body of emigrants took the wagons along the stream now called Donner Creek. Others went ahead with six wagons. They worked their way for two miles along the north shore of the lake (Donner). A quarter-mile beyond the head of the lake they must have made a halt and what they saw ahead was enough to appall anyone. A thousand feet high . . . so steep that little streams came leaping down in cascades, a rugged granite mass blocked the way. All the wagons were unloaded . . . chains were fastened to the tongues of the wagons and carried to the top of the rock where cattle were hitched to them. Then the men lifted at the wagons, while the cattle pulled at the chains and by this ingenious device the vehicles were all, one by one, lifted across the barrier."



A section of the old Donner road, graded in 1923 and 1924, showing the rocky terrain. Asphalt surfacing was placed in the 1930's. Later, turnout and passing lanes were added.

#### Cold Stream Route

In the following few years, Argonauts used the Cold Stream route south of Donner Lake, which was not quite so rough, but bad enough.

The tragic fate of the Donner party in 1846 was further testimony to the fearsomeness of this part of the Sierra.

But a rocky wagon road was gradually hacked around the boulders and, following selection of this pass as a railroad route, it was opened as a toll road from the railhead at Clipper Gap, near Applegate, to Virginia City. It was used heavily for about five years. However, completion of the railroad threw it into virtual disuse for the next 40 years.

The automobile began to exert its initial influence at the turn of the century, and in 1909 the State Legislature voted funds for the road's improvement.

But little was done until 1923 when a new line was developed north of the original road, once again along the north shore of the lake. In the 1930's it was paved. Turnout and passing lanes were added. Other relocations

followed on the west side of the summit.

It is this route that has now been bypassed or wiped out by the spectacular new Interstate 80 freeway.

Actually, a few traces of the original pioneer road are still visible, especially in the Cisco Grove area and near the foot of the old Donner Grade.

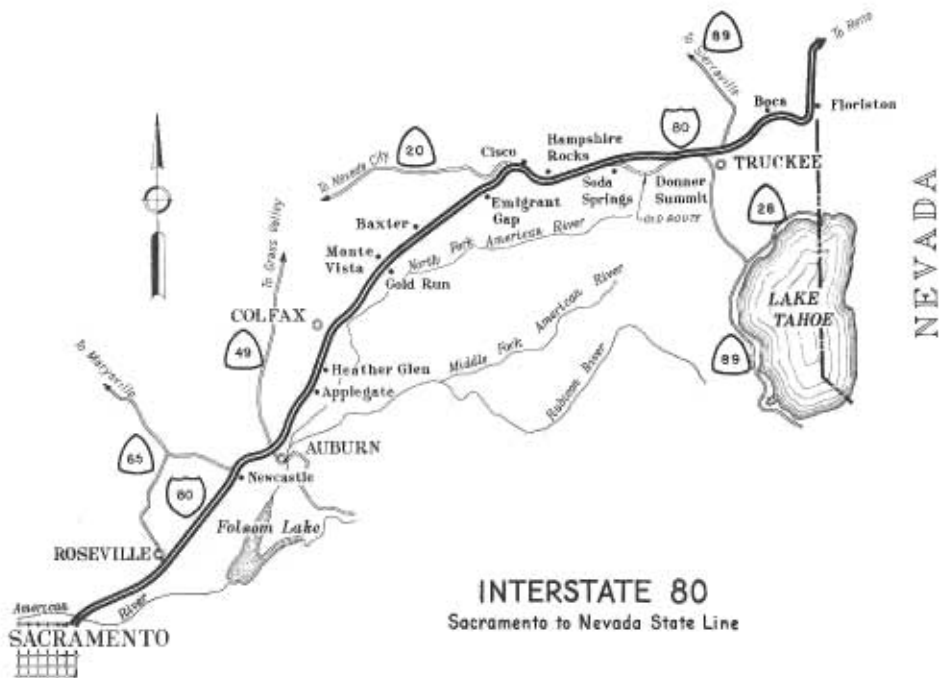
#### First Auto Trip

According to one newspaper report, the first auto trip over the summit and return was accomplished by a car dealer in the early 1920's. From Auburn to the summit took two days.

It was in 1931 that the state first undertook snow removal operations in an effort to keep the road open all year. Previously, of course, it was blocked every winter.

The new summit freeway design will eliminate many winter traffic tie-ups and delays—in fact already has—such as those caused by skidding vehicles, jackknifing truck-trailers and by vehicles unable to move after stopping.

To further minimize snow removal difficulties, flat cut slopes in drift



NEVADA

A map showing the location of the now continuous 115-mile freeway and expressway route from Sacramento to the Nevada state line.

areas are used with sufficient right-of-way and median width to permit at least a 100-foot throw either right or left of both sets of lanes.

Nevertheless, some traffic delays due to closures can be expected—and

have occurred—because of zero visibility during blizzards.

Even though the district's experienced snow removal crews may be able to maintain a passageway to reach and clear drifts, it is sometimes neces-

sary to stop traffic until visibility permits safe driving.

Under severe conditions, such as those experienced last November and during the holiday season, visibility becomes so bad that even the rotary plow operators cannot see to complete their work.

**Included in Scenic System**

This dramatic route has been included in the recently created scenic highway system and will continue to receive priority treatment in retaining its natural environment and inherent beauty.

To recap the final three construction projects—they totaled some 22½ miles at a construction cost of \$25,500,000.

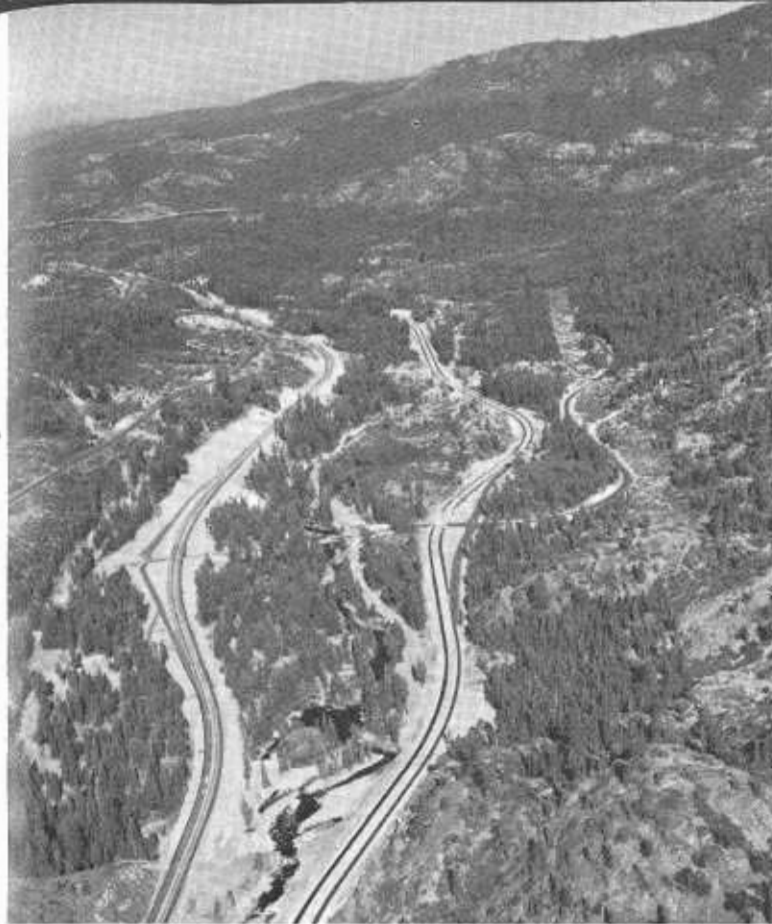
The 12 miles between Emigrant Gap and Hampshire Rocks (see map) was built under two contracts. The 5½-mile section from Emigrant Gap to the junction of State Highway 20 was completed October 2 by Guy F. Atkinson Co. at a cost of \$8,700,000.

The adjoining Cisco Grove project, from the Highway 20 interchange to Hampshire Rocks, was finished November 11 by the joint venture firm of Fredrickson & Watson, Granite

PHOTO BELOW, LEFT—Emigrant Gap on new Interstate 80 looking east. The observation point (foreground) overlooks Bear Valley. It was at this site that Forty-niners dropped their wagons by rope to the valley (left). Highway design engineers had to solve a complex problem here, where room had to be found along a narrow mountain ridge to accommodate the old highway, the new freeway, utility lines and a double set of railroad tracks. To accomplish this they reduced the median width and built a concrete tunnel for trains which underpasses the freeway (lower center). PHOTO RIGHT—An aerial, looking west, of the new summit area of I-80 in the vicinity of West Lakes. Rest areas can be seen on each side of the freeway in the middleground.







This photo shows the unusual median on the new I-80 freeway in the Cisco Grove area (see story). The river is the South Yuba.



Aerial looking northeast from above Soda Springs. The old highway paralleling railroad (right) will remain in service as access to ski resorts.

Construction Co., and Briggs, Conley & Dennis & Son at cost of just over \$12,000,000, the largest contract completed in District 3 to date.

The Emigrant Gap-Highway 20 job involved moving 2,500,000 cubic yards of roadway excavation, production of 487,000 tons of aggregate, placement of 35,000 square yards of cement concrete pavement, and construction of five reinforced concrete structures including interchanges east of Emigrant Gap, at Yuba Gap, and at Highway 20.

#### Glacial Deposit Furnishes Material

More than 80 percent of the excavation was drilled, blasted, and moved with shovels. Aggregate base and subbase, and the asphaltic concrete used for paving shoulders and ramps, was produced from a glacial deposit two miles south of the center of the project.

Approximately 75 percent of the concrete for the traveled way was placed with side forms and the remainder by the slipform method. Most of it, about 80 percent, was centrally mixed.

On the ridge at Emigrant Gap, at the site formerly occupied by Nyack Lodge, a vista point was built overlooking the lush Bear Valley below on the north. It was also near here that some of the earliest pioneers lowered their wagons over the sharp drop into the valley for the journey down the Bear River to Camp Far West near Wheatland, then on to Sutter's Fort.

Except for the short distance between Emigrant Gap and Carpenters Flat, one or the other set of opposing lanes overlapped the old road.

Construction procedure was to build one set of lanes and switch two-way traffic onto them, so that motorists were using portions of the new highway most of the length of the contract.

On a two-mile eastbound section east of Carpenters Flat, a third lane was added to the upgrade for trucks and other slow-moving vehicles.

#### Eastbound Lanes Built First

On the adjoining Highway 20-Hampshire Rocks job, the eastbound lanes were built first and the westerly

4½ miles were opened to two-way traffic in September 1963, the remainder in September 1964. Westbound lanes were opened and the entire 6.8 miles were put into full operation on October 21.

Most of the 2,225,000 cubic yards of roadway excavation here was granite, granodiorite, and quartzite. Blasts of up to 10 tons of powder were not uncommon in the reduction of rock for removal by 2½- to 5-cubic-yard buckets.

Aggregate base and subbase were hauled an average of 20 miles, a portion of the haul route being the old Donner Grade. The slipform technique was used throughout and excellent riding qualities were obtained.

Fifteen bridges were built. For access to residential and recreational areas, interchanges were located at Indian Springs Road, Cisco Grove, and Hampshire Rocks. A major portion of the old road was preserved for access to summer homes and year-round recreational facilities.

Opposing lanes are actually independent roadways with varying hori-

zontal and vertical alignments. Median width ranges to over 1,000 feet at one point in the Yuba River canyon where unique conditions dictated not only that the river flow between the lanes, but that the frontage road and even private property be located there.

#### Section Is Washed Out

An unexpected additional construction project occurred in 1963 when, along with several other Sierra Nevada rivers, the South Yuba flooded January 21 under an unusual combination of weather and ground conditions. About 1,300 feet of the then-in-use US 40 near the middle of the project washed out. Extensive pavement and shoulder damage also occurred at numerous locations along the easterly four miles of the job.

With the immediately availability of the contractor's men and equipment and state engineers, and by dint of a feverish around-the-clock operation, old US 40 was restored and reopened on February 7.

This project took three construction seasons to complete, and the Emigrant Gap-Highway 20 job, four—still another testimony to the rugged nature of the high Sierra terrain where weather conditions permit only about 100 working days a year, ap-

proximately June through November—in a good year.

The new Donner Summit freeway was opened to traffic November 20 after a massive snow removal job following early and unexpectedly heavy snows and wind at the beginning of the month. Scheduled ribbon-cutting ceremonies November 1 were swamped by a snowstorm.

Actually, the project is 94 percent complete and final details will be completed this summer.

Roughly 10½ miles in length, this section was built under three contracts which will total about \$15,000,000. The first two were for major excavation, grading, and structures on the east and west slopes. The third was mainly for base and surfacing.

#### Runs North of Old Road

The project begins its 3½-mile ascent just west of Soda Springs on an alignment that, at its farthest point, runs nearly two miles north of the old road and peaks at elevation 7,239, over 100 feet higher than the former route.

After a nearly flat crossing of the summit in the West Lakes area, the split-level new route begins its seven-mile descent into the Truckee Valley on grades varying from 1½ to 6 per-

cent, to an elevation of 5,920 feet near the east end of Donner Lake in the vicinity of one of the presumed campsites of the Donner party.

Maximum upgrade is 5 percent.

Grading was completed in 1963, and a total of four million cubic yards was excavated under the two contracts and placed in embankment, the largest of which is 130 feet high and contains nearly 600,000 cubic yards of granite and andesite blasted from the highway path.

An embankment unique for a mountain highway was built just east of the new summit where it was necessary to pass the eastbound alignment through the north end of an eight-acre glacial cirque. It was set by the mud displacement method commonly used in crossing tidal flats.

At the east end of this fill, a dike had to be built on either side of the embankment and an impervious cutoff constructed below the level of the roadway prism, as well as in the fill itself, since from this point east the road begins dropping on a 6 percent grade below the mean lake level.

#### Streambed Relocated

It was also necessary to relocate the streambed of the creek which flowed from this small lake because the east-

*The freeway roadways as seen from the Yuba Gap overcrossing. Blizzards with zero visibility conditions had made it necessary to close the freeway for a short time a few days before.*



*The eastbound roadway and frontage road shortly after they had been cleared of heavy snow near Donner Summit. The westbound lane is visible part way up the slope to the right.*







A typical winter traffic queue on the old highway about one mile west of Donner Summit.



Graders remove snow after the big storm of 1952 on the old Donner Grade about halfway up the east slope near Big Shot.

bound alignment followed the creek channel for about 800 feet to a point below a 30-foot waterfall.

At first glance the nature of the country, mostly granite and andesite, might indicate that little trouble would be encountered with subsurface drainage. However, due to snow melt percolating into pockets of decomposed granite and glacial till, it was necessary to use 37,000 feet of perforated metal pipe to prevent ground water and seepage from damaging the roadway.

This was nearly twice the linear footage of pipe needed to handle surface runoff.

The eight-inch cement concrete slab for the traveled way was placed on four inches of cement-treated base and 12 inches of aggregate sub-base by a slipform paver. All downgrades were paved a standard 24-foot width. A 36-foot slab was poured on maximum 5-percent uphill grades to provide an extra lane with 3-percent maximum superelevation for slow, heavy vehicles.

A total of 135,726 barrels of cement were used, of which 117,000 were converted into 336,690 square yards of concrete paving—nearly 70 acres.

#### Six Major Structures

Six major structures were built. Three are reinforced concrete bridges, two composite, and one is a 15' x 15' reinforced concrete box culvert which

carries the South Yuba under the highway near the west end of the project.

The longest and highest is the composite bridge for the westbound lanes of the Donner Lake interchange which serves the business and residential area at the foot of the Sierra around the western end of Donner Lake. It is 273 feet long, provides a roadway width of 91 feet, and is 64 feet above the undercrossing road which runs down to connect with the old highway on the lakeshore. It is 490 feet above the lake while the old route directly below is only 12 feet above mean lake level and just beginning its westerly circuitous climb up the forbidding Sierra.

Contractor for the base and paving contract was the joint venture of R. A. Westbrook, Inc., and Morrison-Knudsen Co.

Lee Hawkes was resident engineer. Construction engineer was Don M. Young.

For the Emigrant Gap-Highway 20 job, Hal Lopez was resident engineer. On the next-door Cisco Grove project, the resident was K. C. Jones. Don Hislop was construction engineer for both.

E. L. Miller was assistant district engineer—operations.

District engineer during most of the construction was Alan S. Hart, now head of District 4 (San Francisco). He was succeeded in District 3 by W. L. Warren in July 1964.

#### Several Projects Remain

Although the tough and exacting jobs of planning, designing, and construction in punching a modern highway over the once-impossible Sierra have been nearly completed, several projects yet remain to bring the entire Sacramento-Nevada line route to full interstate standards.

Finished in 1956, before the federal interstate program went into effect, the 13 miles from Auburn northeast to Illinoistown, near Colfax, is an expressway requiring 12 interchanges to eliminate grade crossings.

Bids were opened February 17 for interchanges at Heather Glenn and Illinoistown, which will add nearly six miles of freeway to this section since there is already one at Weimar, located between these two sites. The other locations will be built as funds become available in the next few years.

Also, as part of the interstate program, the existing freeway between Sacramento and the vicinity of Colfax will be widened to six and eight lanes.

In January, a public hearing was held by the district to present studies for a proposed additional eight-lane freeway in the corridor between the American River and Del Paso Park—an eight-mile stretch in the northeastern Sacramento area. The proposal will be presented to the California Highway Commission later this year.

# I-80 in Solano County

By HERMAN R. JENTZEN, Resident Engineer



Interstate 80 (formerly US 40) is one of the transcontinental highways of a nationwide system scheduled to be completed by 1972.

This heavily traveled road traverses the entire width of the state, a distance of 210 miles, from San Francisco to the Nevada state line just west of Reno.

All of the 44-mile section of Interstate 80 in Solano County is located in District 10. When the last of the three projects currently under construction is completed in October, the district will be more than 80 percent through its schedule of meeting the 1972 interstate deadline.

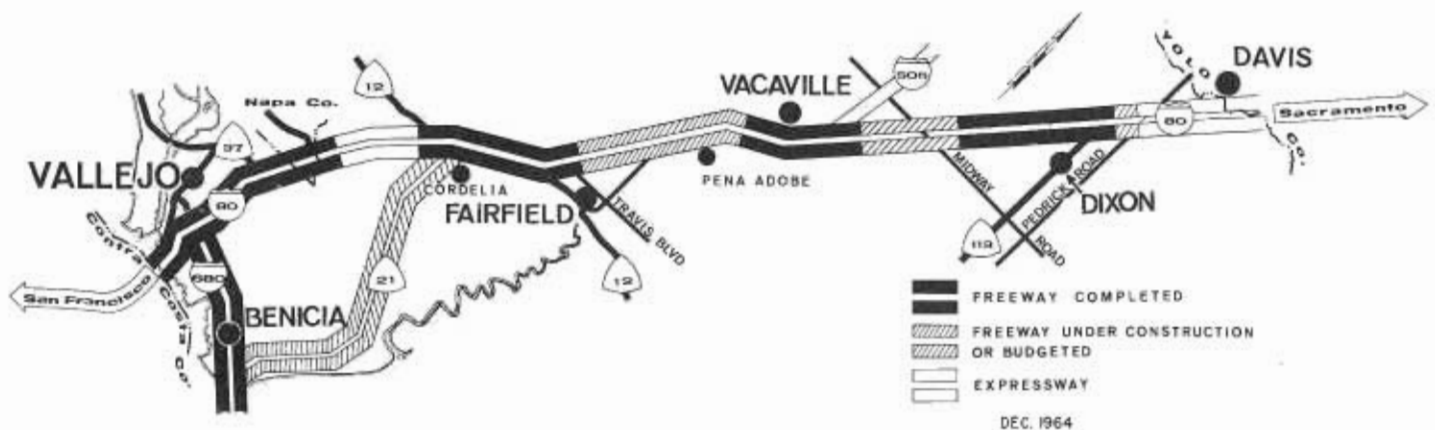
This route is of historical importance, since it was traveled by thousands of Forty-niners in settling California. It was first surveyed for a wagon road in 1860 and its development since then has been relatively continuous. It became a part of the state highway system when it was established in 1912. The original paving of this road in Solano County began in 1914 and was completed in 1917.



Looking east on Interstate 80 (then US 40; this photo was taken in 1943) toward the signalized intersection at Benicia Road in Vallejo.

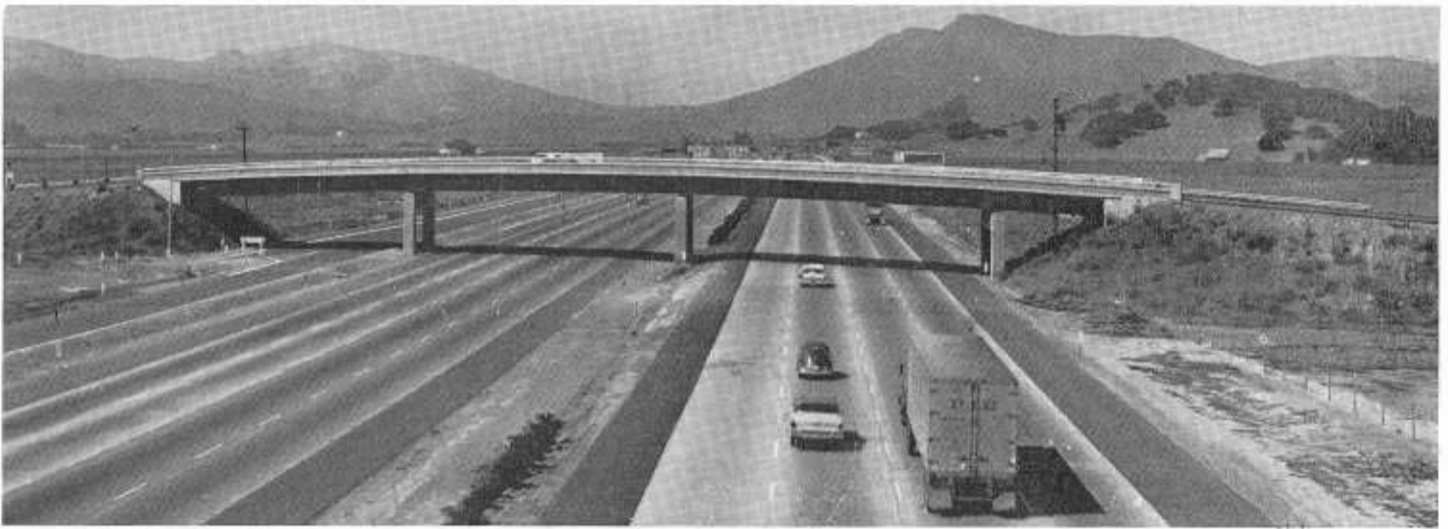


Interstate 80 traffic now speeds safely toward Sacramento over Interstate 680 (foreground) and under Benicia Road (background) near Cordelia.

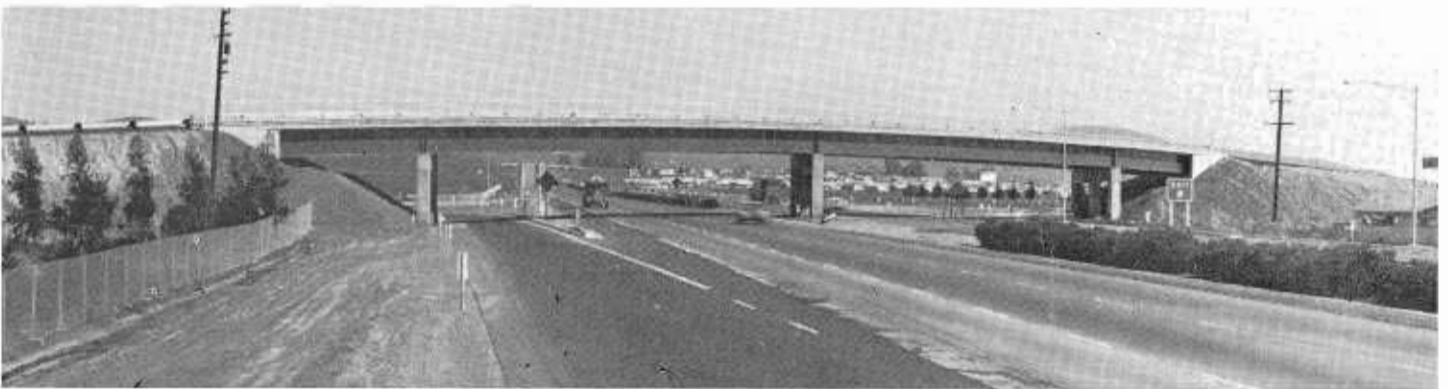


This map shows current construction status of Interstate 80 through Solano County.





*Interstate 80 traffic heads toward San Francisco under Green Valley Road near Cordelia.*



*Traffic to Travis Air Force Base near Fairfield now travels over Interstate 80 on the overcrossings at Travis Boulevard (foreground) and the Air Base Parkway, farther north.*



*Looking east toward the Nut Tree on the left of Interstate 80.*



In 1937 looking toward Vacaville, formerly Route 7 and which twisted through Vaca Valley, has been realigned and reconstructed as Interstate 80 freeway.



The site of the Pena Adobe built in 1842 by the Pena-Vaca families on Rancho Los Putas. Interstate 80 is to the left of the photo.

Portions of the original pavement laid in 1914 are still in service on the old two-lane road, known then as Route 7, in the vicinity of Cordelia. No major realignment or grading work was performed on this section of highway for about 15 years, however, efficient maintenance kept it in good condition.

Between 1932 and 1940, major improvements continued with an emphasis toward realignment. About \$7,200,000 was spent between 1941 and 1956 to convert Interstate 80 from a two-lane road to four-lane expressway standards. Since 1957, construction has been accelerated to convert this interstate highway from expressway to full freeway standards, with all construction providing for an ultimate six or eight traffic lanes.

Since the last progress report on Interstate 80 in Solano County (in the May-June 1963 issue of *California Highways and Public Works*), two contracts have been completed, adding 13.9 miles of full freeway at a cost of about \$8,500,000. Three more construction contracts totaling approximately \$8,300,000 are currently in progress and their completion will add another 12 miles of full freeway.

#### Dixon Project

The first of the two recently completed contracts consisted of widening seven miles of the existing four-lane divided highway to six lanes, between Midway Road and a mile east of the Sign Route 113 interchange, near the Milk Farm Restaurant, about two miles north of Dixon.

This project was awarded to Fredrickson and Watson Construction Company in January 1962, and was completed in December 1963 at a cost of \$2,600,000. Merle Larrabee was the resident engineer for the state. The 1965-66 fiscal year budget contains \$70,000 to install functional planting and trees along this section.

#### Vacaville Project

Last October the other contract was completed. This project converted an existing four-lane divided highway to a six-lane freeway, for a distance of five miles between two miles southwest of the City of Vacaville and one mile northeast of the junction with In-



terstate 505, near the Nut Tree Restaurant.

This project required the construction of 17 major structures and related frontage roads with the necessary connecting ramps. Completion of this project eliminated two railroad grade crossings and several at-grade intersections.

The major problem encountered during construction was providing adequate pavement area for the 30,000 vehicles which use this highway daily.

Eight detours were constructed during the various stages of this project. It was even found necessary on one occasion to provide a temporary detour in order to construct a primary detour. These items alone cost \$80,000.

A new highly efficient slipform paving method expedited the completion of a major portion of the concrete paving. A Guntert and Zimmerman slipform paver placed both a 24-foot and a 36-foot pavement in one pass while automatically installing tie bars at 30-inch intervals and placing a plastic strip to form the longitudinal weakened plane joints.

This project was awarded in November 1961 to Gordon H. Ball and Syar and Harms, and was completed at a total cost of \$5.73 million. The state engineers for the project were G. W. Thompson, Bridge Department representative, and the author was the resident engineer.

The 1965-66 fiscal year budget also allocated \$100,000 to install functional planting and trees along 4.4 miles of this project. It is anticipated that this contract will be advertised for bids in the spring.

#### Fairfield to Vacaville

Last July, work began on an estimated \$5,300,000 project to convert another section of Interstate 80 from a four-lane expressway to a full freeway for a distance of 7.1 miles from the Travis Boulevard Overcrossing in Fairfield to Vacaville. This project, which is approximately 30 percent complete, also includes the reconstruction of the Air Base Parkway Overcrossing and the construction of interchanges at the intersection of Texas Street, Cherry Glen and Pleasants Valley Roads.



Construction on Interstate 80. The dirt fill (middleground) is the Meridian Road overcrossing. In the background is the P.G. & E.'s Vacaville substation.



The substructure of the Pedrick Road overcrossing near Dixon on Interstate 80.



An unusual feature of this project was the necessary relocation of a small private cemetery which dated back to the Mexican occupation and contained the graves of several Solano County pioneers. This cemetery was relocated near the Peña Adobe, a California historical landmark about two miles south of Vacaville adjacent to Interstate 80. This historical landmark identifies the site where an adobe house was constructed in 1842, by the Peña-Vaca families on Rancho Los Puntos, and acknowledges the establishment of the "Town of Vacaville" in 1851.

This construction project was awarded last June to Gordon H. Ball and Syar and Harms and it is anticipated that construction will be completed in December 1965. Jerry A. Hanto is the state's resident engineer.

#### Vacaville to Dixon

Construction also began last July on another project for freeway conversion, extending 3.7 miles between one mile east of the junction with Interstate 505 and the Midway Road Overcrossing. Two concrete lanes will be added to the existing four-lane divided highway to provide six lanes of traveled way. This project also includes the construction of frontage roads; in-



*This grade separation carries Dixon-Grant Road traffic over Interstate 80.*

terchanges at Leisure Town, Meridian and Midway Roads; and a bridge at Gibson Canyon Creek.

This project, also about 30 percent complete, was awarded to Gordon H. Ball and Syar and Harms last August

and should be completed in September at an estimated cost of \$2,200,000. William F. Birt is resident engineer for the state.

#### Pedrick Road

The third project under construction consists of converting about one mile of four-lane expressway to a six-lane freeway and the building of an interchange at Pedrick Road, where an at-grade intersection had been the scene of numerous fatal accidents. Construction of this interchange is almost complete.

This project was awarded to the Granite Construction Company last May and the estimated cost of construction is \$792,000. William H. Gilmore is the resident engineer.

#### Future Planning

The remaining two sections of the 8.2 miles of expressway to be converted to full freeway standards in Solano County, before 1972, are in the planning and design stages. One section extends 3.9 miles from the Napa County line to the junction of Sign Route 12 in the vicinity of Cordelia. The other section runs from Pedrick Road to the Yolo county line, a distance of 4.3 miles. The estimated total cost for the completion of these projects is approximately \$10,000,000.



*When Interstate 80 is widened near the Yolo County Line, this at-grade intersection adjacent to the University of California Davis campus will be eliminated.*



# Vista to Escondido

Key Route 78 Link Completed In South

By M. A. CHASE, District Design Engineer



DISTRICT  
**11**

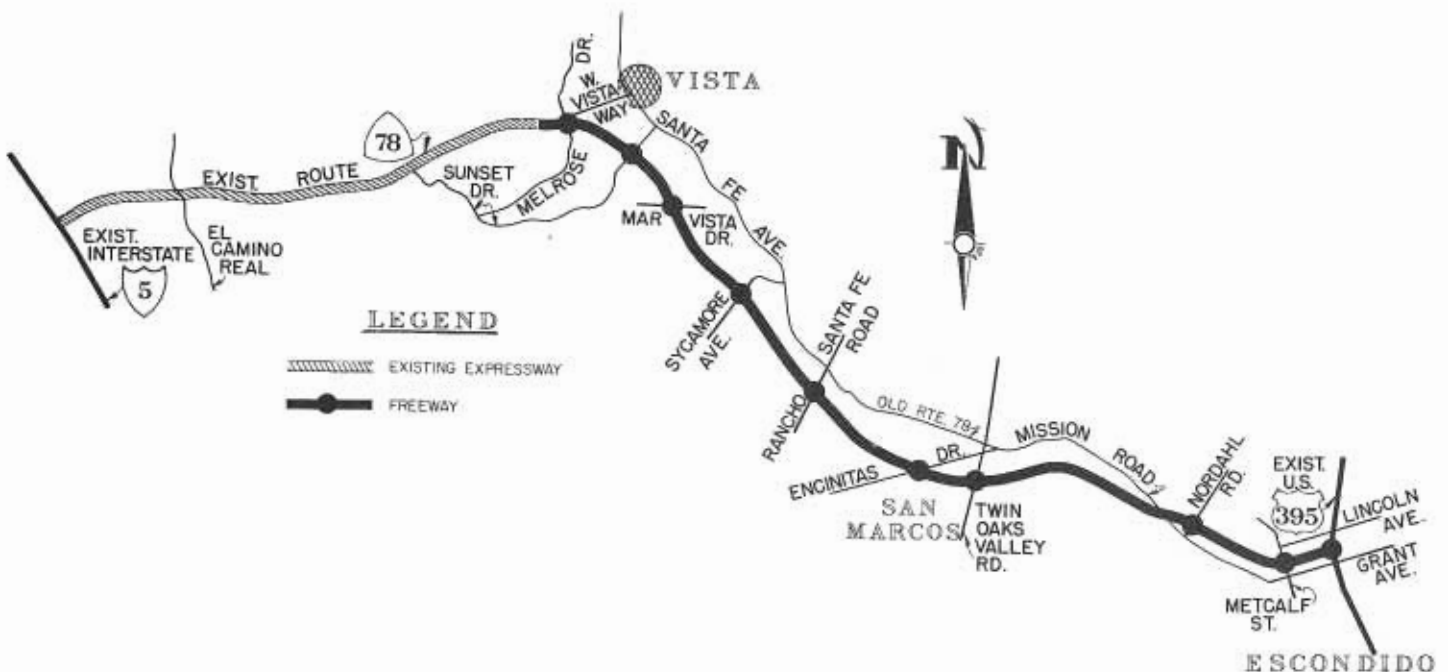
In December 1964, the final freeway link between Vista and Escondido was completed. A dedication ceremony was held on the Metcalf Street Overcrossing in Escondido on

December 21. This long-awaited event culminated approximately 10 years of planning and construction.

Freeway development through this area is acknowledged as a major contributing factor to the economic growth of the section. Until quite recently the area was mainly agricultural, noted for its large poultry ranches and dairies. The specifications for the first freeway construction unit even directed the contractor's attention to possible adverse effects on poultry caused by construction operations. Fortunately, there is no record of any.



The completed section of Route 78 Freeway looking east from the Mar Vista Overcrossing.





Looking south from Encinitas Road Undercrossing. Escondido is at the top of the picture. Large white buildings in upper right are a poultry ranch.

#### Other Developments

Roughly coinciding with freeway construction have been several other developments, two of which are the Lake San Marcos community and the expansion of Palomar Junior College. The Lake San Marcos development is a \$12,000,000 residential and resort community built around an 80-acre manmade lake and an 18-hole golf course. Palomar Junior College has an enrollment of more than 2,000 students and is claimed by the San Marcos Chamber of Commerce to be California's fastest growing junior college. The college has achieved the distinction of being a landmark because of its geodesic-domed gymnasium which is visible for many miles.

#### Area Growth

A further indication of the growth of the area is typified by the increase in population of San Marcos from 518 in 1956 to 5,000 in 1961. The City of San Marcos was incorporated in 1963.

The total of 12.4 miles of four-lane full freeway between Melrose Drive in Vista and Route 395 in Escondido was constructed under three separate contracts at a total cost of \$9,294,000. The V. R. Dennis Construction Company handled the first unit between Rancho Santa Fe Road and Nordahl Road. This 5.4-mile section was completed in April 1962 at a cost of \$3,231,000. The second contract between 1.0 mile west of Vista and Rancho Santa Fe Road, a length of 5.1 miles, was completed in February 1963 at a cost of \$4,199,000. The contractors were the Riha Construction Company and the C. W. McGrath Enterprises. The third and final section covers the 1.9 miles between Nordahl Road and Route 395. The contractor was Pentaco-Rados and the estimated construction cost \$1,864,000.

#### All in Freeway System

All of Route 78, which extends from Route 5 in Oceanside to Route 10 near Blythe in Riverside County, is in the California freeway and expressway system. The section, however, between Vista and Escondido is the only part that has been completed to full freeway standards. Expansion to full freeway status of the expressway portion between Oceanside and Vista is now under study.



# Underpasses Replaced

By P. C. WARRINER and W. T. EGLOFF, Associate Bridge Engineers



DISTRICT  
3

Two recent bridge construction projects in District 3 have replaced old, and long outmoded, railroad underpasses with new, modern structures. Construction was performed under

two contracts, one on Route 20 in Marysville, and the other on Route 49 in Auburn.

These projects were similar in many respects. In each case a troublesome traffic problem was eliminated. The "bottleneck" in each case was an old railroad underpass which, although still structurally adequate, no longer accommodated highway traffic satisfactorily. Both projects were located in cities with rich histories. Each project required careful planning and con-

struction, since Southern Pacific Company mainline tracks had to be shifted from old to new structures without interruption of heavy rail traffic.

## EAST MARYSVILLE UNDERPASS

Route 20 leads east from Marysville toward the foothills and the cities of Grass Valley and Nevada City. This highway generally follows the route which has linked Marysville with the gold country for many years.

In East Marysville, the road to Grass Valley was, and still is, 12th Street. The first railroad in the area (originally the California Northern Railroad, it later became part of the Southern Pacific system) stretched from Marysville to Oroville and crossed 12th Street at A Street.

For many years the highway and railroad crossed at grade. In 1910 it

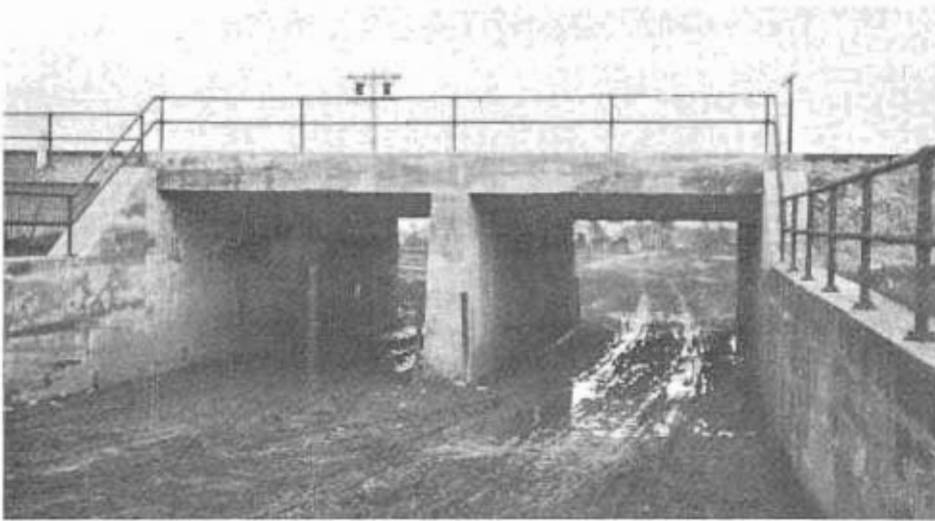
was decided to elevate the railroad tracks in Marysville. Railroad forces constructed an underpass at 12th Street as a part of the project. The railroad bridge consisted of massive, unreinforced concrete abutments and center pier spanned with closely spaced, concrete-encased steel beams. The underpass provided 12th Street with two 15-foot roadways. Vertical clearance was 9 feet 11 inches. The structure, known as the East Marysville Underpass, was completed in 1911.

### Included in State System

In 1933 the Grass Valley road and the East Marysville Underpass became a part of the state highway system. As highway traffic increased and vehicle size grew, the underpass gradually changed from an occasional nuisance to a notorious bottleneck and hazard. Truck traffic had to be routed over a



The new East Marysville Underpass on Route 20 carries four lanes of traffic under the Southern Pacific railroad tracks and has a vertical clearance of 15 feet 1 inch.



*This Southern Pacific photo of the old East Marysville Underpass was taken shortly after its construction in 1911.*

grade crossing on 10th Street. The underpass became the lowest in the state highway system. Local residents were well aware of the situation, but many "foreign" drivers failed to note impaired clearance signs and encountered a structure through which they could not pass.

The heart of the reconstruction plan was elimination of the railroad's existing switchyard, and its replacement north of the underpass site. The old switchyard had extended from 8th Street to north of 12th Street. Four tracks, two of which were switching tracks, had been carried by the old railroad bridge. Several city streets had grade crossings through the yard and switching frequently blocked traffic for long periods. Elimination of the old yard and its relocation produced the following desirable results:

1. The new railroad bridge could be designed to accommodate two rather than four tracks—so structure costs were greatly reduced.
2. Local city traffic would not be delayed by railroad switching operations (there are no city streets in the new yard area).
3. No expensive temporary shoofly construction was necessary, as the railroad was kept in service by a series of relatively simple track changes. The old bridge, because of the greater number of tracks, was much wider than its replacement. The extra width

provided enough room to allow passage of rail traffic over a portion of the old bridge while the remainder of it was removed. The new structure was constructed in space provided by this removal.

4. Material obtained from the underpass excavation could be utilized to construct a portion of the new railroad switching area and thus did not have to be wasted.

The new structure consists of a riveted steel through plate girder bridge. It provides a vertical clearance of 15 feet 1 inch and a clear span over the four-lane highway. Reinforced

concrete retaining walls form the sides of the underpass. The pavement is eight inches of concrete over cement-treated base. A pumping plant transports drainage water out of the depressed roadway.

#### **Built in 15 Months**

Construction of the new underpass was accomplished in approximately 15 months. A prearranged sequence of operations was necessary in order that rail, highway, and local traffic could be maintained at all times.

The first phase of construction work entailed building a part of the new railroad switching yard. When this yard was completed and in service, 12th Street was closed and Route 20 traffic detoured over the truck route on 10th Street. Rail traffic was then using only one track on the old bridge, the most easterly. A heavy steel sheet pile retaining wall was installed parallel to this track and as close to it as train safety permitted. The sheet pile wall kept the live track safely in place while the contractor removed the westerly two-thirds of the old bridge. The area inside the sheet pile wall was excavated to 26 feet below track elevation. The new structure was completed within the limited space afforded by the excavation, and rail traffic was routed onto the new bridge. Finally the remainder of the old bridge was demolished and the underpass walls and roadway on 12th Street were completed.



*This photo of the old East Auburn Underpass is dated December 15, 1914. The view is eastward.*





The new East Auburn Underpass is a two-span reinforced concrete box girder bridge over a four-lane highway. It was constructed on new alignment.

### EAST AUBURN UNDERPASS

The East Auburn Underpass is located on Highway 49 in the City of Auburn, and carries the Southern Pacific Company westbound tracks over the highway.

Highway 49 is a scenic highway through the Mother Lode country and in this area runs from Grass Valley to the north through Auburn and to Placerville in the east. Auburn is a foothill or mountain city where the streets generally follow the path of least resistance and are randomly located.

The city is divided into several sections by the mountainous terrain, the Interstate 80 Freeway and the Southern Pacific Company railroad tracks. Highway 49 traffic plus all local traffic from the main business section of the city to the subdivisions and businesses to the east normally pass through the East Auburn Underpass. Traffic is heavy and much of it is truck traffic, including many logging trucks.

#### Was Traffic Bottleneck

Because the existing underpass had a roadway width of only 18' 9", was on poor alignment and had heavily used cross streets on each side, it is not difficult to see that it was both dangerous and a traffic bottleneck. It

had become a one-way street, with the drivers waiting at the entrance until opposing traffic had cleared before entering.

The history of the old road and underpass is rather obscure. The railroad fill at the site of the underpass was placed as part of the first transcontinental railroad by the Central Pacific Railroad Company under the supervision of Charles Crocker in 1865. Early traffic probably used the grade crossing at Forest Hill Avenue, just one block north of the underpass. This grade crossing, although in use until the new underpass was completed, was dangerous, being immediately adjacent to a railroad cut.

In 1905 the Southern Pacific Company constructed the underpass at its present site. This underpass consisted of granite rubble abutments with timber stringers to carry the tracks. Sometime around 1925 the timber stringers were replaced by steel girders. This structure remained in use until completion of the new underpass structure, when it was removed. It is interesting to note that although these granite abutments were placed with very little mortar, the stones were so well seated that it became impractical to dislodge them with a large bulldozer and dynamite was used to separate them for removal.

#### Old Underpass Replaced

Last year the old underpass was replaced by a new modern structure and Highway 49 was widened to four lanes through the structure. The new underpass is a two-span reinforced concrete box girder bridge with reinforced concrete pier, abutments and wingwalls, all supported on steel bearing piles. It carries two tracks over the highway. This was the first reinforced concrete structure designed and constructed by the state to carry mainline railroad tracks.

To make this improvement with a minimum of interference to rail traffic, the new underpass was constructed on new alignment, and new fills were placed. Tracks were shifted to the new alignment, the existing underpass and fills were removed and the roadway under was constructed.

The new alignment for the railroad was so close to that of the existing one that construction of the new underpass did not proceed as simply as it had been planned. It was necessary to place shoring to maintain the existing railroad embankment before the excavation for the new structure could be completed. The contractor used sheet piling for this shoring. At the north abutment timber walers and braces were used. At the south abutment



steel walers were used with steel tension rod ties through the existing fill. Anchorage for these ties consisted of additional sheet piling set in place behind a low granite rubble wall. Backfill material capped with concrete was also placed behind these piles.

#### Southeast Wingwall

The southeast wingwall actually extended out into the existing mainline track and was designated on the plans as stage two construction, to be built after the tracks had been moved to the new structure. To have moved both tracks to the new structure simultaneously would have required that additional shoring be used to maintain the new fill while this wingwall was being constructed. With the permission of the Southern Pacific Company, the mainline track was moved to the new alignment, the wingwall was completed, backfill placed and then the siding track was moved to the new alignment.

Before work could begin on the underpass, it was necessary to provide a detour for traffic and relocate the Boardman Canal. This canal, owned by the P.G. & E. Company, supplies water to a large area below Auburn and can only be stopped for a few hours and then only during the slack season. The detour was provided by widening and paving existing city streets. As a part of the widening it was necessary to remove an old house and widen a culvert over Boardman Canal. The relocated canal consisted of a concrete-lined ditch on a fill, except at the widened Highway 49 where it consisted of a 48" reinforced concrete pipe siphon with reinforced concrete inlet and outlet structures.

\* \* \*

Both the East Marysville Underpass and the East Auburn Underpass were constructed by A. Teichert & Son, Inc., contractor. The job superintendents were Ray Bertelsen in Marysville and Jack Malte in Auburn.

The East Marysville Underpass was completed at a cost of approximately \$650,000. The East Auburn Underpass was completed at a cost of approximately \$350,000. The major portion of the construction was financed

## STATE'S HIGHEST VALOR AWARD FOR FRED BOUCHER



**PROUD FAMILY**—They have reason to be proud of him—he has reason to be proud of them. On December 15 when Fred Boucher received his Medal of Valor Pin with Diamond, here's how the family lined up: from right to left, father Fred, his wife Dolly, and "down the scale" are Jim, Sue, Annette, Dawn and Joni. They stand ahead of the plaque on which are inscribed the names of employees who have been honored for acts of heroism extending above and beyond the call of duty.

The State of California's highest award—the Medal of Valor Pin with Diamond—was presented to Fred L. Boucher, District 3 highway engineering associate, by Governor Edmund G. Brown on December 15, following the Governor's press conference in his office.

In a heroic attempt to save the life of a man trapped in an overturned pickup truck on September 26, 1963, Boucher was hurled about 20 feet by

with highway funds. The Southern Pacific Company participated in the cost at Marysville. The Southern Pacific Company, Placer County and the City of Auburn participated in the cost at Auburn.

Philip C. Warriner was the resident engineer and J. F. Loomis, the district representative on the Marysville contract. W. T. Egloff was resident engineer and Merl Coburn district representative on the Auburn contract.

an explosion. In addition to suffering numerous burns and lacerations, an eardrum was ruptured, a leg shattered, and an elbow dislocated. Boucher was en route to Coloma at the time, to inspect a construction project.

Ellis R. Lynn of Diamond Springs and Walter Hokanson of Placerville were presented with letters of appreciation by Governor Brown in recognition of their efforts at the accident scene. Hokanson was hospitalized for six days with burns, lacerations and eardrum rupture. Lynn was at a sufficient distance to escape injury, although he was knocked down by the explosion, and his clothes shredded.

Boucher was back at work as of November 12, 1963, after spending several weeks in a hospital, and several more weeks recuperating at his home in Fair Oaks. His wife and five children shared in the Medal of Valor presentation ceremony.



# Donated Trees

Gift of Palms for  
Los Angeles Freeway



DISTRICT  
7

Seven palm trees ranging in height from 20 to 40 feet were donated by the Southern California Edison Company for planting on the San Diego Freeway near Manchester Avenue and Century Boulevard.

The palm trees, which lined Pacific Coast Highway between Western Avenue and Crenshaw Boulevard, were doomed for destruction because of interference with Edison's power lines. Rather than destroy them, the company offered to uproot the trees and move them to the nearby San Diego Freeway, where a Division of Highways landscaping project is in progress.

Valley M. Knudsen, president of Los Angeles Beautiful, praised the donation as "a contribution to community beauty by private enterprise which we hope will inspire others."

Five of the trees, all queen palms, are being placed at the freeway's interchange with Century Boulevard. The other two, both Mexican fan palms, will be planted at the Manchester Avenue interchange.

The \$400,000 landscaping project runs from El Segundo Boulevard to La Tijera Boulevard and calls for placement of 1½ million ground cover plants, nearly 5,000 trees, and over 8,000 shrubs.

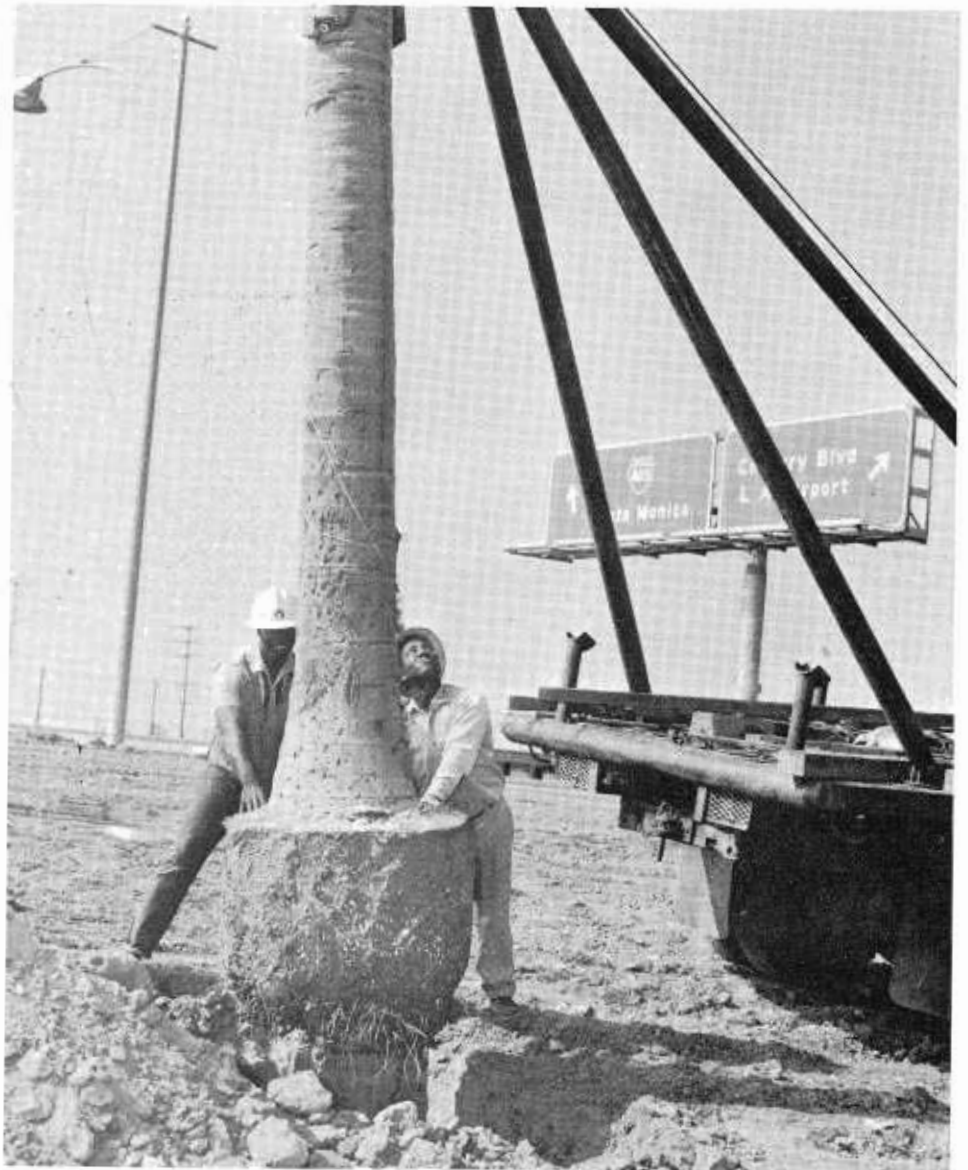


PHOTO BELOW: Looking over landscape plans (l. to r.) are Resident Engineer Harold Toohig, Division of Highways; Highway Engineer Forrest A. Norton, Bureau of Public Roads; C. E. Lee, line clearance supervisor, Southern California Edison Company; Mrs. Valley Knudsen, president, Los Angeles Beautiful; Landscape Architect James Gordon, Division of Highways.

PHOTO ABOVE: Division of Highways maintenance men place one of the palms at the San Diego Freeway-Century Boulevard Interchange. PHOTO BELOW: A palm tree being transported down Pacific Coast Highway to the San Diego Freeway.





# Routes Adopted

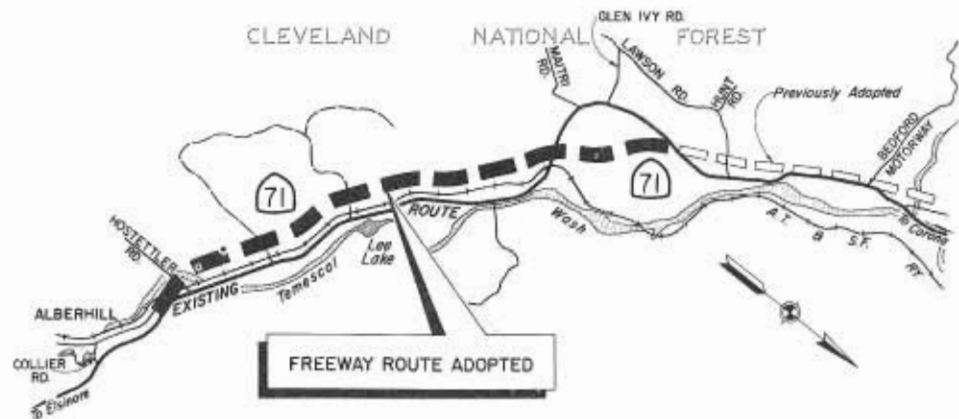
77 Miles of Freeway  
Located in Late 1964

The California Highway Commission adopted the locations for 77 miles of freeways on 10 routes at its September-December meetings.

Three of the route location studies generated sufficient local interest as to require public hearings by the commission itself. All of the route adoptions were preceded by public hearings conducted by the Division of Highways.

The most challenging task faced by the commission was the locating of three interconnected freeways in the South Pasadena-Pasadena-La Canada-Glendale and Tujunga-Sunland areas of Los Angeles County, the subject of a commission hearing in Pasadena on June 3 and 4, 1964.

The joint routing extends the Long Beach Freeway (now under construction between the San Bernardino Freeway and Valley Boulevard, and previously adopted to Huntington Drive in South Pasadena) four miles northerly to the adopted route for the Colorado Freeway in Pasadena; the Interstate 210 Freeway for 15.4 miles from this point to Wheatland Avenue in the Sunland area; and the



Glendale Freeway four-tenths mile between Verdugo and Foothill Boulevards.

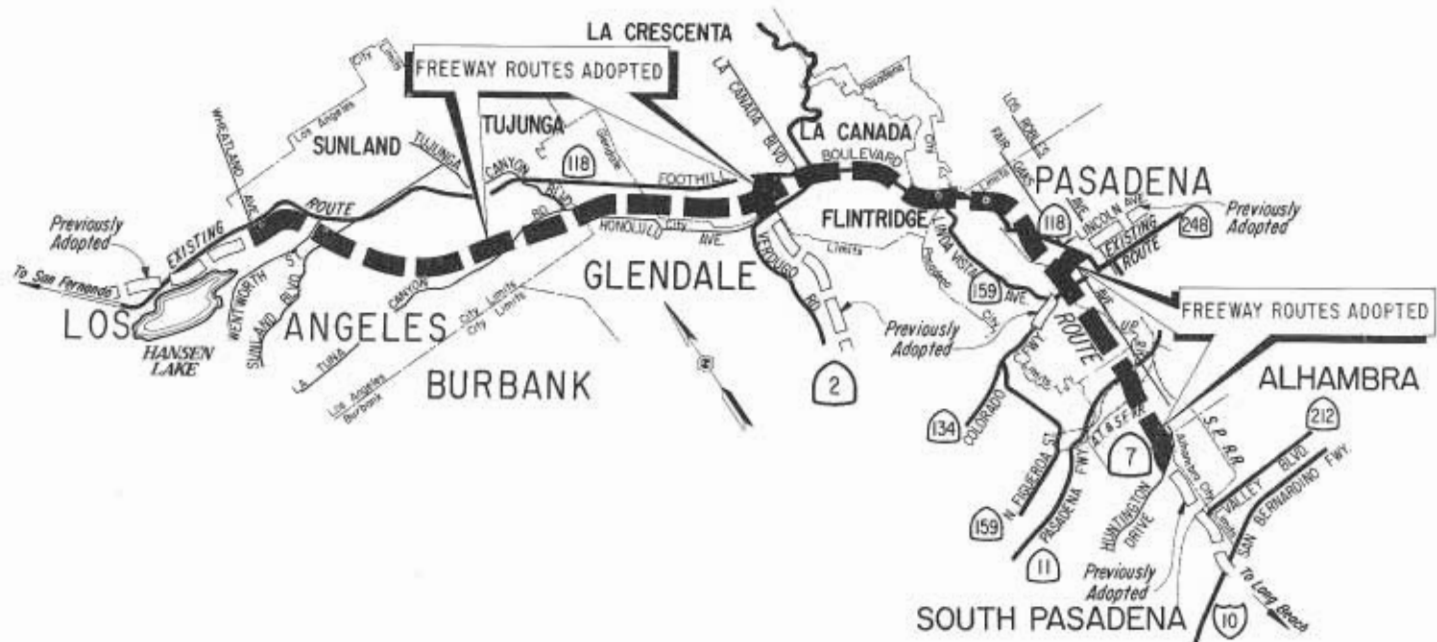
Starting at Huntington Drive, the newly adopted route continues northerly to interchange with the Pasadena and Colorado Freeways, swinging westerly just south of Devils Gate Dam and proceeding generally south of Foothill Boulevard through the Verdugo Mountains and across Big Tujunga Wash to Wheatland Avenue.

Another routing, in San Mateo County, was the subject of a commission hearing in Woodside last July 31.

The commission adopted a 1.7-mile freeway location for Route 84 between the adopted route for the Interstate 280 Freeway and Santa Cruz Avenue in Menlo Park, following the general alignment of Sand Hill Road.

In the resolution of adoption, the commission specified that the design of this freeway must conform to guides approved by the state's Advisory Committee on a Master Plan for Scenic Highways.

The third commission hearing, held in Hopland in Mendocino County on March 12, concerned the adoption of





8.7 miles of US 101 between six-tenths mile south of the Hopland Overhead and Crawford Ranch, and a short connection between this route and Lakeport Road (Route 175).

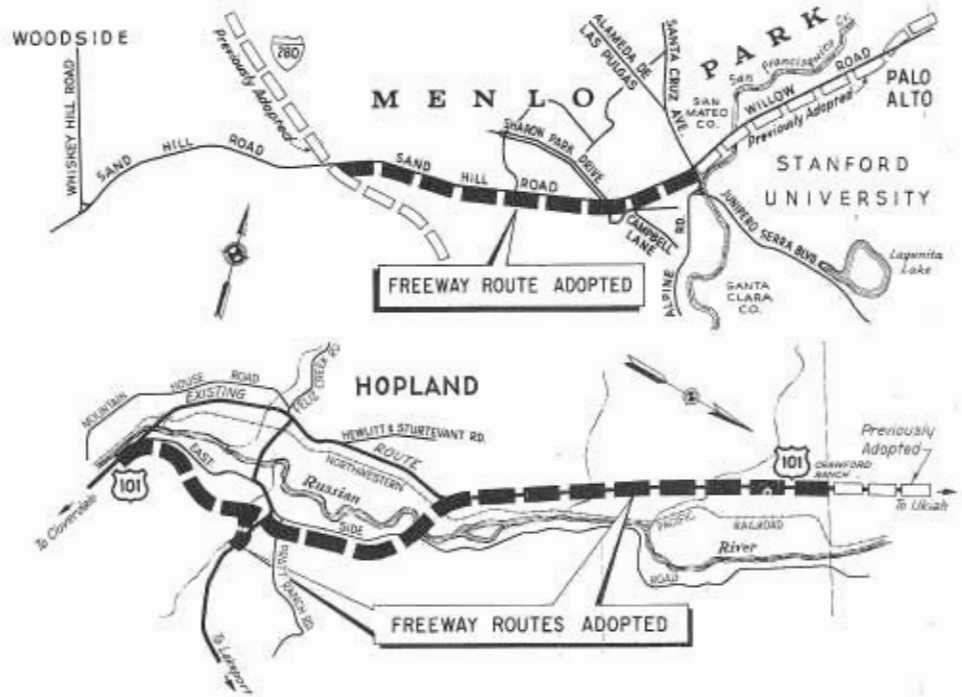
The newly adopted routing runs east of the Russian River for about four miles, then crosses the river and rejoins the existing highway, following it to Crawford Ranch, where it connects with a previously adopted routing.

In San Diego County, the commission located two freeway stretches on Route 125. One is for approximately four miles between Interstate 8 in La Mesa and two-tenths mile south of Mission Gorge Road west of El Cajon. The second extends for 8.5 miles between four-tenths mile north of the Otay River and future Route 54 in the unincorporated community of Sunnyside.

Two other route adoptions concerned Mono County, one on Route 120 (Tioga Pass Highway) and the other on US 395.

The newly adopted Route 120 extends 1.2 miles from the Lee Vining Ranger Station to a junction with US 395 southeast of Lee Vining. The 3.7-mile section of US 395 follows the general alignment of the existing highway between two-tenths mile south of Route 89 and the Nevada line.

In Ventura County, a 19.3-mile freeway routing for Route 118 was adopted between six-tenths mile west of La Vista Avenue near Saticoy and three-tenths mile east of First Street near Simi; also a 13.1-mile section of



Route 23 between three miles south of Tierra Rejada Road and the adopted route for the Route 126 Freeway near Fillmore. The three-mile segment south of Tierra Rejada Road superseded a section adopted in November 1962.

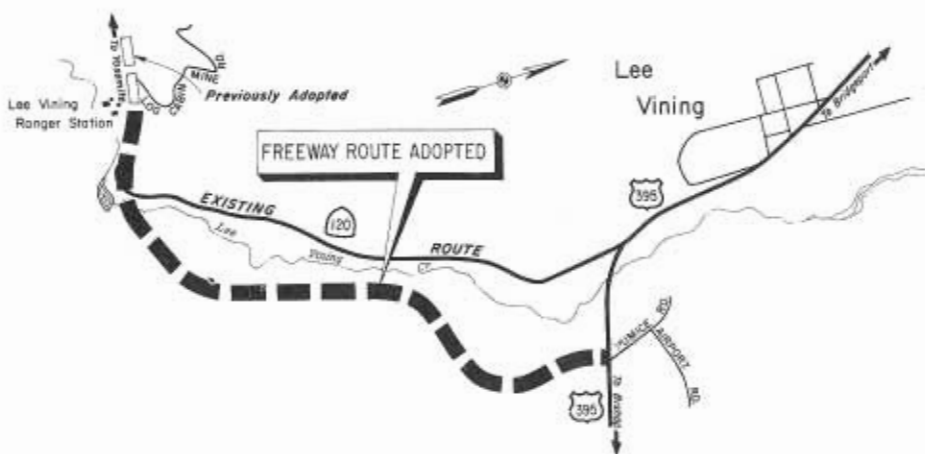
Two route adoptions during the September–December period involved revision of previously adopted freeway routings in Riverside and Colusa Counties.

The revised routing in Riverside County affected 5.5 miles of Route 71 between 1 mile north of Alberhill and 5 miles south of Corona. The revision located the freeway south of the Atchison, Topeka & Santa Fe Railway tracks for most of its length.

The commission also revised its routing for 6.6 miles of a 14-6-mile section of Interstate 5 which was adopted in October 1962.

The revised segment is in Colusa County between Maxwell–Colusa Road east of Maxwell and 1 mile north of Delevan Road, approximately 1.5 miles south of the Glenn county line. The revision will cause the freeway to cross from the east to the west side of the existing highway north, rather than south, of Wadleigh Road. From this crossing, it will proceed northerly one-fifth mile west of, rather than adjacent to, the existing highway.

In other route actions, the commission adopted 4.1 miles of local roads and streets in the Monterey–Pacific Grove area as a new section of Route 68, extending between Route 1 at the Carmel Hill Interchange and Asilomar Beach State Park; adopted a new routing for US 40 traffic in Sacramento, employing the P and Q Streets one-way couplet between 5th and 15th Streets and 3rd and 16th Streets, pending completion of the Interstate 80 Freeway through the city; and re-located seven-tenths mile of Route 49 in the Bagby area of Mariposa County, as the existing highway will be inundated by the Exchequer Reservoir, now being enlarged by the Merced Irrigation District.



# Foreign Visitors

*French, Brazilian Officials  
Inspect State's Highways*

Districts 7 (Los Angeles) and 4 (San Francisco) welcomed 150 engineers from all parts of France during September and 21 Brazilian highway engineers were guests of District 8 in San Bernardino in November.

The French visitors, most of whom represent various branches of the French government and are involved in public works activities of all kinds at home, arrived in Los Angeles directly from Paris, to begin a three-week tour of the United States which included inspection of freeways in Los Angeles and San Francisco.

Christian Gerondeau of the Ministry of Public Works and Transport, Paris, acted as advance spokesman for the group.

Following a September 9th visit to Disneyland, the French tour proceeded to San Francisco, from where they were to separate into five smaller groups, each moving eastward across the country, to meet again in Washington and New York and thence home.

The Brazilian engineers, sponsored by the Agency for International Development (AID), toured state and county highways in San Bernardino and Riverside Counties.

Aim of the visit was to observe techniques and methods used to design,



*C. V. Kane, District Engineer in San Bernardino, discusses a model of a structure with Luiz F. Moura (left) and P. F. Freitas (right), two of a group of 21 Brazilian highway engineers visiting the district.*

construct and maintain two-lane rural secondary roads. Most of Brazil's highways are of this type.

Brazil hopes to build 3,000 miles of new highways while improving 8,000 miles of existing roadways.

Members of the study team included chief engineers of Brazil's highway agencies, two professors in soil me-

chanics and highway design, and a member of the Brazilian Highway Research Council.

The group departed for St. Louis in late November, and returned to Washington, D.C., during the first week in December as guests of the Bureau of Public Roads.



*150 visiting French engineers pour out of their buses to photograph the view from the Santa Monica-San Diego Freeway Interchange, during their stay in Los Angeles.*



# Slipform Paving

New Process Brings  
Marked Cost Savings

By L. R. GILLIS, Assistant State Highway Engineer and  
L. S. SPICKELMIRE, Assistant Construction Engineer

This report was first presented at the Highway Research Board symposium on slipform concrete paving at Washington, D.C., in January 1965.

In California, slipform paving has now been used for five years, and during this period an estimated 16,000,000 square yards of pavement has been slipformed. Of the 6,000,000 square yards of concrete pavement placed in each of the last several years more than 80 percent has been slipformed. This was irrespective of terrain, geometric features, location, or relative importance of the highway routes involved.

All of our major paving contractors, except one, have now abandoned the use of sideforms in favor of slipform.

A situation occurred recently on one of our interstate projects which may be illustrative. The contractor, faced with a last-minute hiatus in his plans for placing the 1,800,000 square yards of concrete pavement, was forced to decide on one of two possible alternatives: (1) utilize two paving crews, working two 11-hour shifts, to slipform another job, then move the paver and work two 11-hour shifts to pave the principal job; or (2) pave both jobs simultaneously, using sideform equipment on the principal job. Even though he would be delayed two weeks, he selected the slipform alternative on the basis of estimated savings in excess of \$40,000.

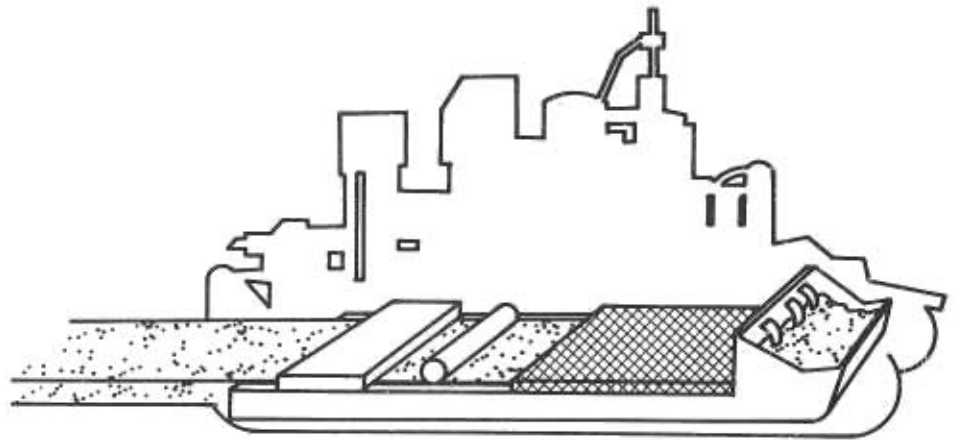


FIGURE 2—Sketch of the conforming screed slipform process.

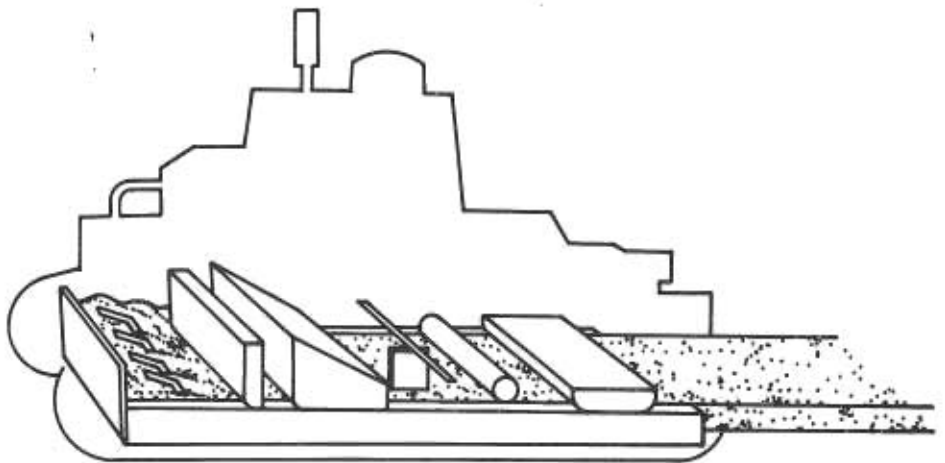


FIGURE 3—Sketch of the pressure meter slipform process.

## One of Many

This contractor is but one of many in California now able to exploit the

advantages inherent in slipform. Benefit to the highway user, as the ultimate recipient of all cost saving advances,

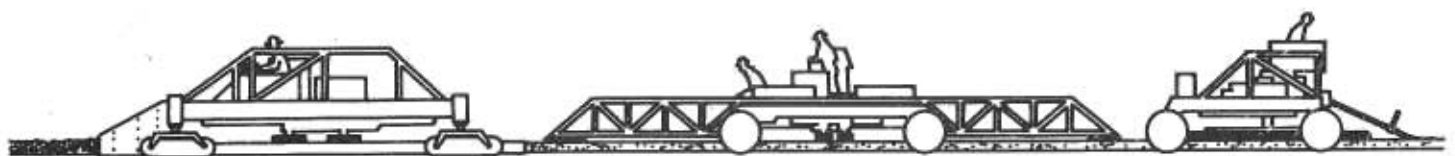


FIGURE 1—Profile sketch of the multiple screed slipform process.

is clearly apparent. It is also discernible in the trend of recent bid prices as illustrated in Table 1.

Lack of restriction on usage of slipform methods regardless of topography, climatic conditions, geometric section or traffic considerations has undoubtedly contributed to this favorable trend.

Several projects which have been slipformed were located in mountainous terrain involving grades up to 6 percent and superelevation up to 12 percent. One of these was paved three lanes at a time.

The other projects which have been slipformed are located in flatter terrain. All of our urban projects are included in this group.

Paving two lanes at a time is the most common practice, largely because 24 feet is the most frequent width of pavement slab required. This paving width is also convenient in placing 48-foot pavements for the increasing number of eight-lane urban freeways being constructed today.

Placing 36-foot pavement, for the substantial mileage of six-lane rural and urban freeways built in recent years, has been accomplished either by first putting down a 24-foot slab followed by a 12-foot slab or by paving

### SYNOPSIS

After five years of use, slipform paving now accounts for more than 80 percent of all concrete paving in California. It provides significant production advantages to the contractor and benefit of less cost to the highway user, as compared with sideform paving. Three different types of slipform pavers have been successfully employed, but only one is capable of paving three lanes at a time. The procedures utilized when paving three lanes at a time are not significantly different from those utilized when paving narrower widths with the same type of equipment. Successful use of this type of equipment is dependent upon: establishing standard operating procedures through a logical analysis of cause and effect; technically qualified field level supervision; experienced operators and mechanics; properly maintained equipment; uniform concrete at the paver; and, close attention to operational details before, during and after concrete placement.

the entire 36 feet, three lanes at a time. The amount of pavement constructed by each procedure is split about equally.

### Different Types of Pavers

Placing pavement in 36-foot paving widths is not a separate subject of itself. In reality, the procedures used to place this width of pavement cannot be said to be significantly different from those used to pave narrower widths when proper allowance is made for certain basic considerations.

Thus, it must be realized that there are several different slipform methods just as there are several different types of slipform pavers. These different pavers are not all presently capable of placing pavements more than 24 feet wide in a single pass. A description, therefore, of construction practices for three-lane at a time paving logically involves discussion of a more general subject: that is, the procedures and techniques utilized with the paver capable of placing three lanes at a time.

### Origin of Term

The term "slipform paving" undoubtedly originated because short lengths of sliding sideforms are used instead of the preset sideforms conventionally used. While all methods utilize sliding forms, the term "slipform paving" has come to be generally thought of in a more encompassing sense. We now think of it as applying to the upper surface of the

TABLE 1  
BID PRICES AND CALIFORNIA HIGHWAY CONSTRUCTION COST INDICES

	Portland cement concrete pavement		Portland cement concrete structures	Bar reinforcing steel	Asphalt concrete pavement	California Highway Construction Cost Index
	Per cubic yard	Per square yard <sup>1</sup>	Per cubic yard	Per pound	Per ton	
1st quarter 1961	\$13.44	\$3.15	\$53.70	\$0.094	\$5.92	229.6
2nd quarter 1961	15.35	3.60	52.32	0.093	6.36	252.8
3rd quarter 1961	14.44	3.38	56.35	0.091	5.96	230.5
4th quarter 1961	14.35	3.36	57.97	0.096	5.30	238.5
						Year 239.1
1st quarter 1962	14.87	3.48	57.02	0.092	5.99	235.7
2nd quarter 1962	15.31	3.59	58.65	0.095	6.50	271.1
3rd quarter 1962	15.20	3.56	59.22	0.091	6.71	289.1
4th quarter 1962	14.45	3.39	56.30	0.091	5.68	232.6
						Year 256.2
1st quarter 1963	12.72	2.98	62.87	0.096	6.22	250.4
2nd quarter 1963	12.64	2.96	58.69	0.093	6.47	243.7
3rd quarter 1963	13.14	3.08	57.16	0.082	5.87	249.5
4th quarter 1963	14.49	3.40	59.56	0.091	5.78	243.0
						Year 246.8
1st quarter 1964	14.00	3.28	58.34	0.084	5.61	246.1
2nd quarter 1964	13.09	3.07	58.24	0.088	6.20	248.7

<sup>1</sup> Calculated on the basis of an estimated 1650 cubic yards per lane-mile.



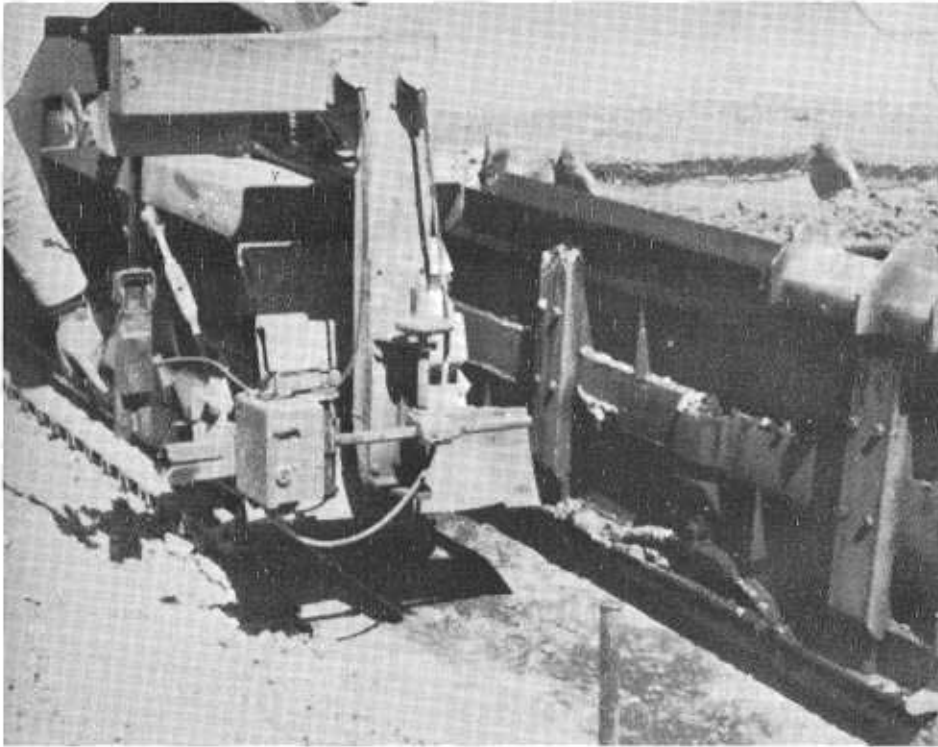


FIGURE 4—A close-up photo of the grade and alignment sensors.

pavement as well as to the edges. It is in the latter respect that significant differences in method are found.

Three different types of slipform pavers have been used in California. Each type is different in operation, and each involves a different method of paving as we construe the terms.

One type forms the pavement surface by a repetitive screeding action. Multiple screeds are used as illustrated in Figure 1, and the operation is similar in many respects to conventional sideform paving. This type has not been used in three-lane-at-a-time paving.

#### Single, Large Screed

A second type of equipment forms the pavement surface by conforming the concrete to desired cross section and profile under a single, relatively large screed as illustrated in Figure 2.

This action has sometimes been referred to as "extrusion." For the purpose of this article the word "extrusion" will be avoided. It implies that concrete is pressed or forced into shape as is metal through a die. In point of fact, the action is that of flowing concrete into position to completely fill a transient form consisting of conforming screed, sliding sideforms and underlying subgrade. The

action can be analogized more accurately to the process of permanent mold casting rather than extruding metal.

This second type of slipform equipment is the only one used to date to

place pavement three lanes at a time. With it, the paving width can be varied by changing the number of 12-foot-wide modular sections which make up the main chassis.

A third type of equipment has been used only in experimental applications where the paving width was 24 feet. It incorporates an interrelated initial strikeoff screed and a vibrating float pan as illustrated in Figure 3. An excess of material passing under the strikeoff screed causes an upward pressure on the float pan which results in an automatic lowering of the strikeoff screed. Conversely, the strikeoff screed is automatically raised when a deficiency of material occurs under the float pan.

This action is independent of the control derived from the grade wires and, in effect, meters the concrete to a rotating screed located behind the float pan. The rotating screed functions to remove the slight variations resulting because of the finite distance between strikeoff and float pan.

#### Two Subclasses

In addition to these three type classifications of slipform pavers, two subclassifications can also be identified. They have to do with the presence or absence of automatic controls.

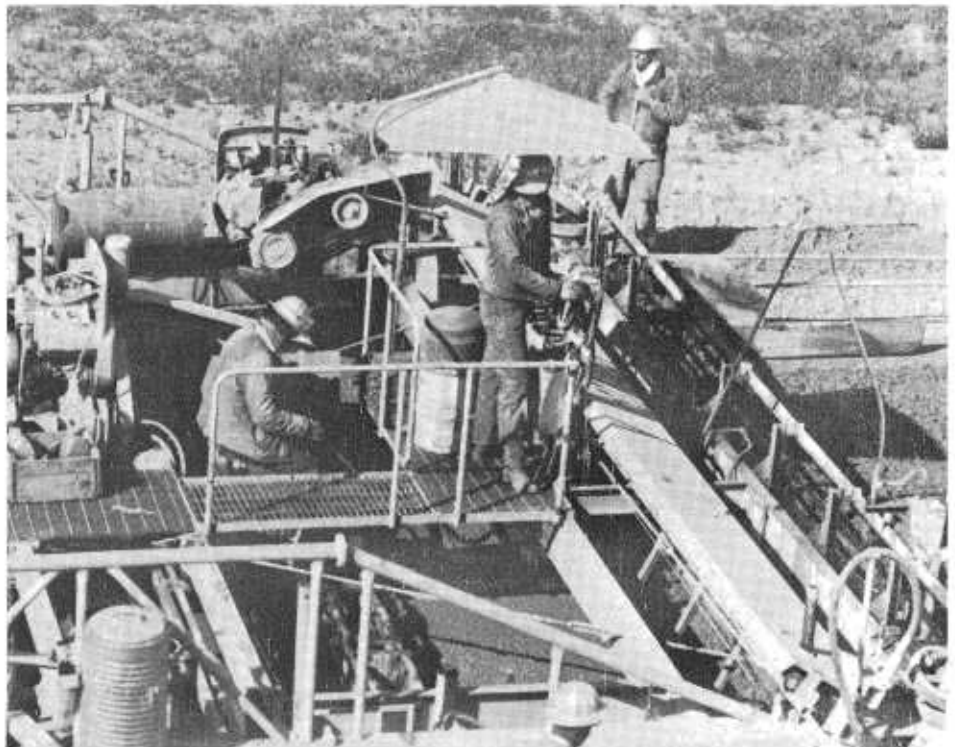


FIGURE 5—Operators (center) can steer manually by use of plumbbob and stringline.

One subclassification includes those pavers which are automatically controlled for line and grade by sensors operating on preset grade wires. The other includes those pavers which are manually steered and have preset screeds.

There are non-automatically controlled pavers of both the multiple screed and conforming screed types. There are automatically controlled pavers of the conforming screed and pressure meter types. We will confine our attention henceforth to automatically controlled machines of the conforming screed type although pavers of the pressure meter type also have potential capability of placing pavement three lanes at a time.

The equipment our interest centers on, then, is that where the pavement profile and cross section is established by flowing concrete into position, by internal vibration, under a relatively large conforming screed automatically maintained at correct alignment and grade.

#### Key Factors Influencing Results

Success with this equipment is greatly influenced by a number of factors which can be listed as follows:

- 1—Experienced field level supervision
- 2—Skilled operators and maintenance personnel
- 3—Proper care and adjustment of the paver
- 4—Consistent mix

- 5—Uniform delivery of concrete
- 6—Control and integration of all elements of the operation
- 7—Continuous forward motion of the paver
- 8—Single set of surveying stakes for subgrade and pavement
- 9—Accurately set grade wires
- 10—Well compacted subgrade constructed to tight grade tolerances
- 11—Proper type and length of side-forms
- 12—Effective location and frequency of internal vibration
- 13—Means of compensating for variations in the concrete at the paver
- 14—Constant surveillance of grade and alignment sensors



FIGURE 6—A photo of the three-lane, 36-foot highway slipform paver in operation.



- 15—Continuous audit of pavement thickness
- 16—Conscientious final finishing
- 17—Progressive analysis of smoothness results

The significance of these factors will become apparent as our discussion proceeds. Their importance is painfully manifest as we look back on our initial efforts.

#### Analysis of Cause and Effect

In the early period there were few known guidelines and most efforts to improve results were frustrated by aimless, often frantic guesswork.

This chaotic situation was not brought under control until the necessity for an orderly analysis of cause and effect was clearly understood.

The technique adopted then is valid today and it is recommended to all those embarking upon their first slipform experience. It is simply the preparation of a detailed log as the work progresses, listing chronologically all conditions and events which might conceivably affect the completed pavement. Daily analysis of the log for previous work in light of the results obtained will very quickly pinpoint sources of difficulty and indicate proper corrective measures.

California contractors still employ this technique when new equipment models are evaluated or unexpected difficulties are encountered.

The operating procedures evolving from these studies of cause and effect form the basis of our construction practice today.

#### Ability of Personnel

Any discussion of operating procedures would be sterile without first dealing with the ability required of the men who are to implement them. It should not be surprising that the skill and training of field supervisors, operators and mechanics required to cope with the complex, automated slipform paving equipment is considerably greater than that with conventional sideform equipment. Nevertheless, this fact is not always apprehended, much to the detriment of the results achieved. The so-called "old pro" is rapidly vanishing from the scene. He is being replaced by men with the background of technical

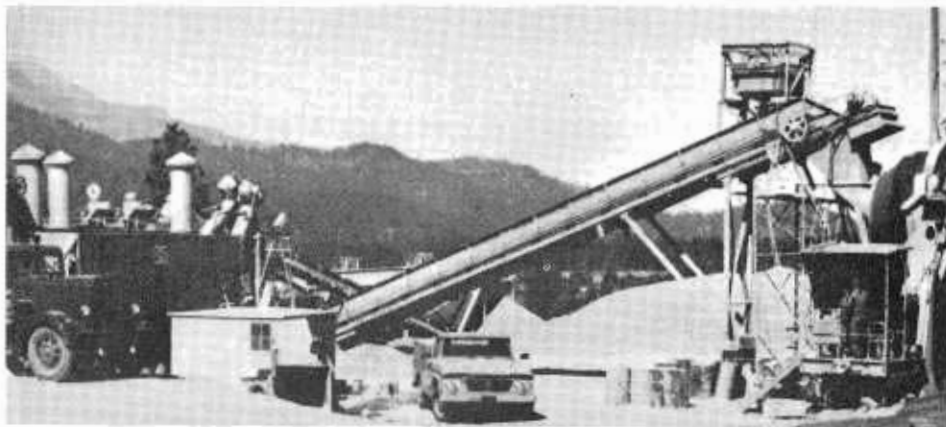


FIGURE 7—The low-profile central mix plant combines portability and high productive capacity.

training necessary for an understanding of the equipment and the ability to calmly analyze complicated situations and act with logical purpose.

#### Maintenance of Equipment

Proper maintenance and adjustment of the paving equipment is also an obvious prerequisite for successful employment of operational procedures. Our experience indicates that the manufacturers are coming to have an increasing responsibility in this area.

The complexity of slipform equipment makes it of paramount importance that skilled technicians only be entrusted with the specialized care required. In practice, this requires occasional factory assistance, which only the manufacturer can provide, plus routine attention by qualified personnel on the contractor's payroll. The most effective arrangement, it seems, is for the manufacturers to maintain factory technicians where they can reach any job in hours, and for the contractors to employ specialized mechanics trained to service the inter-related hydraulic-electrical-mechanical systems involved.

We find that each time the paver is transported from one place to another, whether on or between jobs, it must be thoroughly inspected for misalignment, warping, breakage or inadvertent changes in the setting of various control elements. Adjustment of the screeds must also be checked. The latter is accomplished by driving steel stakes to an offset grade for each corner of the screed and measuring up when the paver is in position over them.

#### Control of Concrete

Uniform quality of the concrete is another prerequisite to a successful paving operation. It is a matter of general agreement now that uniform quality is absolutely essential in the use of slipform methods, and similar importance is attached to an adequate delivery rate at the paver. Accordingly, a significant change has come about in the proportioning and mixing equipment in current use.

Onsite paving mixers, supplied by batch trucks, have been almost completely replaced. In lieu of these more conventional means, central-mix plants have become very popular and appear destined to be universally adopted.

The new low-profile plants in particular have been well received because of their portability and high productive capacity. Several of these plants in current use are capable of producing 600 cubic yards of concrete per hour. They can be moved from one location to another and set up for full operation in a matter of hours.

One or two of our contractors have taken full advantage of this portability by relocating the plant several times during the course of long paving jobs. A significant advantage of this procedure on a large project is the reduction of hauling units.

While most of the contractors are using stationary tilt-drum mixing units with the low-profile batching plants there are a few who are using the new tilt-drum truck mixers.

#### New Development

An interesting new development has recently been exploited with respect



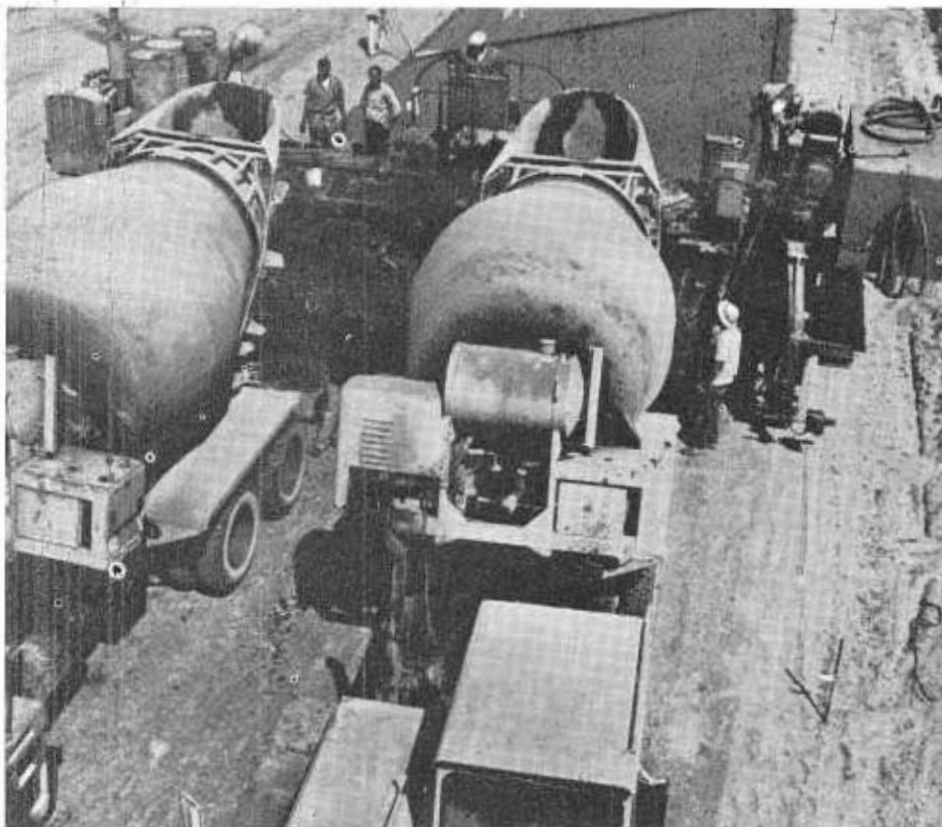


FIGURE 8—A photo of tilt-drum mixers which are being used increasingly with slipform pavers.

to the location of the batching and mixing equipment. The contractor claimed substantial savings were realized in placing his batching plant at the aggregate source and moving his stationary mixer three times during the job. Double bottom-dump trucks were used to haul two eight-cubic-yard batches of proportioned aggregate between plant and mixer. At the mixer a specially built transfer unit off-loaded the trucks onto a covered high-speed conveyor belt which charged the mixer. The transfer unit utilized a hopper with agitating side plates, a self-contained ramp for the trucks, and it was portable. Cement was batched directly into the stream of aggregate as it was charged onto the high-speed belt conveyor.

There is reason to believe that this relatively dust-free technique may be well adapted for use on urban projects. On many of these, smog control rules pose a real problem because of the dust incident to normal batching operations.

#### Control Facilities

Absorbed as they are with these developments in the type of plant setup,

the contractors have not overlooked the importance of control facilities within the plant. We have noticed significant improvement in several important respects. Bins and conveyors have been modified to minimize degradation and segregation. The batching cycle and bin gates have been better coordinated to obtain optimum blending of ingredients prior to mixing. Cement silos have been redesigned to achieve better charging and batching rates. Fully automatic batching and mixing controls have been accepted as indispensable, and their proper use is more effectively policed by the contractors. These and other measures have contributed to a noticeable improvement in the uniformity and quality of the concrete as well as to productive capacity.

#### Mixing Times

With the increasing attention to all of these aspects of quality control and production capacity it was inevitable that the subject of mixing times also received searching appraisal.

It is common knowledge that for many years California has permitted a

minimum of 50 seconds for mixing paving concrete in onsite paving mixers. The performance of our paving concrete and the data from many quality tests all attest to the adequacy of this requirement. With stationary mixers, however, the criterion differed and minimum mixing time was dependent on mixer size.

For an eight-cubic-yard mixer the minimum was 3 minutes and 15 seconds—60 seconds for the first cubic yard plus 15 seconds for each additional cubic yard.

Realizing the serious economic consequences of excessive mixing time requirements, we undertook a series of tests on various sizes and types of mixers. These tests clearly demonstrated the feasibility of modifying our requirements.

We are convinced that the revised requirements resulting from these studies had an important bearing upon the development of slip form paving in California. It was evident that three-lane-at-a-time paving would be prohibitively expensive with the additional mixing equipment necessary to provide sufficient mixing capacity if three minutes plus of mixing were specified.

The basic requirement now is that all concrete must be mixed a sufficient amount of time to produce an adequate mixture, but in no event less than stated minimum periods which are dependent on the type rather than the size of the mixers. These minimums are: 50 seconds for both stationary and onsite paving mixers; 40 revolutions in special truck-type paving mixers; and 70 revolutions in conventional truck mixers.

Adequacy is determined by tests performed on samples of concrete taken from the first and last quarter of sample batches. Differences in slump and distribution of coarse aggregate are noted and the mixing time is adjusted if the data fails to conform to specified tolerances. This is a rare occurrence with modern mixing units in good condition, and minimum permissible mixing times are generally sufficient to produce an adequate mixture.

(Conclusion of this article will appear in the next issue of the magazine.)



# High-ranking Distaff Engineer

Carol Schumaker of La Mirada has just become the highest ranking female engineer in the California Division of Highways.

As a senior highway engineer in the Route Planning Section of District 7 in Los Angeles, Mrs. Schumaker is one of four unit chiefs in charge of highway route planning.

Mrs. Schumaker is a registered civil engineer and a member of the American Society of Civil Engineers. In June 1964, she acquired her master of science degree at the University of Southern California. In addition to her full-time job with Highways, Carol also teaches a night graduate class in geometric highway design at California State College at Long Beach. Her students are nine men working toward their master's degrees.

Her recent promotion to senior highway engineer followed 10 years of service with the division as junior civil engineer, assistant highway engineer, and associate highway engineer. She has been eligible for senior appointment since April 1962, when she was one of two young women and 84 men to pass the civil service examination for this classification. (The division employs 22 women in junior civil, assistant, or associate engineering capacities. Nine of them are in the Los Angeles area.)

In her new position, Mrs. Schumaker supervises three associate engineers engaged in route planning. Route planning begins following the State Legislature's designation of two particular points or termini between which a highway is to be constructed. The Route Planning Section then prepares a project report which covers the engineering investigation and analysis of

the specific project, and which discusses the need for and the type of the planned highway improvement and how it should be accomplished, including basic design features. Possible alignments, cost factors of each, community considerations and general feasibility are studied. Close teamwork with city and county planners and engineers is required.

Upon completion of the project reports, a public hearing is held in the area concerned, at which the route planning studies are presented. All of the alternate routing studies are explained in terms of relative advantages and disadvantages, with the assistance of maps and aerial photographs. Many individual questions are answered by the route planning engineers at the hearing and at map displays which precede it.

With all the information assembled, including public reaction, the project is ready for the State Highway Engineer's final review and his recommendation to the Highway Commission. Adopting a route, after notification of local authorities and perhaps another hearing, is done by the Highway Commission.

A typical example of major freeway routings with which Mrs. Schumaker will be immediately concerned is a 26-mile section of the proposed Route 64, starting at State Sign Route 1 about

10 miles west of Santa Monica, running north through mountainous terrain and swinging east through San Fernando Valley to connect with US 99-Interstate 5.

Another routing of particular interest because of its designation as a scenic highway is the proposed improvement of a 10-mile section of State Sign Route 150 in the Ojai Valley in southwestern Ventura County.

Mrs. Schumaker's new job brings her well over a thousand dollars a month. The top figure for a senior highway engineer is \$1,166. This compares with a range of \$829 to \$1,008 in her previous job as associate highway engineer.

As an associate, Mrs. Schumaker worked in Design, which is the next



Checking details on a route planning study still on the drafting board are Senior Highway Engineer Carol Schumaker and Associate Highway Engineers Harold Yamaguchi (center) and William R. Juergens.

Mrs. Schumaker holds a master of science degree from the University of Southern California. In addition to her responsible position with the Division of Highways, she teaches an evening graduate class in Geometric Highway Design at California State College in Long Beach. Her nine male students are working toward their master's degrees.



step after the Highway Commission has adopted a route. At this stage, geometric and structural design of the roadbed are completed, contract plans are reviewed, and research and special studies are carried on. Also, drainage and other cooperative agreements are drawn up, and erosion control and roadside development are worked out.

Her biggest project while in Design was the San Diego-San Gabriel River-Garden Grove Freeway Interchange, under construction in Orange County, near the Los Angeles county line. Although only two levels, it has many complicated connections. A portion of this interchange is scheduled for opening in the early summer of 1965. She also worked on the interchange of the San Diego and Long Beach Freeways, which has been in use for about a year.

Mrs. Schumaker's desire to become an engineer had already formed in high school. She particularly liked math, physics and science courses. This was in Kingsford, Michigan, near Hancock—her birthplace in 1929. She attended Purdue University, graduating in 1952 with a B.S.C.E. degree. About half-way through her senior year Carol Rogge married Bernard Schumaker, also a Purdue graduate and an engineer.

In 1954 they came west, and she began her career with the California Division of Highways. Her husband pursued structural engineering, working for the Building and Safety Department of the City of Los Angeles, and also with consulting engineering firms in the area. Several years ago he left engineering to enter teaching, and presently is a science instructor at the Sunny Hills High School in the Fullerton Union High School District in Orange County. The Schumakers have a son, Paul, 11.

Charles Ford, in charge of freeway route planning in the Los Angeles District says, "I have followed Mrs. Schumaker's career for some time and I particularly admire the fine work she has done in the design of major interstate freeways. In what is largely a man's world, she has the professional, yet definitely feminine touch. She is now entering the very important early planning phase of this work and I am sure her talents will continue to serve us well."



*On a previous assignment for the Design Section, Mrs. Schumaker checked blueprints of an interchange with Resident Engineer John H. Muhich (right), and William T. Robinson, a highway engineering associate. The resulting two-level structure, designed under her supervision, will connect the San Diego, San Gabriel River, and Garden Grove Freeways in Orange County. A portion of this interchange is scheduled to open this summer.*

For the present, Mrs. Schumaker has not set her sights on any further pinnacles of achievement. "It's challenge enough to come up with the full information needed for the Highway Commission to select the most advantageous route for all concerned," she says, "and

I'm primarily concerned with doing justice to the job at hand.

"California's Division of Highways offers real professional opportunity to women, not only in engineering, but in other high-level jobs as well. It's gratifying to know that 'the door is open.'"

*Mrs. Schumaker reviews a route-planning study with the three associate highway engineers under her supervision. Clockwise around her desk are William R. Juergens, Robert E. Tomlinson, and Harold Yamaguchi (back to camera).*





## George M. Webb Wins Top National Award

Nationwide recognition for his accomplishments in traffic engineering was given to George M. Webb by the Institute of Traffic Engineers at its 1964 annual meeting in Miami Beach, Florida.

Webb, who retired in 1963 after nearly 10 years as traffic engineer for the California Division of Highways, was announced as the recipient of the Theodore M. Matson memorial award "for outstanding contributions to the advancement of traffic engineering."

He is the eighth person to receive the award, and the first from the western United States. It is considered the top award nationwide in the traffic engineering profession.



GEORGE M. WEBB

State Highway Traffic Department.

The formal presentation was made on behalf of the I.T.E. by Charles W. Prisk, deputy director of highway safety for the U.S. Bureau of Public Roads and a previous Matson award winner. Prisk praised Webb's leadership in traffic engineering and traffic safety research not only in California but nationwide, through his service on numerous special study committees.

Prisk called Webb "a traffic engineer's traffic engineer."

Webb, whose home is in Sacramento (1825 Caramay Way), retired from state service in May 1963, after a highway engineering career that began in 1919 in his native Oregon and was interrupted only by service in the Army Transportation Corps in World War II.

From 1919 to 1928, Webb worked for the Oregon Highway Department on location, construction and maintenance in the central part of the state, around Bend. Moving to California,

## DIVISION WILL INCREASE USE OF MEDIAN BARRIERS

Close examination of the results achieved by median barriers in preventing spectacular and usually fatal head-on crashes between vehicles traveling on freeways has resulted in a decision by the California Division of Highways to increase their use.

The barriers, which block drivers from crossing medians and entering lanes bearing opposing traffic, are now installed on approximately 250 miles of the state's 1,500 miles of freeways.

A series of dynamic tests, in which remote-controlled automobiles carrying anthropometric dummies were purposely driven at high speed into barriers of various construction, were conducted by the Division of Highways beginning in 1958. Examinations of the crash effects on the vehicle, the dummy and the barrier materials themselves led to the use of particular barriers under specific conditions.

They normally consist of heavy steel cables or metal beams, but in areas where pedestrians might be tempted to cross a freeway, the cables

he was assigned to the location crew for the Feather River Highway, and then worked in the Redding and Eureka districts and in the Bridge Department. He transferred to Division Headquarters in Sacramento in 1942, and subsequently devoted almost all his engineering activities to the traffic field. He was appointed division traffic engineer in 1953.

For each year of Webb's service as traffic engineer, California won or tied for first place in traffic engineering achievement in the nationwide inventory of traffic safety activities sponsored by the National Safety Council.

He also achieved national prominence through his authorship or co-authorship of numerous widely published reports and articles on traffic engineering, and his service on committees of the Highway Research Board, the American Society of Civil Engineers and the American Association of State Highway Officials.

are augmented with chain link fencing. Other types are used where drifting snows present a particular problem.

Highway engineers and other traffic experts entertain mixed opinions regarding the dividers, for although fewer accidental deaths and critical injuries occur where they are emplaced, the overall accident rate generally rises.

This is because most drivers who do momentarily lose control and veer into opposing traffic lanes are able to recover in time to avoid accidents.

But according to James E. Wilson, Division of Highways traffic engineer, a vehicle traveling at high speed obviously cannot careen into a median barrier without suffering substantial damage.

"We are trading property damage for lives," says Wilson. "The barriers must be strong enough to stop or turn a car and head it back into its own traffic flow where the odds are good that the driver can either stop or regain control without hitting another vehicle."

Wilson notes that persons are sometimes killed and injured in accidents involving median barriers but he points out the frequency is far below the rate experienced in head-on collisions.

In the past, barriers were not used in medians over 36 feet wide unless special hazards existed or an abnormal number of wrong-way accidents occurred in a specific area. Now medians up to 46 feet in width are eligible for barriers.

During the 1958 studies, it was discovered that two-thirds of the head-on crashes could be eliminated if median barriers were erected on freeways where daily average traffic exceeded 60,000 vehicles. After the dividers were installed in keeping with this criterion, fatal accidents from this type of mishap dropped from 45 in 1959 to an average of 20 a year, despite a doubling in freeway traffic.

## DIVISION BEGINS INSTALLATION OF WRONG-WAY SIGNS

Statewide installation of two new signs will take place during the next few months as another step in the continuing program of the California Division of Highways to discourage drivers from entering freeways in the wrong direction.

Red-background signs bearing the message **WRONG WAY** will be placed on each side of all off-ramps, near the exit points. The letters will be white on the red background and both colors will be highly reflective. The signs will not be visible to drivers proceeding in the proper direction.

On-ramps will be identified by signs that read **FREEWAY ENTRANCE**. This reassuring message will also be in white letters, but on the standard green background which motorists associate with normal state highway directional signs.

The red and green backgrounds were purposely selected because of the respective "stop" and "go" situations most people identify with them.

Although the new signs have been officially approved for installation, it will take several months before the signs can be procured and installed at all the approximately 5,000 ramps included in the freeway system, according to State Highway Engineer J. C. Womack.

In some off-ramp locations, two experimental devices will be tested in conjunction with the new signs.

The first is a reflective pavement arrow visible only at night. It consists of a series of inconspicuous plastic wedges that pick up the beams of automobile headlights aimed in the wrong direction and transforms them into a red arrow pointed at the oncoming vehicle.

The second is an auxiliary white and red sign that reads **GO BACK—YOU ARE GOING WRONG WAY**. Single installations will be made on the right side at the approximate midway point of all off-ramps in the San Francisco Bay area. They will be visible only to wrong-way traffic.

Womack expressed the hope that the new devices will prove effective in curbing at least some of the 8 percent of freeway fatal accidents now caused by wrong-way movements. These accidents result in 30 to 35 deaths each year. He pointed out that the fatalities include not only offenders but many innocent persons who were proceeding in the right direction.

Womack cited a recent study by the Division of Highways which indicates that approximately 50 percent of the wrong-way drivers enter freeways at off-ramps.

The study also revealed that approximately one-third of the offenders had been drinking—and more important—that drinking drivers were the offenders in 85 percent of wrong-way fatal accidents.

Womack hoped the signs will have a positive effect on even drinking drivers, but observed that they are "an extremely difficult group to reach with a safety message."

All the devices have enjoyed a high degree of success at an Interstate 80 on-and-off ramp northeast of Sacramento where they have been installed for several weeks, according to traffic engineers.

## Change in Bid Form Will Reduce Error

The State Division of Highways has revised the proposal form for submission by bidders on highway projects.

Beginning with all projects advertised for bids on or after November 16, "figures only" will be used by bidders to specify prices of items. The old form calling for both words and figures has been discontinued.

This change is designed to reduce the possibility of error in proposals submitted.

The first bid opening incorporating the change to "figures only" took place January 6 in Sacramento.

## Highway Site Yields Oldest Artifact Yet

A lump of cooking charcoal recently discovered in the buried remains of an ancient Indian village in eastern Mendocino County has proven to be nearly 1,000 years older than any previously recorded history of man in northern California. State Archeologist Francis A. Riddell has reported, according to a recent report by the State Department of Parks and Recreation.

Riddell said radiocarbon tests just completed by Geochron Laboratories, Inc., of Cambridge, Massachusetts, have established the charcoal's age at 5,320 years. The earliest previously recorded traces of man in northern California were from an Indian village site near Alamo, in Contra Costa County, and were 4,400 years old.

The historic charcoal find was made by James Dotta of Redding, president of the Northern California Archeological Society, working under contract with the State Division of Beaches and Parks. It was unearthed on the Porter Chaffee ranch on Cold Creek, at the junction of State Highway 20 and Potter Valley Road, between Ukiah and Upper Lake.

Dotta has been working at four Cold Creek area sites that will soon be destroyed by highway construction. The Division of Highways is paying for an archeological search of the sites and the removal of their significant artifacts.

To date the charcoal discovery site on Cold Creek has yielded 620 artifacts. They include dart points of flintlike chert, obsidian knife blades, a variety of crude stone tools, stone mortars and pestles, and a number of *manos* and fragments of stone *metates* used in grinding flour from grass seeds.

The January 1965 edition of the *California Historian*, publication of the Conference of California Historical Societies, contains a message from Governor Edmund G. Brown mentioning the Mendocino find and adding:

"The state is doing this work because California cannot afford to lose its history."



## Henry McCarty Ends Long State Career

Henry C. McCarty, office engineer in the Division of Highways Sacramento Headquarters since 1947, retired in November.

McCarty has had the key responsibility of advancing budgeted highway projects to the construction contract stage as soon as the planning and right-of-way acquisition have been completed by other units of the division. He has also had the responsibility



HENRY C. McCARTY

of processing payments to highway contractors as work progressed and has supervised the preparation and submission of agreements and supporting documents under which California has collected the federal aid highway funds apportioned to this state.

The advancement of projects to contract stage includes correlation of plans, specifications and estimates prior to advertising for bids, advertising for bids, issuance of proposal forms to prospective bidders meeting prequalification requirements, opening the bids, preparing contract award recommendations and preparing and processing contract documents after award. Some 500 major highway projects with a total construction value of more than \$350,000,000 per year are placed under contract through McCarty's office.

A registered civil engineer, McCarty is a native of Kansas, where he received his primary schooling. He moved to San Diego in 1917, attending high school and San Diego State College and later the University of California at Berkeley, where he received his degree in 1925.

His first six years of employment after graduation were with the city engineer's office in San Diego.

He entered state service in 1931 as a draftsman-computer in the division's Sacramento Headquarters and transferred to the District 6 office in

## Bridge Department's E. L. Walsh Retires

Everett L. Walsh, bridge office engineer for the California Division of Highways, has retired after 37 years in state service.

Walsh has been responsible for administering all service units of the Bridge Department including accounting and personnel and the negotiating of maintenance and construction agreements with railroads concerning grade crossings and separations.

A native of Minnesota, Walsh attended grade and high school at Tacoma, Washington, and studied engineering at the University of Washington in Seattle.

From 1917 to 1924 he worked as surveyor and inspector for the Northern Pacific Railroad and the Weyerhaeuser Timber Company.

He joined the Washington State Division of Highways as assistant resident engineer in 1924 and came to work for the California Division of Highways in 1928.

He served as field engineer in charge of preliminary investigations and borings on the construction of the San Francisco-Oakland Bay Bridge and was promoted to supervising bridge engineer in 1947.

Walsh is a member of the American Society of Civil Engineers and is past president of the Sacramento section. He is also a member of Delta Upsilon and the University Club of Sacramento.

Walsh and his wife, Mary, will take up residence in their new home at Little River on the Mendocino County coast.

Fresno in 1935, where he worked in construction and maintenance. McCarty returned to Sacramento Head-

## IN MEMORIAM

### District 1

John H. Kennedy, assistant highway engineer.

### District 3

Alvin E. Smith, highway maintenance man III.

### District 4

Gerald D. Davis, junior civil engineer.

### District 5

Virgil D. Martin, highway maintenance man III.

Frank S. Sackrider, assistant highway engineer.

### District 7

Kathryn L. Anthony, delineator.

Byron V. Hauger, associate right-of-way agent.

John P. O'Hara, assistant highway engineer.

Robert C. Van Marter, engineer aid II.

### District 9

Robert E. Miller, highway maintenance man III.

### District 11

Mike R. Ramirez, highway maintenance man III.

### Headquarters

Ray D. Lenau, highway engineer associate.

### Shop 7

Einar W. Carlson, heavy equipment mechanic.

quarters in 1940 to work in the planning and design functions. In 1943 he was appointed assistant office engineer, and in 1947 to his present position.

His avocations include electronics.

He and his wife, Ada, live at 1448 Arvilla Drive, Sacramento.



## Paul C. Sheridan Is Office Engineer

Appointment of Paul C. Sheridan of Marysville as office engineer for the California Division of Highways was announced by State Highway Engineer J. C. Womack.

Sheridan, who was promoted from assistant district engineer of District 3, which includes 11 Sacramento Valley and mountain counties, assumed his duties in Headquarters office in Sacramento on November 18. He succeeds Henry C. McCarty, who recently retired.



PAUL C. SHERIDAN

In his new position, Sheridan will be responsible for a wide range of activities involving the advancement of budgeted highway projects to the construction stage as soon as planning and right-of-way acquisition have been completed. Other administrative engineering functions of the office engineer include processing payments to contractors and the supervision of the preparation of federal aid documents.

A native of Oakland, Sheridan was raised there and in San Rafael, and attended Marin Junior College and the University of California. He joined the Division of Highways in 1931, the year following his graduation with a degree in civil engineering.

Virtually all his highway career, beginning as a construction inspector in the Lake Tahoe area, has been in District 3.

Sheridan was promoted to assistant district engineer in 1950.

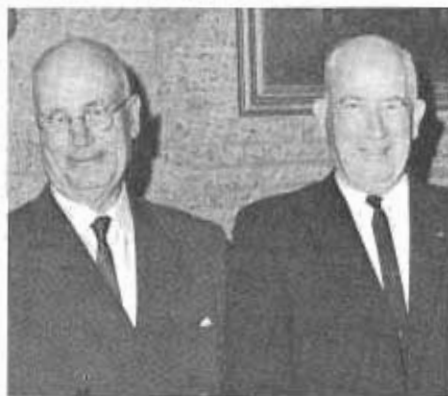
Sheridan is a past president of the Marysville Branch, Sacramento Section, American Society of Civil Engineers. He is a member of the Commonwealth Club of San Francisco and of E Clampus Vitus. He has also been active in Parent-Teacher Association and Boy Scout work in the Marysville area.

He and his wife Eleanor have four children and one grandchild.

## Bartlett Twins of District 2 Retire

Wallis H. (Pat) and Willis H. (Bart) Bartlett, twin employees with the Division of Highways, recently retired in Redding.

Pat and Bart were born in Redding and attended high school in Klamath Falls, Oregon. Bart also attended Oregon State College, where he received his B.S. degree in civil engineering.



WALLIS H. (left) and WILLIS H. BARTLETT

The Bartlett twins worked on the initial surveys and construction of Route 70 in the rugged Feather River Canyon between Oroville and Quincy.

Pat, who retired as a highway engineering technician I, completed his entire state service in District 2. His initial appointment dates back to September 30, 1921. He left the state service in April 1923 for private employment and returned in May 1927. He served in the U.S. Army during World War II. The major portion of his highway service has been on construction work. Pat and wife Wilda plan to continue their residence in the Redding area.

Bart, one of the earliest to join the District 2 organization, signed up as an axman and chainman on June 11, 1919. He worked intermittently while attending school until he graduated from college and returned on a permanent basis in May 1927. He was temporarily transferred to District 6 in 1937 and to District 5 in 1941. Bart has served on location surveys, design, and construction. He retired as an associate highway engineer.

Bart and wife Hazel plan to continue residence in the Redding area.

## John Kozak Joins Bay Toll Crossings

Appointment of John J. Kozak of Sacramento as principal bridge engineer with the State Division of Bay Toll Crossings in San Francisco has been announced by Chief Engineer E. R. Foley.

Kozak has been supervising bridge engineer in charge of special studies for the State Division of Highways headquarters office in Sacramento since 1961.

In his new position, Kozak will serve as assistant to Foley in the general administration of the Division of Bay Toll Crossings which was established by the Legislature as a separate division of the State Department of Public Works last year.



JOHN J. KOZAK

His appointment was effective November 1.

A native of Rhode Island, Kozak holds a bachelor of science degree from the University of Rhode Island and a master of science degree from Yale University. He served with the U.S. Corps of Engineers from 1942 to 1946 and was awarded a bronze star medal.

Kozak came to work for the California Division of Highways in 1947.

From 1947 to 1949 he was resident engineer on several bridge construction projects in the San Francisco Bay area, after which he joined the bridge design section in Sacramento.

He was promoted to senior bridge engineer in 1953 and was put in charge of adapting electronic computer methods for use by the Bridge Design Section in 1956.

Kozak is a member of the American Society of Civil Engineers and the Toastmasters Club of Sacramento.

He and his wife, Margaret, who reside at 2024 Santa Lucia way in Carmichael, have five children.



## Highways List of Recent Retirements

### District 1

Sydney W. Anderson, assistant highway engineer, 36 years; George A. Bradburn, highway maintenance man II, 36 years; Carlton H. Clark, highway maintenance man II, 18 years; Benjamin J. Dashiell, highway foreman, 44 years.

### District 2

Wallis H. Bartlett, highway engineering technician I.

Willis H. Bartlett, associate highway engineer, 38 years; Adolph L. Jacobson, highway maintenance man II, 8 years; Jack Swank, highway maintenance man III, 23 years.

### District 3

Sam L. Ferguson, highway landscape leadingman, 11 years.

### District 4

Noble T. Haakensen, assistant highway engineer, 11 years; Herbert A. Hart, associate highway engineer, 32 years; John P. Dietrich, assistant highway engineer, 13 years; George F. Oliveira, groundsman, 17 years; Fred W. Walker, highway engineering technician I, 11 years.

### District 5

Herman J. Bender, assistant highway engineer, 35 years; John A. McAnallan, highway field office assistant, 17 years; James C. Meehan, highway maintenance man II, 33 years.

### District 6

Tracy O. Cunningham, highway foreman, 36 years.

### District 7

David T. Coull, highway landscape maintenance man, 10 years; Carl R. Hagberg, highway engineering technician I, 30 years; Larry P. Madrid, highway maintenance man II, 21 years; Harry Royal, highway maintenance man II, 31 years.

### District 8

Clarence V. Blackburn, highway maintenance man III, 33 years; Clark

## Twenty-five-year Awards Announced

The following Division of Highways employees have received their twenty-five-year awards since the last list was published in the May-June 1964 issue of the magazine.

James E. Bennett, Robert W. Bower, Charles B. Bye, Lelia R. Conwell, Mary E. Darling, Dorothy F. Dixon, Bernal E. Gold, A. J. Grewe, Calvin J. Jackson, Donald H. Johns, Robert T. Martin, Ernest Lee Mastus, Dewey C. Miller, A. L. Muller, Wm. J. Metz, J. C. Obermuller, James N. Olivieri, Paul G. Ostrom, Prescott R. Reed, J. R. Ruppe, Sterling S. Searcy, Alvin E. Smith, Jos. E. Turnham, Claude L. Williams, Vernon B. White, Fred H. Yoshino, Robert D. Zaniboni, Wayne LeFevre.

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L. Hopkins, highway maintenance man II, 25 years; John L. LeBarge, senior highway foreman, 37 years.

### District 9

George M. Bennett, building maintenance man, 10 years.

### District 10

Herbert M. Parker, senior highway foreman, 33 years.

### District 11

George A. Gray, associate right-of-way agent, 34 years; Emil B. Johnson, senior delineator, 31 years; Roy Still, highway maintenance man II, 28 years; Elmer F. Wolin, highway maintenance man II, 13 years.

### Headquarters

Harry D. Bowers, supervising landscape architect, 36 years; George J. Grohman, associate highway engineer, 35 years; Walter Landers, senior highway engineer, 36 years.

### Bridge

Aldrich D. Dykstra, associate bridge engineer, 34 years; John K. Neff, assistant bridge engineer, 31 years; Charles R. Poppe, supervising bridge engineer, 37 years; Albert J. Stocks, associate bridge engineer, 38 years.

## Right of Way Loses George J. Grohman

George J. Grohman, associate highway engineer with the California Division of Highways, has retired after 34 years with the state.

Grohman is a recognized expert in right-of-way engineering, a field that has come into special importance as a result of the accelerated highway and freeway construction throughout the state and nation.

Grohman, who was born in Tampa, Florida, attended grade and high school in Stockton, California, and graduated from the University of California at Berkeley with a degree in civil engineering.

Following graduation he worked for several years doing drafting and surveying for private utility and title companies.

From 1929 to 1931 he worked for the State Department of Water Resources as part of the staff of a groundwater investigation in San Joaquin County.

Grohman came to work for the State Division of Highways in May of 1931. He transferred to the District 6 (Fresno) office in 1936 and returned to the Sacramento office six months later.

He is a member of the American Society of Civil Engineers and the American Right of Way Association. He has been active for many years in church affairs in Sacramento.

Grohman and his wife, Myrtle, live at 1732 Vallejo Way in Sacramento. They have a son and two daughters and seven grandchildren.

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### Materials and Research

Jessie E. Early, engineering aid II, 27 years; Ralph H. Kipp, associate steel inspector, 39 years.

### Shops—Headquarters

Phyllis J. Smith, accounting technician II, 36 years.

### Shop 7

Harold L. Ryan, automobile mechanic, 16 years.

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## Advance Plans Chief For Bridges Retires

Charles R. Poppe, advance planning engineer for the Bridge Department of the State Division of Highways, has retired after 37 years in state service.

Poppe's job included responsibility for all bridge site investigations, preliminary design reports, review of project reports and collecting and correlating data for bridge design. The Bridge Department initiates design on more than 500 structures annually.



A native Sacramentan, Poppe attended local schools here and obtained his B.S. degree in engineering from the University of Nevada. He joined the California Bridge Department in 1927 as an assistant resident engineer. He became a resident engineer in 1930 and supervised construction on many bridges throughout the state. He went into bridge design in 1942 and became chief designer in 1946. He was appointed federal aid secondary engineer for bridges in 1948 and was promoted to advance planning engineer in 1950.

Poppe is a member of the American Society of Civil Engineers, the Masonic Lodge and the Shrine.

Poppe, and his wife, Eloise, have two sons.

### SIGN ROUTE 4 JOB

The State Division of Highways has opened bids on a project in Contra Costa County for grading and paving and structures on 4.7 miles of four-lane freeway on Sign Route 4 between two-tenths mile west of Cummings Skyway and one-tenth mile west of Howe Road in Martinez. Included in the project is construction of the Cummings Skyway Overcrossing; the McEwen Road, Alhambra Avenue and Alhambra Way Undercrossings; and the Muir Spur Overhead for the Atchison, Topeka & Santa Fe Railway.

## Tempus Fugit Column

### January 1940—Tehachapi Pass Unit Opened

A 4.6-mile section of State Highway 58 has just been completed between Bear Mountain Ranch and one mile north of Keene, as part of the reconstruction of the important Tehachapi Pass route, eliminating many steep grades and sharp curves. During the past five years, weekday traffic has increased 148 percent. During the wildflower season, daily traffic flow reaches nearly 4,000 vehicles. Another 4.3-mile segment to the east of the newly opened section is now under construction.

The original road through the pass was a wagon trail built during the mining excitement caused by the discovery in 1870 of silver in the Panamint Valley just west of Death Valley.

### February 1940—Cost of Snow Removal

Each winter approximately 3,400 of state highways which traverse the high mountain areas are cleared of snow so that normal communication and travel will be possible. The magnitude of the task is apparent from the size of the annual bill, which has varied from \$390,000 during a mild winter, to as much as \$575,000 during a severe winter.

### January 1940—Newhall Tunnel Replaced by Cut

Across the northerly end of the San Fernando Valley, the rugged Santa Susana Mountains have long represented a troublesome barrier to road building. Until 1910, a narrow vertical cut known as Fremont Pass served travelers to the north of Los Angeles. For the next 20 years an arch

### SISKIYOU COUNTY CONTRACT

The State Department of Public Works has announced the award of a \$1,456,000 contract in Siskiyou County to Peter Kiewit Sons' Company, Medford, Oregon, for converting the existing two-lane US 99 to four-lane divided Interstate 5 Freeway between the Oregon state line and 1.5 miles south.

tunnel, 17½ feet wide, served the rapidly increasing traffic. In 1928-29 Division of Highways constructed a three-lane highway through Weldon Canyon, west of the tunnel, for traffic to the San Joaquin and Sacramento Valleys, thus relieving the seriously bottlenecked tunnel of a large portion of traffic. But with the huge increase in traffic from 1930-40, Newhall Tunnel again became an intolerable bottleneck.

In 1938, a contract for reconstruction of this portion of the route as a unit new alignment between the San Fernando Valley and Mojave along the so-called Mint Canyon Shortcut. Major interest centered around replacement of the 435-foot tunnel with an open cut. Traffic was carried through the tunnel during construction, and the project finally emerged as a modern four-lane highway with raised central dividing strip.

Approximately 857,000 cubic yards of earth were removed. Cost for excavation was approximately \$191,000; total cost of the project being \$475,700.

### January 1940—Old Indian Trail Over Mountain Springs Grade Being Modernized

The old Mountain Springs Grade connecting San Diego and Imperial Counties, which supplanted ancient Indian trails, is in turn to be replaced by a standard highway over the Inko-pah Mountain Range, with complete realignment of Route 12 (now a part of Interstate 8) between Boulder Park and Coyote Wells, reports E. E. Sorenson, District 11 construction engineer.

The average passenger car, which negotiated the old grade at 20 miles per hour, can now travel the new route at the legal speed limit. Sight distance, which hampered travel on the old route, has been increased to eliminate all interference. Construction involved about 270,000 yards of rock excavation.

Past records indicate that the Mountain Springs route between the Imperial Valley and the coast proved difficult, but nevertheless the only feasible one for the primitive Indians, as well as the motorist of today.

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# 12,000 SHRUBS AND TREES AND HOW THEY GREW

Roadside slopes on US 99 through Tulare were barren before an ambitious landscaping program by the Division of Highways was begun, but a 3½-mile project from Paige Road to Prosperity Avenue brought results almost sooner than one could expect. Armed with 1,019 firethorns and 9,712 oleanders (shrubs) and 655 trees of several kinds, the planters had wrought such a difference in the appearance of the freeway in one year's time that Editor Tom Hennon of the *Tulare Advance Register* was prompted to describe it in editorial and pictorial form last summer. Since then, we have been waiting for the wintertime show of color (which resulted in this issue's back cover). Their editorial is reprinted below, as are the before and after pictures which originally appeared in the *Advance Register*.



## A REAL PLANTING JOB

*There was a time when we were riding the Division of Highways pretty hard to get them to landscape the freeway through the east part of the city. It seemed like the "Gulch" would forever remain an unsightly, dusty trench through the city.*

*Eventually, however, they got around to do a job of landscaping.*

*And believe us, they knew what they were doing, once they started.*

*The area around the Tulare Street overpass today is well on its way to being one of the*

*heaviest landscaped intersections to be found anywhere. We can't recall a single spot anywhere between Los Angeles and Sacramento that is as well planted, as green or as attractively laid out as that one.*

*Just take a drive along the freeway, including the off-ramps and the on-ramps, and you'll see what we mean.*

*And take a careful look at the pyracantha plantings. Come next Christmas time we're going to have a spectacular show of color.*

*Thanks for a job well done.*



