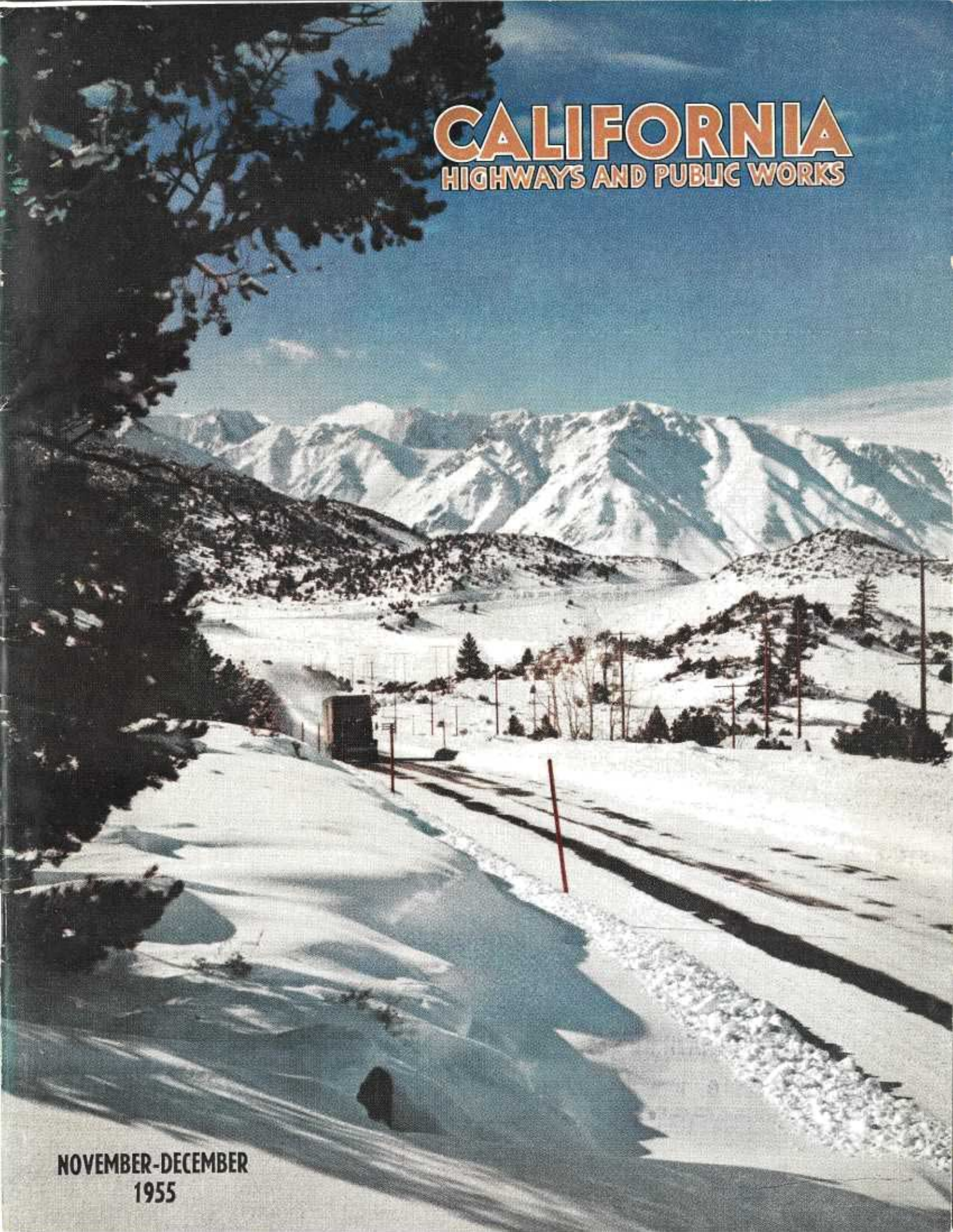
CALIFORNIA
HIGHWAYS AND PUBLIC WORKS
NOVEMBER-DECEMBER
1955

California Highways and Public Works

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

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Vol. 34 November-December Nos. 11-12

Public Works Building
Twelfth and N Streets
Sacramento

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FROM THE CHIEF JUSTICE

SUPREME COURT OF THE UNITED STATES
Washington 13, D. C.

CHAMBERS OF
THE CHIEF JUSTICE

November 14, 1955

MR. K. C. ADAMS, *Editor*
California Highways and Public Works

Dear Ken: Enclosed you will find the card requesting the *California Highways and Public Works.* I would feel lost without it. For me, it is as exhilarating as a western thriller. I read and reread every issue because it reflects more than any other publication the growth, development and progress of California.

With best wishes to you and all of your associates in the Department of Public Works, I am

Sincerely,

EARL WARREN

Published in the interest of highway development in California. Editors of newspapers and others are privileged to use matter contained herein. Cuts will be gladly loaned upon request.

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

Freeways In District XI

By J. DEKEMA
District Engineer

San Diego Meets Challenge For Modern Highways

THE PHENOMENAL growth of the San Diego area continues to demand the modern highway transportation that is the foundation of today's economy. As an illustration of the growth of San Diego County, suffice it to state that the population has increased in the past 50 years at a rate almost 2½ times as great as the growth rate for the State of California as a whole.

Fortunately, the citizens of San Diego have been acutely highway conscious since the advent of the automobile. The county is blessed with many fine highways built years ago as a result of public donations and local bond issues. Austin B. Fletcher organized the county highway system in such a fine manner that he was offered the position of State Highway Engineer to do a similar job for the State after passage of the first state highway bond issue.

Advance Planning

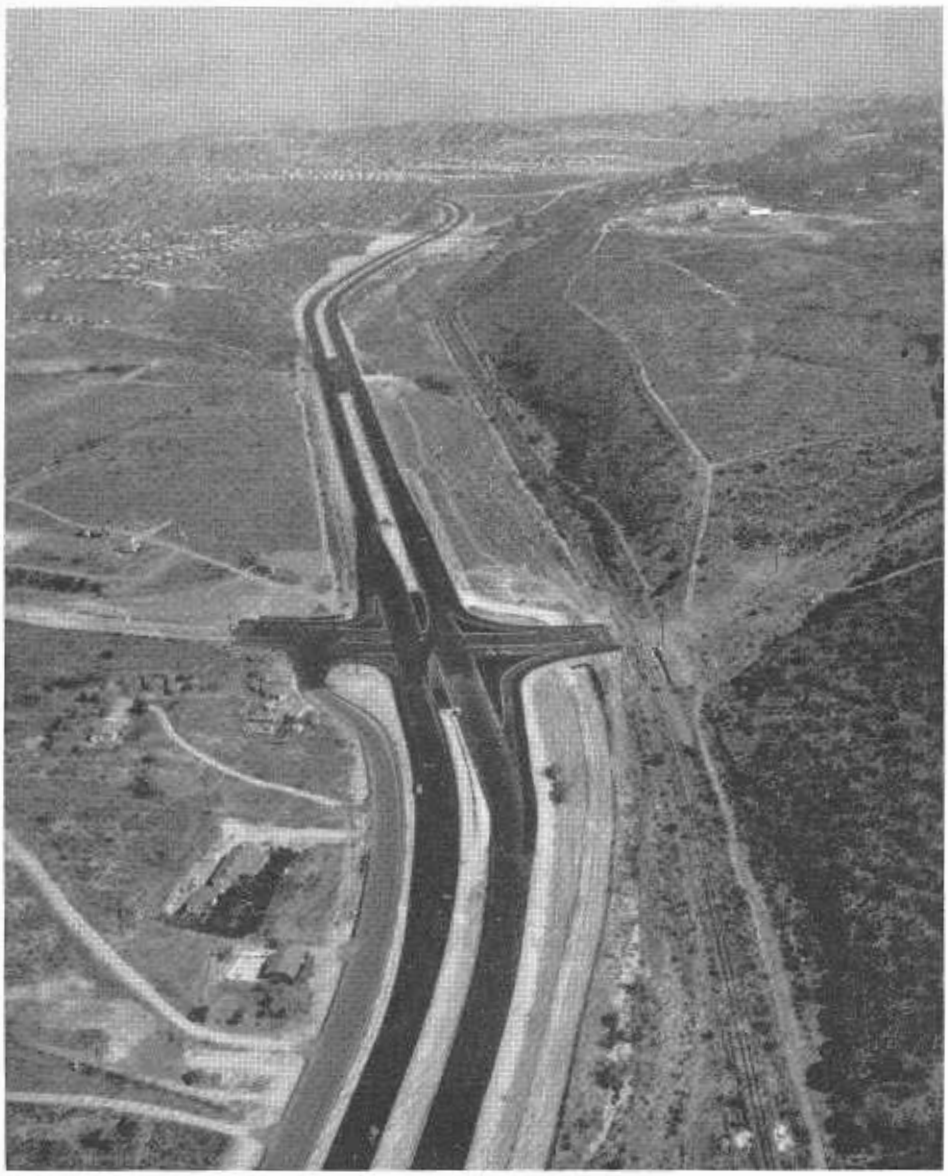
Far-sighted advance planning has continued, and as early as 1931 the City of San Diego adopted a "Major Street Plan" that incorporates many of today's freeway projects.

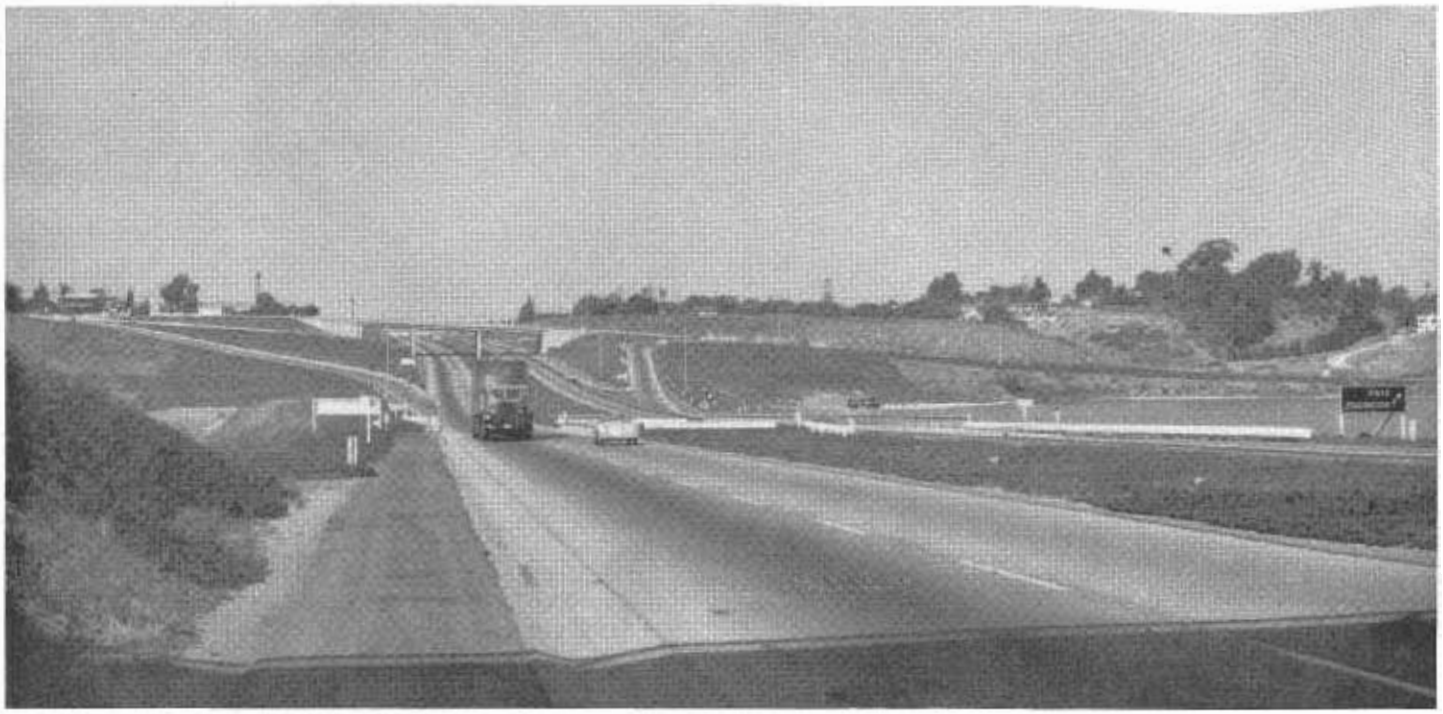
The California Division of Highways, the County of San Diego, and the cities of the metropolitan area are cooperating in the development of an integrated system of freeways, major highways and city streets. The City of San Diego has established a technical coordinating committee, including a committee on transportation research, which is establishing a long range system for the ultimate development of the entire road system in this area. This committee is integrating the city and county major street and highway plans with the State's freeway system. The ultimate aim of this committee is the adopted location of all future freeways and major highways and the establishment of final grades and the advance geometric design of all interchange facilities.

Local Agencies Cooperate

The Division of Highways in cooperation with local agencies is establishing the ultimate location of all future state freeways and the location of all future interchanges and ramp connections so that local planning departments can establish outlets and connections for their systems.

Federal Aid Secondary job in Alvarado Canyon in La Mesa, Jackson Street intersection. Fletcher Hills in background. Limited access design.





Vista Way separation at junction of US 101 and Sign Route 78 between Oceanside and Carlsbad, showing diamond type ramps

The goal in mind has been a system that will make it easy for motorists to enter the downtown area, or to avoid it if they wish. The San Diego traffic survey in 1952-53 showed 24 percent of all trips originate or end in the downtown business area. The basic freeway system consists essentially of the state highways in the area. The California Highway Commission has adopted a freeway routing for each of the state highways traversing the City of San Diego, US 80, US 101, US 395, and State Sign Route 94. In the remainder of the county all of US 395, most of US 101 and segments of US 80 and State Sign Routes 67 and 78 have been adopted as freeways by the commission.

The accompanying map indicates the status of freeway progress in San Diego County.

Cabrillo Freeway Expansion

Much of the work contemplated is the further improvement of existing freeways and expressways. The well-known Cabrillo Freeway, carrying US 395 through the heart of beautiful Balboa Park, requires expansion from four lanes to six and the modernization of several interchanges. On the same road, north of Mission Valley, through the Linda Vista area, Griffith Company holds a $668,472 contract to convert 1.95 miles of the present expressway to a full freeway. Interchanges are to be built at Genesee Avenue and Aero Drive and a frontage road is to be constructed between them. At-grade intersections at Fulton Street and Homewood Avenue are to be closed. The resident engineer, James A. Jesperson, expects completion of the contract about July 31, 1956.

Because of the heavy traffic generated by the Naval Air Station at Miramar, the elimination of all grade intersections on the present expressway is being planned. Increasing commuter and commercial traffic between San Diego and Escondido will also require expanding the present facility from two lanes to four north of Miramar. In District VIII further improvement of US 395 through the Cities of Riverside and San Bernardino, combined with eventual completion on modern standards of State Sign Route 71 from the junction with US 395 between Temecula and Murrietta through Elsinore and Corona to Pomona will ultimately generate sufficient traffic to require conversion of all of US 395 in San Diego County to freeway standards. Fortunately, much of the right of way originally purchased is of sufficient width to permit expansion, and most of the access rights have been bought.

On US 101

The other major north-south highway facility serving San Diego County is US 101. Except for a short section from Del Mar to Leucadia, the entire route has been declared a freeway by the California Highway Commission. Studies on this short section have progressed sufficiently so that meetings are being conducted by the district engineer to acquaint the public with the facts that have been developed and to obtain additonal information that will enable the State Highway Engineer to arrive at a tentative conclusion for consideration by the commission.

Several sections of US 101 have been completed to freeway standards. At the south end of the county the Montgomery Freeway, with the exception of three at-grade intersections, has been completed from the Mexican border to 13th Street in National City, a distance of 13 miles. From this point north to the completed portion of the San Diego Freeway through Carlsbad

and Oceanside the existing highway consists of short stretches of freeway together with sections of highly improved multilane divided highway. Pacific Highway (US 101) past the San Diego Civic Center is now carrying an A. D. T. of 40,000 vehicles, and at Oceanside it is about 25,000.

During 1952 and 1953 a cooperative origin and destination study was conducted by the Federal Government, the State of California, and the City of San Diego. Through personal interviews with motorists, post card surveys, traffic counts, and projection of traffic patterns, were determined the needs, desires and traffic requirements throughout the San Diego metropolitan area.

Lack of Crosstown Arteries

The lack of crosstown or around-town arteries has been a serious handicap in the San Diego area, for the terrain is bisected by many deep canyons. One of the chief difficulties has been that motorists wanting to get to the opposite side of the city from any given point have had to pass through the congested business area. The origin-and-destination traffic study showed that 30,000 cars a day shuttled through the city without stopping. Most of these cars were starting from and stopping at points within the county. This meant wasted gasoline and wasted hours for many motorists.

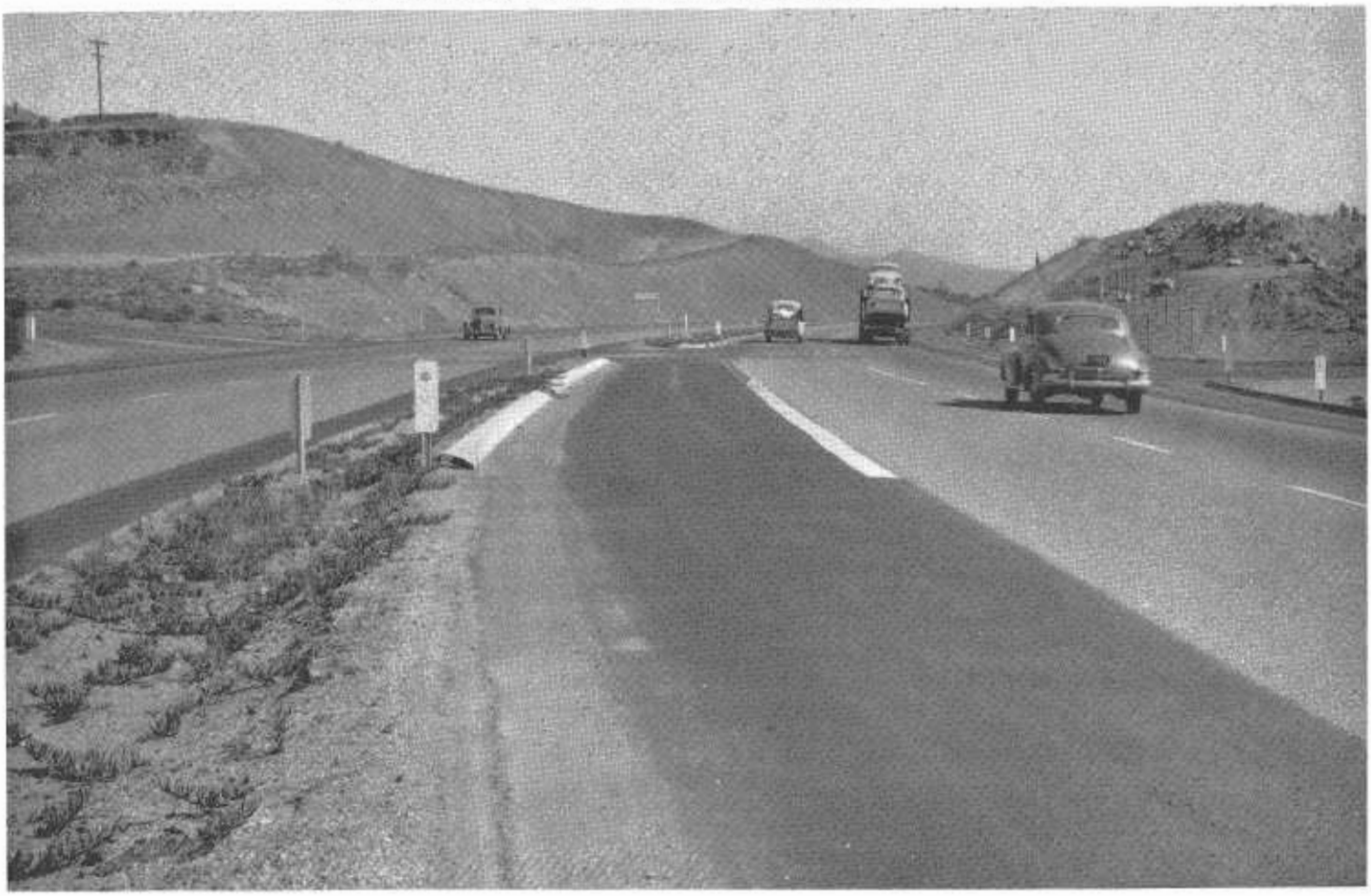
These studies indicated that to reduce the load on the existing US 101 to a volume that it can comfortably carry, a new freeway location swinging around the downtown area to the north and east is necessary. The total estimated cost, from the end of the Montgomery Freeway in National City to the junction with the existing highway at Washington Street north of the civic center, is 45 million dollars. Plans are now being prepared for this freeway to gradually ascend the hillside southerly of Washington Street, overlooking San Diego Bay, looping into Balboa Park to cross the Cabrillo Freeway at Date Street, and then south to join the Montgomery Freeway.

East-west Freeways

Two major east-west freeways appear on the map of metropolitan San Diego. One of these, US 80 through Mission Valley, was constructed to expressway standards by the City and County of San Diego (FAS) and subsequently taken into the State Highway System as Route 12 to replace the outmoded El Cajon Boulevard. The district is actively engaged in preparing plans to convert the entire road from US 101 to El Cajon to a full freeway, eliminating the hazardous and congestion-creating signals at various intersections.

The first unit is planned for construction in the immediate future. The first contract in this conversion program is construction of an interchange

Sign Route 78 between Oceanside and Vista. Typical intersection. Limited access design.



at Baltimore Drive near La Mesa. Bids for this project were opened on October 14, 1955, V. R. Dennis being low with a price of $410,913. Work should be completed by July 1, 1956, according to resident engineer, A. C. Estep. This project includes a frontage road paralleling the highway from east of Maryland Avenue to the Baltimore Drive overcrossing. This job is about three-fourths of a mile in length and will provide an excellent connection for traffic using the federal aid secondary contract now nearing completion on Alvarado Avenue extension. The latter project is itself an expressway and will feed traffic to and from the nearby Fletcher Hills residential section and from the northerly El Cajon area.

Interchange Projects

The 1956-57 Fiscal Year budget allocates funds for an interchange at Lake Murray Boulevard and conversion of 1.5 miles of the present US 80 at that location to a full freeway. Elimination of signals at Fairmount Avenue, Ward Road and Texas Street will follow as soon as funds can be made available.

One of the pending Mission Valley projects which is unique is the proposed revision of the present interchange at the junction of Routes US 80 and US 395. The existing facility was one of the foremost highway developments in this area at the time it was constructed, being the first of its type in Southern California. It was a noteworthy advance in highway design and proved satisfactory for the traffic volumes that were contemplated at the time it was designed. However, the phenomenal population and traffic growth in the San Diego area could not be rationally predicted. Thus the design capacity of the existing facility has been reached at a much earlier date than could possibly be foreseen. Plans are currently being completed to revise the interchange to accommodate present and anticipated traffic volumes.

The second major east-west freeway in metropolitan San Diego consists of a combination of State Legislative Routes 200 and 198, Sign Routes 94 and 67. The new freeway route was adopted by the Highway Commission in three units: the first, Wabash Boulevard to Campo Road on June 17, 1953; the second, from Campo Road to Highway 80 on October 22, 1953; and the last from 18th Street to Wabash Boulevard on November 17, 1954. Two projects are already under contract, a third advertised, the fourth is in the 1956-57 Fiscal Year budget, and the fifth and final link will be built as soon as the right of way can be cleared and construction funds made available.

This freeway begins at a junction with the new US 101 freeway near 18th and F Streets in downtown San Diego, and joins US 80 at Grossmont Summit in La Mesa, 11.1 miles away.

Bridge Structures

The two contracts under way are held by the Guy F. Atkinson Company and total 4.5 million dollars for 4.5 miles of six-lane freeway that can be ultimately expanded to eight lanes. Clarence E. Walcott is resident engineer on the first contract, with R. L. Hathaway the representative for the Bridge Department. The following four bridges are included:

College Avenue Undercrossing. A single span welded steel bridge with composite reinforced concrete deck slab approximately 84 feet long, providing two roadways, one, 61 feet wide and the other, 56 feet wide.

Broadway On-ramp O. C. A single span welded steel bridge with composite reinforced concrete deck slab approximately 114 feet long, providing a roadway width of 22 feet.

Federal Boulevard On-ramp U. C. A single span reinforced concrete box girder bridge about 46 feet long, providing two separated roadways, each 49 feet wide.

Fifty-sixth Street O. C. A four-span reinforced concrete bridge about 225 feet long, consisting of two 70-foot box girder spans and two flat slab spans; one, 35 feet and the other, 60 feet.

Trepte Corporation is subcontractor on the bridges.

MAP OF
SAN DIEGO COUNTY
SHOWING
FREEWAY PROGRESS ON
STATE HIGHWAYS
AS OF NOV., 1955

LEGEND

- FREEWAYS AND EXPRESSWAYS COMPLETED, UNDER CONSTRUCTION OR BUDGETED.
- EXPRESSWAYS, INITIAL TWO LANES COMPLETED, UNDER CONSTRUCTION, OR BUDGETED.
- ADOPTED FREEWAY AND EXPRESSWAY LOCATIONS CONSTRUCTION TO BE BUDGETED.
- FREEWAY ROUTINGS UNDER STUDY

Beginning US 101 and Montgomery Freeway at Mexican border. International Gate in foreground, old US 101 junction in upper right background.

Donald C. Smith is resident engineer on the second contract, which includes the following structures:

Massachusetts Avenue U. C. Two separate structures, each consisting of a welded steel girder span and two concrete girder spans. The westbound structure is approximately 156 feet long with a roadway width of 40 feet and the eastbound structure is about 172 feet with a roadway width of 50 feet.

Waite Drive U. C. Two separate structures, each with one reinforced concrete box girder span and two concrete "T" beam spans. The westbound structure is about 166 feet long with a roadway width of 40 feet, and the eastbound structure is about 146 feet long with a 42 feet wide roadway.

Grove Street O. C. The two span reinforced concrete box girder bridge about 216 feet long, providing a roadway width of 28 feet.

Grove Street U. P. A two-span riveted structural steel girder bridge about 247 feet long, providing for a single railroad track.

Route 198/200 Railroad Separation. A single span reinforced concrete "T" beam bridge about 55 feet long and providing two separate roadways, one 49 feet wide and the other providing a minimum of 61 feet. The three pedestrian structures are as follows:

Costa Bella Drive P. O. C. A four-span reinforced concrete girder bridge about 301 feet long and providing an eight-foot walkway.

Quarry Road P. U. C. A reinforced concrete box and "U" section about 264 feet long, providing an eight-foot walkway.

Dexter Drive P. U. C. A reinforced concrete box and "U" section about 298 feet long, providing an eight-foot walkway.

Mr. Hathaway is also Bridge Department Representative on this contract.

The first contract, from Euclid Avenue to College Avenue, a distance of 2.4 miles, is expected to be com-

Sign Route 94, 56th Street separation near east city limits of San Diego, with new subdivision development in area.

pleted by April, 1956. The second unit, from College Avenue to Campo Road should be open to traffic less than a year later.

From Campo Road to the junction with US 80 near the Grossmont Summit is a distance of 1.90 miles, and bids will be opened on December 2, 1955. The four bridges included in this proposed contract are:

Panorama Drive U. C. A three-span welded steel girder bridge about 165 feet long and providing a 28-foot roadway.

Mariposa Street O. C. A two-span welded steel girder bridge about 123 feet long, providing a 28-foot roadway and one five-foot sidewalk.

Lemon Avenue U. C. Two parallel bridges each consisting of two reinforced concrete "T" beam approach spans and one welded steel girder span about 130 feet long. The westbound structure provides a 28-foot roadway and the eastbound provides a 44-foot roadway.

Grossmont Boulevard U. C. Similar to Lemon Avenue U. C. except each roadway is 28 feet wide and the westbound bridge is about 137 feet long and the eastbound about 158 feet long.

The development of the existing highway through the Grossmont Summit involves several interesting and complex problems. This section must merge two large freeways, Route 12, US 80, and Route 198, State Sign Route 67; must provide adequate service to the La Mesa area via East La Mesa Boulevard; must adequately provide for the circulation of local traffic, both to and from the freeway as well as across the freeway, and must make adequate provision for the handling of pedestrian traffic to the Grossmont High School. The easterly section of the Grossmont Summit development will provide a primary connection to the El Cajon Valley area via the existing El Cajon Boulevard, and will provide for a relocated freeway development of US 80 to the north and east.

System of Ramps

These various movements and connections will be adequately provided for with a system of ramps and structures that will safely channelize traffic into the various arteries with no conflicting movements. A structure will be provided to permit direct access to La Mesa Boulevard from US 80; a second structure will separate conflicting movements from both US 80 and State Sign Route 67; an overhead structure will be provided at Fuerte Drive to permit the circulation of local traffic and to provide access to and from both freeways; a separation structure will be provided near Murray Boulevard to permit circulation of local traffic and to provide access to and from the freeway to areas on the east. A pedestrian overhead structure will be provided near Murray Boulevard to accommodate pedestrian traffic between the Grossmont High School and areas south of the freeway. In a future contract a major structure will be provided just east of Grossmont Summit to carry the new freeway over the S. D. and A. E. Railway and to provide a direct connection to the freeway westbound from the El Cajon area (US 80).

Bridge Advertising

At the other end of the freeway the section from Wabash Boulevard to Euclid Avenue is in the 1956-57 Fiscal Year Budget and should be ready for advertising in the near future. The bridges on this proposed contract are:

Home Avenue Off-ramp U. C. A six-span steel girder bridge about 422 feet long, providing a roadway width of 22 feet.

Home Avenue On-ramp Bridge. A four-span reinforced concrete "T" beam bridge about 140 feet long and providing a 22-foot roadway.

Forty-seventh Street O. C. A four-span reinforced concrete bridge about 255 feet long, consisting of two box girder spans and two "T" beam spans, and providing a roadway of 52 feet and two five-foot sidewalks.

Euclid Avenue O. C. A four-span reinforced concrete bridge about 292 feet long, consisting of two box girder spans, one flat slab span, and one "T" beam span and providing two divided roadways, each 26 feet wide.

To summarize, there are 17 bridges and three pedestrian structures included in these four contracts. They include six structural steel bridges of which five have a concrete deck and one is a railroad bridge, eleven reinforced concrete bridges and three bridges which are part structural steel and part reinforced concrete. There is approximately $2,750,000 worth of bridges included in these contracts.

Plans are being completed for the portion between 18th Street and Wabash Boulevard and the entire freeway from downtown San Diego to Grossmont Summit should be open to traffic in a few years. Further extension of State Sign Route 67 to the north through Lakeside is also planned for the future and the freeway route through this area has been adopted.

In the northern part of the county heavy traffic between Oceanside, Vista, and Escondido has necessitated the start of freeway construction in this area. An expressway from Oceanside to Vista was constructed under two contracts, the last of which was completed on June 28, 1955. Cost of the first contract covering 3.48 miles was $608,865 and it was built by the Griffith Company. The second contract, covering 3.41 miles was held by W. F. Maxwell Co. and Hermreck and Easter with a final cost of $602,-000. J. A. Jesperson was resident engineer on both projects.

Studies are underway to extend the project 11 miles from Vista to a junction with US 395 at Escondido. This freeway will complete a loop of limited access facilities around San Diego-Oceanside-Escondido-El Cajon that will bring a freeway to the doorstep of 90 percent of the population of San Diego County. The continued growth and economic prosperity of the area are assured by this distribution system now either completed or on the engineer's drawing boards.

CLEANING HIGHWAYS EXPENSIVE

A total of $5,000,000 is expended yearly in Los Angeles, Orange, and Ventura Counties to clean up roadside litter tossed on the highways by careless motorists, according to a State Division of Highways official.

Low Accident Rate On Freeways Can Be Further Reduced

The relatively low accident and fatality rates on freeways can be further reduced if motorists will follow a courteous and sensible safety program of freeway driving "musts," says the California State Automobile Association. The motorists' organization lists the five points of the program as follows:

1. Slow drivers keep to the right. Remember, if you're being repeatedly passed on your right, you're probably in the wrong lane. Carefully move over to the lane farthest to the right.

2. Adjust your speed and following distance to the flow of traffic and weather. One car length for each 10 m.p.h. of speed is advised; in other words, at 40 m.p.h. stay four car lengths behind the car ahead, at 50 m.p.h. stay five car lengths.

3. Decrease your speed and increase your following distance during rain or poor visibility; also use headlamps, not parking lights.

4. Watch the signs and avoid excessive or abrupt lane changing by planning ahead. If you intend to exit at a given point, allow yourself plenty of time to change lanes easily. In all cases, look first, then be sure to signal and change lanes one at a time.

5. If you miss a turn-off, don't slow up or engage in any erratic maneuvers. Continue as you are, for there is only one thing to do in such a case and that is to go on the next exit point. It is always prudent to study beforehand a freeway map of a city in which you have never driven before, but if you do find yourself on a strange freeway without previous study, be extra alert to spot the exit you want.

Speaking before the Los Angeles Chamber of Commerce Los Angeles Beautiful Committee, W. D. Sedgwick, district maintenance engineer for the division, said a large portion of the time of maintenance and landscaping crews is spent in picking up trash on state highways in this district.

"Open Water" Fill

Unique Project Is Nearing Completion

By VINCENT O. SMITH, Senior Highway Engineer

On November 9, 1955, a contract was awarded to Guy F. Atkinson Co. for completion of the grading of one of the most unusual and interesting highway projects ever attempted. This portion of Bayshore Freeway, between the intersection of Third Street and Bayshore Boulevard in San Francisco and South San Francisco, will cross an arm of San Francisco Bay approximately two miles wide, bypassing one of the most congested sections of highway in the Bay area.

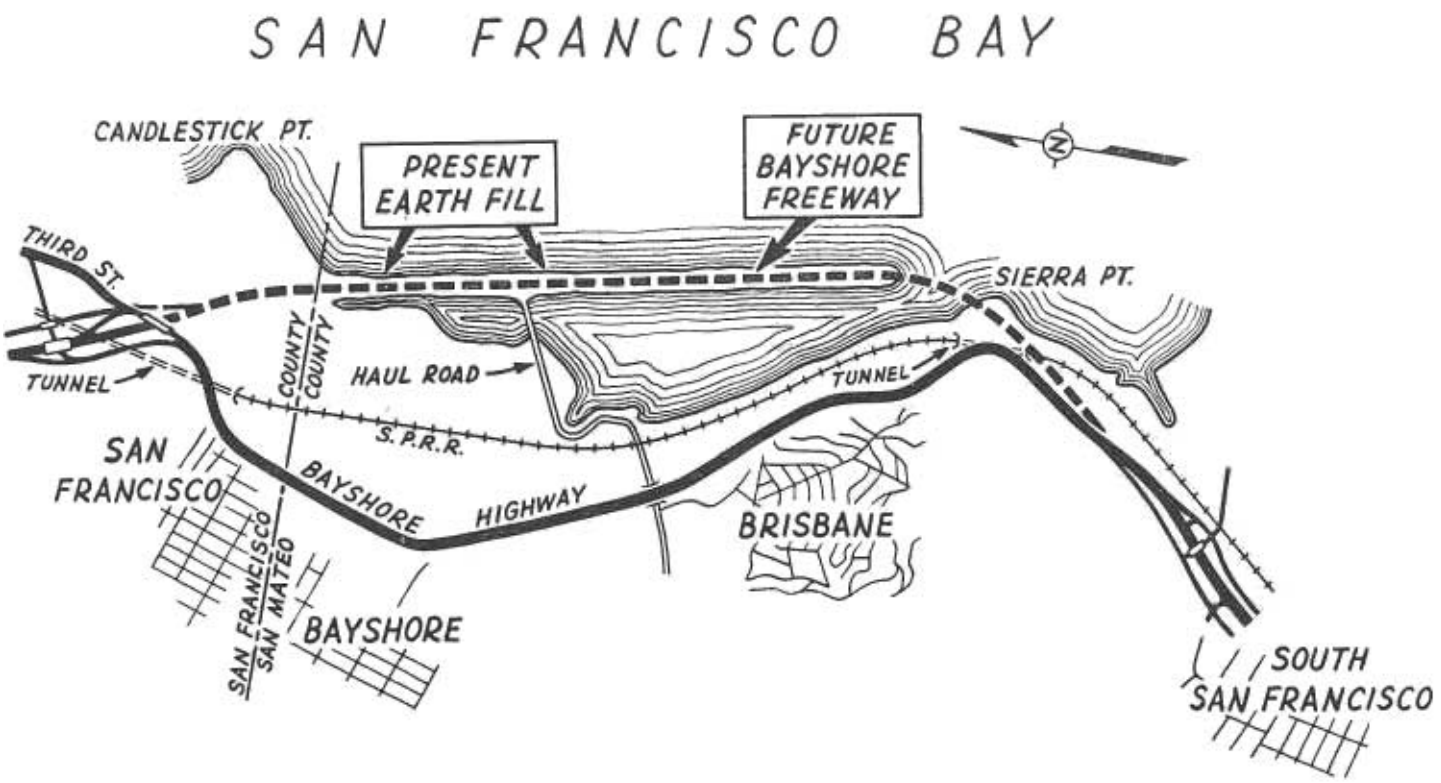
The need for additional highway facilities to handle the increasing traffic between San Francisco and the fast developing peninsula area became apparent in the mid-1930's and numerous traffic studies were made to determine the type and extent of expansion that would best alleviate the growing congestion. Due to the highly developed industrial sections, substandard alignment, grades, and constricted right of way on the existing route through the Visitacion Valley area, it was determined that the most economical and desirable solution was to bypass this area with a new location. This would provide two facilities through this area with a new freeway for through traffic and the existing route to serve local traffic.

Several Routes Studied

Studies of several routes bypassing this area led to recommendation of the present route. It subsequently was adopted and declared a freeway by the Highway Commission in July, 1941.

Since the new route crossed an arm of San Francisco Bay, with underlying mud ranging in depth from a few feet to nearly 80 feet, construction presented a major problem. Comprehensive studies were made to determine the most feasible and economic type of method of building this project. After eliminating the possibility of a causeway the two methods most carefully analyzed and compared were: (1) displacing the mud with dry fill by end dumping and (2) several variations of predredging the mud to provide a reasonably stable embankment with a minimum of mud displacement.

Because of large cuts on each end of the project and the fact that an ample quantity of borrow material was readily available from nearby sources, it was determined that substantial savings would be realized if the end dump mud displacement method would provide a stable embankment. Since this method of construction had never been used on such a large scale with dimensions and conditions resembling those to be encountered, it was questioned whether the fill could be successfully con-



Fill for open water section of Bayshore Freeway across Candlestick Cove. Widening at center of picture is location where reinforced concrete box culverts will be constructed to equalize water level.

structed in this manner. Hence to determine the feasibility of the proposal funds were made available and a contract was let in January, 1952, to construct an experimental section of fill by end dumping.

Mud Fill

Material for this contract was obtained from the right of way and was placed using 20 cubic yard carryalls and tournapulls. The fill was advanced on a 400-foot-wide front in an attempt to float the fill with a minimum of mud displacement. As the fill progressed, it was determined by borings that much greater penetration and displacement of mud was occurring than had been originally estimated. Calculations showed this greater penetration would allow the width to be reduced and still obtain reasonable stability so the fill was advanced further into the bay at a width of 300 feet.

Reducing the width caused greater displacement, so the fill was narrowed again. The remainder of the experimental fill unit was constructed 250 feet wide, being completed in August, 1952.

Based on the success of obtaining a reasonably stable fill over mud of a maximum depth of 40 feet on this first contract, a second experimental project was recommended to be placed by the same method to determine the feasibility of construction over mud which reached a depth of 80 feet.

Overhead Crossing

This second contract was awarded in June, 1953, and it included building an overhead crossing over eight tracks of the Southern Pacific Railroad and nearly two miles of haul road to a borrow site west of the existing Bayshore Highway. To reach the center line of the proposed freeway fill it was necessary to cross 1,200 feet of the bay with the haul road which was to be constructed 30 feet wide over mud that reached a depth of 60 feet. Construction of a fill of this width resulted in nearly 100 percent displacement of the soft bay mud and provided a road over which nearly 3,000,000 cubic yards of fill material has been hauled with only normal grading for maintenance.

The successful completion of this haul road confirmed further the feasibility of the method of construction, so instead of feasibility, our main concern during construction of the second experimental fill became placing the fill in such a manner as to obtain a uniform displacement of mud both laterally and longitudinally.

Uniform Displacement

If the fill could be placed so that a uniform displacement of mud could be obtained, differential settlement would be a minimum and only normal maintenance would be required.

Borings were made during construction to determine the depth of displacement, and records of quantities and methods of placement were correlated with these borings to determine factors affecting displacement.

Numerous variable factors were found that influenced displacement, the prime ones being:

1. The shape of the advancing face of the embankment.
2. The type of equipment used to place the fill material.
3. The rate at which the fill was placed.
4. The elevation at which the fill was carried.
5. Stoppages.
6. The type of material of which the fill was constructed.
7. Strength of the underlying mud.
8. Depth of the underlying mud.
9. Tide action.

A change in any of these factors caused others to vary and resulted in a change in displacement. Controls had to be established and varied during construction to meet the conditions at hand.

... Continued on page 28

New Expressway

Freeway Through Placerville Completed at Cost of $1,649,000

By P. C. SHERIDAN, Assistant District Engineer, and
T. G. SMITH, District Construction Engineer

MODERNIZATION of the portion of US 50 between Sacramento and Lake Tahoe is advancing with the completion of two projects; one the portion between near Clarksville and Shingle Springs, a two-lane facility constructed on right of way acquired for future expressway development; and second, and more spectacular, the new expressway through Placerville.

US 50, or the Lincoln Highway as it is sometimes known, and in the past known as the Pony Express Route, follows the general route of the original historic pioneer trail. As an emigrant road, Johnson's "cut-off" gradually increased in popularity and importance, diverting travel from the Carson Pass Road. Its chief advantage was lower elevation with a longer period of freedom from snow. This largely accounted for its being chosen as the route of the transcontinental mail and passenger stages. About 1860, portions were rebuilt between Placerville and Virginia City, a distance of 116 miles, at a cost estimated at $500,000. As much more was spent between then and 1868 for betterments and maintenance, which during the same period was more than repaid by tolls amounting to approximately $6,000,000.

Old State Wagon Road

The first indication of a new era was an act approved March 26, 1895, creating the "Lake Tahoe State Wagon Road" which included the Placerville Road from the junction near Smith's Flat to the Nevada state line. The rights to the toll road had been purchased by El Dorado County and it was declared a public highway in 1886. With the signing of an indenture dated February 28, 1896, it became the first state road in California.

This historic route notes the continuing changes of the times. First as a trail with its strings of mules, the Pony Express and the mountain schooners, followed by Concord coaches to the early gasoline buggy, and on to the modern motor car and powerful motorized freight trucks of today.

With the changes in type of transport, the road itself has undergone necessary changes. Much of the tortuous, winding, narrow highway was reconstructed in the late 1920's and the 1930's by the State Division of Highways and the Bureau of Public Roads, leaving what was then the "tolerable" stretches for later construction.

SHINGLE SPRINGS PROJECT OPENED

The five-mile section of US 50 in El Dorado County, between 2.3 miles east of Clarksville and Shingle Springs, was opened to public traffic on Friday, October 7th.

The new section of highway is entirely on new location, with only a few slight curves, as contrasted with the existing highway which contains numerous sharp curves posted for reduced speeds. The new section has also been built on a wide right of way, and consists of two 12-foot lanes with eight-foot surfaced shoulders.

Construction on this portion of US 50 has been in progress for a little more than a year, at a cost of more than $700,000. The contractor is A. Teichert & Son of Sacramento.

Aerial photo showing realigned US 50 from 2.25 miles east of Clarksville to Shingle Springs. Old route shown with dotted line on right.

Motorists no longer have to contend with the traffic congestion on US 50 through Placerville as shown in these two photographs taken just before completion of the Placerville freeway

Meyers Grade Realignment

Realignment of Meyers Grade from the summit to Lake Tahoe Valley was started prior to World War II, but not completed until after the war. Also, immediately following World War II, the section between Pollock Pines and Fresh Pond was constructed by the Bureau of Public Roads. The State completed projects, also immediately following World War II, between Shingle Springs and near El Dorado, followed within a few years by projects from near Nimbus to White Rock, bypassing the town of Folsom, and the construction of the project just east of Placerville from the railroad crossing near Merryman's to Five-mile Terrace. In 1951 the construction from the foot of Meyers Grade to Mays was completed by the Bureau of Public Roads.

Early in 1948 consideration was being given to the project through Placerville. The route was adopted and declared a freeway by action of the Highway Commission on November 16, 1949.

Route of Freeway

The route as proposed generally follows the course of Hangtown Creek through the city. Placerville lies in the narrow ravine formed by Hangtown Creek with its main street on the south side roughly paralleling the creek. The residential portions of the town follow up the tributary ravines and residences dot the surrounding hillsides. The superseded highway follows Main Street, which with the narrow width, parking, and pedestrian traffic, barely allows for two-way traffic. On some holiday weekends the traffic has been jammed so that it has taken up to an hour to traverse the two miles through the community.

The new expressway follows the course of Hangtown Creek on the north side with the Southern Pacific Placerville Branch tracks located between the highway and the creek.

The new facility is a four-lane divided expressway with grade crossings at Canal Street, Spring Street and Bedford Avenue. These three intersections at grade will be signalized. Pedestrian overcrossings are provided at the former crossing of Coloma Street and at Bedford Avenue. Grade separations without connections to the facility are provided at Clay Street and Locust Street. A complete two-quadrant interchange is provided at Washington Street where the structure spans the railroad tracks and Emigrant Ravine, as well as Washington Street. Ramp connections are provided at the beginning of the project to the old highway and to Coloma Street near the center of town, as well as the connections previously mentioned.

Right of Way Problems

Because of the terrain, residential, commercial and industrial building sites are at a premium in Placerville. As a result, right-of-way acquisition negotiations were made difficult in that in many cases it was necessary to provide substitute facilities. For example, the Christian Science Church, the Shakespeare Club, the Standard Oil bulk plant, and the Southern Pacific Railroad depot and freight handling facilities, as well as many residences had to be relocated. The January-February, 1952, issue of *California Highways and Public Works* contains an interesting account of right-of-way acquisition for this project.

The Placerville Branch of the Southern Pacific Railroad and its interchange with the Camino, Placerville and Lake Tahoe Railroad roughly parallel the new facility throughout most of its length. Because of the restricted width available in the bottom of the ravine it was necessary to relocate most of the railroads' facilities. This work was done by railroad forces under service agreement at a cost which will approximate a quarter million dollars.

Again, because of restricted space available, negotiations with the Placerville Fruit Growers Exchange were complicated. This plant, one of the largest pear packing plants in the world, lies between the railroad and the new facility near the east end of the project.

Started in 1953

Actual construction on the project, other than right-of-way adjustments, started in March of 1953 on a contract for the construction of the Locust Street and Washington Street grade separation structures. This unit was followed successively by a grading contract, a base and surfacing contract, and last, a signal and lighting contract.

LEFT—Looking easterly at beginning of project. Old highway swings right across tracks and Hangtown Creek to follow Main Street. Spring Street (S.S.R. 49) crosses the expressway near center of picture. RIGHT—Looking westerly from near end of project. Washington Street Overhead in foreground. The structure spans relocated Washington Street, the Southern Pacific Railroad, and Emigrant Ravine. Placerville Fruit Growers pear packing plant, one of the world's largest, LEFT CENTER.

Construction problems galore were encountered while building the road. Chief among these was redoing the town's utility systems to make way for the freeway. In a town as old as Placerville, the location of many of the water and sewer pipes was lost in antiquity and it was found most practical to excavate until a pipe was discovered by breaking it with a tractor and then to figure out where the pipe started, whether it was in use, and what to do with it. The difficulty was that while this was being decided some of the town might be out of water, and so immediate action was necessary. However, the townspeople knew the problems that were being faced and were very cooperative. Surprisingly few complaints were received when the vast amount of utility changing is considered.

This photograph shows the Camino, Placerville and Lake Tahoe Railroad truss that was salvaged and used to span a highway grade separation structure to permit the use of over-legal loads during construction

Utilities Relocated

In addition to moving the water and sewer lines, power and telephone lines had to be relocated. The work of railroad relocation was complicated by carrying city traffic across the project at every intersection, and it is obvious a great deal of cooperation was necessary between the various forces on the project in order to get all jobs done at the right time. However, all work was completed with a minimum of delay.

The roadway material consisted mostly of a clayey shale which required some blasting to break it up enough to handle with a power shovel. Fortunately only a small amount of blasting was necessary.

Many springs were intercepted on the project. At times it was difficult to tell whether the springs were natural or the result of a broken water pipe or septic tank. In order to stabilize the subgrade it was necessary to place about 2,500 feet of perforated metal pipe, some of which drains the year round.

Four Contracts

The work was done under four contracts. The first, early in 1953, was let to Fredrickson & Watson Construction Company, and included the grade separation structures at Washington Street and Locust Street at a cost of $308,000. J. H. Horn of the Bridge Department was the resident engineer.

The second contract, the main grading and structure work, was awarded to Piombo Construction Company of San Francisco in January, 1954. The structures included pedestrian overcrossings at Coloma and Bedford Streets. These crossings presented many problems in forming and constructing. Particularly difficult were the ramps circling the columns. This contract was completed in May, 1955, at a cost of about $875,700. T. G. Smith was resident engineer.

The base and paving contract was awarded to Harms Bros. of Sacramento in May, 1955. The whole length of the project is curbed, and for a time it was believed that placing this amount of curb and gutter would prevent the contractor from finishing the project during the 1955 construction season. However, this did not prove to be the case, as the contractor moved in an excellent curb and gutter crew and completed enough of this part of the contract so that no delay was encountered. The cost of this unit will approximate $399,365. E. F. Silva was resident engineer.

Lighting System

The fourth and final contract for highway lighting and signals was awarded in September, 1955, to R. Flatland. The lighting is a standard mercury vapor installation, but the signal system is unusual. The equipment includes a traffic actuated cycle selector with railroad pre-emption. Six possible cycles are available in the equipment being installed. The cost of this work approximates $66,000. T. H. Madsen was resident engineer.

An interesting event on the grading project was the discovery of an old mining tunnel. The surface opening had seemingly been lost for many years as none of the old-timers in town could remember this mine being worked, or even where it had started. Whoever had dug the mine was careful to keep his work from prying eyes. The tunnel ran back from the cut slope about 75 feet and showed evidence of very careful hand digging. No shoring had been used and a remarkably small amount of material had sloughed from the sides or top of the tunnel. However, it looked as though the tunnel was a failure as no evidence of gold was discovered.

During construction old-timers in town were observed searching some of the excavation areas for evidence of gold. So far as is known, no great strikes were made but it is assumed

... Continued on page 29

Sherwin Grade

Historic Inyo-Mono Route Will Be Reconstructed

By DOROTHY SHERWIN VELLOM *

ON SEPTEMBER 20, 1955, the California Highway Commission voted $1,515,000 for grading and surfacing US 395 in Mono County between Birchim Canyon and Whiskey Canyon, a distance of 11.3 miles.

DOROTHY S. VELLOM

Construction will be started next year as soon as weather permits.

The story of Sherwin Hill and Sherwin Grade has its beginning in the life of one of the earliest pioneers in the eastern slopes of the High Sierra. James L. C. Sherwin, called by the lure of the west and its gold, brought his bride from Kentucky, first to Virginia City, Nevada, in 1859, then to Benton, then to Round Valley in 1866 to homestead on Rock Creek. In 1874 he saw the need for building materials so built the road over Sherwin Hill to Rock Creek where he established a sawmill. The family then moved to what is now known as Swall Meadows from where Mr. Sherwin continued to operate the sawmill at the foot of the grade. He developed another sawmill at Mammoth when that became a busy mining camp and built a road from Round Valley to Mammoth. Many, many changes have been made since those early days but both hill and grade bear his name and are still known as Sherwin Hill and Sherwin Grade, though long ago this road ceased to be a private toll road and became a public highway.

Project Started in 1915

Factually, Day Labor Work Order No. D-79 dated October 4, 1915, was the formal authorization for state highway construction between the Inyo-Mono county line and Sherwin Hill, a distance of 5.8 miles, on US 395. The day the work actually started is not available from any known records. It is safe to say that on that particular unknown, yet highly historical day in the highway annals of the Inyo-Mono region, no whistles blew, no speeches were made, no traditional first shovelful of earth was turned nor was there any particular significant event marked for posterity.

Very likely work was formally started by some native eastern Sierra Paiute driving a team of mules, banging his Fresno scraper into the warm earth on Sherwin Hill.

This section of Sherwin Grade north of the summit will be modernized to eliminate bad ascent and curves

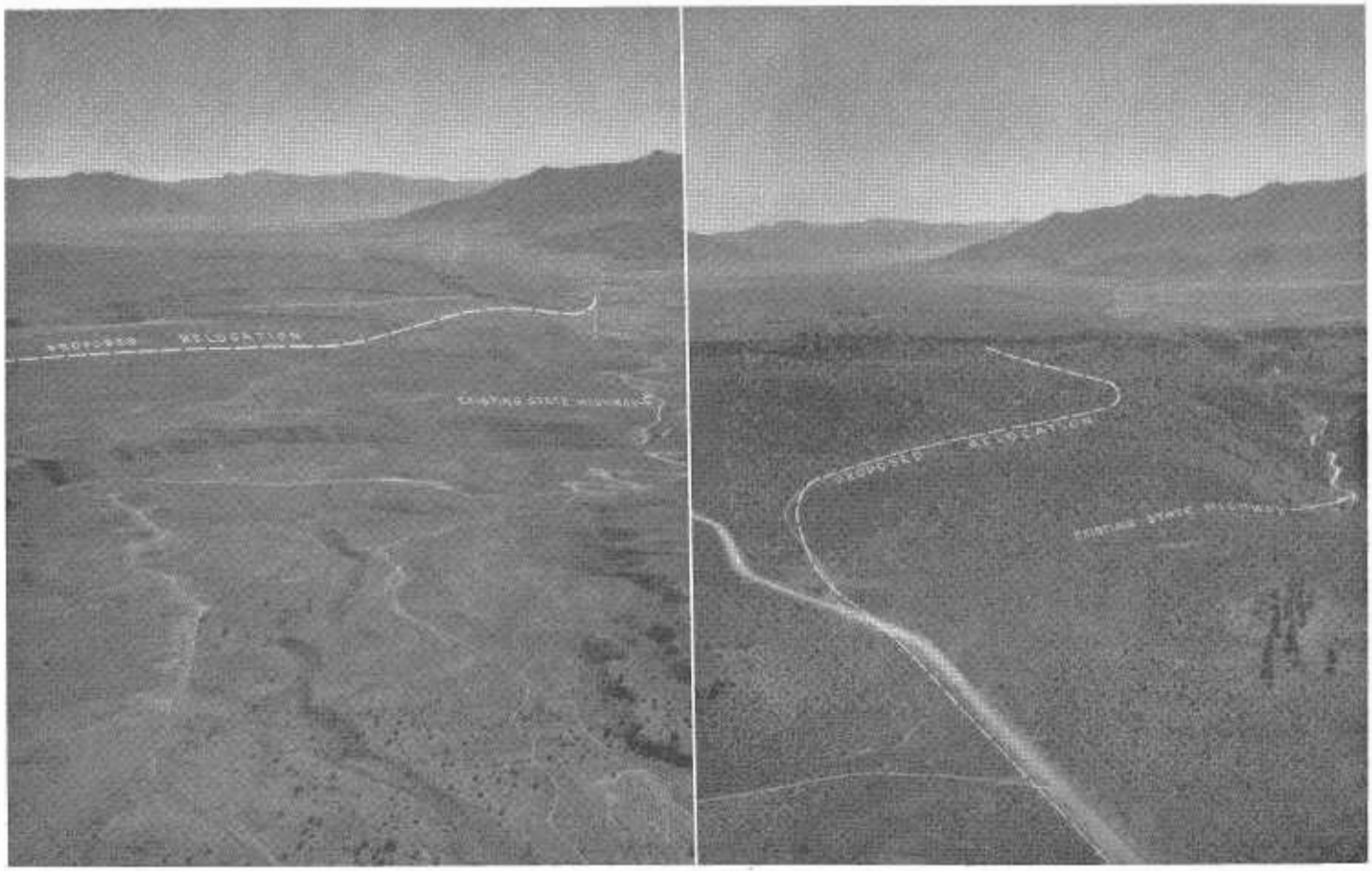
First Route Study

Division Engineer Woodson was then in charge of this Inyo-Mono area with headquarters across the mountains in Fresno, and assigned as resident engineer of the first state highway project in what is now known as District IX, the man who actually made the first route and reconnaissance study, C. C. Boyer.

Boyer's originally announced plans were to hire as many local men and teams as available in order to furnish employment to home people. He expressed hopes of completing the grading of about 6 miles of the 10-mile section between September and the time storms would cause a winter shut down. Contemplating a construction project of 10 miles, Boyer evidently was anticipating approval of work northerly from Sherwin Hill. Subsequent work orders proved him correct.

Before work could actually start it was necessary to make innumerable arrangements for labor, equipment, stock, fuel, groceries and supplies of all natures. A camp was set up and maintained for the workmen, it being

* Secretary to District Engineer F. E. Baxter, Bishop, and granddaughter of the original builder of Sherwin Grade.



LEFT—Sherwin Grade, looking south. Dotted line shows proposed relocation. RIGHT—Upper East Mesa, looking south. Proposed relocation to the left; existing State highway on right.

moved from time to time to keep it as close as possible to the job site. When the work site became as far as 2½ or 3 miles away, camp was moved. Camps were tents; the kitchens and dining rooms were constructed in sections which could be bolted together and then covered with canvas. Boyer, as both superintendent and resident engineer, had his office "under his hat."

Early Day Problems

In some cases dry camps were established and then it became a necessity to haul water to the camp sites. This was done in wagon tanks hauled by mule teams. All supplies this first fall were hauled to camp by mule teams. Hay and grain available locally were so purchased but all other supplies were either hauled from Bishop or from Laws which was the railroad point of delivery.

The highway which was actually built up Sherwin Hill was mostly on an 8 percent grade and followed a zig-zag development up the slope. Some 40 to 60 men were employed in the construction work, all of whom were on the State's pay roll. Personnel employed was generally local. A few professional mule skinners who followed railroad and highway work made up the skilled labor contingent. Quite a few local Indians were engaged on this project. Work done in the fall of 1915 was grading and minor drainage structures. Wherever the earth was such that it could be moved with teams and scrapers, that method was used. Because of the general scarcity of pure earth material numerous grade changes were made nearly all of which were raises in grade to avoid heavy rock work.

Hand Drilling Necessary

Rock excavation was done by drilling and blasting; hand drilling was of necessity done. The blasted material was removed by stoneboats and mules and by wheelbarrows. Where no earthy material was encountered for smoothing off the roadbed it was necessary to complete the grade with borrow material wherever it could be found.

For the next 40 years this road as herein described continued to serve ever increasing traffic needs with only surface changes.

It is a sincere tribute to our early road builders and a marvel that they could build so well with so little with which to do.

January, 1916's, headlines carried the news of one of the worst storms in eastern Sierra history. This storm had the effect of closing down the newly inaugurated highway project for a period of about three months. Four feet of snow on Sherwin's slopes plus extremely cold weather made productive work on the road impossible. It wasn't until late March before the snows had melted and the temperatures risen sufficiently that the construction men were able to resume their labors. In April, 1916, the first

truck was assigned to this area. It was a two-ton truck, chain driven and equipped with solid tires. This truck was put on the Laws-Bishop-to-camp route carrying needed supplies and materials. The original field book showing the log of trips, type of cargo and cost of repairs is still available and makes interesting reading in itself. The first car assigned to this area was a four-door sedan used by Boyer.

Unit Completed in 1916

By June, 1916, the grading and structures were essentially completed to Sherwin Summit. In order to continue on the much needed northerly descent from Sherwin Summit into Rock Creek, Day Labor Word Order No. D-101 was issued under date of April 4, 1916, for 4.8 additional miles. The same crews and camp setup arrangements were used in what amounted to a continuation project northerly under Boyer's direction. While this extension work was under way funds were made available to provide a penetration oil surfacing to this 5.8-mile section up Sherwin.

Because the Owens Valleyites in their travels northerly could witness the completion of the grading work it was only natural that they should burn with a desire to try out the new road. Boyer appealed to the traveling public in every way to forego trying to go through the new work. During one weekend 90 cars were counted traveling over the new road. Such heavy traffic through construction made it necessary for Boyer to establish road control hours during the last two weeks of the construction period. No one was allowed through the job from 7 to 11.30 a.m. or from 1 to 4.30 p.m.

Celebration Held

Having worked so long and diligently for highway progress in this area it was only natural that the people of Inyo-Mono should desire to celebrate their first highway project completion with a colossal whing ding. The local newspaper carried headlines in large capital letters and in the framed center of the front page the following announcement: "Celebration of Sherwin Hill Conquest to Occur One Week From Monday in Rock Creek Canyon." Invitations were sent to the owners of 300 license cars to come and bring as many friends as their cars would hold, as well as a basket lunch except meats and coffee which would be provided.

The actual ceremony occurred on September 4, 1916, when about a thousand people shared the pleasures of an outing on Rock Creek when El Camino Sierra's first unit was auspiciously dedicated. For 35 years since J. L. C. Sherwin created his toll road over that rock strewn slope and into the canyon beyond, humans and horses had expiated their sins on its punishing climb and descent.

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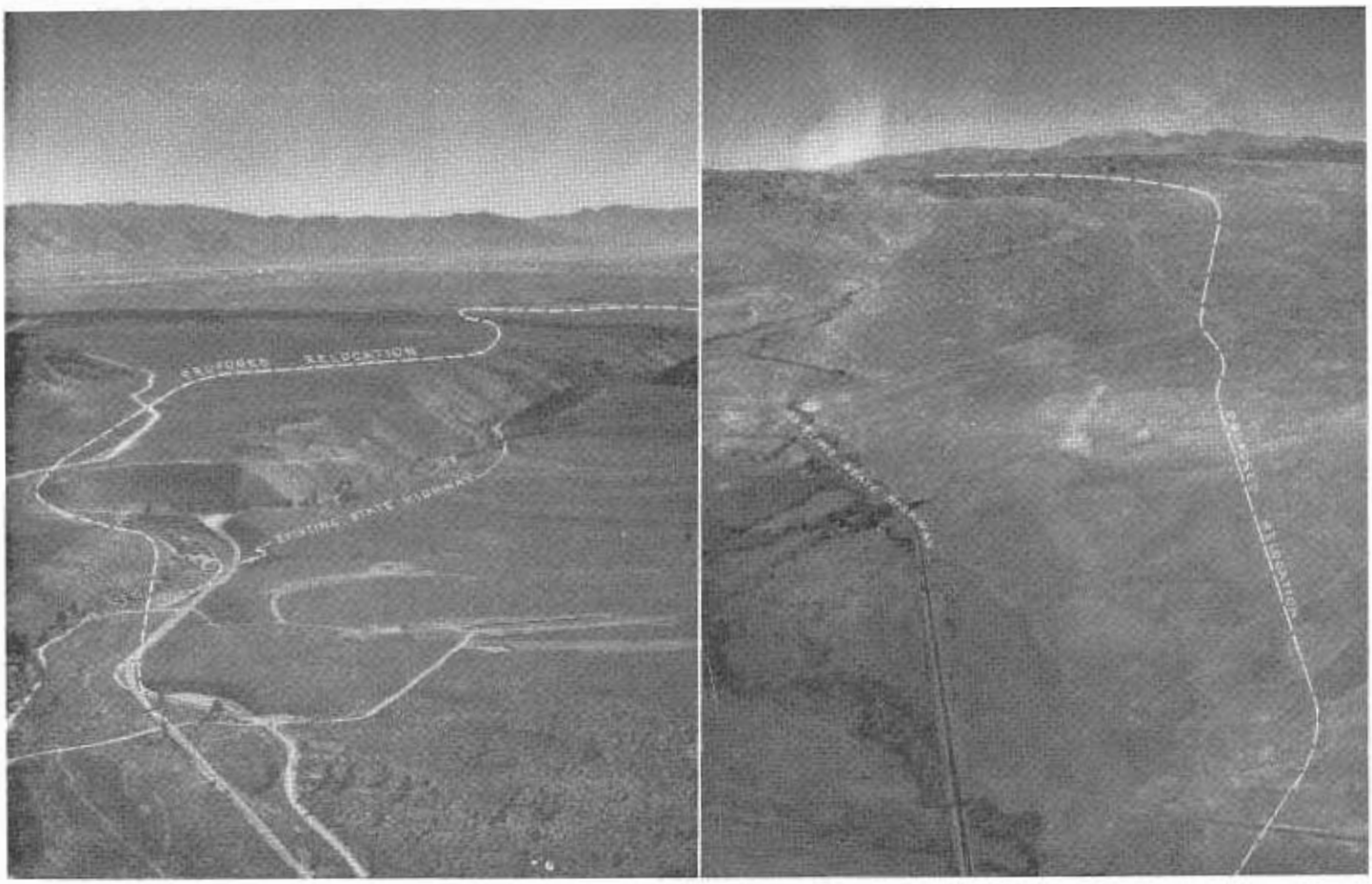
LEFT—Looking south from Whiskey Canyon, showing existing route and proposed relocation. RIGHT—Looking north from Bircham Canyon showing proposed relocation on right.



Redwood Empire

Convention Cites Need for Federal Highway Appropriations

PRESSING NEED for many additional millions of dollars in highway construction appropriations was accented during Redwood Empire Association's 35th Annual Convention at Hoberg's in Lake County, October 20th-22d.

Particular emphasis was laid on the need for new federal-aid funds.

The convention was one of the most successful and heavily attended in the association's long record in behalf of highway development, tourist-vacationist traffic promotion, and related activities. Organization policies were set on a wide range of issues affecting the present and future welfare of the Empire although the main themes of discourse related to highway and highway problems.

Long List of Notables

The official and public interest with which the association's activities are viewed was attested to by the long list of notables who attended the Governor's dinner the closing night of the convention. A crowd of 450 filled the huge dining room to virtual capacity. Speakers included U. S. Senators William F. Knowland and Thomas H. Kuchel. Toastmaster was Robert R. Gros of San Francisco, Vice President of Pacific Gas & Electric Company, who returned recently from a month behind the Iron Curtain.

Unable to attend the function because of his absence from the State, Governor Goodwin J. Knight was officially represented by State Director of Public Works Frank B. Durkee, Chairman of the California Highway Commission. Representing Governor Paul Patterson of Oregon was Niel R. Allen of Grants Pass. Official greetings from the California Highway Commission were extended by Commissioner F. Walter Sandelin of Ukiah.

Robinson Reelected President

Presiding at the Governor's dinner as well as at other major functions of the convention was Reed W. Robinson of San Francisco, who was elected to a second term as president. He was presented by Arthur J. Schilder of Ukiah, a past president. Robinson paid singular tribute to the organization's veteran general manager, Clyde Edmondson of San Francisco, whom he introduced as "Mr. Redwood Empire." Edmondson has been directing head of the association since 1925.

REED W. ROBINSON

Others at the speaker's table included State Senators A. W. Way and James E. Busch, and Assemblymen Frank P. Belotti and Ed Gaffney. Senator Busch welcomed the association's representatives and guests on behalf of the citizens of Lake County.

State and federal officials at the dinner included: T. Fred Bagshaw, Assistant State Public Works Director, who served for many years on Redwood Empire Association's Executive Board; R. H. Wilson and B. W. Booker, Assistant State Highway Engineers; C. E. Bovey, Cooperative Projects Engineer; Milton Harris, Construction Engineer; A. E. Elliot, Bridge Engineer; Alan S. Hart, L. A. Weymouth and J. P. Sinclair, District Engineers; C. A. Maghetti, Highway Commission Secretary; Kenneth C. Adams, Editor, and Robert Rose, cameraman, *California Highways and Public Works* magazine; Peter Mitchell, President, and Ralph Bell, Press Relations Officer, State Public Utilities Commission; Forest Fiorini, Chairman, California Aeronautics Commission and Clyde P. Barnett, Director of Aeronautics; F. H. Raymond, State Forester; John L. McLaughlin, State Department of Motor Vehicles; J. Stuart Watson, Assistant Executive Officer, State Lands Commission; Ralph Phillips, U. S. Bureau of Public Roads Engineer; Webb Kennedy, Chief Engineer, U. S. Forest Service; and Fred T. Johnson, U. S. National Park Service.

Other guests included: Russel Ells, President, California Redwood Association; Harold J. McCurry, Past President and Edwin J. Moore, General Manager, California State Automobile Association; Archie D. Stevenot, President, Mother Lode Highway Association; Frank E. Marsh, Executive Vice President, San Francisco Bay Area Council; Vincent Cooper, Assistant General Manager, County Supervisors Association of California; and many others.

Senator Kuchel Urges Highway Legislation

Durkee and Allen delivered messages from the governors of their respective states pledging energetic support of sound highway programs aimed at eliminating traffic hazards and otherwise improving highways linking California and Oregon.

Although Knowland devoted a major portion of his address to international affairs, he strongly endorsed Kuchel's earlier call for bipartisan support of President Eisenhower's recommendations for an adequate interstate system of highways.

Kuchel blamed politics for the defeat of the President's multibillion-dollar highway program in the last session of Congress.

Supervisors Unit

The supervisors unit, the association's policy-setting body on highways and legislative matters, met prior to the Governor's dinner. In furtherance of some of its long-established policies, the unit reiterated its intentions to:

1. Continue its campaign to promote additional federal-aid highway construction appropriations in all classifications;

2. Increase its efforts to bring about the inclusion of US 101 and US 199 in the national system of interstate highways;

3. Campaign to promote additional federal funds for the U. S. Forest Service highways, U. S. Forest Serv-

Frank H. Bartholomew, New York City (right), President United Press Association, was featured speaker at newspaper publishers unit breakfast session during the annual convention Redwood Empire Association at Hoberg's, October 22. Ukiah publisher, Ben A. Cober (center), presided as president of the publishers unit. At left is Earle W. Fullerton, Mendocino County vice president.

OFFICERS AND EXECUTIVE BOARD MEMBERS, REDWOOD EMPIRE ASSOCIATION FOR THE NEW FISCAL YEAR 1955-56. FRONT ROW LEFT TO RIGHT—Board member George H. Allen, General Manager Clyde Edmondson, President Reed W. Robinson, San Francisco; Past President Leo H. McLeod, Fortuna; Senator A. W. Way, President Shoreline Highway Association; Association Counsel Elliot M. Epsteen, San Francisco; Albert F. Beecher, Josephine County (Oregon); Unit President Leland J. Guglielmetti, Santa Rosa. BACK ROW LEFT TO RIGHT—Lake County Vice President Don Emerson; Unit President E. R. Freyer, Piercy; Board member Ted Huggins, San Francisco; Marin County Vice President Elias S. Day; Judge Raymond A. Lathrop and Josephine County Vice President Edwin S. Heydenburk, Grants Pass; Sonoma County Vice President Harry S. Graham.

ice roads and trails and for other federal highway projects;

4. Pursue with increased vigor its campaign for repeal of the remaining 10 percent federal transportation tax against persons.

Chairmaned by its president, Earle W. Wrieden of Middletown, the supervisors unit unanimously decided that the association should continue to coordinate certain phases of its programs with those of the National Association of Travel Organizations, American Association of State Highway Officials and other influential groups in an effort to realize some of its major objectives.

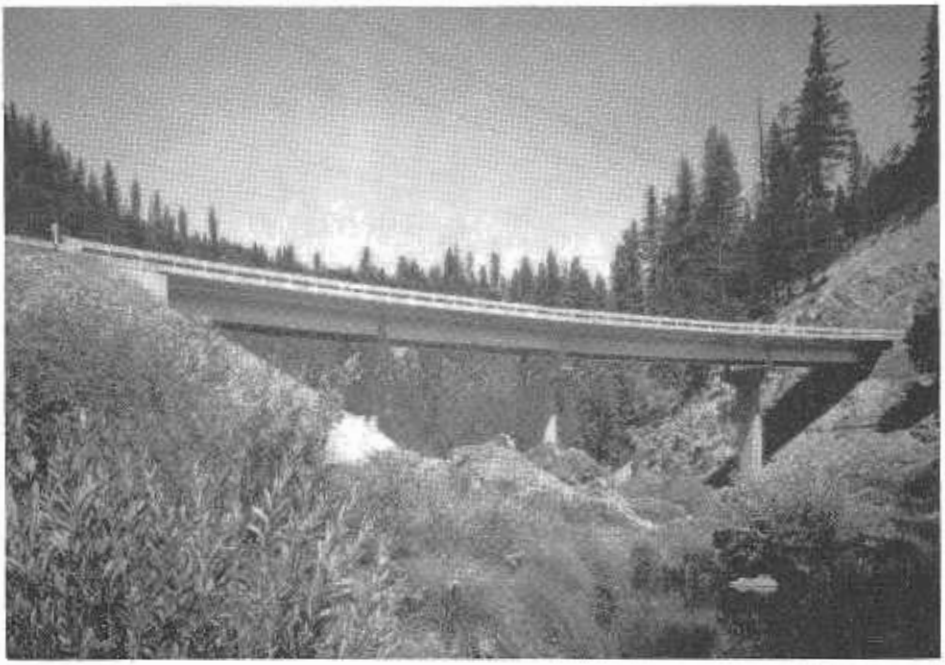
Shoreline Highway

The unit also adopted into policy a series of recommendations of Shoreline Highway Association, a Redwood Empire Association affiliate of which Senator Way is president, calling for important highway improvements in Marin County and along the Empire coastline.

During the final convention assembly, resolutions were unanimously adopted expressing appreciation to Governors Knight and Patterson; the State Highway Commissions of California and Oregon; Director of Public Works Durkee; George T. McCoy, State Highway Engineer, and other officials and engineers of the State Division of Highways; U. S. Bureau of Public Roads; U. S. Forest Service; federal and state legislators, for their interest in state and federal highway projects and legislation, and for funds allocated for highway improvements.

Other public officials who participated in unit and committee sessions were: Assemblyman Lloyd W. Lowrey; Harold B. LaForge, Engineer, Federal-aid Secondary Highway Projects; William L. Berry, Principal Hydraulic Engineer, State Division of Water Resources; Ruben Johnson, representing Division and District Engineers, Corps of Engineers, U. S. Army; Kenneth A. Brown, Deputy Real Estate Commissioner; Homer F. Potter, acting Regional Director, Small Business Administration; Randall Ward, President, California Mission Trails Association; Henry T. Maschal, nationally known research analyst; and Frank H. Bartholomew of New York, President, United Press Association, who was the principal speaker at the newspaper publishers unit breakfast.

PLUMAS COUNTY BRIDGE RECEIVES AWARD



This is the bridge given an honorable mention award by the American Institute of Steel Construction

California Division of Highways received recognition for the appearance of one of its structures this month when honorable mention award was received from the American Institute of Steel Construction in its annual competition for the bridge over Indian Creek in Plumas County. This structure on the scenic Feather River Highway bridges Indian Creek near Keddie, where it joins Spanish Creek to form one of the forks of the Feather River. The structure is composed of two riveted girders, six feet deep, supporting a 28-foot concrete roadway. The single shaft concrete piers add to the trim lines of the finished structure. The new 248-foot bridge was completed August 24, 1954, replacing an old 327-foot timber deck truss structure built in 1929.

The award states: "This bridge was chosen because it is well integrated with the mountainous landscape, hardly an episode, but seemingly continuous with the rugged highway construction."

PLANS ARE MAPPED FOR ARBA ROAD SHOW AND CONVENTION

Plans for the 1957 American Road Builders' Association Annual Convention and International Road Show are developing fast. Preliminary arrangements for the show, which will exhibit all types of heavy construction machinery, were worked out by representatives of ARBA and CIMA (Construction Industry Manufacturers Association) in September.

The most spectacular indoor exhibition of its kind ever held will draw tremendous throngs to the enlarged Chicago Amphitheater from January 26 to February 3, 1957. Space exceeding 300,000 square feet will be devoted to the equipment display. Delegates from every state and from most foreign countries, representing all branches of government and industry, will participate in the brilliant convention program to be offered by ARBA and in the special activities of the road show.

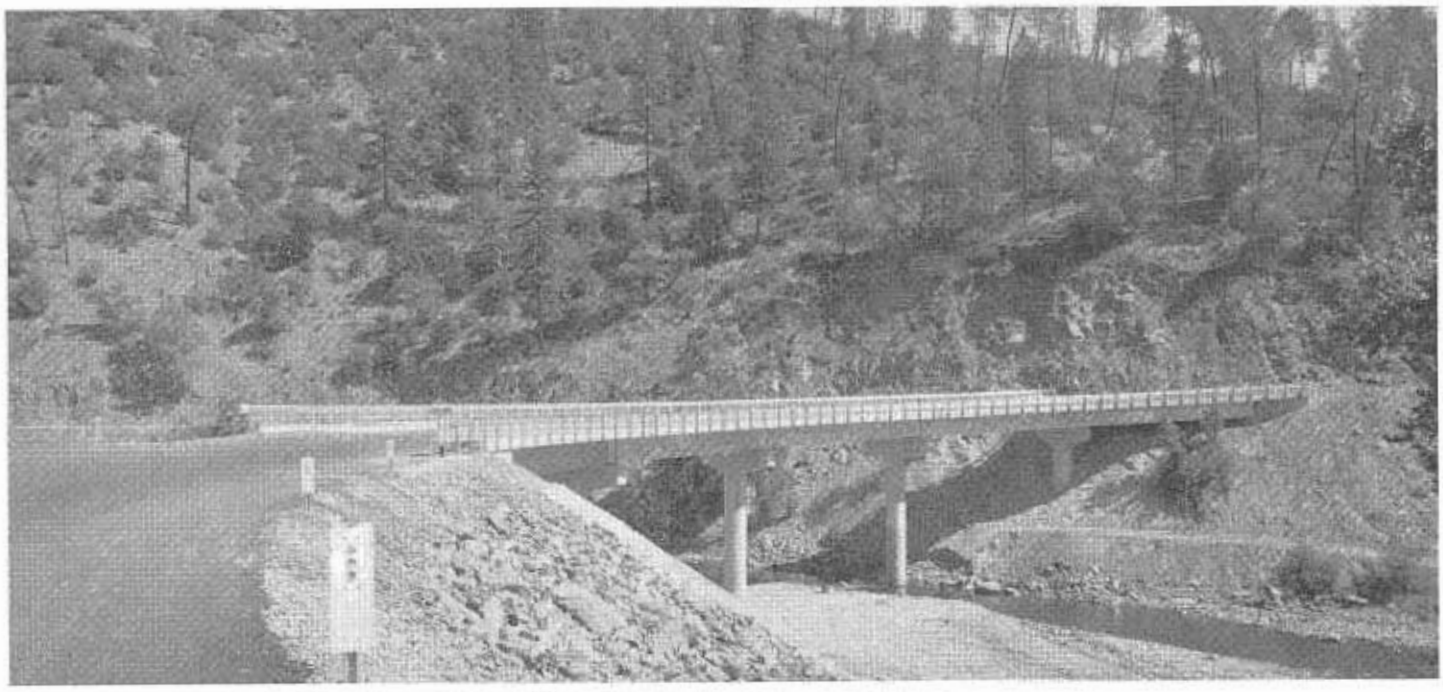
PLACER COUNTY USES FAS FUNDS TO REPLACE OUTMODED BRIDGE

By HERBERT E. ABELL, Road Commissioner

The Mother Lode country has removed another obstacle to modern transportation by the completion of a new bridge across the north fork of the American River in Placer County, three miles east of Auburn. The bridge lies on the historic route of the '49ers between Auburn and the fabulous placers of the American River Basin, the Foresthill Divide and the Town of Foresthill. Prior to 1862 the old timers forded or ferried the river at this point but soon recognized the advantage of a dry crossing and constructed a low level wooden bridge. Between that time and 1911 several wooden structures and a combination truss bridge served the traffic of those times. In 1911 a steel bowstring truss bridge was erected serving traffic on a one-way basis until 1944 when it was deemed necessary to strengthen the structure to adequately provide for the ever-increasing loads. Even with this added reinforcement it was necessary to ford the stream with overweight out-size equipment needed for present-day logging operations.

A new bridge downstream constructed by Placer County under the Federal Air Secondary Highway Program replaced this narrow steel truss bridge which served the Foresthill area between 1911 and 1955

Close-up of Placer County new FAS bridge



Two different views of the new bridge across the North Fork of the American River in Placer County

Current average daily traffic is approximately 700 vehicles, made up of the trucks that haul 60,000,000 feet of lumber to market annually, and all of the people engaged in that production, a vestige of the '49ers and those of our cities who have found the peace of solitude in the vast recreational area served.

Designated FAS Road

With advent of the federal-aid secondary program for county roads in 1944, the people of Placer County and particularly those of the Foresthill Divide were given hope of relief from some of the inadequacies of their vehicular transportation system. Accordingly, the county road from State Highway No. 49 to Baker Ranch, via Foresthill, was designated as FAS Route 767, connecting with the $3,000,000 Mosquito Ridge forest access road terminating at Foresthill, and other important access roads which provide the outlet for forest products to the ever-demanding market. A project, correcting the deficiencies of the grade climbing easterly out of the Middle Fork Canyon, was initiated and constructed with three fiscal year allotments of federal-aid secondary highway funds plus matching funds made available by the County Highway Aid Act of 1945, the California Construction and Employment Act of 1946 and the county. County projects of stage construction and stepped up maintenance activities have, in part, kept apace of traffic.

No. 1 Deficiency

By 1952 the bridge constructed in 1911 had become the No. 1 deficiency of the entire county primary road system. The county programmed a federal-aid secondary project to correct this deficiency. In January, 1954, foundation investigations, preliminary surveys for approaches and the procurement of other pertinent data were initiated. The determination of the most economical and most suitable type of structure was made immediately after adequate data were obtained. Of economic consideration was the proposed use of the area as the reservoir site for the downstream

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Manteca Freeway

Major Traffic Bottleneck On US 99 Is Broken

By K. N. HATCH, Resident Engineer

WITH THE opening to traffic of the Manteca Freeway early in November of this year, a major traffic bottleneck on US 99 was broken.

This unit east of Manteca is the third section of full freeway to be opened to travel on US 99 in District X. The 4.6-mile relocation consists of a four-lane divided highway with full control of access. It eliminates some 5.7 miles of two-lane highway through the very center of the Manteca business area, three railroad grade crossings and a highway intersection at grade controlled by four-way "stop" signs.

Can Be Expanded

In designing the four-lane facility, provisions were incorporated to allow expansion to six lanes when such a need developed. The through lanes have been constructed of portland cement concrete on cement-treated subgrade, and ramps and frontage roads are paved with plant-mix on untreated base. Intermediate weakened plane joints were sawed and paper joints provided at 60-foot intervals.

Imported borrow was obtained from a site one mile southeast of the project. The procurement of borrow material in this area presents a number of problems due to the level terrain, the highly developed agriculture and the water table. This subject was discussed by Sam Helwer in this year's May-June issue of *California Highway and Public Works*.

Six structures were required. Partial interchanges to serve traffic to and from Manteca were provided at the north and south ends; a full interchange at the new intersection of US 99 and Route 66 replaces the old intersection at grade, and separation structures serve local traffic on Cottage Avenue, Louise Avenue and on Lathrop Road. Frontage roads were constructed between Route 66 and Cottage Avenue and between South Avenue and North Avenue connecting with Lathrop Road east of the overcrossings.

All structures are reinforced concrete and consist of two continuous box girder spans supported on reinforced concrete center bents and hollow type reinforced concrete abutments on reinforced concrete piling, except the south Manteca overcrossing which consists of but a single span.

These two photographs show the traffic congestion in Manteca at the intersection of Yosemite Avenue, State Route 66, and Main Street, US 99, which was a daily occurrence before completion of the Manteca Freeway

The new route traverses a highly developed agricultural area served by the South San Joaquin Irrigation District. It was necessary for the contractor to schedule the placing of reinforced concrete pipe for eight irrigation ditches and four drainage ditches so as to provide uninterrupted irrigation service.

Irrigation System

Because of a high water table, the contractor selected the "well-point" system in placing irrigation structures. He drilled a series of shallow wells at 12- to 15-foot intervals and backfilled with a pervious material which facilitated the percolation of water into the wells where it could be removed by means of small pumps. This system lowered the water table sufficiently to allow the placing of concrete pipe without difficulty.

Some 60 parcels of land, containing a total of 193 acres, were acquired for right of way on the new freeway. With the exception of two parcels requiring condemnation, all property was acquired by mutual agreement with the owners. The cost of land and improvements was $560,000 and utility relocations amounted to $50,000.

Troublesome Bottleneck

The former highway was constructed in 1925 and consisted of two concrete lanes. The northern portion traversed Main Street, the major north-south business thoroughfare in Manteca. The intersection of Main Street with Yosemite Avenue (State Route 66) has been a bottleneck to traffic and a source of dissatisfaction to both motorists and residents of Manteca.

The intersection of these two narrow streets impeded the movement of trucks which had difficulty negotiating the short radii returns, and the four-way stop signs introduced additional delay to traffic. Residents of Manteca and the surrounding area found it difficult to shop in Manteca due to vehicular congestion and lack of parking areas.

Modernization of US 99 and State Route 66 through Manteca has been under study for a number of years. The first major step towards achieving this goal was an origin and destination study conducted in 1948 and 1949.

Aerial view of Manteca Freeway, looking south, showing Cottage Avenue and Louise Avenue separation structures

Destination Survey

From a total of 21,000 vehicles, 20,000 driver interviews were conducted. The results indicated that 60 percent of the north-south traffic desired to bypass Manteca and that 35 percent of traffic west of Manteca on Route 66 entered or left the south leg of US 99. In removing the route from Manteca, it is estimated that the traveling public will save $14,000,000 in 20 years because of reduced transit time and distance. These and other factors were considered in determining the ultimate routing and on March 18, 1953, the California Highway Commission adopted the present route as a freeway.

Bids were received June 30, 1954, and the contract awarded to A. Teichert and Son of Sacramento who bid $1,821,227.40. Collins Electric Company of Stockton was the successful bidder on the lighting contract at $27,777.77.

Adolph Bauer was the contractor's superintendent and Eric Nordlin was Bridge Department representative for the State.

Work commenced August 5, 1954, and the scheduled date for completion is in December. Because one approach to the Lathrop Road overcrossing would block use of the old highway at the north end of the project, it was necessary to have the freeway open before constructing this approach. For this reason, the contractor's operations continued some eight weeks after the project was opened. During this period, local traffic on Lathrop Road was served by a system of frontage roads and portions of the old highway and the new freeway.

Bay Bridge

New East Bay Distribution Structure Opened to Traffic

By WILLIAM TRAVIS, District Construction Engineer

On October 24, 1955, the final portions of the newly reconstructed East Bay distribution structure were opened to traffic. The occasion was marked by ribbon-cutting ceremonies at the site and a luncheon-reception sponsored by the Alameda County Highway Advisory Committee. The guests were welcomed by President Norris Nash of the Oakland Chamber of Commerce and Chester E. Stanley of the Alameda County Highway Advisory Committee acted as chairman of the day. Speakers included Director of Public Works Frank B. Durkee, B. W. Booker, Assistant State Highway Engineer in charge of District IV, Assemblyman W. Byron Rumford, Mayor Clifford E. Rishell of Oakland and Supervisor Kent D. Pursel of Alameda County.

View looking easterly, showing East Bay distribution structure as originally constructed in 1936

View looking easterly, showing East Bay distribution structure as reconstructed

The original interchange at this location was placed in service in 1936 when the San Francisco-Oakland Bay Bridge was first opened to traffic. The design provided interchange of Bay Bridge traffic, Eastshore Freeway traffic and traffic from MacArthur Boulevard. While the original design was extremely advanced in its conception it did contain weaving sections 550 feet in length which have for some years been greatly overtaxed by reason of the tremendous increase in traffic in the East Bay. The design, however, did provide a full directional interchange with relatively high speed ramp design.

Third Traffic Level

The new construction provides a third level of highway traffic by the construction of separate ramps to interchange traffic between MacArthur Boulevard and either the Bay Bridge or the Eastshore Freeway. This construction completely eliminates the weaving sections of the original structure. Because, however, of the excellence of the original design the greater part of the original structure remains in service to interchange traffic between Cypress Street and either the Bay Bridge or the Eastshore Freeway.

The main line of the Southern Pacific railroad runs through the interchange area as does the Key System Interurban Line which passes beneath the Southern Pacific tracks. Consequently, there are five separate levels of traffic in the completed interchange.

Of primary importance in the design of the new facility was the necessary provision for the 120,000 vehicles which daily pass through the interchange. Several designs were developed which, upon completion, would adequately serve traffic but which designs were discarded when no practical means could be worked out to serve traffic during construction.

Directional Interchange

The design finally adopted provides a full directional interchange with an ultimate capacity of 240,000 cars daily. Traffic service throughout construction was provided by the inclusion of two timber detour bridges at a cost of $150,000. The use of these detour bridges was so correlated with construction of the new facility as to provide full traffic service at all times.

Construction of the new ramps was started in March, 1954, under contract by MacDonald, Young and Nelson, Inc., and Morrison-Knudsen Co., Inc. Completed at a cost of $4,500,000 the new construction includes 10,000 linear feet of new elevated structures which, together with about 6,000 linear feet of the original structure, amounts to roughly three miles of viaduct in the interchange area.

Northerly of the interchange the Eastshore Freeway has been reconstructed as an eight-lane modern facility to the El Cerrito overhead. Southerly of the interchange the $6,000,000 contract for the construction of a double-deck viaduct along Cypress Street is progressing rapidly. Plans are also being prepared for the reconstruction of MacArthur Boulevard to full freeway status. Completion of these projects will establish a system of the highest type of highway facilities throughout the metropolitan East Bay.

Pictured at reception sponsored by Alameda County Highway Advisory Committee are, left to right—B. W. Booker, Assistant State Highway Engineer, District IV; W. A. Sparling, General Manager, Oakland Chamber of Commerce; Mayor Clifford E. Rishell, Oakland, with his grandson, Dennis King, in center.

TEHAMA COUNTY SECTION OF US 99E COMPLETED

Paving on the section of Route 99E in Tehama County between the Butte county line and Los Molinos has been completed. This culminates five years of planning and construction under five contracts on the part of the Division of Highways. It likewise represents the expenditure of approximately $2,000,000.

The work accomplished consisted of widening all the bridges and structures. In the case of irrigation pipes, many of these were leaking and had to be replaced as well as lengthened.

The alignment of the improvement varies in only a few locations from the original alignment. However, the old grade had a number of short pitches and rolls which restricted sight distance. All of these have been removed.

The new surface is 40 feet wide. This provides two driving lanes 12 feet wide with eight-foot shoulders. This section has been found to be the most suitable design for two-lane roads The inclusion of these wide shoulders provides a place for a disabled vehicle to park and a maneuver area for vehicles to operate. They definitely help to reduce accidents.

The roadbed is supported on imported subbase (gravel) material, generally from 3 to 15 inches thick, dependent upon the results of tests of the bearing value made of the underlying material in the grade. Upon this is a cement treated base six inches thick with a three-inch plant mix surface.

J. W. Trask, District Engineer of the Division of Highways at Redding, expressed his gratification over bringing the section of 99E in this district up to current standards.

Trask said that as in the case of all present day state highway construction, the facility was designed to meet the needs of the traveling public for the next 20 years on this route. With the care that was used in estimating the traffic needs, the attention given to all details in the design and the care and attention given to the actual construction, he feels the highway will be entirely adequate.

Cajon Pass

Improvements on Historic Route Eliminate Two-lane Road

By C. G. BEER, Assistant District Engineer

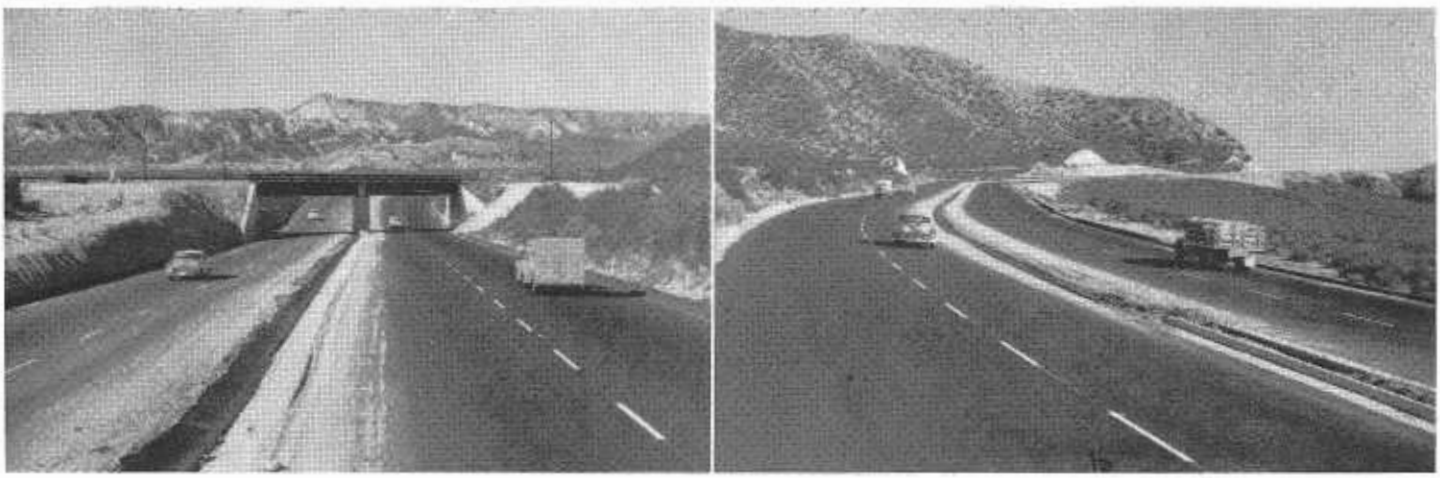
FOUR-LANE divided expressway replaced the former two-lane road over a long and important segment of historic Cajon Pass in San Bernardino County on October 13, 1955. Griffith Company, contractor for construction of a 17.4-mile section of US 66-91-395, opened the new construction to traffic on that date. The summit of the pass is included in the newly completed section, which extends from 0.5 mile south of Gish Underpass to Palmdale Road. Work started on this $1,860,000 contract on April 20, 1954, and is expected to finish on schedule. A. Kinnamon has been superintendent of construction for Griffith Company, and H. C. Prentice and Tom Borman represented the State as resident engineers.

As is indicated by the photographs, the provision of four lanes in this area will greatly expedite the passage of faster traffic around heavy trucks slowed by the grades of the pass. It is also anticipated that closure of the highway under ice and snow conditions will be considerably reduced. These conditions occur several times each winter. They have, in the past, been aggravated by the difficulties of maneuvering traffic on the two-lane road. Many of the closures have been caused as much by traffic blockades as by the snow and ice which were present.

Important Gateway

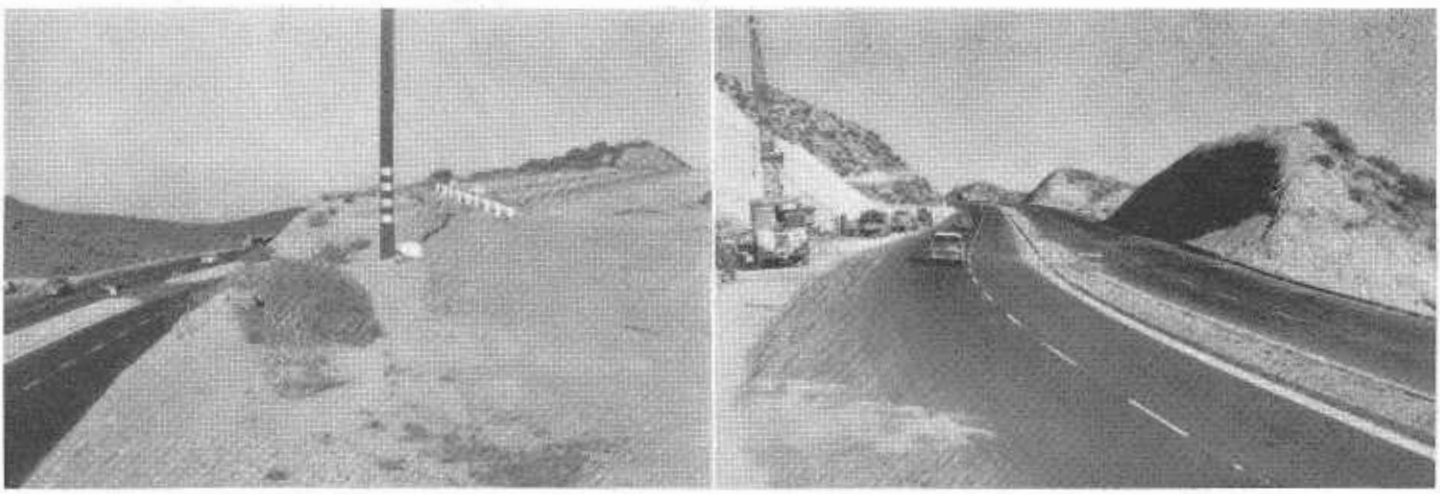
The history of Cajon Pass, one of the important gateways through the mountains surrounding Southern California, was traced in an article pub-

. . . Continued on page 40



LEFT—Gish Underpass as widened to four-lane divided roadway. RIGHT—Approaching Cajon Pass from the south

LEFT—Summit of Cajon Pass. The old replaced highway is shown on the right. RIGHT—Construction view taken immediately south of Cajon Pass Summit.



View of open water section of fill for Bayshore Freeway across Candlestick Cove, Sierra Point in foreground. Both railroad and highway will be relocated across the Point to the right of existing facilities. Purpose of railroad relocation is to provide additional tracks. Freeway will be carried over railroad on structure on solid ground at Sierra Point.

"OPEN WATER" FILL

Continued from page 9 . . .

Effects of Stoppages

Using the information and experience gathered on the two experimental fills, specifications were prepared designating the shape of nose, type of equipment, constant rate of production and the use of dynamite placed in the mud ahead of the fill to overcome the detrimental effects of stoppages. Fortunately, the majority of material obtained from the borrow site was very uniform and rocky in nature, ideal for placement in the mud. Using these controls, the elevation at which the nose was carried, and the rate at which the fill was advanced was varied to correlate with the depth and strength of the underlying mud, type of material, and the positon of the

SUMMARY OF COMPLETED FILL PROJECTS

Contractor	Cu. Yds. Placed	Sta. Limits	Inclusive Dates
Edward Keeble Co.*	418,000	6+00± to 20+00	Jan., 1952-Aug., 1952
Guy F. Atkinson Co.†	956,000	35+00± to 56+00±	Sept., 1953-June, 1954
Guy F. Atkinson Co.	1,953,000	56+00± to 110+00±	Aug., 1954-Oct., 1955
John Delphia Co.	450,000	20+00± to 35+00±	May, 1955-Oct., 1955
Excess Material from Projects in S. F.	230,000	20+00± to 35+00±	Jan., 1952-Sept., 1955
Total	4,007,000		

* First experimental project. † Second experimental project.

tide. This procedure gave satisfactory results in obtaining uniform displacement of mud on the two filling contracts just completed.

It is estimated that an additional quantity of 1,200,000 cubic yards of fill will be required to complete the embankment. This material is being placed under the current contract on which work was recently started. Included in this contract is the construction of an overpass over the railroad tracks at Sierra Point and box culverts to equalize the water level in the lagoon that will be enclosed by the freeway embankment. One more contract will be required to cover the paving of this freeway bypass. It is expected that bids for this final project will be called for in 1956, in coordination with progress on the current contract so as to provide a continuous freeway from the central district of San Francisco to the heart of the peninsula at the earliest possible date.

NEW EXPRESSWAY

Continued from page 13 . . .

that a small amount of color was discovered.

Old Trestle Removed

Another interesting problem was the removal of an old railroad trestle and truss structure used by the Camino, Placerville and Lake Tahoe Railroad. The structure was replaced by a grade crossing at Washington Street. The railroad company removed the rails from the structure, but it became the responsibility of the contractor to remove the remainder. The contractor wanted to use the truss portion to place over one of our structures so he could use overweight roadway equipment, and therefore wanted to save the truss at all costs. Dismantling and loading the structure without dropping it gave everyone some bad moments, but the project was completed successfully and the end results of building a bridge over a bridge gave the contractor an economical hauling arrangement.

This 1.5-mile new facility will save through motorists from five minutes to an hour in time, depending on traffic volumes, and will provide for easier circulation of local traffic on Main Street.

Bay Bridge Is One Of Seven Modern Engineering Wonders

Included in the Seven Modern Engineering Wonders of the United States designated by the American Society of Civil Engineers is the San Francisco-Oakland Bay Bridge. This world-famous span was designed and built under the personal supervision of the late Charles H. Purcell, State Highway Engineer and later Director of the Department of Public Works of California.

The other projects named are:

Chicago Sewage Disposal System—involving Herculean excavation; reversal of the flow of the Chicago River and construction of the world's largest treatment works.

Colorado River Aqueduct—serving 66 municipalities in Southern California with water brought almost 250 miles, traversing desert and mountains and involving part canal, part tunnel and part siphon.

Empire State Building, New York City—tallest building man has constructed.

Grand Coulee Dam and Columbia River Basin Project, Washington—an irrigation marvel; has world's largest hydroelectric power plant.

Hoover Dam, Arizona-Nevada—world's highest.

Panama Canal—greatest of geographical surgical operations; of distinguished service to entire world.

MONTHLY TRAFFIC COUNTS

Regular monthly traffic counts for October, 1955, show an increase of 6.8 percent over October, 1954. They show a decrease of 5.7 percent under September, 1955. Based on a five-year average, October counts normally show a decrease of 5.5 percent under September.

For the first 10 months of 1955 the monthly counts show an increase of 5.5 percent over the same period of 1954.

Comparing October, 1955, with October, 1954, passenger vehicles show an increase of 6.9 percent and freight vehicles show an increase of 6.8 percent. Freight vehicles represented 20.3 percent of the total week-day traffic.

Posts in Division of Water Resources Temporarily Filled

The following temporary assignments in the Division of Water Resources, effective November 2d, were announced by Frank B. Durkee, Director of Public Works:

Harvey O. Banks, Assistant State Engineer, in addition to his regular duties with respect to water rights and water quality investigations, assumed the duties of State Engineer.

State Engineer A. D. Edmonston retired from state service on November 1st.

Walter G. Schulz, Principal Hydraulic Engineer, took over the duties of G. H. Jones, Assistant State Engineer, in charge of flood control projects and supervision of safety of dams.

Jones retired from state service effective November 1st.

William L. Berry, Principal Hydraulic Engineer, assumed the duties of T. B. Waddell, Assistant State Engineer, in charge of state-wide investigations and related matters.

Waddell retired from state service on November 1st.

The three staff members to whom the assignments have been made are not being appointed to the vacancies resulting from the retirement of their superiors, Durkee stated. They will continue to carry on their regular duties for the time being.

Civil service examinations for the position of Assistant State Engineer will be held.

The State Personnel Board has not been requested to hold an examination for the position of State Engineer. This will make it possible for the Legislature in March of next year to have a free hand in discussing the formation of a new Department of Water Resources without having to consider the vested rights of any individual with respect to the position of State Engineer.

STIFF PENALTY

The maximum penalty for drunken driving in South Africa, says the California State Automobile Association, is a $2,800 fine or 10 years in prison, or both.

SHERWIN GRADE

Continued from page 16 . . .

Colorful Ceremonies

The ceremonies took place in a deep, rocky cut before reaching the summit across which was a barrier of vines and flowers. On the upper side a band of mounted Indians in paint and feathers typifying the old order rode up to the barrier while the official car was driven to the opposite side by a charming young lady who took a machete from the auto and walked to the barrier as the brown chief of the Paiutes raised his hand in the command to halt. After a brief parley the cord was severed and the procession permitted to pass. The Pathe moving picture people were reeling in many feet of dedication views and mountain scenery while the head chef served some 575 steaks and 200 pounds of trout. Such an auspicious dedication and celebration was only the beginning of what was then known as El Camino Sierra, now US 395.

This first project covering grading, structures and oiling of the 5.8 miles of Sherwin Hill was finally reckoned to cost $44,928. Of this total $38,621 were for teams, equipment and labor, $3,317 for materials and $2,990 for engineering. The companion project from Sherwin Summit down to Rock Creek was eventually totaled up to cost the State $18,982, broken down into $18,651 for labor, supplies, teams and equipment, $13 for materials and $318 for engineering.

About 1927 or 1928 there was some discussion of a 5 percent route on the easterly mesa. Late in 1931 the question came up again and funds were provided to cover a complete study of the problem but before the reconnaissance report stage was reached all work was dropped suddenly. In April, 1948, a representative of Headquarters Office and the district engineer explored the possibilities of several routings, from which it appeared necessary to develop a grade line on the possible eastern routing, or Mesa line, and a formal request for $1,000 was made for preliminary studies.

A project report dated December 17, 1953, was submitted covering the proposed 12.0-mile relocation between Birchim Canyon and Whiskey Canyon and an aerial survey was made. The route adoption map filed September 3, 1954, for presentation at the September meeting of the Highway Commission met with favorable action. This was a preliminary step toward relocation of a 12-mile section of US Highway 395 (Three Flags Highway) north of Bishop, Inyo County, to eliminate the Sherwin Hill-Rock Creek Grade bottleneck and other steep pitches and sharp curves.

Employees Receive Twenty-five-year Awards

Employees of the Division of Highways who became eligible for 25-year awards during October and November, 1955, are:

Name	Total service Yrs.	Mos.	Days
ELIGIBLE ON October 31, 1955			
District I			
Snyder, Charles W.	25	0	24
District IV			
Ray, Serge	25	0	1
District VI			
Anderson, George F.	25	0	8
District VII			
Elster, Margaret	25	0	20
Central Office			
Deardorff, Herbert H.	25	0	18
Hines, Grace Marie	25	0	23
Ledden, Charles T.	25	0	28
MacLachlan, K. A.	25	0	1
ELIGIBLE ON JUNE 30, 1955			
District III			
Potts, Earl C.	25	0	11
District V			
Barrick, Dewey L.	25	0	13
Lamb, Albert L.	25	0	6
Snyder, Charles H.	25	0	15
District VII			
Rockfellow, George E.	25	0	22
District VIII			
Lasater, Roy M.	25	0	29
Bridge Department			
Dykstra, Aldrich D.	25	0	27

A BOW TO YOU, BILL

MR. KEN ADAMS, *Editor*

DEAR MR. ADAMS: May I join the great number in congratulating you on the excellence of the format, art work and display of *California Highways and Public Works,* which performs a great service in keeping the public abreast of major highway construction projects, perhaps the most important single problem confronting our State.

Kindest personal regards

Sincerely

W. A. SPARLING
General Manager

LONGEST STREET

Figueroa Street in Los Angeles, which extends for 22½ miles, is the longest city street in California.

WINTER ROAD REPORTS

Closer teamwork than ever before between the State Division of Highways and the California Highway Patrol in keeping state highways open despite snow and ice conditions will be possible this winter through the use of radio.

The two state agencies have completed installations of receiving equipment in Highway Patrol cars, highway maintenance vehicles and local headquarters whereby the patrolmen and maintenance workers will hear each other's messages concerning road and traffic conditions, weather, and accidents and other emergencies.

This winter the intercommunication radio system will be installed in the Donner Summit area of US 40 and the Ridge Route section of US 99.

At the same time the Division of Highways announced that its system of state-wide road condition reports covering state highways subject to adverse weather will be extended this winter to cover the entire Pacific Coast, by an exchange of information with the States of Washington and Oregon. Information on main highways in Nevada has been available to California on an exchange basis for the past three years.

SAN FRANCISCO BAY

San Francisco Bay encloses more than 450 square miles of water.

New Budget

Highway Agency Votes Total of $247,338,000 for Construction

A STATE HIGHWAY BUDGET providing $247,338,000 for major construction purposes for the 1956-57 Fiscal Year has been adopted by the California Highway Commission.

The new state highway budget, the largest ever adopted in California, contains a grand total for all state highway purposes of $310,721,600, including maintenance and other items. The construction items include $163,360,000 for major projects, including construction engineering, and $83,978,000 for acquisition of rights of way for future construction.

The $247,338,000 for major construction purposes exceeds by $23,443,000 the comparable allocations for the 1955-56 state highway budget as revised in December, 1954. Almost half of the increase—$10,000,000 represents a portion of the reimbursement to the State Highway Fund, as provided by the Legislature, of previous expenditures for the operation and maintenance of the San Francisco-Oakland Bay Bridge. The rest of the reimbursement, approximately $7,000,000, has been incorporated in the 1955-56 state highway budget.

Early Start on Construction

A faster than usual start on construction of some of the newly budgeted projects has been made possible by a law enacted at the 1955 Session of the Legislature, permitting award of state highway contracts as early as January 1st, six months before the start of the budget year. This provision will enable the Division of Highways to advertise some of the projects for bids within the next few weeks, permitting earlier opening of road improvements to traffic through maximum use of favorable construction weather. Under previous state law, contracts could not be awarded before April.

In addition to highway and bridge improvements on many rural routes, the projects included in the new state highway budget provide for the completion or extension of many multilane freeway and expressway projects both within urban areas and on long stretches of intercity highways.

Freeway Projects

For example, freeway projects budgeted for 1956-57 in Tulare, Fresno, San Joaquin and Sacramento Counties will, when completed, provide a multilane divided highway on US 99 between the Los Angeles area and Sacramento approximately 360 miles long, continuous except for less than a mile of four-lane undivided highway at two railroad separations and short sections through a few northern San Joaquin Valley cities.

Other major freeway projects in the budget will complete the 38-mile section of the Eastshore Freeway from Oakland to San Jose; extend the Bayshore Freeway 7.5 miles to the San Mateo-Santa Clara county line, and complete the four-mile over water section across Candlestick Cove; and provide 7.5 miles of freeway construction on US 101 in the San Fernando Valley.

Additional major projects will convert most of the remaining multilane divided sections of the Santa Ana Freeway to full freeway by construction of separation structures and frontage roads, and extend it 10 miles to El Toro, Orange County. With the 10 miles of the Hollywood Freeway already in operation, and the freeway construction completed, under way or newly budgeted on the Santa Ana Freeway, this will provide 53 miles of continuous full freeway, except for intersections at grade at Orangethorpe and Magnolia Avenues where separation structures are planned but not yet financed.

Added Freeway on US 101

On other sections of US 101, additional freeway and expressway construction is scheduled in Santa Barbara, San Luis Obispo, Marin, Sonoma, Mendocino, Humboldt and Del Norte Counties. Two projects in San Luis Obispo County, when completed, will make US 101 a continuous four-lane freeway and expressway for more than 65 miles between north of Santa Maria and San Miguel, except through the cities of Arroyo Grande and Pismo Beach.

On US 40 in Contra Costa County, freeway construction now under way

Commission Adds $7,060,000 to Its Current Road Funds

The California Highway Commission on October 19th added $7,060,000 in construction and rights of way to the Northern California portion of the State Highway Budget for 1955-56 representing part of the additional funds made available by virtue of a refund from San Francisco-Oakland Bay Bridge toll revenues.

Largest item included in the current budget is an allocation of $2,050,000 for widening of the Eastshore Freeway from four lanes to six lanes between High Street in Oakland and San Lorenzo.

Another $900,000 was allocated for acquisition of a new vessel for the Benicia-Martinez Ferry.

The remaining $4,110,000 consisted of allocations for acquisition of rights of way, as follows:

Alameda County, US 50 (MacArthur Freeway in Oakland), $1,800,000.

Contra Costa County, Sign Routes 21 and 24 in the Lafayette-Walnut Creek-Danville area, $1,230,000.

San Mateo County, Bayshore Freeway, between San Mateo and the Santa Clara county line, $700,000.

Santa Clara County, San Jose-Los Gatos-Campbell area, various portions, $380,000.

The remaining approximately $10,000,000 from the $17,000,000 Bay Bridge refund to the State Highway Fund will be incorporated in the 1956-57 State Highway Budget, not yet adopted by the commission.

Construction Projects in State Highway Budge

County	Route	Description	Approximate mileage	Estimated cost
Alameda	5	Foothill Boulevard—North city limit of Hayward to Mattox Road; grade and pave for 6-lane divided highway	1.3	$800,000
Alameda	69 (SR 17)	Eastshore Freeway—Warm Springs to Beard Road; grade, pave, and structures for 4-lane freeway (completes 38 miles of Eastshore Freeway between Oakland and San Jose)	9.0	5,785,000
Alameda	69 (SR 17)	Eastshore Freeway in Oakland—Magnolia Street to 17th Street; structure (completes freeway viaduct between Distribution Structure and Market Street)	0.8	2,650,000
Alameda	227	Mountain Boulevard in Oakland, between US 50 and SR 24 (portions); grade and surface continuing cooperative freeway project with City of Oakland and County of Alameda		300,000
Alameda	Various	Rights of way on state highway routes		4,991,000
Butte	45	At Cherokee Canal; bridge and approaches		205,000
Butte	47 (SR 32)	Chico to Hog Springs; grade and surface, initial two lanes of ultimate 4-lane expressway	4.9	680,000
Butte	Various	Rights of way on state highway routes		52,000
Calaveras	24 (SR 12)	0.1 mile east to 1.8 miles east of Valley Springs; grade and surface on new location	1.7	235,000
Calaveras	Various	Rights of way on state highway routes		115,000
Contra Costa	14, 106 (US 40)	South of Hilltop Dr. (Co. R. 24) to north of north city limits of Hercules; grade, pave, and structures for 6-lane freeway (connects to beginning of Carquinez Toll Bridge project)	4.9	6,800,000
Contra Costa	Various	Rights of way on state highway routes		2,225,000
Del Norte	1 (US 101)	At Panther Creek, bridge and approaches	0.1	80,000
Del Norte	1 (US 101)	De Martin's Ranch to 1 mile north of Wilson Creek; grade, surface and structure for 4-lane expressway	1.1	640,000
Del Norte	Various	Rights of way on state highway routes		65,000
El Dorado	11 (US 50)	Five-mile Terrace to east of Camino; grade, surface and structure for 4-lane expressway	3.3	970,000
El Dorado	Various	Rights of way on state highway routes		175,000
Fresno	4 (US 99)	Santa Clara Street to San Joaquin Street; grade, pave and structures for 6-lane freeway (completes freeway through Fresno)	1.2	1,930,000
Fresno	41 (SR 180)	B Street to Broadway; grade, pave and railroad grade separation structures on Stanislaus and Tuolumne Streets	0.6	1,500,000
Fresno	41 (SR 180)	Ten-mile Creek Bridge, redeck		25,000
Fresno	76 (SR 168)	Chestnut Avenue to 0.13 mile north of south city limits of Clovis (portions); grade, surface and widen bridges on existing highway		40,000
Fresno	125 (SR 41)	Shields Avenue to 0.3 mile north of Shaw Avenue; grade and pave for 6-lane divided highway	2.3	600,000
Fresno	125 (SR 41)	0.4 mile north of Herndon Avenue to San Joaquin River; revise road approaches for control of access		25,000
Glenn	Various	Rights of way on state highway routes		60,000
Humboldt	1 (US 101)	0.4 mile north of Fernbridge to 0.7 mile north of Hookton Road; grade and structures for 4-lane expressway	4.4	1,130,000
Humboldt	1 (US 101)	0.2 mile south of Elk River to south city limits of Eureka; grade, surface and structures for 4-lane highway	1.4	300,000
Humboldt	1, 20 (US 101, 299)	0.6 mile north of Plaza Avenue to 1 mile south of Mad River Bridge on US 101, and from new interchange to Mad River Bridge on US 299; grade and surface (structures now under contract), for 4-lane expressway connecting with 8 miles of expressway north of Eureka	3.7	715,000
Humboldt	1 (US 101)	At Turner Draw, Bridge and approaches		65,000
Humboldt	20 (US 299)	Willow Creek to South Fork Trinity River Bridge; base and seal coat	4.2	125,000
Humboldt	Various	Rights of way on state highway routes		625,000
Imperial	187 (SR 111 and 115)	Orita Turn to Brawley (portions); grade and surface (widening and reconstruction)	6.7	590,000
Imperial	187	At Alamo River, redeck bridges 9 miles north of Brawley and 3 miles east of Brawley		26,000
Imperial	Various	Rights of way on state highway routes		548,000
Inyo	Various	Rights of way on state highway routes		20,000
Kern	33 (US 466)	Between Lost Hills and Wasco, replace four bridges and approaches		165,000
Kern	57 (SR 166) (SR 33)	Maricopa to US 99 (portions), grade and surface for drainage correction	1.9	250,000
Kern	58 (US 466)	Sivert to Sand Cut, grade and surface	1.3	45,000
Kern	58 (US 466)	Between Sivert and Bear Mountain Ranch, construct two cattlepasses and approaches		25,000
Kern	58 (US 466)	Cameron Road to Big Cache Creek; grade, surface and structure (widening and some realignment)	5.6	455,000
Kern	139	Central Valley Highway, 4.9 miles south to 2.8 miles south of Wasco (portions); grade and surface (widening and some realignment)	2.1	100,000
Kern	Various	Rights of way on state highway routes		4,115,000
Kings	Various	Rights of way on state highway routes		5,000
Lake, Mendocino	15 (SR 20)	0.2 mile east of Cold Creek to Laurel Dell; grade and surface (including relocation)	3.2	640,000
Lake	89 (SR 29)	At Thompson Creek and Thompson Creek Overflow, bridges		50,000
Lake	Various	Rights of way on state highway routes		50,000
Lassen	Various	Rights of way on state highway routes		80,000
Los Angeles	2, 159 (US 101)	Hollywood Freeway—Lankershim Boulevard to 0.1 mile north of Moorpark Street; grade, pave and structures for 8-lane freeway	1.1	2,350,000
Los Angeles	2 (US 101)	Ventura Freeway—Sepulveda Boulevard to Encino Avenue; grade, pave and structures for 8-lane freeway	2.6	2,970,000

SR—State sign route

et for 1956-57 Fiscal Year Are Approved

County	Route	Description	Approximate mileage	Estimated cost
Los Angeles	2 (US 101)	Ventura Freeway—Kelvin Avenue to Calabasas; grade, pave and structures for 6 and 8-lane freeway	3.8	$3,300,000
Los Angeles	4, 161 (US 99) (US 6)	Golden State Freeway—Glendale Boulevard to 0.5 mile north of Los Feliz Boulevard; grade, pave and structures for 8-lane freeway	1.4	1,690,000
Los Angeles	4, 161 (US 99) (US 6)	Golden State Freeway—0.5 mile north of Los Feliz Boulevard to 0.9 mile south of Los Angeles River Bridge near Victory Boulevard and connection to San Fernando Road near Colorado Boulevard; grade, pave and structures for 8-lane freeway	1.3	3,200,000
Los Angeles	4 (US 99)	North of Los Angeles city limit to Kern county line (portions); surface		440,000
Los Angeles	9 (US 66)	Huntington Drive and Foothill Boulevard—Monrovia to Azusa Underpass (portions); channelization and signals		150,000
Los Angeles	26 (US 70, 99) (US 60)	San Bernardino Freeway in West Covina and Baldwin Park, Barranca Avenue and Bess-Frazier Avenue Interchange; structures and approaches		560,000
Los Angeles	158 (SR 7)	San Diego Freeway—McHelen Avenue to Florence Avenue (Redondo Boulevard); borrow site		1,500,000
Los Angeles	158 (SR 7)	San Diego Freeway—0.2 mile south of Valley Vista Boulevard to 0.2 mile north of Burbank Boulevard; grade, pave and structures for 8-lane freeway	1.8	4,565,000
Los Angeles	162 (SR 2)	Glendale Freeway—Los Angeles River to Eagle Rock Boulevard; grade, pave and structures for 6-lane freeway (includes Taylor Yard railroad overhead)	1.6	3,270,000
Los Angeles	166, 2 (US 101)	Santa Ana Freeway—Marianna Street to Camulos Street; grade and pave (widen freeway to 8 lanes)	2.3	500,000
Los Angeles	167 (SR 15)	Long Beach Freeway—0.3 mile south of Imperial Highway to Florence Avenue; grade, pave and structures for 4-lane freeway	2.8	4,915,000
Los Angeles	173 (SR 26)	Olympic Freeway—Santa Ana Freeway to Harbor Freeway (portions) structures for future 8-lane freeway		1,000,000
Los Angeles	Various	Rights of way on state highway routes		42,415,000
Madera	4 (US 99)	Califa to Merced county line; grade and pave for 4-lane freeway	7.0	2,900,000
Madera	135 (SR 41)	San Joaquin River to 1.5 miles north; revise road approaches for control of access		20,000
Madera	Various	Rights of way on state highway routes		10,000
Marin	1 (US 101)	Alto Intersection to 0.6 mile north of Greenbrae Intersection (portion); grade, pave and structures for 6-lane freeway (including Corte Madera interchange)	3.5	2,700,000
Marin	1 (US 101)	At Forbes Station; grade, pave and structure (widen and reconstruct overhead)		430,000
Marin	8 (SR 37)	At Novato Creek, reconstruct bridge		10,000
Marin	69	Tiburon Street to near San Quentin Wye, grade, surface and structures for 4-lane freeway	2.1	900,000
Marin	Various	Rights of way on state highway routes		288,000
Mariposa	18 (SR 140)	4.0 miles west of Mariposa to Mariposa; grade and surface (widening and some realignment)	4.0	325,000
Mendocino	1 (US 101)	0.5 mile south of Ridgewood Summit to 0.5 mile north of Northwestern Pacific Railroad Crossing; grade, surface and structure (extension of new 5-mile expressway)	2.0	610,000
Mendocino	1 (US 101)	0.5 mile north of Hilvilla to 1 mile south of Irvine Lodge; structures for future 4-lane expressway		825,000
Mendocino	1 (US 101)	0.4 mile south to 1 mile north of Tan Oak Park; drainage tunnel (for channel change)		45,000
Mendocino, Lake	15 (SR 20)	0.2 mile east of Cold Creek to Laurel Dell; grade and surface (including relocation)	3.2	640,000
Mendocino	48 (SR 128)	Coon to Ornbaun Creek; grade and surface (on new location)	0.8	155,000
Mendocino	56 (SR 1)	At Brush Creek, bridge and approaches	0.3	157,000
Mendocino	Various	Rights of way on state highway routes		255,000
Merced	4 (US 99)	At Atwater, Canal Creek to Grove Avenue; grade, pave and structures for 4-lane freeway	4.5	2,500,000
Merced	Various	Rights of way on state highway routes		340,000
Modoc	28 (US 299)	8 miles east of Adin to Pit River; base and surface	9.2	295,000
Mono	40	Pole Line Road, US 395 to Nevada state line (portions); grade	21.7	125,000
Mono	96	Sweetwater Road, Walker Reservoir to Nevada state line (portions); reconstruction	8.5	180,000
Mono	Various	Rights of way on state highway routes		10,000
Monterey	2 (US 101)	Two miles south of San Ardo to Salinas River (portions); replace two bridges		285,000
Monterey	56 (SR 1)	At Limekiln Creek, bridge and approaches	0.2	360,000
Monterey	Various	Rights of way on state highway routes		395,000
Napa	49 (SR 29) (SR 128)	4.0 miles north of St. Helena to Calistoga; grade and surface for initial two lanes of ultimate 4-lane expressway	3.7	545,000
Napa	Various	Rights of way on state highway routes		250,000
Nevada	15 (SR 20)	0.4 mile west of Casey's Corner to Rough and Ready (portions); grade and surface (reconstruction and widening)	2.1	90,000
Nevada, Sierra	38 (US 40)	Near Floriston to Nevada state line; grade and surface for 4-lane expressway	5.4	2,600,000
Nevada	Various	Rights of way on state highway routes		235,000
Orange	2 (US 101)	San Diego and Santa Ana Freeway—El Toro Road to Laguna Road; grade, pave and structures for 4-lane freeway	4.6	1,865,000
Orange	2 (US 101)	Santa Ana Freeway—0.3 mile south of Laguna Road to 0.3 mile north of Browning Avenue; grade, pave and structures for 4-lane freeway	5.7	3,280,000
Orange	175 (SR 14)	Route 175 Freeway—Route 174 to 0.2 mile east of Route 2; borrow site		300,000
Orange	185	Laguna Road, mile 7.0 to US 101; grade, pave and structures, widening and some realignment	1.9	300,000
Orange	Various	Rights of way on state highway routes		3,150,000

SR=State sign route

County	Route	Description	Approximate mileage	Estimated cost
Placer	17, 37 (US 40)	1 mile east of Newcastle to Elm Avenue in Auburn; grade, pave and structures for 4-lane freeway	3.1	$1,300,000
Placer	37 (US 40)	Heather Glen to Colfax; grade, surface and structures for 4-lane expressway	6.1	3,250,000
Placer	37 (US 40)	Colfax to 3 miles west of Gold Run; grade, surface and structures for 4-lane expressway	6.5	3,900,000
Placer	Various	Rights of way on state highway routes		224,000
Plumas	Various	Rights of way on state highway routes		40,000
Riverside	26 (US 70, 99) (US 60)	Indian Avenue Interchange at Garnet; structure and approaches	0.3	200,000
Riverside	43 (US 91) (SR 18)	Arlington Avenue to 14th Street; grade, pave and structures for 4-lane freeway	2.1	1,800,000
Riverside	64 (US 60, 70)	At Blythe Crossing of Colorado River; California share of new bridge (cooperative project with Arizona)		595,000
Riverside	146	Imperial County Line to US 60-70 (portions); base and surface, widening and some realignment	2.5	180,000
Riverside	187 (SR 111)	At Palm Canyon Wash, bridge and approaches	0.3	220,000
Riverside	Various	Rights of way on state highway routes		2,095,000
Sacramento	4 (US 99) (US 50)	1.8 miles south of Cosumnes River to 0.2 mile south of Elk Grove Road; grade, pave and structures for 4-lane freeway (completes budgeting of freeway between Lodi and South Sacramento)	5.9	2,250,000
Sacramento	11 (SR 24)	Freeport Boulevard—0.4 mile north of Florin Road to 0.1 mile north of Sutterville Road (West); grade and pave for 4-lane divided highway	2.5	650,000
Sacramento	11 (US 50) (SR 16)	Folsom Boulevard—65th Street in Sacramento to Perkins; grade, pave and structures (widening to 4 lanes and additional Brighton Underpass)	2.0	700,000
Sacramento	Various	Rights of way on state highway routes		1,005,000
San Benito	Various	Rights of way on state highway routes		160,000
San Bernardino	31 (US 66) (US 91)	Victorville Overhead and Mojave River, bridges and approaches (for 4-lane freeway)	1.2	1,500,000
San Bernardino	43 (US 395) (US 91) (SR 18)	Mill Street to Fifth Street; grade, pave and structures for 4-lane freeway	1.2	1,700,000
San Bernardino	43 (SR 18) (SR 30)	Lakeview Point to Big Bear Dam (portions); grade and surface (widening and some realignment)	1.6	450,000
San Bernardino	59 (US 466)	0.2 mile east of Hinkley R.R. Crossing to north junction of US 91; grade and surface (widening and some realignment)	7.3	200,000
San Bernardino	58 (US 66)	Needles to 3 miles west of Colorado River; grade, surface and structures (initial 2 lanes of 4-lane expressway)	8.5	1,200,000
San Bernardino	Various	Rights of way on state highway routes		2,477,000
San Diego	12 (US 80)	0.9 mile west of 70th Street to 0.6 mile east of 70th Street; grade, pave and structure for 4-lane freeway	1.5	605,000
San Diego	12 (US 80)	0.4 mile west of La Mesa Boulevard to Chase Avenue in El Cajon; grade, pave and structures for 4-lane freeway	1.9	2,720,000
San Diego	200 (SR 94)	Wabash Freeway to 0.6 mile east of Euclid Avenue; grade, pave and structures for 6-lane freeway	2.4	2,295,000
San Diego	Various	Rights of way on state highway routes		3,066,000
San Francisco	2 (US 101)	Lyon St. to State Sign Rt. 1 connection; grade, pave and structures for 8-lane freeway	1.3	3,900,000
San Francisco, San Mateo	68 (US 101 Bypass)	Bayshore Freeway—0.3 mile north of Butler Road to Salinas Avenue; pave (completes 8-lane freeway across Candlestick Cove)	4.1	1,435,000
San Francisco	224	Embarcadero Freeway—Fremont Street to Broadway; grade, pave and structures for 8-lane freeway	1.2	5,300,000
San Francisco	Various	Rights of way on state highway routes		2,270,000
San Joaquin	4 (US 99)	Kingsley Road to Mariposa Road; grade, pave and structure for 4-lane freeway	2.9	1,190,000
San Joaquin	4 (US 99) (US 50)	0.6 mile south of Mokelumne River to 0.5 mile north of Jahant Road; grade, pave and structures for 4-lane freeway	4.8	2,350,000
San Joaquin	5, 66 (US 50) (SR 120)	Mossdale to Richards Avenue (south of French Camp) and Sign Route 120 Connection, grade, pave and structures for 4-lane freeway	6.1	1,800,000
San Joaquin	Various	Rights of way on state highway routes		360,000
San Luis Obispo	2 (US 101)	Hourihan Grade to Russell Turn; grade, pave and structure for 4-lane expressway	7.0	1,720,000
San Luis Obispo	2, 33 (US 101) (SR 41)	On US 101 from 0.3 mile south of Paso Robles to 0.8 mile north and on Sign Route 41 from US 101 to Huer Huero Creek; grade, pave and structures (4.1 miles of 4-lane freeway on US 101 and 2.7 miles of relocation on SR 41)	6.8	3,150,000
San Luis Obispo	56 (SR 1)	Oso Flaco Underpass, new structure and approaches	0.7	290,000
San Luis Obispo	56 (SR 1)	At Arroyo Grande Creek, bridge and approaches	0.3	90,000
San Luis Obispo	Various	Rights of way on state highway routes		400,000
San Mateo	56 (SR 1)	1.0 mile south of Pigeon Point to Lake Lucerne; grade and surface including some realignment (State's share, Joint Highway District No. 9 project)	3.8	285,000
San Mateo-San Francisco	68 (US 101 Bypass)	Bayshore Freeway—0.3 mile north of Butler Road to Salinas Avenue; pave (completes 8-lane freeway across Candlestick Cove)	4.1	1,435,000
San Mateo	68 (US 101 Bypass)	Bayshore Freeway—0.6 mile north of Marsh Road to Bransten Road; grade, surface and structures (extension of 6-lane freeway)	3.8	4,000,000
San Mateo	68 (US 101 Bypass)	Bayshore Freeway—0.4 mile north of Marsh Rd. to 0.2 mile north of Willow Rd.; grade, surface and structures (extension of 6-lane freeway)	2.0	1,700,000
San Mateo, Santa Clara	68 (US 101 Bypass)	Bayshore Freeway—0.3 mile south of Willow Road to 0.1 mile south of Santa Clara county line; grade, surface and structures (extension of 6-lane freeway)	1.8 1.8	1,500,000
San Mateo	Various	Rights of way on state highway routes		1,350,000
Santa Barbara	2 (US 101)	Elwood to Orella; grade and pave for 4-lane expressway	9.0	2,675,000

SR=State sign route

County	Route	Description	Approximate mileage	Estimated cost
Santa Barbara	80 (SR 150)	San Marcos Pass Road—2.5 miles to 3.0 miles north of US 101; grade and surface (widening with some realignment)	0.5	$130,000
Santa Barbara	Various	Rights of way on state highway routes		1,400,000
Santa Clara	5 (SR 17)	In Los Gatos, connection from Route 5 Freeway to San Jose-Los Gatos Road; grade, surface and structures (cooperative project with Town of Los Gatos)	0.4	240,000
Santa Clara, San Mateo	68 (US 101 Bypass)	Bayshore Freeway—0.3 mile south of Willow Road to 0.1 mile south of Santa Clara county line; grade, surface and structures (extension of 6-lane freeway)	1.6	1,500,000
Santa Clara	113 (SR 9)	0.2 mile east of Laurence Station Road to 0.2 mile east of San Jose-Alviso Road; grade surface for initial two lanes of ultimate freeway	2.1	610,000
Santa Clara	114 (SR 9)	0.4 mile south of McClellan Road to El Camino Real; grade and surface (widening)	3.9	320,000
Santa Clara	Various	Rights of way on state highway routes		2,410,000
Santa Cruz	116 (SR 9)	Sidehill Viaduct (portions); structure		150,000
Santa Cruz	Various	Rights of way on state highway routes		300,000
Shasta	20 (US 299)	In Redding, 0.7 mile east of west city limits to Southern Pacific Overhead; grade and surface for 4 lanes	1.6	220,000
Shasta	Various	Rights of way on state highway routes		280,000
Sierra, Nevada	38 (US 40)	Near Floriston to Nevada state line; grade and surface for 4-lane expressway	5.4	2,600,000
Sierra	Various	Rights of way on state highway routes		36,000
Siskiyou	3 (US 99)	4.5 miles south of Yreka to Oberlin Road; grade and surface initial 2 lanes for ultimate 4-lane expressway	4.5	675,000
Siskiyou	46 (SR 96)	At Swillup Creek; bridge and approaches	0.1	55,000
Siskiyou	Various	Rights of way on state highway routes		616,000
Solano	Various	Rights of way on state highway routes		380,000
Sonoma	1 (US 101)	0.6 mile south of Wilfred Crossing to Santa Rosa; grade, pave and structures, extension of 4-lane freeway (13 miles now under construction)	5.0	2,900,000
Sonoma	1 (US 101)	At Mark West Creek; bridge and approaches		125,000
Sonoma	Various	Rights of way on state highway routes		540,000
Stanislaus	13 (SR 120)	2.1 miles east of Oakdale to 1.5 miles east of Orange Blossom Road; grade and surface (widening and some relocation)	3.8	400,000
Stanislaus	Various	Rights of way on state highway routes		2,000,000
Sutter	Various	Rights of way on state highway routes		300,000
Tehama	Various	Rights of way on state highway routes		30,000
Trinity	20 (US 299)	Weaverville to 1.8 miles east; grade and surface, widening, some realignment	1.8	230,000
Trinity	20 (US 299)	3.2 miles west to 0.2 mile east of Burnt Ranch Post Office (portions); base and surface	2.5	60,000
Trinity		Rights of way on state highway routes		20,000
Tulare	4 (US 99)	Visalia Airport Interchange to 1 mile north of Goshen; grade, pave and structures for 4-lane freeway	2.8	870,000
Tulare	4 (US 99)	0.5 mile south of Traver to Kings River; grade, pave and structures for 4-lane freeway (this project with the one above completes virtually continuous multilane divided highway from San Fernando to Fresno)	4.7	1,285,000
Tulare	4 (US 99)	Kings River to Clark Avenue; replace old Kings River Bridge	1.0	250,000
Tulare	135	Central Valley Highway—Sunrise City to 0.5 mile north of Deer Creek; grade and surface (widening and drainage correction)	2.7	230,000
Tulare	Various	Rights of way on state highway routes		110,000
Tuolumne	40 (SR 120)	South Fork Tuolumne River Bridge (Berkeley Camp); redeck bridge		15,000
Tuolumne	Various	Rights of way on state highway routes		20,000
Ventura	2 (US 101)	Ventura Freeway—Santa Clara Avenue-Rice Road Interchange; structure and approaches		205,000
Ventura	9 (SR 118)	At Santa Clara River near Saticoy, bridge and approaches	0.3	670,000
Ventura	9 (SR 118)	0.5 mile north of Santa Clara Avenue, southeast of Saticoy, drainage correction	0.2	40,000
Ventura	60 (US 101A)	0.3 mile south of Calleguas Creek to 0.1 mile southeast of Date Street in Oxnard; grade, pave and structures for 4-lane freeway	7.4	2,055,000
Ventura	Various	Rights of way on state highway routes		1,350,000
Yolo	Various	Rights of way on state highway routes		260,000
Yuba	3 (US 99E)	Olivehurst to Marysville; grade and surface for 4-lane expressway (structures now under contract)	4.0	1,200,000

SR=State sign route

will be extended from San Pablo to the beginning of the Carquinez Toll Bridge Project at Hercules; while on the same route in Placer County, the four-lane expressway through the Sierra Nevada foothills will be extended three miles westerly from Auburn and 12.6 miles easterly to Magra, about 6½ miles east of Colfax. Another 5.4 miles of four-lane expressway will be built on US 40 immediately west of the Nevada state line.

Construction of urban freeways will be begun or continued in the Cities of San Francisco, San Diego, San Bernardino, Riverside and Fresno.

For Right of Way

Among the budget allocations for acquisition of rights of way on major freeway routes are:

Alameda County—US 50 freeway in Oakland, $3,200,000; Route 226 (Webster Street Tube), $1,000,000.

Kern County—East-west freeway in Bakersfield $2,825,000.

Los Angeles County – Olympic Freeway, $11,000,000; Golden State Freeway, $13,000,000; Ventura Freeway, $6,000,000; San Diego Freeway, $2,740,000.

Sacramento County—South Sacramento Freeway, $800,000 (total now expended and budgeted $5,250,000).

... Continued on page 51

Cost Index

Almost Stationary During Third Quarter of 1955

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

THE 12.2 percent rise which occurred in the California Highway Construction Cost Index during the second quarter of 1955 did not continue into the third quarter of the year. On the basis of bids received during the third quarter the Index stood at 208.6 (1940=100) which is 1.8 percent lower than the 212.4 for the second quarter. Considering the height of the Index at the present this would indicate that the over-all highway construction costs were practically stationary during July, August and September.

As stated in our release on the California Highway Construction Cost Index in July it was the opinion of this department that the 12 percent upsurge during the second quarter of 1955 was the beginning of an upward trend in highway construction costs. This is still our opinion, as it is felt that the slight drop in the Index of 1.8 percent during the third quarter is the temporary result of some half dozen very large freeway projects involving unusually large quantities of concrete, bar reinforcing steel and structural steel. These freeway projects were all located in urban areas, close to sources of supply and distribution, resulting in favorable unit prices. Analysis of the smaller jobs presented a different picture. Unit bid prices on these jobs were definitely up. In many instances the bids exceeded the recently revised estimates by 3 or 4 percent, however, the weight of the quantities in the large freeway jobs was sufficient to result in a decrease on the Index.

It is still felt that competing bidders have reached the limit in devices for cutting prices and trimming profits and that bid prices must reflect the effects of rising labor and materials costs.

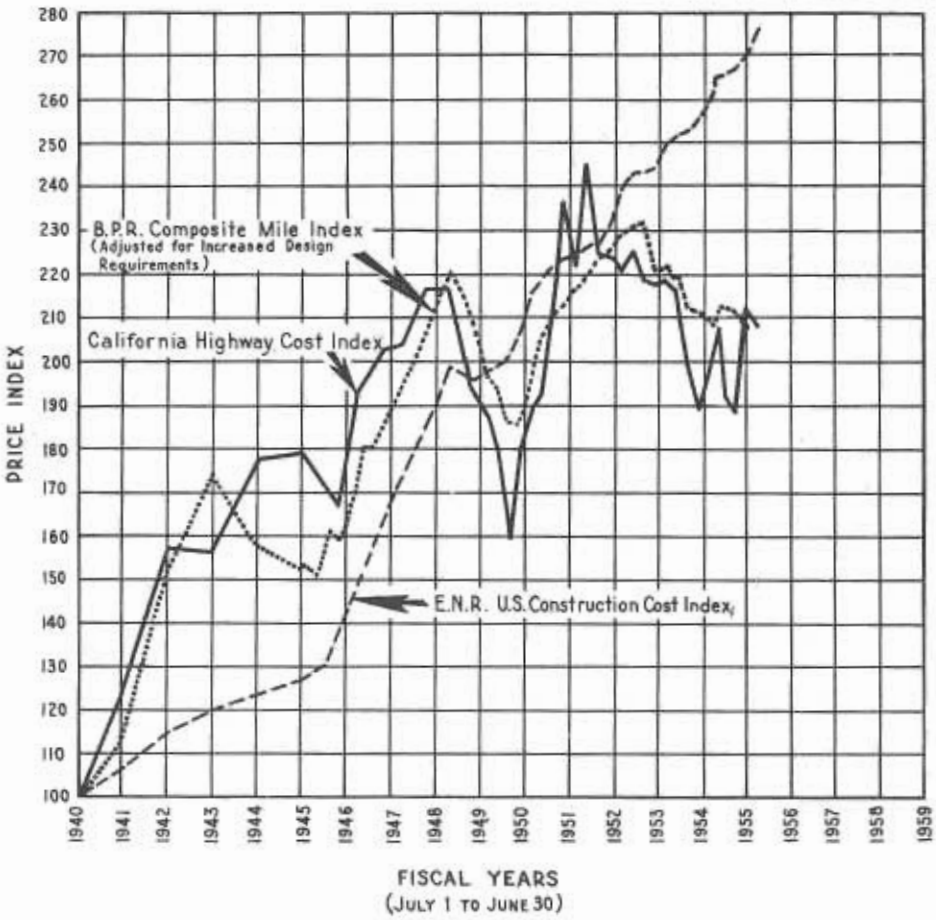
It is noted that the Engineering News-Record, reporting on the Associated General Contractors executive meeting in Minneapolis in its October 6 issue, stated that in the near future "there would be a steady surge toward a new record breaking volume of construction with exceedingly intense competition" and that, in addition, is the prospect of higher materials prices before February.

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

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

PRICE INDEX
CONSTRUCTION COSTS

1940 = 100



THE CALIFORNIA HIGHWAY CONSTRUCTION COST INDEX

Year	Cost Index
1940	100.0
1941	125.0
1942	157.5
1943	156.4
1944	177.8
1945	179.5
1946	179.7
1947	203.3
1948	216.6
1949	190.7
1950	176.7
(1st Quarter 1050—160.6)	
1951	210.8
(4th Quarter 1951—245.4)	
1952	224.5
1953	216.2
1954 (1st Quarter)	199.4
1954 (2d Quarter)	189.0
1954 (3d Quarter)	207.8
1954 (4th Quarter)	192.2
1955 (1st Quarter)	189.3
1955 (2d Quarter)	212.4
1955 (3d Quarter)	208.6

Inspection of the average unit prices bid during the third quarter of 1955 for the eight items upon which the California Index is based (see accompanying tabulation) shows a decline in bid prices for five items and an increase for two. As no bids were received for asphalt concrete pavement during the previous three quarters there was no firm comparison for the unit price of this item in the third quarter of 1955.

The average bid price during the quarter for roadway excavation dropped only 2 percent, from 42 cents to 41 cents per cubic yard. Untreated rock base showed the greatest rise, up 17 percent from an average price of $1.99 in the second quarter to $2.33 per ton in the third quarter; this is almost the same increase for this item as was made during the second quarter of 1955 when it rose 18 percent. Part of the increase in untreated rock base prices may be the result of recent labor difficulties in the sand, rock and gravel industry in Southern California.

Plant-mixed surfacing prices rose 1 percent during the third quarter from $5.39 to $5.43 per ton.

The average unit prices for the other four items all declined: portland cement concrete pavement down 7 percent, from $14.46 to $13.46 per cubic yard; structure concrete down 3 percent from $51.36 to $49.64 per cubic yard; bar reinforcing steel dropped 5 percent from $0.098 to $0.093 per pound; and structural steel was down 4 percent from $0.136 per pound in the second quarter to $0.132 in the third quarter.

CALIFORNIA DIVISION OF HIGHWAYS AVERAGE CONTRACT PRICES

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

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

As previously stated, the six large freeway projects which involved unusually large quantities of concrete and steel, located in city areas close to sources of supply and at favorable prices were responsible for the decreases in the average bid prices of these four items.

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

The *Engineering News-Record* Index which comprises all types of construction is nation-wide in scope. For the third quarter of 1955 this index was up 2.3 percent from the second quarter of 1955.

The U. S. Bureau of Public Roads Composite Mile Index was down 1.6 percent in the second quarter of 1955 from the first quarter. Figures on this index are not as yet available for the third quarter of 1955.

The California Highway Construction Cost Index is by its very nature and limitations a sensitive tool and the changes which it shows from one quarter to another do not of themselves necessarily indicate trends. However, two or three quarters may definitely establish a trend. In the present instance it is believed that the 12 percent jump in the second quarter signaled a break in the more or less stationary status of the index and the 1.8 percent drop during the third quarter may prove to be only a point of hesitancy in a rising trend.

ABREAST OF HIGHWAYS

DEAR MR. ADAMS: *California High-Ways and Public Works* is so informative and pictorial that it keeps me abreast of the rapid progress and growth being made to our highway system, and the problems encountered therein.

You and your staff accept my congratulations.

Yours truly,

GILBERT S. BARKER
Inspector, Department of
Water and Power
City of Los Angeles

Do People Like Freeways?

THE TROUBLE with freeways in Los Angeles," wrote L. L. Wise, Associate Editor of *Engineering News-Record*, in a recent issue of that publication, "is that too many people use them.

"This statement, often seemingly made in jest, is actually a relatively good analysis of the current stage of development of the system of superhighways that crisscrosses downtown Los Angeles and extends out to suburban areas."

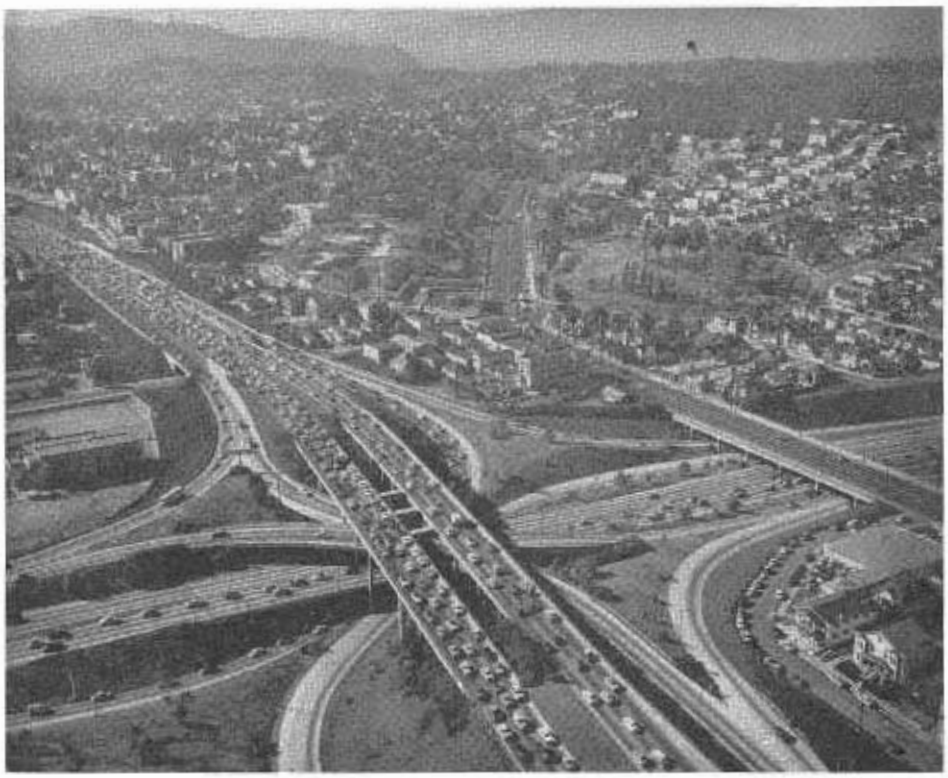
The aerial photographs on these two pages, taken during the afternoon rush hour on September 16, 1955, bear out Wise's statement. They show graphically how the vehicle-operating public has gravitated away from the main boulevards and onto the freeways.

The photographs bring to life the impressive statistics which have often been cited to substantiate the claim that the Hollywood Freeway is the most heavily traveled traffic artery in the world and the four-level interchange structure at the junction of the Hollywood-Santa Ana, Harbor, and Pasadena Freeways is the most heavily traveled intersection in the world.

Through the four-level interchange there pass, in a 24-hour period, well over a quarter of a million vehicles. One estimate has placed the daily traffic there on a heavy day at 281,500.

The Hollywood Freeway west of the four-level structure carries up to 180,000 vehicles a day on busy days. At certain peak hours, the traffic flow is in the vicinity of 8,000 vehicles per hour for four lanes in one direction.

Studies have shown that freeways draw traffic from parallel routes as much as two miles away. Why? Because people have discovered that freeways do the job they were designed to do: carry more traffic more safely and with less delay than the surface streets with their intersections at grade, their signals, and their unrestricted access from adjoining property.



Looking west toward Hollywood from the Four-Level Interchange structure, showing heavy traffic on the Hollywood Freeway and virtually none on famous Sunset Boulevard, which parallels the freeway

Paradoxically, this lure of the freeways has at times reduced traffic on once-congested parallel arteries to a mere trickle, as the photographs show. It is the freeway that appears congested. Yet motorists prefer the crowded freeway to the lightly traveled city street.

As it was summarized by Lloyd Aldrich, former city engineer of Los Angeles, in a recent study:

"Three times as much traffic can move on a freeway as on a parallel boulevard in half the time, at half the cost, and with one-fifth the fatal accident risk."

The State Highway Budget for the 1956-57 Fiscal Year contains approximately $73,000,000 for rights of way and construction on the metropolitan freeway system in the Los Angeles area.

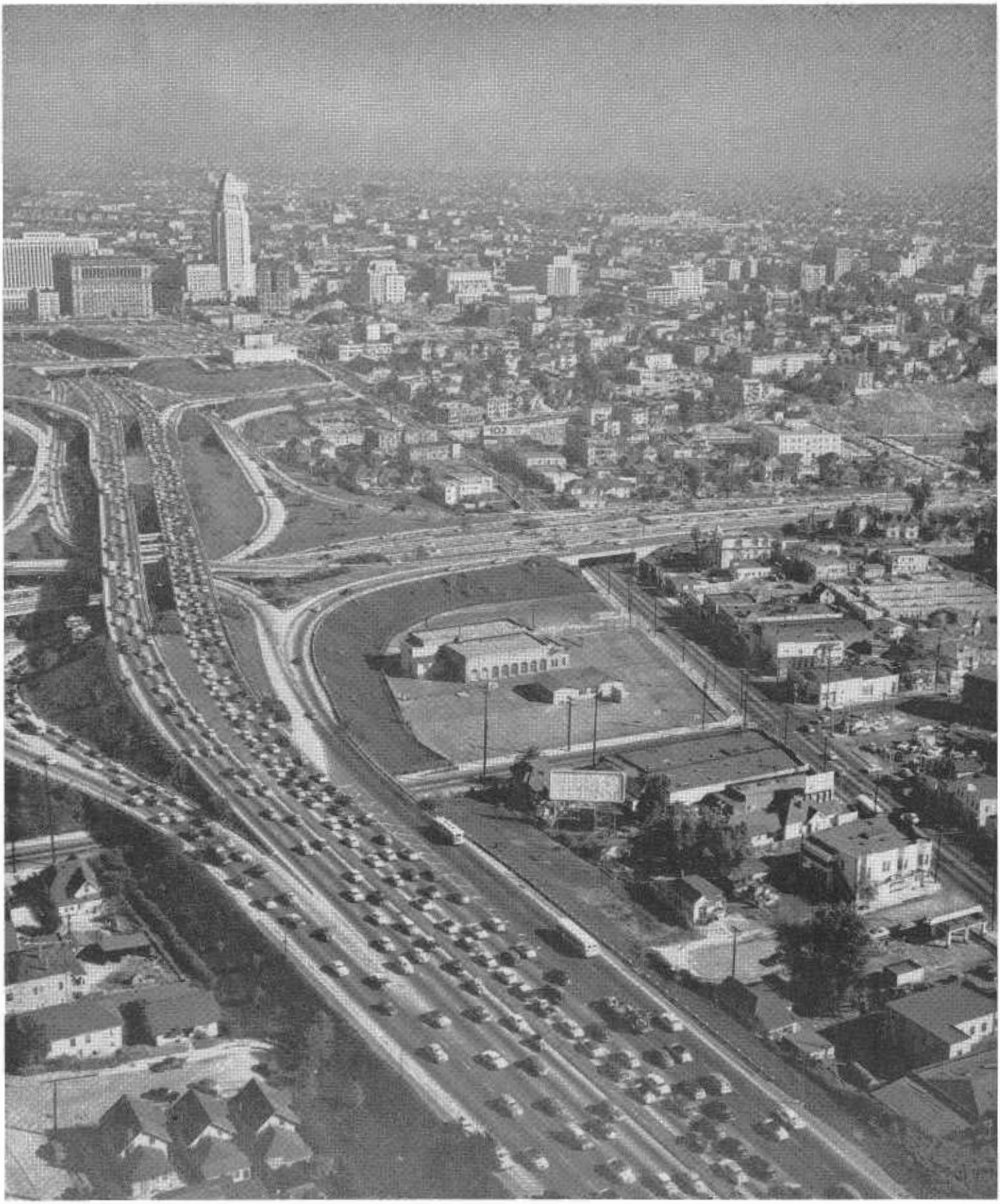
In the foreseeable future, depending on the rate of financing, motorists will have their choice of a number of freeways passing through or around the central section. This integrated network of freeways will provide greater safety and freedom from congestion for the motoring public.

DRIVING NEAR PARKED CARS IS DANGEROUS

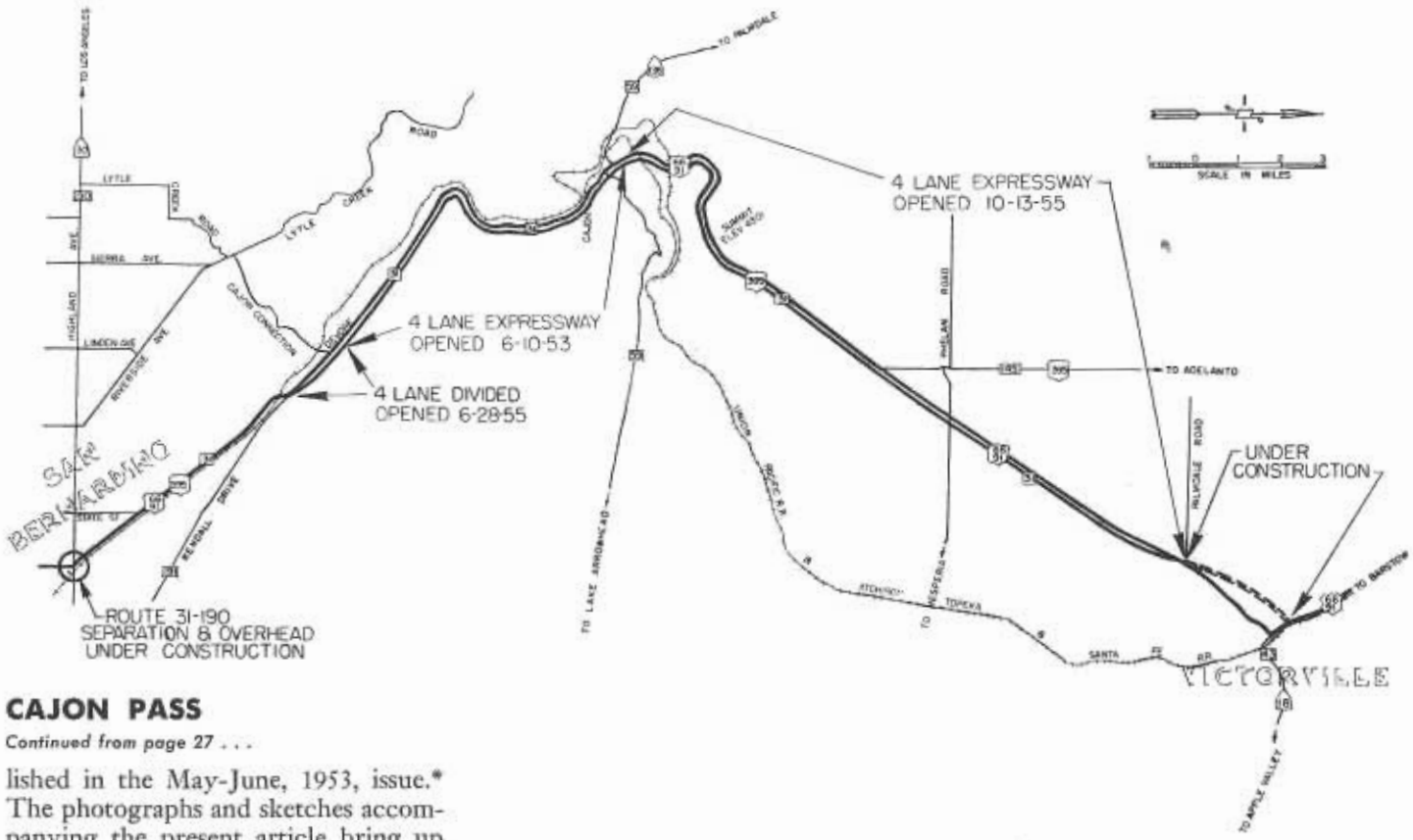
City driving has many dangers and not the least of these dangers is the danger of driving near parked cars.

Almost anywhere you drive on city streets, points out the National Automobile Club, you'll find these long lines of parked cars and driving near them you'll find that the unexpected can happen so suddenly and so close at hand that you rarely have time to avoid the consequences. Irresponsible drivers whip out from the curb right into your line of travel.

When driving near parked cars, be alert and avoid an accident.



Looking east toward Los Angeles Civic Center, showing heavy peak-hour traffic on the Hollywood-Santa Ana Freeway. The wide street to the right of the freeway is Temple Street, formerly a congested boulevard but now carrying very little traffic.



CAJON PASS

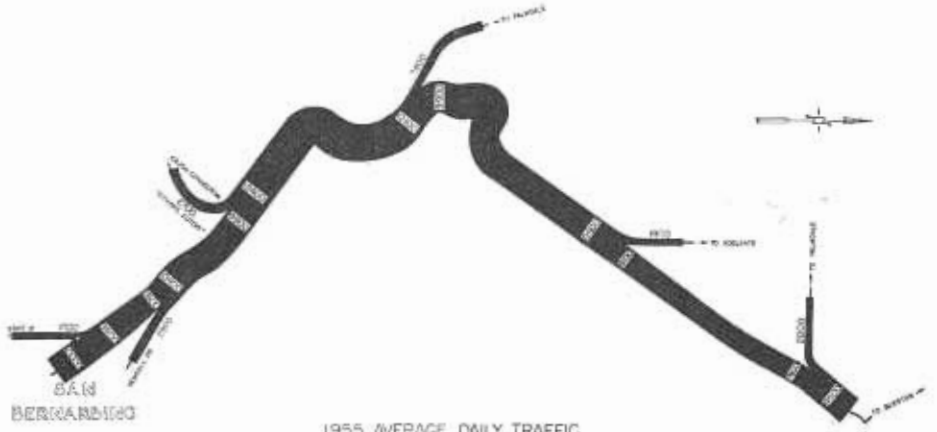
Continued from page 27 . . .

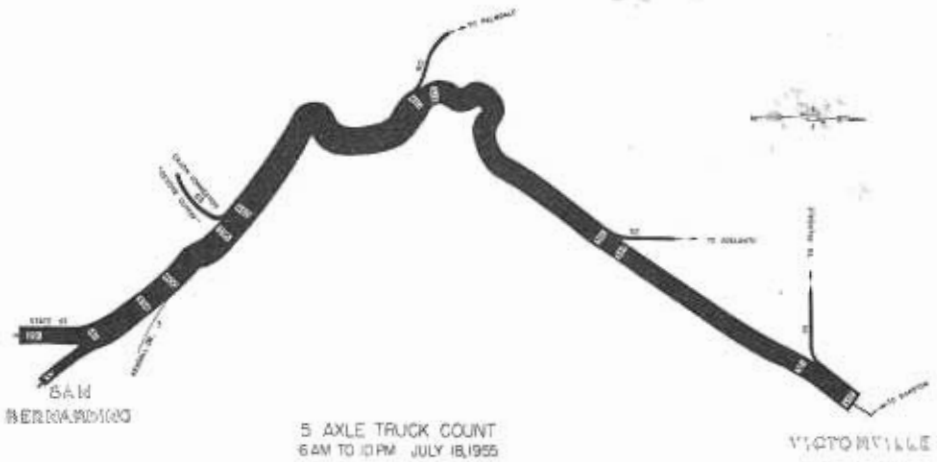
lished in the May-June, 1953, issue.* The photographs and sketches accompanying the present article bring up to date the most recent chapters in the history of US 66-91-395 between San Bernardino and Victorville.

Conversion to four-lane expressway of the section from Devore to Gish Underpass was completed on June 10, 1953, as indicated on the sketch. A southerly extension, including channelization of intersections at the "Devore Cutoff" and at Kendall Drive (US 66 Alternate), was completed on June 28, 1955. Channelization of the intersections proved to be a great benefit, resulting in much smoother and safer traffic flow. This extension was an "interim improvement," to provide safe and adequate traffic service during the years before further extension of the freeway can be financed. The freeway southerly from Devore will be located on new alignment, and is now in the design stage.

Traffic Flows

An indication of the traffic service provided by the Cajon Pass is given by the two traffic flow diagrams. These depict the average daily total traffic and also the volume of five-axle





* "Cajon Pass, Reconstruction of Historic Road from Trail to Expressway", by J. Dekema.

truck traffic, the most prevalent type of heavy commercial trucking. It is evident in the latter diagram that heavy trucks entering Cajon Pass from the southwest utilize State Street, a county primary road, as the main route. By so doing, the grade crossing of the Union Pacific and Santa Fe tracks on the "Devore Cutoff" is eliminated. The "Devore Cutoff" is also a county primary, and the grade crossing is closed by long and slow-moving freight trains for considerable periods every day. It is anticipated that a large amount of the truck traffic now using State Street will be diverted to the freeway as soon as it is completed to a junction with the San Bernardino Freeway (US 70-99) in Colton.

Additional Work

Additional work is under way on the southern approaches to Cajon Pass, where a $785,000 contract was awarded to R. M. Price Company on October 7, 1955, for construction of the Highland Avenue Separation and Railroad Overhead. This will later become an integral part of the freeway for US 91-395 through the City of San Bernardino, on which construction has commenced.

Northerly of the Griffith Company project which has just been completed, the US 66 "Victorville Bypass" is well along toward completion. This consists of a 3.8-mile section on new alignment between Palmdale Road and "D" Street, in the westerly portion of Victorville. It is being constructed by Norman I. Fadel, Inc., Altfillisch Construction Company, and Bert C. Altfillisch. Work on this $716,000 job started April 28, 1955, and is about 70 percent complete. J. Fadel is superintendent for the contractor, and Tom Borman is resident engineer for the State Division of Highways.

Further extension of the "bypass" northward toward Barstow was provided on October 20, 1955, by the California Highway Commission allotment of $1,500,000 for the Victorville Overhead and Mojave River Bridge and approaches in the budget for the 1956-57 Fiscal Year.

PLACER COUNTY BRIDGE

Continued from page 21 . . .

Auburn Dam, the controlling grade and alignment features of the entire route and the dollars and cents savings per vehicle crossing. Upon the basis of these considerations it was determined that a $275,00 project would amortize itself in approximately 15 years by actual savings in time and distance traveled. On this basis the new structure was designed on a 265-foot radius horizontal curve with 8 percent superelevation and a vertically curved grade line. Ample width for two vehicular lanes is provided by a 28-foot roadway with a four-foot pedestrian sidewalk on the downstream side. The necessity to provide for a secondary county road approach at the east end of the structure complicated the design considerably. Eddying currents caused by the confluence of the north and middle forks immediately downstream dictated the use of approach embankment protection. The entire project was designed with a freeboard of three feet above the 1950 flood plane. The length of the bridge, 340 feet, together with approaches, made a project 0.44 mile in length.

Contract Awarded in 1954

The project was advertised for bids over date of July 9, 1954, and bids were received August 4, 1954; James B. Allen of San Carlos being the successful bidder. The contract was awarded August 13, 1954, and approved September 8, 1954, allowing 200 working days for the completion of the work.

The early stages of construction developed into a race with nature to complete footings, abutments, and pedestal columns to a point above normal high water anticipated in the rainy season. However, normal high water did not develop during that season even though the contractor had his work in the clear. Construction progressed at a steady pace, the only major changes consisting of reduction in the excavation for footings and the addition of a heavy rock riprap foundation for the sacked concrete embankment protection. The bridge and approaches were opened to traffic on July 29, 1955. The remaining incidental work was accepted as complete on August 29, 1955.

An indication as to how closely the original estimate of cost was adhered to is as follows:

	Original estimate	Final cost
Contract items	$198,146.00	$198,954.38
Supplemental work	3,518.00	15,650.30
Contingencies	10,083.20	
Subtotals	$211,747.20	$214,604.68
Construction engineering	$19,814.60	$19,258.25
Preliminary engineering performed by State	$11,000.00	$7,837.84
Preliminary engineering Performed by county	5,600.00	$5,24.16
Totals	$248,161.80	$246,944.93

Financing of the project was accomplished with 2½ fiscal years' allotment of federal-aid secondary highway funds totaling $135,000 plus matching funds consisting of state highway funds in the amount of $78,388 and county funds in the amount of $33,056.93.

The county gives credit for the success of the project to the close cooperation of the county engineering staff with that of the U. S. Bureau of Public Roads and the California Division of Highways. On the part of the county, special commendation goes to E. C. Whiting, resident engineer; Clayton R. Taylor, inspector; and Norman Andregg for preliminary approach plans. In the Division of Highways, the county is grateful to Ted Jain of District III, now retired, and W. C. Kiedaisch of the Bridge Department. Expeditious preparation of plans by the Bridge Department saved an entire year in opening the project to traffic.

MAMMOTH SUGAR PINE

A mammoth sugar pine tree is located off Oregon Highway 62 on the way to Crater Lake National Park. The tree is 224 feet high, 500 years old, 7 feet 11 inches in diameter, and contains 29,000 board feet.

Retirements *from* Service

R. M. Gillis

Deputy State Highway Engineer Ridgway M. Gillis retired on November 1, 1955, after 26 years of service with the California Division of Highways.

On the eve of his retirement, Mr. and Mrs. Gillis were guests of honor at a dinner attended by 250 friends and associates.

Most of Gillis' career with the State has been in positions of broad responsibility for the carrying out of a statewide highway construction program which has increased tenfold during the past quarter century.

Gillis was born in Oakland in 1885, and was graduated from Whitman College in 1906 with an A.B. degree. He received his B.S. degree in civil engineering from the Massachusetts Institute of Technology in 1910.

After various engineering jobs which included service with the Northern Pacific Railroad, Gillis joined the Washington State Highway Department in 1912. He remained there until 1926, resigning to accept a position with the Pacific Bridge Company.

Deputy State Highway Engineer Ridgway M. Gillis, Retired

Joins Division of Highways

In April, 1929, he came to work for the California Division of Highways as construction engineer in District X, covering the northern San Joaquin Valley and Mother Lode regions. Later the same year he became assistant construction engineer for the division, working out of Sacramento Headquarters and inspecting highway projects in every corner of the State.

He was promoted in 1933 to district engineer of District VI, with headquarters at Fresno, where for five years he was in charge of state highway planning, construction and maintenance in the central and southern San Joaquin Valley counties.

In 1938 Gillis returned to Sacramento as construction engineer for the Division of Highways. He was a strong early advocate of cement treated base construction. California still leads the Nation in the use of this method of stretching the highway dollar by adding a small percentage of cement to available local base materials, thereby reducing the total thickness of base and pavement required to support traffic.

When the division was reorganized in 1947 to meet the expanded construction program under the Collier-Burns Act, Gillis was promoted to assistant state highway engineer in charge of operations, which includes supervision of these four departments: Construction, Maintenance, Equipment, and Materials and Research.

Named Deputy Highway Engineer

In July, 1950, Gillis became Deputy State Highway Engineer upon the retirement of Fred J. Grumm. In this capacity he has worked directly under State Highway Engineer G. T. McCoy in administering a highway program which this year involves total expenditures for state highway purposes of about $290,000,000.

Gillis was elected to membership in the American Society of Civil Engineers in 1916. He is a life member of the society, and past president of its Sacramento section. He has served as the Division of Highways representative on the Advisory Committee of the Institute of Transportation and Traffic Engineering of the University of California.

Gillis and his wife, Marjorie, live at 3650 West Lincoln Avenue, Sacramento. They have three sons, Lyman R. Gillis of San Mateo, an assistant district engineer with the Division of Highways; Jackson C. Gillis of Los Angeles; and William M. Gillis of Orinda.

Earl T. Scott

Earl T. Scott, District Engineer of District VI of the State Division of Highways with headquarters at Fresno, retired from state service on November 1st.

Scott was with the division 41 years and had been district engineer at Fresno since 1938. The territory under Scott's direct supervision included Fresno, Madera, Kings, Tulare and Kern Counties. An estimated $60,000,000 worth of construction has been completed along state highways in his area since he took over as district engineer 17 years ago.

Scott had charge of much of the major construction work which converted the San Joaquin Valley section of US 99 into multilane, divided highway. When jobs now under way or budgeted are completed, only 10 miles of the total 189-mile length within his district will remain to be financed and constructed as divided roadway. A great deal of planning work has also been accomplished by Scott's staff, looking toward further improvement of much of the completed multilane mileage to full freeway standards. Scott came to work for the division in 1914 as an assistant resident engineer in the Los Angeles district and then as superintendent of construction on work along the Old Ridge Route between Bakersfield and Los Angeles.

During World War I he served overseas as a 1st lieutenant in the 23d Engineers, U. S. Army, and returned to state service in 1919.

He was with the U. S. Bureau of Public Roads for a short time during 1921 and 1922, but returned to the division to accept a post in the maintenance department of the Los Angeles office.

He was later promoted to district maintenance engineer, the position he held in 1938 when he was appointed to take over as district engineer of District VI.

Scott was born in Tacoma, Washington, and came to California in 1892. He attended elementary and high schools in Los Angeles and graduated

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RETIREMENT PARTY PHOTO. At lower left corner is Mrs. Thomas A. Scott, Mr. Scott's daughter-in-law; Otto C. Soennichsen; Chief Clerk Walter P. Kelso; E. T. Scott, and C. F. Waite.

W. P. Kelso

W. P. "Walt" Kelso, Chief Clerk for the Division of Highways, District VI in Fresno, retired on November 1, 1955, ending a 24-year career with the State.

All of Kelso's service was with District VI where he started work as a bookkeeper in February, 1931. He was promoted to chief clerk in 1944.

Kelso was born in Brooklyn, New York. He served with Company K, 106th Infantry, during World War I and was wounded in action in Belgium in August, 1918, for which he was awarded a Purple Heart.

After discharge from military service he attended New York University, graduating with a degree in accounting in 1923. He came to California in the fall of the same year and worked as an accountant for several private firms in the San Francisco Bay area before he came to work for the State.

Kelso and his wife live at 1500 Roosevelt Avenue in Fresno. They have one son who is a pilot in the U. S. Air Force.

William L. Welch Succeeds Earl Scott in Fresno

Appointment of William L. Welch as District Engineer of District VI of the State Division of Highways, to succeed Earl T. Scott who retired November 1st, was announced by State Highway Engineer G. T. McCoy.

WILLIAM L. WELCH

District VI, with headquarters at Fresno, comprises 1,609 miles of state highways in Madera, Fresno, Tulare, Kings, and Kern Counties.

Welch has for the past five years served as chief assistant to the Engineer of Design in the division's Headquarters Office in Sacramento. He has been an engineer with the Division of Highways since 1929.

Native of New York

A native of Newburgh, N. Y., Welch was educated in Iowa and Nebraska, and studied civil engineering at the University of Nebraska.

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William L. Fahey

William L. Fahey, district engineer in charge of construction, maintenance, and administration for District VII of the State Division of Highways, retired December 1, 1955, bringing to a close a notable engineering career of 27 years service with the State of California. District VII comprises the three Counties of Ventura, Orange, and Los Angeles where much of the state highway work being done is in the development of a freeway system for the Los Angeles metropolitan area, which is fast becoming rec-

WILLIAM L. FAHEY

ognized as comprising just about all of the three counties of the district.

Bill was born in Lyons, Iowa, and received his early education in the grade and high schools of that city. He received his university education at the Iowa State College of Agriculture and Mechanics Arts at Ames, where he received his bachelor of science degree in civil engineering in 1914. It will be recalled that this college has maintained the Iowa Engineering Experimental Station that has contributed so much to basic engineering knowledge concerning highway construction and operation. Among this college's distinguished alumni is Thomas H. MacDonald, who was U. S. Commissioner of Public Roads for many years, and recently retired.

Worked in Iowa

Bill's first engineering position was inspector and resident engineer for the Iowa Engineering Company. He then worked as assistant city engineer of the City of Clinton, Iowa. Following these assignments he worked for the Iowa State Highway Commission as a bridge construction engineer and later as assistant county engineer and county engineer for Clay County, Iowa. Then came World War I in which he served the Army as a 2d lieutenant. At the close of the war, Bill resumed civilian life by engaging in private practice as a civil engineer and also doing city engineering work, until 1928 when he came to California, accepting a position as engineering draftsman in the Los Angeles district office.

Fahey rapidly advanced in state service through the positions of assistant resident engineer, resident engineer, becoming assistant district maintenance engineer on September 1, 1936. Bill was promoted on March 28, 1938, to fill the position of District VII maintenance engineer, which position he held until November 1, 1948, when he became district engineer. This position in which he has responsibilities for the functions of highway construction, maintenance and administration in District VII he held until his retirement. This has been an important period in state highway history because, with the Collier-Burns Highway Act of 1947 going into effect, increased financing has greatly stimulated freeway construction particularly in District VII.

Fine Record

While Bill has been the administrative head of the District VII Construction Department, over 150 miles of multiple freeways and expressways have been completed in this district at a total cost of some $350,000,000. As administrative head of the district maintenance department he has had responsibility for taking care of the 1,417 miles of the State Highway System in District VII. The work of the district has been steadily mounting. In 1948 there were 688 employees on the staff pay roll, while in 1955 the number is 1,464.

Bill's many friends and associates within and outside state service gathered to do him honor at a retirement dinner party held at the Rodger

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Langsner to Succeed Fahey

George Langsner, Assistant District Engineer, Programs and Budgets for District VII, was promoted to fill the position vacated by District Engineer W. L. Fahey.

Langsner started work for the Division of Highways on a survey party after graduation from California Institute of Technology in 1931.

GEORGE LANGSNER

He was principal assistant resident engineer on the construction of the Arroyo Seco Parkway, now the Pasadena Freeway, and resident engineer and utility coordinator on the Terminal Island Freeway construction. His experience also includes four years of right of way work.

Langsner became district utility engineer in 1947 and was promoted to assistant district engineer, design, in 1949, In that capacity he was responsible for the design of many of the metropolitan freeways in the downtown Los Angeles area. He was assigned to program and budget duties in 1954.

Born in Brooklyn, New York, Langsner attended grade school there and high school in Ontario, California.

He is a member of the American Society of Civil Engineers, the American Right of Way Association, the Highway Research Board and the engineering honor fraternity Sigma Xi. He also has served as editor of the *Cal Tech Alumni Review* and is past director and Vice President of the Cal Tech Alumni Association.

Langsner, who lives at 101 Pamela Road in Arcadia, is married and has a son and a daughter.

A. I. "Irv" Rivett

A. I. "Irv" Rivett, Safety Engineer for the Division of Highways, retired on October 7, 1955, bringing to an end 40 years of service with the State. The past 17 years of his career were in safety work. The present-day employee safety program now in operation throughout the 11 highway districts in the State was developed largely by Rivett.

In 1938, he was called in as assistant engineer in the newly-formed Safety Department, forerunner of the present Traffic Department. For the next few

A. I. RIVETT

years he toured the State lecturing before civic and school groups on the engineering aspects of highway safety and accident prevention. Rivett was one of the first men in the country to mount a movie camera in the windshield of his car so that he could catch candid shots of traffic violators in action as he traveled over the state highways going to or from his assignments. He used some of this film to illustrate points in his lectures.

Employee Safety Program

It was shortly after coming to work in the Safety Department that Rivett began to realize the need for an employee safety program within the Division of Highways itself. During the next few years he initiated and developed such a program with the result that in 1945 he became Safety Engineer for the division, devoting himself 100 percent to employee safety.

In 1950, full-time safety supervisors were appointed for each of the 11 highway districts in the State, and for Headquarters departments with large field or shop forces putting into effect one of the first over-all employee safety programs among highway departments in the Country.

Under Rivett's direction, these men, along with assistant safety engineers working out of the headquarters office in Sacramento, travel through their districts and the state supervising employee safety programs, inspecting shops and yards and visiting maintenance and other field crews on the job, on the alert for unsafe equipment or work practices that might mean loss of life or limb to one of their fellow employees.

Rivett and his crew have used many methods in addition to the inspection tours to get their message over to the 11,000 employees in the division. Posters, lectures, movies, filmstrips and reaction tests all play their part.

Accident Frequency Drops

Since 1940, when the employee safety program started, the accident frequency among division personnel has dropped to well below half of what it was 15 years ago.

An additional responsibility assigned to Rivett since 1951 has been the coordination of the employee suggestion system for the Division of Highways. In the past four years he has processed about 1,650 suggestions submitted by state employees to the State Merit Award Board.

A man of broad interests, Rivett has an impressive list of "firsts" to his name. He is a charter member and past state vice president of C. S. E. A. and one of the founders and past president of the State Employees Credit Union. He is a charter member of the Valley Chapter of the American Society of Safety Engineers,

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A. L. Anderson

District XI of the State Division of Highways is losing the services of one of its most loyal and conscientious employees in the person of A. L. "Andy" Anderson who has announced his retirement on December 1, 1955, after 36 years with the State Division of Highways.

A. L. ANDERSON

Andy was born January 15, 1894, in LaMont, Illinois, where his early boyhood was spent. Then as now, however, California's golden gleam could not be denied and Fresno's school bells were soon beckoning him to class. In preparation for his future career, he specialized in several business schools, after his ties were severed with the local high school. In 1913 he decided to try the life of a rancher, but this was interrupted in 1915 when he answered his country's call and entered the U. S. Navy as a yeoman, serving throughout World War I.

November 17, 1919, began his employment with Highways as an assistant clerk in his home town of Fresno, the headquarters for District VI. Less than two years later he had risen to chief clerk of the district, continuing to occupy that important position until September 1, 1933. At this time, E. E. Wallace, now retired, District Engineer of District VI was transferred to the fledgling District XI as District Engineer, and gathering the best of District VI including Chief Clerk Andy, moved bag and baggage to San Diego.

During his long career with Highways, Andy has seen many improvements in accounting techniques placed into effect as our division has grown and grown, no few of which are his own ideas now become policy. He is a charter member of the C. S. E. A. and served as the first secretary of the Fresno Chapter. His interest in employee welfare and efficient operation has remained uppermost in his mind,

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A. I. RIVETT

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charter member and past president of the State Men's Club and one of the organizers of the State Men's Speakers Club. He is also a charter member of the Public Relations Round Table of Sacramento.

Native of Sacramento

He also served as editor of the *State Employee*, the official publication of the C. S. E. A., and was the first to issue the paper in tabloid form, its present format. He also served on the Committee on Safety of Maintenance Personnel of the National Highway Research Board.

A native Sacramentan, Rivett attended grade and high school in Sacramento. His first job with the California Highway Commission, forerunner of the Division of Highways, was in 1912 as a draftsman with the District III office, then located in Sacramento. For the next 11 years his state service was interrupted with time out for engineering studies at the University of Nevada and two periods of service with private electrical concerns. In 1923 he became an engineer in the Division of Water Resources.

Six years later he returned to the Division of Highways to accept an appointment as assistant maintenance engineer for District X, whose headquarters at that time also were in Sacramento. In 1933 he moved to Stockton when the District X offices were transferred there. He returned to Sacramento in 1938 when he was appointed assistant engineer in the newly created Safety Department.

Rivett and his wife, Ora, live at 2722 Fifth Avenue in Sacramento. They have two sons, Donald, a placement officer with the California Youth Authority, and Dexter, with the public relations section of the McClatchy Newspapers; a daughter, Leora, and six grandchildren.

MOTOR VEHICLE REGISTRATIONS

Motor vehicle registrations are expected to reach 61 million in the United States for 1955. Passenger cars will comprise almost 51 million of the total.

A. L. ANDERSON

Continued from page 45 . . .

and he leaves to his successor undoubtedly the best organized department in the State. He and his wife, Frances, have their home at 4630 Norma Drive, San Diego, and plan after extensive traveling to just rest and pursue the elusive fish, and cheer the local baseball team to victory. Lately the shutterbug has bitten him and he is in the throes of gathering color pictures of all and sundry. And just to keep from getting old, he has admitted that he may return to one of his earliest loves, bowling. Return, that is, if he has time. Our best wishes are extended to an exemplary employee and an unsurpassed department head as he enters retirement, A. L. Anderson.

EARL T. SCOTT

Continued from page 43 . . .

from Stanford University in 1914 with a degree in engineering.

Scott is a member of the California Society of Professional Engineers, past president of the Fresno Engineers Club, past commander of the American Legion's 23d Engineers Post 345 and a member of the Transportation and Highway Committee of the San Joaquin Valley Council, State Chamber of Commerce.

He also served as chief of engineering services for Region 6 of the California Office of Civil Defense.

Scott's home is at 872 Peralta Way in Fresno. He has two sons, Thomas, also of Fresno, and Robert, of Menlo Park, and three grandchildren.

WILLIAM L. FAHEY

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Young Auditorium in Los Angeles on the evening of December 2, 1955.

Mr. and Mrs. William L. Fahey at the present time live at 8056 Langdon Avenue, Van Nuys, in the San Fernando Valley. Their plans after retirement include the development of 10 acres of hilly and canyon land in the City of Oceanside, California, where they expect to make their future home.

WELCH SUCCEEDS SCOTT

Continued from page 43 . . .

After a few years of engineering work on railroads and highways in that state, he came to California in September, 1929, and joined the staff of District I, Division of Highways at Eureka, as a draftsman.

In 1933 Welch moved to Los Angeles, where he first served as resident engineer on construction jobs. During the next nine years he worked on highway design, specifications and estimates, planning, and administration, most of the time in District VII (Los Angeles, Orange and Ventura Counties) and part of the time in Sacramento headquarters office.

During World War II Welch served three and a half years with the U. S. Marine Corps. For most of that time he was the operation officer of an engineering battalion, serving on Guadalcanal and in other Pacific combat areas. He held the rank of Major at the time of his relief from active duty.

In Charge of Traffic Surveys

For two years after his return to the Division of Highways, he was in charge of the origin and destination surveys of traffic which served as a basis for metropolitan freeway planning in the San Francisco Bay area. He then returned to the Los Angeles area to take charge of materials investigation survey and design for freeways and other state highways there.

In November, 1949, Welch was assigned to the division's Headquarters Design Department. While serving as administrative assistant to the Engineer of Design, his responsibilities have included development of California's recognized outstanding highway designs, and final design review of construction plans for the state's expanded program of metropolitan area freeway development and other highway improvements.

Welch is married and has two grown sons, William R., living in Sacramento, and Richard J., San Francisco.

Twenty years from now the American consumer will be using 60 percent more oil than he uses today, according to the National Automobile Club.

Dave Langford

Dave Langford, Highway Chief Clerk I, District V, San Luis Obispo, retired on December 31, 1955, after 35 years of notable state service.

Dave was employed by the State on May 7, 1921, as a clerk and since 1923 has been continuously in charge of the District V accounting office, advancing steadily through many grades to his present position.

DAVE LANGFORD

Born at Milton, California in 1893, Dave was graduated from Stockton Commercial College in 1912. He worked as an accountant for the Sterling Iron Works in Stockton until the outbreak of World War I when he enlisted in the United States Navy, serving two years, chiefly in Scotland and France. He was discharged as pharmacist mate first class. He then was employed by the Shell Oil Company, Stockton, and E. C. Loomis and Son, Arroyo Grande, before entering state service.

Dave has been very active in affairs of the California State Employees' Association, serving in a number of Chapter 10 offices, including president in 1939 and delegate to the General Council several times, where, in 1937, he was elected treasurer and thereafter a member of the Board of Directors of the CSEA headquarters organization.

An ardent sportsman, Dave expects to devote his energies to hunting and fishing throughout the West. His leisure will be spent at his home, 652 Mitchell Drive, San Luis Obispo, and visiting his son and twin granddaughters in Santa Barbara.

REWARD FOR KIT CARSON

Kit Carson's former employer offered a 1-cent reward for the return of 16-year-old Kit when, according to the National Automobile Club, he ran away from Missouri to become a fur trader and guide in New Mexico.

DEPUTY STATE HIGHWAY ENGINEERS NAMED

Appointment of J. W. Vickrey and Charles E. Waite as Deputy State Highway Engineers for the California Division of Highways was announced on November 17th by State Highway Engineer G. T. McCoy.

The appointments were made retroactive to November 3, 1955, two days after the retirement of Ridgway M. Gillis, who had been Deputy State Highway Engineer since 1950.

J. W. VICKREY

Because of the increased workload which has developed in California's accelerated state highway program, McCoy said, two deputies were being appointed to provide the "additional top level administrative assistance required to handle the increasing program."

In this first reorganization since 1947 of the top management structure of the Division of Highways, Vickrey was designated as Deputy State Highway Engineer—Engineering and Waite as Deputy State Highway Engineer—Administration and Management.

Both men have been serving as Assistant State Highway Engineers, and were selected for promotion from a recently established civil service list.

J. C. Womack, Planning Engineer for the State Division of Highways since 1948, was named to the position of Assistant State Highway Engineer—Planning. He will fill the position formerly held by Vickrey.

Assistant Planning Engineer John A. Legarra has been promoted to the Planning Engineer post formerly held by Womack.

CHARLES E. WAITE

Along with these changes, McCoy announced the assignment of personnel and public relations functions for the Division of Highways to J. P. Murphy, principal highway engineer who has been in charge of public relations. The new duties which Murphy is assuming were formerly carried out by Waite.

J. C. WOMACK J. A. LEGARRA

Shasta County Project Now Is Completed

The contract for the four-lane divided highway from Mountain Gate to Bass Hill in Shasta County has been completed. This is the culmination of construction begun in 1953 to improve the highway from Redding to Shasta Lake.

The first contract let in that year covered the grading from Boulder Creek to Project City. Fredrickson & Watson Company completed the work at a bid price of $555,555.55.

The next spring, a contract was awarded to Rice Bros., which covered paving for this grading contract and extended the grading and paving to the foot of Sulphur Creek Hill in Redding. This work was performed under a bid of $579,390.

Later in the year, a contract was awarded to Fredrickson & Watson Company for grading and paving from Project City to Mountain Gate for $686,680.

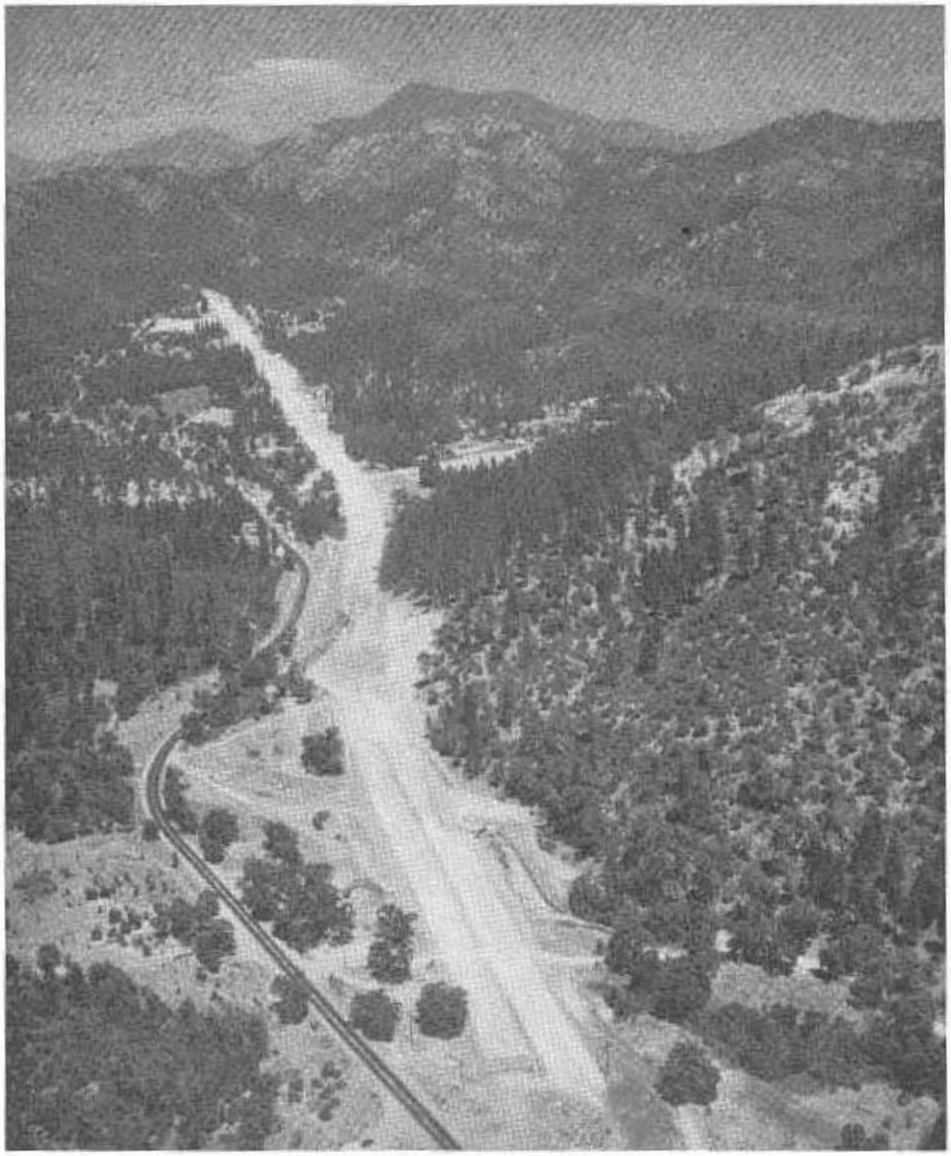
Expenditures $2,607,181

Just before the first of 1955, another contract was awarded to Fredrickson & Watson Company for grading and paving from Mountain Gate to Bass Hill for $785,555.55. This is the contract just completed.

The expenditures on these sections and their lengths are:

Fredrickson & Watson Co. (included in Rice contract)		$555,555.55
Rice Bros.	5.2 miles	579,390.00
Fredrickson & Watson Co.	3.7 miles	686,680.00
Fredrickson & Watson Co.	2.9 miles	785,555.55
Totals	11.8 miles	$2,607,181.10

The first thing that impresses the driver on the new highway is the scarcity of traffic. After being accustomed to driving on the old highway which was crooked, narrow, and frequently loaded to capacity, he gets on the new one and feels like asking "where did everybody go?" Well, all the traffic which was on the old highway is present plus an additional small percentage. When traffic from the old highway was turned into a new facility capable of comfortably handling at least four times as many vehicles as the old one, they did not appear to be nearly as numerous.



Looking northerly along new alignment towards Bass Hill from Mountain Gate. This photo taken during construction shows old highway on left.

Sacramento Canyon Project

J. W. Trask, District Engineer of the Division of Highways at Redding, says this 11.8-mile improvement might well be considered the start of the Sacramento Canyon's improvement. While its location is not definitely in the canyon, it would have been very poor policy to start construction in the real canyon north of Shasta Lake and leave this bottleneck between Redding and the relocated highway around Shasta Lake.

As the status of construction stands, right now the highway between Redding and Shasta Lake has been improved to current standards. The road around Shasta Lake, relocated when the dam was built, while not up to current standards, will provide service at least until the improvements in the canyon are completed.

North of this section, there are now underway two grading contracts and the Dog Creek Bridge contract. The aggregate cost of these will be about $3,000,000.

There still remains about 21 miles to be relocated and constructed beyond the end of the current construction and the new Sacramento River bridge in North Dunsmuir.

Traffic Lines

Marking Equipment Specially Built by Highways Division

By EARL E. SORENSON, Equipment Engineer

RAILWAY TRAINS, operated by skilled crews, require steel rails and flanged wheels to control them, keep them in their paths of travel, prevent collision, and guide them to their destination. Highway traffic depends on painted lines and the eccentricities of drivers of varying skill.

Each highway unit is of very small tonnage in comparison to that of a railway unit. However, there are many thousands of cars and trucks operated, for each train, and each one has lethal possibilities if not properly handled and controlled.

No doubt most of you have wondered what lies behind the signs and the familiar stripes that are painted on our highways and which flow smoothly for thousands of miles to direct you in the proper travel paths. Striping a modern complex highway requires the utilization of the most modern technique on the part of today's traffic engineers, for stripes must not only be designed and positioned to make manipulation of vehicles natural and easy, but they must be designed to convey control messages in a manner so simple that even the poorly informed driver can understand and follow them.

Concepts of Traffic Control

The latest concepts of traffic control, through stripes and signs, as conceived by the traffic engineers, would be of little value without the modern equipment and machinery to place them in effect. The striping of our highways has become a major operation, and requires this specially-built equipment and machinery to accomplish the desired results without excessive cost.

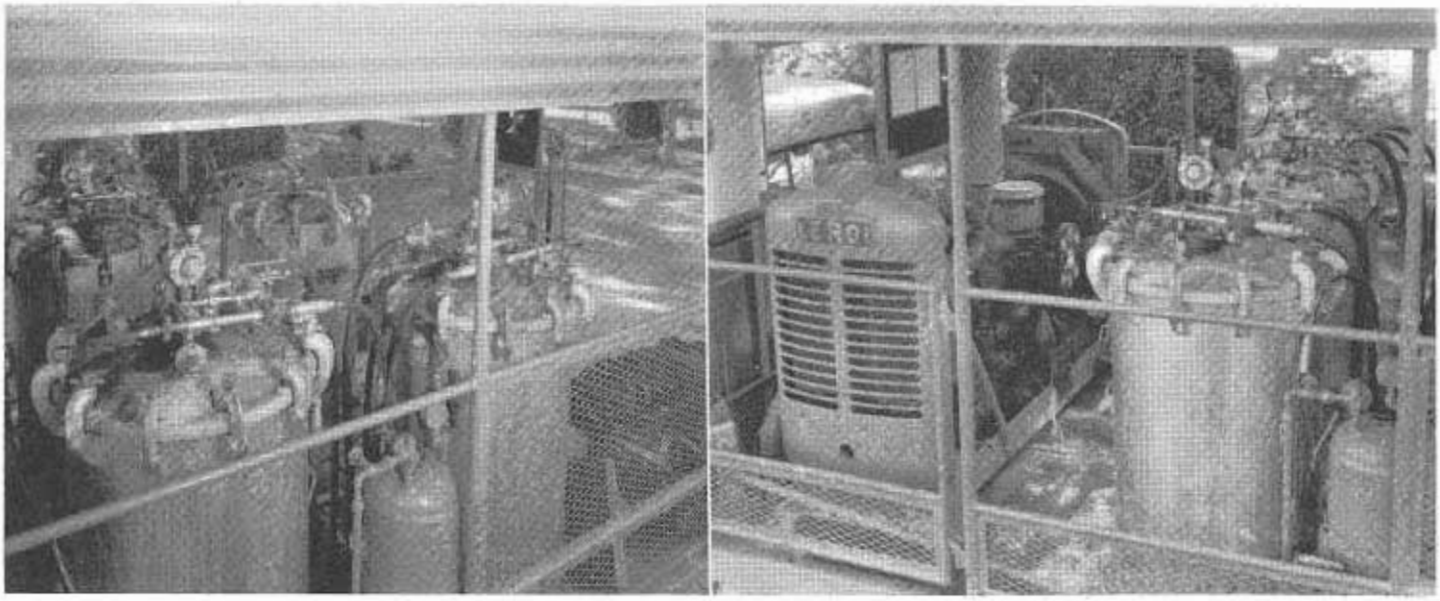
The Equipment Department of the California Division of Highways has pioneered in the development of modern, fast, economical highway marking machines. Approximately 30 other states have built markers following, to a large degree, the Equipment Department's design. Plans have also been requested by several South American countries, as well as some of the states and territories in the Commonwealth of Australia.

The modern highway marker, as designed and built by the Equipment Department, is capable of not only painting the stripes, but of precleaning the surface to be painted, placing the stripes, and applying reflector-type glass beads, all in one combined operation. It is capable of continuing this process for long periods with only necessary shut-downs for loading paint and rest periods for the skilled maintenance crews who operate it.

Composite Machine

The composite machine is made up of a three-ton cab-over-engine type truck chassis with a special flat-rack body, the truck pushing a marking

Modern traffic line marker with "mother" truck



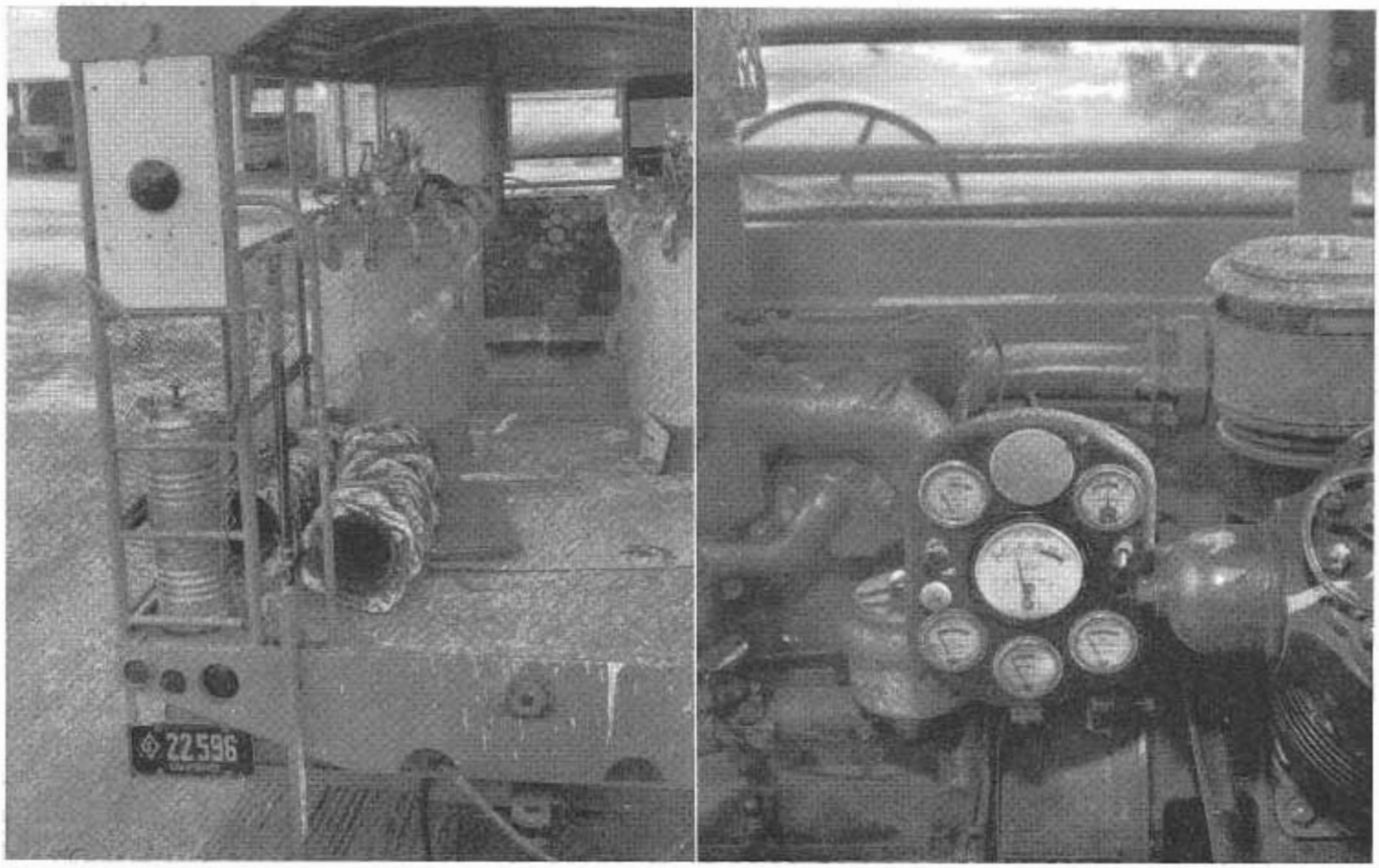
LEFT—Arrangement of paint tanks showing air driven mechanical agitators. RIGHT—Close up of compressor and paint tanks using air-driven mechanical agitator.

machine which is equipped with a motor-driven cleaning brush, paint gun, and bead dispensers.

The truck, which requires a long wheelbase and bed, carries an air compressor, air receiver, paint tanks equipped with either electric or air agitators, a solvent tank, and an engine-generator when equipped for electric-motor-driven paint agitators.

The cylindrical pressure tanks are mounted vertically, in such a manner that they may be readily and easily filled with paint by removing the top. They may be flushed and cleaned by

LEFT—Interior view of "mother" truck. RIGHT—Control panel on main compress of "mother" unit.



means of a drainage system through the bottom of the truck-bed. Paint solvent is carried in an auxiliary tank, under pressure, and piped so that all lines and equipment may be flushed clean at the end of the day's work.

Agitation of the paint is accomplished either by means of electric or air-driven agitator paddles. Either system gives satisfactory results.

Winter Operations

For winter operations, the traffic line paint is passed through a shop-designed hot water heater mounted on the front of the truck and obtaining its hot water supply from the truck radiator. The heater can be adjusted to bring the temperature of the paint to the desired level for application.

The truck is equipped with a large, vertically adjustable rear platform for the dual purpose of facilitating the loading of the paint and the placing of traffic-marker cones to protect the newly painted stripe during the drying period.

An automatic chute is now in process of being designed which will permit the placing of these traffic cones by a man standing in the bed of the truck.

A metal canopy is provided which covers the entire truck bed, and affords protection, from the weather, to the men and equipment.

The marking machine, which is pushed ahead of the truck, is designed for one-man operation. The controls are largely automatic and are located in the machine's cab, within easy reach of the operator. The marking machine, which is guided by the operator, is provided with a sight, or pointer, to assist in the accurate alignment of the stripe. This arrangement requires that the truck driver maintain his truck in an approximate position only, the accurate location of the stripe being under the control of the striping machine operator.

Most Effective Results

Stripe spacing, paint control, and bead placing, as well as the alignment, are under the control of the operator. The most effective results are obtained at an approximate five mile-per-hour speed.

Placing the stripes, with this equipment, consists of only three operations. First, the placing of signs, by a pilot vehicle, to warn oncoming traffic that the striping equipment is following; next, the actual striping operations, including the placing of protective marker cones; and the final step, the gathering up of the protective marker cones when they have accomplished their purpose. The three steps are carried on simultaneously.

The operation of this complicated striping equipment is under the supervision of the Maintenance Department of the Division of Highways. They have developed highly skilled crews, who operate these machines with efficiency and a minimum of delay. Like all machinery of a complicated nature, the successful operation depends upon the skill of the operators. The striping crews are deserving of credit for the results.

Equipment Design for Safety

Striping must, of necessity, be carried on under heavy traffic conditions. which involves some hazard to the men. While safety records for this operation are excellent, insofar as this State is concerned, the Equipment Department is continuing equipment design studies to improve the equipment from this standpoint.

It is possible that the marking machine, which is pushed ahead of the truck, may be eliminated by using a long wheelbase vehicle with a front-wheel drive. This would make possible the elimination of the driveshaft and rear axle, which would permit the marking machine and the operator to be suspended near the rear of the truck and between independently mounted rear wheels, thus affording him protection from traffic and also combining the present two units into one.

Study is also being given to the feasibility of suspending the marking machine from the front end of the truck by cantilever support, and controlling it from the truck cab.

With the cooperation of the Maintenance Department and the benefit of their operating experience continued improvements will be added to the complicated equipment used in this important phase of traffic control.

NEW BUDGET

Continued from page 35 . . .

Stanislaus County—US 99, vicinity of Ceres and Modesto, $2,000,000.

The major construction projects in the budget affect nearly 300 miles of state highways and provide for 45 bridges over streams and 165 other structures, including highway separations and railroad separations. Approximately 135 miles of the proposed improvements involve full freeways, which when completed will bring California's total of full freeways to more than 500 miles. In addition, the 65 miles of proposed expressway and other multilane divided construction (with some intersections at grade) will increase the State's total of multilane divided highways of all types to nearly 1,900 miles, or some 13.5 percent of the 14,000-mile State Highway System.

Over-all Budget $348,704,600

The over-all budget total, including certain allocations for such nonstate highway purposes as city streets and county roads, is $348,704,600. Of this amount $37,983,000 is for nonstate highway expenditures, including $27,660,000 to cities for city streets (⅛ cent per gallon of the gasoline tax); $6,530,000 in the federal aid secondary funds for county roads; $3,707,000 in state funds to counties to assist in the required matching of federal aid secondary funds; and $86,000 for outdoor advertising supervision.

Apart from the $247,338,000 for major construction purposes, other state highway items in the budget include: $25,000,000 for maintenance; $6,850,000 for administration; $4,507,600 for contingencies; $18,026,000 for preliminary engineering; and $4,500,000 for buildings and plants.

DRIVING NEAR PARKED CARS

When driving near parked cars, drive with care. Drive as far away from the line as conditions will permit. And look ahead. Practice the habit of anticipation. Be alert for any indication of movement among the cars, for any indication of erratic movement among the adults or children on the sidewalk.

Findings

The Effect of Clay on the Quality of Concrete Aggregates

By BAILEY TREMPER, Supervising Materials and Research Engineer, and W. E. HASKELL, Associate Materials and Research Engineer

CLAY * when it is present as a coating on the surfaces of the mineral particles that constitute concrete aggregate has long been regarded as deleterious. Evidence of this may be found in many specifications that require the aggregates to be "free from clay or other deleterious coatings" or by requirements that the aggregates shall be washed. The enforcement of restrictions against clay generally are in the form of a maximum limitation on the percentage passing No. 200 (or finer) sieve as determined by wet sieving (wash). But this test does not distinguish between clay and inert dust nor does it furnish a clue as to the degree of activity of the clay, if it is present. The inclusion of the No. 270 sieve in the sieve analysis, although a step in the right direction, has not resulted in the needed discrimination.

Wet Sieve Analysis

Because of the shortcomings of the wet sieve analysis, and the time required to complete it, personal judgment is often resorted to as a means of evaluating the cleanliness of the aggregate. Frequently such opinions cannot be justified by the results of wet sieve analysis. If the investigation is carried far enough to make concrete with the questionable aggregate and the same material after thorough scrubbing it is not unusual to find that the suspected clay has not reduced the strength significantly. Instances are on record of the use of a soil as an admixture to concrete with evident improvement in workability and without serious effect on the compressive strength, particularly if the mix was lean and harsh. On the other hand there is a great deal of evidence showing that excessive amounts of clay whether in the form of a coating or as discrete finely divided particles have resulted in serious reductions in strength. There is a lesser amount of evidence to show that the clay contributes to excessive volume change.

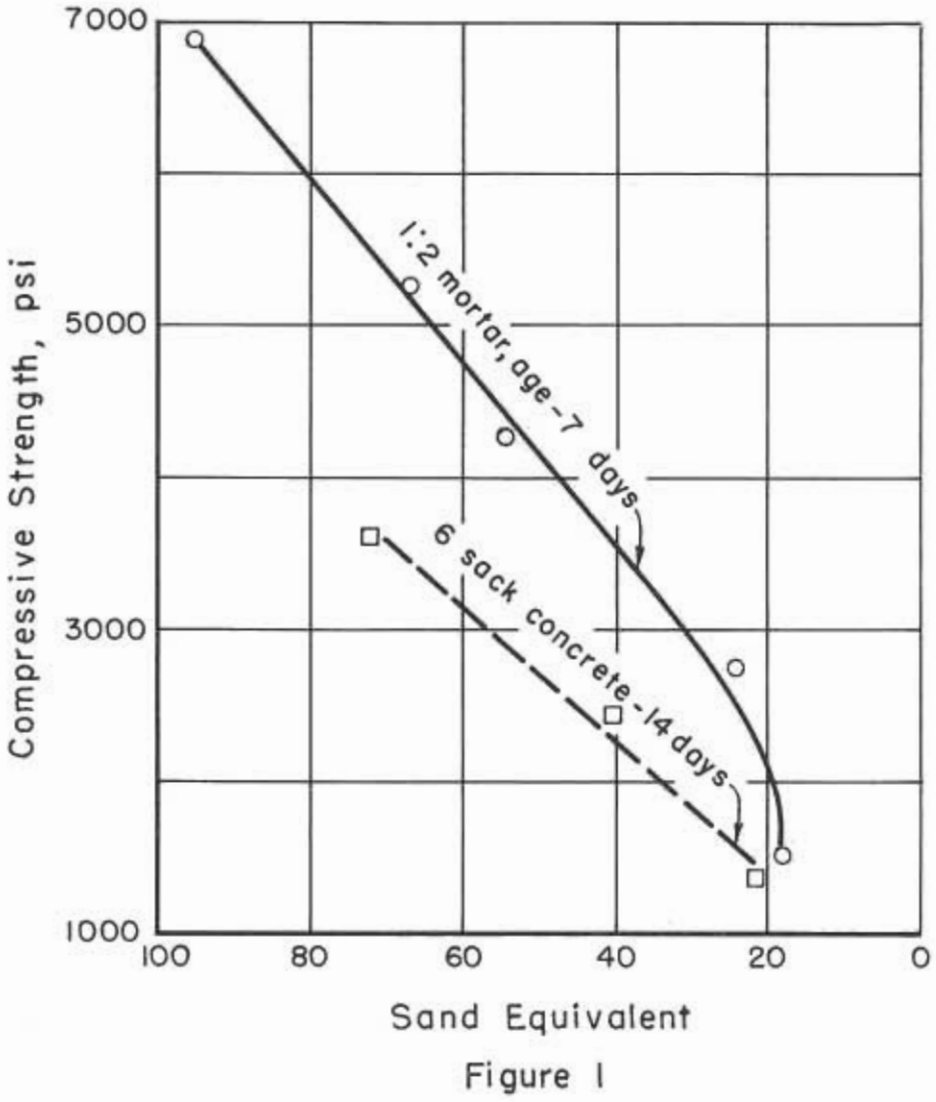


Figure 1

Relationship between sand equivalent and compressive strength

Sand Equivalent Test

These apparent anomalies may be explained by the deficiencies of human judgment and the fact that no test method has been available to yield an evaluation of either the quantity or the activity of the suspected clay. Clearly a test of another type is indicated. Tests of the desired type have been developed in the laboratory of the Materials and Research Department of the Division of Highways. These are known as the Sand Equivalent Test which is applied to sand

* The term "clay" is used in a broad sense and may not necessarily be restricted to the true clay minerals. It may include mixtures of colloidal particles with finely divided inert material such as silt. The term is intended to include only mixtures that contain colloidal particles and exhibit some degree of plasticity as distinguished from inert rock dust.

passing a No. 4 sieve and the sedimentation test which is applied to coarse aggregate.

The theory, background and development of the sand equivalent test has been described in the technical literature.* Aside from an interdepartmental report, nothing has been published concerning the functions of the sedimentation test. The exact methods for conducting the tests however have been described and they form a part of the Manual of California Test Procedures of the Materials and Research Department.

Details of Manipulation

Although differing in details of manipulation, because of particle size of the aggregates involved, both methods are based on the same principle. Clay if present in the sample either as a coating or in the form of discrete particles is brought into suspension in a dilute solution of calcium chloride which causes colloidal particles to coagulate. The suspension is allowed to settle for a definite period and the height of the suspension is measured. The units in which the results are expressed is different for the two tests. Higher values of sand equivalent indicate less clay while higher sedimentation values indicate more clay. The possible range in sand equivalent value is from 0 to 100 whereas the range in sedimentation values is from about 2 to 15.

Laboratory studies have been made to determine the effect of variations in sand equivalent and sedimentation values of fine and coarse aggregates on the quality of mortar and concrete made from them.

SAND EQUIVALENT

Sand from one pit was treated to yield five degrees of cleanliness ranging from the pit-run material having a sand equivalent of 18 to well-scrubbed product having a sand equivalent of 95. Tests of these sands when mixed into mortar and concrete showed that the compressive strength decreased sharply, and the linear shrinkage upon drying increased, as the sand equivalent became lower (i.e. more clay). The results of these tests are shown in *Figures 1 and 2.*

* F. N. Hveem, Sand-Equivalent Test for Control of Materials During Construction. Proceedings of the 32d Annual Meeting of the Highway Research Board.

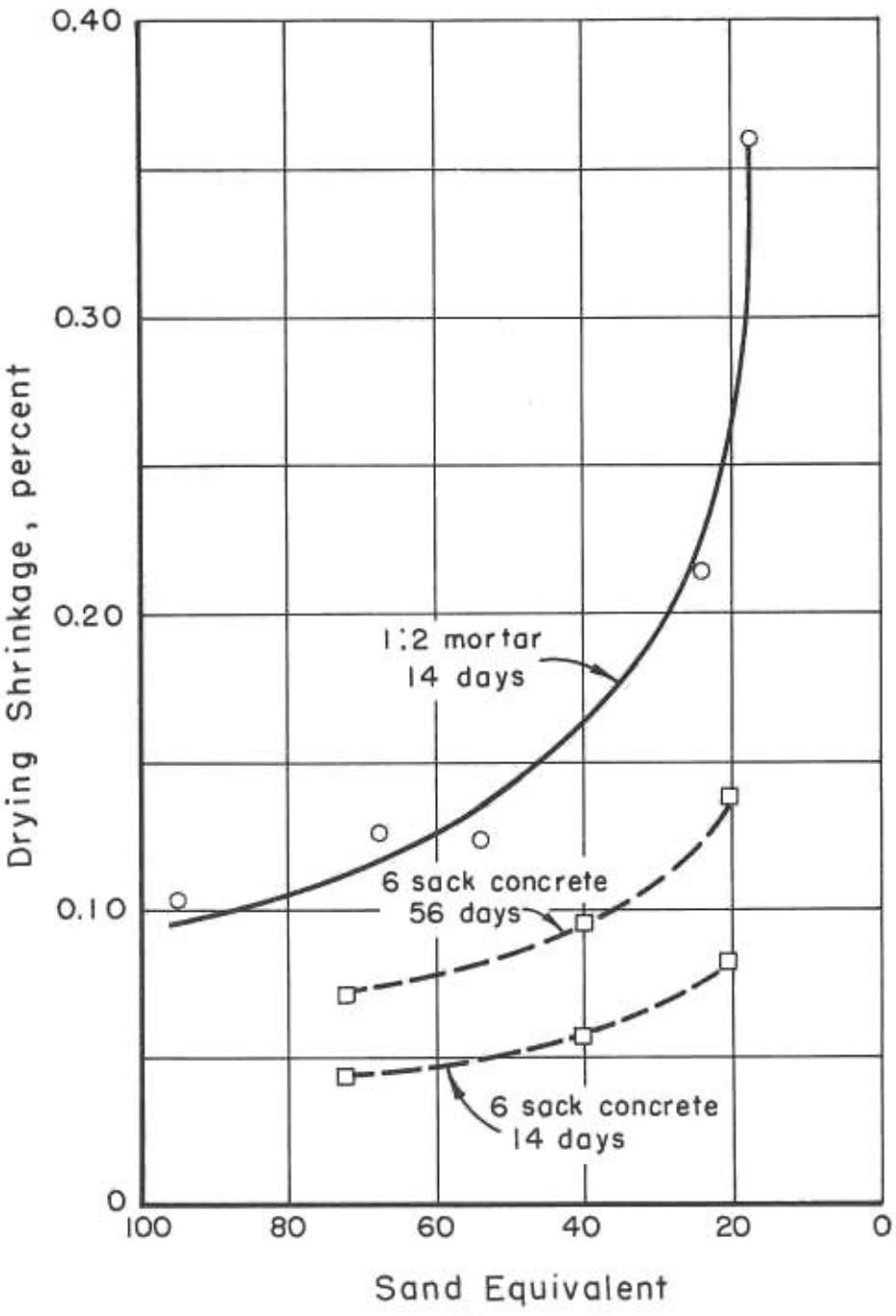


Figure 2

Relationship between sand equivalent and drying shrinkage

It is believed that volume change as exemplified by drying shrinkage is often a more important factor in the performance of concrete used in highways than is strength. Unfortunately volume change in the form of either shrinkage or expansion has received only a fraction of the attention in the design of concrete that has been devoted to strength. Unequal drying between top and bottom of pavement slabs is partly responsible for curling and the consequent reduction in support of the slab ends. Excessive shrinkage of concrete that is restrained by reinforcing steel, or by the friction of the subgrade under pavements, produces cracks that are entry points for agencies of deterioration. Unless volume change is known accurately during the design of prestressed members they may not function as intended.

Clearly it is essential to control volume change within reasonable limits.

More Information Obtained

In order to obtain more information on the range in drying shrinkage to be expected in practice, and to learn to what extent the sand equivalent may affect drying shrinkage, each sample of concrete sand that was received in the laboratory during a period of 15 months was tested for sand equivalent, absorption and drying shrinkage of mortar containing the sand. In all, 248 samples from 142 sources of supply were tested by these methods. *Figure 3* shows the results obtained in these tests. The sloping solid line shows the statistical relationship between the two variables. The equation shown in the diagram is the mathematical expression of the relationship. The broken lines represent the probable range in accuracy of the equation. Statistical analysis shows that the correlation is real and of a relatively high order.

Sampler Tested

Most of the sands tested were produced to meet specifications that did not include a sand equivalent requirement. The sand equivalent of many was in the range of 60 to 80 although a large number exceeded 80. In many cases two or more samples were received from the same source of supply in which event the results were averaged and are shown as solid dots in *Figure 3*. Open circles represent tests of single samples from a given source of supply. It will be noted that the majority of points that lie outside the broken lines represent tests of single samples. Had results of repeat samples been available it is probable that some of them would have conformed more closely to the general equation.

The equation as derived means that a sand having a sand equivalent of 60 produced twice the drying shrinkage that results from a sand equivalent of 92. Nearly all of the samples tested complied with the specification requirements that not more than 4 percent shall pass the No. 200 sieve. The establishment of a minimum value of sand equivalent in the specifications is thus seen to provide a means of improving the quality of concrete that was not available formerly. A minimum value of 80 was selected as the best compromise between the desire for highest quality and the ability of producers to meet the requirement without greatly increased expense.

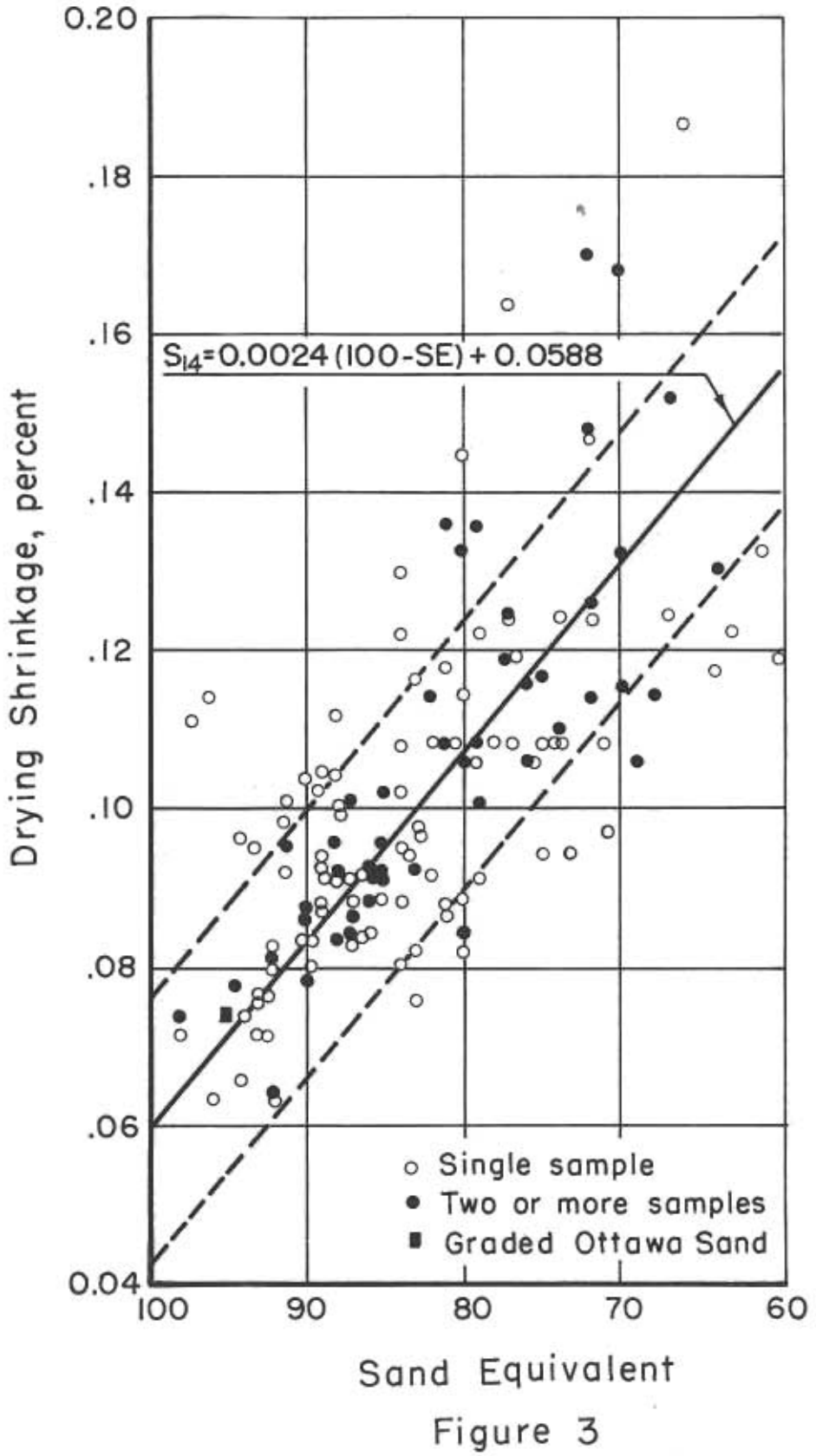


Figure 3

See Figure 3

With further reference to *Figure 3* it will be noted that a number of sands, tests of which were made on several samples, are represented by points that fall outside the broken lines. These points all represent sands produced in Northern California and, further, can be grouped into a few geographical areas. It is indicated therefore, that there is some factor other than sand equivalent that affects drying shrinkage. Other investigators have concluded that cement paste in attempting to shrink is restrained by the particles of aggregate and that the greater the rigidity of the aggregate the greater is the restraint to shrinkage. It was further concluded that the restraining effect of the aggregate was related to its porosity as measured by the absorption test. Such a conclusion is borne out by the results of the present tests. In *Figure 3*, the average absorption of the sands plotted above the upper broken line is 1.4 percentage points higher than the average for the sands which are plotted below the lower dashed line. The data strongly suggest that a correlation exists between absorption and drying shrinkage and statistical analysis shows this to be true. A computation of the multiple correlation between sand equivalent and absorption combined and drying shrinkage shows that it is exceptionally high. The adoption of limitations on both sand equivalent and absorption in the specifications would furnish nearly a perfect control on drying shrinkage insofar as it is affected by the character of the sand.

The sand equivalent of an aggregate can be improved by manufacturing processes but a reduction in absorption would be difficult, if not impractical, to accomplish. A stringent limitation on absorption would virtually eliminate some pits as potential sources of supply. The effect of such elimination would present a serious economic problem.

SEDIMENTATION VALUE

Studies of the sedimentation value of coarse aggregates to date have consisted of tests of eight ¾-inch x No. 4 gravels, which are considered to represent fairly the range of available commercial products and of three pit-run aggregates to determine the effects of high amounts of clay coating. In the preparation of these samples all loosely adhering fine material was removed by dry sieving and the test results reported herein measure the effect of clay as a coating. Test specimens were molded from concrete mixtures containing each of the coarse aggregates and a single lot of sand.

In these tests the amount of water required to mix the concrete to a common slump varied among the aggregates and tended to increase with increasing sedimentation value. The test data are shown diagrammatically in *Figure 4*. The coefficient of correlation while indicating real correlation is not particularly high. Relationships between sedimentation value and flexural strength, compressive strength and drying shrinkage are shown in *Figures 5 and 6*. Coefficients of correlation are relatively high and indicate that the sedimentation value has an effect on the quality of the resulting concrete that is not accounted for entirely by variations in water demand.

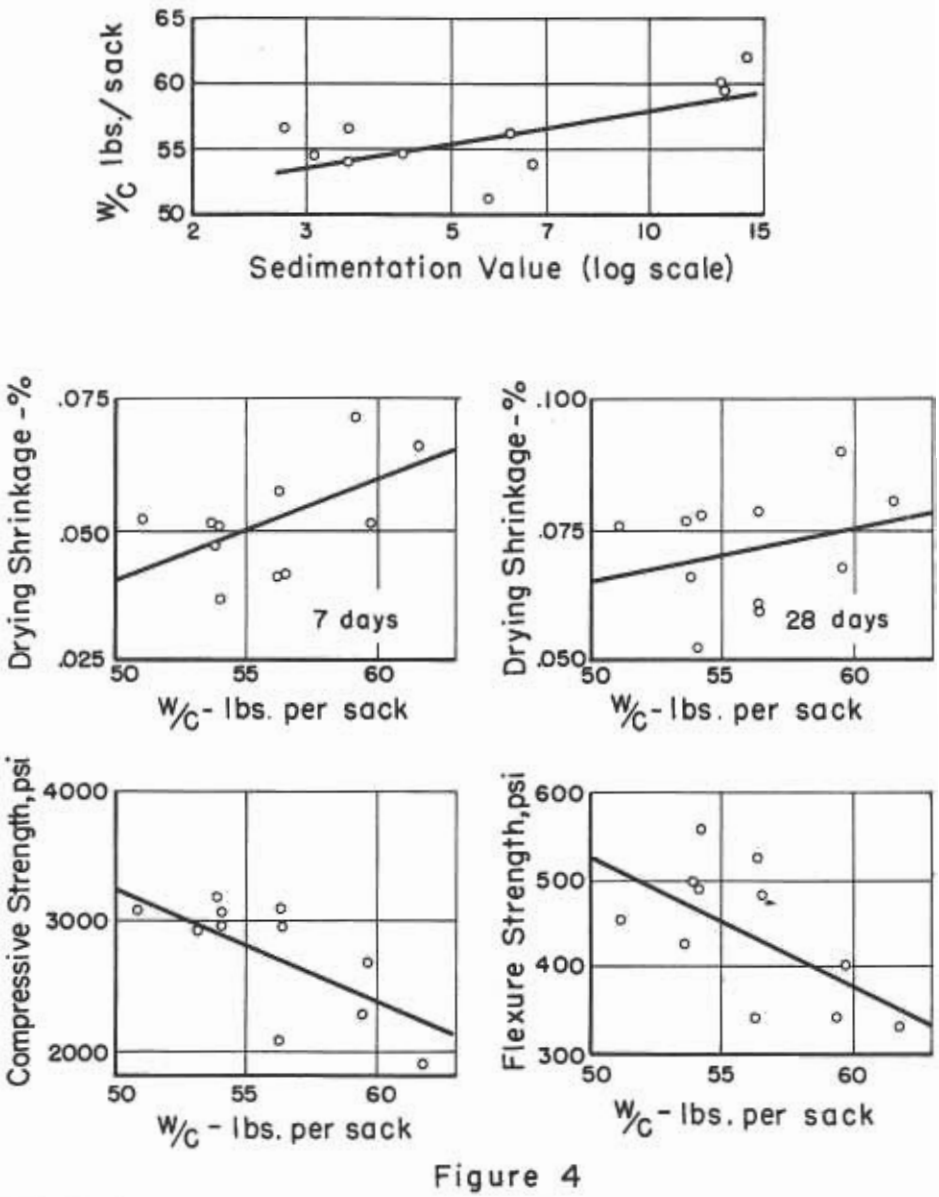


Figure 4

Relationship between water-cement ratio and drying shrinkage, compressive strength, and flexural strength

Equations Derived

Equations derived from the test data by statistical methods indicate the following:

. . . Continued on page 64

FACTORS IN OUTPUT OF HIGHWAY ORGANIZATIONS

By HARMER E. DAVIS, Director
Institute of Transportation and Traffic Engineering,
University of California, Berkeley

Over the past decade enlarged programs of highway construction initiated by the states, and stepped-up federal-aid appropriations have called for continually increased output from the state highway departments of plans, designs, specifications, and construction supervision relating to new construction, and of operational control of increasing lane-miles of existing facilities. All indications point toward the necessity of a further marked increase in output to meet the demands of highway transportation in the decade ahead.

Highway engineering agencies, the country over, have achieved a remarkable record of new and improved facilities put in place since 1945. They have done this by marshalling increased manpower and by a gradual development of time-saving techniques. But there now appears to exist a shortage of some 4,000 engineers in the state highway departments alone, according to a recent survey.[1] With a substantial further acceleration of highway construction programs on a nation-wide basis, which seems probable, a very critical manpower situation could develop. However, those who have looked into this rising problem agree that it will be possible to avoid an overly critical situation if appropriate counter measures, some already well-developed, are put into general effect.

INVENTORY OF ENGINEERING MANPOWER

It is my purpose here to analyze some of the aspects of this manpower and output problem, and to describe some of the developments that are taking place.

As a first approach to a consideration of the problem, it is helpful to make an inventory of the factors which bear upon the situation. These include an inventory of present manpower, and of the trends in production of new manpower.

EDITOR'S NOTE: This study of the engineering manpower problem was presented by Professor Davis at the annual meeting of the Western Association of State Highway Officials at Jackson Lake, Wyo.

Harmer E. Davis

In a survey made by the Highway Research Board in the fall of 1954 it was reported [1] that the number of engineers employed by the highway departments of the 48 states, the District of Columbia, Hawaii, and Puerto Rico was 18,034. About two-thirds of these departments also used the services of private consulting engineering firms to some extent, and it was reported that 4,192 additional engineers would have been needed if the consultants had not been employed. Combined, these are equivalent to 22,226 persons in engineering classifications engaged on the 1954 state highway programs. The report of the survey also indicated that the highway departments estimated they would have needed 3,990 additional engineers in order to work at maximum effectiveness.

In the response to the survey, the highway departments also estimated the number of engineers they would need for programs 50 and 100 percent larger than their 1954 programs. Granting that such inventories and estimates contain elements of uncertainty, nevertheless the order-of-magnitude of such figures are useful and significant in appraising the type of situation we are dealing with here. The estimates indicated that the minimum number of engineers needed for a 50 percent increase in the programs would be about 8,700, and for a 100 percent increase almost 14,000. It is presumed that these estimated needs are based on a projection of utilization of engineering personnel under current methods of office and field practice. But the significant factor that comes to mind immediately, as I shall show later, is that it is unlikely that engineers in any such numbers will become available for recruitment, at least for a considerable number of years to come.

Significant Finding

There was another highly significant finding brought out by a study of the results of the survey: there appear to be appreciable differences in the number of engineering personnel (excluding maintenance engineers) employed per dollar volume of construction. It was calculated that the ratio of engineers employed per million dollars of capital outlay ranged from 2.0 to 28.2, with a median value of 7.2. Now it is quite possible that, to some extent, differences in designation of personnel in engineering classification may account for this large variation; some preliminary results of a special study now going on in selected states with very high or low

ratios indicate that this is the case. Another factor may be the characteristics of the construction program. There are some indications that work in urban areas, requiring more details of planning, design and control, may require more engineering personnel per dollar volume of construction. But this finding also leaves the thought that some states have developed different practices in the utilization of personnel in engineering classifications. Pursuing this point one step further, it was estimated in the study that, if the utilization of engineers per million dollars of capital outlay were held to a value not to exceed the median value found in the survey, for a 100 percent expanded program some 26,000 engineers would be required by all state departments instead of the indicated 35,000.

Distribution of Personnel

Another finding of the survey which is of interest is the distribution of personnel among the engineering functions. The average distribution for the state organizations is shown in the following tabulation:

Function	*Percent of engineering personnel*
Planning and traffic	6
Location	5
Road design	23
Bridge design	8
Construction	40
Materials and testing	7
Maintenance	6
Admin., contracts, R/W, etc.	5

This indicates that if time- and labor-saving procedures can be devised functions which might certainly be examined are those of the design office and of construction control.

In the 1954 study by the Highway Research Board, a sampling of cities, consulting firms, and toll road authorities was also made. This was not inclusive enough to enable a firm estimate of the total requirements for these agencies; also it did not include counties, townships, special highway districts, or the engineering personnel in other agencies of government performing highway engineering functions. Thus an over-all picture is lacking, although the survey does give a reasonable guide to requirements under current practices.

New Manpower Production

Some statistics concerning trends in civil engineering enrollments, prepared by Professor R. A. Moyer,[2] based on Engineers' Council for Professional Development data published by the American Society for Engineering Education, are reproduced in Tables 1, 2, and 3. Significant points to be drawn from these data are as follows:

TABLE 1. TOTAL COLLEGE ENROLLMENT AND THE ENGINEERING ENROLLMENT IN THE UNITED STATES IN 1940 AND 1947-1954

Year	*College enrollment in the United States* [a] *Total college*	*Engineering*	*Percent engineering of total college*
1940	1,490,000	113,497	7.6
1947	2,333,000	244,390	10.5
1948	2,410,000	241,554	10.0
1949	2,456,000	198,266 [b]	8.0
1950	2,297,000	161,324 [b]	7.0
1951	2,116,000	147,694 [b]	7.0
1952	2,148,000	158,518 [b]	7.4
1953	2,251,000	171,832 [b]	7.6
1954	2,499,750	187,454 [b]	7.5

[a] Includes graduate and undergraduate enrollment.
[b] Includes only ECPD accredited institutions.

1. While engineering college enrollment in the immediate postwar years was 10 percent or better of the total college enrollment, the percentage of engineering enrollment has dropped back to something slightly over 7 percent, which is about what it was just prior to World War II. Engineering college enrollment (in Engineers' Council for Professional Developments accredited colleges) totaled about 187,454 in 1954 and is now increasing at about 8 percent per year.

2. While, prior to World War I, civil engineering attracted the largest number of engineering students of all the branches of engineering instruction, since 1935 the civil engineering undergraduate enrollments have been between 10 and 15 percent of the total undergraduate engineering enrollments. In 1954, the total number of civil engineering undergraduates in Engineers' Council for Professional Development accredited schools was 21,560, about 13 percent of the total undergraduate engineering enrollment.

3. While the civil engineering departments currently have only about one-eighth of the total undergraduate engineering enrollment, the number of first degrees granted (B.S. or equivalent) is something less than one-fifth of the total first engineering degrees granted. In 1954, some 3,597 civil engineers were graduated.

TABLE 2. ENROLLMENT OF CE, EE, ME AND THE TOTAL FOR ALL UNDERGRADUATE ENGINEERING STUDENTS AT ECPD ACCREDITED SCHOOLS IN UNITED STATES DURING THE FALL TERM FOR SELECTED YEARS, 1910-1954

SOURCE: Journal of Engineering Education

Year	*Enrollment of undergraduate engineering students in United States during fall term* CE Number	%	EE Number	%	ME Number	%	*Total all engineers* Number	%
1910	77,900	26	5,500	18	6,400	21	30,337	100
1920	8,800	17	9,300	18	11,900	23	51,908	100
1925	12,200	22	17,500	33	10,300	19	54,337	100
1930	13,813	19	18,500	25	15,000	20	73,386	100
1935	7,800	13	10,000	17	12,000	20	60,395	100
1940	11,152	10	15,500	14	28,600	26	110,618	100
1945	6,820	10	11,100	16	13,100	19	69,146	100
1947	29,609	13	52,292	22	53,459	23	234,484	100
1949	27,135	15	40,946	23	42,758	24	180,646	100
1951	19,744	15	24,564	19	27,134	21	128,367	100
1952	20,283	15	26,696	19	29,335	22	138,170	100
1953	20,882	14	30,916	21	31,390	21	150,426	100
1954	21,560	13	36,987	22	35,126	21	167,103	100

Total number of ECPD Schools, 150 in 1954.

The influence of the current upswing in college enrollments is just beginning to be felt in the senior years, but the effect of this on the number of civil engineering graduates is not likely to be felt for another year or so.

TABLE 3. ENROLLMENT OF CE UNDERGRADUATES AND OF ALL ENGINEERING UNDERGRADUATES AND THE NUMBER OF FIRST DEGREES GRANTED IN CIVIL ENGINEERING AND IN ALL BRANCHES OF ENGINEERING AT ECPD ACCREDITED SCHOOLS IN THE UNITED STATES FOR SELECTED YEARS, 1930-1954

	Undergraduate enrollment				*First degrees granted*			
	Civil engineers		*Total all engineers*		*Civil engineers*		*All engineers*	
Year	*Number*	*%*	*Number*	*%*	*Number*	*%*	*Number*	*%*
1930	13,813	19	73,386	100	1,977	24	8,303	100
1940	11,152	10	110,618	100	1,430	13	11,358	100
1947	29,609	13	234,484	100	2,692	14	18,592	100
1948	31,798	14	226,117	100	3,271	12	27,460	100
1949	27,135	15	180,646	100	6,119	15	41,793	100
1950	22,449	16	142,954	100	7,312	15	48,160	100
1951	19,744	15	128,367	100	6,473	17	37,904	100
1952	20,283	15	138,170	100	4,917	18	27,155	100
1953	20,882	14	150,426	100	4,070	19	21,642	100
1954	21,560	13	167,103	100	3,597	18	19,707	100

Shortage of Engineers

An important general observation that is voiced by a number of agencies concerned with this matter is that students are not being attracted to the sciences and engineering at the rate that might be expected from the increases in high school graduates now becoming available. Some observers attribute this to a relatively decreased emphasis on preparatory subjects in the high schools that are a basis for entering the sciences and engineering in the colleges. In addition, it appears that in the engineering schools the appreciable enrollment increases are occurring in subjects that have attracted large public attention, such as electronics.

A net conclusion from the examination of these statistics and trends is that we shall probably not produce from the engineering schools in the United States more than 4,000 to 5,000 civil engineering graduates per year for the next several years.

Most of the college-trained engineering personnel recruited by the highway agencies are drawn from the civil engineering schools. Only a fraction of the civil engineering graduates, however, go into highway work. The demands for graduates in other phases of civil engineering are extensive. No accurate statistical data are available, but as a rough guide, I might cite a study we recently made at the University of California on the placement of graduates of civil engineering, from the classes of 1949 through 1953. Here we found that 22 percent of these graduates were employed in highway engineering; this may be higher than the percentage in many other schools, however, since considerable impetus is given to this field in California, both by the recruitment activity of the Division of Highways, and by the attention given in the curriculum. With this figure as a guide, it may be reasonable to expect that the number of graduates of civil engineering who will enter highway engineering work throughout the United States will not exceed 1,000 per year during the next five years.

Information is not available to give a good over-all picture of the replacements in highway engineering personnel needed each year. Moyer [2] places an extremely conservative estimate of losses due to deaths, retirements, and transfers out of the field at 2 percent per year. This means a replacement requirement of about 400 per year under present state programs. If an accelerated program at double the present volume were undertaken, the replacements needed would almost equal the current production of new civil engineering graduates currently willing to enter the highway engineering field.

Implications of Manpower Inventory

Considering the number of new graduate civil engineers, and the demands from other segments of civil engineering activity (besides highway engineering), it must be concluded that the total pool of professional civil engineering manpower, current and potential, is severely limited. This has two important implications:

1. Merely to make shifts of personnel from one state agency to another or from public to private employ, or vice versa, would not appear to offer a satisfactory solution to the manpower problem. Rather, the real problem with respect to the available pool of manpower is to utilize it most effectively.
2. The greatest possibilities for increased output of the highway agencies appears to be in the development and use of:
   a. Job organization, so as to utilize nonengineering personnel.
   b. Development and application of time- and labor-saving devices, methods, and procedures.

POSSIBLE METHODS OF INCREASING OUTPUT

As an approach to the general problem of increasing the output of highway facilities, from the standpoint of the highway agencies, we might consider the range of possibilities, summarized below in outline form.

I. Personnel Factors
   A. Recruitment:
      1. New graduates.
      2. Engineers from other industries.
   B. Reduction of turnover.
   C. Contract for engineering services.
   D. Improved utilization of existing professional personnel:
      1. Delegation of nonprofessional functions to technicians.
      2. Delegation of nonengineering work to individuals trained in other fields.

II. Organizational Factors
   A. Cut down lead time through reorganization of administrative practices (such as external and internal checking, approvals and clearances).
   B. Cut down lead time through improved legal requirements.
   C. Cut down construction supervision time through changes in construction control practices (such as methods and requirements for kinds of pay items, record keeping, cost accounting).

III. Technique Factors
   A. Streamlined office and field procedures.

B. Mechanized methods of performing operations:
   1. Technical computations.
   2. Accounting operations.
   3. Special techniques, such as:
      a. Airphoto reconnaissance of topoography, materials.
      b. Photogrammetric mapping for location.

Comments on aspects of some of these possibilities are given in the following paragraphs.

Recruitment and Reduction of Turnover

Because new engineering graduates may be in short supply, especially strong efforts at recruiting will probably be necessary to attract a share of new men into the highway organizations. Not only is it necessary to bring the possibilities of careers in highway engineering to students by many kinds of recruiting techniques, but also the keenness of competition from other fields is making necessary an examination of what the job has to offer the man. Young graduates are not motivated by salary alone; the challenge of the work and the opportunity for advancement appear also to be serious considerations for today's graduates. They will avoid jobs in which there are likely to be several years of subprofessional work; this places a premium on a recognizable engineer-in-training program and advacement to work carrying some professional challenge. Many young men are also inquiring not so much about the starting salary but about the potentials 5, 10, or more years from now. Recently, many highway agencies have been able to raise the entrance salaries, but relatively little has been accomplished in the higher grades. This reduction in salary range has no doubt been the reason why good men have been attracted elsewhere after two to four years in this field. Perhaps the next step should be to raise the salaries of the top administrators so that adjustments can be made all down the line.

Contracting for Engineering Services

The practices of highway agencies in their use of private engineering firms to perform selected engineering services vary widely. A report of a recent study on this subject is available.[3] The first consideration here is the most effective utilization of consulting services within the framework of the over-all operations, and the selection of contractual agreements to achieve this.

Improved Utilization of Existing Professional Personnel

There are two aspects to the matter of utilization of professional engineering personnel. One relates to the segregation of professional and nonprofessional tasks or functions, and the other relates to possibility of drawing on personnel trained in other disciplines or fields to perform professional functions now ofter performed by engineers.

Information assembled by the National Manpower Council[4] indicates that the ratio of supporting technicians to professionals is considerably lower in engineering than in other professions such as medicine. The valuable time of a physician is devoted to the actual use of medical skill and judgment; other functions are performed by nurses and laboratory technicians. Perhaps one of the difficulties we encounter in engineering is a lack of a clear distinction between the purely technical and the purely professional—and perhaps this is where some heavy thinking needs to be done. At any rate, the key to this situation on a practical basis may have to be a job analysis and job reclassification procedure. Already in some departments, jobs such as draftsmen, delineators, computers, etc., are well established. Perhaps what needs to be done is to make them more highly valued vocations, with reasonable rewards for long and productive service. At any rate, when jobs of this kind are disentangled from the engineering professional ladder, personnel can be recruited from high schools or elsewhere, and trained through short-term, specialized courses. This kind of procedure offers great opportunities for increasing the output of a limited supply of experienced professional personnel. It was utilized very effectively early in World War II, in turning out a vast fleet of aircraft.

The use of professional people trained in disciplines other than engineering is proving advantageous to a number of highway departments. Statisticians, economists, accountants, and business administration graduates can perform certain functions just as readily as can engineers. Some of the functions such as right-of-way acquisition, traffic analysis and forecasting, and budgetary analysis and forecasting are areas that may be worthy of study in this respect.

Organizational Factors

Because there are usually no clear guides or direct means of evaluation, the way an organization does business is generally developed by trial-and-error methods, and continued by inertia. The staff resists even slight modifications because of the collective pain caused by such changes.

Organizational changes conceived by outsiders, however well-intentioned in the interests of efficiency, often have unforseen side effects. A smoother change can frequently be developed by the man on the job, but he often lacks the opportunity to make the change and live with it.

Here is an area that may be worthy of your critical examination. I am sure that many of you can think of changes in the legal and/or administrative procedures which would reduce lead time and the human time consumed in getting out projects. Urgencies and crises will provide the opportunities for organizational changes, and that agency is fortunate which has carefully analyzed what changes are desirable and takes advantage of a crisis to put them into effect.

Streamlined Office and Field Procedures

Dozens of ideas have been emerging in recent years about ways of reducing time and technical labor through improved office and field procedures. Standardization of certain features of plans and specifications is a possibility. Decrease in data required on plans is another; I recently heard of an engineering department where one design division was using 50 percent more time than another for plans because greater detail was presented, yet it was found that the facilities constructed were similar and the results produced

were equal. The development of tabular data instead of making computations, or of simplified methods of record keeping, are other examples.

Mechanized Methods of Performing Operations

New methods of using machines for many formerly laborious computational processes are developing rapidly. For example, the California Division of Highways recently reported [5] a method of handling traverse computations on its IBM machines. Likewise, special processes, or adaptations thereof, such as photogrammetric survey methods on location, are developing. These entirely bypass some of the older procedures. A growing number of reports is becoming available on the use of mechanized field and office operations.

CURRENT DEVELOPMENTS

A realization of the importance of the manpower and output problem has led to a number of activities, now going on, which can be of aid to the highway departments. The Highway Research Board study of last fall is being supplemented by a detailed technical-personnel study in six states. In addition, the board has been getting information from the states on their time- and labor-saving possibilities, with a view to pooling the information and making it available. Preliminary results [6] are apparently showing a wealth of information, which will be summarized and issued as rapidly as possible. The developments include the following:

14 States report using personnel from other disciplines with time savings for the engineering staff.

34 States report having realigned functions of divisions with increased efficiency.

35 States report the use of mechanized procedures basic to compiling road inventory and related data.

12 States report having mechanized procedures for traffic assignment computations.

16 States report having evolved rule-of-thumb methods for quick evaluation of alternate routes.

10 States report having developed high-speed computer methods for determining yardage for earthwork or for drainage structures.

34 States report having replaced bridge computations by use of tabular data.

4 States report having developed new methods in final cross-sectioning.

19 States report having modified specifications to simplify methods of measuring items.

20 States report having developed short cuts in routine materials testing.

16 States report having developed short cuts in traffic field studies.

To supplement the research on time- and labor-saving methods and to fill in the gaps in knowledge which will permit a general appraisal of the manpower problem, a committee of the Highway Division of the American Society of Civil Engineers, under the chairmanship of Carl Fritts, and supported by the Automotive Safety Foundation of Washington, D. C., has been working in recent months and should be able to give some detailed information later.

The use of high speed computers has found important application in many fields of industry. A special study to determine the use and applicability of several schemes of such computational methods is being made in the U. S. Bureau of Public Roads.

SUMMARY COMMENT

The increasing tempo of highway development, and the prospects of still further increase in the years ahead, highlights the problem of manpower required to perform highway engineering functions. It is unlikely that the demands can be fully met by recruitment of additional, experienced, professional highway engineers or by new engineering graduates, whose numbers will remain inadequate for at least the next few years. This situation, in turn, highlights the need for increasing the output of highway engineering organizations by attention to better utilization of the existing pool of engineering manpower and by the use of time and professional labor-saving devices, procedures, and techniques.

No single course of action, no one personnel or methodological change is likely to solve our manpower problems. But many procedures are being developed, and we can be confident that they will include the basis for the handling of increased highway programs.

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[2] Moyer, R. A., "Trends in the Numbers of Students Enrolled and Graduating in Civil Engineering, as a Factor in Providing the Additional Engineering Manpower Required in an Accelerated Highway Program in the United States," in *Engineering Manpower in an Accelerated Highway Program, Special Report*, I. T. T. E., University of California, Berkeley, California. March, 1955.

[3] Berry, D. S., *et al.*, *The Use of Private Engineering Services by State Highway Departments*, Research Report No. 21, I. T. T. E., University of California, Berkeley, California. June, 1955. See also Highway Research Board Bulletin No. 106, p. 25.

[4] National Manpower Council, *Proceedings of a Conference on the Utilization of Scientific and Professional Manpower*, Columbia University Press, New York, N. Y., 1954.

[5] Osofsky, S., and Breece, R. K., "Automation—Machine Computations Save Engineering Time," *California Highways and Public Works*, July-August, 1955.

[6] "Time Savings in Highway Engineering," (Progress Report) Highway Research Correlation Service *Circular 286*. Highway Research Board, National Research Council, Washington, D. C., July, 1955.

HIGHWAY ENGINEER TRAINEE EXAMINATIONS ARE CALLED

The United States Civil Service Commission has announced an examination for Highway Engineer Trainee positions paying $3,415 and $4,345 a year, in the Bureau of Public Roads located throughout the United States.

To qualify, applicants must have completed their third or fourth year of a professional engineering curriculum in civil engineering (or expect to complete such study by September 30, 1956), or they must have had at least four years of progressive experience in civil engineering. A written test will be given.

Further information and application forms may be obtained at many post offices throughout the country, or from the U. S. Civil Service Commission, Washington 25, D. C. Applications must be filed with the Board of U. S. Civil Service Examiners, Bureau of Public Roads, Department of Commerce, Washington 25, D. C. They must be received, or postmarked, not later than January 24, 1956.

DOOR TO MEXICO

More automobiles enter Mexico from the United States by way of Laredo, Texas, than any other point of entry. Some 30,000 cars entered through Laredo during the first seven months of 1955.

ENGINEER'S WIFE WRITES ABOUT JUNGLE ROAD BUILDING

The many friends of Donald (Bud) Hall in the Division of Highways and the highway contracting industry in the West may be interested in the accompanying letter to "California Highways and Public Works" from his wife, Maxine. Hall is locating a road through jungle country for the Bolivian Government. — Editor.

We have been here in Cochabamba four months—time has gone by on wings. We love it here. Cochabamba is an enchanting city with its red tiled roofs, pink churches, and blue skies. The city cuddles against a grand range of mountains, one of which, El Nevado, is snow-garbed all year. One hears the chiming of bells all day long as we have many venerable old churches. Our climate comes straight from Heaven.

We have had some wonderful trips, by automobile, throughout this country—the traveling is far different than in the States. Here one really pioneers the road. We took a safri (I call it that) into the Pondi Jungle, which was thrilling. We left in a pick-up truck with a power wagon following carrying fuel, spare parts, and two extra drivers—one never travels here with less than two cars. We were making a trek to the Yacapani River—Bud had to scout a road job which the Bolivian government wants built. We made our own trail, hacking our way along. Since bridges are unheard of here and Bolivia is threaded with rivers we spent a great deal of our time being towed through water. The jungle was wonderful: strange birds, and hundreds of bright yellow chattering monkeys. We were met by suspicious Indians peeking out of the foliage, all carrying knives and bow and arrows. They were apparently as afraid of us as we were of them; even so we did not try to overstay our welcome, getting out of there in short time.

This week Bud took Mary and me with him into the Caroni and ChaCha Jungle country. The company is building a road into this area for the purpose of constructing a power plant and dam to supply more electrical power to Bolivia. We really saw rural life here and many of the small villages—poor, poor people. We left here at 8 in the morning and started ascending, a steady climb for four hours; just one long looping, winding trail up the mountain—on one side the mountain and on the other a tremendous gorge; thousands of feet below a small speck of a river flowing along. Such vistas, such magnificent country, make one feel so insignificant. On many of the switchbacks the front end of our car appeared to be suspended into space; I closed my eyes and prayed for everyone. At one point we walked down the side of a mountain to see a falls which rushes and tumbles down a sheer rock cliff for 2,000 feet—the noise alone is frightening. I had considerable trouble making the climb back up the mountain, was panting like a tired old dog. The young man with us was trying to help me and kept saying "breathe slowly and through your nose or else you will catch a terrible cold."

"Look, I don't care how in the heck I breathe, just give me some air or else some wings for my feet!" I finally said. We were at an altitude of 11,400 feet—the air is very thin and cold, just not any oxygen. Well, I saw the falls. After some hours of touring we started down into the jungle, sudden change of scenery from the bleak Andean Mountains into this rich green growth. We had our picnic lunch in a mahogany grove—sandwiches, pickles, cake, and tea with cognac—such fun. On our return trip we stopped at the company camp, which is perched out on a rock ledge overlooking a river and fertile green valley, bleak and windswept spot. Here we were served black, syrupy Bolivian coffee. The first sip guarantees to roll the head right off your shoulders. Our return trip was a fast one as it was all down hill.

So many amusing things happen here. Bud noticed the other morning that his driver, George, was wearing glasses for the first time, so he asked him about them. George said: "Since the Senor Hall wears glasses I thought I would wear them and look more important."

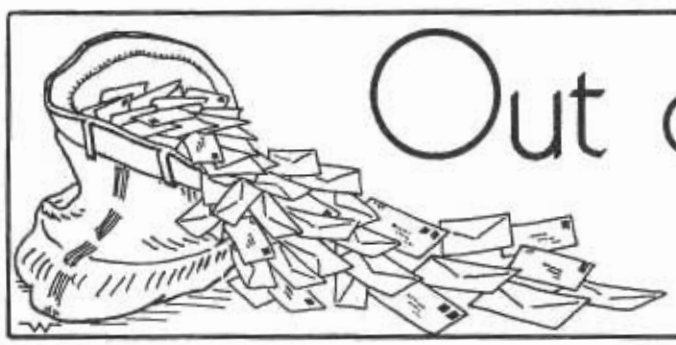
Bud said: "I hope he can see out of them and not be driving us over a cliff." These people are very child-like in many ways.

We have two wonderful girls working for us—my cook is only 17 years old but what a fine responsible child. I was forced into a situation about two weeks ago, where I had to call Emma and ask her if she could have dinner for 10 people instead of the usual three—to be ready to serve within two hours. I returned to the house a half-hour ahead of our "unplanned" company, to find the table set beautifully with a lovely flower arrangement, everything under control in the kitchen. We served 14 people without any confusion all because of Emma. I might add it was delicious food, even to hot rolls and a pie made all in that short time. The Indians working for one are very anxious to show-off, so will kill themselves doing everything perfectly. I shall be one spoiled "witch" when we return to the States—all we do is dress ourselves.

Last Sunday we were guests at a Bolivian luncheon party, starting at 12.30 and lasting until 5. We ate and drank until I thought I'd collapse. After the lunch we were invited over to some friends for dinner and cards. Bud and I left around midnight, headed for bed, but some of our friends decided the Halls was a fine place in which to "party it up." We finally fell into bed at 4.30 Monday morning. We have had a phonograph-radio console loaned to us with a wonderful collection of recordings. Our guests were showing us all the Bolivian folk dances, lovely but very active. It was fun.

Mary (the Hall's daughter) is with us, which is wonderful for me as Bud is away a great deal of the time. She arrived on the plane wearing four full petticoats, which were too big to pack,

. . . Continued on page 64



Out of the Mail Bag

FINE SERVICE

BERKELEY 4, CALIFORNIA

MR. KENNETH C. ADAMS, *Editor*

DEAR MR. ADAMS: About two years ago I asked you to send *California Highways and Public Works* to our son, Harry L. Pottol, who was then in Korea. You will be pleased to hear his reaction to the fine service you gave.

When he returned from Korea, we took him around to see the various freeway developments, and he told us he knew about these things; he had seen them in your magazine, and it was "a great comfort" to have it come to him so far from home.

Sincerely yours,

LAURA LEE POTTOL
(Mrs. Charles A. Pottol)

AVID READER

MYRON S. WALL
San Francisco 4

K. C. ADAMS, *Editor*

DEAR MR. ADAMS: I would not be without *California Highways and Public Works*. Every copy I have goes to my son who was raised in California and now lives in New York.

Faithfully yours,

M. S. WALL

GLAD YOU LIKE IT

California Highways and Public Works

DEAR SIR: My husband and I deeply appreciate receiving *California Highways and Public Works*. May we congratulate you for an interesting, well-edited, and informative magazine.

Sincerely yours,

WILMA B. ANDERSON
(Mrs. Jack C. Anderson)

SOURCE OF INFORMATION

MR. K. C. ADAMS, *Editor*

DEAR MR. ADAMS: As we are sure you will appreciate, *California Highways and Public Works* is a most valuable source of information and reference to this department, in particular.

We believe that without question, it is the finest magazine of its type to be published anywhere.

Yours very sincerely,

CALIFORNIA STATE AUTOMOBILE ASSOCIATION
C. H. A. DUKE, Manager
Touring Bureau

ANOTHER LETTER OF THANKS

ANGWIN, CALIFORNIA

California Highways and Public Works

GENTLEMEN: *California Highways and Public Works* is a really fine publication, and one of which we Californians can be proud.

We get great pleasure from its pages and considerable information, and we thank you for all our past issues.

Very sincerely,

NOAH E. PAULIN

PROUD OF HIGHWAYS

PASADENA

K. C. ADAMS, *Editor*

DEAR SIR: The magazine is enjoyed very much by our family. While we are not engineering people we do a lot of traveling in the State. We are proud to show our eastern friends our wonderful roads.

Very truly yours,

W. K. JARFFO

ARTICLES INTERESTING

ARCADIA

MR. K. C. ADAMS, *Editor*

SIR: It has been a real pleasure to receive your fine magazine for the past two years. From the pages of this publication a greater appreciation of California highways has been gained. I am certain, I know, that it has led to my investigating more of California's highways as well as using the primary routes of travel more to advantage. The articles on construction of freeways, costs and award of contracts are very interesting to me as I am engaged in construction work.

After I have read your magazine I send it on to England where it goes to some friends and thence to the local road council in Bucks County.

I look forward to your magazine every two months with relish and hope to receive it for many years. Best wishes.

Sincerely yours,

JAMES E. COGSWELL

KEEPS POSTED

LOS ANGELES

K. C. ADAMS, *Editor*

DEAR SIR: Again may I express my extreme gratification for having the magazine. It keeps me posted on my state highway situation as well as in my work with design of freeways for the City of Los Angeles.

I can think of nothing that should be added to or taken away from the publication.

Thanking you again.

DON E. FISHER
Street and Freeway
Design Division

THANKS FROM YREKA

CHAMBER OF COMMERCE OF YREKA

MR. K. C. ADAMS, *Editor*

DEAR MR. ADAMS: I would at this time like to express our appreciation for your fine work in the magazine. Up here where distances are greater between towns, highways are of prime importance. Your published study on Camarillo is one that will be saved for future reference as the time will come when some of the towns in this area will be bypassed.

Thanks again.

Sincerely yours,

HARRY CREBBIN
Secretary-Manager

FROM AN EDITOR

DEAR BROTHER EDITOR:

I appreciate your *California Highways and Public Works* very highly. When I finish reading them I pass them on to others.

I regard the publication as a signal public service. It gives information freely on where our money is spent and we can look the work over and form our own opinion as the benefits show up.

EDWIN F. JACKSON
Editor and Business Manager
Engineers Hall News

ENJOYS STATE HIGHWAYS

BERKELEY

California Highways and Public Works
Sacramento, California

GENTLEMEN: Have been reading the *California Highways and Public Works* publication for the past few years with interest and have enjoyed keeping abreast of the development throughout the State. I have been traveling throughout the State rather regularly and certainly do enjoy our fine highway system and its development.

It therefore gives me pleasure to express my appreciation for the fine work your body is doing and for the privilege of reading your publication from time to time as it reaches my home.

Very truly,

H. H. GLESSNER

AN ENGINEER WRITES

MANHATTAN BEACH

California Highways and Public Works

GENTLEMEN: I find your magazine to be not only very interesting but also very instructive. I have always been greatly interested in this publication as roads or highways have occupied my attention for a long time. I was a draftsman and then a chief of party with the former Los Angeles County Highway Commission from November, 1909, to the latter part of January, 1911. Arthur Loder was chief engineer and S. V. Cortelyou was office engineer.

Sincerely,

E. L. YOUNG

MAGAZINE HELPFUL

California Highways and Public Works

GENTLEMEN: We have found your magazine very helpful in our work, and think it is most informative and beautifully prepared. Thanks very cordially.

Yours very truly,

TOFFELMIER & TORBUTT
REALTY CO.
By H. E. TORBUTT

LIKES MAGAZINE

LAGUNA BEACH

MR. K. C. ADAMS

DEAR SIR: *California Highways and Public Works* is the most interesting magazine I receive, and we subscribe to several.

The last edition was very fine (as are all of them), as it dealt with our Santa Ana Freeway "close to home."

Want you to know how much I appreciate your sending me the publication.

Sincerely yours,

WILL HOPE

THAT'S A LOT

America's 58,000,000 cars, trucks and busses consume an average of more than 120,000,000 gallons of gasoline each day, reports the California State Automobile Association.

REMINISCING

ATASCADERO, CALIFORNIA

MR. KENNETH C. ADAMS, *Editor*

DEAR SIR: One of my neighbors loaned me a couple of copies of your wonderful magazine.

I have read every article in both of them and think they are very fine. The one about the new double bridge across Carquinez Strait was very interesting to me. At the time the first bridge was opened in 1926 I drove the first bus load of passengers over on the eastern trip to Salt Lake for the old Yelloway Stages.

I am an old freight and bus driver—having started to drive in California in 1917 over all the old grades—San Juan, Cuesta, Grapevine, Donner Summit, Peach Tree, Santa Cruz and Lakeport, to name a few. I can appreciate what this State has done for the motorist in the way of modern grades and freeways.

At 74 I am still driving and as I live on US 101, I drive a few miles on that highway every day. It is a lot different than when I drove over this same highway for the old Pickwick Stages as it was a two-lane, 18-foot road then.

At times I get to reminiscing over the old means of San Francisco bay transportation; the old Broadway ferry to Oakland and ferry to Sausalito and across from Point Richmond; the old drag over San Juan Grade, full truck and two trailers in low gear all the way and no brakes on either trailer. Do the drivers of today with modern equipment and freeways and easy grades really appreciate what California has done for the motoring public?

This is my thank you to the Division of Highways and the Department of Public Works.

Very respectfully,

FRANK H. GRIFFIN

THE DANGEROUS FEW

There's a small minority of drivers who don't seem to be able to drive according to common sense rules. They zoom in and out of traffic, taking chances right and left. The only protection against them is to be constantly alert and give them a wide berth.

FINDINGS

Continued from page 55 . . .

1. Aggregates processed to have a sedimentation value of 3 produced concrete having 18 percent greater flexural strength, 14 percent greater compressive strength and 19 percent lower drying shrinkage than did those processed to a sedimentation value of 6.

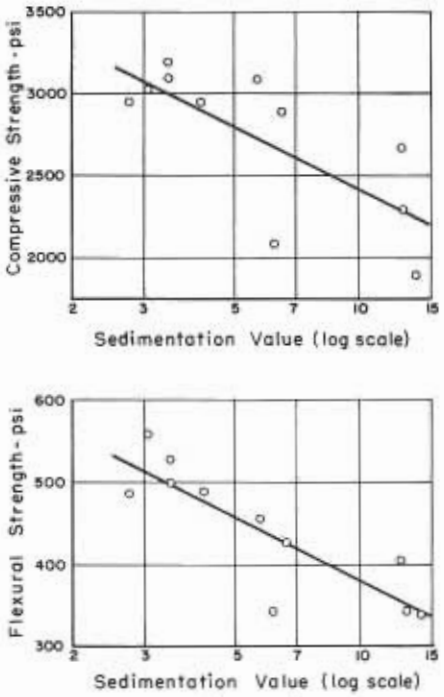


Figure 5

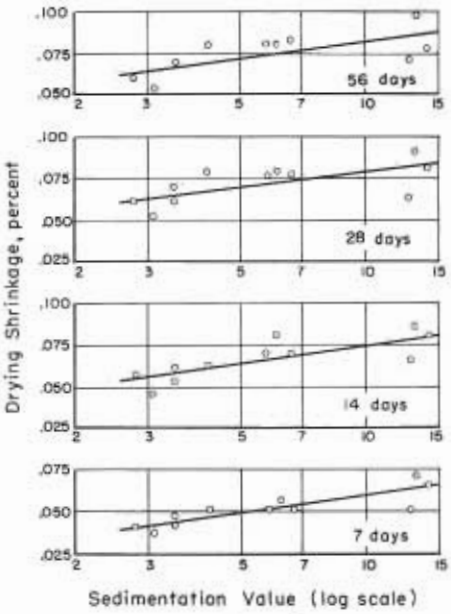


Figure 6

LEFT—Relationship between sedimentation value and strength. RIGHT—Relationship between sedimentation value and drying shrinkage.

2. If a pit-run aggregate having a sedimentation value of 12 is washed to a sedimentation value of 6 the improvement in quality is only one-half of that potentially available by processing to a sedimentation value of 3.

The Standard Specifications of the Division of Highways require that the sedimentation value of coarse aggregate for concrete shall not be greater than 5. This maximum value was selected as a practical compromise between the desire for highest quality and the problems of manufacturing.

SUMMARY

The sand equivalent test and the sedimentation test furnish indexes of the quantity and activity of clay in aggregates that could not be obtained by other test procedures. These tests appear to be the only rapid ones presently available that can be used to insure that aggregates are really "clean."

Extensive test data show the inclusion in the specifications of a minimum sand equivalent of 80 for fine aggregate and a maximum sedimentation value of 5 for coarse aggregate for portland cement concrete, while requiring more thorough processing than formerly, results in an improvement that is real in its effects on strength and more importantly on volume change of the resulting concrete.

TWO-WAY RESPONSIBILITY

Driving an automobile is a two-way responsibility, says the California State Automobile Association. You must be responsible for your own driving as well as that of the others. Obviously you can't watch *all* the motor vehicles in traffic, but you owe it to yourself and your passengers to be constantly alert for dangerous drivers.

NEW CAVE ROCK TUNNEL

Construction is due to start early in 1956 on the boring of a second tunnel through Cave Rock at Lake Tahoe, on U. S. Highway 50 in Douglas County. Estimated cost of the project, which will include a roadside park, is $885,000, to be provided by the Federal Government through forest highway funds.

JUNGLE ROAD BUILDING

Continued from page 61 . . .

and carrying a flour sifter. I had written and told her to bring a sifter as one cannot find any here. She flew from the East Coast having spent a month with Joan at Cape Cod. When she arrived a large group of people was at the airport to meet her. This is a custom here. She received lovely bouquets of flowers and champagne. She likes it here as well as we do; has met some very nice young people.

CRACK DOWN ON TRAFFIC OFFENDERS IN SAUDI ARABIA

When they crack down on traffic offenders over in Saudi Arabia, they really crack down.

Just a few months back the government there issued another decree to keep the wayward motorist in line. According to this decree, if an accident occurs as a result of speeding and negligence, but no one is killed in the accident, the offending driver is imprisoned for one year and has his license taken away. If anyone is killed in the accident, the offending driver has to be summarily executed.

Since the passing of this decree, points out the National Automobile Club, drivers in Saudi Arabia have been conspicuously sober and sedate. Some of them have even put the car away in the garage and hung the key up on a high place by the door.

THANK YOU

Los Angeles

Dear Mr. Adams: We continue to appreciate your wonderful publication more and more as the years go by. The September-October number just came today and is so very good. That cover is grand enough to frame.

We also appreciate the splendid freeway pictures you have featured recently, and for several years for that matter, inasmuch as we live right on Pasadena Freeway and have been constant users since January, 1940.

We have been a research and planning engineer for nearly 40 years and so appreciate these modern highways perhaps a little more than some citizens do. Frank W. Scott

GOODWIN J. KNIGHT
Governor of California

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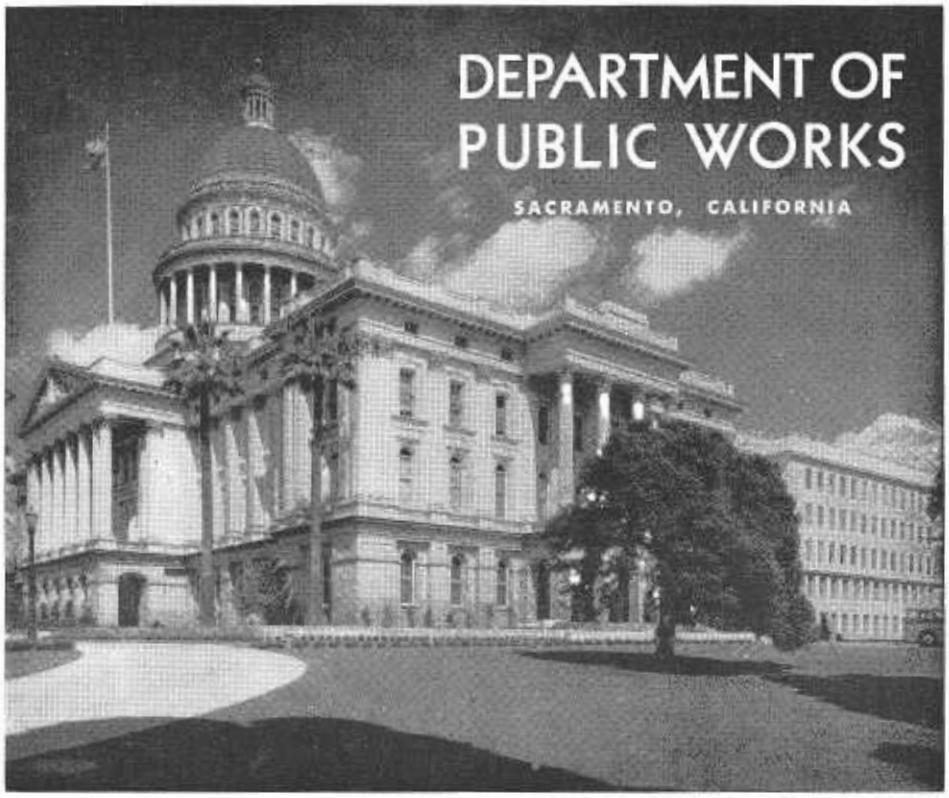

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printed in CALIFORNIA STATE PRINTING OFFICE 28055 10-55 40,300

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