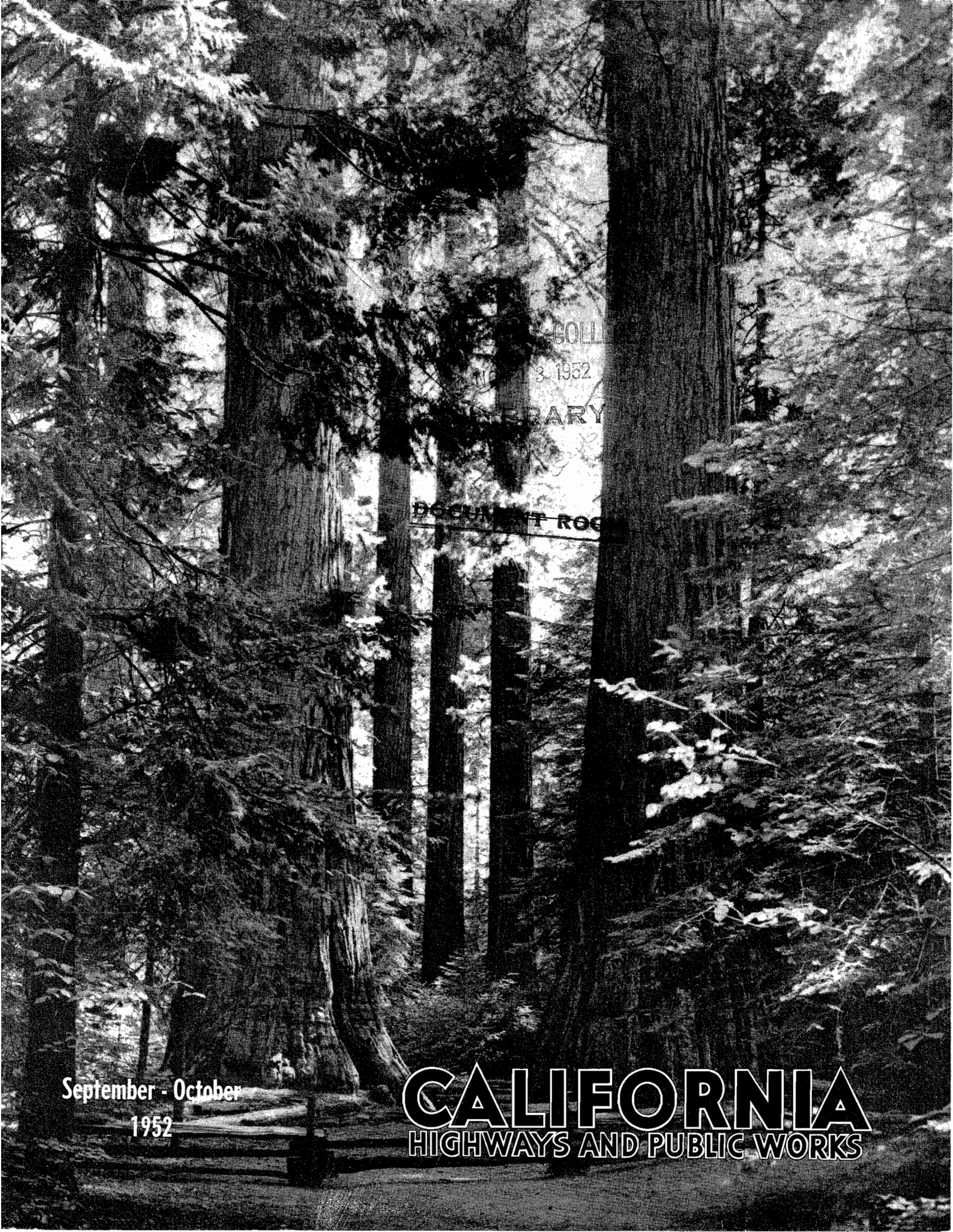
September - October
1952
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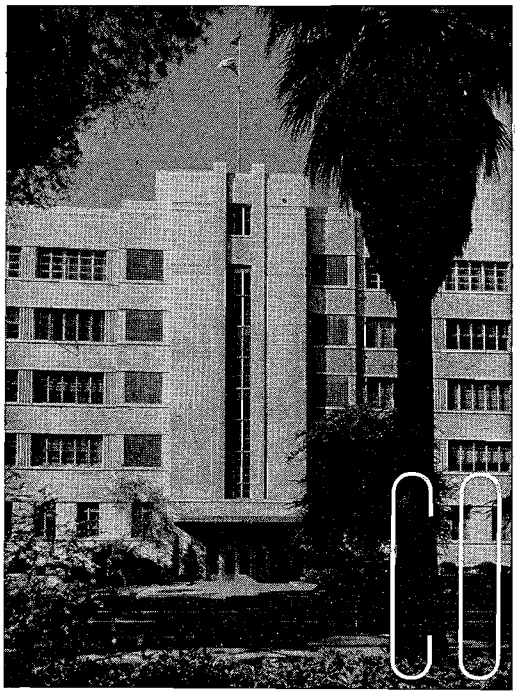

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CONTENTS

Contour Grading Highway Maps

Their Use in Mountain Terrain Is Successful

By C. V. KANE
District Highway Engineer *

THE VOLUME of earthwork—both excavation and embankment—for practically all highway construction projects is determined during the design stage. This volume is used to ascertain the balance between excavation and embankment and as an estimate of quantities for comparing bids for contract work. The quantity determined at that time may or may not, depending on job conditions, be used as final pay quantities. Earthwork volume is determined by what is known as the cross-section method. The routine is for survey parties to take ground elevations across the proposed roadbed at intervals of about 50 feet throughout the length of the job.

After these elevations are plotted by draftsmen to scale in the office, the finished construction section proposed (a template when feasible) is superimposed, and the area between the two lines determined as a basis for volume calculation by the "average end area" method. The same ground is again covered by a construction survey staking party. In mountain work the method is laborious, and in all cases is time consuming for both field and office forces. This is especially true since the advent of the freeway. Mathematically, the "average end area" method of calculations is not exact. The error is accumulative and is represented by the prismoidal correction, which for convenience is not usually made. This fact is recognized and stated in grading contracts to avoid disputes. Cross-section sheets included in highway construction plans are bulky and voluminous. This article deals with results of a limited scope effort to streamline and speed up this operation by substituting a contour grading plan for the cross-section method.

* Mr. Kane wrote this article while he was Assistant District Engineer in District VIII. In August of this year he became District Highway Engineer in District I.

CONTOUR GRADING PLAN FIRST USED BY LOCATION ENGINEER

Contour maps have been extensively used by location engineers to determine alignment and grade prior to staking the line on the ground where the position is controlled generally by the contour of the terrain. This condition always exists in mountain work and oftentimes in "rolling" terrain. When establishing the City Creek Road location in San Bernardino County in 1944 to high standards through rugged mountain terrain excellent contour maps were available. The earthwork quantities were very large for a two-lane facility and any shift of the line for only a few feet would change excavation and embankment quantities by large amounts and, therefore, for reasons of construction economy, close study was given several trial lines before establishing the one to use on construction plans. Various methods have been used in the past for determining earthwork quantities on trial lines by the use of contour maps. The shortcomings of these methods were either lack of accuracy or the time consumed to produce accuracy.

Recognizing the deficiencies of the usual highway and railroad methods, District VIII borrowed from landscape and hydraulic engineers the method of preparing a grading plan by superimposing contour lines of the proposed construction on the existing contour map. By this method earthwork quantities on trial lines were quickly and accurately determined.

Subsequently, the contour grading plan method has been used as routine in District VIII for establishing locations in mountain and rolling terrain. This practice has resulted in saving time and has produced accuracy and economy of design.

CONTOUR GRADING PLAN USED FOR CONSTRUCTION PLANS

Modern highway design was generally first practiced by railroad engineers who adapted railroad methods, handbooks, etc., to highway needs. Until recent years the highway roadbed, like the railroad, was generally narrow and had uniform widths and uniform excavation and embankment slopes. This uniformity of section made possible easy design and calculation of earthwork by the cross-section method. By reason of the extreme uniformness of the roadbed, railroad practice was usually able to eliminate the step of plotting the cross-section and performed the calculations directly from the field survey notes. Actually, the field work combined the operations with slope staking.

Highway practice, on the other hand, by reason of a somewhat wider section and some less uniformity of width and slopes coupled with necessities of public contract work, established the practice of plotting the cross-sections for purposes of design and calculation of earthwork quantities. Construction stakes are then placed by a subsequent survey operation. Evolvement of the freeway principle greatly changed the picture as to widths and slopes. A single roadbed was replaced with a double one, often on different levels and separated by a varying width median. Many significant roadbed safety appendages were added to reduce the "friction" produced by high volume and high speed vehicular flow. The "appendages" are "bulb" connections, speed change lanes, channelized intersections, interchanges, frontage roads, etc. In addition, excavation and embankment slopes of variable pitch and warped surfaces have come into use to produce a more pleasing appearance and to reduce erosion. These variable features

produce a construction cross-section that is far more complicated than the simple railroad section for which the cross-section method was so well adapted.

Contour Grading Plan

The contour grading plan for design and calculation of earthwork appears well adapted for application to the variable features of freeway design. District VIII has used it successfully for interchange construction plans for several years. It was also used for one six-mile project, the plans for which originally were prepared for day labor work, but subsequently let to contract. Later a mountain channelization project was constructed from a contour grading plan. This experience has revealed no engineering or construction difficulties.

bankments, and all other parts of the design. Its application to odd-shaped construction, such as intersections, either channelization or interchange, is readily apparent. For such use, the contour grading plan affords an especially easy method of designing the drainage system, determining earthwork quantities, and designing rounded and warped surfaces between roadbeds necessary for pleasing landscaping. It is somewhat impracticable at interchanges to use the cross-section method for either design or construction slope staking. Grading contours can be staked on the ground to control the work. From the standpoint of the contractor and the construction engineer, many advantages are self-

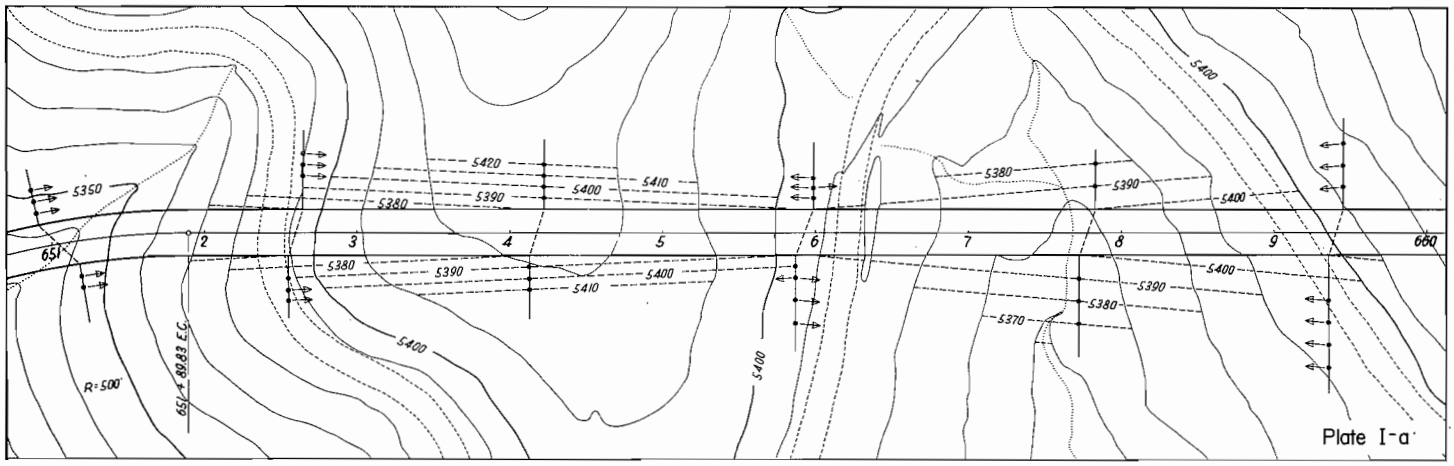
DRAFTING THE GRADING CONTOUR PLAN

Plate I-a—Plot highway center line and shoulder line control on the contour map. Determine position of grading contour crossing of roadbed. (Crown) Set up guides for controlling position of successive grading contours falling on cut or fill slopes. Draw in the grading contours which will terminate at the original ground contours of the same elevation and form closed contours.

Plate I-b—Connect grading contour terminal points by irregular line which represents toe of cut and fill slope.

COMPUTING EARTHWORK QUANTITIES (Approximate Method)

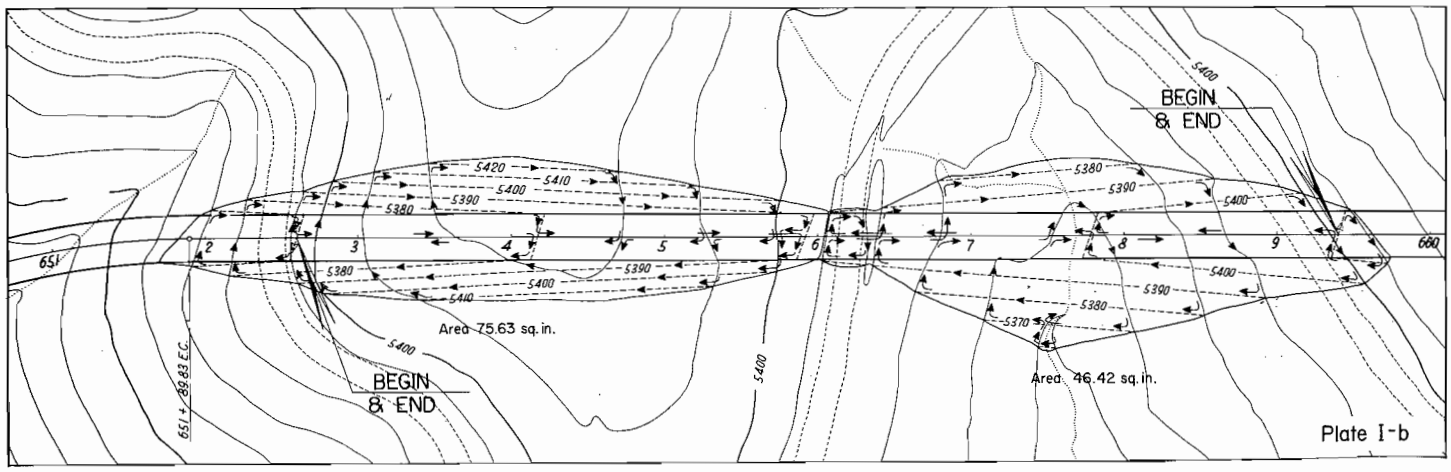
The areas bounded by the closed contours are determined. Volume is then taken from the average contour



The contour grading plan in effect is a three-dimensional view of the proposed construction, correlating alignments, profiles, drainage facilities, structures, limits of excavation and em-

evident in that a three-dimensional plan of a large portion of the work can be viewed on a single sheet in lieu of having plan and profile on one sheet with cross-sections on additional sheets.

areas as illustrated on *Plate I-c* profile. *Plate I-b* also illustrates method of accumulating contour areas by using the planimeter as an adding machine. Each closed contour is planimetered and in



a continuous operation is shifted to successive contours along centerline and thence back to point of beginning as illustrated by arrows. A planimeter reading is then taken. Reduction to earthwork volume is made as shown in sample calculation for entire length of excavation or embankment.

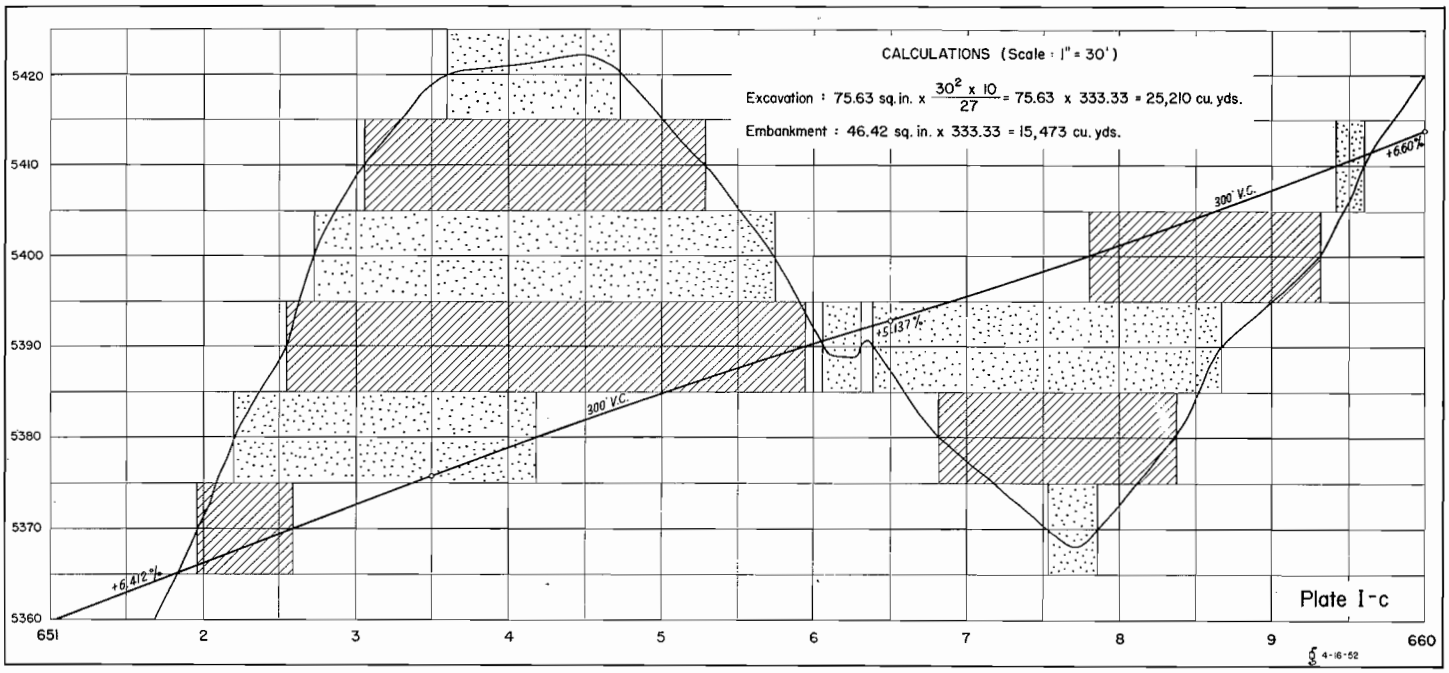
The data shown here indicates an error of 6.9 percent when the approximate method is compared with that of cross-sections taken from the same contour map. Comparison with field cross-sections indicates an error of 4.4 percent. The method neglects partial contour intervals.

station division. This method supplies a more rational approach and would more nearly conform to present practice of determining earthwork quantities as a pay item for contract work and facilitates conventional construction of the mass-haul diagram.

For purpose of illustration, sample calculations are shown. In order to clarify the process, all of the contour plane areas involved between Station 654 and Station 655 are shown as separate crosshatched areas. To assist in visualizing the process, a perspective sketch with separated sections is also shown. Calculations are illustrated in

Contour Method for Calculating Earthwork

The use of the contour method for calculating earthwork, where it is necessary to know the volume between each station, is not generally recommended, because, as illustrated in the perspective sketch, there is likely to be a large number of areas involved. Note that it is necessary to insert additional areas at points of abrupt change in prism outline, such as at elevation 5,385 and 5,414 in the illustration. In practice, the station-to-station method might be dispensed with and divisions of length used that would conform to abrupt changes in profile of the



The approximate method is usually satisfactory for projection work or trial runs of quantities. Its advantage is the great speed by which results can be obtained.

COMPUTING EARTHWORK QUANTITIES (Precise Method)

Plate II (see page 4) illustrates the method of calculating earthwork quantities taking into account partial contour intervals that will usually exist, in lieu of ignoring them as was done in the approximate method set forth above. Also it illustrates the method of obtaining quantities of any portion of the whole cut or fill such as the station-to-

table labeled "Sample Calculations." It is to be noted that the contour plane areas involved are simple trapezoids in four cases out of the seven areas involved. These areas might be determined by calculations using scaled dimensions instead of using a planimeter. In calculating the volume of excavation in cubic yards, when "Distance 'D'" contains a series of contour intervals which are constant, areas can be combined by applying the formula $S = A_1 + 2A_2 + 2A_n\ (n + 1)$, where A_1 is the first area involved, A_n is the next to the last area involved and A_{n+1} is the last area in the series.

ground. This would satisfy mass-haul diagram and pay quantity requirements even though present practice would be altered.

The following tabulation of calculations was prepared for comparative purposes by expanding existing work data for a 2,100-foot section of a mountain highway design. The section was selected at random after the project was completed. The contour map was made by the stadia method for the purpose of fixing the location. The scale was 1 inch = 50 feet. Cross-sections were made from the contour map and included in the construction plans. The field cross-sections were taken at the time of slope staking the project

EARTHWORK VOLUME (IN CUBIC YARDS) BY SEVERAL FIELD AND OFFICE METHODS

Station to station	Excavation					Embankment				
	Contour plan		X-sections from contours		Field X-sect.	Contour plan		X-sections from contours		Field X-sect.
	Av. level areas	Prism corr.	Av. end areas	Prism corr.	Av. end areas	Av. end areas	Prism corr.	Av. end areas	Prism corr.	Av. end areas
651+80 — 656+02	24,039	23,994	23,452	23,299	23,632	.....	.....	.....	.....	.....
656+02 — 659+62	.....	.....	.....	.....	.....	14,989	14,905	14,603	14,385	15,343
659+62 — 662+80	8,116	7,910	7,814	7,643	7,970	.....	.....	.....	.....	.....
662+80 — 664+25	.....	.....	.....	.....	.....	2,424	2,382	2,394	2,376	2,628
664+25 — 668+50	6,320	6,184	5,990	6,113	5,932	.....	.....	.....	.....	.....
668+50 — 672+45	.....	.....	.....	.....	.....	30,111	29,590	30,354	30,071	31,582
Totals	38,475	38,088	37,256	37,055	37,534	47,524	46,877	47,351	46,832	49,553

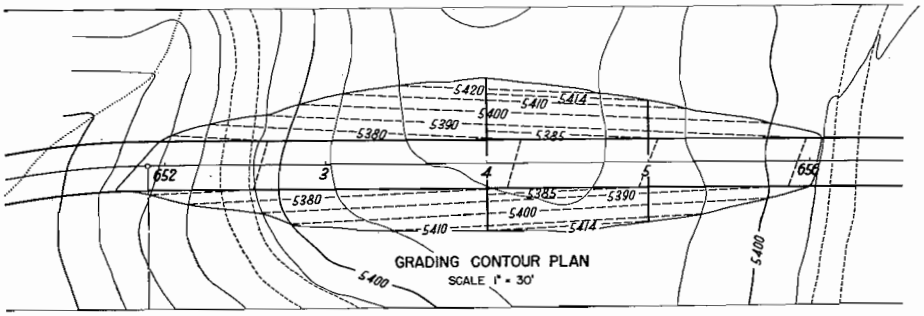
for construction to determine the contract pay quantity of earthwork.

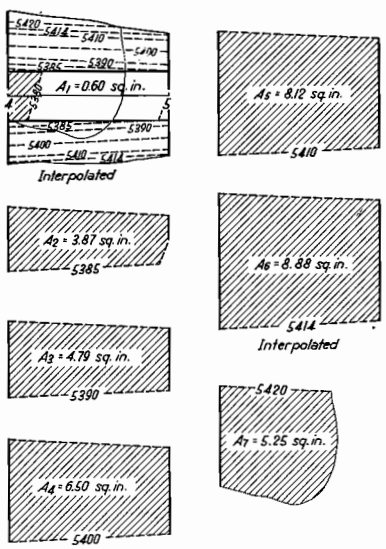
Test of Correctness

A test of the mathematical correctness of the contour grading plan method of obtaining earthwork quantities would be a comparison between the quantities as shown under "Contour Plan" as against those as shown under "X-Sects from Contours" because the same field data was used. In this instance the average discrepancy without prismoidal correction is 1.7 percent with a maximum of 2.7 percent.

Prismoidal corrections were made to the above quantities to reduce them to more exact figures so that the effect on each system could be compared. The results appear to be rather uniform with an average correction of −1.2 percent for the contour method and −0.8 percent for the cross-section method.

Comparison of the grading contour plan method with the field cross-section method indicates that there is an average discrepancy of 0.5 percent, with a maximum of 7.7 percent. This comparison is more of a test of discrepancy between the field methods





SAMPLE CALCULATIONS

STA. 654 to STA. 655

Contour	Area Sq. In.	Sum. Area "S"	Distance "D"	Volume* Cubic Yards
5378	0.00	0.60	2	20
5380	A_1 = 0.60	13.13†	5	1094
5385	A_2 = 3.87		5	
5390	A_3 = 4.79	25.91	10	4318
5400	A_4 = 6.50		10	
5410	A_5 = 8.12	17.00	4	1133
5414	A_6 = 8.88	19.38	6	1938
5420	A_7 = 5.25		6	
5426	0.00		Total	8503

NOTES

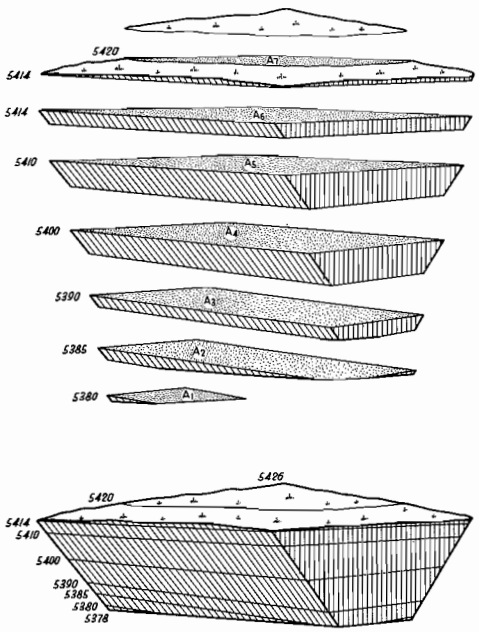
*Volume = S x D x C

†S = Sum Area. Where "D" is constant for two contour intervals, $S = A_1 + 2A_2 + A_3$

D = Distance between contours.

C = Constant = $\frac{M^2}{2 \times 27} = \frac{30^2}{54} = 16.667$

M = Map Scale = 30 in this case since 1 inch = 30 feet.



PERSPECTIVE SKETCH WITH SEPARATED SECTIONS

Plate II.

than it is of the method of calculation. The two field surveys were independent and were not compared and reconciled prior to making the calculations.

The preferred practice in obtaining quantities from contour maps, especially if pay quantity is anticipated, would be to run one or more profiles for checking and correcting the contour map. The largest discrepancy observed here obviously resulted from a difference in the field surveys. It is not known which survey was in error. Preliminary results here indicate that earthwork quantities calculated by the precise method from a contour grading plan should not be questioned as to accuracy if the contour map has been checked in the field.

Saving in Time

A time study was made on a 3,300-foot section of the City Creek mountain highway. It was found that a 40 percent saving in man-hours resulted from the use of the grading contour plan over the conventional cross-section method. This ratio includes the field time in making the contour map, cross-sectioning the excavation sections at the time of slope staking and calculating the pay quantities from the cross-sections. This control test was of limited scope and might be representative of work in this type of terrain only.

SUMMARY

The following conclusions are based on limited application of the contour grading plan in District VIII. It is not to be construed that they are intended to be conclusive, but rather an indication that the method has sufficient merit for further study and examination of the many attendant matters that would be affected by elimination of cross-sections from a portion of highway contract work.

Advantages of the Grading Contour Plan

1. It is estimated that earthwork calculations, together with attendant drafting and survey operations can be accomplished with a saving in man-hours of about 40 percent.
2. Culvert location, length, and skew can be accurately and easily determined. The entire drainage system is presented by a clear and comprehensive picture.
3. Design and calculation of earthwork and construction staking at interchanges with warped cut and fill slopes coupled with roadways intersecting at odd angles would be materially improved.
4. It is ideally suited for full advantage adaptation to aerial photogrammetry. Surveying by photography is rightfully coming into general use and unquestionably is the key to speeding up highway construction plans to keep pace with expansion of highway construction programs.
5. It sharply reduces number of drawings included in a set of highway construction plans.

Possible Practicable Application of the Grading Contour Plan

1. Approximate method of computing earthwork is ideally adapted to projection work to determine final line and grade for mountain locations. Its use for the same purpose in rolling terrain is often advantageous.
2. Precise method of computing earthwork (without division by station) is preferable for plan work even though pay quantities are to be obtained by cross-sections taken during construction.
3. Scale for contour grading plans should preferably not be less than 1 inch = 50 feet. Scale at interchanges where staking might be performed by scaling should be 1 inch = 20 feet.
4. Contour interval for mountain terrain can be 10 feet. Contour interval for rolling terrain can be 5 feet. Contour interval for flat terrain can be 1 foot to 2 feet. It is not always practicable with photogrammetric methods to make different contour intervals on original map to conform to changes of terrain. Additional contours can be added by interpolation and with field assistance when justified.
5. Grading contour plans could supplement usual construction layout plans or in some instances could be superimposed on the plan and profile sheets.
6. Until such time as more experience has been had with earthwork quantities, it would seem preferable to use grading contour plans generally for the purpose of preliminary estimate only. An exception might be made at interchanges when it is rather impracticable to use cross-sections. These applications appear in conformance with Standard Specifications. Excavation pay quantities could be obtained from cross-sections taken at the time of slope staking a project. It usually should not be necessary to cross-section embankment areas.
7. A suitable mass-haul diagram can be obtained by dividing quantities in a cut and fill at occasional critical points.
8. Contour grading plans would not be of any benefit for "scratch" grading jobs. Here some form of lump sum grading item has economy advantages.

ACKNOWLEDGMENT

Full credit for any value this contour grading plan method may prove to have belongs essentially to two District VIII engineers who, without known precedent, developed it. In 1944 L. Maynard Goode, then assistant location engineer, established the routine of drafting the construction contours for purposes of determining limits of grading. By logical sequence, he then began taking off earthwork quantities by the approximate method to assist in establishing mountain locations. In 1946 when preparing construction plans and incorporating contour grading plans, District Design Engineer L. D. Wanée developed the precise method of computing earthwork quantities.

CALIFORNIA LEADS IN GASOLINE TAX PAYMENTS

Highway users in California paid more than $209,500,000 in state and federal gasoline taxes during 1951-1952 Fiscal Year, the highest of any state, the California State Automobile Association reports. Of this record amount, more than $149,500,000 was paid to the State through California's 4½-cent tax, and about $60,000,000 to the Federal Government. On November 1, 1951, the federal gasoline tax was increased from 1½ to 2 cents per gallon.

Festival of Arts

Construction in Laguna Canyon Did Not Interfere With It

THE Nappe Construction Company contract to widen and improve State Highway Route 185 in Laguna Canyon is nearing conclusion, being 95 percent complete, and the City of Laguna Beach is winding up its summer season, having concluded a very successful presentation of the annual Festival of Arts. To those not familiar with the local scene, the connecting link between the state highway project and the City of Laguna Beach Festival of Arts will not be apparent, and it is the purpose of this story to explain that connection.

Festival of Arts

For years prior to the construction of the Coast Highway, the Laguna Canyon Road, 10 miles in length from U. S. 101 to the coast, was the only road serving the art colony and summer resort known as Laguna Beach. It has played an important part in the growth and development of the City of Laguna Beach. During the last war it served as the main highway from the El Toro Marine Base, located inland some 12 miles, to officers' quarters established in the Laguna Beach Hotel and the residences of officers, enlisted personnel, and civilian workers in Laguna Beach. On this highway near the easterly city limits of Laguna Beach, on the Irvine City Park grounds, is the present home of the world-famous Festival of Arts.

THE LAGUNA BEACH POST

September 10, 1952

We who were concerned when the strike held up completion of the Laguna Canyon Freeway just before our annual Festival of Arts opened in late July have reason to praise the cooperation given by the State Highway Department. As a result possibly disagreeable factors were avoided, such as traffic snarls, dust and dirt. In fact, conditions were generally better than they have ever been, which may explain in part why the season was the most successful in Festival history.

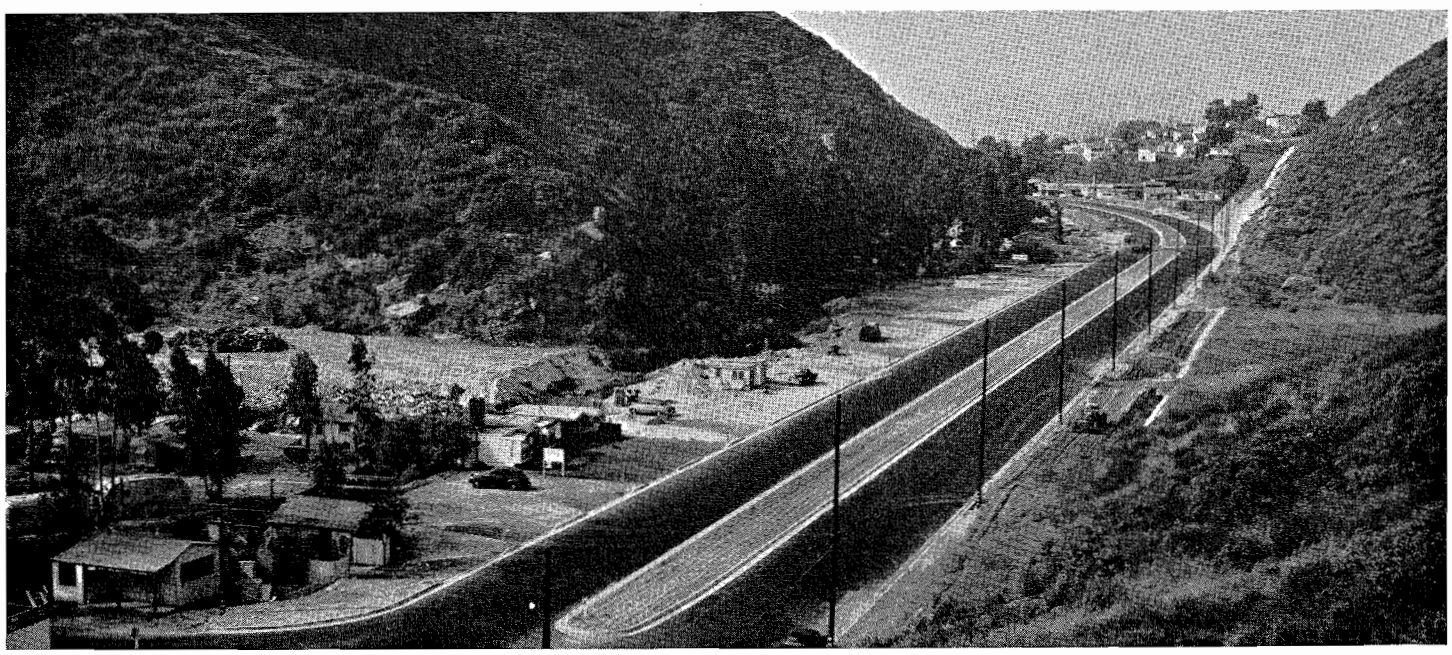
GLEN INGLES
Editor

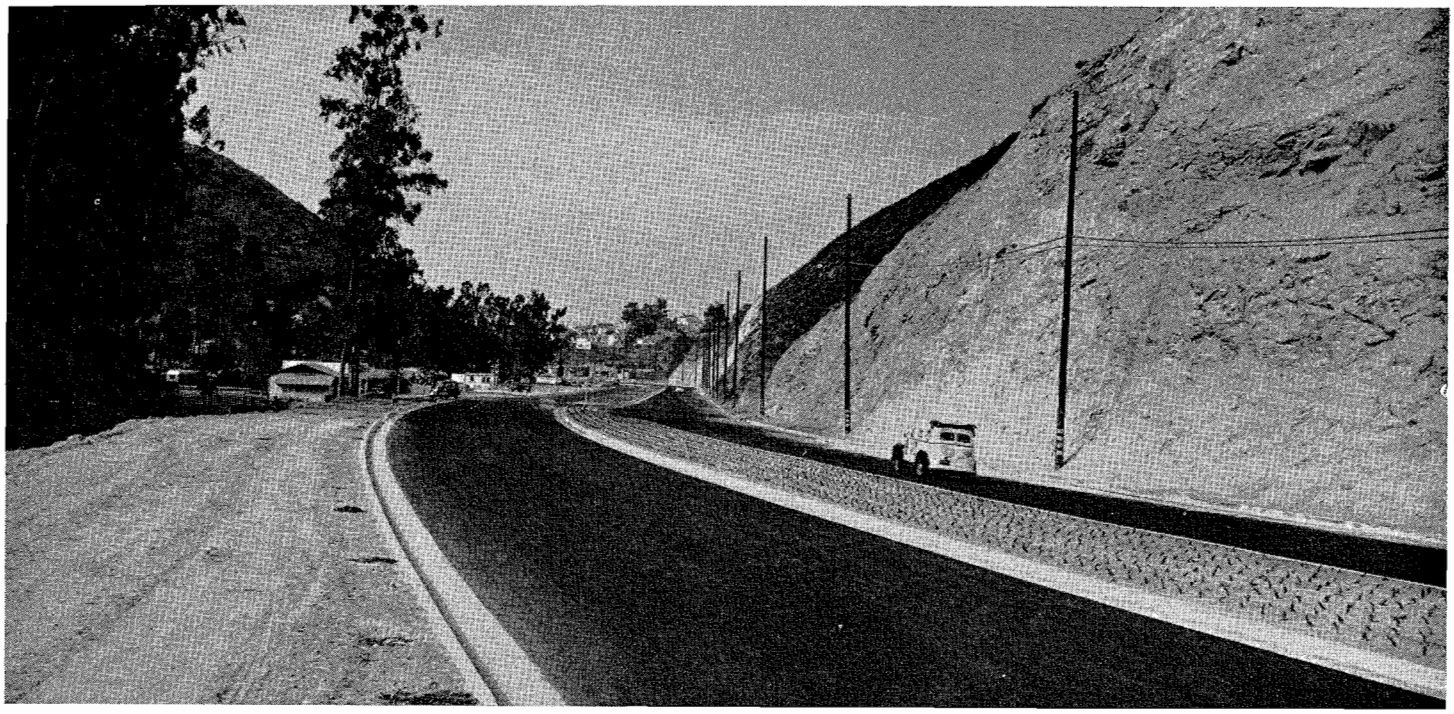
As the City of Laguna Beach grew in size to its present estimated permanent population of 8,000, traffic on this state highway increased so that widening improvement became very necessary. Before this project was started, the local people expressed considerable apprehension as to the effect the construction might have upon the success of their summer season, and particularly the Festival of Arts. Local people were assured that the State Division of Highways would do everything possible to see that the highway construction did not seriously interrupt the summer activities of Laguna Beach.

Artists' Colony

The Laguna Beach Festival of Arts is very dear to the hearts of the local people. The Festival of Arts idea was born in the early thirties, when Laguna Beach was a very small village by the sea. The natural beauties of the coast line, with its backdrop of rolling hills and canyons, lured artists to the quaint spot and, of course, they painted many pictures. In the early days, these artists

Looking westerly from Woodland Drive along completed State Highway construction in Laguna Canyon. City of Laguna Beach and Pacific Ocean in background.





Looking westerly from Canyon Acres Drive, showing completed highway construction with recently planted mesembryanthemum cuttings in the central dividing strip

displayed their paintings during midsummer on the fences in El Paseo Alley near the ocean front and held dances in the street to draw customers. From this spontaneous start the Festival of Arts came into being, and in 1933 the first presentation was made of living pictures. This started the festival in its present form.

The following year the Festival of Arts Association was formed by Laguna residents to encourage the artistic and cultural pursuits of the community. Several years later the festival found a permanent home when the property now known as Irvine Bowl was acquired. Since that time, omitting the war years, the Festival of Arts has flourished until it has become not only a significant Laguna institution, but a nation-wide attraction.

Successful Season

The 1952 presentation, being the seventeenth annual season of the Festival of Arts, was unusually successful, in spite of the highway construction work going on at its front door. It is reported that for the season just closed the living pictures, the lighting, the timing, the music, the attendance, the exhibit booths, and the sales by exhibitors all were better than ever before. There were more than 50,000 paid admissions to the 1952 Festival of Arts. According to the record, people came from 38 states and from eight foreign countries.

The Festival of Arts thrives in Laguna Beach on the strength of an eager community spirit. People from all walks of life and of all ages enter into the work with enthusiasm. This year over 700 volunteer workers participated in the cast and the crew necessary for carrying out the Festival of Arts activities. Under the able leadership of the Rev. Philip E. Gregory, the Neighborhood Congregational Church, as in previous years, operated the food concession where home-cooked, full-course meals, as well as light snacks, were served on the festival grounds.

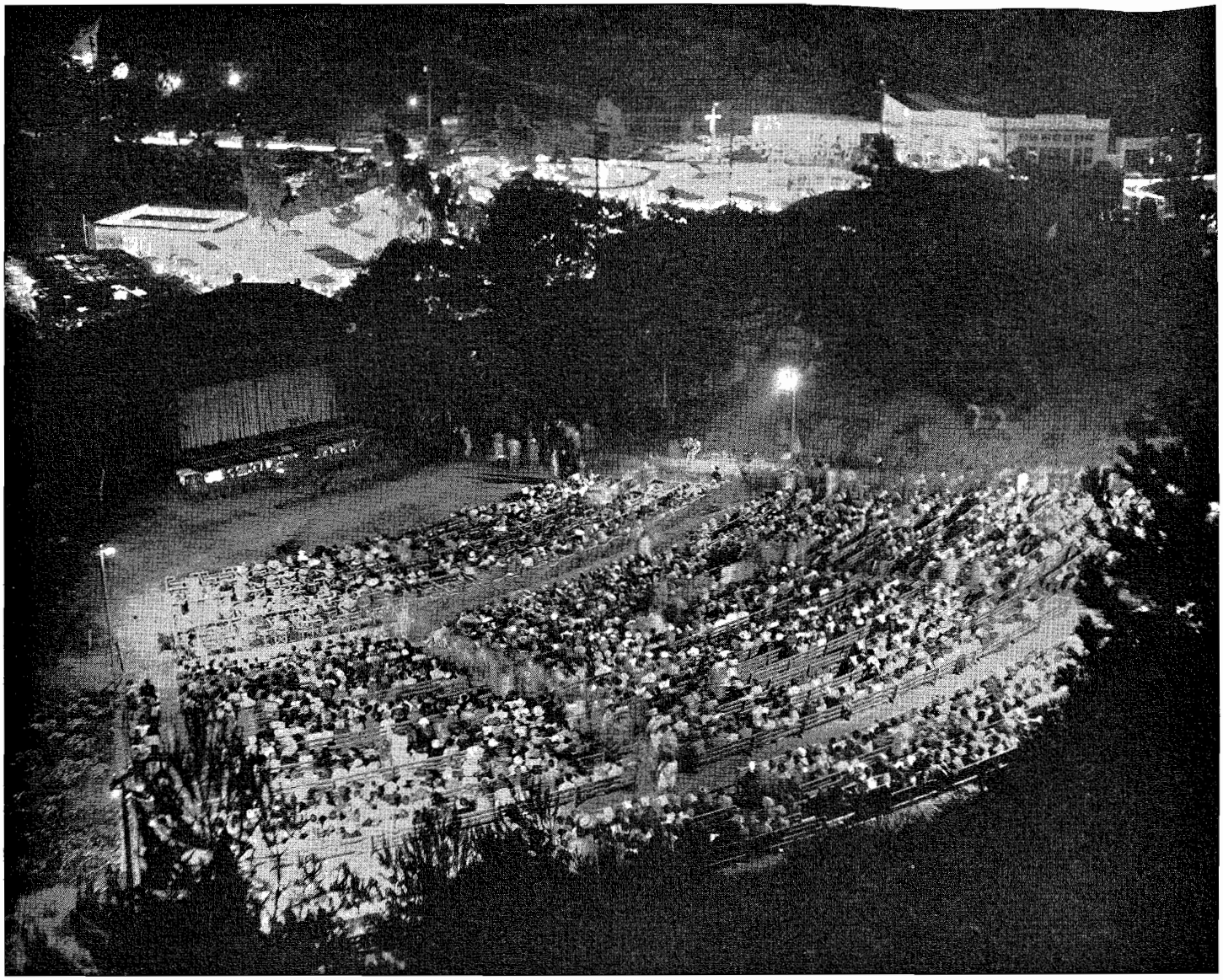
McCulloughs Give Generously

Among the many volunteers who have given so generously of their time and services to further the Festival of Arts are C. J. (Slim) McCullough, his wife, and three daughters. McCullough, who is the Resident Engineer for the Division of Highways on this Laguna Canyon construction project, and his family first established their home in Laguna Beach in 1932 so that McCullough could be close to state highway construction work in Orange County.

In 1935 Mr. and Mrs. McCullough started their participation in the activities of the Festival of Arts. In 1936 Mrs. McCullough had charge of properties and McCullough acted as stage manager for the Festival's Pageant of the Masters, which is the presentation of the living pictures. This year marked the first presentation of Leonardo da Vinci's "The Last Supper." This presentation was truly a stupendous undertaking and its immediate success set the pattern for the future living pictures in the Pageant of the Masters. In all subsequent presentations of these living pictures, the showing of "The Last Supper" has been the final number on every program.

McCullough Girls Pose

Throughout the years the McCullough family has continued to take an active part in the Pageant of the Masters presentations. All three daughters have appeared in the living pictures. Gloria for many years posed in "The Gleaners," by Millet; Sheila posed in "Lady and Gentleman Drinking Wine," by Vermeer; and Caroline took part in "On the Dyke." McCullough continued as stage manager through 1941, when presentations were



Irvin Bowl open air theater at Laguna Beach during Pageant of Masters, showing illumination of Art Festival grounds. Photo by Larry Kronquist

interrupted by the war. When showings were resumed in 1946, McCullough's work with the State Division of Highways required him to be on a construction job in Stockton and this forced him to give up his position as stage manager.

Mrs. McCullough has continued with the festival activities of later years in the capacity of librarian and executive secretary. In issue of *The South Coast News* of July 25, 1952, there was reported concerning Mrs. McCullough's activities the following:

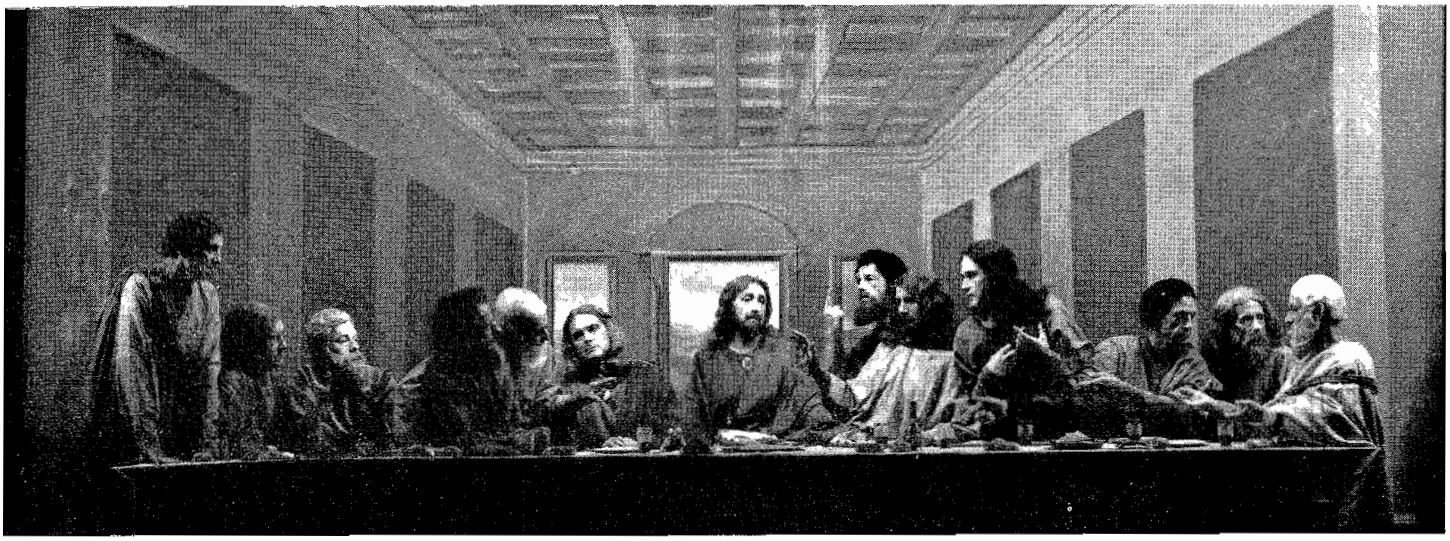
"Among her many 'jobs' the one she enjoys perhaps the most is that of pageant librarian. In that capacity she searches out prints of the masterpieces to be staged as living pictures. Sometimes her search leads her into by-ways, as when she was looking recently for a *Saturday Evening Post* cover by Norman Rockwell. 'The one we needed this year was a cover he had painted in 1938,' she said.

" 'Years ago I used to go up to Los Angeles to a store on Main Street that specialized in old periodicals. It was fun to go through back issues, and finally to find just the print for which we had been searching. This year's Rockwell, known on the program as "Sweet Adeline," was to be found only in New York, strangely enough also at a periodical dealer's. The copy they sent us, incidentally, was the only one they had.'

"She spoke also of correspondence with art galleries all over the United States and in several foreign countries in search of needed prints. 'We received one from the Louvre and one from the Mauritshuis Art Gallery in The Hague, Holland, for this season's production. Everywhere we sent inquiries, the persons in charge were most helpful. If they couldn't supply us with the necessary print, they could often refer us to another gallery or dealer who could'."

Public Agencies Cooperate

The successful consummation of state highway construction in Laguna



Live models pose for reproduction of Da Vinci's famous painting, The Last Supper

Here again artists pose for Shepherds of Arcadia, by Nicolas Poussin

Models faithfully bring to life Marcellus and the Princess by Dean Cornwell. Photo by Susan French, Santa Monica.

Canyon is due to the wholehearted cooperation of public officials and citizens of the City of Laguna Beach and the Orange County Board of Supervisors, Road Department, and Flood Control Department with the State Division of Highways. During the designing of this highway project, many visits were paid to the State Highway District Office in Los Angeles by Mayor Frank Wharton and City Engineer Craig Leland of the City of Laguna Beach, Orange County Supervisor Heinz Kaiser, County Road Commissioner Harold Sprenger, County Flood Control Engineer Jack Bradley, and many others.

It developed very early in the design stages that it was necessary for flood control construction to be carried out by the county simultaneously with the highway work by the State, and plans were developed to that end. The construction work by Orange County on the storm water channel in Laguna Canyon is now nearing completion, all concrete being placed and ready for backfill and fencing.

Problems of Right of Way

There were many problems that developed in connection with right of way acquisition. Unfortunately, the proposed widening of the state highway required the taking of land on the southerly side of the canyon to such an extent that a small industrial district had to be entirely wiped out. The property in the City of Laguna Beach and in Orange County area zoned for industry is very limited, and it was only by cooperation of the Orange County Planning Commission and the City of Laguna Beach Planning Commission that details were worked out so that new sites could be developed for the industries which the State was forced to have removed.

A total of 48 parcels were needed for right of way and these areas were all acquired by negotiation between State Division of Highways right of way agents and the property owners. With such difficult and complicated right of way situations as existed, it is indeed remarkable that in no case was it necessary for the State to resort to the drastic procedure of condemnation proceedings.

It was originally hoped to let the contract in the fall of 1951, but so many details had to be worked out that it was not possible to award the contract until January 7, 1952, at which time McCullough was assigned as Resident Engineer. McCullough is one of the "Old Timers" in District VII, having first come to work in this district in 1924 as an assistant resident engineer on construction of the Coast Highway through Encinitas. Since then he has been resident engineer on many important state highway construction projects. Recently he was resident engineer on the Piru Gorge section of the Ridge Route reconstruction, coming from there to the Laguna Canyon project.

McCullough and his two Assistant Resident Engineers, John F. Smith and William E. Brown, were fully aware

CITY OF LAGUNA BEACH, CALIFORNIA
J. Frank Wharton, Mayor

September 8, 1952

Department of Public Works, Division of Highways
Los Angeles, California

Gentlemen: Now that the new highway work is completed, I wish to express the appreciation of the City of Laguna Beach for the wide highway which makes a beautiful gateway to our community. The design and realignment of the old right of way has enhanced the usefulness of the city park facilities and added materially to the value of the adjoining property.

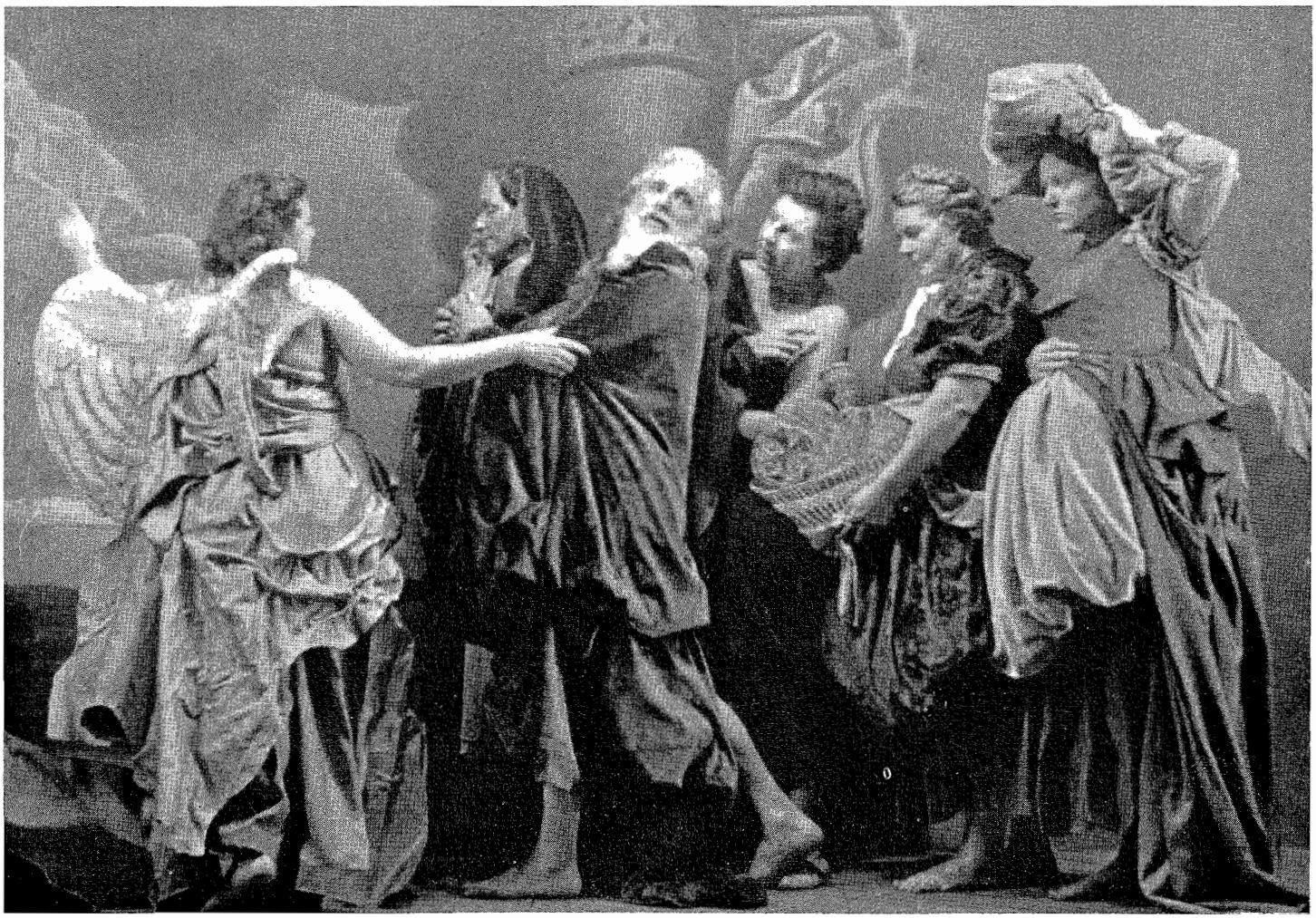
We especially wish to commend the personnel of the various departments of the highway for their cooperation and understanding of the city's problems, starting with the land purchase, which was equitable, and arranging for the convenience of our citizens, down through the construction of the project in which all consideration was given so as not to interfere with the functions of the city in carrying out its services.

We have enjoyed the contact with the Resident Engineer, Mr. McCullough, and assure you that he has made many friends for the Highway Department.

Very truly yours,

J. FRANK WHARTON
Mayor

Lot and His Family Leaving Sodom. Painting by Rubens. Artists give it life. Photo by Susan French, Santa Monica.



of the importance of this highway project to the summer activities of Laguna Beach and the Festival of Arts, and of the necessity for handling traffic through construction as expeditiously and smoothly as possible. How good a job McCullough and his assistants did is evidenced by the reports that have come in from the local people.

Notwithstanding the delay in letting the contract, the construction work would have been completed before the 1952 Festival of Arts started except for the strike of the operating engineers and steel workers that occurred during the months of June and July. The strike so delayed the contractor that his paving operations on the Laguna Canyon highway had to be in progress during the period that the Festival of Arts was under way from July 26th to August 10th.

At the end of the strike the contractor, in order to reduce interference with the Festival of Arts to a minimum, placed all of his construction crew on the festival end of the project and completed grading, placing of untreated rock base, and placing of plant-mixed surfacing level course on the two lanes adjacent to the festival grounds. This portion of the new highway was then turned over to the city officials for parking automobiles of patrons attending the Festival of Arts and Pageant of the Masters. All construction operations were then transferred to the other end of the project during the period the Festival of Arts was in progress.

FESTIVAL OF ARTS
Laguna Beach, California

September 9, 1952

Mr. P. O. Harding
California Division of Highways
120 South Spring Street
Los Angeles 12, California

Dear Mr. Harding: The board of directors of the Festival of Arts and Pageant of the Masters wish to express to you our sincere thanks and appreciation for the splendid cooperation and courtesies shown previous to the opening and during the showing of our annual Festival and Pageant.

Your courtesy in permitting use of part of the new highway for parking automobiles solved a problem which had caused us considerable worry during the preparatory stages of our annual Festival, and we heard many complimentary comments about your thoughtfulness.

We feel that much of the success of our 1952 Pageant was due to your cooperation.

Sincerely,

BAIRD B. COFFIN
President

Contract Was for $291,200

The allotment of the Nappe Construction Company contract was $291,200. Representing the contractor on the job were William H. Irwin, General Manager, and James Blackledge, Superintendent. Their coopera-

. . . Continued on page 28

CITY OF LAGUNA BEACH

September 8, 1952

Mr. P. O. Harding
Asst. State Highway Engineer
Division of Highways VII
120 South Spring Street
Los Angeles 12, California

Attention: Mr. A. D. Griffin

Gentlemen: It is the desire of the office of the city engineer and the police department of this city to extend to the Division of Highways, District VII, and to the Contractor, Nappe Construction Company, their gratitude and appreciation for the unexcelled cooperation received during the construction of Route 185, Laguna Canyon Road, now nearing completion.

We wish to particularly thank your office and the Resident Engineer, Mr. C. J. McCullough, for the many courtesies extended. With the construction being underway at the time of the Annual Festival of Arts, the traffic situation was handled by the police department with minimum effort due to the cooperation of the Engineer and Contractor.

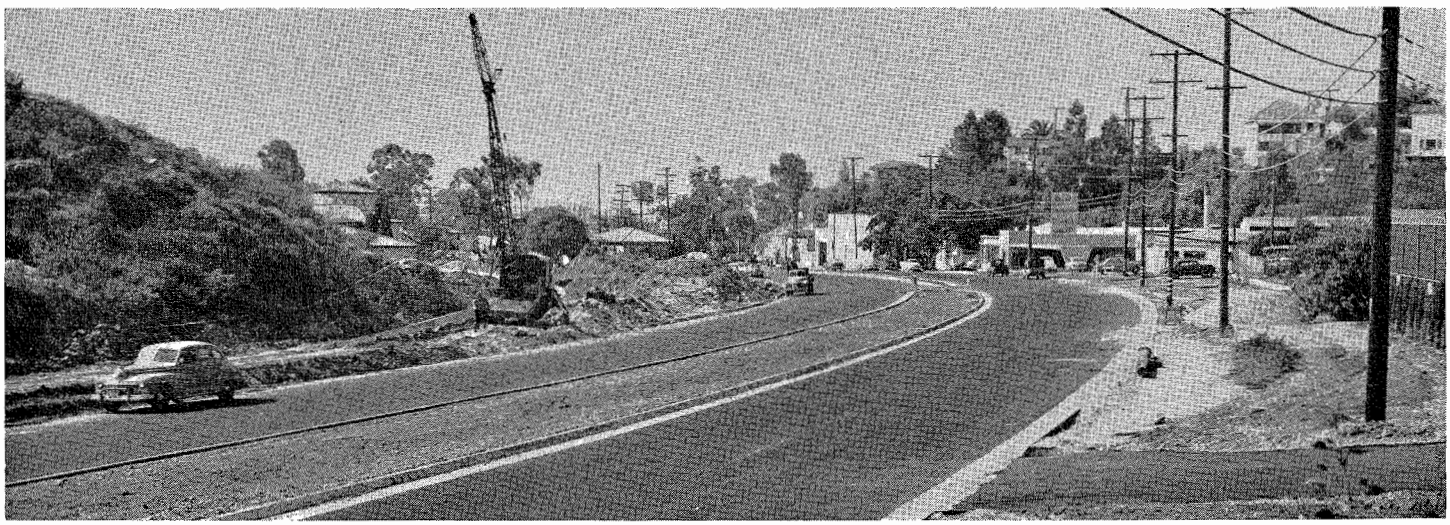
This office and the office of the chief of police greatly appreciate your courtesies and cooperation and extend their thanks to all state officials and employees concerned.

Very truly yours,

CRAIG G. LELAND
City Engineer

WM. H. BACHMAN
Chief of Police

Looking westerly from north city limits of Laguna Beach, showing on the right City Park and Festival of the Arts office and on the left construction in progress on storm drain by Orange County Flood Control District



Successful Job

Bayshore Freeway Experimental Tideland Fill Is Justified

By H. L. MOSES, Resident Engineer

THE RAPID growth of industry, residential areas and population in the San Francisco peninsular area makes it of vital importance that the Bayshore Freeway between San Francisco and peninsular points be completed at the earliest possible time commensurate with available funds.

With work now under way and recently completed in San Francisco through South San Francisco and southerly thereof through San Mateo, a good start has been made.

Development to freeway standards of the 3.2-mile section of the old road between the city limits of San Francisco and South San Francisco has been given much thought and study.

Overwater Unit

Many investigations of proposed sites and designs were considered, all of which occasioned the utmost scrutiny, for it had to be decided whether to attempt to establish freeway standards along the existing route with its limited room for expansion, bad geological formations, and high property severance values or to attempt an "over the water" crossing of an arm of San Francisco Bay between Sierra Point and Candlestick Cove.

To develop the existing roadway to freeway standards under traffic would create serious traffic interference on the already overcrowded highway, and the fact that the present road would provide an additional facility to connect the rapidly expanding peninsular areas with San Francisco were decisive factors in selection of the open water crossing for freeway development.

Route in Tidewater

The water route lay in tidewater up to 12 feet in depth over soft bay mud for some 12,000 feet, the mud varying in depth from 40 feet to 80 feet, the latter being encountered across a short reach of the bay's floor, while an average depth of some 60 feet seemed to prevail. Intensive and exhaustive investigation, research and calculations by our Materials and Research Department revealed that beneath the soft bay mud lay a thick mass of firmer mud which had been, in an earlier geological age, exposed to the atmosphere and had dried out somewhat, during which process the mud had developed strength sufficient to resist a load of at least 10 tons per square foot. This resisting strength was found to be greater than any load to be placed upon it by the proposed roadway fill and the

Aerial photograph of experimental fill clearly showing displaced mudwave

Aerial photograph of experimental fill looking north toward Sierra Point. Ultimate freeway alignment to pass through housing development and saddle in upper left-hand corner in photograph.

feasibility of constructing an earthen fill was indicated.

Further consideration of the matter resulted in the determination to conduct an experimental job based on using ordinary excavation material of whatsoever category that might be encountered in the Franciscan Formation adjacent to the proposed crossing.

The purpose of this experiment was to see if the soft mud in the upper portion of the bay floor could be satisfactorily displaced from under the roadway embankment by direct loading or whether pre-dredging would be necessary to secure stability for the roadway.

Basis for Future Design

The material was to be placed in two layers; a lower embankment 400 feet wide constructed by end dumping dirt to a height sufficient to support the contractor's equipment above high tide, but in no instance less than elevation plus eight feet and a roadway prism to be built thereon to a crown elevation of 17.8 feet with a roadway section 132 feet wide at grade.

The information obtained from building this short section is to serve as a basis for considering the method of designing and constructing the rest of the over-the-water crossing estimated to require some 6 to 8 million cubic yards of fill.

Terms of Contract

Accordingly, a contract was let which provided some 418,000 cubic yards of roadway excavation to be obtained from a state-owned borrow pit site adjacent to the beginning of the job, supplemented by some 84,000 cubic yards of excess excavation to be brought to the fill from the 17th Street to Army Street section of the Bayshore Freeway in San Francisco which was under construction at the same time. A minimum production of 5,000 cubic yards per day of roadway excavation was required in order that the mud-wave displaced by the fill be kept moving. Provision was also made to permit slowing down of the work to allow controlled settlement and consolidation of the mud under the fill.

The special provisions permitted the engineer to shut the work down when necessary to control the rate of settlement or to protect the work already in place, and the contractor would thereupon receive the bid price per hour for "idle time" for shutdown periods. No use was made of this provision as it was found to be unnecessary.

Job Extended

Work started on the job on February 5, 1952, and at the onset it became

apparent that the penetration of the fill into the mud was greater than had been estimated. As the prime object in undertaking the work was to achieve pertinent information it was felt that the job should be extended at least as far as its conceived limits into deeper water than could be reached under the full width of 400 feet and therefore a change in design was authorized which resulted in constructing the first 400 feet of the fill to a width of 400 feet in the lower embankment, the next 200 feet being 300 feet wide in the lower embankment, and the remainder to be 250 feet wide, there being no change in the roadway prism section above elevation 8.

Work for Bulldozers

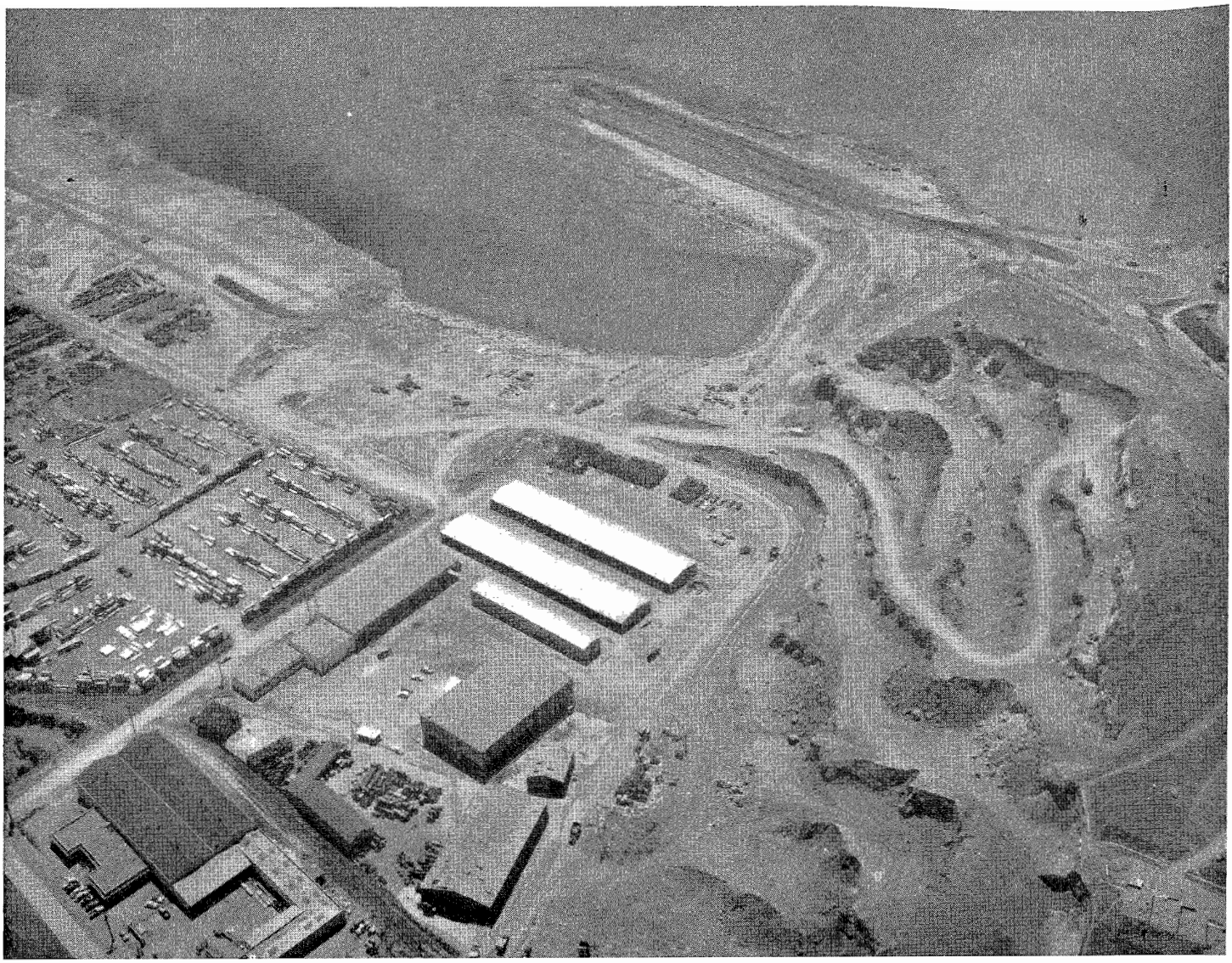
The process of construction began when bulldozers broke down the steep bluff adjacent to the shore line and built a steep ramp which could be traversed by carryalls of 15-cubic yard capacity which carried the dirt to the water's edge where 'dozers pushed it out and up against the mud wave which encompassed the fill from its beginning. The fill was carried forward with a pointed bow which was found to be most effective in shearing and displacing the mud. As the fill advanced and more area developed in the borrow pit, the contractor brought in 20-cubic-yard carryalls and then Tournapulls, and when the roadway prism was constructed, sheepsfoot tampers and a 12-ton three-wheel roller provided compaction.

As the fill progressed, large shear cracks appeared, ahead of which the nose of the fill would sink and the displaced mud would emerge from under the fill in much the same manner as toothpaste being squeezed from a tube.

Problem of Settlements

The practice was to keep filling up the sunken area ahead of the cracks and to restore it to elevation +8.0 and to advance the fill by dumping around the periphery of the unstable and not fully developed areas until stability and width was reached. Sometimes a settlement of as much as five feet took

Aerial view of experimental fill looking south from Candlestick Point toward Sierra Point, the ultimate terminus of the open-water fill



Aerial photograph of the general area of the experimental fill. Visible in left foreground is the borrow pit of the Sanitary Fill Company.

place in 30 minutes, and in one instance more than 25,000 cubic yards were placed in an area of less than 30,000 square feet without extending the fill one square foot. On stabilizing an area, the fill material would be pushed out against the surrounding and forever receding mud wave, and the process would start all over again.

After completing the lower embankment the placement of the roadway prism was constructed in single eight-inch lifts, each being completed for the full length of the fill before a second lift was started. In addition, a 330-foot length of the fill received a five-foot surcharge which caused settlement to be resumed along a crack line through the surcharge area which had been extremely active during the placement of the lower embankment. Equilibrium was restored in this area in a few days and settlement slowed down to normal. The balance of the dirt remaining to be placed after the surcharge was placed was used to build the lower embankment to Station 21 which is 1,500 feet from shore.

Experimental Success

The job has been a success in that a wealth of information has been obtained on which to base the design for future extensions.

The project has received more than the usual attention in the Division of Highways because of the challenges it presented and its experimental nature. Former Assistant State Highway Engineer Jno. H. Skeggs gave it his personal attention before his retirement, and to no less a degree has his successor, Assistant State Highway Engineer B. W. Booker, District Engineer J. P. Sinclair, Assistant District Engineer R. P. Duffy, and District Construction Engineer W. Travis. The Materials and Research Department maintained liaison through Supervising Physical Testing Engineer A. W. Root and Assistant Physical Testing Engineer W. Weber. The contractor was Edward G. Keeble of San Jose, and the Superintendent, Anthony Bruno. The writer was Resident Engineer.

Good Investment

Division of Highways Benefits From Bishops Road Disposal Area

By RAY A. COLLINS, Associate Highway Engineer

THE BISHOPS ROAD disposal area had its origin due to the initiative and foresight of Spencer V. Cortelyou, formerly Assistant State Highway Engineer for the Los Angeles metropolitan area, who retired in 1949 after 37 years of state service.

On state highway projects generally, it is possible to so establish the alignment and grade systems that roadway excavation to be made usually balances with the required roadway embankments, so that there is no problem of providing locations for disposal of excess material. Generally speaking, this is not the situation in the case of freeway construction in a metropolitan area such as Los Angeles presents. Right of way costs and other vital considerations more than outweigh any possible savings that could be made by balancing the grading quantities, and unavoidably large amounts of excess roadway excavation develop.

During the preliminary studies for the Los Angeles Metropolitan Freeway System, Mr. Cortelyou was impressed by the magnitude of excess roadway excavation and also the large amount of concrete and masonry removal that the freeway construction would require. It was evident to him that if the State could provide a site for the disposal of excess excavation within a reasonable haul distance, contractors would be able to submit to the State much lower bid prices for grading work on the freeway projects than if this matter of disposal was uncertain and left to the contractors to work out as construction proceeded.

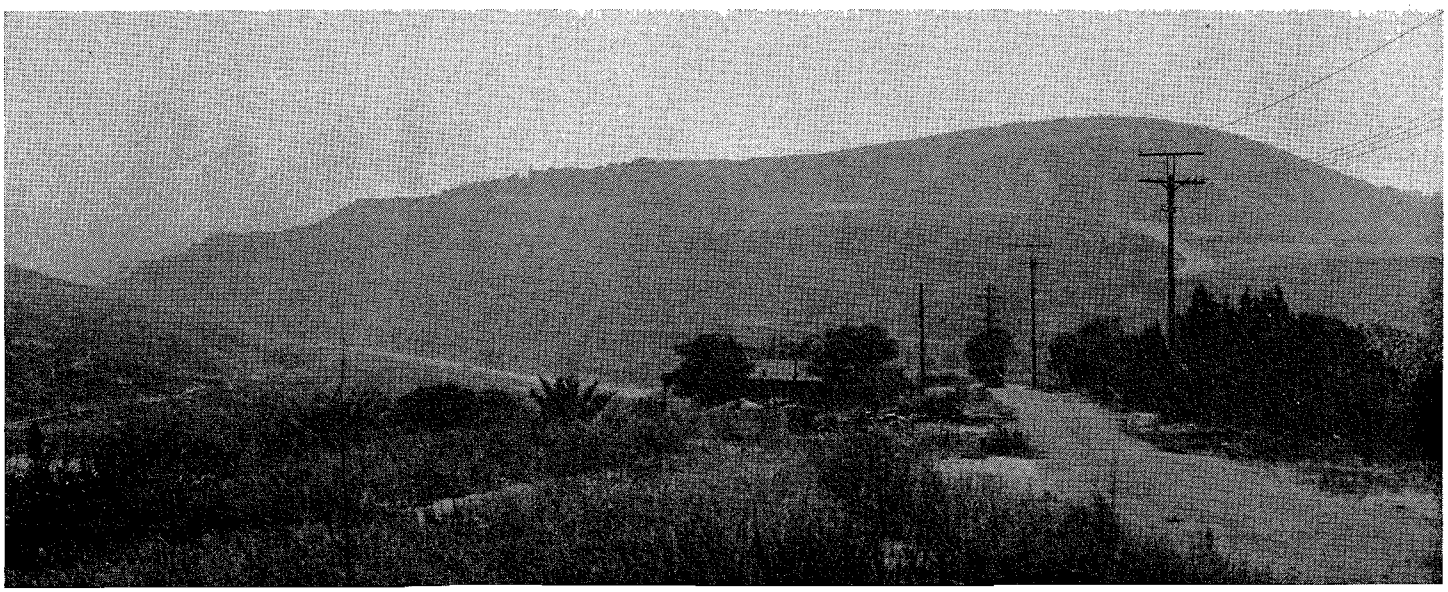
Mr. Cortelyou made a thorough investigation of available sites and finally picked the location in the canyon occupied by Bishops Road, a distance of 1½ miles from the Los Angeles Civic Center. The site which he chose was the area lying between Yale Street on the east, Effie Street on the west, Bishops Road on the north, and the top of the ridge which divides Bishops Road Canyon and Chavez Ravine on the south.

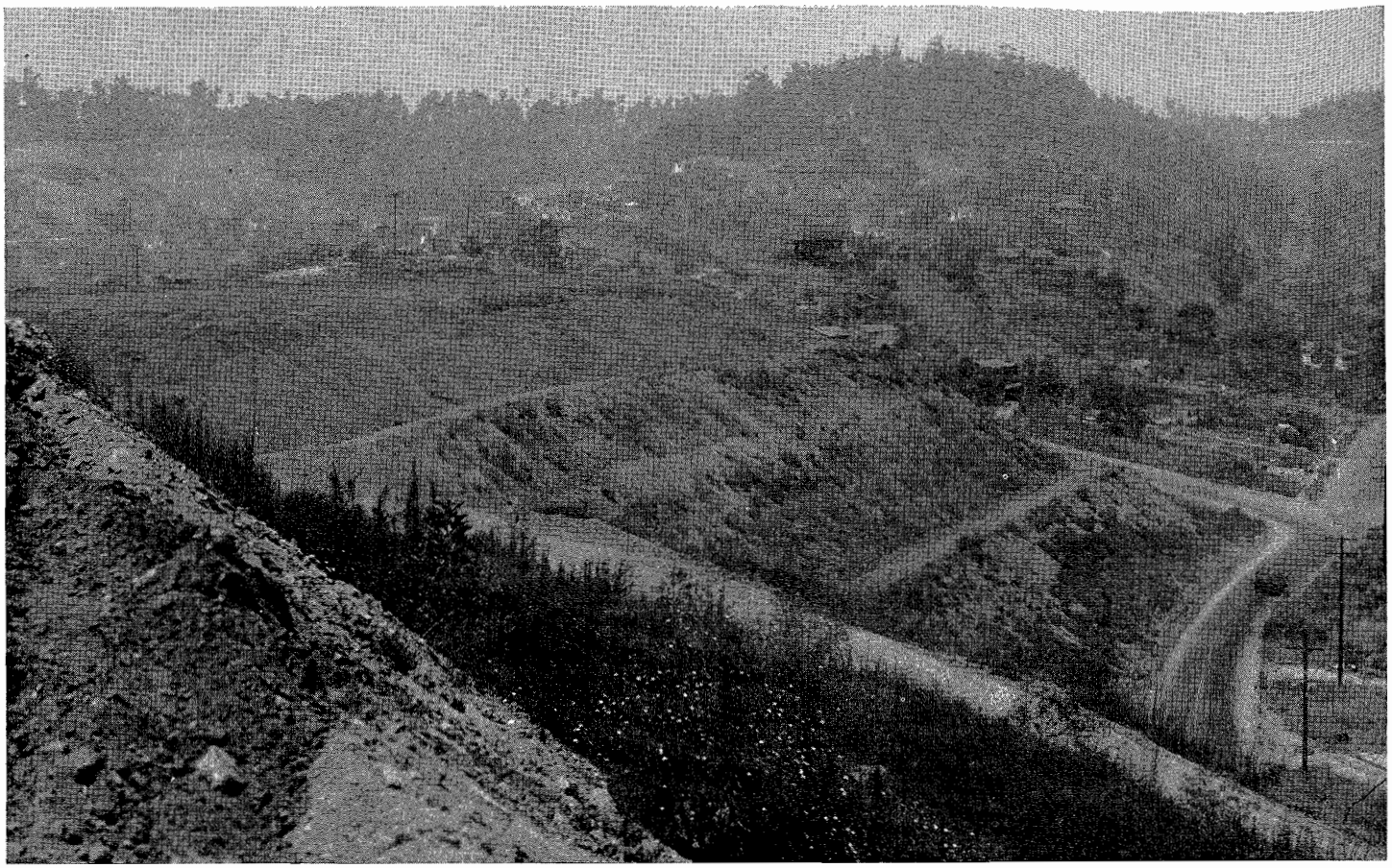
Bishops Road got its name from the fact that back in the early Spanish days when the city was called "El Pueblo de Nuestra Señora la Reina de los Angeles de Porciuncula," a monastery was located in this canyon. Next in development came a brick manufacturing establishment which supplied material for many of the early buildings in the Los Angeles Civic Center area.

At the time the State entered into negotiations for acquisition of property along Bishops Road, this land was officially listed as uninhabited. However, this was not strictly in accordance with the facts because there were a large number of packing box, sheet iron, and palm leaf shacks and some caves nestled in the gullies and among the brush that were the homes of winos and other characters in the no-income bracket. These substandard dwelling places, of course, had to go when the State Division of Highways started dumping material in this area.

During the year 1945 Headquarters Office approval was obtained and right of way acquisition negotiations were started that resulted in the purchasing of 36.6 acres of privately owned property at a total cost of $79,000. In 1947, when it became desirable to have additional area available, Mr. Cortelyou made arrangements with the

Looking southerly toward Bishops Road disposal area from top of opposite hill. Trees in Elysian Park show on skyline center left. Haul road in center of photograph near top of ridge is at 600-foot elevation. Bishops Road, at approximately 400-foot elevation, is shown center left.





Bishops Road disposal area from top of dump looking northwesterly, showing terraces that have been constructed as filling has progressed. The loaded truck shown at right is traveling on Bishops Road and is about to make left turn onto Effie Street to get to the top of the dump. Trees in the background are in Elysian Park.

Los Angeles City Park Department to get permission to place waste material upon 9.1 acres of the Elysian Park area adjoining the privately owned land that had already been acquired. Before permission was granted the State to utilize the city park land for filling purposes, the State was required to move to other permanent locations a large number of quite sizable ornamental trees. Many of these had been officially planted and dedicated with appropriate ritual and ceremony by various organizations.

In making this total area of 45.7 acres available for disposal of waste material from the freeway construction contracts, it was necessary for the State Division of Highways to remove and reconstruct 525 feet of four-inch steel water line belonging to the Los Angeles City Park Department, and also rebuild outside the fill area 1,500 feet of 24-inch cast-iron pipe that belonged to the Los Angeles Department of Water and Power. The cost of this pipeline reconstruction was about $31,000, thus making the total cost of the Bishops Road disposal area $110,000. As will be shown later on, this is but a small fraction of the monetary advantage to the State which has already been obtained by having this area available during the freeway construction.

The Bishops Road disposal area is not at all the usual type of a dumping ground with a deep hole to be filled. The waste material is being disposed of by dumping between the road in the bottom of the canyon and the top of the ridge to the south, the result being the narrowing of the canyon and the creation of a hillside slope considerably steeper than originally existed. The Bishops Road disposal area as now filled has been called "the man-made mountain." One feature story writer went so far as to call it "a hill of a fill."

The fill is being carried up using approximately 1½-to-1 slopes. At each 50 feet of height, a bench 25 feet wide is being provided to create a terraced effect. On the terraces thus created and on the slopes eucalyptus trees are being planted for erosion control and beautification. The specifications require that the fill material shall be brought up in layers that do not exceed two feet, and that as much compaction as possible shall be obtained by routing the trucks over the filled area.

Filling operations were started on the Bishops Road disposal area in 1946 and have proceeded almost continuously since that time. The freeway construction contracts that have contributed waste material to the Bishops Road disposal area, in chronological order, are as follows: the Grand Avenue Overcrossing; the four-level traffic interchange structure; the Figueroa Street Overcrossing; the Alpine Street Overcrossing and Arroyo Seco Parkway southerly extension; the Main Street Overcrossing; Los Angeles Street Overcrossing; Broadway Overcrossing; Hill Street Overcrossing; the Los Angeles County parking lots adjoining Hill Street from Temple Street to the Hollywood Freeway; the Los

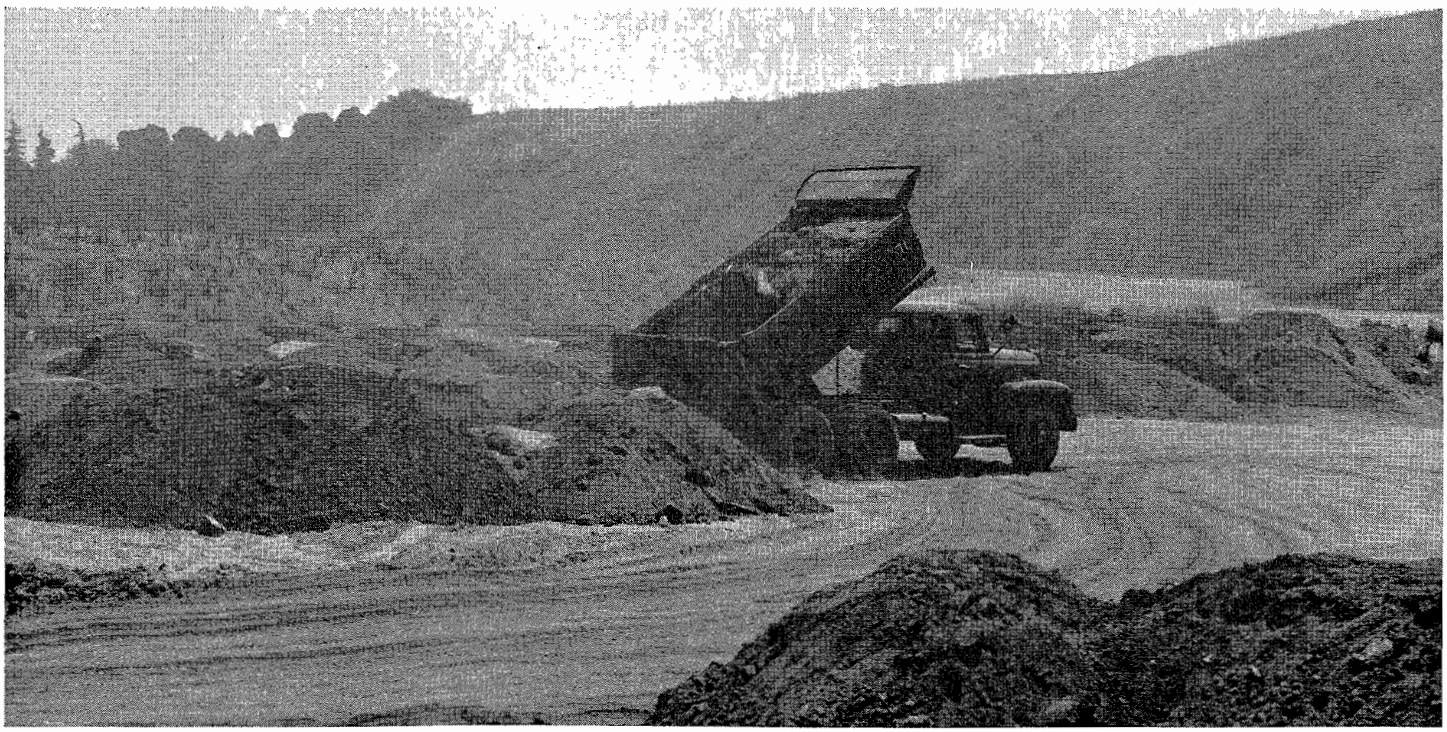
Angeles City Board of Education parking lot adjoining the Hollywood Freeway; and the various sections of the Hollywood Freeway from Hollywood Boulevard to Los Angeles Street. At the present time waste excavation is being hauled to the Bishops Road disposal area from the Alameda Street Overcrossing on the Santa Ana Freeway. Very soon excess excavation material will be hauled to the disposal area from the construction operations now under way on the Hollywood Freeway from Hollywood Boulevard to the Pilgrimage Bridge.

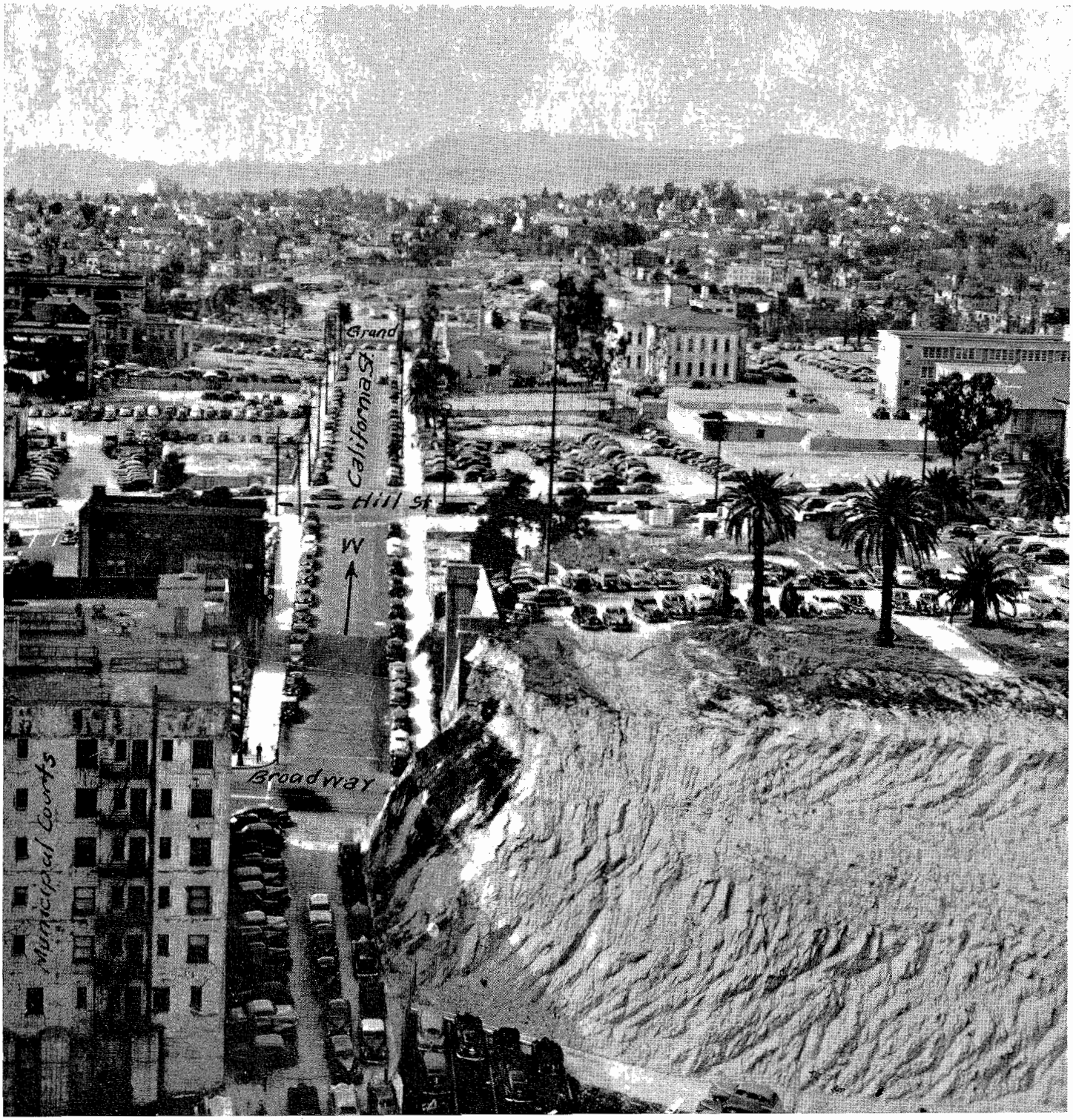
In order to be sure that the excess excavation hauled to the disposal area was distributed and compacted in accordance with the specifications and also to prevent unauthorized dumping, it has been necessary for the State Division of Highways to maintain a representative on the ground at the disposal area. For the past five years this position has been held by Dick Jones, Assistant Highway Engineer. Since Jones has been on the job continuously and watched the dump grow from small beginnings to great proportions, with the fill rising from the bottom of the canyon for some 200 feet above Bishops Road, he has earned the title and is frequently called "The Old Man of the Mountain." At other times he is more respectfully referred to as "The Master of the Dump."

On the disposal area there are no monuments or gravestones telling what is buried underneath, but very deep down within the mass of fill are the last remains of the historic Fort Moore Hill, the famous double-roofed Broadway Tunnel, the Pacific Electric Railway Tunnel, the remains of the old original Los Angeles High School, and a large portion of the City of Los Angeles Board of Education Administration Building. Buried here also are the hopes of the prospectors who avidly sought the hidden treasure they were so certain that the Spaniards had concealed in Fort Moore Hill.

Very great benefit has been obtained from the Bishops Road disposal area not only as a place upon which to dump excess and waste material, but also because of what it has furnished to some of the freeway projects. When the four-level traffic interchange structure was being finished, imported borrow was needed to make the embankment approaches. This the contractor obtained by making excavations at the Bishops Road disposal area. Some 52,000 cubic yards of imported borrow was obtained. During the removal of the portion of Fort Moore Hill to make way for the Hollywood Freeway and to provide building and parking sites in the Civic Center for future planned Los Angeles County and Los Angeles City buildings, a stratum 35 feet thick of ancient stream bed of the Los Angeles River was uncovered. Tests indicated that this granular material was suitable for use in subbase under portland cement concrete pavement. With this information it was decided to stockpile this material in a certain section of the Bishops Road disposal area for future use in paving contracts on the Hollywood Freeway. A stockpile was created of 180,000 cubic yards of selected subbase material that was later utilized on Hollywood Freeway paving contracts. Thus the Bishops Road disposal area has served a triple purpose. Not only is it a dumping ground for unwanted waste material, but it has contributed badly needed imported borrow material for roadway embankments and also served as a temporary storage space for high-grade imported subgrade material.

Truck depositing waste material from Santa Ana Freeway excavation now in progress for the Alameda Street overcrossing. Dumping operations where shown are at the 585-foot level of the Bishops Road disposal area. Trees in left background are in Elysian Park. The top of the ridge is at approximately 675-foot elevation, and this ridge is the southwest property line of the Bishops Road disposal area.





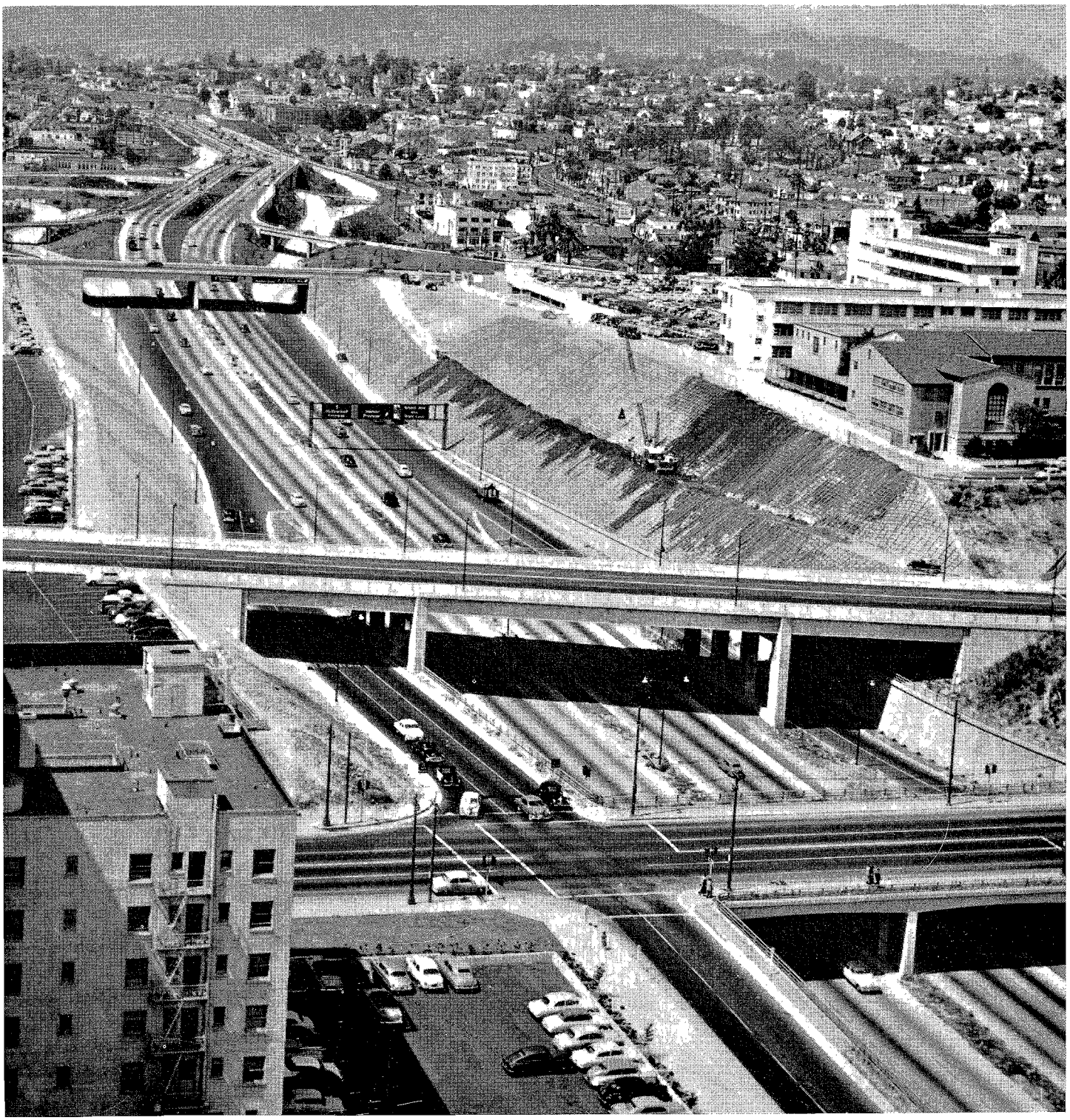
BEFORE—Looking westerly from roof of Federal Building in Los Angeles Civic Center along Hollywood Freeway location before start of grading construction. In foreground right is Fort Moore Hill with Broadway Tunnel portal showing in center foreground; just to the center right is the old Los Angeles High School before wrecking operations had started; still further to the right are the Los Angeles City Board of Education buildings with foundations showing where 60 feet of one of the buildings had already been removed. In background are the Hollywood Hills.

Evaluation of Items

As of the present time a very conservative evaluation has been made of the items involved in the Bishops Road disposal area, as follows:

52,000 cu. yds. imported borrow for roadway embankments @ 50¢	$26,000
180,000 cu. yds. selected subbase for use under pavement @ $1	180,000
5,000,000 cu. yds. wasted excess excavation material @ 50¢	2,500,000
Total	$2,706,000

With the total cost of the Bishops Road disposal area, as indicated above, being $110,000, this represents a 2,500 percent return on the original investment and certainly vindicates Mr. Cortelyou's good



AFTER—Taken from top of Federal Building, showing completed Hollywood Freeway extending from Broadway in the foreground to Belmont Avenue pedestrian bridge in background. To the right are the Los Angeles City Board of Education buildings with erosion control landscaping operations in progress on the cut slope alongside the Board of Education buildings. Comparing this photograph with the one on page 20 will give a good idea of how much material was hauled from the section of the Hollywood Freeway in the Los Angeles Civic Center to the Bishops Road disposal area.

judgment in advocating and arranging for the acquisition of this disposal site. And best of all, the favorable balance is increasing day by day.

After the filling has been completed on the Bishops Road disposal area, the acreage formerly in Elysian Park will be turned back to the Los Angeles City Recreation and Park Department along with other filled areas adjoining, so that road construction and developing can be carried out.

THE FOUR-LEVEL GRADE SEPARATION STRUCTURE ON LOS ANGELES METROPOLITAN FREEWAY SYSTEM

THE LOCATION of the four-level grade separation structure, about one-half mile westerly of the Los Angeles Civic Center where the Hollywood Freeway crosses the Harbor Freeway-Arroyo Seco Parkway (one being a continuation of the other), has been referred to as the "hub" of the freeway system. At this location, where a very complicated traffic interchange problem was recognized to exist, the State Division of Highways initiated, designed, and constructed a four-level grade separation structure that is the first of its kind to be built.

The top level of this structure is now in use carrying traffic on the Hollywood Freeway between Los Angeles Street, in the Civic Center, and Western Avenue, in Hollywood. Other levels of this traffic interchange structure were placed in use when the half-mile section of the Harbor Freeway was completed between Temple Street and Third Street on July 30th.

The building of the four-level grade separation structure has introduced a new method of handling exchange traffic between freeways that is greatly simplified over the conventional types of interchange systems such as the four-leaf clover type, in which the left turn is accomplished by means of a three-quarter turn or 270-degree loop to the right. In the clover-leaf type there is also an overlap of acceleration and deceleration traffic with resulting serious conflict and confusion. Other types of interchange systems employ reversing curvature and circuitous travel for some of the traffic movements, together with numerous bridge structures, all of which are detrimental to smooth and economical operation.

The four-level grade separation eliminates these objectional features by providing a simple turn for all traffic movements in the direction in which each wishes to go, and without excess distance over that which would be required in ordinary highway travel. It should be noted that the take-off from one freeway and junction with another freeway is in all cases made on the right side of the freeways.

In the four-level grade separation the basic feature is that the four separate roadway levels are so arranged as to pass one another at one point in a

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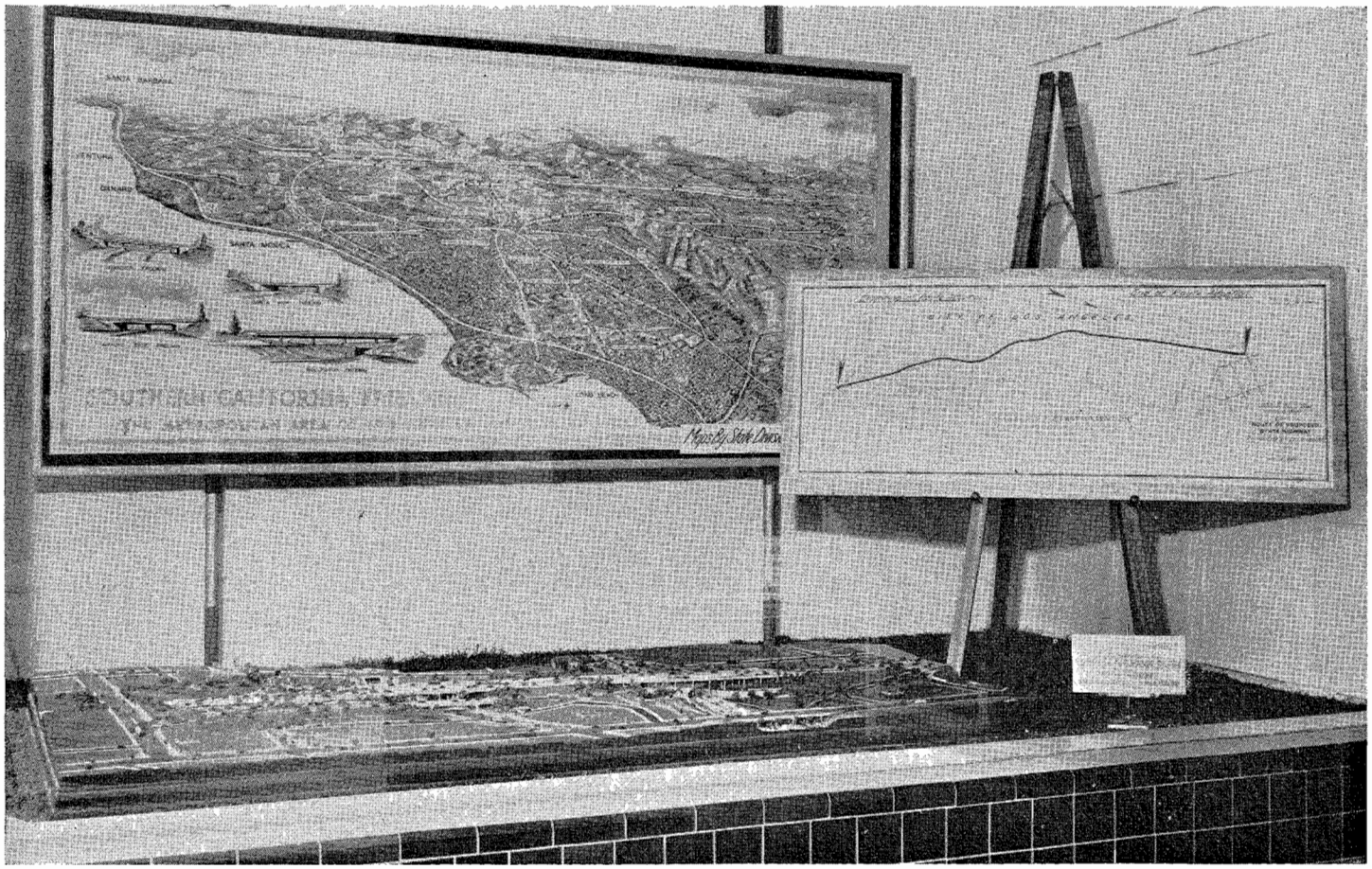
This display of four-level structure in window of Hollywood Citizen-News attracted much attention



Harbor Freeway

Important New Section Is Opened to Traffic

A SMALL but important section of the Harbor Freeway in Los Angeles was opened to public use on July 30th. The new section is but 0.6 mile long and extends from Temple Street to Third Street in the downtown crowded district.

The section is not so important as a traffic artery as it is as an adjunct of the big four-level structure that was started in 1948. This structure is to be the separation point for all the freeways entering Los Angeles.

Heretofore, the Hollywood Freeway has been using the top level only. The section through the Civic Center, leading to the Santa Ana and the Ramona Freeways, is a continuation of the Hollywood Freeway.

But with the opening of this new section of the Harbor Freeway the public has begun to use three levels of the massive structure. With the opening of the connection to the Arroyo Parkway, some time next spring, all four levels of the big structure will be in use.

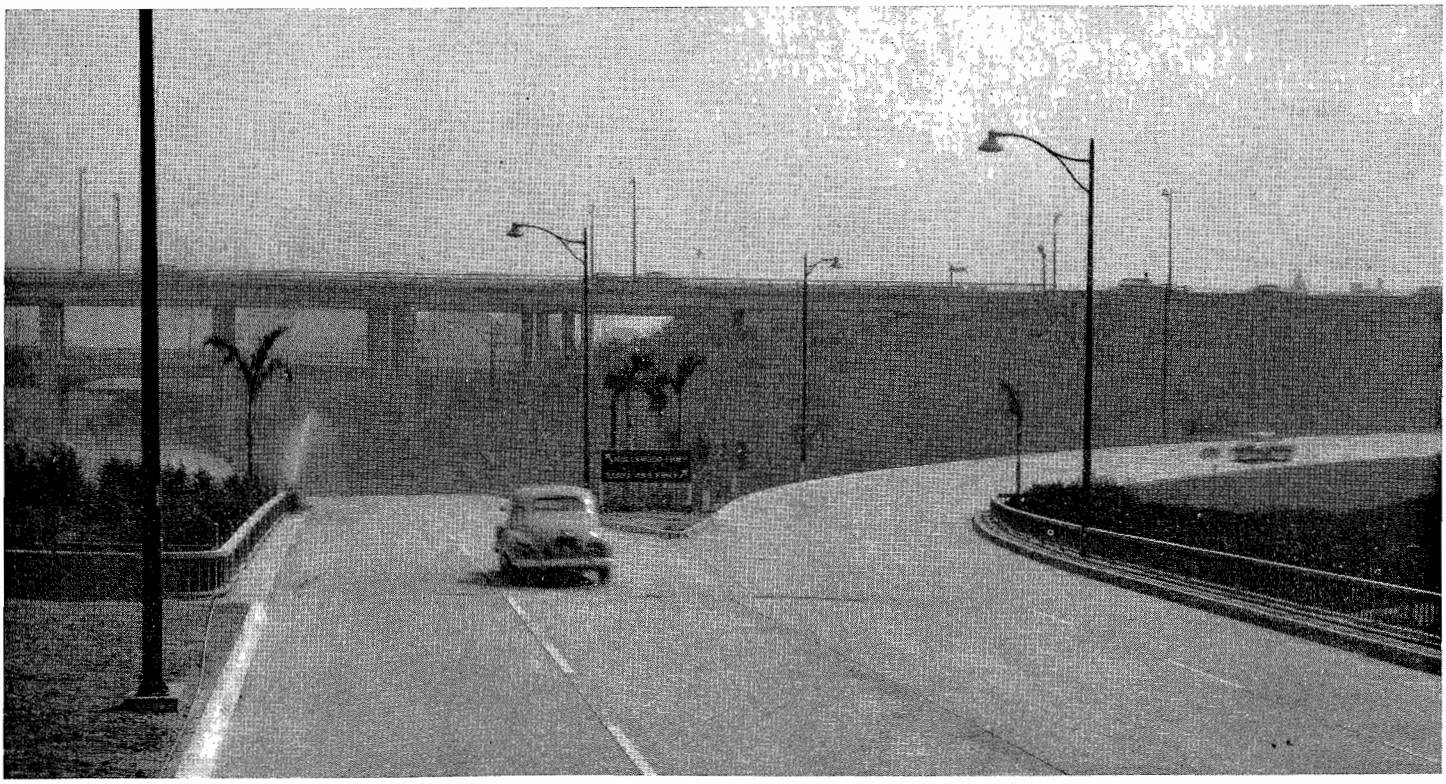
Civic leaders from the City and County of Los Angeles participated in dedicatory ceremonies. John Anson Ford, represented the Board of Supervisors; Mayor Fletcher Bowron, the City of Los Angeles; Felix Chappellet, the Los Angeles Chamber of Commerce; and Edward R. Valentine, the Downtown Business Men's Association. Robert Mitchell acted as master of ceremonies and represented the Los Angeles Metropolitan Traffic Association.

The speech officially opening the new section was made by Harrison R. Baker, Highway Commissioner from Pasadena, who also was the ribbon cutter. He introduced James A. Guthrie, Highway Commissioner from San Bernardino. Baker stressed the importance of this new section, not so much for its length but because it started the use of the four-level structure.

As far as length is concerned it was pointed out that the exit from the new section was on Beaudry Street near Second Street and the entrance was from Third Street. But the shortness of the new section did not detract from its cost as the over-all costs for bridges, grading, paving, lighting, and right of way totaled something over $4,000,000.

Baker pointed out that the next section of the Harbor Freeway, to be completed some time next spring, would take the motoring public as far as Olympic Boulevard and that shortly after that section is opened the connection with the Arroyo Parkway will be completed.

Harbor Freeway looking east from near Temple Street. Four-level structure in background.



Notable Career

Charles H. Whitmore Retires On Record of Achievements

NEARLY 500 persons gathered in the Elks Club in Marysville on August 29th to pay honor to Charles H. Whitmore on the occasion of his retirement from a distinguished 29-year career of service with the Division of Highways.

For all but the first six of those 29 years Mr. Whitmore was District Engineer of District III, which comprises 11 counties in the Sacramento Valley and Sierra Nevada regions. The civic and professional leaders present to pay tribute to his outstanding contributions to the development of the road network in that large area included officials of the various counties and cities with whom he worked, as well as engineering colleagues and contractors.

CHARLES H. WHITMORE

Born in Kansas

In half a century of engineering work, Mr. Whitmore's career paralleled those of many engineers and surveyors who contributed to the building of the West, particularly its transportation facilities.

He was born in Emporia, Kansas, August 21, 1882. When his father died in 1894 the family moved to DeKalb, Illinois. His basic education was acquired in the public schools of both those states, and his engineering studies took place at Oberlin College in Ohio, supplemented by correspondence courses.

Like many other highway builders of his generation, Mr. Whitmore's first engineering work was on railroad location and construction. From 1902 to 1907 he held positions ranging from chainman to resident engineer on railroad projects.

His Work in Texas

In 1908 El Paso County, Texas, provided funds for construction of the first hard surface roads in the county outside the limits of the City of El Paso. Mr. Whitmore obtained the position of assistant county engineer and later became county engineer. In the course of three years there he supervised construction of about 30 miles of crushed rock base and oil penetration surface roads. The project was one of the first in the United States to which the U. S. Bureau of Public Roads assigned an official observer for training.

Between 1911 and 1915 Mr. Whitmore was in Montana, this time engaged in irrigation work. As district engineer for a land and water development company he was in charge of constructing canals, laterals and a rock-fill dam and storage reservoir.

He returned to road construction in 1915, for Multnomah County in Oregon. As in El Paso, that county was undertaking the paving of many miles of county roads, the first roads in Oregon to be paved outside the limits of cities. For the next three years he served as Assistant County Engineer and then as County Engineer.

Pioneered Oregon's Gas Tax

The paved roads of Multnomah County spurred a demand for paved state highways. Funds were lacking, however. Mr. Whitmore participated in the ensuing discussions of ways and means which brought forth the idea of a tax on gasoline, in which Oregon pioneered, enacting in 1919 the first gas tax measure for highway construction revenues.

From county work Mr. Whitmore's next and logical move was to state highway work, and he served as a District Engineer for Oregon until he came to California in 1923.

For approximately five years he served as District Construction Engineer in District IV, San Francisco, under Colonel John H. Skeggs, who retired earlier this year. In 1928 Mr. Whitmore was appointed District Engineer of District I, at Eureka, and the following year moved to Marysville in a similar capacity.

Fine Record in District III

The 1,340 miles of state highway contained within the boundaries of District III range from high mountain pass routes to metropolitan freeways. About 600 miles of this total were former county roads added to the State Highway System in 1933. Under Whitmore's guidance maintenance standards were raised and many improvements were accomplished despite a lack of adequate funds to meet the ever-increasing needs of traffic.

Some of the projects accomplished or begun during the last several years of Mr. Whitmore's tenure are providing or will provide relief from serious traffic congestion on heavily traveled routes. The North Sacramento Freeway is one of these. Others included the Roseville Underpass, the Marysville-Yuba City Bridge and its approaches and the four-lane divided highway between Davis and Sacramento on U. S. 40.

The most challenging task for the construction and maintenance personnel under Whitmore's direction has been, of course, the reconstruction of surfacing, maintenance of roadway and removal of snow on U. S. Highways 40 and 50 and other routes over Sierra summits and in the Lake Tahoe area. This task assumed herculean proportions in the wake of record-breaking storms during the winter 1951-52.

Mr. Whitmore will continue to make his home, upon retirement on a two-acre tract on Franklin Road, near Yuba City, where many friends have admired his secondary accomplishments as gardener and chicken raiser.

A. M. Nash Now Is in Charge Of District III

RESPONSIBILITY for improving and maintaining the 1,340 miles of state highway in 11 Sacramento Valley and Sierra Nevada Counties has been assumed by A. M. Nash as District Engineer of District III, State Division of Highways, with headquarters at Marysville.

He succeeds Charles H. Whitmore, who retired after 29 years of service with the Division of Highways, the last 23 of them as District Engineer in District III.

Nash was transferred to his new post from District I, Eureka, where he had served as District Engineer for seven of the last 10 years. A native of Kansas, Nash was educated in the public schools of Idaho and Washington and attended the University of Washington. After a short period of highway and railroad engineering work he served as a second lieutenant in Army Aviation in World War I, and in 1920 began his career with the Division of Highways as a draftsman and computer in the headquarters office in Sacramento.

From 1924 to 1934 Nash was on the staff of District X, Stockton, successively as chief draftsman, district right of way agent and resident engineer on construction projects. He then returned to the Sacramento headquarters office for seven years, doing administrative and planning work.

In 1924 he was appointed District Engineer of District I, holding that post until he was recalled to Sacramento in 1946 as Engineer of Design. In October, 1949, he returned to Eureka as District Engineer.

Nash's highway engineering accomplishments have won recognition beyond the borders of California. He is a former vice president of the Western Association of State Highway Officials; a member of the Committee on Culverts and Culvert Pipe of the Highway Research Board; and a member of the Committee on Highway Location, Surveying and Mapping of the American Road Builders Association.

A. M. NASH

CLYDE V. KANE

NIGHT DRIVING

Slow down at sundown. If you drive faster than 45 at night, you are overdriving your headlights. When you can't stop your car within the visibility range of its headlights, you are headed for unseen trouble.

Clyde V. Kane Moves to New Post in Eureka

THE POST of District Engineer in District I, comprising Del Norte, Humboldt, Mendocino and Lake Counties, has been assumed by Clyde V. Kane, succeeding A. M. Nash.

Nash has been appointed District Engineer of District III, an 11-county area with headquarters in Marysville, to fill a vacancy caused by the retirement of C. H. Whitmore.

Kane comes to the northwestern district after 24 years of highway engineering work in District VIII, San Bernardino and Riverside Counties, where he advanced through the ranks to the post of assistant district engineer.

Part of his boyhood was spent in his new district. He was born in New Mexico, but was graduated from Clear Lake Union High School in Lakeport in 1921.

His first engineering job was on a survey party for the Southern Pacific Railroad, initially in the Imperial Valley and later in Oregon. He then entered the University of California, and received his B.S. in civil engineering in 1927. After brief periods in South America and in San Francisco, he joined the San Bernardino office of the Division of Highways as a draftsman.

Successively he become construction inspector, resident engineer on highway construction projects, and chief draftsman. In November, 1942, he entered military service with the Army Engineers. He served for more than a year as chief of the engineering division for the construction of a portion of the Pan American Highway in Central America, and then moved halfway round the world to Burma, where he was area engineer in charge of constructing and maintaining part of the Ledo Road and nearby airstrips.

Returning to California in 1946, Kane was placed successively in charge of highway location and construction for the San Bernardino District, and in 1950 he assumed administrative duties as assistant district engineer.

Kane will make his home in Eureka, headquarters of District I, with his wife and two children.

Veterans Retire

Maintenance Department Loses W. A. Smith and H. L. Cooper

WILLIAM A. SMITH—1952

TWO VETERANS of the Maintenance Department of the Division of Highways retired on the same day, August 1, last. Both of them, William A. Smith and H. L. Cooper, held the title of Assistant Maintenance Engineer. The former served with the department for 33 years and the latter for 27 years.

Mr. Smith was born in West Settlement, a farm community near Roxbury-in-the-Catskills, New York. He began his education in the same red schoolhouse where John Borroughs, the naturalist, and Jay Gould, the New York financier, sat as boys a generation earlier. He then attended the Roxbury High School. In 1911 he received his science degree in civil engineering from Iowa State College.

Served in Army

From 1912 to 1917 Smith was employed by the Baltimore and Ohio Chicago Terminal Railroad on construction and railroad valuation work in Chicago as well as in Ohio and Indiana. He was with the Quartermaster Corps of the U. S. Army during 1917 and 1918 on the construction of Camp Taylor at Louisville, Kentucky, and of the Port Terminals constructed at Newark, New Jersey, and at Charleston, South Carolina. At the close of the war he returned to railroad work at Baltimore, Maryland. In 1919 he moved to California and in September of that year was employed by the California Highway Commission. He was assigned as assistant and resident engineer to various construction projects in District III, which at that time included the present District X territory. From 1921 to 1923 he was in charge as resident engineer of construction work in Colusa, Amador, and San Joaquin Counties. In 1924 he was advanced to office engineer for District III at Sacramento.

Transfers to Headquarters

In 1926 Smith transferred to the Headquarters Maintenance Department as assistant maintenance engineer in charge of the office administration and related matters. He continued in this work together with occasional special assignments, until his retirement. During this period he was active in the development of the maintenance work, particularly in connection with programming the work and organization matters.

HERBERT L. COOPER

WILLIAM A. SMITH—1919

Smith has a daughter, Marian, who is employed as assistant personnel technician by the Division of Highways, and a son, George, who is an associate highway engineer with the District III organization at Marysville. Smith and his wife plan to continue to live in Sacramento.

N. R. Bangert succeeds Smith.

Herbert L. Cooper

Herbert L. Cooper was born in Chicopee, Massachusetts, and graduated from Lehigh University as civil engineer in 1913.

He worked one year as civil engineer for the Springfield Massachusetts Gas Company; two years as surveyor for U. S. Forest Service in Tennessee, Virginia, and New Hampshire; one

. . . *Continued on page 28*

Retirements *from* Service

HARVEY P. GAY

On September 1, 1952, Harvey Page Gay, machinist at Headquarters Shop of the Division of Highways at Sacramento, retired after 29½ years of service.

He entered state service at Headquarters Shop on April 30, 1923, and, with the exception of a period of several years, when he was stationed in Willits, has been continuously employed at Sacramento.

HARVEY PAGE GAY

Gay was born 66 years ago at Rockingham, North Carolina, and graduated from high school there. After one year of study at the University of North Carolina, he began his apprenticeship to the machinist trade in October, 1902, with the Mecklenburg Iron Works at Charlotte, N. C., completing his training in 1906.

From then on, Mr. Gay led an interesting and varied existence, one which carried him to the British Isles, to Panama and Cuba, and to every state in the Union except North Dakota.

As a young journeyman, he worked as machinist and as tool and diemaker for various railroads and manufacturing concerns, and also as roundhouse foreman for the Southern Railway. On leaves of absence he found time to play three seasons of professional baseball with the South Atlantic League and the Southern Association.

Admitted to Bar

In the period between 1908 and 1916 he attended night classes at Atlanta Law College, and in 1916 was admitted to the Georgia Bar. It didn't take Harvey long to find out that the legal profession was not for a young man with

. . . Continued on page 28

LOUIS F. RAMPONE

Louis F. Rampone, Highway Maintenance Leadingman, of San Juan Bautista, retired from state service on July 1, 1952.

Mr. Rampone was born in Oakland, California, May 30, 1894. In 1914 he was employed by the Bank of America and in 1915 he took his first job with the State. His job was "shaking plow" during the construction of the Old San Juan Grade, a concrete highway.

He entered the military service as an observer in reconnaissance on August 4, 1917. He was with the 88th Aero Squadron and has seven campaign ribbons—Château-Thierry, Belleau Wood, Meuse-Argonne, Montfaucon, Aisne-Marne, Oise-Aisne and Saint-Mihiel. He received his discharge from the Army on August 7, 1919, after having spent about seven months with the Army of Occupation in Trier, Germany.

After his discharge from the Army he worked at various jobs and again returned to work for the Division of Highways October 5, 1926, as a truck driver at San Juan Bautista. Later he was made leadingman at Hollister.

On June 8, 1925, he was married to Lillie Sarah Baccala at Hollister. They make their home in San Juan Bautista.

"Louie" is very popular with all the men in the territory who worked with him and is considered by them to be a very able and conscientious worker. On July 2d, his friends with the Division of Highways honored him with a dinner at the Villa Pace in Hollister.

Mr. Rampone expects to remain in San Juan but looks forward to spending a lot of time fishing and hunting, his favorite sports.

W. H. HOLMES

After 24 years of continuous service with the Division of Water Resources, W. H. Holmes resigned on October 3, 1952, to enter private practice. He had been principal engineer, design and construction of dams, for the State with headquarters in Sacramento for the last 10 years. For the prior 12 years, he was located in Los Angeles in charge of similar work for that area.

W. H. HOLMES

Following the disastrous failure of the St. Francis Dam in Los Angeles County in 1928, the Legislature, in 1929, passed the act providing for supervision by the State Engineer of construction and maintenance of all dams in the State with the exception of federally owned dams.

During the first 13 years of Holmes' activities in state supervision of dams, 41 dams were constructed in the southern part of the State at a cost of $48,000,000 and 58 dams constructed in the northern area at a cost of $11,000,000. In the last 10 years, 129 dams have been constructed at a cost of $68,000,000.

In addition to supervision of construction, inspection of 507 dams previously constructed revealed many of them had not been built satisfactorily. Patience and persistence have developed an acceptance by the public of increase in standards of safety requirements and extensive repairs have been made to many dams.

Prior to World War I service in France, Holmes worked a short time for the Highway Department. He began his professional career by designing and working on the construction of Stanford Stadium, after graduating from Stanford University in 1921. His

. . . Continued on page 28

W. H. HOLMES

Continued from page 27 . . .

first experience on dam construction was on Don Pedro Dam, owned jointly by the Turlock Irrigation District and Modesto Irrigation District.

He was irrigation engineer for the Modesto Irrigation District for six years, but resigned in 1928 to work on state dam supervision which gave him an opportunity to extend his study of prior college interest in mathematical and photoelectric studies of stress distribution in mass concrete. He has maintained an interest in study of soil compaction. The art of soil mechanics started about 1930 and sufficient theory and experience has been developed to justify the construction of high earth compacted dams.

After some relaxation, Mr. Holmes plans to do some research and enter private engineering practice in Sacramento. Holmes lives with his wife at 905 46th Street in Sacramento.

Festival of Arts

Continued from page 12 . . .

tion in carrying out the construction on this project was greatly appreciated by the city officials and Art Festival Committee, as attested by the letters that have been received.

Kenneth E. Overaker, Managing Editor of the *South Coast News*, published the following editorial:

> "Those of us in Laguna Beach who had been here long enough to know some of the traffic and parking problems created by the crowds who throng to our annual Festival of Arts groaned when we heard that the State Highway Department was undertaking construction of the new four-lane canyon highway in the spring of the year. 'They'll be working on it just about the time of the festival,' was heard around town. Reassurances came from highway officials that the work would be done by the time the festival started.
>
> "And it would have been had it not been for the strike by the operating engineers.
>
> "How it came about that one lane was completed and opened to traffic and the other was surfaced and opened to parking for the festival crowds bespeaks splendid cooperation on the part of the State, the construction company, and others concerned. Many of us appreciated this effort and the added parking facilities.
>
> "As the parkway becomes planted and the improvement completed, more and more we recognize what a splendid 'doorway' to Laguna Beach has been developed for us."

WILLIAM A. SMITH
HERBERT L. COOPER

Continued from page 26 . . .

year as estimator for Johns-Manville Company, Philadelphia, Pa., and from there went to Officers Training Camp at Camp Lee, Virginia.

He served as 2d and 1st Lieutenant, Corps of Engineers, in the United States and France about one and one-half years. He worked for Jones and Laughlin Steel Company as civil engineer for one year and due to poor health came to California. For three years he was with San Diego and Imperial Counties as inspector and resident engineer and one year with Standard Oil Company at El Segundo; and two years with U. S. Bureau of Public Roads as resident engineer in Arizona.

Enters State Service

He entered state service in District VIII, September 21, 1925, acting as resident engineer, transferred to District I as resident engineer and then to District V in 1928. He served as resident engineer, chief draftsman, assistant district maintenance engineer, and district maintenance engineer from 1928 to 1945.

Cooper was transferred to Headquarters Maintenance Department as assistant maintenance engineer on special assignments and maintenance experimental work under Thomas H. Dennis to reduce costs and perform more efficient maintenance work. He was appointed representative of the Department of Public Works in 1950 by the Director of Public Works, the late C. H. Purcell, to represent the department on the staff of General W. M. Robertson, State Director of Civil Defense.

Herbert P. O'Donnell was elevated to Cooper's post.

HARVEY P. GAY

Continued from page 27 . . .

the wanderlust, or for one with a love for heavy machinery and transportation. He accordingly gave up his practice and, with the entry of the United States into the first World War, entered the service of the United States Government with the Railroad Administration, which at that time assumed control of the railroads of the United States. Later he worked at Washington, D. C., Navy Yard and, after a period of touring the Country as a "boomer" machinist, he drifted out to the West Coast where he was employed as tool and diemaker at Mare Island Navy Yard, settling down later at Sacramento.

Mr. Gay was married on September 14, 1919, to Eleanor (Merry) Gay of Sacramento.

Active Mason

He has been very active in Masonic circles, is a Past Master and is now Treasurer of Capital City Lodge No. 499, F. & A. M. He is a talented singer and quite active in church circles.

Harvey is one of those fortunate people whose occupation is also their hobby. He plans on devoting quite a bit of his spare time to his home machine shop; his present project being the construction of a milling machine.

While Mr. and Mrs. Gay plan on remaining in Sacramento, their plans do include quite a bit of traveling around the United States. In particular Harvey intends to visit North Dakota, thereby completing the tour of the United States which his state employment interrupted. They will be pleased to greet their many friends at their home at 2630 San Jose Way, Sacramento.

FINGERPRINTING A HIGHWAY

By M. L. NELSON, Assistant Physical Testing Engineer

ENGINEERS of the California Division of Highways are constantly striving through materials research and design methods to provide highways which will offer the maximum in safety to the traveling public. One of the hazards to vehicles operating at high speed is the danger of skidding, and a great deal of research and study is being directed toward a solution to this problem.

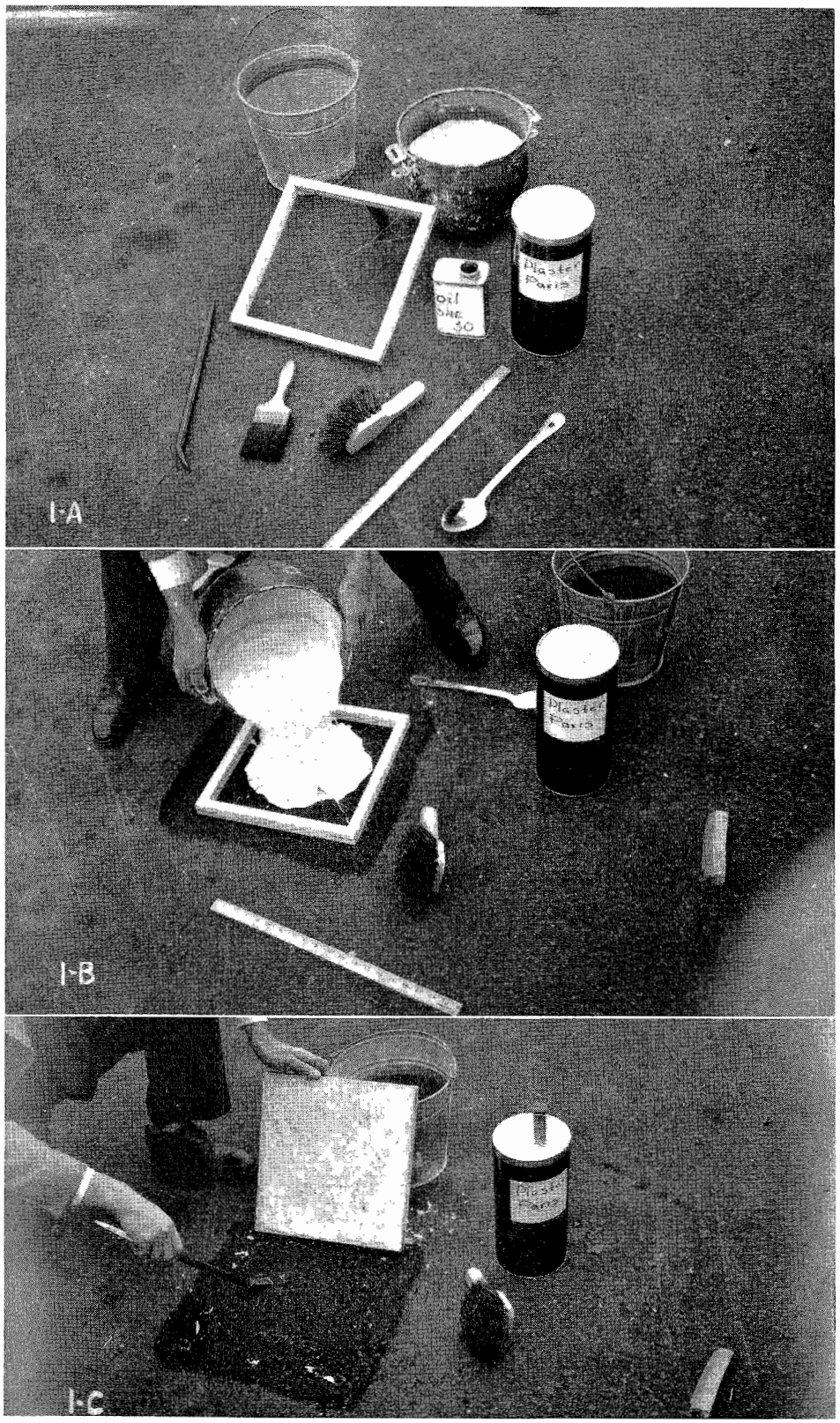
Under the direction of Professor Ralph A. Moyer, personnel of the Institute of Transportation and Traffic Engineering of the University of California have been engaged for some time in performing physical tests with special equipment which measures, at various speeds, the coefficient of friction of tire contact with pavement surface on all types of highway surfaces both in wet and dry conditions. (*Reference Highway Research Board Bulletin No. 37, R. A. Moyer and John W. Shupe.*)

Skid Resistance Study

As an integral part of the skid resistance study, close-up photographs of the pavement texture were desirable; however, due to the many variables of lighting and differences in coloring of the aggregates, it was readily apparent that a true picture of the surface texture would depend on some method that would eliminate camouflaging factors of color and lighting. The Materials and Research Department assumed this part of the operation and solved this problem by making plaster casts or "negatives" of the pavement surface and photographing positive plaster replicas of the pavement surface under controlled lighting.

The equipment for making the plaster casts is simple *(See Figure 1-a)* and consists of the following items:

- Wood frame 12 inches by 12 inches by 1 inch, reinforced with wire laced through the frame, crossed at the center and twisted to tighten.
- Mixing bowl, approximately 6-quart capacity.
- Water container.



Large spoon for mixing plaster.
Straight edge for striking off excess plaster.
Stiff broom or brush for cleaning pavement surface.
Paint brush for applying oil to the surface.
Small wrecking bar for removing cast from pavement.
Plaster of Paris.
S.A.E. 30 lubricating oil.

The procedure for obtaining the cast consists of selecting a representative area of pavement where skid tests were made, thoroughly cleaning the area by brooming with a stiff brush or broom and painting the cleaned surface with S.A.E. 30 lubricating oil. The frame is placed flat on the oiled surface and filled with the plaster of Paris which has been mixed with water to a consistency approximating thick paint (*See Figure 1-b*). The sides of the frame are tapped lightly to assure the plaster flowing down into the surface irregularities and with the straight edge the excess plaster is struck off.

The normal waiting time for the plaster to harden is approximately 40 minutes and any attempt to remove the cast sooner usually results in a cracked cast.

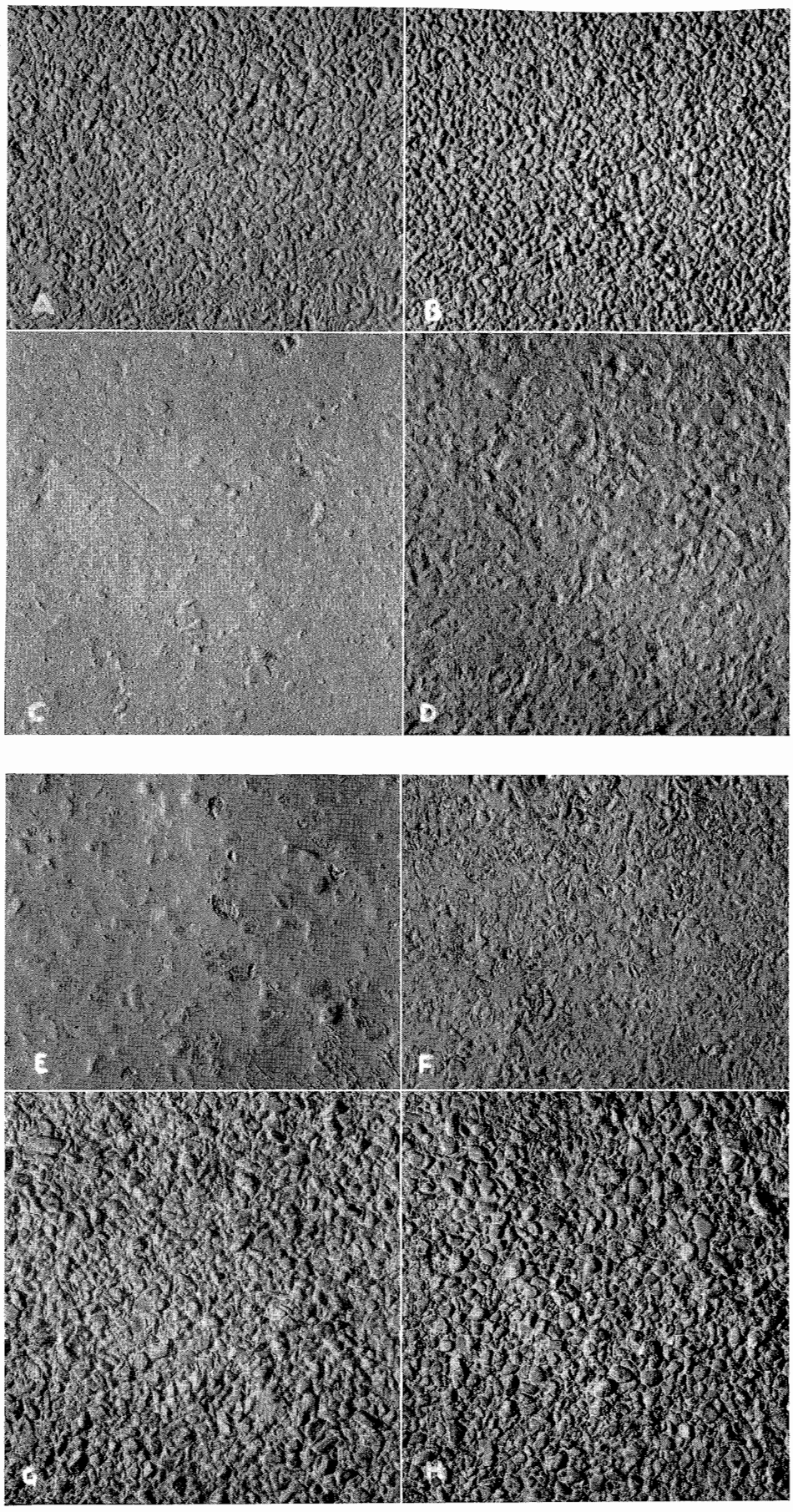
A small wrecking bar works very well in prying the completed cast from the pavement (*See Figure 1-c*).

The cast made from the pavement surface represents the negative and from this negative a superimposed plaster cast is made to provide a positive or exact duplicate of the pavement surface texture.

The positive casts were photographed in the laboratory for use in connection with evaluating the skid resistance test results and to preserve a record of the surface characteristics of the sections tested. A few typical photographs of plaster cast positives are shown on this page.

An examination of these casts is often quite revealing as it is evident that surface textures are often very similar even though the appearance of the road surface has given rise to the belief that marked differences must exist.

These casts are one more tool permitting the engineer to base comparisons on evidence free from many factors that distort visual impressions.



Shasta Lake

Effect of Recreational Activities On the Redding-Yreka Highway

By H. CLYDE AMESBURY, District Traffic Engineer

WHEN THE construction of Shasta Dam necessitated the rerouting of U. S. 99, the Redding-Yreka highway, the cost of the job and the magnitude of the undertaking, rather overshadowed some secondary features. One of these was the public attraction based on the fishing which has developed in the reservoir. From experience with other dams, the Bureau of Reclamation was able to foresee that the dam itself would be a center of interest. Fishing just didn't register along with multimillion-dollar dams and powerhouses and rerouting of railroads and highways.

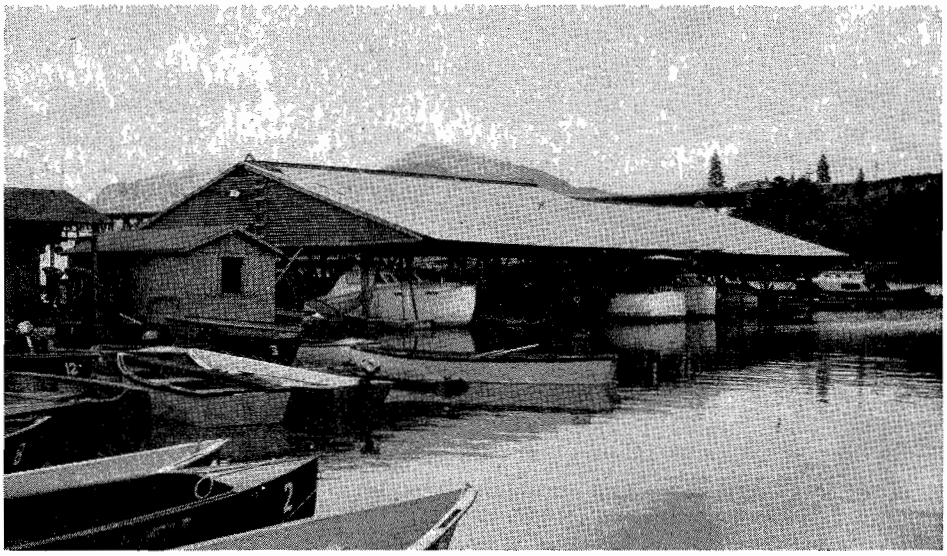
When the matter of fish in the reservoir was discussed with the Fish and Wildlife Service, its experts were not too hopeful. They said they didn't think the water would support enough feed to sustain a large fish population.

Just what happened to confound the experts, we do not know, but the fish are there. In the Sacramento, McCloud and Pit Rivers, prior to their being submerged in the reservoir, there were rainbow trout, suckers, pike and carp. There were even a few sunfish and catfish. Considerably above the reservoir area there were black bass in the Pit. Undoubtedly some of these bass came down in the high water.

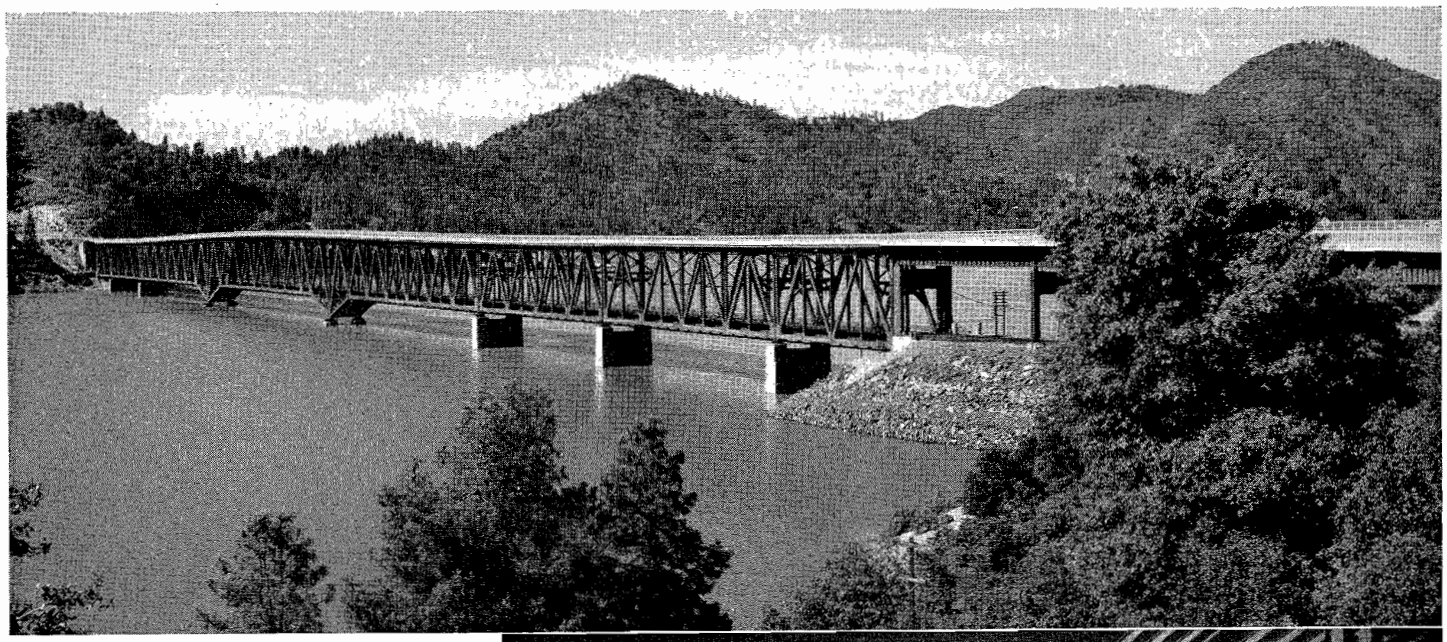
The first year the reservoir contained water, wonderful fishing for rainbow developed just where the rivers encountered the quiet water behind the dam. This appeared to have resulted from an accumulation of the fish from the flooded streams. After they were caught out, fishing slumped.

Then an irrigation district down in the valley decided to drain its reservoir. The hundred or two black bass were moved to Shasta Lake. The State Fish and Game Department also made one or two moderate-sized plantings. It appeared as though nothing had happened.

Then in the fall of 1950, some fishermen trolling for trout caught some bass. In the following spring, fishermen



UPPER—One of boat houses on Shasta Lake. LOWER—Black bass taken in lake.



began to work the shore and coves and discovered lots of bass. It appeared that the young suckers, pike and carp had really provided rations for the bass. Of course, the bass is not a particular feeder. What he wants is quantity; minnows, frogs, insects, small snakes and even small birds that get near the water, all impress him as just items on his menu. He has no prejudice against dining on any other bass that is a little slow on acceleration and is small enough for him to swallow. When he is feeding, he just doesn't know his capacity. Frequently a bass is taken with the tail of a fish too large to be swallowed protruding from his mouth. Still he bites a lure.

This year the bass fishing has been a revelation. Almost everyone who goes up to the lake and uses live bait gets fish. A little later various plugs will probably be fully as effective, especially with the more skillful fishermen.

However, something else has occurred that is likely to have a great effect on the fishing. The full impact is not yet apparent but it has developed far enough to give a good inkling of future prospects. Rumors of huge trout caught in Lake Pend Oreille in Idaho began to filter down to Redding. They were called Kamloops. Investigation revealed that they were a subspecies of rainbow, practically devoid of any in-

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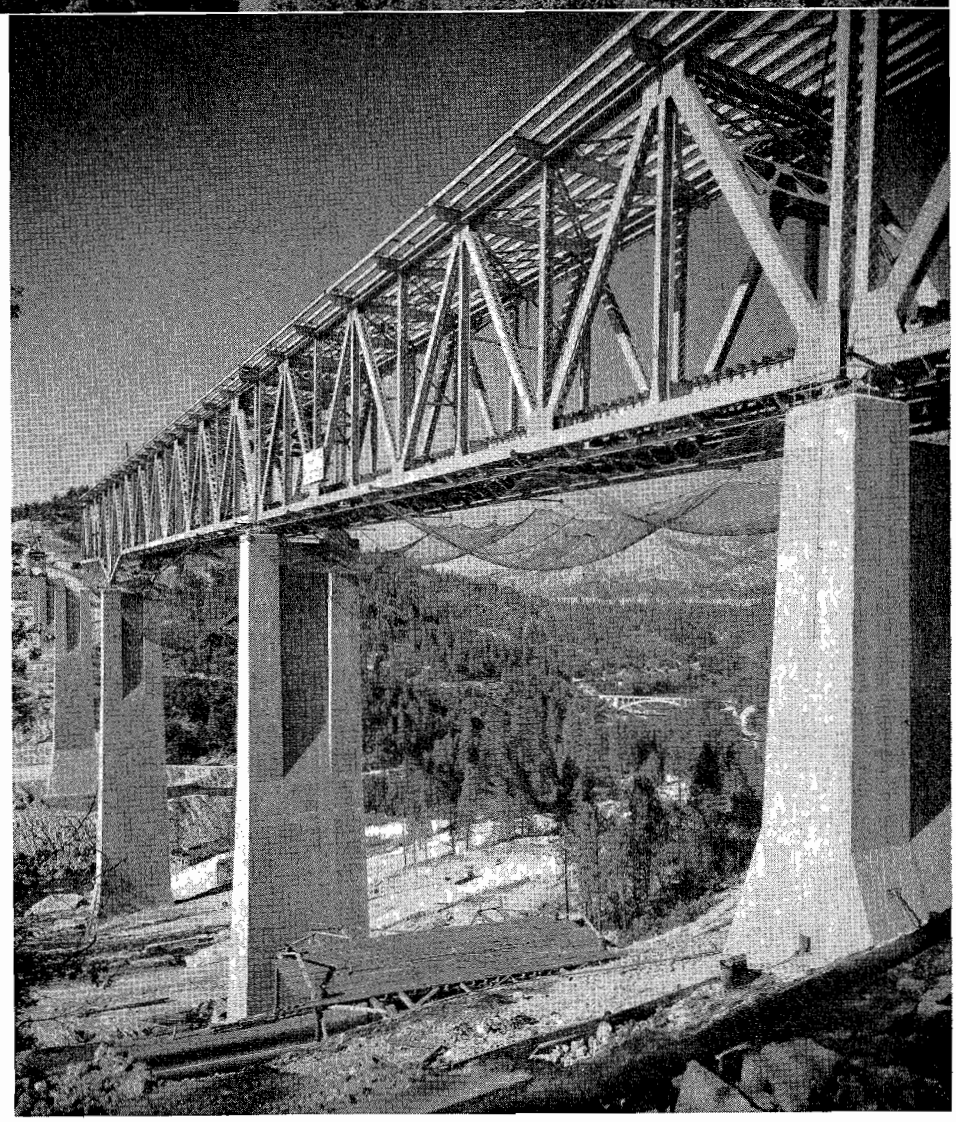


UPPER—Stream view of Pit River Bridge. LOWER—Bridge during construction. River is between third and fourth piers. Old span in background.

Forbes Overhead

Another Redwood Highway Project Is Completed

By C. W. SCHEMEL, Resident Engineer

UPON COMPLETION in late September of the current contract between Forbes Overhead, north of San Rafael, and Ignacio, a distance of 5.4 miles, another section of limited access modern highway replaced the last link of three-lane road on the Redwood Highway in District IV.

The area of lower Marin County traversed by this project has been primarily devoted to dairy farming for many years, but because of its proximity to San Francisco and due to the rapid increase in population in the Bay area, it is rapidly developing into suburban home subdivisions.

The Air Force Base at Hamilton Field lies immediately to the east of the project and its large civilian and military personnel added to those who have made their homes in the area, creates a peak hour commuter traffic that has heavily overtaxed the existing facility.

Increased Traffic Flow

As an indication of the increased traffic flow in this area, the July, 1951, count was 2.5 times that of July, 1938, when the three-lane section was built.

While this route serves the Redwood Empire as well as the Pacific Northwest, the recreational areas of the Russian River and other resorts in the North Bay make easy one-day trips from the San Francisco metropolitan area across the Golden Gate Bridge attractive. Rapid subdivision and housing project development in lower Marin County contributes heavily to this traffic flow, the 1951 Sunday average being 34,000 vehicles, and the 1951 Monday average being 21,555 through the length of this project.

This section was first paved in 1917 with a 15-foot wide, 4-inch thick portland cement concrete pavement; reconstructed in 1928 to a 20-foot by 8-inch concrete; and expanded to a 3-lane, 33-foot roadway by the addition of a 13-foot concrete strip in 1938.

Future Development

The present contract provided for the construction of a 24-foot 4-inch plant-mix surfacing on eight inches of cement-treated crusher-run base over six inches of selected material, with 10-foot outside shoulders and 5-foot inside shoulders.

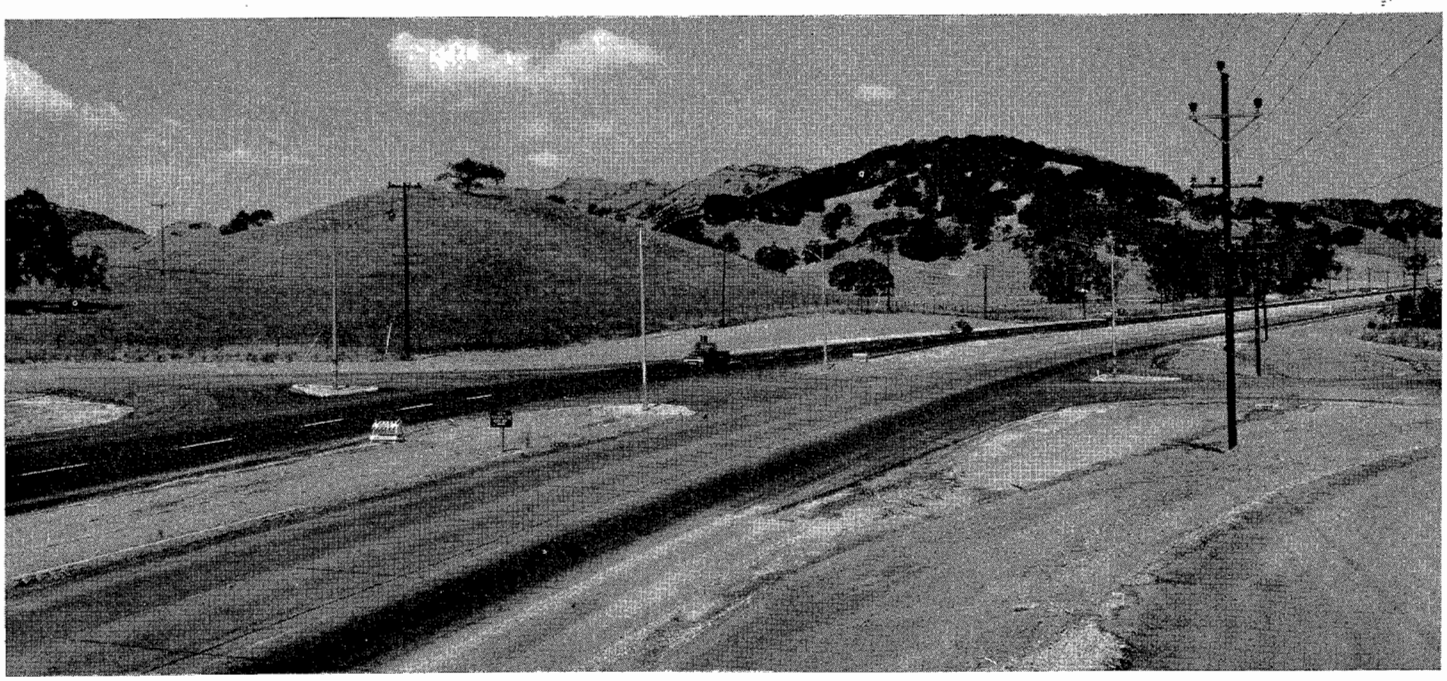
This construction lies west of the existing roadway with a variable width division strip separating opposing lanes of traffic, the separation between pavement edges throughout most of the length being 46 feet, thereby allowing room for future development to a six-lane divided highway.

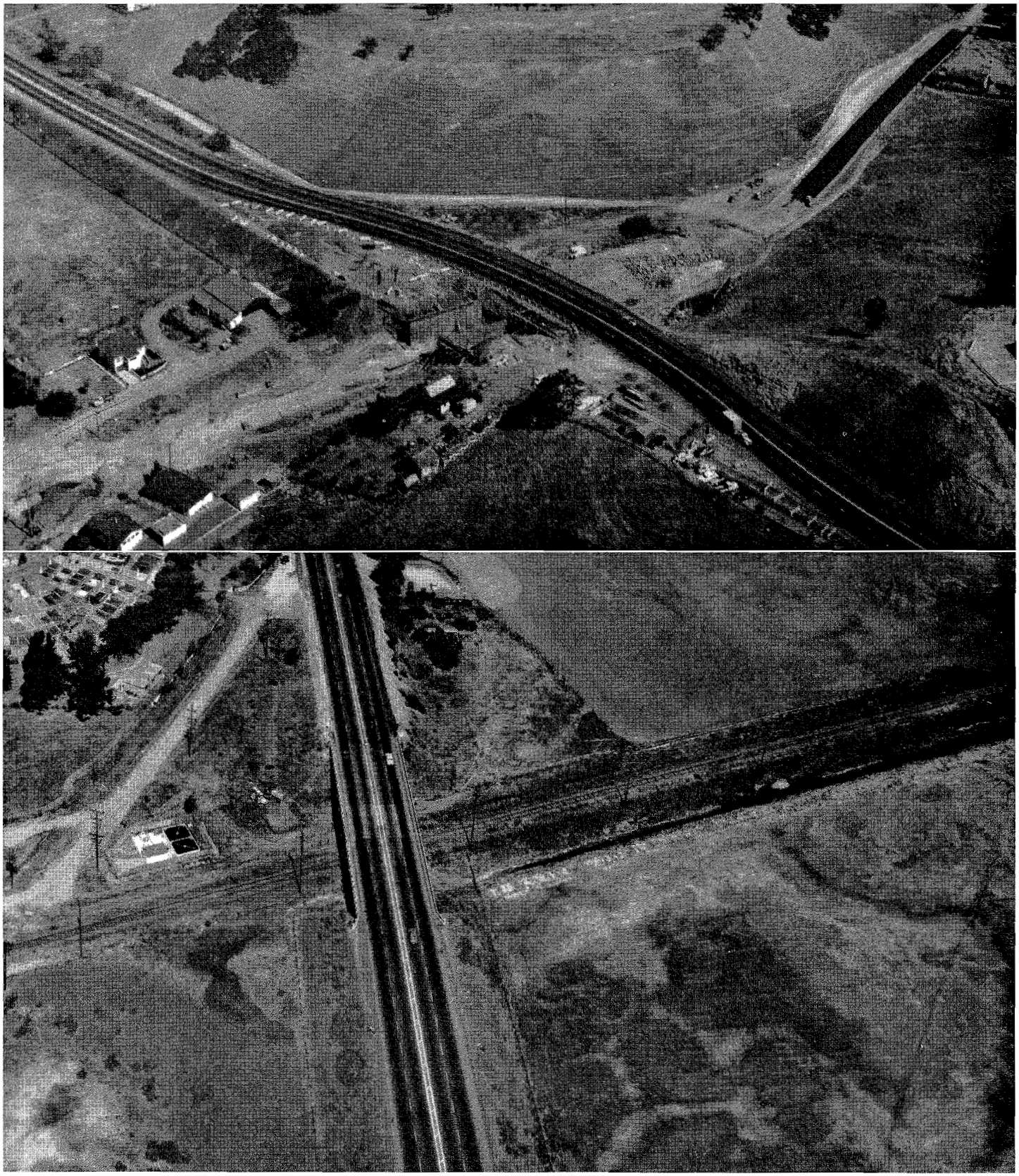
Frontage roads are included in the project near Ignacio, at Hamilton Field, and near the southerly end of the project where roadside development justified these requirements.

Twin bridges at the county road intersection at Lucas Valley provide for traffic interchange without conflict, while channelization, signals and illumination provide traffic protection to the military base at Hamilton Field.

Considerable slowdown and delay was encountered on this project due to the heavy rainfall during the winter of

Frontage road one-fourth mile north of Forbes overhead





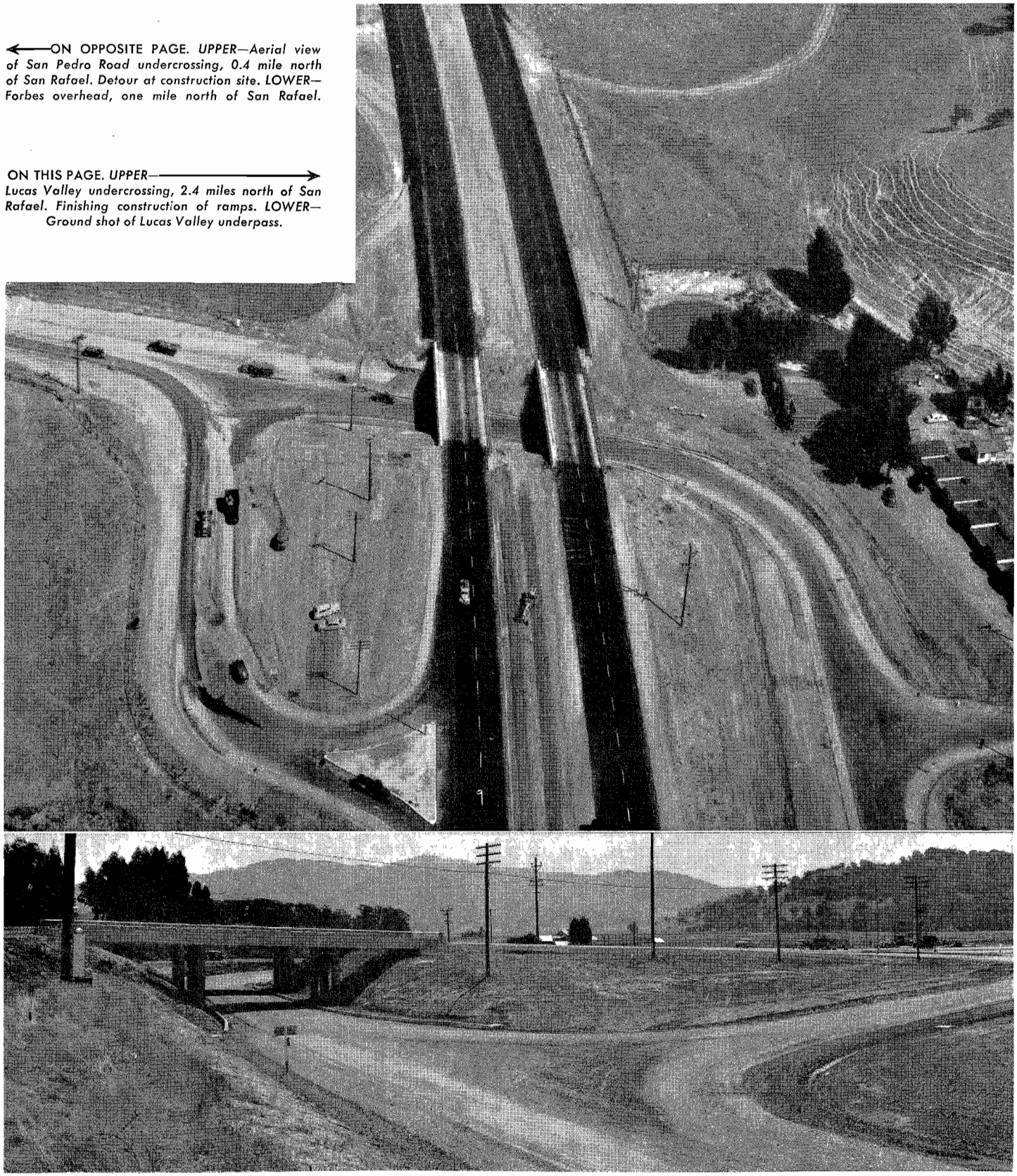
1951-1952 when over 55 inches were recorded, and high ground water delayed resumption of work until late spring.

A parallel bridge over Miller Creek and numerous culvert installations and underdrains were installed as part of the project.

Additional right of way was acquired for the project, developing a right of way width of 200 feet, plus additional widths for frontage roads at

←ON OPPOSITE PAGE. *UPPER—Aerial view of San Pedro Road undercrossing, 0.4 mile north of San Rafael. Detour at construction site. LOWER—Forbes overhead, one mile north of San Rafael.*

ON THIS PAGE. *UPPER—*→
Lucas Valley undercrossing, 2.4 miles north of San Rafael. Finishing construction of ramps. LOWER—Ground shot of Lucas Valley underpass.



strategic locations. Access rights to abutting properties were secured in these negotiations limiting access to controlled points along the route. A right of way plus right of way clearance costs for the project total $620,000.

The work was financed with state gas tax and federal aid funds at a construction cost of $1,140,000, exclusive of right of way and right of way clearance costs.

... Continued on page 49

DUBLIN BY-PASS IS NEARING COMPLETION

By J. H. SMITH, Resident Engineer

RECONSTRUCTION of U. S. 50 as a four-lane divided highway from Mountain House through Altamont Pass and on beyond Dublin is being realized.

The first four-lane divided highway project on this route in District IV was constructed between Greenville and the Mountain House in 1938. During the years of World War II, it became increasingly evident that the inadequacy of the remainder of the route required early attention. In March, 1944, application was made to the federal agencies for authority to begin construction on a section 13.4 miles in length between Greenville and Dublin. This application was denied by the War Production Board on June 16, 1944, on the grounds that construction of this project would seriously disturb the manpower situation in this locality.

Work Began in 1948

During the period between 1944 and 1948, planning of this improvement was continued and when materials and manpower was available, work began in 1948 on the 5.8-mile section between Greenville and 1.5 mile west of Livermore. This section was completed in September, 1950, and is locally known as the Livermore By-Pass.

In May, 1950, a section between the westerly terminus of the previous work and Hopyard Road was under way, being completed in August, 1951.

The most recent 4.6-mile section of this route from Hopyard Road westerly, is now under contract at a construction cost of $1,500,000 and should be completed for traffic this fall. When completed, this will eliminate all two-lane highway between the San Francisco Bay area and the entrance of the San Joaquin Valley, providing a continuous four-lane divided highway from Mountain House to a point 2.5 miles west of Dublin, a total distance of 23.4 miles.

Additional sections of freeway westerly of that now under construction are on the drafting tables and are scheduled for contract as rapidly as they can be financed. As planned, this ultimate construction will connect with the Eastshore Freeway at the Washington Avenue interchange in San Lorenzo.

LIKE OUR HIGHWAYS?
THANK THE BIKE

If the automobile wishes to boast that it is responsible for the fine quality of today's highways, all well and good. But if we're going to be really honest about giving credit where it is due, an appreciative word for the bike.

"The bicycle, which was to plant an early seed of desire for better roads, appeared in sizeable numbers in 1877," the American Society of Civil Engineer's Centennial Convention was reminded by Rex M. Whitton. As Chief Engineer of the Missouri State Highway Commission, Mr. Whitton is concerned with providing good passage for automobiles, but in so doing he does not overlook the part the bicycle played in road improvement thinking before there were horseless carriages.

Aid to National Defense

In addition to heavy passenger car traffic, this route carries a very heavy truck and bus traffic as it serves as a primary route between the metropolitan bay area and the San Joaquin Valley and points east.

The reactivation of Camp Parks as the Parks Air Force Base and the construction of an Atomic Research Laboratory in the Livermore Valley increases the importance of this route as an aid to national defense and military needs as may be required.

These federal installations have promoted a heavy influx in population, resulting in a proportional increase in traffic volume. The present construction will alleviate this traffic congestion.

A line change located southerly of the old route on direct alignment between Hopyard Road and the intersection of Route 5 and Route 107 eliminates a two-lane bottleneck between Hopyard Road and Dublin. The old route was particularly hazardous because within its limits there are two narrow bridges located on curves having small radii and poor sight distance which as a contributing factor have contributed to numerous accidents in the past. These two bridges which cross the Alamo and Amador Creeks are also inadequate to permit the flow of water during peak floods. As a result, the hazards involved become more acute as a portion of the old roadway between these bridges becomes inundated during heavy winter storms. The new alignment to the south will entirely eliminate this condition. Maximum grade within the above limits is 1.52 percent and the minimum radius curve is 4,000 feet. Westerly from the intersection of Route 5 and Route 107 near Dublin, the roadway departs from the relatively flat valley lands and begins to climb into the hilly and rugged sections of the Dublin Canyon.

New Alignment

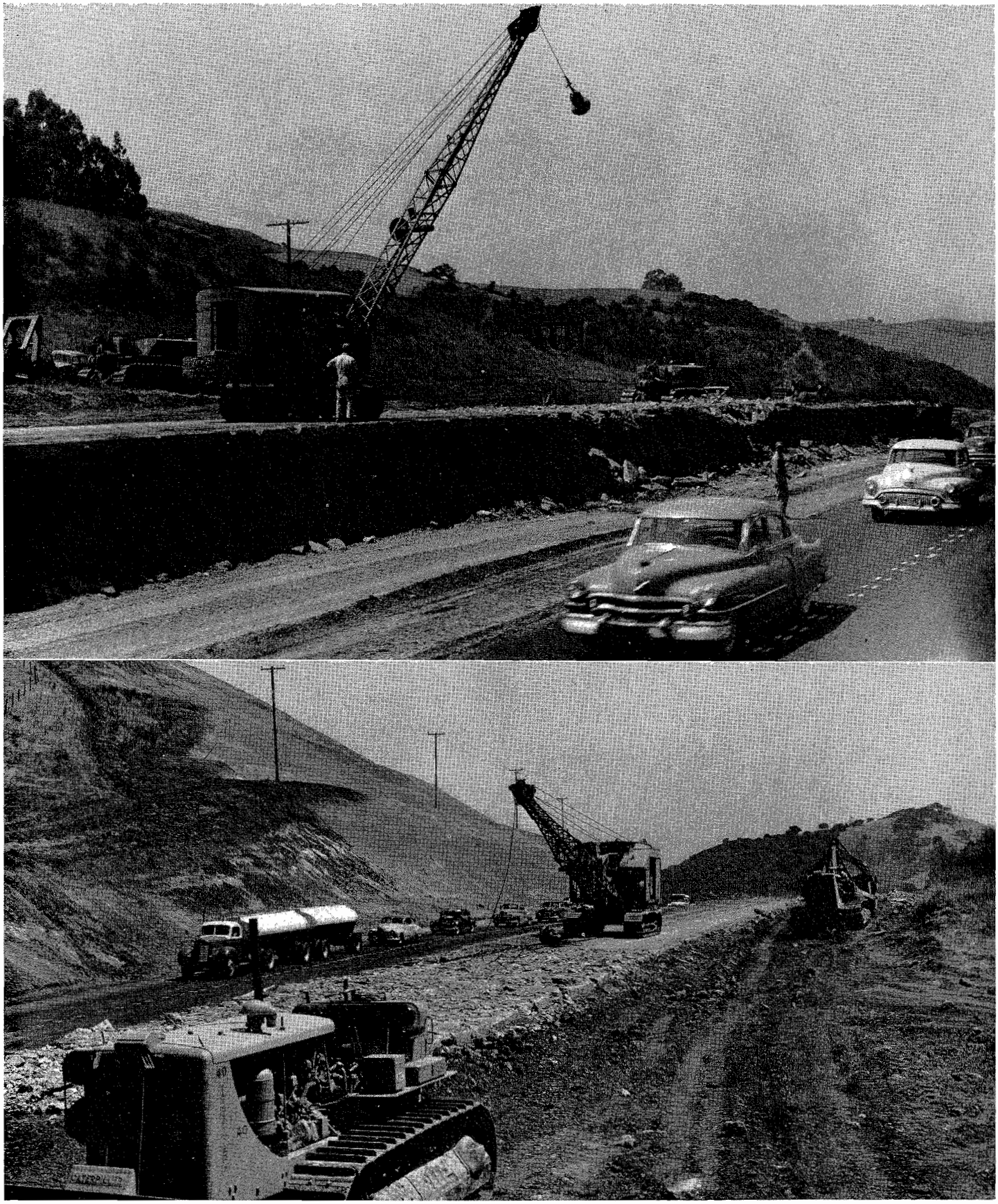
The new alignment intersects the old alignment at the summit of Boehmer Hill, resulting in a grade change of minus 15 feet in elevation on the old alignment, which provides for a greater sight distance.

A continued line change northerly of the existing route is carried to the west limits of the project. The maximum gradient as constructed on this section is a plus 3.36 percent grade with curves having a minimum radius of 2,005 feet.

This new alignment involved many heavy cut and fill sections, the maximum heights being 55 feet and 45 feet respectively.

A portion of the existing roadway near the west terminal of the present

UPPER—New alignment one mile west of State Route 21 and Dublin. LOWER—New construction in same area.



Heavy equipment working on construction one mile west of State Route 21 and Dublin

contract was planned to be utilized as eastbound lanes. This was accomplished by restriping and applying a three-foot width class "C" medium seal coat on the edges of the existing 30-foot PMS pavement; thus making two 12-foot lanes with three-foot improved shoulders.

The freeway pavement is portland cement concrete construction, which provides two 12-foot traffic lanes in each direction, divided by a 42-foot median strip from Station 393 to 511+50. From 511+50 to 590 the median strip is of variable widths. Westerly from Station 590 to the end of the project (Station 625+75) the traffic lanes are divided by a 34-foot median strip.

Limited Freeway

The precipitous nature of the terrain westerly of the intersection of Routes 5 and 107 on the new northerly alignment limits access to effect a limited freeway. There is an average difference in elevation of 45 feet between this new alignment which will carry westbound traffic and the existing alignment which will carry eastbound traffic.

Further, the nature of this terrain, especially in heavy cut and fill sections, presented an acute erosion problem. This was compensated for by seeding these slopes with barley and western rye grass seed.

On the present contract some 415 feet difference in elevation is encountered in approximately 3.5 miles distance. This rise in elevation was also in a westerly direction.

Intersections at Grade

Illuminated channelizations at grade are provided at Hopyard Road and Route 5, Route 107 and Route 5, on-ramp, and at the Old Dublin Road (County Road No. 35) and Route 5. The first two intersections are lighted by using incandescent group replacement lamps.

The structural typical cross-section of the freeway pavement consists of eight inches portland cement concrete upon four inches cement treated subgrade upon 12 inches imported base material. In all cut sections, six inches of imported base material upon six inches of imported pervious subbase material was placed in lieu of the 12 inches imported base material. This blanket of pervious material was placed to provide drainage for any subsurface water which may be encountered.

Grading Equipment

The contractor elected to use a fleet of 10 Caterpillar DW-20 jeeps and scrapers, supplemented by five Caterpillar DW-10 jeeps and scrapers, and several Caterpillar D-8 bulldozers with scrapers.

The DW-20 units were highly efficient in the valley section for hauling and placing embankment, as they can carry an estimated load of 20 cubic yards at a maximum speed of 26 miles per hour. After pioneering was done in heavy cut sections by D-8 dozers, the DW-20 units went on to further prove their versatility and efficiency in hilly terrain.

Major Construction Items

Major construction items on the present contract include 845,000 cubic yards of roadway excavation; 4,020 cubic yards of concrete removal; 21,000,000 station yards of overhaul; 195,000 tons of imported base material; 105,700 square yards of mix and compact cement treated subgrade; 3,394 barrels of portland cement for cement treated subgrade and base; 10,800 tons of plant-mixed surfacing; 24,069 cubic yards of PCC pavement; and 968 cubic yards of Class "A" structure concrete.

There was also 3,290 feet of cast-in-place concrete piling, and 14,448 linear feet of 6" perforated metal pipe.

The project is financed with state gas tax and federal aid funds.

Construction was under the supervision of Assistant State Highway Engineers Col. Jno. H. Skeggs and his successor, Assistant State Highway Engineer B. W. Booker, and Assistant District Engineer R. P. Duffy.

The resident engineers were the late Edwin Carlstad and his successor, J. H. Smith. R. F. Calou was general superintendent for the contractor, Fredrickson and Watson Construction Company.

PUBLIC ROADS OF THE PAST

"Public Roads of the Past, 3500 B.C. to 1800 A.D." is the title of a new publication of the American Association of State Highway Officials. The paper-bound, 101-page volume is a reprint of a series of popular articles which originally appeared in the official AASHO magazine *American Highways* under the by-line of "The Old Roadbuilder." The new volume reveals that "The Old Roadbuilder" is Albert C. Rose, veteran highway engineer in the Northwest and historian of the U. S. Bureau of Public Roads.

The articles are the result of intensive research on the part of Mr. Rose, who became interested in the history of roads and road building technique early in his career. He brings a freshness and enthusiasm to his subject which has made easy and informative reading for layman and engineer alike.

Some of Mr. Rose's interest-getting chapter headings are "How the Road Got Its Name," "The Oldest Road in the World," "The Queen of Them All" (which, it turns out, is the Appian Way built by the Romans in the third century B.C.), "Our Right Hand Rule of the Road" and "How Automobile Type Names Were Derived."

The chapters are illustrated with reproductions of 109 paintings and sketches prepared by artist Carl Rakeman. Each painting was preceded by exhaustive research and both author and artist believe them to be accurate in every detail. The last five pages contain an extensive bibliography.

Copies are priced at $3 and may be obtained from AASHO, 917 National Press Bldg., Washington 4, D. C. A second volume of "Public Roads of the Past," which will include others of Mr. Rose's articles in "American Highways" dealing with American road development from 1800 to the present, is being planned.

Precedent

First Pre-stressed Highway Bridge Planned for Fresno

By THOMAS J. BEZOUSKA, Junior Civil Engineer

THE CITY of Fresno will soon have the first pre-stressed concrete highway bridge in the State designed for heavy traffic loading. Known as the Weber Avenue Overcrossing, it will be located over the east approach to the Belmont Avenue Underpass in the City of Fresno. The proposed structure is to carry traffic southbound on Weber Avenue over U. S. 99 and Belmont Avenue traffic in order to permit elimination of one phase of the existing three-phase traffic signal system. At this point, just north of the central district, Belmont Avenue runs under the Southern Pacific Company tracks and carries more than 14,000 vehicles per day. Farris Avenue and H Street flow into Belmont, and Weber Avenue cuts across the intersection. (*See illustration.*) The total traffic entering this five-point intersection is 29,000 per day. This has been called "Fresno's worst bottleneck."

Costs Kept to Minimum

Since a limited amount of money was available for the project, it was necessary to keep costs to a minimum. The relocated portion of Weber Avenue was to be kept as short as possible, and the approach grades were to be kept as flat as possible to reduce the additional amount of right of way that would have to be acquired. At the same time, a minimum clearance of 14 feet 4 inches had to be maintained over Belmont Avenue. For these reasons it was essential that the structure depth be held to a reasonable minimum. In addition it was stipulated that traffic through the existing underpass could not be obstructed during construction of the new structure. This meant that the new bridge had to be of such a type that falsework would not be required. Another requirement was that the existing gravity type concrete retaining walls on either side of the underpass be used as abutments for the new structure if at all possible.

Choice of Three Types

These considerations limited the choice of structure to one of three types: a steel girder span with cast-in-place concrete deck; precast, conventional reinforced concrete girders with cast-in-place concrete deck; or a precast, pre-stressed concrete girder span with bituminous wearing surface.

A rough design of each of these three types was worked out by the Bridge Department with the following results:

Steel girder span	Structure depth—3′-10″
Precast, reinforced concrete	Structure depth—4′- 8″
Precast, pre-stressed concrete	Structure depth—3′- 4″

On the basis of unit prices assumed the pre-stressed span was apparently the cheapest of the three. It also showed an appreciable saving of both steel and concrete. One pre-stressed girder weighed 10,000 pounds, less than one reinforced concrete girder and the whole superstructure weighed 125,000 pounds less than the precast reinforced concrete girders with the cast-in-place deck.

Design of Bridge

This, of course, made it that much easier to adapt the gravity walls mentioned earlier for use as abutments.

For the foregoing reasons it was decided to design the bridge superstructure in pre-stressed concrete.

The bridge, skewed 41 degrees right, is 22 feet wide between curbs, and has a 6-foot sidewalk on one side with a 1-foot 9-inch safety curb on the other. It is 66 feet 9 inches center to center of bearings and about 70 feet long over-all. The 10 girders are modified T sections 36 inches deep. The top flange is 36½ inches wide, the bottom flange 16 inches wide, and the web is 6 inches thick. The flanges vary in thickness from 4 inches at the edge to 6 inches where they join the web. (*See illustration.*)

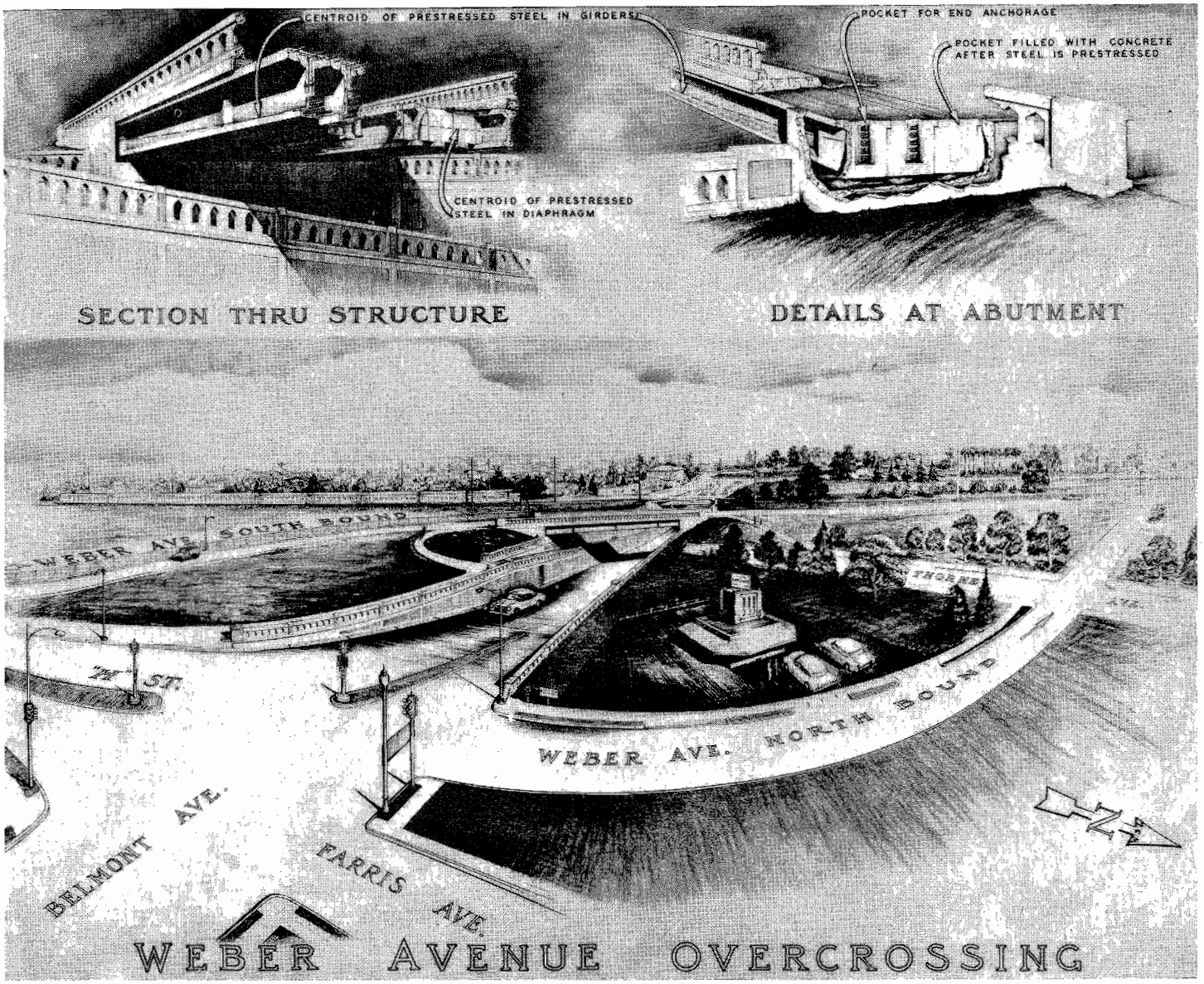
The girders are to be cast in a working yard, prestressed longitudinally, and then hoisted into place. A small space is to be left between the girder flanges and ends of diaphragms which will be filled with mortar. After five days the five diaphragms will be prestressed. The girders will weigh about 18 tons apiece. Just for comparison, it might be mentioned that the 113-foot girders for the Arroyo Seco pedestrian bridge in Los Angeles (California's first prestressed concrete bridge) weighed 50 tons apiece, and the 160-foot girders of Philadelphia's prestressed concrete Walnut Lane bridge weighed 160 tons apiece. Although the span is relatively short, the Weber Avenue structure is designed for a heavier highway loading than Walnut Lane.

Pre-Stress Force

The longitudinal prestress force that will remain in each girder after all losses due to shrinkage and creep in the concrete and creep in the steel have taken place will be 312,000 pounds. This will require an initial force of about 367,000 pounds since a loss of 15 percent in the initial force was assumed in the design. The initial force in the diaphragms will be 85,000 pounds. The concrete, containing seven sacks of cement per cubic yard, is to have an ultimate strength of 4,500 pounds per square inch, and a working stress of 1,500 pounds per square inch. If wires are used, the high tensile strength steel is to have an ultimate strength of at least 200,000 pounds per square inch and a working stress of 60 percent of the ultimate. If steel bars are used, the steel is to have an ultimate strength of at least 155,000 pounds per square inch and a working stress of 94,500 pounds per square inch.

Compressive Strength

It is interesting to note that there will be a compressive stress of about 2,000 pounds per square inch in the bottom fiber under initial prestressing force. This stress will quickly diminish to 1,700 pounds per square inch, and



Artist Van der Goes, Bridge Department, Division of Highways, visualizes Weber Avenue overcrossing when construction and landscaping are completed

under full dead load will be slightly more than 1,400 pounds per square inch. Under full design load—dead load plus live load plus impact—there will be no tensile stress in the bottom fiber. Since this compressive stress of 2,000 pounds per square inch is a temporary one and can never recur under any condition of loading after the bridge is put into use, it is considered quite satisfactory. Another interesting peculiarity of these prestressed girders is that they rise three-fourths inch at the midpoint of the span under the initial prestressing force. They are so stiff that even under full design load they retain a slight upward deflection.

Five Prestressing Methods

There are at least five generally recognized prestressing methods in common use, and these girders were designed so that any of the methods of post tensioning could be used at the option of the contractor. This presented quite a problem in itself, since the number of prestressing units—individual bars or cables consisting of groups of wires—could range from two to nine.

A particularly difficult problem to solve in the design of this bridge was that of choosing a girder cross-section. There was an almost infinite number of possibilities. For instance, how thick should the web be? Why 6 inches? Why not 8 inches, or 10 inches? How wide should the bottom flange be? Why should it be wider than the web in the first place? Fortunately, the width of the top flange was more or less fixed by the over-all width of the bridge, but all of the other dimensions could be varied at the discretion of the designer. The only way to answer these questions is to design a number of different sections and compare the amount of steel and concrete required by each. When a promising cross-section is discovered, it is then possible to refine it slightly until the most economical section of that type is

found. It is not claimed that the girder section chosen was the most economical one possible, but of all those sections tried, this one showed the lowest cost based on the unit prices assumed for steel and concrete.

T Beams

It has been the Bridge Department's experience that in reinforced concrete T beams and box girders, for a given span, the shallower girder is generally more economical than the deeper one until an optimum depth to span ratio is reached. Under ideal conditions of alignment and balanced spans, the optimum depth-span ratio for continuous T beams is .065, and for continuous box girders it is .050. The three-foot-deep prestressed girders used in this bridge have a ratio of 3/66.75 or .045. Since continuous beams can be made shallower than simply supported beams of the same span, it is obvious that the prestressed girder depth-span ratio for continuous spans could be even less.

In prestressed concrete, because of the various combinations possible of stem and bottom flange width, the optimum depth-span ratio is not constant. For instance, another, slightly different cross-section considered had an economic depth-span ratio of .037. This would have permitted a girder depth of 2 feet 6 inches for this span, but would not have resulted in a more economical girder. The 6-inch saving in structure depth would have lowered the approach grades and saved fill material. However, the extra concrete and steel used, the greater difficulty in forming and casting the girders, and the increased weight of the girders would probably have offset the saving in the cost of the approach work.

Prestressed Concrete Girders

In general, prestressed concrete girders can be built with a depth-span ratio as low as .033, but this extremely shallow section requires ideal conditions and will not be the most economical as far as the cost of the superstructure alone is concerned. Prestressed concrete has the great advantage of allowing extremely shallow sections to be used where minimum structure depth is the most important consideration.

Other prestressed concrete bridges in this Country have been designed using a safety factor based upon the ultimate strength of the structure, that is, the load that will cause actual failure. A commonly used factor is 1.0 dead load plus 4.0 (live load plus impact), or 2.5 (dead load plus live load plus impact). In general, however, if the structure were loaded almost to failure, the yield of the steel would be so great that upon removal of the excessive load, the structure would no longer function as a fully prestressed unit. Therefore, this structure was designed on the basis of what may be called "ultimate carrying capacity."

This is defined as that load which does not cause stresses in the concrete to exceed the ultimate strength, or the steel stresses to exceed the "proportional limit" of the steel.

Proportional Limit

The "proportional limit" may be a little difficult to determine exactly, but it can be determined sufficiently close for practical purposes by finding the point where the stress-strain diagram leaves a straight line. The "ultimate carrying capacity" is to be sufficient to provide for 1.0 dead load plus 2.4 (live load plus impact). The live load plus impact is to be distributed across the roadway width. In the design the "proportional limit" was assumed to be 150,000 pounds per square inch, which is considered conservative. At this stress the girders will carry 1.0 dead load plus 2.7 (live load plus impact). The concrete compressive stress in the top fiber is only 2,400 pounds per square inch at this time. On the basis of ultimate strength the failure load of the girders would be 1.0 dead load plus 4.6 (live load plus impact) or 2.6 (dead load plus live load plus impact).

Test Girders Not Necessary

Because of the more than adequate safety factor inherent in the design, because of California's experience with the Arroyo Seco bridge, and because of the experience accumulated by other states, it was felt that test girders would not be necessary. It is believed that prestressed concrete design has progressed to the point where it can be relied upon without the necessity of proving itself each time a new structure is being contemplated. After all, steel or reinforced concrete beams are not tested to destruction every time a bridge is built.

In the past contractors have apparently been hesitant about bidding on prestressed jobs due to their unfamiliarity with this new technique. Now, however, it is felt that prestressing is reaching the stage where it will be accepted as just another one of many familiar construction methods. Those familiar with the unique properties of prestressed concrete do not claim that it is going to replace steel or reinforced concrete as a building material. They do believe that under certain conditions it is a material that can do the job economically, as in this bridge.

APPRECIATES HELP

Modesto, California

San Francisco-Oakland Bay Bridge
Oakland, California

DEAR SIRS: While coming home from San Francisco via your bridge last night I had a clogged gas line and was forced to stop on your bridge. While I was trying to clear the line your Mr. E. Souza drove up in the service car. I wish to commend your department for having such fine men for Mr. Souza was very helpful in seeing that I was able to get on my way without endangering traffic on the bridge.

I visit San Francisco often and cross your bridge many many times but this is the first time that I have ever contacted one of the men that keep the traffic flowing. It's indeed a pleasure to know that when motorists are in distress on your bridge they will be well taken care of by your department.

I want to express my thanks to Mr. Souza again and your department for having men of such fine caliber.

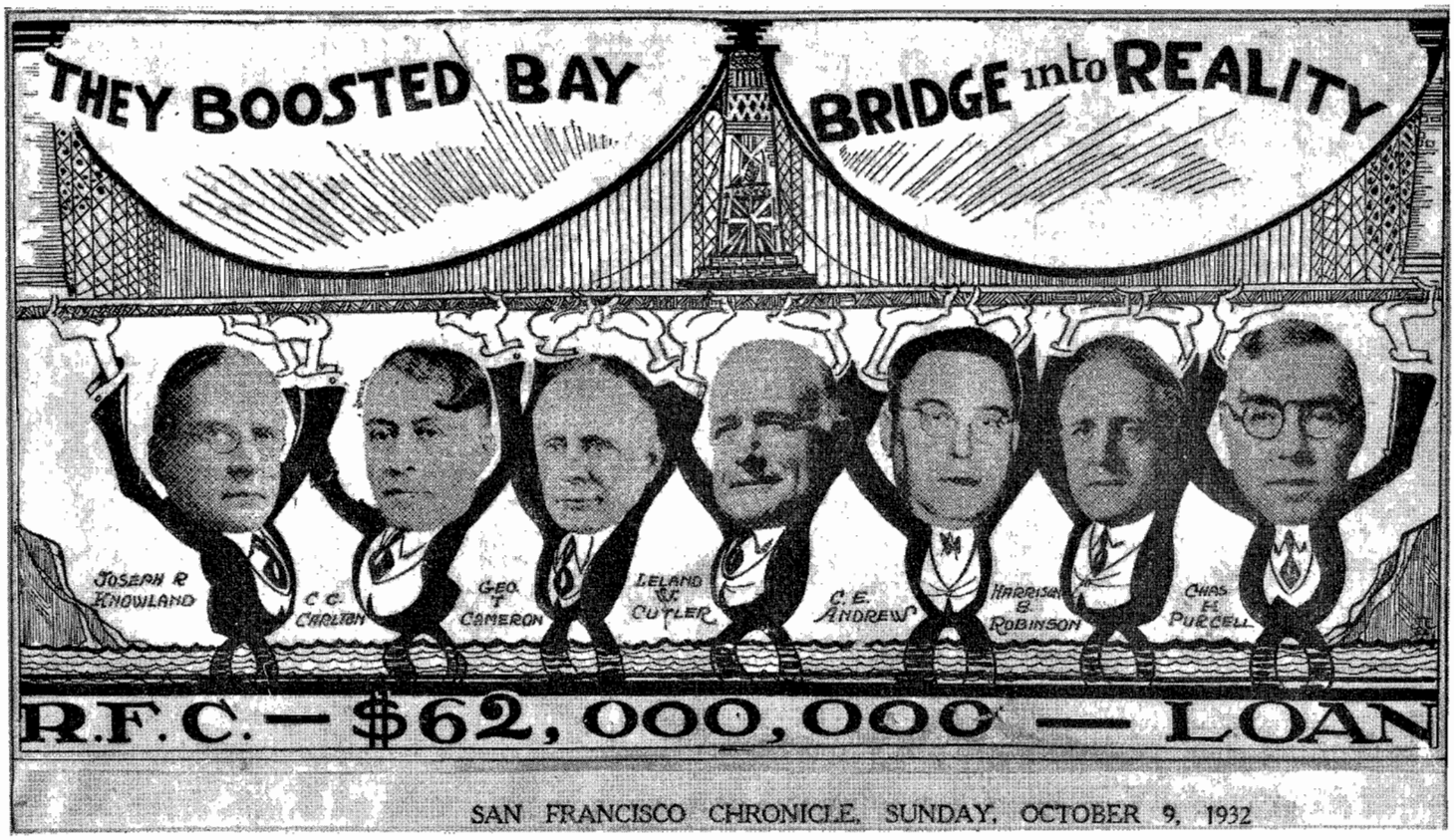
Very truly yours,

GEO. C. SUE, D.C.

LIGHT UP AND BE SEEN

The light tans and similar colors of today's automobiles often blend with tawny hills and other background colors of the countryside. For this reason some motorists turn on their lights to assure being seen by opposing traffic when pulling out to pass, reports the California State Automobile Association.

FAMOUS BAY BRIDGE FINANCED TWENTY YEARS AGO



TWENTY years ago, October 8, 1932, was the date when California was electrified by the news that the Reconstruction Finance Corporation, during the administration of President Herbert Hoover, had agreed at its meeting in Washington, D. C., to finance the proposed San Francisco-Oakland Bay Bridge by the purchase of $62,000,000 of revenue bonds to be issued by the California Toll Bridge Authority.

For a number of weeks a committee composed of Harrison S. Robinson and Joseph R. Knowland of Oakland and George T. Cameron and Leland W. Cutler of San Francisco, together with the late Charles H. Purcell, then State Highway Engineer, C. E. Andrew, State Bridge Engineer, and C. C. Carleton, Chief Attorney for the California State Department of Public Works, had presented their case on the application of the State of California for a loan and on Saturday, October 8, 1932, the delegation then present in Washington was informed that its mission had been crowned with success.

The action by the Hoover Reconstruction Finance Corporation had sprung the barrier that released the huge enterprise, the building of the world's longest bridge.

It is interesting to note that in the short span of 20 years since the bridge construction began (it was opened for public travel November 12, 1936) the traffic has far exceeded the original estimates when the loan was granted; and a second crossing has now become a pressing need.

Grade Separation

Continued from page 22 . . .

single bridge structure. The Hollywood Freeway and the Harbor Freeway-Arroyo Seco Parkway intersect at approximately right angles. The Hollywood Freeway is on the top level, the Harbor Freeway-Arroyo Seco Parkway on the second level, with two pairs of interchange roadways occupying the lowest level and the third level. In this manner all the necessary traffic movements are adequately provided for with a minimum amount of turning movements.

A model of the now famous structure built by Elrod Bradt with the help of H. Dana Bowers and M. R. Blacow is being extensively exhibited in Southern California and is attracting considerable attention. Bradt, who was in the Bridge Department, Division of Highways, now is in the Design Department. Bowers is Landscape Engineer and Blacow is his assistant.

THE POLITE THING

Little courtesies you show in social circles may win you new friends. Little courtesies on the highway may save your life.

Early Days

Minutes of First Highway Commission In 1912 Make Interesting Reading

By R. C. (CASS) KENNEDY, Secretary, California Highway Commission

(Continued from last issue)

On April 23, 1912, at 10 o'clock a.m., the commission met and Commissioner Darlington reported that it had convened in regular session in Los Angeles in the Union Oil Building on April 15th, 16th, and 17th. He stated that on April 15th the commission listened to a Chowchilla and Brawley delegation. On April 16th, heard delegations from Imperial Valley, the Foothill Boulevard Association, a Chula Vista group, a Santa Paula committee, and the Ontario Chamber of Commerce. On the 17th, hearings were accorded the Oxnard Board of Trade, a delegation from Antelope Valley, one from Ventura County, and groups from Orange County and Santa Monica, which urged the adoption of a route along the so-called "All-Level Route" from Los Angeles to Santa Ana by way of Huntington Park and Norwalk.

Commissioner Darlington further reported that on the morning of April 18th the commissioners left Santa Barbara for Gaviota, Las Cruces, Santa Ynez Mission, Los Olivos and Los Alamos, returning by way of Lompoc, Las Cruces and Gaviota to Santa Barbara. They also made an examination of Ortego Hill.

They returned to Los Angeles, leaving there Friday night, April 19th, and arriving in Fresno on Saturday, April 20th, where they met representatives from Tulare and Kings Counties regarding highways in Tulare County and in Kings County.

Headquarters Leased

On the evening of April 23d, the commission reconvened in Sacramento where the Advisory Board ratified leases made for different headquarters at Sacramento, Redding, San Luis Obispo, and San Francisco. The Highway Engineer presented a report signed by F. G. Somner, of Division I, relative to that part of Route 1 which is north of Willits, and the commission voted that the Highway Engineer be requested to cause a survey, plans and estimates to be made in Division I of that portion of Route 1 in Mendocino and Humboldt Counties beginning at Willits and going all the way to Eureka. The commission also approved seven other routes for surveys and plans.

On the morning of April 24th, the commission met again and listened to a delegation from Siskiyou County and one from Shasta County. That took up all the morning, so it recessed until 2 o'clock that afternoon, when it gave orders to the Highway Engineer to cause a reconnaissance survey for a highway in Division III from Folsom in Sacramento County, to Placerville in El Dorado County.

San Francisco's Mission Street

It was also voted that Commissioner Blaney be requested to take up with the city authorities of San Francisco the matter of the improvement of Mission Street to the Ferry Building, and to urge upon the city authorities the necessity of the improvement of Mission Street as an essential link in the State Highway System. One must remember that in those days the state highway did not go through cities; that all city streets were built and kept in repair by the cities and not by the State.

That afternoon on the oral recommendation of the Secretary to the Commission, Miss Helen Simonton, employed as a stenographer at $100 a month, was promoted to Assistant Secretary at a monthly salary of $125.

At the meeting on May 20th, it was voted that the Highway Engineer be authorized to purchase all the necessary laboratory equipment for cement, oil and asphalt testing. It seems that the commission had obtained some room at the State Fairgrounds and had set up a small testing laboratory. Fred D. Maddox, of Oakland, was hired to be a testing engineer under the immediate direction of Mr. Osborne, a geologist.

Start of Highway System

On May 21st, the commission reconvened in regular session, voted approval of the recommendation of the Highway Engineer, dated May 15, 1912, that a portion of the proposed state highway between South San Francisco and Burlingame, about 5.4 miles in length, be designated as Division IV, Route 2, Section A, and that all the forms accompanying the recommendation for layout, advertising, receiving bids, and for contracting for the construction of the highway be approved.

That was the first state highway project put out to bid and to be done under the supervision of the new California Highway Commission. The commission also adopted a route in Division I, Route 1, Section A, which was between the southerly boundary of Mendocino County and Hopland, as a state highway; selected a road between Madera and Califa in Madera County as a state highway; and in Divi-

RECALLS EARLY DAYS

Stockton, California

Mr. Kenneth C. Adams, *Editor*

Dear Mr. Adams: As the first stenographer of the California Highway Commission I found Mr. Kennedy's "Early Days" most interesting, and I will very much appreciate being included on your mailing list for *California Highways and Public Works.*

Sincerely,

(Mrs.) Adria L. Harrison

Start of actual construction on State Highway Contract No. 1 was made in San Mateo County on August 7, 1912. In the group are Chairman Towne of the Highway Commission with shovel; W. J. Martin, South San Francisco; L. E. Aubury, Ex-State Mineralogist; Judge P. E. Lamb, Burlingame; Ex-County Recorder of San Mateo County, H. O. Heiner; Dr. F. C. McGovern; A. E. Ritchie, Fred Cunningham and Supervisor W. H. Brown, San Mateo County.

sion III, approved the proposed state highway between Morrison's Crossing and Marysville, being that portion thereof in Yuba County, about nine miles in length and designated as Division III, Route 3, Section B.

The commission also did a very important piece of business this day by recommending to the Advisory Board of the Department of Engineering that at least $2,000,000 of the $18,000,000 bonds be sold so that these jobs could be done.

Progress was being made. One must remember that on August 9, 1911, the California Highway Commission consisted of three men who had just been appointed. They didn't have an office; they didn't have a secretary; they didn't have a stenographer; they had a Highway Engineer, but they had nothing else to go by or to go with; and on May 21, 1912, they were able to adopt certain routes as part of the new State Highway System.

That afternoon the commission met again. It listened to a group from the Winters Chamber of Commerce and citizens of Davis regarding a highway between Woodland Junction and Vacaville.

That evening, it met at 8 p.m. and voted that bids for the construction of the sections of state highway in San Mateo, Mendocino, Madera and Yuba Counties, laid out this day, be opened at 2 p.m. on June 24, 1912.

First Bids Received

On June 24th the commission met at 2 p.m. and opened bids for the construction of certain sections of the new State Highway System. On a job in Mendocino County, from the Sonoma County line to Hopland, the bids ran from $67,000 plus to over $122,000 for the project. The engineer's estimate was $65,000. On a job in South San Francisco, in San Mateo County between South San Francisco and Burlingame, the bids ran from $89,000 plus to $128,000 plus. The engineer's estimate for this job was $96,000 plus.

Incidentally, the name A. Teichert & Son, of Sacramento, appears in the list of bidders on this job in San Francisco. This firm is still in existence, and is presently doing work on the Capitol Grounds in the way of landscaping. It has just finished a large contract for the Division of Highways in Piru Gorge on U. S. 99 in Southern California.

On the job from Madera to Califa in Madera County, the bids were opened and ran from $72,000 to $83,000, with the engineer's estimate at $66,000. There was another set of bids in Yuba County in Division III from Morrison's

Crossing to Marysville, and the bids in this case ran from $67,000 to $76,000. The engineer's estimate was $60,000.

At 3.30 that afternoon, the commission met again and Mr. Towne reported that the Advisory Board had O.K.'d all its acts up to the present.

Contract No. 1

On June 26, 1912, the commission met at 10 o'clock in the morning, listened to a number of delegations, and then proceeded to execute contracts with successful bidders for the construction.

Contract No. 1 was let for a section of state highway in San Mateo County, Division IV, Route 2, Section A (between South San Francisco and Burlingame) to F. R. Ritchie & Company of San Francisco. Contract No. 2 was for a section in Mendocino County between the Sonoma County line and Hopland, and was awarded to the General Contracting Corporation of San Francisco. Contract No. 3 was for a section of state highway in Madera County between Madera and Califa, and was awarded to the Ransome-Crummery Company of Oakland. Contract No. 4 was for a section of state highway in Yuba County between Morrison's Crossing and Marysville and was awarded to F. E. Frey of Sacramento.

Dick Wilson Employed

The commission met again on July 22, 1912. It is noted that one Richard H. Wilson, who resided at that time at Covello, was appointed and employed as a draftsman and computer attached to Division I, for the monthly salary of $85. This Richard H. Wilson is now affectionately known throughout the State of California as "Dick," and is Assistant State Highway Engineer in charge of Administration. Dick worked for quite a little while for the California Highway Commission and then left for greener fields in the State of Washington. After working in Washington for quite a while and serving in World War I, he came back to the Division of Highways as Assistant District Engineer. The return of Dick was on August 1, 1927. His employment has been continuous with the California Division of Highways since that time.

In July, the commission got quite a jolt. The attorney for the commission reported that the Attorney General's Office had orally ruled that the commission did not have the power to make the award of the four contracts as voted, and that the award of such contracts must be made by the Advisory Board at its next meeting.

It didn't take long to overcome this difficulty, as the commission adjourned to meet that afternoon with the Governor and the Advisory Board of the Department of Engineering. The Advisory Board passed a resolution making it lawful for the Highway Commission to award contracts.

There is a notation in the July 24th minutes about the refund of $172.50 which was sent back to the State Controller with a request that it be put to the credit of the State Highway Fund. It seems that this $172.50 represented compensation made by one Walter Holmes to the State of California for the fatal injury to a horse and damage to a camp wagon belonging to the State.

Publish Bulletin

On August 26th, the commission voted on the recommendation of Chairman Towne that the California Highway Commission publish a monthly bulletin recounting therein a record of the commission's acts; the same to be compiled by the secretary and approved by the commission. This was the start of our present *California Highways and Public Works* magazine. Copies of this original bulletin from that time to this are all on file in our State Library, and the editor has the complete file here. In looking at the first copy, the remarkable growth of the magazine is immediately apparent. It started out as a small publication with some illustrations.

On August 27th, Chairman Towne read a letter from Mrs. Cora B. Woodbridge of Roseville, later an assemblywoman, urging that the commission place itself on record in favor of the abolition of road signs upon the state highways. As you probably know, during the past year and a half there has been a concerted effort on the part of many people to eliminate billboards along our landscaped freeways. It would seem that even back in 1912 there were people who didn't want billboards alongside our state highways.

First Registration of Autos

On September 23, 1912, it was voted that the Highway Engineer and the attorney be requested to prepare a rough draft of the bill in regard to the registration of automobiles and the licensing of operators thereof. The receipts from these sources were to be used for the maintenance of the state highways. This was the start of our Department of Motor Vehicles.

On October 12th, it was voted that certain warning signs be adopted for erection in appropriate places at the expense of the State on all state highways under construction. There were three types of signs. Type 1 stated that the highway was under construction and there was positively no passing. Type 2 stated that the highway was under construction and that it was dangerous but passable. Type 3 stated that the state highway was under construction so many miles beyond this sign and to turn here.

And here begins the first of our road signs which now are standardized and upon which you, as a driver of an automobile, depend to get you places in the most expeditious manner.

Also, on October 22d, a letter was received from L. Sperbeck, of La Mesa, California, which enclosed a petition of the citizens of La Mesa asking that the highway be routed through that town. Since that time, in various meetings of the commission citizens of La Mesa have appeared before the commission to tell them how glad they are that the highway does not go through their town at the present time, and that they are better satisfied with Highway 80 going past the town rather than through it.

Start of Laboratory

In the middle of November, at a meeting of the commission, the Highway Engineer was authorized to request from the State Architect specifications and bids for a hollow tile building, approximately 16 feet square, for the use of the Geological Department of the division. This building was to be erected on the State Fairgrounds and was to be substantially in accordance with the sketch submitted to the

commission by the State Architect. This was the beginning of our Materials and Research Laboratory. If this building was to be 16 feet x 16 feet, it would give approximately 256 square feet of laboratory. At the present time, the Division of Highways laboratory has 25,000 square feet of floor space, and is crowded. We have about 200 square feet per employee at the present time, and the standard for employees and laboratories is 650 square feet.

The Board of Control asked the commission for a statement of its financial condition, and also wanted a statement of the amount necessary to carry the work along until March 15, 1913. The Highway Engineer was requested to prepare such a statement.

Record was made at this meeting of the receipt of a letter from W. B. Hogan, Assistant Engineer of the Highway Maintenance Department of San Joaquin County at Stockton. He called the attention of the commission to the importance of considering and devising means for the protection of improved highways from damage caused by heavily loaded and narrow-tired wagons, and recommended that this subject be taken up by the State so that the Legislature might be induced to make the necessary general laws in the premises. Evidently some engineers were looking a long way ahead as to overloads and breaking up of our highways.

End of 1912

At the December meeting a Mr. Crummey, representing the Southwest Surety Insurance Company, appeared before the commission and requested an extension of time for the completion of Contract No. 1. This contract was originally awarded to F. R. Ritchie & Company and from the minutes one would gather that he couldn't complete it and the Southwestern Surety had taken on the Ransome-Crummery Company, of Oakland, to do the job. The request was referred to the Highway Engineer to submit a report with his recommendation.

This is the end of the minutes for the year 1912, and gives some idea of the trials and tribulations of the beginning of the California Highway Commission.

You must remember that in August, 1911, it started from scratch, and that in 17 months it was a going concern, with a sizeable organization and with a number of contracts let, and with the Highway Engineer authorized to make surveys for many, many more roads.

You may remember that in several instances we have stated that the Highway Engineer furnished lists of employees each month to the commission. This was with the exception of cooks and laborers and teamsters.

For the information of many, let it be said here that in the olden days of engineering, camps were established with cookhouses and tents for the engineers and the engineering parties. Nearly all of these salaries of $40, $50, $60, and $75 a month included board and room. By board and room, I mean a cot on which to sleep, and the board furnished by the State or the corporation for which the employee worked. These engineering camps were established due to the fact that they were sometimes a great distance from headquarters and suitable transportation, such as we have today, was woefully lacking.

In looking back over the record of 1911 and 1912, you can see that the Highway Commission had most of its meetings in Sacramento. However, it held meetings in Los Angeles and San Francisco, and individual members had traveled to several parts of the State to hear different groups of people advocating different locations of roads. Even back there the commission was, seemingly, very grateful to people who would express their opinions, as they are today.

(To be continued)

LIKES ROAD SIGNS

151 Fairlawn Drive,
Berkeley 8, California

Division of Highways
Sacramento, California

GENTLEMEN: A word of praise and thanks!

I recently did a lot of driving over unfamiliar roads alone with my two small children. I was constantly grateful for the excellence of your road signs and markings. They are an invaluable aid to safe driving.

Thank you.

MRS. J. V. K. HARGER

AND NOW LOOK AT ARROYO SECO FREEWAY

One of the great needs of the time is a fine thoroughfare between Pasadena and Los Angeles. Time and again projects of this kind have been started but have been defeated.

At present the roads between the two cities are nothing more than patchwork—desultory efforts here and there, and there is no continuous road which is in good condition.

No cities of such importance similarly situated with reference to each other have such poor connecting roads. They are rough, poorly kept and almost impassable at times.

Pasadena and Los Angeles should see that the necessary improvements are made without delay.—*Pasadena Star*, March 1, 1905.

AND NOW LOOK AT THE BAY BRIDGE

Ferry companies may now transport automobiles using gasoline as a motive power, allowing them to be driven on and off the boat under their own power, the only restriction being that the engine must be stopped while the boat is in transit. This news will be hailed with delight by the automobilists of California and especially those of this city. The local autoist in crossing the bay has been obliged to stop his engine at the ferry, get out of the car and push it on board, then the full length of the boat and up the approach at the other end of the ferry before the engine could be started.—*S. F. Examiner*, February 28, 1905.

W. B. BOGGS HONORED

Wallace B. Boggs, County Surveyor and Road Commissioner of Alameda County, has been appointed by Thomas H. MacDonald, Commissioner of the U. S. Bureau of Public Roads, to the Board of County Engineer Consultants.

The Board of County Engineer Consultants is composed of 10 nationally recognized county engineers, and their function is to advise the Commissioner of Public Roads on all matters pertaining to county roads, particularly regarding procedure, administration and techniques in the use of federal-aid secondary funds.

Cow Palace

New Highways Expected to Boost Attendance Again This Year

WHEN the thousands of animal enthusiasts from all over the Nation flock to this year's Grand National Livestock Exposition, Horse Show and Rodeo in the San Francisco Cow Palace, they will experience the best highway traffic situation in the history of the show.

This was disclosed by Nye Wilson, Secretary-Manager of the Cow Palace, after a conference with R. P. Duffy, Assistant District Highway Engineer, District IV, Division of Highways, San Francisco.

Principal improvements in the routes to the Cow Palace will be the almost certain completion of the freeway construction on Highway 101 from the Forbes Overhead north of San Rafael to Ignacio. Hundreds of exhibitors and thousands of spectators of the Grand National originate in the Redwood Empire and use Highway 101 to reach the Cow Palace.

Duffy told Wilson that the freeway construction from San Rafael to California Park will be still going on during the dates of the exposition but that there will be no impediments to the free flow of traffic. There will be two lanes open in each direction in this area, Duffy said.

New Highways Boost Attendance

Last year the Grand National was immensely benefited by the opening of the freeway overpass leading out of San Francisco on Bayshore Boulevard, Wilson told Duffy. This year's improvements on 101 north of San Rafael will also be a big help to the show, he said.

The Grand National, mighty combination of national livestock exposition, full division national horse show, official National and Pacific Coast Cutting Horse Association Championship Finals and the official Grand National Championship Rodeo Finals, will be held in the Cow Palace this year from October 31st to November 9th, inclusive.

Headlining the spectacular Arena Show this year will be the world's most famous and spectacular mounted drill troop, the Royal Canadian Mounted Police Musical Ride. This troop of 35 R. C. M. P. constables and officers was the smash-hit sensation of the 1939 Golden Gate International Exposition on Treasure Island, in San Francisco.

Features of Show

The Arena Show will be produced nightly, October 31st through November 9th, with matinees on Saturday and Sunday, November 1st and 2d and 8th and 9th. The arena entertainment show of the exposition alternates championship rodeo events with horse show classes, cutting horse competition and tanbark specialties. Other specialties in addition to the featured R. C. M. P. Musical Ride will be Buddy Heaton's famous clowning horse "El Rocco," the Pope Pony Hitch, working in conjunction with the huge six-horse draft teams of Raymond Church, Rio Vista,

Interior of San Francisco Cow Palace during a performance of the annual Grand National Livestock Exposition, Horse Show and Rodeo arena show

The Royal Canadian Mounted Police Musical Ride will be the featured attraction at the 1952 Grand National Livestock Exposition, Horse Show and Rodeo in San Francisco's Cow Palace, October 31st-November 9th. This division of the Royal Canadian Mounted Police is considered the world's most spectacular and famous mounted drill.

California, and the Coverly West Company of Shafter, California.

Slim Pickens, world's most famous and daring Brahma bull fighter, will again dare death on the horns of the most vicious of all cloven-hooved animals. Cy Taillon will be the announcer. Christianson Brothers of Eugene, Oregon, will furnish their famous bucking and riding stock for the rodeo events as primary contractor. Additional stock will be obtained from California stock producers.

Most of the 10,927 seats of the Cow Palace for each of the 14 arena show performances will be reserved. Choice mail order reserved seat tickets may be obtained by writing the Cow Palace, San Francisco 24, and enclosing a check or money order (no cash) and a stamped and self-addressed return envelope. Total prices for reserved seats are $2 and $2.50 and box seats $3.50.

Shasta Lake

Continued from page 32 . . .

hibitions in respect to size attained, and they had been brought from Kamloops, B. C. They were naturally voracious, otherwise they would not grow so large and so fast. In Idaho they had been caught up to 37 pounds in weight.

Imagine giving information like this to a bunch of fishermen who had a spot that they thought might be just what the Kamloops needed! Some of the enthusiasts dashed up to Idaho for a first-hand investigation. Others made the long trek clear up to Kamloops, B. C. There is no group of men from whom sanity takes flight as readily as from fishermen. That is, with the possible exception of hunters of deer, pheasant and duck.

Many Plantings Made

The reports were all favorable and a few eggs were obtained. The anglers were so certain of success that they even got some Kokanee eggs to be sure that the young Kamloops would have this small species of fresh-water salmon available for food when they got big enough to be on their own in Shasta Lake.

The government salmon hatchery at Coleman was persuaded to hatch both varieties of eggs. The Kokanee and

. . . Continued on page 61

Forbes Overhead

Continued from page 35 . . .

Granite Construction Company at Watsonville was the contractor.

The work was started in January, 1951, under the general supervision of Assistant State Highway Engineer Jno. H. Skeggs, now retired, and is continuing under the direction of his successor, Assistant State Highway Engineer B. W. Booker, District Engineer (Operations) J. P. Sinclair and Assistant District Engineer (Construction) R. P. Duffy. As the Resident Engineer, the writer was assisted by Bridge Department representatives W. H. Jacobson and M. H. Jacobs.

Report on Progress and Records in Pavement Construction During 1951

By CARL ALZUETA
Assistant Engineer, Construction Department

BECAUSE of the continuous improvement in both equipment and "know-how," Standard Specifications for highway construction cannot remain "standard" for very long. The periodic revisions of the Standard Specifications issued by the Division of Highways are hardly off the press before new methods of construction and of processing materials are developed which make changes and additions necessary.

The result has been to increase the size of the special provisions which are prepared for each project since they must now include specifications which have become "stock" since the latest volume was issued in 1949.

Formal revision of the 1949 Standard Specifications has been going on since 1951. Field engineers throughout the 11 districts were canvassed for suggestions, as were the various departments at Headquarters Office. Correlating of the many suggestions and the editing of the text by both engineers and attorneys is taking approximately two years.

Some of the proposed changes in the Standard Specifications have been undergoing a trial. They are being inserted into special provisions to see how they work out in field practice before being inserted into the Standard Specifications.

The Construction Manual now in use, issued in 1950, is also being revised as a parallel operation. Instructions are being revised to keep abreast of current construction practices, materials and equipment.

SKID RESISTANCE

Among the significant paving developments during the year was a growing consciousness on the part of engineers of the problem of slippery pavements. It has become apparent that the problem will play an increasingly important role in the future and will influence construction operations as well as pavement mixture design. In conjunction with the University of California's Institute of Transportation and Traffic Engineering more than 140 sections of pavements have been studied and their skid properties noted. Current investigations are being made by the institute to determine the effect of various gradations of aggregates in bituminous mixtures and the effect of various types of construction equipment and procedures.

It is hoped that improvements can be made in the surface texture of bituminous surfacings to increase their skid resistance properties, and that this will eliminate any necessity for rock screenings seal coats for this purpose. This is important since problems have arisen from the attempt to place this type seal coat over newly laid paving mixtures. On several projects on heavily traveled routes, screenings which had been placed on the new surfacing were worked into the matrix of the mix. The newly placed mix had not had time to harden or for the volatile oils to escape. At other times, in an attempt to complete a surfacing contract in its entirety without suspending for the winter, serious seal coat failures have resulted. Such seals left without their cover material result in a glazed surface and constitute a skid problem.

The preferable policy for rock screening seals is to defer their placement until the need for such a seal is apparent.

PAVEMENT PROGRESS

Year	PCC PAVEMENT Class "B" Concrete Average C.Y./day	PCC PAVEMENT Class "B" Concrete Aver. Roughness Index inches/mile	PMS Aver. Roughness Index inches/mile	RMS Aver. Roughness Index inches/mile
1940	374	7.4	23.1	49.2
1941	460	7.8	19.3	29.4
1942	367	8.0	14.6	25.5
1943	337	14.2	18.8	23.4
1944	426	10.3	16.8	32.9
1945	236	14.2	19.5	31.2
1945-1949*	-----	-----	-----	-----
1950	662	6.3	11.2	23.1
1951	686	6.8	11.4	21.2

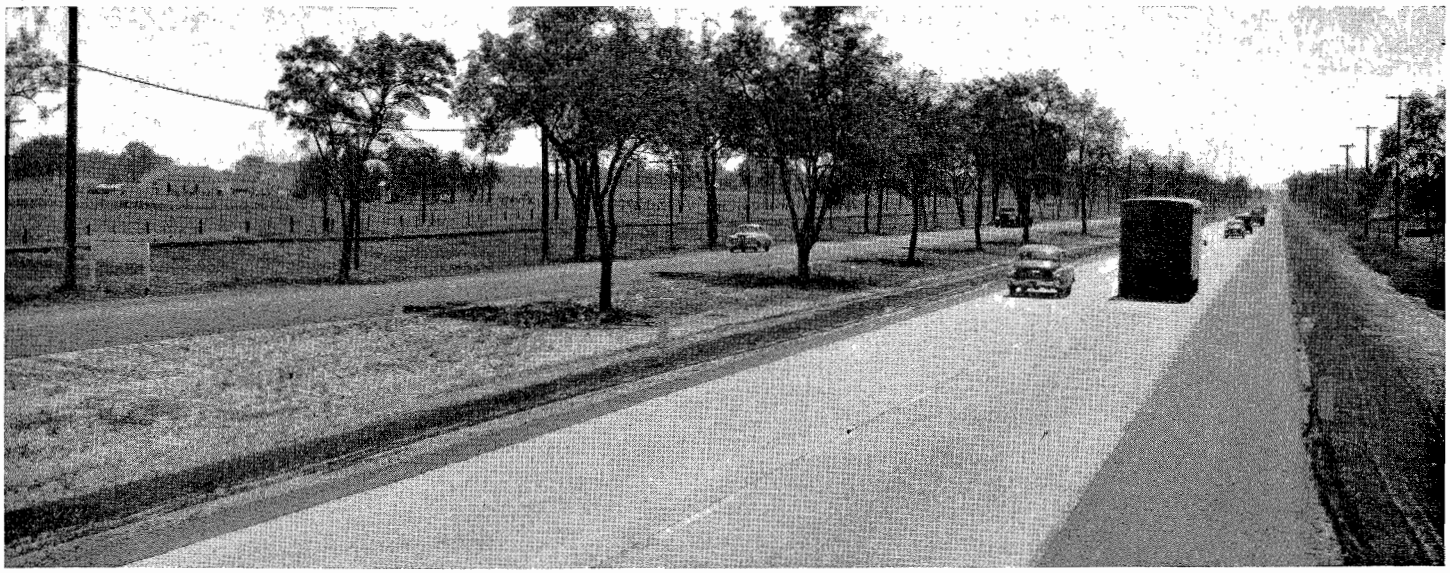
* No records were compiled in this period.

PORTLAND CEMENT CONCRETE

Methods of placing concrete pavement remained essentially the same as in the past; however, several changes were made during the year in specifications which will apply to future work.

One of the changes for this type of pavement is the introduction of the sawed weakened plane contraction joint. By substituting the cut joint it is hoped that much of the spalling characteristics of the premolded paper strip joints will be eliminated and will result in better riding qualities.

Cutting is tentatively planned for 8 to 10 hours after the placing of the concrete for those joints at 60-foot centers. Sawing intermediate joints will be delayed an additional 12 to 24 hours. It is anticipated that the cutting sequence will have to be adapted somewhat to each paving project to compensate for variable placing temperatures and other local conditions. Since delaying the sawing of the green concrete lengthens the life of the diamond saw and reduces spalling, sawing of the joints will be deferred until random cracking has become a limiting factor.



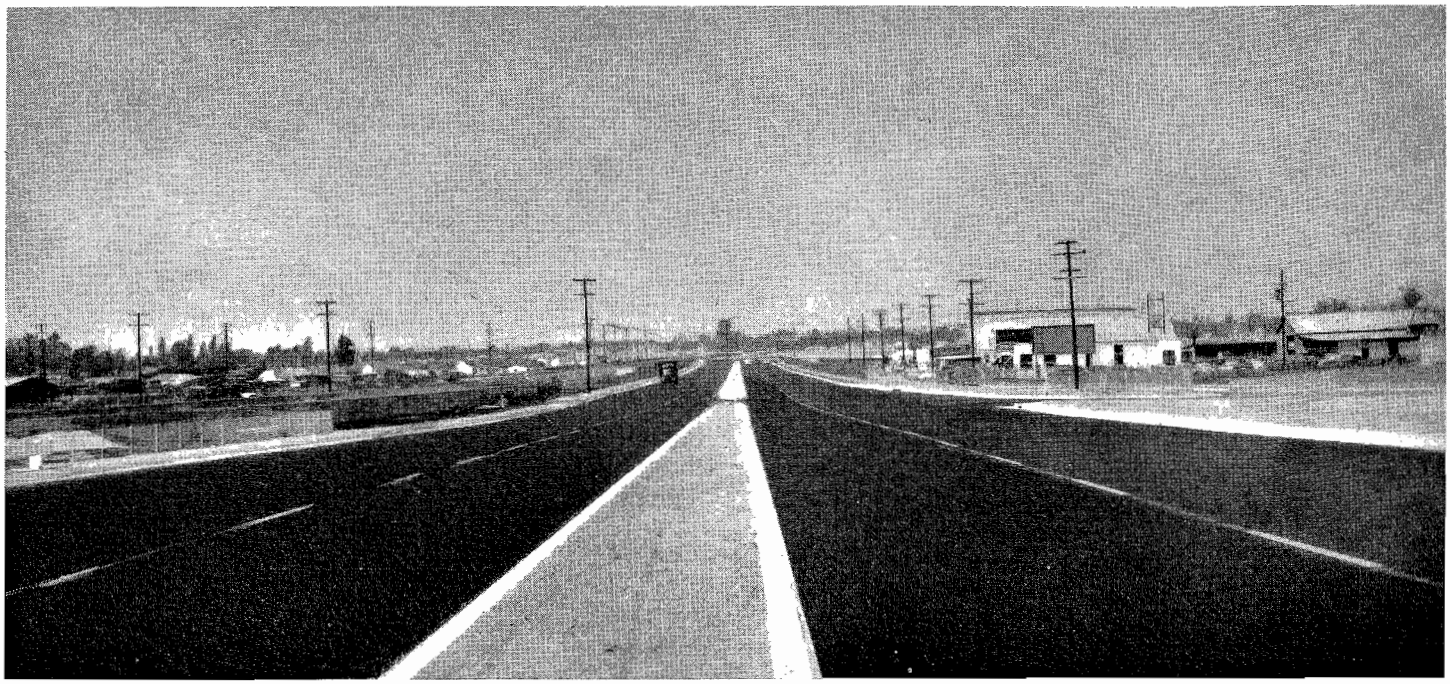
Concrete pavement recently completed on U. S. 99 just south of Turlock

An alternate method will be used to join the longitudinal and transverse contact joints by permitting the use of an unhooked one-half-inch steel reinforcing rod in addition to the present tie bolt assemblies.

Calcium chloride was used successfully during the year as an admixture for portland cement concrete to accelerate the early strength of the pavement. Added in flaked form to the mixer in percentages up to 2 percent, it may aid greatly in the early opening of the pavement to traffic. (This procedure was described in some detail in the March-April, 1952, issue of *California Highways and Public Works*).

The highest average daily production of pavement concrete was accomplished on Contract 1-10TC61-F, on Route 4, just south of Merced. Guy F. Atkinson was the contractor, and W. F. Fleharty and A. E. Conto, resident engineer and street inspector, respectively. An average daily output of 1,080 cubic yards was attained. The individual high for a single day's out-

Recently completed resurfacing of U. S. 40 near Vacaville with a bituminous mixture



This section of four-lane divided highway has a bituminous plant-mixed surfacing over a cement-treated base. Recent construction on Rosemead Boulevard in Los Angeles.

put is claimed, however, by N. M. Ball Sons for their production of 1,508 cubic yards in a 9½-hour day on Contract 1-6VC42 on Kern-4-C.

During the year, 68 miles of concrete pavement were constructed with an average roughness index of 6.8 inches per mile. The best riding quality was obtained by Fredrickson & Watson on Contract 52-5TC2-F, on Route 2 between Chualar and Spence Underpass, with a low of 5.6 inches per mile. R. H. Roberts was the resident engineer, with W. H. Melcher and R. W. Gainer as paving inspectors.

PLANT-MIXED SURFACING

Modification has been made in recent contracts with respect to plant control and quality of the mineral aggregate. These changes are forerunners of contemplated revisions of the present Standard Specifications.

The highest quality mix involves close grading tolerances and exacting quality requirements for the mineral aggregate and is intended for use on the major routes. A second type of surfacing which closely parallels the present surfacing would be specified for routes of a secondary nature.

The grading of the mineral aggregate for plant-mixed surfacing has been coarsened to produce a less dense paving mixture and to reduce the quantity of fines previously permitted. It is also hoped that the coarser grading will result in a better nonskid surface texture. In some instances this reduction in fines will mean that the aggregate will have to be washed, or as an alternate, portions of the natural fines will have to be wasted.

The trend continues toward higher daily production of surfacing material as mixing plants increase in capacity and methods of handling the stockpiles of the raw materials are improved. A few batch plants with a three-ton mixing capacity are now in operation in the State and other contractors have indicated their interest in such units.

The continuous mixing type plant has proved itself capable of producing very large tonnages of paving materials. Basich Bros. employed this type of mixer last year to achieve the highest average daily tonnage in the State. On their contract on Route 4 near Castaic they produced an average of 1,480 tons per day. R. E. Deffebach and F. E. Sturgeon were resident engineers on this project.

The special 5,000-pound sample weigh hopper now being required for this type of plant has added materially to the positive controls possible with this mixing method and has eliminated many of the previous objections to it. The use of this hopper enables the engineer to readily and accurately determine the quantity of each bin size being proportioned, as well as the total quantity of aggregate entering the pugmill. It also facilitates the sampling of each bin size.

As in previous years, plant mix continues as the predominating type of surfacing. It was specified on 83 percent of the higher types of bituminous surfacings completed under contract in 1951. A total of 409 miles of this type of surfacing was completed during the year.

The smoothness record for plant-mixed surfacing was made on Contract 52-1TC1 on Route 71 near Smith River in Del Norte County. Mercer-Fraser was the contractor and Ralph Harkness the resident engineer. The typical section for this highway consisted of a dense-graded plant mix over a cement-treated base, with a one-half-inch open-graded wearing course.

ROAD-MIXED SURFACING

A total of 87 miles of road-mixed surfacing were completed under contract during the year and of this total mileage 87 percent was laid in the dry, warm regions of Districts IX and XI.

It is interesting to note that this mileage of road-mixed surfacing constitutes only 17 percent of the total higher type of bituminous mileage constructed in 1951, while in the previous year the percentage was 28. This illustrates the growing trend toward the hot-mixed, hot-laid type of surfacing. Though initially more expensive, plant-mixed surfacing has a greater ability to withstand present-day traffic and climatic conditions, which is becoming more generally recognized.

The new specifications will provide a less restrictive type of plant-mixed surfacing which can be used instead of road-mixed surfacing to gain the advantages of a drier, to provide better asphalt control, and to permit the use of harder asphalts. It is anticipated that this type of surfacing will become increasingly popular due to its inherent advantages at a very little increased cost.

The 1951 record for riding qualities on road-mixed surfacing was made on Contract 51-9BC1-F, on Route 23 in Mono County. R. P. Shea was the contractor, and F. E. Thompson the resident engineer.

PORTLAND CEMENT CONCRETE PAVEMENT

County	Location	Contractor	Resident engineer	Street inspector	Average cubic yards placed per day	Roughness index inches/ mile	Remarks
Mendocino	City of Ukiah, Smith St. to Low Gap Rd.	O. C. Jones	H. W. Benedict	A. Wallace	121	13.1	Transit mix
Alameda	1½ mi. W. of Livermore and Hopyard Rd.	Fredrickson & Watson	J. F. O'Brien	A. A. Andrade	658	6.8	
San Francisco	Augusta St. to 25th St.	G. F. Atkinson & Chas. Harney	H. A. Simard	M. Hogan	369	8.6	
Monterey	Between Chular and Spence Underpass	Fredrickson & Watson	R. H. Roberts	W. H. Melcher, R. W. Gainer	661	5.6	
Kern	0.6 mi. S. of McKittrick Rd. to Haskins Rd.	N. M. Ball & Son	J. W. Cole	W. Adams	982	6.6	
Kern	Famosa Underpass to McFarland	Griffith Co.	P. A. Boulton	D. E. Peaslee	841	6.1	
Los Angeles-Kern	2.5 mi. S. of Rt. 59 and Fort Tejon	N. M. Ball & Son	W. M. Nett	D. D. Howell	1,043	6.5	
Madera	1.5 mi. N. of Madera to 0.3 mi. N.	G. F. Atkinson	T. E. Whaley	J. Walser	1,039	6.5	
Madera	0.5 mi. N. of Berenda to Califa	G. F. Atkinson	T. E. Whaley	J. Walser	806	6.6	
Tulare	1.0 mi. N. of Goshen and Traver	Griffith Co.	R. Windele	C. R. Blanthorn	779	5.3	
Los Angeles	Hollywood Freeway, Virgil Ave. to Glendale Blvd.	N. M. Ball & Son	H. E. Belford	R. De Laney	731	7.5	
Los Angeles	Hollywood Freeway, Western Ave. to Virgil Ave.	Griffith Co.	J. Ritter	A. N. George, R. Palmer	585	9.2	
Los Angeles	Hollywood Freeway, Glendale Blvd. to Grand Ave.	N. M. Ball & Son	H. Ayanian	J. Needham	472	9.2	
Los Angeles	Ramona Freeway, Evergreen Ave. to 0.2 mi. E. of Helen Dr.	J. E. Haddock, Ltd.	B. N. Frykland	E. L. Thompson	597	8.1	
Los Angeles	Rosemead Blvd., Garvey Ave. to Valley Blvd.	Vido Kovacevich	R. M. Cooley	J. H. Patterson	515	9.2	
Merced	Bet. Dutchman Creek and Lingard	G. F. Atkinson	W. F. Fleharty	A. E. Couto	1,080	5.9	
San Diego	Bet. the Willows and 4 mi. E.	Clyde N. Wood	L. G. Cline	N. Garlock	384	10.1	
				Average	686	*6.8	

* Weighted average.

ROAD-MIXED SURFACING

County	Limits	Contractor	Resident engineer	Roughness index inches/ per mile
Humboldt	Bet. 0.7 mi. E. of Fortuna City Limits and Hydesville	Mercer Fraser Co. and Mercer Fraser Gas Co.	F. Brann	31.0
Lake	Bet. 0.4 mi. and 0.7 mi. E. of Tulelake	M. W. Brown	P. A. Main	24.2
Mendocino	Bacon Gulch to ⅛ mi. N. of Signal Port Creek	A. B. Siri	R. B. Keeble	20.2
Mendocino	20 mi. S. of Fort Bragg at Salmon Creek	A. B. Siri	H. G. Fellman, A. J. Braga	20.2
Napa	Bet. 1.5 mi. S. and 4.5 mi. S. of Lake county line	C. Y. Syar	P. Karst	31.1
Riverside	Lakeview Ave., Nuevo to Lakeview	Foster & McHarg	P. E. Stout	20.3
Inyo	11 mi. N. of Trona and Death Valley Monument	Verne MacArthur	R. W. Fisher	19.5
Inyo	Bet. Division Creek and Aberdeen and bet. Keough Hot Springs and Stevens Corner	Verne MacArthur	R. E. Waters	18.2
Mono	Bet. 0.8 mi. N. of McGee Creek and 1.6 mi. N. of McGee Creek	Conrad Construction	C. H. Jackson	30.1
Mono	Bet. 5 mi. N. of Sonora Junction and Antelope Valley	R. P. Shea	F. E. Thompson	16.9
Kern	Bet. 1.7 and 7.2 mi. N. of Randsburg Junction	E. C. Young	G. J. Snyder	30.9
Imperial	Main St. bet. First St. and E. city limits of El Centro	Anderson Company	J. B. Howse	25.9
Riverside	Bet. Imperial county line and 3 mi. SE. of Mecca	Griffith	C. E. Walcott	17.9
Imperial	2 mi. NW. of Niland and Riverside county line	Hensler Construction	D. C. Smith	21.3
			Weighted average	21.2

PLANT-MIXED SURFACING

County	Limits	Contractor	Resident engineer	Tons per day	Roughness index inches/mile	Remarks
District I						
Del Norte	Smith River bridge to ¼ mi. N. Winton Corners	Mercer Fraser Co.	R. C. Harkness	510	7.3	
Humboldt	Trinidad to 2.8 mi. northerly	Mercer Fraser Co.	E. J. Reed	340	8.1	
Mendocino	In City of Willits, S. city limits to N. city limits	Harms Bros. and C. M. Syar	A. Bragg and H. W. Benedict	390	16.4	
District II						
Modoc	Toms Creek to Cedarville	Rand Construction	H. H. Hoover	510	11.6	Continuous mixer
Shasta	Anderson to Redding	Frederickson and Watson	W. Z. Hegy	430	7.9	
Shasta	Hatchet Creek line change	Eaton and Smith	W. H. Bartlett	580	19.6	Continuous mixer
Siskiyou	Spring Hill to Weed	Rand Construction	E. Engle	770	12.7	
District III						
Butte	Bet. Oroville and Oroville-Quincy Highway at Ward Ave.	Rice Bros.	E. H. Wyman	470	12.3	
Colusa	6.8 mi. N. of Colusa to Glen County line	Harms Bros.	D. W. Klar	1,020	11.2	
Yolo	County road 29 to county road 27, about 6 mi. S. of Woodland	W. C. Railing	W. R. Green	540	11.9	Continuous mixer
Butte	0.7 mi. N. of Yuba County line to Union school	M. J. Ruddy & Son	M. Chapman	760		
Colusa	Colusa to Meridian	Harms Bros.	W. J. Breaker	520	18.8	
El Dorado	Railroad crossing E. of Placerville to Five Mile Terrace W. of Camino	H. Earl Parker	E. F. Silva	430	9.7	
El Dorado	Railroad crossing near W. city limits to E. city limits in Placerville	Rice Bros.	E. F. Silva	710	11.9	
Glenn	1.1 mi. S. of Walker Creek to Walker Creek	C. V. Kenworthy	W. J. Breaker	300	16.0	2,000 lb. batch plant
Sutter	Meridian to 3 mi. W. Yuba City	Rice Bros.	M. Chapman	710		Production records incomplete
Yolo	East St. in Woodland to Yolo Bypass	A. Teichert & Son	H. A. Towne	910	12.5	Continuous mixer
Yuba	Simmerly Slough to 0.4 mi. S. of Butte County line	Rice Bros.	M. Chapman	710		
Alameda	Alvarado to 3 mi. southeasterly (portions)	Clements & Co.	F. E. Thompson	680	12.2	
Contra Costa	On Byron Rd., State Hwy., Rt. 75 and 1.6 mi. southeasterly of Byron	J. R. Armstrong	W. C. Dalton	500	12.1	
Contra Costa	On Marsh Creek Rd., 7.1 mi. E. of Clayton to 12.4 mi. W. of Byron	Louis Biasotti & Son	W. C. Dalton	280		Slides on pavement
Napa	Imola Ave. W. bet. Napa State Hospital and 1.3 mi. W.	E. A. Forde	F. C. Smigle	520	12.2	
Alameda	Eastshore Hwy., Ashby Ave. to El Cerrito Overhead	Lee J. Immel	J. A. Whyte	540	9.8	
Contra Costa	Port Chicago Rd. to Pittsburg	Parrish Bros.	D. M. Young	580	15.2	Continuous mixer
Contra Costa	Hercules to Oleum	J. R. Armstrong	J. A. Whyte	360	13.8	
Contra Costa	Monument to Concord (portions)	J. R. Armstrong	G. E. Beckwith	710		
Contra Costa	Luzon Underpass to Christie Underpass	Lee J. Immel	D. M. Young	730		
San Mateo	1 mi. S. of Lobitas to ½ mi. N. of Lobitas	Westbrook & Pope	W. G. Remington	450	9.9	
San Mateo	Bayshore Hwy., S. city limits of San Francisco to N. city limits of So. San Francisco	Charles L. Harney	G. W. Levier	630	18.5	
Santa Clara	Bet. Palo Alto and Sunnyvale	Frank B. Marks	L. A. Marks	470	13.0	
Santa Clara	Cape Horn to Merced County line	Eaton & Smith	G. W. Levier	650		Fill settlement
Santa Cruz	At Respini Creek bet. 2.3 mi. and 1.5 mi. S. of Davenport	Elmer J. Warner	W. G. Remington	480	9.4	
Sonoma	Bet. Cloverdale and Healdsburg (various locations)	J. R. Armstrong	G. Dillon	490	13.0	
Sonoma	Various locations bet. Healdsburg and Santa Rosa and at Sonoma	A. G. Raisch	G. Dillon	490	8.4	
Sonoma	Bet. Petaluma Creek and Tolay Creek	Piombo Const.	W. Travis	470	13.5	
District V						
Monterey	Moss Landing to 2 mi. S. of Watsonville Airport	Leo Piazza	H. J. Holman	740	14.2	
San Benito	Chittenden Rd. to 1 mi. N. of San Benito River	Granite	H. J. Doggart	620	8.5	
San Benito	Hollister to Santa Clara County line	Fredrickson & Watson	C. F. Roderick	790	8.0	
San Luis Obispo	Atascadero to 1 mi. S. of Templeton	M. J. B. Const.	V. E. Pearson	640	8.6	
San Luis Obispo	San Luis Obispo County, Rt. 33 and Kern County line (portions)	Granite	W. J. Paivine	500	14.8	
Santa Barbara	In city of Santa Barbara, Salsipuedes St. and bet. Bath St. and Junipero St.	N. M. Ball Sons	T. L. Miller	310	16.5	2,000 lb. batch plant
Santa Barbara	Bet. 0.5 mi. N. of Las Cruces and 1 mi. N. of Summit	Granite	A. P. Campbell, A. L. Lamb	735	11.1	
Santa Barbara	San Julian Ranch to 1.8 mi. N. of Ytias Creek	Valley Paving & Construction	T. L. Miller	420	11.0	
Santa Barbara	Tequepis Canyon to 1½ mi. E. of Santa Ynez River Bridge	Kirst & Sons	A. L. Lamb	840	11.6	4,000 lb. batch plant
Santa Barbara	Hot Springs Canyon to Tequepis Canyon	J. A. Payton	A. L. Lamb	760	11.4	4,000 lb. batch plant
District VI						
Fresno	Shaw Ave., State Hwy. to Fruit Ave.	Gene Richards	P. A. Rockas	600	18.2	
Fresno	On Manning Ave., Zediker Ave. to Kings River Bridge	Baun Construction	H. R. Longworthy	625	16.0	
Kern	Weed Patch-Wheeler Ridge Rd., Davis Rd. to Wheeler Bridge	Oilfields Trucking & Phoenix Const.	W. M. Nett	1,090	12.3	
Kings	10th Ave., Seventh St. and Grangeville and Layton Hwy. Last Chance Ditch to Kings River	Baun Const.	C. J. McKee	850	22.8	
Tulare	Lovers Lane, FAS 1143 and State Rt. 10 and Ben Maddox Way, bet. State Rt. 10 and State Rt. 133	Rice Bros.	W. C. Clark	810	11.6	4,000 lb. batch plant
Tulare	Bet. E. city limits of Dinuba and Orosi	Oilfields Trucking & Phoenix Const.	W. C. Clark	820		
Kern	Junction Rt. 136 to the Tulare County line	Griffith Company	P. A. Boulton	710	7.6	Production records incomplete
Kern	Famosa Underpass to McFarland	Griffith Company	P. A. Boulton	710	7.5	
Kern	4.4 mi. E. Sivert to 2 mi. W. of Bear Mountain ranch	Oilfields Trucking & Phoenix Const.	W. M. Nett	630	16.8	

County	Limits	Contractor	Resident engineer	Tons per day	Roughness index inches/mile	Remarks
District VI—Continued						
Los Angeles-Kern	2.5 mi. S. of Rt. 59 to Fort Tejon	N. M. Ball Sons	W. M. Nett	1,140	11.4	
Madera	Cottonwood Creek to N. city limits of Madera	P. J. Moore	T. E. Whaley	710	16.0	
Madera	1.5 mi. N. of Madera to 0.3 mi. N. of Dry Creek	Guy F. Atkinson	T. E. Whaley	760	15.0	
Madera	0.5 mi. N. of Berenda to Califa	Guy F. Atkinson	T. E. Whaley	750	7.4	
District VII						
Los Angeles	1.5 mi. W. of Calabasas to 1.6 mi. E. of Malibu Junction	Basich Bros.	L. E. Steele	1,090	12.2	Continuous mixer
Los Angeles	Hollywood Parkway, Hill St. to Spring St.	Guy F. Atkinson	R. A. Collins	290	19.2	Asphalt concrete
Los Angeles	Front St. and Providencia Ave. 200 ft. westerly Olive Ave. to San Fernando Blvd.	Jesse Smith	L. W. Sixt	670	18.3	Asphalt concrete
Los Angeles	0.4 mi. S. of Castaic Creek to 0.4 mi. N. of Palomas Wash	Lefever, Bing, Basich Bros.	R. E. Deffebach, F. E. Sturgeon	1,480	9.0	Continuous mixer
Los Angeles	Mint Canyon Highway, 0.5 mi. S. of S. P. Railroad overhead and Sodamint	Basich Bros.	R. E. DeLaney	700	11.1	
Los Angeles	Sierra Highway, Tunnel Station to northerly end of Sec. H	Basich Bros.	R. E. DeLaney	1,090	14.6	
Los Angeles	Pacific Coast Hwy. at Sunset Blvd. and Chautauqua Blvd.	Jesse Smith	H. F. Meinke	310	17.0	
Los Angeles	Lincoln Blvd. S. city limits of L. A. to Washington Blvd.	Oswald Bros.	D. J. Faulkner	610	17.8	
Los Angeles	Pacific Coast Hwy., Vermont Ave. to Figueroa	Warren Southwest	C. C. French	500	12.8	
Los Angeles	Palisades Beach road westerly Tunnel Portal at Colorado Ave.	Schroeder and Company	H. F. Meinke	940	13.1	
Los Angeles	Centinela Ave., Freeman Blvd. to Sepulveda	Oswald Bros.	D. J. Faulkner	710	15.7	
Los Angeles	Lakewood Blvd., Carson St. to Center St.	W. S. Mecham	L. W. Sixt	770	9.2	
Los Angeles	Rosemead Blvd., Garvey Ave. to Valley Blvd.	Vido Kovacevich	R. M. Cooley	730	10.4	
Los Angeles, Ventura	Bet. 2 mi. E. of LA-Ventura County line to 1 mi. W. Moorpark Road	Fredericksen & Kasler	M. F. Masters	860	9.3	4,000 lb. batch plant
Orange	Sea Scout Base to S. city limits of Newport Beach	Cox Bros.	D. J. Faulkner	680	13.4	
Orange	Santa Ana Freeway, Los Angeles County line to 0.2 mi. SE of Euclid Ave.	Sully-Miller	B. N. Frykland	760	16.2	Asphalt concrete
Orange	Santa Ana Freeway, 0.2 mi. SE. of Euclid Ave. to State Rt. 2 at Miraflores	Griffith Company	C. E. Dresser	450	13.5	4,000 lb. batch plant
Orange	Garden Grove Blvd., Stanton Ave. to the Pacific Electric RR in Garden Grove	Roland T. Reynolds	J. L. Needlam	720	15.1	Portions under water
Ventura	State Rt. 2 to the Santa Clara River	Conrad Const.	M. F. Masters	530	11.9	
District VIII						
San Bernardino	Central Ave., Foothill Blvd. to Phillips Blvd.	Hess Construction	P. E. McKean	880	13.8	
Orange-Riverside	Bet. 1.7 mi. W. of Orange County line to Corona	Peter Kiewit Sons	W. H. Crawford	1,120	10.1	Continuous mixer
Riverside	Southern Pacific RR to Sedgwick Ave. in City of Riverside	R. A. Erwin	J. B. MacDonald	460	11.1	
Riverside	In Corona, W. city limits to E. city limits	E. L. Yeager	L. M. Barnett	640	12.3	
Riverside	W. of Hemet and Sanderson Ave.	R. A. Erwin	Paul Wittig	500	7.4	
Riverside-San Bernardino	2.3 mi. E. of Redlands and Beaumont	Fredericksen and Kasler	E. A. Bannister	1,010	11.2	6,000 lb. batch plant
San Bernardino	Bet. State Rt. 26 to Grant Ave.	Hubbs Equipment	J. H. Chaudom	490	17.1	
San Bernardino	On Main St., through Barstow and Main St. to N. junction with Rt. 68	Peter Kiewit Sons	R. E. Small	670	8.3	Continuous mixer
San Bernardino	1.3 mi. W. of Running Springs and Running Springs	Hess Construction	M. E. Nelson, R. H. Ramey	630	13.7	Portions covered by snow
District IX						
Inyo	Bet. Rt. 63 and 1.3 mi. N. and bet. W. city limits and Main St. in Bishop	G. W. Ellis	W. R. Coons	315	9.9	
District X						
San Joaquin	Bet. State Highway Rt. 4 and Jacktone Road at Collegeville	M. J. B. Construction	C. A. Plecarpo	690	8.6	
Stanislaus	On McHenry Ave., State Highway Rt. 13 to San Joaquin County line	M. J. Ruddy & Son	C. D. Hof	400	18.1	2,000 lb. batch plant
Stanislaus	Bet. City of Oakdale and town of Waterford	United Concrete Pipe	C. D. Hof	340	12.3	
Stanislaus	On Oakdale-Valley Home Road, State Hwy. Rt. 66 to Valley Home	United Concrete Pipe	C. D. Hof	570	8.9	
Stanislaus	Bet. Turlock and Crows Landing Road and bet. Monte Vista Ave. and Turlock	United Concrete Pipe	C. D. Hof	910	11.1	
Stanislaus	Bet. Modesto and 5.4 mi. W.	United Concrete Pipe	C. D. Hof	600	9.4	
Calaveras	Bet. Murphy's and Big Trees	M. J. Ruddy & Son	K. N. Hatch	520	15.0	
Mariposa	Bet. Cathay junction and 5 mi. E.	Munn & Perkins	J. H. Kurata	560		
Merced	Bet. Dutchman Creek and Lingard	Guy F. Atkinson	W. F. Fleharty	670	10.9	
Merced	Bet. Santa Clara County line to 3.5 mi. E.	Munn & Perkins	H. R. Jantzen	580	12.6	
Stanislaus	Portions bet. 10.5 and 5.0 mi. W. of Modesto	M. J. Ruddy & Son	H. C. Landon	480	11.5	
Tuolumne	Bet. Montezuma Road to 1 mi. S. of Jamestown	Geo. F. France	F. L. Lucas	450	11.2	
District XI						
San Diego	Bet. Cabrillo Freeway in the City of San Diego and Fairmont	Griffith	F. D. Pearce	880	14.0	
Riverside	Indio to Black Butte	J. L. Miller & Son	W. R. Connelly	600	9.4	
San Diego	Bet. H St. in Chula Vista and 4th St. in National City	MacClosky & Hazard	W. T. Rhodes	920	16.1	4,500 lb. batch plant
San Diego	Balboa Ave. in City of San Diego and Las Flores	Griffith	A. C. Estep	950	13.8	4,000 lb. batch plant
San Diego	Chambers St. in El Cajon and Second St.	R. E. Hazard	Don C. Smith	910	16.0	
					11.4	Weighted average

Wanted . . . Engineers

By G. F. WINSLOW
Associate Highway Engineer

Wanted—Engineers.

Thirty thousand graduate engineers are wanted in the United States each year, a number almost as great as the population of Reno, the biggest little city in the world. Thirty thousand, besides the engineering aids and technicians who never completed a college course.

What is an engineer? Instead of using the dictionary, I would rather quote the late C. S. Pope, who was Construction Engineer with the California State Highway Department: "Engineers are and should be eminently practical men, and men who are not only necessary, but who should be sought in every public undertaking of a constructive nature."

F. C. Wright in a technical paper used different words to say the same thing: "Engineering is the directing of the powers of nature to the use of man. An engineer is one who can do for one dollar what any fool can do for two. We think of Civil Engineers as men who come in daily contact with three things: (1) natural forces, (2) men, and (3) money. To coordinate those three so that they jointly can do the best work, is the real job of the engineer."

What Makes an Engineer

But the masterpiece was written about 150 years B.C. by Marcus Vitruvius:

> "He should be a good writer, a skillful draughtsman, versed in geometry, and optics, expert at figures, acquainted with history, informed on the principles of natural and moral philosophy, somewhat of a musician, not ignorant of the sciences, both law and physics, nor of the motions, laws and relations to each other of the heavenly bodies."

But why the cry for engineers, a group of which there were only about 25,000 in the United States 60 years ago? At the turn of the century there were less than 40,000; by 1940 they had increased to about 250,000; while today there are about 400,000 engineers, the third largest profession, exceeded only by the teaching and nursing professions. The statistics are funny. In 1946, a year when there were 12,000 engineering graduates, a survey indicated that 25,000 graduates per year would satisfy the demand by 1952. In 1950 alone there were 52,000 graduates, and now there is still a deficiency of 60,000. Keeping in mind that 30,000 graduate engineers are needed each year, the estimated prospects are 26,000 in 1952, 20,000 in 1953, and 12,000 to 17,000 for 1954.

Engineer Shortage

Now the estimate is that the supply will not meet the demand until 1965. In other words, the present third grader in primary school might have some competition in the engineering field when he graduates from college. One writer explains the shortage by these reasons:

1. The GI Bill sent unpredicted numbers to college.
2. Industrial demands increased.
3. Korea demands caused precipitous drop in students.

When the large increase in students was noted, schools and vocational advisors warned against impending surplus of engineers and danger of unemployment.

The present-day engineering graduate does not have to consider unemployment but rather which of the many offers is the best. A graduate of Columbia University had offers from Colgate-Palmolive-Peet Company, U. S. Steel, Westinghouse, Hughes Tool Company, Otis Elevator, Chase Brass & Copper, Continental Can, Eastman Kodak, Union Carbide & Carbon, Electro Metallurgical Company, Brown Instrument Company, Procter & Gamble, Ford, General Electric, and du Pont Company.

Plenty of Jobs

One company tried to employ the entire graduating class of Southern Methodist University. Three hundred twenty graduates of Case Institute of Technology had a total of about 1,400 offers. General Electric, with a starting salary of $325 a month, expects to fill only 500 out of 1,500 openings. One company sent out 22 engineers to interview graduates. They not only failed to obtain recruits, but lost one of their own engineers in trying.

The California State Personnel Board, in obtaining junior civil engineers for the Highway Department, contacted schools across the Nation early last year. It found about 2,640 interested enough to take the examination, and obtained a list of 1,300 eligibles, of which 675 were appointed, the remainder presumably taking employment elsewhere. This year only about 1,080 were interested.

Junior Civil Engineer

California sets up the following in its announcement:

"*Facts About the Position:*

"Under supervision, a Junior Civil Engineer assists in engineering work related to land, hydraulics, roads, bridges, wharves, piers, dams, levees, and similar works; acts as instrument man on a surveying party; keeps survey and construction notes; makes engineering calculations; does simple design work and drafting work; makes maps, charts, and diagrams; acts as inspector on highway construction and structural steel, concrete and timber construction; makes tests, or takes samples for laboratory analysis on materials being used for construction projects; makes field inspections of existing structures to determine deterioration or defects; assists in the preparation of construction reports and estimates; and does other work as required.

"*Scope of the Examination:*

1. Knowledge of the basic principles of physics, chemistry, and mathematics as applied to civil engineering.
2. Knowledge of surveying.
3. Knowledge of hydraulics.
4. Knowledge of stress analysis and mechanics.
5. Knowledge of the strength, properties, and uses of engineering construction materials.
6. Familiarity with the methods and equipment of engineering construction.
7. Familiarity with engineering economics and with the common descriptions of real property.

"All candidates must possess the personal qualifications generally recognized as essential in good public employees including integrity, initiative, dependability, courtesy,

good judgment, and ability to work cooperatively with others."

Paul Cohen in an article on "The Shortage of Engineers" stated: "Of the various shortages currently facing the American economy, none is potentially more serious than the scarcity of engineers."

Raymond Archibald at the Western Association of State Highway Officials said: "You do not need to be told there is a shortage of engineering manpower because you are faced with that situation today, but the real problem is ahead of us because prospects of relieving that shortage in the future are on the minus side. Graduate engineering students will not fill the demand and the number graduating is on the decline. Conservative estimates indicate that in three or four years the colleges will be sending us only one-third of the highway engineers actually needed. We will have to do with fewer engineers what we are committed to do, and find means of doing it."

A national program by the U. S. Labor Department and engineering groups for alleviating the shortage of engineers includes:

1. Making maximum use of engineers already employed.
2. Making better use of supporting nonengineering personnel.
3. Making more exhaustive use of training facilities.

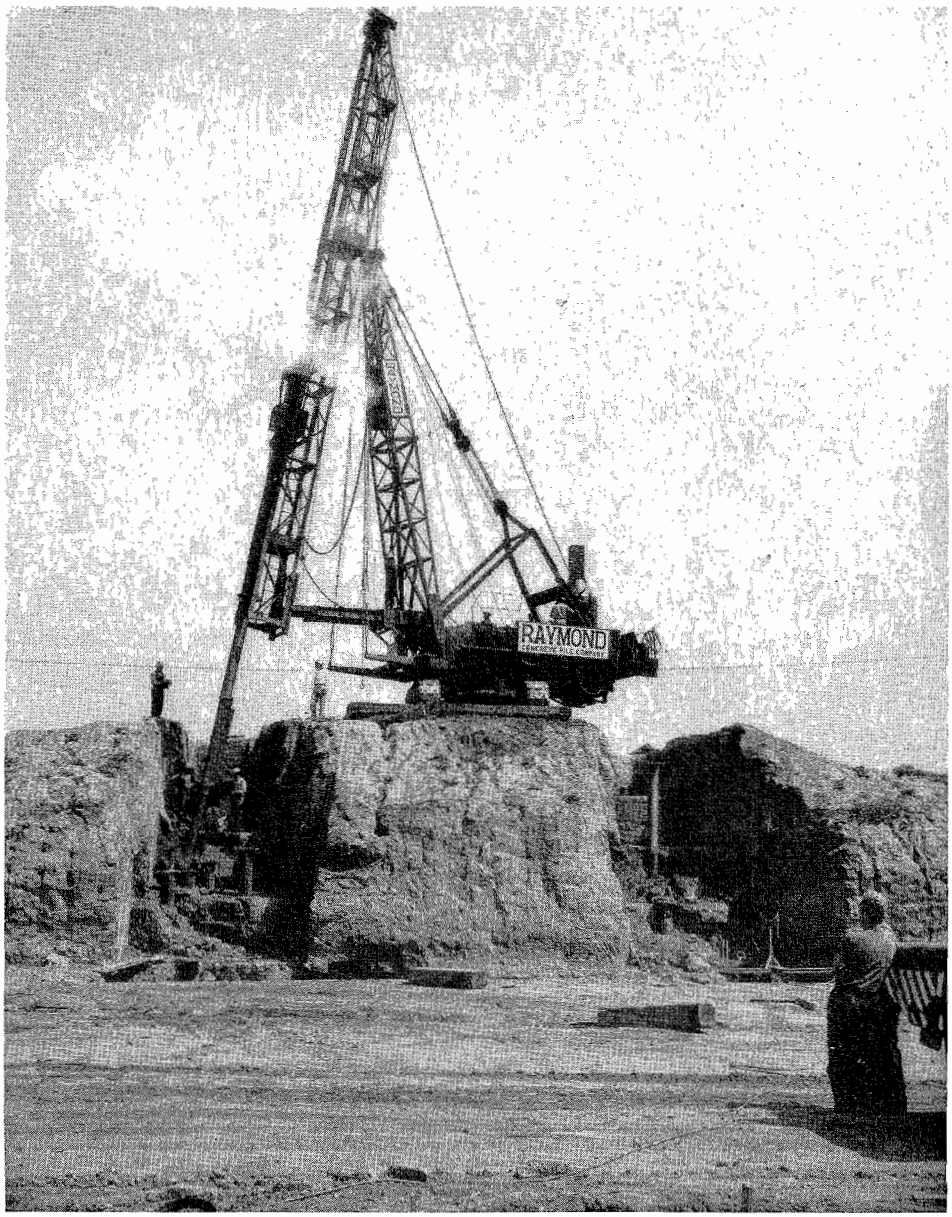
While aerial surveying and radio communication cut down the ground work for the field and improved equipment aids the office force, the demand for trained engineers is still increasing. If you have a son or friend in high school or entering college, tell him of the shortage of engineers.

COMMISSIONER BAKER BUSY MAN

Highway Commissioner Harrison R. Baker of Pasadena has reluctantly refused reappointment to the city planning commission of his home city because of the pressure of state business.

Mr. Baker was senior member of the planning commission, having served on it continuously since June 27, 1929. He was first appointed to the California Highway Commission by Governor Warren in 1943. He advised Mayor Alson E. Abernethy of Pasadena that increasing work on highway matters made it necessary for him to resign from the planning commission.

AN UNUSUAL PILE-DRIVING PROJECT



On the Ramona Freeway in Los Angeles, approximately 22,000 lineal feet of piles are being driven under conditions such as depicted in the above photograph. As the photograph shows, both batter and plumb piles are being driven and the one pile-driving rig is doing the entire job. The weight of this piece of equipment with all attachments is over 100 tons.

The work is being done by the Raymond Concrete Pile Company for the contractor, Griffith Company of Los Angeles, under plans and specifications prepared by the State Division of Highways.

RUSH-HOUR DRIVING

Little time is saved by weaving from lane to lane and trying to hurry through rush-hour traffic on streets and highways. Your chances of an accident are much less if you stay in your own lane, and you'll get to your destination in just as good time.

Freeway Between Grass Valley and Nevada City Planned

CONSTRUCTION of a four-lane divided freeway between Grass Valley and Nevada City has been brought a step nearer as a result of route adoptions by the California Highway Commission.

The actions were taken following receipt of resolutions from the city councils of Nevada City and Grass Valley, and from the Nevada County Board of Supervisors, all stating that a hearing by the Highway Commission was not considered necessary before final decision by the commission.

Altogether nearly eight miles of relocation of existing routes are involved. The recommendations of the Division of Highways, as adopted by the commission, were based on an origin and destination survey of the traffic and also on studies made with the assistance of local authorities and civic groups to determine the best location considering present and anticipated future needs of through and local traffic.

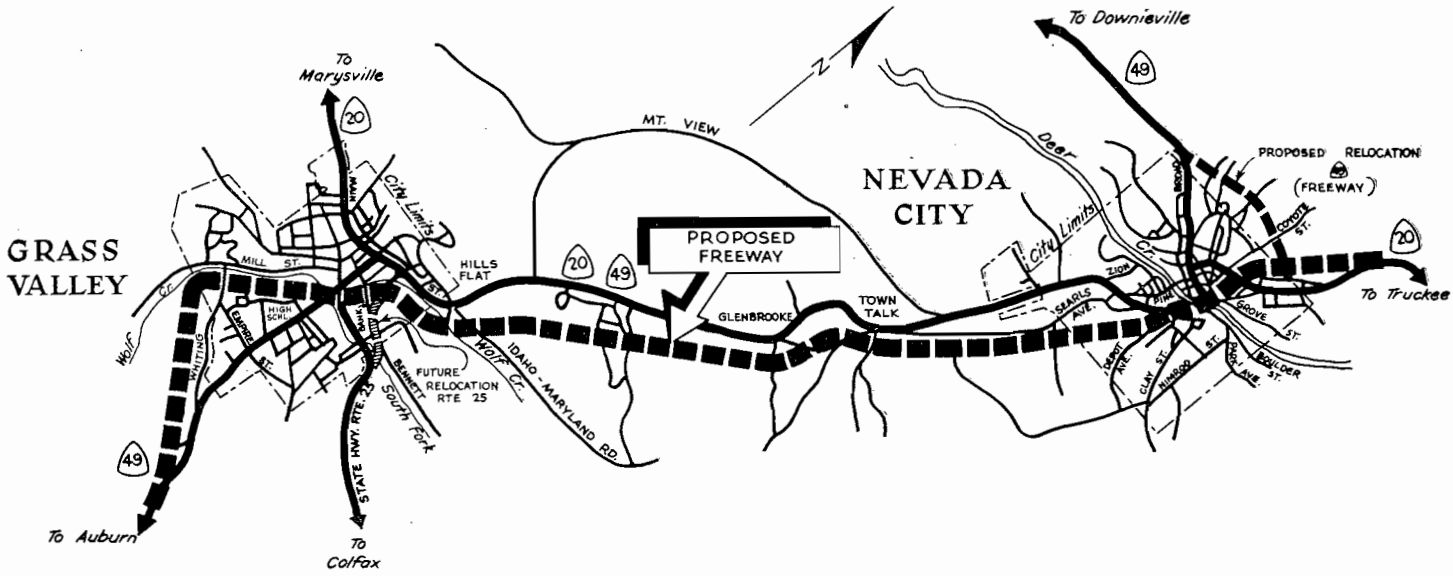
One of the important features of the proposed plan is the removal of Sign Route 49 from Broad Street in Nevada City. Most of the streets in the historic mining centers of Grass Valley and Nevada City are unsuited to large volumes of through traffic, with the complication of a high percentage of large trucks. Broad Street in Nevada City presents a particular problem in this respect because of its steepness. The people of Nevada City and the state engineers are particularly desirous of accomplishing relocation of this portion of Sign Route 49.

Several highway grade separations and other structures are included in the proposed design for the new freeway.

The joint section of Sign Routes 20 and 49 serves both the important north-south Mother Lode Highway and the east-west Tahoe-Ukiah lateral, as well as the fast growing local traffic.

Rolling grades, curving alignment, narrow width and roadside development made the present highway between Grass Valley and Nevada City congested and inadequate.

Funds are not immediately available for construction. Several years will be required for rights of way purchase alone and decision will then have to be reached as to which portion of the relocations will be constructed first.



The routings adopted and declared freeways are as follows:

On State Sign Route 49, from three-fourths of a mile south of Grass Valley to Sign Route 20 in Grass Valley; thence along a new joint routing of Sign Routes 20 and 49 to the east city limits of Nevada City. At that point, the relocation of Sign Route 20 continues northeasterly for one-half mile to a junction with the existing route leading toward U. S. 40 by way of Bear Valley. The proposed relocation of Sign Route 49 toward Downieville from the new junction of Sign Route 20 at the north city limits of Nevada City is nearly a mile in length, rejoining existing Sign Route 49 near the northwest corner of the city limits of Nevada City.

MAGAZINE INFORMATION

EDWARD R. BACON COMPANY

San Francisco 10, California

MR. KENNETH C. ADAMS, *Editor*

DEAR MR. ADAMS: Over a period of many years which we have been receiving this magazine we believe it to be the most outstanding magazine of its kind. We have a complete file since 1935 and many times they are referred to for information.

Thanking you for renewing our listing.

Yours very truly,

EDWARD R. BACON COMPANY,

H. J. LEARN, Manager,

Fresno Branch

State Employees Save Taxpayers Money With Ideas

CALIFORNIA taxpayers were saved $81,130 in the first eight months of 1952 through the Employee Suggestion Plan that resulted in significant departmental savings and increased efficiency.

The State's Merit Award Board, in recognizing alert and conscientious employees who submit money-saving ideas, announce that more than 100 state civil service employees had their suggestions adopted so far this year. Of these, 62 were cash winners, ranging from $5 to $500.

State departments which benefited from monetary savings awarded a total of $2,525 to employees on recommendation of the Merit Award Board which surveys submitted ideas and investigates their practicability.

Actual cost to the State in awarding cash was slightly more than 2 cents of every dollar saved as a result of adopting the ideas.

INFORMATION SOURCE

COUNTY OF LOS ANGELES
Road Department

DEAR SIRS: I am presently employed by the Los Angeles County Road Department as a civil engineer assistant in the Location and Design Section of the Construction Division.

I've recently had the pleasure of seeing a copy of your publication, *California Highways and Public Works*, and was very greatly enthused by the wealth of valuable information it contains.

I would appreciate it if you would consider me for your mailing list because I'm sure that I will find your magazine very instructive and applicable to a great deal of my work. It is certainly one of the finest sources of information that I've seen in the field of highway and road design.

Very sincerely,

J. RAMIREZ

LITTLE JUNIOR DOES BIG JOB

By W. D. SEDGWICK, Assistant District Engineer

THE LARGE highway vacuum cleaner now operating in District VII has recently been receiving considerable publicity, but now we want to introduce "Junior," a small-size vacuum cleaner and sweeper which is also doing a fine job. We have a 48-inch Wilshire power sweeper which is so small that it can easily be transported between jobs on a tilt-trailer that can be towed behind a three-quarter-ton pickup truck.

Junior is used to clean the gutters in the small cities and towns like Hueneme, Camarillo, Somis and Ojai. It is also used to advantage in sweeping the railroad underpasses and cleaning up around curb returns at channelized intersections where there are always unsightly accumulations.

Junior does much that did not get done at all before we had it. It is efficient and economical in operation. It replaces four men with brooms, thus making them available for other much needed maintenance work that could not otherwise be accomplished due to limited maintenance funds which keep allowable manpower to a minimum.

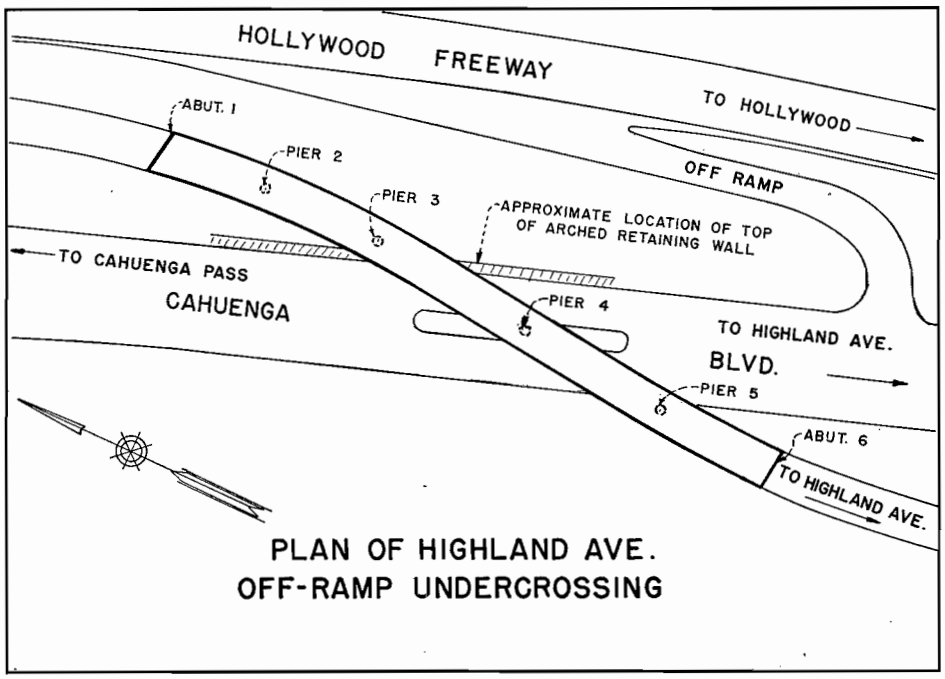
Unusual Problem

Bridge Footings Are Revised To Clear Obstruction

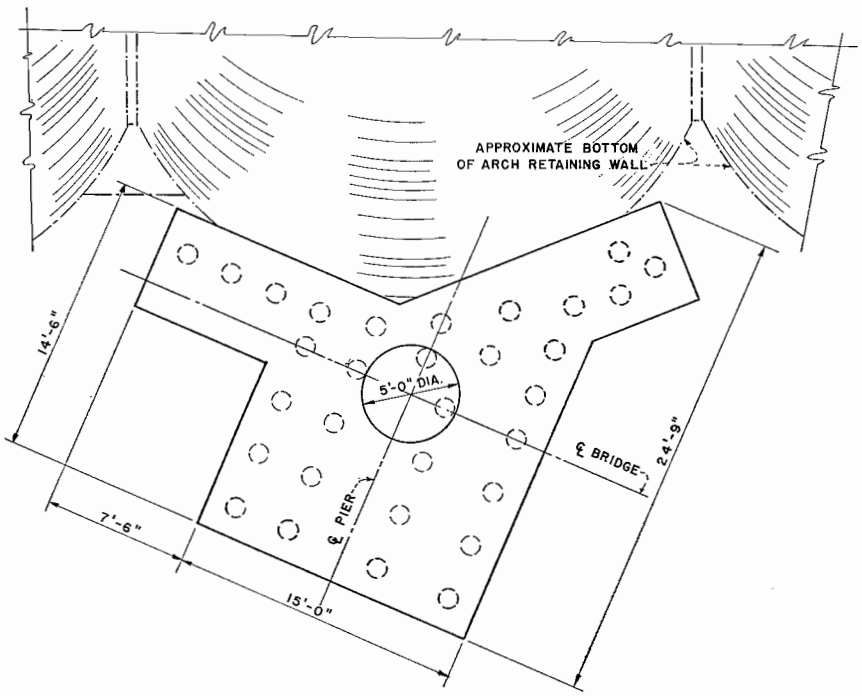
By JASON PLOWE, Senior Bridge Engineer

WHEN EXCAVATION for footings of the Highland Avenue Off-ramp Undercrossing on Hollywood Freeway was started an unexpected and unique obstruction was encountered. This proved to be a long buried concrete arch and buttress-type retaining wall. As this wall interfered with pier footings 3 and 4 of the new bridge, exploration of the area by means of drilling was necessary to determine the exact location of the old wall with respect to the footings of the bridge.

With work already started a speedy determination of the extent and location of the old wall was required. Two drilling crews were immediately sent to the site and put down 17 holes aggregating over 700 feet. With the information secured from this drilling, revised footing details for two piers which the original plans placed over the wall, could be made. To save time the revised footing plans were prepared on the job by the writer.



PLAN OF HIGHLAND AVE. OFF-RAMP UNDERCROSSING



PIER 4 FOOTING PLAN

Change in Design

As originally planned the bridge was of the continuous concrete box girder type. The piers were single circular columns; Pier 3 was to be supported on concrete piles and Pier 4 on a spread footing. The buried wall was found to be 50 feet high with 30-foot barrel arch spans.

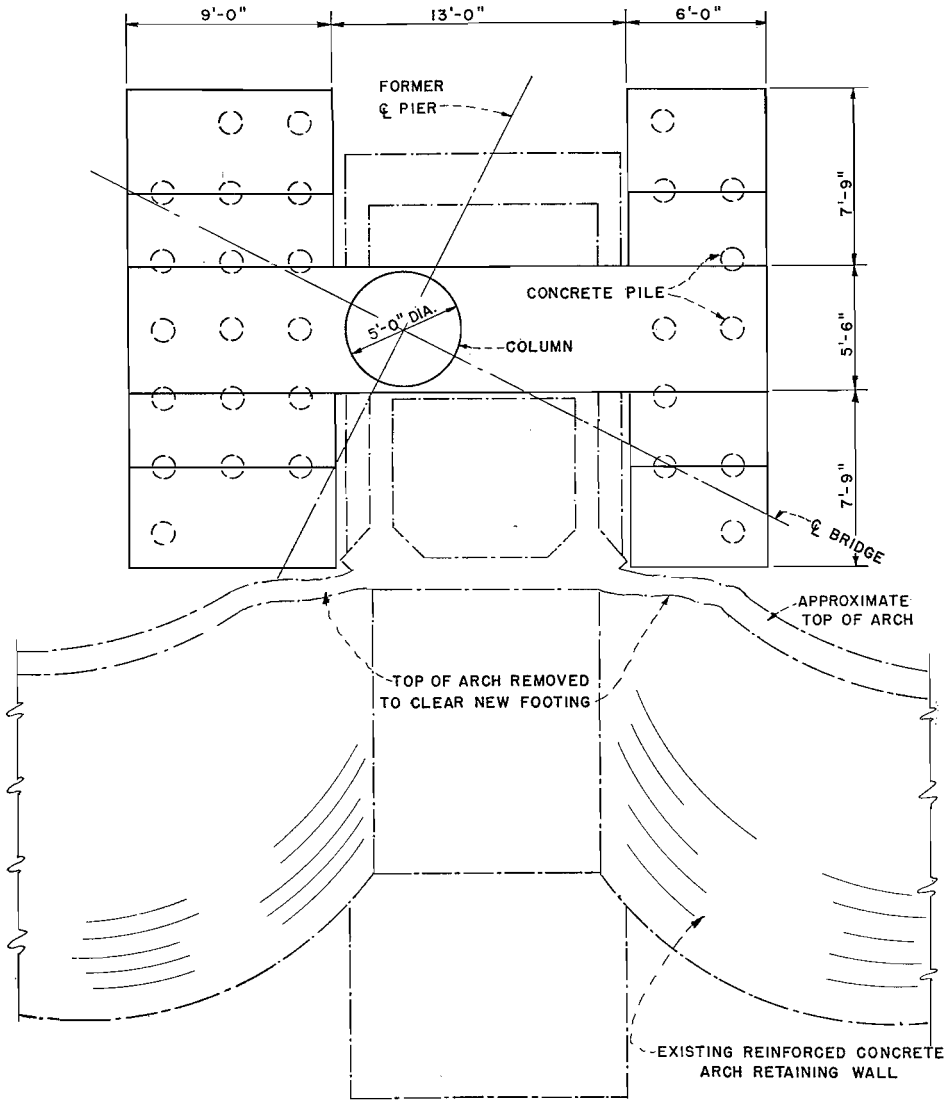
In the revised scheme at Pier 3, the column was supported upon a reinforced concrete beam which straddled the old wall. This beam in turn rested upon concrete pile footings which were clear of the wall; the whole being H-shaped in plan.

Pier 4 of the new structure was located with its footing center a few feet from the rear face of the old retaining

wall arch and about midway between buttresses. For the revised footing concrete piles were grouped around the contour of the obstructing arch. This retained a fairly simple pile-driving layout in an obstruction-free area. The new concrete footing was heavy slab construction roughly Y-shaped in plan as required by the relocated piles.

Thus, a blanket of earth and paving materials covers another evidence of a struggle with the difficulties and problems encountered in building bridge substructures below the ground level. The trim and finished lines of the bridge columns and girders tell little of the efforts necessary to properly support them. Foundations may sometimes appear as ugly ducklings better to be covered up with a mantle of earth but this does not belie the fact that without proper bridge foundations the sturdiest bridge superstructure will have little value.

Drilling crews operated under the supervision of T. L. Sommers, Associate Engineer Geologist; C. J. Verner was Resident Engineer on bridge construction and Bongiovanni Construction Company, general contractor.



PIER 3 FOOTING PLAN

Shasta Lake

Continued from page 49 . . .

half the Kamloops were put in the lake. The other half of the trout were kept as brood stock.

This was three years ago. Since then other plantings have been made and are continuing. The first trout put in the lake had some fins clipped so they could be later identified. Some have been caught up to 28 inches in length and to a weight of eight pounds. From here on they will grow faster.

How about the native rainbow? They are doing well, thank you, and if they were not overshadowed by the bass and Kamloops they would really be getting attention in their own right.

Kamloops Incorporated

This year Kamloops Incorporated held its first annual convention. The members met on an area leased from the Forest Service on the McCloud arm of Shasta Lake. It was an overnight affair. In fact, most everyone came Friday and went home Sunday. Over 200 members brought their sleeping bags and bedded down under the stars. Governor Warren was among the notables who attended. They all reported a wonderful time. The success of this year's meeting undoubtedly means a still larger attendance next year.

What effect has this had on highway travel? There were 222,780 registrants at the Vista House at Shasta Dam last year. By August 1st of this year, 157,515 had registered; 40,770 of these came in the month of July. Many others did not register.

Just why is all this so important to the Division of Highways? Every one of these visitors to the Vista House at the dam and all these fishermen come in and depart over U. S. 99. By all indications there will be a heavy increase in the number of sportsmen. Visitors may see Shasta Dam once and be satisfied, but a person who has a successful fishing trip is only satisfied if he can come again.

HIGHWAY BIDS AND AWARDS

July, 1952—Continued

ALAMEDA COUNTY—Between 2.3 miles east of Redmond Overhead and Greenville, about 6.7 miles to be surfaced with plant-mixed surfacing on cement treated base material and portions to be reconstructed. District IV, Route 5, Section E. Clements & Co., Hayward, $260,389; M. J. B. Construction Co., Stockton, $292,226; Fredrickson & Watson Construction Co., Oakland, $295,744; Harms Bros., Sacramento, $295,817. Contract awarded to Lee J. Immel, San Pablo, $249,921.50.

ALAMEDA COUNTY—In the City of San Leandro, between north city limits and San Leandro Creek, about 0.7 mile, the outer lanes to be reconstructed with plant-mixed surfacing on cement treated base. District IV, Route 105. Lee Construction Co., San Leandro, $79,996; Lee J. Immel, San Pablo, $81,073; J. Henry Harris, Berkeley, $81,155. Contract awarded to Independent Construction Co., Oakland, $75,077.50.

DEL NORTE COUNTY—At Crescent City maintenance station, superintendents office building to be constructed. District I, Route 1, Section C. Osborne-Wheelon Construction Co., Crescent City, $6,595. Contract awarded to A. R. Ogburn, Crescent City, $6,200.

FRESNO COUNTY—At Whites Bridge, across Kings Slough, about 2.7 miles south of Mendota, a reinforced concrete bridge and approaches surfaced with plant-mixed surfacing to be constructed. District VI, Route 41, Section P. Thomas Construction Co., Fresno, $115,476; E. G. Perham, Los Angeles, $127,806; George Pollock Co., Sacramento, $129,-373; C. B. Tuttle, Long Beach, $133,485; Tumblin Co., Bakersfield, $141,846. Contract awarded to Baun Construction Co., Fresno, $108,551.

HUMBOLDT COUNTY—At Shively Bluffs, about 0.2 mile to be graded and surfaced with plant-mixed surfacing on cement treated base and slope protection to be constructed. District I, Route 1, Section D. Fredrickson Bros., Emeryville, $196,-043; Eaton & Smith, San Francisco, $208,888; J. Henry Harris, Berkeley, $216,762. Contract awarded to Humboldt Constructors, Inc., Eureka, $182,203.

HUMBOLDT COUNTY — Between Gannon Slough and 0.9 mile north of Plaza Avenue, about 2.9 miles to be graded and portions to be surfaced with plant-mixed surfacing on imported base material or cement treated base. District I, Route 1, Sections H, Arc., I. Ball & Simpson, Berkeley, $671,-065; Guy F. Atkinson Company, South San Francisco, $694,099; Ukropina, Polich & Kral, San Gabriel, $784,609. Contract awarded to Mercer, Fraser Company & Mercer, Fraser Gas Co., Inc., Eureka, $629,293.70.

KERN COUNTY—Between east city limits of Bakersfield and 1.4 miles east of Route 143, about 4.9 miles to be surfaced with plant-mixed surfacing and corrugated metal pipe culvert to be installed. District VI, Route 58, Section C. Dicco, Inc., Bakersfield, $74,917. Contract awarded to Griffith Company, Los Angeles, $66,761.

LAKE COUNTY—At Dry Creek and Dry Creek Overflow, about ½ mile west of the junction of routes 89 and 49 in Middletown, two reinforced concrete bridges to be constructed and about 0.3 mile of approaches thereto to be graded and surfaced with road-mixed surfacing on cement treated imported base material and a seal coat to be applied thereto. District I, Route 89, Section B. Arthur B. Siri, Inc., Santa Rosa, $89,242; Lefever & Bing, West Sacramento, $91,399; Al Erickson & Co., Napa, $96,835; O'Connor Bros., Red Bluff, $97,003; J. Henry Harris, Berkeley, $97,777. Contract awarded to Harold Smith, St. Helena, $81,284.50.

LOS ANGELES COUNTY—On Harbor Freeway, at 11th and 12th Streets in the City of Los Angeles, two reinforced concrete box girder bridges to be constructed and city streets to be graded and paved. District VII, Route 165. J. E. Haddock, Ltd., Pasadena, $369,934; George W. Peterson, Jack W. Baker, Los Angeles, $372,658; Oberg & Cook, Gardena, $373,695; W. J. Disteli, Los Angeles, $382,-464; Ukropina, Polich & Kral, Baldwin Park, $393,-011; Charles MacClosky Co., San Francisco, $396,890; Byerts & Sons & Geo. K. Thatcher, Los Angeles, $419,910; FEPCO, Los Angeles, $484,026. Contract awarded to Obert Bros. Construction Co., Inglewood, $352,246.

LOS ANGELES COUNTY—On Santa Ana Freeway between Orr and Day Road and Pioneer Boulevard, about one mile to be graded and surfaced with Portland cement concrete pavement on cement treated subgrade; interchange roadways, acceleration and deceleration lanes to be surfaced with plant-mixed surfacing on untreated rock base; and a bridge over the Southern Pacific Railroad tracks to be constructed, to provide a freeway with a four-lane divided roadway. District VII, Route 166, Section A. J. E. Haddock, Ltd., Pasadena, $731,832; Griffith Company, Los Angeles, $785,610; A. Teichert & Son, Inc., Sacramento, $802,595; J. A. Thompson & Son, Contractors, Inglewood, $832,485; Webb & White, Los Angeles, $887,722. Contract awarded to Ukropina, Polich & Kral, San Gabriel, $694,419.50.

LOS ANGELES COUNTY—Between Washington Boulevard and Flory Drive, about 0.5 mile to be widened and paved with asphalt concrete. District VII, Route 170, Section A. Vido Kovacevich Co., South Gate, $128,501. Contract awarded to J. E. Haddock, Ltd., Pasadena, $118,290.

LOS ANGELES COUNTY—On Artesia Street between Long Beach Boulevard and east city limits of Long Beach (Downey Avenue), about 2.4 miles, a graded roadbed to be constructed and surfaced with asphalt concrete pavement on untreated rock base; portions of the existing roadbed to be surfaced with asphalt concrete pavement on existing pavements; and seal coats to be applied to provide a four-lane divided highway. District VII, Route 175. J. E. Haddock, Ltd., Pasadena, $366,062; Vido Kovacevich Co., South Gate, $367,571; Warren Southwest, Inc., Torrance, $395,213; Griffith Co., Los Angeles, $400,-377; C. O. Sparks, Inc., & Mundo Engineering Co., Los Angeles, $413,081. Contract awarded to M. S. Mecham & Sons, South Gate, $360,727.50.

MENDOCINO COUNTY—Across Ten Mile River, about 7.6 miles north of Fort Bragg, a timber trestle detour bridge on timber pile bents to be constructed. District I, Route 56, Section F. Lord & Bishop, Sacramento, $45,350; Al Erickson & Co., Napa, $48,296; Humboldt Constructors, Inc., Eureka, $49,930. Contract awarded to LeBoeuf-Dougherty Contracting Co., Richmond, $41,695.

MONTEREY COUNTY—Between 25 miles and 55 miles south of Monterey, 10 cattle passes to be replaced. District V, Route 56, Sections C, D, F. N. M. Saliba Co., Los Angeles, $68,860; Thomas Construction Co., Fresno, $74,296; Granite Construction Co., Watsonville, $86,715; C. B. Tuttle, Long Beach, $95,899. Contract awarded to E. G. Perham, Los Angeles, $58,796.50.

NAPA COUNTY—Between 1.9 miles north of Union Station and 2.7 miles south of Yountville, about 1.7 miles to be widened and surfaced with plant-mixed surfacing on cement treated base and existing Portland cement pavement to be resurfaced with plant-mixed surfacing. District IV, Route 49, Section B. E. A. Forde Co., San Anselmo, $94,839; Munn and Perkins, Modesto, $108,752; A. G. Raisch Co., San Rafael, $122,912. Contract awarded to J. Henry Harris, Berkeley, $94,299.

RIVERSIDE COUNTY—Between Route 64 and Nuevo Road, about 4.7 miles to be graded and surfaced with plant-mixed surfacing on cement treated base, two reinforced concrete overcrossings and nine reinforced concrete bridges to be constructed and highway lighting system to be installed. District VIII, Route 78, Sections C, Per, D. Matich Bros. & Matich Bros. Paving Co., Colton, $737,444; George Herz & Co., San Bernardino, $760,024; Ukropina, Polich & Kral, San Gabriel, $767,735; J. A. Payton Co., Riverside, $774,551; Griffith Company, Los Angeles, $803,991; A. Teichert & Son, Inc., Sacramento, $822,425; J. E. Haddock, Ltd., Pasadena, $925,640. Contract awarded to E. L. Yeager Co., Riverside, $725,672.65.

SAN BERNARDINO COUNTY—Between Euclid Avenue and Archibald Avenue, eight reinforced concrete bridges to be constructed. District VIII, Route 26. Guy F. Atkinson Co., Long Beach, $753,-588; Charles MacClosky Co., San Francisco, $765,-330; Ukropina, Polich, Kral, San Gabriel, $776,292; J. E. Haddock, Ltd., Pasadena, $826,253. Contract awarded to W. F. Maxwell, Los Angeles, $724,-873.10.

SAN BERNARDINO COUNTY—Between Route 192 and Pipe Line Avenue, about 5.1 miles, existing roadbed to be widened with imported base material and plant-mixed surfacing to be placed over existing surfacing and widened roadbed. District VIII, Route 77, Section A. R. A. Erwin, Colton, $73,940; E. L. Yeager Co., Riverside, $74,830; George Herz & Co., San Bernardino, $75,183; Matich Brothers, Colton, $82,700. Contract awarded to J. E. Roberts, San Bernardino, $72,275.

SAN DIEGO COUNTY—Between Del Mar and Encinitas, about 5.2 miles, additional roadway widths to be graded, cement treated base and plant-mixed surfacing to be placed and bridges across San Dieguito River and San Elijo Lagoon to be widened. District XI, Route 2, Section A. Griffith Company, Los Angeles, $704,888; J. E. Haddock, Ltd., Pasadena, $714,182. Contract awarded to R. E. Hazard Contracting Co., San Diego, $585,385.80.

SAN DIEGO COUNTY—Between 0.5 mile south of Nestor and Palm Avenue, in Palm City, about 1.1 miles to be graded and surfaced with plant-mixed surfacing on cement treated base and reinforced concrete bridge to be constructed. District XI, Route 2, Section G. R. E. Hazard Contracting Co., San Diego, $359,209. Contract awarded to Griffith Co., Los Angeles, $340,704.50.

SAN DIEGO COUNTY—Between 3 miles west of Route 77 and Route 77 at Miramar, about 3.2 miles to be graded and surfaced with plant-mixed surfacing on untreated rock base. District XI, Miramar Road. R. E. Hazard Contracting Co., San Diego, $223,494; Daley Corp., San Diego, $229,385; Griffith Co., Los Angeles, $255,280. Contract awarded to Cox Bros. Construction Co., Stanton, $216,962.20.

SAN FRANCISCO COUNTY—On 13th Street between Mission Street and Route 68, the superstructure and a portion of the substructure for a portion of a bridge and miscellaneous road work to be constructed. District IV, Route 2. Peter Kiewit Sons' Co., San Francisco, $2,926,032; Guy F. Atkinson Co., South San Francisco, $2,972,669; Granite Construction Co., Watsonville, $3,019,520; Fredrickson & Watson Construction Co. & M & K Corp., Oakland, $3,026,122; Bates & Rogers Construction Corp. & J. H. Pomeroy & Co., San Francisco, $3,026,-240; William & Burrows, Inc. & Carl N. Swenson Co., Inc., Burlingame, $3,188,967; Ukropina, Polich & Kral, Baldwin Park, $3,303,608. Contract awarded to Chas. L. Harney, San Francisco, $2,905,604.15.

SAN JOAQUIN COUNTY—Between Alameda county line and Janney Station, about 3.7 miles to be surfaced with plant-mixed surfacing. District X, Route 5, Section A. Stephens Trucking Co., French Camp, $109,865; Clements & Co., Hayward, $119,-975; Louis Biasotti & Son, Stockton, $124,629; Munn & Perkins, Modesto, $128,517; A. Teichert & Son, Inc., Sacramento, $128,752; J. Henry Harris, Berkeley, $129,168; Harms Bros., Sacramento, $136,032. Contract awarded to M. J. Ruddy & Son, Modesto, $109,595.80.

SAN LUIS OBISPO COUNTY—Between Bellevue School and Santa Fe Bridge intersection, about 0.24 mile to be graded and surfaced with plant-mixed surfacing on cement treated base. District V, Route 2, Section E. Granite Construction Co., Watsonville, $32,217; Madonna Construction Co., San Luis Obispo, $36,741; Thomas Construction Co., Fresno, $39,465; M. J. B. Construction Co., Stockton, $41,468; Walter Bros. Construction, San Luis Obispo, $46,068. Contract awarded to Hermreck & Easter, $29,765.15.

SAN LUIS OBISPO, MONTEREY, MADERA, KERN, TULARE, FRESNO COUNTIES—Sealing pavement joints at various locations. District V. Dana R. Tyson Co., Sacramento, $49,990; James M. Pope, Long Beach, $63,592; N. M. Saliba Co., Los Angeles, $63,936. Contract awarded to Concrete Pavement Maintenance Co., San Francisco, $45,832.

SANTA BARBARA COUNTY—Between three miles west of San Luis Obispo County line and San Luis Obispo County line, about 2.8 miles to be surfaced with road-mixed surfacing and bituminous surface treatment applied to shoulders. District V, Route 57, Section D. Granite Construction Co., Watsonville, $47,055; J. E. Roberts, San Bernardino, $52,975. Contract awarded to Hermreck & Easter, Santa Maria, $37,562.

SANTA CLARA COUNTY—Portions between Three Oaks Way near Saratoga and Main Street in Los Gatos, about 1.3 miles, to be surfaced with plant-mixed surfacing, untreated rock base and cement treated base. District IV, Route 42, Sections A, LGts. A. J. Raisch Paving Co., San Jose, $105,312; Leo F. Piazza Paving Co., San Jose, $106,194; Granite Construction Co., Watsonville, $132,479; J. Henry Harris, Berkeley, $132,558. Contract awarded to L. C. Smith Company, San Mateo, $103,479.60.

SANTA CLARA COUNTY—On Bayshore Highway at Taylor Street-Maybury Road, San Antonio Street, Story Road; and Tully Road, in and near the City of San Jose, full traffic-actuated signal system to be furnished and installed, highway lighting to be modified, and channelization to be constructed at two intersections, highway lighting to be furnished and installed at one intersection, and flashing beacons to be furnished and installed at one intersection. District IV, Route 68, Sections SJs, C. Howard Electric Co., Gilroy, $63,560; A. J. Raisch Paving Co., San Jose, $64,141; J. Henry Harris, Berkeley, $71,-269. Contract awarded to R. Flatland, San Francisco, $58,888.

SHASTA COUNTY—At Hatchet Creek, about 0.6 mile of existing roadway to be widened and portions surfaced with plant-mixed surfacing on cement treated base. District II, Route 28, Section C. O'Connor Bros., Red Bluff, $34,915. Contract awarded to Fredrickson & Watson Construction Company, Oakland, $33,446.20.

SOLANO AND NAPA COUNTIES—Between 0.7 mile east of Route 208 and Cordelia Underpass, about 5.5 miles, existing roadbed to be reinforced with cement treated base and surfaced with plant-mixed surfacing. District X, Route 7, Sections G, H, A. Fredrickson Bros., Emeryville, $339,230; Harms Bros., Sacramento, $351,618; Parish Bros., Benicia, $354,444. Contract awarded to Peter Kiewit Sons' Co., Arcadia, $335,592.

SONOMA COUNTY—At Tolay Creek, near Sears Point, about 0.1 mile of main roadbed and 0.1 mile of detour roadbed to be constructed and surfaced with plant-mixed surfacing. District IV, Route 208, Section A. A. G. Raisch Co., San Rafael, $24,484; J. Henry Harris, Berkeley, $25,994; E. A. Forde Co., San Anselmo, $26,297; Harms Bros., Sacramento, $26,861; Huntington Bros., Napa, $28,501. Contract awarded to Parish Bros., Benicia, $21,041.75.

SUTTER COUNTY—Between 0.2 mile west of Onstott Road and Route 3 in Yuba City, about one mile, a four-lane divided highway to be graded and surfaced with plant-mixed surfacing on cement treated base. District III, Routes 15, 3, Sections B, YC, YC. W. H. O'Hair Company, Colusa, $296,045; Harms Bros., Sacramento, $323,240. Contract awarded to Rice Brothers, Inc., Marysville, $279,-407.89.

TRINITY COUNTY—At China Slide, about 1.5 miles east of Burnt Ranch Post Office, C. R. B. aggregate to be furnished and stockpiled. District I, Route 20, Section D. Granite Construction Company, Watsonville, $64,750; M. W. Brown, Redding, $67,500; Clements & Co., Hayward, $70,000; E. W. Simpson, Auburn, $84,000. Contract awarded to R. P. Shea Company, Indio, $54,000.

TUOLUMNE COUNTY—At Moccasin Creek, about 4.6 miles south of the junction of Routes 65 and 40, a reinforced concrete bridge to be constructed and about 0.3 mile of approaches to be graded and surfaced with plant-mixed surfacing on untreated rock base. District X, Route 65, Section B. Charles S. Moore and Robert R. Murdoch, Oakland, $75,979; Friant Construction Co., Fresno, $83,773; Lefever and Bing, West Sacramento, $89,399; Wheeler Construction Co., Oakland, $114,419. Contract awarded to Beerman and Jones, Sonora, $68,264.

F. A. S. County Routes

ALAMEDA COUNTY—On Crow Canyon Road between Route 5 in Castro Valley and Contra Costa County line, about 6.7 miles to be graded and surfaced with plant-mixed surfacing. District IV, Route 801. M. J. B. Construction Co., Stockton, $451,957; Clements & Co., Hayward, $462,275; Close Building Supply, Inc., Hayward, $467,634; J. R. Armstrong, El Cerrito, $472,351; Fredrickson Bros., Emeryville, $497,556; McCammon-Wunderlich Co., Palo Alto, $504,806; Harms Bros., Sacramento, $521,905. Contract awarded to Fredrickson & Watson Construction Co., Oakland, $426,249.90.

NAPA COUNTY—On Silverado Trail between Oak Knoll Avenue and Parker Hill, about 2.2 miles, to be graded, imported borrow and untreated rock base to be placed and seal coat to be applied. District IV, Route 607. Harold Smith, St. Helena, $74,-063; E. A. Forde Co., San Anselmo, $74,242; Huntington Bros., Napa, $79,549; Slinsen Construction Co., Napa, $79,966; J. Henry Harris, Berkeley, $86,494. Contract awarded to Munn & Perkins, Modesto, $68,567.50.

SIERRA COUNTY—Between 6.9 miles and 5.2 miles west of Loyalton, about 1.8 miles to be graded, imported base material placed, and treated with portland cement and penetration treatment to be applied. District III, Route 524. Lefever & Bing, West Sacramento, $59,446; Joe Chevreaux, Auburn, $59,857; Claude L. Youngs, Sacramento, $63,875; J. Henry Harris, Berkeley, $64,345; O'Connor Bros., Red Bluff, $65,212. Contract awarded to Harms Bros., Sacramento, $59,190.

SONOMA COUNTY — Petaluma-Valley Ford Highway, between 4 miles and 5.4 miles westerly of Petaluma, about 1.2 miles, to be graded and surfaced with plant-mixed surfacing on imported base material. District IV, Route 777. E. A. Forde Co., San Anselmo, $122,113; Lefever & Bing, West Sacramento, $122,328. Contract awarded to J. Henry Harris, Berkeley, $113,257.50.

August, 1952

CALAVERAS AND TUOLUMNE COUNTIES—Between 2 miles northwest and 0.2 mile south of the Calaveras-Tuolumne county line, a bridge to be constructed across the Stanislaus River, and about 1.1 miles in net length, a portion on new alignment, to be graded and surfaced with road-mixed surfacing on untreated rock base over imported subbase material, and other portions to be widened to provide material for approach embankments to the bridge. District X, Route 65, Sections C, A. Eaton & Smith, San Francisco, $468,759; Nomellini Construction Co., Stockton, $440,878.50; Lord & Bishop, Sacramento, $319,551.90; Lefever & Bing, West Sacramento, $318,090. Contract awarded to Granite Construction Co., Watsonville, $271,759.

INYO COUNTY—At Olancha Maintenance Station, a well to be drilled and cased. District IX, Route 23, Section J. Evans Bros., Lancaster, $2,576. Contract awarded to Frank Rottman, Lancaster, $2,410.

KERN COUNTY—Between Bear Mountain Ranch and west end of Tehachapi Overhead, about 10.8 miles in length, to be scarified and surfaced with plant-mixed surfacing over cement treated base. District VI, Route 58, Sections E and F. Clements & Co., Hayward, $300,029; Clyde W. Wood & Sons, Inc., North Hollywood, $293,507.05. Contract awarded to Griffith Co., Los Angeles, $274,452.10.

LOS ANGELES COUNTY—City of Pasadena, on Colorado Freeway, between Avenue 64 and Holly Street, highway lighting and illuminated sign systems to be furnished and installed. District VII, Route 161. Westates Electrical Construction Co., Los Angeles, $92,363; Electric and Machinery Service, Inc., South Gate, $91,765; C. D. Draucker, Inc., Los Angeles, $89,976; Newbery Electric Corporation, Los Angeles, $85,327. Contract awarded to Fischbach and Moore, Incorporated, Los Angeles, $79,386.

LOS ANGELES COUNTY—On Colorado Freeway in the City of Pasadena, between Avenue 64 and San Rafael Ave., a four-lane divided highway with frontage road and connections to be graded and surfaced with Portland Cement Concrete pavement and plant-mixed surfacing and three grade separation structures and a pedestrian undercrossing to be constructed. District VII, Route 161. J. E. Haddock, Ltd., Pasadena, $988,724.50. Contract awarded to Guy F. Atkinson Company, Long Beach, $958,873.

LOS ANGELES COUNTY—On Santa Ana Freeway, between 0.2 mile southeast of Lakewood Blvd. and Orr and Day Road, about 2 miles in length, to be graded and surfaced with Portland Cement Concrete pavement on cement treated subgrade; street connections, frontage road, inlets and outlets, and acceleration and deceleration lanes to be surfaced with plant-mixed surfacing on untreated rock base, and two over-crossing structures to be constructed to provide a freeway with a four-lane divided roadway. District VII, Route 166, Section A. Warren Southwest, Inc., Torrance, $1,119,942.20; Griffith Company, Los Angeles, $1,084,686.80; J. E. Haddock, Ltd., Pasadena, $1,077,453.40. Contract awarded to Ukropina-Polich Kral, San Gabriel, $958,841.50.

MADERA COUNTY—Between Arcola School and Madera, about 2.2 miles in length, cross-overs and road connections to be graded, imported base material to be placed and surfaced with plant-mixed surfacing, and right of way fence to be constructed. District VI, Route 4, Section A. J. Henry Harris, Berkeley, $95,273.50; Thomas Construction Company, Fresno, $84,697.20. Contract awarded to Baun Construction Company, Fresno, $82,473.

MONTEREY COUNTY—Across San Jose Creek and Dolan Creek, about 5 miles south of Monterey and about 6.5 miles north of Lucia, two existing bridges to be repaired. District V, Route 56, H, D. Bos Construction Co., Berkeley, $75,761.60; Barton Construction Company and K. S. Scheyer, Oakland, $54,322; N. M. Saliba Co., Los Angeles, $54,038; Laredon Const. Co., Los Angeles, $52,876.50; E. G. Perham, Los Angeles, $48,241. Contract awarded to Stolte, Inc., Monterey, $45,071.78.

SAN BERNARDINO COUNTY—At the intersection of Route 19 with Central Avenue, traffic signal system and highway lighting to be furnished and installed. District VIII, Route 19, Section A. Fischbach and Moore, Incorporated, Los Angeles, $17,961; Electric & Machinery Service, Inc., South Gate, $17,214. Contract awarded to Paul R. Gardner, Ontario, $16,931.

SAN BERNARDINO COUNTY—At Kramer railroad crossing, about 37 miles west of Barstow, about 0.5 mile of roadway to be graded and bituminous surface treatment to be applied. District VIII, Route 58, Section A. E. S. and N. S. Johnson, Fullerton, $49,936; Hubbs Equipment Company, Colton, $43,897.50; E. C. Young, San Fernando, $42,696; Matich Brothers, Colton, $37,032; Arthur A. Johnson, Laguna Beach, $34,829. Contract awarded to George Herz & Co., San Bernardino, $32,473.20.

SANTA BARBARA COUNTY—Across Santa Ynez River, about one mile north of Lompoc, repairs to an existing bridge, consisting of new piers, abutments, and spans to be constructed. District V, Route 56, Section C. Norman I. Fadel, North Hollywood, $286,816; Chas. McClosky Co., San Francisco, $274,730; O. B. Pierson, Bellflower, $251,-871.80; Dan Caputo, San Jose, $250,656; Granite Construction Co., Watsonville, $246,432; Thomas Construction Co., Fresno, $239,856.60. Contract awarded to Madonna Construction Co., San Luis Obispo, $221,592.

SANTA BARBARA AND SAN LUIS OBISPO COUNTIES—Between Montecito Separation and Park Place in Santa Barbara, portion between Hot Springs Canyon and Tequepis Canyon, and between 2.6 miles and 5 miles east of Route 56, a net distance of about 6.4 miles, plant-mixed surfacing to be placed on portion and a seal coat to be applied to other portions. District V, Routes 2, 80, 125, Sections B; A. Granite Construction Co., Watsonville, $25,778. Contract awarded to Valley Paving Company, Pismo Beach, $25,315.

SANTA CLARA COUNTY—Between Gilroy and 0.4 mile south of Sargent Overhead place protective screen planting in the areas within the medium strip and at bridge abutments. District IV, Route 2, Section C. Stephen L. Vistica, San Mateo, $11,-501.80; Watkin & Sibbald, San Anselmo, $11,474; Leonard Coates Nurseries, Inc., San Jose, $8,916.40; Justice-Dunn Co., Oakland, $7,502.28; Huettig-Schramm & Bennett, Inc., Palo Alto, $7,245.60. Contract awarded to Dana R. Tyson Co., Sacramento, $7,021.60.

SANTA CRUZ COUNTY—In the City of Santa Cruz, at Branciforte Creek, about 0.07 mile in length, the existing concrete bridge to be widened, the existing pavement to be widened with untreated rock base, and the widened portions and existing pavement to be surfaced with plant-mixed surfacing.

District IV, Route 56, in Santa Cruz. E. G. Perham, Los Angeles, $123,807.50; Dan Caputo, San Jose, $110,269. Contract awarded to Granite Construction Company, Watsonville, $92,272.

SOLANO COUNTY—Between Frese Corner and Putah Creek Bridge, about 2.6 miles in length, to be surfaced with plant-mixed surfacing. District X, Route 7, Section E. McGillivray Construction Company, Sacramento, $67,468.10; A. Teichert & Son, Inc., Sacramento, $53,290. Contract awarded to Fredrickson Bros., Emeryville, $42,242.50.

VENTURA COUNTY—Between Oakview Avenue and Route 151, about 2.3 miles in length, plant-mixed surfacing to be placed over existing pavement and on untreated rock base, and seal coat applied. District VII, Route 138, Section A. Baker and Pollock, Ventura, $47,745. Contract awarded to Jesse S. Smith, Glendale, $44,343.50.

YOLO COUNTY—Between 2 miles east of Yolo Causeway and Merkley Avenue, about 0.6 mile of storm drain system to be constructed. District III, Route 6, Section C. A. Teichert & Son, Inc., Sacramento, $51,394.50; B. J. Ukropina, T. P. Polich, Steve Kral, San Gabriel, $40,894; Lefever & Bing, West Sacramento, $38,199; L. G. Lentz, Sacramento, $35,805.60. Contract awarded to McGuire and Hester, Oakland, $32,826.

YOLO COUNTY—Between Esparto and Brown's Corner, about 12.2 miles in length, imported base material borders to be constructed, seal coat to be applied and existing drainage structures to be widened. District III, Route 50, Sections C and D. A. Teichert & Son, Inc., Sacramento, $212,753; B. J. Ukropina, T. P. Polich, Steve Kral, San Gabriel, $199,105.10; Harms Bros., Sacramento, $188,226.25. Contract awarded to Al. Erickson & Company and W. C. Railing, Woodland, $176,765.

YUBA COUNTY—Repairing a bridge across Yuba River at south city limits in Marysville. District III, Route 3, Section B, Marysville. Contract awarded to C. C. Gildersleeve, Grass Valley, $8,499.61.

F. A. S. County Routes

BUTTE COUNTY—Between Wade Road and Gridley, about 1.6 miles in length to be graded, imported base material and untreated rock surface to be placed and bituminous surface treatment to be applied. District III, Route 758. Contract awarded to Clements & Co., Hayward, $57,688.

GLENN COUNTY—Between Winslow Bridge at Stony Creek and Fruto, about 5.6 miles in length, to be surfaced with imported base material. District III, Route 531. W. H. O'Hair Co., Colusa, $91,185; O'Connor Bros., Red Bluff, $78,432; P. J. Moore & Son, Tracy, $64,255. Contract awarded to Lefever & Bing, West Sacramento, $61,970.

KERN COUNTY—Wheeler Ridge Road, between David Road and State Route 140, about 10 miles in length to be graded and surfaced with road-mixed surfacing on cement treated base. District VI, Route 574. Norman I. Fadel, North Hollywood, $427,622.50; Claude C. Wood Co., Lodi, $393,212.10; Granite Construction Company, Watsonville, $339,560; Clyde W. Wood & Sons, Inc., North Hollywood, $308,057.50; Baun Construction Company, Fresno, $280,890; Griffith Company, Los Angeles, $280.140.75. Contract awarded to Madonna Construction Co., San Luis Obispo, $254,155.

STANISLAUS COUNTY—On Lander Avenue, between the south city limits of Turlock and Merced County line about 2.2 miles in length, to be surfaced with plant-mixed surfacing. District X, Route 914. Standard Materials, Inc., Modesto, $29,935; B. J. Ukropina, T. P. Polich, Steve Kral, San Gabriel, $27,906.25. Contract awarded to M. J. Ruddy & Son, Modesto, $27,215.

SUTTER COUNTY—Between Striplin Road and Nicolaus Ave., about 3.0 miles in length to be graded, surfaced with imported base material and a penetration treatment and seal coat applied. District III, Route 1168. O'Connor Bros., Red Bluff, $133,557; Ted Schwartz, Grass Valley, $126,855; Clements & Co., Hayward, $115,745; P. J. Moore & Son, Tracy, $111,053.50; B. J. Ukropina, T. P. Polich, Steve Kral, San Gabriel, $109,167.15. Contract awarded to Lefever & Bing, West Sacramento, $105,000.

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ALAMEDA COUNTY—In the Cities of Alameda and Oakland, approaches to Bay Farm Island Bridge, a graded roadbed to be constructed and surfaced with plant-mixed surfacing on untreated rock base, over imported subbase material, and install a highway lighting system. District IV, Route 226. J. Henry Harris, Berkeley, $366,222.50; Gallagher & Burk, Inc., Oakland, $310,271. Contract awarded to Fredrickson & Watson Construction Co. and M & K Corporation, Oakland, $306,029.15.

EL DORADO COUNTY—Across South Fork American River, about 2.3 miles north of Placerville, the existing reinforced concrete arch bridge to be repaired. District III, Route 93, Section A. Al Erickson & Co., Napa, $31,786; Friant Construction Co., Fresno, $31,206; Barton Construction Co. and K. S. Scheyer, El Cerrito, $30,405. Contract awarded to Lord & Bishop, Sacramento, $30,217.50.

FRESNO AND MADERA COUNTIES—Between Kingsburg and one-half mile north of Berenda, right of way fences to be constructed and concrete access delineators to be placed. District VI, Route 4, Sections A, Fow.,B.; A,B. United States Steel Co., American Steel & Wire Division Cyclone Fence Department, Oakland, $49,345.40; Pacific Fence Co., Los Angeles, $46,781.10. Contract awarded The California Wire Cloth Corp., Oakland, $44,463.38.

FRESNO COUNTY—Between Clinton Avenue and Biola Junction, about 2.6 miles in length, existing pavement to be surfaced with plant-mixed surfacing. District VI, Route 4, Section C. Gene Richards, Fresno, $41,295. Contract awarded Stewart & Nuss, Inc., Fresno, $35,010.

FRESNO COUNTY—At Enterprise Canal, and at Dog Creek, about 2 miles and 6½ miles respectively northeast of Clovis, a reinforced concrete bridge, a box culvert and road approaches to be constructed. District VI, Route 76, Section A. Trewhitt-Shields & Fisher, Fresno, $47,717.50. E. G. Perham, Los Angeles, $47,038; Friant Construction Co., Fresno, $41,629.25; Wheeler Construction Co., Oakland, $39,799.50. Contract awarded Paul E. Woof, Fresno, $36,827.

FRESNO COUNTY—At Sales Creek (Location 1) and at Big Dry Creek (Location 2) about 2.6 miles northeast of Fresno. At Location 1, a reinforced concrete box culvert to be constructed and about 0.15 mile of roadway to be graded and bituminous surface treatment applied; and at Location 2, a reinforced concrete bridge to be constructed and about 0.2 mile of approaches to be graded and bituminous surface treatment applied. District VI, Route 76, Section B. E. G. Perham, Los Angeles, $79,848.50; Trewhitt-Shields & Fisher, Fresno, $76,505.95. Contract awarded Thomas Construction Co., Fresno, $68,802.35.

HUMBOLDT COUNTY—In Richardson Grove State Park, at Durphy Creek, about 0.04 mile in length, to be graded and a field-assembled metal plate culvert to be furnished and installed. District I. O'Connor Brothers, Red Bluff, $25,000; Reed & Tuttle, Redwood Valley, $22.260; A. C. Johnson & Sons, Eureka, $21,494.50; Pike & Hill, Carey Bros. & Bailey, San Rafael, $20,721.75; E. A. Forde Co., San Anselmo, $19,713.50. Contract awarded Dana R. Tyson Co., Sacramento, $16,134.20.

KERN AND TULARE COUNTIES—Between Bakersfield and Fresno county line, right of way fences to be constructed, and concrete access delineators to be placed. District VI, Route 4, Sections G,E; B,F,E. Wulfert Company, San Leandro, $31,783.10; United States Steel Co., Oakland, $27,324.96. Contract awarded The California Wire Cloth Corp., Oakland, $24,056.70.

LOS ANGELES COUNTY—On Harbor Freeway at Pico and Venice Boulevards, in the City of Los Angeles, two reinforced concrete box girder bridges to be constructed and city streets to be graded and paved. District VII, Route 165. Webb & White, Los Angeles, $510,251; Norman I. Fadel, North Hollywood, $499,453.50; Byerts & Sons, and George K. Thatcher, Los Angeles, $496,216; Charles MacClosky Company, San Francisco, $495,705; George W. Peterson and Jack W. Baker, Los Angeles, $489,339; J. E. Haddock, Ltd., Pasadena, $477,872.90; J. A. Thompson & Son, Contractors, Inglewood, $465,945.20; W. J. Disteli, Los Angeles, $465,179. Contract awarded Oberg Bros. Construction Co., Inglewood, $454,637.

LOS ANGELES COUNTY—At the intersection of Whittier Boulevard with Pioneer Boulevard and with Coffman-Pico Road; Rosemead Boulevard with Rush Street and with Lower Azusa Road, and in and adjacent to the City of Whittier, Norwalk Boulevard with Beverly Boulevard, fixed-time traffic system, semi-traffic-actuated signal system, full-traffic-actuated signal system and highway lighting to be furnished and installed, and channelization to be constructed. District VII, Routes 2, 168, 170; Sections D,C,B,Wit. Westates Electrical Construction Co., Los Angeles, $55,012.50; Electric & Machinery Service, Inc., South Gate, $54,620. Contract awarded Fischbach & Moore, Incorporated, Los Angeles, $52,918.90.

LOS ANGELES COUNTY—City of Los Angeles, on Arroyo Seco Freeway, between Sunset Boulevard and College Street, and in the four-level area, highway lighting and illuminated sign systems to be furnished and installed, street lighting system to be modified, and existing circuits to be completed. District VII, Route 165. Fischbach and Moore, Incorporated, Los Angeles, $46,525; Electric and Machinery Service, Inc., South Gate, $45,110; Westates Electrical Const. Co., Los Angeles, $43,365; C. D. Draucker, Inc., Los Angeles, $41,333; Newbery Electric Corporation, Los Angeles, $40,898; Ets-Hokin & Galvan, Wilmington, $33,124. Contract awarded A. S. Schulman Electric Company, Los Angeles, $33,056.

LOS ANGELES COUNTY—On Arroyo-Seco Freeway, between Sunset Boulevard and College Street, about 0.4 mile, to be graded and paved with Portland cement concrete and asphalt concrete. District VII, Route 165. George W. Peterson and Jack W. Baker, Los Angeles, $645,298; Norman I. Fadel, North Hollywood, $531,642; Webb & White, Los Angeles, $479,934.50. Contract awarded J. E. Haddock, Ltd., Pasadena, $479,915.80.

NEVADA COUNTY—Between 2.1 miles west of Rough & Ready and 0.6 mile east of Rough & Ready, about 1.2 miles, existing road to be widened and penetration to be applied. District III, Route 15, Sections A,B. Joe Chevreaux, Auburn, $59,197.50; O'Connor Bros., Red Bluff, $42,791.80; J. Henry Harris, Berkeley, $39,399. Contract awarded Huntington Bros., Napa, $37,133.50.

ORANGE COUNTY—In City of San Clemente, at the intersections of El Camino Real with Avenida Palizada, and with Avenida Del Mar, traffic signal systems to be furnished and installed and modified. District VII, Route 2. C. D. Draucker, Inc., Los Angeles, $7,270; Electric & Machinery Service, Inc., South Gate, $7,019; Westates Electrical Construction Co., Los Angeles, $6,983; Fischbach & Moore, Incorporated, Los Angeles, $6,853. Contract awarded Ed. Seymour, Long Beach, $6,560.

ORANGE COUNTY—Removing palm trees on State highway between Seventeenth Street and Bay Street, in Costa Mesa. District VII, Route 43, Section A. Collins Equipment and Tree Service, Los Angeles, $7,025.78. Contract awarded Sam La Fon Tree Service, Gardena, $4,827.50.

PLUMAS COUNTY—Near Sloat Road, southeast of Spring Garden, mineral aggregate to be furnished and stockpiled. District II, Route 21, Section E. R. P. Shea Co., Riverside, $41,500; Rice Bros., Inc., Marysville, $32,500; M. W. Brown, Redding, $30,000; Allen & Reddy, Red Bluff, $29,500; Clements & Co., Hayward, $25,000. Contract awarded Floyd O. Bailey, Madera, $24,900.

SACRAMENTO COUNTY—Across Steamboat Slough and across Sacramento River at Isleton, about 5.7 miles north of Walnut Grove and 1 mile west of Isleton, two bridges to be repaired. District III, Route 11, Sections D,E. Bos Construction Co., Berkeley, $94,994.20; John C. Gist, Sacramento, $93,769; Al Erickson & Co., Napa, $92,676; D. M. Sandling, San Pablo, $91,751; Barton Construction Co., Oakland, $80,171.24. Contract awarded Payne Construction Co., Oakland, $74,896.80.

SAN BERNARDINO COUNTY—Between Yucca Station and Lakeview, 5 timber trestle bridges to be redecked with reinforced concrete slabs. District VIII, Route 31, Section N. George Herz & Co., San Bernardino, $53,751.50; E. G. Perham, Los Angeles, $47,037; John Strona, Pomona, $46,826; Norman I. Fadel, North Hollywood, $42,839.50; E. S. & N. S. Johnson, Fullerton, $42,211; Friant Construction Co., Fresno, $41,185; Laredon Construction Co., Los Angeles, $40,619; O. B. Pierson, Bellflower, $40,508.50; Owl Truck & Construction Company, Compton, $37,807. Contract awarded C. B. Tuttle, Long Beach, $36,807.50.

EARL WARREN
Governor of California

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FRANK B. DURKEE
Director of Public Works

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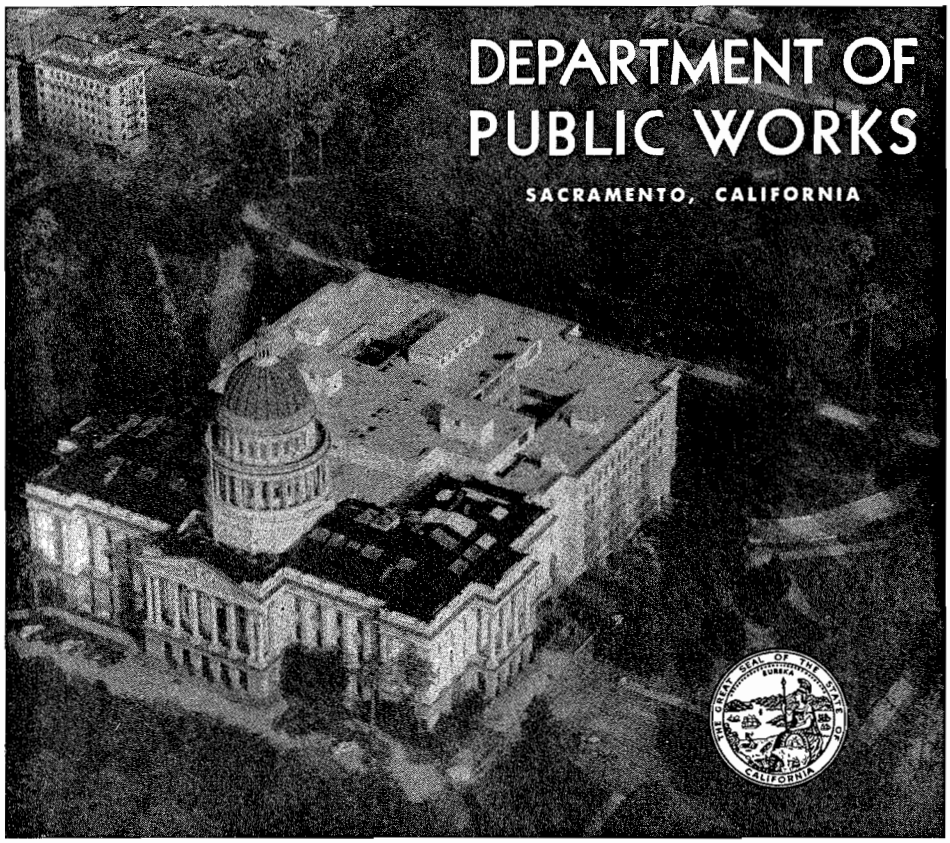

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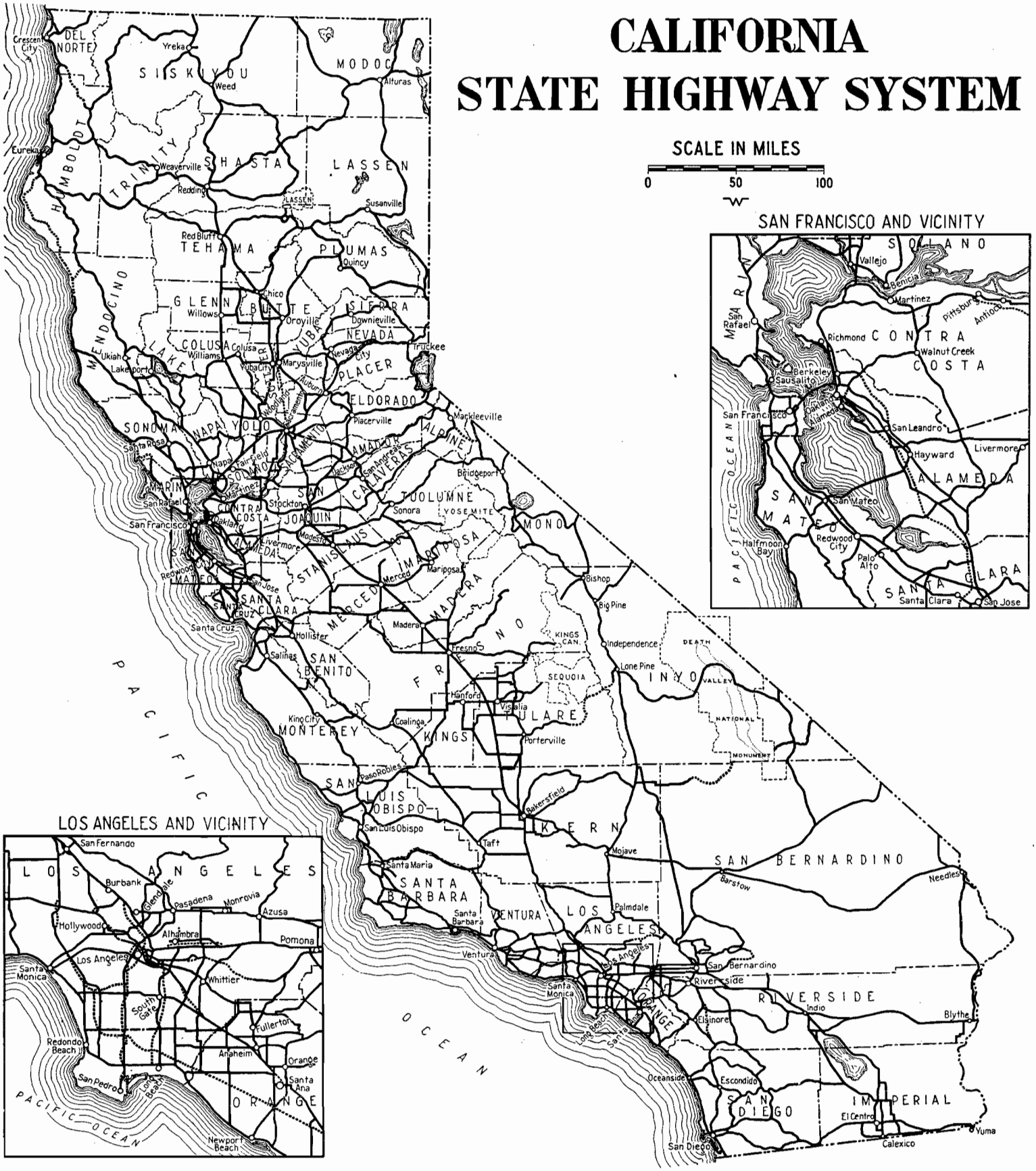

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