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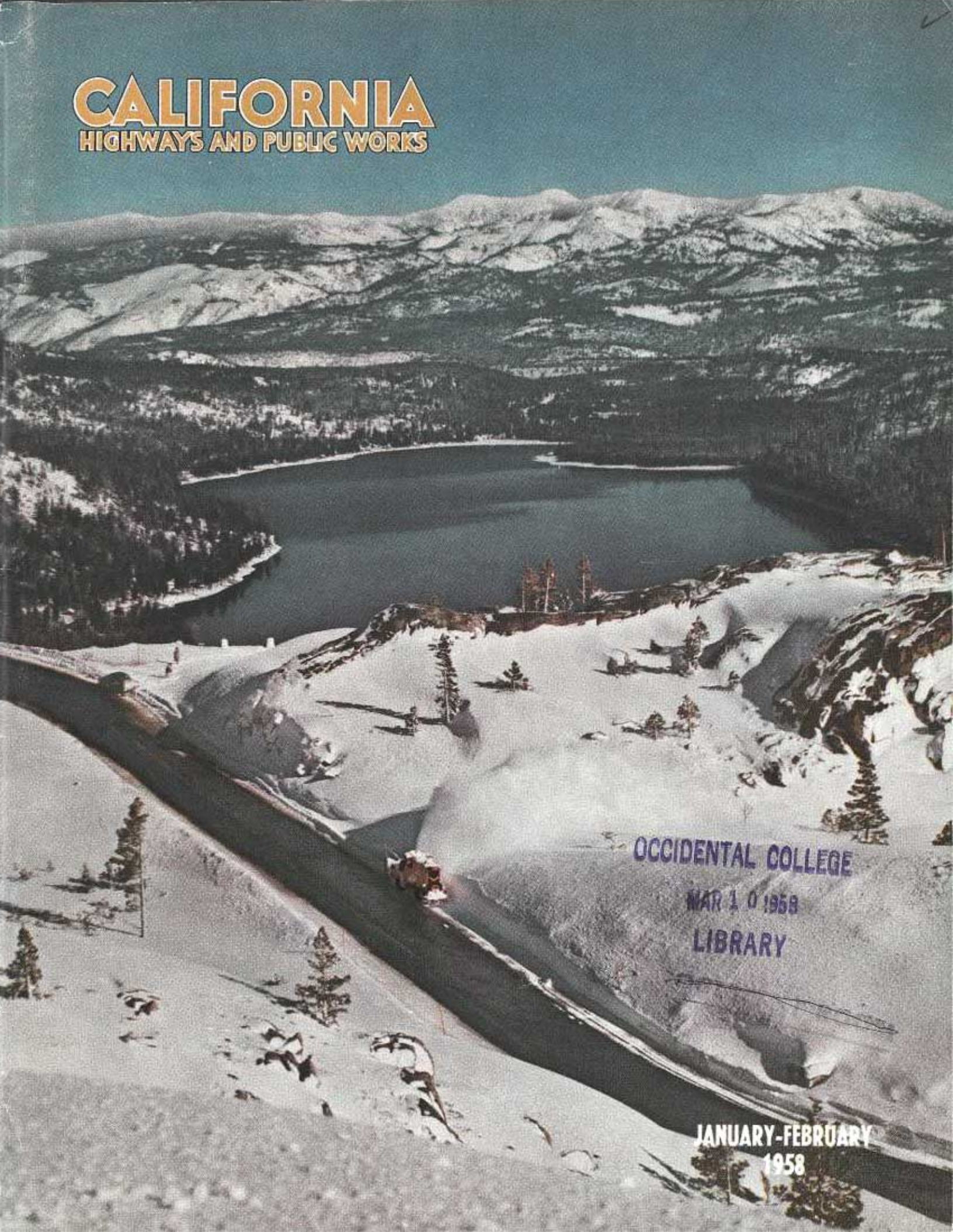

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FRONT COVER

A rotary snowplow, dwarfed by the snow-blanketed landscape, puts the finishing touch on a cleanup job along a section of US 40 at Donner Summit. Donner Lake and the crest of the Sierra Nevada range lie beyond, to the east. —*Photo by Robert Munroe*

BACK COVER

California contrast is provided by this winter scene of the Mojave Desert region east of Victorville. Two school busses drive along a section of State Sign Route 18 toward a community in Lucerne Valley.
—*Photo by Robert Munroe*

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Aerial photo looking north along a completed section of the Harbor Freeway from above Manchester Avenue

Freeway System Taking Shape In Greater Los Angeles Area

Report from District VII

By EDWARD T. TELFORD
Assistant State Highway Engineer

DISTRICT VII of the State Division of Highways includes the three counties of Los Angeles, Orange, and Ventura, within which are 87 incorporated cities. Here there reside over 6,000,000 people who operate more than 3,000,000 motor vehicles, roughly 45 percent of the State's total motor vehicle registration. Of the total population of the district, approximately 40 percent live within the City of Los Angeles. The existing State Highway System in District VII includes approximately 1,400 miles of traversable routes, with another 100 miles, more or less, in routes which have been included in the system by the Legislature with the understanding that the State would not be called upon to maintain these routes until constructed on final alignment. Approximately 326 miles of U. S. interstate routes are in the system.

The pressure of population and traffic in this area brought about consideration of freeway development at an early date. The first actual freeway construction was a six-mile length on the Arroyo Seco Parkway, now known as the Pasadena Freeway, which was completed and opened to traffic December 30, 1940. Considerable planning was done on other freeways during the early years in addition to the Pasadena Freeway; however, there was no comprehensive financial program which would permit an adequate rate of progress until the enactment of the Collier-Burns Act in June of 1947. The results of this 1947 legislation were helpful in that some increase in progress was possible, but the rate was still much less than desirable. In 1953 the California Legislature increased funds available for highway construction, and then the passage of the 1956 Federal Aid Highway Act by the Congress of the United States made further substantial increases, principally by adding the financing of the Interstate Highway System to the previously existing federal aid program. The accelerated construction program resulting from these upward steps in financing is shown by the following tabulation of expenditures, contract obligations and budgeted projects for the period 1947 through the 1957-58 Fiscal Year, for construction, rights of way, and engineering:

July 1, 1947, to June 30, 1952

Los Angeles County	$143,672,371
Orange County	14,615,486
Ventura County	7,945,354
Total for five years	$166,233,211

July 1, 1952, to June 30, 1955

Los Angeles County	$169,146,220
Orange County	22,634,489
Ventura County	14,441,750
Total for three years	$206,222,459

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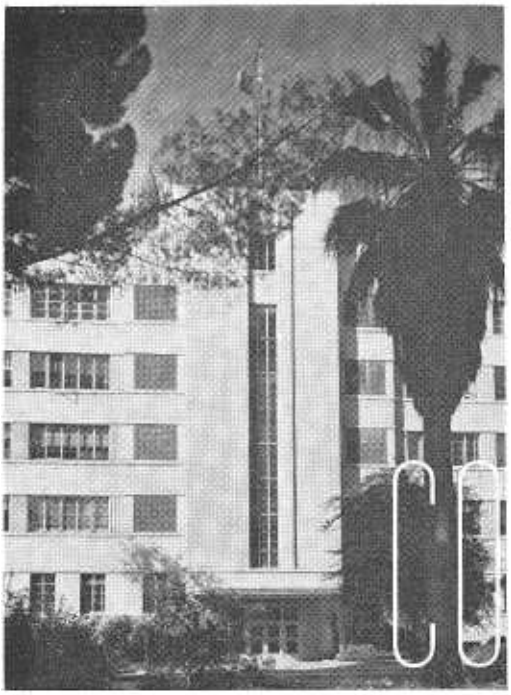

Public Works Building
Twelfth and N Streets
Sacramento

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DISTRICT VII

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July 1, 1955, to June 30, 1958

Los Angeles County	$258,393,000
Orange County	51,200,000
Ventura County	18,688,000
Total for three years	$328,281,000
GRAND TOTAL	$700,736,670

The rate of expansion of this program is graphically indicated on the two accompanying maps of District VII freeways. One of these, dated March of 1953, indicates progress as of that time, and the other indicates the status as of January 1, 1958, including projects budgeted for the 1958-59 Fiscal Year. The abrupt changes in the financial picture that have taken place from time to time can best be indicated by considering certain of the District VII annual budgets:

1952-53 Fiscal Year	$44,263,000
1953-54 Fiscal Year	$77,232,000
1956-57 Fiscal Year Budget was increased by revenue from Federal Aid Act of 1956 from about $86,000,000 to $119,000,000	
1958-59 Fiscal Year	$115,064,000

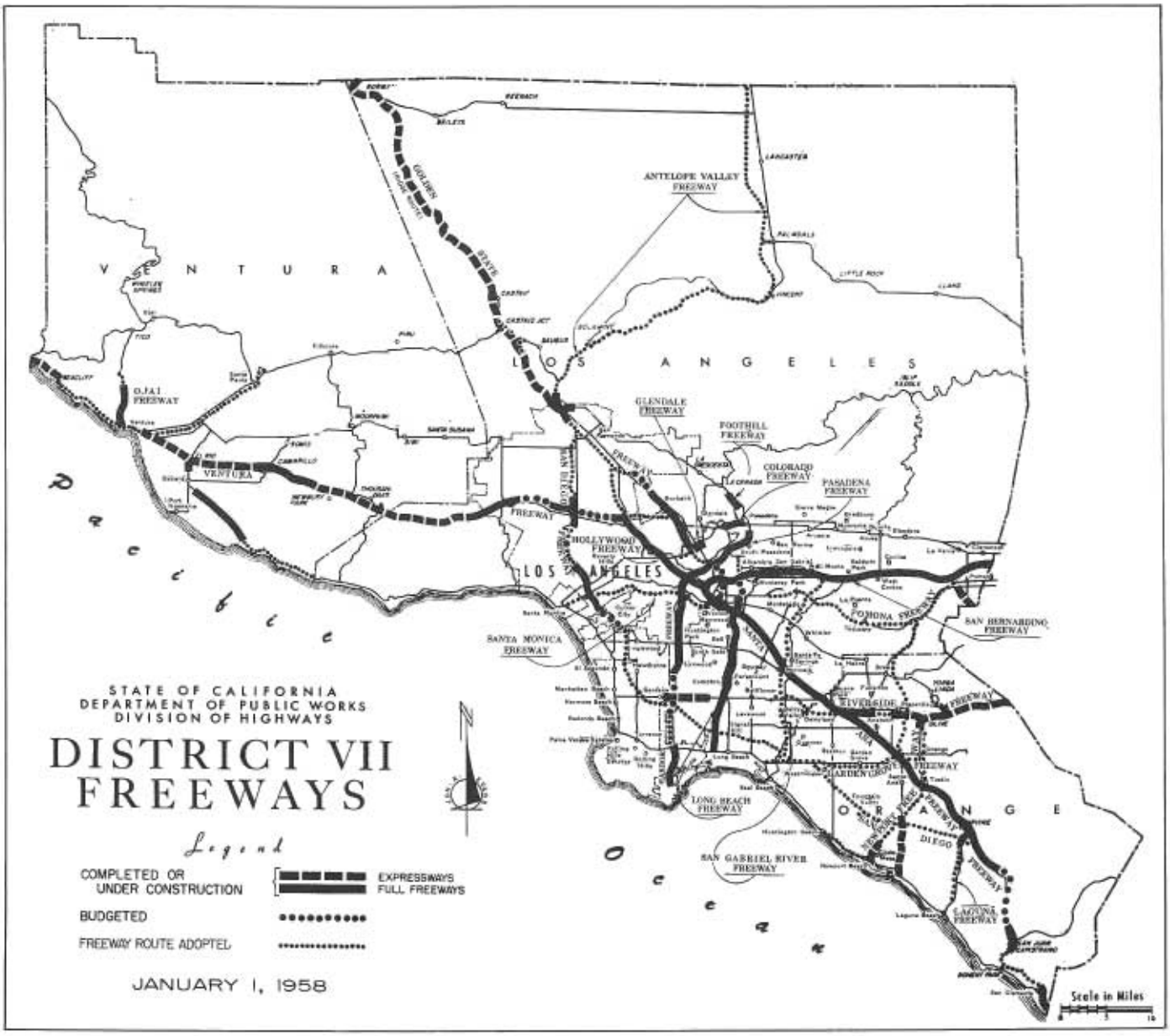
Freeway Progress to January 1, 1958

	Miles
Routes adopted as freeways	647.0
Constructed or under construction	
Freeways	180.4
Expressways	107.2
Budgeted (including 1958-59 Fiscal Year) Freeways	32.7
Total value freeway contracts under way	$79,508,934

An examination of the District VII Freeways Map for January 1, 1958, indicates that we now are beginning to have a sufficient mileage of connected freeways and expressways in operation so that we are justified in referring to it as a "freeway system." Three important freeways, the Pasadena, the Hollywood, and the San Bernardino, have been completed within the district, and gaps are now being closed where necessary to connect our freeways in the so-called Los Angeles Metropolitan Area with the expressways in the outlying areas for Los Angeles, Ventura, and Orange Counties.

One System

When it is considered that on all of the freeway routings in District VII the extreme distance between the Los Angeles Civic Center and the outlying



boundaries of the district is less than 100 miles, and that in time they can easily be traveled in less than 2½ hours, it is certainly now in order to speak of the District VII freeways as being the "*Greater Los Angeles Freeway System.*"

This is perhaps a better descriptive title than the previously used "Los Angeles Metropolitan Freeway System" which at best makes it necessary to define a vague area originally considered to be the coastal plain occupied by the City of Los Angeles and other cities in Los Angeles County between the mountains and the Pacific Ocean. Later thinking has indicated the reasonableness of including a considerable portion of Orange County in the so-called "Los Angeles Metropolitan Area." In their thinking now, the people of this area are definitely inclined to get away from consideration of county boundaries and recognize the importance of the freeways being built for their use in outlying areas of the three counties, as well as those that are close in.

From the standpoint of offering vitally needed traffic service in the movement of people and goods, who can say that the Golden State Freeway over the Ridge Route is not as important as any of the freeways in the central Los Angeles area? Therefore, it is perhaps not out of line to suggest that the District VII freeways be called "*The Greater Los Angeles Freeway System.*"

Interstate Highways

The general location of the national system of interstate highways was designated in September, 1955, by the Bureau of Public Roads of the U. S. Department of Commerce. Included in this national system are seven important state highway routes in District VII that are being developed as

freeways. These interstate freeways constitute an important part of the District VII Freeway System. These freeways are: the Golden State, the Santa Monica (previously called the Olympic), the San Diego, the Santa Ana, the San Gabriel River, the San Bernardino, and the Foothill. The first six of these freeways are in various stages of design, right-of-way acquisition, construction and completion, as will hereinafter be described.

The only interstate route for which the California Highway Commission has not yet made an actual route adoption and freeway declaration throughout its entire length is the Foothill Freeway.

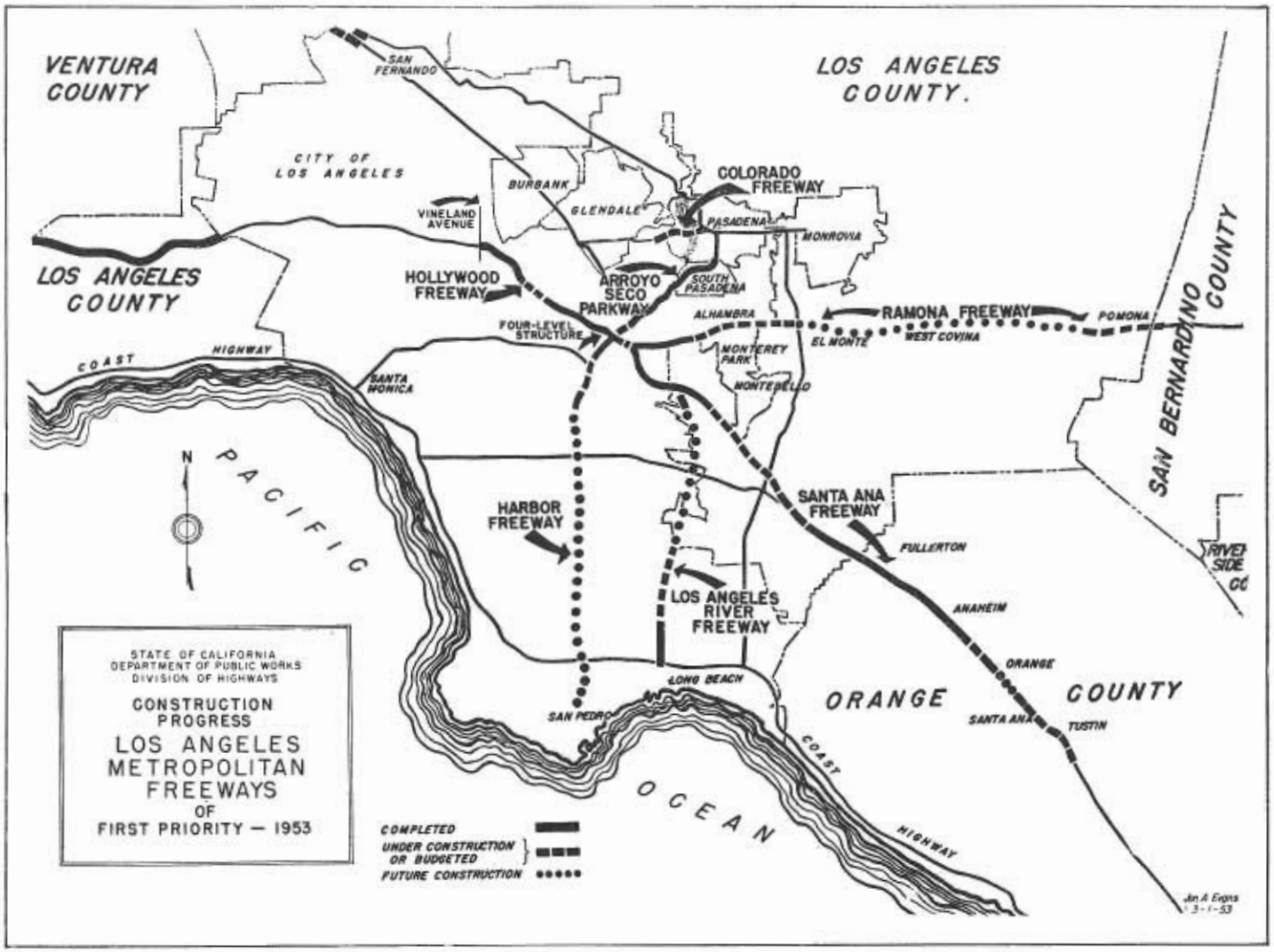
Important sections of freeways in District VII were completed and opened to public traffic during 1957 as follows:

	Miles
Santa Ana Freeway	
Broadway to Lewis Street in Santa Ana	2.5
San Bernardino Freeway	
Azusa Avenue in West Covina to Ganesha Boulevard in Pomona	8.2
Harbor Freeway	
From Santa Barbara Avenue to 88th Place in the City of Los Angeles	3.8
Long Beach Freeway	
From Atlantic Boulevard to Firestone Boulevard in East Los Angeles area	3.2
Golden State Freeway	
From Glendale Boulevard in Los Angeles to Ash Street in Burbank	4.7
San Diego Freeway	
Casiano Road to Ohio Street in West Los Angeles area	2.1
Pacific Coast Freeway	
From Calleguas Creek to Date Street in the City of Oxnard	7.2
Total	31.7

Traffic Counts

G. T. McCoy, State Highway Engineer, recently made public the 1957 Statewide Traffic Count figures. As he says, "The annual statewide traffic count taken on Sunday and Monday, July 14 and 15, 1957, showed an increase of 4.44 percent over the previous annual count of July, 1956. Gains were generally well distributed over all routes and regions. Among the major routes, a very substantial increase was shown on Route 26. Opening of several miles of full freeway on the heavily traveled portions of this route near Los Angeles probably contributed to this increase."

The freeway to which McCoy refers is the San Bernardino Freeway that is now completed throughout its entire length in Los Angeles County of 30.7 miles. On this freeway the av-



UPPER—Looking north along the Harbor Freeway in the City of Los Angeles showing the Wilshire Boulevard Bridge crossing the freeway in the foreground and the Four-level Traffic Interchange, hub of four major freeways, in the background. LOWER—Looking north along construction in progress on the Harbor Freeway from above 124th Street. Figueroa Street is to the left, Broadway to the right.

erage daily traffic at Soto Street two miles out from the Los Angeles Civic Center is 93,000. Ten miles out at Rosemead Boulevard the average daily traffic is 90,200. Fifteen miles out at the easterly city limits of El Monte the average daily traffic is 78,400. Twenty-four miles out at Kellogg Hill the average daily traffic is 50,200. This shows the extensive use which traffic is making of this new freeway facility throughout its entire length.

The 1957 traffic counts on District VII freeways indicate that in certain cases perhaps the maximum capacity has been reached with the result that some of the motorists, for short, close-in trips, are going back to existing surface streets which are being made more attractive due to efforts of local jurisdictions.

The average daily traffic volumes on major freeways in this area for the past four years is shown by the following:

Location	*1954*	*1955*	*1956*	*1957*
Hollywood Freeway (4-level Westerly)	168,000	180,000	185,000	192,000
Pasadena Freeway (Elysian Park)	110,000	112,000	114,000	109,000
Santa Ana Freeway (Soto Street)	90,000	113,000	145,000	145,000
San Bernardino Freeway (Soto Street)	80,000	88,000	96,000	93,000
Harbor Freeway (4-level Southerly)	125,000	160,000	175,000	190,000
Colorado Freeway (Linda Vista)	30,000	27,000	29,000	23,000
Long Beach Freeway (Pacific Coast Highway)	10,000	31,000	37,000	35,000
Using 4-level interchange	242,000	280,000	300,000	318,000

In this connection attention is directed to a "driving-time study" that was made in the Los Angeles area recently.

During the month of June, 1957, the Engineering Department of the Automobile Club of Southern California undertook to make a between home and work driving-time study embracing an area of metropolitan Los Angeles within a circle having a radius of 20 miles. The selection of routes was based on normal travel by Auto Club employees coming to work from suburban residential areas, and returning to their homes. Referring back to similar studies this organization had made previously during the year 1936, it was possible for them to work out travel time comparisons for the 21-year interval. These results have proven so interesting that Table III from this driving study report is reproduced here:

Los Angeles—Travel Time Comparisons

(All times given in minutes)

	1936 off-peak periods	*1957 a.m. and p.m. rush hours*	*1957 off-peak periods*
FROM Seventh St. and Broadway			
TO:			
Woodland Hills	57	64	—
San Fernando	43	50	
South Pasadena	26	21	15
Whittier	35	44	—
Torrance	34	31	—
Playa del Rey	37	37	—
Venice	40	30	—
Monterey Park	25	—	21
Pasadena	31	—	21
San Marino	30	—	22
Sierra Madre	40	—	34
El Monte	31	—	26

Vehicle registration in Los Angeles County in 1936 was 967,981; in 1956 it was 2,741,422.

The conclusion of this report presents important findings of great value in obtaining an understanding of the transportation problems in this area, and is herewith quoted:

"The overall average speed of 24 miles per hour accomplished during the heaviest congested periods of the day revealed that Los Angeles has a good transportation system when compared with other major cities.

"In comparison of freeway versus surface street travel, in no case did we find any surface street route to be faster than its freeway alternate nor even any five-mile increment of surface street travel to be faster than the corresponding five miles via freeway.

"A review of the study reveals that travel time, as might be expected during today's peak hours, is in some cases slower than travel time obtained during off-peak periods recorded in the earlier studies. Several subsequent test runs revealed that travel time during the off-peak periods from Seventh Street and Broadway in Los Angeles to various outlying suburban communities has been reduced, however.

"It appears that we have been able to better than hold our own during the last 20-year period in spite of a three-fold increase in motor vehicle registration. We anticipate that with the expected increase in availability of construction money for highway improvements in the future we will begin to make significant gains in the years to come.

"It is our belief that the primary reasons for our ability to travel as well as we do are the following:

"1. Freeway construction.

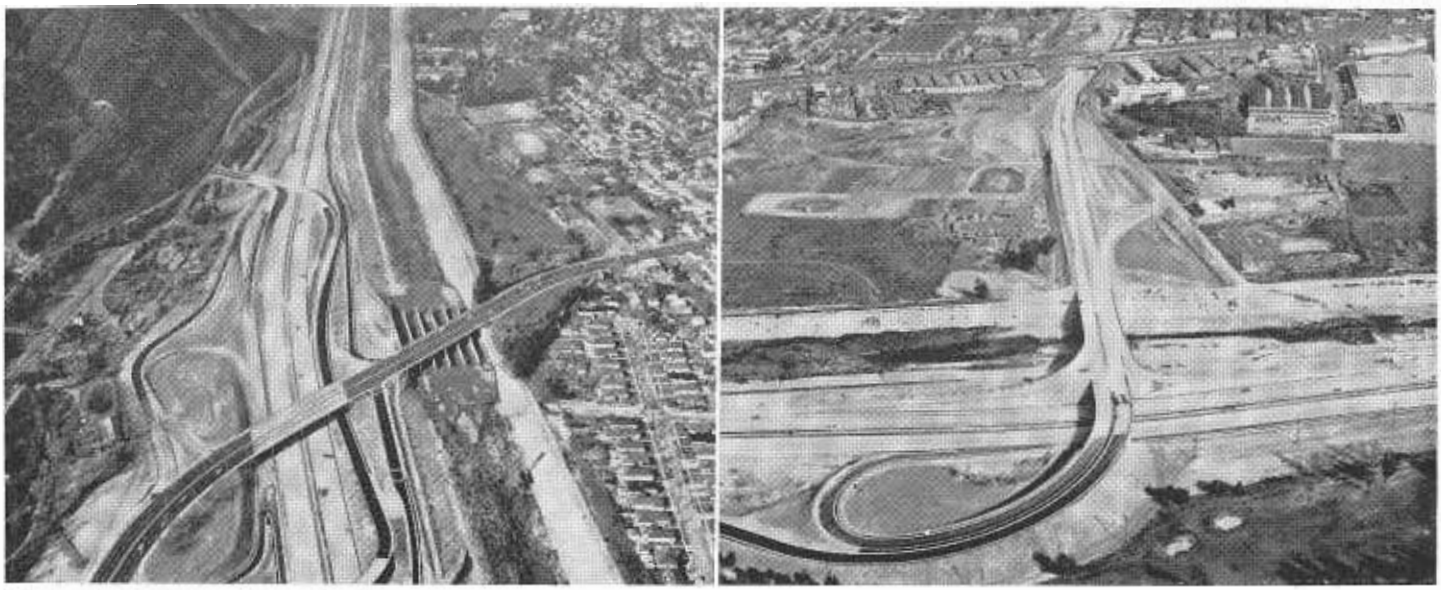
"2. Traffic engineering:
- (a) Synchronization of traffic signals.
- (b) Rush-hour turning prohibition.
- (c) Rush-hour parking restriction.
- (d) Channelization of problem intersections.
- (e) One-way streets.

"3. Improved construction of motor vehicles:
- (a) Better brakes and steering.
- (b) More rapid acceleration—automatic transmission.
- (c) Large rear windows, permitting greater visibility for motorist to observe sudden stops as many as five vehicles ahead.

"4. Experienced drivers who handle their cars in such a manner as to increase efficiency, particularly on freeways."

During the calendar year 1957, the California Highway Commission passed resolutions adopting five very important District VII freeway routings. On January 23, 1957, the commission passed a resolution adopting a freeway routing for U. S. Highway 399, State Highway Route 138, in the City of Ventura from the Ventura Freeway near River Street to the existing Ojai Freeway near Mission Street. This route adoption was for the purpose of connecting the completed section of the Ojai Freeway with the proposed Ventura Freeway. On this same date the commission also adopted a routing in Orange County for Route 182, State Sign Route 22, now called the Garden Grove Freeway, from the Santa Ana Freeway easterly to Route 43, which the Highway Commission has recently officially named the "Newport Freeway."

On November 25, 1957, the commission adopted resolutions affecting three District VII freeways. Two of these adoptions applied to portions of Route 23, U. S. Highway 6, from the



LEFT—Looking north along Colorado Boulevard connection with Golden State Freeway. RIGHT—Looking northwest along Golden State Freeway in Griffith Park, now under construction. Los Feliz Boulevard Interchange in foreground.

Santa Clara River to a point one mile north of the Angeles Forest Highway, and from Neenach Road northerly to the Kern county line. These two freeway route adoptions now fix the location of the Antelope Valley Freeway location in District VII from junction with U. S. Highway 99, the Golden State Freeway at the north city limits of Los Angeles to the Kern county line. On November 25, 1957, the commission also adopted a freeway routing for a section of the Golden State Freeway, U. S. Highway 99, at Castaic Junction. This routing extended from a point one mile south of Route 79, State Sign Route 126, to a point 0.7 of a mile north of Route 79.

The year 1957 has been one of significant accomplishment from the standpoint of major District VII freeway construction contracts that have been advertised and awarded. These contracts, in chronological order of bid openings, are as follows:

	Miles
Santa Ana, San Diego, and Laguna Freeways Between Niguel Road and Laguna Canyon Road in Orange County	6.6
San Bernardino Freeway Overcrossing for Barranca Street in West Covina	
Glendale Freeway Between Los Angeles River and Eagle Rock Boulevard in City of Los Angeles	1.5
Long Beach Freeway From Atlantic Avenue to Rosecrans Avenue in Los Angeles County	1.4
Ventura Freeway Between Conejo Grade Summit and Fifth Street in Camarillo in Ventura County	5.0
San Diego Freeway Between San Mateo Creek in San Diego County and Avenida Cadiz in San Clemente	2.3
Riverside Freeway From Santa Ana Freeway in Orange County south of the City of Buena Park to US 101 in Fullerton	3.6
Santa Monica Freeway (formerly called Olympic Freeway) Bridge substructure across the Los Angeles River in the City of Los Angeles	
Santa Ana Freeway Between 10th Street in the City of Buena Park and Palmer Avenue in Anaheim	1.7
San Diego Freeway From Trabuco Creek southerly through San Juan Capistrano in Orange County	4.1
Santa Ana Freeway Two additional lanes between Brookhurst Avenue in Orange County and Euclid Avenue in City of Anaheim	
Temescal Freeway Between Fifth Street in the City of Pomona and 0.9 mile south of Riverside Drive in San Bernardino County	3.7
Hollywood Freeway Ventura Freeway from Moorpark Street to Laurel Canyon Boulevard in the City of Los Angeles	2.0
San Diego Freeway From Ohio Avenue in the City of Los Angeles to Venice Boulevard in Culver City	3.6
Golden State Freeway Between Alameda Avenue and Burbank Boulevard in the City of Burbank	1.6
Total	37.1

Pasadena Freeway

The Pasadena Freeway is 8.2 miles in length, extending from the four-level structure near the Los Angeles Civic Center to Glenarm Street in Pasadena. The first unit was completed and opened to traffic on De-

Looking north showing cloverleaf interchange for Golden State Freeway and Western Avenue in Glendale

cember 30, 1940. The last unit of construction on this freeway was completed and opened to traffic on September 22, 1953. The total cost of this freeway was $11,444,000.

The southerly two miles of this freeway that is referred to as the Elysian Park section is an eight-lane freeway and it is now carrying, according to the 1957 traffic count, a total of 109,000 vehicles per day.

Hollywood Freeway

The Hollywood Freeway extends for 16.8 miles from Spring Street in the Los Angeles Civic Center northwesterly to junction with the Golden State Freeway.

It is divided into two sections. The southerly section is 10 miles in length, from Spring Street through Cahuenga Pass to Vineland Avenue, and was completed and opened to public traffic throughout its entire length on August 5, 1954. The total cost of this 10-mile unit was $55,000,000, not including the current construction contract for widening and other necessary improvements that is now in progress between Highland Avenue and Lankershim Boulevard. This construction is being carried out by the Tomei Construction Company at a cost of $1,193,000, and is scheduled for completion in February, 1958.

The northerly unit of the Hollywood Freeway is known as the Hollywood Freeway Extension. This joins the Cahuenga Pass portion of the Hollywood Freeway near the intersection with Lankershim Boulevard and extends northerly therefrom for seven miles to the proposed Golden State Freeway near Wentworth Avenue.

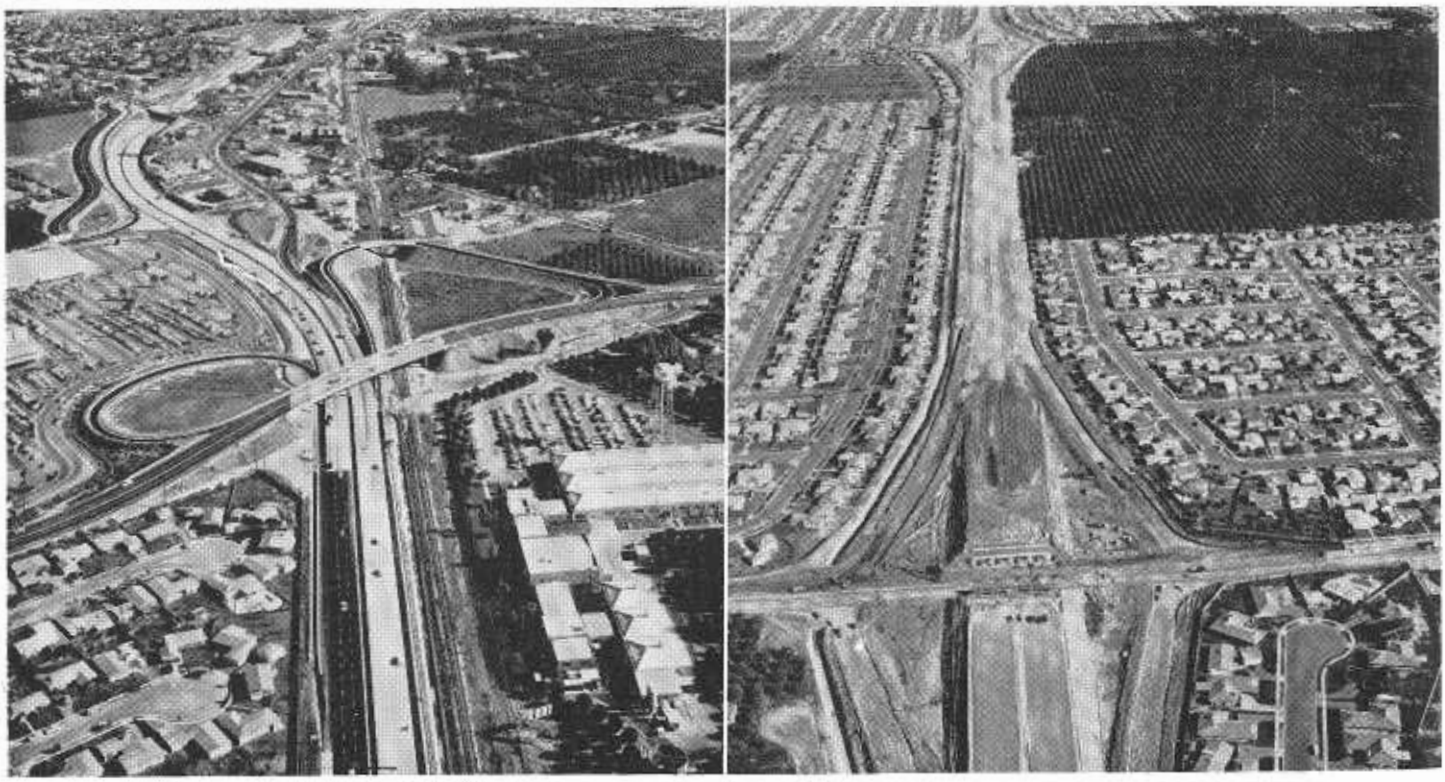
Currently under construction on this unit with date of completion being set for February, 1958, is the Griffith Company contract for building 1.1 miles of the Hollywood Freeway Extension from Lankershim Boulevard to Moorpark Street. The construction allotment is $2,325,000. Work is also now under way on a second Griffith Company contract for constructing two miles of the Hollywood Freeway Extension and adjoining Ventura Freeway between Moorpark Street and Laurel Canyon Boulevard. This contract carries an allotment of $4,467,000, and is scheduled for completion in December, 1958.

The remainder of the Hollywood Freeway Extension is now in process of planning and designing, and in some areas negotiations are under way with property owners for acquisition of rights of way.

Santa Ana Freeway

The Santa Ana Freeway extends from the easterly terminus of the Hollywood Freeway at Spring Street in the Los Angeles Civic Center in a generally southeasterly direction for total length of 42.9 miles through the Cities of Buena Park, Anaheim, Santa Ana, and Tustin to a junction with the San Diego Freeway near the Town of El Toro. This freeway, following as it does a northwesterly-southeasterly direction generally paralleling the Pacific Ocean coastline, makes it of great strategic value because so many of the other important traffic arteries in this part of the State have been established in a generally northerly-southerly or easterly-westerly direction.

The entire 42.9 miles of this freeway are now either fully completed, under construction, or financed. By the end of 1958 it will be entirely



LEFT—Looking southeast on Santa Ana Freeway; Euclid Avenue Interchange in foreground. RIGHT—Looking east on Riverside Freeway near Brookhurst Avenue.

completed to full freeway standards. The total cost is $76,419,000.

Current construction on the Santa Ana Freeway is described in detail in this issue of *California Highways and Public Works by* Basil N. Frykland, District VII Construction Engineer.

The 1958-59 Fiscal Year budget contains an item for widening existing Santa Ana Freeway from four lanes to six lanes from Norwalk to Buena Park, 2.9 miles, $1,420,000.

San Bernardino Freeway

A four-mile section of the San Bernardino Freeway from Azusa Avenue to Barranca Street was opened to public traffic on January 18, 1957, and another of approximately the same length from Barranca Street to Ganesha Boulevard was completed and opened to traffic on April 19, 1957. The entire 30.7 miles of the San Bernardino Freeway from Aliso Street near the Los Angeles River easterly to the San Bernardino county line at Claremont is now completed. The total cost of this freeway including right-of-way acquisition costs, as well as construction costs, is $53,888,000.

Traffic counts taken in 1957 on this freeway in the City of Los Angeles at Soto Street indicate an average daily traffic of 93,000 vehicles.

Harbor Freeway

The Harbor Freeway is 22.2 miles in length, extending from the four-level traffic interchange structure to San Pedro. On April 24, 1957, a four-mile length of the Harbor Freeway was completed between 42d Street and 88th Place. This four-mile unit had a total cost for right-of-way acquisition and construction of $22,000,000.

On December 4, 1956, a contract was awarded to the Guy F. Atkinson Company for constructing a 2.5-mile section of the Harbor Freeway from 88th Place to 124th Street. The contract allotment for this construction is $5,902,500. The construction is now 60 percent along toward completion, with a completion date being September, 1958. The contract is well ahead of schedule.

Including previous completed sections of the Harbor Freeway, there is now open to public traffic 10.6 miles. The total amount expended for construction to date is about $86,000,000. The section of the Harbor Freeway just south of the four-level structure is now carrying an average daily traffic of 190,000 vehicles.

Looking west along Ventura Freeway construction showing Conejo Grade in the foreground

In the budget for the 1958-59 Fiscal Year is the item for constructing the Harbor Freeway from 124th Street southerly 4.9 miles to 190th Street in the amount of $6,000,000 (total estimate $8,700,000, with $2,700,000 to be financed in the 1959-60 Fiscal Year Budget.) Construction will be started on this unit during 1958.

On the remaining six-mile section of the freeway plans and right-of-way acquisition are substantially completed and start of construction is dependent upon financing.

Long Beach Freeway

The Long Beach Freeway is one of the newer freeway developments. Ground-breaking ceremonies at the southerly terminus of this freeway at Pacific Coast Highway in the City of Long Beach were held on June 27, 1951. However, since that time there has been steady progress in constructing this important freeway in the East Los Angeles area.

The total length of the Long Beach Freeway from Pacific Coast Highway (Route 60) in Long Beach to Huntington Drive in East Los Angeles approaching the City of Alhambra is 21.7 miles. As of the present time, seven miles of the Long Beach Freeway at the south end have been com-

pleted from the Pacific Coast Highway northerly to the crossing of Atlantic Boulevard east of the City of Compton, and 4.8 miles have been completed at the northerly end from Verona Street north of the Santa Ana Freeway southerly to Firestone Boulevard near the City of South Gate.

Three construction contracts are now under way to complete the gap on the Long Beach Freeway from Firestone Boulevard to Atlantic Avenue. This current construction covers a distance of five miles and the contract allotments total $8,755,000. All construction work under these three contracts is expected to be completed in April, 1958, and at that time public traffic will have the use of 17 miles of completed freeway from Long Beach to junction with the Santa Ana Freeway. To date there has been expended for right-of-way acquisition and construction on the Long Beach Freeway a total of $48,000,000.

In the budget for the 1958-59 Fiscal Year as adopted by the California Highway Commission on October 25, 1957, there are three items for construction work on the Long Beach Freeway, as follows:

At Del Amo Boulevard for grading and paving ramp	$180,000
For major construction from the Santa Ana Freeway northerly for 3.6 miles to the San Bernardino Freeway	6,150,000
For landscaping between Sheila Avenue and Olympic Boulevard	85,000

These three contracts will be advertised during 1958.

Golden State Freeway

The Golden State Freeway extends 73.2 miles from the southerly terminus at the junction with the Santa Monica and Santa Ana Freeways near Soto Street in Los Angeles northerly to Kern county line. The total spent and obligated on the freeway is close to $80,000,000.

The portion of the Golden State Freeway, U. S. Highway 99, locally known as the "Ridge Route" between Tunnel Station and the Kern county line, 45.2 miles in District VII, has been converted to a four-lane expressway. The total cost of this reconstruction, completed February, 1953, was $13,500,000. Southerly from Tunnel Station for 27.5 miles the Golden State Freeway is to be carried out to full freeway standards to its southerly terminus at junction with the Santa Ana Freeway. Of this portion the northerly three miles from Tunnel Station southerly to Sepulveda Boulevard was completed as a four-lane expressway at a cost of $3,200,000 on August 25, 1955.

Two very important contracts on the Golden State Freeway were under way during 1957 and are now completed. The contractor on this five miles of construction, extending from Glendale Boulevard in the City of Los Angeles to Ash Street in the City of Burbank, is Vinnell Co., Inc., and Vinnell Constructors. The sum of the two contract allotments is $9,799,000.

Right-of-way acquisition is under way for acquiring rights-of-way needed for the Golden State Freeway to complete it throughout its entire length. The 1958-59 Fiscal Year Budget of the Highway Commission contained items totaling over $10,000,000 for continuing right-of-way acquisition on the Golden State Freeway.

Financed from the 1957-58 Fiscal Year Budget, a contract was awarded by the Director of Public Works on November 18, 1957, for 1.3 miles of this freeway between Alameda Avenue and Burbank Boulevard in Burbank. The contractor is Ukropina, Polich & Kral, and the contract allotment is for $4,878,900.

Also in the 1957-58 Budget is an item of $8,900,000 for 3.1 miles of this freeway from Sixth Street to Mission Road in the City of Los Angeles. This latter project includes the traffic interchange facilities with the San Bernardino Freeway. Construction on this unit is expected to start early in 1958.

The freeway agreement for the last-remaining unit of the Golden State Freeway from the north city limits of Burbank to junction with San Fernando Road near intersection with Sepulveda Boulevard was approved by the Los Angeles City Board of Public Works and was executed February 13, 1957, by the city council. This covers an 11.8-mile length of freeway and is the longest continuous stretch of freeway that has yet been presented to the Los Angeles city officials for freeway agreement.

For the Golden State Freeway the budget for the 1958-59 Fiscal Year contains four construction items, as follows:

From Mission Road to Pasadena Avenue, 1.1 miles	$4,600,000
Landscaping, from Glendale Boulevard to Los Angeles River, with freeway connection to San Fernando Road	246,000
Landscaping, Los Angeles River to Ash Street in Burbank	84,000
From Burbank Boulevard to Roscoe Boulevard, 3.9 miles	6,000,000
(Total estimate $7,648,000, with $1,648,000 to be financed in the 1959-60 Fiscal Year Budget).	

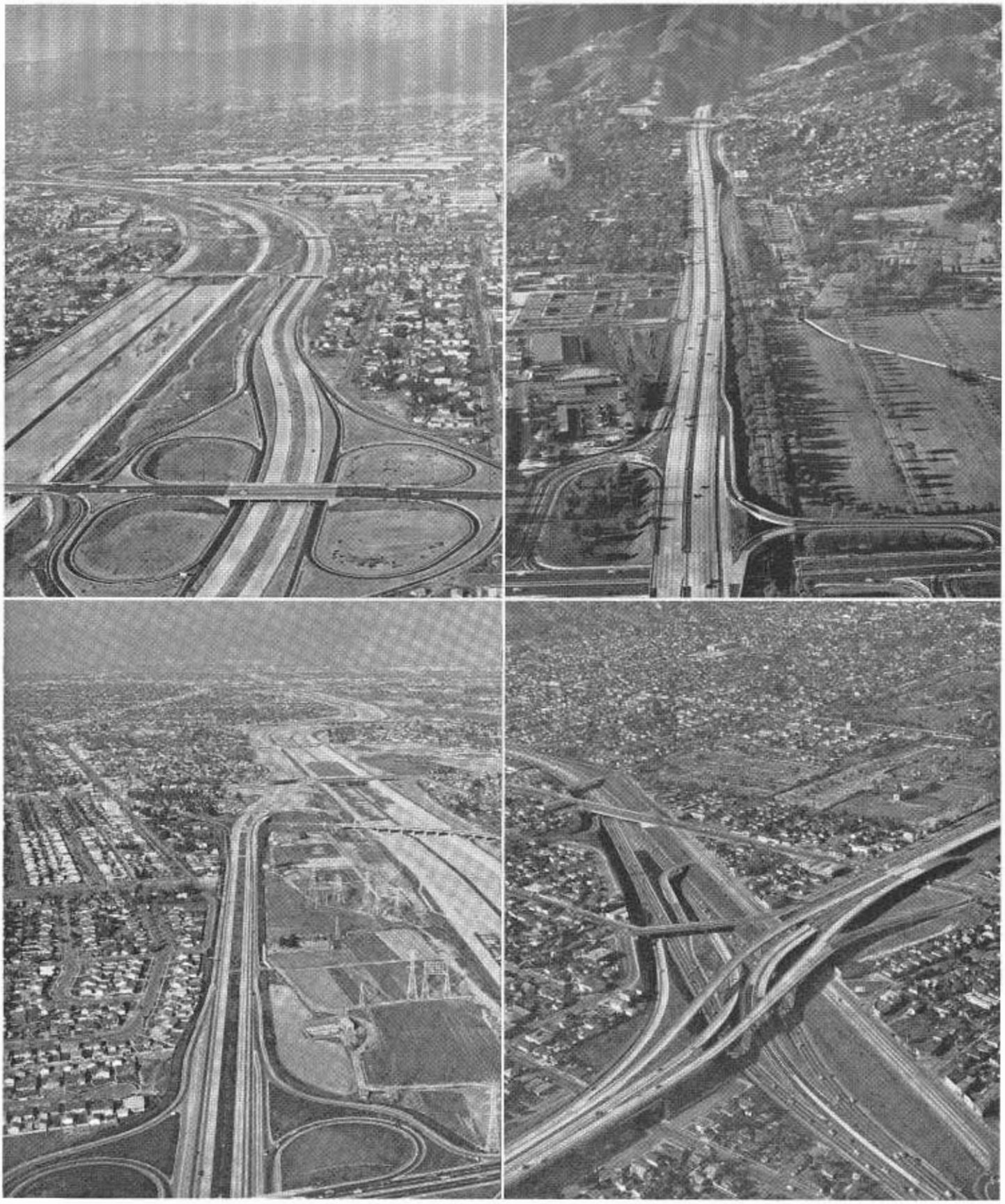
Also in the 1958-59 Fiscal Year Budget are allocations for right-of-way acquisition on the Golden State Freeway totaling $10,000,000.

Ventura Freeway

The Ventura Freeway extends from the Golden State Freeway in Griffith Park to the Santa Barbara County line, a distance of 75.4 miles. Of this mileage, 37.7 have been completed at a construction cost of $13,923,000 to provide four-lane divided highway or expressway standards. This completed construction is all westerly of the west city limits of Los Angeles at Calabasas.

The Highway Commission on May 18, 1955, adopted a freeway routing to carry the Coast Highway (US 101) through the City of Ventura. Plans are now in progress so that construction can go forward whenever financing can be arranged for this entire 5.5 miles through the City of Ventura. The budget for the 1958-59 Fiscal Year contains an item of $2,880,000 for right-of-way acquisition on this section.

The budget for the 1957-58 Fiscal Year contained an item of $3,400,000 to convert to full freeway status the existing two- and three-lane undivided section over the Conejo Grade. This is five miles in length, extending from Conejo Grade Summit to Fifth Street in Camarillo. Contract was awarded for this construction by the Director of Public Works on April 29, 1957, to J. E. Haddock, Ltd. The construction



UPPER LEFT—Looking north along a completed section of the Long Beach Freeway showing Florence Avenue Interchange in the foreground. UPPER RIGHT—Looking north along the Long Beach Freeway showing portion of Artesia Avenue cloverleaf. LOWER LEFT—Looking north along the San Diego Freeway with Wilshire Boulevard in foreground and Sunset Boulevard in background. LOWER RIGHT—Looking northwest, showing Long Beach Freeway crossing Santa Ana Freeway.

is now 50 percent complete, and the scheduled finish date is in late 1958.

Within the City of Los Angeles two major freeway construction contracts are now in progress on sections of the Ventura Freeway. These extend from Sepulveda Boulevard to Encino Avenue, a length of three miles, and from Kelvin Avenue to Calabasas, a length of 3.6 miles. The value of this current construction is $9,779,000.

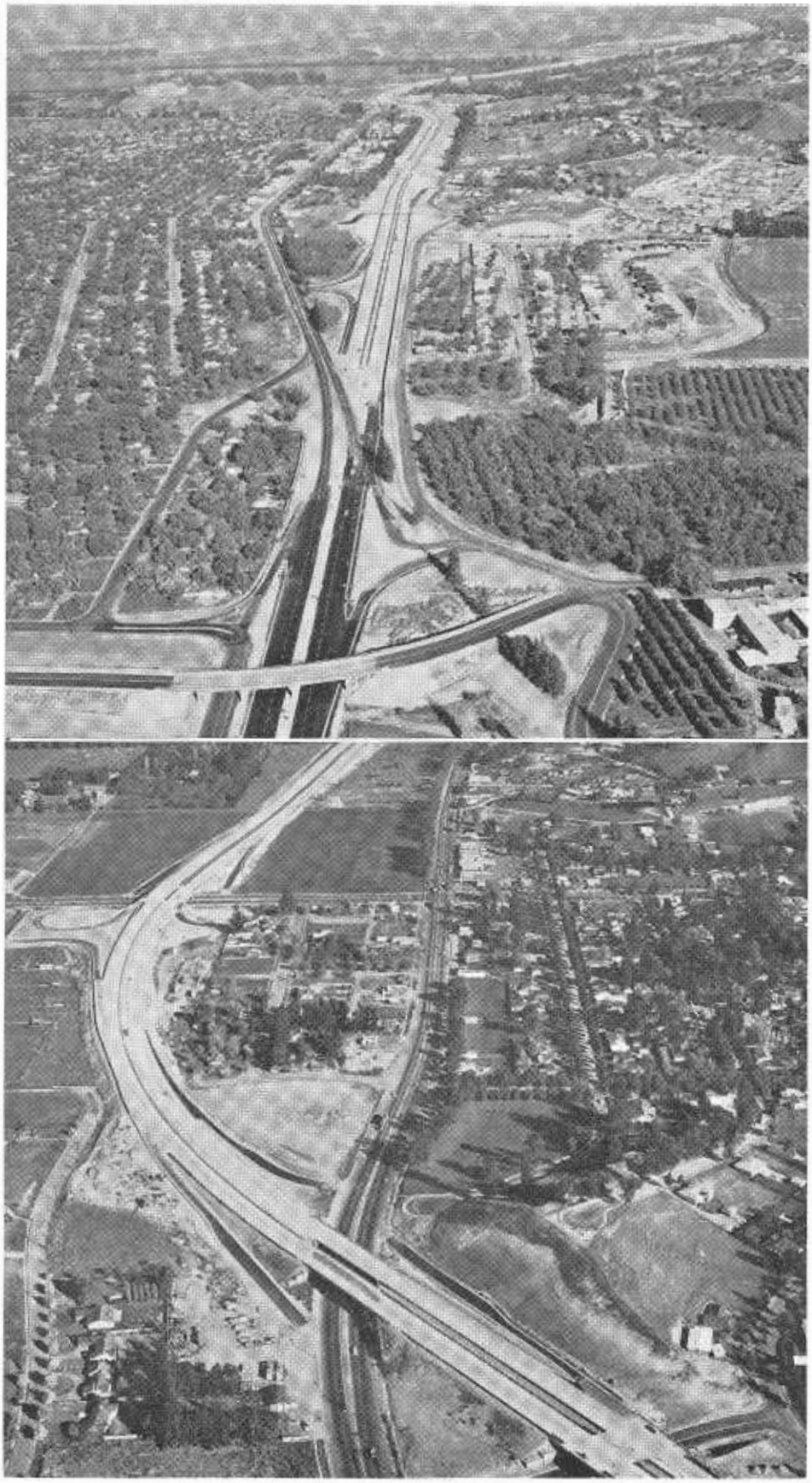
In the 1958-59 Fiscal Year Budget are two items for continuing construction on the Ventura Freeway, as follows:

From Laurel Canyon Boulevard to San Diego Freeway, 4.1 miles (Total estimate $11,100,000 with $4,852,000 to be budgeted in the 1959-60 Fiscal Year Budget.)	$6,248,000
From Encino Avenue to Kelvin Avenue, 3.9 miles (Total estimate $7,300,000, with $1,300,000 to be financed from the 1959-60 Fiscal Year Budget.)	6,000,000

San Diego Freeway

The San Diego Freeway is 90.5 miles in length in District VII. It extends southerly from junction with the Golden State Freeway near the City of San Fernando in close vicinity to existing Sepulveda Boulevard over the Santa Monica Mountains through the West Los Angeles area and along the easterly side of the Los Angeles International Airport. Then it swings easterly, passing to the south of the Long Beach Municipal Airport and then southeasterly into Orange County to a junction with the Santa Ana Freeway at El Toro. Then it proceeds in close vicinity to existing US 101 through San Juan Capistrano and San Clemente to the Orange-San Diego county line.

In many locations, advance right-of-way acquisition funds, frequently called "Chapter 20 money," have been utilized in the purchase of vacant lands to forestall construction of private improvements which, if allowed to proceed, would have made future right-of-way cost many times greater. On December 11, 1956, a contract was awarded to Oberg Brothers for construction at the crossing of the San Diego and Ventura Freeways. This in-



UPPER—Looking east along Ventura Freeway construction near Calabasas showing Mulholland Drive Bridge in foreground. LOWER—Looking east along Ventura Freeway construction in the Woodland Hills area.

Looking northwest along Hollywood Freeway Extension. Traffic artery in center is Moorpark Street.

cluded 1.3 miles of the San Diego Freeway from Valley Vista Boulevard to Burbank Boulevard, estimated to cost $2,500,000. Work is 75 percent completed.

There are three units of construction on the San Diego Freeway in Orange County upon which work is proceeding under State Division of Highways contracts. This construction is located at San Clemente, at San Juan Capistrano, and from Niguel Road northerly for two miles near El Toro. In all, 8.4 miles of the San Diego Freeway in Orange County are now under construction, for which the construction cost is $7,300,000.

On March 29, 1957, a 2.1-mile length of this freeway between Ohio Avenue and Casiano Road in West Los Angeles, valued at $10,000,000, was opened to public traffic. On August 12, 1957, Guy F. Atkinson Company of South San Francisco was awarded contract on the low bid of $5,748,745 for 3.5 miles of construction on this freeway from Ohio Avenue to Venice Boulevard. A substantial start on construction has been made.

In the budget for the 1958-59 Fiscal Year are three major construction items, as follows:

San Diego Freeway in Los Angeles County, from Jefferson Avenue to Venice Boulevard, 2.5 miles (Total estimate $7,500,000, of which $1,500,000 is to be budgeted in the 1959-60 Fiscal Year Budget).	$6,000,000
San Diego Freeway in Los Angeles County, Mulholland Drive relocation	1,100,000
San Diego Freeway in Orange County, from Trabuco Creek to El Toro, 7.9 miles	5,530,000

In the 1958-59 Fiscal Year Budget are also allocations totaling $13,200,000 for continuing right-of-way acquisition negotiations on the San Diego Freeway.

Colorado Freeway

As adopted by the California Highway Commission the Colorado Freeway routing is 2.3 miles in length extending from Eagle Vista Drive in Eagle Rock to Holly Street in Pasadena. The last unit of construction on the Colorado Freeway from Eagle Vista Drive to Avenue 64 was completed July 28, 1955. This freeway unit extends both easterly and westerly from the new Pasadena Pioneer's Bridge over the Arroyo Seco, and as a major traffic artery leading into Pasadena from the west it is of vital importance. The total expenditure on this freeway to date has been $8,500,000.

Foothill Freeway

From Hampton Road to Montana Street in the Flintridge area, a 1.8-mile unit of the Foothill Freeway including crossing of the Arroyo Seco at Devil's Gate Dam was completed October 28, 1955. This construction was enthusiastically welcomed by the people of Pasadena, Flintridge, and Altadena because it corrected an exasperating traffic congestion problem at Devil's Gate Dam. The total cost was $2,675,000.

The Foothill Freeway is the only interstate route in District VII for which the California Highway Commission has not as yet passed a resolution adopting a freeway route for the entire length. We are now engaged in preliminary engineering studies and are conferring with engineering departments and planning commissions of Los Angeles County and of the various cities that will be passed through by

this freeway, in order to obtain the most economical route to provide the greatest possible traffic service.

Glendale Freeway

As adopted by the California Highway Commission, the Glendale Freeway is 2.6 miles in length from Glendale Boulevard to Avenue 36 near Eagle Rock Boulevard.

On this freeway a contract was awarded on February 8, 1957, to the Thompson Construction Company of Inglewood for the construction of a one-mile length between the Los Angeles River and Avenue 36 near Eagle Rock Boulevard. The contract allotment is for $2,832,200. Construction includes a grade separation bridge over Taylor Yard tracks of the Southern Pacific Railroad. This contract is now 50 percent completed. The budget for the 1958-59 Fiscal Year contains an allocation of $2,105,000 for continuing right-of-way acquisition on the Glendale Freeway.

Artesia Freeway

This freeway takes its name locally from Artesia Street along which it follows for considerable distance in Los Angeles County. It is a part of State Highway Legislative Route 175 (State Sign Route 14) that extends from the Coast Highway (Route 60) in Redondo Beach westerly into Orange County.

The State Highway Commission has adopted two portions of this route as freeway. One of these extends from Normandie Avenue to Santa Fe Avenue, and the other from Palo Verde Avenue to Santa Ana Freeway. The total mileage of freeway adoption is 12.4 miles. Of this, 4.9 miles have been constructed to expressway standards at a cost of $2,453,000. The extension of this route in Orange County easterly of the Santa Ana Freeway has recently been named the "Riverside Freeway."

Riverside Freeway

On October 25, 1957, the California Highway Commission announced the official naming of the freeway route for State Sign Route 14 that had formerly been called locally the "Houston Freeway," and State Sign Route 18 (U. S. Highway 91) that had formerly been called the "Santa Ana Canyon Freeway." Thus the Riverside Freeway now extends from the Santa Ana Freeway easterly to near the Town of Olive where it joins the freeway through Santa Ana Canyon and follows along it to the Riverside county line. The total length from the Santa Ana Freeway to the Riverside county line is 20.4 miles. From Cypress Avenue near Placentia, easterly through the Santa Ana Canyon to the Riverside county line, it has been completed to expressway standards. Construction contract is now in progress with Griffith Company for completion to full freeway standards of a section 3.5 miles in length, extending from the Santa Ana Freeway, easterly through Anaheim and Fullerton to Spadra Road (State Highway Route 2). The construction allotment for this contract is $3,500,000. It is 40 percent completed and the date for final completion is September, 1958.

Ojai Freeway

The total length of freeway adoption for the Ojai Freeway is six miles. A contract was awarded June 29, 1955, for four miles of the Ojai Freeway in Ventura County, extending from the junction with West Main Street in the

Looking northwest along Hollywood Freeway Extension. Lankershim Boulevard is in foreground. During construction traffic uses inbound lanes of Hollywood Freeway and Ventura Boulevard to left.

STATUS OF DISTRICT VII FREEWAY PROJECTS—JANUARY 1, 1958

Freeway name	Total miles	Completed projects		Under construction		Right-of-way costs	Total obligated costs to date
		Miles	Construction costs	Miles	Estimated construction cost		
Pasadena Freeway							
4-Level Structure to Glenarm St., Pasadena	8.2	8.2	$10,435,078	.....	.....	$1,009,100	$11,444,178
Hollywood Freeway							
Spring St. via Cahuenga Pass to Junction on Golden State Freeway Near Wentworth St.	16.8	9.9	30,016,344	1.7	$4,649,600	32,662,000	67,327,944
*Santa Ana Freeway							
Spring St. (Los Angeles) to Junction of San Diego Freeway Near El Toro	42.9	29.0	43,417,974	13.9	14,031,207	18,970,000	76,419,181
*San Bernardino Freeway							
Santa Ana Freeway Near Los Angeles River to San Bernardino County Line in Claremont	30.7	30.7	36,027,862	.....	.....	17,860,000	53,887,862
Harbor Freeway							
4-Level Structure to San Pedro	22.2	10.6	28,338,347	2.5	6,118,800	50,948,000	85,405,147
Long Beach Freeway							
Pacific Coast Highway in Long Beach to Huntington Dr. in South Pasadena	21.7	10.7	17,678,550	5.7	8,755,000	21,700,000	48,133,550
*Golden State Freeway							
Junction of Olympic and Santa Ana Freeway Near Soto St. to Kern County Line	73.2	51.2	26,249,481	1.3	4,878,927	48,596,000	79,724,408
Ventura Freeway							
Golden State Freeway to Santa Barbara County Line	75.4	37.7	13,922,874	12.8	16,355,200	29,468,000	59,746,074
*San Diego Freeway							
Golden State Freeway Near San Fernando Reservoir to San Diego County Line	90.5	2.5	5,776,011	12.5	16,502,800	39,677,000	61,955,811
Colorado Freeway							
Eagle Vista Dr. in Eagle Rock to Holly St. in Pasadena	2.3	2.3	6,209,405	.....	.....	2,295,000	8,504,405
*Foothill Freeway							
Hampton Rd. to Montana St. in Flintridge	1.8	1.8	2,054,436	.....	.....	624,000	2,678,436
Glendale Freeway							
Glendale Blvd. to Ave. 36, Near Eagle Rock Blvd.	2.6	.....	.....	1.0	2,832,200	4,057,000	6,889,200
Artesia Freeway							
Normandie Ave. to Santa Fe Ave. and Palo Verde Ave. to Santa Ana Freeway	12.4	4.9	2,452,500	.....	.....	2,844,000	5,296,500
Riverside Freeway							
Santa Ana Freeway to Riverside County Line	20.4	13.7	4,022,066	3.5	3,500,000	5,169,000	12,691,066
Ojai Freeway							
West Main St. in Ventura to 0.4 mi. North of Foster Park	6.0	4.0	2,084,353	.....	.....	1,167,000	3,251,353
*Santa Monica Freeway							
Santa Ana Freeway Near Soto St. to Lincoln Blvd. in Santa Monica	14.9	.....	.....	.....	466,600	30,118,000	30,584,600
Pacific Coast Freeway							
Oxnard to Los Angeles County Line and Huntington Beach to Newport Beach	22.1	7.2	2,519,000	.....	.....	1,961,000	4,480,000
Other Freeways							
Covered by Resolution of Adoption by Highway Commission	182.9	3.3	1,171,300	5.0	1,418,600	9,529,000	12,118,900
Total	647.0	227.7	$232,375,581	59.9	$79,508,934	$318,654,100	$630,538,615

* Interstate Highways

City of Ventura northerly to Mills schools. This contract was completed and opened to public traffic on December 3, 1956. Total expended to date is $3,251,000.

Santa Monica Freeway

By action of the California Highway Commission in 1956, a freeway routing was established for the Santa Monica Freeway (previously called the Olympic Freeway) throughout its entire length of 14.9 miles from junction with the Santa Ana Freeway in East Los Angeles to Lincoln Boulevard in the City of Santa Monica.

A start was made in the actual construction of this freeway at groundbreaking ceremonies on June 9, 1957, when Jones Brothers Construction Corporation commenced work on the substructure portion of the bridge to carry the Santa Monica Freeway over the Los Angeles River, a project which was financed in the 1957-58 Fiscal Year budget.

The contract allotment for this work is $466,000. In the 1957-58 Fiscal Year budget there is a total allocation for Santa Monica Freeway construction of $8,400,000. Bids were opened January 9, 1958, on part of the 4.2-mile unit of the Santa Monica Freeway between Hoover Street and the Santa Ana Freeway that involves long lengths of viaduct to carry the

Santa Monica Freeway over the southeast business and industrial section of the City of Los Angeles. The total cost of right-of-way acquisition and construction for this unit is estimated at $66,000,000.

In the 1958-59 Fiscal Year budget of the California Highway Commission, there is a total of $13,600,000 set up for continuing right-of-way acquisition on the Santa Monica Freeway. The work of planning, design and right-of-way acquisition on this important freeway is proceeding at a satisfactory rate to insure construction and ultimate completion at the earliest possible date, consistent with problems of financing.

Pacific Coast Freeway

The Highway Commission has adopted as the Pacific Coast Freeway, two sections of Route 60, Pacific Coast Highway; one at Ventura County and one in Orange County. The portion in Ventura County, 17.4 miles long, extends from Ventura Freeway to the Los Angeles county line, and of this, 7.2 miles from Date Street, Oxnard, to Calleguas Creek was under construction during 1956-57.

The contractor was Peter Kiewit Sons Company, and the contract allotment was for $2,320,000. Work under this contract was completed November 15, 1957.

The other portion of this freeway in Orange County is 5.6 miles in length, with one section 4.6 miles long, extending from Huntington Beach to Newport Beach, and the other section, one mile long, being in the San Juan Creek area.

Other Freeways

In the summary of District VII freeway projects printed herein, the last item is entitled "Other Freeways." This is what might be termed a "catch-all" to include all of the freeway routes that have been covered by resolution of adoption by the California Highway Commission, but upon which extensive construction has not as yet been carried out. This is not meant as any reflection upon the importance of those freeways that are all vital to the overall system. On all of these other freeways which now total 182.9 miles, considerable advance planning work, some detailed designing, and some right-of-way acquisition have been carried out, and this work is continuing. There are two freeways included in this category, concerning which special mention should perhaps be made.

On the Temescal Freeway from Fifth Street in the City of Pomona southeasterly for 3.2 miles into San Bernardino County to a point one mile south of Riverside Drive, construction is in progress under a state highway contract with Eric L. Peterson. The contract allotment is for $765,000, the construction work is 50 percent completed, and the estimated date of completion is April, 1958. The construction is on the basis of providing a four-lane expressway.

Included in this classification of "other freeways" is one in Orange County that should be given special mention. On October 25, 1957, the California Highway Commission announced the official naming of the new freeway routing for State Sign Route 55 between the City of Newport Beach and the Town of Olive as the "Newport Freeway." The existing state highway route follows along Newport Boulevard through the City of Costa Mesa and along Tustin Avenue through the City of Tustin and the City of Orange.

The freeway routing was adopted by resolutions of the California Highway Commission in two sections, on March 17, 1944, for the southerly portion to Dyer Road, and on July 20, 1954, for the northerly portion. The total length of the Newport Freeway is 17.5 miles.

Cities Concur

The District VII Office of the State Division of Highways is now actively engaged in design of this freeway. Freeway agreements have been consummated with the City of Tustin and the City of Orange, and through these cities, design details are now being prepared for grade separations and traffic interchange facilities at important cross streets. Freeway agreements are under negotiation with the County of Orange and with the City of Costa Mesa. We are now negotiating with the City of Costa Mesa relative to proceeding at an early date with an interim program of construction for frontage roads through this city from 20th Street to Palisades Road. Details for construction in county areas cannot be fully designed until the County of Orange and the State have executed the freeway agreement that is now under discussion.

The Newport Freeway is being designed on the basis of an ultimate six-lane freeway with initial construction to be for four lanes. There are no funds as yet available for construction. Good progress is being made on right-of-way acquisition for this freeway. To date, 44 parcels have been acquired at a total cost of about $1,000,000. Additional funds for right-of-way acquisition are now available, and negotiations are proceeding as design details and appraisals are completed.

The budget for the 1958-59 Fiscal Year contains an item of $1,300,000 for continuing right-of-way acquisition on this freeway.

Outlook Good

Speaking of the immediate future, it would appear that the calendar year 1958 is about to break all previous records for completing District VII freeway construction projects within any one-year period. A review of the record of going contracts on January 1, 1958, indicates that during the present calendar year we will complete and open to traffic 18 major freeway construction contracts. These 18 contracts will make available to the motorists an additional 55 miles of freeways for which the total construction cost is $70,000,000.

As to the long-range picture, we estimate that approximately $1,000,000,000 will be required to complete the 647 miles of District VII freeways presently adopted by the California Highway Commission.

Further studies are being made and correlated with local planning groups, and the results will be embodied in the department's report on Senate Concurrent Resolution No. 26 that will provide for correction of highway transportation deficiencies on a statewide basis and result in the establishment of a complete and comprehensive freeway system for the State of California.

Operations and Activities of Materials and Research Department

PART V—FOUNDATION SECTION

By A. W. ROOT

This, the fourth of a series of articles describing the activities of the Materials and Research Department of the California Division of Highways, will describe the operation and activities of the Foundation Section. As explained previously, this section is one of the five major subdivisions of the Materials and Research Department.

The Foundation Section of the Materials and Research Department, in addition to performing routine tests on all aggregates submitted to headquarters laboratory, performs numerous services when requested by a district or by one of the Headquarters Departments. These services include: investigation of foundations for highway embankments; locating, sampling and testing potential sources of construction materials; investigation of potential or active landslides; obtaining field data and making recommendations pertaining to design of cut slopes; planning and installing horizontal drains; assisting the districts in controlling compaction, measuring fill settlement, and evaluating construction compacting equipment.

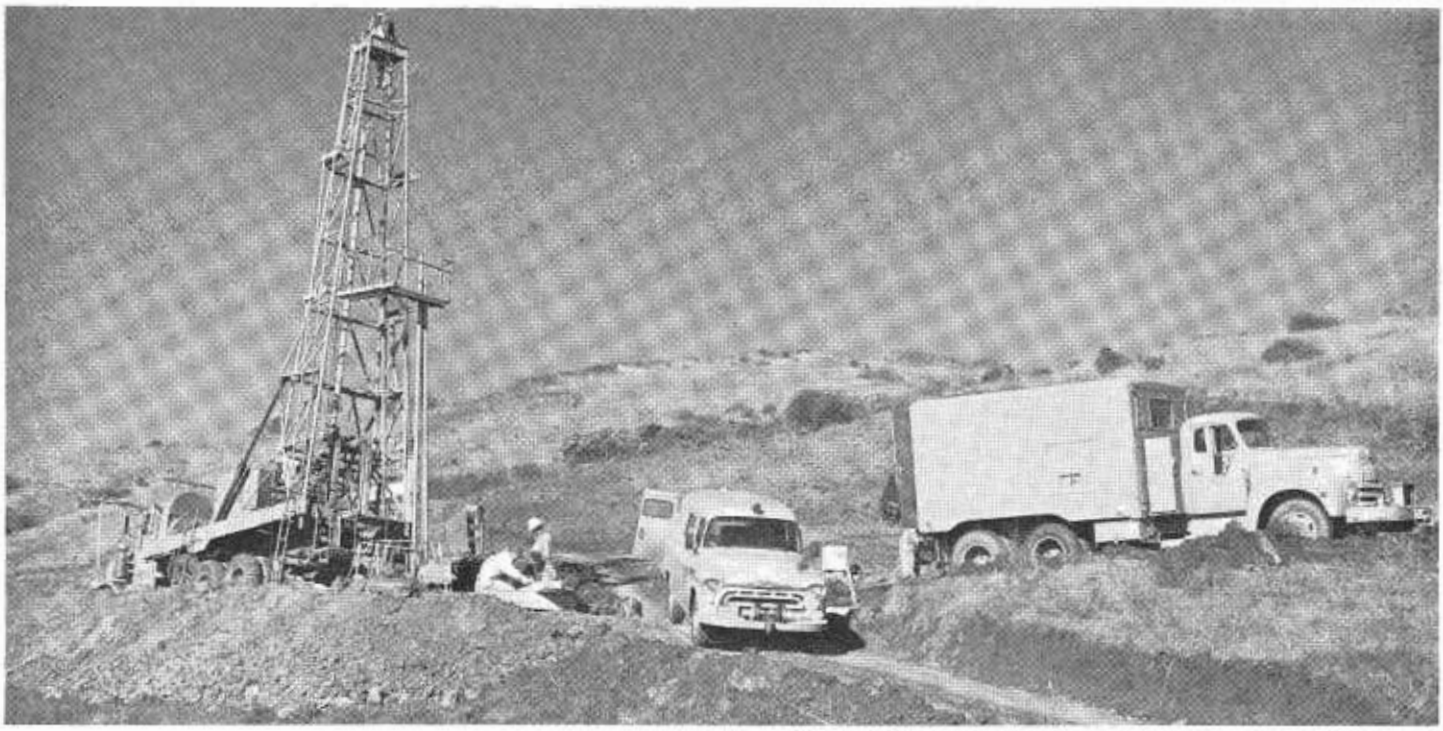
The Foundation Section also assists in preparation of specifications pertaining to aggregates and earthwork, and performs research work directed toward improving test procedures, methods and materials pertaining to these phases of highway design and construction.

For organizational purposes the section is divided into four units or subsections: Aggregates, Foundations, Geology and Construction Control. Following is a more detailed description of the functions and activities of the four units.

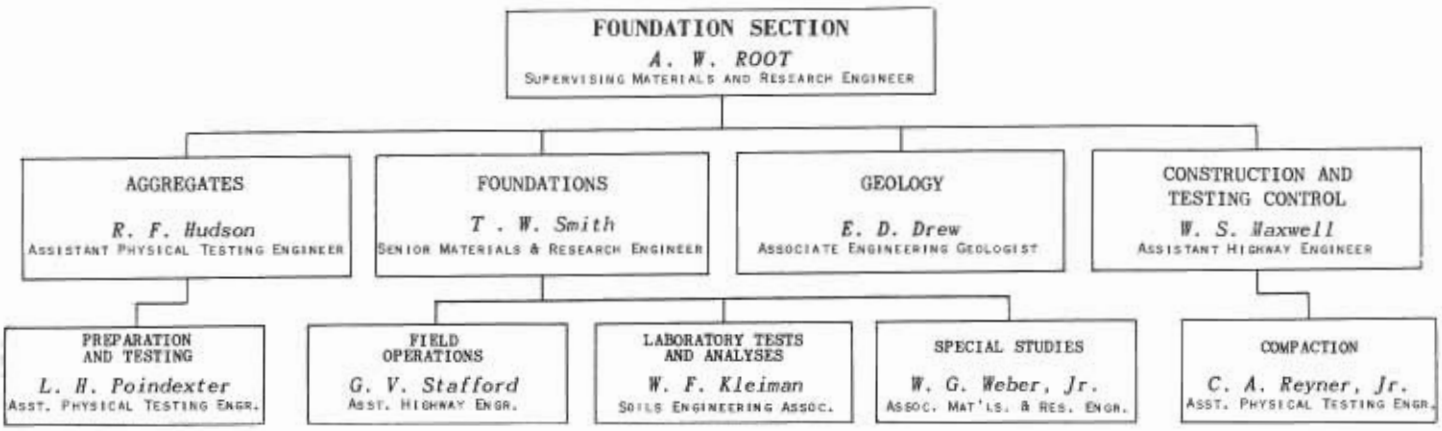
Aggregate Subsection

In most cases the layman attaches little importance to rocks, sand, silt, clay and the like. To the engineers, however, they are his chief building material, and many of them fall under the heading of mineral aggregates, or more popularly, just aggregates. The term of course implies that a piece of stone or a sand grain is an aggregation of one or more minerals.

It is frequently said among engineers that no two aggregates are exactly alike. This statement might well be considered the hallmark of aggregates; for they vary in almost every conceivable way. The particles differ from one another in size, shape, texture and color. They vary in mineral composition and structure. In the case of gravels, the aggregates also vary in the relative proportions of the various particle types.



Large drill rig in position for making deep borings in a landslide area. Undisturbed samples can be obtained with this equipment with a drive-type sampler or a rotary type core barrel. Cores have been taken with this machine from depths in excess of 300 feet.



Obviously these variables have a significant effect on the physical characteristics of the individual particles and on the mixtures of particles; these variations, in fact, make aggregates a versatile construction material. The engineer must ascertain which properties an aggregate should have for a particular use, and then measure those properties, either directly or indirectly. It is the function of the aggregate section of the Materials and Research Department to perform many of the tests to determine the suitability of aggregates for the purpose intended.

Sieves Used

The simplest of these tests is the sieve analysis, used to measure directly the relative proportions of aggregate particles of various sizes. This is done by sieving the aggregate over a series of sieves with the opening of each successive sieve smaller than in the sieve above. By scrutiny of the particle size distribution obtained from the sieve analysis, it is possible to estimate other properties such as porosity, surface area, and workability of concrete mixes made of the aggregate.

Hardness and resistance to impact and abrasion are important in aggregates intended for many uses. The objection to excessively soft and weak particles in aggregates for concrete and pavement wearing surfaces, for example, is obvious. The test most frequently used to measure these properties is the "Abrasion by use of the Los Angeles Machine," commonly referred to as the "Rattler Test." Where it is desired to measure the resistance to abrasion in the presence of water, the older "Deval Machine" or "Wet Shot Test" is used. In both tests steel balls are tumbled and rolled together with the aggregate sample in rotating cylinders under specified control conditions. Breakage, wear and particle loss are determined by sieving.

Specific Gravity Test

Another test performed in this section is the specific gravity determination, usually performed separately on the coarse and fine portions of the aggregate. Knowledge of the specific gravity or density of the individual particles makes it possible to translate proportions by weight into volume relationships. The final design of both asphaltic and portland cement concrete mixtures is based on absolute volumes rather than weight. The absorption of water by the aggregate is determined concurrently with the specific gravity test. This is indicative of the porosity of the mineral particles and is used directly in concrete mix design to compute water requirements.

The "soundness" of aggregate—that is, the resistance to frost action and weathering—is evaluated by the sodium sulfate soundness test, a form of accelerated weathering test. In this test the aggregate is subjected to five cycles of alternate oven drying followed by immersion in a concentrated sodium sulfate salt solution, after which the degree of disintegration is measured. Sodium sulfate crystals expand in the pores of the stone much as does water upon freezing. This test is used primarily for aggregates proposed for use in portland cement concrete.

Test for Clay

The suitability of aggregates for many purposes is affected by the quantity and character of the dust or claylike material present, either as coatings on coarse aggregates or as discrete particles in the mixture. Clay coatings on aggregate particles may inhibit bonding of an asphalt binder; excessive fines may cause increased water demand in portland cement concrete, or cause excessive volume change with resultant reductions in quality of the concrete. By means of a sedimentation type of test the cleanness of coarse aggregate is measured.

The amount of claylike materials contained in fine aggregates is determined by the sand equivalent test, which is performed on mineral aggregate for bituminous mixtures, sand for portland cement concrete, and on base and subbase materials. This simple test, which can be performed quickly in either field or laboratory, indicates the amount of those fines which affect the quality of the aggregate. A relatively small quantity of clay, for example, can greatly reduce the stability of a graded aggregate, whereas a similar quantity of silt might have negligible effect.

Aids Districts

In the above paragraphs mention has been made of some of the properties of aggregates that are investigated by laboratory tests. The Aggregate Section performs all of the tests noted, and numerous others as an aid to the 11 highway districts and other departments in controlling materials going into highway jobs.

In this respect, the Aggregate Section's testing frequently supplements the well established testing programs of the districts, and often is for "referee" purposes. Perhaps of greater importance than the direct determinations themselves is the constant attention the section gives to the adequacy of the standard procedures themselves. All sections of the Materials and Research Department, in fact, give considerable attention to this phase of materials work.

In addition to the work outlined above, the aggregate section is actively engaged in research and special investigations. The improvement of test procedures and the development of new tests generally requires considerable research. Unless these efforts are made, test procedures may become out dated and fail to keep up with the fast pace set by modern construction equipment. The heavy pounding of modern vehicles in ever-increasing numbers is making greater demands for uniformly high quality of road materials. The study of degradation and weathering of aggregates, and the development of test procedures for accurately predicting aggregate durability are examples of important research projects now underway in the Aggregate Section.

Foundations Research

The work of the Foundations Unit consists of three primary activities: field operations, which comprises the exploratory drilling and sampling and the installation of horizontal drains; laboratory tests and analyses, which includes the laboratory testing of samples obtained in the field operations, and the interpretation of the test data; special studies, which consists of various control and research installations.

Soils engineers and geologists contribute to the sound and economical design of our state highways. Not many years ago, most earthwork design was by rule of thumb, arbitrary rules being used for establishing designs. Many designs by these methods were adequate, but no one really knew how adequate, or inadequate, unless the structure failed. Nowadays most engineers working with soil supplement their experience and judgment with factual information about the depth and character of the formations encountered in a project. They know that natural deposits may vary greatly from point to point in their strength, density, and other properties; however, they attempt to secure representative samples and perform laboratory tests to evaluate the important properties. Engineering calculations are made to establish basic design features, such as steepness of slopes and amount of settlement to be expected.

Assists Other Engineers

An important part of this work consists of the mechanics of obtaining the engineering data. The Foundation Section of the Materials and Research Department assists the engineers in the various districts in solving special foundation problems where they exist or are suspected. The section maintains several drill rigs which are manned by experienced personnel. One of the larger drills is capable of drilling and obtaining undisturbed soil samples and rock cores to depths of several hundred feet. Samples from critical locations are tested and analyzed in the laboratory. The drill holes also provide a means of making ground water observations. Most of the work of these crews is performed for the Division of Highways; however, investigations are sometimes made for other state departments, such as the Division of Architecture in connection with their work on state buildings, and for other governmental agencies.

Before recommendations are made for the solution of particular foundation problems samples of soil or rock are examined and tested in the laboratories and the basic properties determined. The problems are then analyzed in the light of the field and laboratory data obtained.

Slow to Admit Need

Although earth and rock are the oldest of construction materials, less has been known of their properties than of man-made materials such as steel and concrete. Engineers and builders of the past have readily recognized the need for measuring the tensile strength of steel and the compressive strength of concrete, but have been slower to admit the need for

Disassembling 2-inch California sampler to remove soil samples which are contained in 4-inch-long brass tube liners

basic knowledge of the properties of earth and rock. They have wanted to know accurately the strength of steel and concrete, and have insisted upon liberal factors of safety in the use of these materials. In dealing with earth and rock many have been willing to use the most meager basic information and have been satisfied with unbelievably small margins of safety.

In spite of the complexity and variable nature of most natural soil deposits, much progress has been made in soil engineering during the past two or three decades. Development of improved and standardized testing equipment and modern soil mechanics have done much to eliminate the guesswork on earthwork.

Some of the mechanics of obtaining field data have been discussed. Having programed the field explorations, the engineer plans laboratory tests and analyses to help him answer such questions as: What is the strength of the soil? What is its allowable bearing capacity? How much settlement can be expected? How much settlement will occur after the job is completed? In obtaining soils data for the study of these questions the engineer employs modern testing methods such as the Triaxial Shear Test, the Consolidation Test, the Unconfined Compression Test and many others. He studies factors such as cohesion, permeability, compressibility, time factors, and plots the data on time-consolidation curves, pressure-void ratio curves, Mohr diagrams, and other useful charts and diagrams. He analyzes the data and makes engineering calculations to verify the adequacy of a proposed design or to establish features for a new project.

Foundation Problems

Engineers in the Soils Testing and Analyses Unit do the things outlined above. They evaluate the properties of many types of soil. Experience has shown that sandy soils and stiff clays usually do not present serious foundation problems to the highway engineer. Sandy soils consolidate rapidly under applied loads, and stiff clays are relatively incompressible under moderate loads. Consequently this unit does most of its work on soft compressible clays, peaty clays, and peat which are prevalent in the San Francisco Bay area and Delta regions along the lower San Joaquin and Sacramento Rivers. On some projects the settlement of compressible soils has been controlled by use of vertical sand drains, embankment overloads, and controlled rates of construction.

Completed horizontal drain in foreground and boring being made for another drain on a recently completed horizontal drain installation in San Luis Obispo County

Although the testing of foundation soils has become quite routine along well established lines, the engineering calculations frequently are complicated by the difficulty of properly evaluating the many factors entering into the calculations. Much field and laboratory experience is needed for rational interpretation of the laboratory test results. Ground water levels, the horizontal and vertical extent of soil masses, and other important field conditions must be taken into consideration in a logical analysis of a problem.

Special Studies

Most of the work described above is of a more-or-less routine or standard type. The Foundations Unit also does a great deal of nonstandard work that may be classed under special studies. Much of this work is done upon request by the districts of the Division of Highways, for the Division of Architecture, and other public agencies. It may be grouped roughly into two categories: investigations and studies to correlate predicted and actual performance; research and the development of new processes and methods.

A major item of the correlation and control work consists of construction control for embankments and fills. Generally stability and settlement are of prime interest. This work utilizes such devices as settlement platforms, piezometers, heave stakes, etc. The installation of these special devices, and soil sampling generally are done by Materials and Research Department personnel. Observation and recording of engineering data generally are done jointly by District and Materials and

Research Department personnel during construction. The department also assists the districts in interpreting the readings. In this work, Materials and Research Department personnel are made available to the districts upon their request. When the districts desire, the department makes the complete installation, records the data, and furnishes the information to the District Engineer for his use.

Co-operation With Districts

In addition to the type of work just described, the department works with the districts during the design of projects. Special studies at this time frequently relate to drainage in depressed cuts for grade separations or permeability studies of soft foundations possibly requiring special treatment.

As in other phases of materials and research activity, constant research is in progress. Studies are made of testing procedures and their results to determine their adaptability to problems encountered in highway construction. By way of example, a new *in place* method of determining strengths of soils is being investigated. A method of measuring the field permeability of foundation soils has been developed by the department and is now being used for estimating rates of settlement of foundation soils. At present, an *in place* method of determining soil moisture and density is being studied to determine its applicability to highway construction.

Horizontal Drains

Most landslides are caused or aggravated by the presence of subsurface water. Horizontal drains are two-inch perforated metal pipe drains installed in holes drilled horizontally, or on slight plus grades, into the slide area to reduce the driving forces causing sliding by drawing down the water table or tapping impounded ground water.

A few of the outstanding examples of success in stabilizing slide areas by the installation of horizontal drains are at the following locations: Piercy Slide near Piercy in District I; Baxter Slipout near Baxter in District III; Orinda Slide west of the Orinda Crossroads in District IV; and at several locations on Cuesta Grade in District V. It was on Cuesta Grade in 1939 that this department installed the first horizontal drains on the State Highway System. A recent installation at this location has produced some of the most spectacular flows ever recorded. Several of these drains were estimated to have each produced maximum flows of one-half to one million gallons per day.

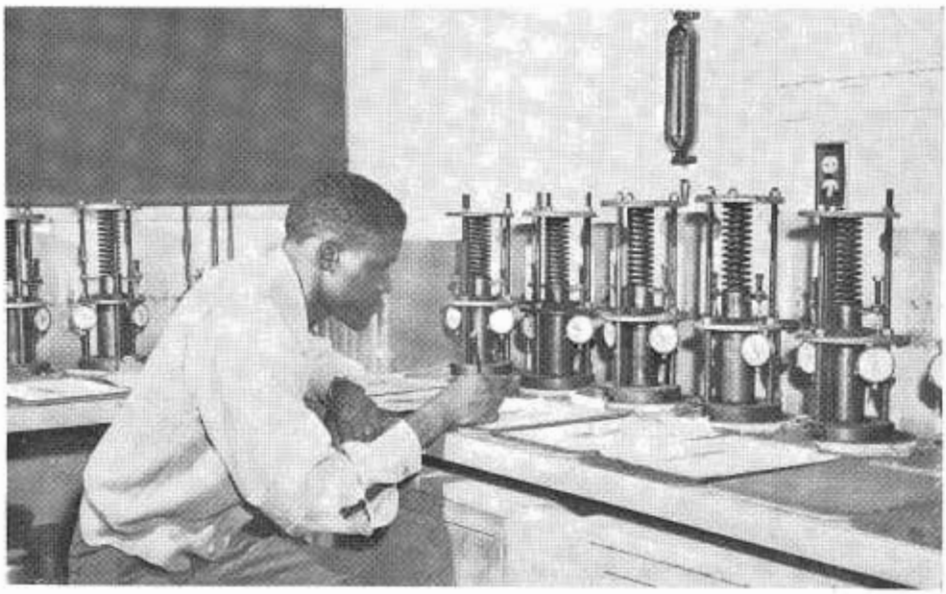
Equipment Modified

Light, portable, air-powered drilling machines were first utilized to install horizontal drains. This original equipment, purchased in 1939, was modified during the ensuing years until the quest for more depth and greater drilling speed exceeded the structural capacity of the machine. A heavier machine designed to use continuous flight helical augers was purchased in 1950 and was later adapted to rotary drilling. This rig was more effective but had some definite operational limitations.

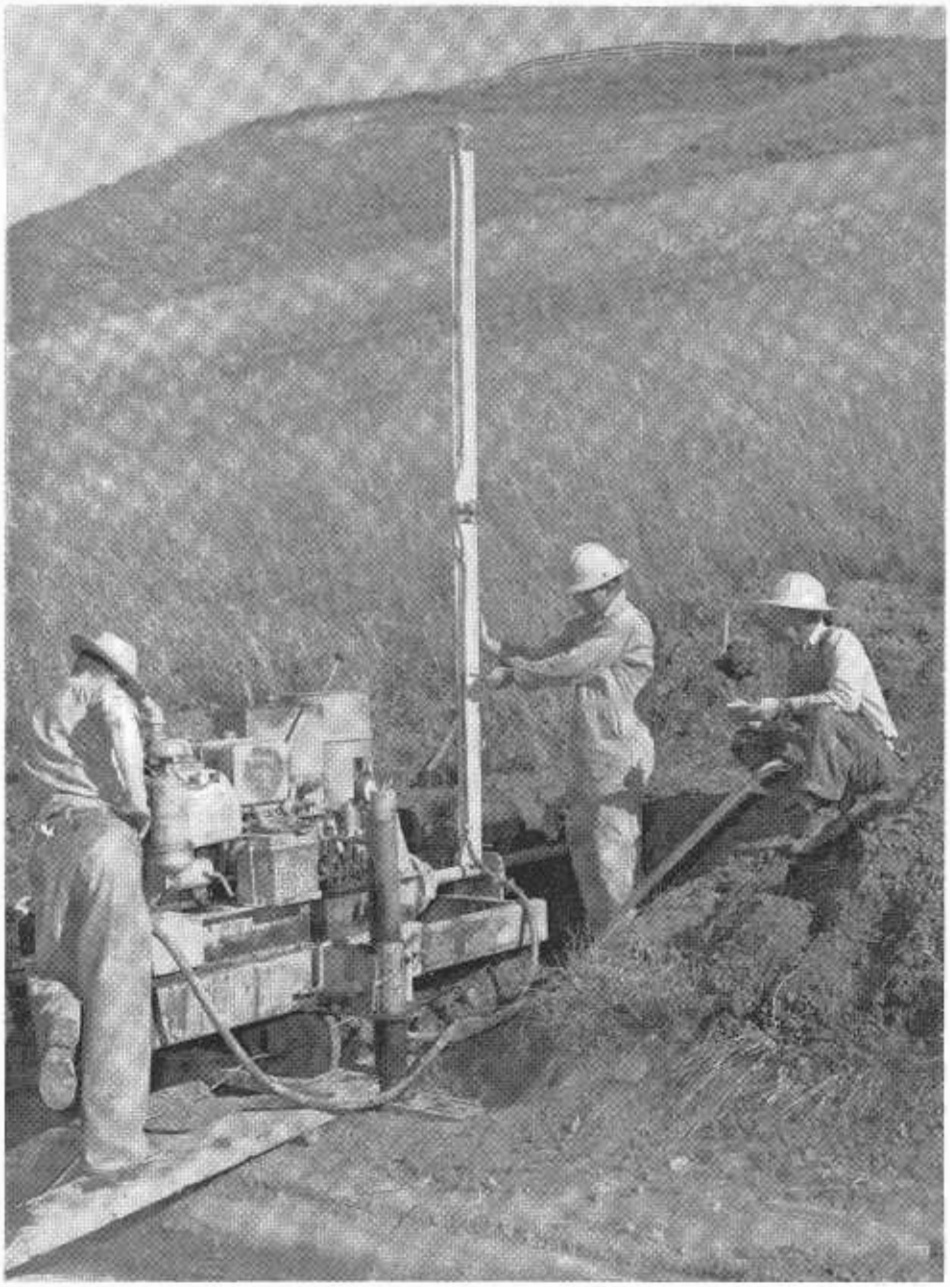
Reading settlement of ground beneath the weight of a fill by means of California designed settlement measuring device

Since no drill rig was commercially available which exactly fitted our needs the Materials and Research Department in co-operation with the Highway Equipment Department designed and built a unit exclusively for installing horizontal drains. This original design has been continually developed and improved upon and we now feel we have evolved a very efficient machine, although additional improvements are already contemplated.

It is now possible to install horizontal drains consistently to depths of 150 to 300 feet in most formations and drilling speed has been increased to more than keep pace with rising operational expenses.



Reading spring-loaded consolidometers to obtain test data used for estimating settlement



Technicians work in the field with a horizontal drill designed and constructed by the Division of Highways

Geology Unit

The late Dr. Charles P. Berkey, the dean of engineering geologists, once stated: "To make suitable field inspection, to indicate what important questions are still unsettled, to suggest how to secure more complete or more reliable data, and to determine what they mean is the task of the geologist. If he can do these things successfully and can transmit this information in usable form to the designing engineer and the construction staff, he is then by that token an engineering geologist."

The California Division of Highways has for many years utilized the services of engineering geologists in varied phases of highway engineering including: location, design, construction, materials, foundations, landslides, ground water and many others.

Can Request Survey

When relocation or reconstruction of a portion of highway is proposed, the highway district in which the project is located may request that the Materials and Research Department make a geological survey of the route, especially if the route traverses rugged or unstable terrain. Such a geologic study will locate areas where structural conditions are adverse or where subsurface exploration will be required; also, possible sources of construction materials will be located. The geologic study may involve the use of various techniques, such as airphoto analysis, geophysical exploration, geologic mapping, and the old reliable method of plodding the route on foot.

The department is frequently asked to make recommendations on the design of cut slopes for roadway excavation on proposed construction projects. The geology subsection is called upon to determine the structural attitude and character of the rock formations, and this information is used in deriving the most economical cut slope design. In areas which are inaccessible to drilling equipment, and in which there are no existing cut slopes for guidance, the design of the cut slopes must be based largely on geology. Excessively steep slopes may cause disastrous landslides, while unnecessarily flat slopes will result in waste of construction funds for excess excavation. Knowledge of the rock type, hardness, bedding, jointing, weathering and other geologic features helps to determine the probable stability of the proposed excavation slopes.

The Materials and Research Department often assists the districts in locating satisfactory sources of construction materials, such as mineral aggregate, base materials, and rock for riprap. The geology unit may use geologic maps, airphoto interpretation or geophysical exploration in locating potential sources of construction materials. Photogeology, one of the new tools of the geologist, is being used to eliminate much arduous fieldwork, with a resultant saving in cost. The geology unit is equipped with a 12-channel seismograph and the most modern resistivity apparatus for geophysical exploration. These methods often provide valuable information to supplement the data obtained by borings, and may effect a saving in cost

by reducing the amount of more costly boring exploration.

Construction Control

The construction control subsection of the Foundation Section is concerned with control tests and devices utilized during the actual construction stage of the earthwork portion of the roadway. In the early days of highway building fills were formed by simply dumping successive loads of dirt over the area until the desired height of fill was attained, and the mass was then allowed to settle over a period of time before placing the final surfacing or pavement. As highway designers progressed in their efforts to improve curvature and reduce steep grades, deeper cuts and higher fills were required and settlement became a major consideration. Paving of the road could no longer be deferred until these massive fills had settled and the need for compaction of the soil as it was being placed was apparent. While it was a relatively simple matter to draft specifications requiring layer construction and the use of compacting rollers, control of the work to assure compliance with the specifications and a satisfactory finished product posed a considerably more difficult problem. California pioneered in the field of compaction in 1929 and devised the first highway compaction control test. Following the general pattern initiated by California the majority of road building agencies throughout the United States and in many foreign countries now require all earthwork to be compacted during construction and control their work by compaction tests.

Critical Soils Problem

The compaction of soils requires the forcing together of the individual particles of aggregations into a dense mass by means of rollers or tamping devices. Water in the mass is essential to act as a lubricant between the particles and facilitate their movement. While all types of soils have a certain water content which provides the highest degree of compaction for the particular soil and compacting equipment concerned, some soils are especially critical to an exact amount of water and to the uniform distribution of it throughout the mass. To complicate life for the road building personnel, these critical soils often resist the penetration of applied water and special mixing devices must be employed by the contractor constructing the highway. Soil as excavated from the native ground generally requires additional water for satisfactory compaction, and California requires pressure type water distributors to assist in securing uniform coverage and distribution. Should the soil as excavated be too wet for proper processing, it is necessary to aerate the material to dry it to the correct water content. In addition to determining relative compaction, the compaction test also indicates the approximate water content needed for each soil.

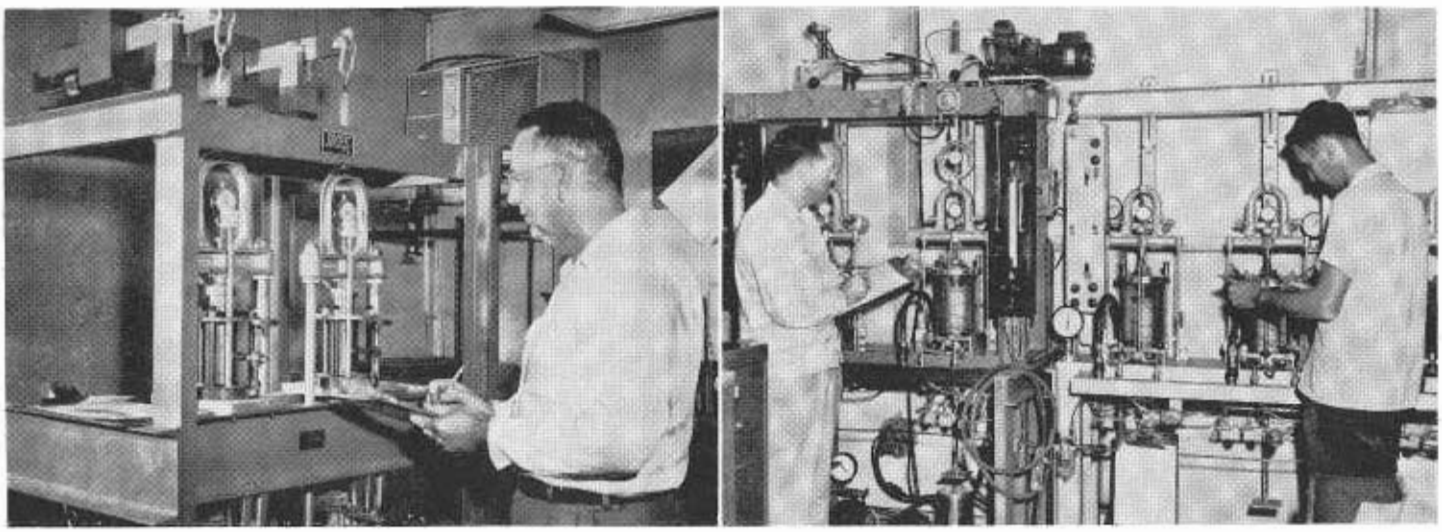
Check Compaction

Specifications stipulate that the fill must be placed and compacted in layers and that each layer must be compacted to the specified relative compaction prior to placing subsequent layers. Field testing personnel check the compaction frequently to disclose any areas not meeting specification requirements.

During the past eight years, compaction equipment manufacturers have produced a wide variety of new design compactors intended to increase production and lower unit costs. The new units are often demonstrated before state representatives and contractors prior to full-scale sales promotion and a series of tests are performed to appraise the effectiveness of the machine. These evaluations are conducted by representatives of the Materials and Research Department under practical working conditions in co-operation with the Construction Department.

Roadbed Sagging

Notwithstanding all efforts to eliminate settlement by rigid compaction control, sags continue to occur occasionally in roadbeds constructed over high fills and raise a question as to whether the fill is compressing within itself or whether the native ground on which it was built is sink-



LEFT—Lever type loading device with consolidometers in place. Data from consolidation test are used in estimating settlement under an applied load, such as embankment. RIGHT—Triaxial compression test for determining shear strength of soils. At left, soil specimen being tested. In chambers on right specimens being consolidated to simulate field loading before testing.

ing under the weight of the embankment. This condition is usually not discernible until several years after construction and long-range studies are necessary to reveal the basic cause of the movement. Such studies have been in progress for the past four years and are presently being expanded to include a wide range of conditions believed to contribute to settlement problems. Obviously, the native ground surface is not accessible for direct observations or measurements of movement after the fill is completed and a remote control type of apparatus is required to indicate any change in the original elevation. A fluid level device has been designed by the Materials and Research Department for this purpose. The standpipe unit is installed on the surface of the existing ground prior to the starting of embankment construction and in such location that it will eventually be under the maximum height and weight of the fill. The indicating unit installed outside of the limits of the fill is connected to the standpipe unit with a copper tube and the system is filled with water. Because it is placed directly on the native ground surface, the standpipe unit will settle exactly the same amount as does this surface and this amount will in turn be denoted by a corresponding lowering of the fluid level in the sight tube of the indicating unit.

Compaction Control Difficult

Construction of modern freeways with wider roadbeds and higher standard of alignment necessitates deeper cuts and higher fills than in the past. Economical construction and safe uninterrupted operation of these freeways make it imperative that the cut slopes and embankments be designed for stability and economy. This can be accomplished only by thorough exploration, analysis, and judicious application of the principles of soil mechanics. Improper design may result in closure of a heavily traveled freeway by landslides or embankment failures.

Continuous development of larger and more efficient earth-moving equipment has resulted in greater construction speed and lower excavation costs.

Unconfined compression apparatus for obtaining the unconfined compressive strength of clay soil

This greater speed has, however, made the control of campaction more difficult. Because present compaction test methods are slow and tedious, sufficient tests are not always made to assure thorough compaction. Embankment settlement due to improper compaction causes distortion of the roadbed, damage to the pavement and possibly failure of the embankment. All possible methods are being investigated to develop a more rapid and simple compaction test procedure.

Due to degradation of aggregates during placement and also after completion of the pavement, pavement failures may occur due to deterioration of aggregates, even though the material conformed to specifications when sampled at the point of delivery. Research studies are in progress to develop better test procedures for evaluating the durability of aggregates, and to identify those which may degrade due to action of traffic, weathering and moisture.

These and numerous other problems are being studied by the Foundation Section. In Materials Engineering, merely to maintain the status quo is to retrogress, and every effort is being devoted to research and development which will produce design methods, control tests and materials specifications necessary to keep pace with the ever-increasing demands on our roads and freeways.

Robert E. McClure Again Named to CHC

Governor Goodwin J. Knight has announced the reappointment of Robert E. McClure of West Los Angeles, publisher of the Santa Monica Evening Outlook, to the California Highway Commission, for a new term ending January 15, 1962.

McClure, a native of Ohio, has lived in California since 1922, and has been connected with the Santa Monica

Commissioner McClure busies himself with document signing at a recent commission meeting

Evening Outlook since 1937. He is widely known in the southern part of the State as a newspaper editor and publisher, novelist and civic leader. McClure has long taken an interest in the highway problems of his section of the State, campaigning actively for more highways to serve the western section of Los Angeles County and for a freeway to the coast. He has been active on the Highway Committee of the Santa Monica-Ocean Park Chamber of Commerce. He is a graduate of Yale University and a veteran of World War I. He originally was appointed to the Highway Commission on January 15, 1954.

California Highways . . . 1957

An Annual Report

By G. T. McCOY, State Highway Engineer

The report which appears on Pages 25 through 40 basically covers the 1956-57 Fiscal Year, but has been revised to include important developments extending to December 31, 1957. Copies of this report may be obtained upon request.

THE CALIFORNIA way of life and the future of the State's expanding economy are closely tied to motor transportation and a modern system of roads, streets and highways.

With more cars and trucks than any other state, California's need for bigger and better highways touches the daily life of every citizen—and the need becomes more critical as the population and traffic increase.

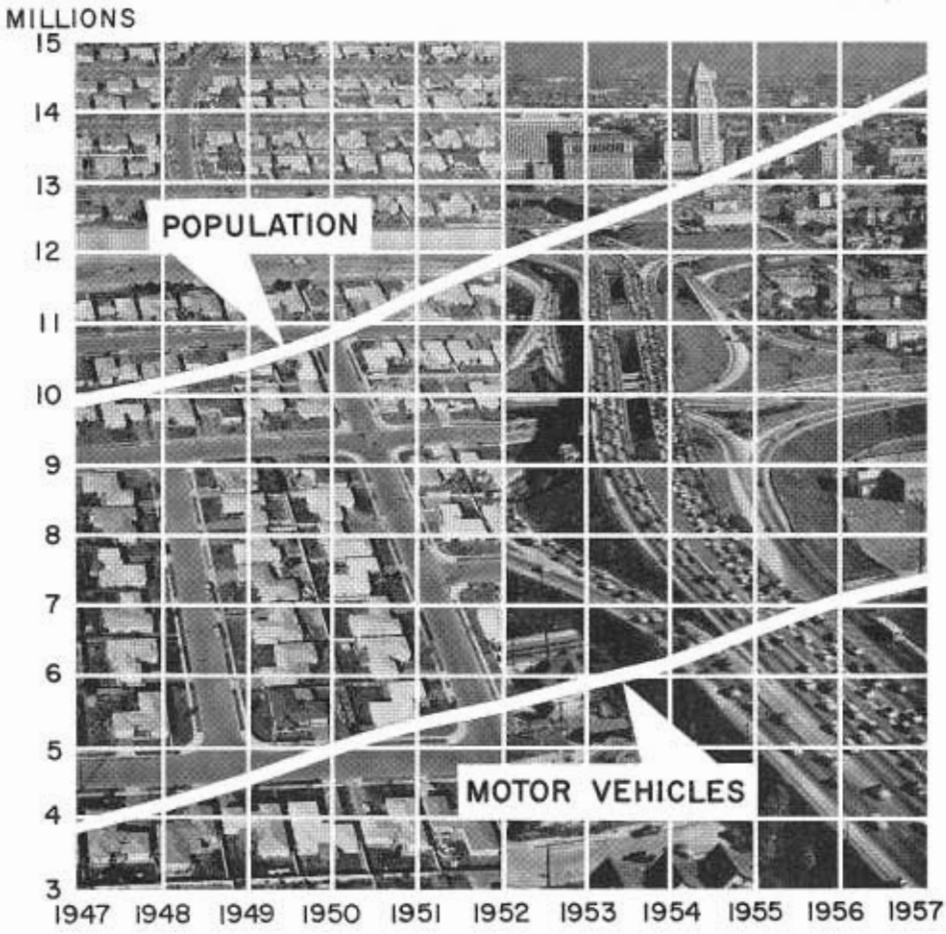
Today, California has 14,445,000 residents and nearly 7,500,000 motor vehicles. The population is expected to be 16,000,000 by 1960 and 20,000,000 by 1970. A corresponding, if not greater, increase in the number of motor vehicles is also expected.

To meet the challenge of this soaring growth, Californians are engaged in an extensive and carefully planned program of highway improvement which has already resulted in major advances.

California now has the greatest mileage of toll-free multilane divided highway in the United States, and its entire network of state highways has been described by competent observers of the national scene as "the best in the Country."

A favorable political and fiscal atmosphere has been provided by the California Legislature to make this progress possible.

The Legislature, on the basis of various studies, has provided financing through highway user taxes to help meet the increasing needs. At the same time it has continued to delegate to the California Highway Commission the authority and responsibility to determine highway routings and to allocate construction funds, the latter subject to certain statutory geographical controls.



These time-tested legislative policies, not enjoyed in many other states, have permitted orderly, steady progress in state highway development—"advance planning and continuity of fiscal policy," as the Legislature expressed it in the Streets and Highways Code.

The day-to-day and year-to-year administration of the state highway program and related functions is carried on by the California Division of Highways, a unit of the State Department of Public Works. Activities of the division cover the whole broad area of highway work from spectacular new freeway construction to routine maintenance.

State highway development and operation during the fiscal year ending June 30, 1957, are recorded in the Eleventh Annual Report to the Governor by the Director of Public Works. The report contains detailed financial tabulations, construction contract statistics and other data. (Some of the material in that report, together with other more recent data, is included here.)

Notable progress was made during the year toward the still distant goal of an adequate highway system for California—for example, by the end of 1957, 2,180 miles, or about 15 percent of the State Highway System, were completed, under construction or advertised for bids as multilane divided highway.

Travel in California amounted to a total of about 60,000,000,000 vehicle miles in 1957 on the approximately 136,000 miles of roads and streets in the State. About 45 percent of this travel was on the 14,000 miles of state highways.

Ever-increasing traffic volumes have resulted in serious deficiencies on many of these streets and roads, including state highways.

Traffic congestion and accidents are the principal villains, with many problems involved:

Thousands of miles of two-lane roads should have four or more lanes and dividing strips; alignment of many routes is antiquated and unsuitable for today's vehicles; maintenance cost is excessive on some older sections; bridges and traffic lanes in numerous instances are too narrow, and dangerous cross traffic chokes travel throughout the State.

This aerial photograph, taken just east of Los Angeles Civic Center, shows recent, current and coming freeway construction in one view. Traffic on the Santa Ana Freeway moves along smoothly under the bridges which carry the Long Beach Freeway. The section of the Long Beach Freeway extending upward (south) from the interchange was recently opened to traffic, while construction is scheduled to start in 1958 on the northward extension for which preparation is evident at bottom left.

Construction Expenditure, 1956-57

A total of $336,501,116 was allocated for construction and rights of way on state highways in the 1956-57 Fiscal Year. Comparable amounts are being expended in the current (1957-58) fiscal year, and the State Highway Budget for 1958-59 provides $337,000,000 for construction and right-of-way purposes. Even greater expenditures are needed in the future if California is to keep from losing ground in its battle against mounting highway deficiencies.

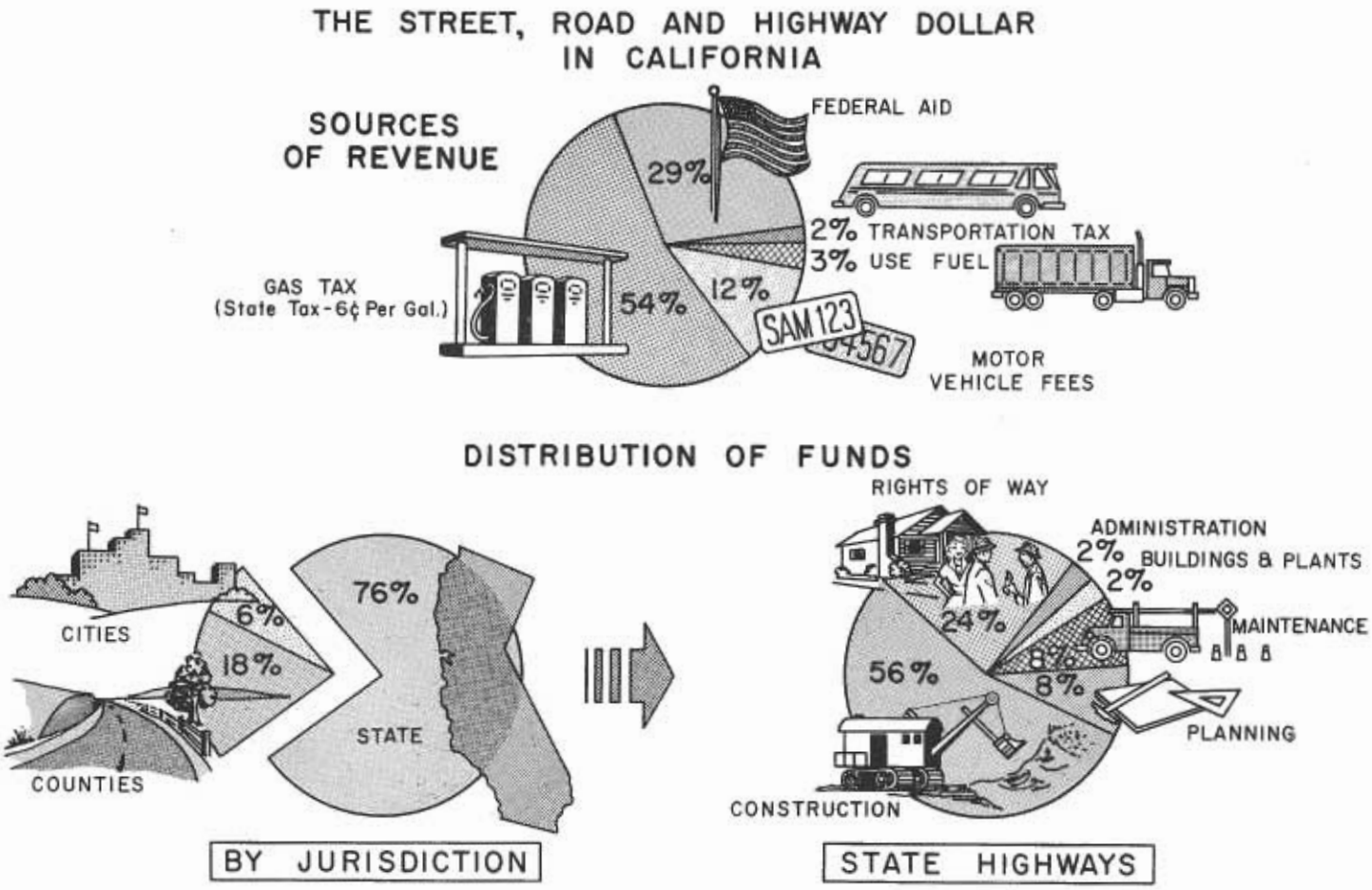
Californians pay 9 cents a gallon in gasoline taxes, of which three cents is a federal tax. Four cents per gallon goes for state highways, one and three-eighths cents for county roads, and five-eighths of a cent for city streets. This tax is the main source of revenue. Other user taxes include use fuel (diesel) taxes, transportation taxes and miscellaneous motor vehicle and registration and weight fees. (Revenue sources and distribution for road purposes are depicted in the accompanying charts.)

Federal apportionments to California for state highways were sharply increased by the Federal Highway Act of 1956. A total of $102,000,000

THE ENGINEER'S ANSWER

With motor vehicle registration now over 7,000,000 in California, it has been estimated that by 1975 our roads will be used by more than double the present number of cars and trucks. So we must build highways not only for the traffic we now have, but we must also anticipate the huge numbers of vehicle movements on our highways in the years ahead.

The engineer's answer to the problem of moving all of this traffic is the "FREE-way." That is to say, free of oncoming traffic, free of crossing traffic, free of traffic moving at random onto the highway from the side of the road. A full freeway can do these things because it allows no left turn movements, and it limits access to strategic points where traffic can enter it or leave it safely. Intersecting roads are carried over or under the main highway.



was allocated in 1956-57, $134,000,000 for 1957-58, and $153,000,000 for 1958-59. In addition to these amounts for state highways, federal funds also were allocated each year for roads included in the Federal Aid Secondary System. Under California law, nearly all F. A. S. funds are expended on county roads.

According to the statutes, 55 percent of the state highway construction money available in any fiscal year must be allocated to the 13 southern counties, with the remaining 45 percent going to the northern 45-county group. A further provision guarantees each county a minimum percentage of construction funds, during a specified period of years.

The California Highway Commission allocates funds for highway projects in the two groups of counties after considering all available data, including studies of traffic volumes, accidents, population changes and road conditions and other factors to determine the most needed improvements.

Highway Construction

California's 1956-57 record of highway construction and development was impressive. Improvements of various types, from new freeway construction to spot corrections, covered a record total of 2,317 centerline miles.

Broken down, this total represents approximately 1,640 miles of paving and surfacing, 640 miles of seal coating, and 30 miles of grading, as well as numerous bridge, traffic signal and illumination and other miscellaneous projects.

In 1947 there were about 480 miles of divided highway with four or more lanes. Ten years later, on June 30, 1957, there were 1,728 miles of this type of highway, including both freeways and expressways, and an additional 383 miles under construction. By the end of the calendar year the totals were 1,810 miles in operation and 358 under construction.

The heavy emphasis in recent years has been on freeways because of their proved ability to handle more traffic with greater safety than any other type of highway facility. This is possible through the control of access, the elimination of cross traffic and left turns at grade, and the separation of opposing traffic.

A total of 467 miles of full freeway was in operation at the end of 1957 with 215 miles under construction. In addition, most of the State's 926 miles of expressways, which have some intersections at grade, are designed for future conversion to freeway status. Also constructed in recent years have been a number of miles of "two-lane freeways" on which two lanes are built initially, with access control, right-of-way, and design provisions made for an ultimate freeway.

In 1957, as during the 10 preceding years, the state highway construction

program resulted in improvements which are readily evident in all areas of California.

Except for a few short sections, U. S. Highway 99 is now four-lane divided highway over the 360 miles between San Fernando and Sacramento. Projects among those completed in 1957 on this route include freeway sections in rural portions of Kern and Tulare Counties and through the Fresno and Atwater urban areas.

On US 99 north of Sacramento current and recently completed construction will provide almost 13 miles of continuous expressway in the Sacramento River Canyon north of Shasta Lake.

North of San Francisco U. S. Highway 101 was completed as a divided highway between the Golden Gate Bridge and Santa Rosa, and further north construction began in 1957 on the first unit of the long-anticipated Redwood Freeway in Humboldt County.

In the San Francisco region large scale advances have been made in the major cities and on freeway arteries serving adjacent population centers.

Construction completed or under way in 1957 on the Eastshore Freeway, together with projects budgeted for 1958-59, will mean completion of this important freeway between Vallejo and Los Gatos, a distance of 75 miles.

Recently completed in the City of Oakland was the Cypress Street Viaduct, a 1.3-mile double-deck structure with separate levels for opposing freeway traffic. It is California's first double-deck freeway.

In San Francisco construction is proceeding on the elevated Central Freeway and on the double-deck structure which will carry the Embarcadero Freeway along the waterfront.

Traffic on the Bayshore Highway now has the use of 27 continuous miles of freeway as a result of the 1957 completion of the link between Candlestick Point in San Francisco and Sierra Point in San Mateo County. This new freeway section is built on a large earth fill across the open water. Current and budgeted projects will carry the Bayshore Freeway well into Santa Clara County.

Particularly rapid progress is being made toward the development of U. S. Highway 40 to freeway standards between Oakland and the Nevada state line.

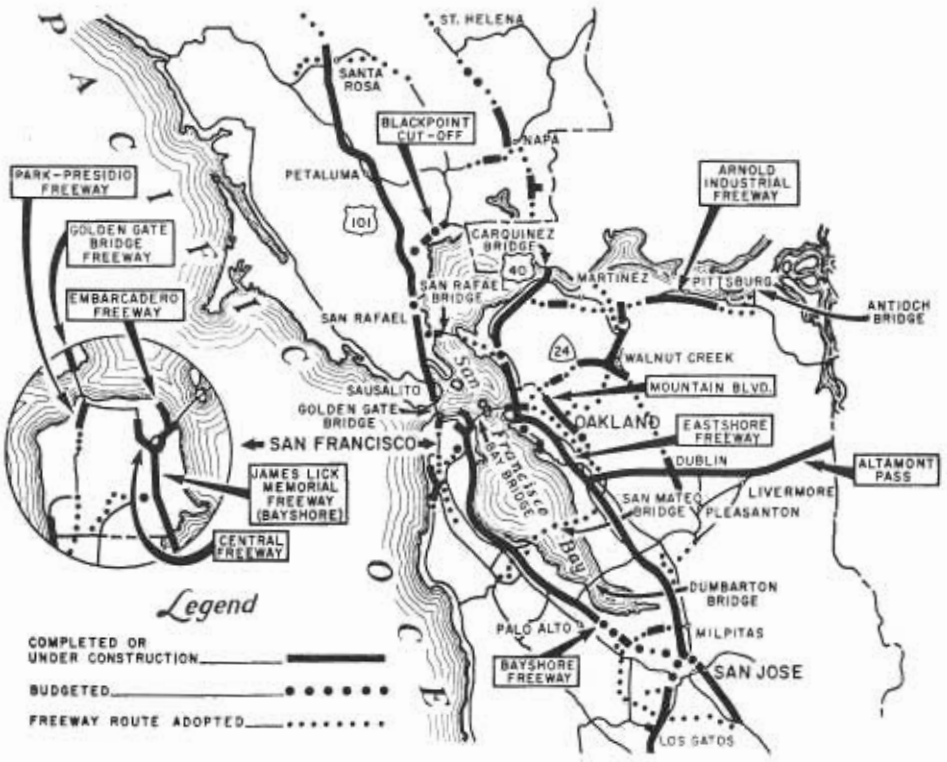
Now under construction on this route is the parallel Carquinez Bridge, with freeway approaches in Contra Costa and Solano Counties. This toll project, due to be completed in late 1958, will eliminate a series of traffic bottlenecks north of San Francisco.

East of Sacramento, particularly in the rugged terrain of the Sierra Nevada Mountains, construction is in progress or budgeted on nine major freeway and expressway projects on US 40. Five projects, with an estimated total cost of $34,650,000 are contained in the 1958-59 State Highway Budget. When these current and budgeted projects are finished, there will be about 83 miles of freeway or expressway in operation on the 117 miles of US 40 between Sacramento and the Nevada state line.

On US 101 between San Francisco and Los Angeles, several new sections of freeway and expressway were completed and others placed under contract, particularly in Monterey, San Luis Obispo and Santa Barbara Counties.

In the Los Angeles area 24.5 miles of freeway were completed in 1957, and nearly 60 miles were under construction at the end of the year. The 1958-59 State Highway Budget provides for additional advances in the continuing Greater Los Angeles freeway development program.

During 1957 the last gap was closed in the San Bernardino Freeway (US 70-99) between Los Angeles and east of Ontario, and to the east further freeway construction and conversion of the existing expressway to full freeway are continuing.

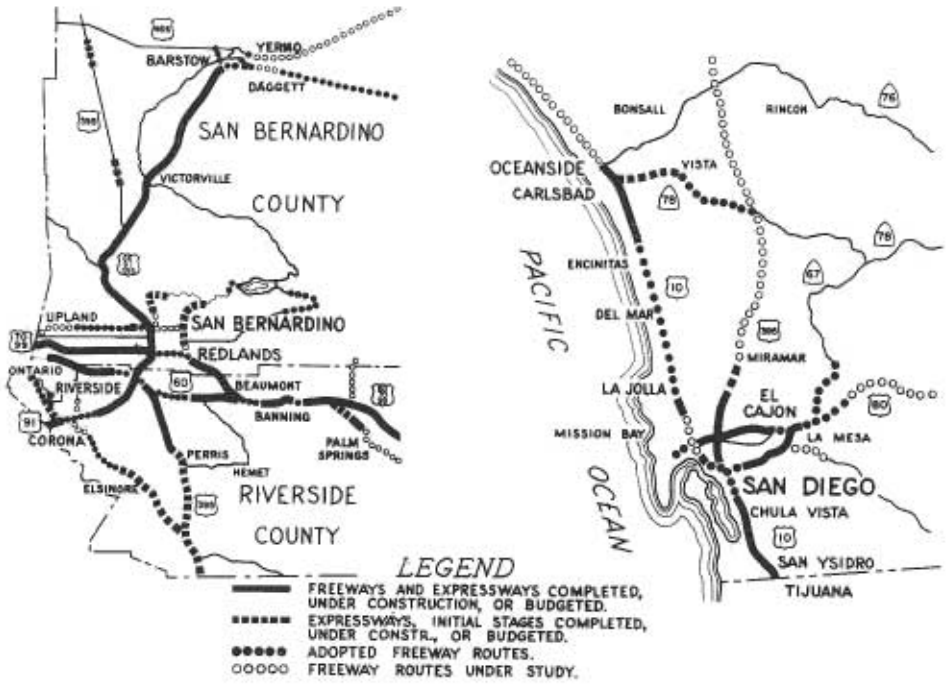


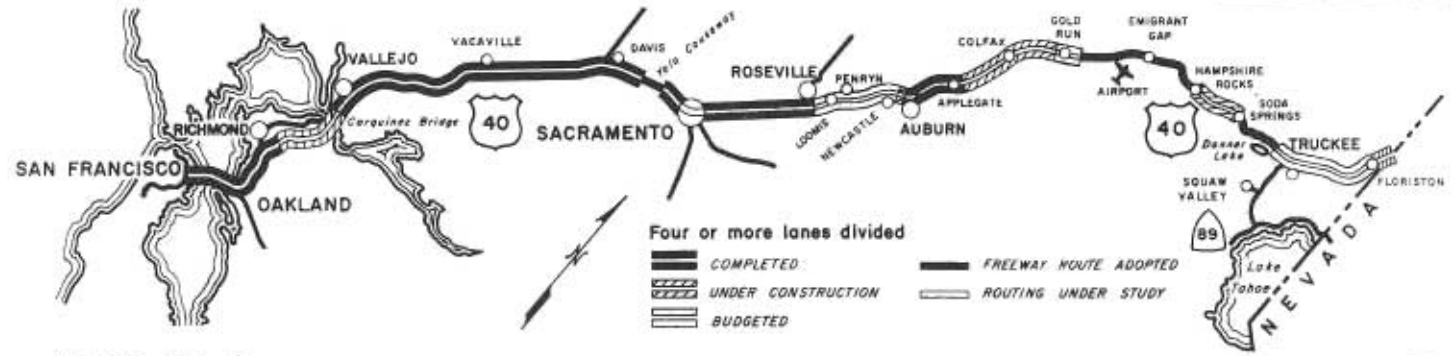
FREEWAY NETWORKS

The maps on these pages illustrate the expanding freeway and expressway networks in the San Francisco, Los Angeles, San Bernardino-Riverside and San Diego areas as well as the status of two important routes, US Highway 99 between Los Angeles and Sacramento, and US Highway 40 from the San Francisco Bay area to the Nevada state line. Progress on these and other routes is following a long-range plan of orderly development tailored to priority of needs and availability of funds.


LOS ANGELES
GLENDALE FREEWAY
FOOTHILL FREEWAY
COLORADO FREEWAY
PASADENA FREEWAY
HOLLYWOOD FREEWAY
SANTA MONICA FREEWAY
POMONA FREEWAY
SAN BERNARDINO FREEWAY
RIVERSIDE FREEWAY
GARDEN GROVE FREEWAY
LONG BEACH FREEWAY
SAN DIEGO FREEWAY
LAGUNA FREEWAY
ORANGE
Legend
COMPLETED OR UNDER CONSTRUCTION
EXPRESSWAYS
FULL FREEWAYS
BUDGETED
FREEWAY ROUTE ADOPTED


SACRAMENTO
ELK GROVE
GALT
LODI
STOCKTON
MANTECA
MODESTO
TURLOCK
ATWATER
MERCED
CHOWCHILLA
CALIFA
MADERA
HERNDON
FRESNO
KINGSBURG
TRAVER
GOSHEN
TULARE
PIXLEY
EARLIMART
DELANO
BAKERSFIELD
GRAPEVINE
SAN FERNANDO
BURBANK
GLENDALE
LOS ANGELES
Four or more lanes divided
COMPLETED
UNDER CONSTRUCTION
BUDGETED
FREEWAY ROUTE ADOPTED
ROUTING UNDER STUDY


BARSTOW
YERMO
DAGGETT
SAN BERNARDINO
COUNTY
VICTORVILLE
UPLAND
SAN BERNARDINO
REDLANDS
ONTARIO
RIVERSIDE
BEAUMONT
BANNING
CORONA
PERRIS
PALM SPRINGS
HEMET
ELSINORE
RIVERSIDE
COUNTY
BONSALL
RINCON
OCEANSIDE
CARLSBAD
VISTA
ENCINITAS
DEL MAR
MIRAMAR
LA JOLLA
EL CAJON
MISSION BAY
LA MESA
SAN DIEGO
CHULA VISTA
SAN YSIDRO
TIJUANA
PACIFIC
OCEAN
LEGEND
FREEWAYS AND EXPRESSWAYS COMPLETED, UNDER CONSTRUCTION, OR BUDGETED.
EXPRESSWAYS, INITIAL STAGES COMPLETED, UNDER CONSTR., OR BUDGETED.
ADOPTED FREEWAY ROUTES.
FREEWAY ROUTES UNDER STUDY.


SAN FRANCISCO
OAKLAND
RICHMOND
Carquinez Bridge
VALLEJO
VACAVILLE
DAVIS
Yolo Causeway
SACRAMENTO
ROSEVILLE
PENRYN
LOOMIS
NEWCASTLE
AUBURN
APPLEGATE
COLFAX
GOLD RUN
EMIGRANT GAP
AIRPORT
HAMPSHIRE ROCKS
SODA SPRINGS
TRUCKEE
Donner Lake
SQUAW VALLEY
FLORISTON
Lake Tahoe
NEVADA
40
89
Four or more lanes divided
COMPLETED
UNDER CONSTRUCTION
BUDGETED
FREEWAY ROUTE ADOPTED
ROUTING UNDER STUDY

Contracts which were under way in 1957 on the Long Beach Freeway will complete this route from the Santa Ana Freeway to the Pacific Coast Highway in Long Beach.

Additional mileage also was completed in 1957 on the Harbor Freeway. When current and budgeted projects on this route are finished, there will be only six miles still to be constructed.

The 1958-59 State Highway Budget provides funds for the extension of the Golden State Freeway (US 6-99) through and north of Burbank. This freeway job will connect with current construction which in turn connects with the section between the Los Angeles River and Alameda Avenue opened in 1957.

The 1958-59 budget also provides funds to close the present gaps in the Ventura Freeway (US 101) west of North Hollywood.

This work on the Ventura Freeway, together with other current, budgeted and completed freeway projects on US 101 to the south (Santa Ana and San Diego Freeways) will mean 80 miles of continuous full freeway from Calabasas, through the City of Los Angeles, to San Juan Capistrano.

The projects referred to in the preceding paragraphs represent only a small portion of the work which has recently been completed or which is now budgeted or under construction.

Not covered is extensive construction on less-traveled highways which are nevertheless important arteries in rural and scenic areas. Work on these routes during the year resulted in many miles of new highway, completed reconstruction, realignment and other improvements throughout the State.

All these projects, whether minor spot corrections, improvements on conventional two-lane routes, or major freeway construction, are contributing to relief from congestion and hazard in the face of rapidly growing traffic volumes.

Planning

The division's planning department prepares plans and estimates on projects in advance of the time when construction funds actually become available.

This advance planning program has enabled the Highway Commission to put to immediate use all money made available for state highway purposes.

Rapid utilization of funds has meant huge savings to Californians due to early completion of projects in an era of rising construction costs. It also has meant savings in fuel and upkeep to the motorists who enjoy early use of the improved highways, and savings in life and limb as well.

An example of the prompt use of funds is provided by the Commission's record of committing federal highway aid to specific projects.

STATE HIGHWAYS

The State Highway System includes all roads which have been designated "state highways" by the Legislature or by constitutional amendment. The first state highway, designated in 1895, was the Lake Tahoe Wagon Road from Placerville over the Sierra.

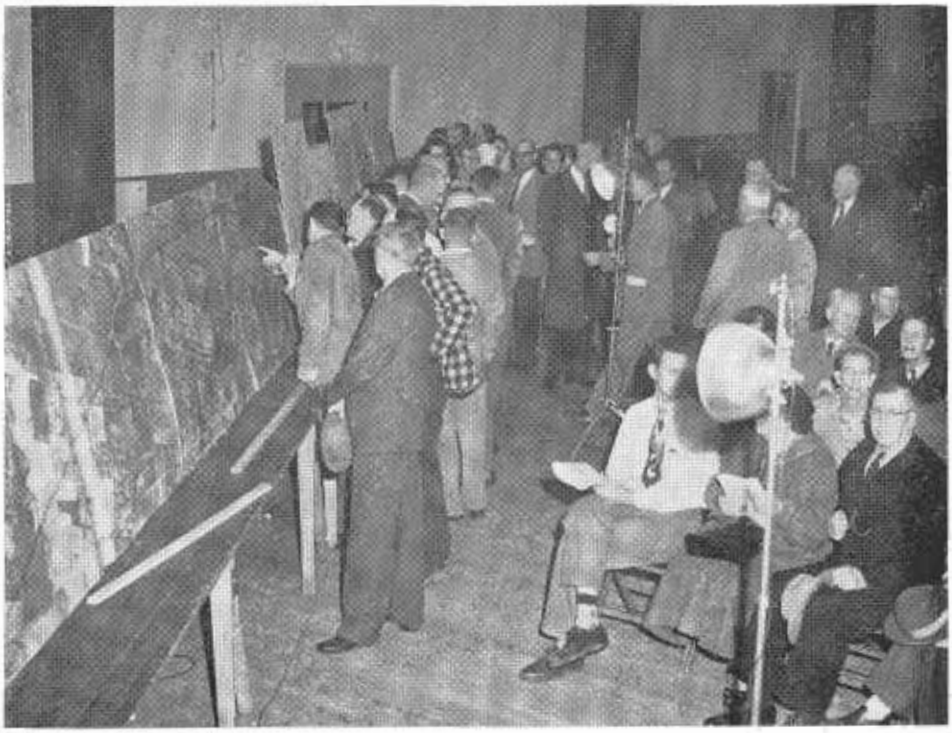
The Highway Bond Act of 1909 provided for 3,082 miles. Periodic additions brought the total to 7,300 miles in 1932. The 1933 Legislature practically doubled the mileage, making the total nearly 14,000, a figure which has since remained relatively constant.

Legislative designation of state highways usually consists of naming only the termini, with possibly a few intermediate points. Adopting the general location is one of the duties of the California Highway Commission.

The Bayshore Freeway link between Candlestick Point in San Francisco and Sierra Point in San Mateo County was placed in operation in 1957. The new freeway section (left) is built on an earth fill across open water at the edge of San Francisco Bay. Below is a photograph taken in 1954 during an early stage of the project.

In 1956 the Federal Highway Act of that year increased California's share of federal aid by about $62,000,000. Thanks to a backlog of planned and designed projects, the entire amount was promptly placed under contract.

Even more impressive, California was the first of all the states to commit its 1957-58 federal apportionment. This $134,000,000 allotment was translated into specific projects by June, 1957, before the fiscal year had even started. The $153,000,000 federal apportionment for state highways for the 1958-59 Fiscal Year was made in August, 1957; by the end of the calendar year 55 percent of it had already been programed on specific approved projects, with additional projects pending approval which would more than take up the remaining 45 percent.



Local citizens view maps, query engineers and discuss proposed route alternates at public meetings called by the Division of Highways. Full public discussion of proposed freeway routes is a long-standing policy of the California Highway Commission and the State Highway Engineer.

Freeway Route Discussions

One big reason for the effectiveness of California's planning program is the early determination of freeway routes by the Highway Commission. In most instances routings are adopted several years before construction funds are available.

Freeway routes are adopted by the commission only after long and extensive studies by Division of Highways engineers and after public meetings at which local views are offered and thoroughly discussed, and later considered by the division in its recommendations and by the commission in its determinations. A booklet entitled "Freeway Facts," distributed at these meetings, explains the route selection procedure. (Copies of this booklet are available on request).

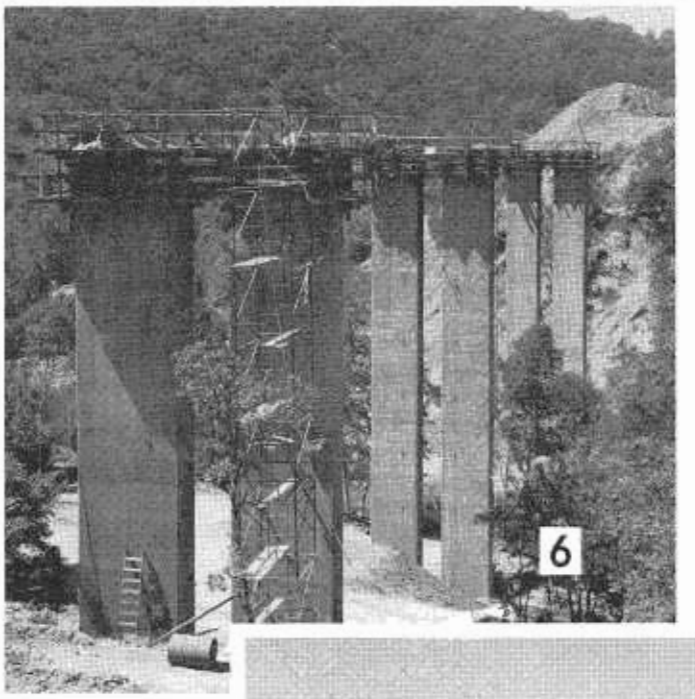
Full public discussion of proposed freeway routes is a long-established policy of the Legislature, the Highway Commission and the State Highway Engineer.

Special emphasis was given this phase in 1956-57. Ninety formal public meetings regarding routings were held by the Division of Highways. In addition, there were several hundred preliminary informational meetings and map displays.

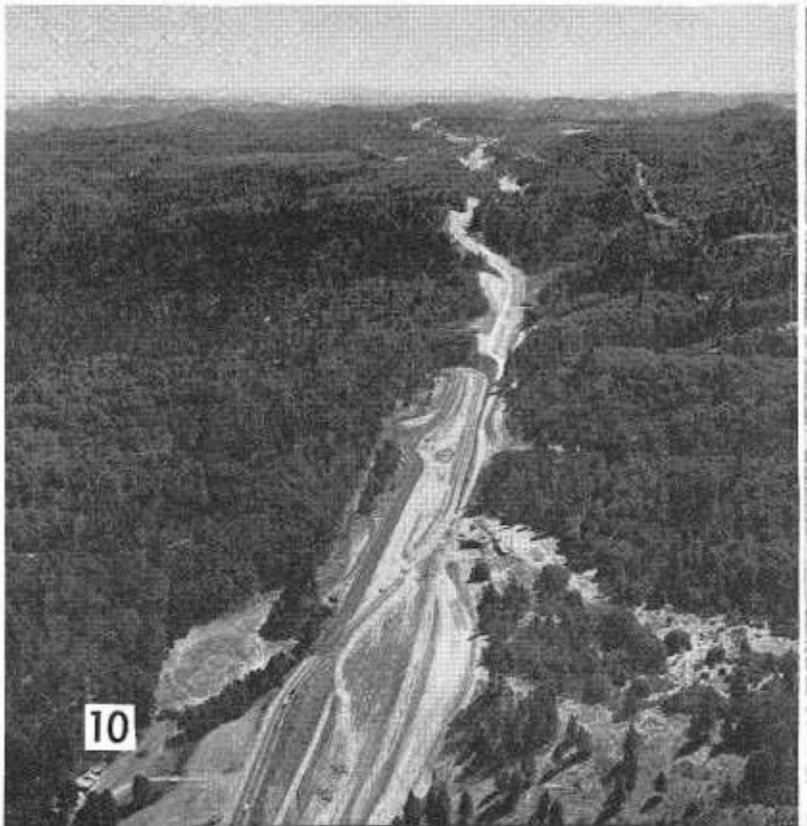
The Highway Commission frequently holds full-scale, official public hearings in the vicinities where new freeway routes are being considered. These hearings were scheduled either at the request of local authorities or on the Commission's own initiative.

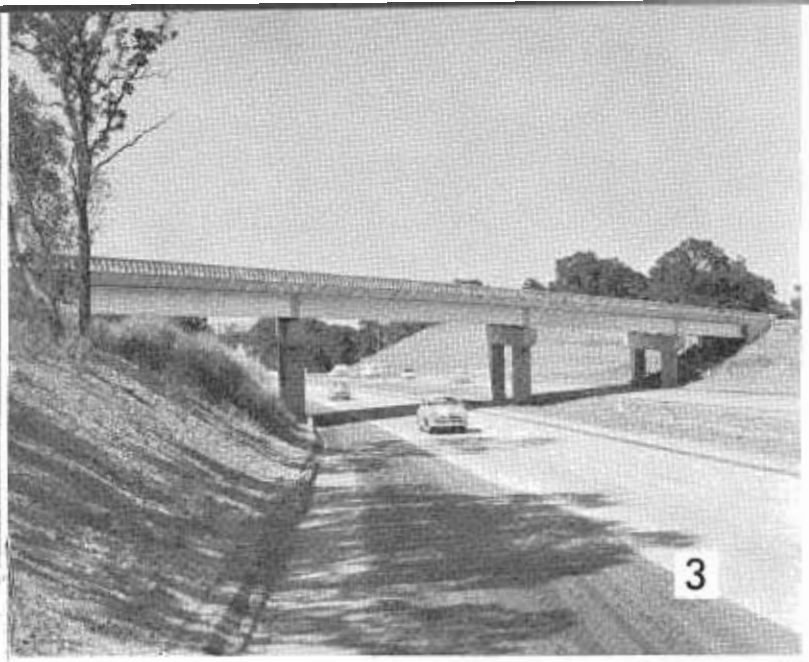
Freeway routes covering 551 miles were adopted during the fiscal year, and the total mileage of declared freeways on the State Highway System was 3,894 on June 30, 1957. By the end of the calendar year, it was 4,205 miles.

The Cypress Street Viaduct in Oakland, first double-deck freeway in the State, was completed and opened to traffic in 1957. It is a unit of the Eastshore Freeway.



1. *Victorville Bypass on US 66-91 tension of expressway across M*
2. *New section of San Diego Fr Sepulveda Canyon in West Los*
3. *Overcrossing on new expressw Atascadero, San Luis Obispo C*
4. *US 99 now carries traffic thr Valley center, on a full freewa*
5. *New section through Dublin lanes Oakland to Tracy.*
6. *Piers for bridge across East F 20 relocation around Coyote D*
7. *At Dyerville on US 101 (Red contractor used donkey engine*
8. *Alto interchange on US 101 s son Bay Bridge in background.*
9. *Cypress Street double-level fr Freeway with S. F.-Oakland B*
10. *Construction near Colfax, Pla making US 40 a divided highw*
11. *Newest section of Golden St Western Avenue Interchange;*
12. *On east side of Sierra Nevad 395 relocated; old winding ro*





1, with grading in progress for ex-
Mojave Desert to Barstow.
reeway extending southward from
s Angeles area.
way relocation of US 101 south of
County.
rough Fresno, major San Joaquin
ay.
Canyon makes US 50 now four

Fork of Russian River on Highway
Dam reservoir, Mendocino County.
dwood Highway freeway project),
es and cables to pull earth movers.
south of San Rafael; new Richard-

reeway viaduct connects Eastshore
Bay Bridge Distribution Structure.
cer County; another step toward
way across Sierra Nevada.
tate Freeway in Glendale above
looking toward Griffith Park.
da, Sherwin Grade section of US
oute in canyon in lower right.

Improved Methods

The stepped-up program of highway construction in California has been carried on successfully despite a nationwide shortage of engineers. This shortage has been overcome in large measure in this State through the use of new and improved methods, procedures and equipment.

Utilization of such improved techniques and equipment was increased in 1956-57.

Electronic computers were put to greater use in the tabulation of traffic data and other statistics, in the calculation of traverses in surveying, in the computation of earthwork quantities, and in making structural calculations in bridge design.

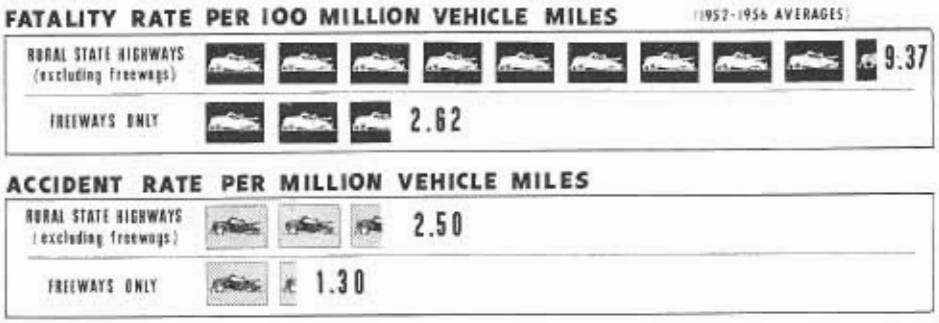
California also has expanded its use of aerial photography in connection with highway location, planning and design. Most preliminary surveys are now carried on by this timesaving photogrammetry method, with ground survey crews required only for establishing aerial control points and for checking.

Long-range Planning and Surveys

Several long-range surveys were in progress or completed during 1956-57 for incorporation in broad areas of highway planning.

Five major studies of this type were required by the Federal Aid Highway Act of 1956. These covered cost estimates for interstate highway needs; data on vehicle sizes and weights; possible reimbursement for previously constructed interstate highways; highway safety; and various phases of federal highway taxation.

Data developed in another long-range survey will be used in formulating a statewide system of freeways and expressways without regard to State, city or county jurisdictions. This study was required by Senate Concurrent Resolution 26, adopted by the State Legislature in 1957.

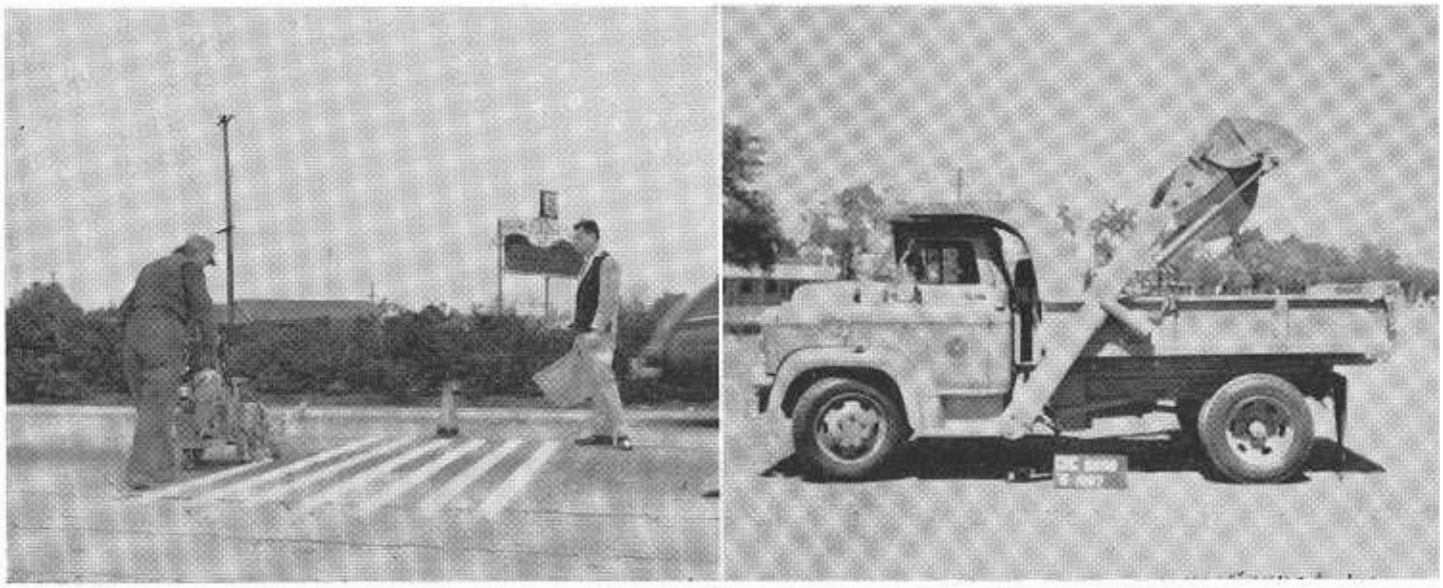


Traffic Flow—Accidents

The value of the modern freeway in saving life and limb, as well as in carrying large volumes of traffic, is once more demonstrated by the latest accident record figures.

The overall accident rate on rural state highways for the calendar year of 1956 was 2.60 per million vehicle miles; on full freeways, the rate was 1.25, despite the fact that the average daily traffic on freeways was more than 10 times higher. The average accident rates for the five-year period from 1952-1956, inclusive, were 2.50 per million vehicle miles on conventional highways and only 1.30 on full freeways.

Comparative rates on fatal accidents are even more impressive in favor of freeways. In 1956 the fatality rate on rural state highways was 9.47 killed per 100 million vehicle miles of travel; on full freeways the rate was 3.06. According to this record, the life of a motorist on a modern freeway is more than three times as safe per mile of vehicle travel as on conventional highways. The fatality averages for the 1952-56 period were 9.37 per 100 million vehicle miles on conventional highways and 2.62 on full freeways.



LEFT—Applying traffic stripes in connection with tests of various paints, part of the continuous program in materials research. RIGHT—The Equipment Department often modifies or adapts equipment to meet special requirements. This self-loader was installed on the truck by Highways Shop personnel for use in roadside cleanup work.

The average daily traffic on rural state highways in 1956 was 3,804 vehicles. Traffic on rural and urban freeways in operation during 1956 averaged 44,150 vehicles a day.

Heaviest travel in the State was recorded on a section of the Hollywood Freeway in downtown Los Angeles, which carried more than 190,000 vehicles a day.

Roadside Development and Erosion Control

During 1956-57 plans were prepared on 32 roadside development, landscaping or functional planting projects. In addition, on all construction contracts for projects situated in erosive soil areas plans were developed for basic erosion control planting.

Large quantities of various kinds of plants, shrubs and trees were used, including approximately 8,500 trees, 145,000 shrubs and more than 5,000,000 ground cover plants.

In 1957 the Highway Commission, in response to expressions of the Legislature, adopted a new policy calling for a moderate increase in freeway landscaping in the future. The budget for 1958-59 provides approximately $3,000,000 for both landscaping and functional planting projects.

Maintenance

Maintenance is an important and constant part of the work of the division, and California's varying climate and topography dictate a program of wide scope.

Snow removal in the passes of the Sierra Nevada Mountains is a difficult job handled each winter by the division's maintenance men. Here a rotary plow chews into a high snow bank on US Highway 40 near Donner Summit and deposits the snow on the far side.

Equipment and personnel are required for diverse tasks ranging from difficult winter snow removal in the high Sierra to the regulation of electronic traffic signals in many cities.

Cleanup and repair after winter storms is an annual maintenance chore. Care of roadside trees and landscaped highway sections is another duty. No small task, also, is picking up after litterbugs.

These jobs, together with constant patching, sealing, painting, spraying, shoulder maintenance, and various specialized tasks such as posting of warning and directional signs, make up much of the work of the division's maintenance crews.

To better co-ordinate its broad, statewide activities and keep up-to-the-minute tab on road conditions, the maintenance department has developed a system of radio communication which at the end of the fiscal year included 159 radio stations, 13 microwave stations and 700 mobile units throughout the State.

Weather, a dominant factor in the maintenance of highways, favored the operations of the maintenance organi-

Traffic engineers strive for maximum legibility in all types of traffic signs. Illuminated overhead signs such as the one pictured during the day (left) and at night (right), are used extensively on highways throughout the State.

zation during 1956-57. Road closures due to storms and other disruptions, such as forest fires and earthquakes, were held to a minimum. The total expenditure for maintenance work during the year was $27,240,234.

Equipment

Equipment maintained by the Division of Highways ranges from passenger cars and highway striping devices to motor graders and a fleet of 40 rotary snowplow units mounted on four-wheel-drive trucks.

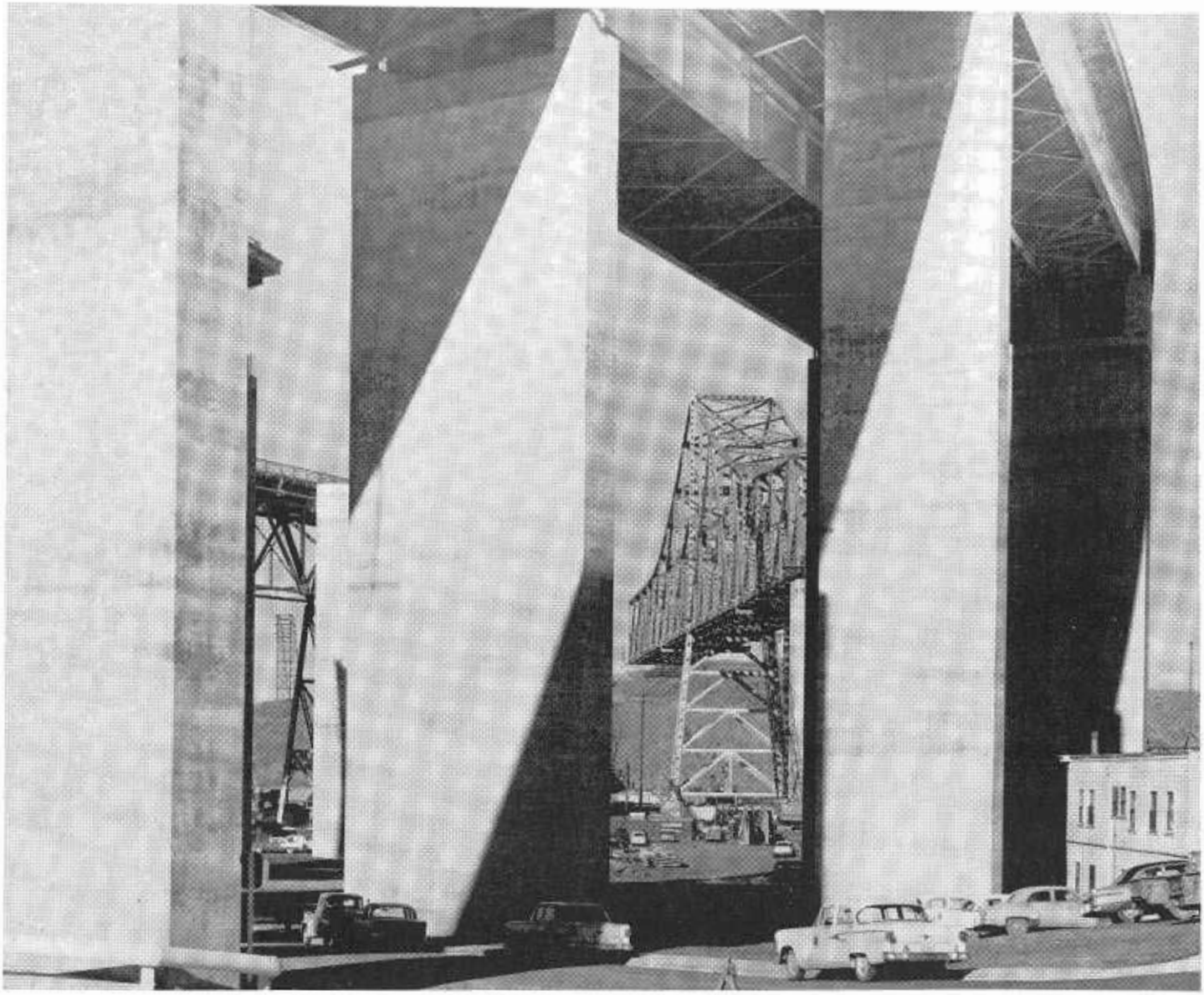
The accelerated highway program has resulted in increases in the Equipment Department's regular activities involving the procurement, repair and administration of major equipment used for highway maintenance. It also has meant increases in other activities such as the construction of experimental equipment to fill special needs and the modification of standard units to better meet specific requirements.

Most of the district shops have been enlarged in the past five years, and new shops, incorporating modern repair facilities, were completed during the fiscal year in Bishop, Fresno, and San Luis Obispo. Improvements also were made at the Eureka and San Diego shops.

Materials and Research

Two of the principal phases of Materials and Research Department activity are the testing of materials to be used in highway construction, and research aimed at developing improved use of materials and better construction methods.

This work is divided between the Headquarters Laboratory in Sacramento, four branch laboratories located in Los Angeles, Berkeley, Santa Maria and Bakersfield, and individual laboratories in each of the 11 state highway districts.



Construction is progressing on the parallel Carquinez Bridge which will connect with freeway sections now being built on US Highway 40 northeast of Oakland and through Vallejo. The bridge is one of several major projects which are under construction or budgeted on this interstate route between Oakland and the Nevada State Line. In view (center) between the giant piers which support approach roadways is a portion of the superstructure of the new bridge.

The district and branch laboratories for the most part are equipped to inspect and test various highway construction materials and carry on required special investigations. Additional testing, plus research and development work, is carried on at the Headquarters Laboratory in Sacramento.

Studies and research of the department involve investigations of such subjects as the design of roadways on soft foundation soils, the fatigue resistance of bituminous pavements, the resiliency of soils, volume changes in concrete, traffic paints and protective coatings, and the properties of prestressing steel and prestressed concrete.

Work on a new Division of Highways Materials and Research Laboratory Building is now under way in Sacramento and is expected to be completed in the spring of 1958. The new building will centralize the Headquarters Laboratory activities which are now carried on at four locations in the city.

Bridges

The Bridge Department, with its own facilities for design, construction, operation and maintenance, is responsible for all structures on state highways.

These include elevated freeways, traffic interchanges, overcrossings and undercrossings, and highway-railroad separations, as well as bridges over rivers, streams and other bodies of water.

The Bridge Department also supervises the operation of the state-owned toll bridges. Largest of these is the San Francisco-Oakland Bay Bridge, which carried a total of 33,751,448 vehicles in 1956-57.

The 1956-57 budget contained funds for construction, widening or strengthening of structures on the State Highway System at an estimated cost of $56,552,000.

Most spectacular of the current bridge projects is the Carquinez Bridge in Contra Costa and Solano Counties. This large scale project is financed by a $46,000,000 bond issue authorized by the California Toll Bridge Authority.

Construction of a freeway approach to the bridge in Contra Costa County involves the largest known highway cut in the history of road construction. The "Big Cut" will require the excavation of more than 9 million cubic yards of earth. By June 30, 1957, the contractor had completed excavation of nearly 7 million cubic yards.

Federal aid secondary county road projects are planned by the county and in most instances constructed with county supervision following review and approval by the Division of Highways. One large-scale 1957 FAS project was this improvement and interchange on the Alfred Harrell Highway near Bakersfield, Kern County.

At the end of the year nearly all phases of the bridge and approach construction were up to expected schedules. Provided normal weather and other factors prevail, the estimated date for opening the new bridge to traffic is December, 1958.

Right-of-way

A total of 9,391 right-of-way transactions were concluded in 1956-57. Of these, 97.16 percent were negotiated settlements with property owners; in only 2.84 percent of the cases was it necessary to complete court proceedings in eminent domain. Money expended for rights-of-way, including administration, amounted to $130,416,963.

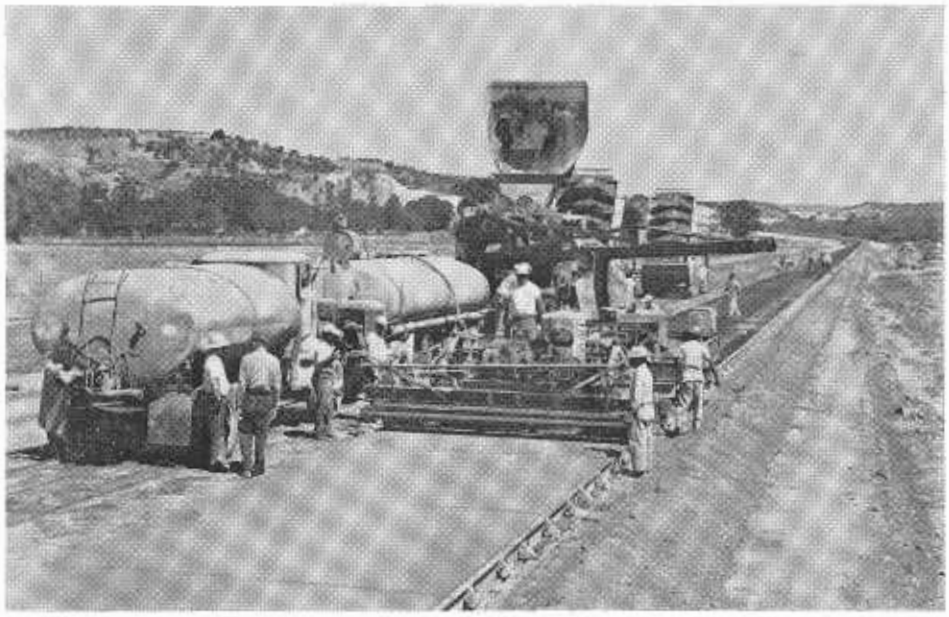
One reason for this success in concluding amicable negotiations is the division's policy of paying fair market value for required property. In dealings with right-of-way personnel owners can expect to receive the same amount for their holdings as they would from any other buyer under normal market conditions.

The methods and policies of the right-of-way department are outlined and explained in the booklet "14 Million People Want My Property," which is mailed to affected property owners before their property is appraised. (Copies of this booklet are available on request.)

Acquisition of rights-of-way in California is expedited in some cases by a special fund which has been authorized by the Legislature.

This $30,000,000 revolving fund has been set up for the advance purchase of rights-of-way on which costly improvements are slated. Expenditures from the fund are repaid from regular revenue when the construction period is reached for each project. The effect of this legislation is to make sufficient funds available to purchase land before improvements are made, even though actual highway construction may be some years in the future.

By making early purchases with revolving fund money it is estimated that a $164,000,000 reduction in rights-of-way acquisition costs has been made in the five years since the fund was established.



A contractor's paving train at work on a freeway section of US Highway 101 now nearing completion in the vicinity of Paso Robles

Federal Aid Secondary Projects

Out of the 68,000 miles of county roads in California, a total of 6,780 are on the Federal Aid Secondary System. For the most part, these roads are next in importance to state highways in terms of traffic volume and economic service. They are often referred to as "feeder roads" or "farm-to-market roads."

Federal money apportioned to the counties in 1956-57 for use in improving roads on the F. A. S. System amounted to $7,705,681. State highway funds made available to the counties for use in matching their federal allocations totaled $4,034,515.

Two changes in highway laws by the 1957 Legislature have meant an increase in county F. A. S. funds for 1957-58 and a corresponding decrease in the amount available for state highways.

One change was increasing from $100,000 to $200,000 the yearly maximum to be provided to a county as matching money from state funds. The other was increasing from 87½ percent to 98½ percent the amount of the State's F. A. S. apportionment which must be made available to the counties. Previously, the State retained 11 percent to improve state highways on the F. A. S. System. The State continues to use 1½ percent for long range planning. For 1958-59 the federal apportionment available for these county roads is $9,615,571; the state matching funds will amount to $6,-002,924.

Projects on federal aid secondary routes are planned and in most instances constructed under the direct supervision of the county involved. The Division of Highways, under federal regulations, has the responsibility for reviewing and approving these county projects. The division also assists in other phases when requested by the counties.

The largest source of revenue for all county road purposes is the 1⅜ cents share of the State's six cents a gallon gasoline tax. These funds are distributed directly to the counties by

Contractors' bids on highway construction projects are carefully checked as a part of the bid opening procedure

the State Controller, and are administered by local boards of supervisors. Apportionments are made according to law on the basis of proportionate motor vehicle registration and mileages of county maintained roads. For 1956-57 the counties received as their share of the gasoline tax, along with a portion of vehicle registration fees, a total of $72,682,437.

City Projects

The Division of Highways administers the allocation of the five-eighths of a cent gasoline tax revenue which goes to incorporated cities and reviews and approves city street improvements financed with these funds.

In addition, it also allocates engineering and administrative funds to the cities. These range from $1,000 for cities with a population of less than 5,000 to $20,000 for cities of more than 500,000 population.

During the year the total gas tax and engineering apportionment to cities was $29,219,480. City street construction and improvement projects approved by the division numbered 486.

Rising Costs

A constant problem in planning and financing highway improvements is the upward trend of construction costs. These increases have resulted from rising costs of labor and material, which were not fully offset by improved efficiency in construction machinery and operations.

The construction cost index maintained by the division reached a record high in the first quarter of 1957. After dropping slightly in the second and third quarters, the index again showed a rise in the final quarter. Costs at the end of the year were approximately 30 percent higher than in 1947.

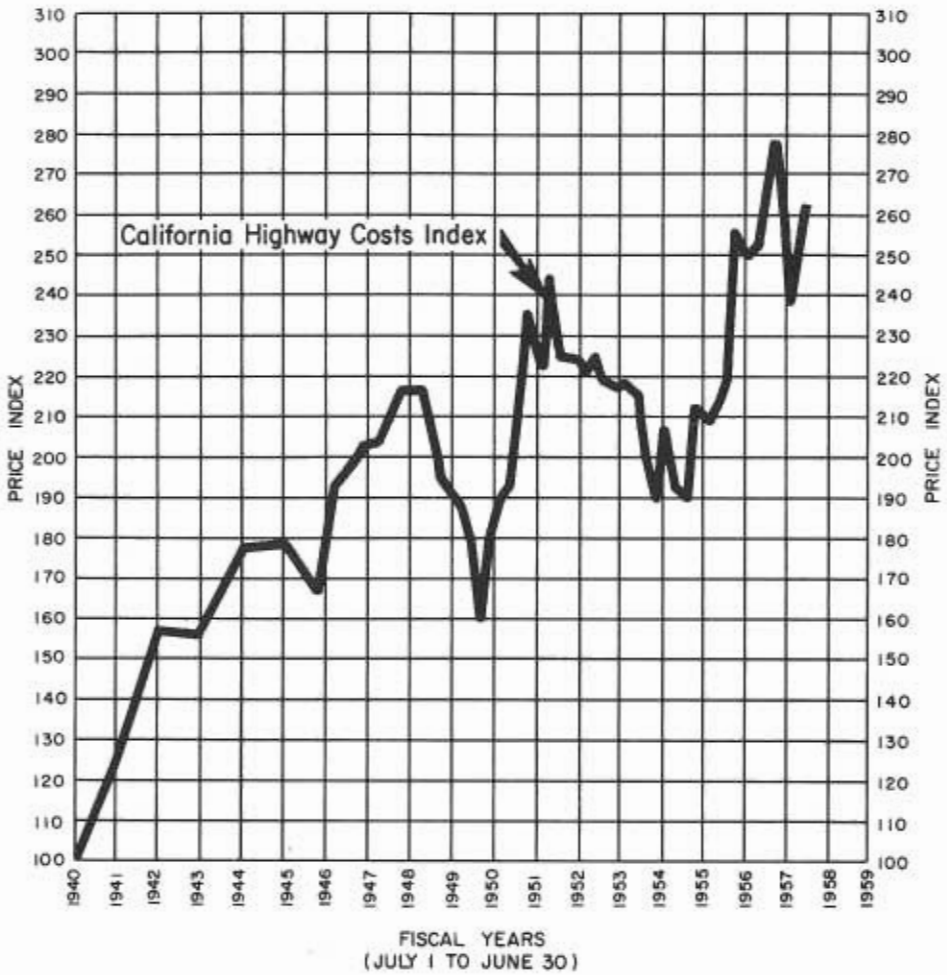
The average cost per parcel in right-of-way transactions also climbed. In 1955 this average was $9,789, and in 1956 it had risen to $14,430. A slight decrease to $14,128 was recorded in 1957, probably because fewer high-priced parcels in downtown areas were required.

Construction Contracts

Construction is performed by contract under competitive bidding, to insure that the public receives the greatest value for its highway tax dollar.

PRICE INDEX
CONSTRUCTION COSTS

1940 = 100



Contractors who desire to bid on state highway projects estimated to cost more than $15,000 are required to be prequalified by the division. Each contractor's financial capabilities, experience and resources are studied in determining the type and size jobs he is qualified to handle.

On June 30, 1957, there were 992 contractors, with varying prequalification ratings, eligible for bidding on state highway projects. Total bidding capacity of these contractors was approximately $1,800,000,000.

Construction projects are advertised for bids by the Division of Highways after the Director of Public Works, on the division's recommendation, has approved the plans, specifications and estimates. Contracts are awarded by the Director of Public Works, also on the division's recommendation.

The California Highway Commission

As indicated earlier, responsibility for highway route adoptions rests not with the Division of Highways, but with the California Highway Commission, which is a nontechnical, nonsalaried board of business and professional men representing the people of the State at large. Commissioners are appointed by the Governor, and the appointments are confirmed by the State Senate. The commission is a seven-man body with the State Director of Public Works as ex officio chairman. The other six members serve four-year staggered terms.

Present commissioners are Robert L. Bishop of Santa Rosa; H. Stephen

Chase, San Francisco; James A. Guthrie, San Bernardino; Robert E. McClure, Santa Monica; Fred W. Speers, Escondido; Chester H. Warlow, Fresno, and C. M. Gilliss, chairman and Director of Public Works. Frank B. Durkee retired as commission chairman and Director of Public Works on December 31, 1957.

In addition to administering highway finances and adopting freeway routes, the commission also approves county primary road systems and authorizes the execution of deeds, condemnation proceedings, and right-of-way abandonments.

The Division of Highways

Chief of the Division of Highways is State Highway Engineer G. T. McCoy. He directs the work of the division in planning, constructing, maintaining and operating the State Highway System and acquiring rights-of-way.

The State Highway Engineer has a headquarters staff in Sacramento composed of two deputy state highway engineers, four assistant state highway engineers, a chief right-of-way agent, and a comptroller. Each of the assistant state highway engineers is in charge of a group of specialized units.

For localized administration of the highway program, the State has been divided into 11 state highway districts. These districts have approximately equivalent state highway mileage. A district engineer is in charge of each district except that in the San Francisco and Los Angeles areas an assistant state highway engineer is in charge.

The district engineer is responsible for all phases of the highway program in his district. Information concerning local highway matters is most readily obtained at his office.

District offices are in these cities:

District I
Eureka
430 West Wabash Avenue
Sam Helwer, District Engineer

District II
Redding
1657 Riverside Drive
H. S. Miles, District Engineer

District III
Marysville
703 B Street
Alan S. Hart, District Engineer

District IV
San Francisco
150 Oak Street
B. W. Booker, Assistant State Highway Engineer

District V
San Luis Obispo
50 Higuera Street
A. M. Nash, District Engineer

District VI
Fresno
1352 West Olive Avenue
W. L. Welch, District Engineer

District VII
Los Angeles
120 South Spring Street
E. T. Telford, Assistant State Highway Engineer

District VIII
San Bernardino
247 Third Street
C. V. Kane, District Engineer

District IX
Bishop
South Main Street
E. R. Foley, District Engineer

California's 11 state highway districts. The black dots represent cities in which district offices are located.

District X
Stockton
1976 East Charter Way
J. G. Meyer, District Engineer

District XI
San Diego
4075 Taylor Street
J. Dekema, District Engineer

A Look at the Future

All highway improvements, whether resurfacing, minor realignments or new freeways, mean added convenience and safety for California motorists.

Completed projects, which alleviate acute local traffic problems, take on added significance as part of the continuing, long range program of highway development.

Thus, the improvements of 1956-57 will be enhanced by those financed in the current 1957-58 State Highway Budget and the already adopted 1958-59 Budget. A combined total of approximately a billion dollars has been provided for highway construction, including rights-of-way, in the three fiscal years.

Spectacular progress will be made with this money, and these gains will be important, but measured against the State's increasing population and traffic congestion, they will represent only a portion of the work that must be done.

Durkee Retires; Gilliss Named

31-year Career in State Service Comes to Close

Frank B. Durkee, Director of the California State Department of Public Works since 1951, closed a 31-year career in the service of the State by retiring December 31, 1957.

He chose the end of the month in which he reached his 65th birthday to retire as departmental director, as Chairman of the California Highway Commission, and as Member of the California Toll Bridge Authority and other state boards, commissions and committees.

Many paid tribute to Durkee.

Governor Goodwin J. Knight said:

"Mr. Durkee has faithfully served the people of California for more than three decades and no one is more deserving of relief from the heavy burden of responsibility than he.

"The achievements of the Department of Public Works during the past six years reflect great credit upon his administration."

Lauded for Progress

Resolutions of local governmental groups and chambers of commerce lauded Durkee for the "outstanding contributions" he made to the progress of California public works and for the "devotion he gave to the highway system for more than 30 years."

"His outstanding ability, tact and judgment have added lustre to the state office in which he served," said a resolution of the Golden Gate Bridge and Highway District.

Typical of the resolutions of governmental bodies was one adopted by the City of Redding. It commended Durkee "for his long and faithful service to the people of the State of California in the many activities to which he has contributed and the offices he has held."

Honored by Commission

The California Highway Commission adjourned its December meeting to honor Durkee. Chester H. Warlow, a commission member for 14 years, spoke for his fellows in paying tribute to the man who has been commission chairman for the past six years.

"Frank Durkee has served the State magnificently," Warlow said, "from

... Continued on page 42

FRANK B. DURKEE

C. M. GILLISS

Deputy Promoted to Head Public Works Department

C. M. Gilliss, public works executive, engineer and accountant, became Director of the California State Department of Public Works and Chairman of the California Highway Commission on January 1st.

He was appointed by Governor Goodwin J. Knight to succeed the retiring director, Frank B. Durkee.

Gilliss has been a highway and public works administrator for a decade and has been in the State Department of Public Works for the past five years.

The Governor's appointments name him to the California Toll Bridge Authority, State Public Works Board, and State Allocation Board, as well as to the directorship of the Public Works Department and the chairmanship of the Highway Commission.

On Governor's Staff

Gilliss has been Deputy Director of the Department of Public Works since September 23, 1955, except for the period January 3 to September 16, 1957, when he was a secretary on Governor Knight's staff assigned to legislative duties.

Born and reared in Oklahoma, Gilliss attended Riverside Junior College, Riverside, California; Oklahoma A. and M. College, and the University of California at Los Angeles where he majored in business administration and engineering.

He began his business career at Riverside in 1937 as an accountant for a private corporation and later became chief of its central accounting systems. He became associated with the International Business Machines Company in 1940 as an engineer and later was an engineering instructor and sales representative in New York, Seattle, and Los Angeles.

Becomes Highways Administrator

In November, 1946, he entered public service for the first time as a systems

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DURKEE RETIRES

Continued from page 41 . . .

the bottom of the ladder up to the top.

"He has given the people of the State dedicated service, coming from his heart and soul. He has done much toward building the California Highway System up to where it stands the envy of the Nation."

Warlow told Durkee that the commissioners and Public Works Department employees "have every hope you will stay young in retirement and will keep busy doing the things you want to do."

Durkee briefly reviewed his directorship in his letter to Governor Knight, announcing his intention of retiring.

"It has been an honor," the letter said, "to have served as Director of Public Works during your administration and that of Governor Earl Warren. During this period of California's great growth, the Department of Public Works, through its Divisions of Architecture and Highways, has administered the greatest construction program in the State's history.

"In relinquishing my duties and responsibilities, it is a source of great pride to me that the highway organization of this department has been recognized as being outstanding among the highway departments of the Country, and that the Division of Architecture has become the largest such organization in any state."

Durkee is an attorney and was a newspaperman and a chamber of commerce executive before going into state service. He was born in Oregon on December 3, 1892.

His first state post, which he took in November, 1923, was as editor of *California Highways and Public Works* and public relations representative of the California Highway Commission.

He became a member of the legal staff of the Department of Public Works in 1927 as a general right-of-way agent. His first assignment in this position was the planning of a rights-of-way organization for the Division of Highways.

He resigned in 1928 but returned again to state service in February, 1931, moving up through the legal staff of the department to the position of principal attorney in the Division of Contracts and Rights-of-Way. In May, 1948, he was selected as deputy director of public works, a position he held until his appointment as director by Governor Warren.

In 1927 Durkee served on a committee to draft plans for the formation of an organization of state employees. Out of the work of the committee grew the present-day California State Employees' Association. He is a charter member of Sacramento Chapter No. 2 of the C. S. E. A.

Durkee spent most of his boyhood in Chico, Butte County, where he was later manager of the chamber of commerce for several years. He is a graduate of Chico High School and studied law at the University of Southern California.

He is a long-time resident of Sacramento. Mrs. Durkee is the Secretary and Treasurer of Natomas Company. They have two sons, Frank B., Jr., who is with the Division of Architecture, and Travers E., an administrative analyst with Los Angeles County.

Through his many years of association with the Department of Public Works, Durkee is familiar with, and has worked on, legal and administrative phases of many major highways, water resources, architectural and bridge projects of the State of California.

He is a member of the Commonwealth Club, and a charter member in Sacramento of the American Society for Public Administration. He is also a Rotarian and a member of the Grandfathers' Club of Sacramento.

Latest Highway Statistics Given

The Division of Highways had under way 242 contracts with a total value of $382,243,800 on January 1, 1958.

The length of freeways, expressways and other multilane divided highways on the State Highway System either completed or under construction on the same date was 2,180 miles.

Forty highway contracts totaling $24,367,800 were completed during December, 1957.

Twenty-three highway contracts totaling $6,707,900 were awarded during December, 1957. On January 2d, an additional five contracts totaling $3,854,100 were awarded from the 1958-59 Budget.

Retirement Ends 34-year Service

Mrs. Jessie Hillery Steen of District X retired on January 1, 1958, after having served with the State of California for some 34 years.

Mrs. Steen was born in New York City. She was educated in a private school, started her business career as a stenographer, and moved to California in December of 1920, settling in Sacramento where she was employed by an automobile concern.

MRS. JESSIE STEEN

Mrs. Steen was given an appointment as stenographer in Governor Stephen's office in the fall of 1921. At the expiration of Governor Stephen's term, she again went to work for private industry and later was appointed as stenographer in the Board of Control, Department of Finance.

In June, 1928, she went to work for District X of the Division of Highways as a clerk. When headquarters office was moved to Stockton in 1933, Mrs. Steen transferred with many of the other "old timers." Since then she has been employed as switchboard operator and receptionist.

Mrs. Steen is a member of Rhodora Club, the Business and Professional Women's Club and El Toyon Chapter of Daughters of the American Revolution. She expects to be busy with activities in connection with these clubs, as well as with her church work. She is especially fond of history and is planning to devote considerable time to reading on the subject.

Governor Officiates at Ground Breaking for New State Building

Ground breaking ceremonies were held in Los Angeles January 3d for a new state office building designed to be California's most adaptable structure of its kind.

The new building will have interior partitions, lights, heating, cooling, and even the number of elevators adjustable to the needs of 4,000 employees of 25 state agencies who will occupy the building in 1960.

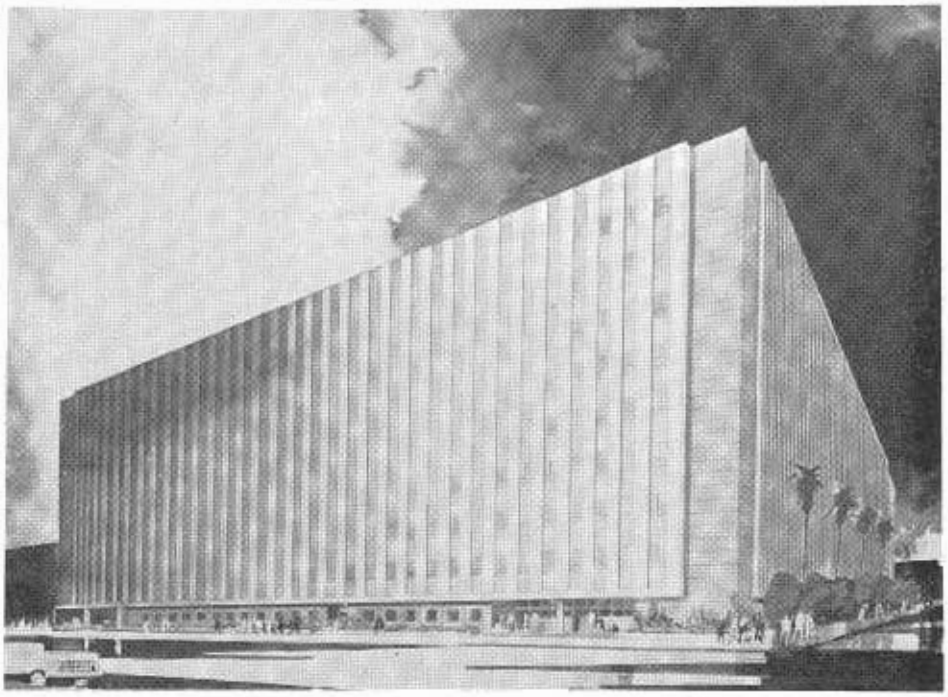
Governor Goodwin J. Knight was the principal speaker at the ceremony, which took place on the construction site in Los Angeles' Civic Center.

"The project for which we break ground today," Governor Knight said, "will be a notable addition to the magnificence of this city and to the perpetuation of efficient government for all California.

"There is no better example of how much the world is changing than that provided by the unprecedented expansion of the State of California. It may well be that Los Angeles itself is the scene of the most unrelenting development to be observed anywhere in the world."

Legislators and other state officials were guests at the ceremony along with city and county officials and business and labor leaders. They were introduced by C. M. Gilliss, Director of the State Department of Public Works, who presided.

The new office building will cost $8,500,000; an adjacent garage and a tunnel under the Broadway-First Street intersection, connecting with the existing State Office Building, will bring the total project cost up to $12,000,000. The new building will have 550,000 square feet of space which may be partitioned and rearranged as required. In addition to movable partitions throughout there will be movable ceiling light panels and heating and refrigerated air conditioning adjustable to provide the temperatures desired in different zones or offices of the building. Space will be provided for later additions of elevators and installation of escalators when they are needed.



Governor Goodwin J. Knight, heading a group of state legislators and other state and local leaders, spoke at the ground breaking for the State's newest and most adaptable office building. The artist's sketch shows how the building will appear.

Provision has been made in the plans for the seven-story, 900-car state garage to be built next to the office building so that two additional stories may be added in the future when needed.

A food service facility will be constructed on the second floor and will include an outdoor eating area. A 400-seat auditorium and nine conference rooms will be built on the first floor.

The main lobby of the building will be on the Broadway side. A second lobby, opening onto First Street, will be for the primary use of the Department of Employment. A third lobby on the Hill Street side will serve the Departments of Corrections and Youth Authority.

Another new feature of the building will be sets of tracks around the exterior supporting wheeled trucks or spiders for the use of window washers and repair men.

Design, planning and construction of the entire project are under the supervision of the Division of Architecture of the Department of Public Works. The department contracted with a private architect, J. E. Stanton of Los Angeles, for the buildings.

The two new structures will occupy the northern three-quarters of the block bounded by Broadway, Hill and First and Second Streets. The office buildings will be built on 1½ acres and the garage will occupy about three-fourths of an acre.

Cost Index

Costs Resume Upward Trend In Fourth Quarter of 1957

By J. P. MURPHY, Assistant State Highway Engineer
H. C. McCARTY, Office Engineer
LLOYD B. REYNOLDS, Assistant Office Engineer

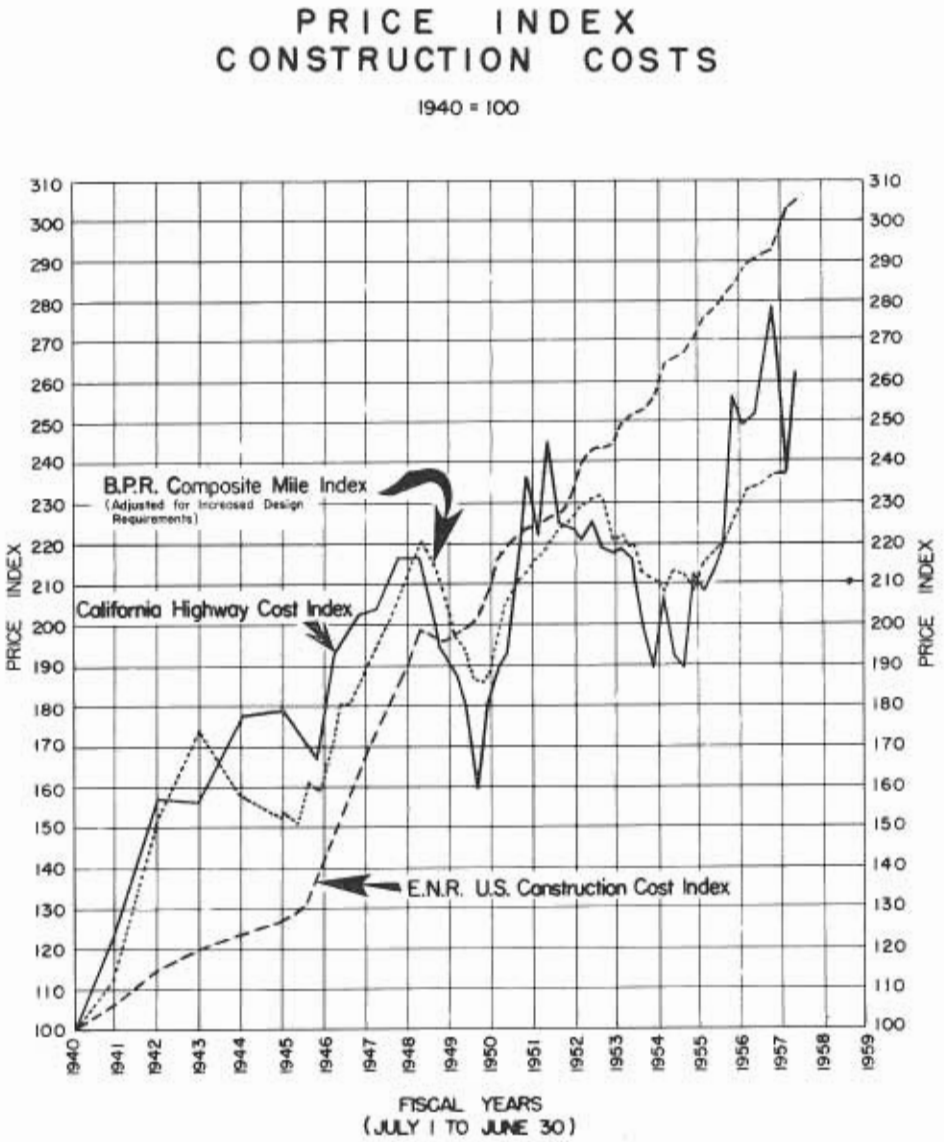
THE CALIFORNIA Highway Construction Cost Index returned to an upward course in the fourth quarter of 1957 after successively following a downward direction in the second and third quarters. The Index now stands at 262.1 (1940 = 100) which is 24.6 index points or 10.4 percent above the third quarter. It is 10 points or 4 percent above the fourth quarter a year ago.

Projects for which bids were opened during this quarter were smaller in number than prevailed last year. The percentage of multimillion-dollar freeway projects was about equal in the two periods but the value of smaller projects was considerably less this year. This has had the tendency of excluding the item values of small projects from exercising an influencing effect on the overall index behavior.

The increase in the Index standing during this period is, in great part, caused by bid prices received for roadway excavation in connection with two major freeway projects. These projects are situated on US 40 at high elevations in the Sierra Nevada range of mountains where almost solid granite formations are encountered. The short construction season of less than seven months as well as the difficult excavation to be encountered undoubtedly had an effect on the bid prices for these high altitude projects.

In addition to the effect of the roadway excavation price on the Index, the prices of the plant-mixed surfacing and portland cement concrete for both pavement and structures on the same projects had considerable influence. The mountain location of these projects is such that aggregate production and transportation costs for aggregates, cement and asphalt are all considerably greater than are generally required.

Portland cement concrete pavement to be used on these projects will consist of a six-sack mix. Data for this Index was adjusted to compare on the same basis with other projects where five-sack mixes were required. Pavement using five sacks of cement per cubic yard is standard in California but in these special instances because of severe winter weather conditions coupled with heavy traffic volumes a higher cement content was specified.



Four of the seven items used in this Index show increases in varying amounts while the remaining three items represent decreases.

Roadway excavation averaged $0.68 per cubic yard, increased from $0.42 prevailing in the third quarter. Reasons for the increase are explained above.

Untreated rock base dropped to $1.78 per ton from last quarter's price

of $2.34 establishing a new low. It appears that project location and supply of this material are the cause of the reduction.

Asphaltic and bituminous mixes with higher price averages in previous quarters rose from $5.10 per ton to $5.45 in this period. The previous $5.10 per ton price was attributed to a large project favorable to lower costs and the large resurfacing program in progress during the early part of the third period. These conditions did not prevail in this quarter and with the explanation above, a price increase was to be expected.

Portland cement concrete pavement with a previous standing of $14.34 per cubic yard rose to $16.88 which price was adjusted for two projects requiring six sacks per cubic yard.

Class "A" portland cement concrete, structures, increased $0.92 to $59.76 in this period. The price, while higher, is almost identical to the average for the same period last year.

Bar reinforcing steel shows a negligible decrease of $0.001 to $0.129 this quarter.

Structural steel dropped from the previous average of $0.200 to $0.177 in this quarter. The decrease is substantial and it would indicate that advances previously included in steel bid prices to allow for delivery delays are no longer a consideration.

At the right is a tabulation showing average unit prices upon which this index has been computed since 1940.

Data for preparation of this quarter's index was provided by 95 projects of which 52.6 percent were under $50,000; 7.4 percent ranged from $50,000 to $100,000; 17.8 percent ranged from $100,000 to $250,000; 7.4 percent ranged from $250,000 to $500,000; 5.3 percent ranged from $500,000 to $1,000,000 and 9.5 percent were over $1,000,000. The total bid value of these projects amounted to $40,045,400 and the projects under $50,000 accounted for 2.1 percent of the total; between $50,000 and $100,000 was 1.4 percent; between $100,000 and $250,000 was 7.0 percent; between $250,000 and $500,000 was 6.0 percent; between $500,000 and $1,000,000 was 7.9 percent and over $1,000,000 was 75.6 percent.

Bidder competition was extremely good during this quarter showing an average of 8.8 bidders per project. The average for the third quarter was 6.2, and was 5.1 for the fourth quarter of 1956. An average of 5.1 was obtained for the fiscal year ending June 30, 1957. The accompanying table shows in detail the number of

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CALIFORNIA DIVISION OF HIGHWAYS AVERAGE CONTRACT PRICES

	Roadway excavation, per cu. yd.	Untreated rock base, per ton	Plant-mixed surfacing, per ton	Asphalt concrete pavement, per ton	Asphaltic and bituminous mixes, 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	0.064	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[1]	5.31	4.58	--	12.74	50.59	0.093	0.133
1954	0.45	2.13	4.50	4.86	--	14.41	48.42	0.094	0.124
1955	0.39	2.22	4.93	--	--	13.35	45.72	0.095	0.142
1st quarter 1956	0.49	2.08	5.40	6.50	--	14.05	52.51	0.105	0.166
2d quarter 1956	0.51	2.06	6.27	--	--	14.64	57.13	0.113	0.219
3d quarter 1956	0.52	2.27	6.12	--	--	15.57	56.32	0.121	0.178
4th quarter 1956	0.52	2.21	--[2]	--[2]	$5.93[3]	14.95	59.63	0.112	0.197
1st quarter 1957	0.63	2.10	--	--	5.94	17.28	61.14	0.129	0.235
2d quarter 1957	0.63	2.10	--	--	6.18	15.59	58.61	0.119	0.204
3d quarter 1957	0.42	2.34	--	--	5.10	14.34	58.68	0.130	0.200
4th quarter 1957	0.68	1.78	--	--	5.45	16.88[3]	59.76	0.129	0.177

[1] The item of crusher run base was used before 1953.
[2] Asphalt concrete pavement combined with plant-mix surfacing in fourth quarter 1956, and will be identified as asphaltic and bituminous mixes in the future.
[3] Two projects with six-sack mix adjusted to five-sack basis.

NUMBER AND SIZE OF PROJECTS, TOTAL BID VALUES AND AVERAGE NUMBER OF BIDDERS (July 1, 1957, to December 31, 1957)

Project volume	Up to $50,000	$50,000 to $100,000	$100,000 to $250,000	$250,000 to $500,000	$500,000 to $1,000,000	Over $1,000,000	All projects
Road projects							
No. of projects	96	24	30	12	7	2	171
Total value*	$1,630,100	$1,831,305	$4,920,950	$4,071,504	$4,603,119	$2,731,297	$19,788,275
Avg. No. bidders	5.5	7.3	8.6	10.4	9.1	10.0	6.9
Structure projects							
No. of projects	22	2	11	2	----------	4	41
Total value*	$444,988	$136,720	$1,855,778	$526,398	----------	$15,102,276	$18,066,060
Avg. No. bidders	6.5	8.0	12.1	10.0	----------	8.5	8.4
Combination projects							
No. of projects	----------	----------	----------	----------	----------	11	11
Total value*	----------	----------	----------	----------	----------	$41,285,240	$41,285,240
Avg. No. bidders	----------	----------	----------	----------	----------	10.0	10.0
Summary							
No. of projects	118	26	41	14	7	17	223
Total value*	$2,075,088	$1,968,025	$6,776,728	$4,597,902	$4,603,119	$59,118,813	$79,139,575
Avg. No. bidders	5.7	7.3	9.6	10.4	9.1	9.6	7.3

* Bid items only.

Total Average Bidders by Months

	July	August	September	October	November	December	Average for six months
1957	6.2	6.3	5.7	8.2	9.2	9.5	7.3
1956	3.8	3.7	3.7	4.2	5.3	6.1	4.3

Atwater Bypass

Further Progress Made on US 99 Freeway Construction

By ROBERT W. GILLISPIE, Resident Engineer

ANOTHER traffic bottleneck on U. S. Highway 99 has been eliminated by the opening of the Atwater Bypass. The 4.5 miles of full freeway was dedicated by the Mayor of Atwater and opened to traffic on October 14, 1957. Work was completed approximately one month later.

The $2,500,000 project was awarded to Gordon H. Ball Company and Erickson, Phillips and Weisberg as a joint venture in July of 1956. Their work was finished well ahead of the scheduled completion date of December 12, 1957.

The City of Atwater is a farming community located in the Central Valley area and is the home of many personnel stationed at nearby Castle Air Force Base. The former Highway 99 through Atwater is a narrow two-lane road with two sharp reversing curves at each end of the business district. Due to restricted sight distance and the interference of local traffic, speed zones of 45, 35 and 25 miles per hour were in effect in the four-mile stretch. A portion of the old highway was reconstructed to serve as a frontage road serving Atwater and also used as an on and off ramp to the freeway for traffic entering and leaving the city. This portion of US 99 was taken into the State Highway System in 1912 and was declared a freeway in 1955. Part of the reconstruction work done on old US 99 was over old concrete pavement on which no surfacing had ever been placed since it was constructed in 1926.

Local traffic is served by four interchanges and almost continuous frontage roads providing short travel time to every area of the community. Erickson, Phillips and Weisberg constructed seven structures of which two are of reinforced concrete girder construction and five are welded steel girder bridges. Five of the bridges cross the Southern Pacific Railroad tracks which roughly parallel old US 99.

The Buhach Road interchange consists of two bridges, one a reinforced concrete girder structure carrying northbound traffic over the southbound ramps and one of steel construction which carries local traffic over the four-lane divided highway and the railroad. This interchange is unique in that the southbound acceleration and deceleration lanes are to the left of traffic and approximately

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An aerial view looking northwest along the new US 99 Bypass of Atwater. In the foreground is the East Atwater overhead and the Broadway frontage road. The dark road in the center of the picture extending from foreground to background and paralleling the railroad tracks is old US 99.

Orange County

Freeway Construction Program Moves Ahead

By BASIL N. FRYKLAND, Construction Engineer, District VII

THE COMPLETION of the Santa Ana-San Diego Freeway in its entirety through Orange County will provide that fast-growing important area of California, now having more than 584,000 population, with one of the most modern and efficient highway facilities yet engineered. In addition to handling a large part of the county's registered vehicles (242,640 out of a total of 7,212,642 for the entire State) it will provide a through portal for transportation of people and goods from metropolitan Los Angeles southeasterly. Greatly benefited will be Orange County's 135 nationally known manufacturers and the thousands of travelers in and about the area.

BASIL N. FRYKLAND

The southbound traveler using the Santa Ana Freeway route in Orange County through the Cities of Buena Park, Anaheim, Santa Ana and Tustin is struck by the homes, industries and businesses along this great traffic artery. As he continues south of Santa Ana, after passing beyond El Toro, industry and business gives place to sprawling ranch lands and truck farms, walnut and citrus groves, eucalyptus windbreaks, olive trees, California oaks, tomato farms, sheep and cattle pastureland.

Irvine Ranch Longest

The freeway here bisects the vast terrain known for the past 90 years as the Irvine ranch, one of the most fertile regions in California, lying between the Santa Ana Mountains and the Pacific Ocean. The Irvine ranch, one of the largest in California, is 22 miles long by nine miles wide, extending over an acreage in excess of 80,000 acres. It entirely surrounds the El Toro Marine Corps air base, the site for which was carved from the Irvine ranch. In 1957 the acreage was used for crops as follows: barley, 6,000 acres; lima beans, 7,000; persimmons, 100; oranges, 3,450; walnuts, 1,000. The ranch also raises avocados, grapefruit, lemons, blackeye beans, sugar beets, and vegetables. Grazing over the 48,000 acres of hilly pasture are 2,500 head of range cattle.

The landscape is hillier farther south, approaching the coastal area of San Juan Capistrano and San Clemente. Here the existing highway proceeds along a canyonlike defile, through orange and avocado groves and the surrounding hills—green pasture lands in the rainy season—until it opens onto the coast at Capistrano Beach. The existing highway then follows along the base of the cliffs through the City of San Clemente where it crosses the line into San Diego County.

Construction in Progress

The southernmost construction on the Santa Ana-San Diego Freeway is the beach city of San Clemente, a section 2.3 miles in length, between San Mateo Creek and 0.1 of a mile south of Avenida Cadiz. Robert M. Innis, Resident Engineer, reported that the $2,724,400 job is progressing as scheduled with an anticipated completion date of September 18, 1958. The contractors are J. E. Haddock, Ltd., and Cox Bros. One of the principal problems at the construction site is the necessity of relocating existing utilities at an estimated cost of $300,000. Workmen also have the further problem of excavating beside a high pressure gas line—a pipe 14 inches in diameter carrying gas at 400 pounds of pressure per square inch—throughout the length of the job. An important additional feature is the installation of 22,000 feet of storm drain to provide water runoff, and construction of a 172-foot-span steel girder bridge at a cost of $250,000. Construction is continuing normally with excellent cooperation from utility personnel and local city officials.

Not far distant to the north of San Clemente, at the junction of U. S. Highway 101 and 101 Alternate on the rocky shelf of the Pacific, is Dana Point, which has taken its name from Richard Henry Dana, author of the autobiographical novel *Two Years Before the Mast*. In 1834-36 Dana shipped aboard the brig *Pilgrim* and came to the coast at San Juan Capistrano, where he helped gather cargoes of steer hides, then a flourishing business there. The hides were brought by cart from the mission to the seaside and pitched from the cliff to the beach below.

Will Erect Bridges

Inland from Dana Point, northwesterly of San Clemente, is San Juan Capistrano where another link of the San Diego Freeway is now under construction. This portion of the freeway is located between 2.2 miles south of Route 64 and Trabuco Creek, a distance of 4.1 miles, and is scheduled for completion in September, 1958, at a total cost of $4,233,000. Peter Kiewit Sons Co., is the contractor, and the resident engineer is James L. Needham. Two bridges will be erected over San Juan Creek—both steel girder structures 600 feet in length and costing a total of $1,000,000. The contractor has been faced with the serious complication of pumping excess ground water at the bridge site prior to driving, piling and constructing bridge footings. The path of this freeway link through San Juan Capistrano and around the Mission was designed from aerial surveys and, as such, is unique in District VII freeway development.

The San Diego Freeway at San Juan Capistrano traverses a colorful

Looking northwest along Santa Ana Freeway under construction between City of Anaheim in foreground and City of Buena Park in background. In center is Broadway-Anaheim shopping center.

bit of California rich in history and local lore. It was here in November, 1776 that under the direction of Franciscan Father Junipero Serra the seventh mission of a total of 21 in California, stretching from San Diego to Sonoma was founded and called San Juan Capistrano. Styled as "the jewel of the missions," it today attracts tourists from everywhere who come to look at the mission corridors, arches, gardens, fountained courts and famous colony of swallows.

Murietta's Tree

A northerly access road to the San Diego Freeway through San Juan Capistrano passes a massive 300-year-old sycamore, said to have been a trysting place of the early Californian bandit Joaquin Murietta. The meeting of this ancient landmark with the modern freeway was discussed by a local paper, the *Coastline Dispatch*, on August 8 and August 15, 1957.

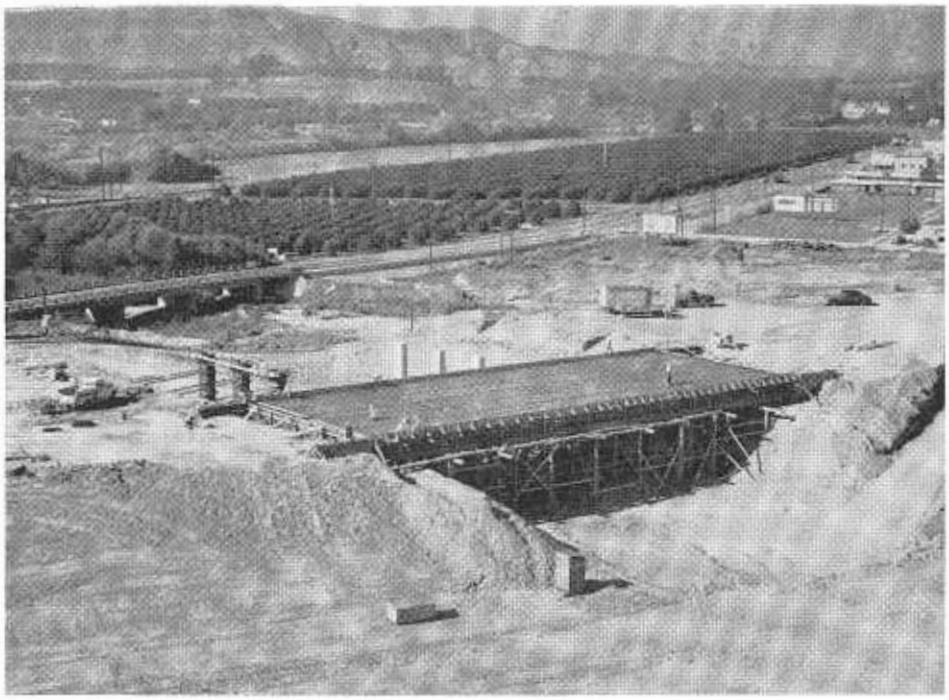
"The large sycamore at one time had Murietta's name carved in its base, but it has gradually been obscured by the growing giant, until only a scar remains. It is more than 170 feet high and covers the better part of an acre. It was probably a landmark as far back as Padre Serra's day. The tree is located approximately one-half mile north of Mission San Juan Capistrano and is about 200 yards from Highway 101. * * * An example of the State Highway Department interest in maintaining historical sites, is (the) certainly favorable decision on rerouting an access road on former Buchheim property to bypass a landmark tree."

Northwesterly of San Juan Capistrano, along the old U. S. Highway 101 there is no new construction until reaching Niguel Road intersection at El Toro. Construction is in progress from Niguel Road to Laguna Road on a section 6.6 miles in length. This link will cost $2,420,200 and is scheduled for completion in September, 1958. The resident engineer is James D. Hetherington, and the contractors J. E. Haddock, Ltd., and Cox Bros.

Big Drainage Problem

The next in line, constructionwise, along the San Diego-Santa Ana Freeway is a Winston Bros. contract, 5.7 miles in length, between 0.2 mile south of Laguna Canyon Road and 0.3 mile north of Browning Avenue, costing $3,614,000. This portion of the freeway is scheduled for completion in June, 1958. The resident engineer is Chas. J. McCullough. In order to handle the considerable drainage problem, airblown mortar is being used in the runoff channels, which range from the two-foot, round-bottom type to the 15-foot V bottom. This drainage facility is the longest in the district, requiring 42,000 square yards of mortar at a cost of $200,000.

By far the most complex system of interlacing roadways on this freeway is in the Anaheim area at the junction of the Santa Ana Freeway and the Route 175 Freeway, locally called the "Houston Freeway." A 6.5-mile length of the Santa Ana Freeway is being constructed in this area under three separate contracts held by J. E. Haddock, Ltd., and R. M. Price Company, of Pasadena. These contracts extend from Coyote Creek in Los Angeles County, a short distance northerly of the Orange county line, to Ball Road in the City of Anaheim. A single contract on



Overcrossing on the San Diego Freeway. This section of the freeway passes through San Juan Capistrano. It is 4.1 miles long and will be completed sometime during the fall of 1958 at a cost of $4,223,000.

the Houston Freeway, held by Griffith Company of Los Angeles, extends from the Santa Ana Freeway easterly to Spadra Road in the City of Fullerton, a distance of 3.61 miles. Twenty-five bridges are included in the four contracts. Seven are under construction to provide traffic interchange at the junction of the two freeways. Six additional bridges will be required when the Houston Freeway is extended to the west at some future date.

Cars Make Problem

Construction of the Santa Ana Freeway in this area is characterized by the very heavy traffic to be carried through and around the work. Average daily traffic is approximately 50,000 cars and as many as seven separate detours have been necessary at a single intersection to enable traffic to move freely through construction. Throughout the work on the Santa Ana Freeway the number of traffic lanes available to freeway traffic has been maintained equal to that which existed prior to construction. The fact that these contracts have continued to smoothly move ahead on schedule is a tribute to the ingenuity and co-operative attitude of the contractors. Contracts in this area are scheduled to be completed by summer of 1958 with the bulk of the work on the Santa Ana Freeway to be completed by January, 1958.

Contracts on the Santa Ana Freeway, in the Buena Park and Anaheim area, total value of which is $8,921,377, are under the supervision of O. V. Janeway, C. C. French, R. D. Seifried, resident engineers, and H. O. Will, Bridge Department representative. The contract on the Houston Freeway is under Peter Varvis, resident engineer, and W. B. James, Bridge Department representative. Construction engineer for these projects is C. W. Ford.

Through the years past, including the Fiscal Year 1957-58, a total of $88,450,000 has been expended by the State Division of Highways on construction, rights-of-way acquisition and engineering on freeways in Orange County. The recently budgeted funds covering freeways in Orange County for the Fiscal Year 1958-59 will swell the previous total by an additional $11,821,000. The Santa Ana Freeway contracts now under construction will be fully completed by the close of next year, at which time the Santa Ana Freeway will be opened uninterruptedly to through traffic for a distance of 42.8 miles, from the Los Angeles Civic Center to a junction with the San Diego Freeway at El Toro.

Looking southeast along construction of Santa Ana Freeway through City of Anaheim. In foreground, Broadway-Anaheim shopping center.

1957 ANNUAL TRAFFIC COUNT

By G. T. McCOY, State Highway Engineer

The annual statewide traffic count taken on Sunday and Monday, July 14 and 15, 1957, showed an increase of 4.44 percent over the previous annual count of July, 1956. Gains were generally well distributed over all routes and regions. Among the major routes, a very substantial increase was shown on Route 26. Opening of several miles of full freeway on the heavily traveled portions of this route near Los Angeles probably contributed to this increase.

For the fifth consecutive year, monthly traffic counts show freight vehicles increasing at a substantially faster rate than passenger vehicles. Also, for the sixth time in the last seven years, Sunday traffic shows appreciably less gain than Monday traffic.

One major change was made in the classification of vehicles. Counting out-of-state passenger cars separately from California passenger cars was eliminated and, instead, passenger cars are classified as those without trailers and those towing heavy trailers, such as house trailers. More directional counts have been included because of the expanding traffic volumes on multilane facilities. Actual recording covers the 16-hour period from 6 a.m. to 10 p.m. for both Sunday and Monday. At selected representative stations, counts are continued for the entire 24-hour period and are extended to record each of the seven days of the week. Traffic is segregated into the following classifications: Passenger cars without trailer, passenger cars with trailer, buses, pickups, 2-axle commercial units, 3-axle units, 4-axle units, 5-axle units, and 6-or-more-axle units.

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

Because of the growth of the State, many routes have become multipurpose and it is no longer practicable to classify them into meaningful groups by primary use as has been done in the past. Hence, the tabulation of groups is omitted.

The gain and loss of traffic volume for the various state highway routes are shown in the tabulation below. For the first time, all routes on which counts were made are included in the summary. The very large percentage changes shown on some of the minor routes may not be significant because the total number of vehicles counted was quite small.

Route	Termini	Percent gain or loss for 1957 count as compared with 1956			
		Sunday		Monday	
		Gain	Loss	Gain	Loss
1.	San Francisco-Oregon Line	2.12		2.95	
2.	Mexico Line-San Francisco	1.59		4.52	
3.	Sacramento-Oregon Line	4.74		4.29	
4.	Los Angeles-Sacramento	0.28		0.55	
5.	Santa Cruz-Junction Route 65 near Mokelumne Hill	0.62		0.33	
6.	Napa-Sacramento via Winters	4.34		3.15	
7.	Route 69, Albany-Route 3 near Red Bluff	1.35		2.03	
8.	Ignacio-Cordelia via Napa	2.38		1.67	
9.	Route 2 near Montalvo-San Bernardino		12.20		2.08
10.	Route 2 at San Lucas-Sequoia National Park		3.47		0.60
11.	Route 75 near Antioch-Nevada Line via Placerville		2.40	1.32	
12.	San Diego-El Centro		2.88		1.69
13.	Route 4 at Salida-Route 23 at Sonora Junction		11.48		7.89
14.	Oakland to Route 7, Richmond	No count		No count	
15.	Route 56 near Fort Bragg to Route 37 near Emigrant Gap		0.28	4.82	
16.	Hopland-Lakeport	2.82			1.42
17.	Route 3 at Roseville-Route 15, Nevada City		0.08	0.49	
18.	Route 4 at Merced-Yosemite National Park	0.59		0.32	
19.	Route 2 at Fullerton-Route 26 at Beaumont		5.92	2.41	
20.	Route 1 near Arcata-Route 83 at Park Boundary	5.08		5.27	
21.	Route 3 near Richvale-Route 29 near Chats via Quincy	7.78		9.20	
22.	Route 56, Castroville-Route 32 via Hollister		5.43	4.10	
23.	Route 4 at Tunnel Station-Route 11, Alpine Junction	2.87		5.88	
24.	Route 4 near Lodi-Nevada State Line		7.85		2.50
25.	Route 37 at Colfax-Route 83 near Sattley		6.65		10.02
26.	Los Angeles-Mexico via San Bernardino	26.78		24.44	
27.	El Centro-Yuma		5.47		1.33
28.	Redding-Nevada Line via Alturas		2.55		5.98
29.	Peanut-Nevada Line near Purdy's	0.75		0.24	
31.	Colton-Nevada State Line	2.01		4.96	
32.	Route 56, Watsonville-Route 4 near Califa	0.57		2.94	
33.	Route 56 near Cambria-Route 4 near Famoso		3.66	2.66	
34.	Route 4 at Galt-Route 23 at Pickett's Junction	7.22		2.65	
35.	Route 1 at Alton-Route 20 at Douglas City	3.51		6.31	
37.	Auburn-Truckee	1.65		3.35	
38.	Route 11 at Mays-Nevada Line via Truckee River	26.18		33.41	
39.	Route 38 at Tahoe City-Nevada State Line	1.82		7.21	
40.	Route 13 near Montezuma to Nevada State Line	39.02			5.33
41.	Route 5 near Tracy-Kings River Canyon via Fresno	0.72			0.16
42.	Redwood Park-Los Gatos		7.94		4.10
43.	Route 60 at Newport Beach-Route 31 near Victorville		3.76	0.26	
44.	Boulder Creek-Redwood Park	8.46		1.62	
45.	Route 7, Willows-Route 3 near Biggs	17.56		10.05	
46.	Route 1 near Klamath-Route 3 near Cray		22.48		20.98
47.	Route 7, Orland-Route 29 near Morgan	1.40		0.24	
48.	Route 1 north of Cloverdale-Route 56 at mouth of Navarro River		1.85		3.90
49.	Napa-Route 15 near Sweet Hollow Summit		2.24	4.50	
50.	Sacramento-Route 15 near Wilbur Springs		0.01		2.22
51.	Route 8 at Shellville-Sebastopol	5.86			0.53
52.	Alto-Tiburon	21.68		17.38	
53.	Route 7 at Fairfield-Route 4 near Lodi via Rio Vista		9.45		3.84
54.	Route 11 at Perkins-Route 65 at Central House	0.37		15.60	
55.	Route 5 near Glenwood-San Francisco	18.93		15.82	
56.	Route 2 at Las Cruces-Route 1 near Fernbridge	11.41		7.06	

TRAFFIC COUNT

Continued from page 50 . . .

Route	Termini	Percent gain or loss for 1957 count as compared with 1956 — Sunday Gain	Sunday Loss	Monday Gain	Monday Loss
57.	Route 2 near Santa Maria-Route 23 near Freeman via Bakersfield	6.89		4.00	
58.	Route 2 near Santa Margarita-Arizona Line near Topock via Mojave and Barstow	2.14		3.44	
59.	Route 4 at Gorman-Route 43 at Lake Arrowhead	2.38		9.92	
60.	Route 2 at Serra-Route 2 at El Rio	5.34		8.42	
61.	Route 4 south of Glendale to Route 59 near Cajon Pass	0.91		1.74	
62.	Route 171 near Buena Park-Route 61 near Crystal Lake	18.91		19.98	
63.	Big Pine-Nevada State Line		0.32		35.04
64.	Route 2 at San Juan Capistrano-Blythe		7.17		1.59
65.	Route 18 near Mariposa-Auburn		0.12	5.90	
66.	Route 5 near Mossdale-Route 13 near Oakdale		0.20		2.76
67.	Watsonville to Route 2 near San Benito River Bridge		8.69		1.40
68.	San Jose-San Francisco	6.76		9.22	
69.	Route 68 at San Jose-Route 1, San Rafael	13.21		12.19	
70.	Ukiah-Talmage		5.41	12.96	
71.	Crescent City-Oregon Line		11.65	4.64	
72.	Weed-Oregon Line	1.75			3.05
73.	Route 29 near Johnstonville-Oregon Line		12.29		1.64
74.	Napa Wye-Cordelia via Vallejo and Benicia	3.29			1.68
75.	Oakland-Junction 65 at Altaville		7.39		6.64
76.	Route 125 north of Fresno to Huntington Lake and Camp Sabrina	8.91		7.05	
77.	San Diego-Los Angeles via Pomona		3.12	5.38	
78.	Route 12 near Descanso-Route 19 near March Field		1.08	7.24	
79.	Route 2 at Ventura to Route 23 via Saugus	8.14		11.60	
80.	Route 151, Rincon Creek-Route 2 near Zaca		1.37	15.59	
81.	Route 1 near Hiouchi Bridge to Route 71 near Smith River		40.99		0.93
82.	Etna Mills to Montague via Yreka		21.92		21.04
83.	Route 38 at Truckee to Route 3 near Mt. Shasta City		8.08		5.64
84.	Route 20 near Willow Creek to Route 46 near Weitchpec		25.46	9.04	
85.	Route 1 near McKinleyville to Route 20 north of Mad River	28.71		18.76	
86.	Route 29 near Mineral to Route 83 near Park Boundary		11.42		1.58
87.	Woodland to Route 3 near Chico via Oroville		2.62		0.12
88.	Route 87 at Knights Landing to Route 47 at Hamilton City		2.39		11.98
89.	Route 49 at Middletown to Route 15 at Upper Lake		6.81		1.26
90.	Route 7 near Vacaville to Route 7 near Dunnigan via Winters		4.16	4.75	
91.	Route 3 at Lincoln to Route 17 at Newcastle		2.09		13.81
93.	Route 65 at Placerville to Route 65 at Cool via Georgetown	7.18		1.90	
94.	Route 38 at Tallac to Fallen Leaf Lake	16.83		3.05	
95.	Route 23 to Nevada State Line via Coleville		23.13	0.00	
96.	Bridgeport to Nevada State Line	51.59		47.13	
97.	Route 4 near Stockton to Route 54 near Waites Station	5.00			1.75
98.	Route 4 at Sacramento to Route 3, Arden Way	8.99		19.76	
99.	Route 53 near Rio Vista to Route 6 near Sacramento	1.04		4.12	
100.	Route 99 west of Ryde to Route 11 at Ryde	8.83		2.49	
101.	Route 53 west of Rio Vista to Route 7 at Dixon		13.35		10.02
102.	Route 49 at Rutherford to Route 6 near Monticello	19.98		37.03	
103.	Route 49 near Calistoga to Route 1 near Geyserville	3.44		2.89	
104.	Route 56 near Jenner to Route 8 near Shellville	12.82		5.54	
105.	Route 56 near Half Moon Bay to Route 5 near Hayward	8.22		7.10	
106.	Route 7 near Hercules to Route 75 north of Concord		11.53		10.24
107.	Route 55 at La Honda Pass to Route 75 near Walnut Creek via Woodside and Redwood City		3.76	0.68	
108.	Route 5 at Mission San Jose to Route 5 east of Livermore	1.74		2.65	
109.	Route 4 at Modesto to Route 13 near Salida		12.85		2.95
110.	Route 5 near Tracy to Route 65 near Coulterville		3.96		3.78
111.	Route 23 at June Lake Junction to Route 23 near Rush Creek	21.96		21.41	
112.	Lake Mary to Junction Route 23	10.73		18.07	
113.	Route 2 near Mountain View to Route 5 at Milpitas	4.85		25.81	
114.	Route 42 at Saratoga to Route 68 near Sunnyvale	8.38		11.62	
115.	San Jose to Mt. Hamilton	2.86		0.22	
116.	Route 56 at Santa Cruz to Route 42 at Waterman Gap	1.06		3.41	
117.	Monterey to Route 2 at Salinas	20.88		8.95	
118.	Route 2 at Salinas to Route 56 at Castroville	9.60			3.89
119.	Route 10 in Peachtree Valley to Route 2 at Carnadero Creek		5.29	12.99	
120.	Route 2 near Soledad to Route 119		14.80		3.21
121.	Route 32 west of Los Banos to Route 41 at Centinella	23.43		16.28	
122.	Route 41 at Gustine to Route 4 at Merced via John C. Fremont Ford Road		10.87		0.56
123.	Route 32 near Madera-Merced County Line to Snelling	8.34		9.94	
124.	Route 32 west of Califa to Route 4 at Chowchilla		4.67	10.42	
125.	Route 56 near Morro Bay to Yosemite National Park via Fresno		0.50	9.77	
126.	Route 41 near Kerman to Route 125 six miles south of Bates Station via Madera	8.82		10.22	
127.	Route 4 near Tipton to Route 31 near Baker via Lone Pine		2.97		3.09
128.	Death Valley Junction to Nevada State Line	19.12		32.14	

. . . *Continued on page 52*

Merit Award Board Winners Announced

Employees of the Department of Public Works receiving certificates of commendation and cash awards since the last list was published in the magazine are:

Marlowe E. Hardin, Division of Highways, San Francisco. $100 for designing a project check sheet to be used by design squad leaders to prevent costly omissions, revisions and delays due to oversights.

J. D. Groff and Mr. John H. Smith, Division of Highways, Los Angeles. $150, to be divided equally, for recommending a spray boom to be used to spray and control weed growth along highways.

Albert S. L. Hewes and Steve J. Zvara, Division of Highways, Los Angeles. Certificates of commendation for recommending a remodification of an auxiliary GPT timer.

Jack Roy, Division of Architecture, Los Angeles. Certificate of commendation for recommending the use of a check-out system for sepia transparency sheets.

Tommie C. Hamner, Division of Architecture, Sacramento. Certificate of commendation for recommending the placing of road maps in state cars.

William E. Weeks, Highways, San Francisco. $50 for preparing a design squad manual to be used by the division employees.

James H. Coan, Highways, Sacramento. $25 for designing and building a device to facilitate the removal of cement and cement mortar test bars from the double molds in laboratory.

Alden R. Strople, Highways, Altadena. Certificate of commendation for recommending that manhole hooks be supplied to survey parties as a safety device.

Henry S. Smith, Highways, Colton. Certificate of commendation for recommending the use of thin ozalids or autopositives by the Bridge Department in lieu of ozalid prints.

Evelyn L. Bradley, Highways, North Hollywood. Certificate of commendation for designing a plastic ruler to be used by the clerical personnel working on Form S-14, Equipment Time Record to increase the efficiency of the checking operation.

James L. Johnson, Highways, San Luis Obispo. Certificate of commendation for recommending the purchase and use of 11-inch wide ozalid paper for project reports in lieu of the 12-inch which had to be trimmed.

Andrew B. Schoellkopf, Highways, Sacramento. $150 for recommending legislation to appoint the State Treasurer as trustee for all counties in condemnation proceedings instituted by all agencies of the State.

Leroy R. Eglin, Highways, Oakland. $15 for recommending that check identification forms be made up in duplicate and in book form.

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Fred J. Grumm

Fred J. Grumm, who retired in 1950 as Deputy State Highway Engineer of the California Division of Highways, died of a heart attack at his home in Sacramento January 8th. He was 72 years of age.

During his retirement he took an active interest in civic affairs in Sacramento and at the time of his death was Chairman of the Sacramento Redevelopment Agency, a position he had held since 1953. He became a member of the agency on its inception in 1950.

Grumm, a native of Iowa who came to California in 1907, joined the Division of Highways in 1922 after holding engineering positions with San Diego County and the San Diego and Arizona Railroad.

Associates credited him with an important part in meeting the challenge of the growth of the State and development of California highways.

After attention was first drawn in the Biennial Report of 1936 to the advantages of controlled access, the forerunner of the freeway principle in California, Grumm carried out further studies which contributed to the adoption by the Legislature of the California Freeway Act of 1939.

Grumm was a member of a number of professional societies and of the Commonwealth Club and Sutter Club.

He leaves his wife and two sons, Gunther S. Grumm of Marysville, an employee of the Right of Way Department, Division of Highways; and Watson J. Grumm of San Mateo, an engineer with the Standard Oil Company.

AWARD WINNERS

Continued from page 51 . . .

Heber G. Player, Highways, Sacramento. $50 for suggesting the insertion of hardened steel bushings in the Snogo fan spider and hub, where the shear bolts go through, which will reduce the repair work now required when the hub and shear bolt holes become damaged.

Miss Lucille H. Forrest, Highways, Nevada City. Certificate of commendation for suggesting a revision of Form A-99, Stock Card.

John A. McCrea, Highways, Niles. Certificate of commendation for suggesting an improved hook for removing metal guide posts that have been damaged or broken off.

TRAFFIC COUNT

Continued from page 51 . . .

Route	Termini	Percent gain or loss for 1957 count as compared with 1956 — Sunday Gain	Sunday Loss	Monday Gain	Monday Loss
129.	Route 4 near Bakersfield to Route 41 near General Grant National Park		1.78	2.07	
130.	Route 132 at Orosi to Route 129 near Cottonwood Creek	25.26			19.64
131.	Route 4 at Kingsburg to Route 10 near Lemon Cove		2.46		6.87
132.	Route 134 near Tulare to Orange Cove		3.70		2.23
133.	Visalia to Route 129 at Woodlake	4.79		1.02	
134.	Route 135 at Corcoran to Route 129 at Lindsay		0.14	3.82	
135.	Routes 33 and 139 at Wasco to Route 10 at Hanford		10.07		3.32
136.	Route 4 at Delano to Route 129		3.98	2.19	
137.	Route 58 near Santa Margarita to Route 125 near Creston		23.53	29.73	
138.	Route 2 at Ventura to Route 41 at Mendota		2.33	3.07	
139.	Route 140 south of Kern River to Route 33 at Wasco	5.25		6.45	
140.	Route 138 at Taft to Route 58 near Caliente		8.71	0.13	
141.	Bakersfield Junction Route 4 near Brundage Lane to Junction Route 4 near Beardsley School	1.12		0.63	
142.	Bakersfield to Route 57 at Isabella		9.91		11.85
143.	Route 140 at Weed Patch to Route 57 at Loma Park	8.03			0.83
144.	State Institution for Men to Junction Route 58 near Old Town	6.81			0.92
145.	Route 31 near Adelanto to Route 23 near Brown	6.77		12.57	
146.	Imperial County Line near Palo Verde to Nevada State Line via Needles	2.26			3.11
147.	Route 2 at Arroyo Grande to Route 2 at San Luis Obispo	1.55		13.18	
148.	Sisquoc to Route 56 near Guadalupe		2.03		4.66
149.	Surf to Route 80 at Santa Ynez	1.55		7.49	
150.	Route 2 near Santa Barbara to Route 2 at Hollister Underpass	19.99		24.24	
151.	Route 2 near Carpinteria to Route 79 at Santa Paula		5.69	11.40	
153.	Hueneme to Route 9 near Somis	4.18		7.54	
154.	Route 2 at El Rio to Route 79 near Saticoy	6.27		7.12	
155.	Route 60 at Decker Road to Route 79 at Fillmore		0.87	19.91	
156.	Route 60 at Topanga Canyon to Route 9 near Chatsworth	6.68		23.39	
157.	Route 9 near San Fernando to Route 4 near Tunnel Station	3.91		3.30	
158.	Route 60 near El Segundo to Route 4 north of San Fernando		0.35	2.69	
159.	Route 2 north of Hollywood to Route 4 south of San Fernando	2.03		6.01	
160.	Route 162 south of Hollywood to Route 2 at Hollywood		7.24		0.90
161.	Route 2 near Vineland Avenue to Route 9 near Monrovia		10.19		0.17
162.	Route 60 at Santa Monica to Route 161 at Eagle Rock		2.26	0.54	
164.	Route 60 at Hawthorne Avenue to Route 158 at Centinela Ave.	8.23		7.71	
165.	San Pedro to Route 9 at Altadena	20.36		21.65	
166.	Route 172 at Downey Road to Route 174 near Norwalk		3.63		1.20
167.	Long Beach to Route 26 near Monterey Park	1.10		6.04	
168.	Route 60 near Long Beach to Route 9 at Pasadena		9.05		7.13
170.	Route 60 near Seal Beach to Route 26 near West Covina		0.94	1.87	
171.	Route 60 near Huntington Beach to Route 2 at Whittier	4.60		3.29	
172.	Route 2, Fourth and Boyle, Los Angeles, to Route 19 near Walnut Station	1.19		1.47	
173.	Route 60 in Santa Monica to Route 2 near Soto Street		1.36	2.75	
174.	Route 60 west of Inglewood to Route 2 south of Orange		7.88		1.20
175.	Route 60 near Hermosa Beach to Route 43 in Santa Ana Canyon	7.19		7.14	
176.	Route 62 near La Habra to Route 43 in Santa Ana Canyon		29.85		13.77
177.	Route 176 near Loftus Station to Route 77 south of Chino		5.87	9.80	
178.	Route 168 near Lakewood to Route 174 near Anaheim		4.08	6.54	
179.	Route 60 near Long Beach to Route 43 near Orange	0.74		1.79	
180.	Route 2 north of Chapman Avenue to Route 175 via Placentia Avenue		27.98		27.87
182.	Route 2 near Orange to Orange County Park		2.62		13.13
184.	Route 60 near Corona del Mar to Route 2 at Santa Ana		5.10		2.17
185.	Route 60 at Laguna Beach to Route 2 near Irvine		41.22		43.15
187.	Route 202 at Bonds Corner to Morongo		1.19		0.60
188.	Route 43 near Mt. Anderson to Route 59 near Cedar Springs	4.01		8.25	
189.	Route 43 near Squirrel Inn to Route 59 at Lake Arrowhead	22.63		12.46	
190.	Route 9 near San Dimas to Route 43 at Big Bear Lake	1.97		7.50	
191.	Junction Route 31 at Verdemont to San Bernardino	17.91		5.18	
192.	Route 77 to Route 190 in Upland		1.16	5.24	
193.	Route 43 at Corona to Route 19 northwest of Mira Loma	2.40		9.89	
194.	Route 78 near Aguanga to Route 19 west end of Moreno Grade		7.26		4.68
195.	Oceanside to Route 78 near Lake Henshaw		10.20		15.55
196.	Route 2 at Oceanside to Route 77 at Vista	12.93		9.82	
197.	Route 198 at Ramona to Route 77 at Escondido		20.18	17.96	
198.	Route 200 near La Mesa to Route 26 near Kane Springs		4.43	13.52	
199.	Route 2 near Otay to Coronado	11.00		8.40	
200.	San Diego to Route 12 at White Star	17.19		31.21	
201.	Route 26 near Heber to Route 187 at Calipatria		2.15		0.57
202.	Route 12 near Coyote Wells to Route 27 at Midway Wells	21.08			2.54

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Eastshore Opening

Jackson Street to Beard Road Section Now Open

By WEBSTER C. HITE, Resident Engineer

On November 14, 1957, after a short but colorful ceremony, the third from last unit of the Eastshore Freeway between Richmond and San Jose, was opened to traffic. The last unit to the south is now under construction.

This latest 5.8-mile project for which the opening ceremonies were held, is located in Washington Township in Alameda County and extends the completed freeway from Jackson Street in Hayward on new location to the intersection with the old highway at Beard Road, just north of Centerville. Construction work was performed as a joint venture by the contracting firm of Gordon H. Ball and Ball & Simpson at a cost of approximately $4,600,000.

Completion of this project is another step toward the soon-to-be-realized freeway system following the shoreline of San Francisco Bay, giving easy access to the many communities that have developed over the years along this general route.

Two other units remain to be completed: a 10-mile section from Warm Springs to San Jose which will be completed in the fall of 1958, and a 1.6-mile section in Oakland between Fallon and Market Streets which will be completed in the winter of 1958.

The completed section between Jackson Street and Beard Road bears testimony to the phenomenal growth of the area and the awesome changes in our very way of life over a relatively short period of time.

Two opening ceremonies were observed for this latest unit, one at each end of the project. The ribbon was cut for the southbound lanes at Jackson Street in Hayward by Supervisor Francis Dunn of Alameda County. The ceremonies were then moved to Beard Road at the south end of the project where Chester E. Stanley, chairman of the Alameda County Highway Advisory Committee, cut the ribbon sym-

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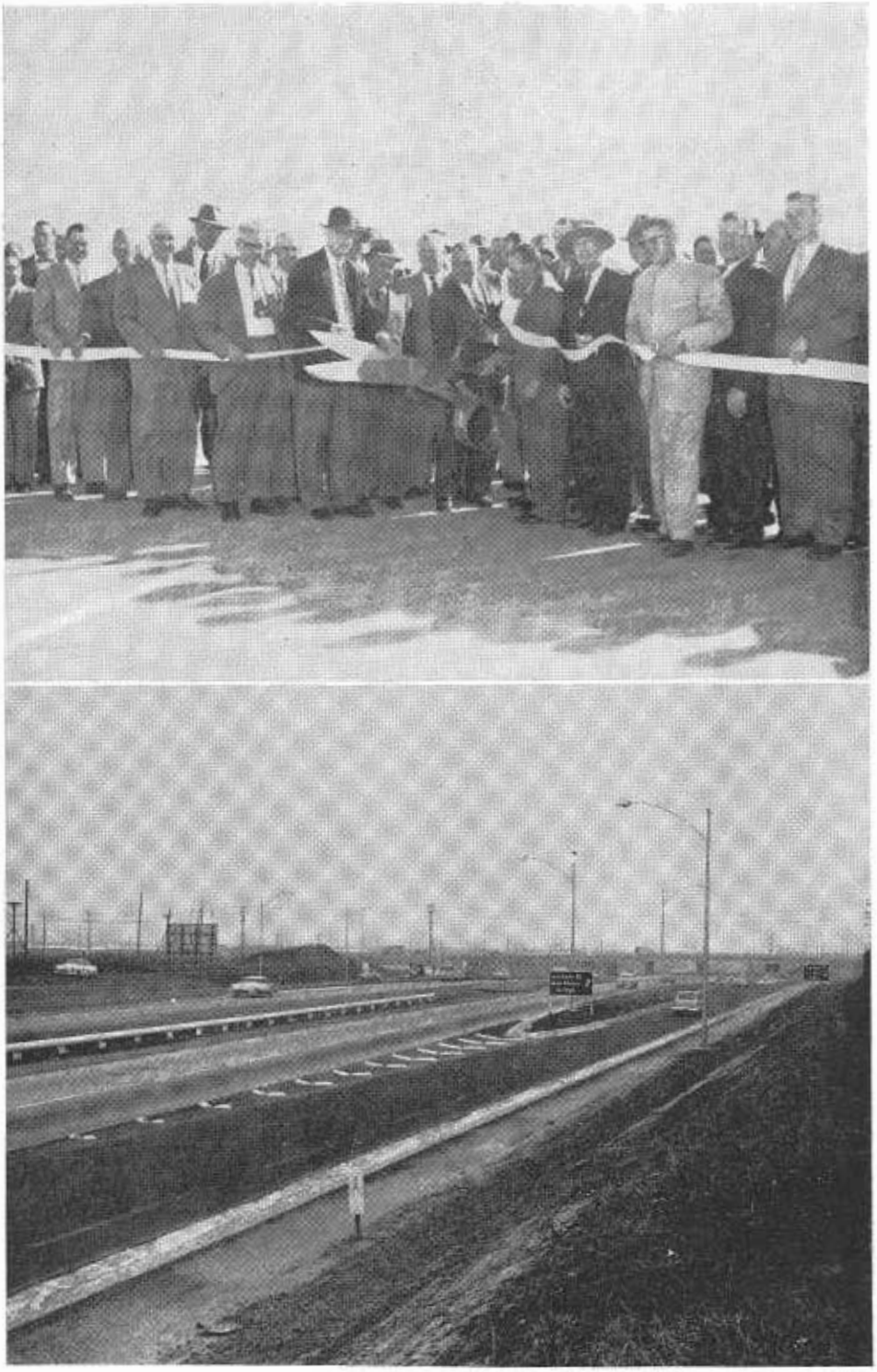


UPPER—Giant scissors cut a ribbon and open to traffic the most recently completed section of the Eastshore Freeway. LOWER—The Jackson Street separation shortly after the freeway was opened to traffic.

San Diego's US 80

Historic Highway Sees Improvement

By C. WIGGINTON, District Administrative Assistant

OLD MAN EUCLID of geometry fame once casually remarked that a straight line is the shortest distance between two points. He not only qualified to be one of the front starters for a place in history as a charter member in the Mathematicians' Union, but he laid out the ground rules for modern freeway design. US 80, beginning in San Diego, the birthplace of California, and ending in Savannah, Georgia, aptly qualifies as a straight line highway from coast to coast, and under the impetus of the federal interstate program, is to be constructed to freeway standards from the Pacific to the Atlantic Ocean. Truly a tribute to Euclid and his mathematics and the highway designers of the eight states through which it passes.

This article deals with plans for US 80 in San Diego. Present planning provides for an ultimate eight-lane full freeway from US 101 in San Diego to the eastern outskirts of the City of El Cajon, with frontage roads as necessary, lighting, illuminated signs, and all of the highway design features common to modern freeway practices. Studies are in progress from El Cajon easterly; however, this article will be limited to discussion of the metropolitan areas.

Existing Bridges Replaced

Construction of additions to the US 80-US 395 Interchange should be under way before the end of this year, with bids to be opened November 7, 1957. This one-mile project includes provision for five new bridges and necessary roadwork to completely modernize a very essential facility. The existing bridges which have been laboring valiantly to handle overwhelming traffic will remain in place with minor modifications to fit them into the traffic pattern.

Fall of 1958 should see the three-and-a-half-mile portion of US 80 under construction from the US 80-US 395 Interchange to one-tenth mile west of Fairmount Avenue. This multimillion-dollar project provides for the East Cabrillo, the Texas Street, and the Ward Road overcrossings and a new bridge over the San Diego River at Ward Road. A frontage road presently parallels existing US 80 on the south through this area and where possible, this road has been incorporated into the design.

Highway Relocated

In order to make room for an interchange, plans at Ward Road provide for a complete relocation of the road to the west of its present position and erection of a new bridge across the river. This is an extremely important artery providing access between east San Diego and booming developments on Kearny Mesa. The road also provides access to old Mission San Diego de Alcala, one of the many historic monuments in the San Diego area.

The interchange at US 80 and Fairmount Avenue is at present being constructed by the Griffith Company. The bid price of $1,695,500 includes provision for grade separation structures at three locations, together with frontage roads and approaches. Fairmount Avenue ties into Mission Gorge Road leading past the old Mission Dam and thence to Santee. Work on this project should be completed by the fall of 1958.

Extensive Residential Areas

Design for the 2.2-mile section of US 80 from Fairmount Interchange to 70th Street in La Mesa is being prosecuted rapidly. San Diego State College lies on the south side of this section and US 80 provides access to this rapidly expanding educational institution. On either side of this section are extensive residential developments depending on US 80 for transportation. This project is included in the 1958-59 Fiscal Year budget.

At 70th Street, the Griffith Company is constructing another interchange to serve the La Mesa-Lake Murray area. This project, involving a bridge over the freeway with entrance and exit ramps, has a bid price of $1,229,800 with completion expected near the first of the year. Completion of this contract will provide full freeway from the interchange to the recently constructed Baltimore Drive Interchange near La Mesa's industrial area along El Cajon Boulevard.

Traffic Relief Provided

Although design is in progress for a revision of the section from the Baltimore Drive Interchange to Grossmont Summit on the eastern outskirts of La Mesa, no timing is yet available. This portion has been improved rather recently to limited access standards and has served faithfully considering the growing traffic demands of the La Mesa-El Cajon area. The most recently completed project is the Jackson Boulevard Undercrossing of US 80 sponsored by the City of La Mesa. This provided relief for north-south traffic from downtown La Mesa to the industrial area and to recently completed Fletcher Parkway, a Federal Aid Secondary project of the County of San Diego. This Parkway connects with US 80 at Baltimore Drive and extends through Fletcher Hills, connecting with State Sign Route 67 along Magnolia Avenue and Broadway in El Cajon.

Contractors Kenneth Golden, M. H. Golden, E. C. Young, and Young & Arrieta are busy with the $3,594,000 project from Grossmont Summit in La Mesa to Chase Avenue in El Cajon. This two-mile project features a multibridge interchange with State Sign Route 67 and La Mesa Boulevard, as well as a bridge at Fuerte

Drive and a pedestrian overcrossing for Grossmont High School. This portion should be completed and carrying traffic by fall of 1958.

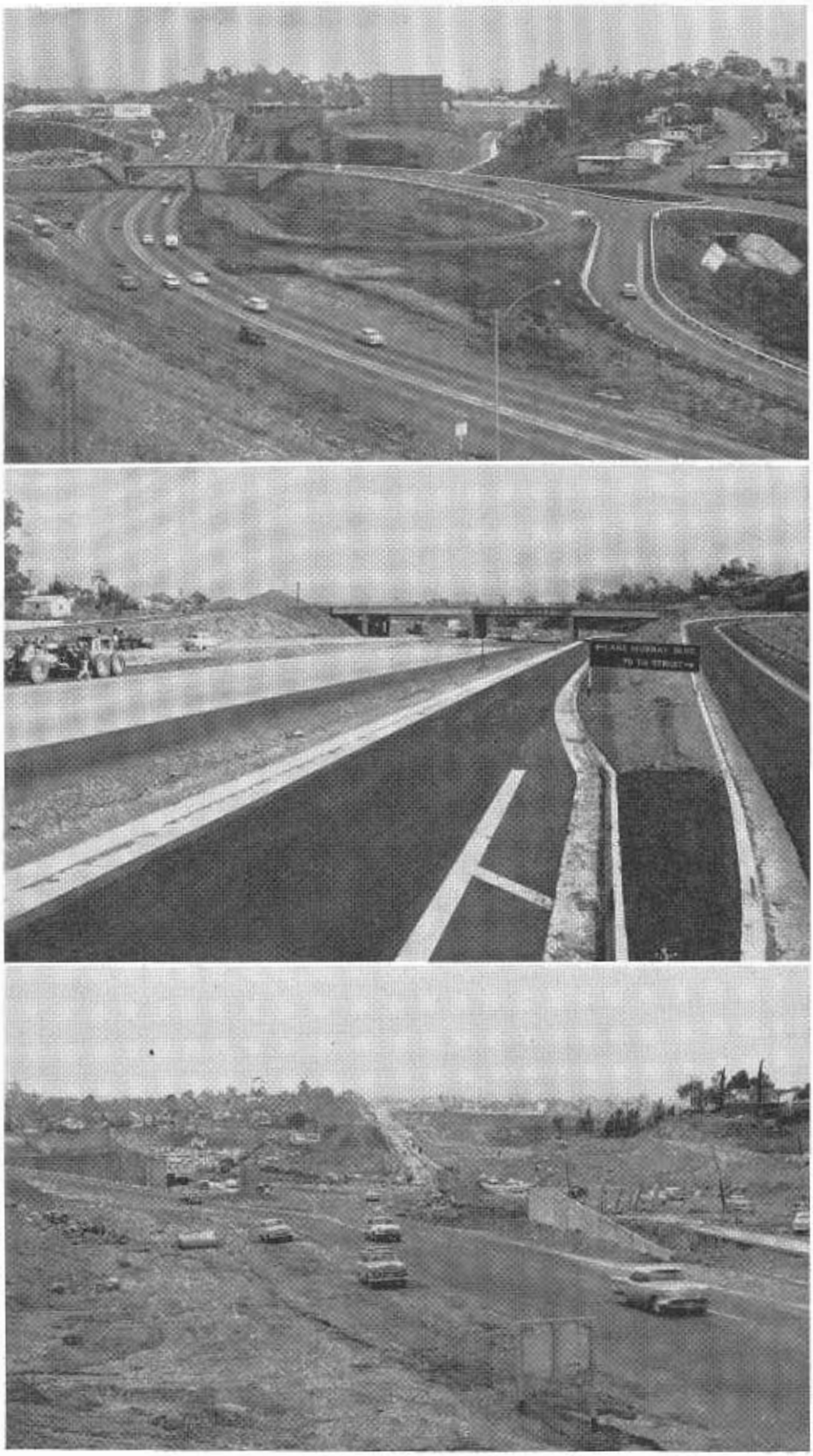
Six-lane Freeway

A freeway agreement is in effect with the City of El Cajon to provide a relocation of US 80 through El Cajon from Chase Avenue to Tunnel Hill east of the city. This project is in the design stage with considerable rights-of-way already acquired. Construction on this section will provide six lanes of traveled way with major interchanges at Main Street, Magnolia Avenue, Mollison Avenue, Second Street, existing Highway 80 at Third Street, and Greenfield Drive. Other bridges will be provided at Marshall Avenue, Johnson Avenue, Ballantyne Lane, First Street, Broadway and a pedestrian overcrossing at Grape Street. A bridge at the connection to the existing highway at Tunnel Hill will provide access with safety until the next section is ready to go.

So ends our first project report on accomplishments to date for US 80. Many miles of highway design and many headaches are in prospect before the ultimate goal at the Colorado River is reached. Studies are under way for the balance of the line, taking advantage of the newest fields of automation in order to gain valuable engineering time. Aerial photos are providing survey information previously gathered by weary surveyors, patiently plodding through the brush of the mountains and the sands of the desert. Electronic machines click the answers for traverses and roadway excavation quantities.

But electronic machines, even of the most advanced design, are not able to think. They are only able to supply lightning-fast answers to problems submitted to them by trained personnel. The skill of submission and interpretation of data still must be accomplished by engineers using the very basic science of mathematics pondered over and developed by pioneers of the past.

Our modern freeway is a memorial to men of the stature of Pythagoras, Archimedes, and Euclid—mental masters of the ages.



UPPER—View looking east on US 80 with Baltimore Driving Overcrossing in foreground and City of La Mesa beyond. CENTER—Looking east on US 80 showing Lake Murray Boulevard Overcrossing during construction.—LOWER—Looking west on US 80 showing construction of US 80—State Sign Route 67 interchange in the foreground.

US 66 Project

New Type Bridges Used In Job Near Needles

By K. B. STONE, Resident Engineer, and
E. M. RIKER, Bridge Department Representative

On October 15, 1957, more than eight miles of new construction on US 66 were opened to traffic. The project was on entirely new alignment, extending south from the City of Needles, and was reported to be the first completely new highway in the Needles area in 45 years. The construction consisted of two lanes of what will later become a four-lane freeway, and featured novel methods of bridge construction in crossing eight large desert washes.

This improvement of heavily traveled US 66 is on new alignment, from the south city limits of Needles to three miles north of Topock. This project provides two lanes of ultimate four-lane freeway. The highway has eliminated many sharp curves and dips with new alignment and eight modern precast, prestressed concrete bridges and smaller culverts which provide drainage facilities to eliminate bottlenecks caused by the frequent summer desert storms.

This project was located and designed from the beginning by aerial photography. Aerial survey was flown by Pafford, Jones and White under contract in 1955. They furnished one set of contact prints and a contour map with a scale of 1″ = 50′, and a contour interval of two feet.

From these aerial maps the Division of Highways completed plans and specifications for the highway. It was let to contract December 24, 1956, under a joint venture consisting of E. L. Yeager, Yeager Construction Company, Bert C. Altfillisch, Altfillisch Construction Company and Lowe and Watson. The contractors finished the contract October 23, 1957, one month ahead of schedule.

New Type Bridges

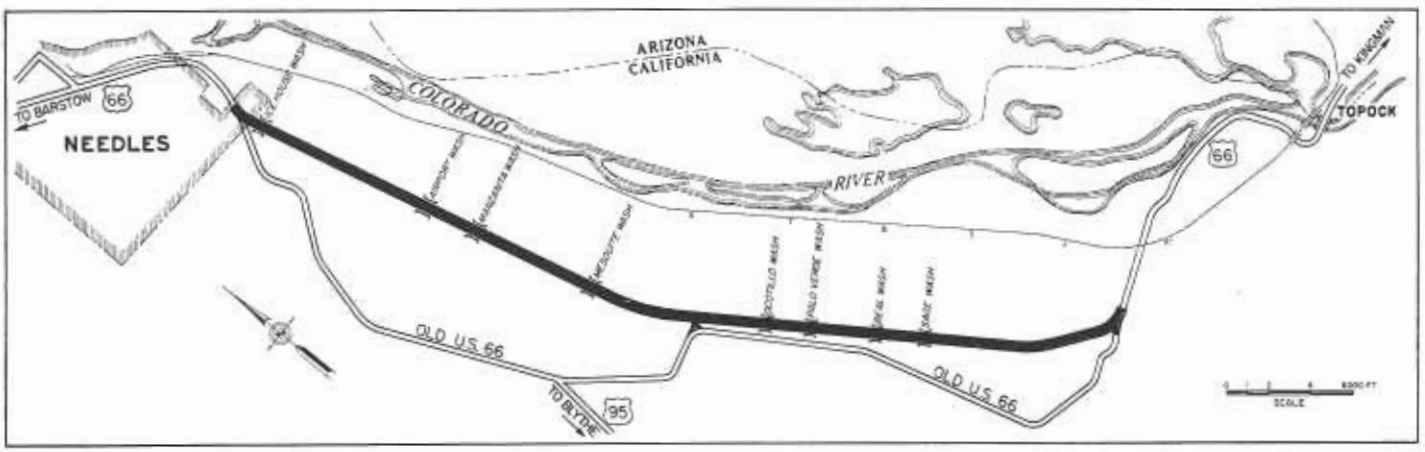
There are eight precast, prestressed, reinforced concrete slab bridges on this project, with each bridge crossing a major desert wash. All of the bridges have precast, prestressed concrete decks, with plant-mixed surfacing. Two of the bridges have conventional closed type abutments using cast-in-place reinforced concrete; the remaining structures have precast, prestressed, reinforced concrete abutments, wingwalls and piers. Bridge lengths vary from 30 feet to 183 feet. Bridge widths are a nominal 40 feet, which includes two 12-foot lanes and adjacent shoulders. Deck spans are of standardized design in lengths of 30 and 40 feet. The designs of the precast abutments, piers and wingwalls are standardized as much as possible. The bridges are on straight alignment with bridge skews varying from zero to 28 degrees. The total cost of the eight bridges was approximately $515,000. All bridges are supported on reinforced cast-in-place concrete footings and piling.

All precast, prestressed, reinforced concrete bridge members were cast by the Concrete Conduit Company, subcontractors, at their casting yard at Azusa, California. The members were transported by truck to the construction site at Needles, a distance of about 250 miles. The largest precast unit was a 40-foot deck unit which weighed 16 tons. There was a total of 477 units transported by 225 truck loads.

Prestressing is used to reduce the size and weight of concrete structural members. It consists of applying high tension stresses to the steel reinforcement and releasing them to react on the concrete after the concrete has hardened. For this purpose high-strength steel wires or cable are usually used instead of the ordinary reinforcing bars.

Pretensioning

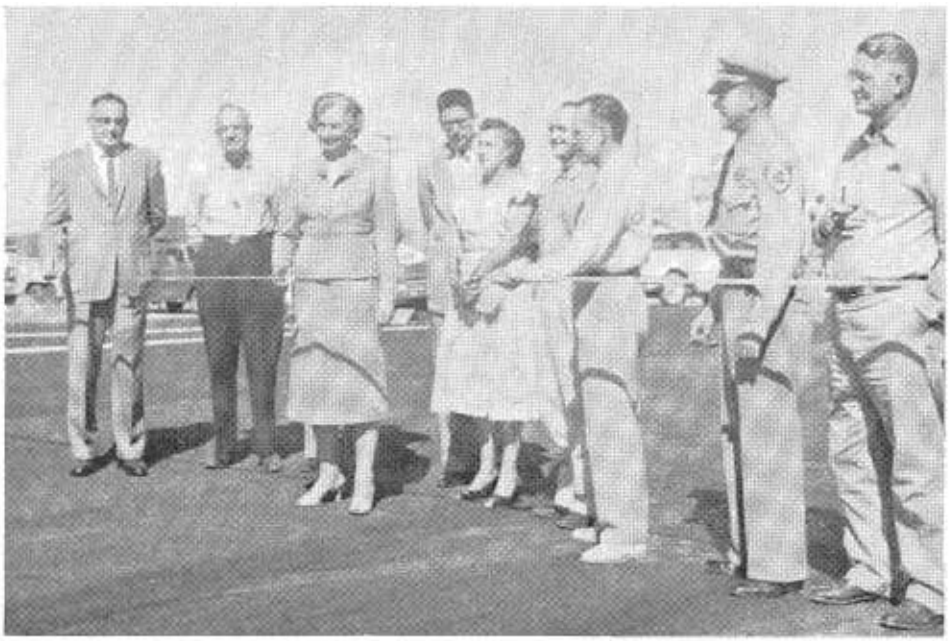
The prestressing may be done by tensioning (stretching) the wires and pouring the concrete around them. Adhesion of the hardened concrete to



the wires thereafter retains most of the tensile stress. This is called pretensioning. Another method, called posttensioning, consists of stretching the steel after the concrete is hardened, through holes left in the concrete when it is cast. The tensile stress is then held by end ties which bear against the hardened concrete at the ends of the member.

All deck units were pretensioned longitudinally at the casting yard and posttensioned transversely after erection. Both pretensioning and posttensioning were performed using high-strength ⅜-inch-diameter, stress-relieved, seven-wire strand.

All precast substructure members were of conventional reinforced concrete. The precast substructure members were secured to the footings with steel dowel bars and anchor bolts. After erection, the substructure units were posttensioned transversely. The purpose of all transverse posttensioning was to tie all adjacent members together, thereby causing them to act under load as a completely integrated unit.



County Supervisor Magda Lawson cuts ribbon opening new section of US 66 south of Needles. Others present included, left to right: Clyde V. Kane, District Engineer for the Division of Highways; W. H. Hirschmann, H. L. Smith, Mrs. Boyd C. Cunningham, P. C. Griswold, D. N. Baker, President, Needles Chamber of Commerce; Capt. A. G. Strom, California Highway Patrol, and Kent B. Stone, Resident Engineer. (Photo by San Bernardino Daily Sun.)

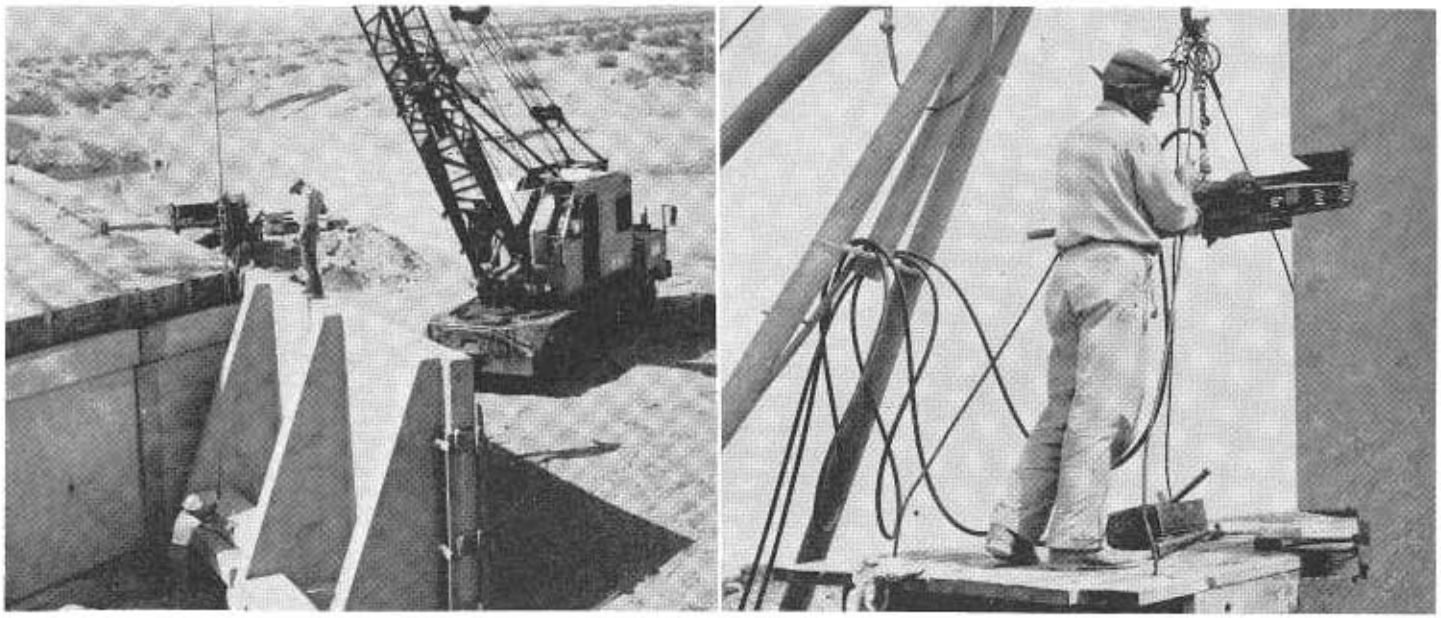
Precast Beams Used

Erection procedures in general consisted of erecting and aligning the precast members, grouting the joints between adjacent members, inserting the posttensioning strand through the transverse posttensioning ducts in each adjacent member, stressing the strand, and pressure-grouting each posttensioning duct.

Erection of the precast substructure units was complicated somewhat by vertical field adjustments, necessary to obtain perfect alignment of the transverse posttensioning ducts.

Grouting the joints between the precast members without plugging the transverse posttensioning ducts was accomplished by placing a one-inch pipe completely through the duct. The pipe was rotated frequently to prevent it from bonding to the grout. After grouting, the pipe was removed from the duct. The posttensioning strand was inserted into the duct immediately after the pipe was removed.

. . . Continued on page 64



LEFT—Workers place heel planks on wingwall units of a bridge. RIGHT—Tensioning the transverse reinforcement on an abutment.

Harry D. Johnson Retirement Marked

Harry D. Johnson, highway superintendent for the Division of Highways District VII Office in Los Angeles, has retired after 30 years of service.

Johnson first worked for the State Division of Highways in 1922 in surveys as a rodman, a chainman, and a transitman. Later he joined construction as a junior highway engineer. In 1947 he took over the position of prison camp superintendent at Angeles Crest and was in charge of all convict labor to the time of his retirement on December 1, 1957.

HARRY D. JOHNSON

A roadbuilder and an inventor to boot, Johnson is well known today for his invention in 1937 of the "Johnson Float" (a concrete finishing machine), now a common sight in paving operations on highway construction. The machine is now in use in 11 western states and Alaska. Johnson's innovations resulted in a method of delayed finishing which allowed workmen to finish a thousand feet distant from the mixer.

Another Johnson invention which was in service for a number of years was an expansion joint end-clip, designed to prevent the concrete from spreading to the end of the expansion joint filler.

Johnson was a construction superintendent on the Angeles Crest Highway job. The Angeles Crest Highway across the San Gabriel Mountains through the Angeles National Forest was almost 50 years in the making, cost approximately $10,000,000, and stretches 55 miles into the Big Pines recreational area. Ten years of Johnson's life was spent in this rocky, mountainous country, at the head of a convict gang working on the highway. In the daytime he worked them on construction and in the evening returned them again to the prison officials at the detention camp. Johnson today says: "I found them in every way as fit as others doing the same work someplace else."

Johnson's work in the years past has been mainly connected with paving, but he had a hand in most everything in construction on the Ridge Route in 1933-34.

Born in San Bernardino and raised in Riverside, Johnson attended Riverside Polytechnic High School and later enrolled in correspondence courses to further his education in civil engineering. He is an army veteran of World War I, 1916-1918. He is also a navy veteran of World War II, serving with the Seabees in Samoa until 1945.

Johnson is married and has a son and a daughter.

Johnson owns a 27-foot sailboat in Santa Barbara, with which he intends to cruise the coast of Mexico. He also intends to tour Mexico inland.

A total of 7,118,862 drivers' licenses were outstanding in California on August 31, 1957, as compared with 6,783,746 a year before.

Vincent J. Preston

Vincent J. Preston, right-of-way agent for the Division of Highways in Los Angeles, died on November 11th following a heart attack.

Preston was born in Jersey City, New Jersey, on March 5, 1914. He served in World War II as a storekeeper 1/C U. S. N. R. After this war service, he completed his education at Seton Hall College, New Jersey, where he received his B.S. degree in 1947.

In 1947 he came to California to accept employment as Supervising Property and Supply Clerk for the U. S. Navy Bureau of Yards and Docks at Port Hueneme. He began work for District VII of the State Division of Highways in 1949 as a right-of-way agent.

During recent years his right-of-way acquisition activities were largely in Orange County. He brought to a successful conclusion some of the complex right-of-way problems connected with development of the Santa Ana Freeway. He was an active member of Chapter 1 of the American Right of Way Association.

Lloyd Dunbar Craig

A 32-year career with the State Division of Highways came to a close October 19, 1957, with the sudden passing of Lloyd Dunbar Craig, Service and Supply Co-ordinator for Northern California.

Craig, who was 61, joined the ranks of civil service in 1925 as a laborer. The following year he rose to maintenance foreman. By 1931 he had become maintenance superintendent on Highway 40 projects in the Sierras during which time he initiated snow removal operations on Donner Pass.

He was maintenance superintendent in the Quincy and Red Bluff areas from 1932 until 1947, when he joined Headquarters staff in Sacramento as co-ordinator-troubleshooter for the Service and Supply Department.

Craig was born in Garden City, Kansas, on December 19, 1895. He served in the U. S. Army from May, 1917, until July, 1919. After his discharge, he managed his own ranch for a few years before coming to work for the State.

He was a past master of the Plumas Lodge No. 60 of the Free and Accepted Masons in Quincy, Plumas County, and a past patron of the Vesper Chapter No. 20 of the Order of the Eastern Star in Red Bluff, Tehama County.

Surviving are his wife, Alta Mae; his son, Eldon Lewis Craig, of Sacramento; grandchildren, Alisa Dene and Brian Dunbar Craig; sisters and a brother, Mrs. Walter E. Hunzeker and C. F. Craig of Gridley, Butte County, and Mrs. Russell Mills of Carlsbad, New Mexico.

Highway 'Danger Red' Finds Another Use

Remnants from Division of Highway red warning flags are used at Merritt Hospital in Oakland to wrap sterilized equipment used for emergency treatment of heart stoppage.

The bright red wrappings enable hospital personnel to identify the emergency trays among other equipment kept in the hospital's emergency room, surgery, and central supply area.

'Equity for State,' Governor Reports

Governor Goodwin J. Knight expressed satisfaction with California's position in federal developments concerning the National System of Interstate and Defense Highways when he returned in mid-January from a visit to Washington, D. C.

The estimated cost of completing the 2,135 miles of the interstate system in California is $3,266,360,000, which represents 10.162 percent of the total cost of the program nationwide. These cost estimates will be used as the basis for apportioning funds authorized for the Fiscal Years 1960, 1961, and 1962. The program is financed with 90 percent federal funds, matched by 10 percent state funds.

In view of the fact that California motorists contribute approximately 10 percent to the Federal Treasury in highway user taxes, the allocation of approximately 10 percent of federal funds to California for the Interstate and Defense Highway System brings about an interesting coincidence in equity, the Governor said.

Governor Knight commended California's Highway Division for the record made thus far in putting funds to work in the development of the National Highway System. California leads the states in meeting the challenge of the expanded highway program and has been able to match funds and award contracts as rapidly as federal funds have been made available. California has to date utilized available federal interstate funds through the 1958-59 Fiscal Year, amounting to approximately $250,000,000.

Although Washington reported cost estimates had increased over those in the 1956 Highway Act, Governor Knight said there was no indication that there will be an increase in federal highway user taxes.

Basic reasons for the increased costs were explained as: (1) nationwide traffic forecasts for 1975 are 15 percent higher than previous forecasts, resulting in a need for more traffic lanes and other facilities, with additional construction required on the interstate system to handle this additional traffic; (2) higher design standards to serve local needs will require more highway grade separations, interchanges and other structures, and additional frontage roads; (3) miscellaneous items such as utility adjustments, lighting, signing, etc.; (4) increased highway construction costs.

EASTSHORE OPENING

Continued from page 53 . . .

bolizing the opening of the northbound lanes. Following the two ribbon cuttings and a tour of the job, the official caravan proceeded to Niles where a reception and luncheon were held at the International Kitchen, sponsored by the Alameda County Highway Advisory Committee.

The recently completed unit was under the immediate supervision of G. L. Beckwith, district construction engineer. W. C. Hite was resident engineer in charge, with R. C. Colley as Bridge Department representative.

The construction forces of the contractor, Gordon H. Ball and Ball & Simpson, were under the direction of R. G. Webster, superintendent.

Separation structures such as this on the Eastshore Freeway are typical of the State's freeway construction program

William R. Cobb Ends 26 Years With State

William R. Cobb retired from state service on November 30, 1957.

Cobb came to California in 1889 from his birthplace in Grafton, North Dakota, when he was only two years old. After graduating from Mission High School in San Francisco, he entered Stanford University.

WILLIAM R. COBB

His education at Stanford was interrupted by the 1906 earthquake which partially destroyed the campus. He completed his engineering studies at the University of California at Berkeley in 1912.

From 1912 to 1916 he was employed as a party chief by the Board of State Harbor Commissioners, then engaged in varied waterfront projects including the Fort Mason Tunnel.

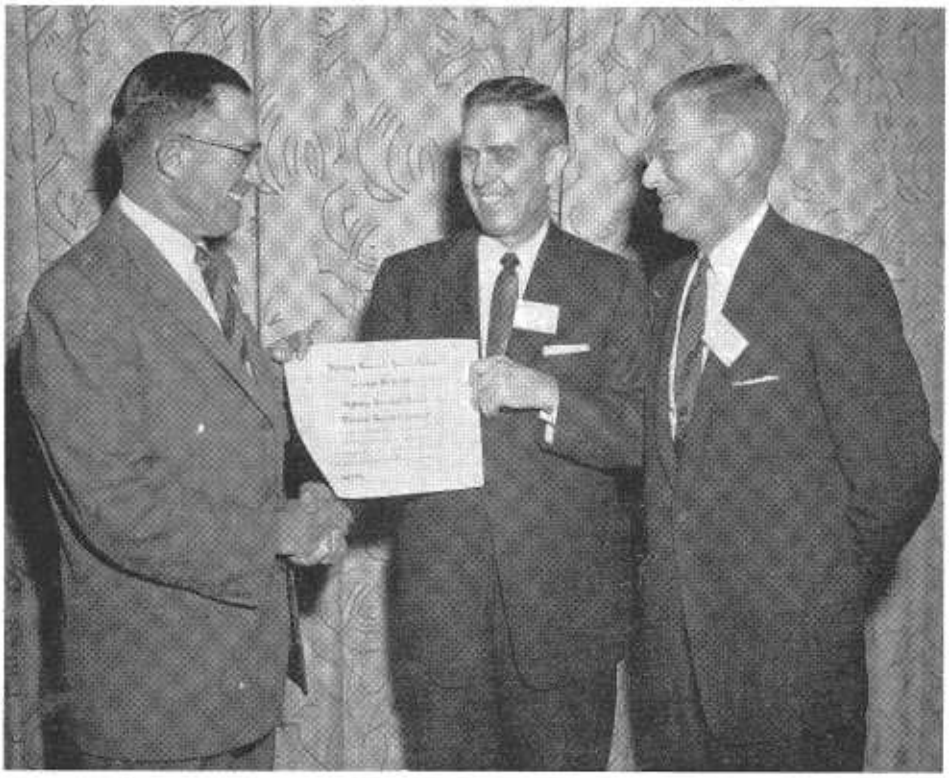
As a Lieutenant (JG) in the Naval Reserve he was called to active duty at the start of World War I in 1917, and after a year of sea duty he was ordered to Naval Aviation. He won his wings as Naval Aviator, becoming a member of a small group of pioneers who founded the air arm of the Navy

Upon termination of his naval duty Cobb entered private industry, both in business and in engineering. In 1931 he joined the Division of Highways. He has been with District IV in all the intervening years except for a short tour of duty with the San Francisco-Oakland Bay Bridge. At the end of World War II he became Assistant District Engineer, Traffic, of District IV, in 1948 and has so served since that date.

Cobb is married and has two daughters and three grandchildren.

A total of 83,770 vehicles on the San Francisco-Oakland Bay Bridge were supplied gasoline and miscellaneous services by the Highway Division from the time the bridge opened through September, 1957.

National Honors Accorded State Engineers



The annual award for the best paper presented to the Highway Research Board in 1957 is being accepted by George M. Webb (left), Traffic Engineer of the California Division of Highways, from Rex M. Whitton, Chief Engineer of the Missouri State Highway Department and chairman of the HRB. At right is Karl Moskowitz, Assistant Traffic Engineer, and coauthor of the winning paper on "California Freeway Capacity, 1956." Moskowitz received a similar certificate.

A California Division of Highways traffic research project won national honors in the highway engineering field at the annual meeting of the Highway Research Board held in Washington, D. C., early in January.

The study, entitled "California Freeway Capacity Study, 1956," made by George M. Webb, traffic engineer, and Karl Moskowitz, assistant traffic engineer of the State Division of Highways, was accorded the Highway Research Board annual award for the best paper presented at the board's 1957 meeting.

The Webb-Moskowitz research, an analysis of the operating characteristics of high-volume freeways, has been in demand among highway planners and designers all over the Country since it was published a year ago. The facts which this study discloses are being applied in the planning of many new freeways on the National Interstate System.

The 105-page study includes photographs and charts showing and interpreting the movements of traffic on the Hollywood, Harbor and other freeways in the Los Angeles area, the Bayshore and Eastshore Freeways in the San Francisco Bay area and the North Sacramento Freeway. Some of the data were also used in an article entitled "Freeway Traffic Flow" which appeared in the July-August, 1956, issue of *California Highways and Public Works*. Another result of the research was a motion picture which has been widely shown to highway engineers throughout the Nation.

Selection of the California paper from among the hundreds presented annually at the scientific meeting was made by a special executive committee on awards.

The papers from among which the winner was chosen covered not only traffic studies, but also research in all phases of highway engineering, including soils, materials, design, economics, urban problems, and maintenance.

The last time a California Division of Highways paper was similarly honored was in 1949. The winner then was a study entitled "The Factors Underlying the Rational Design of Pavements," written by Francis N. Hveem, materials and research engineer, and Robert M. Carmany, assistant engineer of design.

Hveem has also been the recipient of the other annual award made by the Highway Research Board, the Roy W. Crum Distinguished Service Award. This honor, conferred for continuing distinguished contributions to highway research, was presented to Hveem for 1956. A previous California winner of this award was Ralph A. Moyer of the Institute of Transportation and Traffic Engineering, University of California.

TRAFFIC COUNT

Continued from page 52 . . .

Route	Termini	Percent gain or loss for 1957 count as compared with 1956 — Sunday Gain	Sunday Loss	Monday Gain	Monday Loss
203.	Route 26 near Oasis to Route 204 west of Mecca		19.76		9.63
204.	Route 26 Bendels Corner to Mecca via Avenue 66	3.22			4.75
205.	Pasadena Freeway		6.14		0.40
206.	Route 69 Eastshore Highway to Route 75 via Ashby Avenue	5.53		4.24	
207.	Route 190 near Highland to Route 43 at Running Springs	2.59		7.15	
208.	Sears Point to Vallejo		8.52		8.57
209.	Route 3 to Shasta Summit near Summit City		4.54		6.66
210.	Route 28 near Canby to the Oregon Line	13.62		18.04	
212.	Nevada and California State Line to Route 23 near Freeman	6.28		2.95	
224.	Route 2 near Lombard Street to the San Francisco-Oakland Bay Bridge Approach	No count		No count	
226.	Route 69 in San Leandro to Posey Tube	25.05		39.34	
227.	Route 75 in Oakland to Route 5 near San Leandro		12.27		12.73
228.	Route 5 to Route 69 near San Lorenzo	No count		No count	
230.	Route 172 to Route 173 via Indiana Street		6.32		15.17
232.	Sacramento to Marysville	No count		No count	
233.	Sierraville to Vinton via Loyalton	No count		No count	
235.	Route 69 near 42d Avenue to Route 5 near High Street in Oakland	No count		No count	
237.	Route 56 to Daly City to San Bruno	No count		No count	
All routes		2.26		4.80	

COST INDEX

Continued from page 45 . . .

projects, the project values and the average number of bidders arranged by value brackets for the period July 1, 1957 to December 31, 1957.

The California Highway Construction Cost Index, the Engineering News-Record Construction Cost Index and the United States Bureau of Public Roads Composite Mile Index, all reduced to the base 1940=100 are shown on the accompanying graph. The latter two indexes are based on nationwide construction costs.

The Engineering News-Record Cost Index which now stands at 304.8 again shows a rise but at a lower rate of increase than in the third quarter of 1957. It is up 1.6 index points or 0.5 percent from the second quarter.

The Bureau of Public Roads Composite Mile Index for the third quarter of 1957 at the level of 237.3 which is the latest available, was up 0.1 index point or 0.05 percent over the second quarter of 1957.

Faced with a general round of wage increases and the possibility of an expanded federal defense program, a rising tendency in the cost index can be anticipated. However, this will be offset to some extent by strong competition for contracts, and it is expected that the next quarter will show a level tendency or perhaps a slight increase.

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	181.2
(1st Quarter 1950—160.6)	
1951	225.0
(4th Quarter 1951—245.4)	
1952	225.9
1953	215.2
1954	193.5
(2d Quarter 1954—189.0)	
1955 (1st Quarter)	189.3
1955 (2d Quarter)	212.4
1955 (3d Quarter)	208.6
1955 (4th Quarter)	212.6
1956 (1st Quarter)	219.5
1956 (2d Quarter)	255.9
1956 (3d Quarter)	249.1
1956 (4th Quarter)	252.1
1957 (1st Quarter)	277.7
1957 (2d Quarter)	266.9
1957 (3d Quarter)	237.5
1957 (4th Quarter)	262.1

ATWATER BYPASS

Continued from page 46 . . .

one-quarter mile from the northbound acceleration and deceleration ramps. The Applegate Interchange serves local traffic and is a four-quadrant cloverleaf constructed in two quadrants. The East and West Atwater Overheads consist of two parallel steel bridges spanning the railroad and old US 99.

The Gordon H. Ball Company started imported borrow operations in September of 1956 and reached a daily production of 16,000 tons placed in a nine-hour day. The borrow material consisted of Atwater sand, a sandy silt material with a very high "R" (resistance) value. One million tons were placed in approximately four months of good weather. Many compaction devices were experimented with, including a grid roller, vibratory compactors, and a vibratory roller. Two 50-ton pneumatic rollers were found to be the most satisfactory in handling the large borrow output.

Normally, drainage of a project of this magnitude in the flat valley lands represents a major undertaking; however, the "Atwater Sand" over which this project passed is a free-draining sandy-silt and by constructing drainage sumps to serve as settling basins the drainage problem has been solved. Other drainage facilities consisted of various sizes of reinforced concrete boxes and corrugated metal pipes.

Because of the high "R" value of the subbase material, a standard structural section of four inches of cement treated subgrade under the portland cement concrete pavement was all that was required. A cement content of 7 percent was used in order to arrive at a compressive strength of 650 psi. The cement and top four inches of subgrade were mixed with a self-propelled mixer. The frontage road structural section consisted of six to eight inches of untreated base under two to three inches of plant-mixed surfacing.

Extensive fencing was placed; both six-foot chain link in the populated areas and field fence in the remaining areas.

Outstanding results were obtained in the placing of the portland cement concrete. A "bump meter" reading of four inches per mile was recorded, one of the finest ever obtained in this district. Due to the hardness of the Merced River agregate used in the concrete sawing of the 30-foot joints was discontinued and paper joints were substituted.

This project was under the supervision of District Enginer J. G. Meyer, Operations Engineers Sam Helwer and E. L. Tinney and Construction Engineer W. L. Hurd. The Bridge Department was represented by Don Nance and later by Charles Negus.

GILLISS NAMED

Continued from page 41 . . .

expert for Riverside County and chief of its central accounting system. In 1947 he was named Riverside County assistant road commissioner and highways administrator.

Gilliss was appointed special representative of the State Department of Public Works December 1, 1952; assistant deputy director of the department in August, 1953, and deputy director September 23, 1955.

The new director is a member of the American Road Builders Association, American Right of Way Association, National Institute of Traffic Engineers, American Society for Public Administration, Western Governmental Research Association, Inland Association for Personnel Administrators, Inland Society of Public Administration, International Accountants Society, Toastmasters International, and State Men's Club. He holds a public accountant's license in California.

Gilliss is married and has two daughters, Charlene, 15, and Donna, 13. His home is in Sacramento.

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January to December, 1957

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US 66 PROJECT

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Stressing of the posttensioning strand was performed with a hydraulic jack with an adapter which allowed stressing of one complete duct (four to six strands) in one operation.

Pressure grouting was performed with a grouting machine capable of producing 100 psi at the far end of the duct. Pressure grouting material consisted of cement and water mixed to the consistency of thick paint.

Wingwall Design

The design of the precast wingwalls deserves special mention. The wingwalls were of the counterfort type and had precast face panels, counterforts and heel planks set on a cast-in-place footing. The counterforts had flanged bases which were fastened to anchor bolts set in the footing. Face panels set between the counterforts were provided to transfer the horizontal thrust to the counterforts. These face panels were secured by grouted keys and horizontal posttensioned strands. The heel planks spanned between adjacent counterfort units and transferred the vertical load of the backfill to the counterforts for the necessary stability.

The roadway embankment areas were protected by ditch and dike sections adjacent to bridges and culverts, supplemented by light stone riprap on the dikes.

There was a total of 12,700 cubic yards of structure excavation, with 7,600 yards of structure backfill. The ditches and dikes required 46,200 yards of excavation and embankment quantities. There were 11,600 tons of light stone riprap placed on the dike sections.

Overhaul Reduced

The contractor found excellent materials for both the embankment and imported base materials. Due to the excellent side borrows the contractor elected to waste approximately 175,000 cubic yards of roadway excavation, thereby reducing the overhaul from the original estimated quantity of 22,700,000 station yards overhaul to 3,769,900 station yards.

The contractor was paid for 567,800 yards of roadway excavation. The project required 226,000 pounds of steel, 1,201 cubic yards of concrete (not including precast bridge members), 65,700 tons of imported base material, and 7,230 lineal feet of corrugated metal pipe varying in size from 8 inches to 84 inches.

The roadbed was completed with 36,780 tons of plant-mixed surfacing, 3 inches in depth, placed on 6 inches of imported base material.

Charles K. Benedict

Charles K. Benedict, Right-of-way Agent in District III of the Division of Highways, Marysville, died on November 21, 1957, of a heart attack.

Benedict was in charge of one of the appraisal sections in the Right-of-way Department. He had supervision of many of the appraisals made on right-of-way required in converting US 40 from Sacramento to the Nevada state line to full freeway standards as part of the Interstate Highway System. Prior to this time he had been in charge of the Condemnation Section in which he handled the many varied legal matters required in connection with the filing and prosecution of lawsuits when it became necessary for the State to acquire rights-of-way under eminent domain. Earlier he was in charge of the District Right-of-way Clearance Section dealing with utility and railroad companies in the relocation of their facilities required by highway construction.

Benedict was born in New York City on March 28, 1905. His family moved to the West Coast when he was seven years old. He graduated from Palo Alto High School and received a B.A. degree from Stanford University with a major in chemistry in 1928.

In 1931, he enlisted as a naval aviation cadet. He was released to inactive duty in 1933 as an ensign in the U. S. Naval Reserve.

From 1933 to 1941 he worked in retail selling, personnel management and fire and casualty insurance in Oakland and in San Francisco.

On the outbreak of World War II he resumed his active status in the U. S. Navy and was assigned as flight instructor in the aviation cadet training program. He rose to the rank of commander, and served in many areas.

Benedict entered state service in March, 1947.

He was a member of the American Right-of-way Association and an associate member of the Society of Residential Appraisers. He was a commander in the U. S. Naval Reserve and at the time of his death was Assistant Training Officer, Electronics Division 1218. He was also quite active in civic affairs.

He is survived by his wife, Barbara, daughters, Susan, Martha and Nancy, and a brother, Howard Courtney, of Chico.

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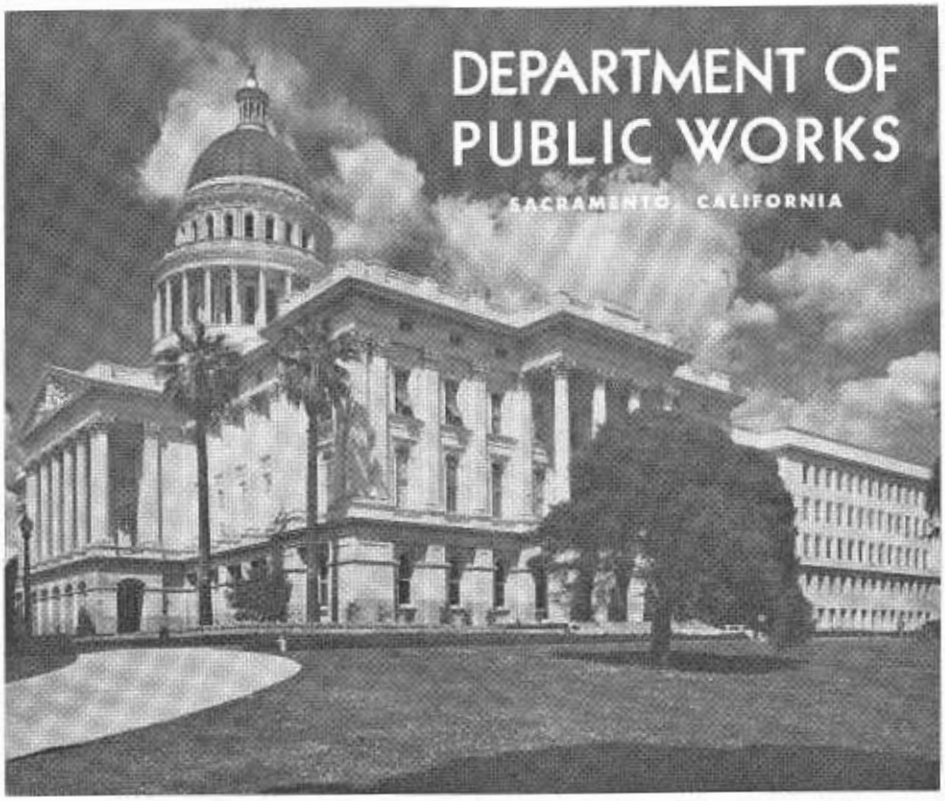

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