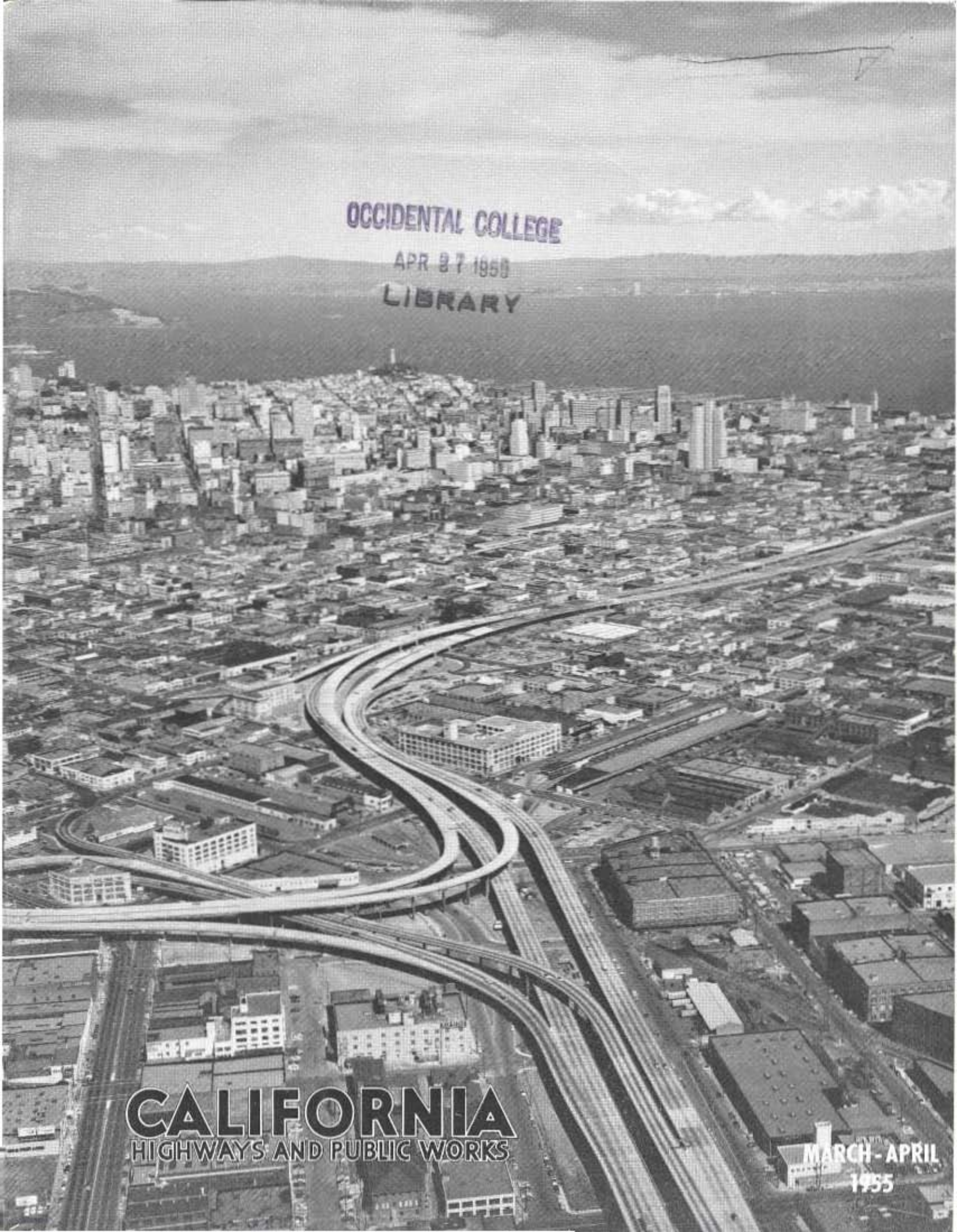

CALIFORNIA
HIGHWAYS AND PUBLIC WORKS

MARCH - APRIL
1955

California Highways and Public Works

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

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Vol. 34 March-April Nos. 2-3

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Twelfth and N Streets
Sacramento

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District IV Freeways Make Great Strides

By B. W. BOOKER
Assistant State
Highway Engineer

Developments During The Past Year

THE MARCH-APRIL, 1954, issue of *California Highways and Public Works* reported on the strides which had been made in the construction of freeways in the metropolitan area which surrounds San Francisco Bay. While the groundwork for California's freeway system was laid through enabling legislation which was enacted in 1939, the evidence of the accomplishments which have unfolded from this program became apparent only recently.

The accelerated construction of these facilities through the postwar period now is rapidly being expanded into long avenues of modern highways as the initial short stretches of freeway continue to be linked into connected thoroughfares.

Substantial Results

The past 12 months period has produced substantial results in the development of a system of freeways in District IV measured in mileage, expenditures and other terms. One year ago a total length of 140.5 miles of freeways and expressways were carrying traffic in District IV. Since that time an additional 18.1 miles were completed and it is noteworthy that all but 2.3 miles of the additional length were initially constructed to full freeway standards.

The role which these state highway facilities play in helping to solve the transportation problems of a major metropolitan area is significant. In 1951 the San Francisco Planning Commission adopted a trafficways plan as the[6] transportation section of their master plan. The text of this plan, in part, states:

"The trafficways plan of San Francisco is designed as a guide for the attainment to the greatest degree possible of the following objectives:

"1. Adequate provision for the expeditious, convenient and safe movement of vehicular traffic, including rubber-tired public transit vehicles where appropriate, between all neighborhoods, community areas, and working areas of the city, and the gateways leading into and out of the city.

"2. Development of an efficient, economical and balanced system of major trafficways consisting of freeways, major thoroughfares, and secondary thoroughfares, each employed where it is most suitable and effective from the standpoint of present and prospective traffic movement and from the standpoint of the present and desirable future use and development of adjoining land areas.

"3. Coordination of the trafficways system with related transportation plans and facilities of other categories, especially public transit, as well as with other related features and facilities of land development provided for in other sections of the 'master plan.' "

City Planning Report

The San Francisco Department of City Planning in its annual report dated January, 1955, makes the following comment concerning progress on the trafficways:

"Closely related to the city-wide land use plan is the trafficways plan. Adopted July 17, 1951, by the City Planning Commission, it is now beginning to take shape in a rather spectacular manner, through projects being built by the city as well as others being constructed by the California State Division of Highways. Bayshore Freeway, a state project, now nearing completion for its entire length, is adding a new feature to the character of the city.

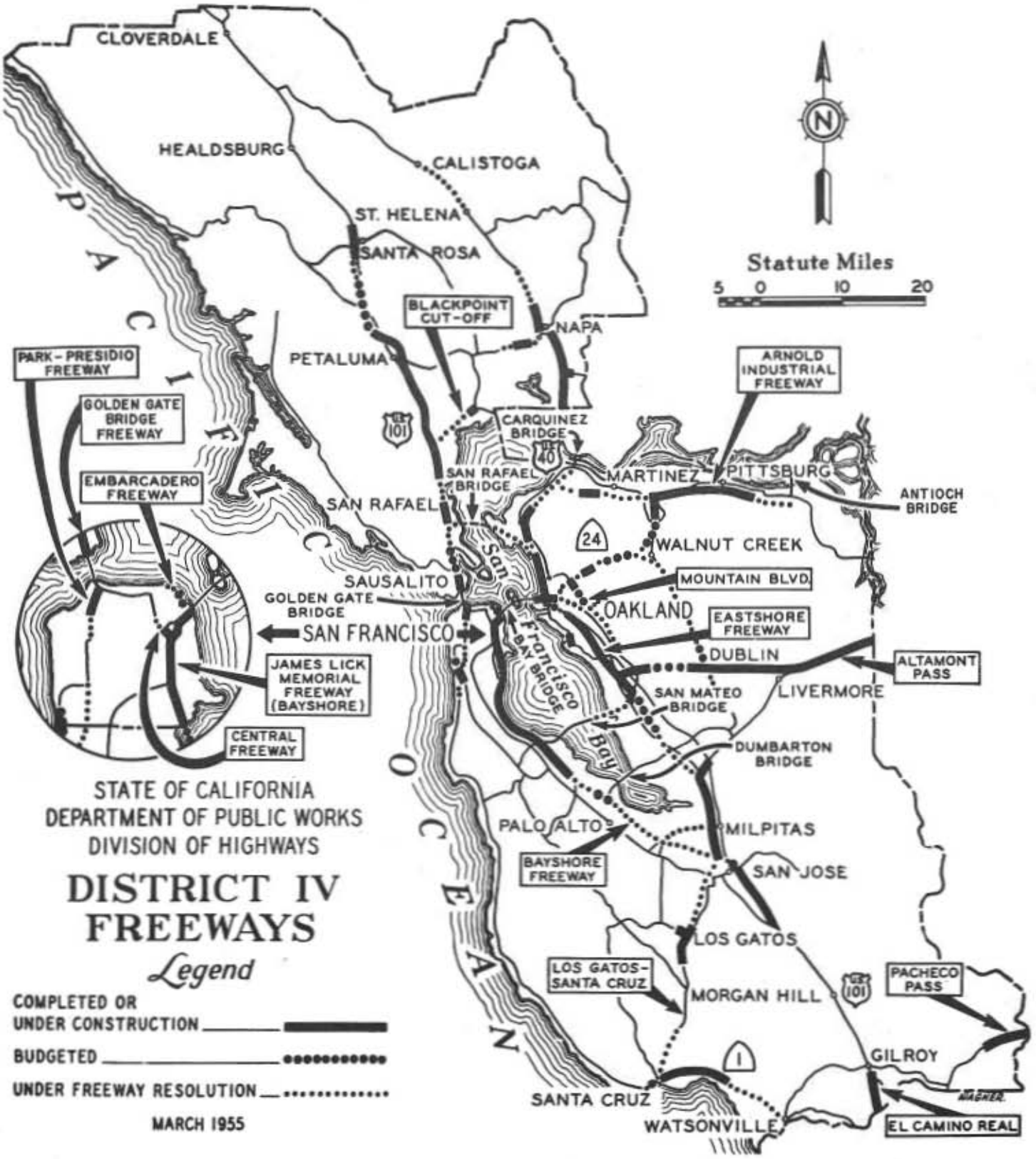
"A national award was recently granted the State Division of Highways for the design of its 'skyways' in the complex 'over and under' pattern of viaducts at the junction of the Bayshore, Central and Embarcadero Freeways with the Bay Bridge in the South-of-Market area. The state engineers have opened up new vistas that can be seen by motorists from these new viaducts, a panorama of imposing city skyscrapers developing with breathtaking suddenness.

Bayshore Freeway Costs

Construction and right of way costs for the 6.4 miles of the Bayshore Freeway in San Francisco come to a total of approximately $39,832,000, of which over $20,000,000 were for the acquisition of rights of way. Total length of structures is approximately 8.4 miles. San Franciscans using this artery can now report average daily time savings of from 10 to 25 minutes per trip. Benefits have likewise accrued to users of thoroughfares formerly carrying traffic now using the freeways. The choking peak hour congestion is gone, and abutting property owners are benefiting from a chance of easier access and less noise."

The annual report of the City Planning Commission of Oakland dated September 8, 1954, also comments on the contribution made by freeway construction in that city. The report states:

"Adopted in 1948, the freeways and major streets section of the master plan sets forth a 20-year program for meeting the needs of the automobile age. The plan provides a well-knit pattern of traffic arteries designed as the framework of the city's circulation system. Since adoption, notable progress has been made in translating the plan into reality.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CALISTOGA
ST. HELENA
SANTA ROSA
PACIFIC OCEAN
BLACKPOINT CUT-OFF
NAPA
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PARK - PRESIDIO FREEWAY
GOLDEN GATE BRIDGE FREEWAY
EMBARCADERO FREEWAY
ARNOLD INDUSTRIAL FREEWAY
CARQUINEZ BRIDGE
SAN RAFAEL BRIDGE
SAN RAFAEL
MARTINEZ
PITTSBURG
ANTIOCH BRIDGE
WALNUT CREEK
MOUNTAIN BLVD.
SAUSALITO
GOLDEN GATE BRIDGE
SAN FRANCISCO
OAKLAND
EASTSHORE FREEWAY
DUBLIN
ALTAMONT PASS
LIVERMORE
SAN MATEO BRIDGE
DUMBARTON BRIDGE
JAMES LICK MEMORIAL FREEWAY (BAYSHORE)
CENTRAL FREEWAY
PALO ALTO
MILPITAS
BAYSHORE FREEWAY
SAN JOSE
LOS GATOS
LOS GATOS-SANTA CRUZ
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DEPARTMENT OF PUBLIC WORKS
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DISTRICT IV
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COMPLETED OR UNDER CONSTRUCTION
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UNDER FREEWAY RESOLUTION
MARCH 1955

LEFT—Division Street Interchange on Bayshore Freeway in San Francisco showing progress of construction on final units of the freeway which will connect with the Bay Bridge approach in the center right of the picture. RIGHT—Looking westerly along the initial unit of the Central Freeway in San Francisco from its junction with the Bayshore Freeway at the Division Street interchange to its present terminus at 13th and Mission Streets.

"A major traffic bottleneck was substantially relieved with the rerouting of Eastshore Freeway traffic from Seventh and Eighth Street to Fifth and Sixth Streets between Oak Street and Market Street. This was accomplished by the construction of bridges over the Posey Tube approach. These bridges will later serve as on and off ramps for the elevated freeway."

Elevated Roadways

The engineering achievement in providing an artery of high utility from a traffic standpoint has also added to the aesthetic qualities of the metropolis. The elevated roadways of the freeway in San Francisco afford motorists an excellent opportunity to view the splendor of her world famous skyline as they approach the central district of the city. The magnificence of the view has appropriately led to the local designation of the elevated freeway system as "skyways."

To complement the beauty of the vista from the roadway of the skyway structures the construction has attained distinction in yet another manner. The unit of the viaduct first to be finished which terminated with ramps connecting to Ninth and Tenth Streets at Bryant Street was judged by the American Institute of Steel Construction to be the most beautiful Class II steel bridge opened in 1954. This award was on the occasion of an annual nation-wide competition which includes bridges costing over $500,000 and having no span over 400 feet.

Forty-five Contracts Under Way

As of March 1, 1955, District IV had a total of 45 construction contracts under way which represent a construction cost totaling $62,300,000. A number of these projects cover improvements of a conventional highway type including those which are minor in scope. However, 26 of the jobs are for construction of full freeways on an additional 41.0 miles of modern facility at a cost of $58,764,000.

With the revenue now anticipated, financing is provided for construction and acquisition of right of way totaling $60,893,000 in District IV during the 1955-56 Fiscal Year. Of this amount, $57,170,000 has been allocated for freeway type improvements. Thus in the Bay area, in excess of 90 percent of the current and programmed funds have been and will continue to be expended for freeway development.

The accompanying map illustrates how the freeway routes are encircling the Bay and are radiating out from the metropolitan area to the north, east and south. The development of these routes together with the six existing bridges and with the Richmond-San Rafael Bridge now under construction, is gradually contributing to the breaking of the barrier imposed by the geography of the Bay area. At the same time progress on this combination of facilities is adding to the convenience and safety for large volumes of traffic in their movement between residential and occupational centers of the region as well as for other users whose needs are served by a highway transportation system.

The items which follow cover highlights of the progress during the past

12 months in the development of a system of freeways in District IV, together with information concerning future projects for which financing has been provided:

BAYSHORE FREEWAY

An important unit of the Bayshore Freeway in San Francisco between Sixteenth and Seventh Streets was placed into service when the northbound lanes were opened on July 20, 1954, followed by opening of the southbound lanes on August 27, 1954. The roadways are carried on elevated structures of all-welded steel construction similar in design to the adjacent award-winning section of the skyway.

As the previously completed section of the freeway concentrated the bulk of the traffic on the on and off ramps connecting with Bryant Street at Tenth and Ninth Streets, the new section materially relieved the congestion on the terminal ramps and clearly indicated that further freedom of movement could be anticipated as ramps on subsequent sections are made available. The work on this 0.7-mile project was done by the Guy F. Atkinson Company at a cost of $3,230,000.

Immediately east of the finished portion, work is nearing completion on two subsequent contracts. The unit from Eighth Street to Fourth Street, which was started in October, 1953, extends over a distance of 0.7 mile and will provide on and off ramps at each end of this unit. Charles L. Harney, Inc., is the contractor on this $3,900,000 project.

Other Units

The other job is 0.2 mile long, between Third Street and Fifth Street. The work which is being performed by Eaton and Smith at a cost of $830,000 will provide a connection with the San Francisco-Oakland Bay Bridge and will later furnish a tie to the future Embarcadero.

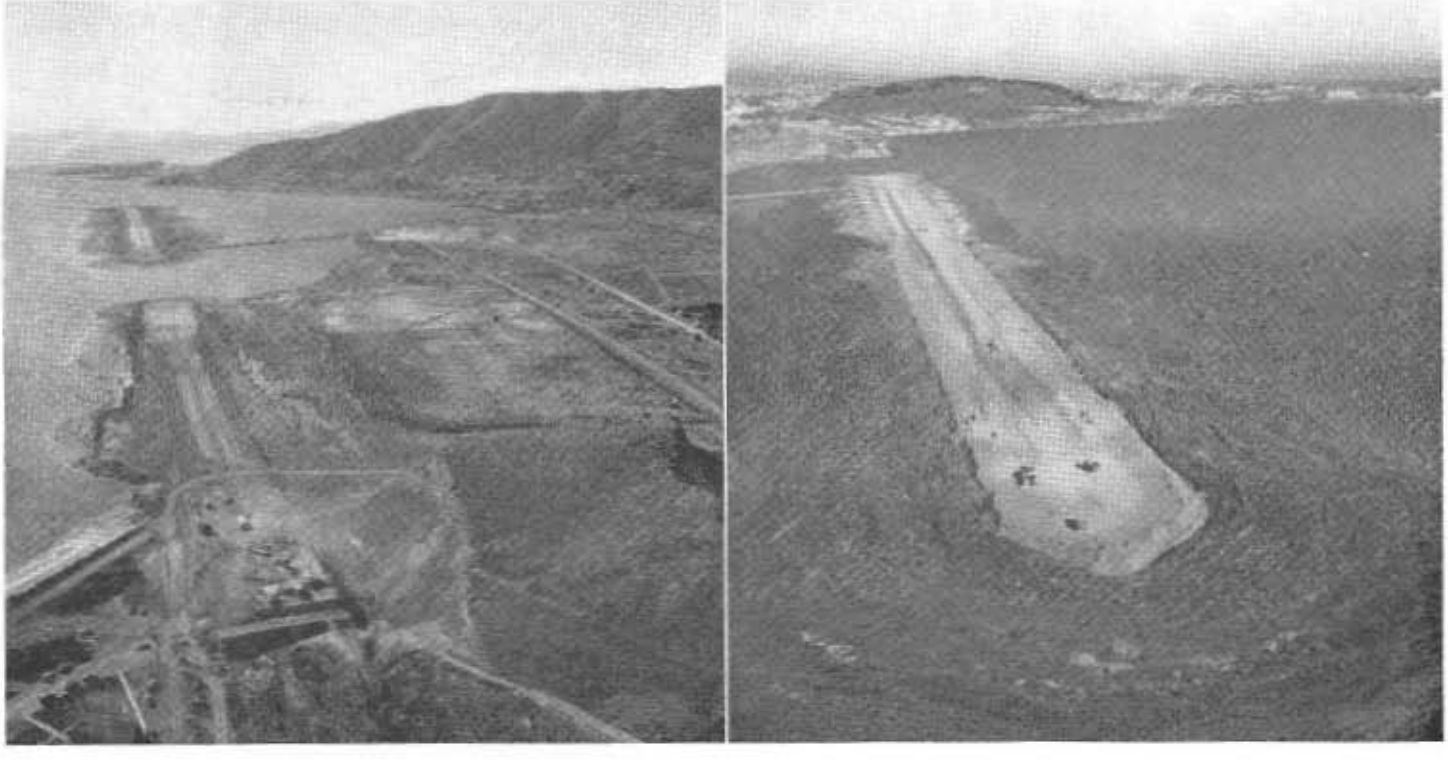
To the south of the first unit of the Bayshore Freeway which was completed in San Francisco, work has been under way on a 1.7-mile contract which was awarded to Charles L. Harney, Inc., on May 25, 1953. This $2,400,000 project will be completed this July. The freeway lanes have already been opened to traffic and the only work which remains to be done is at the Third Street interchange. Thus, at this time a continuous section of freeway is in service for a total length of five miles in San Francisco from Third Street and Bayshore to the perimeter of the central district.

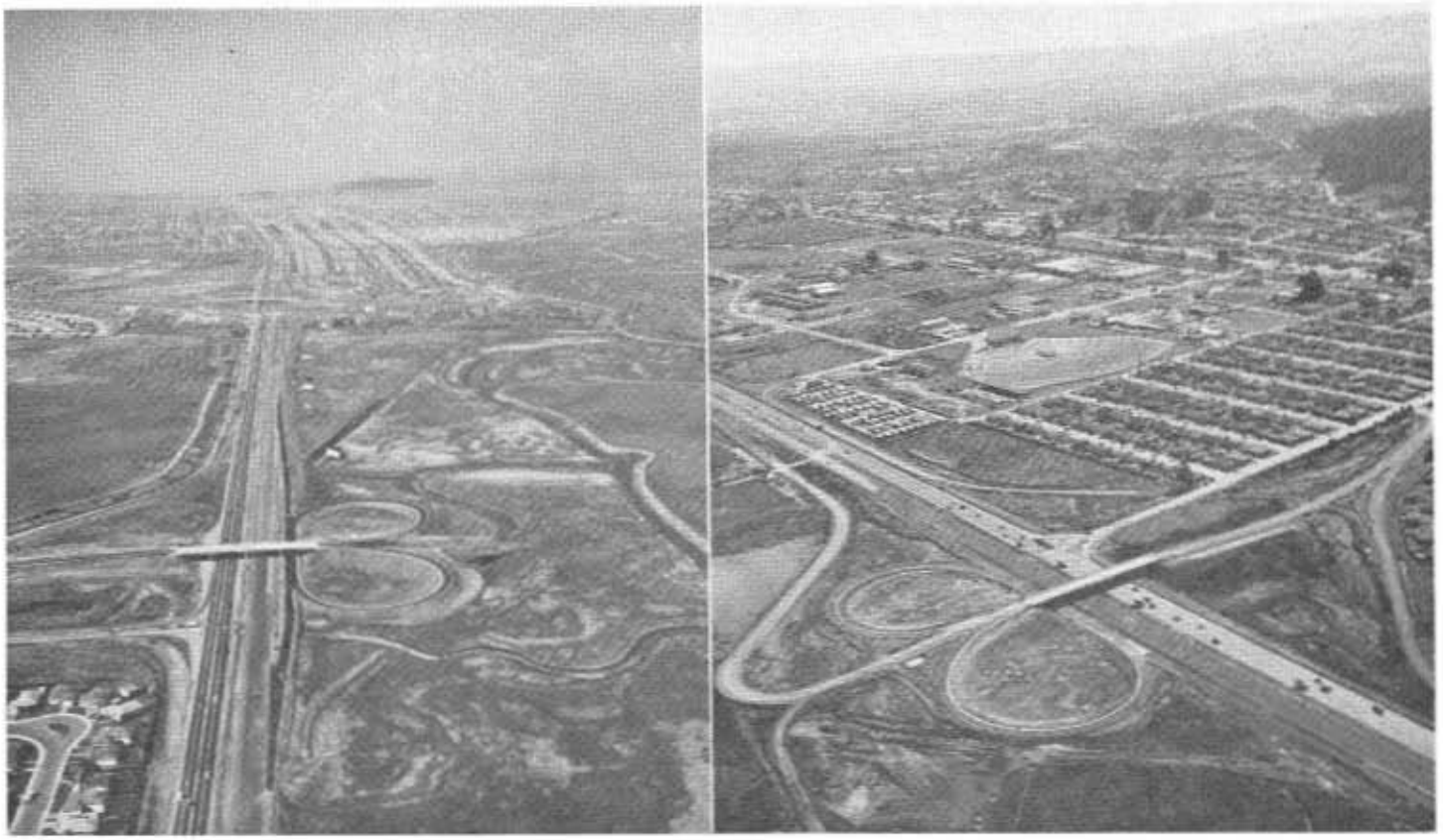
Urgently Needed Link

The most urgently needed link on the Bayshore Highway is the ultimate bypass of the congested area through Visitacion Valley in San Francisco and through Brisbane, between Third Street and Sierra Point. On the north end of this section, work was started on a contract in May, 1954, which was awarded to Edward Keeble for grading and structures between Third Street and Candlestick Point. This $700,000 project is 0.7 mile long.

Continuing southward from Candlestick Point the freeway alignment traverses open water of an arm of San Francisco Bay. Work was previously completed on two contracts for filling experimental sections of embankment on the bay mud. The first job extended 0.3 mile southward from Candlestick Point and the

LEFT—View of construction operations for closing of 3.6-mile gap in Bayshore Freeway. Candlestick Point in foreground, looking south across open water toward Sierra Point. RIGHT—Fill operation for Bayshore Freeway midway between Candlestick Point and Sierra Point. Wedge-shaped form is used during end-dumping operation to maintain outward flow of mud. This view, which shows shape of mud wave, was taken during low tide.





LEFT—View of Bayshore Freeway during final stages of construction looking north from vicinity of Hillsdale Boulevard interchange in San Mateo. RIGHT—View of Ralston Avenue interchange on Bayshore Freeway in Belmont near completion of construction.

second unit, 0.4 mile long, was located farther out in the bay where the mud depth was greater. Another step was taken when bids were opened March 16, 1955, for a $400,000 project to fill the gap between the two experimental units.

Over Water Fill

The work of constructing this fill is an interesting undertaking. The mud which reaches a maximum depth of 70 feet is highly fluid in its natural state. It has been determined that a dry fill could be constructed so as to reach a fairly stable condition through displacement of the mud by the weight of the fill material. This operation results in a mud wave extending ahead some 600 feet to 800 feet. As it was found that this mud has a tendency to set up when it remains undisturbed for a short period once initial displacement has occurred, a placing plan has been followed which concentrates the end-dumping of material on a small area at the forward end of the fill as long as subsidence continues at an appreciable rate. Also, the fill is pushed forward in the form of a pointed nose to maintain an outward flow in the mud wave. Whenever there is cessation of operations for more than 24 hours, such as over a weekend, charges of dynamite are jetted into the mud in advance of the fill and are set off to start the movement of the mud again as further weight is applied.

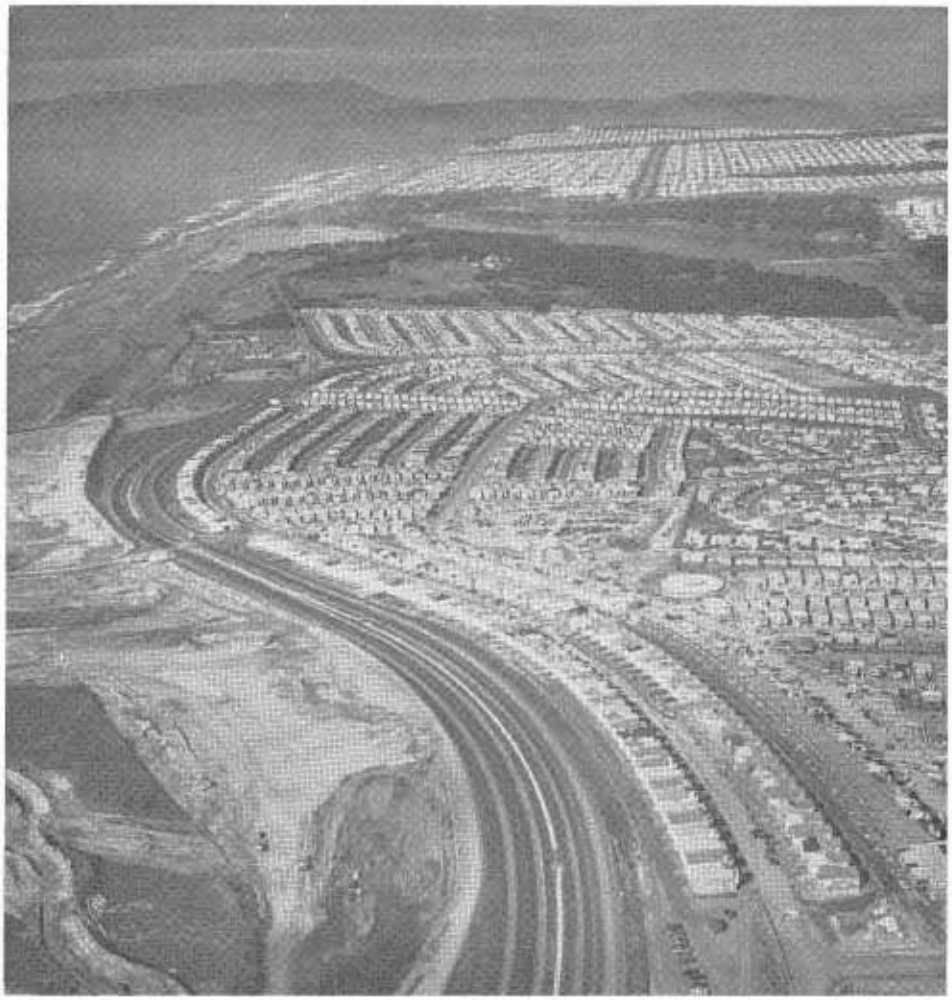
In this manner, work is progressing on a double shift basis on a $1,500,000 contract held by Guy F. Atkinson Company for continuing the fill southward through the central portion of the open water link. Continued progress is assured through funds which have been included in the 1955-56 budget in the amount of $3,200,000 to finance the final fill operation and building of structures on this section. Still another contract for paving of this 3.6-mile link will be required before a continuous freeway on the Bayshore from San Francisco to San Mateo County becomes a reality.

In San Mateo County

Continuing southward in San Mateo County, finishing touches are being applied to a five-mile contract by Piombo Construction Company on the Bayshore Freeway between Sixteenth Avenue in San Mateo and San Carlos. This $4,100,000 project is already serving traffic and has increased the continuous length of the facility already in use on the peninsula to 16.2 miles.

Thus, when the construction across the open water is completed, which is expected in 1957, a total length of 25 miles of freeway will be in operation from downtown San Francisco to San Carlos.

Further progress on this route is indicated through the opening of bids on April 6, 1955, for an 0.8-mile unit in the vicinity of Menlo Park, which includes an interchange at Willow Road. This intersection is presently the scene of maximum congestion on the remaining portion of the original Bayshore Highway between the San



Expressway improvement on Skyline Boulevard through area which is being rapidly developed in the northerly portion of San Mateo County

Carlos terminus of the freeway and San Jose.

In the San Jose area plans have been completed for a 1.6-mile section of the Bayshore Freeway from Santa Clara Street to Rosa Street. It is expected that the right of way will be cleared soon to permit early advertising for bids on this unit. Financing is provided through $1,600,000 in the 1955-56 Fiscal Year construction program.

CENTRAL FREEWAY

The start of a new freeway route was made available to San Franciscans through the opening of the initial unit of the Central Freeway on March 1, 1955. This freeway is shown on the city trafficways plan as extending from the Division Street Interchange on the Bayshore Freeway to the approach leading to the Golden Gate Bridge at a location near Lombard Street and Van Ness Avenue.

The completed section which is 0.8 mile in length, follows Thirteenth Street to a terminal ramp at Mission Street. The steel structure which supports the freeway, resembles the previously completed portion of the skyway and makes provision for local traffic at ground level beneath the facility.

Viaduct structures which form a wye at Division Street to permit direct interchange of traffic in three directions at Division Street, were finished at the same time as the Thirteenth Street lateral. The work on the wye connections and the main freeway unit was done by Charles L. Harney, Inc., under three contracts at a total construction cost of $4,500,000.

On April 1, 1954, a further step was taken when the California Highway Commission adopted the route for another section of this freeway which extends northerly to Turk Street. Plans are being prepared for this extension of the Central Freeway and the tempo of right of way acquisition will be stepped up by virtue of an allocation of $5,100,000 in the 1955-56 Fiscal Year program for this purpose.

EMBARCADERO FREEWAY

On March 2, 1955, MacDonald, Young & Nelson and Morrison Knudsen Company, Inc., submitted a low bid of $5,200,000 for building the first unit of the Embarcadero Freeway in San Francisco. This project will continue the skyway easterly from the point where the Bayshore Freeway connects with the San Francisco-Oakland Bay Bridge approach at Fourth Street to on and off ramps which connect with Mission Street at Beale Street and Main Street, respectively. The design for this project utilizes a two-level type of viaduct which separates opposing traffic vertically in order to keep the right of way needs to a minimum.

The 1955-56 Fiscal Year budget also provides financing in the amount of $2,600,000 for a second unit of the viaduct which will extend to the Embarcadero. Meanwhile, work is progressing on plans and negotiations are under way for the acquisition of right of way for the continuation of this artery northerly along the Embarcadero to Broadway.

SOUTHERN AND WESTERN FREEWAYS

With the approaching completion of final work on the Bayshore and the progress which has been made on the portions of the Embarcadero and Central Freeways, for which the routing has been determined, attention is now being directed to other segments of an integrated freeway system in San Francisco.

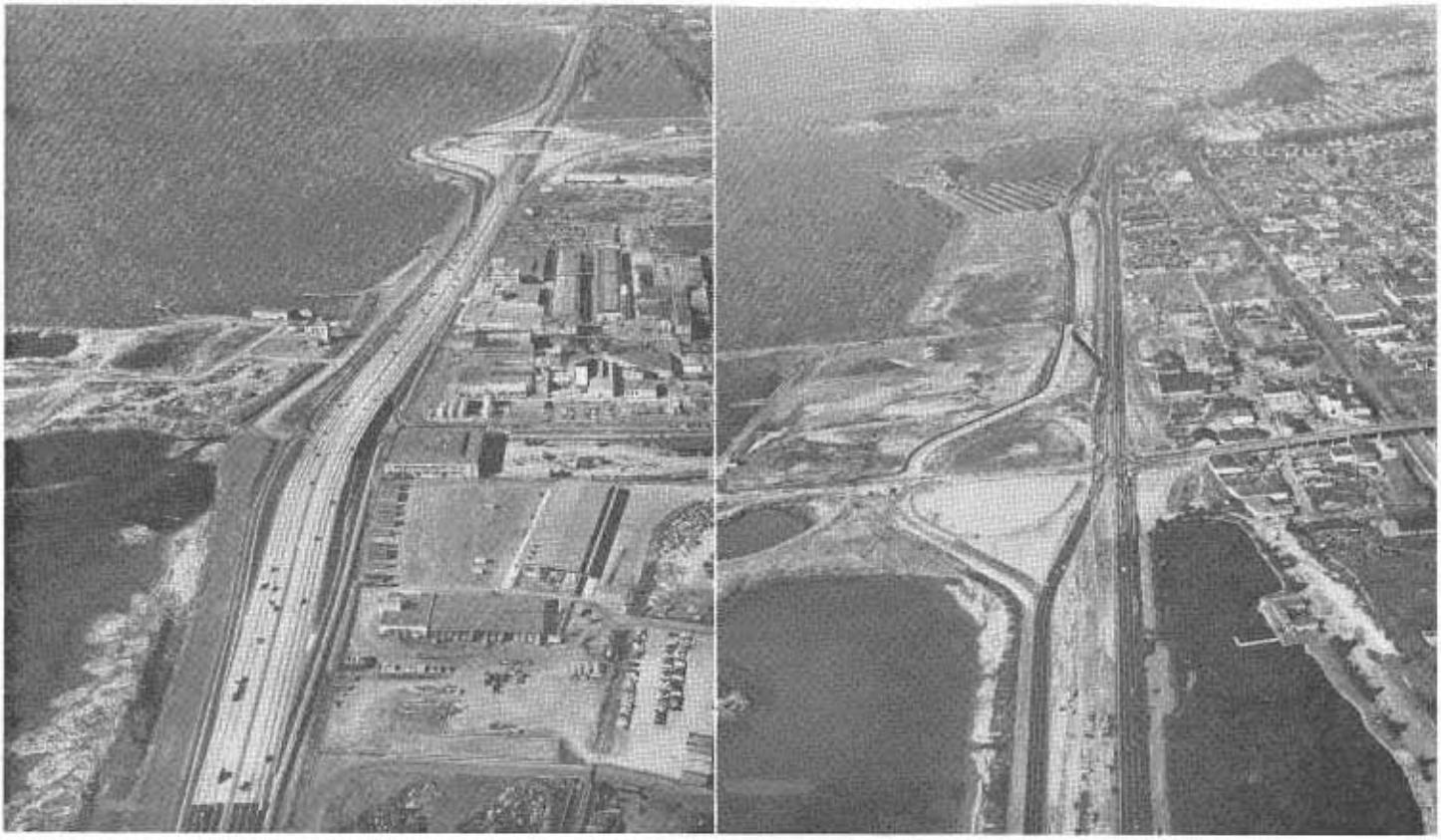
Two additional routes merit a high priority as projects which will facilitate the movement of large volumes of traffic within the city. These have been designated as the Southern and Western Freeways. The first of these routes starts at the county line in the

UPPER—Construction operations on additions to the distribution structure looking westerly toward the approach to the San Francisco-Oakland Bay Bridge. The dual two-lane roadways in the lower left of the picture are detours which have been constructed on temporary timber trestles. LOWER—View of construction operations on East Bay Distribution Structure looking east toward MacArthur Boulevard.

vicinity of Junipero Serra Boulevard and traverses the southerly portion of the city to a junction with the Bayshore Freeway at Alemany Boulevard.

The general route for the Western Freeway under study starts at the same location at the county line and traverses the western portion of the city in the area to the south of the Golden Gate Park and thence runs easterly to a junction with the proposed Central Freeway in the vicinity of Oak Street.

While both of these routes follow the general location of a combination of freeway facilities which have been delineated on the San Francisco Trafficways Plan, a number of alternate locations in these general areas will be reviewed during the study. The city



LEFT—View of the first completed unit of the Eastshore Freeway to the north of the distribution structure; Powell Street interchange in center; Ashby Avenue interchange beyond. RIGHT—View of construction operations for north section of Eastshore Freeway looking north from site of the University Avenue interchange toward the El Cerrito Overhead.

is also taking steps to implement the work which is being performed by the Division of Highways and their present studies include a proposal for a continuation of the Southern Freeway from the Bayshore Freeway to a junction with the proposed Southern Crossing.

EASTSHORE FREEWAY

Much activity has taken place in the metropolitan Bay area on the Eastshore Freeway during the past year. In September, 1954, Fredrickson & Watson Construction Company and M & K Corporation started work on a $1,700,000 contract on this route. Extending from Market Street between Fifth and Sixth Streets to Eleventh and Cypress Streets, this 0.7-mile project will provide an elevated facility which should be ready to carry traffic this September.

On the intervening 1.4 miles between this construction and the distribution structure, bids will soon be received for the continuation of the improvement. On this particular section the freeway is to be carried on a double-deck viaduct in a manner similar to the plan which has been developed for the Embarcadero Freeway in San Francisco. A budget allocation of $7,015,000 to finance the work is the largest amount that has ever been earmarked for a single highway contract in the Bay area.

Next in sequence on this route is the $4,500,000 contract with MacDonald, Young & Nelson, Inc., and Morrison Knudsen Company, Inc., for the expansion of the distribution structure. Three additional ramps are being provided in conjunction with the modification of portions of the existing structure.

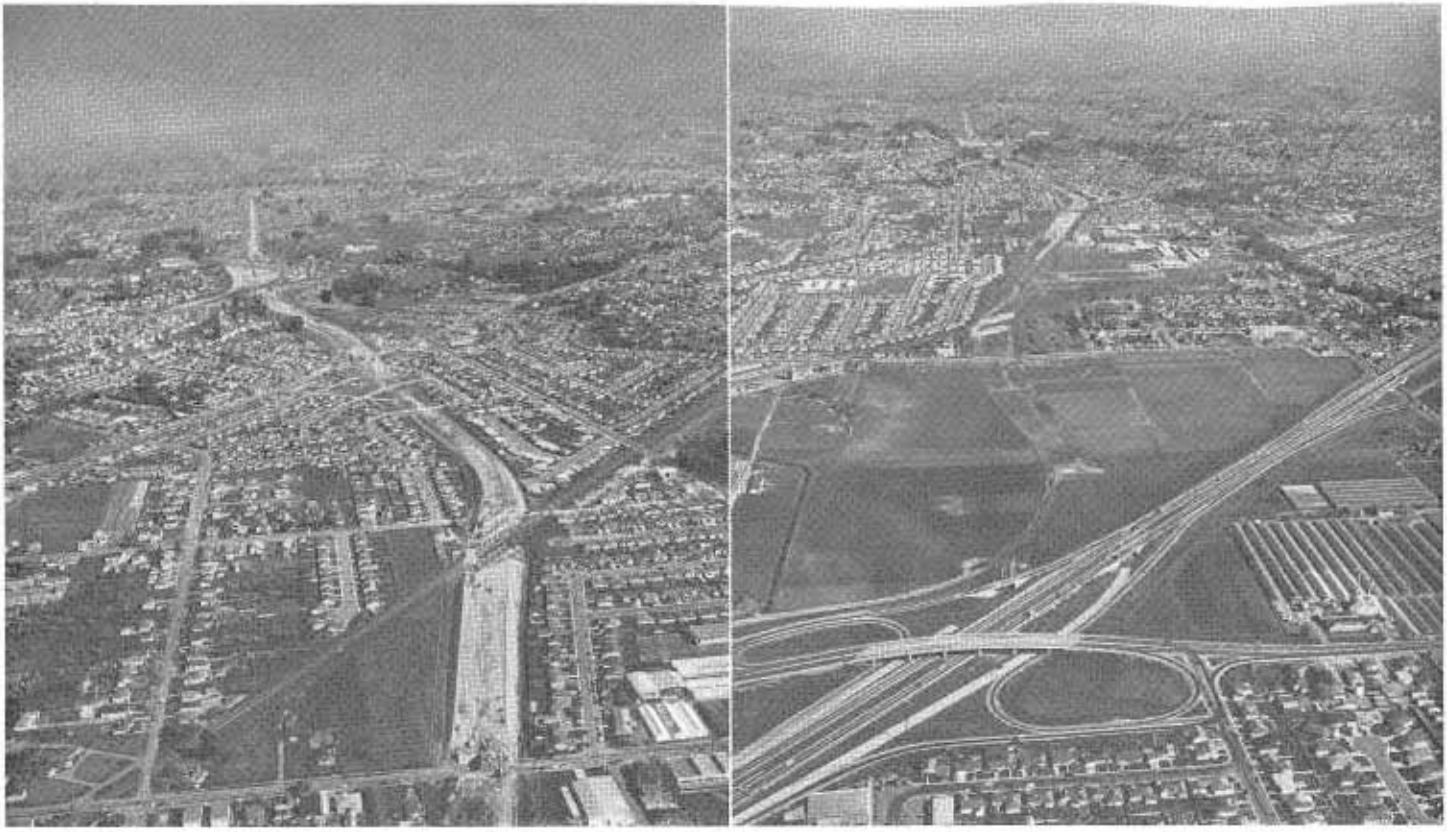
The original structure was an early example of a direct type of interchange that served traffic well until a fourfold increase to a volume of about 120,000 vehicles per day occurred. The improvements now under way which are expected to be finished in October, will allow for doubling of present traffic without congestion. The expanded structure is laid out on three levels which results in the elimination of cross weaving traffic movements.

Congestion Eliminated

Continuing north from the distribution structure a 1.5-mile section of the Eastshore Freeway was completed in November, 1954, by Peter Kiewit Sons' Company at a cost of $2,800,000. This project eliminated the congestion which resulted from the first of a series of signalized intersections on the Eastshore Highway through an interchange which was provided at Powell Street.

From Ashby Avenue northerly to the El Cerrito Overhead work has been under way on a $4,800,000 contract, also held by Peter Kiewit Sons' Company for the continued conversion of the northern section of the Eastshore Highway to an eight-lane freeway. This contract which is scheduled for completion in August covers grading for the full three-mile

Construction scene on Eastshore Freeway project in Oakland from Market to 10th Street where route turns into Cypress Street and runs north. The 1.4-mile section along Cypress from this project to the distribution structure is scheduled to be started this year as a two-level viaduct at an estimated cost of $7,015,000.



LEFT—Construction operations on Route 228 connection between the Eastshore Freeway at San Lorenzo and Castro Valley. RIGHT—Looking east along location of Route 228 connection from Washington Avenue interchange on Eastshore Freeway to the recently completed Castro Valley Bypass which appears in the distance.

length, paving between Ashby Avenue and University Avenue, and construction of the Ashby Avenue Interchange.

This interchange is now in use and as a result the second in the series of signalized intersections is now carrying heavy volumes of traffic without interruption. The scheduled completion date for the remaining work on this project is August, 1955.

On January 3, 1955, work was started on a $2,250,000 contract awarded to Stolte, Inc. & Gallagher & Burk, Inc., for the balance of the paving and structures between University Avenue and the El Cerrito Overhead. The operations on this 1.6-mile project are expected to be completed in October, 1956.

On the southerly section of the Eastshore Freeway a noteworthy addition to the Bay area freeway system was made on July 2, 1954, when a 9.3-mile portion from Warm Springs to San Jose was opened. Constructed to full freeway standards, this facility includes traffic interchanges at important intersections and affords a much needed measure of relief to traffic on Highway 17 between San Jose and Oakland. The work was accomplished in two contracts, one held by the Fredrickson & Watson Construction Company and M & K Corporation, and the other by the Granite Construction Company, at a total cost of $4,000,000.

At the present time a 14-mile gap exists on this route between Warm Springs and the southern end of the previously constructed freeway units between Oakland and Hayward. Progress toward the final elimination of this gap is seen, however, as $4,500,000 has been included in the 1955-56 Fiscal Year budget for a 5.6-mile southward extension to Beard Road.

It is expected that bids will be received for construction of this project late this summer. Meanwhile, work is going forward on plans and acquisition of rights of way for the section which will culminate in the final closing of the gap. When this is accomplished a total length of 38.0 miles of modern facility will be providing traffic service between San Jose and Oakland and the Eastshore Freeway-south will be completed except for a short stretch within the City of Oakland.

US 50

A 1.5-mile freeway bypass through Castro Valley on Route US 50 was opened to traffic on September 14, 1954. The work was performed by Fredrickson Brothers under a $1,270,-000 contract.

Continuing westerly from the completed unit, work has been under way since June, 1954, on a 2.9-mile section of full freeway that will tie into the Eastshore Freeway at San Lorenzo. The construction which is being performed on this $2,900,000 contract by Ball & Simpson, Erickson, Phillips & Weisberg, is expected to be completed next December.

To the east of the Castro Valley bypass plans have been completed for the improvement of a final 5.3-mile section of the original route between

Castro Valley and the San Joaquin Valley which remains to be improved to modern standards. As the 1955-56 budget includes an item of $4,680,000 for this final link, it is expected that work will be under way on a contract at this location this summer.

At the easterly boundary of Alameda County a District X project which extended from Tracy to the Altamont Pass included a 1.7-mile section in Alameda County. The completion of work on this expressway marked an important step forward in providing an adequate highway facility from the San Joaquin Valley to the Bay area. The completion of two projects, one currently under construction and one which has been budgeted, will result in a continuous freeway or expressway ride from Tracy to Oakland, a distance of 51 miles via US 50 and the Eastshore.

The heavy traffic on the metropolitan terminus of this route emphasizes the need for the completion on a direct alignment to the Bay Bridge approach in Oakland. Such a measure would not only relieve the load caused by through traffic on this route which is presently using the Eastshore Freeway between San Lorenzo and Oakland, but would also furnish a vital traffic service to local users. To accomplish this a step was made on January 26, 1955, when the California Highway Commission adopted a route for a portion of a freeway along MacArthur Boulevard between the distribution structure and Park Boulevard in Oakland.

Following the commission action work has been pressed on the plans for this freeway unit and funds have been made available to commence the acquisition of necessary rights of way.

Expressway on US 50 at crossing of the Delta Mendota Canal near the Alameda-San Joaquin County line. New construction joins with the original four-lane divided facility through the Altamont Pass in the distance where the ramps of an interchange are discernible.

Meanwhile, studies are also under way which will lead to the determination of the remaining section through Oakland, together with its easterly extension to Castro Valley.

MOUNTAIN BOULEVARD

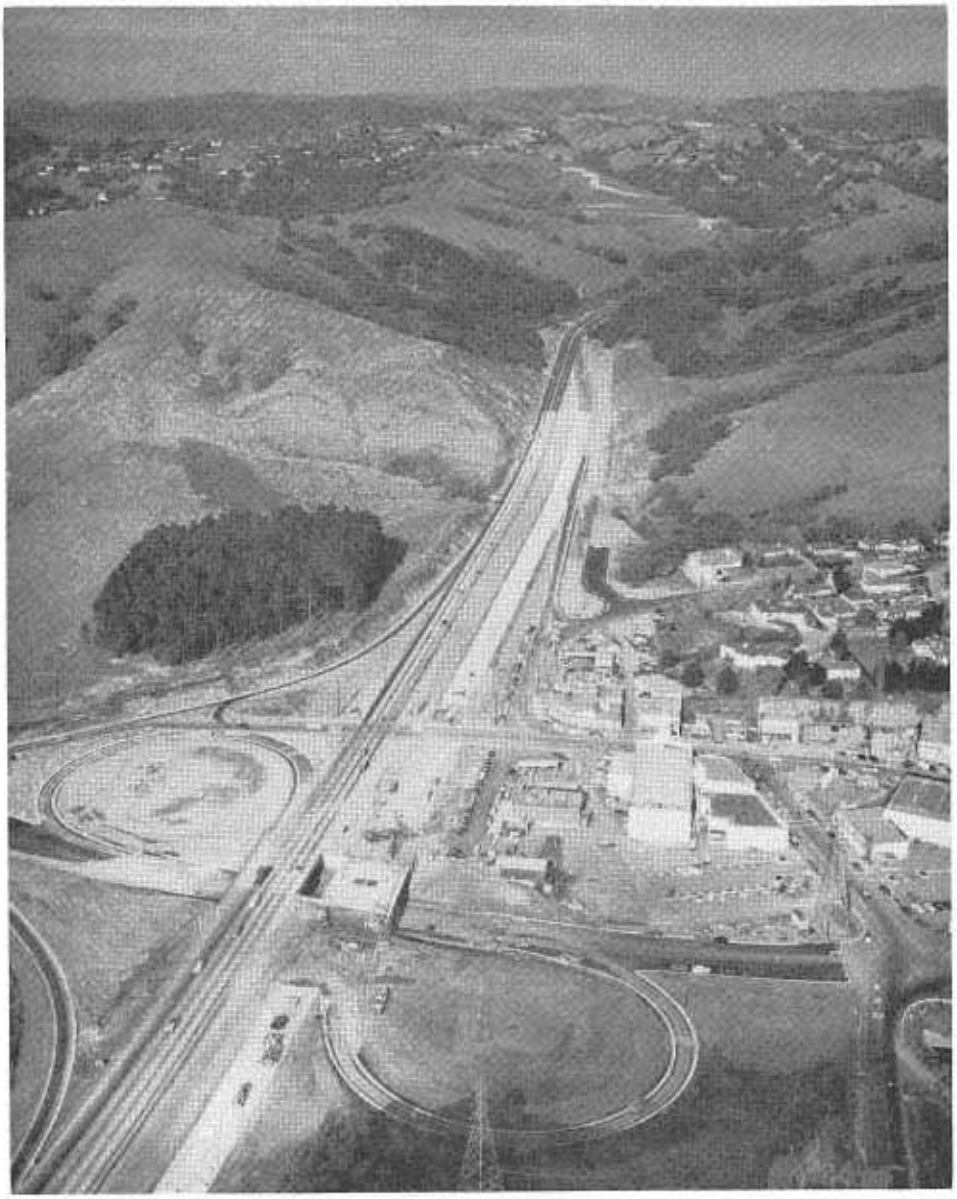
The improvement of Mountain Boulevard in the City of Oakland to freeway standards was originally undertaken by Joint Highway District No. 26. Work on a 1.1-mile section near Lake Temescal was previously completed under the direction of the joint highway district. At the request of Alameda and Contra Costa as member counties, together with the City of Oakland, the State agreed to the dissolution of the joint highway district on July 1, 1954, in a measure which was taken in an effort to speed up the development of this route. The action was taken with the understanding that Alameda County and Oakland would continue to contribute toward the financing of the future projects.

On March 30, 1955, bids were opened for a one-mile project between Thornhill Drive and Ascot Drive with an estimated cost of $1,200,000. It is also expected that bids will soon be received for a $150,000 separation structure at Lincoln Avenue on this route.

US 40—RICHMOND TO CARQUINEZ

Construction of this freeway was started at the Richmond end by the award of a contract to MacDonald, Young & Nelson, Inc., for two structures, one over the Santa Fe tracks at 47th Street and one over San Pablo Creek. This work was completed in November, 1954, at a cost of $380,000. Work on the principal contract was started in November, 1954, when Fredrickson & Watson Construction Company started operations on a $5,400,000 contract which will complete the initial 4.8-mile unit in July, 1956.

Meanwhile work is continuing on the plans and acquisition of right of way for remaining sections of this route northerly to the Carquinez Bridge and southerly to the Albany Overhead in Alameda County where the work previously described as part of the Eastshore Freeway commences.



View of final stage of construction of the Orinda interchange

OAKLAND-WALNUT CREEK AND CONCORD-DANVILLE

The congestion on Highway 24 to the east of the Broadway Low Level Tunnel has been at record level for the past few years due to the accelerated development which has occurred in the westerly portion of Contra Costa County. The first material progress toward alleviating this condition was realized on March 10, 1955, when a 1.2-mile section of freeway, including an interchange at Orinda Crossroads was fully opened to traffic.

The work was performed by Fredrickson & Watson Construction Company and M & K Corporation, at a cost of $1,500,000.

Bids were opened on March 30, 1955, for a similar type of project which will provide an interchange at the Pleasant Hills Road intersection. The estimated cost of this 1.3-mile undertaking is also $1,500,000.

Additional work which has been included in the 1955-56 Fiscal Year program includes a 2.8-mile freeway bypass of Lafayette which is immediately west of the Pleasant Hills Road Interchange project and another section, also 2.8 miles in length, extending northerly from Walnut Creek to Monument. The budget allocations for these projects are $3,800,000 and $3,580,000 respectively, and it is anticipated that right of way will be cleared to permit receiving bids for both of these projects early this summer.

Further progress in the improvement of highway transportation in this area occurred on January 26, 1955, when the California Highway Commission adopted a route for the further extension of the freeway system from a wye in Walnut Creek in a southerly direction to a point one mile south of Danville. Meanwhile, improvement of another portion of the Danville Highway is foreseen as bids were opened on March 23, 1955, for improvement of a 2.1-mile section extending northerly from Dublin to a point near the Alameda-Contra Costa county line.

While an interchange will be provided through a separation which is to be built at the Dublin intersection with US 50, a plan is being followed that has been used on other recent construction in rural areas. The initial two lanes of a future divided facility will be constructed on this project and sufficient right of way together with access control has been acquired in order that the improvement may later be developed into a full freeway when traffic conditions and availability of further funds warrant such action.

ARNOLD INDUSTRIAL FREEWAY

With the previous improvement of the portion of the Arnold Industrial Highway in Contra Costa County as a partial freeway through the congested area between Willow Pass and Antioch, work on this thoroughfare was limited to a single project during the past year.

The conflict of traffic at the intersection at grade which was originally provided at Loveridge Road reached a magnitude which warranted a higher standard of development. Under a cooperative agreement with the county, an agreement was made calling for the State to pay for the cost of a separation structure and Contra Costa County to pay for the connecting ramps, which actually constituted the major portion of the project.

A contract was subsequently let to Gallagher & Burk, Inc., at a cost of

$280,000 in March, 1954, for the construction of an interchange at this location and the improvement was opened to traffic on April 1, 1955.

Thus, while a limited freeway does not provide the same measure of safety and convenience which is obtained from the full development, the work which has been done at the Loveridge Road intersection is an example of what may be accomplished in the future at other locations on expressways.

SKYLINE BOULEVARD

With the development of the residential areas in San Mateo County extending easterly from the coast and westerly from the peninsula to a point where the subdivisions are converging upon the ridge along which Skyline Boulevard is located, emphasis has been placed upon the need for an improved facility to serve as an additional major connection with San Francisco.

December, 1954, marked the completion of the first project which provided a 2.3-mile section of expressway from Edgemar Road at Alemany Boulevard, at a cost of $1,000,000.

To the north of the completed section plans have been completed and bids will soon be received for two additional units which will extend the improvement to Lake Merced Boulevard in San Francisco at an additional expenditure of approximately $1,000,000.

LOS GATOS-SANTA CRUZ

To keep pace with the traffic needs beyond the immediate metropolitan area, emphasis has been placed on freeway bypasses designed to relieve congestion which accompanies locations through residential and commercial districts. Such a situation is being met in the town of Los Gatos through the construction of a 2.4-mile bypass.

Work will soon be finished on structures for the future freeway under a $370,000 contract with Carl N. Swensen Company.

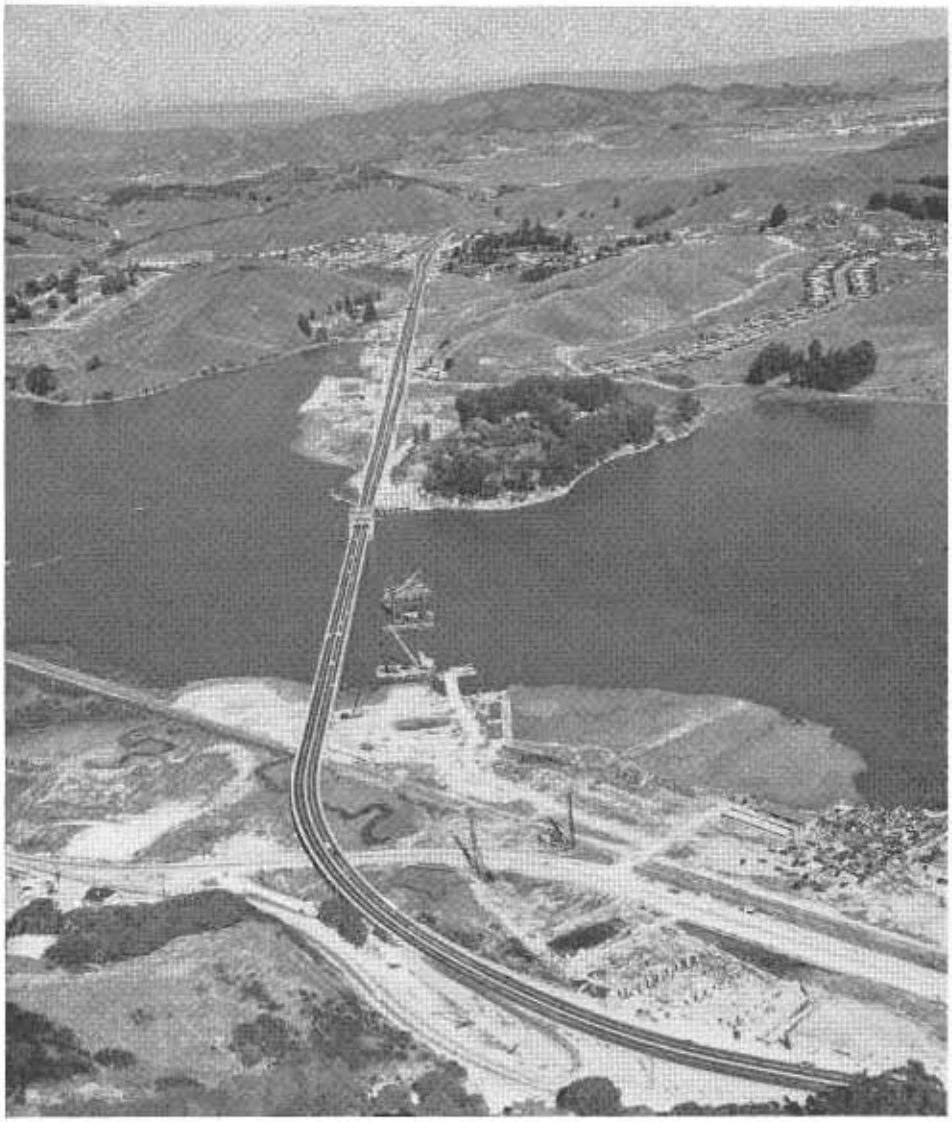
Meanwhile, operations are now under way on a second contract which was awarded to L. C. Smith for the balance of the roadwork on this project. It is expected that work, which will cost $1,300,000, will be completed in November.

In Santa Cruz action also has been taken to relieve the congestion which has resulted from the routing of highway traffic over city streets. Here, a $1,270,000 project which will extend from the north city limits of Santa Cruz on the Santa Cruz-Los Gatos highway to Mission Street, is scheduled to be ready for the advertising of bids by mid-year.

US 101—GOLDEN GATE BRIDGE TO SANTA ROSA

The past year has witnessed a number of important steps toward achieving a continuous freeway be-

LEFT—Construction operations on Golden Gate Bridge Freeway immediately north of the bridge. New lanes will lead to portal of twin bore of Waldo Tunnel which appears to right of existing tunnel portal. RIGHT—Construction operations for Golden Gate Freeway.



Construction operations on foundations for new bridge across Richardson Bay in Marin County. When the new six-lane divided facility is completed the existing timber bridge which has reached the end of its useful life will be removed.

tween the Golden Gate Bridge and Santa Rosa. The Waldo approach which has recently been appropriately designated as the Golden Gate Bridge Freeway, has been the scene of two major contracts.

The Guy F. Atkinson Company is finishing their work on a $4,500,000 contract which covered grading, construction of a twin bore opposite the Waldo Tunnel and structures on a 4.0-mile section of this route. Work has also been started on the second job, a $1,300,000 contract with A. G. Raisch Company, for completing the construction and paving of this unit. The work on this final contract is scheduled to be finished in December. The Golden Gate Bridge and Highway District contributed $5,000,000 toward the cost of this project.

One mile north of the Waldo approach, the building of a new bridge across Richardson Bay is well under way. The contract for this $3,200,000 structure is held by Duncansen, Harrelson & Pacific Bridge Company, and work is scheduled for completion in October, 1956. Meanwhile, funds have been budgeted in the 1955-56 Fiscal Year to fill in the gap between the Waldo approach and the new Richardson Bay Bridge, as well as to extend the freeway to a point 0.3 mile north of the Alto intersection. Bids have been requested for this 1.5-mile unit for which $1,730,000 has been allocated.

Greenbrae Intersection

Several miles to the north a measure of relief will be provided at the Greenbrae intersection. This will be in the form of construction which is proposed from a $1,000,000 allocation in the same budget to finance a portion of the Greenbrae interchange. The initial work which will serve as an interim development will separate southbound traffic and thus remove the most serious bottleneck on US 101 in Marin County and at the same time provide substantial relief for northbound traffic. The balance of the work required to complete this interchange, together with the adjacent sections of the freeway including an interchange at the Corte Madera intersection, will follow at a later date.

Another step in the over-all program to provide an integrated modern highway transportation network, occurred on June 17, 1953, when the California Highway Commission adopted the routing for a freeway connection between the San Quentin wye just south of San Rafael and the westerly end of the Richmond-San Rafael Bridge. Plans are being prepared for this 2.2-mile link so as to permit scheduling of the improvement to coincide with the completion of the bridge. The initial facilities will be required in October, 1956, when it is expected that the first deck of the bridge will be finished. The planning includes the necessary consideration for the expansion of these facilities at such time as the second deck of the structure is placed into service.

Petaluma Bypass

Strides are also being made in the area from Petaluma to Santa Rosa to overcome the congestion on the existing route through the heart of the business district in Petaluma, and upon the present two-lane highway extending northerly to Santa Rosa.

Two current contracts cover work which is in progress on the Petaluma Bypass. The first one to be let covered two sets of twin structures which are being built across the navigable channel of Petaluma Creek and over the tracks of the Northwestern Pacific

Railroad. This construction, done at a cost of $900,000, is practically completed, and was performed by Erickson, Phillips and Weisberg.

The second contract, held by Parrish Brothers and Carl N. Swenson Company, extends northerly 8.6 miles from a point one mile south of Petaluma Creek. This job covers grading for the entire length and paving and structures on the southerly five-mile portion which will constitute the Petaluma Bypass. The operations are scheduled for completion in June, 1956, at a cost of $3,700,000.

On March 16, 1955, bids were opened for a northward extension of this freeway to Wilfred Crossing. This project, which is estimated to cost $2,800,000, includes paving of a three-mile graded section of the preceding contract and will result in a freeway unit 7.9 miles in length when finished.

Plans are nearing completion and right of way is being acquired for the remaining section between Wilfred Crossing and Santa Rosa, a distance of 5.0 miles.

NAPA AREA

Representative of a project which has been designed to replace a section of substandard alignment in a rural area, is the work under way on a 2.7-mile section on Sign Route 37 in Napa County. The work extends easterly from a point two miles east of the Sonoma-Napa County line and the current operations cover the construction of the initial two lanes of a future four-lane freeway facility for which the right of way and access control have already been provided. The $410,000 contract with Arthur B. Siri, Inc., will be completed later this summer.

Route of the freeway bypass of Petaluma where operations are under way on two contracts for the structures and roadwork for the new facility

A further improvement of this nature is also projected at another location in Napa County. On August 25, 1954, the California Highway Commission adopted a freeway routing for a five-mile section of the St. Helena Highway, extending from the north end of the Napa Bypass to one mile south of Yountville. While the initial construction has not yet been programmed, funds have been included in the current budget to commence the acquisition of rights of way.

Plans are completed and right of way is being acquired for the construction of an expressway between four miles north of St. Helena and Calistoga, a length of 3.7 miles. An initial two-lane facility with right of way for ultimate four lanes is proposed.

SERVING HEAVY URBAN TRAFFIC DURING CONSTRUCTION

Most of the major freeway projects in this area have been developed along the locations of the existing highway routes as economics have dictated the incorporation of some of the original improvements and right of way as a part of the new facility. This condition has posed many problems of a complex nature in the planning and construction of the individual projects.

As the freeways which have been started or completed thus far were of high priority because of traffic congestion, it was considered essential that traffic should be subjected to a minimum of inconvenience during the construction period. In this regard the actual goal has been to make provisions for the conduct of traffic through the work on a par with the service offered by the original facility. In many cases this meant construction of multilane, paved detours conforming to geometric standards acceptable for prevailing speeds. In some cases portions of ramps and frontage roads were developed on an expanded basis to serve this purpose.

No doubt the greatest challenge to our design and construction engineers has occurred on the current contract for the modification of the East Bay Distribution Structure. Here, an existing facility which in its original form

was a complex direct type of interchange carrying 120,000 vehicles per day, is being expanded to more than twice its initial size. The new construction is closely interwoven under, over and alongside the present ramps.

It has also been necessary to remove portions of the structure where connections are being made to the new facilities. This has been accomplished in part by the construction of two sections of a trestle type detour alongside portions of the ramps. Except for a relatively few occasions when it was necessary to erect steelwork over traveled roadways, and a small number of vehicles was required to follow a detour routing during early morning hours, the bulk of the traffic has continued to use the facility without inconvenience from the work.

RIGHT-OF-WAY ACQUISITION

Perhaps the most important and certainly the most remunerative single step in economical use of highway funds was the creation of a revolving fund for the advance acquisition of rights of way. The California Legislature in 1952 made available to the Highway Commission, the sum of $10,000,000 as an advance fund to be used for the purchase of rights of way where pending expensive development patently conflicted with proposed freeway routes, and where construction could not be financed for several years. In 1953 the fund was increased to $30,000,000 permitting full operation of this program of prior purchase.

Funds in the amount of approximately 5 million dollars have been authorized in this district and of this total, about 3 million has been obligated. Time and effort required in the acquisition of real property is a matter of common knowledge. To reap the potential savings in the advance acquisition plan has required constant vigilance, however, the results have justified the intensity of the effort. In addition to preventing development on land required for future projects which would later be removed to the inconvenience and possible intangible loss to investors, properties now purchased under the advance acquisition plan for $19,000,000 would otherwise cost the State an amount estimated at $114,000,000.

CONCLUSION

The expeditious, convenient and safe movement of traffic has been a primary objective in this program of modernizing highway transportation. Elimination of grade crossings, reduction of side friction due to multiple access, high standards of grade and alignment, wide traffic lanes, and improved signing, have, among numerous other features, produced facilities which encourage rapid and convenient transportation through maintained speeds over long distances. What, then, is the story of safety?

Unfortunately, safety cannot be effectively discussed without reference to accidents; the lack thereof, being the direct result of the degree of safety which the facility offers. The period of observation has been sufficiently long to permit reliable appraisal, particularly with respect to accidents involving fatalities. While accidents involving property damage or minor injury are of great consequence, the heavy toll of fatal accidents in itself, stresses the need for effective action.

It is customary to refer to fatality statistics in terms of 100,000,000 vehicle

... Continued on page 21

STATUS OF DISTRICT IV FREEWAY PROJECTS

March, 1955

	Total miles	Completed projects		Under contract		Budgeted		Right-of-way cost
		Miles	Construction cost	Miles	Construction cost	Miles	Construction cost	
Bayshore Freeway; Bay Bridge to San Jose	48.8	15.1	$23,126,000	9.1	$14,394,000	5.9	$5,850,000	$30,159,000
Central Freeway; Bayshore to Turk Street	1.9			0.8	3,649,000			1,865,000
Eastshore Freeway; Richmond to San Jose	55.7	26.1	26,583,000	5.7	14,785,000	7.0	11,515,000	21,767,000
U. S. 101; Golden Gate Bridge to Santa Rosa	51.1	26.0	5,298,000	13.6	13,578,000	7.1	5,530,000	16,867,000
Black Point Cutoff; Ignacio to Sears Point	7.3	0.7	1,004,000					222,000
Napa Area; Solano County Line to Union Station	31.1	14.6	1,441,000					712,000
U. S. 40; Richmond to Carquinez Bridge	13.8		388,000	4.8	5,441,000			4,120,000
Arnold Industrial Freeway; Hercules to Bridgehead Ave.	53.2	13.8	4,400,000		285,000			1,358,000
Oakland to Arnold Industrial Freeway near Ohmer	19.4	2.3	226,000	1.2	1,579,000	6.7	8,880,000	2,700,000
Mountain Blvd; Tunnel Freeway near Lake Temescal to San Leandro	9.3	1.1	1,297,000			1.0	1,350,000	540,000
Altamont Pass; San Lorenzo to San Joaquin County Line	33.9	26.4	7,094,000	2.9	2,900,000	5.3	4,680,000	7,341,000
Pacheco Pass; 1 Mile east of Bell's Station to Merced County Line	5.3	5.3	1,285,000					20,000
El Camino Real; San Jose to San Benito County Line, portions	14.4	14.4	2,856,000					1,269,000
Santa Cruz to Watsonville	15.3	7.7	2,740,000			1.3	1,270,000	1,779,000
San Jose to Santa Cruz	21.1	1.8	1,337,000	2.4	1,699,000			2,577,000
Skyline Boulevard; San Francisco County Line to Edgemar Road	3.4	2.2	640,000			0.9	348,000	1,073,000
Embarcadero Freeway; Bay Bridge to Broadway	1.5					1.2	8,000,000	9,950,000
Park-Presidio Freeway; Golden Gate Bridge to Fulton Street	2.0	1.1	1,172,000	0.5	454,000			50,000
Totals	388.5	158.6	$80,887,000	41.0	$58,764,000	36.4	$47,423,000	$104,369,000

Monticello Dam

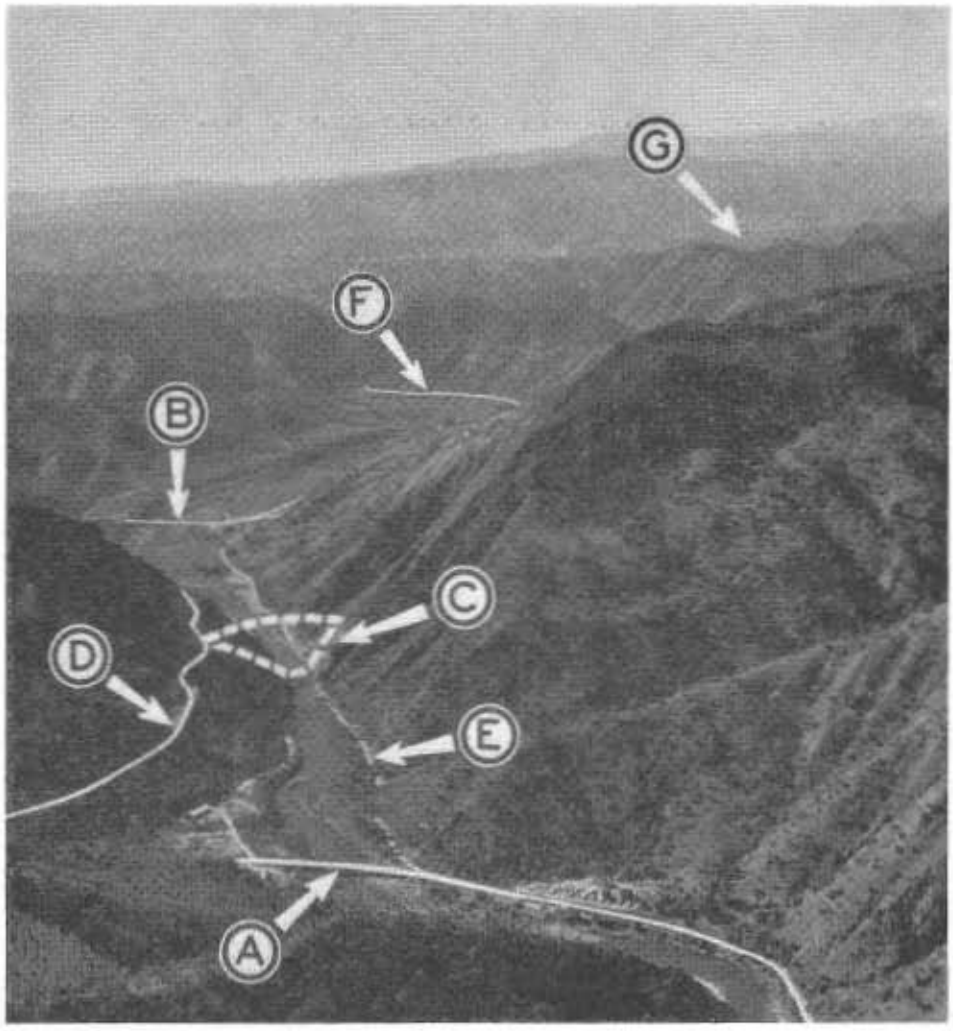
Highway Relocation Is Through Rugged Terrain

By L. C. GABEREL, Senior Highway Engineer

CONSTRUCTION of the Monticello Dam as part of the Solano Project of the U. S. Bureau of Reclamation has necessitated the relocation of portions of Routes 6 and 102, State Sign Routes 37 and 128.

The dam, as presently being constructed, is a reinforced concrete arched type, 270 feet high and 1,017 feet long. It is located on Putah Creek at "Devil's Gate," at the approximate junction of Napa, Yolo and Solano Counties where Putah Creek is in a rocky canyon. The reservoir will stretch for more than 20 miles above the dam, the main body of the reservoir being in the Berryessa Valley. This valley is about 11 miles long and 2½ miles wide and is composed of fertile lands devoted to agriculture. The Town of Monticello is located in this valley and will be covered with approximately 100 feet of water when the reservoir is full. The capacity of the reservoir is 1,600,000 acre-feet and it covers more than 20,000 acres of land.

When the dam is completed and the reservoir is full of water, approximately 16 miles of the existing state highway will be inundated. The total amount of existing highway replaced by the 16.3 miles of new construction will be 21.5 miles. The portions of existing highway not subject to inundation but replaced by the new location will probably remain as county road.

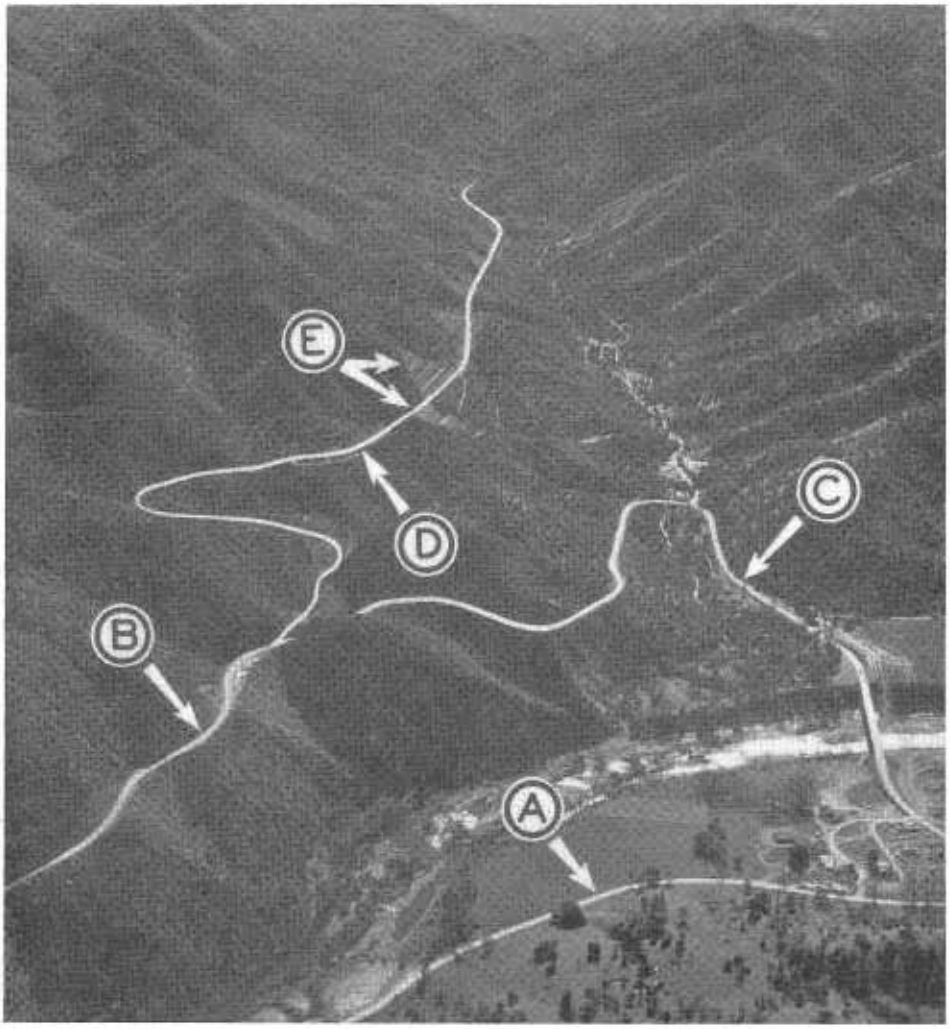


(A) Permanent bridge across Putah Creek; (B) Temporary bridge across Putah Creek; (C) "Devil's Gate" damsite, Monticello Dam; (D) Relocated highway, Unit No. 1; (E) Highway Route 6 now abandoned; (F) Highway Route 6 to be abandoned; (G) Berryessa Valley

Project in Three Units

The sections of relocated highway are being built in three units. The survey and design work for all three units have been accomplished by the Division of Highways with the Bureau of Reclamation handling the field engineering and inspection work during construction.

Since the existing highway passed through the location where dam construction must start, a detour road above the top of the south abutment of the dam had first priority. About one-half of this 2.8-mile-long detour is on temporary location that will be inundated, but is necessary to carry public and contractor's traffic during construction of the dam proper. This first unit cost approximately $1,175,000 and was included as part of the initial contract for the dam. It starts in Yolo County and immediately crosses Putah Creek into Solano County. It then runs on a 7 percent grade up Cold Canyon across rocky bluffs above the dam and to a point just beyond where the permanent construction ends. The temporary construction then descends on a 9 percent grade, again crosses Putah Creek and ties back into the existing highway just west of the dam site in Napa County. The bridge across Putah Creek on the permanent construction was designed by the Bureau of Reclamation to Division of Highways standards. It is 26 feet wide between curbs, 448 feet 8 inches long, of re-



(A) Abandoned State Highway Route 6; (B) Permanent portion, Unit No. 1; (C) Temporary portion, Unit No. 1; (D) Unit No. 2, showing relocated Route 6 winding down into Markley Canyon; (E) Shows 160-foot fill at Station 118 and 185-foot cut at Station 121

inforced concrete, with prestressed-precast beam construction on round piers with eight equal spans. The bridge across Putah Creek on the temporary portion, also designed by the Bureau of Reclamation, is of timber construction 24 feet wide and 456 feet long.

Heavy Construction

The second unit of road, now under construction, is about 10 miles long and runs from the approximate dam site to the head of the Capell Valley at the junction with the existing Route 6. This unit, at the approximate cost of $1,700,000, was let as a separate contract by the Bureau of Reclamation. The construction is through precipitous country with brush-covered, rocky hillsides. Grades up to 7 percent must be used on rather tortuous alignment. There are many deep cuts and high fills; the maximums are 185 feet and 160 feet respectively.

The third unit, about 4.9 miles long and estimated to cost approximately $725,000, is soon to be advertised for construction by the Bureau of Reclamation. It runs from the head of Capell Valley to the junction with Route 102, about 15 miles east of Rutherford. Some of this unit is also in steep, brushy country but a good portion is through comparatively level meadow lands along Capell Creek. There is one bridge on this unit designed by the Bridge Department. It is 26 feet wide and 205 feet long with steel girders on concrete piers.

Major Construction Items

The roadway section for the permanent construction is 26 feet wide, all paved with two inches of plant-mixed surfacing. The total cost of all this road construction is approximately 3.6 million dollars. The major construction items for the total relocation amount to: 210 acres of clearing, 2,200,000 cubic yards of roadway excavation, 13 million station yards of overhaul, the one temporary and two permanent bridges previously mentioned, a double 8 x 8 foot reinforced concrete bridge at Soda Creek, a double 8 x 7 foot reinforced concrete bridge at Oak Moss Creek, a large number of multiplate culverts ranging in size from 60 inches to 150 inches in diameter, and many smaller pipe culverts of reinforced concrete and corrugated metal.

The first unit, now completed, was part of a $7,628,991 contract let to Peter Kiewit Sons' Co. & Parish Bros. as a joint venture. The second unit is a $1,663,806 joint venture contract let to Stolte, Inc., Gallagher & Burk, Inc., and Lee Stephens.

The third unit has been designed and the Bureau of Reclamation is preparing to advertise for bids.

The Solano Project, of which the highway relocation is a part, is under the supervision of B. P. Bellport, Construction Engineer for Region 2, Bureau of Reclamation, with headquarters in Winters. Road construction resident engineer for the bureau is Dee Wren.

NEW COMMISSIONER PUBLIC ROADS

Secretary of Commerce Sinclair Weeks has accepted the resignation of Francis V. du Pont, of Wilmington, Delaware, as Commissioner of Public Roads, and appointed him Special Assistant to the Secretary in developing the President's 10-year National Highway Program. Simultaneously Secretary Weeks appointed Charles D. Curtiss of Kensington, Maryland, Deputy Commissioner, to succeed du Pont as Commissioner.

Mr. du Pont has served as Commissioner of the Bureau of Public Roads, U. S. Department of Commerce, since April 1, 1953.

To Death Valley

Main Access to Monument From West Greatly Improved

By GENE SNYDER, Resident Engineer

Completion of a contract on State Sign Route 190 in Inyo County was the fourth in a series of projects which have greatly improved the main access route to Death Valley National Monument from the west. The last unit constructed began two miles south of Lone Pine at the junction with US 6/395 and continued southeasterly around the north side of Owens Lake, which is now dry, to a point approximately four miles northwest of the town of Keeler, a distance of 7.9 miles.

The old roadbed was exceedingly narrow and alignment and sight distance were poor. Throughout the project the grade line followed the existing ground line and was well below the adjacent ground, mostly in a trench section which collected runoff water, blowsand and debris.

Route Is Shortened

The new alignment shortened the route about 0.4 mile and eliminated two crossings of spur tracks to mines and quarries from the narrow gauge Southern Pacific Railroad. The roadbed section consisted of two 12-foot lanes with 2-foot shoulders of road-mixed surfacing over three inches of imported base material.

The eastern half of the project traversed an area of sand dunes which during extremely heavy sand storms, had buried the old road at various times in the past. A turnpike design was used in this area to raise the grade line well above the surrounding countryside to prevent the accumulation of drifting sand on the roadway.

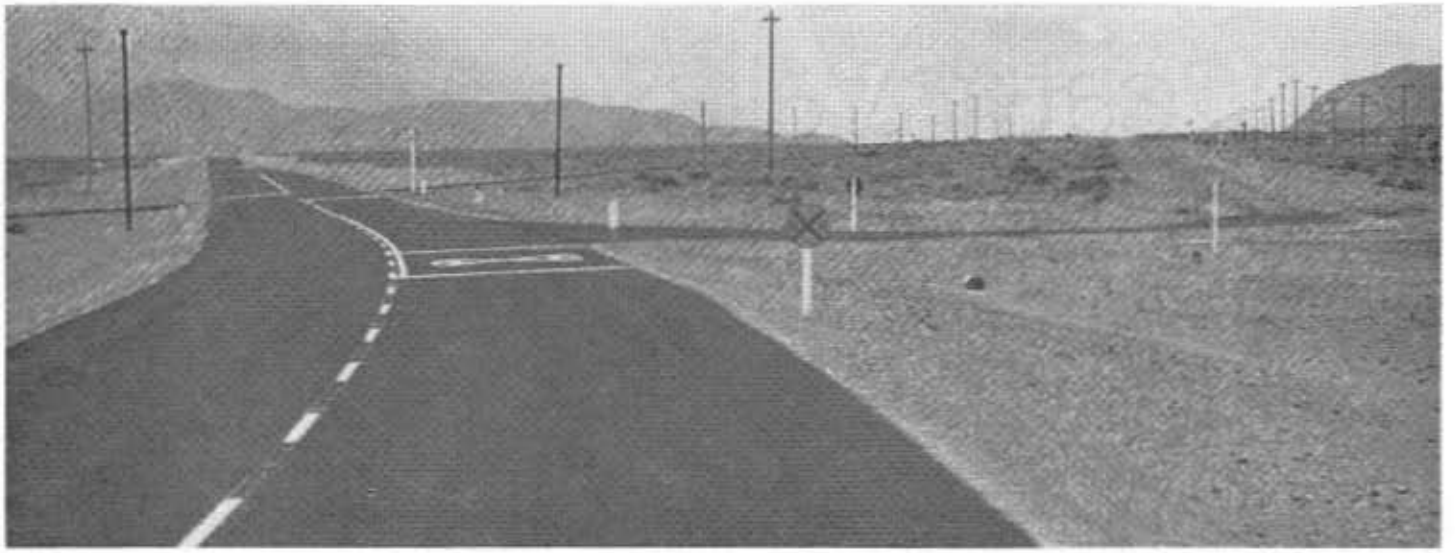
The contract for this project was awarded on April 5, 1954, to George E. France Co., Inc., of Bakersfield. Work was started April 16 and completed August 16, 1954, at a cost of $158,900, exclusive of engineering.

Slope Finishing

The major portion of the earthwork consisted of excavating sandy material from borrow ditches at the sides of the road to make the roadway embankment in the middle. Side slopes were mostly 6:1 with back slopes excavated at 4:1. As the grading progressed on the project it was noted that the contractor was having trouble finishing the loose sand slopes with ordinary grading equipment. At the suggestion of Milton Harris, then district engineer, the contractor built a drag, consisting of a 10-foot piece of railroad rail and six truck tires. The drag was laid out in a triangular shape by tying three tires to the rail, then a row of two tires followed by a single tire, thus forming a flexible mat. The drag was pulled rail side first by a small crawler tractor and did an excellent job of finishing the slopes.

While constructing embankments the contractor had some difficulty applying enough water to obtain compaction. Nearly twice the amount of

Looking easterly. Owens River Bridge in middle distance. Old road to left and new alignment to the right in background.



UPPER—Looking northwesterly from end of project. Old highway to the right with new crossing of the Southern Pacific Railroad narrow-gauge tracks to the left. CENTER—Beginning of job looking easterly from junction with US 6/395. LOWER—Looking easterly showing junction of old and new alignments.

water estimated was necessary to complete the earthwork. While excavating for culverts it was noted that water applied during construction of embankments had percolated to a depth of eight feet.

Water From Owens River

Water was obtained from the Owens River which crosses the project about 2.6 miles from the point of beginning. Normally water flows the year around at this location even though the main flow of the river is diverted into the Los Angeles Aqueduct approximately 30 miles upstream. Fortunately, the work was well ahead of schedule as the water supply dried up during the week the contractor finished hauling imported base material.

State Sign Route 190 east of the Sierra carries local traffic of the Keeler, Darwin and Panamint Valley area and through traffic from the Death Valley and Las Vegas area. A special traffic count taken February 25, 1953, revealed that about 80 percent of the traffic consists of trucks hauling ore and vehicles transporting employees to and from the mines.

Each year this route is becoming more important as an outlet for a large area where strategic minerals are mined and ores milled and carried by trucks to mills and markets. One of the largest mines in the area is the Anaconda Copper Mining Company's lead and zinc mine at Darwin which employs 250 people when in full production.

GUTHRIE VICE CHAIRMAN

James A. Guthrie, member of the California Highway Commission and publisher of the San Bernardino *Sun*, was elected vice chairman of the commission to serve for the year ending January, 1956, it was announced by Chairman Frank B. Durkee.

Guthrie, serving his fourth term on the commission, succeeds Chester H. Warlow of Fresno as vice chairman.

TAXI, TAXI

There are some 750 taxicabs in San Francisco and over a thousand in Los Angeles.

FOURTH ANNUAL BONNEROO

The Construction Department of District VII, Division of Highways, will have its Fourth Annual Bonneroo Stag Party at the Rodger Young Auditorium, 936 West Washington Boulevard, Los Angeles, on the evening of May 6, 1955.

F. B. Cressy, Assistant District Engineer, Construction, District VII, conceived the idea for these annual get-togethers some four years ago, and they have proved a great success in promoting a spirit of friendly rivalry and competition among both engineers and contractors to produce the best work.

The purpose of this party is to honor resident engineers and contractors who completed the 10 best contracts in District VII during the calendar year 1954. The occasion also provides an opportunity for Division of Highways personnel and contractors to become better acquainted by spending an enjoyable social evening together.

The 10 best contracts will be announced at the party. The resident engineer and the contractor on the best contract will each be awarded a "topper," a trophy consisting of a miniature gold plated roller, mounted on a pedestal with suitable inscription commemorating the award and the occasion. Assistant resident engineers and the contractor's superintendent on the best contract will be awarded certificates of merit.

Last year's winners were Haig Ayanian, resident engineer, and Ukropina, Polich and Kral, contractors.

Division of Highways personnel and contractors and their employees, are cordially invited to attend.

DISTRICT IV FREEWAYS

Continued from page 16 . . .

miles, and expressed in such figures, the rate on rural highways is 9.39—far too many, but nonetheless true. However, on the same basis, the rate on full freeways is 2.12, thus permitting the comparison that despite high volumes of traffic, motorists are four to five times as safe per mile while travelling on the modern freeway. Such a comparison is a measurement of progress which is most gratifying.

This report covers a year of significant progress in the development of the metropolitan freeway system in District IV. As in all projects of magnitude, the initial planning and processing is not apparent. Only in the latter phases of development does achievement meet the eye. While greater accomplishments may be attained, nevertheless this has been a year of visual evidence that a continuous and integrated freeway system is developing toward the usefulness its planners envisioned. With continued progress on an undiminished scale the light can be seen which will mark the realization of such a system.

FARMERS AND THE MOTOR VEHICLE

Farmers in the United States own nearly 7,000,000 cars and trucks.

Prof. Moyer Honored

A university of California engineer has received a distinguished service award for outstanding achievement in highway research, the National Research Council has announced.

Ralph A. Moyer, professor of civil engineering at the university's Berkeley campus and research engineer in the Institute of Transportation and Traffic Engineering, was one of two men to receive the Roy W. Crum Award for Distinguished Service at a recent meeting of the Highway Research Board, National Research Council in Washington, D. C.

Professor Moyer has done considerable work in pavement design, driving safety, and road surface characteristics. In addition, he has done much work on the economics of freeways, and the results of his studies have been available through scores of articles, papers and research reports.

CAR MILEAGE

One out of every five cars in use in the United States has been driven more than 80,000 miles.

US 97 Improvement

Dorris to Oregon State Line Unit Completed

By W. H. JACOBSEN, Resident Engineer

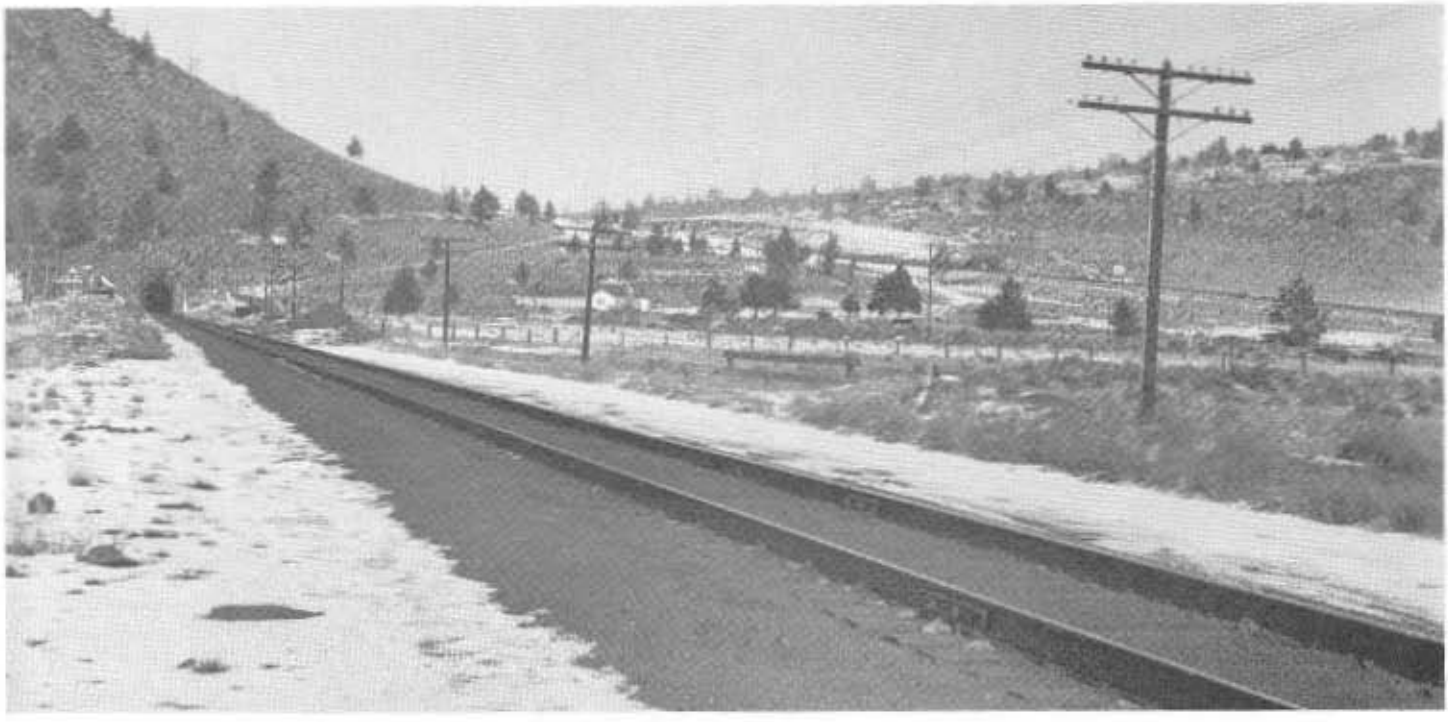
THE FIRST stage is complete! The initial unit of the Macdoel to the Oregon state line project on U. S. Highway 97, State Route 72, in Siskiyou County was completed on December 7, 1954. With the completion of this contract by Clements Construction Company and Clements Company the first major improvement in Route 72 to modern standards in 20 years has been achieved. The completed section eliminates a serious traffic bottleneck between the town of Dorris and the Oregon state line.

The alignment of the 2.8 miles of new construction followed very closely the old highway alignment and required that the contractor maintain a suitable two-way road for traffic at all times. While this ordinarily constitutes only a normal construction problem, at this location the excavation had to be blasted through large lava boulders laid down by water or ice action. Normal blasting would have closed the road to traffic. In addition to the problem of maintaining traffic was the danger to a main line railroad tunnel belonging to the Southern Pacific Railroad Company which was approximately parallel to the highway for 1,500 feet and below the cut slopes in various places.

Excavation Problems

In this area (known locally as Dorris Hill) was located the largest portion of the excavation. Owing to these two hazards the contractor was obliged to confine his blasting to small shots, which could be cleaned up readily and at the same time cause no damage to the railroad tunnel which had been relined the previous year at considerable expense.

Looking south from Oregon line. The highway passes through cut in the background. In right foreground is turnout.



Showing railway tunnel at the left, with highway passing through cut in center background

The contractor hired an expert seismologist to inspect the tunnel prior to the blasting operations tnd to check on the possibility of structural damage due to the blasting. This was done by using a pin type seismograph placed in the railroad tunnel to determine the effect of passing trains and then the effect of the blasts.

Only that portion over Dorris Hill was built to complete four-lane

. . . Continued on page 58

Looking south from the Oregon state line. Highway and railroad go through the low gap—Dorris Hill—which appears in the distant skyline.

Freeway Vistas....

Motor Trip in South Offers Attractions

THE NEW freeway through Ontario, Claremont and Pomona is by far the most interesting piece of road between Redlands and Los Angeles. At least, that was our impression Saturday while making a round trip.

Never in modern times has the motorist had such a magnificent view of the California scenery. As you leave the old alignment of Highway 99 in the Guasti vineyards and veer toward Upland, the full sweep of the snow covered mountains stands before you. There is nothing to obstruct your view—bill boards, hot dog stands, or the like—and Mt. Wilson is almost centered in the view.

Splendid View

On the reverse trip, the scene is even more striking since the road rises on a series of fills through Pomona and Claremont. These elevations sweep away the usual clutter of roadside foreground and take your eyes out over the vast orange groves and to the steep and spectacular San Gabriel Mountains.

You suddenly realize that we have been hiding our much-acclaimed California scenery—that thousands of motorists have driven east from Los Angeles without ever seeing the beauty of our land.

(The accompanying observations on a recently completed section of the San Bernardino Freeway appeared in the column entitled "With a Grain of Salt," written by Frank and Bill Moore and appearing in a recent edition of the Redlands *Daily Facts*.—Editor.)

We have heard that on the Pennsylvania Turnpike the straightaway driving is so monotonous that tired motorists tend to become inattentive and accidents befall them.

The design of the Ontario-Pomona freeway, with its balance of cuts at one end and fills at the other, was not addressed to the problem of monotony and accidents. But the changing elevations certainly do lend interest and variety.

You are west bound on a road that is at ground elevation. Then it goes down into a big ditch for a mile or two, climbs back to ground level, goes up on a fill, back down to earth, up over another fill, and so on through Pomona.

Saturday Morning Trip

The road is a roller coaster with the ups and downs reduced to a gentle, pleasurable sensation.

It was 9 a.m. Saturday morning when we went through Claremont and the lack of traffic was little short of astonishing. But on a moment's reflection the reason is not hard to find.

The freeway was carrying very little local traffic. Those motorists were to be found elsewhere—on city streets.

On Saturday morning many people are using their cars to go to town for shopping and all of the other errands people do. The commercial district of the city becomes jammed and stays that way.

But on Saturday morning the weekend, holiday traffic is only beginning. The volume doesn't amount to much—not when put on a superhighway.

The visible separation of local and through traffic is something new and striking.

Traffic flows smoothly through the Claremont area, where the freeway is bordered by orange groves, subdivisions and palm trees. Note gentle rise and dip of freeway grade. View is east from Alexander Avenue.

County Road Bridge Designs

Standards Are Steadily Raised With State Help

By W. C. KIEDAISCH
Supervising Bridge Engineer

In the last eight years there has been a marked advance in the design and construction of county bridges. This advance is one of the more valuable results of the Federal Aid Secondary Program and is best illustrated by the excellent structures recently designed and constructed by county engineering staffs.

In allocating the federal funds to the counties, the states were assigned the responsibility of administering the expenditures. In California, the federal aid secondary projects are advertised and constructed as state contracts. This necessitates state standards as far as specifications, project plans and construction engineering are concerned.

All FAS projects are initiated by the board of supervisors through the county road commissioner and outlined in a project report and program. On projects which consist of, or include, a bridge the next step is a field review at the site made jointly by representatives of the Bureau of Public Roads, the Division of Highways and the interested county. At this review, the details of the structure are discussed and, if possible, fixed. Various types of structure suitable for this site are considered and, occasionally, the most economical choice must await estimates based on rough structure quantities required for practical alternate bridges.

Counties Do Good Job

Also at the field review, the county representatives indicate their ability with respect to performing the preliminary and construction engineering for the project and they are encouraged to assume those responsibilities. The counties usually have confidence in their ability to construct satisfactory roadways as controlled by their individual local conditions, but the majority are often wary of the technicalities involved in the design and construction of a bridge. The confidence and experience they have gained when they have performed the engineering on a structure have enabled them to raise the standards of construction, increase the economic life of their projects and they will ultimately reap the resultant financial rewards.

In most instances, the counties have been pleased with the talent buried in their own engineering organizations which was uncovered in the processes of handling the complete engineering for these projects. This talent was then available for use on projects involving county funds only and the result has been to raise the standard of county design and construction.

Cooperation From State

Close contact with the engineering staffs of the counties has been maintained by the Division of Highways to carry out a basic objective of the Collier-Burns Act of 1947 that the counties become as self-sufficient as possible in engineering their projects.

That great advances have been made in this respect is shown by the following comparison.

Of the 20 FAS bridge projects constructed or under construction by June 30, 1947, the counties designed 15 percent and furnished the construction engineering for 45 percent.

Of the 105 FAS bridge projects constructed or under construction by June 30, 1954, the counties designed 44 percent and furnished the construction engineering on 57 percent.

Many Types of Bridges

These bridge projects vary in total contract cost from $9,000 to $637,000. They also range in structure types from widening of a small bridge through movable bridges to those carrying expressways over major streams.

Following Division of Highways practice, two counties have recently initiated an expansion of their engineering organization to include a department primarily interested in recording the data pertinent to their existing bridges, with particular reference to their structural condition and adequacy for traffic. They also propose regular inspections of each structure in the hope that minor repairs will correct a distressed condition before it necessitates major repairs or structure replacement. From this information the counties will be better qualified to determine their present and future needs with respect to structures and distribute their construction and maintenance funds accordingly. As the counties expand this phase of their operations the maps produced for the county by the Highway Planning Survey should prove of great value.

Foundation Studies

Also following Division of Highways practice, the counties have recently tended toward obtaining foundation studies of proposed structure sites in order to ensure the most economic structure design and life. Often the lack of proper subsurface information has caused the destruction of or major damage to a structure long before it would be obsolete for other reasons. These cases can be suddenly embarrassing to the county owner in a political and financial way. Also, the cost of the foundation study is usually returned to the county in the shape of savings in foundation cost and construction.

... Continued on page 29

Horizontal Drill

New California Approach In Landslide Control

By A. W. ROOT, Supervising Materials and Research Engineer

THE AVOIDANCE, prevention and control of landslides constitute an important phase of highway design, construction and maintenance in California. There are numerous types of landslide, which have been variously classified according to kind of material, type of movement, causes and a great many other factors.

Probably the most prevalent type of landslide, and the one which is most troublesome to highway engineers in California, is the "slump" type. In this type of landslide the movement occurs along internal slip surfaces, and characteristically the surface cracks are concentric, and concave toward the direction of movement; the top surfaces of the moving blocks or units are often tilted backward toward the slope; the surface of rupture may approach an arc of a circular curve, concave upward, but the shape of the curve is greatly affected by any discontinuities in the material. Most roadway slipouts are slump-type landslides.

Causes of Landslides

The factors or conditions conducive to land movement are numerous, and it is seldom that one "cause" can be assigned to a landslide. Nevertheless, it is generally agreed that ground water is a major contributing factor in the vast majority of slump-type landslides in California. Ground water may act in several ways to induce land movement: the activating forces are increased by hydrostatic pressure or by seepage forces; in the presence of ground water, resisting forces are reduced by pore pressure or by lower shear strengths of the soil.

Interception and removal of subsurface water is often an effective method of preventing or controlling landslides, especially the "slump" type. One method of subdrainage used extensively in California consists of installation of horizontal drains, which are 2-inch perforated pipes placed in drill holes bored into a slope. The drains are usually 100 feet to 300 feet in length, and on gradients varying from 1 percent to 20 percent. Horizontal drains are frequently, but erroneously, described as "Hydrauger" drains. "Hydrauger is the proprietary name of one type of drill used for installing horizontal drains.

One of the principal advantages of the horizontal drain method of controlling landslides is the relatively low cost compared to other methods of stabilization. The use of horizontal drains is restricted to soil formations which can be drilled economically with available drilling equipment. Constant efforts to improve methods and drilling equipment have made possible the economical installation of horizontal drains in all but the most difficult formations.

Hydrauger and McCarthy Drills

For several years all of our drilling was done with "Hydrauger" equipment and some of these units are still in use. Diamond * drill A-rods are used with these drills; all of our earlier drilling was done with fish-tail or auguer-type bits having tungsten carbide inserts. These bits were made up in our own shops. When small size oil-field type roller bits became available we experimented with them and found them greatly superior to the fish-tail and auger bits

* This is a name designating standard core drill fittings, which may be used with any type of drill bit. Diamond-set bits, although used for coring solid rock or concrete, are not normally used for drilling horizontal drains.

UPPER—4½-inch rock bit, 3⅛-inch rock bit, and 4-inch fish-tail bit with tungsten carbide inserts. LOWER N-rod coupling and A-rod coupling.

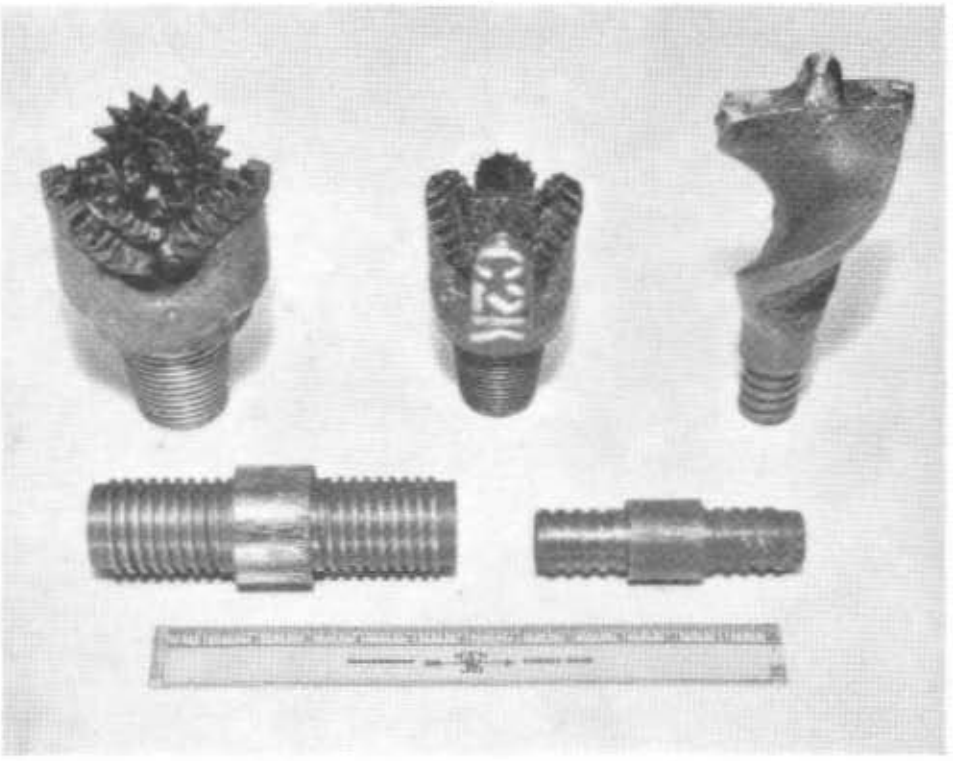


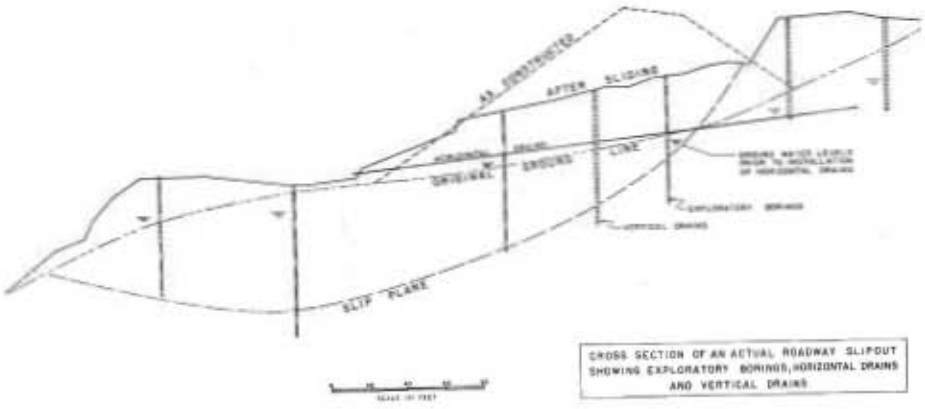
FIGURE 1

for drilling rocky formations. Accordingly, we adopted the roller-type bit for all drilling except in rock-free earth. *Figure 1* shows the rock bits and fish-tail type bit.

Adoption of the roller type bit enabled us to drill to greater depths and through more difficult rock formations which could not be penetrated with the fish-tail and auger bits previously used. But at the same time the more difficult drilling increased power requirements and caused greater stresses on both the drill rods and the drill unit. As a result, breakage of the A-rods became excessive, and it was found that the Hydrauger air motors did not supply sufficient power. The type of drilling which we do with the rock bits appeared to require a more rugged and more powerful drill unit than the Hydrauger which had been used exclusively in the past.

Heavier Drilling Equipment

Our first attempt to use heavier drilling equipment was with the McCarthy Rock Boring Machine shown in *Figure 2*. This drill, which was designed for use with continuous helical augers, drills rapidly in earthy formations, but cannot drill to depths greater than about 150 feet, nor will it penetrate broken rock formations. By means of a water swivel fabricated in Headquarters Shop of the Equipment Department the McCarthy machine was converted to a rotary type drill, using diamond N-rods and a 4½-inch roller type rock bit. *Figure 1* shows the relative sizes of the A-rod and N-rod. The converted machine operated very satisfactorily, and we found that the use of heavier drill rod, the hydraulic feed and superior power all were advantageous. This machine, however, had one serious drawback: when using the machine for forcing the casing into the drilled hole, the casing must be in front of the drill carriage, as the design of the machine prevents working through a chuck; this necessitates using lengths of casing which can be inserted between the carriage and outlet end of the drain at the ground surface. In restricted working areas it is necessary to use five-foot lengths of casing, with a correspondingly large number of field welds. Also the McCarthy machine is somewhat larger and more powerful than necessary for the rotary drilling work on our drain installations, which results in some sacrifice in mobility.



CROSS SECTION OF AN ACTUAL ROADWAY SLIPOUT SHOWING EXPLORATORY BORINGS, HORIZONTAL DRAINS AND VERTICAL DRAINS

Development of Improved Machine

We could find no drill rig on the market designed specifically for drilling holes for horizontal drains, and none which satisfied our requirements. We desired a drill rig incorporating the following features: the drill unit should be complete with a gasoline engine of adequate power; a suitable transmission to permit control of speed of rotation over a wide range; a hydraulic feed with a minimum stroke of six feet, capable of exerting a 4,000-pound thrust; provision for slowly rotating the casing concurrently with the jacking operation when necessary; a chuck readily interchangeable for A-rod, N-rod or casing and so designed that long lengths of rod or casing can be operated through the chuck; rugged but easily operated spuds for maintaining alignment and grade of the drill; rubber-tired wheels and three-point suspension to permit sharp turns; and, finally the over-all length not to exceed 12 feet and the weight of the complete drill to be not more than 3,000 pounds.

New Machine Designed

The Materials and Research Department had for several years realized the need for such an improved horizontal drill, and as no completely suitable machine could be purchased, it was decided to design and build a drill unit specifically for horizontal drilling. Accordingly, the Equipment Department was requested to design and build a machine meeting the specifications outlined above. As a result of this request Mr. Jim Keleher, equipment design engineer, was assigned by

McCarthy rock-boring machine with helical auger and drill head

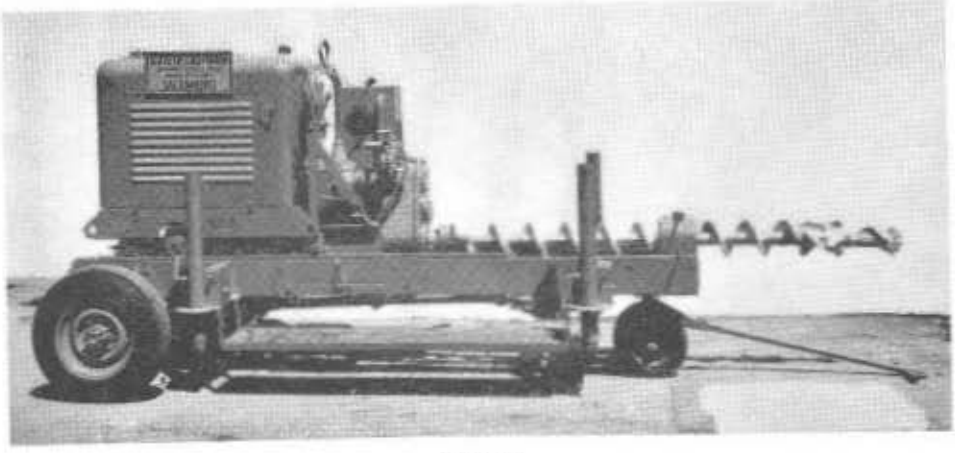
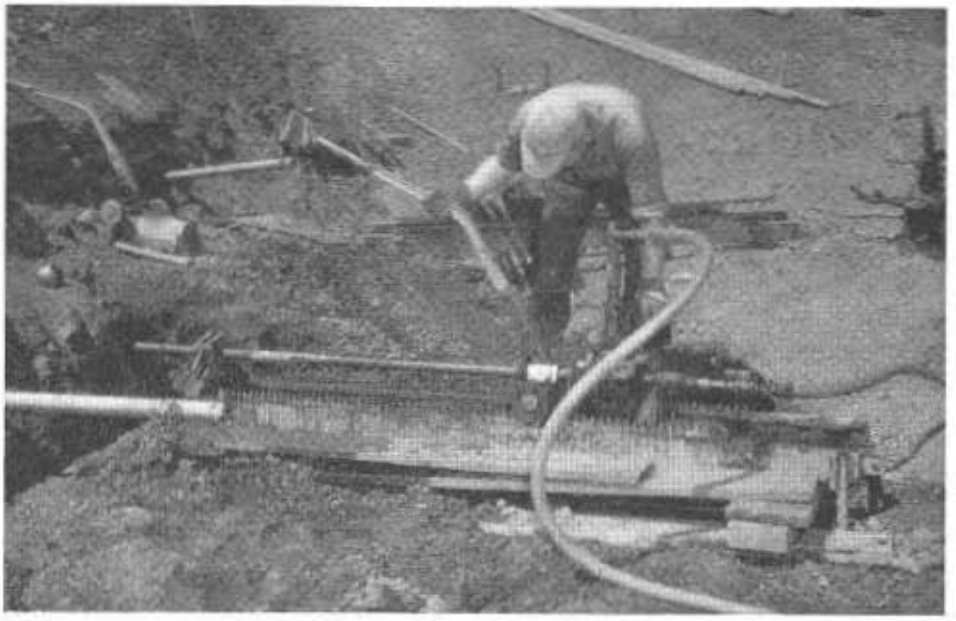


FIGURE 2

Equipment Engineer Earl E. Sorenson to do the job. Mr. Keleher, with the cooperation of the author and other personnel of both the Equipment and Materials and Research Departments, began designing the rig in January, 1954. By March, 1954, the final drawings had been completed for a machine having the desired features and meeting our specifications; on June 30th the shop had completed its construction.

The new drill rig, for the most part, is comprised of standard or proven parts or subassemblies similar to those used in manufactured drills. The machine is unique because it incorporates the desirable features of various machines into a light-weight, compact drill rig especially suitable for the type of drilling required for installation of horizontal drains. The power unit is a 20-h.p. Wisconsin four-cylinder, air-cooled engine, connected through a fluid drive to a four-speed Ford transmission. Rotation of the chuck is accomplished by a gear train from the transmission enclosed in an oil-tight housing. The entire drive assembly is mounted on a hydraulically operated carriage with a travel of six feet. A Vickers 10-gallon-per-minute oil pump, driven by the Wisconsin engine, supplies oil to two hydraulic cylinders, by means of which the thrust can be controlled at any desired feed pressure up to 4,000 pounds.

FIGURE 3
California horizontal drill with drill rod and bit in drilling position



Hydrauger drill in operation

California horizontal drill with casing in chuck

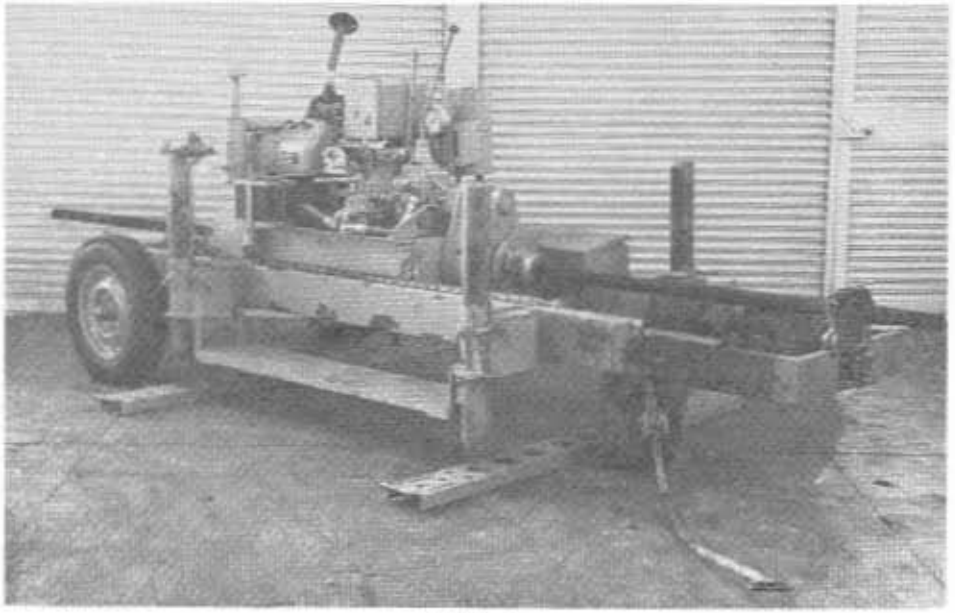


FIGURE 4

Special Chuck Assembly

A specially designed chuck assembly was required to permit the use of long lengths of drill rod or casing, and to provide for interchanging chucks for different size rods. Standard A-rod and N-rod chuck heads are used, with a shop-designed chuck holder which permits quick change of chuck heads. A special chuck for gripping the two-inch casing is used in the same chuck holder. The completed drill rig is shown in *Figure 3 and Figure 4.*

During the design of the machine many difficulties were encountered. Because these problems were solved

on the drafting-board rather than by cut and try methods, very few modifications were required after the machine was fabricated. The cost of constructing the drill did not exceed the preliminary estimate.

On completion of the drill rig it was taken to American Canyon on U. S. 40 in Solano County for its first operational test. During this test it performed satisfactorily, and has since been used on two other horizontal drain jobs. One of these installations was in District V on San Marcos Pass where the new California horizontal drill rig was used exclusively. Eighteen drains were installed at this location, five of which were 300 feet or more in depth and 7 others at least 250 feet deep. This drilling was done at a very reasonable unit price, comparatively speaking, and the drains were very successful in intercepting the subsurface water. The ease with which this work was accomplished by the new drill rig was a new experience and a great satisfaction to every one associated with it.

As was expected, operation of the new drill revealed some "bugs"; however, only a few minor changes were found necessary and these are currently being made. The satisfactory performance of this first drill unit and its freedom from defects attest to the soundness of design and the high quality of workmanship. All personnel who participated in the conception, design and construction of this new horizontal drill are to be commended for their ability and efforts.

COUNTY ROAD BRIDGES

Continued from page 25 . . .

The final proof of the value of the program is the quality of the bridges recently designed and constructed by the more rural counties on county roads without any aid from federal, state or other agencies. These examples prove that these counties can, on their own initiative, construct adequate, economical, modern structures which will compare favorably with those constructed by any other agency.

Highway Unit Has Woman Road Planner

Quite a "drawing attraction" they have in District VII of the State Division of Highways here * * *

She is Miss Marilyn Jorgenson, 28, and blonde. She also holds the distinction of being the only fully licensed and registered female civil engineer in the entire state-wide Division of Highways. She is the only woman in the entire division holding a rating of associate highway engineer.

Miss Jorgenson is in the design section of the highway headquarters here. Which means that she designs freeways—ramps, gradings, drainage, rights of way. Everything but bridges. The job also entails estimating, tons of technical reports, and comparative studies. Her immediate supervisor is Jess Reynolds, senior engineer in charge of the design section.

Minnesota Grad

Right now, she is wrestling with a five-mile section of the San Diego (Sepulveda) Freeway in the vicinity of Venice. On this job, she heads what is called a "design squad." In addition to herself, it includes an engineering aide, a delineator, and a junior engineer.

The pretty young woman, of Scandinavian extraction, graduated from the University of Minnesota in 1948 with her bachelor of civil engineering degree.

Why did she take up civil engineering?

"Well," she explains simply, "I like mathematics and I didn't want to be a teacher."

Miss Jorgenson and her parents moved to Los Angeles shortly after her graduation and she went to work for the Division of Highways.

MARILYN JORGENSON

Holds Chapter Office

It wasn't until last summer that she was able to take a two-day examination that resulted in her license as a full-fledged civil engineer. This is because six years' experience is required before an applicant is eligible to take the stiff licensing exam. There were 1,500 applicants taking the test and, as you might imagine, Miss Jorgenson was the only woman among them.

So, they're pretty proud of her over at the Division of Highways. And all her other conferees also must regard her rather highly. They've just elected her secretary-treasurer of the transportation group of the Los Angeles Chapter of the American Society of Civil Engineers.—*Art Ryon in the Los Angeles Times.*

TRAFFIC STRIPING

Traffic lines were painted and maintained on about 11,500 miles of state highways during the 1953-54 Fiscal Year. The cost, exclusive of work performed by cities, was $716,105, including the painting of pavement markings.

BETTER SIGNAL LAMPS

The Division of Highways now uses traffic signal lamps with a guaranteed life of 6,000 hours instead of the previously specified 4,000 hours. This permits replacement of lamps on an eight-month instead of a six-month schedule.

Prestressed Girders

San Bernardino-Santa Ana Freeway Bridge Interchange

By WARREN B. JAMES, Resident Engineer

The Route 26/2 Separation, which will provide for improvement of the interchange facility between the San Bernardino Freeway and the Santa Ana Freeway is located in the City of Los Angeles in the vicinity of Aliso Street on the easterly side of the Los Angeles River. The existing facilities are lacking in provision for direct interchange for westbound traffic from the San Bernardino Freeway to the Santa Ana Freeway. The new bridge being constructed will provide for this direct interchange.

The interchange structure is built to span the four existing freeway arteries and their two connecting ramps and the rather unusual interweaving of roadways at this point has called for many innovations in design and construction.

Construction work under these conditions presents many interesting problems for both the contractor and the engineer.

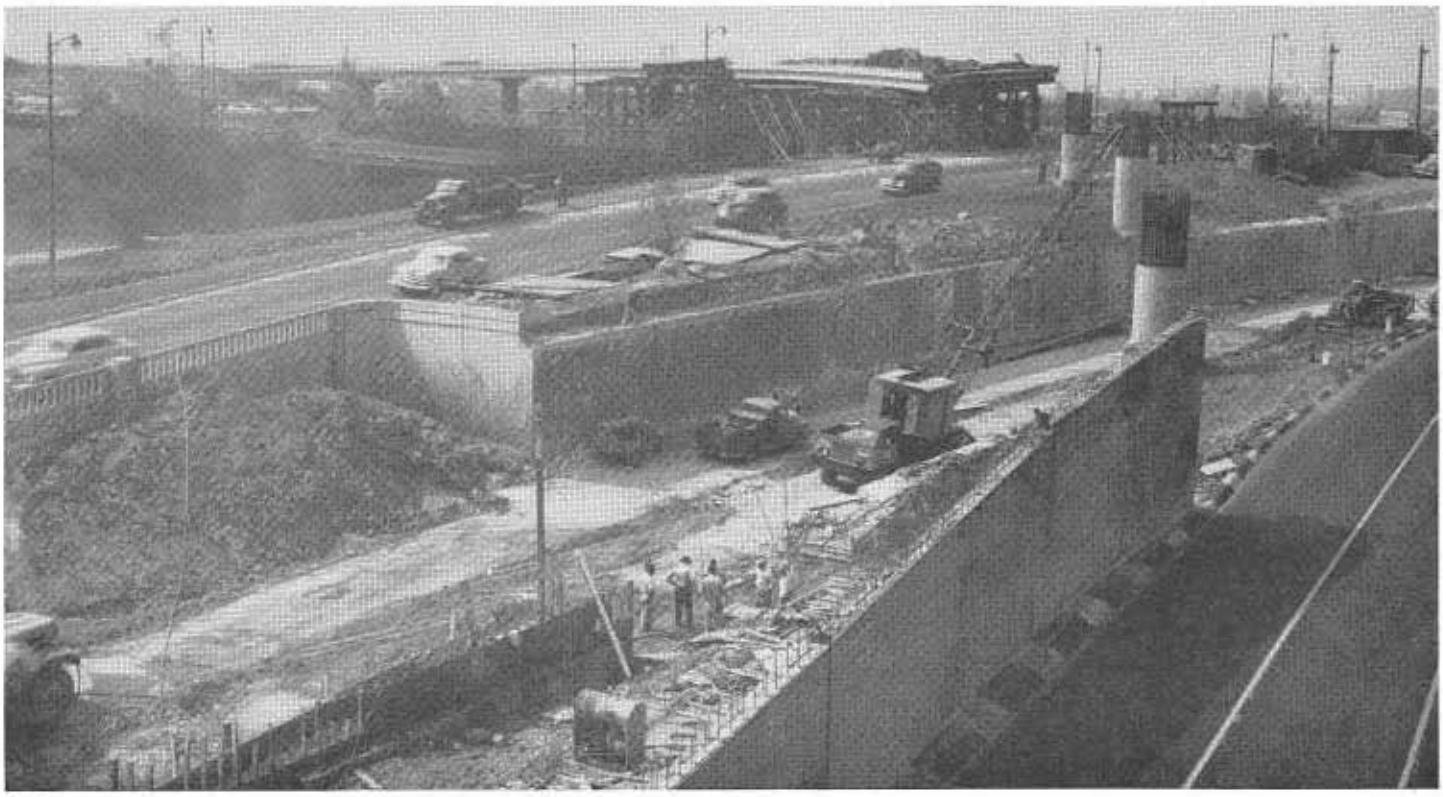
Detours Required

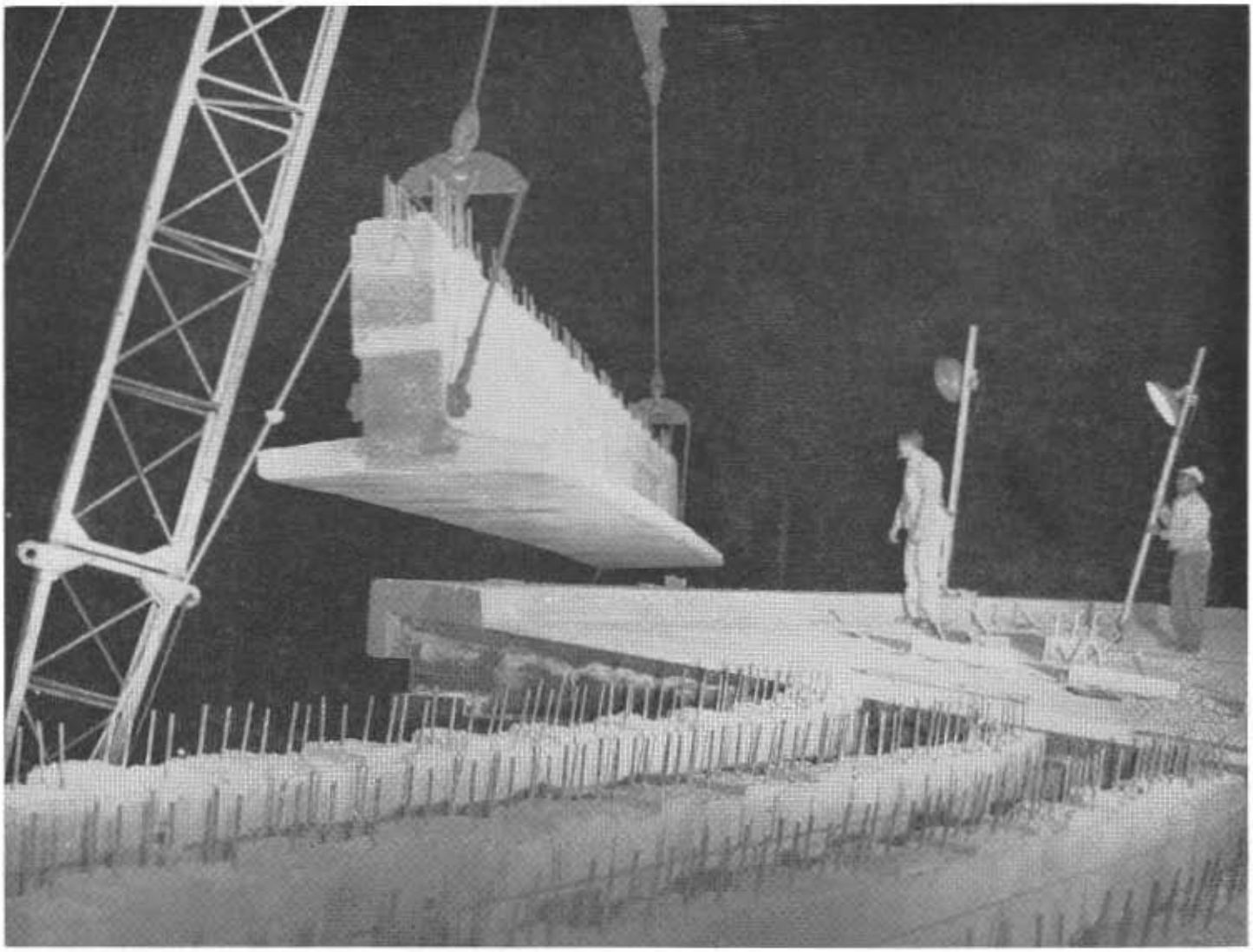
Problems for the contract began with the start of the job. The first was that of providing a detour for the westbound San Bernardino Freeway in a space only wide enough for two lanes of traffic. The limiting factor was the space available under the Macy Street Bridge where the Pacific Electric Railway occupied the major portion of the area with a main line freight track. The need for a three-lane detour to take care of the three lanes of freeway traffic was considered so urgent that conferences were called with the railway to evolve some method of alleviating the situation. The railway finally agreed to move their tracks into a restricted clearance position thereby providing enough space for an additional nine-foot lane. With the resulting 28 feet of width three narrow lanes were provided which although below the standard width of 12 feet, actually handled traffic in a quite satisfactory manner.

Tunnel Walls Removed

The detour was tied in with and was a part of one of the larger contract items, that of removing the top and one side of the old Pacific Electric Railway Underpass for the westbound San Bernardino Freeway. As soon as the above detour was finished and traffic switched over to it the contractor moved in with a battery

General view of the separation as seen from Macy Street Overcrossing





Lifting prestressed girder into place

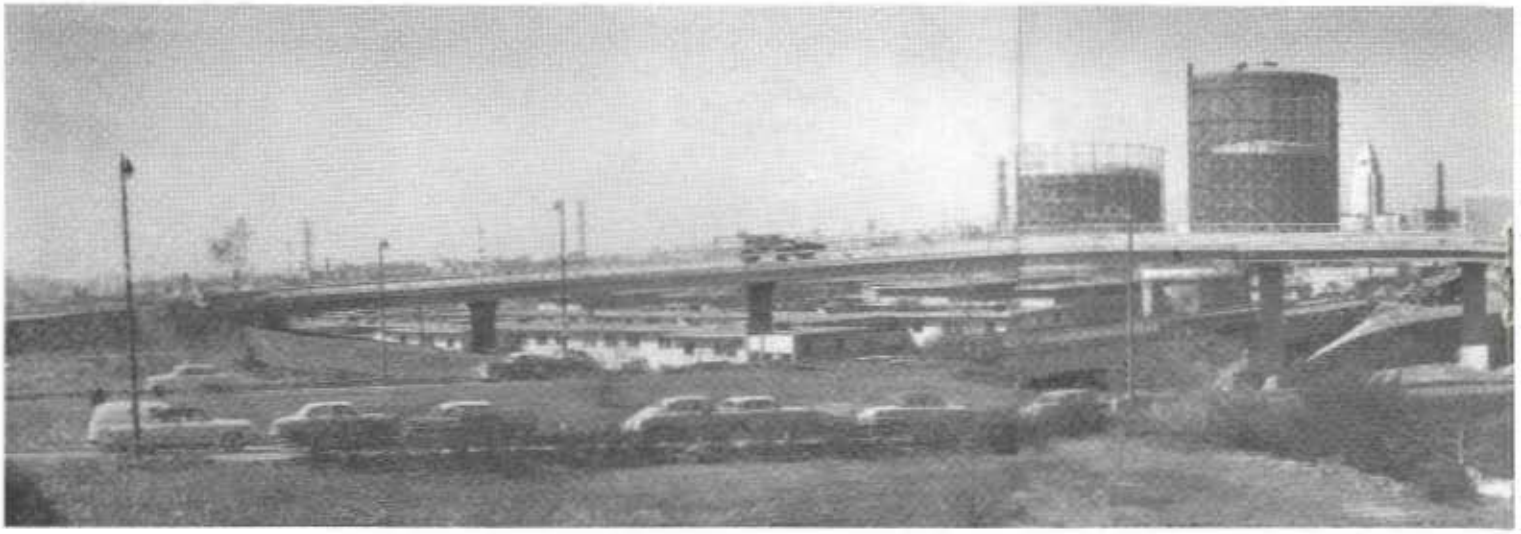
of 3-inch pneumatic rock drills which were put to work on the side walls of the tunnel and approach. Following this the roof of the tunnel was cleared of earth overburden and a steam pile hammer fitted with a special cutting bit, and handled with the usual pile driving rig, was set on it for breaking up the slab. This top averaged three feet in thickness and was heavily reinforced. The pile hammer and bit broke out the concrete in sizes generally easily handled. About 100 tons of reinforcing steel was salvaged as scrap. The walls, on the other hand, were principally of gravity type and without reinforcing. They varied from about four feet thick at the top to 12 feet at the bottom.

The drills were used to outline the walls in rectangular blocks about six feet square with holes spaced closely together. The outlined blocks were then broken out by use of internal hydraulic jacks which were run into the holes about two-foot centers and expanded. Those blocks which were too large to handle were reduced to size by means of a swinging ball. Due to the proximity of sewers and storm drains the specifications prohibited dropping a ball. In total about 3,000 cubic yards of concrete were removed at a contract cost of over $60,000.

Restricted Working Conditions

One of the most obvious over-all problems on the job was that of limited working space. The only areas available for operations on most of the work were the narrow strips of planting area between the ramps and roadways. Coupled with this, due to traffic conditions, the contractor's operations in the roadways were limited in the daytime to the hours between 9.30 a.m. and 3.30 p.m. and at night from 6.30 p.m. to 6 a.m. He was also restricted from placing falsework in the freeways and in the ramps. His only access to the work was over the congested freeways and all equipment moved from spot to spot had to be flagged through traffic.

The separation structure is 798 feet long between abutments plus 145 feet of a concrete cellular approach structure on the east end. It also included several hundred feet of paving at each



Panorama view of separation structure taken from center of radius point. In center is view of central portion

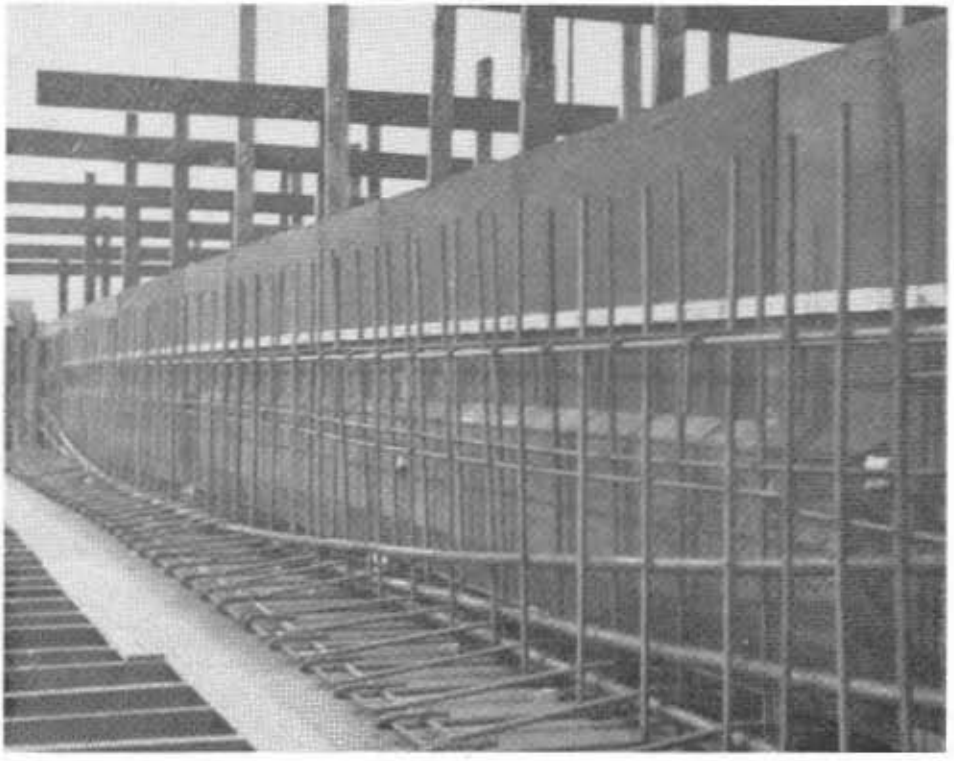
end and beneath the structure. The bridge is 28 feet wide between curbs and is on a 370-foot centerline radius curve. It has a maximum superelevation of 10.5 percent and maximum grade of 8.5 percent. Incorporated in the structure near its center are two prestressed girder spans over the eastbound San Bernardino Freeway and the eastbound Santa Ana Freeway.

Prestressed Girder Construction

The prestressed girders are 48 feet long and 16 in number. They were cast on the ground, prestressed and hoisted into place where diaphragms, facia girders and deck were poured on them. The remaining spans of the bridge were of the usual box-girder type and poured in place. Some of the falsework required for these was over 40 feet high. The deck spans were all supported on single round reinforced concrete columns six feet in diameter.

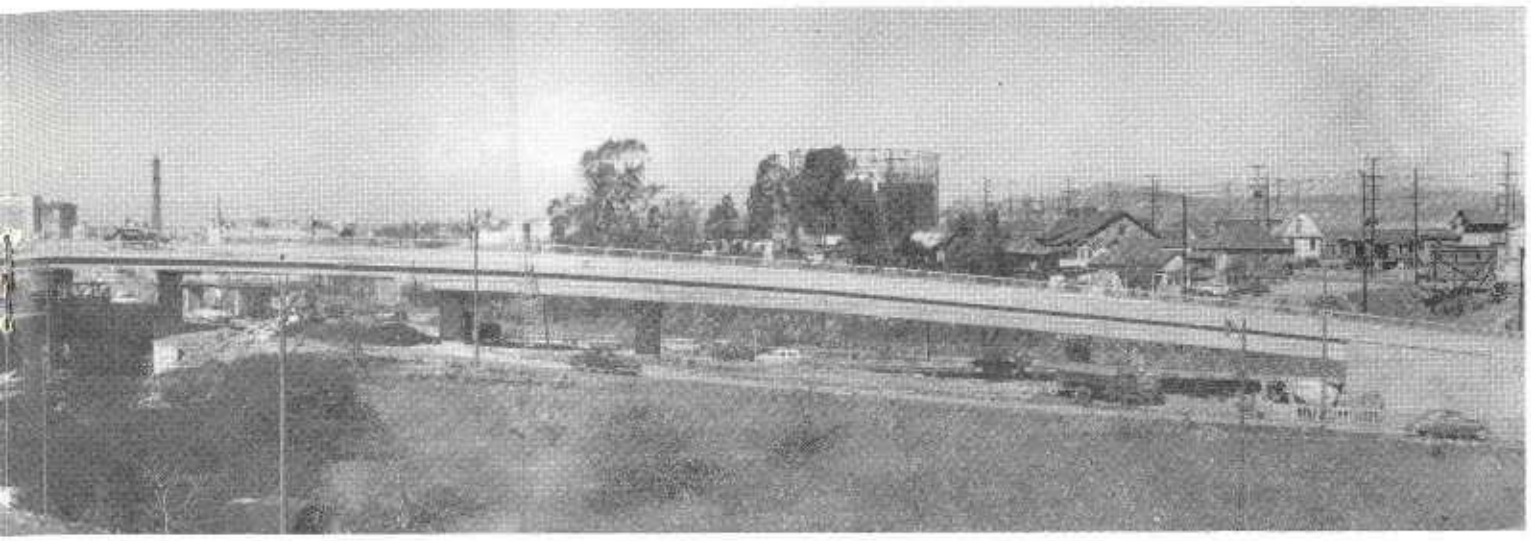
The prestressed girder spans were perhaps the most noteworthy innovation on the structure. They were designed as inverted T-beams on which the deck was to be poured after erection. The bottom flange was 3 feet 8 inches wide and varied from 6 inches thick at the stem to 4 inches thick at the outside edges. The stem was 3 feet high by 1 foot thick at the ends and having a 6-inch wet thickness through the center section of the girder. The stem had step keys on top to key into the deck which together with the protuding stirrups securely bonded the two together. At the girder ends bearing angles were cast in a step at the approximate half height of the girder so that the girder could be hung on the supporting bearings cast in the adjacent spans. These beam bearings were set on the approximate 10 percent superelevation of the deck so that the beams would hang with their bottom flanges parallel to the soffit of the adjoining box girder sections.

Cables and shear reinforcement



High Strength Concrete

The wide and thin bottom flange of the prestressed girders contained ½-inch shear and temperature bars on 12-inch centers which made the girders hard to pour. Both high strength and workability were demanded in the concrete and this was obtained by the use of seven sacks



n of bridge showing the three levels of freeway separation at this point. Los Angeles City Hall in background.

of cement per cubic yard. A working strength of 4,000 pounds per square inch was obtained and girders were all poured without rock pockets appearing.

Prefabricated and prestressed concrete girders were used over the freeways primarily to eliminate the necessity for falsework in the streets but also the use of concrete carried out a uniformity in line and materials that blended with the rest of bridge. The necessity for keeping the freeways open at all times is quite obvious when viewed at the site. By the latest count, each of the four legs of the freeway carries between 38,000 and 40,000 vehicles per day.

Traffic reaches a peak in the morning and again in the afternoon but is very heavy throughout the day. It lightens somewhat at night particularly after midnight but it still remains a great hazard for contract work due to the increased number of trucks and their high speed. The contractor selected the night period for his girder erection operations on the two spans which he accomplished on two occasions several weeks apart. The eight girders in each span were set in from five to six hours.

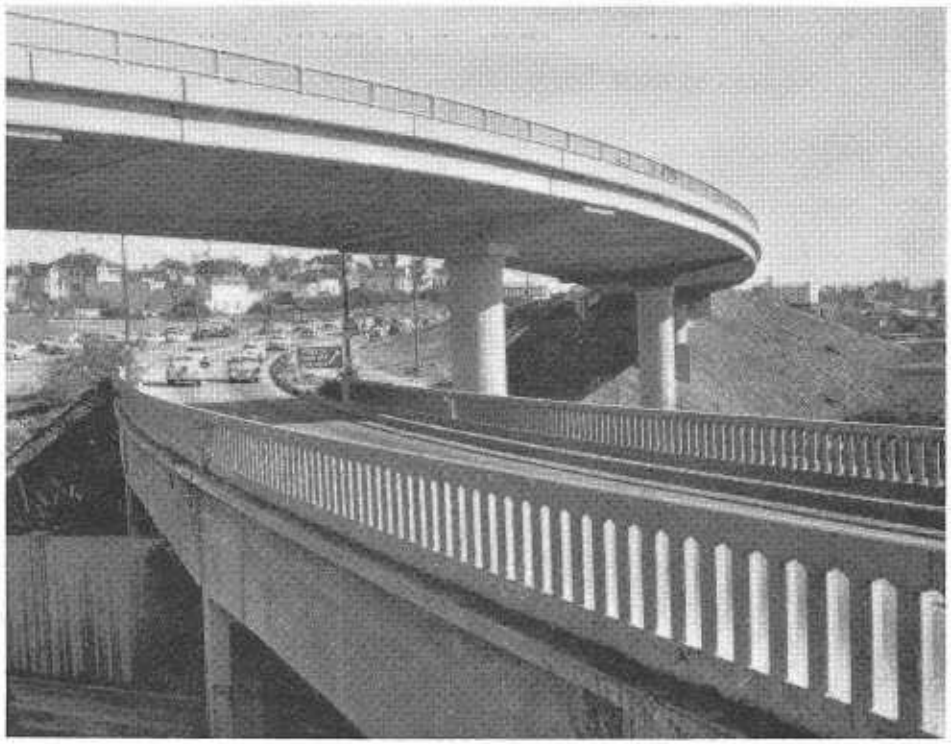
Economies Effected

In general it should be stated that prestressed girders save considerably in materials over the conventional reinforced concrete girder designs. The entire depth of the girder is utilized in compression rather than just the top one-third thus allowing the beam to be reduced in section. The required steel is reduced as much as 75 percent for main reinforcement by the use of high tensile steel wire. Although the conventional steel shear bars are still required the over-all steel saving is relatively large.

The prestressed beams on this contract contained three prestressing cables. Two of them contained 10 wires each and the third 12 wires all of ¼-inch diameter and each group enclosed in a flexible metal sheath. These units were equipped at each end with a 4 x ⅞ x 7 inch steel bearing plate and a 2½-inch round by 1¼-inch threaded pulling unit having 5/16-inch holes through which the

. . . Continued on page 36

Prestressed span over the eastbound Santa Ana Freeway bridge and the on-ramp for the eastbound San Bernardino Freeway below, showing the three-level separation at this point. View also shows bottom flanges of the prestressed girders and the general shape of the girder step bearings.



Lexington Dam

State Constructs Curved Spillway Chute Extension

By G. W. DUKLETH, Associate Engineer,
Design and Construction of Dams, State Division of Water Resources

THE DEPARTMENT of Public Works, under authority contained in the Joint Exercise of Powers Act, designed and recently completed the construction of a reinforced concrete spillway extension at Lexington Dam. This construction was deemed necessary, and recommended by the Division of Highways' Joint Bank Protection Committee, as the least expensive method of preventing undercutting and possible failure of an embankment on State Sign Route 17 during periods of spillway operation. State Sign Route 17 is the Los Gatos-Santa Crub Highway.

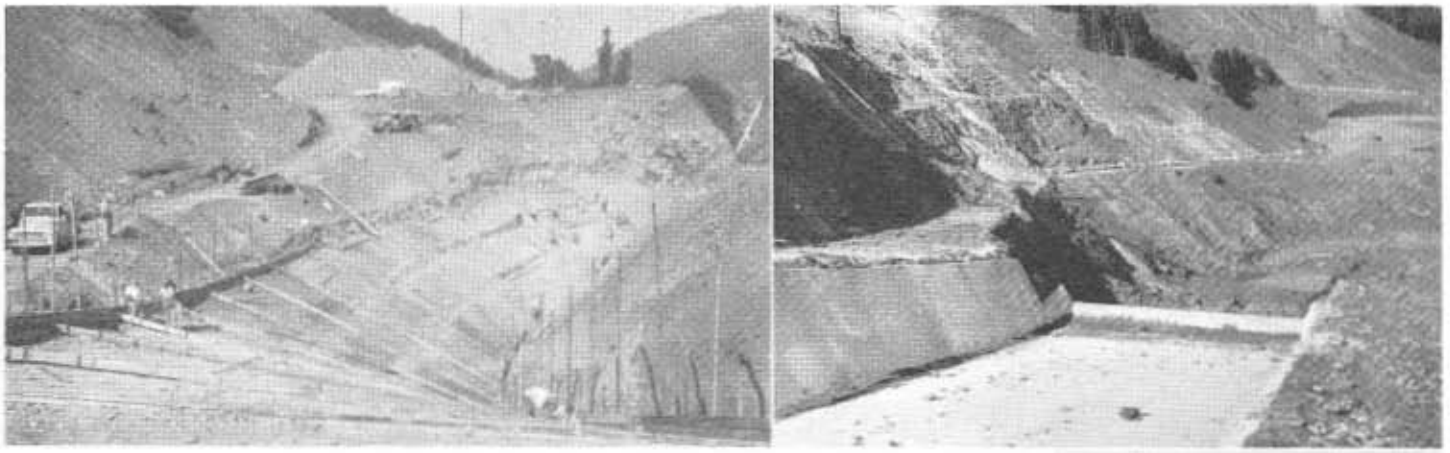
Lexington Dam, a rolled earth structure 190 feet high, is located in Santa Clara County about one mile south of Los Gatos on Los Gatos Creek. The dam and reservoir are the property of the Santa Clara Valley Water Conservation District. Prior to construction of the dam the state highway ran through the reservoir area. The highway was therefore relocated to pass above the left abutment of the dam and the new road was opened for traffic in December, 1951. The relocation work was financed by a special legislative appropriation.

Acting in accordance with state law governing supervision of dams, set forth in Division 3 of the Water Code, the State Engineer gave approval for the construction of Lexington Dam. Construction of the dam began early in 1952 and was completed December 29, 1952. Close inspection of construction of the dam was carried out by the Dam Supervision Section, Division of Water Resources. During the course of construction a large earth slide occurred, the boundaries of which extended into the proposed spillway location, making the spillway relocation imperative. In order to achieve suitable foundation conditions the spillway was relocated nearer the new highway.

Highway Safeguarded

The original concrete lined spillway was designed to terminate in a ski jump or bucket structure on the left abutment approximately opposite

LEFT—Aerial view of Lexington Dam reservoir, with realigned highway on right. RIGHT—This aerial shows realigned highway on left with old highway in center right.



LEFT—Final grading and drain excavation looking downstream. RIGHT—Looking down on flit-bucket terminus of original chute. LOWER—Floor of chute extension about half complete. Looking upstream.

the toe of the dam and near the toe of the highway embankment. The bucket, which directs the water mass in an upward direction, is a device for the dissipation of hydraulic energy.

Impact of the falling water at the toe of the highway embankment, with resultant eddies and turbulence, might well have undermined the embankment and have endangered the highway. Dam supervision personnel recognized the hazard, brought it to the attention of the Division of Highways, and recommended that steps be taken to safeguard the embankment below the relocated highway. The possibility of providing a retaining wall structure was explored by the Division of Highways but was rejected because of the lack of adequate foundation bedrock. It was finally decided that construction of an extension of the originally proposed spillway was the best solution to the problem.

An agreement was reached wherein the Department of Public Works agreed to design and award a contract for construction of the spillway extension and a spillway crossing. As its part in the project the Santa Clara Valley Water Conservation District agreed to secure the necessary rights of way, prepare topographic maps, and amend its application for the construction of Lexington Dam to conform with the revised spillway plans. Sufficient funds were available out of the original legislative appropriation for the highway relocation to finance the extension of the spillway.

The design and specifications for the project were prepared by the Dam Supervision Section of the Division of Water Resources as a party in the agreement. Unusual problems in hydraulic design were involved. From the bucket of the existing spillway, water had to be guided 105 feet vertically and 250 feet laterally to be returned to Los Gatos Creek.

Extension Chute Design

Principles of railroad engineering were used in design of the spillway extension chute. The topography made a short radius of curvature necessary. A compound curve was used beginning with a 180-foot third degree railroad spiral leading into a circular curve of 344-foot centerline radius. Two vertical curves were necessary in the spiral transition.

The spillway, as originally constructed, had an 18.33 percent grade with a bottom width of 40 feet and 11-foot sidewalls on a ½ to 1 sideslope. The bucket was removed and the exposed reinforcing steel bent down into the extension concrete. In the extension section, the bottom width was maintained at 40 feet and the 11-foot sidewalls transitioned to the vertical. The centerline grade was a maximum of 28.5 percent. The length of the reinforced concrete extension lining was 424 feet. The curved and superelevated extension chute drops the water 50 feet. From the end of the concrete lining there is a free fall of 55 feet into the streambed.

The steep grades produced a maximum flow velocity of about 75 feet per second which with the short radius of curvature required a highly superelevated chute floor slab. The superelevation, a function of the velocity and of the radius of curvature, is nowhere constant from one cross section to another. The flow characteristics are those which exist in a free vortex where the velocity multiplied by the radius is equal to a constant. Since the elevation of the floor slab is established from velocity head considerations, the cross section superelevation becomes parabolic in shape. The maximum average superelevation is 1.88 horizontal to 1.0 vertical.

Sidewall Height Determined

The superelevation for the spillway extension was designed for a flow of 10,000 cubic feet per second as a median flow condition. The original spillway structure was designed for a maximum flood flow of 20,000 cubic feet per second and this flow

View of completed spillway extension

was analytically routed through the extension to determine the necessary sidewall height and proper functioning. Similar determinations were made for low flow conditions.

In conditions of high velocity flow, swelling of the water mass occurs due to air entrainment. A conservative entrainment factor of 30 percent was used to account for both swelling and wave action and in determining the sidewall freeboard.

Shallow concrete shear blocks set below the grade of the floor slab and sidewalls in the spillway extension act as keys to prevent movement of the structure on the steep grades. An extensive drainage system is used to eliminate uplift forces.

A short single lane reinforced concrete bridge, designed for heavy maintenance equipment loading, crosses over the spillway extension. The bridge makes it possible to reach the dam which would otherwise be isolated from the highway during periods of spillway operation. A T-beam deck structure continuous over four supports was used. The main central supports are T-stem columns.

The Division of Highways opened bids for construction of the spillway extension on July 14, 1954. The construction firm of Dan Caputo of San Jose was awarded the contract for a low bid of $93,920.

Difficulties Encountered

The construction was difficult both in excavating to the superelevated grade and in the placing of concrete on those grades. In forming for the slab, screeds were set at 20-foot intervals and strike off made on such centers where possible. The warp in some panels made it necessary to set dummy screeds at five-foot intervals. The concrete was vibrated until it started to flow down the slope. Strike off was made by manually pulling the strikeoff board up the slope. An unsuccessful attempt was made to pull the board up the slope by winching.

Concrete was made at the site utilizing imported dry batches and a mobile mixer. Placement was by the use of a truck crane. An air entraining agent was added to the concrete for greater durability, water tightness and workability.

Field personnel of the Bridge Department, Division of Highways, directed the execution of the contract.

SALES TAX ON OIL

Californians paid $3,522,000 in state sales tax on automotive lubricating oil in 1953.

PRESTRESSED GIRDERS

Continued from page 33 . . .

high tensile wires were threaded and held from pulling out by heads cold pressed on the wires. This assembly was completed in the shop and the units were received in the field ready for installation in the forms. This method was very good from the standpoint of assembly in the field although it did lack some of the flexibility of certain other prestress methods. The ease of stressing cables and the positive check on the stress afterwards was very good.

Stresses Applied and Checked

Cables were stressed after the concrete had reached a strength of 3,500 pounds per square inch as indicated by test samples. Two hydraulic jacks of 50-ton capacity were used, one on each end of the cable. They were fastened to the cable by means of the threaded pulling unit or stressing washer enclosing the wires. Jacking was done simultaneously with both jacks keeping them balanced to avoid displacement of the cable longitudinally in the girder. A maximum of approximately 35 tons to 40 tons was placed on the cable depending on the number of wires enclosed. Shims of predetermined thickness were inserted behind the stressing washers and the stress transferred to them by releasing the jacks. Where for various reasons a variation in thickness of shims was found necessary there were ⅛-inch and ¼-inch shims applied.

Pressure gages on the jacks gave a check on the stress being applied and the balancing of stress on each end offered a check between jacks. After the cables were stressed the void in the sheath around the wires was filled with a neat cement grout (without sand) at from 60 to 100 pounds pressure. The final operation was to cover the ends of the cables by filling the recesses in the ends of the girder with a cement-sand dry pack. Levels taken on the girders during stressing operations revealed a rise at the center of only ⅛ inch. This indicated a relatively stiff member which quality was also borne out during the later handling operations.

. . . *Continued on page 63*

Improvement

Highway 99-97 Cutoff Is Completed Under FAS Program

By OREL E. LEWIS, Siskiyou County Road Commissioner

COMPLETION of the 19-mile cutoff route between U. S. Highways 99 and 97 in Siskiyou County marks another chapter of highway progress in the northernmost region of California.

Destined to become one of the major highway links along the southern fringes of the northwest territory, the route as early as 1833 was used as the north-south route by trappers with the Hudson's Bay Company. Later it was used extensively by wagon train parties migrating into the area via the Immigrant Trail and the Military Pass Road. Even before the 1800's, the ideally located pass between a maze of buttes and mountains developed into the natural trail crossing junction of the Pit and Shasta Indians.

With a substantial portion of the construction cost having been borne by federal-aid secondary funds, the 22-foot wide, asphalt-surfaced thoroughfare now stands as a monument to highway construction programs of recent years. Driving with ease across this stretch today, one would hardly believe the highway is the culmination of more than 100 years of violence, sacrifice and road building under the most adverse conditions.

Wagon Road Begun

Just about 20 years after the passage of the Hudson trappers through the Sheep Rock country, now the location of the eastern end of the cutoff, Colonel James L. Freanor and a group of surveyors undertook construction of a wagon road near the site of the present cutoff. The road was designed to provide a route into Yreka from the more southern Pit River trail which led into Red Bluff. Work was discontinued after only slight progress when in 1852 five members of the survey crew were massacred by the Pit Indians.

Despite the ever-present danger from both the Shasta and the Pit Indians, the route around the base of Sheep Rock remained the preferred passage from the south into Oregon. It also continued as the established trail for those migrating west into Northern California. In 1855 Sam Lockhart led a wagon train of migrating Mormons through Yreka, across the trail which is now the Highway 99-97 cutoff, and down the Pit River trail into Red Bluff.

By that time Sheep Rock was a well established landmark for migrants traveling in all directions throughout Northern California and Southern Oregon. The rock is plainly visible from the left side of U. S. Highway 97 when traveling north from Weed. It is located about 12 miles north of weed.

Rugged Terrain

Evidence along the top of the 1,700-foot high rock indicates that immigrants on some occasions missed the pass and took the more difficult route to the plains leading into extreme Northern California points and in Southern Oregon. Until recent years, trees with deep rope burns stood atop the rock to proclaim that a wagon party had missed the pass when moving southward. The Soule party in 1851 pushed up the north side of the route and deep-burned the trees when lowering their wagons down the south slope with ropes. The Soules still live in the area, now working one of the prosperous Shasta Valley ranches along the cutoff.

Beginning in 1856, the California-Oregon stage lines established routes through Shasta Valley and the present site of the cutoff highway. Due to constant Indian threats and intermittent killings, the schedules were not regularly maintained and were discontinued several years later.

Had Many Names

By 1857 the Shasta Valley Route, then known as the Pit River Road and now as the Highway 99-97 cutoff, was heavily traveled as the main north-south route in California. In that year the Government assisted with advancing and maintaining the road, charging Judge A. M. Roseborough with laying out its alignment. It became known as the Military Pass Road, and it seems paradoxical that the road's decline should begin only a few years later.

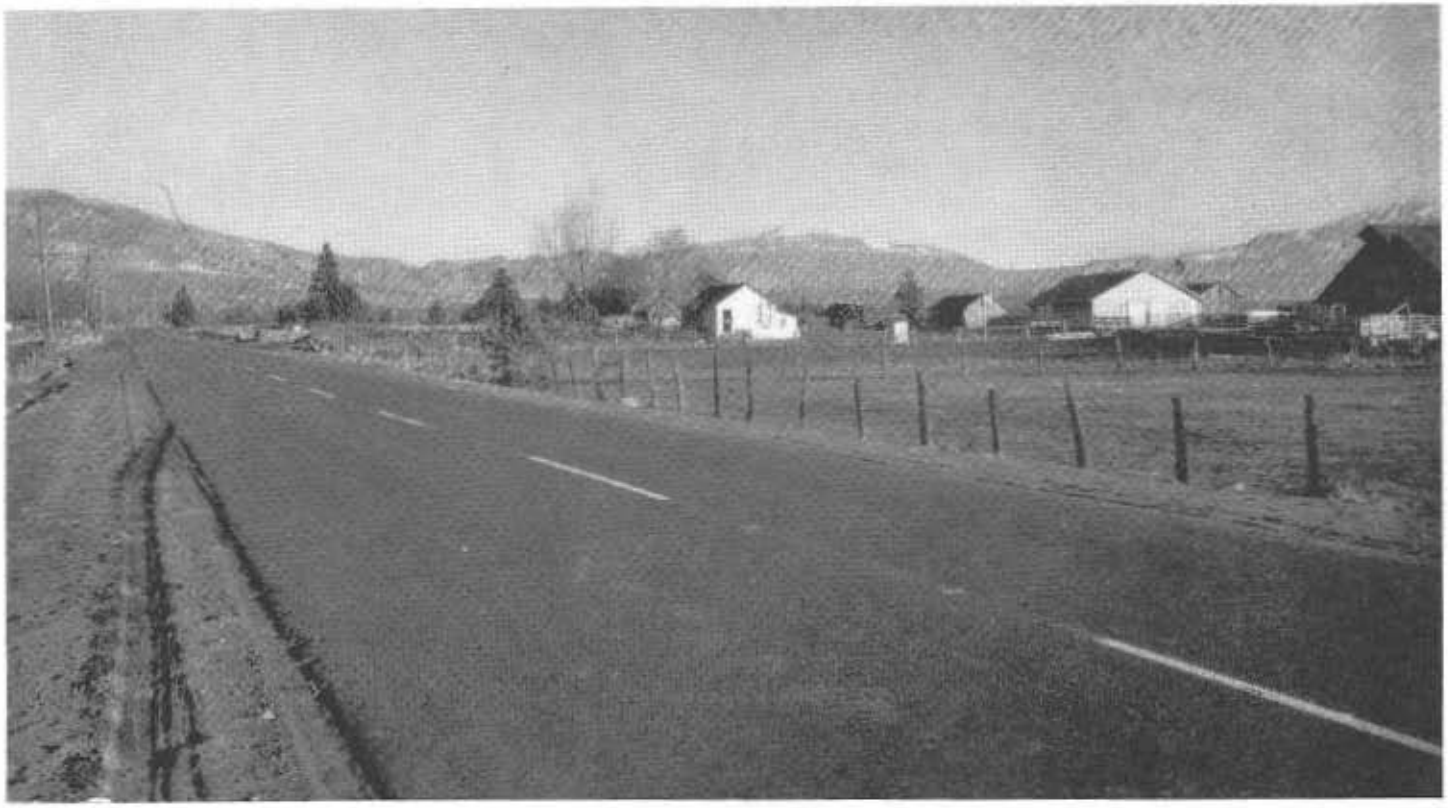
Before 1865 the Scott Mountain Road was in use, affording a passage from Shasta, California, over the mountain into Callahan, through Scott Valley and into Oregon. At the same time the Sacramento Canyon road was brought in, leading traffic from what is now Redding north through Yreka and into Oregon. Also, the Trinity road came into being about that time.

In 1862 the *Shasta Courier*, a Shasta County newspaper, predicted the abandonment of the Military Pass Road. It was right.

There were a few settlers at that time in the sea of sand and junipers lying between what are now U. S. Highways 99 and 97, but it was only with the utmost difficulty that they maintained their homesteads. Travel decreased on the Pass Road and it reverted to a brush-grown trail.

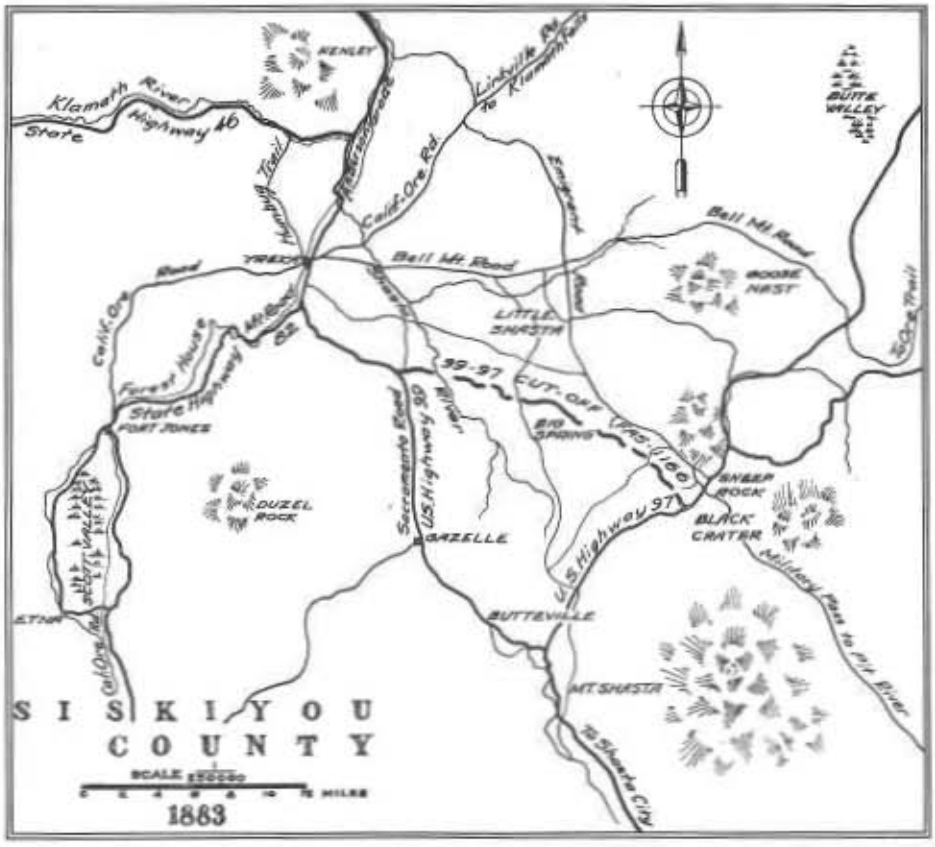
Becomes County Road

The rebirth of the cutoff as a needed wagon trail came in the 1880's when the railroad pushed north and into Oregon. With the advent of the railroad was born the town of Grenada, now located on the 99-97 cutoff about nine miles south of Yreka. Settlers began moving into the Shasta Valley in greater number, the Military Pass Road skirting Sheep Rock regained some of its former life and lustre and shortly after that the



View of recently completed FAS Route 1166, in Siskiyou County, showing typical farm area served

Map of early immigrant trails through Mt. Shasta area. Present location of Highway 99-97 cutoff (FAS Route 1166) is superimposed near center of map.

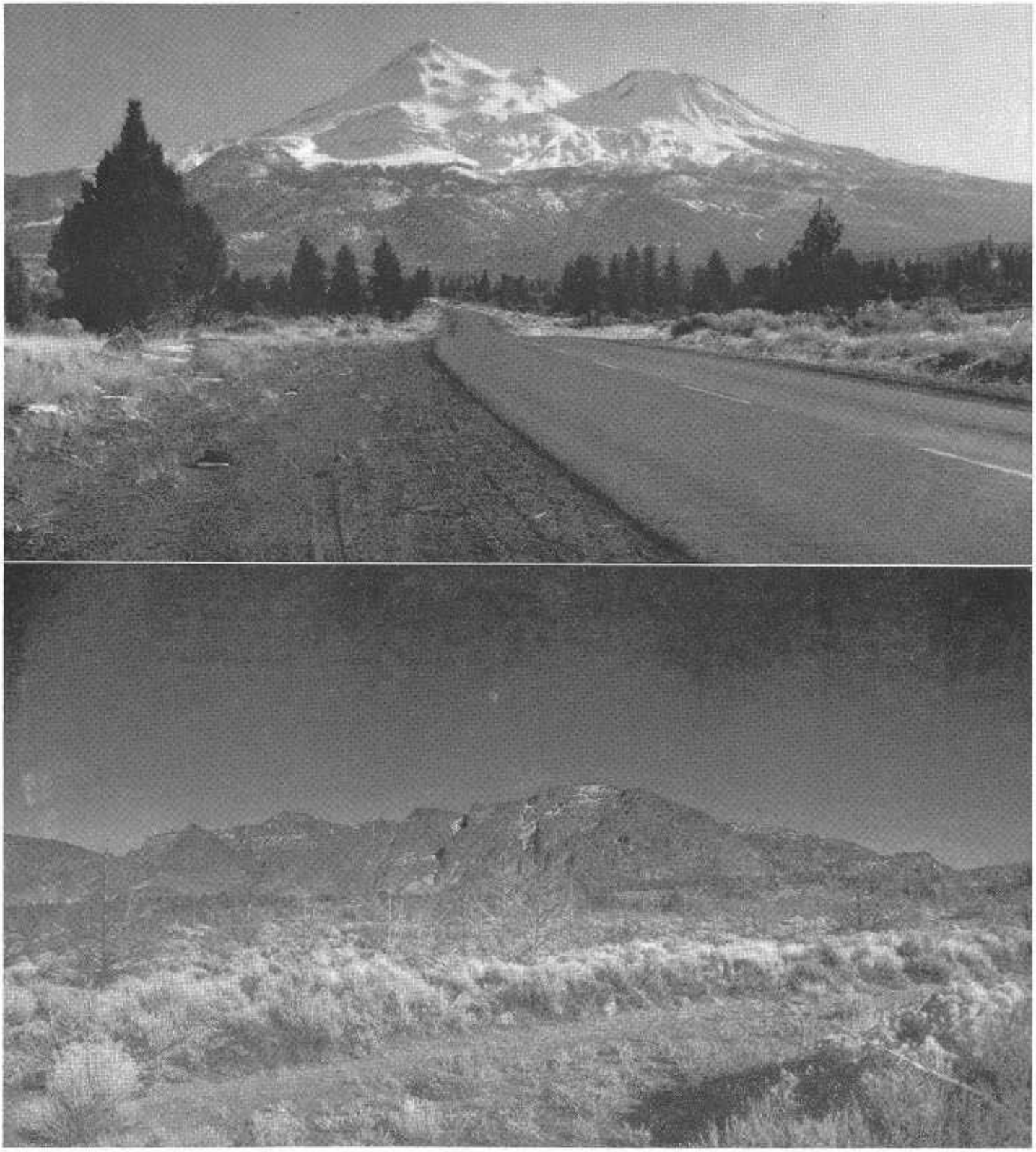


road was incorporated in the Siskiyou County road system.

Although improved and maintained by county road districts through the years, the route remained dirt-top until the mid 1940's. At that time, about half its length was oiled. The first concentrated effort for the realignment and resurfacing of the road was undertaken in 1947. County maintenance crews, hindered by insufficient heavy equipment, struggled with the project until 1951. At that point, the Siskiyou County Board of Supervisors authorized formation of a construction crew to be part of the county road department. Later, the route gained recognition as a federal-aid secondary highway, and construction was greatly speeded up by supplementing the day labor grading operations with contracts for the surfacing and bridge construction.

A Boon to Ranchers

Principal difficulties with realignment included heavy cuts through solid lava rock formations, with extensive fills along the 19-mile route. The road now provides a much im-



UPPER—View of recently completed Highway 99-97 cutoff in Siskiyou County, showing snow-covered Mt. Shasta in background. LOWER—View of Sheep Rock near the westerly terminus of Highway 99-97 cutoff. This landmark was used as a guide for many of the early settlers of Northern California and Southern Oregon.

proved farm-to-market route for the thriving crop and cattle ranches of Shasta Valley, in addition to shortening the paved highway route between Yreka and Klamath Falls, Oregon, by 13 miles.

Although heavy trucking is not permitted over the road at this writ-

. . . Continued on page 43

Sweetwater Road

Pioneers Route in Mono County Is Transformed

By GEORGE E. GRAY, Assistant Highway Engineer

With the recent completion of the contract covering 8.2 miles of F. A. S. Route 580, near Bridgeport in Mono County one more relic of the "horse and buggy" days has faded into the past. A narrow, winding road has been transformed to meet modern standards. Until this contract, the alignment and grades had changed little since the sounds of "gee" and "haw" echoed through the canyon. The impression was extremely bad when compared with the high speed highway which was constructed by the State of Nevada and joined this road at the state line.

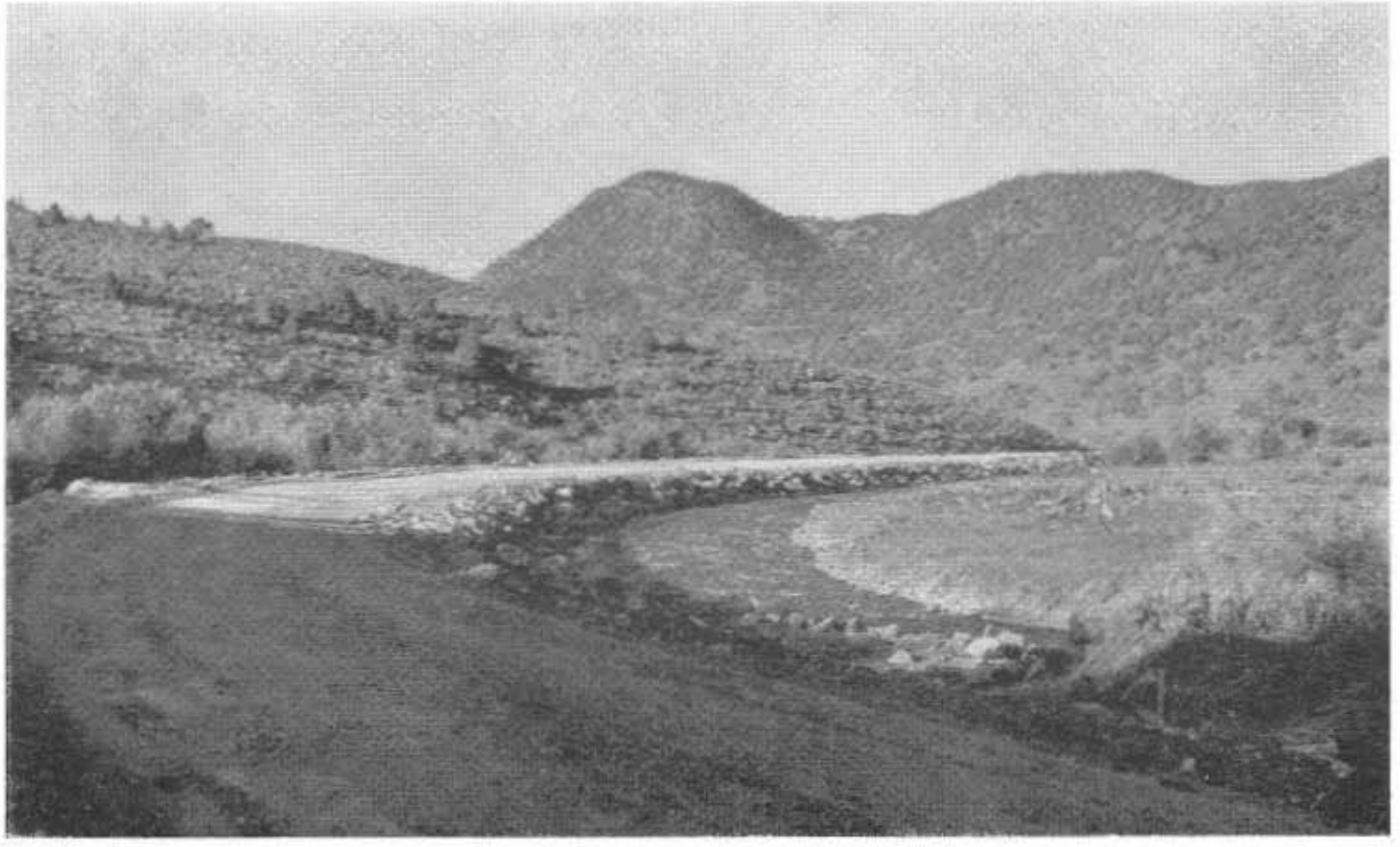
The Sweetwater Road, as it is locally called, extends from Bridgeport, the county seat of Mono County, to the Nevada state line. It follows the East Walker River over this distance and traverses some fairly rugged country. The surveying problems were described in the September-October, 1953, issue of *California Highways and Public Works.*

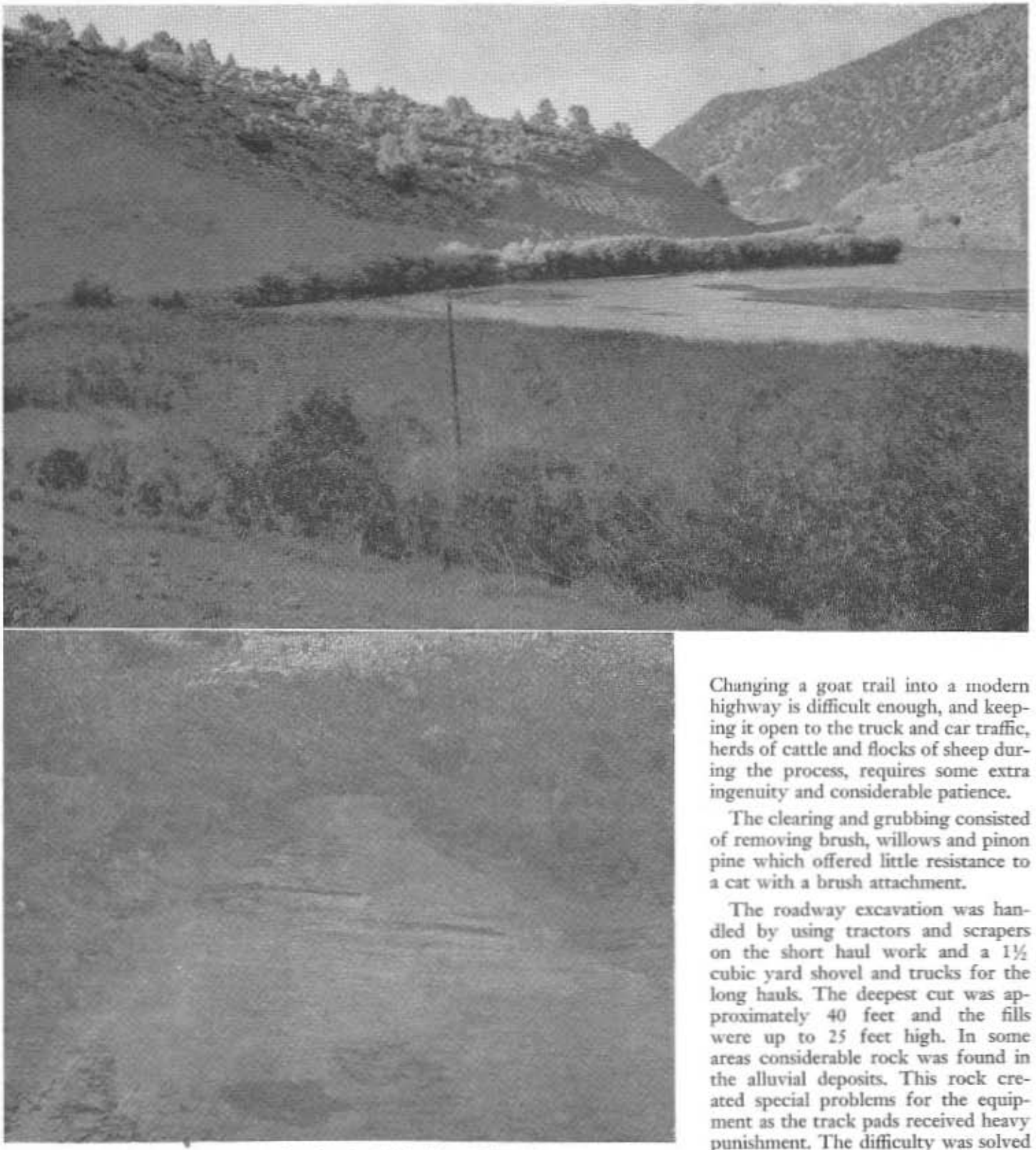
Faster Route

This route connects the rapidly developing copper center of Yerington, Nevada, with the Bridgeport area. Since the only major means of transportation in this section of California is by highway, cattle, lumber, mining products and supplies, as well as items for local consumption, are handled by truck. A good percentage of this trucking uses the Sweetwater route. Now that the highway has been improved, the traveling public can cover the eight miles in approximately 10 minutes instead of the 30 minutes previously traveled.

The contract for the first part of a two-part stage construction was awarded to the firm of Scott, Stecker and Croft. It consisted of roadway excavation, five channel changes where the proposed alignment and the East Walker River conflicted, the laying of imported base material and placing penetration type oil to hold the road until the second stage is started. The usual clearing and grubbing, structures, fence, etc., were also part of the contract. The ulti-

This photo shows channel change on East Walker River





UPPER—New alignment around pond on East Walker River. LOWER This photo shows an example of original alignment.

mate plans call for 3 inches of road-mixed surfacing laid on from 0 inch to 9 inches of additional base material.

One of the problems was traffic control as there were no available detours on the majority of the project.

Changing a goat trail into a modern highway is difficult enough, and keeping it open to the truck and car traffic, herds of cattle and flocks of sheep during the process, requires some extra ingenuity and considerable patience.

The clearing and grubbing consisted of removing brush, willows and pinon pine which offered little resistance to a cat with a brush attachment.

The roadway excavation was handled by using tractors and scrapers on the short haul work and a 1½ cubic yard shovel and trucks for the long hauls. The deepest cut was approximately 40 feet and the fills were up to 25 feet high. In some areas considerable rock was found in the alluvial deposits. This rock created special problems for the equipment as the track pads received heavy punishment. The difficulty was solved by using special manganese track pads. The metal in these track pads is self-hardening and, according to the contractor, this increased the pad life three-fold.

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Carpinteria Expressway

On the morning of December 7, 1954, traffic began to flow around Carpinteria on a new expressway facility which closed the last gap in the four-laning of U. S. Highway 101 from the Ventura county line to the City of Santa Barbara. However, the progress of improving this route in this area has not stopped here as another contract is already underway to build a freeway through Montecito to eliminate the undivided four-lane highway.

The new construction between 1.0 mile east of Carpinteria and 0.5 mile east of Arroyo Parida provides 3.4 miles of four-lane divided expressway with grade separations at major intersections serving the Carpinteria community. By way of contrast the old road was three lanes except through the main business district of Carpinteria where only two lanes of traffic were provided. The 9,000 cars per day that will use this new expressway will benefit from the saving in time, and operating costs that this facility affords.

Carpinteria Expressway, looking east. Seventh Street Overpass in background.

Two Contracts

Construction of this project was accomplished under two separate contracts. The first contract was awarded on April 1, 1953, to Fredrickson and Watson Construction Company of Oakland, California, for the sum of $1,085,489. This contract was for the construction of seven reinforced concrete bridges and three reinforced concrete overcrossings; grading of the four-lane divided roadbed, ramps and frontage roads; construction of an underdrain and storm drain system; and surfacing of certain ramps and frontage roads required for local traffic.

The seven bridges consist of three twin, concrete slab deck bridges for crossings over Carpinteria Creek, Franklin Creek and Santa Maria Creek and one frontage road bridge across Santa Monica Creek. At Casitas Pass Road a concrete haunched slab deck overcrossing was constructed. The other two overcrossings at Linden Avenue and Seventh Street are concrete box girder construction.

Grading Operations Complicated

Grading operations were complicated by wet soil conditions along this project, particularly between Carpinteria Creek and Linden Avenue. The ground water elevation was above the proposed profile grade so it was apparent that control of the water table would be necessary before any excavation could be accomplished. Therefore, the contractor's first operation consisted of digging deep ditches along the sides of the cuts to lower the water table. A 1½ cubic yard dragline was used to remove the saturated material from the ditches which was transported in trucks to the fill areas where it was spread out in thin layers to reduce the moisture content.

After the water table lowered, excavation was accomplished with rubber-tired scraper equipment assisted by pusher tractors. However, this equipment would mire down easily so it was important that the interception ditches be kept well below the line of excavation and that the water have a free outlet. At times it became necessary to delay for several days between successive cuts to allow the water to drain out of the area between the interception ditches.

Embankment Construction

Saturated soil conditions also complicated embankment construction which existed in the vicinity of Linden Avenue, around Seventh Street, and in the general area of Cravens Lane. The natural ground elevation of these areas is so close to sea level that ground water nears the surface at times and removal of this wet material and drainage ground water was not practical. In order to support heavy equipment for the construction of embankments in these areas it was necessary to end dump the first lifts as compaction of the original ground had to be eliminated because pumping action occurred under heavy equipment.

This condition was further aggravated by the embankment material which was obtained from the aforementioned wet cut area and contained moisture in excess of that amount that would cause sponging action in the embankment layers. It, therefore, became necessary to utilize a long section of the fill bed for spreading out this saturated material. The concentration of the spreads in limited areas was avoided, and hauling equip-

Looking west on Carpinteria Freeway. Franklin Creek Bridge in foreground and Seventh Street Overpass in background.

ment was routed over long sections of the fill upon which new layers of the wet material had been spread in thin courses. The sponging of the embankment under loaded equipment lessened with the length of time that the loaded equipment was routed over it. The moisture gradually pumped to the surface under the equipment traffic and by the end of the fall period of 1953 the new embankment had reached a state of stability.

Unstable Soil

The unstable nature of this soil also caused other complications, notably in the drainage facilities. Cave-ins, sloughing and adverse conditions encountered during the installation of culverts, storm drains and underdrain systems impeded the work and in some instances required changes in the work as planned.

In spite of these adverse conditions the contractor completed the contract in February, 1954, 25 days ahead of the date for completion.

The second contract for paving was awarded shortly thereafter on April 1, 1954, to the Griffith Company of Los Angeles on their bid of $742,858. This contract called for paving the freeway lanes with portland cement concrete on cement-treated subgrade; surfacing the freeway shoulders, frontage roads and ramps with plant-mixed surfacing on cement-treated base; and applying seal coats.

J. C. Adams was resident engineer on both contracts and R. M. Herbert was the Bridge Department representative. Superintendent for the Fredrickson and Watson Construction Company was Bernard Fredrickson, and T. W. Oglesby was the superintendent for the Griffith Company.

Looking west. Carpinteria Creek Bridge in foreground and on-and off-ramps for Carpinteria connecting to Casitas Pass Bridge.

IMPROVEMENT

Continued from page 39 . . .

ing, the route will constitute a major boon to west coast trucking when the existing Shasta River Bridge has been replaced with a legal load bridge of reinforced concrete on pile bents. The new bridge, expected to be completed during 1955 under the federal-aid secondary program, will be 120 feet long and 26 feet between curb faces.

Upon completion of the new bridge, the total cost of reconstructing the 19-mile long route will have reached an approximate total of $670,000.

The federal-aid secondary program is, under federal law, a three-party cooperative arrangement between the Bureau of Public Roads, the State Division of Highways, and the county. As we understand the objective in California, emphasis is placed upon a maximum of county initiative consistent with federal requirements that the completed project be adequate for the existing or expected traffic, serviceable in all weather, and maintainable at reasonable cost.

The county acknowledges, with sincere appreciation, the cooperation of the Bureau of Public Roads and the Division of Highways engineers.

Sacramento Featured in New Motorland Magazine

Sacramento and the region of which it is the economic, cultural and recreational center are featured in the first issue of the California State Automobile Association's larger, redesigned *Mortorland* magazine.

A full color view of the capitol dome appropriately forms the new magazine's cover and there are numerous color and black-and-white illustrations inside, all dealing with some phase of Sacramento region resources or activities.

The CSAA announced that for some time to come each edition of *Motorland* would be devoted to a particular region of the State, with attention given not only to present scenic and recreational values but also to highlights of the region's historical background and its economic assets.

A Random Sample

Panning for Gold Unique Task For Materials Department

By WILSON R. MORRILL, Assistant Physical Testing Engineer

MANY of the projects in District II are unusual. They demand *unusually hard work* to be done in an *unusually short period of time* under *unusual weather conditions* in *unusually remote areas of civilization* with an *unusually rugged terrain*, matched only by the *unusual ruggedness* of our Materials Department and personnel.

Since we can't enumerate all of our projects, we have singled out one that meets all of the above conditions and one which we hope will make interesting reading for our fellow random samplers.

Back in the winter of 1952 our Materials Department was assigned the task of evaluating the gold-bearing potential of a gravel bar on the Klamath River. This project was instigated by the Right of Way Department which had become involved in a potential lawsuit while negotiating purchase of right of way over the gravel bar.

This project was located on Sign Route 96 in Siskiyou County between Horse Creek and Walker Bridge on the Klamath River approximately 25 miles downstream from Highway 99 north of Yreka.

The existing highway between the limits of this job traversed the south side of the river, whereas the new line was on the north side. This presented the problem of getting our equipment in to the bar, five miles downstream from Walker Bridge. There was a so-called road over the first three miles which could be negotiated by a jeep or "cat." The remaining two miles were over an unimproved cow trail, negotiable only by ground squirrels and materials men. The contract had been let to Natt McDougall Company; however, they had not pushed a pioneer road through and the time element did not allow us to wait for such.

FOREWORD

The full value to the State of the extraordinary expedition described in Bill Morrill's article may be guessed by the reader when he understands all the circumstances.

Other owners along the river were advancing high claims for "gold value." We suspected still others were planning to do so. After our consulting mining engineer, Ezra Erich, had surveyed the area to find the most promising of all the possible deposits, we organized the strange safari Morrill describes. Before Hislop's crew had finished their work, the gold claims were becoming so much conversation and presently we heard little more about them. Instead of trying a series of expensive condemnation cases, we made rapid settlements. Our total expenditure was less than it would have cost to try the case in court, for we would have had to do precisely the same work in preparation for trial.

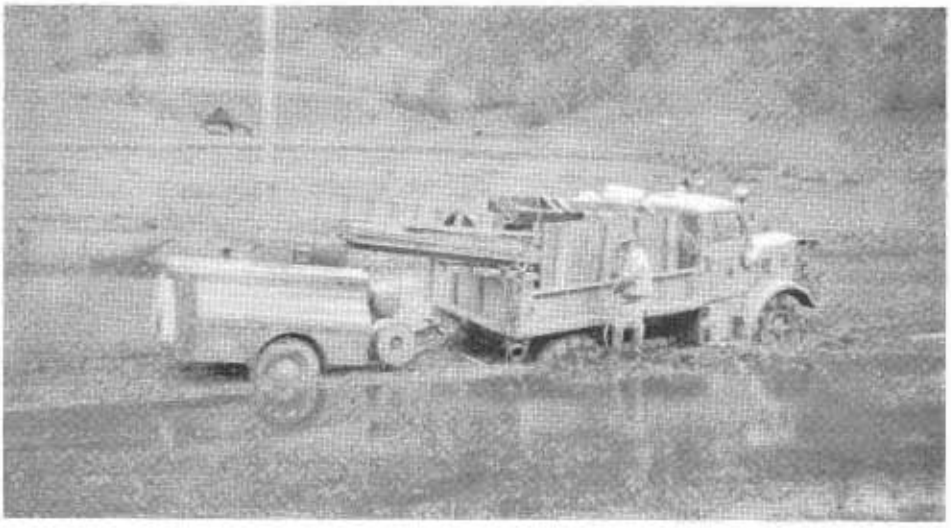
CLARENCE G. PIPER
District Right of Way Agent

Strange Equipment

This type of expedition called for many pieces of equipment that weren't at our immediate disposal. We borrowed some equipment from a mining company, made up part of it ourselves, and made special purchases to obtain the rest. When we assembled all our equipment, it looked like an expedition departing for the far north. The equipment included a set of caissons, a 10-foot sluice box, and air-driven hoist, and air-driven water pump, a 3-inch suction water pump, many feet of hose and connections, a tripod, two 20-foot ladders, a wheelbarrow, two wash tubs, and many miscellaneous pieces of equipment such as ropes, buckets, picks, shovels, lumber, wrenches, oil and gasoline. Our mobile equipment included an FWD which we rented from the maintenance department, an air compressor and one Chevrolet station wagon.

The personnel consisted of three materials men—Joe Hislop, Bill Morrill, and George "Smooch" Moss; one miner, Jim Bassham; and one consulting mining engineer, Ezra Erich.

One of the more stable areas on the way out

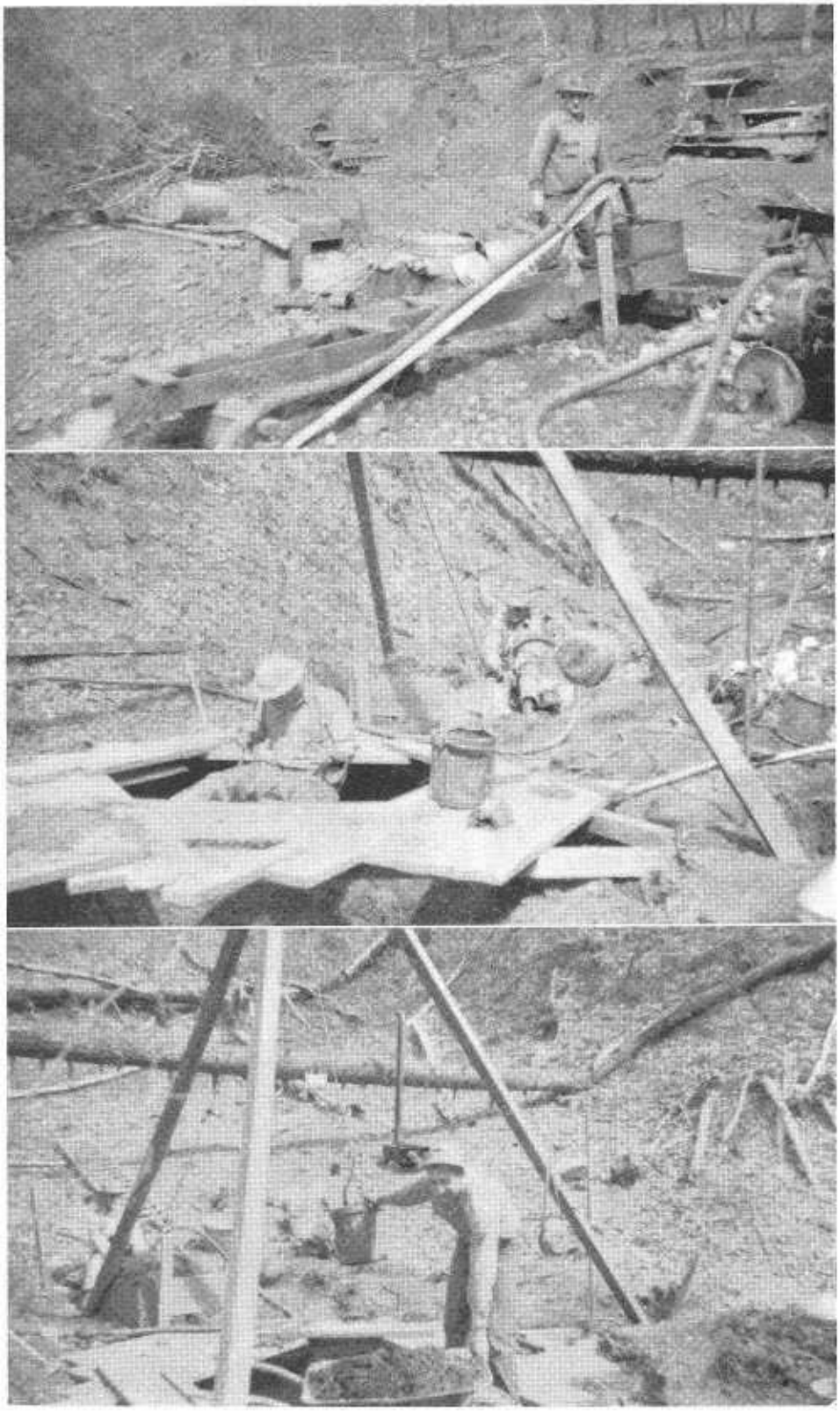


We left the Walker Bridge Maintenance Station at 8 a.m., March 11th with the FWD loaded to the hilt and pulling the compressor. Joe was at the helm attempting to herd this monstrosity toward our destination. I walked ahead and guided him around, over, and through the rough spots. Our first worry was the crossing of Doggett Creek. After sizing up the bridge we eased across. Fortunately, the contractor had a "cat" on the job and he pulled us through several spots of deep mud and steep sidehills which we could not otherwise have navigated. One broken water pipe en route cost Joe $5 for repairs. After seven hours of sloshing, sliding, bouncing, shoveling, chopping and straining, we arrived at our destination, 4.6 miles from point of departure.

Headquarters at Streamwood

For the duration of this job we made our headquarters at Streamwood Lodge, located about one mile upstream from Walker Bridge. Incidentally, one of the bright spots of this project was the food at Streamwood Lodge. It was served family style and we have never seen the equal of the quality and quantity anywhere in the district before, or since.

We traveled to and from the job each day in the station wagon over the existing highway to a point about one-quarter mile from the job and on the opposite side of the river. From this point we negotiated a 200-foot river crossing on a rickety hand-propelled "cable car" which left a lot to be desired for over-water transit of nonswimmers. Jim Bassham was in this category and before the job was over he was giving serious thought to a daily nine-mile round trip hike on the job side of the river. Of course the thrilling extra bounce that some of the fellows put in the cable, causing the car to dip to within a couple of feet of the roaring Klamath River, didn't seem to comfort Jim in the slightest.



UPPER—Jib operating sluice box. Note clearing operations in background. CENTER—Joe on his way down. "Smooch" operating the air hoist. LOWER—Bill handling the bucket line.

The job that confronted us, as laid out by Mr. Erich, was to sink several shafts through this gravel bar to bedrock. All of the material that we excavated had to be washed through the sluice box and panned to retain all gold removed, for evaluation purposes.

Loose Gravel Problem

We anticipated sinking holes to a depth of approximately 25 feet through loose boulderous gravel. This would put us at least 20 feet below the surface of the river. Our two main problems to overcome were loose gravel and an excessive amount of water. To combat the loose gravel and prevent a cave-in, we used a set of caissons. These were cylindrical 4-foot sections of ¼-inch steel with graduated diameters, the largest being 42 inches. They decreased in diameter approximately two inches per section to nest inside the largest one.

After digging the initial four feet the largest caisson was placed and securely anchored to a platform built of 2 x 12's. The second caisson was then placed inside the first and as we dug, working inside the caisson, we worked the second caisson down until it rested on the inside bottom lip of the first. Then the third was inserted and so on.

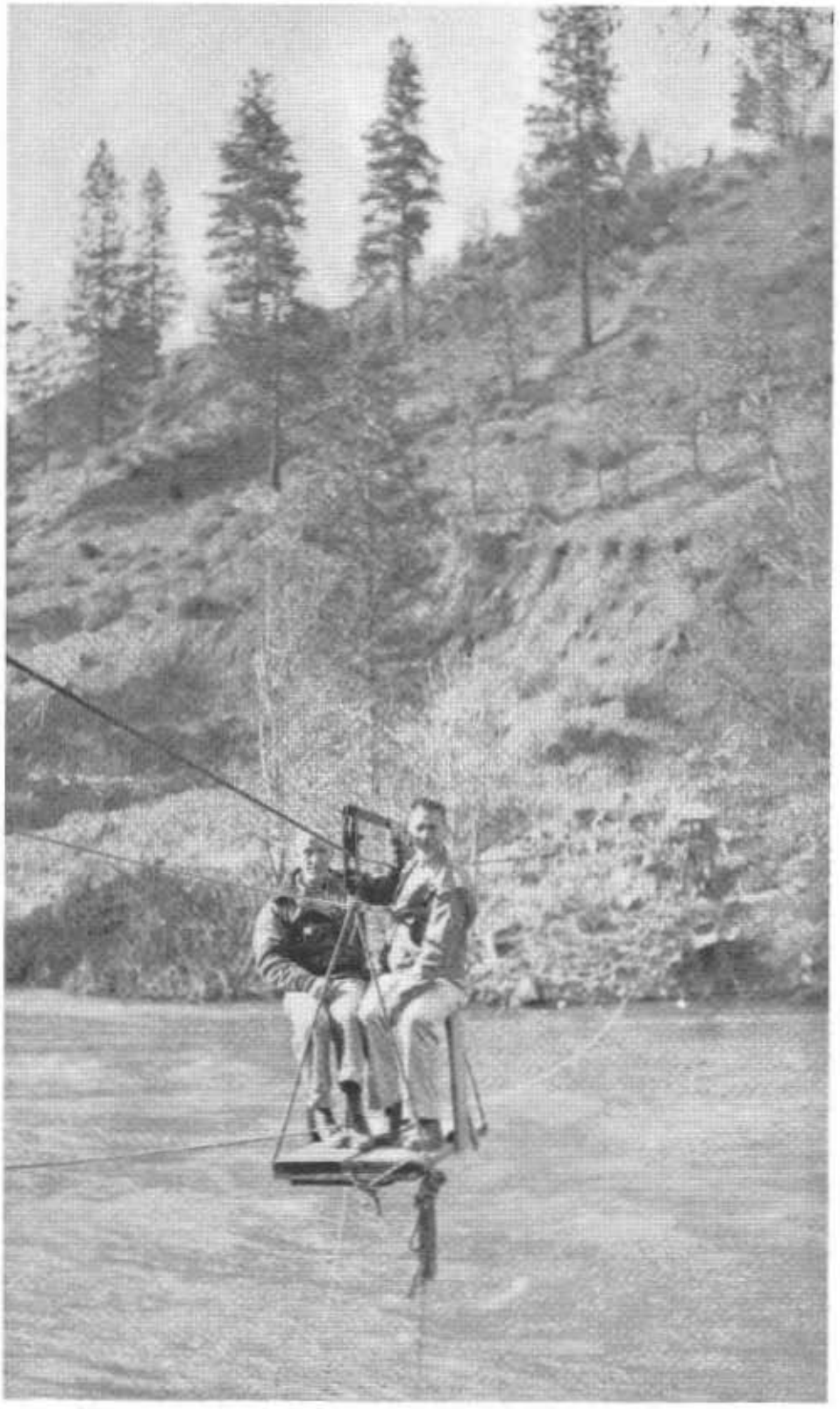
Mining Operations

For the most part, the digging operation was done by Joe, the air hoist was operated by Smooch, Jim did the sluicing and panning, and I handled the muck from the hole to the sluice box.

The working equipment used inside the caissons, besides Joe (who incidentally, is no small item), consisted of a short-handled pick, shovel and sledge hammer, five gallon bucket, an intake hose from the three-inch suction pump, and the air-driven pump with its air hose, discharge hose, and one-inch exhaust pipe which extended above the top of the hole to carry off the fumes. The base of this pump had to be submerged for the pump to function properly. If you can picture Joe and all this gear working inside a 32-inch diameter pipe extracting material which contained boulders up to 15 inches in diameter, you'll have a rough idea of the laborious task that confronted us.

Weather Not So Good

As for the weather during our operations, it wasn't that the cold bothered us so much, it was just that it became quite annoying to have to keep breaking chunks of our breath off as it became solidified in front of our faces! We dug out from under a four-inch snowfall one morning before starting work.



Engineer Erich and Attorney John Horgan riding the commuters' special

Just before we finished the job the contractor caught up with us with his clearing operations and we spent

a good part of one day dodging falling timber and over-enthusiastic "cat-skinners."

All in all, we sank three shafts, the depths being 20, 12 and 6 feet. The 12-foot hole was 150 feet from the river and all the gravel had to be wheelbarrowed that distance to the sluicing and panning operation. We dug to bedrock in the first two holes. However, storms brought the river level up and forced us to abandon the 6-foot hole before reaching bedrock. In addition to these shafts, we reopened and investigated several old sidehill tunnel workings.

Summary of Job

The following is a summation of the job and what was accomplished by it.

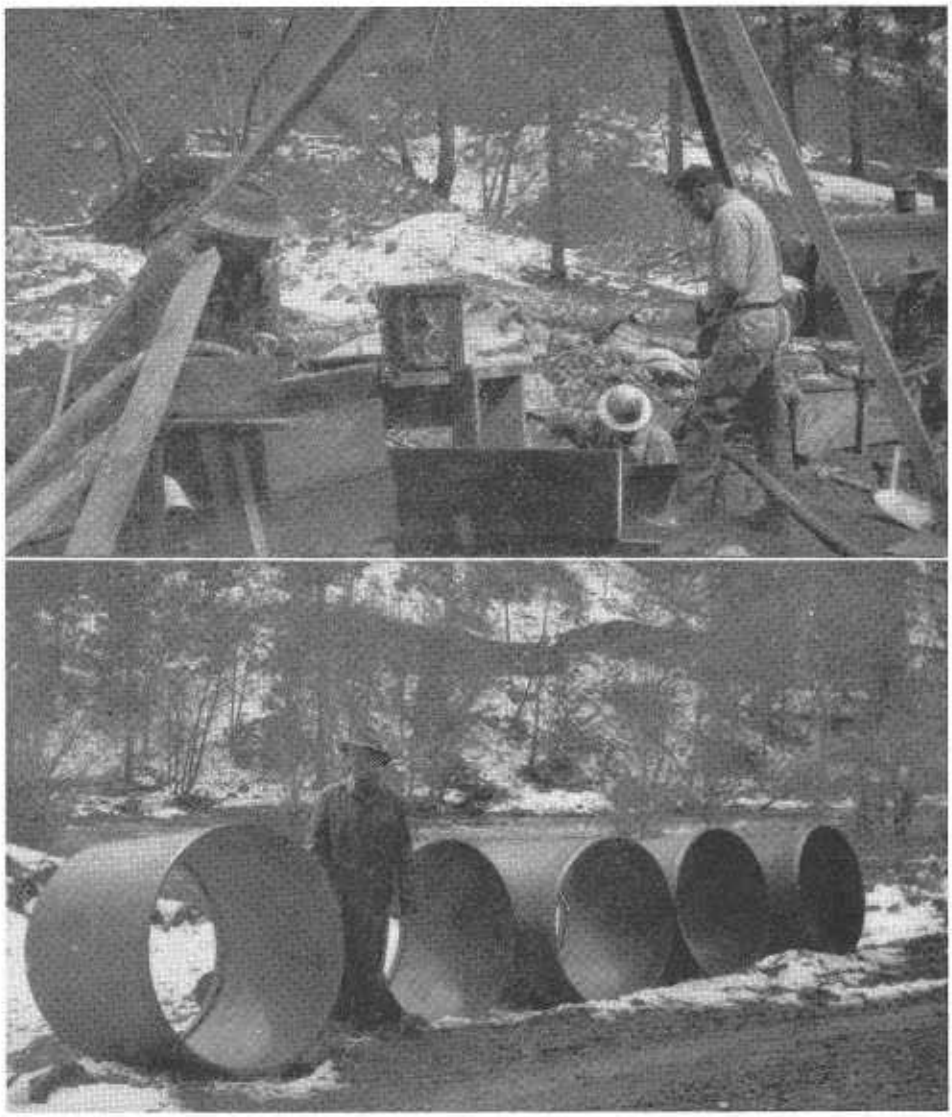
Our phase of the project took 19 working days, exclusive of preparatory work. We handled approximately 20 cubic yards of material, from the three shafts, through the sluice box and from 20 to 25 cubic yards in our sidehill tunnel investigations. The total amount of gold recovered by our operations was $4.86. From this our mining engineer assayed the over-all gold bearing value of the property at 14 cents per cubic yard. The cost of recovering this gold by the most feasible methods at the time of our investigations was estimated at between 35 cents and 50 cents per cubic yard. As can readily be seen by these figures, we conclusively proved that gold mining operations could not be carried on profitably; therefore, the gold bearing potential of the property had no value.

The Right of Way Department had originally appraised the property (14.4 acres) at $564. Based on the property owner's gold evaluation estimates, our mining engineer, Mr. Erick, foresaw a claim possibly in excess of $100,000.

After all the facts were in, the final settlement was made for $1,600. The increase over the original appraisal was due to the cabin site value of the land claimed by the owner.

The total cost of our evaluation project was approximately $4,000. These figures reflect a saving to the State of from $96,000 to possibly more than $100,000.

Our arduous back-aching chore apparently paid off, although those of us who performed the job still shudder every time we are out contacting property owners on material investigations and the word *gold* is mentioned.



UPPER—Operations in full swing. Left to right, Jim, Joe, Bill, and "Smooch." LOWER—Jim and the caissons.

TREE CREW EFFICIENT

WESTERN ENGINEERING

Mr. S. Evans
Division of Highways

Dear Mr. Evans: We wish to thank you for the clean, careful, fast, conscientious job done by your tree crew in the trimming of the trees at Thornton and Walnut Streets, this town, thereby getting rid of the danger to the children of the neighborhood and to our property.

Carl Stell

THE STATE OF WISCONSIN
Highway Commission

Mr. Kenneth C. Adams, *Editor*

Dear Sir: We read your magazine with interest and find many of the articles and particularly the illustrations of great interest and real value. We hope that you may be able to continue to keep us on your mailing list because we do not wish to miss any of the issues of the magazine.

Wayne N. Volk
Engineer of Traffic Services

Retirements *from* Service

Stewart Mitchell

Stewart Mitchell, principal bridge engineer, retired from the Bridge Department, Division of Highways, on March 31, 1955, after 31 years' service.

Stewart was born in Belfast, Ireland, on March 24, 1885, and came to the United States when he was

STEWART MITCHELL

four years old. He lived first in Wisconsin, where his father taught at St. John's Military Academy, and later in Indianapolis, Indiana, where he attended school. He graduated from Purdue University in 1908 with a B.S. degree in civil engineering.

During the next nine years he worked successively for the Union Pacific Railroad in Denver, the Southern Alberta Land Company in Canada and the United States Interstate Commerce Commission in Chattanooga,

. . . Continued on page 49

Arthur S. M. Payne

Arthur Stephen Morley Payne, construction supervisor II, with the Division of Architecture, was honored by more than a hundred friends and associates on the occasion of his retirement by a dinner held at Walker's Restaurant in Napa on January 22d.

Born January 5, 1885, in London, England, Payne, as a young man, was apprenticed as a carpenter, receiving his journeyman's papers, and shortly thereafter setting out to see the world. He landed in Halifax, Nova Scotia in 1904 and worked his way across Canada, arriving in Vancouver, B. C., in 1911. There he worked as a carpenter for four years until he went to San Francisco in 1916, where he held jobs as foreman and superintendent.

After two years in Mexico coal mining, he returned to San Francisco and went into the contracting business for himself in 1922. From that year until 1939 he contracted, building homes and undertaking residential development.

In 1939 he became co-owner of a whaling ship and spent a year whale hunting, but returned to San Francisco again and resumed contracting. During this period he built the million dollar service club at Fort Ord.

With the advent of World War II, Payne, who had seven brothers in the British armed forces, went into war work.

He worked for the Engineering Section of Western Pipe and Steel Shipyards and the Ships' Design Section of Barrett & Hilp Construction Company. In 1945 he became outside superintendent for the Pacific Construction Company.

Payne's service with the Division of Architecture began on August 1, 1948, as associate construction supervisor.

. . . Continued on page 49

Fred B. Dauchy

Fred B. Dauchy, assistant highway engineer in District VIII, retired February 1, 1955, after a long career in all phases of highway work.

Fred was born in Topeka, Kansas, and at an early age moved to the Panama Canal Zone. His father, Walter E. Dauchy, became division engineer in charge of the Culebra Cut of the Panama Canal in October, 1904, and later was made acting chief engineer during the absence of Chief Engineer John Wallace. The family returned to the United States and settled in Riverside, where Fred graduated from Riverside High School. His first engineering position was as a rodman and chainman for the Riverside County Highway Commission. Before coming to work for District VIII, he was also employed by the City of Riverside, several consulting engineers, Los Angeles County Flood Control District, City of Willows, and the Southern California Edison Company.

FRED B. DAUCHY

First employed by the State as a draftsman on October 23, 1925, he soon became one of the most valuable men in District VIII, filling various assignments in the drafting room, on construction, and on surveys. His specialty in later years was in right of way calculations, and he was frequently called upon to take charge of special surveys that had run into unusual complications.

Fred will continue to commute from his home in Riverside, just as he has all the years he worked in District VIII, as he plans to establish himself with a firm of civil engineers in San Bernardino, specializing in subdivision work.

STEWART MITCHELL

Continued from page 48 . . .

Tennessee. In 1916 he married Florence Kidd of Roseburg, Oregon.

During World War I he served as a captain with the 306th Engineers and spent a year overseas, taking part in the Meuse-Argonne offensive. He was one of the delegates chosen to represent the 81st Division in Paris in 1919, at the initial meeting at which the American Legion was created and organized.

After leaving military service he went to work as a resident engineer for the Oregon State Highway Department. Subsequently he came to California to accept a position with the Division of Highways in 1924; first serving as resident engineer on the Klamath River Bridge in Del Norte County.

In 1927 he came to Headquarters Office in Sacramento where he served continuously until his retirement, first as bridge maintenance engineer, then successively as bridge construction engineer, engineer in charge of bridge planning and design and engineer in charge of special investigations.

Mitchell is a past president of the Sacramento Section of the American Society of Civil Engineers and past national chairman of the Structural Division of the Society's Executive Committee. He is also a member of the American Concrete Institute, International Association for Bridge and Structural Engineers, and the honorary engineering fraternity, Tau Beta Pi.

His hobbies are golf, photography and early California history. Perhaps his chief hobby is California history. He is one of the recognized authorities on California immigrant trails and has published several authoritative articles on this subject. He did research work and wrote the topographic section of the recently published book, "Alonzo Delano's California Correspondence." He is a member of the California Historical Society and the Sacramento Book Collectors Club and a charter member of the Sacramento County Historical Society. With his many hobbies and interests, Stewart says he will have no trouble keeping busy after leaving state service.

Mr. Mitchell and his wife reside at 2625 Rochon Way, Sacramento. They have two sons, Stewart, Jr., also with the Division of Highways, and Robert K., an engineer residing in the San Francisco Bay area, and two grandchildren, Douglass Earl, 3, and Gordon Stewart, 1. His co-workers honored him with a luncheon on the day of his retirement.

Mr. Mitchell's flair for research, his vast specialized knowledge and his ability to analyze difficult problems have set him apart as an authority on many of the special problems which have developed during the years. He has been directly responsible for the preparation of numerous special reports, such as the acquisition of existing toll bridges, the justification and feasibility of proposed toll bridges and tunnels, and more recently, studies in connection with mass rapid transit.

SWEETWATER ROAD

Continued from page 41 . . .

Heavy Grading

The shaping and compaction were managed with the usual equipment and presented no difficulties. The final grading, however, was considerably hampered by the large number of oversize rocks near the surface. It was often necessary to re-rip the roadbed several times to remove them and then to haul in more material to bring the road back to grade.

Grading involved 175,000 cubic yards of roadway excavation and 41,000 cubic yards for construction of channel changes. Overhaul of 1,700,000 station yards was necessary and 22,700 tons of base were laid.

Generally the grading presented no major problems. The drainage was quite a different matter. Springs and subsurface water necessitated 676 linear feet of eight-inch perforated metal pipe to free the area of superfluous water. Several previously unsuspected springs were encountered. The worst of these appeared in the semicompleted fill over the old river bed at one of the channel changes. This area was excavated to the old ground level and an underdrain composed of volcanic cinder filter material and perforated metal pipe was installed. Over this several layers of asphalt roofing paper were placed as an impervious membrane. At several other locations the drainage pattern was unusual because of the subsurface water and the tight clayey nature of the basement soil.

The channel changes were excavated with dozers, scrapers and a 1½ cubic yard dragline. They caused considerable trouble because of the disadvantage of working the equipment in water a good deal of the time. The dragline couldn't handle a good portion of the cemented rocky material and dozers were called in to loosen this area. Slope protection of 5,000 cubic yards selected rock was placed to shield the road from the rampages of the river.

The project as a whole ran smoothly with few major delays. Although the Fallon, Nevada, earthquake rolled rocks down the hills and threatened to rock the house trailers off their foundations, no damage was done.

W. R. Coons was the resident engineer under the direction of J. R. Jarvis, District IX Construction Engineer, and the writer of this article was assistant resident engineer.

ARTHUR S. M. PAYNE

Continued from page 48 . . .

He became a senior construction supervisor in November of that year and on March 24, 1952, was appointed construction supervisor in charge of the Arcata-Eureka Subdistrict. During his years of state service, it is estimated that Payne was in charge of $10,600,000 worth of construction work.

STEEL AND CONCRETE

Contract plans, specifications and estimates were prepared for building, widening or repairing 377 state highway structures during the 1953-54 Fiscal Year. Materials required in the construction of these bridges include approximately 44,000,000 pounds of structural steel, 79,000,000 pounds of reinforcing steel and 460,000 cubic yards of concrete.

New Luminaire

Fluorescent Street Light For Wet Pavements Designed

By G. M. WEBB, Traffic Engineer, and
ROY W. MATTHEWS, Assistant Traffic Engineer

In the usual practice of highway illumination, considerable dependence is placed on being able to observe obstructions on the traveled way by silhouette against light reflected from the pavement. Ordinarily, this illumination is provided by point sources of light, such as mercury vapor and incandescent lamps; however, illumination in this manner is not satisfactory when the pavement becomes wet. Each point source creates a narrow streak of light on the wet pavement between the source and the observer and leaves adjacent areas of pavement on either side of the streak in comparative darkness.

Throughout the greater portion of Southern and Central California, wet pavements do not pose much of a problem. However, the coastal area of California between the Pacific Ocean and the Coast Range, and extending for a distance of 150 miles south from the Oregon border, has a mean annual precipitation of from 3 to over 6 *feet*, and 120 rainy days each year. This means that highway pavements are wet on the average of one night in three throughout the year.

New Luminaire

In an attempt to improve the effectiveness of the lighting on these continually wet pavements, electrical engineers in the Traffic Department designed a new fluorescent luminaire. The design was based on the following considerations:

(1) As broad a band of light as practicable should be placed across the road to provide illumination for silhouetting against the wet pavement.

(2) Pavement brightness should be kept near a minimum of one foot-candle and relatively uniform as far as possible in both directions from the source of light, in order to minimize glare contrast since the background is generally completely dark at these isolated intersections.

(3) High-angle glare above 76 degrees should be minimized.

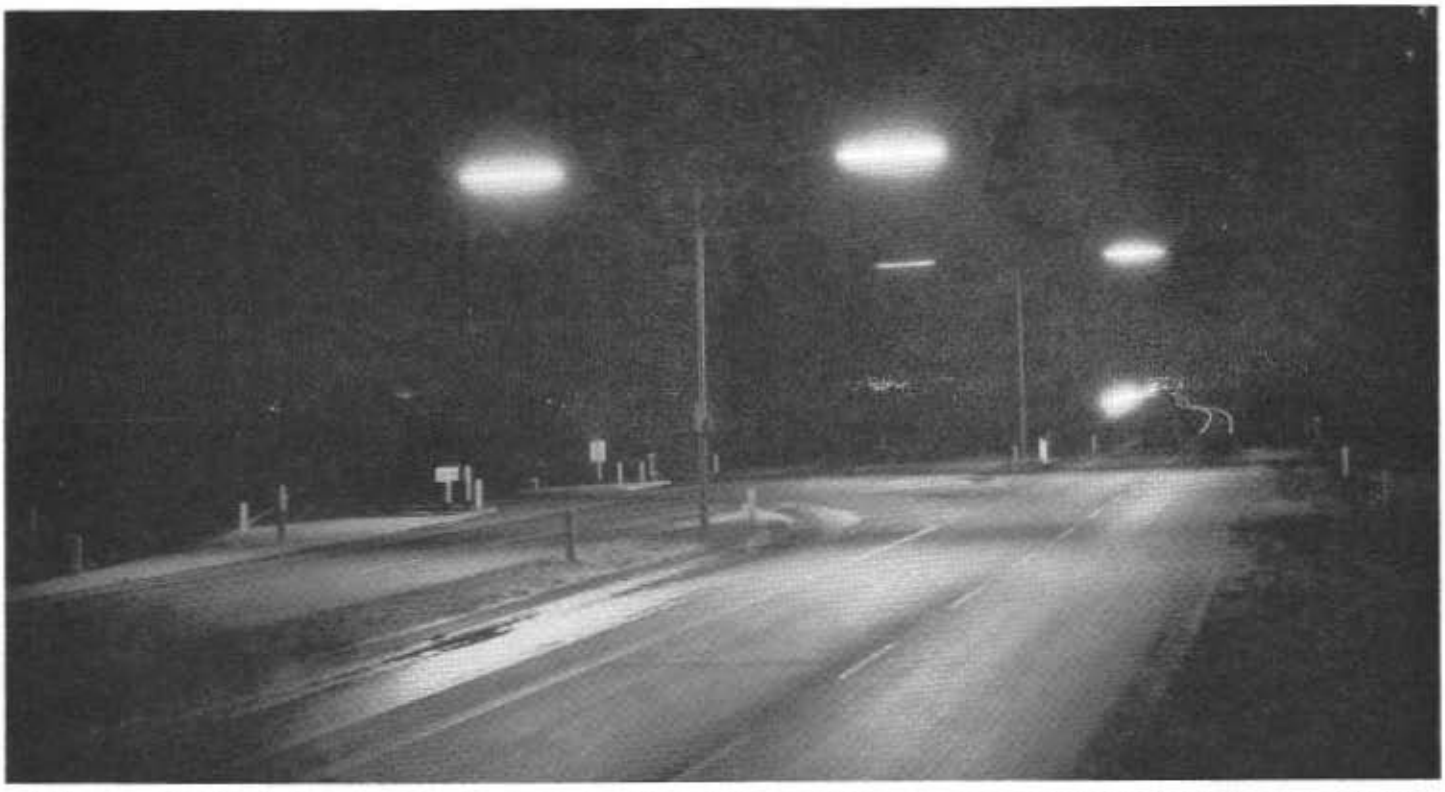
(4) Fixture design should be kept simple in order to reduce first costs.

(5) Power consumption and maintenance costs should be kept as low as practicable.

Experiments

A previously designed eight-foot fluorescent luminaire has provided a number of clues that have contributed

New-type fluorescent luminaires, specially designed for the moist north coastal climate, in place at an intersection on US 101 in Arcata, Humboldt County



Night view on US 101 in Arcata during wet weather, showing broad band of light across intersection and its approaches provided by the new-type luminaire

considerably to the new design. After studying this luminaire, we concluded that with more than one lamp inside a reflector we lost too much control of the emitted light, and as a consequence, wasted light that should be placed out on the aavement. We then proceeded to see how much light from a single lamp we could effectively place on the pavement.

A parabolic reflector was placed behind an eight-foot T12 5,800-lumen lamp and directed at an angle of 70 degrees with the vertical in order to reflect as much light in that direction as possible. A flat surface was then placed above the lamp inclined at the 70-degree angle and about 2½ inches from the center of the lamp. This surface extended out far enough to cut off incident high-angle light. Its extent was limited by the need to keep the fixture from becoming too cumbersome, and a compromise was selected that permitted about 1½ percent of the incident light to show above 76 degrees. This was not considered to be enough to cause objectionable glare. The flat reflector redirected all that light between 80 degrees and that redirected by the parabola, onto the pavement. This light reinforced the direct light from the lamp, which also lighted that area.

Model Tested

A model consisting of two separate lamp and reflector units placed back-to-back and lined with aluminum foil, was tested and gave the pattern shown, which is a great improvement over the original design. Some of the dimensions were adjusted and we were able to place somewhat over one foot-candle on the pavement for 45 degrees out in each direction from the fixture. The flat surface was subsequently curved in order to give a more pleasing appearance and yet not interfere significantly with its primary reflective properties. Tests on a model having a white reflecting surface of better than 80 percent reflection factor, made it obvious to us that specularity, rather than reflectance factor, was the important characteristic of the reflecting surface.

Fixture Not Enclosed

It was not considered practicable to enclose the fixture, for two reasons. It would be impossible to keep the fixture from breathing, due to temperature changes, which would introduce dust onto the inner face of the cover. It was also considered impractical to shape the cover in a manner that would not disturb the light pattern because of refractive properties of the transparent cover.

Since these luminaires are designed primarily for coastal areas, we are considerably concerned as to the corrosive effect of the salt atmosphere upon the reflector aluminum surface. It has been the experience on the San Francisco-Oakland Bay Bridge that exposed reflectors deteriorate quite rapidly. However, the reflectors have been maintained in satisfactory condition for a period of about two years by refinishing and recoating the specular surface with methacrylate resin lacquer. We expect that the maintenance personnel will have to change tubes and refinish reflectors about every two years. To simplify their job on the end of a 30-foot ladder, we have designed the inner reflectors in two four-foot lengths—completely interchangeable units for each lamp. It has been necessary to design a special

. . . Continued on page 64

THE TWIN DRAGONS OF THE SESPE

By HUGH WHITNALL, Associate Highway Engineer

State Sign Route 126 is the only traffic artery serving the entire length of the rich Santa Clara River Valley of Ventura County. One of the most important sections of this state highway is that portion which joins the two principal cities of the valley, Santa Paula and Fillmore. The connecting link between these two cities crosses Sespe Creek. Now this creek, like so many Southern California creeks, is dry a good part of the year. Even in the normal winter months the water flows quietly without destructive force. However, in flood years this creek has a history of violent destruction. It does not merely rise slowly and inundate bordering lands but, rather like a frenzied dragon, it growls and thrashes about, making the whole valley resound with the rumble of rolling and crashing rocks many the size of an automobile!

To effect a safe and economical crossing of this aqueous dragon, both the state highway and the paralleling Southern Pacific Railroad a generation or more ago made a loop up into the draw of Sespe Creek where it enters Santa Clara Valley. This loop adds a length of about one mile to the shortest possible alignment across the creek, but it does afford a relatively narrow crossing. However, the Sespe dragon has more than once come growling and thrashing out of the mountains and reduced both highway and railroad bridges to masses of shattered wood and steel.

Shorter Route Needed

As the Santa Clara Valley grew in importance primarily through the expansion of the citrus and the oil industries, the need became acute to eliminate for the benefit of through traffic the one mile of circuitous travel from the existing Sespe Creek crossing with its old narrow steel bridge. So, some 20 years ago the State instituted studies and drew up plans for a new crossing of the Sespe some distance downstream on direct alignment. This new crossing was to follow essentially the same alignment as that of the just completed project. This former plan provided for the highway to cross the creek on a single bridge 700 feet long spanning the main channel. Plans and right of way acquisition on this basis were being completed at the end of 1937.

Then one night in March of 1938 the dragon of the Sespe again came growling out of the mountains. It not only thrashed its tail around, causing the destruction of everything in its path, but this time its thrashing and writhing were so violent that the dragon exploded into twin dragons each as large as the former water torrent! Not only were all bridges in its path wrecked by one of the dragons but now the twin cut a parallel path of ruin through road, railroad, and farms. The former state highway plan of 1937 was shown to be obviously inadequate, for now it would take two 700-foot bridges spaced about one-third of a mile apart to leap the Sespe.

The proposed project for the new crossing had to be temporarily abandoned and a new engineering study initiated. World War II came along before the new engineering study was completed and before construction funds could be made available by the California Highway Commission.

Unique Problem

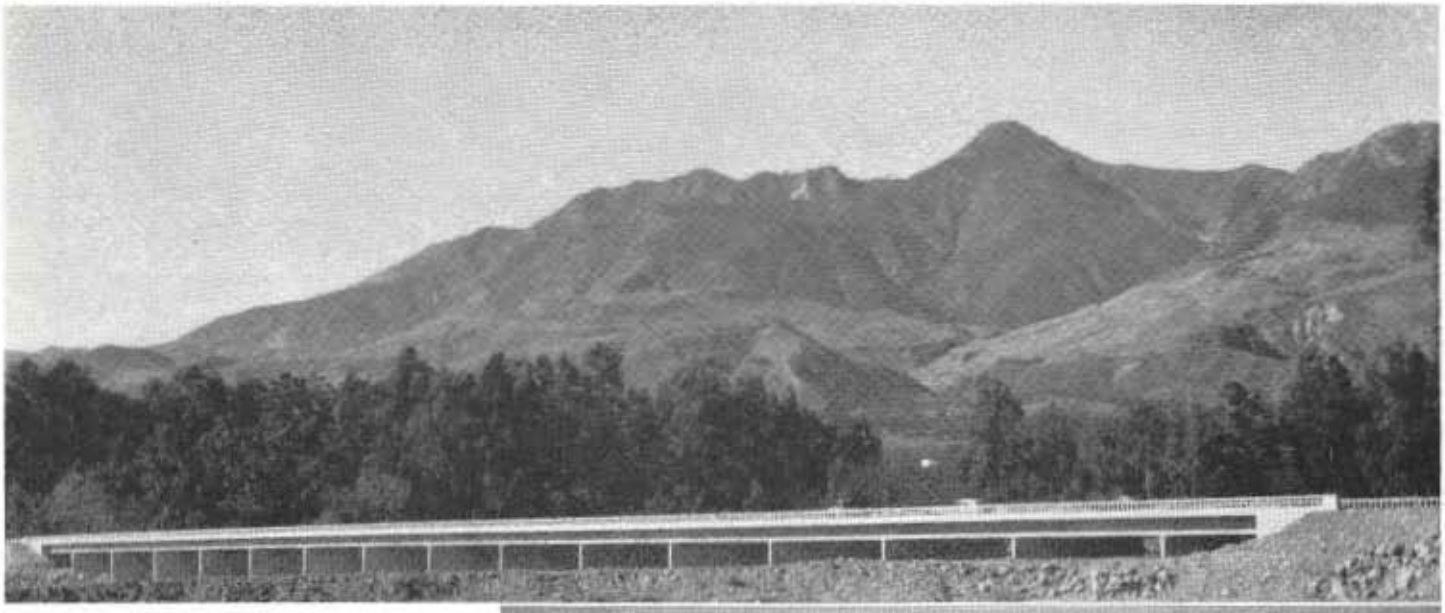
After the war, the project was started again. It was now realized that this project did not revolve around questions of ordinary highway design. This project called for developing some means of holding the twin dragon in place long enough and securely enough to warrant the expense of constructing two 700-foot bridges to carry the state highway across the double river. This challenging problem was assigned to L. M. Wade of the District VII Design Staff under the general direction of L. S. VanVoorhis. Under the able supervision of these engineers, the design to tame the twin dragon was developed. The final plan called for three major construction items:

1. Two miles of heavy section river-bank levees faced with heavy rock riprap to repress and guide the wild maneuverings of the twin dragon.
2. Two 700-foot two-lane bridges to vault across the dragon.
3. Two and one-third miles of state highway on new alignment.

It is evident that the road work was actually a minor portion of the contemplated contract. However, since the value of the river-bank levees plus the road work was somewhat more than one-half of the total estimated cost of the contract, the construction work was carried out under the supervision of district engineering forces. To supervise the construction of the two bridges the Bridge Department assigned one of its most able resident engineers, Donald W. Alden, as the Bridge Department Representative. The two bridges were of reinforced concrete girder design on concrete piers and steel "H" piles. The building of these two structures entailed the use of standard materials and methods, and bridge construction proceeded according to schedule with nothing unusual to report.

"Appian Way" Type Pavement

However, the building of both the river-bank levees and the highway involved unusual construction problems. In the case of the levees, the one item alone of heavy stone riprap was bid in by the contractor at a price $90,000 less than that of the second highest bidder! The subcontractor on this item of work, C. B. Clarkson, was able to make a profitable operation on the low bid by obtaining his rock as a by-product of an extensive land clearing operation on the nearby Ranch Sespe rather than obtaining rock from a commercial quarry in the usual manner. In the case of the highway construction, the contract called for three inches of



plant-mixed surfacing to be laid on a 21-inch base of selected material. The contractor constructed the bottom 15 inches of the base with material consisting largely of boulders, and then topped the boulders with a 6-inch blanket of gravel. The problem of making this "Appian Way" type of pavement with a heavy rock course topped by smaller rock was possibly unique in California road making experience. The many perplexing construction problems involved were solved efficiently by the contractor. The district staff will watch with interest over the years the stability of this Roman type road under heavy high-speed modern traffic.

City Cooperation

Another matter which was unique on this contract, at least in the 18 years of experience of this writer, was the high degree of foresight, initiative, and cooperation extended to the State's representatives by the City of Fillmore through its city manager, C. Leon Harthorn. Through Mr. Harthorn's efforts extensive work on water and sewer lines originally scheduled to be done after the road was opened to traffic was done instead during construction on an emergency basis by the city so that the public would not have to endure the sight of new pavement being immediately torn up for utility line installations.

UPPER—New Sespe Creek Bridge. LOWER—Ribbon-cutting ceremony. Left to right: Paul O. Harding, Assistant State Highway Engineer; Fergus Fairbanks and C. A. Maghetti, Secretary, California Highway Commission.

The opening of this new crossing of Sespe Creek to traffic was celebrated February 8, 1955, by an appropriate ribbon-cutting ceremony and banquet, under the joint auspices of

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California Bridges

Construction Costs Moved Downward During 1954

By J. S. McCLELLAND, Assistant Statistician, and
W. J. YUSAVAGE, Assistant Research Technician, Bridge Department

A NEW DECLINE in bid prices during 1954 carried California bridge construction costs to the lowest levels of the past four years. The moderate upswing of prices during 1953 ended with the first quarter of 1954 as costs declined 6 percent from the level of the preceding quarter. Mid-year prices fluctuated mildly then, during the fourth quarter, prices declined further to a point 9 percent below the level of one year earlier.

A general downtrend of costs originated late in 1951. Since that time, costs have followed this downward course with only brief interruptions by periods of fluctuation and reversal. As of the fourth quarter of 1954 costs have declined approximately 17 percent from the 1951 high and are slightly lower than the level encountered during the 1946-1948 period. The level of costs for each quarter of 1954 can be found in the accompanying chart which indicates the course of California bridge construction costs since 1933.

Computation of Costs

Bridge construction costs are based upon successful bidders' unit prices for 14 contract items of work in bridge construction. These items, which are listed in *Table I*, represent approximately 80 percent of the contract cost to the State for bridge construction. The remaining 20 percent is comprised mainly of work items for which lump sum bids are commonly requested and which are not suitable for periods for periodic comparison. The cost of a schedule of work, also shown in *Table I*, employing the average successful bid unit prices for the period, provides the basis for comparison of periodic costs. The period 1939-1940 provides the base level of costs with which the levels for all other periods are compared and also provides the item quantities of the fixed schedule.

This article is the third in a series dealing with California bridge construction costs. Previous articles appeared in the January-February, 1953, and January-February, 1954, issues.

For total California highway construction costs the reader is referred to a series of articles entitled "Cost Index," by R. H. Wilson, H. C. McCarty, and J. D. Gallagher, the most recent of which appeared in the January-February, 1955, issue of *California Highways and Public Works*.

Volume of Bridge Construction

Contract expenditures by the State for bridge construction are also shown, in index form, in the accompanying chart. Yearly levels of expenditure are shown in one index and expenditures, adjusted to compensate for changes in the level of costs, are shown in the other index. The latter serves an an approximation of the physical volume of work accomplished with the given expenditure.

These indexes show the marked increase in bridge construction which has accompanied the augmentation of state highway budgets during recent years. As a result of legislation which substantially increased highway-user tax revenues during 1953 and also as a result of the continued development of full freeways with their requisite separation structures, expenditures during the past year for bridge construction rose to nearly 45 million dollars or approximately 900 percent of the average annual rate of expenditure during the base period 1939-1940.

Table II lists the index values of the three indexes for periods subsequent to 1933 and the total value of low bids, in millions of dollars, for proposed bridge construction

TABLE I

TOTAL QUANTITIES, WEIGHTED AVERAGE PRICES, AND DOLLAR AND RELATIVE VALUES OF LOW BIDS FOR 14 PRINCIPAL ITEMS OF WORK IN CALIFORNIA BRIDGE CONSTRUCTION
CALENDAR YEARS 1939 AND 1940

Items of work	Total base period contract quantities	Weighted average prices	Dollar values of base period low bids	Relative values
Structure excavation	156,286 cubic yards	$1.56	$244,398.00	3.24%
Class "A" portland cement concrete (structure)	176,634 cubic yards	18.42	3,252,837.00	43.13
Class "A" portland cement concrete (footing block)	12,774 cubic yards	12.04	153,745.00	2.04
Structural steel (plate girder)	5,810,000 pounds	.077	450,221.00	5.97
Structural steel (rolled beam)	4,953,000 pounds	.063	310,900.00	4.12
Structural steel (truss)	7,884,000 pounds	.099	782,269.00	10.37
Miscellaneous iron and steel	766,630 pounds	.138	105,639.00	1.40
Bar reinforcing steel	35,958,000 pounds	.040	1,440,424.00	19.10
Furnishing steel piling	79,329 linear feet	1.79	142,168.00	1.88
Furnishing concrete piling	146,861 linear feet	1.60	235,477.00	3.12
Driving steel piling	2,313 each	25.29	58,490.00	.78
Driving concrete piling	3,781 each	40.84	154,411.00	2.05
Steel bridge railing	21,709 linear feet	5.93	128,798.00	1.71
Concrete bridge railing	42,976 linear feet	1.91	82,190.00	1.09
			$7,541,967.00	100.00%

on which bids were received during the respective periods.

General Trends

Average unit prices for the various items of work, as compiled for each quarter, show considerable variation in trend during the past few years. Bid prices for concrete (structure) rose to their highest level during 1953 but declined approximately 10 percent during 1954. Reinforcing steel has remained virtually unchanged in price during the past three years while structural steel, although subject to fluctuations in price, has declined approximately 20 percent during the same period. Relating the price levels for various items during the fourth quarter of 1954 to the respective item base period prices (shown in Table I), concrete (structure) stands at approximately 250 percent, reinforcing steel and the three items of structural steel at 230 percent and 180 percent, respectively, while the contract item structure excavation, which has undergone the least increase from the base price level, stands at 125 percent.

The decline of costs during the past year has been accompanied by further extensions of competition in bidding. During 1954 the average number of bids received on projects involving structures was approximately 10 percent higher than for the previous year, exceeded the average for the year 1952 by 50 percent, and was approximately double the average for 1951. The nature of competition is indicated most graphically, however, by the further declines in bid prices in view of the continued increases in wage rates and materials prices.

Outlook

The present downtrend of construction costs made its appearance as the dislocations accompanying the early months of the Korean War began to ease. The prospects of more efficient operation improved as materials and experienced labor became more readily available; and, with the pressure of stiffening competition, bid prices began to fall. The decline halted during 1953 and, for the time, it appeared that the trend of construction costs had started upward in response to the rising cost of labor and materials. The upward movement was halted during the past year, however, as strong competition brought about substantial reductions in bid prices.

TABLE II

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	1st	156	342	219	4.4
1946	2d	190	295	155	3.8
1946	3d	224	247* 148	133* 66	12.7 1.9
1946	4th	217	202	93	2.6
1947	1st	224	280	125	3.6
1947	2d	216	629	291	8.1
1947	3d	219	443* 450	202* 206	22.8 5.8
1947	4th	223	412	185	5.3
1948	1st	220	233	106	3.0
1948	2d	225	365	162	4.7
1948	3d	238	307* 381	134* 160	15.8 4.9
1948	4th	231	249	108	3.2
1949	1st	207	186	90	2.4
1949	2d	210	342	163	4.4
1949	3d	191	233* 194	117* 102	12.0 2.5
1949	4th	187	210	112	2.7
1950	1st	177	124	70	1.6
1950	2d	195	357	183	4.6
1950	3d	212	262* 171	129* 81	13.5 2.2
1950	4th	218	396	182	5.1
1951	1st	243	528	217	6.8
1951	2d	250	948	379	12.2
1951	3d	256	617* 598	247* 234	31.8 7.7
1951	4th	253	396	157	5.1
1952	1st	239	396	166	5.1
1952	2d	236	1,017	431	13.1
1952	3d	239	561* 652	237* 273	28.9 8.4
1952	4th	223	179	80	2.3
1953	1st	243	140	58	1.8
1953	2d	224	707	315	9.1
1953	3d	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	220	870* 1,002	399* 455	44.8 12.9
1954	4th	213	590	277	7.6

* Average quarterly information.

Estimates prepared jointly by the U. S. Departments of Commerce and Labor foresee a record volume of construction activity for the coming

. . . Continued on page 64

POLICY OF CALIFORNIA HIGHWAY COMMISSION IN REGARD TO THE ADOPTION OF FREEWAY ROUTES

An expanded restatement of the policy of the California Highway Commission in regard to the procedure leading up to freeway route determinations has been issued to each city council and county board of supervisors throughout the State.

In a letter transmitting the text of a commission resolution covering the statement of policy, Commission Secretary C. A. Maghetti explained to the cities and counties that the purpose of the resolution is to "assure a fuller understanding of the freeway needs and proposals in affected communities."

Maghetti said there is no actual change in procedure involved, but that the applicable laws are cited and the preliminary steps which are taken by the Division of Highways in arriving at route recommendations for commission consideration are now spelled out in official policy.

The text of the commission resolution follows:

WHEREAS, In view of the continuation of present highway user taxes at the level established in 1953, the augmentation of the highway program resulting therefrom, and the state-wide interest in freeways and freeway locations, the California Highway Commission desires to restate and redefine its policy and procedure with reference to the adoption of the location or relocation of any state highway which is to be constructed as a freeway on substantially new alignment; and

WHEREAS, Section 71 of the Streets and Highways Code provides that "The commission may alter or change the location of any state highway if in the opinion of the commission such alteration or change is for the best interest of the State."; and

WHEREAS, Section 75 of said code provides, in part, that "Except as otherwise provided by law, the commission at any time and from time to time may: (a) Select, adopt, and determine the location for state highways on routes authorized by law."; and

WHEREAS, Section 111 of said code provides, in part, that "Whenever the natural course of a state highway passes into or through any city and a state highway route through or around such city is not specifically described by law, the commission shall determine the location of the connecting portion necessary to make the state highway continuous. Such location may be either through or around such city, depending upon the commission's determination as to which location will be of the greatest benefit to through traffic upon such state highway."; and

WHEREAS, Section 100.3 of said code provides, in part, that "From and after the adoption of a resolution by the California Highway Commission declaring any section of state highway to be a freeway, the highway described in such resolution shall have the status of a freeway * * *," subject to acquisition of affected private property or private property rights; and

WHEREAS, In order that the commission may act in the best interest of the State in the selection and adoption of locations for state highways, or sections thereof, being considered for adoption and construction as freeways, it is required by the commission that it have before it all pertinent data relative thereto, including engineering and economic analyses respecting particular proposals; now, therefore be it

Resolved by the California Highway Commission, That the following procedure is hereby established for determination of the location or relocation of any state highway, or portion thereof, which is proposed to be constructed as a freeway on a location not then in use as a traversable state highway:

1. That, when sufficient engineering and economic data have been accumulated to support a tentative conclusion as to a basic plan for the location or relocation of any highway proposed to be constructed as a freeway, the State Highway Engineer, or his authorized representative or representatives, will confer with the appropriate city council or board of supervisors, or both such council and board, and with their technical staffs, including planning commissions and staffs, and will publicize and hold such meetings as may be reasonably necessary to acquaint interested individuals, officials and civic or other groups with the information developed.

2. After such conferences and meetings, the State Highway Engineer will submit a report to the commission covering the results of such conferences and meetings, the studies made, and a recommendation as to the location or relocation of the highway, or section of highway, proposed to be constructed as a freeway which in his judgment, subject to all laws applicable thereto, will serve the best interests of the State.

3. The State Highway Engineer, on authorization of the commission, will give public notice of the commission's intention to consider the adoption of the location or relocation of the highway, or section of highway, in question and will also give written notice to the city council or board of supervisors, or both, as the case may be, of such intention. Unless the local legislative body or bodies by resolution have previously declared that no public hearing by the commission is necessary or desirable, such notice to the local legislative body or bodies shall specify that if any such legislative body considers a public hearing on the matter necessary, the commission will hold, or cause to be held, such hearing, if so requested by any such local legislative body within thirty (30) days after the first regular meeting of such body following receipt of such written notice.

4. If any such legislative body requests such hearing, the commission, or designated members thereof, will hold, or cause to be held, a hearing, after due public notice of the time and place thereof, at which time and place all persons and organizations, and official bodies interested in the matter will be given opportunity to be heard.

5. The commission may, on its own motion, call a public meeting or hold such hearings, or rehearings, as it may deem appropriate.

6. After the expiration of such period of thirty (30) days, if no hearing is requested, or after such hearing, or after such hearing as the commission may hold on its own initiative, the commission will take action in respect to the location or relocation of such highway proposed to be constructed as a freeway.

7. The authorization referred to in numbered paragraph 3 of this resolution, to give public notice of the commission's intention to hold a hearing, shall be by resolution of the commission relating to each specific location or relocation of the highway proposed to be considered. In all other respects, this resolution authorizes the State Highway Engineer, without further resolution or order of this commission, to do such things and take such action as may appear to him to be necessary or proper to comply with the above specified procedure and to comply with the herein announced purpose of the commission to inform the interested individuals and officials as to the nature of and the reasons for the particular proposal.

8. The resolutions of the commission regarding the subject matter hereof, adopted on July 15, 1948, and on July 23, 1953, are hereby rescinded.

SOUTHERN CROSSING PLANS MEET APPROVAL

Southern Crossing consultants meet. Standing: Director of Public Works Frank B. Durkee and Norman C. Raab, Projects Engineer. Seated, left to right: O. J. Porter, Ralph Smillie, and Charles E. Andrew.

PLANS FOR a southern crossing of San Francisco Bay as prepared thus far by Norman C. Raab, Chief, Division of Bay Toll Crossings, have been approved by a board of engineering consultants engaged by the California Toll Bridge Authority.

The consultants, Ralph Smillie of New York, O. J. Porter of Newark, New Jersey, and Charles E. Andrew of Tacoma, Washington—all nationally outstanding engineers—met with Raab and his engineering staff, and with Director of Public Works Frank B. Durkee in San Francisco on February 21st, 22d, and 23d in the first of three planned conferences.

Porter is an authority on bridge foundations, Smillie on underwater tubes, and Andrew on general toll bridge construction.

After three days spent in reviewing the work accomplished by Raab and his aides thus far and in an inspection tour of the proposed anchorages and approach routes on both sides of the bay, it was agreed by the consultants that the project is engineeringly feasible, that the plans are in agreement with the mandate of the statute, and that the work is progressing satisfactorily and as rapidly as can be expected.

Raab estimates that construction of the proposed crossing can begin by the middle of 1956.

The consultants will meet with state engineers again during the progress of the studies, and a third conference will be held late this year, probably in December, when the preliminary plans are expected to be completed and cost estimates computed.

TOLERANCE

Experienced drivers should show tolerance for the faults and errors of those who are obviously beginners. Impatience or wild use of the horn in such cases is likely to confuse the unskilled driver and may make a bad situation worse.

Quarter Century Club Announces Officers for 1955

The Quarter Century Club, an organization of Division of Highways employees who have served more than 25 years, recently announced the results of its annual election. Officers for the year 1955 are: President, F. W. Montell, District IV; First Vice President, E. J. Gribble, District II; Second Vice President, R. B. Luckenbach, District XI; Secretary-Treasurer, B. Van Dalsem, District IV, and Historian, E. E. Sorenson, Headquarters, Equipment Department.

The Quarter Century Club was organized in 1939 by a group of 23 charter members who believed that the older employees should maintain an organization which would serve as an identification of longevity in faithful service to the Highway Department and would also serve as a means of communication between "old timers."

Many members of the club took an active part in the events which lead to enactment of legislation which now permits the awarding of 25-year service awards by the State. The club identifies itself with an emblem patterned after the emblem of the Division of Highways and many members proudly display this emblem in form of a wall plaque engraved with the member's name and the date he entered service with the division.

There are approximately 160 members in the Quarter Century Club at this time. Included in the membership are a number of retired employees of the Division of Highways who were active in the organization of the club. A drive has just been launched for the purpose of increasing this membership to a number more representative of the estimated 900 employees of the Division of Highways who have more than 25 years of service to their credit.

COST OF STORM DAMAGE

The total field cost of slide removal and storm damage repair financed by state highway maintenance funds was $1,257,056 for the 1953-54 Fiscal Year.

Turtle Club

Two Employees of Division Of Highways New Members

FRANKLIN R. SAATHOFF and William D. Cruthirds recently became the first two employees of the California Division of Highways to be awarded membership in the Turtle Club. With the slogan "Shell on head—we're not dead" this exclusive intertional brotherhood allows as members only those who have escaped death or serious injury because they were wearing safety helmets.

Saathoff and Cruthirds, both of the District III (Marysville) staff, became eligible for membership while working as plant inspectors on the Elvas Freeway job near Sacramento.

Saathoff was struck in the head by a swinging clamshell bucket. The blow was strong enough to break away a section of his safety helmet and hospitalized him for several days, but the hat saved him from serious injury and perhaps death.

Cruthirds was struck on the head by a rock while standing beneath a mixing bin but, like Saathoff, he escaped serious injury.

Cruthirds admits that he learned the vital message of safety-every-minute the hard way. A few weeks before, he had been struck by a falling rock when he walked back under the mixing bin for a few moments without wearing his safety helmet. The accident hospitalized him for 11 days.

Both men received membership certificates, lapel pins and new hard hats with Turtle Club insignia from E. W. Bullard of San Francisco, international sponsor of the organibation.

In becoming members of the club all "turtles" pledge themselves to promote the constant practice of safety and the use of safety equipment.

The Turtle Club, organized in 1950 by C. R. Rustemeyer of Vancouver, now has members throughout Canada, the United States and the British Isles.

John Snider (center), Safety Supervisor for District III, examines broken helmet held by Franklin R. Saathoff which Saathoff was wearing when struck in the head by a swinging clamshell bucket. William D. Cruthirds (left) also escaped serious injury when a stone fell from a mixing bin and struck him on the head, putting a large dent in his safety helmet.

US 97 IMPROVEMENT

Continued from page 23 . . .

standards; however, right of way was secured of ample width for future four-lane construction throughout the entire length. The remainder of the project was stage construction in the ultimate design as the money available would permit.

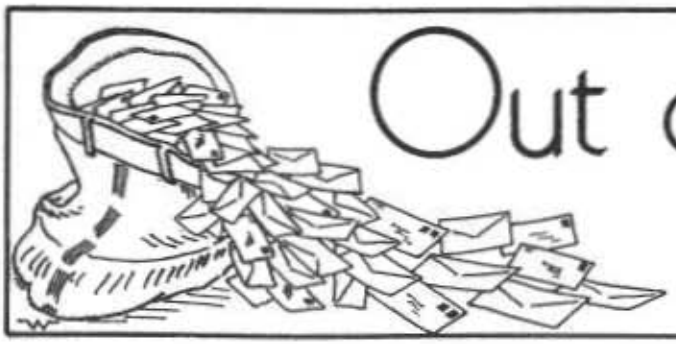
On account of ice and snow conditions on Route 72 during the winter months, the standard superelevations were reduced for safety reasons. An added feature for the safety and convenience of the motoring public was the "chain on and off areas" provided on each side of Dorris Hill. These areas permit the public to park off the traveled ways while putting on or taking off chains.

Eaton and Smith was the subcontractor on the grading operations and the previously mentioned firm of Clements Construction Company and Clements Company was the prime contractor.

The work was done under the direction of J. W. Trask, District Engineer, and George Barry, District Construction Engineer, with the writer as the resident engineer on the project.

SCHOOL BUS

Almost one-third of all school children ride to school in buses, reports the California State Automobile Association.



Out of the Mail Bag

PRAISE FROM TAIWAN

TAIWAN HIGHWAY BUREAU
Taipei, Taiwan

MR. KENNETH C. ADAMS, *Editor*

DEAR MR. ADAMS: Thank you very much for your kindness in sending me and our library your fine magazine, the California Highways and Public Works. We all enjoy it very much.

After I finished my training program in the United States, I visited four countries in Europe. They are France, Belgium, West Germany and Italy. But I found that your freeway and magazine are the best in the world.

With my best wishes,
Sincerely yours,

WEN-TAO CHANG
Bridge Engineer
Taiwan Highway Bureau

FROM FRANCE

REPUBLIQUE FRANCAISE
Monsieur Rene Malcor
Ingenieur en chef des Ponts et Chaussees
Directeur Des Services Techniques
de la Ville de Marseille

K. C. ADAM, *Editor*

DEAR SIR: I have received *California Highways and Public Works* since November, 1952, and I have found in it the most valuable amount of information I ever found in any highway journal.

Following a trip in the States during which I had the opportunity to pay a short visit in California to Districts IV and VII, I will write in a French highway magazine an account of my visit, complete with summaries of some articles of your journal.

Yours very truly,

RENE MALCOR

MISSION TO IRAQ

EDWARDS, KELCEY AND BECK
Consulting Engineers
3 William Street, Newark 2, N. J.

California Highways and Public Works

GENTLEMEN: We have a mission of five highway engineers in Iraq. Their job is to develop a going highway department and assist in progressing an extensive highway program in that country. One of the problems to be dealt with by this mission is route numbering and highway cost accounting.

We understand that an article, entitled "History of United States Numbered Highways," by M. A. O'Brien, Highway Signing Supervisor, appeared in *California Highways and Public Works*, in the March-April and May-June, 1952, issues.

Would it be possible to secure this article or copies of the issues in which it appeared?

Very truly yours,

GUY KELCEY

KIND WORDS FROM WASHINGTON

WASHINGTON
STATE HIGHWAY COMMISSION

MR. KENNETH C. ADAMS, *Editor*

DEAR MR. ADAMS: Your magazine is the outstanding one in the field and you deserve commendation for showing the way. A publication of this type would be a desirable goal of each highway department as a means of not only disseminating technical information, but also of reaching the public with the importance, magnitude, and impact of highway problems and developments.

Yours very truly,
J. K. MLADINOV
Senior Planning Engineer

WELL-EARNED PRAISE

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
Shasta-Trinity National Forests

J. W. TRASK, *Division Engineer*
California State Division of Highways
Redding, California

DEAR MR. TRASK: Please accept our many thanks for the fine work of Mr. Haley and Mr. McGovern of your maintenance section during the recent accident in which one of our employees, Marvin D. Taft, was involved.

Haley and McGovern were the first ones on the scene and by their quick and effective work could well have saved the driver's life had he not been so severely injured. The dispatch with which these men cared for Mr. Taft, before and after the ambulance arrived, calls for special mention. It is reassuring to know that we have a highway crew with men such as Haley and McGovern who are so willing to go far beyond their normal call of duty to provide help.

Please let these men know that the Forest Service is most appreciative of their help. We hope some day to be able to return their kindness. A note of thanks is also due your fine dispatcher and others in your organization who make the job "click" when they are needed most.

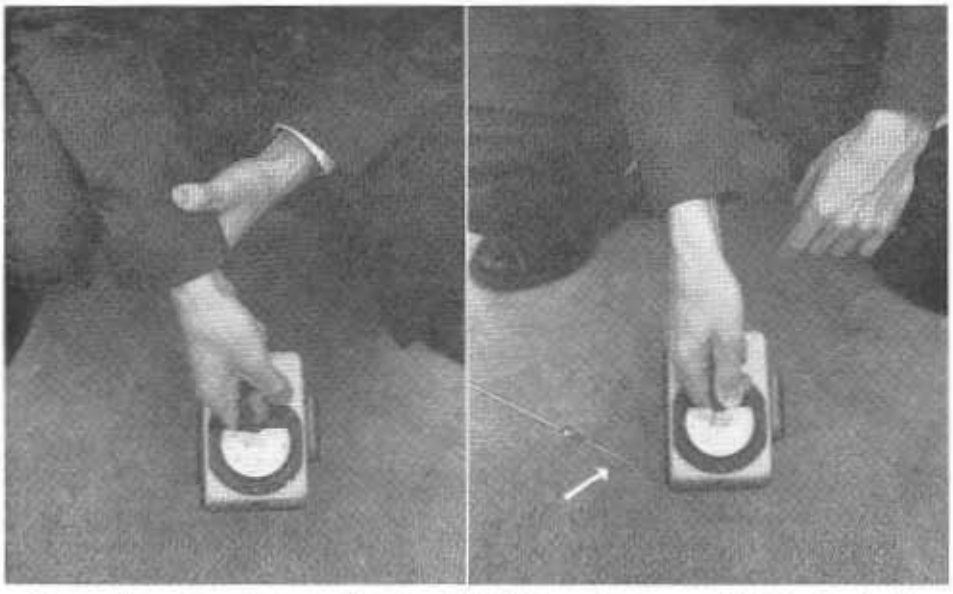
Very truly yours,

PAUL W. STATHEM,
Forest Supervisor

AUTOMOBILES ENTERING STATE

A total of 216,416 automobiles entered California during January, 1955, as compared with the 200,041 that entered during January of 1954, reports the National Automobile Club.

Radiological Monitoring Classes Being Held



The two photos show a Jordan Ion Chamber with (left) the needle at zero and (right) registering the amount of radiation emitted by some radio-activized metal (white arrow) held near it

In keeping with the intensification of the Nation's atomic defense program, the State Division of Highways now is training some of its employees in the use of radiological monitoring methods and equipment.

These men, most of them highway superintendents, are being instructed in the use of ion chambers capable of recording radiation at any time and place.

The classes are being conducted by Harvey A. Towne, assistant maintenance engineer, and Carroll T. Berry and Ralph Zook, assistant safety engineers. Towne, Berry and Zook recently completed an intensive training course in radiology conducted by the State Office of Civil Defense in San Diego.

The course being given to Highways personnel throughout the division's 11 districts takes two days and includes basic radiological theory as well as use of the ion chambers. After completing the course, the highway superintendents are equipped with ion chambers which they carry with them as they make their rounds of the roads under their jurisdiction. If they detect any signs of radioactivity they will report to their headquarters via the two-way FM radios in their vehicles.

State-wide Coordination

State-wide coordination of the monitoring activity will be effected through the district and Sacramento Headquarters offices. Each district maintains contact with a regional civil defense office, and headquarters with the Office of Civil Defense in Sacramento.

The chief danger from radiation is from radioactive fall outs—the contamination of an area from falling or drifting radioactive material. A good example is the recent series of atomic bomb tests at Yucca Flat in Nevada. On a few occasions a limited drift of radioactive particles was recorded across sections of Southern and Central California.

With ion chamber-equipped vehicles now patrolling state highways, it will be possible to detect the presence of such radioactivity and its amount so that the flow of traffic can be controlled through the contaminated area.

The ion chamber, a small metal box measuring 5 x 5 x 3½ inches and weighing 3½ pounds, can register the presence of radioactivity between .0005 and 500 roentgens.

Types of Exposure

An exposure of 200 roentgens would prove fatal to some people not in good health; a 400 roentgen dosage would kill half the people in an affected area and 600 roentgens would be enough to kill everyone.

However, sustained exposure to much smaller quantities can also prove injurious or even fatal. For example, the normal maximum industrial dosage for anyone working with radioactive material for a day is 0.050 roentgens. Above that, the cumulative effect could prove harmful.

The ion chambers, which will be used by Highways personnel, are not as sensitive as geiger counters in recording the lower, nonharmful amounts of radiation, but possess a much greater range. Most geiger counters do not record high enough to be of use in an explosion area.

John Chaffee Is Given Promotion In District V

John M. Chaffee, Assistant Construction Engineer of the California Division of Highways, has returned to San Luis Obispo to assume the position of Assistant District Engineer of District V. He will take over the administrative duties formerly handled by the late John W. Corvin.

Chaffee came to work for the division in 1928. Except for a few months during that year when he served as an inspector on highway construction in District I at Eureka, all of his service with the division was in District V until his promotion to the Sacramento headquarters office in 1952 as Assistant Construction Engineer.

In District V, following several years as construction inspector and resident engineer, he served successively as Assistant District Maintenance Engineer, Assistant District Office Engineer and, from 1947 to 1952, as District Office Engineer.

BRIDGE REPAIRS

Maintenance work and repairs, not including painting, on the 5,047 bridges on state highways cost $375,000 during the 1953-54 Fiscal Year. Work in the nature of minor bridge improvements was performed at a cost of $220,000.

State Highway Contracts Awarded

JANUARY, 1955

Contra Costa County—FAS County Route 800—Between Oak Grove Road and Clayton Road, near Concord, on the Ygnacio Valley Road. Construct a graded roadbed and surface with plant-mixed surfacing on untreated base and selected material, 4.4 miles. Awarded to Transocean Engineering Corp., Hayward, $547,527.95.

Contra Costa County—SR 21—At Martinez. Repair of existing ferry slip. Awarded to Healy Tibbitts Construction Co., San Francisco, $16,986.75.

Imperial County—US 80—Between Winterhaven and the Colorado River. Construct a graded roadbed, surface with plant-mixed surfacing on cement treated base and imported base material, apply seal coats and construct a welded plate girder bridge, 0.8 mile. Awarded to Silberberger Construction, Inc. & J. B. Stringfellow Co., Riverside, $386,886.80.

Kern County—US 399—At the intersection of Date and Harrison Streets. Install two pipe culvert cross drains. Awarded to Oilfields Trucking Co. & Phoenix Const. Co., Inc., Bakersfield, $3,517.

Los Angeles County—Long Beach Freeway—Between 0.1 mile south of Willow Street and 0.2 mile north of Del Amo Boulevard, in and adjacent to the City of Long Beach. Grade a ramp and frontage road and place plant-mixed surfacing on untreated base, construct a retaining wall and furnish and install highway lighting and illuminated sign system. Awarded to J. E. Haddock, Ltd., Pasadena, $48,643.80.

Los Angeles County—Harbor Freeway—Between Figueroa Street and Olympic Boulevard in Los Angeles. Prepare and plant areas, install water system and furnish and plant ground cover plants, 1.0 mile. Awarded to D. & M. Sprinkler Co., Long Beach, $31,499.75.

Los Angeles County—US 99—Between Brand Boulevard and Sonora Avenue, on San Fernando Road. Modify this existing interconnected pretimed signal systems and install highway lighting. Awarded to C. D. Draucker, Inc., Los Angeles, $40,598.

Marin County—SR 1—Between five miles south of Stinson Beach and 1.2 miles south of the Sonoma County line. Replace the existing culverts, place plant-mixed surfacing on untreated base, construct head walls, drop inlets and repair shoulders, end walls. Awarded to Chas. S. Moore, San Jose, $12,706.40.

Monterey County—SR 117—Near Corral de Tierra Road, about 7.5 miles southwest of Salinas. Place imported subbase material on the existing roadbed, place untreated base, surface and plant-mixed surfacing and apply seal coats, 0.2 mile. Awarded to Granite Construction Co., Watsonville, $18,538.

Orange County—At the intersection of Lincoln Avenue with Brookhurst Street and Euclid Avenue, in and adjacent to the City of Anaheim. Furnish and install complete in place full traffic-actuated signal systems and highway lighting. Awarded to Galland Electric Co., South Gate, $18,071.55.

Riverside County—SR 71—Between Junction Route 78 and San Jacinto River, 11.0 miles. Place imported borrow and imported base material, construct cement treated base, place plant-mixed surfacing and apply seal coats and construct a reinforced concrete bridge, completion of which provides a four-lane divided highway on new alignment with Route 77/78 Separation. Awarded to E. L. Yeager Co. & J. A. Payton, Riverside, $1,143,442.21.

San Bernardino County—US 91, 466—At Baker Maintenance Station, 1.3 miles northeasterly from Baker, drill and case a well. Awarded to J. B. Henderson & Sons, Corona, $2,200.

San Diego County—On Cabrillo Freeway at Mission Valley Interchange. Grade and surface a speed change lane with plant-mixed surfacing on concrete base and imported subbase material, 0.1 mile. Awarded to R. E. Hazard Contracting Co., San Diego, $7,995.95.

San Francisco County—SR 1—At Park Presidio Tunnel, remove the existing tunnel lighting luminaires and install a fluorescent lighting system, construct a louver across the top portion of the arch and paint the face of the south portal and adjacent wing walls. Awarded to Ets-Hokin & Galvan, San Francisco, $99,811.

San Joaquin County—US 99—Between 0.2 mile west of Austin Road and North Avenue, near Manteca. Furnish and install complete in place, highway lighting and illuminated signs. Awarded to Collins Electrical Co., Stockton, $27,777.77.

San Joaquin and Sacramento Counties—US 99—Between Jahant Road and 0.5 mile north of Sacramento County line. Grade and pave with concrete pavement and construct four bridges, completion of which provides a four-lane divided highway with a steel bridge at Collier Road Overcrossing, a steel bridge at Liberty Road Overcrossing, a reinforced concrete bridge at South Channel Dry Creek, and a reinforced concrete bridge at North Channel Dry Creek, 3.4 miles. Awarded to M.J.B. Const. Co. & Lord & Bishop, Inc., Stockton, $1,036,230.

San Luis Obispo County—US 101—Between 1.5 miles west of Santa Margarita and Atascadero. Grade roadbeds and place portland cement concrete pavement; grade ramps, approach and frontage roads and place plant-mixed surfacing; construct six bridges and a pedestrian underpass; install highway lighting and illuminated signs, completion of which provides a four-lane divided highway on new alignment together with a steel bridge at Route 58/2 Separation, Santa Rosa Road Overcrossing, two parallel bridges at Route 2/125 Separation and at Traffic Way Undercrossing; concrete bridges at Santa Margarita Creek and Atascadero Creek and a pedestrian undercrossing at Atascadero Creek, 9.3 miles. Awarded to Madonna Construction Co., San Luis Obispo, $2,964,679.20.

San Luis Obispo County—SR 41—Between one mile west and two miles east of Estrella River. Grade and surface with plant-mixed surfacing on cement treated base and construct a steel bridge, completion of which provides a highway on new alignment, eliminating curves, with a bridge across the Estrella River, 2.9 miles. Awarded to John Delphia, Patterson, $476,821.

Santa Barbara County—US 101—Between Miramar Avenue and Park Place, in and near the City of Santa Barbara. Grade and pave with portland cement concrete on cement treated subgrade and with plant-mixed surfacing on cement treated base and construct six reinforced concrete bridges and one reinforced concrete pedestrian undercrossing, completion of which provides a four-lane divided highway with interchange lanes, frontage roads and acceleration and deceleration lanes, at San Ysidro Road Overcrossing, bridge across Montecito Creek, Montecito Creek Bridge, East Olive Mill Road Overcrossing, Olive Mill Road Overcrossing and Route 2/150 Sparation, 2.4 miles. Awarded to Guy F. Atkinson Co., South San Francisco, $1,565,103.55.

Santa Cruz County—SR 9—At four locations on River Street, remove the existing wooden culverts, and replace with concrete valley gutters; reconstruct portions of the existing street to conform with new gutter. Awarded to Granite Construction Co., Watsonville, $2,357.

Shasta County—FAS County Route 1176—Between 0.5 mile south of Igo and 2.6 miles west of Girvan. Grade, place imported subbase and base material, surface with untreated surfacing and construct a welded plate girder bridge with reinforced concrete deck and a reinforced concrete box culvert, 6.2 miles. Awarded to Claude C. Wood Co., Lodi, $359,825.60.

Siskiyou County—SR 96—At Clear Creek, 8.4 miles southwest of Happy Camp. Construct an honor camp including roads, water system, electrical system, sanitary system, gas fuel distribution system and buildings. Awarded to B. & R. Construction Co., San Francisco, $259,488.

Tulare County—SR 134—Across Inside Creek and Outside Creek, about seven miles east of Tulare. Widen the approaches and two bridges across Inside Creek and Outside Creek. Awarded to Thomas Construction Co., Fresno, $18,575.

FEBRUARY, 1955

Contra Costa County—Between Martinez Road and Willow Pass Road, on the Arnold Industrial Highway, at various locations. Remove and repair pavement surfaces with cement treated bases at bridge approaches, 0.2 mile. Awarded to Marchio-Baker-Trewhitt Co., Inc., Antioch, $17,370.

Del Norte County—US 101—Between 11.5 miles south of Crescent City and 8.3 miles south of the Oregon state line, at various locations. Remove existing guard railing and construct new metal plate guard railing, 0.3 mile. Awarded to F. B. McNear, Oakdale, $5,428.50.

Humboldt County—US 101—Across Big Lagoon, about 10 miles north of Trinidad, repair the existing bridge. Awarded to Chas. I. Cunningham Co., Oakdale, $8,865.

Kern County—US 466—At Bena and Lomond cattlepasses about two miles east of Bena. Replace existing timber cattlepasses with earth fills. Awarded to Geo. E. France, Inc., Bakersfield, $5,570.25.

Kern County—US 466—Between one-fourth mile west and one-fourth mile east of Caliente Road. Construct a graded roadbed and surface with plant-mixed surfacing on cement treated base and construct channelization connections and approaches, 0.5 mile. Awarded to Dicco, Inc., Bakersfield, $41,988.

Los Angeles County—San Bernardino Freeway—Between 0.3 mile east of Citrus Avenue and 0.2 mile east of Ganesha Boulevard. Grade and pave with portland cement concrete on cement treated subgrade, place plant-mixed surfacing on selected material on frontage roads and connections, construct a reinforced concrete bridge and two undercrossings, completion of which provides a four-lane divided highway with bridges at Walnut Creek Bridge Widening, via Verde Undercrossing and at Holt Avenue Undercrossing, 5.2 miles. Awarded to Winston Bros., Monrovia, $2,210,075.50.

Los Angeles County—At the intersections of Atlantic Avenue with Compton Boulevard with Rosecrans Avenue and with Brompton Avenue and Bell Avenue. Furnish and install or modify traffic signal systems. Awarded to Westates Electrical Const. Co., Los Angeles, $10,930.

Los Angeles County—SR 15—Between Slauson Avenue and 0.3 mile south of Atlantic Boulevard (portions), 0.5 mile. Excavate a "glory hole" and construct a steel railroad bridge and drainage facilities. Awarded to Oberg Bros. Const. Co., Inglewood, $219,721.

Los Angeles County—Near South Gate, at the intersection of Firestone Boulevard with Rives Avenue, improve intersection by constructing curb returns, removing portland cement concrete box culvert and junction chamber, removing two palm trees and placing plant-mixed surfacing, and install a complete in place coordinated semi-traffic-actuated signal system and highway lighting. Awarded to Electric & Machinery Service Inc., South Gate, $10,889.25.

Los Angeles County—SR 179—Across Los Cerritos Flood Control Channel, on East Seventh Street, at Studebaker Road, about one mile east of Long Beach. Construct a reinforced concrete girder across Los Cerritos Channel, and approaches. Awarded to C. B. Tuttle, Los Alamitos, $72,462.25.

Mendocino County—US 101—At Leggett Valley Maintenance Station. Construct a gasoline and oil

house, and a grease rack. Awarded to S. W. Kellog, Willits, $4,036.46.

Merced County—SR 152—Across Twin Canals and Los Banos Creek, between west city limits of Los Banos and 1.5 miles west. Widen three concrete bridges at Twin Canal, another at Twin Canal and at Los Banos Creek. Awarded to Gene Richards, Inc., Fresno, $51,874.

Orange County—Santa Ana Freeway—Between Lewis Street and Broadway, 2.7 miles. Construct a graded roadway and surface with portland cement concrete pavement and construct 11 bridges, completion of which will provide a four-lane divided highway with reinforced concrete bridges at Placentia Avenue Overhead, Chapman Avenue Off-Ramp Undercrossing, a pair at Chapman Avenue Undercrossing, a pair at Chapman Avenue On-Ramp Undercrossing, one at Chapman Avenue On-Ramp Undercrossing Pumping Plant, at Widening Bridge across Santa Ana River, Bristol Street Overhead, Bristol Street Overcrossing, widening bridge across Santiago Creek, left frontage road bridge across Santiago Creek and a steel bridge at Chapman Avenue Underpass. Awarded to Griffith Co., Los Angeles, $2,817,519.90.

Riverside County—US 60—Between Moreno and four miles west of the junction of Route 26. Widen the existing roadbed by grading and placing plant-mixed surfacing; grade and surface road approaches, road connections and cross-overs; place wire mats and perform slope erosion control work on embankment slopes; place stone riprap as channel lining; construct drainage facilities, completion of which provides a new four-lane divided highway, 5.2 miles. Awarded to Matich Bros. & Matich Bros. Paving Co., Colton, $748,257.

San Benito County—SR 156—At Tequesquito Slough, about 4.5 miles north of Hollister. Construct a graded roadbed, place plant-mixed surfacing and bases and construct a reinforced concrete bridge across Tequesquito Slough, 0.3 mile. Awarded to Baun Construction Co., Inc., Fresno, $37,868.45.

San Bernardino County—US 91-466—At Wheaton Wash Maintenance Station, 38 miles northeasterly from Baker. Drill and case a well. Awarded to Mel Meyer Co., Reno, $2,050.

San Bernardino County—At the intersection of US 66 and US 395 near Victorville. Furnish and install a highway lighting system. Awarded to Paul R. Gardner, Ontario, $2,743.

San Bernardino County—SR 18—Between 6.5 miles and 8.3 miles north of San Bernardino. Install metal plate guard railing, 0.7 mile. Awarded to Wulfert Co., Inc., San Leandro, $10,548.

San Diego County—Across San Luis Rey River, about 1.5 miles southwest of Lake Henshaw. Construct a steel bridge and approaches. Awarded to O. B. Pierson, Bellflower, $56,600.70.

San Diego County—SR 94—Between Euclid Avenue and 0.2 mile east of College Avenue. Grade and pave with portland cement concrete pavement on cement treated subgrade, place plant-mixed surfacing on cement treated base, imported base material or existing pavement, and construct four bridges at College Avenue Undercrossing, Broadway On-Ramp, Federal Boulevard On-Ramp Undercrossing, and 56th Street Overcrossing, completion of which provides a six-lane divided freeway, together with necessary ramps, interchange lanes and street connections, 2.8 miles. Awarded to Guy F. Atkinson Co., Long Beach, $1,620,049.55.

San Diego County—FAS 732—Between Alvarado Canyon Road and Brockton Street. Construct a graded roadbed, place plant-mixed surfacing on imported base material and portland cement concrete base and apply seal coats, 3.5 miles. Awarded to Daley Corp., San Diego, $609,849.50.

Santa Cruz County—At the sewage treatment plant in Big Basin State Park. Clean and paint the steel trusses and rotary sewage distributor over a trickle filter. Awarded to Chas. Murphy, San Francisco, $1,215.

Santa Clara County—At the intersection of Embarcadero Road and Bayshore Highway. Widen a portion of the existing highway and surface with plant-mixed surfacing on untreated base, portland

. . . Continued on page 64

EMPLOYEES RECEIVE TWENTY-FIVE-YEAR AWARDS

Employees of the Division of Highways who became eligible for their 25-year service awards on September 30, December 31, 1954, January 31, and February 28, 1955, are:

Name	Birthdate	Total service Yrs.	Mos.	Days
ELIGIBLE ON SEPTEMBER 30, 1954				
Shop 5				
Nevins, Vernon J.	8-12-08	25	0	21
ELIGIBLE ON DECEMBER 31, 1954				
District I				
Brewster, Henry Elmer	9-13-09	25	0	8
District II				
Saunders, Fred S., Jr.	7-17-10	25	0	6
Weaver, Earl	12- 8-05	25	0	11
District III				
Christman, Louis E.	3-30-12	25	0	14
District IV				
Ives, Thomas H.	2-21-92	25	0	14
Simmons, Albert E.	7-27-05	25	0	29
Spence, James A.	6-24-03	25	0	22
Hite, Webster C.	3- 3-04	25	0	25
District V				
Funk, Luther L.	6-26-01	25	0	29
Bender, Herman J.	11-27-02	25	0	12
Canham, Clarence C.	11- 3-02	25	0	9
District VII				
Van Voorhis, L. Sherrill	3-18-10	25	0	17
Hawkins, Fred K.	3-22-86	25	0	23
Sheff, Vaughn O.	8-18-00	25	0	9
District VIII				
Cox, Walter L.	3- 6-86	25	0	9
District X				
Connor, James	1-23-02	25	0	16
Shop 8				
Prentice, Virginia	8- 1-10	25	0	29
Materials and Research Dept.				
Bennett, William S.	12-27-99	25	0	29
ELIGIBLE ON JANUARY 31, 1955				
District I				
Dunton, Mose	3-02-09	25	0	11
Hart, Alan S.	12-07-07	25	0	16
Stebbins, Ben	6-16-13	25	0	9
District II				
Leoni, Francis F.	2-03-03	25	0	26
Warren, Harvey E.	2-18-95	25	0	28
District IV				
Strahlow, Albert W.	1-25-04	25	0	23
District VII				
Fletcher, Joyce	4-23-07	25	0	19
Gallagher, Bernard M.	12-29-87	25	0	21
Holzman, Zelik	5-12-07	25	0	28
Stuart, Joe A.	8-30-05	25	0	3
District VIII				
Adams, Philip	4-06-04	25	0	4
Maynard, Henry E.	11-21-02	25	0	12
District IX				
Cummings, Raymond C.	1-20-00	25	0	25
District XI				
Schilling, Ernest H.	5-23-90	25	0	14
Central Office				
Fenwick, Kenneth M.	11-08-03	25	0	10
Reynolds, Lloyd B.	11-25-98	25	0	20
Materials & Research				
Nelson, Merle L.	9-06-08	25	0	28
Headquarters Shop				
Rider, Graham G.	11-05-07	25	0	26

Name	Birthdate	Total service Yrs.	Mos.	Days
ELIGIBLE ON FEBRUARY 28, 1955				
District I				
Trepier, James H.	12-21-05	25	0	19
District II				
Carpenter, Walter V.	3-06-05	25	0	15
Robrecht, Augustus A.	12-24-08	25	0	5
District IV				
Campbell, Jack C.	8-13-07	25	0	11
Rothermel, Ted	10-12-08	25	0	12
Summers, Harold A.	11-06-99	25	0	26
District V				
Evans, Paul E.	2-18-04	25	0	17
District VIII				
Dufrain, A. Frank	5-10-93	25	0	26
Goode, L. Maynard	11-27-08	25	0	27
Lakes, Curtis	1-17-09	25	0	27
District XI				
Frezee, Donald B.	5-04-99	25	0	16
Central Office				
Lusich, Minerva	3-20-08	25	0	0
Milton, R. E.	2-02-06	25	0	22
Mitchell, M. H.	1-17-03	25	0	26
Bridge Dept.				
Hutchinson, Ralph W.	12-29-02	25	0	19
Segehorn, Ernest H.	7-16-03	25	0	23
Shop 2				
Henriques, Anthony R.	8-06-92	25	0	0
Headquarters Shop				
Martinson, A. Oliver	7-01-97	25	0	15
ELIGIBLE ON MARCH 31, 1955				
District II				
Coffin, William C.	4-13-11	25	0	11
Duffy, Phil F.	9-26-11	25	0	22
Eckholm, Arthur H.	3-18-00	25	0	11
District III				
Lumley, John W.	7-10-95	25	0	19
District IV				
Ball, Hartwell R.	4-12-03	25	0	6
DistrictVII				
Black, Alex G.	11-08-93	25	0	18
Leonard, Harold W.	4-12-99	25	0	15
District VIII				
Hopkins, Robert D., Jr.	9-10-01	25	0	20
Norton, Richard O.	1-30-07	25	0	3
Central Office				
Culley, William S.	1-22-08	25	0	24
Murphy, John P.	1-29-06	25	0	17
Bridge Dept.				
Wagner, Richard A.	7-23-07	25	0	16
Materials and Research				
Zube, Ernest	6-08-02	25	0	29
ELIGIBLE ON MARCH 31, 1955				
Central Office				
Hanis, Milton	1-13-96	25	0	29
ELIGIBLE ON DECEMBER 31, 1952				
Nickerson, Merritt R.	7-06-97	25	7	25

PRESTRESSED GIRDERS

Continued from page 36 . . .

Overstress for Shrinkage

Stress in the cables at the time of inserting shims amounted to 115 percent of the final calculated working stress. At stress relieving force of approximately 130 percent was applied and held for two minutes before backing off on the shims at the 115 percent. The overstress of 115 percent was considered necessary to allow for shrinkage, creep, plastic flow and other factors which occur during or after prestressing operations which would ultimately reduce the original stress set in the cables.

Beams Raised at Night

Erection of girders was done at night thus causing the least inconvenience to the traveling public. Traffic was shunted down the Mission Road "off" ramp, across Mission Road and back to the freeways by way of the Summit Avenue ramps. This cleared the working area for both span No. 7 and span No. 4 on the separate beam raising nights. The equipment used for raising the beams was a 35-ton truck crane which lifted, carried and placed the girders into position. The lifting slings were fastened to the ends of the girders by means of a 1½-inch bolt passed through the lower hole provided in the ends of the girders for the diaphragm prestressing cables. Safety cables were attached to eyes cast in the top of and at three feet from the ends of the girders but this precaution appeared not to be necessary. The contractor's apprehension as to excessive limberness of prestressed girders was, with this particular design, found to be groundless. The girders proved to be very stiff.

After girders were in place the diaphragms were formed and poured between them at mid span and each end. Six wire high-tensile cables were placed through the diaphragms after the concrete had reached a strength of 2,000 pounds per square inch, and stressed. This was followed by the forming and pouring of facia girders and lastly by forming and pouring the deck and curbs.

A galvanized steel hand rail was placed on each side of the bridge and metal light poles set on the low side for illumination.

Freeway Connections Built

The final items of work on the contract consisted of backfilling the old tunnel area to a depth of approximately six feet thus restoring a normal grade at this point and placing three lanes of concrete paving for the westbound San Bernardino Freeway. This pavement also serves westbound traffic bound for the Mission Road "off" ramp. Short sections of plant-mixed pavement were required to be built for freeway connections to the east and south of the bridge.

The finished bridge rises above the multiple freeways in a graceful curve starting at the San Bernardino westbound freeway under the old Macy Street Bridge, up and over the six freeway roadways to a hilltop connection with the Santa Ana Freeway on the south. It reaches a height of some 45 feet near the center of the structure. The setting is in an area of shrubs, trees and green lawns crossed by the interweaving freeways and banked on the east by the ivy covered bluffs that once overlooked the Los Angeles River. It is a pleasing setting for an architecturally pleasing structure.

Congestion Alleviated

The project represents just one of the many steps being taken currently by the State Division of Highways to eliminate bottlenecks on the freeways and to ease the traffic situation in the congested metropolitan area. The use of prestressed girders was only one of the many details designed to speed this end.

The general contractor on this $465,433 contract was the Charles MacClosky Company. The Prescon Company furnished the prestressing cables for the contract. Other subcontractors were the Macco Corporation who handled pile driving and concrete removal, the Waterbury Company on steel railing, Schulman Electric Company on lighting, C. G. Willis & Sons and Clyde Wood & Sons on earth work and C. O. Sparks & Mundo Engineering Company on paving.

TWIN DRAGONS

Continued from page 53 . . .

the Fillmore and Santa Paula Chambers of Commerce. Among those attending were Assistant State Highway Engineer P. O. Harding and District Engineer W. L. Fahey, from District VII; C. H. Maghetti, secretary of the California Highway Commission; Lester Price, Chairman of the Board, Ventura County Supervisors; Robert Linville, mayor of Fillmore; John Barrington, mayor of Santa Paula; C. Leon Harthorn, city manager of Fillmore, and Fergus Fairbanks, master of ceremonies and one of Santa Clara River Valley's leading citizens over the years in working for the consummation of this project.

Motorists Will Save

The cost of construction was approximately $700,000. The cost of the right of way was approximately $100,000. It is calculated that the total cost of $800,000 will be saved by the motoring public in a five-year period as a result of the one-mile shortening of State Sign Route 126.

The contractor, R. R. Hensler, was represented by Mr. Glenn Burns, superintendent of bridges, and Paul Shaw, superintendent of road work. The State was represented by Hugh Whitnall, resident engineer under the general supervision of F. B. Cressy, district construction engineer, and his assistant, E. A. Parker.

Upon recommendation of State Highway Engineer George T. McCoy final acceptance of this contract, which extended for 2.4 miles, from 0.1 mile east of Lord Creek to State Sign Route 23 in the City of Fillmore, was made on February 28, 1955, by State Director of Public Works Frank B. Durkee.

Design was under the supervision of F. W. Panhorst, assistant state highway engineer. Construction was under the general direction of J. E. McMahon, Bridge Engineer, Los Angeles, and G. L. Laird, Construction Engineer, Los Angeles. W. B. James was resident engineer with John Floryan, principal assistant. Leo Trombatore was district representative.

NEW LUMINAIRE

Continued from page 51 . . .

30-foot pole capable of handling the wind load imposed by these units.

Installed on Burns Freeway

We do not intend to place any of these units in areas where freezing temperatures are normally expected. The handmade full-scale model indicated that this luminaire, with each of its two lamps backed by separate reflectors, will distribute a more uniform, relatively low-level illumination in a much more economical manner than our previous design. A comparison of isolux curves with a 10,000-lumen type V incandescent fixture shows that we get one foot-candle out further on the pavement with less wasted light on the side for 200 watts of fluorescent light than with 600 watts of incandescent light.

Thirty-two of these new units were recently installed on a section of the Burns Freeway, U. S. 101 in and near the City of Arcata in Humboldt County.

These units consist of a fiberglas housing with the polished aluminum reflector.

Field measurements show that the light output and distribution is equal to or in excess of that produced by the handmade model and approximates that of commercially available units which consume twice the power.

Field observation during wet pavement conditions shows that the pavement brightness pattern and resultant visibility far exceed that obtainable with conventional incandescent or mercury lamp sources. There is no objectionable glare.

BIDS AND AWARDS

Continued from page 62 . . .

cement concrete curbs and traffic bars. Awarded to O. C. Jones & Sons, Berkeley, $5,533.

Shasta County—US 99—Between Vollmers and 0.5 mile north of Lamoine. Construct graded roadbeds and surface with plant-mixed surfacing on cement treated base and construct a steel bridge, to provide a four-lane divided highway mostly on new alignment, 4.0 miles. Awarded to Piombo Construction Co., San Carlos, $2,314,554.20.

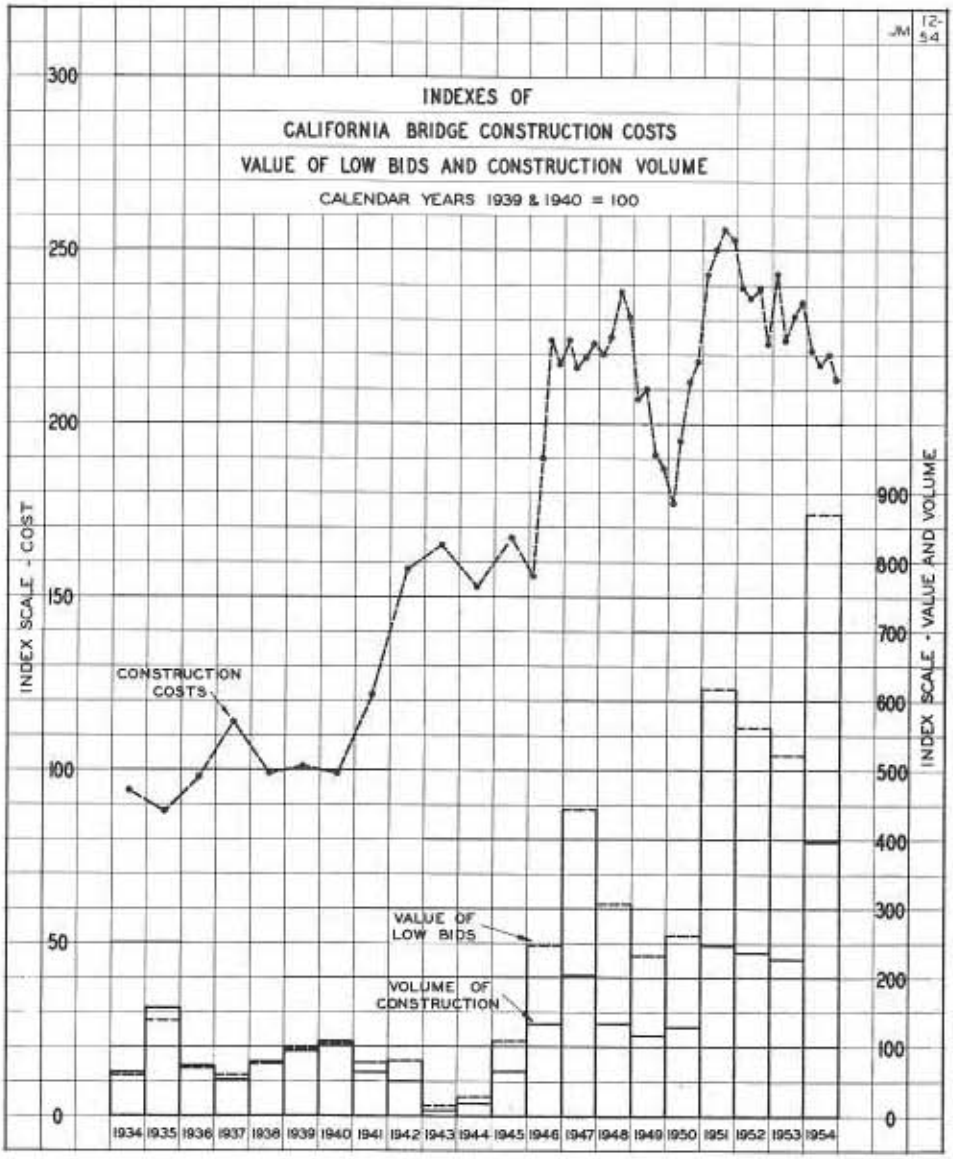
Siskiyou County — FAS 1166 — Across Shasta River, about one mile east of Grenada. Construct a reinforced concrete tee girder bridge. Awarded to R. M. Skamnes, Sacramento, $26,275.50.

CALIFORNIA BRIDGES

Continued from page 55 . . .

year. Total construction is expected to increase 7 percent from the 1954 figure while highway construction is expected to rise 18 percent. A prolonged high level of highway construction is indicated in part by the present expanded federal aid program. Further increases in federal participation recently proposed by the President will, if enacted into law, greatly accelerate the program now scheduled.

With no indications of a major change in the current trend of labor and materials costs, and with the expected increase in the volume of work offered, the outlook for the coming year is for a termination of the recent local trend of decline and, possibly, moderate upward adjustments in bridge construction costs.



FILMSTRIPS ON HIGHWAYS

Division of Highways filmstrips now available for public showing include: "Freeway Bypasses," "Highway Communications," and "Operation Snowflake."

BRIDGE WORK INCREASED

Approximately $43,500,000 in highway bridges and bridge contracts were completed during the 1953-54 Fiscal Year, more than twice the amount for the previous fiscal year.

GOODWIN J. KNIGHT
Governor of California
FRANK B. DURKEE . . Director of Public Works

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DIVISION OF HIGHWAYS

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State Highway Engineer, Chief of Division
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CHAS. E. WAITE . . Assistant State Highway Engineer
EARL WITHYCOMBE . Assistant State Highway Engineer
F. W. PANHORST . . Assistant State Highway Engineer
J. W. VICKREY . . Assistant State Highway Engineer
R. H. WILSON . . . Assistant State Highway Engineer
F. N. HVEEM . . . Materials and Research Engineer
GEORGE F. HELLESOE . . . . Maintenance Engineer
J. C. YOUNG . . . . . Engineer of Design
G. M. WEBB . . . . . Traffic Engineer
MILTON HARRIS . . . . . Construction Engineer
H. B. LA FORGE . Engineer of Federal Secondary Roads
C. E. BOVEY . Engineer of City and Cooperative Projects
EARL E. SORENSON . . . . . Equipment Engineer
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J. P. MURPHY . . . . Principal Highway Engineer
F. M. REYNOLDS . . . . Principal Highway Engineer
E. J. SALDINE . . . . Principal Highway Engineer
A. L. ELLIOTT . . . . Bridge Engineer—Planning
I. O. JAHLSTROM . . . Bridge Engineer—Operations
J. E. McMAHON . . Bridge Engineer—Southern Area
STEWART MITCHELL . Bridge Engineer—Special Studies
E. R. HIGGINS . . . . . Comptroller

Right of Way Department

FRANK C. BALFOUR . . . . Chief Right of Way Agent
E. F. WAGNER . . Deputy Chief Right of Way Agent
GEORGE S. PINGRY . . . . . Assistant Chief
R. S. J. PIANEZZI . . . . . Assistant Chief
E. M. MacDONALD . . . . . Assistant Chief

District IV

B. W. BOOKER . . Assistant State Highway Engineer

District VII

P. O. HARDING . . Assistant State Highway Engineer

District Engineers

ALAN S. HART . . . . . District I, Eureka
J. W. TRASK . . . . . District II, Redding
A. M. NASH . . . . . District III, Marysville
J. P. SINCLAIR . . . . . District IV, San Francisco
L. A. WEYMOUTH . . . . District IV, San Francisco
E. J. L. PETERSON . . . District V, San Luis Obispo
E. T. SCOTT . . . . . District VI, Fresno
W. L. FAHEY . . . . . District VII, Los Angeles
E. T. TELFORD . . . . . District VII, Los Angeles
C. V. KANE . . . . . District VIII, San Bernardino
F. E. BAXTER . . . . . District IX, Bishop
JOHN G. MEYER . . . . . District X, Stockton
E. E. WALLACE . . . . . District XI, San Diego
HOWARD C. WOOD . . . . . Bridge Engineer
State-owned Toll Bridges

DIVISION OF CONTRACTS AND RIGHTS OF WAY

Legal

ROBERT E. REED . . . . . Chief Counsel
GEORGE C. HADLEY . . . . . Assistant Chief
HOLLOWAY JONES . . . . . Attorney

DIVISION OF SAN FRANCISCO BAY TOLL CROSSINGS

NORMAN C. RAAB . . . . . Chief of Division
BEN BALALA . . . . . Principal Bridge Engineer

DIVISION OF WATER RESOURCES

A. D. EDMONSTON
State Engineer, Chief of Division
G. H. JONES . Assistant State Engineer, Sacramento River Flood Control Project, Supervision of Safety of Dams, Sacramento-San Joaquin Water Supervision
T. B. WADDELL
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printed in CALIFORNIA STATE PRINTING OFFICE 19552 5-55 38,500

CALIFORNIA
STATE HIGHWAY SYSTEM

Oct. 1953