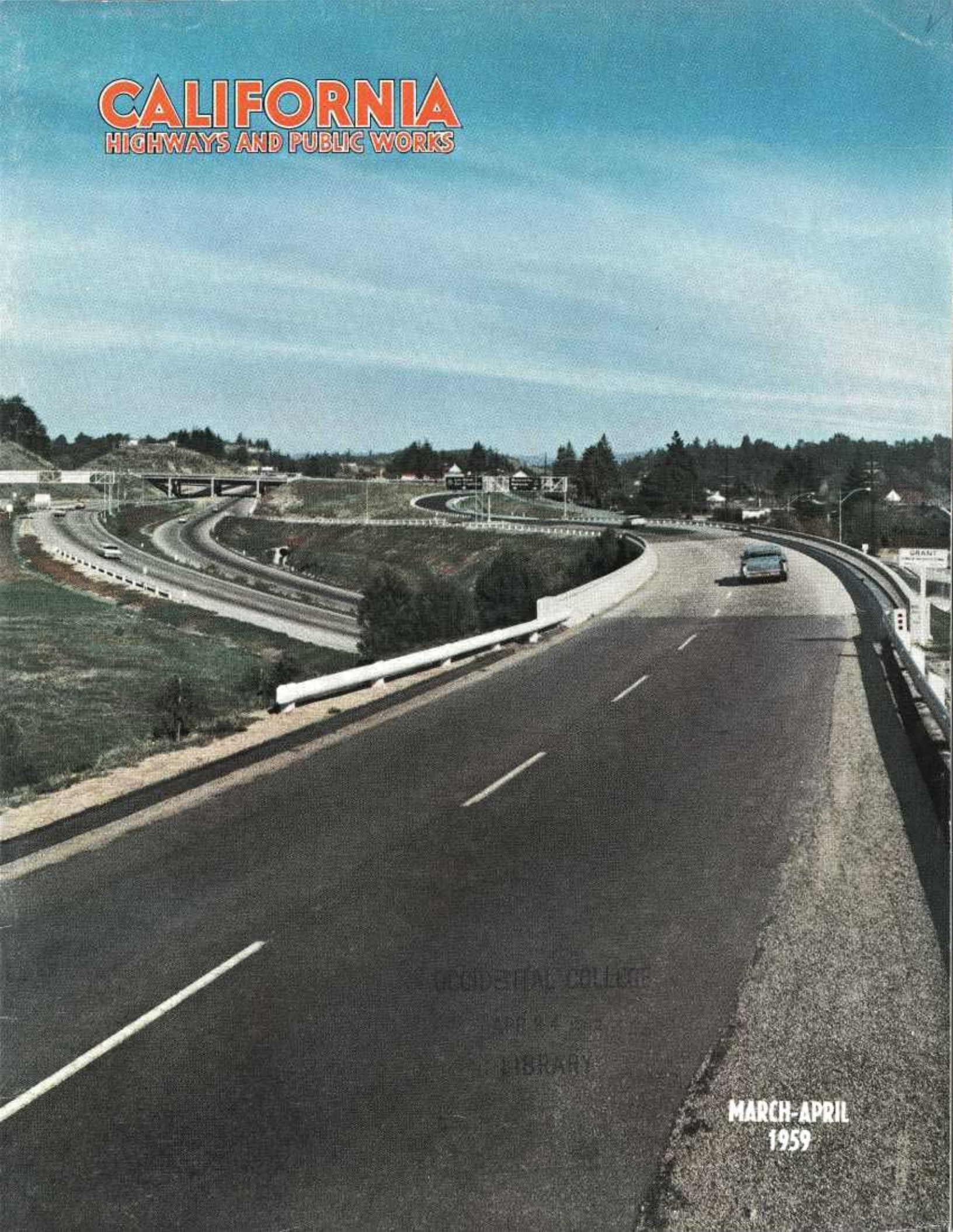


CALIFORNIA

HIGHWAYS AND PUBLIC WORKS



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California Highways and Public Works

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FRONT COVER

The junction of Sign Route 1 and Sign Route 17 in Santa Cruz, with its overcrossings and undercrossings, large directional signs, graceful connecting ramps and multilane, divided roadways, is typical of modern freeway interchanges.

—Photo by William R. Chaney



BACK COVER

All traffic is being routed over the new parallel Carquinez Bridge (right) until the work of widening the old bridge (left) can be completed after which time all southbound vehicles will use the old span and northbound the new one.

—Photo by William R. Chaney

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Address communications to

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SACRAMENTO 7, CALIFORNIA

Report From District IV

By B. W. BOOKER, Assistant State Highway Engineer

WITH population in District IV racing toward the 1970 prediction of 5,000,000, traffic increases in the area demand major routes in all directions from the central core of the metropolitan area. Freeway development is therefore extensive in all populated areas including that in the central core. Construction and planning is well advanced for freeway systems radiating from such communities and cities as Santa Rosa, San Rafael, Richmond, Concord, Walnut Creek, Hayward, Fremont, San Mateo, San Jose, Los Gatos and Santa Cruz.

The year of 1958 witnessed many public meetings and hearings resulting in the adoption of freeway route location by the Highway Commission on a total of 52 miles in our district. This was accomplished in spite of the extremely complex problems of route location particularly in two of the major routes located during the year: the Junipero Serra Freeway extending from San Francisco to San Jose and to the south and the Grove-Shafter Freeway in Oakland, extending from the Nimitz Freeway to Contra Costa County.

The Junipero Serra Freeway adoption followed more than 40 informational meetings, map displays and three official public meetings held in areas adjacent to the routing by the Division of Highways before recommendation of a route was made by the State Highway Engineer to the California Highway Commission. In accordance with its established policy

for route adoptions, the commission itself held two public hearings in the area subsequent to the recommendation and prior to route adoption.

The Grove-Shafter location, though shorter in length than the Junipero Serra, was no less complex, involving location through heavily developed areas.

Meetings Held

Unchronicled herein, though, and in addition to local activities, are the hundreds of meetings and conferences required of the Division of Highways personnel engaged in planning of these route locations. Conferences with local executives, planners, authorities in public works, fire, police, schools, health, parks, cemeteries, as well as churches, civic-minded organizations, industry, commerce, utilities and individuals in general are directed toward assurance that all factors of our way of life are appraised in the development of every reasonable alternate for route selections for consideration in the final determination of the route.

The year 1958 also witnessed much progress in assuring immediate future completion of extensive sections of continuous freeway systems from the metropolitan core. In this year, the

PHOTOS, UPPER—A scenic section of US 101 in Marin County. MIDDLE—An aerial of the Bayshore Freeway in Palo Alto. The University Avenue interchange is in the center of the picture. LOWER—US 40 looking south through the Big Cut from above the approaches to the twin Carquinez Bridges.





Public Works Building
Twelfth and N Streets
Sacramento

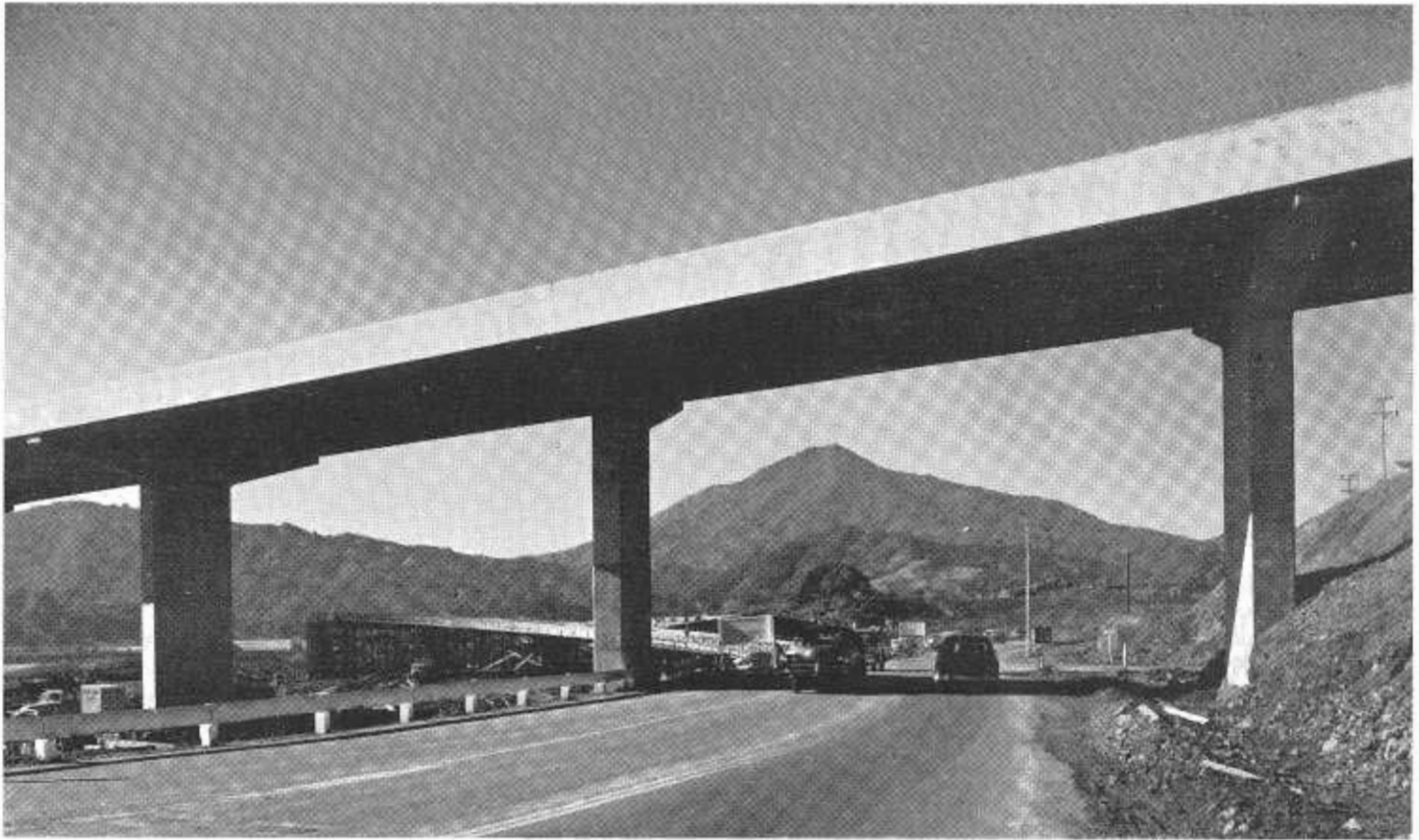
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last links accomplishing continuous freeway from San Jose to Oakland were completed. Construction of the last project on U. S. 40 between Oakland and north of Vallejo is now in progress. When this 2.3-mile project is completed in early 1960 there will be a continuous freeway in service from south of San Jose to north of Vallejo. Also completed were projects extending the Embarcadero Freeway in San Francisco to Broadway and the Bayshore Freeway to Palo Alto. Nearly completed is extension of the Central Freeway in San Francisco to Turk Street. These improvements, together with construction to be completed in late 1960, will provide continuous freeway from Broadway in the downtown financial area of San Francisco or from Turk Street in the Civic Center area of San Francisco to Sunnyvale. Construction now underway extending the Bayshore Freeway northerly in the San Jose area to Brokaw Road leaves only a six-mile section to be financed to provide continuous freeway service from inner San Francisco to south of San Jose. Construction of the last link of the Route 5 Freeway in San Jose is also financed assuring early continuous freeway service from San Francisco via San Jose to beyond Los Gatos. Near future completion of continuous freeway service was also assured on US 101 northerly of San Francisco with the completion of one project at the San Quentin Wye and the start of construction of two projects: one at Greenbrae and the other from US 101 to the completed freeway approaches to the Richmond-San Rafael Bridge. When these projects are completed, continuous freeway service will exist from San Francisco to north of San Rafael and also to Richmond.

Spectacular Project

Among the year's accomplishments involving connecting links, perhaps the most impressive of the year was the completion of the additional Carquinez Bridge with its complex system of approaches, and the five miles of freeway which runs southerly to meet completed sections of US 40 in the hills above Hercules. While the



One of the bridges under construction at Corte Madera Creek on U. S. 101 in Marin County. The old bridge and lift span will be replaced by a new high level structure.

project is spectacular in its own magnitude—the huge structure duplicating the existing one, the graceful curves of interchange ramps serving the bridges from all directions and the monumental cut through high hills southerly from the strait—the most impressive feature is the saving of lives, time and miles between Vallejo and the San Francisco-Oakland Bay Bridge. The old route of transcontinental US 40 through growing cities and through the varied topography of the Bay's eastern shore had long been inadequate. Only a bold solution to the problems involving direct routing along new alignment could properly cope with tremendous volumes, current and predicted, which the artery serves. The completion of this facility saves 20 minutes between Oakland and Carquinez Bridge as compared to the old route. During summer weekends the savings amount to more than an hour.

The system of freeways which has been planned throughout our area for

many years through co-ordination with local authorities is predicated on an integrated system of transportation utilizing expansion of existing facilities. About one-third of the freeway system as planned is completed and can only be considered as the first stage of the network. *It must be built in its entirety to be fully effective.* The congestion occasioned on completed portions of the system such as the Nimitz and Bayshore Freeways during peak hours, is not a reflection of inadequate capacity of these facilities. It is an indication that they are being called upon to serve considerable traffic volumes which would be carried by other portions of the planned system if such were available today. Toward this end, the early construction of the MacArthur and Junipero Serra Freeways, as well as other facilities both state and local, is being expedited.

Let us review in some detail the overall picture of freeway development along the various routes.

US 40—San Francisco to Carquinez Bridge

Starting at the intersection of James Lick (Bayshore) Freeway and Central Freeway at 13th Street in San Francisco, US 40 proceeds across the San Francisco-Oakland Bay Bridge (US 40 and 50) and northerly via the Eastshore Freeway through Richmond to the Carquinez Bridge and points north and east.

The eight-lane freeway from the distribution structure to south of the El Cerrito Overhead on US 40 was completed in November of 1956. This portion of U. S. 40 is also Sign Route 17. A landscaping project costing approximately \$235,000 is presently under way within these limits.

The last link of freeway between the Bay Bridge and Carquinez Straits is presently being constructed from south of El Cerrito Overhead to Jefferson Avenue in Richmond. The 2.3 mile contract is being performed as a joint venture by Piombo Construction Company, M & K Corporation and Connolly Pacific Company. It is esti-

mated to cost approximately \$5,583,000 and is expected to be completed in January of 1960. Three interchanges and a pedestrian overcrossing are included in the development of this six-lane freeway facility.

Immediately to the north of the portion now under construction, 4.8 miles of freeway extending to Hilltop Drive, north of San Pablo, has been open to traffic since early 1957. In keeping with the Division of Highways policy of opening completed portions of freeway as soon as possible, a temporary connection from the freeway to the old highway just south of Rodeo was constructed and a major portion of the 4.9-mile project between Hilltop Drive and Hercules, which was constructed by McCammon-Wunderlich and Wunderlich Contracting Company, was opened to traffic in February of 1958. The remaining portion to Crockett was

opened to traffic in November of 1958. Contractors on this \$7,320,000 project was Ferry Brothers, J. M. Ferry, Peter L. Ferry and L. A. and R. S. Crow. This portion of the freeway contains the largest highway cut in the United States; being 3,000 feet long, 1,370 feet wide at the top and 300 feet deep.

Also opened to traffic in November, 1958, was the new bridge constructed easterly of and parallel to the existing bridge across Carquinez Straits. It is presently carrying two lanes of traffic in each direction. Temporary connections have been provided at each end to divert traffic during the completion of an additional contract for the Crockett approach ramp connection and modification of the present bridge which will carry three lanes of southbound traffic; the new bridge then will carry four lanes of northbound traffic. The contractor on this

work is Rothschild, Raffin and Weirick and the cost is approximately \$1,315,000. The existing bridge is expected to be reopened to traffic in July of this year.

Also completed this year have been signing and landscaping projects on the completed portions of the freeway north of Jefferson Avenue in Richmond.

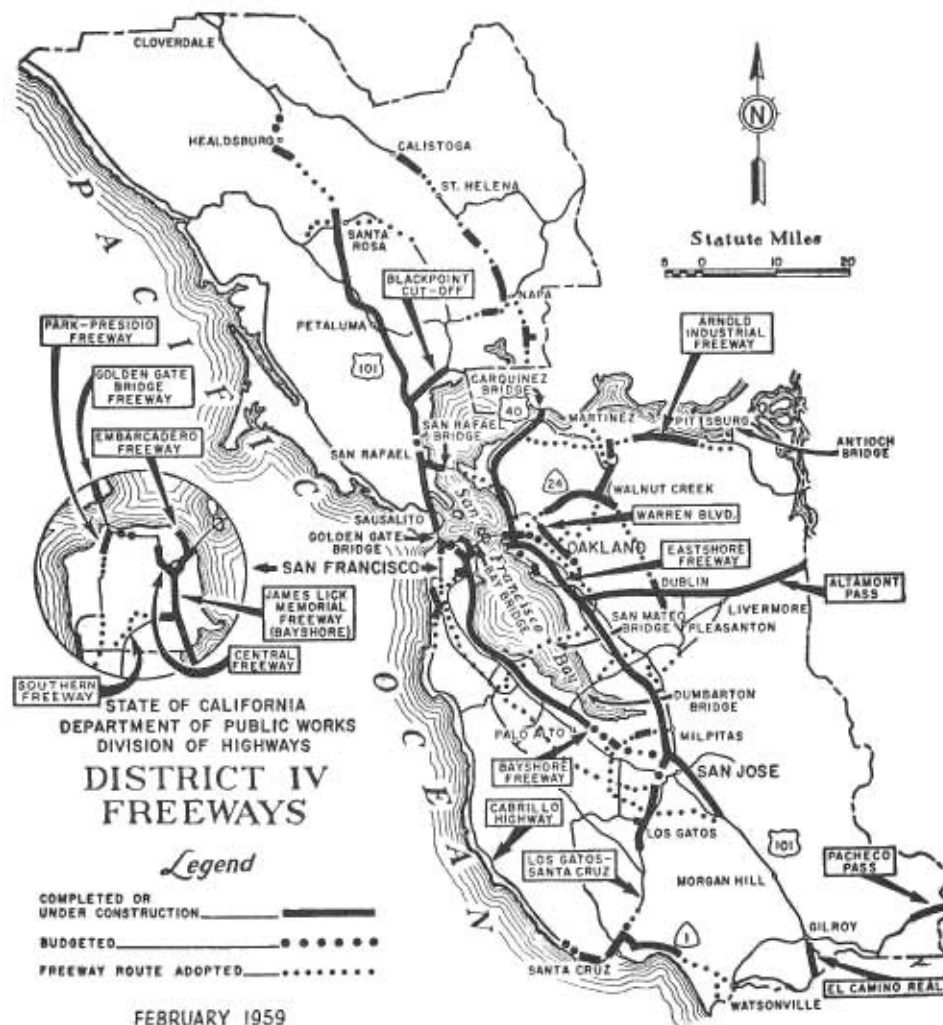
North of State Sign Route 4 (Arnold Industrial Freeway), this project was financed by special toll bridge bonds as an approach to the Carquinez Bridge.

US 50—Bay Bridge to Castro Valley

Design studies are proceeding on the entire 15.3 miles of the future MacArthur Freeway routing between the distribution structure and the completed freeway at Castro Valley to the east. The first construction projects will be at the western extremities and funds in the amount of \$10,000,000 have been included in the 1959-60 Budget to start construction of this eight-lane interstate facility between the distribution structure and Grand Avenue. Additional funds will be required in a future budget to complete this portion; the total construction cost of which is estimated at \$15,000,000. A total of \$39,166,000 has been expended or budgeted for rights-of-way acquisition on this major facility to date. The expediting of construction of this entire interstate freeway is anticipated and should provide relief to congestion now occasioned at peak hours on the Nimitz Freeway which is carrying considerable US 50 traffic at present.

Castro Valley to San Joaquin County Line

Freeway construction was completed in 1957 between Center Street in Castro Valley and Dublin, and to the east US 50 is an expressway with controlled number of intersections at grade. Studies are now under way for the future elimination of at-grade intersections by construction of interchanges along this interstate route. While future elimination of the intersections was contemplated at the time of original construction and some of the right-of-way acquired at that time, detailed design was not completed.



A \$200,000 resurfacing project is included in the 1959-60 Fiscal Year construction program for resurfacing portions of this route between Greenville and Mountain House Road.

US 101—Golden Gate Bridge to San Rafael

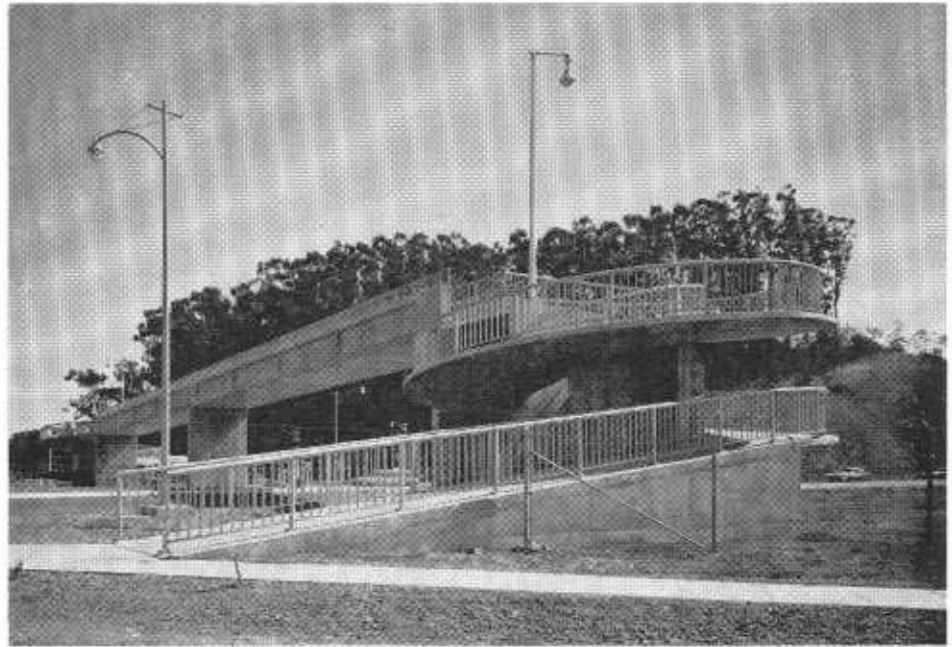
Progress has continued in 1958 toward the completion of US 101 to full freeway. Funds are provided in the 1959-60 Budget for further development to high standards and extension of freeway portions.

Construction was extended northwardly to the Greenbrae Intersection in 1957. Presently under contract is the second stage construction by Dan Caputo Company, Dan Caputo, and Cambrian Gateway, and includes the structures over Corte Madera Creek for the northbound freeway lanes and for the southbound on-ramp from Sir Francis Drake Boulevard. Included in the 1959-60 Budget are funds in the amount of \$1,240,000 to complete this interchange. This work primarily will consist of eliminating the old bridge and lift span across Corte Madera Creek and replacing it with a new high level structure to serve as a northbound off-ramp.

Recently completed is a project extending 1.4 miles from the Greenbrae Interchange to 0.5 mile north of the California Park Overhead. The work which consisted of grading, paving, and structures for a six-lane freeway cost \$1,919,000, and was performed by Frederickson and Watson Construction Company. The existing wooden structure over the Northwestern Pacific Railroad at California Park was replaced by twin three-lane structures. With the completion of the Greenbrae Interchange, US 101 will be completed to freeway standards between north of San Rafael and San Francisco.

From San Quentin Wye to the north city limits of San Rafael, the freeway has been completed and in use by traffic for some time. Included in the 1959-60 Budget are funds in the amount of \$50,000 for landscaping portions of the freeway between Richardson Bay Bridge and San Quentin Wye.

Other projects planned on US 101 in southern Marin County include the improvement of the Vista Point



This pedestrian overcrossing near the Richardson Bay Bridge on US 101 in Marin County is typical of such structures being built across freeways throughout the State.

at the Golden Gate Bridge. A \$40,000 project in the 1959-60 Budget provides for construction of road connections and parking area for southbound traffic.

San Rafael to Petaluma

The 1959-60 Budget includes \$1,250,000 for improvement of portions of US 101 between the north city limits of San Rafael and Lucas Valley Road. The 2.4-mile project includes construction of the Freitas Parkway interchange and frontage roads. An interim interchange will also be provided at San Pedro Road.

Just north of San Rafael, a contract has been completed adding a southbound truck lane over Puerto Suelo Hill. This project costing \$139,000, minimizes congestion on through lanes due to slow moving vehicles on the sustained grade.

Twin bridges were completed in 1957 over the Northwestern Pacific Railroad at Forbes Station Overhead. Planning studies are well advanced for the future development of the existing 18.9-mile expressway between Forbes Overhead and south of Petaluma. This portion is planned as a future full freeway with no at-grade intersections.

Planning studies are well advanced for the future development of the ex-

pressway and nonfreeway portions of the remainder of this route connecting with the completed freeway at Petaluma.

Petaluma to Mendocino County Line

Five contracts were required to complete the 18.5-mile freeway portion from south of Petaluma to the south city limits of Santa Rosa. Presently under contract is a \$21,000 planting project on this portion between Petaluma Creek and Santa Rosa. Through Santa Rosa, the existing expressway has been in use for many years. Agreement has been reached for full freeway development through this area.

North of Santa Rosa, the highway is not as yet constructed to freeway standards. Future freeway location has been adopted as far north as Lytton. Work is now being performed by Guy F. Atkinson Company constructing 1.2 miles of the Healdsburg Bypass south of the city and rough grading an additional 3.7 miles of the future freeway project to the north. This work between Grant Avenue and Chiquita Road will cost approximately \$1,752,000 and includes partial construction of interchanges at Grant and South Healdsburg. Twin plate girder, reinforced concrete deck structures carry the four-lane, ulti-

mate six-lane, freeway over the Russian River. Two million seven hundred fifteen thousand dollars is included in the 1959-60 Fiscal Year Budget to extend the Healdsburg Bypass freeway 4.1 miles to a connection with the present highway at Lytton.

Design for the other portions of the initial four-lane facility northerly of Santa Rosa to Lytton is well advanced. An expressway with some grade separation structures is being planned through this section. From Lytton to the Mendocino county line, studies for future development to freeway standards continue. Informational meetings have been held with the technical staffs of the local agencies and public hearings leading to final route adoption are anticipated in the near future.

Approximately \$12,500,000 has been expended or budgeted for rights-of-way acquisition on US 101 from the Golden Gate Bridge to Lytton and \$34,043,000 has been expended for construction of the 50.5 miles now completed.

US 101 (Bypass)—San Francisco to Palo Alto

From its intersection with US 101 at Alemany Boulevard in San Francisco US 101 Bypass is mostly referred to as the Bayshore Freeway as far as San Jose. With several projects on this route included in the 1959-60 Fiscal Year construction program there are approximately six miles from Fair Oaks Avenue in Sunnyvale to Brokaw Road near San Jose remaining to be financed for completion of this route to freeway standards between San Francisco and San Jose.

While a continuous full freeway is in service between these limits, other improvements are continuing along this portion of the route. Now under contract is a landscaping project across the recently completed "overwater fill" at Candlestick Point. Completed this year were bus stops at the Third Avenue Interchange in San Mateo at a cost of \$41,000. Under construction is a revision of the East Hillsdale Boulevard Interchange and landscaping improvements between Peninsular Avenue and 16th Avenue in San Mateo.

Heavy turning movements during peak hours at various interchanges, providing for local service southerly of South San Francisco to San Mateo, have dictated early expansion of the present six-lane between Colma Creek near South San Francisco and Penin-



When completed this interchange on the James Lick Memorial Freeway (Bayshore) in San Francisco will connect with the first unit of the Southern Freeway under construction in the right middleground.

sular Avenue Interchange serving Burlingame and San Mateo. A \$1,900,000 construction project will be under way in the 1959-60 Fiscal Year which will add an additional lane in each direction. The added lanes will, in general, be constructed along the outside of existing lanes without reduction in median width separating directions of travel. It will, however, be necessary to transition the widening from the outside to the median area at interchange locations. The widening will be accomplished within the existing rights-of-way.

From Bransten Road to the Santa Clara county line, the eight miles has been constructed as four separate projects. The first of these was the Willow Road Interchange completed in 1956. The second contract between Willow Road and 0.5 mile south of the Santa Clara county line was completed in June of 1958 by Charles L. Harney, Inc. Construction on this 2.2-mile section cost \$1,832,000.

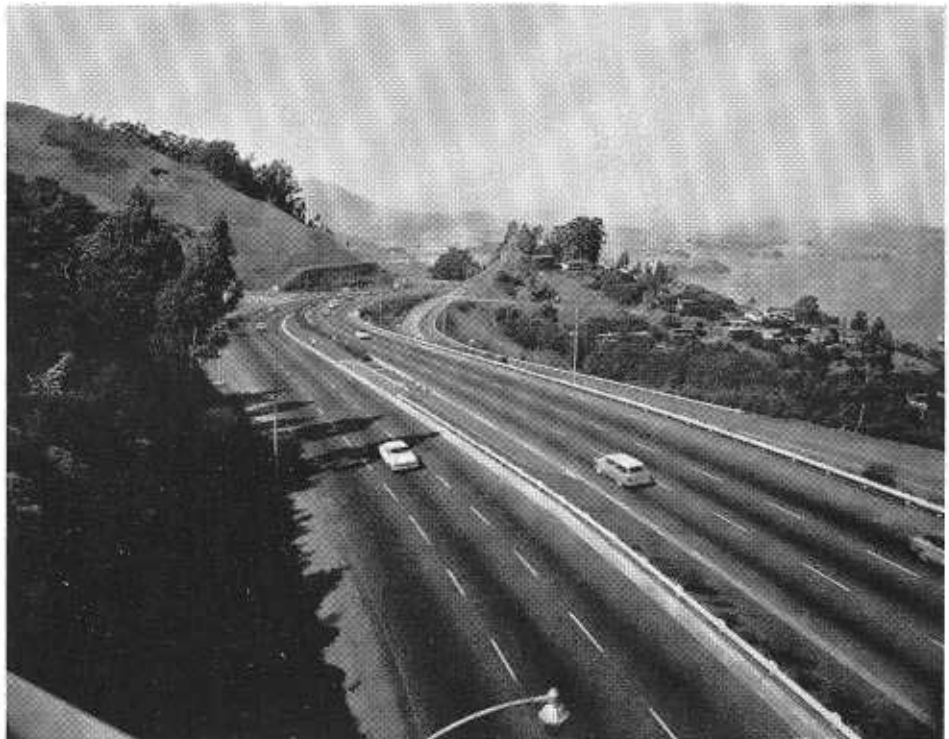
The two-mile project extending north of Marsh Road, the third project, was also completed in June of 1958. Like the other three, it provided an initial six-lane, ultimate eight-lane freeway at a cost of \$1,697,000. The contractor on this project was also Charles L. Harney, Inc.

Linking the above three projects and the completed freeway to the north, the 3.8-mile relocation at Redwood City from Bransten Road to Marsh Road was completed in July of 1958. The \$5,221,000 project was performed as a joint venture by Piombo Construction Co., M & K Corporation, and Connolly and Pacific Co.

Additional improvements are also contemplated during this next year on already completed portions of the freeway. Funds are included in the 1959-60 Budget in the amount of \$200,000 for the landscaping project between Harbor Boulevard in Redwood City and the Santa Clara county line.

US 101 (Bypass)—Palo Alto to San Jose

Contracts are under way for the improvement of much of this section. Presently under construction is the interchange at the intersection with Sign Route 9. This project, costing approximately \$1,257,000, will include



UPPER—US 101 in Marin County north of the Golden Gate Bridge. LOWER—The new Petaluma Creek Bridge on Sign Route 37 at the north end of San Francisco Bay.

an overpass structure carrying Mountain View-Alviso traffic over Bayshore Freeway and short sections of

six-lane and four-lane divided highway within the interchange area. The contract on this portion is being per-

formed as a joint venture by Dan Caputo and M. J. B. Construction Company.

Also under construction is 4.4 miles of freeway extension from the San Mateo-Santa Clara county line to Stierlin Road near Moffett Field costing approximately \$3,465,000. This portion is being constructed by L. C. Smith Company and Concar Ranch and Enterprises.

A further extension to Fair Oaks Avenue in Sunnyvale will be under way this year with \$3,947,000 included in the 1959-60 Fiscal Year construction program.

The section from 0.5 mile north of Brokaw Road to Taylor Street, 2.7 miles long, is now under construction. Estimated cost is approximately \$4,315,000. The project includes a major interchange between the Nimitz Bayshore and Sign Route 17 freeways. It includes work on Sign Route 17 freeway to First Street in San Jose, and extends Bayshore Freeway to north of Brokaw Road. The work is being performed by Gordon H. Ball, Gordon H. Ball, Inc., Ball and Simpson and Lew Jones Construction Company.

Design studies are continuing on the remaining section between Sunnyvale and Brokaw Road. Completion of this 5.8-mile portion together with those portions under construction and already financed will provide a continuous freeway from San Francisco to south of San Jose.

San Jose to US 101 (Ford Road)

The last three-lane portion on the route was eliminated in 1957 by completion of a four-lane, future six-lane, freeway in the City of San Jose extending from Santa Clara Street to north of Taylor Street.

South of Santa Clara Street to Ford Road, the existing expressway has been in operation since 1947. Planning has proceeded for the eventual replacement of intersections at grade by interchanges.

US 101—El Camino Real

While not a freeway, improvements along this route justify inclusion in this article. Traffic signal and channelization projects have been completed at numerous locations. In addition, portions have been widened to

four- and six-lane, undivided and divided, conventional city street arterial standards.

A major project recently completed was a 3.9-mile widening project between San Tomas Aquino Creek in Santa Clara to State Sign Route 9 in Sunnyvale. This \$1,345,000 project was performed as a co-operative project. The Santa Clara County Flood Control District financed an estimated \$175,000 for drainage improvements desired to be constructed at the time of the highway work. Work done consisted of grading, surfacing and structures necessary to widen the highway to four 12-foot lanes with a 16-foot curbed median. The contractor on this project was A. J. Raisch Paving Company.

To be advertised shortly is a \$200,000 project for resurfacing portions of US 101 between State Sign Route 9 and Palo Alto.

Expansion of the existing highway to six lanes between Silva and Chadbourne Avenues in Millbrae was completed in November of 1958. This project which cost approximately \$111,000 also included traffic signals and lighting. The City of Millbrae completed additional work in conjunction with this project including curbs, gutters, and parking lanes.

Also under construction is a traffic signal and channelization project between Shakespeare Street and Theta Avenue in Daly City. This is a co-operative project with the City of Daly City and is being constructed by Electric Maintenance and Service Company.

US 101—Ford Road to San Benito County Line

In 1956, the three-lane width between Ford Road and Llagas Creek was expanded to a four-lane section. Included in the 1959-60 Budget are funds amounting to \$225,000 for the resurfacing of the four-lane section between Llagas Creek and Gilroy. Location studies are still underway for a freeway routing between Ford Road and south of Gilroy following land-use studies completed by the Santa Clara County Planning Department and Trafficways plan recently reported by the DeLeuw Cather and Company. Public meet-

ings will be scheduled upon completion of studies. South of Gilroy to the San Benito County line, 5.8 miles of four-lane expressway have been in operation since 1951. This section is planned for a future six-lane freeway when traffic requirements and availability of funds permit.

US 101—101 Bypass in San Francisco

Construction is now underway on the first unit of the Southern Freeway. It consists principally of an interchange with James Lick (Bayshore) Freeway at Alemany Boulevard. The City of San Francisco is contributing approximately \$1,400,000 to the cost of this \$7,629,000 project. In addition to the interchange, the project being constructed by Guy F. Atkinson includes approximately 0.5 mile of freeway to the west.

The second unit of this freeway is included in the 1959-60 Fiscal Year budget. A total of \$4,850,000 has been provided for construction westward to Mission Street. Route location beyond this point has been determined as far as Orizaba Avenue near the south city limits.

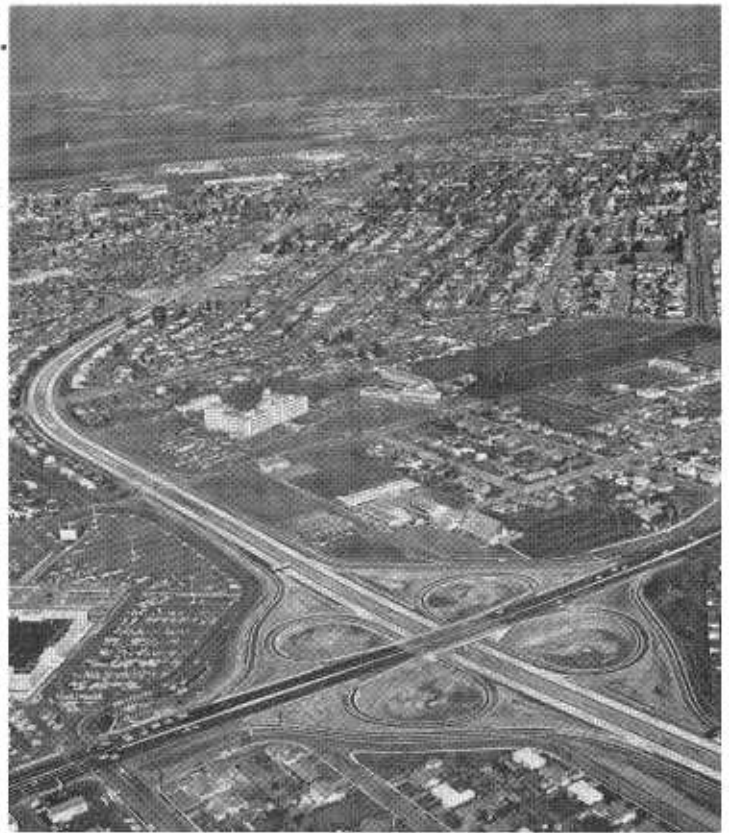
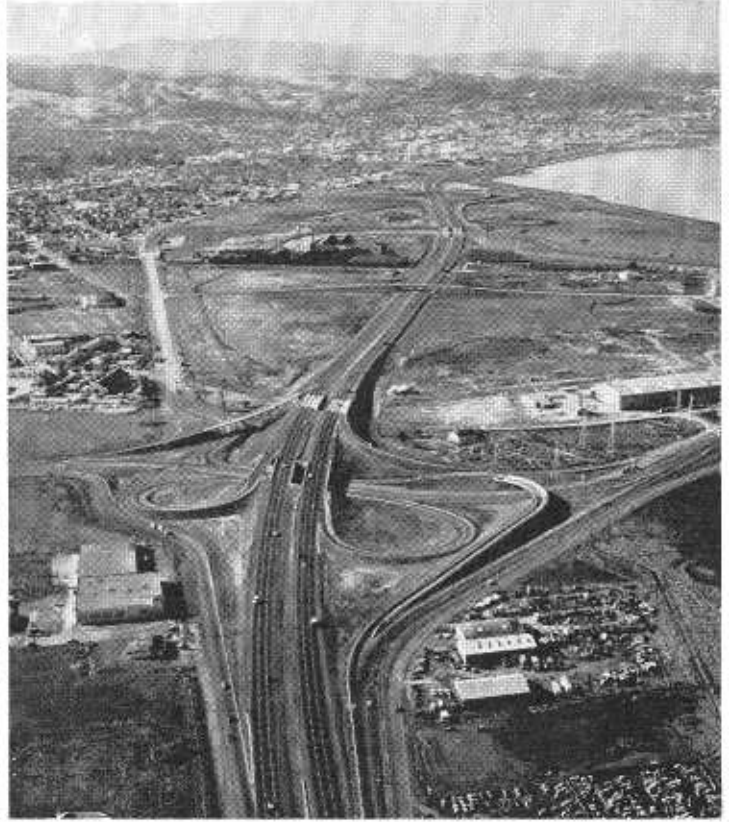
Rights-of-way acquisition is well advanced with \$15,625,000 appropriated prior to this year. An additional \$1,900,000 was appropriated this year and \$1,500,000 is included in the 1959-60 Fiscal Year budget. Overall construction costs on the entire 4.3 miles of the State's portion of the Southern Freeway are estimated at \$18,000,000.

This freeway is intended to serve traffic in conjunction with a freeway project to the east from the James Lick (Bayshore) Freeway on a routing which is not now a part of the State Highway System.

James Lick Freeway (Bayshore)

Except for the revisions in the vicinity of Alemany Boulevard to provide connections to the Southern Freeway, James Lick (Bayshore) Freeway is completed within San Francisco. Landscaping, ground cover and erosion control work continues. A landscaping project costing approximately \$42,500 is now underway between 5th and 15th Streets.

A sum of \$100,000 is included in the 1959-60 Fiscal Year budget for



UPPER LEFT—The new Sign Route 17 freeway from Route 42 in Los Gatos to Bascom Avenue will soon be opened to traffic. UPPER RIGHT—Relocation of the Bayshore Freeway in Redwood City showing the Harbor Boulevard interchange in the foreground. LOWER LEFT—Bayshore Freeway construction near Moffett Field in Santa Clara County. Mountain View-Alviso Road interchange is in the center. LOWER RIGHT—Construction on the San Jose-Los Gatos freeway showing the Stevens Creek Road interchange in the foreground.

the installation of a barrier in the median between Third Street and Army Street. This is the second installation of this type on this freeway, the first unit having been installed in 1957 between 17th Street and Army Street to minimize the number and severity of spectacular accidents resulting from median crossings into opposing traffic.

Central Freeway

This freeway is a distributor to the Civic Center area of San Francisco. The first unit, a single-level elevated structure, was opened to traffic in 1955 from the James Lick Freeway, to South Van Ness Avenue. With the elevated portion of James Lick (Bayshore) Freeway, this portion is often referred to as the "San Francisco Skyway."

Nearing completion is the second unit, a 1.3-mile-long extension from South Van Ness Avenue to Turk Street. This portion is a two-level elevated viaduct over the city streets, leaving them free to handle cross-traffic movements. The \$7,725,000 project is being constructed by the Peter Kiewit Sons Company and is expected to be open to traffic in April of this year. Southbound traffic will

be carried on the three upper-level lanes and northbound traffic will be carried on the lower deck. Shoulders have been provided for emergency parking clear of the through lanes on each level of the facility. Rights-of-way acquisition has cost a total of \$8,626,000 and construction costs will approximate \$11,847,000. \$125,000 has been included in the 1959-60 Budget for landscaping between Mission Street and Turk Street.

Sign Route 17

The freeway entrance to the City of Santa Cruz between the north city limits and Mission Street was completed in December of 1956, providing much-needed traffic distribution facilities in the Santa Cruz recreational area. Seventy-five thousand dollars has been included in the 1959-60 construction program for a landscaping project on Sign Routes 1 and 17 near Santa Cruz.

Bids were opened March 4, 1959, for construction of 3.3 miles of four-lane expressway, ultimate six-lane freeway, between the completed freeway at Sign Route 1 near Santa Cruz and Carbonera Creek near Glen Canyon Road. A total of \$1,880,000 is available for the project which in-

cludes an interchange at Pasatiempo Underpass at Beulah Park and frontage roads along most of the new expressway section. This work will eliminate a section of three-lane highway. The remaining three-lane highway through Scotts Valley will be replaced by a future project now in the design stage.

From Lexington Dam to the Saratoga Avenue Interchange in Los Gatos, expressway facilities were constructed in 1956.

Construction of the 8.8-mile relocation project between the junction of the Saratoga-Los Gatos Highway in Los Gatos and Bascom Avenue in San Jose is nearly completed and may be open to traffic before the printing of this article. This project estimated to cost approximately \$5,835,000 is a four-lane, future six-lane, freeway on relocation. Alignment of this section lies approximately midway between the Santa Clara-Los Gatos Road and the San Jose-Los Gatos Road (existing Sign Route 17). Work is being performed by Gordon H. Ball, Ball and Simpson, and Lew Jones Construction Company.

The 1959-60 Fiscal Year construction program includes \$190,000 for landscaping at the Saratoga Avenue



This new high level bridge now takes US 101 traffic across Richardson Bay in Marin County.

Interchange and along the freeway to Bascom Avenue. It also includes \$100,000 for drainage facilities and channel lining at Los Gatos Creek in Los Gatos.

The two remaining projects required to complete a continuous freeway from southwest of Los Gatos to north of Oakland are now under construction. One project between Bascom Avenue and North Fourth Street in San Jose will be constructed as an initial four-lane, ultimate six-lane, freeway and will complete a four-lane divided freeway through the City of San Jose. The work is being performed as a joint venture by Gordon H. Ball, Gordon H. Ball, Inc., Ball and Simpson, and Lew Jones Construction Co. The 2.5-mile portion will cost approximately \$3,117,000 and will include four interchanges. Work is expected to be completed in the spring of 1960. The other project is the 1.2-mile portion between First Street and 0.3 mile north of existing Bayshore Highway. Initial construction will be four-lane divided with the future addition of two lanes contemplated when needed. The \$4,315,000 project will include a full cloverleaf at the intersection of Nimitz and Bayshore Freeways and 2.7 miles of four-lane freeway on US 101 Bypass. Work is being performed by the same joint venture contractors.

San Jose to Oakland (Nimitz Freeway)

North of this point the initial four-lane freeway has been in service since 1954 as far as Warm Springs. The last unit, which completed the gap in continuous freeway San Jose to Oakland, was opened to traffic late in 1958. The \$6,840,000 project, from Warm Springs to Beard Road north of Centerville in Fremont was constructed as an initial four-lane, ultimate six-lane freeway. The 9.9-mile-long contract was performed by contractors Gordon H. Ball and Ball and Simpson.

Immediately north of Beard Road, a 5.8-mile section of the freeway was completed to Jackson Street in 1957. During the past year, a pedestrian overcrossing was constructed at Eldridge Avenue to provide facilities for school children to cross the freeway. This structure located between Ten-



UPPER The new Embarcadero Freeway in San Francisco connects traffic with Main, Beale, Mission, Fremont and Folsom Streets and north of Market Street with Broadway, Sansome and Battery Streets. LOWER—The Central Freeway Extension from South Van Ness Avenue (lower right) to Turk Street (center left). Civic Center in right middleground.

nyson Road and Jackson Street in Hayward cost approximately \$54,000.

North of Jackson Street, the freeway has been in operation since 1953. The portion between Washington Avenue in San Leandro and High Street in Oakland was widened to six lanes in 1956 to handle the increased flow of traffic resulting from completion of the four-lane freeway connection between US 50 and the Nimitz Freeway. Plans have been completed for a project to provide a barrier in the median between High Street in Oakland and Washington Avenue. This \$306,000 project is expected to minimize the number and severity of spectacular accidents that have occurred due primarily to median crossings on this 6.8-mile facility.

Included in the 1959-60 Budget is a project costing approximately \$320,000 for construction of the Floresta Drive Overcrossing in San Leandro. This project will be performed as a co-operative project between the City of San Leandro and the State, with the city providing an estimated \$160,000 of the funds required.

Nimitz Freeway Through Oakland

In November of 1958, the last unit in Oakland was opened to traffic. This 1.6-mile project extended from Fallon Street to Market Street in Oakland. An eight-lane freeway partially on elevated single-deck structure and partially earth fill was constructed. Construction costs for this project approximated \$5,134,000. The contractor was Johnson, Drake and Piper, Inc. North of this project 2.1 miles of elevated, double-deck freeway was completed in 1957. The Cypress Street Overhead, as it is locally known, provides four lanes of traffic on each deck with opposing traffic traveling on separate levels. The former highway (Cypress Street) was reconstructed at surface level, thereby supplying a divided arterial street for use by local traffic. Funds in the amount of \$57,000 have been included in the 1959-60 Budget for landscaping this portion of Sign Route 17 extending from Market Street to the distribution structure, the northerly terminal of the Nimitz Freeway.

US 40 to US 101

Soon after the completion of the San Rafael-Richmond Bridge in 1957, Sign Route 17 was extended from the Eastshore Freeway to connect with US 101 south of San Rafael at San Quentin Wye. The new bridge carrying three lanes of traffic on separate levels, and the east approaches extending to Marine Street in Richmond were constructed through bond financing by the Division of Bay Toll Crossings.

The route for the future connection between US 40 (Eastshore Freeway) at its intersection with Hoffman Boulevard has been adopted in its entirety. Preliminary design is under way for the initial construction of six lanes between the above limits, with provisions for eight lanes between 32d Street and Marine Street. Numerous interim projects, including channelization of various intersections and drainage improvements have been completed along the present Hoffman Boulevard routing to allow more efficient use of the existing facilities during the interim period prior to freeway construction.

The west approaches of the Richmond-San Rafael Bridge have been and are being constructed by the Division of Highways with state highway funds. A freeway approach from the bridge to west of Sir Francis Drake Boulevard was completed in 1957. Presently under construction is a two-mile project extending the freeway to the north terminus of Sign Route 17 at US 101 south of San Rafael. Construction will cost approximately \$855,000. The work on this four-lane freeway is being performed by Gallagher and Burke, Inc.

Sign Routes 9 and 21

The route has been adopted from Warm Springs to Mission San Jose for the Sign Route 9 portion of this Interstate Route. The adopted location lies to the west of the existing highway. From Mission San Jose northeasterly to Sunol, the route has also been adopted and the location follows in general along the existing Sign Route 21 with substantial reductions in rate of grade over Mission Pass. Design studies are well advanced

along both these sections of the interstate system. From Sunol to the connection with US 50 at Dublin, preliminary meetings have been held in the area and planning studies are under way for determination of final route location.

Dublin to Martinez

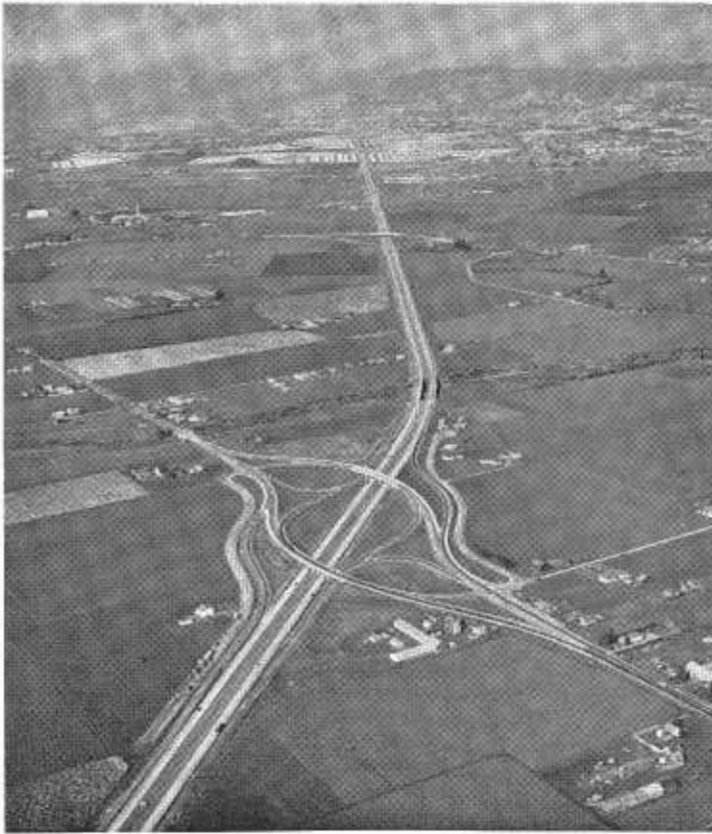
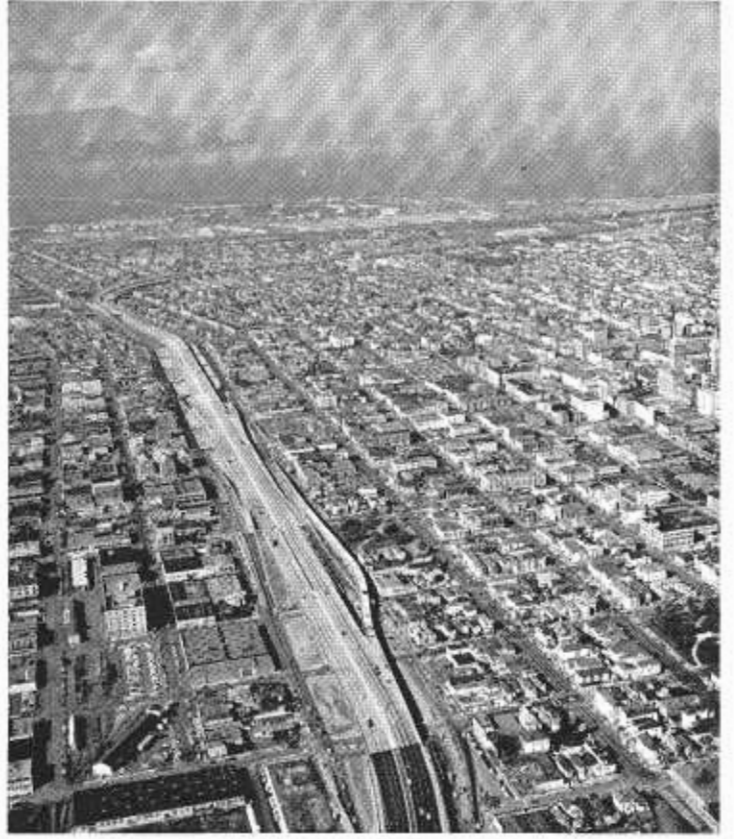
The route has been adopted and design studies are in advanced stages. Right-of-way is being acquired between Danville and Walnut Creek.

From south of Walnut Creek at Rudgear Road to a junction with Route 24 near Oakland Boulevard and thence to the newly completed freeway north of Walnut Creek, a 4.2-mile four- and six-lane initial facility is now under construction. This project started in June of 1957 is expected to be completed in the latter part of this year at a cost of approximately \$8,546,000. The work on this project which includes five interchanges and 11 other major structures is being performed by Charles L. Harney, Inc. This project also constructs a part of State Sign Route 24 from Walnut Creek to the completed freeway east of Lafayette.

From Walnut Creek to Monument a 2.9-mile section of freeway was placed into operation in January of 1957, at a cost of \$2,900,000. The route has been adopted and design is nearly completed from Monument to the future Martinez-Benicia Bridge. Construction of the bridge and approaches is to be financed through revenue bonds in conjunction with toll bridge project authorized by the Legislature in 1952. South of Escobar Street in Martinez, the freeway will be financed from federal and state participation in the Interstate Highway Program. The proposed high-level Martinez-Benicia Bridge will cross the strait immediately west of the existing Southern Pacific Railroad Bridge.

Sign Route 24

Sign Route 24 starts at US 40 (Eastshore Freeway) in Berkeley and proceeds easterly through Walnut Creek, Concord, Antioch and to points north via the Antioch Bridge. At the Broadway Tunnel an additional two-lane bore is to be con-



ALAMEDA COUNTY. UPPER LEFT—Looking south along US 40 toward downtown Oakland with the El Cerrito Overhead in the center and the Eastshore Freeway beyond. UPPER RIGHT—The new Fallon to Market Street section of the Nimitz Freeway. LOWER LEFT—The Beard Road interchange on the Nimitz Freeway south of Hayward. LOWER RIGHT—The Nimitz Freeway in southern Alameda County showing residential development adjacent to the freeway.

structed to the north of the two existing two-lane tunnels initially, then the additional lanes will allow four-lane operation in one direction during peak hours as well as permitting maintenance of the tunnels during off-peak hours without restricting traffic flow. An additional two-lane bore is contemplated for future traffic requirements.

Extending east from the portal of Broadway Tunnel, design is well advanced on a future eight-lane freeway. As an interim measure, an additional lane was added in 1956 to the westbound lanes between the tunnel and Orinda to permit normal traffic to pass slow-moving vehicles safely on this sustained grade. The Orinda Interchange has been in service since 1955.

Orinda to Arnold Industrial Freeway

Presently under construction is a six-lane ultimate eight-lane freeway between Orinda Road and 0.8 mile east of Sunnybrook Drive. This 2.1-mile project connects to the Lafayette Bypass completed in 1957. Work is being performed on this \$3,900,000 project as a joint venture by Gordon H. Ball, Gordon Ball, Inc., and Ball and Simpson. Completion is expected in September of this year. The con-

tract is a co-operative project of the Central Contra Costa Sanitary District, the County of Contra Costa and the State. Sewer work which is being done as a part of the freeway contract is being financed by the county and sanitary district at a cost of \$380,000.

Also completed in 1957 under separate contract was the Pleasant Hill Interchange, immediately east of the Lafayette Bypass. This interchange serves as a connection between the state freeway and an important county expressway to the north. It will also serve in the future as a connection southerly with the Shepherd Canyon Freeway to Oakland. The remaining portion of the freeway to Walnut Creek is now under construction and is covered under Sign Route 21. By the end of 1959 a continuous freeway will be in service from west of Orinda to north of Monument near Concord.

Design is nearly completed for extending the freeway now terminating at Monument to a connection with Arnold Industrial Freeway north of Concord.

Concord to Solano County Line

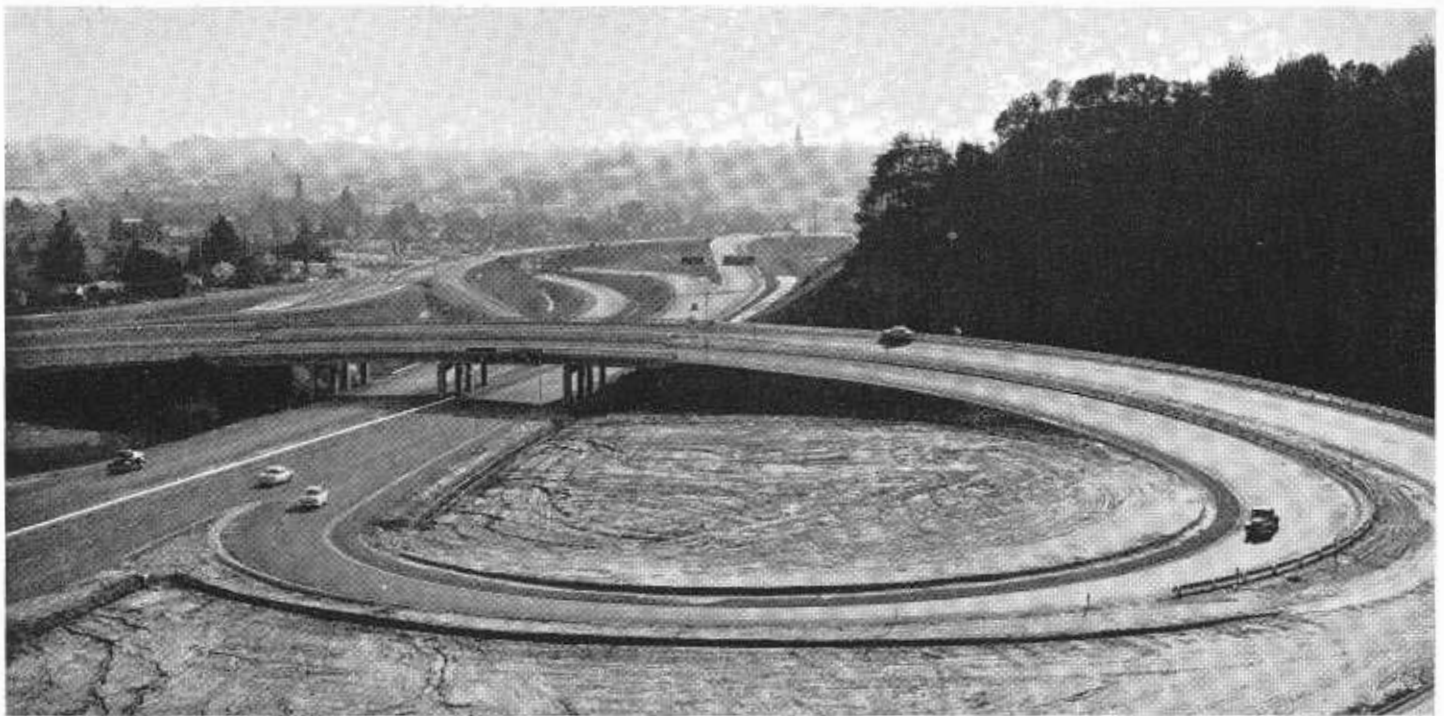
Sign Routes 24 and 4 are identical routings between their westerly junction north of Concord and Neroly

Road east of Antioch. The portion of the freeway between Willow Pass Road to A Street in Antioch was completed in 1952. From A Street to Neroly Road and thence to the Sacramento county line via the Antioch Bridge the route has been adopted and declared a freeway. Design studies are well advanced. East of Neroly Road to the San Joaquin county line the status of development is discussed under Sign Route 4.

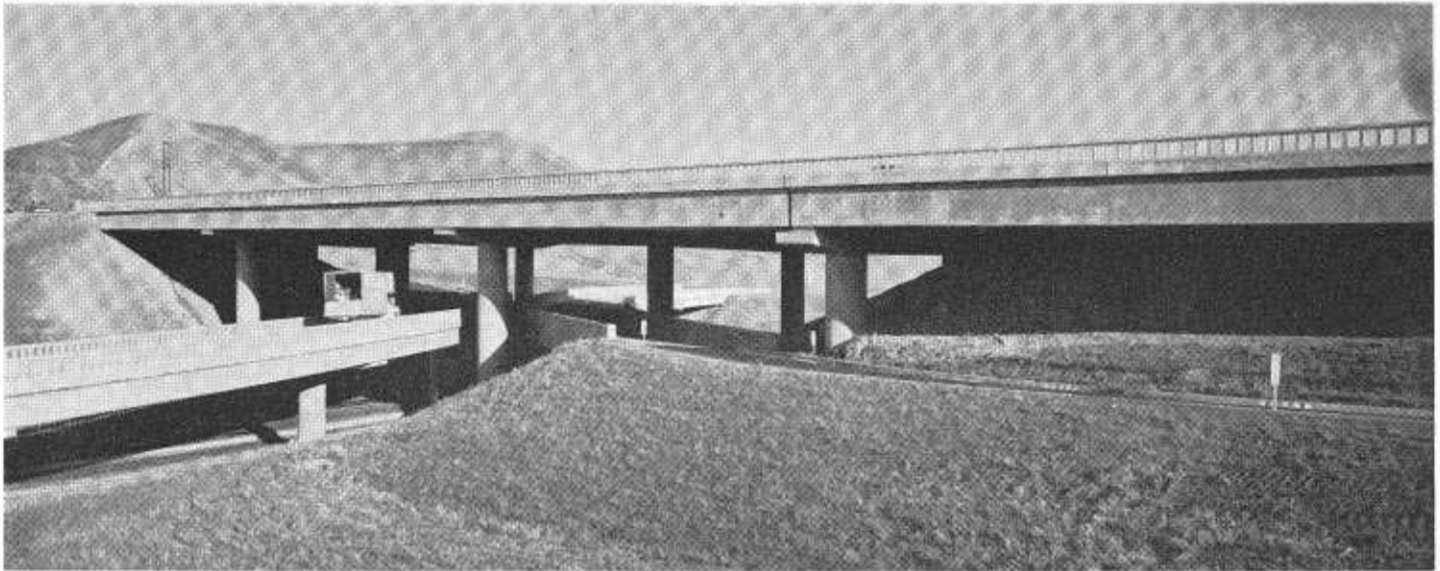
Embarcadero Freeway

The last portion of this multilane elevated freeway for which a routing has been determined was opened to traffic in February of this year. Freeway service is now provided from the on and off ramps at Broadway and Sansome Streets, to the Skyway as well as to the San Francisco-Oakland Bay Bridge. This 1.2-mile section cost approximately \$7,627,000, and work was performed by Charles L. Harney, Inc. Included in the work was extensive reconstruction work required to relocate portions of both the State Belt and Southern Pacific Railroad tracks on the Embarcadero under the freeway.

Construction was started on the first of the three projects for this freeway in May of 1955 by MacDonald,



The Morrissey Avenue interchange in Santa Cruz. Beyond are the ramps connecting Sign Route 17 with Sign Route 1.



The three-level interchange near Hercules where two freeways meet. Top level is US 40; bottom level is the Arnold Industrial Freeway; middle level is for on ramps to US 40.

Young and Nelson, Inc., and Morrison-Knudsen. The entire facility, 1.5 miles in length, has cost approximately \$14,862,000 for construction and \$11,720,000 has been expended or budgeted for rights-of-way acquisition.

Junipero Serra Freeway

On July 23, 1958, the Highway Commission adopted the route for the portion of Junipero Serra Freeway in San Mateo and Santa Clara Counties between San Bruno Avenue near the end of the existing Junipero Serra Boulevard and Saratoga Avenue southwest of Santa Clara. State Highway Route 239 as designated by the State Legislature in February, 1957, has now been entirely adopted from US 101 south of Ford Road near San Jose to San Bruno Avenue. The cost of the initial development is estimated at approximately \$74,000,000 including rights-of-way. The portion of this freeway north of San Jose is a part of the Interstate Highway System, approximately 90 percent of which will be financed from federal funds. Design is being expedited on this very important route and numerous construction projects are anticipated. Extensive rights-of-way acquisition cannot commence until detailed design studies have progressed and freeway agreements reached with local authorities. It is expected that the first construction project, the

limits of which are not known at this time, may not be under way for several years.

From San Bruno Avenue north to the present intersection with Sign Route 1 in Daly City, the existing expressway is designated as State Highway Route 237. It was constructed by Joint Highway District No. 10 which was dissolved by the Legislature in July of 1956 and taken into the State Highway System at that time. Studies are presently under way for possible freeway relocation between San Bruno Avenue and the San Francisco county line. Initial public meetings have been held and further studies are being made prior to other hearings leading to route adoption.

Sign Route 1 (Cabrillo Highway)

This route has been developed as an expressway between Edgemar Road in Daly City to Lake Merced Boulevard in San Francisco. This 4.6-mile expressway was completed in 1956 and the northerly portion from the south city limits of San Francisco to Lake Merced Boulevard was constructed by the City of San Francisco.

A \$1,391,000 project was completed in 1958 between Edgemar in Pacifica and Skyline Boulevard at Edgemar Road in Daly City. This 2.2-mile, four-lane expressway bypassed the section of two-lane coastal road

along Thornton Bluffs south of San Francisco. Maintenance of traffic due to wet weather slides had been difficult and costly on the old coastal road. Contractor was McCammon-Wunderlich and the Wunderlich Contracting Company.

A route was adopted on January 22, 1958, extending this expressway southerly to Pedro Valley in Pacifica and design studies are under way. Relocation studies for the Devil's Slide area are well advanced and preliminary meetings have been held.

In the vicinity of Santa Cruz the 2.1-mile initial four-lane, future six-lane freeway between the junction of Sign Routes 1 and 17 to 0.3 mile east of Morrissey Avenue was completed in November of 1958. The construction was performed as a joint venture by Dan Caputo and Dan Caputo and Edward Keeble. Also completed last fall were the initial two lanes of the future four-lane expressway on new alignment between Swift Street in Santa Cruz and Wilder Creek north of the city limits. This project was jointly financed by the State and Joint Highway District No. 9 with the State contributing \$419,000 to the cost. The contractor was Granite Construction Company. From Wilder Creek to four miles south of Davenport plans are complete for the initial two lanes of a future four-lane, limited-access freeway. Seven hundred



Expressway construction on the Black Point Cutoff (Sign Route 37) with the new bridge across Petaluma Creek in the upper center and the Atherton Avenue interchange in the foreground.

thousand dollars is included in the 1959-60 Fiscal Year program for this project which will be under construction this summer.

South of Santa Cruz, an expressway has been in operation to Rob Roy Junction for some time. Design studies are now in progress to convert this portion to a full freeway. Studies are also being made to expand the existing three-lane highway between Rob Roy Junction and Watsonville. South of Watsonville to the Monterey county line, the route has been adopted and design is well advanced for a four-lane, ultimate six-lane freeway facility.

19th Avenue Freeway (San Mateo)

In March, 1957, the State Highway Commission adopted the route for this freeway extending from Sign Route 5 (Skyline Boulevard) west of San Mateo, to the Alameda county line, a distance totaling 7.2 miles. Design studies on this four-lane facility are well advanced and rights-of-way acquisitions are in progress. This freeway will connect to the route adopted in Alameda County from the county

line to the Nimitz Freeway by action of the Highway Commission in 1952. It is anticipated that construction will begin as soon as availability of funds and priority of other worthwhile projects will permit. The Division of Bay Toll Crossings has recently completed a report of preliminary studies of expanding the San Mateo Bridge and approaches to freeway standards.

Pacheco Pass

Since 1951, a four-lane freeway has been in use on Sign Route 152 over Pacheco Pass. Advance planning studies are being made to extend this facility westerly to San Felipe.

Stevens Creek Freeway

The route has been adopted for this important cross-country freeway from Sign Route 17 in Los Gatos to the Bayshore Freeway near Mountain View and design studies are in progress. The southerly portion will be initially constructed as a four-lane facility and rights of way will be purchased for future eight lanes between the Junipero Serra Freeway in

Cupertino and the Monterey Highway near Ford Road. From Junipero Serra to Bayshore Freeway (US 101 Bypass) an initial four-lane, ultimate six-lane project is being designed.

Mountain View-Milpitas Area

The location of State Sign Route 9 from Bayshore Freeway to Nimitz Freeway was adopted in December of 1954. From El Camino Real to Bayshore Freeway the route was adopted in September, 1958. Two lanes of the future Alviso Bypass Freeway have been in operation since 1957 on the portion between Lawrence Station Road east of Bayshore Freeway and the San Jose - Alviso Road east of Alviso. The 2.5-mile widening project between Lawrence Station Road and Bayshore Freeway was completed in August of 1958 by Edward Keeble, contractor. East of Alviso, design studies are well advanced for realignment in the vicinity of Coyote Creek.

Route 228—Nimitz Freeway to US 50

This important four-lane freeway was completed in September, 1956, and provides a connection from the Nimitz Freeway in the vicinity of Lewelling Boulevard to US 50 in Castro Valley, thus providing continuous freeway or expressway facilities between the Bay Bridge and Tracy in San Joaquin County. A landscaping contract was completed on this portion in October of 1958.

Webster Street Tube

The plans have been completed for a parallel two-lane tube and approaches between Oakland and Alameda and it is expected that this project will be advertised this spring. The new tube will be constructed generally parallel to and a short distance westerly of the existing two-lane Posey Tube. The tube will be 3,350 feet long and together with approaches amounts to a 1.1-mile project. Construction of the parallel tube and the Alameda and Oakland approaches will be accomplished in one contract and upon completion of this work, the new tube will be placed into operation and the existing Posey Tube will be closed for rehabilitation

... Continued on page 52

How FAS Works

Secondary Road Program Outlined

By E. R. HANNA, Road Commissioner, San Benito County

IN ORDER to properly explain the operation of the Federal Aid Secondary Highway Program in California, it is necessary that I explain public works operation in California counties.

California is divided into 58 counties. Fifty-seven of these counties operate under the direction of an elected five-man board of supervisors. San Francisco is in a class by itself, being a combined city-county government by special act of the State Legislature. Since San Francisco is entirely metropolitan and therefore ineligible for federal secondary highway funds, we need not consider them.

The counties are governed by a five-man board of supervisors, elected by districts within the county to four-year staggered terms, and since we do not have township governments in California, the 57 county boards of supervisors are an important influence in California government.

Each county is required by the State Constitution to have a county surveyor. He may be either elected or appointed at the option of the board of supervisors. Each county is required by law to have a county road commissioner. He may, or may not be, the county surveyor, the county engineer, or the Public Works Director, again at the option of the board of supervisors; but in either event he must be an engineer found competent at a public hearing prior to his appointment, to handle the administration of the county road department. The road commissioner is an administrative officer of the county, and is directly responsible to the board of supervisors for the complete operations of the county road department.



E. R. HANNA

This is the text of an address delivered on December 2, 1958, before the Committee on Secondary Roads at the 44th annual meeting of the American Association of State Highway Officials in San Francisco.

Hanna has been Road Commissioner of San Benito County since 1947. He is a past president of the County Engineers Association of California, and was a member of the Technical Advisory Committee of city and county officials on the 1958 statewide freeway study.

Control Operations

Individually, the county supervisors have nothing to do with the county road administration. Collectively, when sitting as a board of supervisors, they are the policymaking board and have full control of the operations through adopting policy, adopting the budget, and providing the funds necessary to implement the budget.

In addition to the two public works officials required by law, the surveyor and the road commissioner, any county may appoint a county engineer for such engineering duties as may be delegated to him outside of the road functions, and the supervisors may, by ordinance, appoint a public works director. Since the road commissioner is responsible directly to the board of supervisors, the only way that a public works department can be set up under a single head, is to appoint the public works director as road commissioner. This has been done in many of the counties, although we can find every possible combination of the four offices from a single person holding all the titles, to a separate individual for each of the four offices.

In California, 98½ percent of the federal aid secondary funds are re-allocated to the counties by formula,

for expenditure upon county roads in the Federal Secondary Highway System. Through the Secondary Highways Act, our State Legislature has provided matching funds to the counties up to a maximum of \$200,000 per county per year. Federal aid urban funds are used only on federal primary routes, which in California are all state highways.

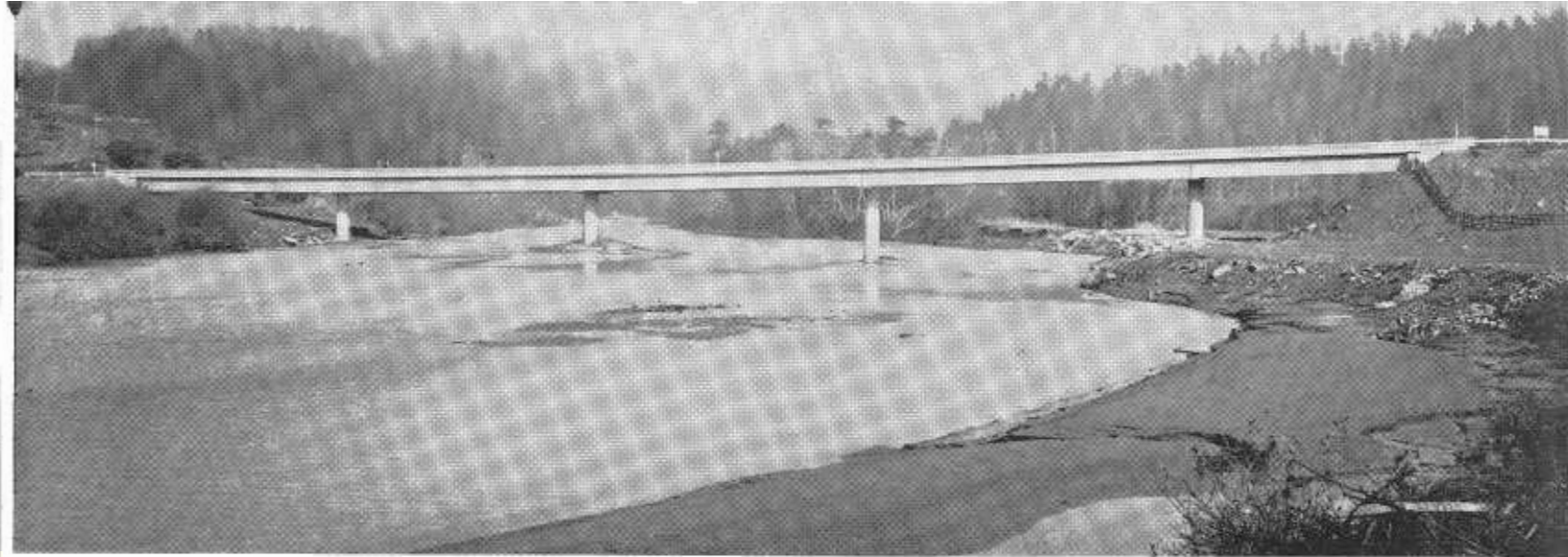
Projects Selected

The counties do not actually receive any secondary money at the local level, but the funds are held by the State and made available for the use of the counties.

The mechanics of setting up and constructing a project are simple. The county, through the road commissioner and the board of supervisors, selects the project, makes an estimate of cost for budgeting purposes, together with a tabulation of the source of available funds, and submits it to the State Division of Highways, along with the proposed typical section. Upon receipt of the program, an engineer from the Bureau of Public Roads, and an engineer from the State Division of Highways, come to the county and together with the county road commissioner, inspect the proposed work. Upon tentative approval of the program by the bureau and the State, the county prepares the plans and the recommended specifications, and submits them to the Division of Highways together with an amended estimate of cost and an amended budget. The Division of Highways then prepares the project for bids, placing it under contract in conformance with the State Contract Act in the same form and manner as any state highway contract.

Upon opening of bids in Sacramento, and before approval of the contract, the county must forward to the State Treasurer the amount of county funds required to complete

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Gualala Bridge

*New Structure Follows
Ferry, Two Older Spans*

THE NEW bridge across the Gualala River on Sign Route 1, opened this winter, is the third bridge to carry north coast traffic across this stream. The latest bridge, of standard reinforced box girder design on single column bents, crosses farther downstream than its two predecessors, and in addition to its historical interest, is typical of the bridge modernization program along this section of the California coast.

The original Gualala Bridge was a joint effort of Sonoma and Mendocino Counties, and was built in 1894. Prior to that there was a cable controlled ferry. This first bridge, a single span truss of wood and steel, was shaken out of position by the 1906 earthquake, but was so well built this did not put it out of service. Eventually it was jacked back into place and used for many more years.

In 1920 the old structure was replaced by another, also of single span, truss construction, but all steel, and sturdier. This span was secondhand, having once been the center portion of the Tuolumne River crossing at Modesto. The counties disassembled it and re-erected it at the new site. When it was replaced this winter after 38 years of service on the Gualala,

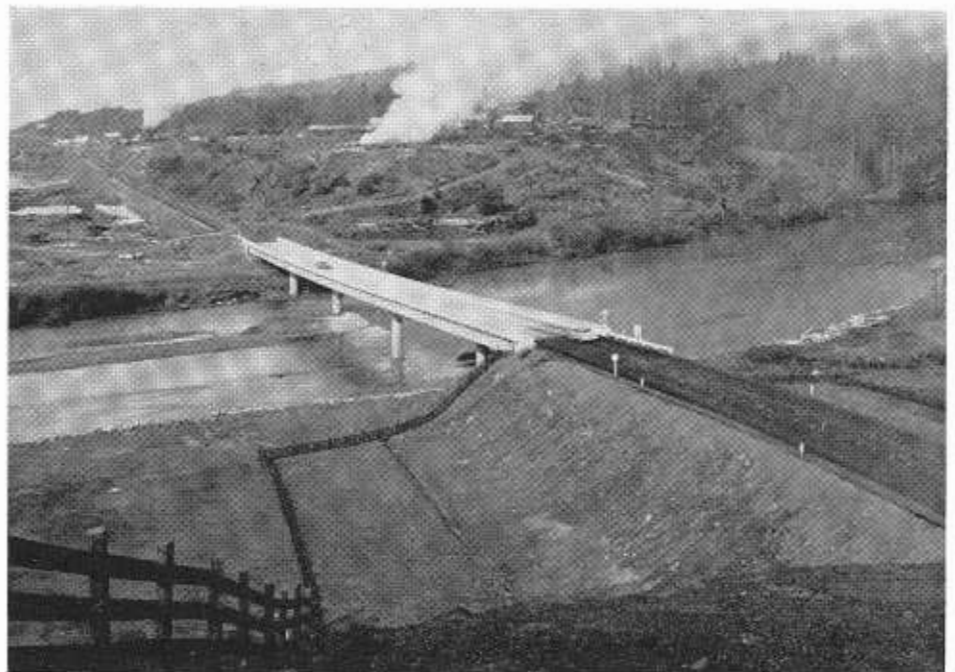
corrosion had eaten holes all the way through its members in places, and it was blown up as valueless.

Placement of the new bridge was on realignment of State Sign Route 1, as part of the long-range modernization program on this route since it became a state highway in 1933. The new bridge is typical of the program, in that it eliminates one more annoying bend in the route.

These bends are carryovers from

the days when the road followed the path of least resistance. When there were no canyons, it stayed just above the coastal cliffs, taking advantage of the level terrain along the old wave-cut terraces.

The jagged ravines at stream outlets were a problem, and there are many in this area of heavy rainfall. In each case, to avoid the steep grade down to the stream level, and the wide span near the mouth of the



PHOTOS ABOVE AND RIGHT—Two views of the new reinforced concrete box girder bridge across the Gualala River on Sign Route 1.

stream, the road turned upstream to an easier crossing. After crossing, it came back to the coast again. With these upstream crossings, bridges could be shorter and cheaper, and the grades were less difficult for the six-horse logging wagons.

Modern engineering and roadbuilding equipment permits much better grading and bridge construction, just as the modern automobile demands fewer curves and better line-of-sight design. In the 25 years since the State took over this section of the Shoreline Highway, almost 90 bridges have been replaced along the Mendocino County coast. In virtually every case, the new bridge was built downstream from the old one, with an accompanying road realignment which eliminated an upstream detour.

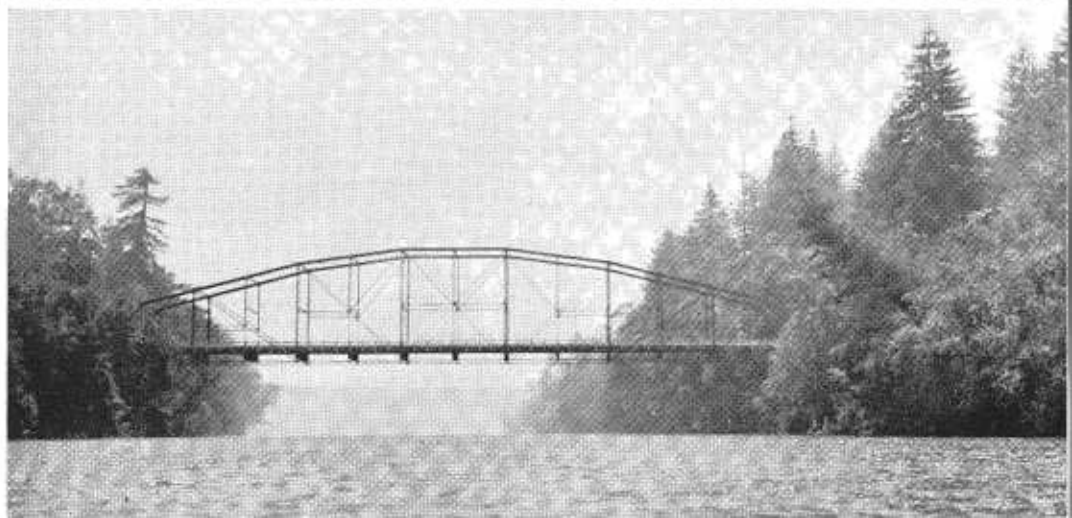
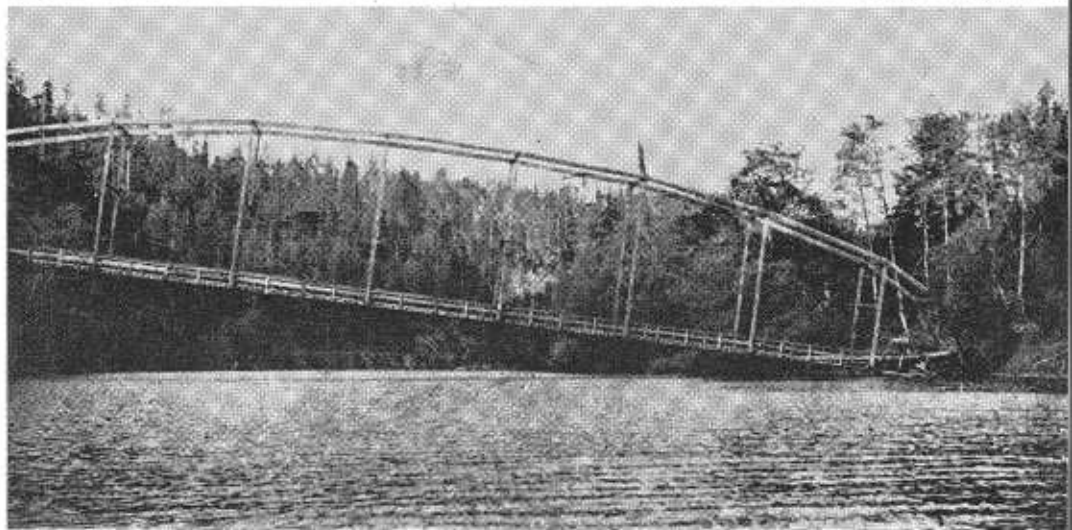
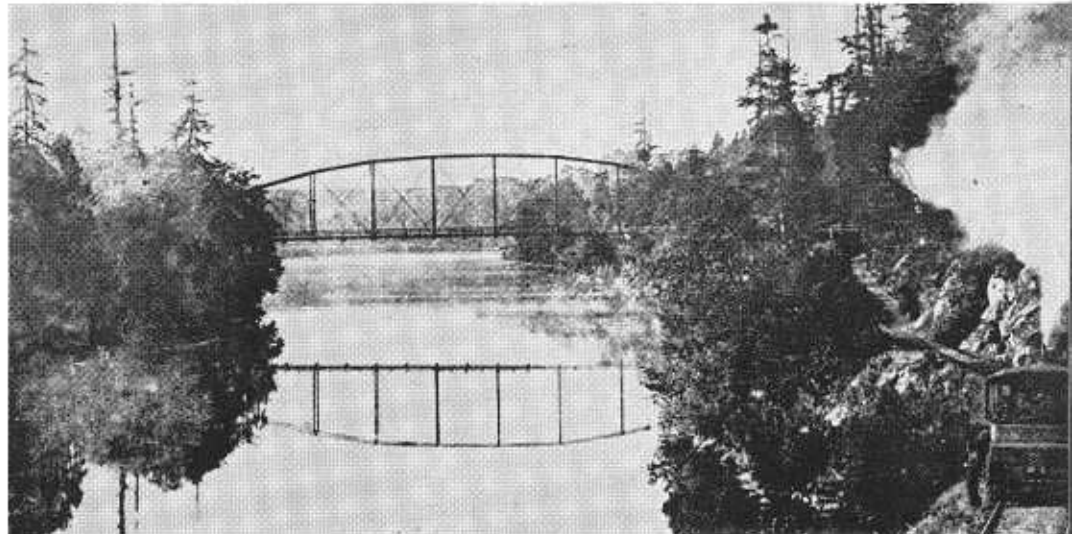
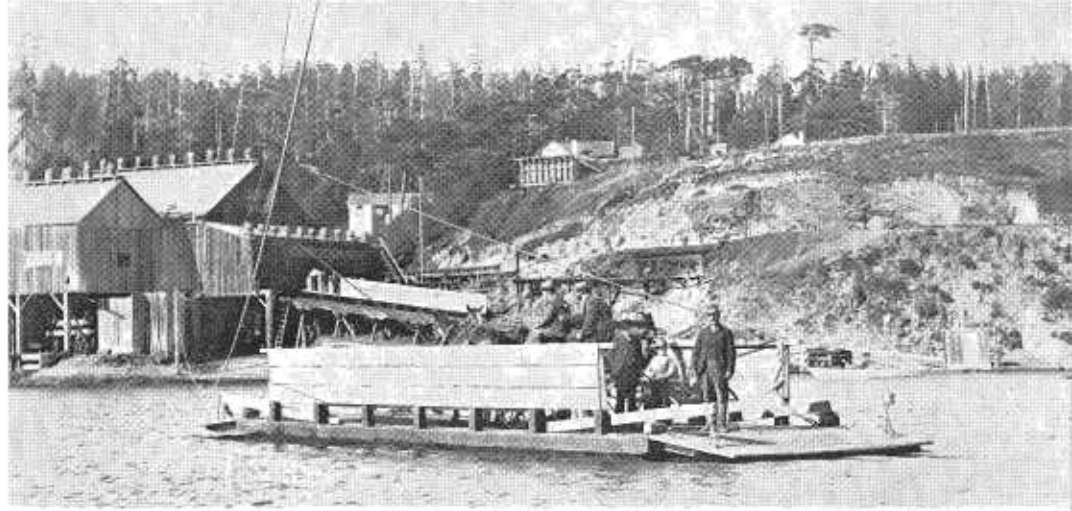
Many of the new bridges have colorful names like Schooner Gulch, Jughandle Creek, Ten Mile River, and Jack Peters Creek—names that reflect the early history of the country.

The Russian Gulch Bridge, just north of Mendocino City, was completed in the 1930's, and has been widely publicized as one of the most beautiful concrete arch bridges in the United States.

The bridges at Big River, Caspar Creek, and Mallo Pass Creek have been partially reconstructed to keep them in service a while longer, but they will be replaced within the next 10 years. A contract was recently let for a new bridge at Pudding Creek.

Only the bridge at Glennan Gulch, and two cattle passes under the highway, remain to be contracted for to complete the 25-year program.

A similar program has already been started on the new section of Sign Route 1 north of Westport, a section which was added to the State Highway System in 1957.



PHOTOS show four phases in the development of a highway crossing over the Gualala River. A cable ferry (top) crossed the river in the early 1890's approximately where the new bridge now stands. (This photo courtesy of Dean Allen of Oakland). The second photo down shows the original bridge near Gualala built in 1894 while the third photo shows the same bridge shaken from one of its piers by the Earthquake of 1906. Traffic used it in this position for some months until it could be reset on the pier. (These two photos courtesy of J. A. Halliday of Piedmont). Bottom photo shows Gualala Bridge Number 2 which was bought secondhand and transported piecemeal from Modesto for reassembly at the site.

Cost Index

Fourth Quarter Prices for
1958 Resume Upward Trend

By J. P. MURPHY, Assistant State Highway Engineer, and H. C. McCarty, Office Engineer

THE CALIFORNIA Highway Construction Cost Index for the fourth quarter of 1958 resumed an upward course after showing a downward trend for the first three quarters of the year. The index now stands at 238.5 (1940 = 100), which is 10.0 index points or 4.4 percent above the third quarter. However, it is still 23.6 points or 9.0 percent below the fourth quarter of 1957.

Increased competition raised the average number of bidders from 5.6 per project in October to 7.0 in November and 6.9 in December, establishing an average for the three-month period of 6.3 bidders per project. There were 5.5 bidders per project for the third quarter of 1958. A tabulation showing the average number of bidders arranged according to types of construction and project value is included with this release. This table includes all projects for which bids were received.

The number of projects for which bids were opened dropped from 187 for the third quarter to 174 for this quarter. These projects, which provide the data for preparation of this quarter's index, are distributed as shown in the accompanying table of the size of the projects considered in this survey.

The total value of the above projects is \$36,189,715.

Four of the seven items used in the preparation of this Index show lower average unit prices than the previous quarter. The other three—Roadway Excavation, Asphaltic and Bituminous Mixes, and Class "A" Portland Cement Concrete (Structures)—show increases, of which Roadway Excavation exerted the greatest influence in raising the Index. The following table shows average unit prices for the seven items used in its preparation.

The average unit price of \$0.52 a cubic yard for roadway excavation

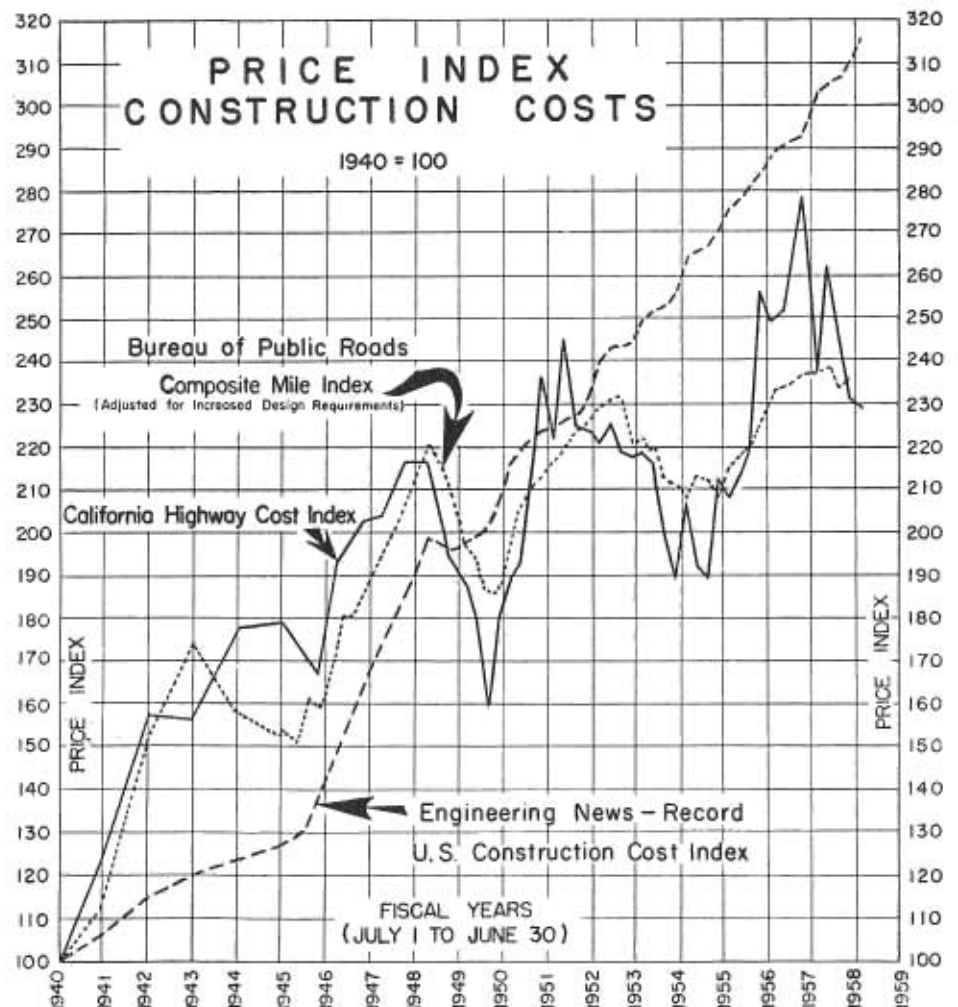
SIZE OF PROJECTS CONSIDERED IN SURVEY

Range	No. of projects	Value of projects
Under \$50,000	95—54.6%	\$2,045,370— 5.6%
\$50,000 to \$100,000	20—11.5%	1,441,403— 4.0%
100,000 to 250,000	30—17.2%	4,681,150—12.9%
250,000 to 500,000	14— 8.0%	4,954,378—13.7%
500,000 to 1,000,000	9— 5.2%	6,040,814—16.7%
1,000,000 to 2,500,000	3— 1.7%	4,038,645—11.2%
2,500,000 to 5,000,000	1— 0.6%	2,564,777— 7.1%
Over \$5,000,000	2— 1.2%	10,423,178—28.8%

is \$0.13 above the third quarter and returns the price for this item to its typical value for the last three years. Unit bid prices in projects exercising significant weight in establishing this average ranged from \$0.27 to \$0.80

per cubic yard, with a large freeway project in Kern County, which included more than 50 percent of the quantity during this quarter, exercising the greatest influence.

... Continued on page 50



Delano

Postfreeway Survey Shows Stability and Development

A Report of the Land Economic Studies Section, Right-of-Way Department

Summation by
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OUR CITY NOW has two main streets with a two-block-wide commercial area. So spoke a leading Delano businessman as he sized up his San Joaquin Valley city two years after new freeway construction.

This simple statement actually summarizes in capsule form an all-important freeway economic effect. It is the change in a "bypassed" business street from a ribbon developed strip with little economic character to a stable commercial area with clearly recognized character and potential.

Elements Involved

Actually, more than a "bypassed" highway is involved here. What happened to other Delano business streets and to the East and West Delano sections are matters of just as much significance.

High Street, the old highway, was the city's first business street. As traffic and congestion increased, it lost most of its pedestrian commerce to Main Street a block away, the major business street today. More recently

Cecil Avenue, a secondary state highway crossing both Main and High to the north, has developed as a third commercial artery. (See diagrams below for location and relationship of freeway and other major streets.)

Originally, High Street competed directly with Main. However, over the years each slowly attracted and developed its own type of businesses. As traffic increased, High Street uses became fixed, and a static condition prevailed. Even the old highway merchants themselves found it difficult to recognize the predominant character of their street—traffic service or non-highway-catering, business district.

Land development and land sales reflected the static nature of High Street in the years immediately preceding freeway construction. Values remained constant and sales were infrequent. Commercial building activity and development in Delano was confined almost solely to Main Street and Cecil Avenue.

In pree freeway days, the West Delano section reflected an economic listlessness as well. The intervening railroad right-of-way and the heavy traffic on High Street discouraged free movement between east and west. As a result, East Delano, with congestion-free Main Street, prospered and grew; West Delano remained static.

With freeway construction, the entire pattern began to change.

New Freeway

On June 22, 1956, the four-mile, four-lane freeway was opened to travel, 3½ years after right-of-way acquisition was commenced in the fall of 1952. The right-of-way was cleared in late 1954, and the actual construction thus took an additional 1½ years.

By 1958, approximately two-thirds of the old highway's former traffic had moved to the freeway. Even so, 7,400 vehicles a day were still traveling on High Street.

Just how the new traffic order along High Street would be reflected on Delano's overall profit and loss sheet, was a question of moment. Concern that a third barrier between east and west had been erected was also expressed. However, before any analysis is achieved, the broader picture should first be sketched.

Economy and Growth

A Kern County city, Delano lies 30 miles north of Bakersfield in the rich and productive San Joaquin Valley. Agricultural activities provide its prime income stream. \$84,000,000 in crops came out of the Delano area in 1957, the highest total in its history.

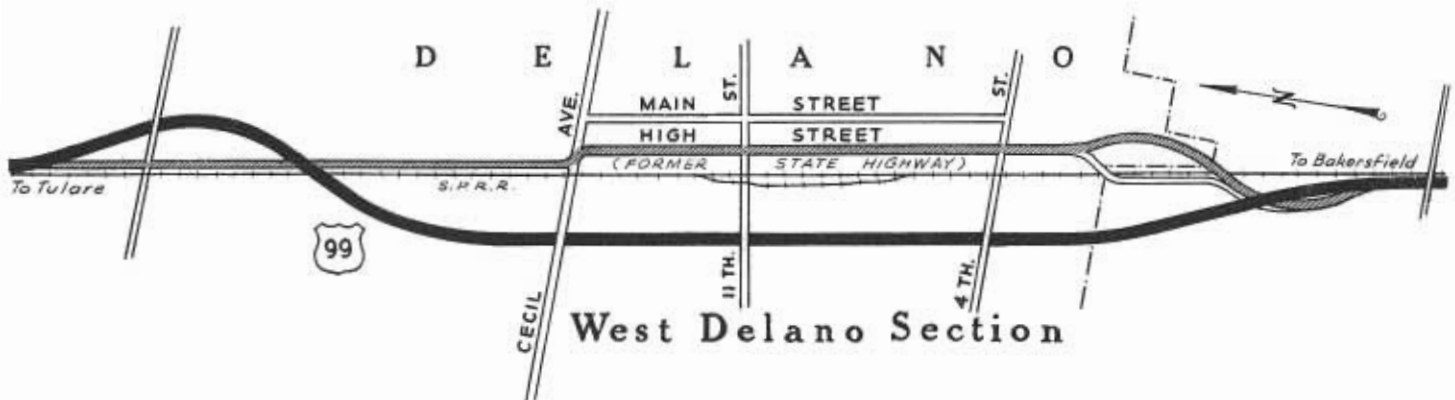


Diagram showing completed US 99 freeway through Delano. High Street, the former state highway, is shown as the shaded line adjacent to the Southern Pacific Railroad tracks. Main Street, Cecil Avenue, and the West Delano section—referred to in the text—are also indicated.

In 1870, Delano was a sheep trading center. Three years later, following construction of the central valley route of the Southern Pacific Railroad, it became a station stop. Subsequently, Highway Route 99 was constructed paralleling the railroad.

Early growth in the area spread both east and west of the railroad tracks. Following a characteristic pattern, a higher type development sprang up on the east side adjacent to the station building and highway. West side activities, on the other hand, centered around freight loading, railroad worker housing, and a minimum of retail developments. It was thus inevitable that the greater commercial and residential wealth of the city would be centered on the east side.

Over the years Delano has been growing and expanding at a steady rate. Unlike many California cities, it has experienced no great booms.

A city population of 4,573 in 1940 has increased to 11,150 in 1958, 8 percent a year on the average. Farm crop values have gone from \$68,457,538 in 1954 to \$84,000,000 in 1957, or at the rate of 5.7 percent annually. Additional acreage placed under cultivation since 1954 has increased at the rate of 3.1 percent annually. School enrollment since 1940 has shown a 5.5 percent annual increase, and postal re-

ceipts from 1948 through 1957 have risen at the rate of 7.3 percent annually. Retail sales have increased also and will be discussed separately in this study. All in all, no segment of Delano's economy has reflected any of the adverse effects of the recent economic recession.

1957 building permit statistics were the only ones not following the consistently upward trend. Here a decrease from 289 permits in 1956 to 178 in 1957, was reported. However, as of mid-1958, 165 permits had already been issued and 1958 was expected to easily re-establish the upward trend.

Reflecting the area's agricultural dependency are 15 cotton gins, 4 wineries, 25 packing sheds and cold storage plants, 8 implement dealers, 1 engineering company, 1 concrete pipe plant, 1 pump firm, 1 foundry, 2 ice plants, and an automatic cotton baler and sampler manufacturing plant. In all, a total payroll in excess of \$4,000,000 is generated annually by these secondary activities. As late as 1956, only about one out of every five workers in the Delano labor market area was engaged in nonagricultural employment.

Overall, Delano may thus be appraised as:

1. Geared to an agricultural economy.

2. Characterized by a stable, uniform growth.

Transportationwise, the three developments of most significance to Delano are:

1. The construction of the railroad. (1873)
2. Original construction of the highway. (1914)
3. Subsequent construction of the freeway. (1956)

This last major occurrence will claim our immediate attention. In the following sections, the results of study into land sales, and land developments, and retail business volumes and characteristics are reported to determine the economic effects upon the Delano community of this significant highway change.

Property Values

Commercial land value changes and trends before and after freeway construction are excellent indicators of economic effect. All of the factors which contribute to a city's economic health and prosperity are ultimately reflected in the prices people pay and ask for available lands.

To develop a land value trend, all property sales on High Street, Main Street and Cecil Avenue were tabulated for the 6½ years from 1952 through mid-1958. This period in-



Representative section of High Street, the former state highway, looking north.

NEW COMMERCIAL BUILDING IN EAST & WEST DELANO SECTIONS

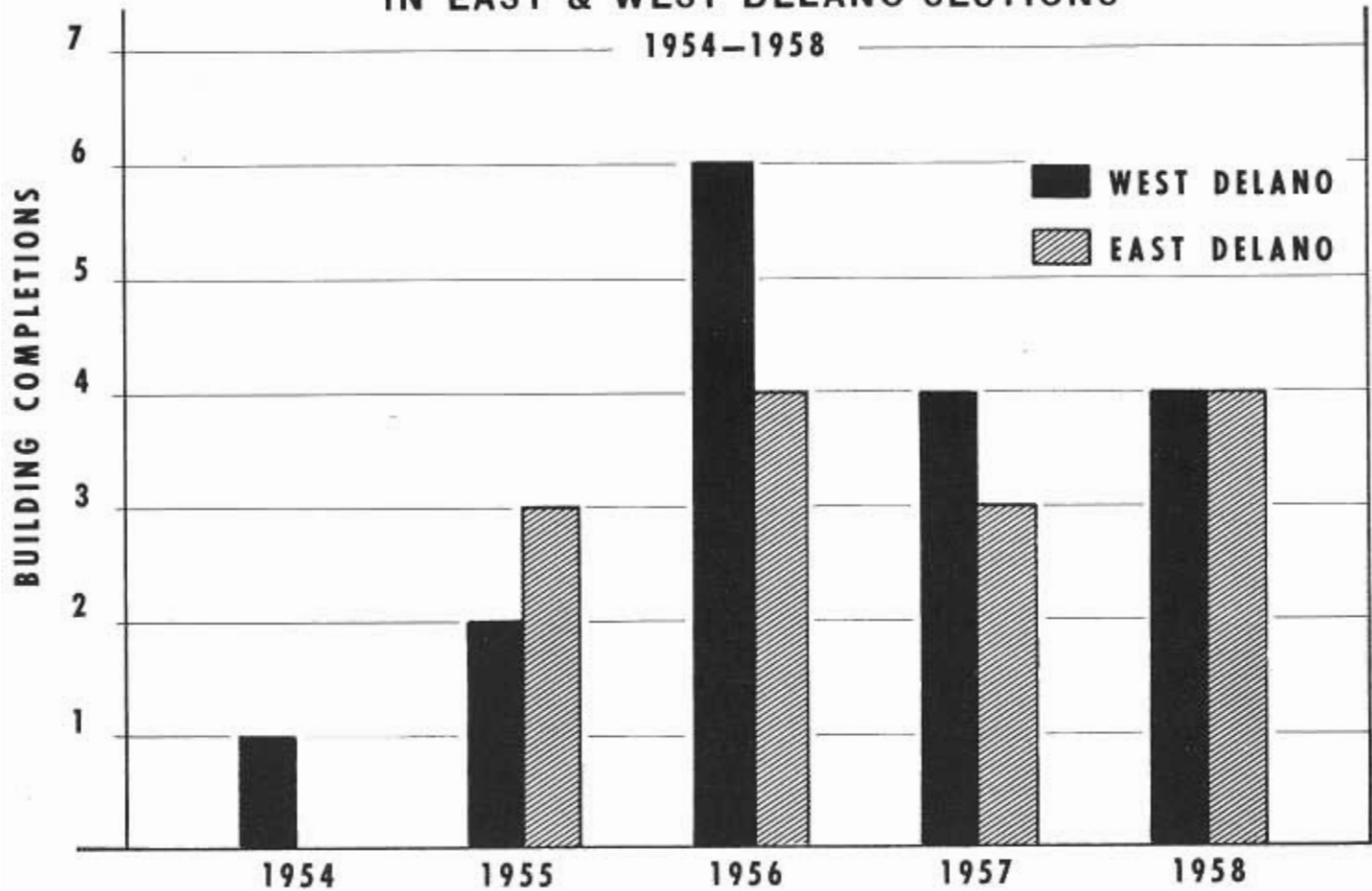


Chart showing East and West Delano business structures completed since commencement of freeway construction in late 1954. The surge of new commercial construction in the West Delano area is clearly indicated.

cluded 2 years after freeway opening and 4½ years before.

Forty-three market sales were recorded in all three areas over the entire period. Ten sales were made on High Street, 27 on Main Street, and six on Cecil Avenue. An analysis of these sales revealed three significant facts.

1. Almost half of all the 43 sales occurred after opening of the freeway.
2. "After" freeway values on Main Street and Cecil Avenue are twice as high as they were for the 4½ years before freeway construction.
3. Land values along Main Street for the entire 6½-year "before and after" period studied have remained relatively constant.

Residential Subdivision

Yearly changes in residential subdivision developments are not in themselves particularly helpful in assessing freeway economic effects. If, however, home construction activity has been stimulated by freeway change, then subdivision development and related comparisons may be directly pertinent to freeway land economic analysis. In the Delano area, such a germane relationship exists.

Residential subdivision activity in Delano has been relatively constant in the "before and after" freeway periods. One 20- to 40-lot subdivision a year has been the long-term average.

In mid-1953—almost a year after right-of-way purchases in the city had started—a 168-lot tract was subdivided, the largest since the original townsite was laid out in 1888. This

subdivision was timed to provide new housing for owners whose properties were required for highway construction.

Two hundred seventy-eight dwellings—slightly over 10 percent of the entire city's total—were purchased for the new freeway. Average value of these dwellings was \$5,000; for the new subdivision, they ran from \$8,000 to \$10,000. Most of the houses now covering a substantial portion of the new tract were acquired by freeway-displaced owners.

Business Plant Changes

What actual physical changes have occurred along the "superseded" highway since freeway construction?

Negatively, two major brand service stations and two cafe buildings have been removed representing four

out of a total of 94 retail business structures. Additionally, two service stations and one cafe are without lessees and are temporarily closed.

Positively, total investment in completed commercial buildings on High Street since freeway opening exceeds a quarter million dollars. Five new structures and major additions to existing buildings account for this total.

Moreover, seven modern service stations adjacent to the new freeway have been added to the city's commercial plant. Two were direct replacements of former High Street stations.

Compared with High Street over the last five years, only one more commercial structure has been erected on Cecil Avenue, an excellent control area. Cecil compares almost exactly with High Street in traffic count and it has never had a major traffic pattern change. If anything, it is an optimistic control since it has been serving Delano's fastest-growing areas and is currently booming.

West Delano Development

Earlier in this report, the characteristic tendency for more and better improvements to develop on the east, "highway side" of the railroad tracks was briefly described. Over the years this east-west stratification has become more fixed and seemingly permanent. Both the railroad tracks and yard facilities and the heavy highway traffic contributed to this pattern—both restricted free and convenient movement between the two areas. Consequently, fewer changes and less development took place in West Delano than in any other part of the city. Even today, West Delano holds only about one-third of the entire city's population. With major developments confined solely to the eastern sections prior to freeway construction, city growth has moved east as well. West Delano thus comprises only one-fourth of the total city area.

Since freeway construction, nothing has changed with respect to the rail facilities and their barrier effects. However, with respect to the heavy High Street traffic, almost everything has been changed. With removal of its congesting traffic components,

High Street is no longer a barrier in any sense of the word. Moreover, the new freeway itself, with conveniently located crossovers serving both sections with no traffic conflict whatsoever, is clearly the exact opposite of a barrier structure.

Prior to freeway construction, no commercial building of any significance has been completed in West Delano since the end of World War II when all building demand was at a peak. Since commencement of freeway construction in late 1954, 17 commercial buildings representing an approximate million-dollar investment, have been erected in West Delano. Over this same period in all the rest of Delano—on High Street, Main Street, and Cecil Avenue—only one more commercial building was constructed.

Retail Business

A direct comparison of all retail business along High Street on a two-year "before" and two-year "after" basis shows a gross business increase of 1.42 percent. This comparison in itself, however, is relatively meaningless—its results must be again measured against those drawn from similar comparisons in comparable areas.

Normally, the parent county is found to be a suitable measuring stick. In this instance, however, it was found that, for two years prior to the opening of the freeway, both High Street business and comparable businesses in Kern County (in which this city is located) were not even going in the same direction at least half of the time. Moreover, High Street business was similarly out of step with all the other business in the town itself. Main Street, for instance, didn't follow a "before" trend similar to High Street four quarters out of every eight. High Street also failed to parallel the statewide trend at least half of the time as well.

Since comparable cities and towns along U. S. Highway 99 which have not been affected by freeway construction are now relatively few, this type of comparison was of little assistance. Comparisons with the only city suitable, the City of Turlock, revealed a similar inconsistency in "before" trends as well.

This unusual dissimilarity is not without meaning in itself. A careful analysis of all retail sales data develops three facts which shed light upon the problem.

1. There are approximately 250 retail outlets in the entire city, about 25 percent of the total being located on High Street. These 25 percent of Delano's merchants, however, are doing 40 percent of the city's entire retail business. Thus even though High Street may not have been considered a "Main Street" prior to highway change, the volume of business it has been contributing would indicate it has been a "main factor" for quite some time.
2. Of all the outlets on High Street, 40 percent are in the traffic-sensitive categories (service stations and cafes and bars) and 60 percent are in the generally non-traffic-sensitive "other business" group. However, the 40 percent traffic-oriented merchants do on the average only about 13 percent of all High Street business, while "other businesses" pile up an overwhelming 87 percent. Since the "other" businesses are not likely to be directly affected by highway change, it can be seen that only a relatively minor portion of total old highway business would be directly subject to any adverse freeway effects if in fact there were any.
3. Of the "other business" on High Street—which is accounting for the 87 percent of total business—almost four-fifths is attributable to the farm supply and equipment group, the building equipment, service and supply group, and the automobile sales group. This concentration, which is peculiar only to the old highway, is of course a major reason why High and Main Streets are following dissimilar trends. Moreover, the predominance of these three groups appears to be becoming even more marked in the "after" years, although the trend in this respect is a gradual one.



Representative of the significant commercial building activity which has taken place in West Delano since freeway construction was started in 1954 are the new supermarkets (upper) and the new block of stores (lower) located on opposite corners of an intersection near the freeway.



Southerly view along Main Street clearly showing dominant pedestrian-type business establishments. This street is the major commercial thoroughfare in the City of Delano.

In any event, High Street seems always to have had its own retail character. Perhaps all that was needed was to remove the congestion so that it could be recognized and maximized.

Conclusions

Complete investigation into the effect of freeway construction upon the City of Delano involved study of five important community aspects. Each has yielded a clear picture of "before and after" changes.

1. Land Values

Main Street, High Street, and Cecil Avenue contain Delano's biggest business concentration. Land values, which clearly reflect economic well-being, were higher along Main and Cecil after freeway construction than they have ever been in the city's entire history. On the other hand, High Street, the old highway, is only now beginning to find its niche. In the last 6½ years—including a 4¼-year "be-

fore" freeway period—land values along High have remained constant.

2. Subdivision

Stimulated largely by freeway acquisition and construction, the largest subdivision to be developed since the laying out of the original townsite in 1888 was commenced a year after right-of-way acquisition had started.

3. New Investment

Investment confidence in High Street's business future remains high. Almost a quarter-million dollars in new commercial investment has been expended on the old highway since freeway opening—about twice the value of all High Street business structures closed or removed for whatever cause in the last two years.

4. West Delano Development

Renewed interest in the entire West Delano area has been a direct reflection of the positive ef-

fects of freeway construction. Safer, more convenient access as a result of the elimination of the heavy traffic barrier on the old highway, has encouraged the first new commercial building of any consequence in West Delano since the end of World War II.

5. Retail Business

As a direct result of freeway construction, "superseded" highway business is uniquely able to capitalize on the benefits of free traffic accessibility. While 40 percent of High Street businesses are in the so-called traffic-sensitive category, they accounted—even before freeway construction—for only about one-eighth of the total old highway business transacted. Thus the truly important segment of High Street merchants—doing seven-eighths of the total business volume—are direct recipients of the positive effects of through-traffic diversion.

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California Bridges

1958 Costs Show
Marked Decline

By H. K. MAUZY, Senior Bridge Engineer and W. J. YUSAVAGE, Assistant Research Technician

This article is the seventh of an annual series dealing with California bridge construction costs. The sixth article appeared in the May-June, 1958, issue.

Overall highway construction costs in California are reported in the articles entitled "Cost Index," which appear regularly in *California Highways and Public Works*.

CALIFORNIA bridge construction costs, after closing 1957, the year of the highest recorded costs with an index value of 281, dropped to 259 during the first quarter of 1958, rose moderately to 268 during the two middle quarters, and closed the year at the level of the first quarter, or 259.

In terms of annual averages, costs during 1958 were down 5.5 percent from those of 1957, a saving to the bridge construction program of about 3½ million dollars for the year. This decrease in costs was the first decrease in a period of four years during which costs had risen to the successively higher values of 228, 265, and 283, during the years 1955, 1956, and 1957, respectively.

The Bureau of Public Roads Cost Index shows a similar reduction of about 5.5 percent in its construction costs during 1958, indicating that a depression in construction costs was general throughout the Country.

The level of costs for successive periods is presented graphically in the accompanying chart which summarizes the course of California bridge construction costs since 1934.

Construction Activity

Bridge construction continued at the high rate established in 1954, the year the additional increase to the State's highway budget voted by the State Legislature took effect and, in recent years, by the increasing amounts of federal aid for the interstate system of highways.

Table 1

INDEXES RELATING TO CALIFORNIA BRIDGE CONSTRUCTION AND PERIODIC DOLLAR VALUES OF LOW BIDS ON CALIFORNIA BRIDGE CONSTRUCTION

I Year	II Quarter	III Index of the cost of California bridge construction (1939-1940=100)	IV Index of the value of California bridge construction (1939-1940=100)	V Index of the volume of California bridge construction (1939-1940=100)	VI Dollar value of low bids on California bridge construction (in millions of dollars)
1934	..	94	*60	*64	3.1
1935	..	88	*138	*157	7.1
1936	..	98	*72	*73	3.7
1937	..	114	*60	*53	3.1
1938	..	99	*78	*79	4.0
1939	..	101	*99	*98	5.1
1940	..	99	*101	*102	5.2
1941	..	122	*78	*64	4.0
1942	..	158	*80	*50	4.1
1943	..	165	*16	*9	.8
1944	..	153	*29	*19	1.5
1945	..	167	*109	*65	5.6
1946	..	182	*247	*133	12.7
1947	..	215	*443	*202	22.8
1948	..	229	*307	*134	15.8
1949	..	201	*233	*117	12.0
1950	..	202	*262	*129	13.5
1951	..	248	*617	*247	31.8
1952	..	235	*561	*237	28.9
1953	1st	243	140	58	1.8
1953	2d	224	707	315	9.1
1953	3d	*229 231	*522 893	*227 387	26.9 11.5
1953	4th	235	350	149	4.5
1954	1st	221	691	313	8.9
1954	2d	217	1,196	551	15.4
1954	3d	*219 220	*870 1,002	*399 455	44.8 12.9
1954	4th	213	590	277	7.6
1955	1st	217	1,039	477	13.3
1955	2d	237	500	211	6.4
1955	3d	*228 228	*930 1,047	*408 461	47.9 13.4
1955	4th	237	1,148	484	14.7
1956	1st	245	833	340	10.7
1956	2d	284	1,083	381	13.9
1956	3d	*265 260	*1,117 604	*422 232	57.5 7.8
1956	4th	273	1,952	715	25.1
1957	1st	292	680	232	8.8
1957	2d	283	2,007	709	25.8
1957	3d	*283 275	*972 460	*343 167	48.0 5.9
1957	4th	281	740	263	9.5
1958	1st	259	1,219	471	15.1
1958	2d	268	1,841	687	23.7
1958	3d	*267 268	*1,287 1,468	*482 548	65.1 18.9
1958	4th	259	528	204	6.8

* Average annual information.

During the past three years, the rate has been about 10 times that of the base (1939-40) period in terms of current dollars and about four times

that of the base period in (1939-40) constant dollars. The difference in the two rates, 10 to 4, is accounted for by

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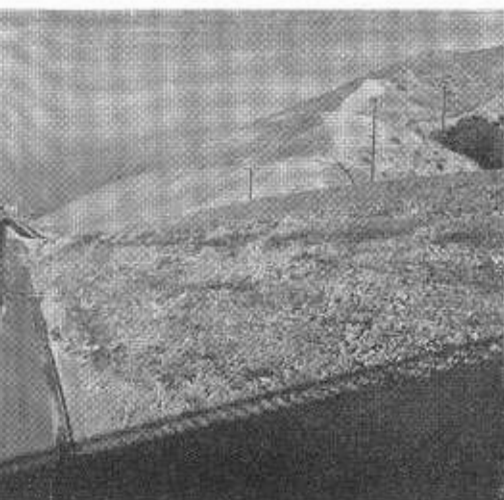
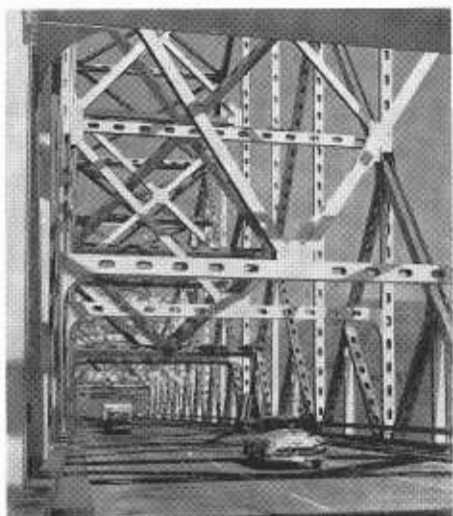


Carquinez Bridge

"Among the year's accomplishments, perhaps the most impressive was the completion of the additional Carquinez Bridge. While the project is spectacular in its own right—the structure duplicating the existing one, the graceful curves of interchange ramps and the monumental cut running south through the hills—the most impressive feature is the saving of lives, time and miles between Vallejo and the San Francisco-Oakland Bay Bridge."

—Report From District IV (see page 1)





Contract Control

Contract Progress Control Study Proves Effective, Realistic Aid

A DIVISION of Highways management study of contract progress is proving to be an effective aid in setting realistic project time limits and a useful tool in gauging the pace of construction against the job deadline.

Made by Milton Harris, Construction Engineer, and E. J. Carter, Assistant Construction Engineer, the study involved a long-term analysis of the relationship between elapsed contract time and the value of completed work on a large number of typical state highway projects.

Goals of the study were to develop a reasonable guide for determining progress of contract work, and to improve methods of establishing rational contract time limits before the call for bids. The study also sought a basis for improved procedures in determining and recording working and nonworking days. The study was begun in June, 1956, and completed in October, 1957.

In the first year after the study was completed, the number of time limit overruns on state highway contracts declined sharply; only 6 percent of the division's contracts went beyond the time limit. By contrast, in the two preceding years about 15 percent of the contracts involved overruns in time.

The study covered the time-progress relationships—value of completed work versus time elapsed—at various stages of 245 satisfactorily completed state highway contracts. The projects included nearly every type and size of job and represented a wide cross section of California highway construction.

Based on a detailed analysis of each of the projects, curves were plotted to show the normal time-versus-progress range for the entire group of contracts. These curves are included in the accompanying chart.

The two solid black lines enclose in an "envelope curve" the normal time-progress range for the contracts included in the original study; the bot-

tom line is the lowest satisfactory progress rate, and the top line is a guide to normally accelerated progress.

The dash line is a hypothetical contractor's progress schedule based on his estimates of time required for various phases of the work. The dotted line represents actual progress charted during construction.

In the hypothetical case shown on the chart, work was progressing ahead of the contractor's schedule and was well within the normal progress range (the two solid curves) with 30 percent of the contract time elapsed. With half the time gone, the contractor was still on schedule, but the progress rate had dropped toward the lower limit of satisfactory progress.

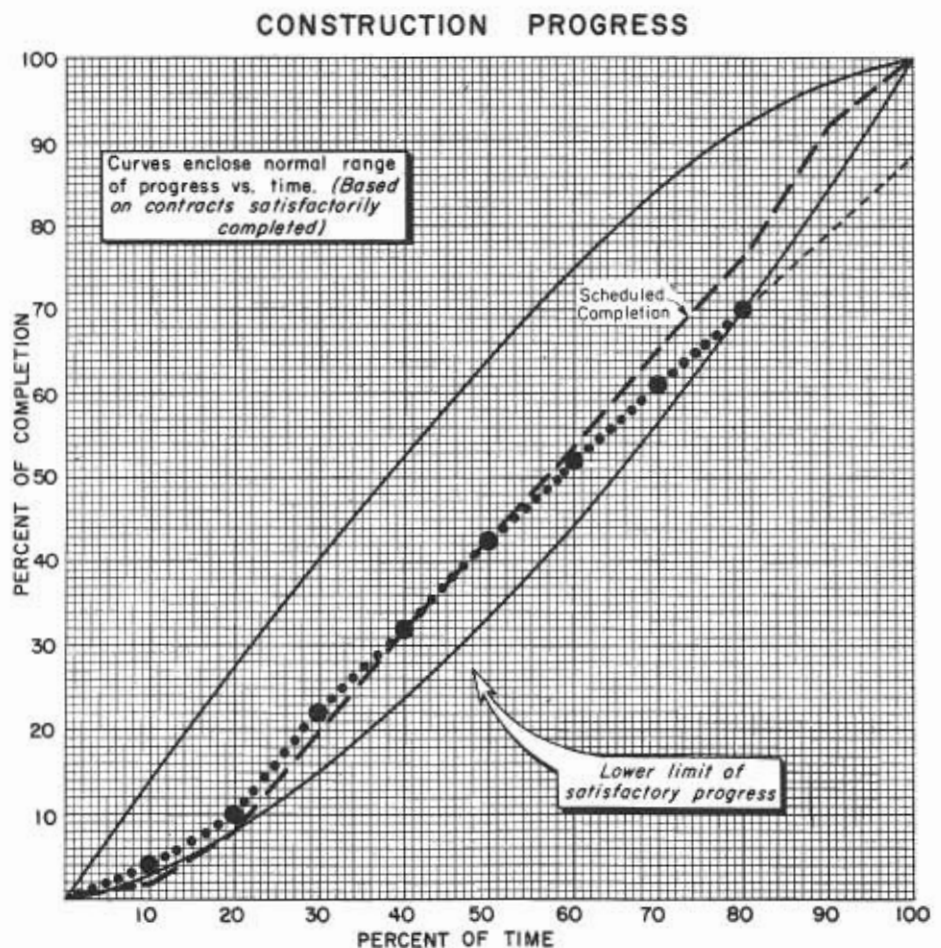
After 80 percent of the contract time had passed, the project was running behind the contractor's schedule and the pace of work had fallen to the lowest satisfactory level.

At this point it is clear that there must be an increase in the rate of progress if the project is to be completed by the contract deadline.

(Followup studies are continuing in order to test the validity of the original envelope curve. As subsequent projects have been integrated with those used initially, only minute changes in the original curve have been found necessary.)

The study report also includes a discussion of time limit estimates for projects in the planning stage. It em-

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Trip to Egypt

Materials and Research Chief
Visits 'Land of Nile' as Adviser

By FRANCIS N. HVEEM, Materials and Research Engineer

AS THE RESULT of a request through the United Nations, I spent two months in Egypt last fall helping that country work out some of the technical details for a modern highway system in the shadow of the 4,000-year-old pyramids.

The mission, originally arranged by the Technical Assistance Administration of the U. N., was concerned only with the reorganization of the Egyptian Central Road Laboratory and the establishment of a research section in it which would use modern techniques. But on arrival, I found that Egyptian engineers were hopeful of more general assistance.

It quickly became evident that the Department Engineers and the Minister of Communications were also concerned over the smoothness of the roads, design, construction practices, and maintenance. They wanted advice covering the whole field of highway design and construction.

Obviously this advice could not be given without a comprehensive inspection of the Egyptian road system, so the major part of my first weeks in Egypt were spent in the field. Between trips I worked in an office assigned to me in the well-designed, modern building which housed the Training Center and Laboratory. Whenever possible, I talked to contractors and construction men.

As in most countries, I found that Egypt suffers from a shortage of engineers. Materials testing for roads was being done by a staff of 10, as compared to several hundred in our organization back in California. The two areas are about equal, but Egypt has 50 percent more population.

Motor Transport Increasing

California has many times the number of motor vehicles that Egypt has, of course, but despite the popular concept of Egyptians traveling exclusively on camels, motor transportation

in that country is increasing rapidly. There is a great need for usable roads to connect villages and farms with the larger cities, for modern high-speed highways between such centers of population as Alexandria and Cairo, and for roads to the frontiers for defense purposes.

The engineer shortage is only part of the problem. In what has been traditionally a purely agrarian nation, the rapidly expanding population can no longer be fed by the available farming land. Although the government is seeking to get more land under irrigation, its main hope lies in expanding industry so its surplus products can be used to purchase food abroad. The first steel mill has just gone into operation, and the world's largest nitrogen fixation plant is under construction at Aswan.

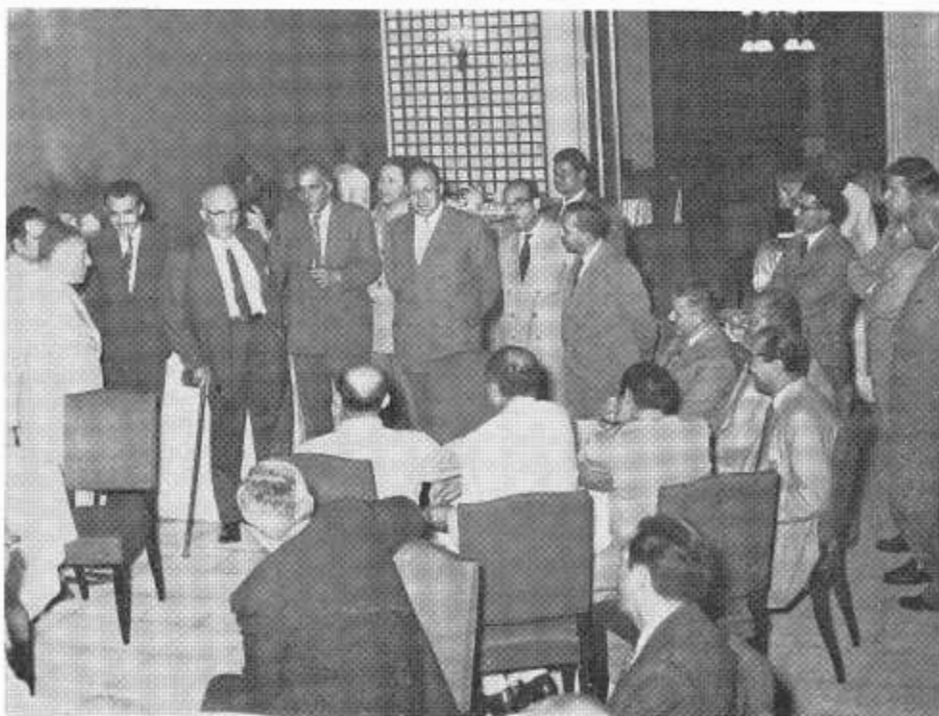
Since the entire country is in a transition stage from a culture based

on hand labor to one employing modern mechanical devices, the quality of the roads varies greatly. There are a few excellent roads, some fairly good ones, and many poor ones. Traffic on these roads is varied, too. On every mile can be seen motor vehicles, pedestrians, and animal transport.

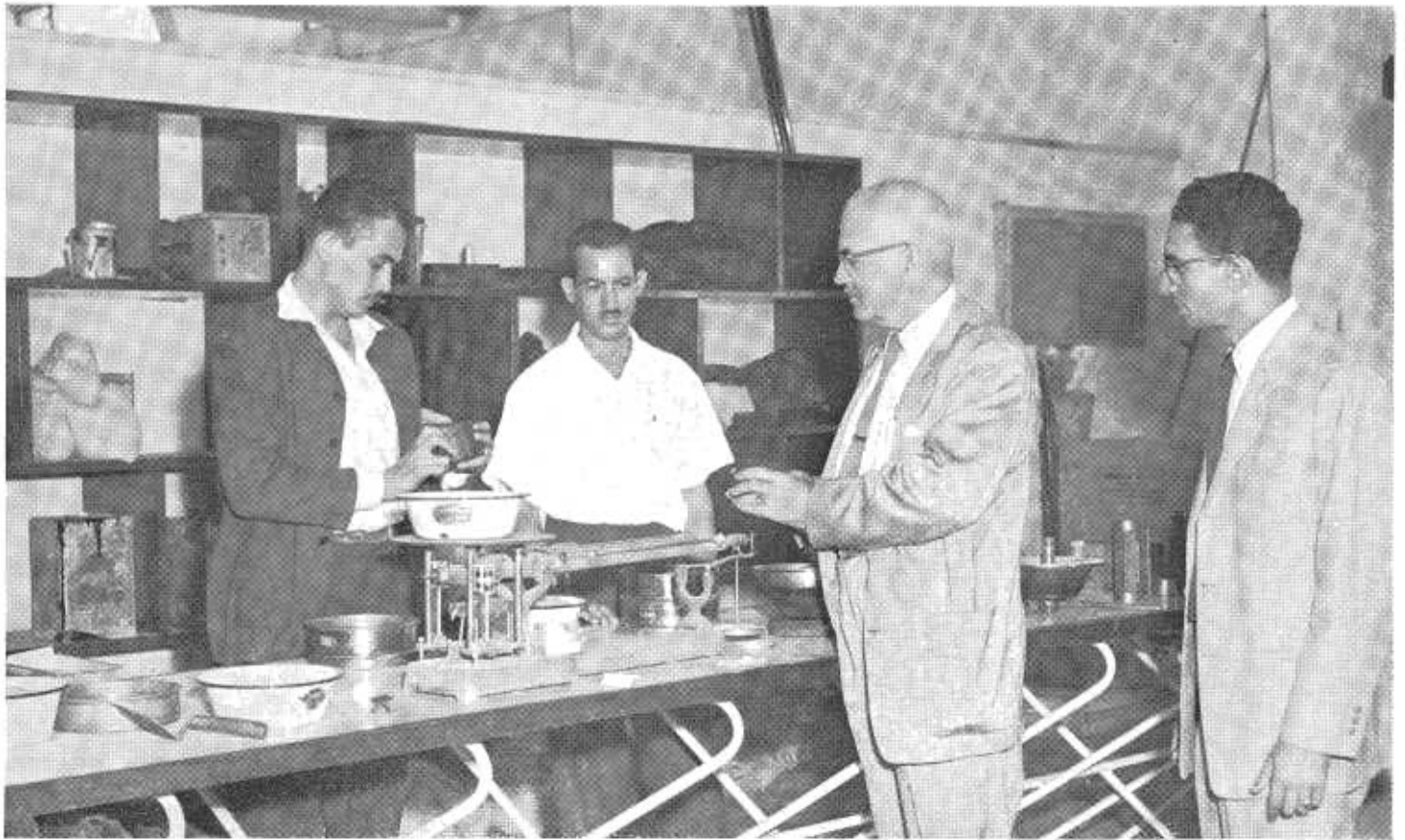
Many of the wagons are equipped with solid rubber tires but many in the rural areas have narrow steel tires. Although the gross load of such vehicles is nominal, the concentration of pressure is great. Deep ruts may be observed on many sections as a result of these slow moving concentrated wheel loads.

Location of Materials

Roadbuilding materials are plentiful in some areas and scarce in others. Limestone is available near Cairo and at points along the Nile as far south as Luxor. There is good quality gran-



Francis N. Hveem, Materials and Research Engineer and author of the accompanying article (with cane), speaks at a special reception given to present him to Egyptian contractors, engineers and materials men.



Hveem in the Laboratory in Cairo discusses techniques with lab men: (left to right) Ismail Shoukry in charge of the bituminous paving section in the laboratory; Ahmed Azab Karim in charge of the Training Section, Hveem, and Youssef Ezzel Din, Assistant Construction Engineer.

ite and basalt in southern Egypt in the vicinity of Aswan.

Limestone is the traditional road building material and I was informed that up to the time of the revolution of 1952, the government had been transporting limestone 500 miles up the Nile to build roads in an area where no limestone was available. Plentiful supplies of basalt and granite close at hand were ignored.

There are large cement mills in Alexandria and Cairo, and a limited mileage of concrete pavement has been laid. The present trend, however, is toward an increasing use of asphalt which comes from two refineries located at Suez, using crude oil from wells along the Red Sea. One of the Suez refineries is owned by the government, the other by Shell Oil, but directed by the government. The asphalt seemed to be of very good quality.

Many serious problems arise for a country such as Egypt when it attempts to convert from a handcraft

system to the modern tools and techniques such as we use in constructing highways in the United States. We rather take for granted the interlocking complex of co-operating agencies such as producers of material, equipment manufacturers, service or-



The Great Pyramid at Gizeh, only one of the original Seven Wonders of the World still remaining, owes its permanence, Hveem feels, to foundations built on bedrock.

ganizations, contractors and engineers.

In its modernized road program, Egypt is using both German and American made equipment. However, skilled operators are not plentiful, and it is also hard to find experienced foremen and superintendents.

Replacement Difficult

One contractor, American educated, summed up his problems in this way:

"Mr. Hveem, contracting in Egypt is a great deal different than in the United States. There, if you break a piece of equipment, you get on the telephone and the parts are delivered the next morning. Here, I would be lucky if I could obtain a replacement part within six months."

He told how on a surfacing project near Aswan he concluded it was cheaper to have his road rock broken by hand than to set up crushing machinery with all its operating problems at such a remote site. The hand crushing later led to some controversy

with the engineers because the product broken by hand met maximum size specifications satisfactorily, but was almost completely deficient in the finer sizes normally produced in a mechanical crusher. Such arguments between the Egyptian contractors and engineers had a very familiar sound.

Naturally, an engineer working in Egypt welcomed the opportunity to inspect the ancient ruins built by engineers of another culture thousands of years before, and I visited many of the important ruins on a sort of postman's holiday. I concluded the reason the Great Pyramid, for instance, still stands is because its foundations rest upon a level base of solid bedrock.

The ancient Egyptians made a great use of sandstone in the construction of their pyramids and temples, but many of the large statues and obelisks were carved from granite quarried near Aswan and transported down the Nile for hundreds of miles. The transportation and erection of these tremendous monolithic blocks of stone is a feat that would tax engineering talent today.

Karnak Temple Massive

The one project of these ancient engineering efforts which impressed me most was the Great Temple of Karnak at Luxor with its tremendous stone columns, some 11 feet in diameter and nearly 70 feet high. I stood before it, and in the best engineering tradition, wondered over the nature of the foundations which have supported these massive columns with no evidence of settlement or perceptible misalignment for more than 30 centuries.

Archaeological reports are silent on whether these column footings extend to solid rock. The temple was constructed quite close to the ancient channel of the Nile and it seems the silt deposits would be of considerable depth there.

At the time I left, the Egyptian highway department was installing equipment for the manufacture of road signs. A complete unit for the fabrication and construction of modern road signs has been furnished the Egyptian government by the United States under the Point Four Program.

Governor Brown Names Roger S. Woolley, San Diego Lawyer, to Highway Commission

Governor Edmund G. Brown announced March 3d he will nominate Roger S. Woolley of Rancho Santa Fe (San Diego County) for a four-



ROGER S. WOOLLEY

year term on the State Highway Commission.

Woolley, a San Diego attorney, replaces Fred W. Speers of Escondido.

The Egyptians have demonstrated a strong preference for American equipment, especially automobiles. While I got no authoritative figures, it was my impression that perhaps 75 percent of the automobiles in Cairo were American made. This contrasts markedly with the average European city.

Contrary to the many reports about treatment of Americans abroad, I want to emphasize that my experience was most pleasant and that I was extended every courtesy and assistance by the Egyptian engineers. I was also very favorably impressed with the personnel and work of the United Nations Technical Assistance Program. With very inadequate funds this organization is attempting to transfer knowledge from those who know, to those who need to know. It is interesting to note that this is by no means a one-way operation. Many of the countries, including Egypt, may need technical advice of one sort while

The appointment requires Senate confirmation.

Woolley was born November 18, 1924, in Chicago, Illinois, and moved to Rancho Santa Fe in 1952. He was graduated from the College of William and Mary in 1947, then took graduate work at London University in 1947 and 1948.

He was graduated from Columbia University Law School in 1951 and was admitted to the Bar in 1952. He is a partner in the San Diego law firm of John Gerald Driscoll, Jr.

Woolley was in the United States Navy from 1942 to 1946 as a lieutenant (j.g.) in the Pacific Theater of Operations.

He has been a member of the San Diego Highway Development Association for the past six years and currently is the organization's first vice president. He was previously a director and second vice president.

Woolley is an elder in the Presbyterian Church, a member of the Rotary Club, San Diego, California, and American Bar Association.

Woolley lives with his wife, Patricia, and two children, Elliott, 6, and Merrit, 2, in Rancho Santa Fe.

they themselves are furnishing experts in other fields to other countries.

One might philosophize on the significance of this interchange between the East and West, and quote Kipling with "never the twain shall meet," but there is much evidence today to show that the East and West are meeting. It is constantly being proved that communication eliminates misunderstanding. Road engineers everywhere can be proud to keep in mind that highways, whether in America or Egypt, offer one of the best means of communication between people.

The Division of Highways Materials and Research Department has started a continuing laboratory training program for district personnel on the selection, use and control of highway materials.

First classes of the new series were held March 16th-20th at the Headquarters Laboratory in Sacramento.

Radio Signs

*New Remote Control Signs
Alert Motorists, Truckers*

BECAUSE of California's great north-south length, and its many mountainous areas, weather conditions in one area may differ markedly from those in another. This is particularly true in winter. A storm may be raging in the passes on the important transcontinental routes while the sun is shining in the valley 75 miles away.

On a single day of this past winter there were heavy snow and blizzard conditions in some of the mountain areas and in the northern end of the State, heavy rains along the northern coast with numerous landslides, and rain in the southern counties of San Bernardino and San Diego. At the same time U. S. Highway 99, the major north-south route, was closed between Bakersfield and Wheeler Ridge by a dust storm.

Such weather extremes mean a wide variety of road conditions, sometimes posing a serious danger to the unsuspecting driver. These varied road conditions, often changing very rapidly, create a difficult problem in keeping drivers informed of the situation on the road ahead of them. One device which offers considerable hope

in coping with this problem is the radio-controlled road sign.

Two such signs have been installed and are now in use experimentally on US 40. They replace the old style wooden signs at Colfax and Baxter which were manually changed whenever necessary to inform eastbound traffic about conditions over Donner Summit.

Development of a radio-controlled sign began in the California Division of Highways about two years ago. A remote control type sign had been developed for use on the Pennsylvania Turnpike, and California Division of Highways technicians began working on an adaptation of the idea suitable for California conditions. Their aim was a system which was simple, fool-proof, and which would indicate to the control station not only receipt of an order, but compliance with an order.

The design finally settled upon employs three long, three-sided units (triangular in cross section), one above the other, which are rotated by electric motors when the proper circuit is closed. The signal for closing

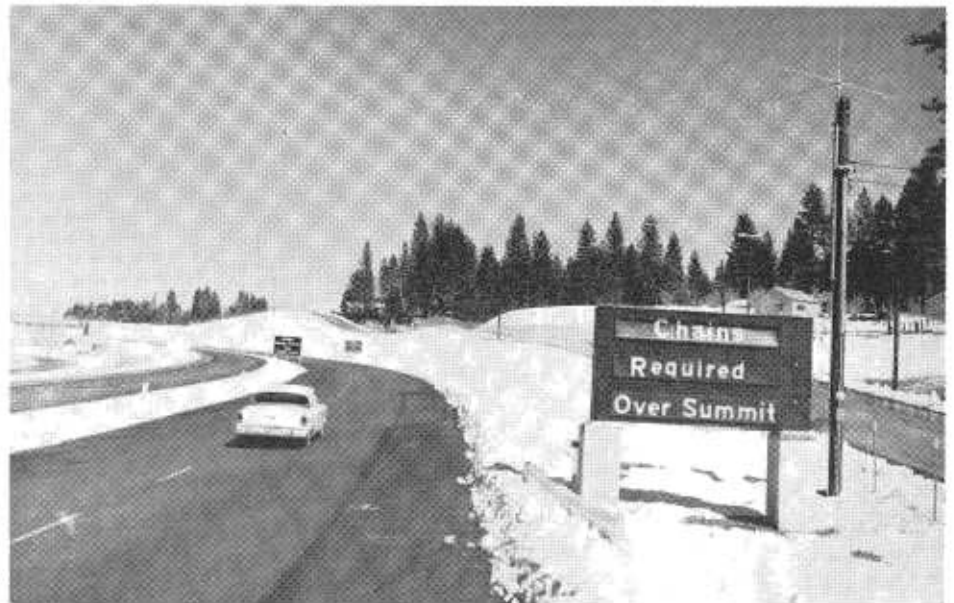
the circuit is provided through a system of relays virtually identical with that used in dialing a telephone. In fact, an ordinary telephone dial is used to send the signal which changes the sign. Three-digit signal numbers are used; those in the 500 series are acted upon by one sign, those in the 800 series by the other.

When the sign changes and the new message panel drops into place, it closes a pressure switch much like the one which turns off a refrigerator light. This actuates another relay circuit and a transmitter, which sends a signal back to control, turning on a green light at the corresponding position on the control panel. A glance at the panel tells the operator what message each sign is showing at any time.

Radio control of the signs is from the highway maintenance station at Yuba Gap. Each is operated independently. In an emergency, control can be assumed by headquarters at Sacramento.

By various arrangements of the three movable units, 27 combinations

... Continued on page 56



LEFT—Cindy Kent of the Maintenance Communications Section demonstrates ease of changing sign. RIGHT—One of the new radio-controlled signs on US 40, this one near Colfax. Note the antenna to the right of the sign.

Embarcadero

*Thirty Miles of Piles Used
On New S. F. Freeway Viaduct*

By DOUGLAS R. BROWN, Senior Engineering Geologist
and DONALD R. HIGGINS, Senior Bridge Engineer

THE EMBARCADERO Viaduct, which was opened to traffic in February, is a double-deck, concrete box girder structure with four lanes on each deck along San Francisco's world-famed waterfront between Howard Street and Broadway. The south terminus connects with approaches to the San Francisco-Oakland Bay Bridge and with the freeway south on Highway 101. The ramps at the north terminus feed onto the busy Broadway thoroughfare and into San Francisco's financial district and North Beach area, several blocks east of the Broadway Tunnel.

An extreme variety of foundation conditions was encountered in the construction of foundations for the viaduct. These conditions necessitated foundations to vary from footings in bedrock to heavy section steel H-piles up to 225 feet long.

Geology of Bay Area

In order to put the foundation conditions of the viaduct into proper perspective, it is necessary to understand

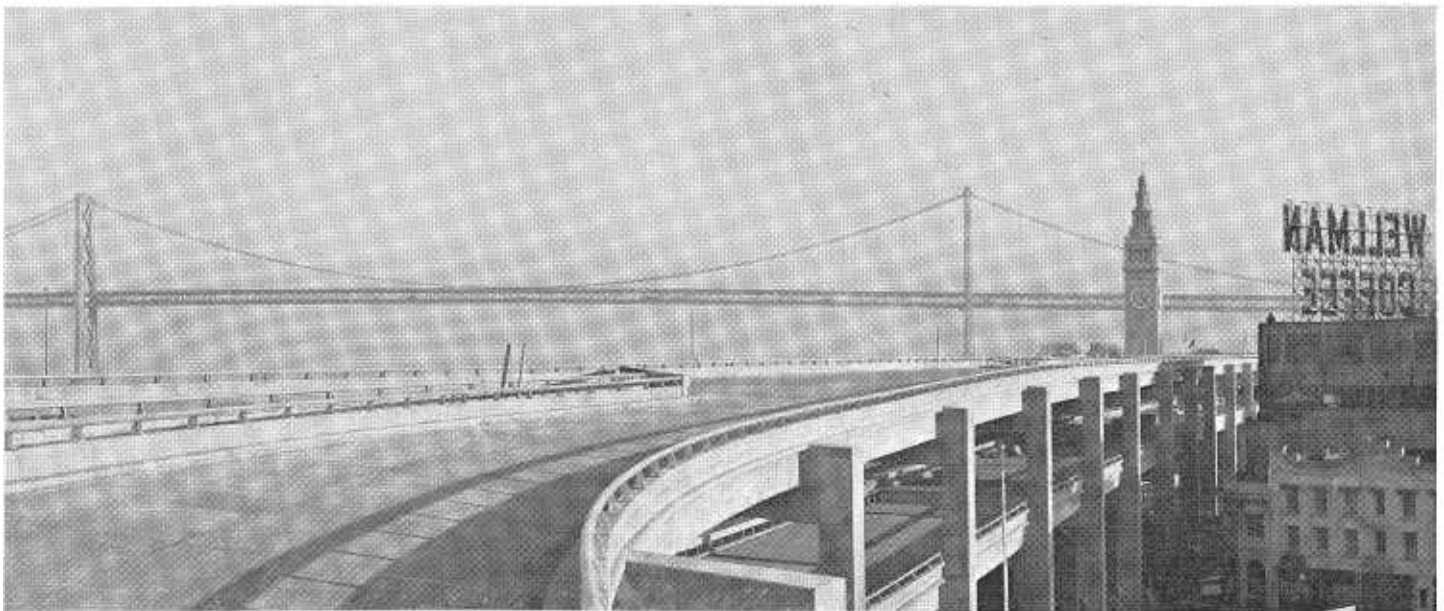
the general geological development of the San Francisco Bay area, since the two are intimately related. The underlying bedrock of the San Francisco Peninsula is the Franciscan formation. This formation consists predominantly of sandstone (but includes shale, chert, and serpentine) which was deposited during the Jurassic period of geologic time approximately 140,000,000 years ago. The sediments comprising this formation were gradually compressed and cemented to form the Franciscan sandstone that we see outcropping today in many areas around San Francisco.

Subsequent crustal deformation and erosion altered the surface of the Franciscan formation through succeeding geologic time. Through these geologic epochs, the situation was further complicated by several stages of uplift and subsidence with subsequent flooding by the ocean.

Uplift in the Bay area during Pliocene time uplifted the coastal ranges, including the San Francisco Peninsula. The uplift was rapid enough to block

many rivers, but a major river, like the Sacramento, was able to erode at a fast enough rate to wear a channel through the rising mountain ranges. Thus were Carquinez Straits and the Golden Gate Strait formed. During this period the present Bay area was above sea level.

At the close of the Pleistocene, or great ice age epoch, the melting of huge continental glaciers, such as cover Greenland today, raised the sea level from between 250 and 350 feet. But, crustal deformation seems also to have been important in the lowering of land with relation to sea level. This was accomplished primarily by broad downwarping or folding, rather than by faulting, and resulted in the inundation by the sea to form the "drowned valley" which is the present-day San Francisco Bay. Sediments have covered the old landscape and filled the valley, or Bay area, to within a few feet of sea level, except for tide channels which have tended to keep clean by natural scouring.



The Embarcadero Freeway in downtown San Francisco shortly before it was opened to traffic showing the Bay Bridge beyond. The view is southeasterly.

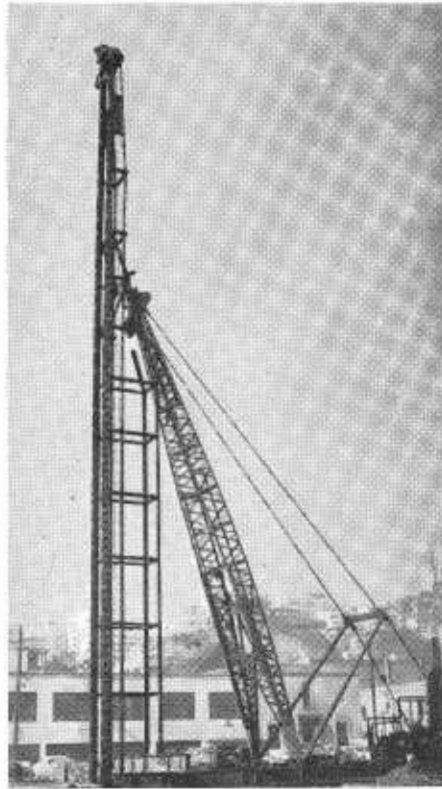
Viaduct Conditions

At the site of the Embarcadero Viaduct before the downwarping the sculpturing of the topography of the Franciscan hills had been essentially completed. Contours on the bedrock surface, established by drill holes, apparently indicate an old shoreline surface with the water level approximately 250 feet deep. This shoreline environment is indicated by what appear to be rather steep wave-cut cliffs, a gently sloping foreshore to the east which steepens considerably two or three hundred feet further to the east. Gravel and cobble deposits were encountered on top of the Franciscan bedrock surface in many areas, though they were not everywhere present. This condition implies a location at or above sea level during the time of deposition, since material this coarse would be dropped almost immediately as a stream's velocity is checked upon entering a large body of water. The cobbles were apparently concentrated in depressions or stream channels in the old Franciscan bedrock surface. This is particularly true of the former river which was located at approximately the present location of Market Street. Immediately in front of the historic Ferry Building, these gravels are encountered at depths exceeding 200 feet.

The Embarcadero alignment was buried by geologically recent sediments just as was the rest of the Bay area. The sediments consisted chiefly of clayey silt and silty clay, though one 20-foot-thick stratum of sand was deposited at a present-day depth of a little over 100 feet. The clays were deposited in a swampy environment with marsh grass and other vegetation. This was dramatically demonstrated during exploratory drilling by the sudden release of trapped marsh gas while drilling at a depth of more than 100 feet. The resulting pressure blew mud fragments approximately 35 feet into the air, built a flat sloped mud cone about two feet high, and continued blowing for almost 24 hours!

Man Complicates Picture

The ends of the presently constructed two approaches to the Embarcadero Viaduct—one linking the viaduct to the Bay Bridge approaches,



Quiet Myrt, one of the pile drivers used on the job, as it was being assembled.

and the other terminating near the Broadway Tunnel just south of Telegraph Hill—are both supported by spread footings in sandstone. As one proceeds toward the center from both ends, the bedrock dips away and is covered by increasing thicknesses of "bay mud." Near the center of this low area, which is almost exactly in front of the Ferry Building at the foot of Market Street, bedrock is approximately 250 feet deep. Man, in most of this area, has greatly complicated the subsurface picture. Extensive dumping of debris to extend the waterfront was practiced for many years. Frequently, boats and large ships were simply covered over, particularly in the gold rush years when crew desertions were common. Timbers were encountered in exploratory borings on several occasions. Huge amounts of debris, resulting from the famed San Francisco earthquake of 1906, were added. To further complicate the picture, a wide sandstone rubble seawall had been built, then covered over, along almost the exact centerline of a substantial portion of the viaduct. A large timber wharf

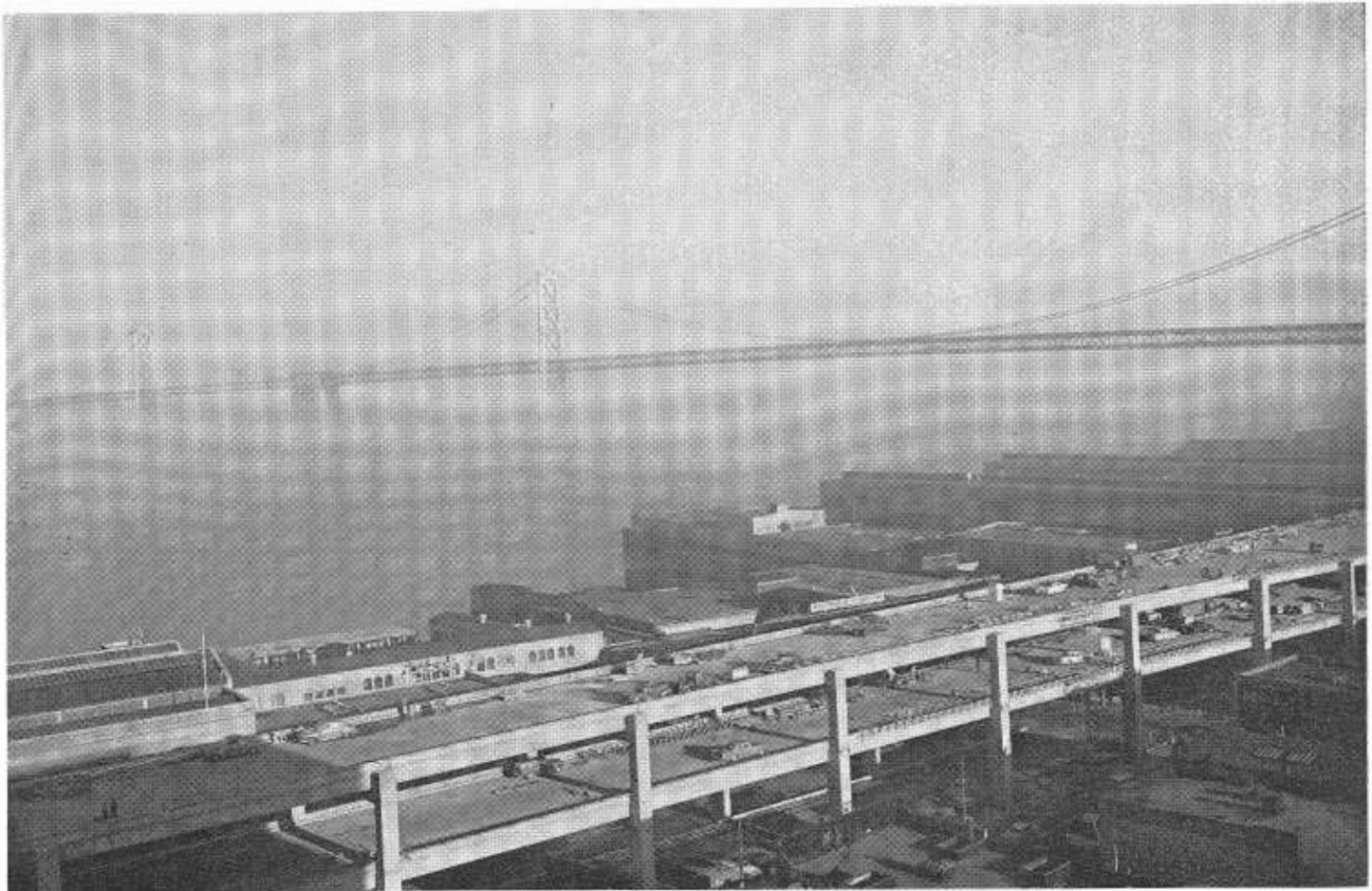
near the Ferry Building had similarly been filled over.

Test Borings Slow Process

Drilling through the 40 feet or 50 feet of rubble fill usually present frequently took more than a day. Obtaining a sample at depths between 150 and 250 feet would normally take almost an hour for the two "round trips" involved, even if all went well and the hole did not squeeze in. Not the least of the problems in the area near the Ferry Building was the traffic (including trains) which seemingly could approach the equipment from every direction except out of the ground. A large number of borings and penetration tests were made, although buildings frequently prohibited drilling in critical areas. Some borings were made in parking lots after dutifully reimbursing the proprietor for the spaces occupied.

All of the debris, plus the low elevation of the ground, made a depressed section very impractical, although strongly desired by some San Franciscans for esthetic reasons. The continuous reinforced concrete design made elimination of appreciable settlement essential. Though the Embarcadero had been filled and paved for many years, settlement of streets caused by continuing consolidation of the normally loaded clays was still occurring at the rate of one-half inch to three-fourths inch a year. However, no lateral or seaward movement had been detected. Many buildings in the area, supported by piles founded in a sand layer more than 100 feet deep, had settled, some more than three inches.

This confirmed boring results which indicated fairly soft normally loaded clay below the sand. Therefore, it was decided that all piles should achieve bearing in bedrock, or in the gravel which existed just above bedrock in some areas. Heavy section steel H-piles were best suited for this purpose. Contours were drawn on the bedrock or gravel surface to serve as estimated pile tip penetrations. In order to test the ability of steel piles to penetrate the sand layer, a special contract to drive three test piles was approved and executed. All three piles encountered high resistance in the sand, but penetrated to bedrock.



Another view of the Embarcadero Freeway Viaduct under construction looking eastward with the San Francisco-Oakland Bay Bridge rising out of the fog.

Variety of Piles

Pile driving on the Embarcadero Viaduct contract was subcontracted to Macco Corporation of Paramount, California.

Piles placed included concrete piles, pipe piles, and H bearing piles. The concrete piles used were cast-in-drilled-hole piles with a design load of 45 tons. The pipe piles were concrete-filled, 12 3/4-inch O. D., one-fourth-inch-thick piles with a design load of 80 tons. The H bearing piles were 14BP89 and 14BP102 sections with design loads of 100 and 125 tons, respectively. Slightly over 30 miles of piles were driven in all. The quantities for each type of pile driven are tabulated as follows:

	Concrete	Pipe	14BP89	14BP102
Number of piles	20	70	82	822
Quantity on plans	210 l.f.	3250 l.f.	11,300 l.f.	144,000 l.f.
Quantity actually used	84 l.f.	3098 l.f.	10,865 l.f.	143,880 l.f.

The pile work amounted to \$1,840,000. This is 26 percent of the total contract cost of \$7,100,000.

Contract Requirements

In addition to the requirements of the Standard Specifications, other stipulations were specified in the Special Provisions to insure a good foundation under the special conditions encountered at the site.

One of these requirements was that the piles be driven in holes drilled or spudded through the rubble fill to the elevations shown on the plans. This was to prevent damage to the piles in driving through the fill, reduce drag on the top of the piles, and to help maintain plumb piles. Having both straight and plumb piles was considered important because of the

long-term settlement of the area which would result in drag down on the piles.

In order to assure penetration to bedrock or gravel, piles were required not only to obtain dynamic bearing based on the Engineering News Record formula but also to penetrate to at least specified elevations within a few feet of the bedrock surface. Pile hammers of adequate size (minimum 28,125 foot-pounds) were required to drive the long, heavy 14BP102 sections.

Footing Excavation

Jackhammers were used to break through the cobblestone street surface. Further excavation for the column footings to depths of five to six feet below street level was accomplished by a backhoe rig. This was anything but easy digging, for old pavements, sidewalks, utilities, and other structures in the area had settled and new ones were built over

them through the years. The remains of many of these old structures were uncovered in digging for the foundations.

In order to confine the limits of excavation and to avoid excessive sloughing due to the vibration of the pile-driving operation and the action of tidal water seeping into the hole, all footing excavations on the Embarcadero were timber lagged.

Pipe and Steel H-Piles Used

The pipe piles were driven by a skid rig which was built on the project by Macco. It carried 95-foot leads reinforced with a double A-frame. The energy was delivered by a 65-horsepower boiler to a single-acting steam hammer modified as explained in the following section on steel H-piles.

Difficult driving was encountered for the pipe piles and more than adequate bearing was obtained for most of the piles about three feet above specified tip. Lengths of piles driven varied from 16 to 70 feet, increasing in length in an easterly direction toward San Francisco Bay. The pipe piles were all located on the Broadway ramps.

The 14BP89 and 14BP102 piles were driven by two rigs affectionately named Quiet Myrt and Silent Sue. Quiet Myrt is the skid rig used also for driving the pipe piles. This rig was equipped with a 35-foot spud and an extractor. The extracting line was designed to exert 100 tons of uplift in addition to having an extracting hammer working simultaneously in the same line. Spudding was required for driving steel H-piles. The first spud used was a riveted box girder which broke up shortly after it was first used. A 14BP102 pile heavily reinforced at both the nose and butt ends was used thereafter. Silent Sue is an old steam shovel converted to a pile driver. Its 65-foot boom handled 60-foot fixed leads. A 140-horsepower oil-burning boiler supplied steam for pile driving as well as for operating the rig. The specifications required that the pile hammer for driving steel H-piles develop sufficient energy to drive the pile at a penetration rate of not less than one-eighth of an inch per blow at the specified minimum

bearing value. Two single-acting steam hammers capable of delivering 32,500 foot-pounds of energy and a smaller single-acting steam hammer modified by adding weight to the ram to meet the specified requirements were used interchangeably on the two rigs as dictated by the need for repairs on any of the hammers.

The 14-inch steel piles were delivered to the job site in 55- and 60-foot lengths. The completed lengths ranged from 80 feet to 225 feet. Segments of pile were spliced by welding on the ground up to lengths of 90 feet in order to keep welding in the leads to a minimum. Three welders were employed for welding in the leads—one on the web and one on each flange.

Spudding and driving of the first section of pile were accomplished by Quiet Myrt. The second section and, where necessary, the third section were welded on and driven to bearing by Silent Sue. Occasionally, where driving was particularly difficult, Quiet Myrt completed driving of some of the piles to bearing in order that the two rigs would not be separated by too great a distance.

Pile Behavior During Driving

Various individual piles were logged during the driving operation. Some of these piles are near locations where test borings were taken. In these cases, it was possible to correlate the behavior of the pile with the geological formation through which it was being driven.

The behavior of a typical 200-foot 14BP102 located on the Embarcadero at Market Street where the longest piles were driven will be described. The spudding operation pioneered a hole through the initial 30 feet of fill consisting of a heterogeneous stratum of sand, pebbles, blocks of rocks, wood fragments and various debris. The pile was placed in this hole and driven through a 90-foot layer of soft clayey silt and clayey sand. Driving was relatively easy during this stage with a gradual increase in blow count indicating bearing resistance (ENR Formula) of from 20 to 40 tons. At approximately 130 feet below the street level, sand was encountered and driving was increasingly difficult

through a 20-foot layer of progressively dense medium sand, coarse sand and gravel. Specified bearing was reached for 10 feet of this stratum as the blow count increased rapidly and then declined as the layer was penetrated. A 60-foot layer of compact grey silt with clay binder was the next obstacle. The blow count here indicated an average of 90 tons bearing capacity for this depth. Finally a shallow layer of very dense gravel was reached, below which was encountered the Franciscan bedrock where specified bearing of 125 tons was achieved.

Project Completion in 1959

Charles L. Harney, Inc., of San Francisco, the prime contractor, started work on this project in December of 1956. Pile-driving operations were started on February 25, 1957, and were completed on June 5, 1958. The only major delay was for two months when realignment of the State Belt Railroad track was necessitated by the proximity of the existing track to some of the footings.

The project was handled by the Bridge Department, Division of Highways, under F. W. Panhorst, Bridge Engineer. Representing the Bridge Department on the project was Resident Engineer D. R. Higgins.

DELANO

Continued from page 26 . . .

It may well be said that a business street, not unlike a man, must find its own niche. Main Street in Delano acquired its pedestrian traffic business character at the very outset; High Street for many years prior to freeway construction, was still grasping for economic identification and recognition. Perhaps the true business character of the old highway might not have emerged for many years had the freeway not been constructed. In any event, High Street—actually the oldest business street in the entire City of Delano—now shows every sign of capitalizing on its “new” business character and economic “respectability” as a second “main street.”

In 1957, 1,330 Americans were killed in train-car crashes.

Crystal Lake

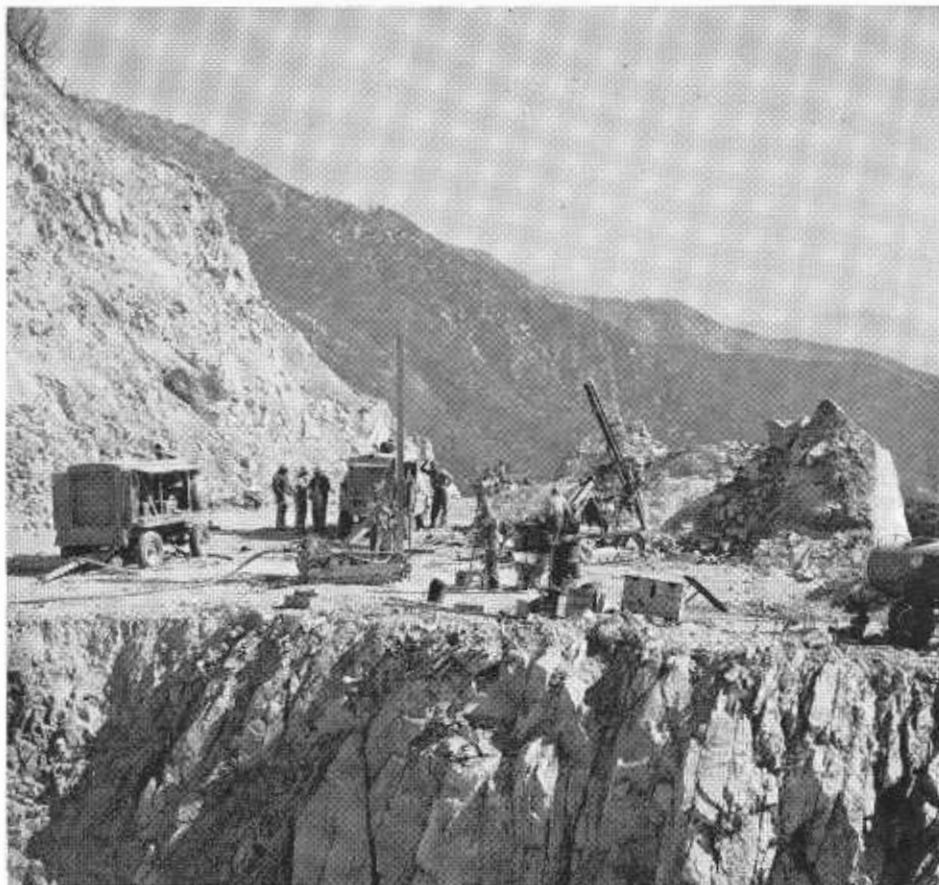
*New 6-mile Road Is Built in
Rugged, Scenic Angeles Forest*

By GEORGE E. DICKEY, Construction Superintendent

CRYSTAL LAKE Road, 6.15 miles in length, a portion of State Highway Route 62, starts at Islip Saddle, on the Angeles Crest Highway, 41 miles north of Foothill Boulevard and extends southward along the easterly slope of Bear Canyon, thence swinging easterly into the head of the San Gabriel Canyon to join the existing paved highway in the vicinity of Crystal Lake.

This road passes through some of the most scenic mountainous areas of the Angeles National Forest and will afford the people of the eastern portion of the Los Angeles Basin a shortcut to the recreational areas. The U. S. Forestry Service is taking great strides in developing campsites and recreational areas in this part of the forest. The ski lifts at Mt. Waterman, Kratka Ridge and those in the Wrightwood area are constantly being improved to handle more skiers and to offer better facilities. As these recreational areas and facilities are improved, more and more people will be driving into the mountains and the Crystal Lake Road will be a useful link in our vast highway system for which California is so well known.

The Crystal Lake Road is being constructed by the State Division of Highways under a conservation camp program in co-operation with the California Department of Corrections under which inmate labor is being used. The inmates at Cedar Springs Conservation Camp No. 37 are drawn from the California Institution for Men at Chino, after being carefully screened and approved for the conservation camp program. E. J. Oberhauser, Superintendent, and Captain J. T. Breen, Chief Camp Supervisor, both of the State Department of Corrections, have been highly co-operative in working out the details of the program. The majority of the men are finishing up their sentences and have less than two years to serve



This photo of drilling operations on a section of Crystal Lake Road gives an idea of the ruggedness of the terrain.

before going on parole. Some of the inmates have been in the various correctional institutions throughout California and have progressed sufficiently to justify their transfer to Chino and inclusion in the camp program.

Few Infractions

While in camp, the inmates are under minimum supervision and are allowed freedom within the camp limits provided they observe the camp rules and regulations. All of the men are in camp at their own request and very few abuse the privileges permitted them. Any serious infractions of the camp rules results in the violators being returned to Chino.

During the working day, the men are assigned to various crews supervised by State Division of Highways foremen. The men assist in the operation of the entire physical plant as well as in the construction of the highway. They have the opportunity to assist with and to get experience in the following types of work: painting, carpentry, plumbing, warehousing, clerical, welding, blacksmithing, stationary power plant operation, heavy and light equipment maintenance, equipment servicing and lubrication, jackhammer operation, blast hole drilling, handling, loading and shooting powders of all kinds, masonry, pipelaying, equipment opera-

tion, grade checking, dirt and rock excavating and other types of construction labor. An effort is made to place the men in the type of work in which they show the most interest and for which they are best adapted.

Construction work started in November, 1952. At this time the camp crews were also working on the Angeles Crest Highway. The work was at the far end of the job and the crews had to travel 15 to 20 miles to get to the site of the work. When the weather was bad, the crews could not get to the job on Angeles Crest Highway so they started working on the Crystal Lake Road. During the winter of 1955 the power shovel was moved onto the Crystal Lake Road job and work then continued on a full-time basis.

Some Hazards

In November, 1956, the Angeles Crest Highway was finished to Big Pines and all of the construction forces were then moved on to the Crystal Lake Road. By this time, the token forces had pioneered a roadway, a distance of 1.2 miles, and by December, 1957, had pioneered an additional two miles. During the year 1958 the pioneer crews worked all the way through to the end of the job and had developed a construction roadway passable to four-wheel-drive equipment.

The mountains of this area are made up of badly decomposed and fractured rock of igneous origin which in some places still retain granite texture and some of which have been metamorphosed and decomposed to such an extent that they have almost lost their geological identity. This condition has made the construction particularly hazardous because of the high cuts encountered and the instability of the excavation slopes. Almost all of the rock has to be blasted because it is too hard and blocky to be ripped and yet it is so fractured and faulted that it is extremely hard to drill.

The construction centerline was established on the ground by Don W. Chesley, Resident Engineer, from an old preliminary survey line run in by the U. S. Bureau of Public Roads

many years ago. The terrain is so rugged in many places that mountain climbing techniques had to be used to set slope stakes. A clearing crew followed closely behind the surveyors or worked with them when necessary and cleared the right-of-way of all brush and timber. All of the timber of suitable size was hauled into the camp sawmill and was cut into lumber for use in construction and camp maintenance.

Precipitous Terrain

As fast as the clearing crews advanced, they were followed by pioneering drill crews who worked themselves out across the precipitous terrain and drilled the initial slope line trail. These men worked in 10-man crews under a highway foreman. Each crew had a 500-cubic-foot compressor, 1,500 feet of aluminum slip joint air line and a number of jackhammers. While four men worked the jackhammers at a time, the remainder of the crew packed in all of the necessary equipment. This work was a continuous process with the crews drilling, moving ahead and then shooting. Several crews were used in this manner as circumstances required. As the pioneering continued, a tractor dozer would work a trail over the shot area as close as possible to the pioneer crews in order to cut down the backpacking distance.

Sometimes an area would have to be hand drilled several times before the tractor could get through, then the area would have to be drilled several more times before we could truck in our supplies. During this period we transported supplies ahead by using a rack on the front of the dozer blade.

After the road is developed to the point where we can pull in our 600-cubic-foot compressors, we then drill 20-foot holes with four crawler-type blast-hole drills. Rippers were tried and were successful in some cases but in most cases the progress was so slow that it was found that blasting was much cheaper.

Work Planned in Advance

Although tractors and scrapers were used for a short time in a location that lent itself to this type of

work, it is necessary to haul most of the excavated material with trucks because the hauls are long and the steepness of the terrain makes the roadway quite narrow. The trucks are loaded with a 2½-cubic-yard power shovel and also with a 3-cubic-yard tracklaying front end loader.

All work is planned in detail a year in advance and the general approach to the work is carried out to this end. However, the work program is revised at short intervals in order to compensate for unforeseen interference such as storms, landslides and other contingencies. J. P. Robinson, foreman, is most helpful in planning and scheduling of the work. As the work progresses and the roadway is brought to approximate grade, several crews follow along, installing culverts, masonry headwalls, retaining walls and other miscellaneous drainage structures.

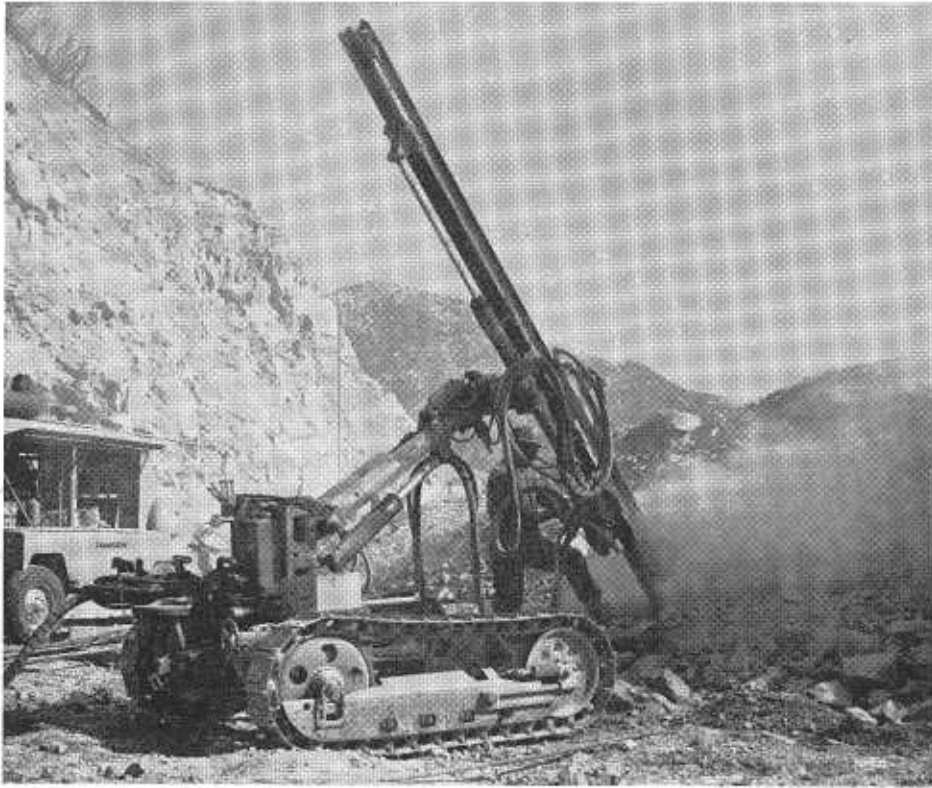
The terrain at one location consists of almost vertical cliffs which extend about 1,000 feet above roadway grade and drop off about 500 feet below grade line. The cuts in this area are nearly 500 feet high in solid rock and it has been a difficult project to get a pioneer road to the top of the initial cut. However, this work is progressing favorably. In the meantime, in order to keep the work moving beyond these cliffs, it was necessary to build a temporary road down across the bottom of the canyon to bypass the cliffs and continue our pioneering. This roadway was quite hazardous at first but as materials were pushed off the top, the road was raised. It is now easily passable except when intentionally closed because of construction work above.

Explosives Used

During the past year 330,000 pounds of explosives were used on this project. When the work is progressing normally, powder is used at the rate of one ton per day. Three-and-one-half-inch bits are used to drill 20-foot holes and are driven with individual 600-cubic-foot compressors. Although the drills are able to tow their own compressor around the



UPPER—Another view of the rugged terrain through which the road is being constructed. LOWER—An aerial showing the alignment of the road. Note the dust cloud in the background where the construction is going on.



One of the late model drills being used on the Crystal Lake Road construction.

working areas, they have to be aided by tractors on the steeper hills.

From 400 to 1,000 feet is the average footage per shift by each drill according to the kind and condition of rock being drilled. The holes are normally drilled on a 7-foot by 9-foot pattern and between 200 and 600 holes are shot at a time, depending on conditions. During the summer months when the work is in full swing, shots are set off every three to five days.

This particular project, being located in the Angeles National Forest, requires that we conduct our blasting operation with minimum damage to the trees outside of our right-of-way line. Our problem is to break up the rock so that it can be economically loaded with a power shovel and still contain the shot so that it does not throw a lot of rock into the trees. When the natural slopes are 1:1 or steeper, a great amount of care must be taken. Various methods of drilling and loading have been used and through experimenting good results have been accomplished.

Conduct Experiments

There has been much discussion regarding the use of ammonium nitrate in large blast holes, but we were discouraged from trying to use it in small holes. It was doubted that ammonium nitrate could be used successfully in holes as small as 3½-inch by 20-foot. However, we have conducted experiments of our own. Everett E. Brooks, foreman in charge of drilling and blasting, kept a systematic record of loadings and shot results and finally came up with results as satisfactory as those using regular blasting powder, and at much lower cost.

The 3½-inch by 20-foot holes are loaded as follows: A primer, consisting of a 2 x 12 stick of 60 percent powder and an electric blasting cap, is placed in the bottom of the hole. The hole is then filled approximately 18 inches with grained ammonium nitrate because it can be packed denser which gives better fragmentation in the bottom. Prilled ammonium nitrate is then poured into the 5-foot level. At this point another stick of 2 x 12 60 percent powder is put in

for a booster. Then the hole is filled to within six feet of the top. Prilled ammonium nitrate is used in the top portion in order to get the powder level higher in the hole without using too much powder. In extremely hard rock about six pounds of 40 percent bag powder is sprinkled in the hole with the prill in order to give a little boost to the prill.

The use of ammonium nitrate has been simplified on this project by the following methods. To be effective ammonium nitrate must be saturated with diesel oil. Originally this was done by pouring four-fifths gallon of oil into the 80-pound bag but spotty oiling resulted. We obtained even dispersal of the oil throughout the ammonium nitrate by using a gallon-size garden sprinkling can and sprinkling the oil over the top of the open bag. The sacks are then dumped into aluminum bodied wheelbarrows. Aluminum sugar scoops are then used to measure the nitrate as the holes are loaded.

Substantial Savings

Average costs have been kept over a period of time and it is found that the powder costs for straight powder are 10.5 cents per cubic yard of rock and the costs when using ammonium nitrate are 5.3 cents per cubic yard of rock. These costs indicate a great saving to the State, therefore this type of loading is being used whenever the weather is good. Ammonium nitrate is completely soluble in water while other powders are more durable in wet weather. Therefore, if there is indication of wet weather, we switch to other powders rather than risk losing a shot.

The progress on this project has been due to the perseverance and interest shown by the foremen and operators employed by the State Division of Highways and also to the co-operation of the correctional officers headed by Lieutenant L. W. Baugh and his recent replacement, Lieutenant B. E. Swisher. Much is to be said about the enthusiasm and interest shown by the inmates and their desire to produce a good job.

At the present rate of production, it is anticipated that this project will be completed in early 1961.

H. R. Lendecke, Bridge Engineer, Retires

H. R. Lendecke, Associate Bridge Engineer, Division of Highways, retired in November after 32 years with the State.

Lendecke was born on September 20, 1895, and received his early education in Georgetown, Colorado.

After returning from service in World War I, he completed his engineering training at the University of Colorado where he received his bachelor of science degree in civil engineering.



H. R. LENDECKE

His early engineering experience included one year of surveying with the Bureau of Public Roads, one year on construction work in Chicago with the Illinois Central Railroad and three years in Miles City, Montana, with the Chicago, Milwaukee, St. Paul and Pacific Railroad on the design of railroad bridges.

After coming to California, Bob worked on the subdividing of the Lake Arrowhead area. Later for a period of two years he was City Engineer of Winslow, Arizona.

He joined the Bridge Department of the State Division of Highways in 1926 and since that time has worked on many of the major bridge projects throughout the State. During the construction of the San Francisco-Oakland Bay Bridge he worked on the construction of all of the caissons for the east bay structure.

The state bridges on which Lendecke was resident engineer include such major structures as the Santa Margarita River Bridge on the Coast Highway, the four-level structure in Los Angeles and the Colorado Freeway Bridge across the Arroyo Seco in Pasadena.

Lendecke married Lucile Smith at the University of Colorado on January 2, 1920.

The Lendeckes live at 11444 East Keith Drive in Whittier.

SUPERVISION COURSE GIVEN IN ELEVEN DISTRICTS

By SCOTT H. LATHROP, Principal Highway Engineer

DURING the past year, a training course on "Principles of Administration and Supervision in Highway Practice" has been presented in each of the 11 districts of the Division of Highways and at the Sacramento Headquarters.

While the course was designed primarily to meet the needs of supervisors in the Division of Highways, it was given in co-operation with the Institute of Transportation and Traffic Engineering of the University of California and was made available at the same time to employees of cities and counties. Approximately 10 to 15 percent of the 1,300 or so who have attended the courses have been employees of organizations other than the Division of Highways.

A survey of all the districts of the Division of Highways some time ago indicated that most employees felt the need of some training in the supervisory area. An opinion survey conducted in June of 1957 confirmed this fact. Preparations for a course to help fill this need were started in late 1957 and completed in early 1958.

Most of the work on the syllabus for the course was done by Robert T. Martin, Administrative Assistant from District III in Marysville, with guidance from Doctor James R. Bell, Professor at Sacramento State College, and William Z. Hegy, engineer in charge of training and safety for the division. Material for inclusion in the syllabus was secured from a number of different sources.

In preparing the course, care was taken to include both theoretical presentations and practical applications pointed toward actual problems encountered in highway work. In selecting instructors, an effort was made to maintain the same balance. Doctor Bell carried the greater part of the theoretical presentation. Doctor Bell's background particularly suited him for the assignment, since for many years before recently joining the Public Administration faculty at Sacramento State he was one of the top executives with the California State

Personnel Board. The other two instructors were selected from within the Division of Highways organization. Rudolf Hess is one of the assistant chief right-of-way agents for the division, and Scott H. Lathrop is the engineer in charge of personnel and public information. Both have had specialized instruction and experience in the training field.

The course itself was 12 hours in length. The presentations, following the usual I. T. T. E. pattern, were generally given on Friday evening and Saturday morning for two successive weeks. The course was divided into three primary sections, dealing with job management, man management, and self-development.

Response to the courses, which were given entirely on the employees' time and required a registration fee, has been excellent throughout the division. Attendants at the course have come from all parts of the highways organization (engineering, right-of-way, accounting, etc.) and from all levels.

Many favorable comments have been received, and many employees expressed a desire that additional opportunities be provided in the area of supervisory training in the future.

As a result of this expressed desire for additional supervisory training several districts are conducting six two-hour conferences in supervisory techniques for their staff, under the guidance of a trained conference leader.

All of the courses stress the consideration which has to be given to the recognition and evaluation of personal traits and qualities of the individual in the creation of a well-functioning organization. They delineate the tools available to a supervisor to improve his skills in handling his subordinates to obtain the objectives of the organization.

At the end of the 1957-58 Fiscal Year, the State Division of Highways was operating 160 radio stations, 21 microwave stations and 800 mobile radio units.

Merit Award Board Announces Winners

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

LOYD B. REYNOLDS, Highways, Sacramento. Certificate of award and \$25 for suggesting printed bidders bond forms to facilitate handling.

ALFRED E. HOERCHNER, Lindsay. Certificate of award and \$10 for recommending that the daily diary be provided with a triplicate copy to be sent to the resident engineer.

FRED H. ROGERS, Sacramento. Certificate of award and \$15 for recommending the elimination of supplemental property survey reports.

JAMES L. ANDERSON, King City. Certificate of commendation for recommending that Form R-13 be provided with additional sheets of carbon.

RICHARD F. GREGORY, Architect, Sacramento. Certificate of commendation for recommending the placing of a routing check list on change order forms.

LEO E. MURRAY, Highways, San Francisco. Certificate of award and \$20 for designing a bracket to be used for painting and repairing signs where the footing for a ladder is not level.

JOHN E. BORCHERT, Highways, Sacramento. Certificate of award and \$25 for proposing an acid titration method for the determination of cement content in cement-treated bases.

RALPH H. YALE, Highways, Sacramento. Certificate of award and \$10 for recommending that grooving tool tips be made of low carbon steel.

JOSEPH L. HART, San Francisco-Oakland Bay Bridge, Oakland. Certificate of award and \$50 for designing a swing or swivel base for winch used to raise and lower scaffolds on East Bay towers of the bridge.

GEORGE E. DUCLO, San Luis Obispo. Certificate of award and \$150 for developing a tool consisting of a mirror, engineer's scale, and protractor, for plotting radial lines and perpendiculars.

MRS. EUNICE R. LATHAM, Oakland. Certificate of award and \$15 for recommending revision of Form A-127.

MARVIN E. METZLER, Fresno. Certificate of award and \$60 for recommending that District VI acquire a typewriter with a special carriage and type to be used for typing tabulations on the contract plans, thus eliminating hand lettering formerly required.

NEAL J. FRANSEN, Sacramento. Certificate of commendation for recommending that

Field Men Enroll in Maintenance Course

More than 100 road and highway field men are enrolled in an adult education course in highway maintenance which is being conducted in San Diego County under the direction of the county road department.

According to J. H. Mack, road commissioner, the course is included in the county's adult education program for the spring semester. Text for the course is the Division of Highways Maintenance Manual. Three-hour classes are held one evening each week at Grossmont High School and at Palomar College near San Marcos.

Instructors are Dale Talbot of the Division of Highways District XI office and J. Settles of the county road department.

Of the more than 100 field men taking the course, 35 are from the Division of Highways, 25 from the City of El Cajon, and the remainder from the county road department.

the stores department stock mass diagram sheets 23" x 36".

TILLIE SCHINDLER, Sacramento. Certificate of commendation for recommending revision of Form A-127.

L. S. SANDERSON, Division of Architecture, Los Angeles. Certificate of award and \$25 for recommending the consolidation of drafting details pertaining to doors, door frames, transoms, sills, mullions, etc., on one sheet of drawings instead of being placed on several sheets.

MRS. GLADYS H. RIPPON, Division of Contracts and Rights-of-Way, Sacramento. Certificate of award and \$10 for recommending that an extra duplicate or triplicate copy of claim documents be made at the time initial copies are made on the Verifax machine.

BOULTON HERTZOG, Division of Highways, Stockton. Certificate of award and \$50 for recommending use of a two-solution developer for photographic materials rather than the standard one-solution developer.

MRS. AURELIA B. RINDERNECK, Division of Highways, San Diego. Certificate of commendation for recommending the padding of Forms M-32 and M-123.32 into pads of 50.

State Division of Highways maintenance forces painted traffic lines and pavement markings on 10,992 miles of state highways during the 1957-58 Fiscal Year. Cost of the work was \$1,073,307.

Ed Wilson Retirement Marked in Marysville

F. E. "Ed" Wilson, District Right-of-Way Engineer for District III, retired on February 1st after a career of over 31 years with the California Division of Highways. All of Wilson's California state service was in District III.



F. E. WILSON

He was born in Madison, Wisconsin, on Christmas Day, 1897. The Wilson family moved to Oregon while he was quite young. He attended public schools in Mosier and graduated in 1924 from Oregon State College with a bachelor of science degree in civil engineering. He was employed by the Oregon Highway Department as a draftsman and transitman from the time of his graduation until 1928.

Wilson joined the Division of Highways on January 13, 1928, as a draftsman. From then until his retirement, he became one of the district's most versatile engineers with experience in right-of-way engineering, in location work, in construction as a resident engineer, in design and in the preparation of reports. He also was among the first in the district to use aerial photography in highway development work.

On January 1, 1949, he was promoted to senior highway engineer and assigned as district location engineer. The initial work on the location of the freeway on Highway US 40 was made during this time. He served as district materials engineer from 1953 to 1957 during the period when the district materials laboratory was built. In 1957 he was appointed district right-of-way engineer.

A registered civil engineer, he is a member of the American Society of Civil Engineers. His fraternal associations include membership in the Masons and Elks.

He plans to remain active in engineering after his retirement from state service. He will make his home at his present address on Live Oak Highway in Yuba City.

District X Traffic Engineer Retires

Richard A. Wilson, District Traffic Engineer of District X in Stockton, retired in January after 37 years of service with the Division of Highways.

Wilson was born in Astoria, Oregon, in 1893. He attended the College of Civil Engineering at the University of California in Berkeley and worked in engineering capacities for the Coast and Geodetic Survey, Oregon Highway Commission and the City of Astoria prior to World War I, during which he served in the Coast Artillery.

After the war he went to work for the Division of Highways in District IV as an assistant permit inspector. He was soon promoted to permit inspector and later maintenance superintendent in Sonoma, Napa and Marin Counties.

In Maintenance Wilson gained experience in traffic engineering, since at that time Maintenance controlled work now performed by the Traffic Department. In 1941 Wilson was transferred to District X as District Traffic Engineer and served continuously in that capacity until his retirement except for a period in 1945-46 when he was traffic engineer for the Headquarters Military Police Division in the European Theater. While on this assignment he established standard road signs and signing procedures and prepared a booklet entitled "Road Sign Manual for the Control and Guidance of Military Traffic."

Wilson is an associate member of the American Society of Civil Engineers, a member of the Institute of Traffic Engineers and a member of the San Joaquin Safety Council. Mr. and Mrs. Wilson have a son, Robert, now living in Costa Mesa, and two granddaughters.

Speeding was blamed for 13,200 deaths on United States highways in 1957.



RICHARD A. WILSON

CONTRACT CONTROL

Continued from page 30...

phasizes the need for careful fact finding as a basis for estimating the time required for each stage of the project, and also offers suggestions on estimating these production limits with reasonable accuracy.

From estimates of the time required for each portion of the job, the report states, a tentative overall contract time limit can be set. This overall limit may be checked against the normal range of progress (as shown on the chart) to see how it fits in with the estimated production rates.

The report emphasizes that the curves on the chart will not actually determine the proper time limit. They will only provide a check by indicating whether or not the proposed overall time limit is consistent with the estimated rates of production.

"It will always be necessary to analyze the work to be done and to set production as reasonably as possible," the report says. "Once this has been done the use of the curves will serve as a check upon the reasonableness of the time specified.

"The methods of analysis presented cannot be considered as an end, rather they are only a means. Final conclusions must always be tempered with sound engineering judgment. The entire problem of time limits, contract progress and controlling items are, on the whole, so complex as to defy exact determination. All processes that may be developed will at best resolve the facts into a picture from which an engineer is able to draw reasonable conclusions.

"While it is not possible to reduce these matters to a mathematical certainty of A, plus B, minus C equals a decision, it is felt that the use of the methods presented herein will produce results within the structure of the specifications that are reasonable and fair to the State and the contractor alike."

Results of the study are reported in the pamphlet "Contract Progress Control" which is available to highway engineers and other interested persons on request to the Division of Highways.

Clementine Dougherty Of District VII Leaves

Clementine Dougherty, a state employee since 1925 and with District VII of the State Division of Highways since 1942, has retired. She was honored at a party in Los Angeles last December. Edward T. Telford,



CLEMENTINE DOUGHERTY

Assistant State Highway Engineer, presented her with a camera, a parting gift from her many coworkers and friends. Since 1947 Mrs. Dougherty had been in charge of the general file room.

She was born in Glendive, Montana, and graduated from Dawson County High School. She came to California in 1925 and married Earl Dougherty (now deceased) in 1927.

Division Publishes Design, Sign Studies

Two studies of interest to highway engineers, one new and one a revision of an earlier study, are now available from the Division of Highways.

The newly published report is entitled "Driver Needs in Freeway Signing." It was prepared for the Division of Highways by the Automotive Safety Foundation. It is believed to be the first time in highway history that the much-discussed question of how to sign freeways properly has been the subject of concentrated research, aimed at developing a set of guideposts for future traffic engineering practice. Interviews with drivers form the basis for the study.

The other publication is "Correlation of Geometric Design and Directional Signing," which was originally issued in 1956. It has now been brought up to date to conform to present day geometric design and signing standards for freeways.

Persons interested in either or both of these publications may request them from G. M. Webb, Traffic Engineer, Division of Highways, P. O. Box 1499, Sacramento 7, California.

CALIFORNIA BRIDGES

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the rise in bridge construction costs since 1939-40. In 1958, as a result of an increased budget, the rates rose to 13 and 5 for value and volume, respectively.

The activity indexes are designated as value and volume indexes in the accompanying charts where the values are given for all periods since 1934.

The average number of contracting firms bidding on contracts which included bridge work was 8.0 during 1958 as compared with an average of 7.4 bidders per contract during 1957. Since a high number of bidders is associated with greater competition, construction costs generally move downward when bidders are more active. In 1958, bidder activity was up and prices were down by 5.5 percent, indicating that competition was fairly strong during the relatively depressed economic period of the past year.

Unit Price Trends

Unit prices for the various bridge items reached record highs during 1957, declined during the first quarter of 1958 and varied very little from the new level for the remaining quarters of 1958.

Class A portland cement concrete (structures) cost an average of \$58 per cubic yard in 1957 and dropped to an average of \$55 per cubic yard in 1958, a reduction of about 5 percent. Structural steel cost an average of \$0.205 per pound in 1957 and dropped to an average of \$0.17 per pound in 1958, a reduction of 17 percent. The rather dramatic reduction in the price of structural steel is a reflection of the change in this industry's economic position from one of high demand and limited availability to one of limited demand and more than ample availability. Bar reinforcing steel, on the other hand, cost an average of \$0.123 and \$0.124 per pound for the years 1957 and 1958, respectively. The economic position of this indus-

try apparently remains one of high demand and limited supply.

The foregoing items together represent a valuation which accounts for about 75 percent of the total value expended for bridge construction. The changes in the unit prices of these items therefore exert a preponderant influence upon the general trend of construction costs.

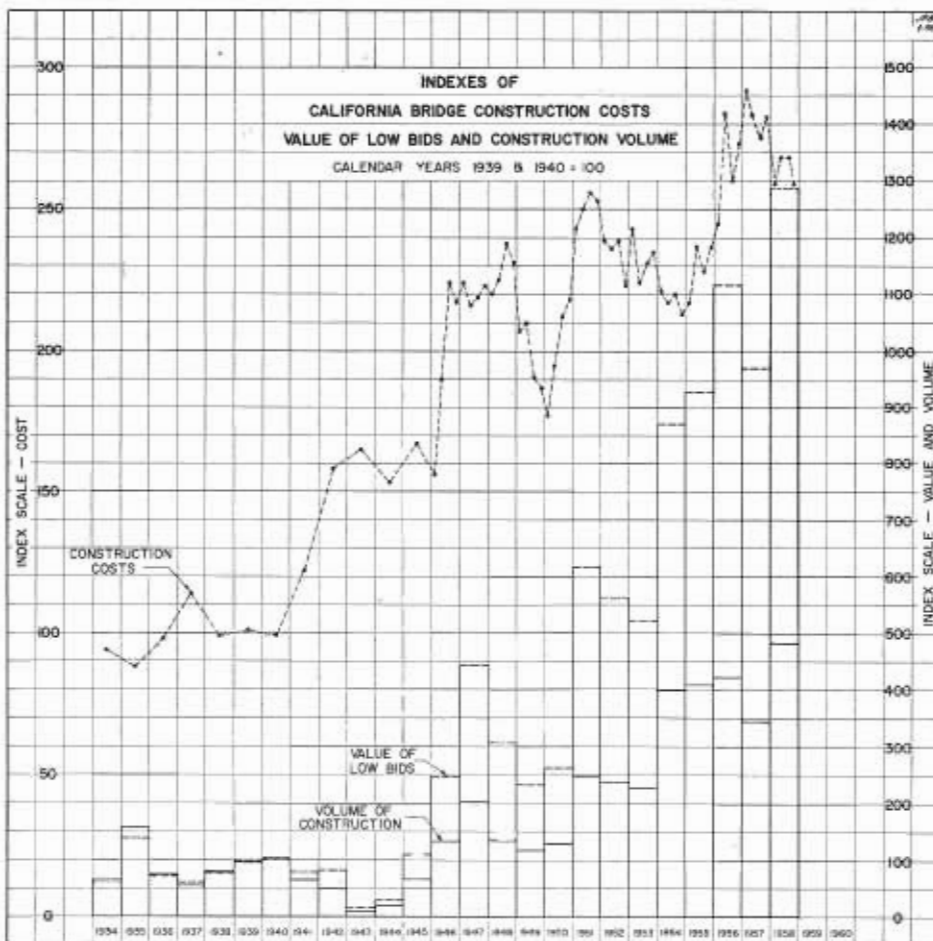
During the past four years the bridge construction program has required about 450,000 cubic yards of concrete, about 18,000 tons of structural steel, and about 50,000 tons of bar reinforcing steel annually. A change of \$1 per cubic yard in the price of Class A concrete therefore implies a change in annual cost of \$450,000, and a change of \$0.01 per pound in the cost of structural steel and of bar reinforcing steel imply changes in annual cost of \$360,000 and \$1,000,000 for the items, respectively. Changes in the prices of these items are therefore significant when considered in terms of the annual program.

The prices for these items declined during the past 15 months, a decline which coincided with the trend of the last general economic recession. Since the general economic trend is now moving upward, the prices of these items may also be expected to move upward.

Summary

The period prior to about the third quarter of 1957 was a period of general prosperity and bridge construction costs were accordingly high. The most recent period of relative recession became apparent in the latter part of 1957 and, once under way, continued through the greater part of 1958. Bridge construction costs declined accordingly.

The year 1959 is currently being described as one of a slow but determined period of economic recovery and growth. It is also being assumed that the inflationary forces will not move into another period of sharp inflation. It may therefore be assumed that California bridge construction costs will again proceed upward during 1959 but at a much more moderate rate than that of the last period of inflation which began in 1955 and ended in the middle of 1957.



HOW FAS WORKS

Continued from page 17 . . .

the financing of the contract, which in no event is less than approximately 10 percent of the contract.

Upon approval of the contract by the state attorney, the county takes over and performs the construction engineering and prosecutes the contract to a satisfactory completion. The State and the Bureau of Public Roads inspect the work occasionally during construction in order to assure themselves that the work is being done to proper standards and that the county is complying with all state contract procedures.

Freedom From Interference

The county certifies to the State each month the amount due as progress payments, and upon completion of the job, the final amount is computed by the county and certified to the State. The State makes all payments due under the contract.

From start to finish the federal-aid secondary projects are county projects. Without interference in any way, we select our projects, determine the standards we wish to use, make our preliminary surveys and plans, and the recommended specifications. We do the necessary materials testing and perform our own construction engineering. When I say that we do this without interference, I mean that as long as we operate within the framework of the appropriate state and federal acts, we encounter absolutely no interference. Inspections by state and federal engineers are in the nature of occasional visits, and are usually the minimum necessary to assure themselves that the project is being constructed within the intentions of the law. They can certainly never be accused of breathing down our necks.

When we get in trouble, or while we are learning, both agencies are Johnny-at-the-Rathole to help us out. When we lack qualified personnel for any phase of a project, we can request and get men from the Division of Highways. They will help us with materials testing and with selection and use of laboratory equipment. Upon request, they will prepare our

plans and specifications, or will perform all construction engineering, or will do both. We can get help from them on short notice and in the degree that we need. Of course the county pays, which is only fair, but I want to emphasize the fact that we get only what we request, and are under absolutely no compulsion to accept any help from the State. Our federal aid secondary projects are truly county projects from start to finish except for printing the plans and specifications, advertising for bids, and awarding of the contract.

Organization Explained

The administrative machinery at the state level is somewhat as follows: Within the Division of Highways is the Officer of Engineer of Federal Secondary Highways, which since the inception of the program has been headed by H. B. (Red) LaForge. He has a staff of eight men, only four of them assigned to the FAS program, and in addition to handling the FAS program, the office is handed such odd jobs as assisting with the highway planning survey and the recent Federal 210 study, which in California was performed at the city-county level; 10- to 20-million-dollar state flood relief programs; and numerous other time-consuming jobs. In addition to the four men in the Sacramento office, each of the 11 state highway district offices in California has an engineer of city and co-operative projects, who works part-time in administering county co-operative programs at the local level.

The administration of the program in California has not always been sweetness and light, and the smooth operation we have today did not come about overnight. It took time and a monumental patience and faith on the part of our state highway engineers. As an example of the efficiency that we have achieved today, I would like to point out the manner in which the crash program, the so-called "D" money, was handled in California. The counties were notified of their apportionment on April 24, 1958, and by September 15, 1958, every one of the California counties had completed the preliminary engineering on their project, and the projects were

ready to put to bids. This was accomplished in four and one-half months.

Activities Centralized

The evolution of this efficient program is interesting, and has developed because a few people in key positions in our State Government had faith in the ability of a strong local government to solve their problems at the local level and to develop the necessary engineering staff to do the job properly.

Back in 1945 when the present federal aid secondary program was started here in California, the counties were operating their road departments on a supervisorial district basis. Each supervisor could, and in most cases did, operate his district as his own little empire. A few counties had seen the light and had centralized their county road operations under a competent engineer. However, most counties were operating in a haphazard manner, and without any engineering organization.

Consequently, the Division of Highways and the U. S. Bureau of Public Roads had a monumental job to tackle. Many of the counties not only had no engineering staff at all, but had supervisors that didn't think that engineers were even a necessary evil. They knew how to build roads—just turn the money over to them and let them handle the work, was all that they wanted. That was the preponderant attitude. The pressure to permit day labor construction was terrific.

Early Jobs

The first federal aid secondary project in San Benito County was typical of many county projects under the 1945 program. The Division of Highways was requested to prepare the plans and specifications and to furnish construction engineering. The county furnished the right-of-way. The supervisors thought that the \$185,000 available would build the seven miles of road for which they furnished the right-of-way, and the screams of anguish were loud and long when the contract was awarded for only three miles of road. The State built us a fine section of road, with three inches of plant-mix surfacing the full width of the roadbed, culvert

inlet boxes, and plant-mix curbs and berms. It was a beautiful job done to the Division of Highways Standards. In the 12 years the section of road has been in service, surface maintenance cost has been zero. However, the county supervisors were very unhappy. They did not think that the county could afford to build roads to such high standards for a relatively low traffic volume.

There was similar grumbling from supervisors all over the State, and they gave the Division of Highways a bad time. In subsequent programs, where the county was required to provide their own matching funds without state assistance, some counties declined to accept their allocations, maintaining that they could take their half of the money and build more and better roads than they could under the federal secondary program.

In 1947, the Collier-Burns Highway Act went into effect, requiring each county to appoint a road commissioner and to operate the county road department as a single road district. Gradually the present efficient operation of the program began to take form. The staff of the Division of Highways were patient, and they stuck to their set of rules and procedures. They sat tight under the pressure, and the pressure came from all directions. There was agitation to have the State take over the program entirely, and there was considerable pressure to permit day labor construction.

Participation Voluntary

However, the cool heads prevailed, and the program was given a chance to prove itself, which it quickly did. Operating closely with both the County Engineers Association and the County Supervisors Association, the state engineers began to explain and to educate the counties.

We were not forced to participate in the program. Counties could elect to relinquish their funds to the State Division of Highways for use on FAS state highway projects within the county, and were thus relieved of the matching requirements and could still get needed improvements on highways within the county, but only upon the state highways. Of the 809

federal secondary highway projects in California since the 1945 act, 48 projects, accounting for 256 miles of state highway and 36 state highway bridges, were constructed all, or in part, with funds relinquished by the counties.

We were offered a program providing substantial funds for much-needed county road improvements, and the only way we could take advantage of these funds was to conform to the rules. The rules under which we are now operating have not been changed since the 1945 act went into effect. They are good, common-sense rules, and we have learned how to use them to the best advantage.

Compulsion by the State Government is not often a healthy influence on local government, but in this program the compulsion has been highly beneficial, both to local government and to the State Government. Being forced to conform to the rules, the counties have improved their engineering management on county roads, and have proved beyond a doubt that local government can adequately do a job without innumerable state laws and without interference from a higher government. State officials and our legislators now have confidence in the ability of local government to live up to its obligations, and this is being reflected in California by an ever-growing tendency on the part of the Legislature to return many governmental functions to county government.

Design Standardized

Being forced to conform in order to avail ourselves of the federal secondary highway funds, pointed up the need in all counties for improvement of management techniques, an engineering staff, and for laboratory facilities. A direct outgrowth of the FAS program has been the development by the County Engineers Association of uniform geometric and structural standards for county roads and for subdivision streets. These standards have been printed and distributed to the counties, and nearly all of the counties have adopted them as the county standard for all work within the county.

Our federal secondary highway system contains very few miles of

primitive roads, and the overwhelming majority of FAS projects are reconstruction of existing all-weather roads to accommodate the ever-increasing traffic volume. The average daily traffic on all county roads in the federal secondary highway system in 1956 was 1,323 vehicles daily, and the average daily traffic on roads reconstructed under the program has been approximately 2,000 vehicles daily. Strangely enough, a paradox of the State's job has been to keep the counties from constructing to too high a geometric standard rather than getting them to raise their standards.

In 1946, over 80 percent of all engineering on the FAS projects was handled by the State Division of Highways at the request of the counties. The counties simply did not have either the personnel or the "know-how" to handle high-type design and construction. Today the situation is reversed. The counties are now handling well over 80 percent of the engineering. This is reflected in the expenditure of our own county funds. More miles of better roads are being constructed. More miles of road are being constructed to a proper alignment and grade, because we now have the engineering staff to do things properly.

No Tax Diversion

In California we do not have any state-imposed rules or regulations on expenditure of our county road funds. Highway users taxes returned to the county by legislative formula must be used on county roads, but the State Division of Highways has no authority over the county in the expenditures of these funds. Each county can operate in any way they wish, providing that they appoint a road commissioner to manage the county road department and that they certify to the State Controller at the end of each year to the effect that all highway users tax funds were expended on county roads. That is the extent of state control over our county road program. There is absolutely no requirement that we adopt uniformity in any degree, and yet we have accomplished an astonishing degree of uniformity through voluntary means.

Any county engineering employee can go to work for another county

or for the State Division of Highways and find the work familiar, just as a contractor bidding on highway construction projects anywhere in the State will find the plans, specifications, and construction standards familiar. A subdivider will find that no matter where he subdivides in the State, the geometric and structural standards to which he must construct his roads and streets are about the same.

Standards High, Uniform

A recent survey among the California counties revealed that in the 1957-58 Fiscal Year, out of a total county road expenditure of \$119,000,000, over \$55,000,000 had been spent on construction. The three-year average of construction work done to standards equaling or exceeding the minimum standards of the County Engineers Association of California, was \$46,000,000 per year. This indicates that approximately 83 percent of all county construction work is being done to extremely high and uniform standards. Federal aid secondary projects account for less than one-third of the total construction done to high standards.

The federal aid secondary highway program in California, since 1946, has resulted in the construction of 809 projects, costing \$149,607,596.42. The work accomplished has given the motorists 2,586 miles of high-type highway and 396 modern bridges.

Of the 68 FAS contracts awarded during the fiscal year ending June 30, 1958, the engineering work was performed as follows:

	Preliminary engineering	Construction engineering
County	50	42
Consultants	16	0
State	2	26
	68	68

The above data are substantially correct. The counties sometimes split the fieldwork, foundation studies and final design between themselves and the consultants. The tables indicate, under construction engineering, the county or state resident engineer. However, as to actual personnel on the job, a canvass, during May of 1957, showed that construction engineering was being performed by 31 state men and 135 county men.

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Leavitt, Meta Powers Retire, Will Travel

Leavitt and Meta Powers, husband and wife with a total of 72 years in the service of the State of California, retired on March 1st from their positions in the Department of Public Works. More than 200 friends feted



LEAVITT POWERS

the couple at a dinner and dance at the McClellan Air Force Base officers' club. The Powerses began their state careers early in the 1920's with the California Highway Commission. Powers, who retired after more than 38 years of service, joined the commission in February, 1921, as a junior bookkeeper for the state highway area office, then called Division III, headquartered at that time in Sacramento at 34th Street and Stockton Boulevard. He was transferred to the commission's Equipment Department when it was created in 1923.

Mrs. Powers retired following 33½ years in state service. She was Meta Marie Bolte when she went to the commission as an intermediate stenographer in May, 1923. She was assigned as secretary to the equipment engineer in the equipment department where she met Powers. In January, 1926, she accepted a position in San Francisco with the commission's one-man contracts and right-of-way office. A year later Powers followed her to San Francisco as chief clerk at Shop 4 of Division IV. The Powerses were married in San Francisco in November, 1930.

In September, 1933, Powers was transferred to Fresno as chief clerk of Shop 6, District VI, of the Division of Highways. Mrs. Powers spent the next four years as housewife.

Late in 1937 Powers was returned to Sacramento to supervise the general accounting office of the Department of Public Works, serving the Divi-

sions of Architecture, Ports and Water Resources, the Water Project Authority and the Water Resources Board. On July 1, 1956, when all water resource functions were separated from the Public Works Department, Powers was appointed accounting officer of the Division of Architecture, the position he held at his retirement.

Upon returning to Sacramento in 1937, Mrs. Powers went to work for the State Board of Control and later was secretary to the Deputy Director of the Department of Finance for five years. In 1944 she returned to her prime work interest, legal stenography, in the Department of Public Works' growing Division of Contracts and Rights of Way. In 1948 she was placed in charge of this division's headquarters clerical staff. She supervised 26 employees in Sacramento and had nominal supervision over 51 employees in San Francisco, Los Angeles and San Diego.

Powers was born in Angels Camp, Calaveras County, and was raised near Virginia City on the Comstock Lode, Nevada. In his youth he was chief clerk of the Nevada State Prison and was secretary to the Nevada State Police for more than a year. He is a member of the American Legion, the Tehama Lodge of the Masons, the Sacramento Consistory of the Scottish Rite, and the Elks. He is a charter member of the California State Employees' Association.

Mrs. Powers was born and raised in San Francisco. She is a former member of the Business and Professional Women's Club of San Francisco, and is a member of the State Women's Club, the Supervisors' Forum, the Woman's Forum and the Rainbow Chapter of the Eastern Star. She is also a charter member of the California State Employees' Association.

Following a three-month tour of Europe this spring and summer, the Powerses will tour the United States next winter. Powers then plans to go to school to study history and philosophy. Mrs. Powers will take up her duties of housewife on a full-time basis.



META POWERS

COST INDEX

Continued from page 20 . . .

NUMBER AND SIZE OF PROJECTS, TOTAL BID VALUES AND AVERAGE NUMBER OF BIDDERS

(July 1, 1958 to December 31, 1958)

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.....	166	47	87	30	14	4	318
Total value*.....	\$3,894,030	\$3,320,422	\$9,305,375	\$10,351,150	\$9,939,759	\$5,250,666	\$41,761,402
Avg. No. bidders.....	4.7	5.5	6.1	6.7	9.1	9.8	5.8
Structure Projects							
No. of projects.....	14	7	5	4	1	5	37
Total value*.....	\$352,213	\$514,017	\$1,068,449	\$1,312,431	\$588,847	\$10,795,057	\$14,621,014
Avg. No. bidders.....	5.7	5.7	9.2	8.3	9.0	8.6	7.0
Combination Projects							
No. of projects.....					6	22	28
Total value*.....					\$4,735,622	\$66,608,179	\$71,343,801
Avg. No. bidders.....					7.0	8.2	7.9
Summary							
No. of projects.....	180	54	63	34	21	31	373
Total value*.....	\$3,946,243	\$3,834,439	\$10,363,824	\$11,663,581	\$15,264,228	\$82,653,902	\$127,725,217
Avg. No. bidders.....	4.8	5.5	6.3	6.9	8.5	8.5	5.8

* Bid items only.

TOTAL AVERAGE BIDDERS BY MONTHS

	July	Aug.	Sept.	Oct.	Nov.	Dec.	Avg. for six months
1958.....	5.4	5.5	5.6	5.6	7.0	6.9	5.8
1957.....	6.1	6.7	5.7	8.2	9.2	9.5	7.3

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	0.054	0.132
1945.....	0.51	2.42	4.20	4.68		10.90	37.20	0.059	0.102
1946.....	0.41	2.45	4.00	4.68		9.48	37.38	0.060	0.099
1947.....	0.46	2.42	4.32	5.38		12.38	48.44	0.080	0.138
1948.....	0.55	2.43	4.30	5.38		13.04	49.86	0.092	0.126
1949.....	0.49	2.67	4.67	4.64		12.28	48.67	0.096	0.117
1950.....	0.40	2.25	4.26	3.75		11.11	43.45	0.079	0.094
1951.....	0.49	2.62	4.34	5.00		12.21	47.22	0.102	0.159
1952.....	0.56	2.99	5.00	4.38		13.42	48.08	0.098	0.150
1953.....	0.51	2.14	5.31	4.58		12.74	50.59	0.093	0.133
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	0.40	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				\$5.93	14.95	0.112	0.197
1st Quarter 1957	0.63	2.10				5.94	17.28	0.114	0.235
2d Quarter 1957	0.63	2.10				6.18	15.59	0.119	0.204
3d Quarter 1957	0.42	2.34				5.10	14.34	0.130	0.200
4th Quarter 1957	0.68	1.78				5.45	16.88	0.129	0.177
1st Quarter 1958	0.52	1.85				5.45	14.96	0.118	0.192
2d Quarter 1958	0.48	1.73				5.67	13.77	0.125	0.158
3d Quarter 1958	0.39	2.18				5.56	13.99	0.126	0.182
4th Quarter 1958	0.52	2.10				5.74	13.55	0.122	0.165

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.

The average price of \$2.10 a ton for untreated rock base is slightly below the third quarter price of \$2.18 per ton. Thus, this item continues in this quarter to approximate the typical value established over the last several years.

While the average unit price of \$13.55 a cubic yard for Portland Cement Concrete is down \$0.44 per cu. yd. from that of the third quarter of 1958, this is a relatively slight change percentage-wise, and within the range of normally expected fluctuations. It is interesting to note that this is the lowest average unit price recorded since 1955.

The average unit price of \$5.74 a ton for asphaltic and bituminous mixes increased \$0.18 from \$5.56 per ton, but is within the range of average unit prices for the last two years.

The average unit price of \$55.20 a cubic yard for portland cement concrete (structures) increased \$1.27 from \$53.93 per cu. yd. This is a return to the average unit price for the first quarter of 1958, which was the lowest average since the first quarter of 1956.

The average unit price of \$0.122 a pound for bar reinforcing steel constitutes a slight reduction below the average unit price of \$0.126 per lb. for the third quarter of 1958. It is interesting to note that the bid price for this item has declined despite rising steel costs and indicates the effect of increased competition in bidding highway construction projects.

The average unit price for structural steel amounting to \$0.165 per lb. is a decrease of \$0.017 under the third quarter 1958. A comparatively small quantity of steel was used in this quarter, with a substantial portion thereof being included in a grade separation project at a unit price of \$0.136 per lb.

General Trends

During the next quarter bids will be opened on several multimillion-dollar freeway projects, including an eight-mile section in the Sierra Nevada Mountains where higher bid prices usually are found. In view of rising prices of basic materials, coupled with the effect of already-

negotiated wage increases for construction workers, and generally improved business conditions, it is probable that an upward trend in prices will occur. On the other hand, increased bidder competition, which is usually evident on large projects, may show its effect to some extent in counterbalancing the tendency toward rising costs and prices. There is also the natural tendency for close competition on early season lettings when contractors endeavor to secure basic projects to engage their forces. The outlook, therefore, appears to be for moderate increases in the cost index in the first quarter of 1959.

Cost Index

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 320.1, again shows a rise over the preceding quarter. It is up 3.5 index points or 1.1 percent from the third quarter. This index is strongly affected by many large projects outside the highway construction field.

The Bureau of Public Roads Composite Mile Index is based on federal-aid highway construction contracts awarded by state highway departments. For the third quarter of 1958, which is the latest available, it decreased 3.9 index points or 1.7 percent from the second quarter of 1958 and now stands at 231.4. This seems to confirm the trend of stabilization in highway construction costs on a nationwide scale which has been established during the year.

THE CALIFORNIA HIGHWAY CONSTRUCTION COST INDEX

Year	Cost Index
1940	100.0
1941	125.0
1942	157.5
1943	156.4
1944	177.8

Husband, Wife Construct Complex Freeway Model



As senior delineators for the Division of Highways in Los Angeles, John and Peggy Unruh have added perspective to their regular drafting jobs by building this model of the future Santa Monica-Harbor Freeways Interchange. After working on some of the drawings and plans for the big interchange as part of their daily jobs, the Unruhs used their spare time to construct the model in their West Covina home. They estimate that materials cost about \$50, and that at least 100 man-hours of work were required. The base of the model is six feet square. Blueprints with a scale of 1"=100' were superimposed to provide a horizontal control.—Photo courtesy Los Angeles Herald-Express.

Year	Cost Index
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)	139.3
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
1958 (1st Quarter)	241.8
1958 (2d Quarter)	231.0
1958 (3d Quarter)	228.5
1958 (4th Quarter)	238.5

Ella Katerndahl Ends 29 Years With State

Ella Katerndahl of the District VII Materials staff in Los Angeles, retired on January 1st after 29 years service with the State of California.

A farewell dinner was given in her honor last December.

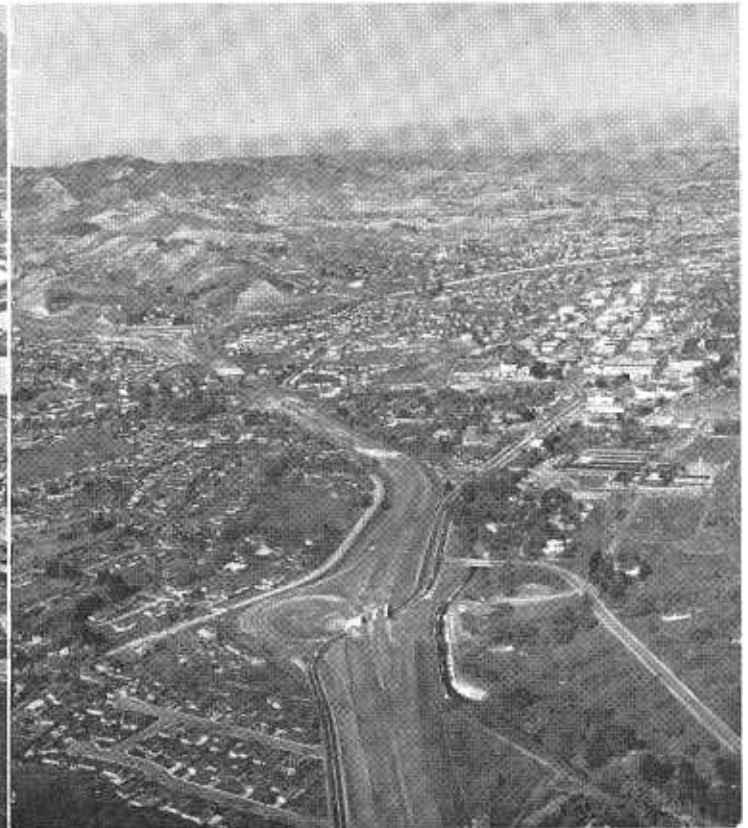


ELLA KATERNDahl

Mrs. Katerndahl was born in Marinette, Wisconsin. Following graduation from the local high school in 1910, she moved on to Chicago, where she worked as a secretary. In 1914, she met and married Carl E. Katerndahl, a high school teacher. She has three daughters and four grandchildren.

Mrs. Katerndahl began her career with the State in the Department of Agriculture in 1928. In 1932 she transferred to Highways as secretary where she remained until her retirement. She has worked in virtually all departments.

Mrs. Katerndahl intends to devote herself to church work as well as doing some traveling.



LEFT—The Greenbrae interchange on US 101 in Marin County. The southbound on ramp from Sir Francis Drake Boulevard is under construction to the right. RIGHT—Construction is under way on the freeway bypass of the Walnut Creek business district in Contra Costa County. The interchange in the left background will connect Sign Routes 21 and 24.

REPORT FROM DISTRICT IV

Continued from page 16 . . .

and maintenance work under another contract. When all work has been completed, directional traffic will be separated from the Nimitz Freeway in Oakland to Atlantic Avenue in Alameda.

The major construction activity at the present time consists of the relocation of a large, metal, Navy-owned hangar from the required rights-of-way area to a new location within Alameda Naval Air Station. The 600-foot by 150-foot structure will be partially dismantled, transported to the new site and reconstructed at the new site as a 300-foot by 300-foot building. Work is being performed by Arntz Brothers at a cost of \$287,000. A contract completed in 1958 provided paved storage areas to replace the area purchased from the U. S. Government for tube construction.

Warren Boulevard (Mountain Boulevard)

This improvement will provide a 5.6-mile freeway from Sign Route 24

near Lake Temescal to a connection with the future MacArthur Freeway (US 50) at Calaveras Street near Mills College. This route, generally along Mountain Boulevard, was originally developed by Joint Highway District No. 26 which was dissolved in July of 1954. The County of Alameda and the City of Oakland have agreed to continue to provide a total of \$300,000 per year, matching a like contribution from the State for the development of this route.

Between Broadway Terrace and Ascot Drive the freeway has been in operation since 1956. This portion includes the Park Boulevard Interchange which was designed as a future connection to the Shepherd Canyon Freeway. In August of 1958 work was completed on the 1.4-mile extension between Park Boulevard and 0.6 mile south of Lincoln Avenue. Contractor on this \$1,290,000 initial four-lane project was Gallagher and Burke, Inc.

To be under construction soon is a further extension from Lincoln Ave-

nue to 0.6 mile south of Carson Street. This 1.6-mile portion will cost approximately \$1,500,000 to construct the initial four-lane, ultimate six-lane freeway. About 1.2 miles will still remain to be constructed from the end of this project to the junction of Warren Boulevard and MacArthur Freeway (US 50) near Mills College. Design studies are in various stages on this section which includes the Redwood Road Interchange and two additional contracts may be required to complete the freeway.

Shepherd Canyon Freeway

Adopted and declared a freeway in December, 1956, this future facility will consist of four lanes initially with provisions for six lanes ultimately. Starting at Park Boulevard Interchange on Warren Boulevard in Oakland, the freeway will traverse Shepherd Canyon and Tunnel approximately 1,400 feet through the Oakland hills. It crosses Moraga Valley just north of the present town site and terminates at Pleasant Hill Inter-

STATUS OF DISTRICT IV FREEWAY PROJECTS

MARCH 1959

Description	Total miles	Completed projects		Under contract		Budgeted		Right of Way expended and budgeted
		Miles	Construction cost	Miles	Construction cost	Miles	Construction cost	
US 101 AND 101 BYPASS								
Bayshore and James Lick Freeway								
US 101 Bypass, Southern Freeway in San Francisco to Ford Road South of San Jose	52.9	38.0	\$42,317,000	5.8	\$8,750,000	3.3	\$5,500,000	\$22,873,000
Southern Freeway	4.7				**8,008,000	1.0	4,850,000	17,009,000
James Lick Freeway	3.0	3.0	8,409,000					12,870,000
Central Freeway	1.8	1.0	4,122,000	0.8	7,725,000			8,574,000
Golden Gate Freeway	1.1					1.1	4,400,000	878,000
Ford Road South of San Jose to San Benito County line (portions)	5.8	5.8	1,095,000					546,000
Redwood Freeway; Golden Gate Bridge to Lytton	66.6	50.5	*33,528,000	1.4	3,670,000	3.7	5,295,000	12,511,000
US 40; SAN FRANCISCO TO CARQUINEZ BRIDGE (portions)	18.2	15.9	156,375,000	2.3	5,818,000		50,000	13,286,000
US 50								
MacArthur Freeway, Distribution Structure to Castro Valley	15.3					2.8	10,000,000	39,166,000
Castro Valley to San Joaquin County Line	31.4	31.4	11,511,000				200,000	4,134,000
SIGN ROUTE 17								
Nimitz Freeway, distribution structure to Bayshore Freeway at San Jose	41.3	41.3	52,440,000		363,000		312,000	21,546,000
Santa Cruz to San Jose (portions)	19.9	13.0	9,200,000	3.4	4,613,000		290,000	10,023,000
US 40 near Albany to US 101 near San Rafael (portions)	9.9	1.0	1,206,000	1.4	768,000			1,377,000
SIGN ROUTE 9 AND 21								
Warm Springs to US 50 (portions)	9.7							653,000
US 50 to Walnut Creek	16.0	2.1	550,000	1.4	2,347,000			5,515,000
Walnut Creek to Monument	3.3	2.0	2,868,000	2.4	6,200,000			6,915,000
Monument to Solano County Line	7.4							1,894,000
Sign Route 9 North of Junction Route 21 in Fremont	2.2							
SIGN ROUTE 24 (portions)								
From Nimitz Freeway in Oakland to Walnut Creek	14.9	4.1	6,030,000	2.0	3,536,000		50,000	6,898,000
North of Monument to Sign Route 4, Concord	3.4		226,000					544,000
EMBARCADERO FREEWAY	1.5	0.4	7,219,000	1.1	7,534,000			11,720,000
PARK-PRESIDIO FREEWAY, GOLDEN GATE BRIDGE TO FULTON STREET	2.1	1.2	1,448,000					3,000
JUNIPERO SERRA FREEWAY								
US 101 South of San Jose to Sign Route 17	10.0							201,000
Sign Route 17 to San Francisco County Line	43.9							3,619,000
CABRILLO HIGHWAY								
San Pedro Creek to Lake Merced Boulevard in San Francisco	10.0	5.4	2,774,000					1,612,000
Watsonville to 4 miles South of Davenport (portions)	22.8	12.4	6,318,000			3.1	775,000	2,849,000
JUNIPERO SERRA FREEWAY TO NIMITZ FREEWAY								
19th Avenue Freeway, Junipero Serra Freeway to Alameda County Line at San Mateo Bridge (portions)	8.0							1,935,000
San Mateo County Line to Nimitz Freeway (portions)	9.2							
PACHECO PASS: 1 MILE EAST OF BELL'S STATION TO MERCED COUNTY LINE	5.3	5.3	1,286,000					12,000
STEVENS CREEK FREEWAY, SIGN ROUTE 17 TO BAYSHORE FREEWAY AT MOUNTAIN VIEW	13.6							2,042,000
MOUNTAIN VIEW-ALVISO FREEWAY-EL CAMINO REAL TO EASTSHORE FREEWAY	10.5	2.1	1,034,000			1.1	647,000	494,000
FREEWAY CONNECTION FROM NIMITZ FREEWAY TO US 50 (ROUTE 228)	2.2	2.2	2,803,000					2,237,000
BAY FARM ISLAND BRIDGE AND APPROACHES	0.6	0.6	2,062,000					165,000
WEBSTER STREET TUBE	1.1		220,000			1.1	7,530,000	2,370,000

STATUS OF DISTRICT IV FREEWAY PROJECTS—Continued

MARCH 1959

Description	Total miles	Completed projects		Under contract		Budgeted		Right of Way expended and budgeted
		Miles	Construction cost	Miles	Construction cost	Miles	Construction cost	
WARREN BOULEVARD FREEWAY; SIGN ROUTE 24 NEAR LAKE TEMESCAL TO MACARTHUR FREEWAY.....	5.6	3.2	\$4,524,000			1.3	\$1,273,000	1,682,000
SHEPHERD CANYON FREEWAY; WARREN BOULEVARD FREEWAY TO SIGN ROUTE 24.....	10.3							257,000
2.6 MILES EAST OF DUMBARTON BRIDGE TO SIGN ROUTE 9 AT NILES.....	5.7							50,000
ARNOLD INDUSTRIAL FREEWAY; (SIGN ROUTES 4 AND 24) HERCULES TO ANTIOCH BRIDGE.....	34.1	14.7	4,694,000					1,214,000
SIGN ROUTE 12; SEBASTOPOL TO KENWOOD.....	17.7							1,948,000
SIGN ROUTE 29; SOLANO COUNTY LINE TO CALISTOGA (portions).....	31.8	19.3	2,792,000	2.9	735,000			2,937,000
SIGN ROUTE 37; FROM REDWOOD FREEWAY AT IGNACIO TO NAPA.....	13.4	1.1	4,040,000	6.1	1,861,000			814,000
Totals.....	588.2	277.0	\$271,091,000	31.0	\$61,928,000	18.5	\$41,172,000	\$225,373,000

* Includes total of \$5,000,000 by Golden Gate Bridge and Highway District.
 ** Includes total of \$1,000,000 by City of San Francisco.
 † \$29,117,000 Toll Bridge Funds in this amount.
 ‡ Includes City of Oakland and Alameda County contributions.

change on Sign Route 24. Design studies are in progress and in various stages on this freeway and some rights-of-way have been acquired in hardship cases. Construction is not anticipated in the near future.

Dumbarton Bridge to Niles (Route 105)

The route was adopted on October 17, 1958, for the 5.7-mile freeway from Dumbarton Bridge Approach Road to Sign Route 9 north of Niles. Design studies have been begun on this initial four-lane, ultimate six-lane facility, which will be built on relocation north of the existing highway.

Sunol to Livermore (Route 108)

A public hearing has been held and the report of the hearing is now being reviewed. Approximately 10 miles long, the route will begin at a junction with Sign Route 9 at Sunol and is entirely on new location, bypassing Livermore, to a junction with US 50 in the vicinity of Livermore. An initial four-lane, ultimate six-lane freeway is proposed.

Arnold Industrial Freeway (Sign Route 4)

Design is in various stages from Hercules to a junction with Sign Route 24 north of Concord at Willow Pass Road. A short relocation at

the Hercules end was constructed in conjunction with the construction of US 40 and was completed in 1958. In October, 1958, the route was adopted between Hercules and Martinez and design studies are under way for an initial four-, ultimate six-lane freeway. From Willow Pass Road to Neroly Road east of Antioch, Sign Route 4 is an identical routing with Sign Route 24 and is covered under that route. Studies are under way and preliminary meetings have been held on the portion between Antioch and the San Joaquin county line.

Grove-Shafter Freeway

The portion of this route from US 50 to the Broadway Tunnel is generally referred to as the Grove-Shafter Freeway. The routing for this unit as well as an extension from US 50 to the Nimitz Freeway was adopted on May 22, 1958. Design studies are now under way and freeway agreements have been negotiated with local authorities.

Construction of this unit will require a major interchange at US 50 (MacArthur Freeway) as well as other traffic service ramps and grade separations along the route.

Sign Route 12

On January 24, 1957, 17.4 miles of freeway route was adopted between Sebastopol and Kenwood. Design studies are under way and rights-of-way acquisition has begun for development of Sign Route 12 as an ultimate six-lane freeway between these points. In general, the adopted route follows the existing highway from the east city limits of Sebastopol to the vicinity of Wright Road, thence northerly of the present route and adjacent to the Petaluma and Santa Rosa Railroad to a junction with US 101 in the vicinity of Santa Rosa. The route then continues on a direct northeasterly course to rejoin the present highway east of Melita near Los Alamos Road and follows the present highway south to Kenwood. From Kenwood the route has not been adopted. However, planning studies are in progress and preliminary meetings have been held on the portion between Kenwood and Schellville.

Sign Route 37

The new bridge for the replacement of the existing two-lane sub-standard lift bridge over Petaluma

... Continued on page 56

George W. Thompson Retirement Marked

George W. Thompson, veteran Resident Engineer of the Bridge Department, retired on January 31st, after almost 39 years with the Division of Highways.

In 1924 the Bridge Department first began supervision of bridge construction in addition to bridge design, with a field force of four resident engineers. Thompson was one of the original four and is the last of these four to retire.



GEORGE THOMPSON

Thompson was born in Marion, Ohio, attended Ohio State University, holds an engineering degree in forestry from Darmstadt, Germany, and in science from the University of Washington. After five years with the U. S. Forest Service and lumber firms in the northwest, he served with the Signal Corps in railroad construction in the Columbia River area during World War I. He began his state service with District IV on the location of the Los Gatos-Glenwood highway and transferred to the Bridge Department in 1924.

Many major state highway structures, particularly in the Bay area, have been under Thompson's supervision. At one time he was in charge of five contracts involving about \$16,000,000 on the San Francisco "Skyway."

Thompson and his wife, Irene, live at 130 Fulton Street, Palo Alto.

TOTAL CONTRACTS REPORTED

The Division of Highways had 284 contracts with a value of \$360,320,400 under way on February 28th. There were 2,012 miles of freeways, expressways or other multilane divided state highways in operation and 346 miles under construction, a total of 2,358 miles.

From July 1, 1956, to February 28, 1959, 67 interstate projects totaling \$228,489,200 were awarded.

TWENTY-FIVE-YEAR AWARDS

Employees who received twenty-five-year awards since those listed in the November-December, 1958, edition of *California Highways and Public Works*

DIVISION OF HIGHWAYS

District I

Fred Trimble
Adolphus O. Boyd
Theodore W. Maxwell

District III

Harry H. Sharp
John Q. Adams
Paul W. Gruenhagen
Carl F. White

District IV

James V. Rodrigues
Alexander White
Margaret E. Keohane
C. I. Largent
A. P. "Pat" Osborne
E. W. Stuenkel
Frank C. Woehl

District V

Charles E. Teague

District VI

Forest W. Pfrimmer
Edward Allen
Preston S. Jordan
Oscar O. Miller

District VII

Wilbur M. Price
Ralph E. Schott
John Simonich
Ellsworth R. Talmon
Henry E. Cowan
Alfred R. Mattos
Carrie S. Neff
Elmo M. Potter
Loral Guy Wiley

District VIII

Drury P. Wieman
Henry N. Noble

District IX

Ned B. Harvey

District X

Rod N. Bierce
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Roneildo Williams
Donald T. Wade

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Jack B. Toller
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Lawrence J. Hubbard
Ralph M. Sherick
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Bay Bridge

Thomas Hugill
Raymond Peter Murphy

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Herbert P. O'Donnell
Mary L. Puccinelli

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William J. Thompson, Jr.

Shop 3

Janice H. Wald

Shop 5

Walter H. Gaskin
Harry J. Kohlstedt

Shop 11

Edmund L. Malloy

DIVISION OF ARCHITECTURE

Lavalette Gardner
John S. Moore

DIVISION OF CONTRACTS AND RIGHTS-OF-WAY

Virginia C. Millerick

State Division of Highways maintenance forces maintained 1,300 signalized intersections of state highways during the 1957-58 Fiscal Year.

Bridge Department's L. J. Hubbard Leaves

Lawrence J. Hubbard, Associate Bridge Engineer in the Construction Office of the Bridge Department, retired on February 28th, completing more than 25 years of state service.

For the past 24 years Hubbard has been in charge of the Bridge Construction Section, responsible for the engineering phases of contract finances and payments to contractors. He has seen total payments on bridge department contracts grow from about \$2,000,000 per year in 1935 to nearly \$30,000,000 in the 1957-58 Fiscal Year.



L. J. HUBBARD

Hubbard was born in San Francisco and was graduated from the University of California in mining engineering in 1910. His first job was with Trinity Gold Mining & Reduction Co. at Carrville, Trinity County, which he left in 1913 after working up to assistant mill superintendent. After six more years with mining firms, eight with the Northern Pacific and Northwestern Pacific Railways and six in business for himself, he came to the Division of Highways as Resident Engineer in the Bridge Department in November, 1933.

Hubbard and his wife, Mildred, live at 2520 Memory Lane, Sacramento.

HOW FAS WORKS

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Tabulations of highway actually constructed to completion under the program are difficult to make due to the large amount of stage construction used by the counties. Most FAS projects are done under some degree of stage construction. In some cases, all stages will be completed under the program, and on other projects, some of the stages are completed entirely by the county with their own funds. We have found stage construction to be the most advantageous way to tailor the FAS program to the needs of the particular county. By starting

REPORT FROM DISTRICT IV

Continued from page 54...

Creek was completed in September, 1958. The new bridge, a single high-level structure, 2,200 feet long, and providing for four lanes initially, ultimately to be widened to six lanes, cost approximately \$2,433,000. Work was performed as a joint venture by Ben C. Gerwick, Inc., and J. H. Pomeroy and Co., Inc.

Presently under construction is a four-lane expressway which will ultimately be converted to a six-lane freeway extending from US 101 at Ignacio Wye to Sears Point. Two lanes of this freeway were completed and opened to traffic in 1951 and under the same contract the roadbed for the future lanes was graded between Petaluma Creek and Tolay Creek. This \$1,860,000 project, completing the four-lane construction, is expected to be completed in the fall of this year. The contractor is Peter Kiewit Sons Company. From Sears Point to the Napa county line, studies are under way for the relocation of this route and preliminary meetings have been held. In 1955, the initial two lanes of a future four-lane freeway were constructed from a point two miles east of the Napa county line to 2.2 miles east of Carneros School.

Sign Route 29

In 1956, a 3.8-mile section of two-lane, future four-lane, expressway was completed between four miles north of St. Helena and Calistoga. Between Rutherford to south of Napa, the route has been adopted and declared a freeway. Presently, construction is in progress for the initial two lanes of a future four-lane expressway bypassing Yountville. This 2.9-mile project will cost approximately \$735,000 and the work is being performed by

with a high geometric standard, and constructing successive stages to high structural standards, we are able to construct economically and to keep the stages under construction ahead of the increasing traffic demand. The end result will be a secondary highway system that will handle the traffic demands for many years to come.

RADIO SIGNS

Continued from page 34...

are possible. All combinations will not make an intelligible message, of course. Six combinations are being used on the US 40 signs, as follows:

Road clear over summit, road closed over summit, caution required icy ahead, chains required ahead, chains required over summit, and caution required ahead. The messages are on glass faces, with lights inside the units, so they can be read at night.

Allen Zellmer and Gene Jordan, supervising radiotelephone technicians of the Division of Highways, did a considerable part of the development of the new signs, under the supervision of Associate Communications Engineer Rolind Mahan. The only difficulty in function has been with wet snow sticking to the sign faces and obscuring the message. This is being corrected by installation of thermostatically controlled electric strip heaters.

The two signs now in use were built by Tele-Dynamics, Inc., of Philadelphia. Installation was by Marshall Electric Company of San Carlos, and Roy T. Phillips of District III (Marysville) was resident engineer for the Division of Highways. The approximate cost of both installations and the remote control equipment was \$25,000.

McCammon-Wunderlich and Wunderlich Contracting Company.

In 1957, the project between Union Station and Orchard Avenue was completed on Route 29 north of the City of Napa. The additional two lanes constructed under this contract converts this 2.3-mile section into a four-lane expressway providing a faster and safer facility for traffic. South of Napa on Sign Routes 12 and 29, the present routes have been operating for many years as expressways, although a hearing recently held before the Napa County Board of Supervisors is the first step in ultimate full freeway development of the section from the Napa State Hospital at Imola Avenue to the Napa-Solano county line.

EDMUND G. BROWN
Governor of California

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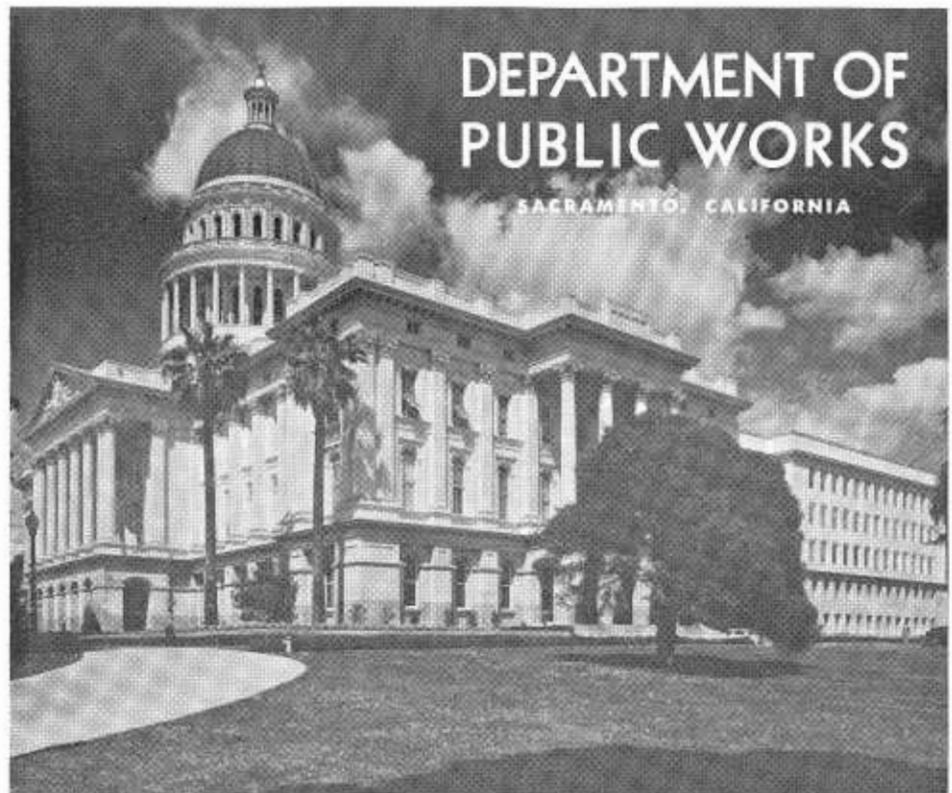
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District IV

B. W. BOOKER Assistant State Highway Engineer

District VII

E. T. TELFORD Assistant State Highway Engineer



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CLIFFORD L. IVERSON Chief Architectural Draftsman
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