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U. S. 395

Improvement of This Important
Route Keeping Pace With Growth

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By S. W. LOWDEN, District Engineer

THE TREMENDOUS growth in population and importance of Southern California in recent years has been reflected in the development of the highways which serve it. Although a major share of attention has logically been focused on the metropolitan freeway system in Los Angeles and the freeways in and near San Diego, highway development in the inland section of Southern California has been keeping pace with improvements elsewhere to a greater extent than many people realize.

A glance at any map showing concentrations of industry and commerce in Southern California will draw attention to a great right triangle, with its hypotenuse (U. S. 101) running between San Diego and Los Angeles and its right angle at San Bernardino-Riverside.

Development of U. S. 395, the major north-south route serving the east side of this triangle, has been progressing for a number of years.

Starts in San Diego

Beginning at U. S. 101 in San Diego, U. S. Highway 395 heads inland by way of Escondido, to enter Riverside County and District VIII near Temecula.

Through Riverside County the existing route passes the town of Temecula, follows along the historic old Butterfield stage trail to Elsinore, and then crosses over the hills to Perris, March Air Force Base, and the City of Riverside. At Riverside, U. S. Highway 395 joins U. S. Highway 91 into San Bernardino County and the City of San Bernardino, where the two take up with U. S. Highway 66 to cross the Cajon Pass together. Across the pass, U. S. Highway 395 takes off alone over the Mojave Desert and enters Kern County and District IX near Johannesburg.

Through Kern, Inyo, and Mono Counties, the highway follows the

California Again Wins Traffic Safety Award

For the fourth time during his tenure of office, Governor Earl Warren has been presented the award of the Institute of Traffic Engineers for outstanding achievement in traffic engineering.

The Governor received the following telegram from M. W. Todd, executive secretary of the institute:

"Judges of National Traffic Safety Contest, for the second consecutive year, have voted a duplicate first place award to your State with Michigan for outstanding achievement in traffic engineering for group 5 states in 1951. Our heartiest congratulations to you and your officials."

California is in the group of states which includes the most thickly populated and heavily trafficked states: New York, Pennsylvania, Ohio, Illinois, Michigan, Indiana, Texas, and California.

easterly slope of the Sierra Nevada for some 300 miles, crosses into Nevada for 70 miles to pass through Carson City and Reno, and then re-enters California for another 200 miles along the easterly slope of the Sierra and Cascade Range to the Oregon line.

Initial Improvement Wartime Project

Modernization of U. S. Highway 395 in District VIII began early in the second World War, even though at that time practically all highway construction was virtually at a standstill, deferred by the Federal Government in favor of more essential war production. The explanation is that the two-lane section of highway from Riverside to March Field and Camp Haan (since combined and now known as

March Air Force Base) was entirely inadequate for the intensive military traffic which developed. So in just a few short months in 1942, with a high priority from the War Production Board because of the strategic importance of the work to the defense effort, the 10-mile section was converted to a four-lane divided highway. As it did for many military access roads during the war, the Division of Highways acted as agent for the Federal Government in designing the work, awarding the contracts, and supervising construction. Cost of construction totaled some \$1,150,000, including a grade separation at the junction with U. S. Highway 60.

Temecula Unit

It was not until almost two years after the war that construction of the next unit of U. S. Highway 395 was undertaken in District VIII. This was the six-mile section between San Diego county line and one mile north of Temecula, which was awarded to contract in June, 1948. The winding old road over the Santa Rosa Mountains was abandoned in favor of a completely new expressway with partial control of access, still two lanes in width except for one short four-lane section, but on vastly superior alignment and grades suitable for modern-day traffic volumes and speeds. Inability to attain minimum design passing sight distance at one particularly rugged stretch was the reason for constructing the short piece of divided highway.

This, incidentally, was one of the early instances in California of a new freeway skirting the main street of a town. The beneficial effect upon the little town of Temecula has served as an example and guide to engineers and local businessmen in the treatment of subsequent similar freeway problems.

This unit was completed in 1949 at a cost of approximately \$780,000.



Upper—One of two 90 degree turns on U. S. 395 and Adelanto, typical of deficiencies in the Mojave Desert portion of U. S. 395. Lower—Junction of old and new U. S. 395 one mile north of Temecula, looking northerly along the Temecula-Antelope road unit recently completed.

La Cadena Freeway

The next most critically deficient section on U. S. Highway 395 in Riverside County lay between the City of Riverside and the San Bernardino county line along the section known locally as La Cadena Drive, which then was a two-lane highway. In May, 1949, the 2.6-mile section between Russell Street and the county line was awarded to contract.

This is the only section of U. S. Highway 395 so far developed with full control of access. The freeway consists of a four-lane divided section, with the median divider wide enough for future development to six-lanes divided when warranted by traffic. Frontage roads parallel the freeway throughout its length; the one on the west side was the old highway. Although not yet a freeway in the full sense of the word, since there are several road crossings at grade, it is proposed to construct grade separations at these locations at some future date when funds become available.

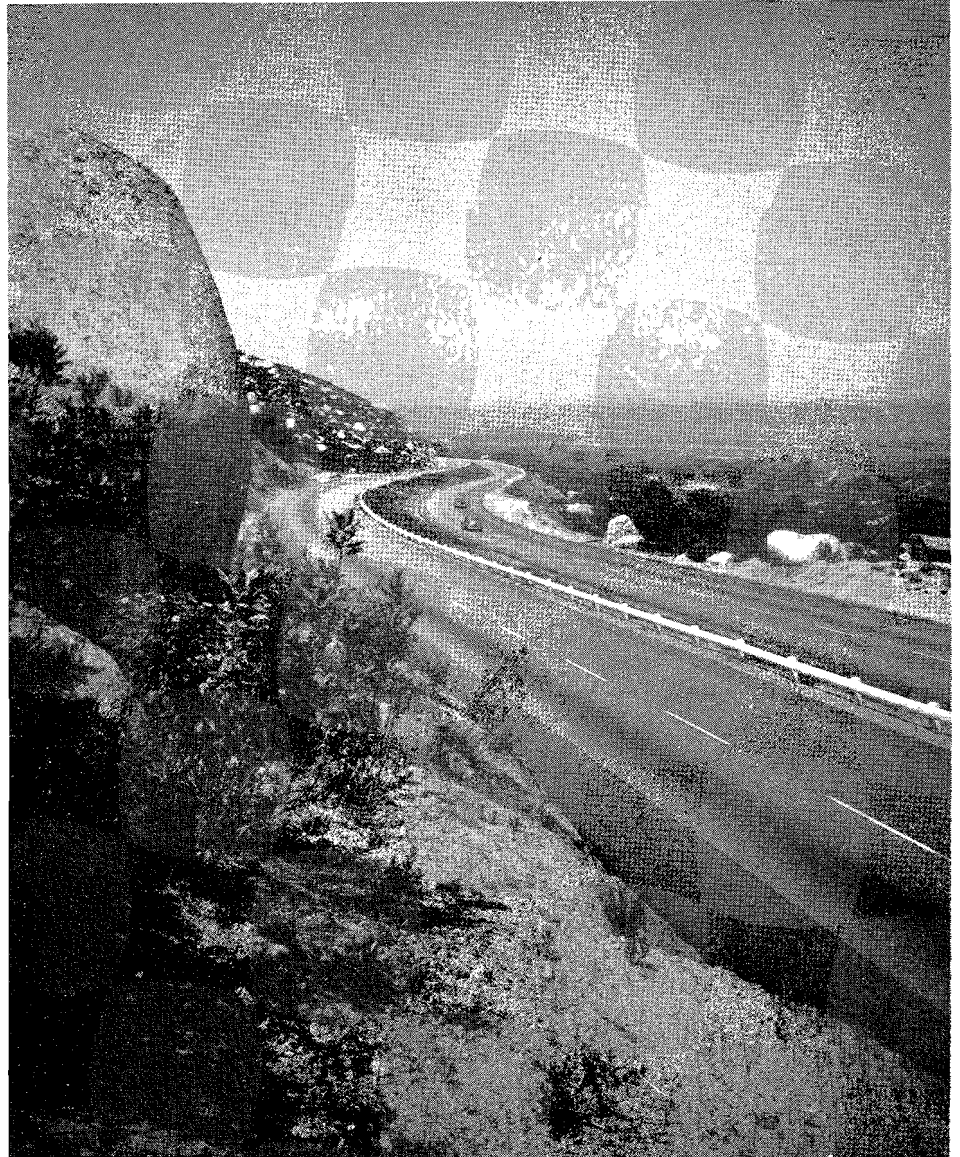
This section of U. S. Highway 395 is also designed to fit into the plan for the ultimate freeway location through Riverside, Colton, and San Bernardino, studies for which are now underway.

The La Cadena unit of U. S. Highway 395 was completed in June, 1950, at a cost of \$550,000. It presently carries about 11,000 vehicles per day.

Temecula-Perris Cutoff

Following the development of U. S. Highway 395 in chronological order, it is necessary now to return to Temecula, where in November, 1950, the first contract was awarded for reconstructing U. S. Highway 395 on entirely new alignment between Temecula and Perris.

Reference to a map will reveal the old dogleg route followed by U. S. Highway 395 up the Temecula Valley through Murrieta, Wildomar, Sedco, and Elsinore, and then northeasterly across the hills to Perris. The new route, adopted after thorough study, takes off a mile north of Temecula in a northerly direction on entirely new alignment through the Antelope and Menifee Valleys, crosses State Sign



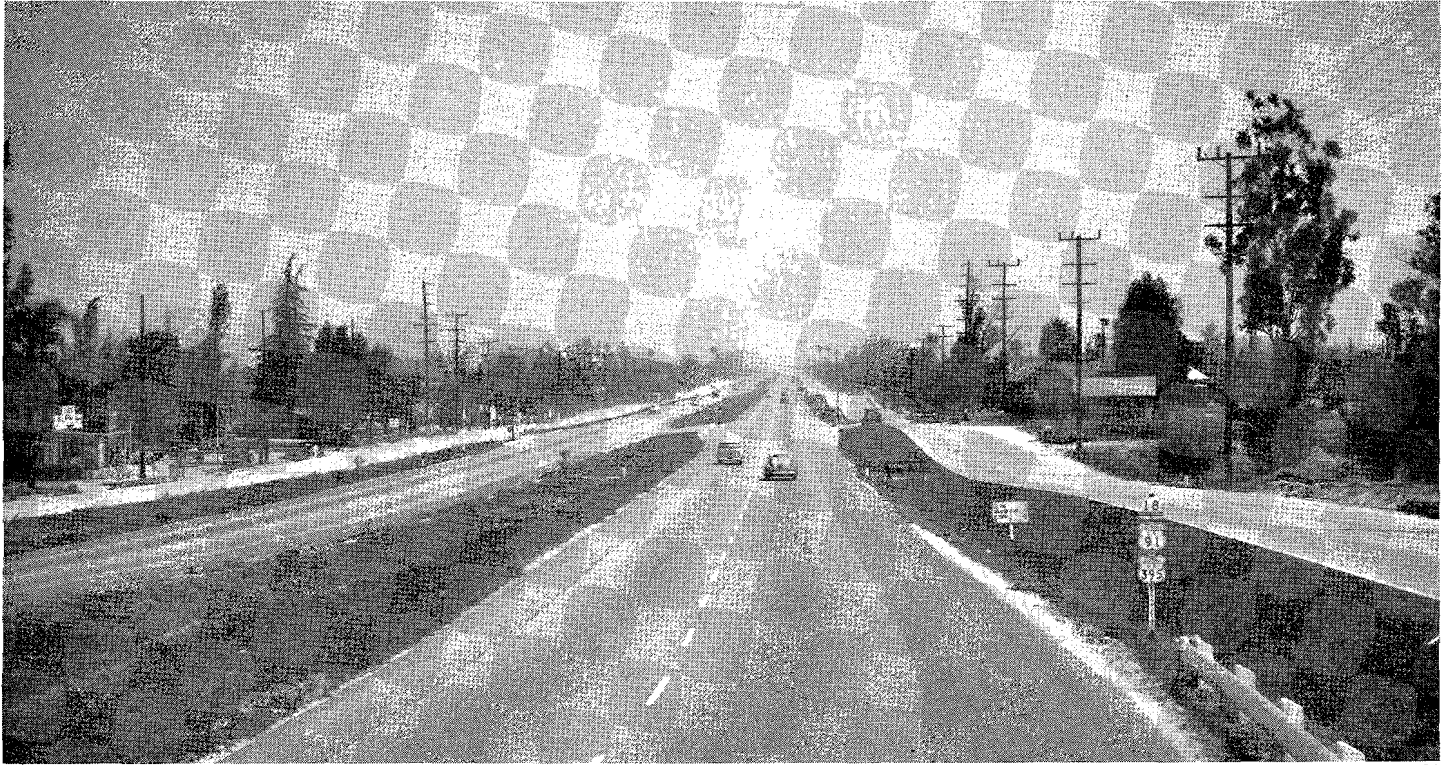
Short section of divided highway on U. S. 395 between the San Diego County line and Temecula.

Route 74 near Romoland and then, turning northwesterly, skirts the business section of Perris to connect with the present highway. The total distance is just 22 miles as compared to 30 miles via the old route.

Present traffic justifies only a two-lane highway on this stretch of U. S. Highway 395, and current construction is on that basis. The design and right of way, however, provide for ultimate development to four lanes divided, with partial control of access.

The cutoff is being constructed in three units. The first, from one mile north of Temecula to Antelope Road,

seven miles in length, was completed in April, 1952, at a cost of \$725,000. The second unit, 10.5 miles in length, from Antelope Road to Route 64 (State Sign Route 74) is currently underway. The contract was awarded in September, 1951, and work is expected to be completed in September, 1952. The estimated cost of construction is \$800,000. The third unit, 4.7 miles in length, from Route 64 to Nuevo Road, is expected to get underway this summer. Plans are completed, the right of way has been acquired and \$850,000 has been budgeted for its construction, including major struc-



Upper—La Cadena freeway section of U. S. 395 between Riverside and Colton, constructed in 1950. Lower—Blasting the big cut on the unit of U. S. 395 currently under construction between Antelope Road and State Sign Route 74.

tures across the San Jacinto River and grade separations at the connections to the City of Perris.

Perris-March Air Force Base Unit

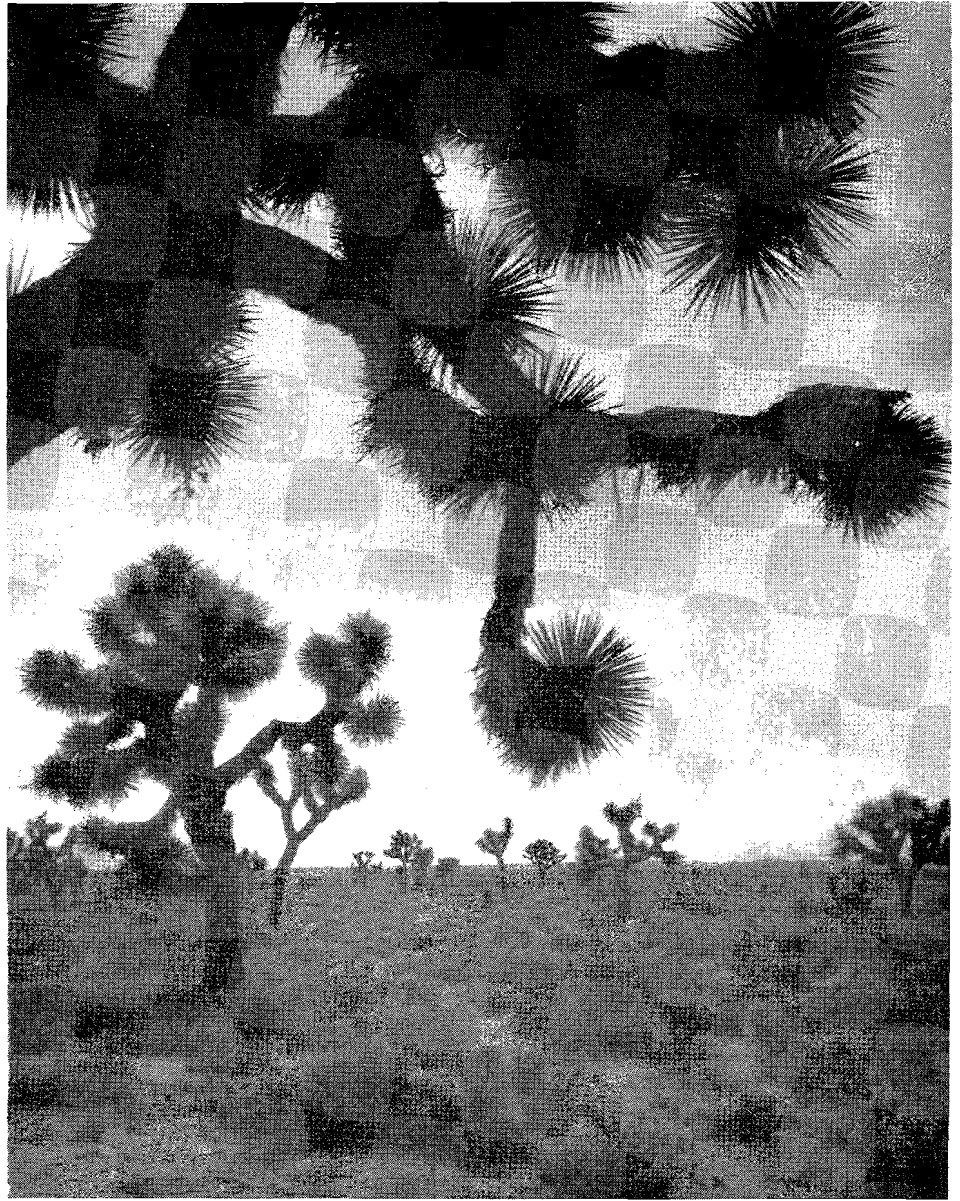
The next section to the north, from Nuevo Road to the beginning of the divided highway at March Air Force Base, is proposed for development to a four-lane divided highway, utilizing the existing two-lane road for south-bound traffic. Plans have been completed and right of way has already been acquired with partial control of access. Start of construction is dependent on availability of future highway funds.

Cajon Pass

In San Bernardino County, construction is now underway on U. S. Highway 395 in Cajon Pass. This is the \$2,118,000 contract in which the southerly 9.3 miles of the pass between Devore and Gish Underpass are being developed from a two-lane highway to four lanes divided with partial control of access.

It was just 20 years ago that this stretch of highway was reconstructed to modern two-lane standards. Two lanes were adequate for traffic in the 1930's, but not today. In addition to U. S. Highway 395 traffic, the pass also serves two major transcontinental routes, U. S. Highways 66 and 91, and the average daily traffic has passed the 5,000 mark and is steadily increasing. Grades are steep and the percentage of truck traffic is high, which aggravates the congestion and intensifies the accident hazards, particularly in the upper regions where curves predominate, and fog, rain, ice and snow are common. It is not apparent because of the high desert plateau, but the highway attains an elevation of 4,300 feet at the summit of the pass.

Although 20 years old, the present road is for the most part adequate for retention as one-half of the divided highway, and the project has been designed accordingly except where other considerations require construction to higher grades. One such instance is in the vicinity of Cleghorn Creek where



Joshua trees, native to the higher desert regions traversed by U. S. 395, north of Cajon Pass, San Bernardino County.

the debris cone has risen since 1932 to such an extent that a higher grade line is necessary.

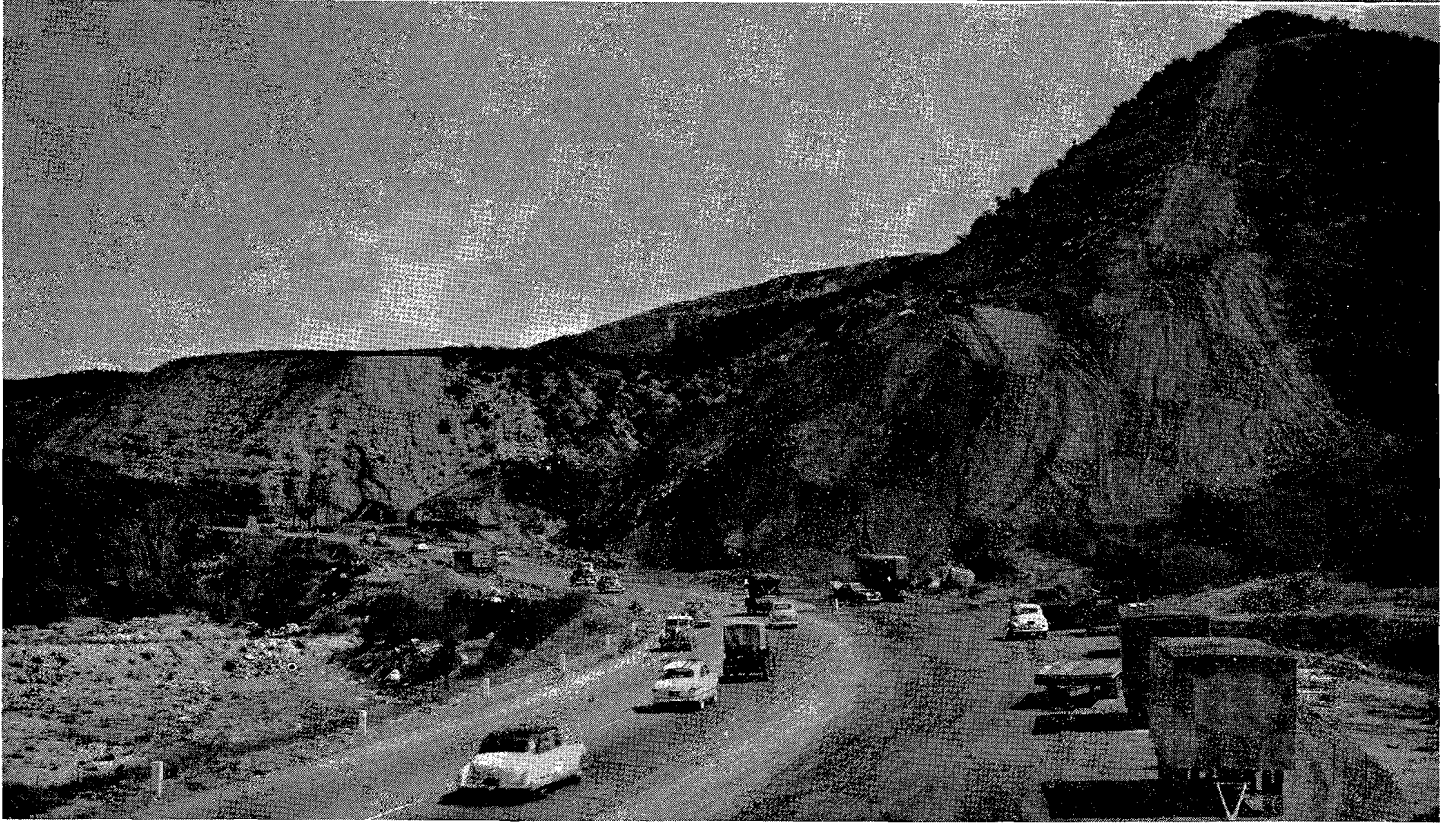
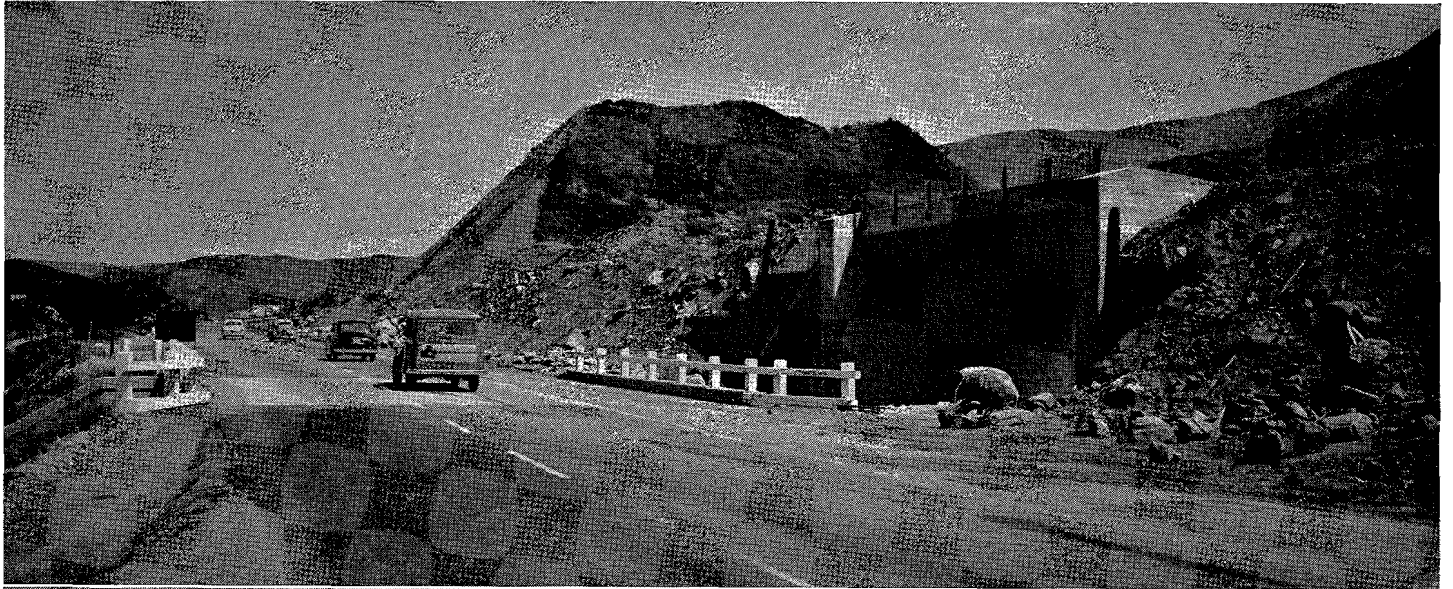
Approximately 900,000 yards of earthwork will be excavated in the course of construction of this unit. The contract is expected to be completed in March, 1953.

The Cajon Pass contract now underway falls $3\frac{1}{2}$ miles short of the summit, but it is planned to continue the four-lane divided expressway development over the summit and beyond as

funds become available. Plans have been prepared and the right of way acquired for the next unit, from Gish Underpass to 1.4 miles north of Cajon Summit; and the third unit, from 1.4 miles north of Cajon Summit to junction of U. S. Highway 395 and U. S. Highway 66-91, is on the drafting tables.

Mojave Desert Projects

Through the Mojave Desert, U. S. Highway 395 is typical of early desert road construction. The roadbed is fairly good but narrow; grades follow



Upper—Construction at Cleghorn Creek on the Cajon Pass contract now under way. Plans call for reconstruction of the lower bridge to the same height as the upper, made necessary by rise in the debris cone during the 20 years since its construction. Lower—Construction operations on the Cajon Pass contract. The plant for base and surfacing materials appears in the left background.

undulations of the natural ground, necessitating numerous no-passing sections; shallow dips serve in lieu of culverts and bridges; long stretches of comparatively straight road are punctuated by occasional sharp curves.

Such conditions have no place on a modern highway system, but north of

the junction with U. S. Highway 66-91 traffic on U. S. Highway 395 falls off to approximately 1,300 vehicles per day to Adelanto, and to approximately 500 north of Adelanto. With present financial limitations extensive development northerly is, therefore, probably some years in the future.

Freeway studies have been underway for several months in the two urban areas of Riverside and San Bernardino, and the future development of U. S. Highway 395 in those areas hinges upon ultimate over-all plans to be adopted by the California Highway Commission.

Eastshore Freeway

Opening of Project to San
Lorenzo Cause for Celebration

By JOHN F. O'BRIEN, Resident Engineer

ON JUNE 13, 1952, the third unit of the Eastshore Freeway will be opened to the traveling public. This 4.2-mile section of high-standard roadway will provide relief for one of the most congested areas in District IV and will mark the completion of approximately 11 miles of the planned facility between Oakland and San Jose.

This project will extend the portion of the Eastshore Freeway, being used by public traffic, southerly from its present terminus at 98th Avenue, Oakland, to a connection with Lewelling Boulevard near San Lorenzo.

It is located entirely on new alignment and passes through rapidly expanding residential developments, potential industrial and subdivision sites, and rich farm land, in and adjacent to the City of San Leandro.

It will replace an outmoded two-lane section of the existing State Highway Route 69.

Another Going Contract

Another contract is currently under way between Lewelling Boulevard and Jackson Street (State Route 105), scheduled for completion in mid-1953, which will extend southerly the Eastshore Freeway available for public traffic another 3.9 miles to a point near Mt. Eden, just west of Hayward.

Simultaneously, construction on Road SCI-69-A, now under way, is beginning to close the gap from San Jose toward Warm Springs. Lack of funds will, however, compel postponement of construction of the final link between Mt. Eden and Warm Springs for some time to come.

The Eastshore Freeway along the easterly shores of San Francisco Bay is located on level terrain. This section's alignment is tangent, except for a 6,000-foot radius curve at Williams Street and a 10,000-foot radius curve in the vicinity of San Leandro Creek.

Grades vary from a maximum of 3.25 percent to a minimum of 0.20

percent. Vertical curves provide 60 m.p.h. nonpassing sight distance.

Separation Structures

Six separation structures are included in the three interchanges and one overcrossing of this contract. All the bridges are steel beam type.

Following the stationing northwesterly, first access to the freeway is at ramps to Lewelling Boulevard.

Next is the unusual layout of the Washington Avenue interchange. Here design was complicated by the terminus of proposed Freeway Route 228 and the acute skew angle of Route 69 with Washington Avenue.

The largest of the three separation structures is a four-lane divided seven-span bridge carrying Washington Avenue traffic over the freeway and exchange roads.

Probably the most unique structure is the one that carries Route 69 over eastbound traffic of Route 228 (U. S. Route 50) destined for Livermore, Tracy and valley points. This bridge features long curved abutments with 36-inch steel girders and two all-welded plate girders. The longest of the plate girders has a 100-foot span. It is one of the largest ever fabricated on the West Coast. The top flange of this girder is encased in the curb, and through composite action utilizes the concrete for compression in carrying live load. For further reference see article by R. H. Kipp in the March-April, 1952, issue of *California Highways and Public Works* magazine.

Westbound traffic on Route 228 will pass under a Route 69 off-ramp structure.

First Avenue Interchange

Continuing northward there is the First Avenue (West Avenue 132d Street) interchange, which is planned as a future full four-quadrant cloverleaf interchange. Under this contract only half of the proposed overcrossing, a two-lane, six-span structure, was built. Construction of an additional

bridge and the two undeveloped quadrants is proposed for a later date.

At Williams Street (West Avenue 129th Street) the freeway was depressed to provide clearance under the existing cross street at grade. Here water was encountered in the cut and an additional foot of base material was placed on a layer of pervious subbase material. Ground water drains through this pervious layer to a storage box or sump, is pumped to a culvert parallel to the freeway, then flows to an existing storm sewer on Davis Street. In addition, rock drains were installed at the toe of the cut along both sides of the roadway.

There is no access to the freeway at Williams Street. The separation structure is four spans in length, and it and the First Avenue structure are of continuous steel girder design. Each girder was shipped to the job in three pieces and butt-welded in the field.

Four-quadrant Cloverleaf

Last in this series of structures on this contract is at Davis Street, State Route 226, where a modified four-quadrant cloverleaf interchange was constructed within tight right of way. The four-lane divided seven-span structure is similar to the Washington Avenue separation, and carries Davis Street traffic over the freeway and collector roads.

At the extreme north end of the project, twin structures, 1,410 feet long and 28 feet wide between curbs, carry the freeway over San Leandro Creek, a City of Oakland drainage channel, and a single-track branch line of the Southern Pacific Railroad. These bridges were built under a separate contract let about two and a half years ago to C. B. Tuttle Co. of Long Beach, and were near completion at the time the general contract work started.

Professor Linn, of the School of Engineering, University of California, is engaged in a research program on one of the San Leandro Creek bridges.

During construction several hundred electrical strain gauges were attached to the structure, and some electric deflection gauges were placed on each girder.

The experiment is especially intended to determine two relationships: first, composite action between structural steel and concrete deck resulting from bond; second, transverse distribution of load, particularly that portion caused by diaphragm action. For the latter phase of the test, both static and dynamic loads were applied with diaphragms initially loose, then firmly attached.

Correlation of data already obtained is not yet complete. It is expected that these tests will continue after traffic begins to use the bridge.

Structural Details

The freeway section as completed is four-lane divided, with a 36-foot median providing for an ultimate six-lane section. Each roadway is 24 feet wide, with eight-inch Portland cement concrete pavement placed on four inches of cement treated subgrade on one foot of imported base material. Ten-foot emergency parking shoulders are provided for the outside lanes. They include a three-foot rolled gutter, and 0.40-foot of penetration-treated imported base material, seven feet wide. Five-foot inside shoulders consist of two-foot-wide armor coat on 0.5-foot crusher run base adjacent to the lanes, and three-foot-wide penetration treatment of the imported base material.

The ramp section is, generally, three-inch plant-mixed surfacing on six inches minimum crusher run base, and nine inches minimum of imported base material.

Major Items of Work

The magnitude of the project is evident from approximate quantities of the major items of work:

Roadway excavation	324,000 cu. yds.
Structure excavation	24,300 cu. yds.
Overhaul	5,200,000 sta. yds.
Imported borrow	572,000 tons
Imported base material	331,000 tons
Portland cement concrete (pavement)	26,400 cu. yds.
Structure concrete	8,660 cu. yds.
Structural steel	3,000,000 lbs.
Reinforcing steel	1,000,000 lbs.
Portland cement concrete (curbs, gutters, sidewalks)....	7,000 cu. yds.

Among drainage items, approximately five miles of reinforced concrete pipe were placed. Two pumping plants were constructed, one at the Washington Avenue interchange, and one at Williams Street as previously described. In addition, an existing storm ditch in the Washington Avenue interchange area was realigned, and a long culvert constructed to pass the storm water under the freeway and ramps. This structure consists of 303 feet of double 10' x 4' reinforced concrete box.

Work on this contract was started in November, 1950, and completed in June, 1952. Progress on the project was delayed by unavailability of structural steel because of defense requirements. Although orders were placed with steel mills in October of 1950, delivery did not begin until July, 1951.

Contract to Cost \$3,000,000

Fredrickson & Watson Construction Co. and M & K Corporation are the contractors on Contract 51-4TC17-F, as a joint venture. They also hold the

contracts for the adjacent Eastshore Freeway unit southerly, and the section in Santa Clara County between San Jose and Warm Springs. Fredrickson and Watson Construction Co. held the earthwork and paving contract on the first unit from Oak Street to 38th Avenue in Oakland, and were paving and structure contractors on the second main unit from 50th Avenue in Oakland to the San Lorenzo Creek structure. Thus, they have been instrumental on all sections of the Eastshore Freeway except for the High Street (42d Avenue) interchange area and the San Lorenzo Creek Bridge.

The present contract will cost approximately \$3,000,000. The work was started under the general supervision of Assistant State Highway Engineer Jno. H. Skeggs, retired. It is continuing under direction of B. W. Booker, Assistant State Highway Engineer, District IV, and Assistant District Engineer R. P. Duffy, with John F. O'Brien as Resident Engineer in direct charge of the work. J. Neil Perry is the Bridge Department representative.

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EDITOR

DEAR MR. ADAMS: I have received your magazine for several years now and would like to take the opportunity of thanking you for continuing to mail it to me.

I have driven over most of the California highways in the past years and your magazine keeps me posted on all the latest improvements. I think the March-April, Vol. 31, issue is outstanding with your coverage of the freeway system in and around Los Angeles.

I am employed by RKO Radio Pictures in Hollywood, as chief electrician. I pass your magazine on to the Location and Transportation Departments who find it very helpful in routing our many motion picture companies over California's wonderful highway system all over the State.

Best of luck and good wishes to you in 1952.

Yours truly,

RAY L. SIMBRO
Chief Electrician

FROM ONTARIO

ONTARIO GOOD ROADS ASSOCIATION

Hamilton, Ontario

KENNETH C. ADAMS, *Editor*

California Highways and Public Works

Sacramento, California

DEAR MR. ADAMS: Recently, I had occasion to read your very fine magazine, *California Highways and Public Works*.

I enjoyed the many articles and the photographs dealing with same and feel that your publication is one of the finest of its kind that has been my good fortune to read.

I would appreciate having my name added to your mailing list, if at all possible. It would be much appreciated.

Trusting that I may be able to receive the above publication regularly. Thanking you,

Yours very truly,

T. J. MAHONY

THE SPECTROSCOPE IN CHEMICAL ANALYSIS

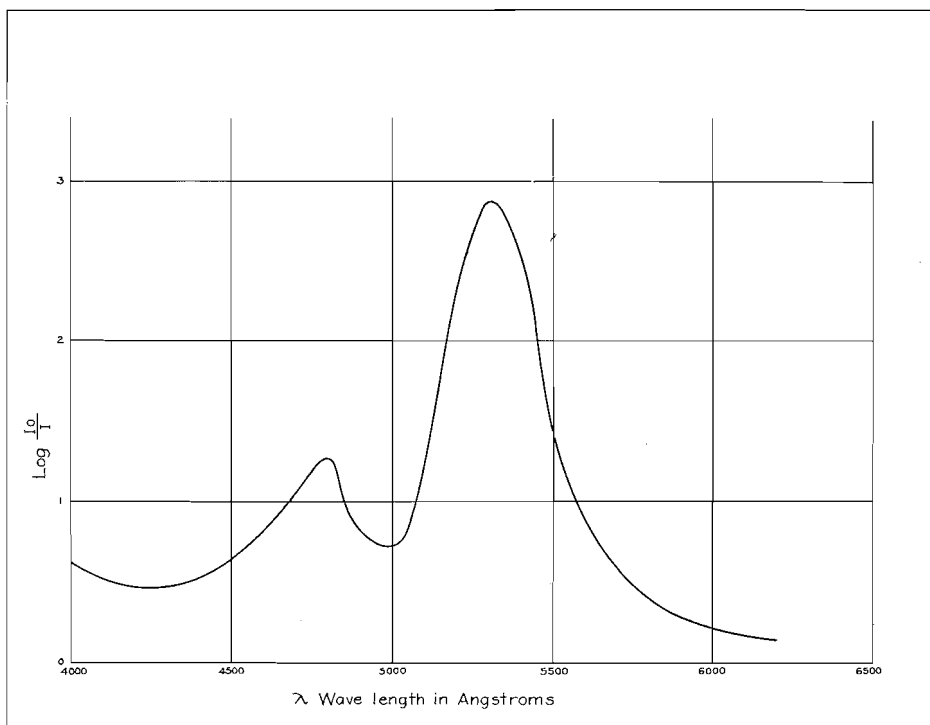
By E. D. BOTTS, Senior Chemical Testing Engineer

The Materials and Research Department of the Division of Highways has recently acquired a spectrophotometer for use in routine chemical analyses and for special research problems.

This device is expected to reduce the time required for many routine analyses with a consequent saving to the State and to make it possible to perform certain work that is very difficult by older methods. The background and development of this instrument is believed to be of interest to many and is discussed in the following article.

In 1860 *Poggendorf's Annalen*, a German scientific journal, contained an article by Kirchoff and Bunsen of Heidelberg University which described a new discovery. These gentlemen had observed that the spectra of flames colored by salts was characteristic of the metallic components. Bunsen's invention of the burner—a device for using and controlling combustible gases as a source of heat—is more widely known but the scientific significance of his observations of flame spectra is infinitely greater. Modern spectroscopy has developed from this modest beginning, and the spectroscope with its modifications and adaptations is rapidly approaching the indispensable in chemical laboratories.

In addition to the observation that a flame colored by salts products a spectrum which is characterized by a definite pattern of lines for each metallic component, Kirchoff and Bunsen noticed that the wave length or position of the lines in the spectra was independent of the temperature of the flame and that more lines could be observed at higher temperatures. This discovery opened the way to a quick method of qualitative analysis and later was developed to such an extent as to permit the analysis of the sun and other astral bodies.



Spectrophotometric absorption curve of a natural red dye in chloroform. Note high absorption around 5400Å —green light.

Scientists Make Discovery

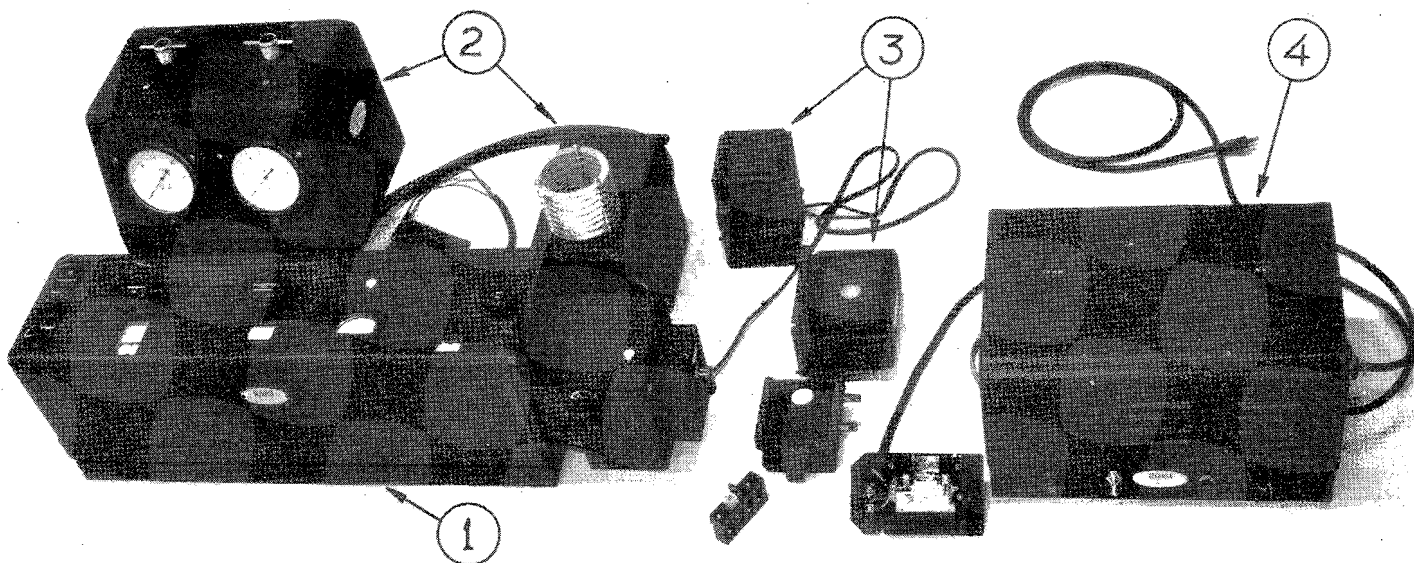
Kirchoff and Bunsen, in the early days of their spectroscope, noticed a building in flames on the opposite side of the Neckar river from their laboratory. They proceeded to focus the light on their spectroscope and determined the components of the burning building. That was the first long distance chemical analysis in history.

Other researchers soon discovered additional features and possibilities of the spectroscope. Not the least of these was the fact that fluids would absorb light selectively according to the composition of the fluid. When white or polychromatic light is passed through a solution, absorption takes place selectively, that is, certain wave lengths are absorbed, depending on the composition of the solution. If the light emerging from the solution is passed through a prism and photographed, absorption bands or dark spaces will appear on the film. These bands will correspond to absorbed wave lengths. The location

and sharpness of the bands in the spectra will depend upon the character of the solution and its concentration. This gives a basis for identification of many compounds and elements. Even molecular constitution and group orientation may be deduced frequently.

How Instrument Works

The instrument recently acquired by the Materials and Research Laboratory is a combination of the spectroscope and the photocolormeter. It separates the light into various regions by refraction (some instruments use diffraction) and by means of a highly sensitive photoelectric tube, measures the intensity of the chosen wave length. When the absorption spectra of a solution is required, individual beams of light are passed first through the pure solvent, then through an equal depth of the solution. The difference between the two values constitutes the absorption of the substance dissolved.



Spectrophotometer and accessory equipment recently acquired by the Materials and Research Department. (1) Basic unit; (2) Flame attachment; (3) Diffuse reflectance accessories; (4) Ultra-violet accessories.

If this procedure is carried on through frequent intervals of wave length across the working spectrum, a curve may be drawn which is characteristic of the substance under observation. (See Fig. 1.) Various conventions are used in drawing these curves. The most popular is the plot of $\text{Log } \frac{I_0}{I}$ against wave length, where I is the intensity of the light after absorption and I_0 is its intensity prior to absorption. When this convention is used in plotting, with expanding values moving away from the origin, peaks in the curve indicate points of relatively high absorption.

Peak Positions

The peak positions are usually chosen as the wave lengths suitable for making quantitative determinations, because at such position, $\text{Log } \frac{I_0}{I} = Kcd$ where K is an absorption constant, c is concentration of the solution and d is the depth of the solution which is penetrated by the light. At any chosen point of maximum absorption for a substance in solution, all factors may be held constant, or nearly so, except c . Calibration curves may be drawn with known concentrations and exact concentrations may be determined in unknowns by a simple measurement.

Modifying attachments are available for these instruments which will permit the preparation of a reflectance chart for all kinds of colored material. A curve, drawn in a similar fashion to that outlined for absorption would define the color accurately. Another attachment provides for excitation of spectral lines by a flame whereby a few of the simpler elements, spectroscopically speaking, may be determined quantitatively from the intensity of a characteristic line emitted by this element.

This method has become almost universal in determining alkalis in cement. It has superseded a long and laborious "wet method" requiring about three days. The spectrophotometer method requires only a few minutes. This instrument simplifies many laborious procedures in the biological field, also. For example, vitamin A in solution, is determined accurately and quickly by measuring its absorption at 3280\AA . That is in the ultraviolet region where many substances are highly colored even though they are completely colorless in the visible range— 4000\AA to 8000\AA for the average human eye.

Photo Electric Tube

The accession of the spectrophotometer to a place formerly occupied

by the spectrograph (cost up to \$50,000) in the laboratory is due primarily to the development of the photo electric tube. This little gadget is far more sensitive to light than any human eye. It is able to pick up the small fragment of light passing through a solution in the range from 2000\AA to $10,000\text{\AA}$. When it does this, it responds by releasing a feeble electric current which is proportional to the amount of light exciting it. This current may be amplified to a measurable quantity which is taken as a measure of the intensity of the light involved.

The instrument is generally constructed so that it is largely automatic in its functioning, requiring only the turning of a few dials for the desired end result. Obviously, it is a complicated instrument in which lie the labor and ingenuity of many people for many years. Further refinements will undoubtedly follow. The use of this instrument and its kin is becoming more and more general in laboratories of all kinds. Many of the chemical "wet methods" are being superseded by these more convenient and more rapid physical methods. Some chemists and physicists predict that eventually the analysis of a Portland cement, for example, will involve merely a

... Continued on page 60

Highway Bridges

State Maintains Almost 5,000 Such Structures on Its Road System

CALIFORNIA, with the Nation's greatest variety of extreme climatic conditions—ranging from subtropical to rain forest conditions on the coast, with swamp, desert, and alpine climates all encountered in the interior—requires an almost unlimited variety of bridge structures to carry her highways. Not only must such natural waterways as arroyos, barrancas, canyons, creeks, rivers, etc., be crossed, but also such artificial features as railroads, foot-

walks, canals, penstocks, and equestrian trails, to mention but a few. Bridges must be built to carry as many as 105,000 vehicles per day on some Los Angeles freeways, and as few as 20 or 30 vehicles per day on some of the more remote desert and mountain roads.

However, the average motorist pays little attention to bridges as he drives along the highway, even though at 55 miles per hour he crosses a bridge on

the average of once every three minutes. Thus, in a typical 100-mile trip, he crosses about 30 bridges. Without bridges highway travel would obviously be impossible.

Since these bridges are such an indispensable part of our highway network, a few interesting statistics relating to bridges on California state routes have been gathered together and are presented here. The statistics do not cover bridges on county roads

Pit River Bridge across Shasta Lake (still being impounded at time this picture was taken). This is one of the few structures which carries both highway and railroad traffic.



and on city streets. Furthermore, the statistics, in general, deal only with those structures 20 feet or more in length; shorter structures are usually classified as culverts.

Almost 5,000 Bridges

On the 15,000-mile State Highway System, there are some 4,800 bridges, with an additional 50 bridges maintained by the Division of Highways in state parks. These bridges, if laid end to end, would extend 120 miles and would cover an area of 527 acres (0.82 square miles). They represent a total value, on the basis of present construction costs, of about 400 million dollars.

Concrete bridges predominate. There are 2,861 bridges of concrete, 587 of steel, 998 built of timber, and 42 masonry arch structures. Incidentally, most of the steel bridges and timber bridges have concrete decks.

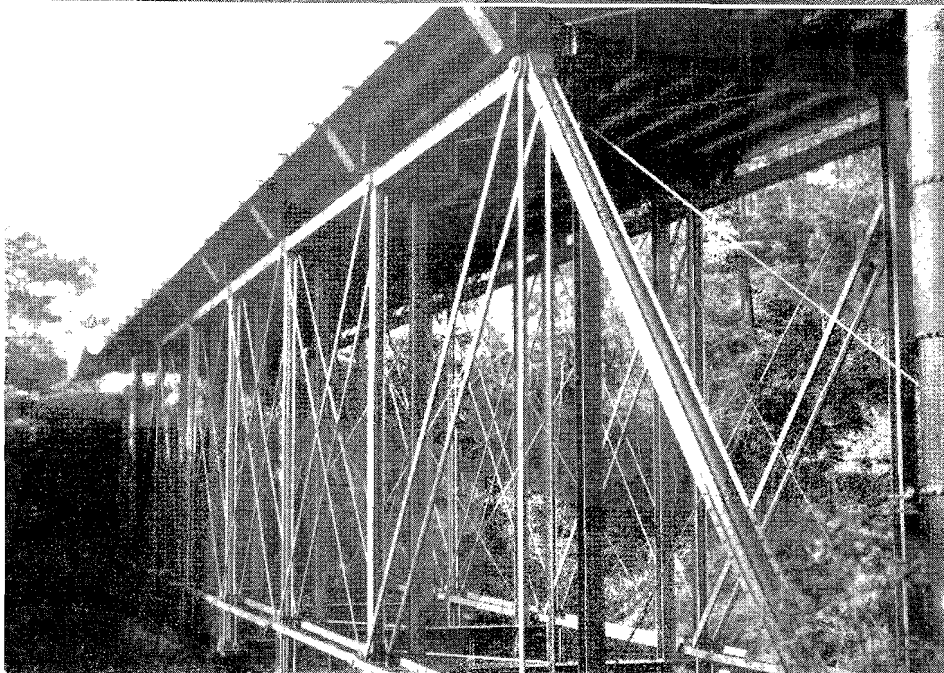
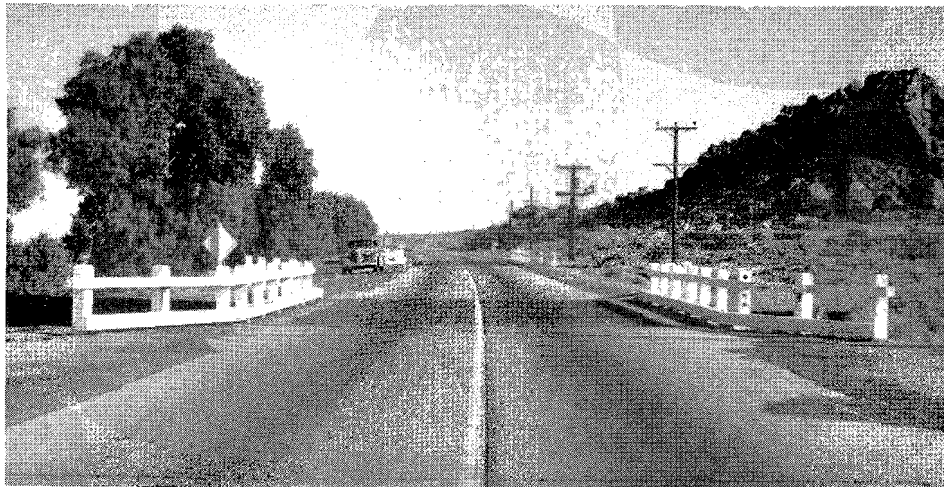
Including those in Yosemite National Park, there are 24 tunnels with a total length of about four miles on the state system. There are 115 structures to permit cattle to pass beneath the highway, 22 structures to allow pedestrians to walk over the highway, and 105 structures for pedestrians to cross beneath the highway. Thus, it is interesting to note, the total number of structures exclusively for pedestrians (127) is almost the same as for cattle. (However, these statistics do not necessarily prove that cattle are very nearly as important as people in California.)

Some Ferries Still Operate

Several ferries still carry traffic at locations where bridges have not yet been constructed. Two of these are on the state system.

Almost 300 structures separate highway traffic from railway traffic. Of these, approximately one-half carry the highway over the railroad, and the other half carry the railroad over the highway. There are still some 909 railroad crossings at grade, or more than three times the number of separations.

On the state system some 29 movable bridges have been erected across navigable streams to permit the passage of water-borne commerce. Of these, 12 are swing bridges (rotating on a center pier), 11 are bascule (opening like a jackknife blade), and six are lift spans (rising like an elevator).



Upper—Near the shore of the Salton Sea (248 feet below sea level). This bridge is one of the lowest in the State. Center—Believed to have been first erected in the 1880's, and formerly carrying one of the now abandoned narrow gauge lines of the Northwestern Pacific Railroad, this structure now carries traffic on Sign Route 1 along the Mendocino County coast. Lower—An unidentified bovine enters cattle pass.

Oldest Bridge

The oldest bridge on the state system is the swing bridge across the entrance to San Leandro Bay connecting the City of Alameda with the Bay Farm Island residential area and the Oakland Airport. This structure, now being replaced with a modern bascule bridge, was originally built by one of California's picturesque early narrow gauge railroads in 1881.

The oldest structure maintained by the Division of Highways is a small stone culvert constructed in the early 1800's at Mission La Purissima, now a state park, and one of the original chain of missions founded by Father Junipero Serra.

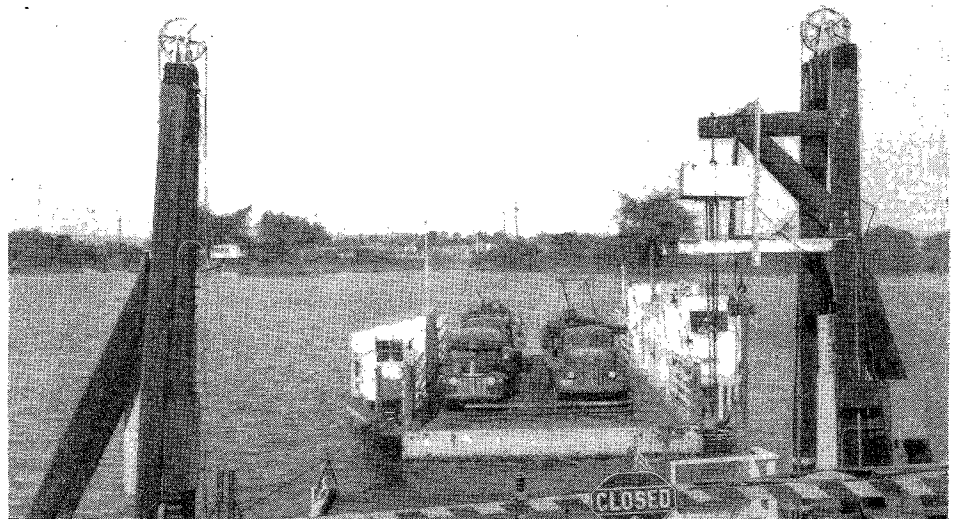
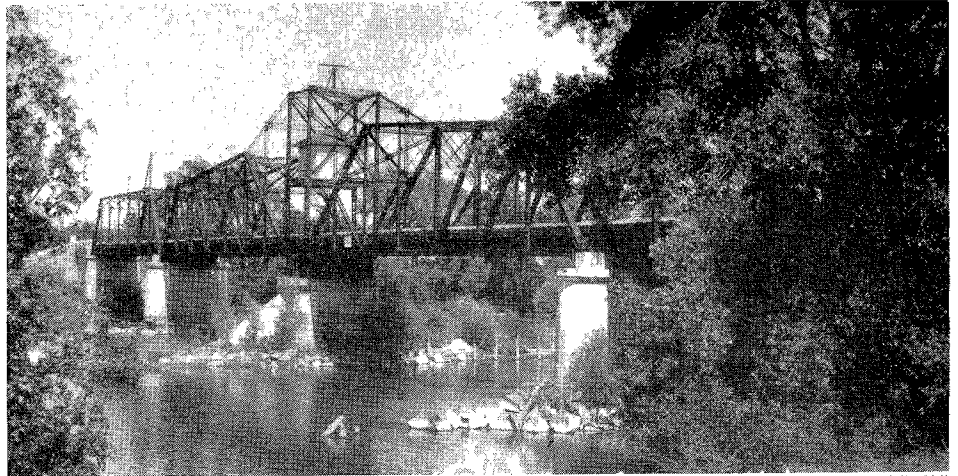
Covered Bridges

Covered bridges, once a familiar and nostalgic sight along California highways, have now disappeared completely. The last covered bridge on the state system was removed about two years ago. However, a few covered bridges remain on county roads.

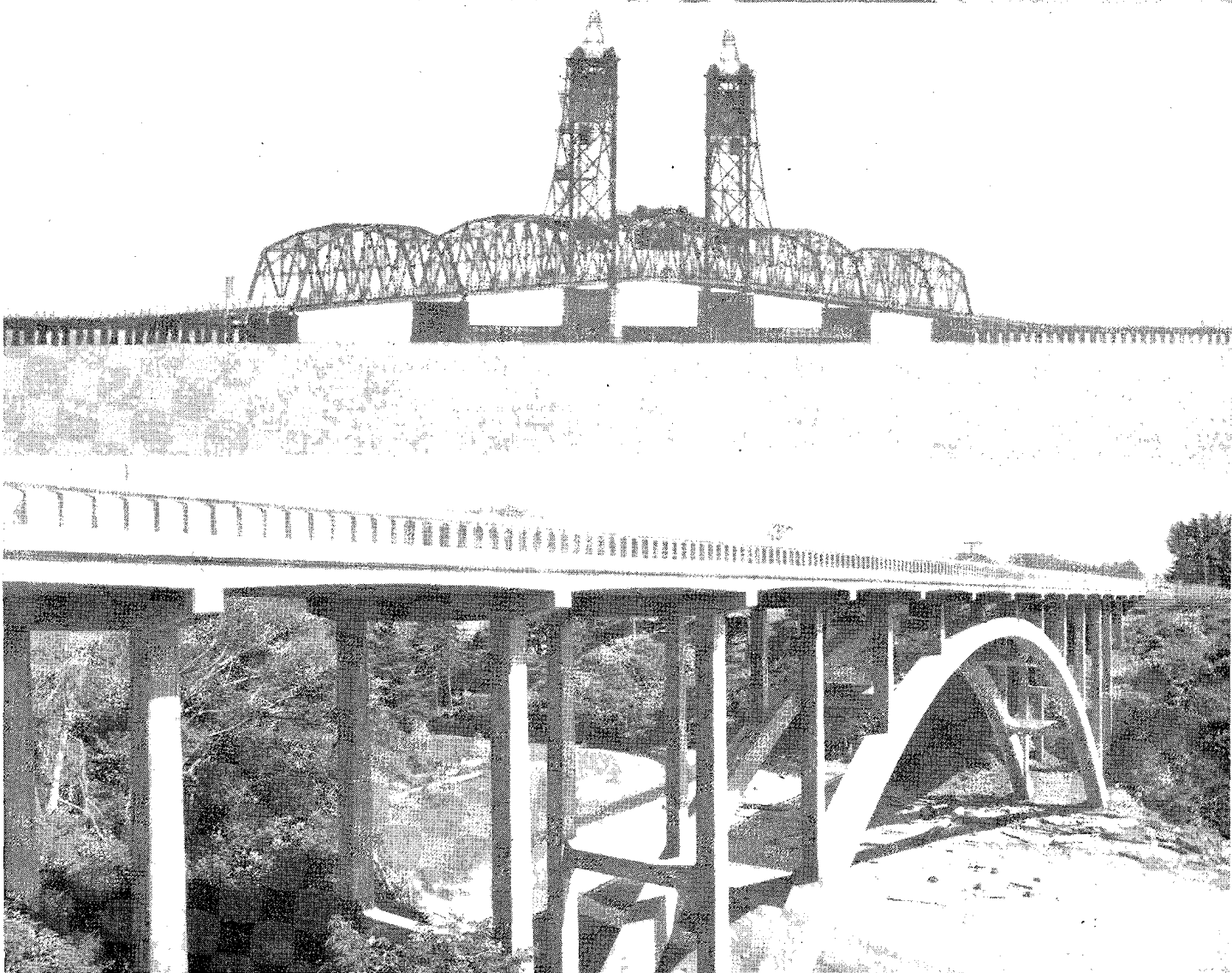
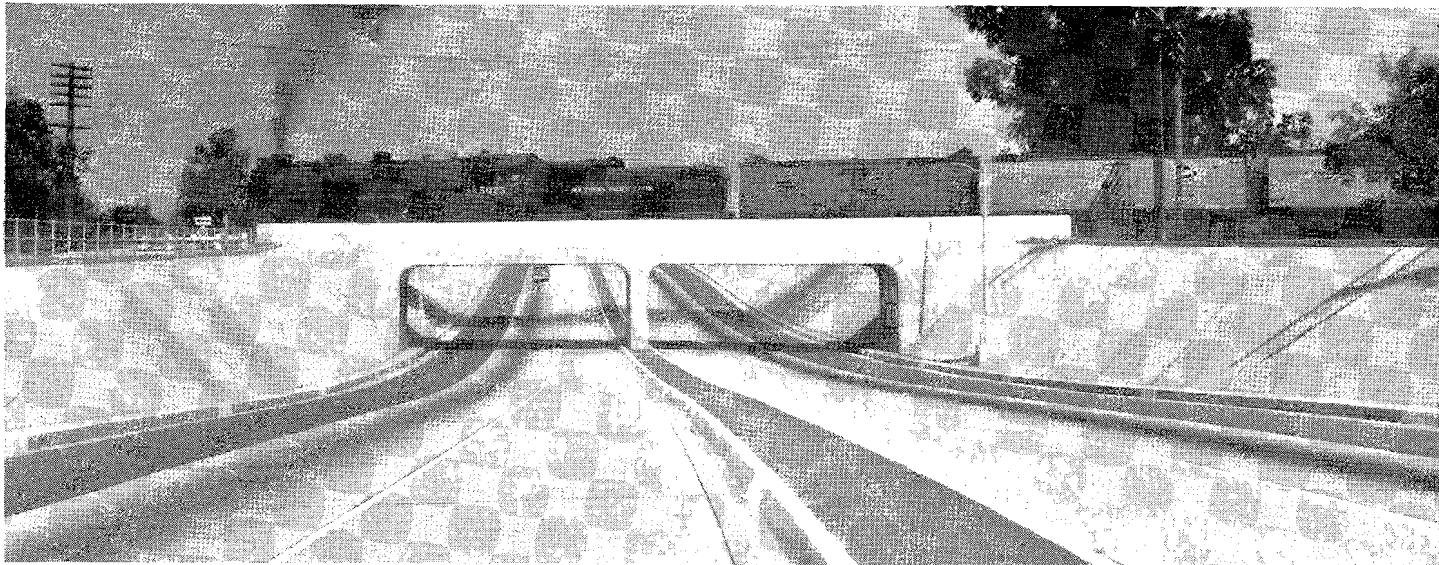
The stream crossing at the highest altitude on the system—located at an elevation of over 9,500 feet—is a corrugated metal arch culvert across Leevining Creek on Tioga Pass, near the east entrance to Yosemite National Park. The lowest bridges in the State are several structures along the shores of the Salton Sea, almost 248 feet below sea level. There are no bridges on the state system in Death Valley, the lowest area in the United States.

Huge Increase Since 1936

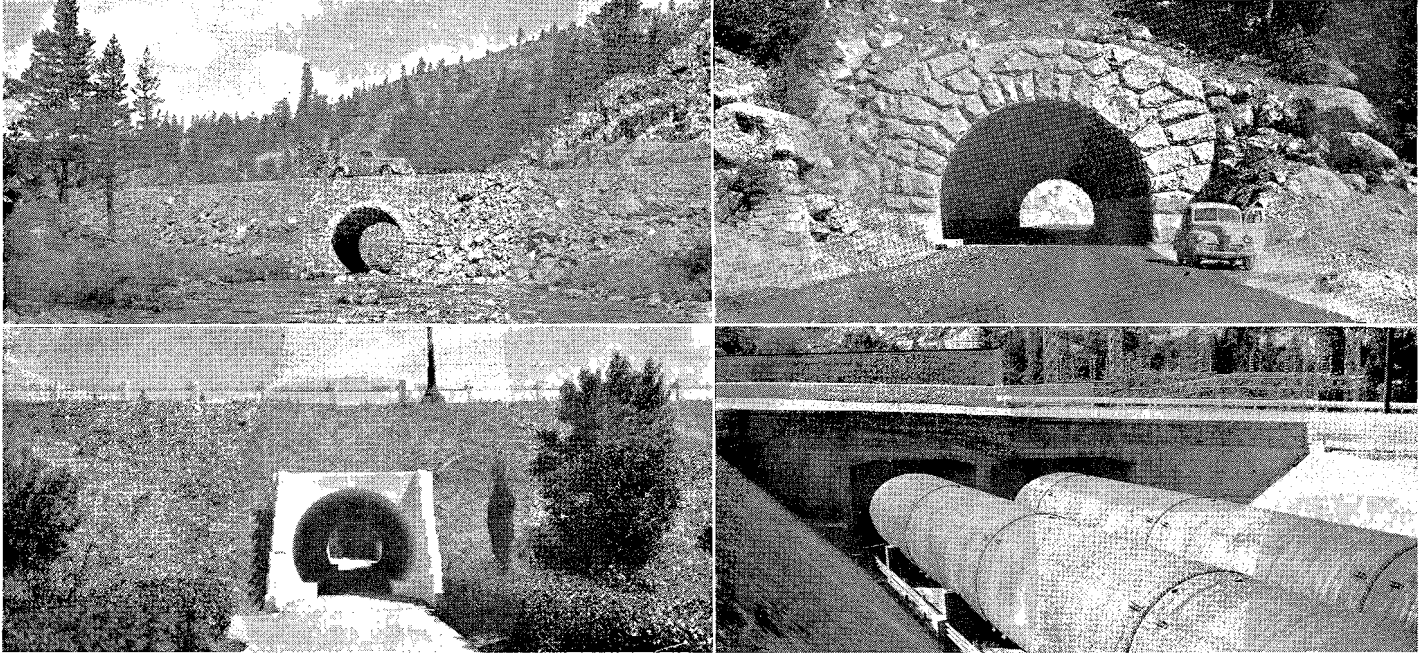
During the past 15 years the number of bridges on the highway system has increased by about 1,350; there were only 3,450 bridges in 1936. This tremendous increase has been the result of: 1—construction of parallel bridges when existing two-lane roads are converted into four-lane divided highways; 2—construction of railroad separation structures to eliminate the hazard of railroad grade crossings; 3—construction of freeways, which require numerous highway, pedestrian, and railroad separations, and 4—replacement of old roads on circuitous and tortuous alignment with modern highways on direct alignment. Due to higher standards of design, bridges are often necessary on realignments even



Upper—One of the 29 movable bridges on the state system. This swing structure, built in 1908 across the Sacramento River at Hamilton City, has not been opened (except for experimental purposes) for more than 20 years. Center—Salmon River bridge in Siskiyou County. Removed in 1942, this was one of the last covered bridges on the State Highway System. Lower—One of the two remaining ferries on the State Highway System. This body of water, Cache Slough, will form a portion of the future Sacramento Deep Water Channel.



Upper—One of the 300 railroad separation structures on the State Highway System. Center—Truss spans and lift span of the recently acquired San Mateo-Hayward bridge, one of the four remaining toll bridges. Lower—One of the 277 concrete arches on the State Highway System. Carries Mendocino Coast Highway, Sign Route 1, over Jughandle Creek.



Upper left—Corrugated metal culvert across Lee-vining Creek, just outside Tioga entrance to Yo- semite National Park. Highest stream crossing structure in California. Upper right—Big Oak Flat tunnel in Yosemite National Park. One of the 24 tunnels on the state system. Lower right—Bridge carry- ing Sign Route 24 across penstocks of the Pacific Gas and Electric Company's Cresta hydroelectric devel- opment in the Feather River Canyon, Butte County. Lower left—Pedestrian undercrossing in Contra Costa County.

To the right—Steel girders and a steel deck truss on high steel towers carry the Monterey Coast Highway, Sign Route 1, over Burns Creek.

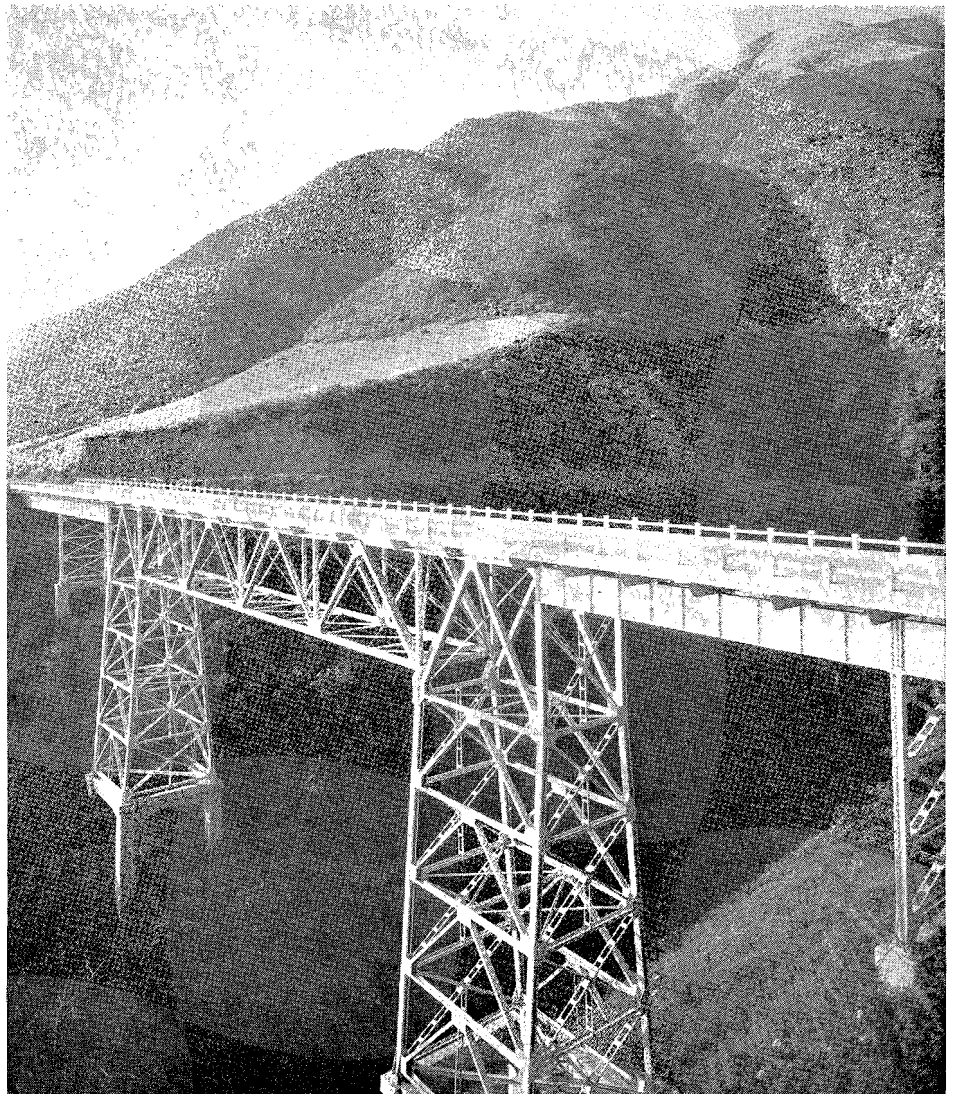
though they were not required on the original highways.

The numerical increase would be even larger were it not for the fact that many old tumble-down timber trestles—formerly classified as bridges—have now been replaced with culverts, which are not considered as bridges.

Los Angeles County Has Most

Of the total of 4,800 bridges, the largest number—660—are in Los Angeles County. San Bernardino County is second with 420, and Riverside County ranks third with 312. (The majority of San Bernardino and River- side bridges are timber trestles across the numerous dry washes in the Mo- jave Desert.) Sierra County with eight bridges has the least of any county in the State.

At the present time there are 107 “posted” bridges on the state system. (A bridge is said to be “posted” when, because of its weak structural condi- tion, the weight of trucks allowed to



cross the structure is restricted to less than the full legal limit, or their speeds restricted to not over 5 or 10 miles per hour.) In 1947 there were some 329 such "posted" bridges. Thus, in the past five years over two-thirds of the "posted" bridges have been replaced.

Of the present 107 "posted" structures, 28 cannot carry full legal loads, and 79 can safely support legal loads only if they cross at very low speeds.

Nearly 1,000 bridges on the system have a width less than 24 feet, which is currently regarded as the absolute minimum for new bridges. Thus, about one out of every five bridges on the state system is narrow, and many are dangerous hazards. However, the present count of 1,000 represents a reduction of almost 400 in the number of narrow bridges as compared with the situation five years ago.

Life of Bridges

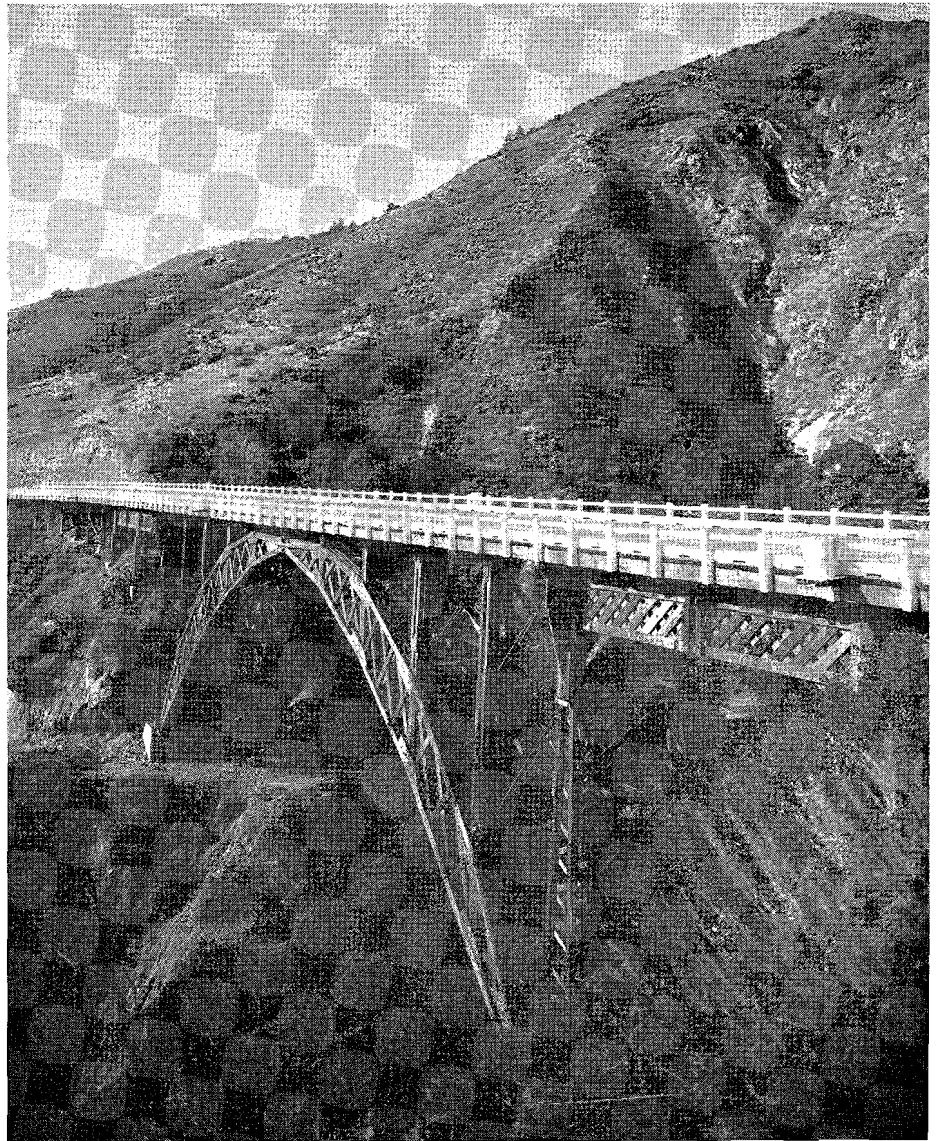
Although mortality tables similar to those for human beings cannot be set up for bridges, they often do have a definite statistical service life. For example, of the large number of bridges which existed in 1900, only a handful remain today.

Most frequently the condition necessitating the replacement of a timber structure is decay and deterioration of the timber members. Every year about 40 or 50 older structures must be replaced for this reason. But there are numerous other causes for bridge replacement. On the average, two or three of the older bridges are seriously damaged or destroyed by flood waters each year. Usually, at least one bridge each year is burned in some sort of truck accident, and another is demolished by a truck but does not burn. One or two bridges must be replaced each year because of inundation by a reservoir development.

For purposes of economic analysis, the bridges constructed today are often considered to have an average life of from 50 to 75 years. No doubt, a few will endure for 2,000 years (as have some of the Roman bridges), while others, due to unpredictable occurrences, will disappear within 5 or 10 years.

Bridges Are "Big Business"

The construction and maintenance of bridges in California is definitely a



Dolan Creek Bridge on Sign Route 1, Monterey County. Only timber arch of its type on highway system.

"big business" operation. Currently, about \$30,000,000 is expended on new state structures each year.

The largest and most expensive concrete bridge now under construction is the new six-lane Colorado Street arch bridge across the Arroyo Seco in Pasadena. Its cost will exceed \$2,400,000. However, in terms of cost the Arroyo Seco Arch will be dwarfed by the steel viaduct carrying the Bayshore Freeway over a section of the downtown area of San Francisco. Work is now under way on some portions of this viaduct, and its ultimate total cost is expected to be about \$15,000,000.

The cost of maintenance and repairs to the 4,800 state bridges totals over \$240,000 per year, or an average of

\$50 per bridge per year. However, this does not include maintenance of the San Francisco-Oakland Bay Bridge, where painting alone requires the full-time employment of from 50 to 60 persons and costs more than one-third million dollars per year. Cost of maintenance of the Golden Gate Bridge is in excess of \$280,000 per year. (The Golden Gate Bridge, the longest single span in the world, is operated by the Golden Gate Bridge and Highway District and technically is not a part of the state system.)

About \$13,000,000 per year is expended by the counties and cities in California for the construction and maintenance of other bridges not on the state system.

Sidewalk "Supers"

*In District VII Ancient Craft Is
In Keeping With Modern Times*

By A. D. GRIFFIN, Assistant District Engineer

WHEN mythology was in the making some 5,000 years ago, Hercules had considerable difficulty with his task of cleaning out the Augean Stables. As fast as he threw the refuse out the door, it came back in through the windows. What mythology does not relate, however, is that Hercules was not successful in this task until sidewalk superintendents took over. By leaning in at the windows to see what was going on, they blocked off the openings through which the refuse returned and enabled Hercules to complete his project.

Then some two thousand years ago, when Julius Caesar was following up his conquests by engaging in vast public works, history records him as saying: "Gallia est omnis divisa in partes tres laborum facilius video." Latin texts do not contain the last three words because scholars have been unable to agree on the proper translation. They were inclined to reason that "laborum facilius video" was Caesar's way of saying: "easy-vision television!" This conclusion, it would seem, might well be taken in the same vein as the claim by archeologists some years ago, when radio was called "wireless," that since no wires were found in the tomb of King Tutankhamen, this indicated that ancient Egyptians had radios. A much more logical interpretation of Caesar's remark is that he had Gaul divided into three parts for administrative purposes so that sidewalk superintendents could view the work more easily and not have to travel so far from their homes to construction jobs.

Role of Sidewalk Superintendents

Be that as it may, modern contractors do recognize the value of having sidewalk superintendents on their jobs. Observers of construction work have, from time to time, offered worthwhile suggestions as to how difficult operations could be simplified. Then

too, sidewalk superintendents perform an important function in spreading information concerning construction work of vital importance. Many times they build up the morale of workmen on the job who realize that their efforts are being viewed and appreciated. Much heretofore unthought of is now being done for the comfort and convenience of sidewalk superintendents.

Up until a few years ago sidewalk superintendents had to find their own knotholes or bring their own boxes to stand on to look over the high board fences which always surround interesting construction activities. Then modern-thinking contractors began to drill peep holes in their fences at convenient heights so that sidewalk superintendents, whether tall or short, could find apertures at eye level through which to view construction work more easily.

A New Idea

A year ago the Guy F. Atkinson Company, contractor on the \$3,500,000 bridge over the Arroyo Seco for the Colorado Freeway, took a big step forward and built a sidewalk superintendents' house at a vantage point on the job. This building measures 20 feet by 30 feet and has wide windows on all sides so that construction activities can be easily viewed. In the center there is a model of the bridge structure on a scale of 1 inch equals 20 feet so that sidewalk superintendents, after viewing disconnected units of construction out on the site, can look at the model and see how the various parts will fit together in the final product. Mr. Atkinson believes this model is of value not only to sidewalk superintendents but also to his own workmen who frequently come in to look at it in order to more easily interpret the plans. By visualizing the completed structure as shown by the model, they can then work out intricate details of form construction more easily.

This is thought to be the first instance where a contractor has taken such elaborate pains to provide adequate housing for sidewalk superintendents viewing his work. They are regarded as important personages by Guy F. Atkinson Company, which maintains a folio-size ledger on a table in this building in which sidewalk superintendents may record their names and addresses. This is certainly a striking indication of the belated recognition that is being accorded the profession of sidewalk superintending and a demonstration of how much it has come up in the world during recent years.

Television Takes Part

However, that was still the problem of transportation for sidewalk superintendents between home and construction. Origin and destination surveys would show unquestionably that some sidewalk superintendents come great distances to view construction activities. Providing transportation for themselves has placed quite a severe burden on sidewalk superintendents.

It has remained for Television Station KTTV, Channel 11, to solve this problem by bringing the construction job into the homes of sidewalk superintendents. This station is operated by the *Los Angeles Times*, and its studio is located in large buildings on the southeast corner of Sunset Boulevard and Van Ness Avenue, directly west of the Hollywood Freeway. When the original studies were being made for the freeway location surveys, the KTTV studio buildings were used as a control and every effort was made to so locate the Hollywood Freeway that these buildings would not be interfered with. The Division of Highways was not 100 percent successful in attaining this objective, as it was necessary to locate an inlet ramp for southbound traffic from Sunset Boulevard close to the easterly side of the



*Upper—Observation post for sidewalk superintendents on site of Colorado Freeway bridge in Pasadena. This building erected by Guy F. Atkinson Co., the contractor.
Lower—Construction operations on Colorado Freeway bridge as viewed from observation post building.*

studio buildings. To make an adequate connection with Sunset Boulevard, it was necessary to clip a triangular section about 20 feet long from one of the studio buildings.

Fine Vantage Point

Producer Roy Maypole, on the staff of General Manager Richard Moore of KTTV, recognized the superb vantage point that the roof of the studio afforded for viewing construction operations on the Webb & White contract on the Hollywood Freeway from Western Avenue to Hollywood Boulevard, since the studio is just about equidistance from these two terminal points of this important contract. The Webb & White contract has an allotment of \$1,461,600 and calls for grading, paving, and incidental work to provide an eight-lane freeway for the 0.7-mile length between Western Avenue and Hollywood Boulevard. Grade separation bridges for cross streets have been constructed under previous contracts at Western Avenue, Fountain Avenue, Wilton Place, and Sunset Boulevard, and construction is nearing completion by the contractors, Fredericksen & Kasler, on the bridge to carry Hollywood Boulevard over the freeway. The Webb & White contract consists of completing all necessary construction to provide the eight-lane freeway under these bridge structures.

Heavy Excavation

There were approximately 600,000 cubic yards of roadway excavation to be hauled away. Some of this excavation was hauled onto the Harbor Freeway in order to make roadway embankment approaches to grade separation bridges on this freeway, and the balance of the roadway excavation was hauled to the State Division of Highways disposal area in Chavez Ravine Canyon about one mile northerly from the Los Angeles Civic Center.

Program Arranged

Mr. Maypole realized the dramatic features connected with the operating of modern earth-moving machinery and equipment, and decided to bring these operations to his television audiences. He arranged for 25 minutes of program time between 1 and 1.30 p.m. Mondays through Fridays.



Looking southeasterly from roof of KTTV studio along Hollywood Freeway showing construction in progress. Wilton Place overcrossing in foreground. Roy Maypole, KTTV producer, left, interviews Haig Ayanian, Resident Engineer, Division of Highways, during broadcast of Sidewalk Superintendent television program.

Mr. Maypole decided to call his program "Sidewalk Superintendents," and he contacted P. O. Harding, Assistant State Highway Engineer in charge of District VII, asking his aid in making the programs interesting, instructive, and generally worthwhile to the television audiences. Mr. Harding delegated to the author the responsibility for conferring with Mr. Maypole and arranging details. Mr. Maypole's idea was that he and a representative of the District VII staff of the State Division of Highways would consider themselves as sidewalk superintendents on the ground viewing construction operations; and that the two of them would carry on informal conversation such as would be expected of two sidewalk superintendents inspecting construction operations of considerable magnitude.

The television camera was set up on the roof of the KTTV studio building nearest the freeway so that good vision could be had of construction operations in both directions along the freeway.

Time and again when the cameraman focused on a distant scene, the sidewalk superintendents on the roof behind the cameraman could not make out the details of the construction operation in progress, but the viewers over the television screen could see the close-up in minute detail. To that extent, at least, sidewalk superintendents in the television audiences had the advantage over the sidewalk superintendents on the roof or those that are always in evidence from vantage points on the ground.

First Broadcast April 1

The first broadcast was made on April 1st, with Resident Engineer Ray Collins being interviewed by Producer Roy Maypole while the camera was showing construction scenes on the Hollywood Freeway.

Then on April 2d Mr. Spencer Webb and Mr. James White, the partners in the contracting firm of Webb & White, were interviewed and gave information regarding construction activities on their contract.

On subsequent days during the month of April, the following representatives of the District VII staff appeared on this television program: R. W. Anderson, District Priorities Engineer; Haig Ayanian, Resident Engineer; Charles Beer, Assistant District Traffic Engineer; H. E. Belford, Resident Engineer; R. H. Butler, Assistant District Construction Engineer; Ray Collins, Resident Engineer; John Davidson, Maintenance Superintendent; Earl Dewing, Assistant District Materials Engineer; Basil Frykland, Resident Engineer; J. W. Greathead, Right of Way Clearance Agent; A. D. Griffin, Assistant District Engineer; Dexter MacBride, Senior Right of Way Agent; W. A. McIntyre, Bridge Department Resident Engineer; J. E. McMahon, Supervising Bridge Engineer; Milton F. Masters, Resident Engineer; A. L. Olmsted, District Landscaping Engineer; W. D. Sedgwick, Assistant District Engineer; Jack Sylvester, Bridge Department Resident Engineer; Jim Woodbridge, Bridge Department Resident Engineer.



Interior of sidewalk superintendents building showing model of new 6-lane Colorado Freeway bridge and the old 2-lane bridge that remains in service.

Mr. Maypole conducted the interviews on KTTV's "Sidewalk Superintendents" program in a most commendable manner. It was probably due to the fact that the interviews were carried out in an informal manner that these programs were received by the general public so enthusiastically. KTTV received so many complimentary telephone calls and letters that it felt justified in continuing this program through the entire month of April.

Typical of letters received was the following:

9161 Duarte Road,
San Gabriel, California
May 8, 1952

KTTV (Channel 11)
Hollywood, California

GENTLEMEN: I am sorry that "Sidewalk Superintendent" has gone off the air, for it has been my favorite daytime TV program for several weeks. It has been entertaining as well as informative, and I have learned many interesting facts from the questions Roy Maypole has asked state highway engineers in regard to the construction of our Los Angeles freeways.

It has been fascinating to sit here in my living room in San Gabriel and see what is going on in Hollywood; the operation of bulldozers and power shovels on the freeway construction project, traffic and pedestrians on Sunset Boulevard, glimpses of the beautiful Hollywood hills and Griffith Observatory, and wonderful TV close-ups made possible by the Zoomar camera lens.

I particularly liked the program when the State Geologist talked about fossils found herein Southern California, and the specimens that appeared on my TV screen showed outlines and patterns even more clearly than real-life fossils I have seen in museums. That thousands of years ago buffaloes and Indians roamed over Southern California, and that millions of years ago this Country was under water, are facts that never before had been called to my attention.

Hoping that Sidewalk Superintendent (or a reasonable facsimile of it) will appear again on television in the near future, and with many thanks to KTTV and all those who contributed to such an enjoyable program, I am

Sincerely yours,

(Mrs.) LEONORA A. PHILBROOK

Highway Engineers Assist

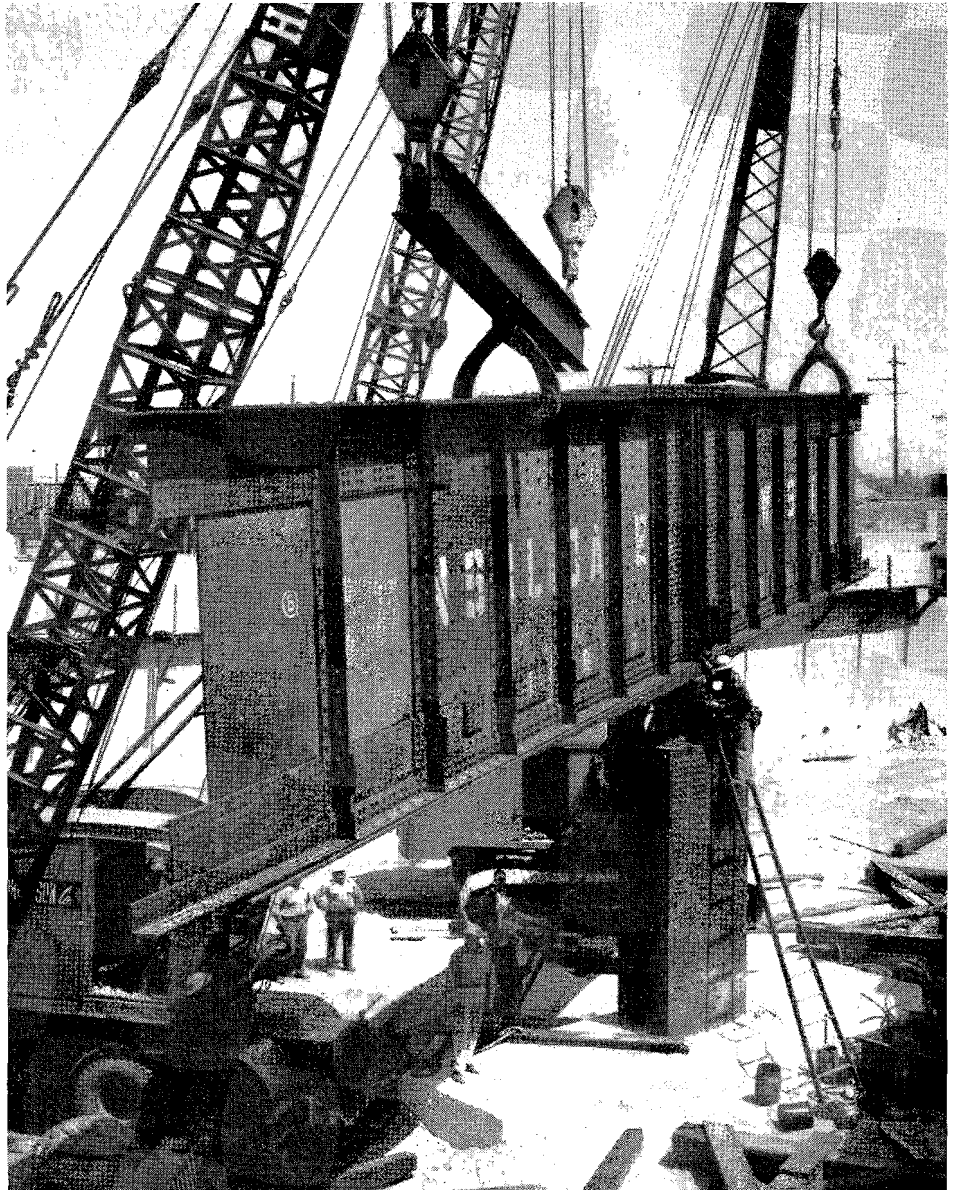
The representatives of the State Division of Highways who appeared on this program were there primarily for discussion and comments on the construction operations being photographed by the television camera. Generally speaking, the comments were just what might be expected of any sidewalk superintendents viewing work of this character. However, Producer Maypole took cognizance of the position held by the Division of Highways representative with whom he was conversing, and often led the discussion into fields of interest concerning the specialty of the man he was interviewing. For instance, one of the Bridge Department resident engineers had made a special study of prestressed concrete, and this subject was discussed with him while the camera was focused on nearby bridge structures over the Hollywood Freeway. Then when visiting resident engineers stationed on

construction contracts on neighboring freeways—the Harbor, Ramona, and Santa Ana Freeways—were interviewed, discussion was led into channels to bring out what was progressing on these particular freeways.

Discussions Varied

In a similar manner, when men representing District VII right-of-way organization appeared on the program, the discussion covered subjects of interest concerning right-of-way acquisition and clearance. It was brought out in connection with the moving of underground utilities at the site of the Sunset Boulevard bridge that coaxial cables, designated as “video” cables, are utilized to transmit television programs from the television stations in Hollywood to Mt. Wilson for amplification and rebroadcasting. Also, within the range of the KTTV television camera was the site of a 40-unit hotel-apartment building that had been moved all in one piece to a new location to make way for the Hollywood Freeway. Details of this operation were described on the television program.

Maintenance Department representatives, in addition to participating in general discussions, had opportunities to talk at considerable length on the problems which maintenance forces have in clearing trash from state highways. A description was given of the new “vacuum cleaner” now in operation that can pick up bottles and cans along with the lighter debris. Also, in one of the broadcasts wintertime problems of snow removal from state highways in the mountainous areas were discussed. Other subjects of this nature, sometimes far afield from the construction being viewed by the television camera, were frequently covered in the broadcasts. In a sense, the action pictures coming over the television screen of construction operations close to the studio served as a background for the conversation between the KTTV producer and the State Division of Highways representative. This was the situation when such subjects were discussed as traffic engineering, steel priorities, functional landscaping for erosion control, and structural geology.



Workmen of Consolidated Western Steel Division of United States Steel balanced on ladders to secure a 78-ton steel girder in place on the Simons Underpass of the Santa Ana Freeway, east of Los Angeles. The girder, largest of its kind ever erected by Consolidated Western engineers in freeway construction, is one of the center spans of a 1,247-ton four-track bridge which goes over the super highway.

The broadcasts were greatly enjoyed by the television audiences doubtless because they were something entirely different from other televised programs, showing construction activities where progress could be noted from day to day, and because variation in the programs was obtained by having representatives of different departments of the District VII organization appearing on consecutive days.

It is believed that much valuable information has been given to the KTTV television audiences during these broadcasts and that viewers now have a far better idea than before of the activities of the State Division of Highways, its problems and its objectives. The television audiences and the State Division of Highways owe KTTV a vote of thanks for putting on this unique series of “sidewalk superintendents” programs.

Erosion Control

Economic Aspects of Reducing Soil Loss From Highway Slopes Discussed

By H. DANA BOWERS, Landscape Engineer

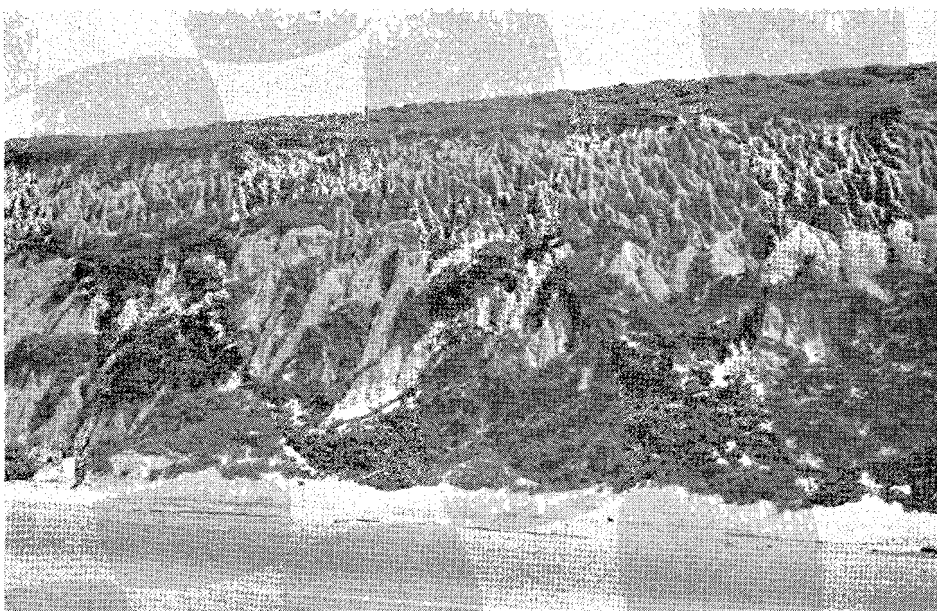
IT HAS NOT been too many years since the traveling public took mud on the highway for granted as being a natural consequence of storm action, and wise drivers drove cautiously because they knew conditions would almost certainly be dangerous. Eroded banks like the one shown below were commonplace, and soil eroded from these banks by even moderate rains had to be picked up and hauled away before the roadway could be considered safe for normal usage.

Fortunately, considerable progress has been made in reducing soil loss from slopes. Slope treatment has been developed to the point where very little erosion is evident after a storm of moderate intensity, and normal usage of the highway is now seldom restricted because of mud on the pavement.

Problem Not Solved

The partial failures of slope protection which result from extremely high intensity rains which come before the soil has become completely consoli-

Eroded, untreated 1:1 excavation slope near Carlsbad. Every storm deposits more soil in the gutter, and no relief is in sight. Vegetation cannot become established in the sterile subsoil subject to constant erosion. (San Diego County)



Heavy growth of vegetation on 2:1 treated slope near Carlsbad. Although the subsoil is identical with that shown in the picture above, the flattened slope plus topsoil and straw treatment provide favorable conditions for the development of a protective cover. This is one season's growth. (San Diego County)

dated and the cover of vegetation completely established, are evidence that

the slope protection problem has not been completely solved as yet. However, even these partial failures do not affect more than a small proportion of the treated area, and when the failed portion is properly repaired it withstands severe storms without further attention.

That it is desirable to prevent soil loss from highway slopes is unquestionable. That the cost of preventing soil loss is less than the cost of picking up and hauling away sloughed material year after year plus the intangible cost involved in danger and delay to the traveling public would seem on the surface to be obvious. Yet we should have comparative costs in order to more completely justify the money spent for slope protection during construction of the highway.

Cost Difficult to Determine

The exact cost involved in picking up and disposing of sloughed soil by

maintenance forces is difficult to determine, since the removal of minor ditch or slope ravelings is considered a routine maintenance operation and the cost thereof is included with other items. Major slide removal and storm damage repair, for which a separate cost is kept, includes removal of slides, restoration of slip outs and excessive settlements as well as the repair of damage to the roadway and facilities occasioned by storms, floods, earthquakes, etc., plus plantings necessitated in erosion repair.

It would seem to be impractical to attempt to separate the cost of removing material which could be definitely said to be the result of slope erosion from the cost of removing material deposited on the highway by slides, runoff from adjacent lands, drainage failures and other causes which could not be corrected by slope treatment, since the cleanup procedure does not involve separate operations. Therefore, a description of what happened during one recent storm on a project under construction, and the cost of cleaning up eroded soil and restoring the slope may serve to indicate the value of slope protection in dollars and cents.

Oceanside Project

On the project now under construction through Oceanside, XI-SD-2-Ocn, between one-fourth mile south of Mission Avenue and the San Luis Rey River, slope protection, involving



Oceanside slope after cleanup, restoration and treatment. (San Diego County)

slope preparation (roughening), topsoil and straw cover was specified for all excavation slopes, since the soil is highly erosive in nature. By January 15, 1952, the contractor had completed slope protection work on most of the slopes and had just finished spreading topsoil on the slope shown on the left of the picture below. Spreading and rolling of the straw cover was scheduled for the next day, but the next day it started to rain.

On January 16th, 0.43 inches of rain fell; on January 17th, 1.09 inches fell; and on January 18th, 1.62 inches was

recorded, most of this amount coming down at cloudburst intensity.

The soil, thoroughly saturated by the preliminary wetting, simply melted and came to rest at the bottom of the slope. It is interesting to note here that the slope on the right upon which the slope treatment had been completed withstood the storm almost perfectly. Damage on the treated slope consisted of two or three very small areas which were restored in a couple of hours by a man with a hand shovel.

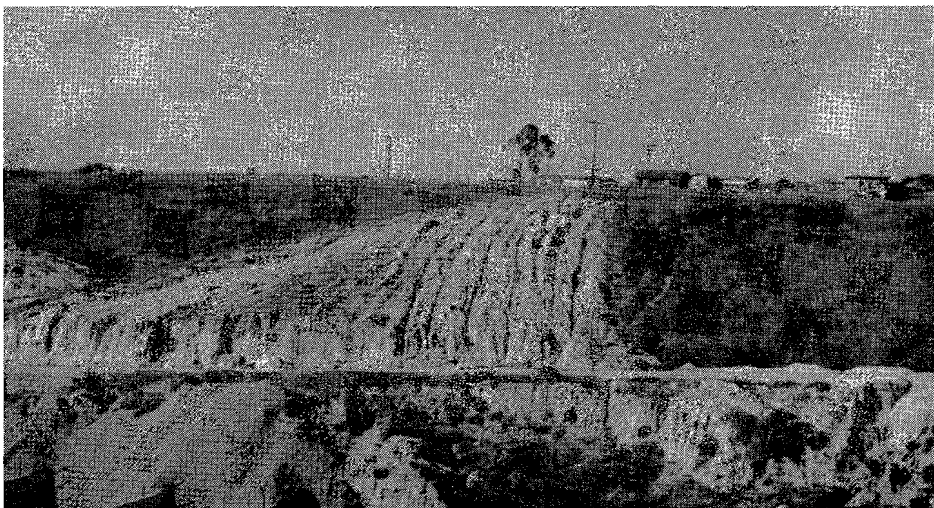
Some Cost Figures

The area of the eroded slope is 5,025 square yards. The contractor's cost for cleaning up and disposing of the eroded material was \$427.71. This works out to \$0.085 per square yard for comparative purposes.

The cost of slope treatment, based on the contractor's bid prices of \$0.10 per square yard for slope preparation and \$50 per ton for straw to be spread and rolled at the rate of four tons per acre works out to \$0.1413 per square yard. The cost of topsoil is included in the excavation quantities and is disregarded in this comparison.

While it would appear at first glance that the cost of slope treatment would be exceeded by the cost of picking up and disposing of the sloughed material from two storms, in this case the conclusion is not quite accurate. Freshly

Soil loss from the recently topsoiled slope at Oceanside after the storm of January 18, 1952. Protection treatment had been completed before the storm, on the slope on the right, and damage was negligible. See text for details. (San Diego County)

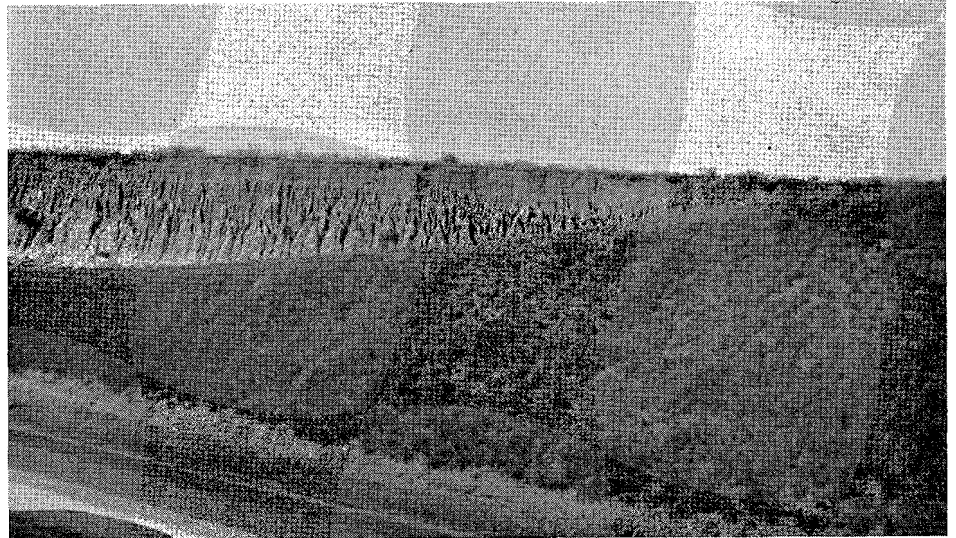


spread, uncompacted topsoil or cultivated material is extremely susceptible to erosion, and if the soil on the slope under consideration had been compacted by several light rains before the "gully washer" came, no such wholesale loss of soil would have taken place. However, if no slope preparation, topsoil or straw had been applied, some soil loss would have taken place, as it did on the freshly graded slope above the old road in the accompanying picture, and maintenance forces would be faced with the never-ending job of cleaning up after each storm. An eroded slope like this continues to lose soil year after year.

Topsoil Necessary for Planting

It might be argued that the best way to keep topsoil from washing off a bank during a storm like this would be to leave it off entirely. That would be fine, provided an adequate growth of vegetation which would provide permanent protection could be established without the use of topsoil. However, it appears to be necessary to provide a layer of loose soil in order to obtain plant growth of effective density, and of course proper incorporation of straw with the soil is impossible unless the soil is loose.

In localities where topsoil is scarce, we have provided for cultivation of



Recently protected 2:1 bank in the foreground withstood the storm of January 18 without damage. Compare with the old eroded 1/2:1 bank in the background. Note absence of growth on constantly eroding bank. (Near Carlsbad, San Diego County)

the subsoil and addition of fertilizer in an attempt to establish vegetation, but growth has been rather weak and sparse and cannot compare with the lush stand of grass and weeds shown in the first picture of the protected slope near Carlsbad. Besides, cultivated subsoil erodes from the bank even more readily than topsoil does, if a storm strikes before slope treatment has been completed.

Fertility, humus, and soil bacteria and other micro-organisms contained

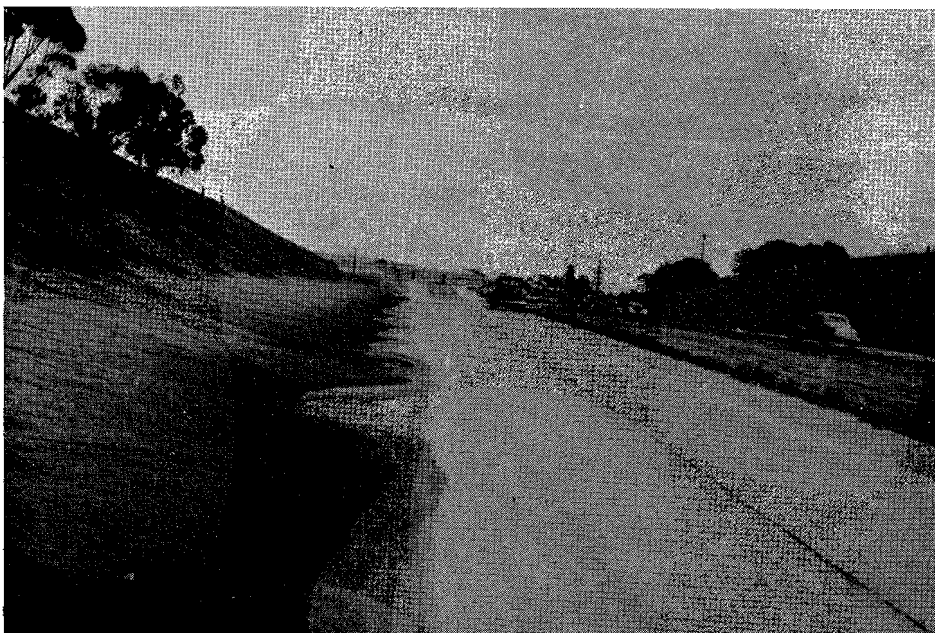
in good topsoil encourage the healthy growth of plants. Seeds of the varieties of plants which have become naturally established in the locality are also brought in with the topsoil, and these plants take over the permanent protection job quite rapidly. Therefore, it would seem that the advantages gained by the use of topsoil wherever it can be economically obtained outweigh the disadvantages of occasional losses.

Some Questions

Anyone who attempts to establish the dollars and cents value of slope protection comes sooner or later to the intangible things which must be taken into account in evaluating the worth of a method. What monetary value can be fairly placed upon the reduction of hazards to traffic through keeping the traveled way unobstructed by mud and slough? What value can be given to the improved appearance of a smooth vegetated slope as compared to a raw gullied bank? Drainage obstruction, deposition of silt upon adjacent lands, emergency calls for the maintenance crews—all these items cost somebody some money, but how can we convert the cost into price per square yard for comparative purposes?

Although the intangible values add to the worth of slope protection by some undetermined amount, it does not seem necessary to rely upon that

Freshly graded slope above an old road at Oceanside after the storm of January 18, 1952. Soil loss has started, and will continue. (San Diego County)



... Continued on page 60



Upper—NBC's agile Cameraman Leppert taking a low angle shot while dumping operations are being explained by Mr. Hanson of the Good Roads Machinery Company of Minerva, Ohio, who flew out especially to inspect the vacuum cleaner. Lower—NBC Cameraman Leppert getting close-up view of vacuum cleaner about to suck up tin cans and other debris.

State Highways Vacuum Cleaner Is on Television

By W. F. AXTMAN

Assistant District Maintenance Engineer

THE NOVEMBER-DECEMBER, 1951, issue of *California Highways and Public Works* magazine, starting on page 46, carried a story by W. D. Sedgwick, Assistant District Engineer in charge of District VII maintenance, entitled: "Vacuum Cleaner . . . New Machine Gathers Trash Motorists Throw on Highways."

This story in our magazine was the basis of many reprint articles in other magazines and publications throughout the Nation and, as a result, many inquiries about the machine have been



received, including one from a foreign country. One of these stories must

have come to the attention of the New York office of the National Broadcasting Company because Mr. Sedgwick received a call from the Los Angeles office of NBC stating it would like to have an opportunity to take moving pictures of the vacuum cleaner in operation which could be used for nation-wide telecasts. Arrangements were made and on May 5th, while the vacuum cleaner was operating on the Ramona Freeway near the east city limits of Los Angeles, Jack Leppert, one of the ace television newsreel photographers, was given the assignment by NBC to photograph the operations. Accompanying this story are photographs showing the vacuum cleaner in operation while being photographed by him.

Mr. Leppert took approximately 500 feet of standard-size motion picture

... Continued on page 60

Traffic Safety

Emphasis Placed on Greater
Cooperation Between Agencies

THE ACCOMPANYING editorial, which appeared in the Santa Barbara *News-Press*, is timely and appropriate in view of the many serious traffic safety problems in California. It typifies the state-wide thinking being encouraged by the California Conference on Traffic Safety to coordinate the various approaches to greater traffic safety on the part of the enforcement agencies, the educational agencies, and the engineering agencies.

The 1952 session of the California Conference on Traffic Safety has just been called by Governor Earl Warren for October 2d-3d in Sacramento.

The writer of the editorial, Herbert F. Orriss, Associate Editor of the *News-Press*, was recently honored with an award of merit from the California Safety Council for his journalistic contributions to increased safety consciousness in his community.

Driver Factor

Research into the "driver factor" in traffic accidents as advocated in the accompanying editorial actually is now being undertaken on a nationwide scale.

A Committee on Highway Safety Research was established in 1951 in Washington, D. C., as a unit of the National Academy of Sciences—National Research Council, and held its first Highway Safety Research Correlation Conference on June 5th and 6th in the Nation's capital.

J. C. Young, Traffic Engineer for the California Division of Highways, was one of the specialists in traffic engineering invited to participate in the conference, along with experts in several other scientific and engineering fields.

The purpose of the committee is "to correlate and stimulate research on highway safety, with emphasis on the human factors in relation to engineering and physical factors." It expects to bring to bear on the problem the different research activities and view-

RESEARCH INTO THE DRIVER FACTOR IN TRAFFIC ACCIDENTS

From time to time, companies that have a great many motor vehicles traveling on the highways and that hire a large number of drivers, give a dinner, or some kind of ceremony, at which honor is paid to drivers with exceptionally good safety records. A few days ago the Safeway Stores, Inc., had such a meeting. There were 175 truck drivers present. One of the drivers received an award for 20 years of driving without an accident. Thirty-six of the drivers received awards for 10 years of driving without an accident.

Whenever such awards are given to men who drive almost all the time of their employment—year after year, without an accident—it gives the average driver, who probably does not drive more than 5 to 10 hours a week, something to think about.

We charge accidents to many things—to lack of safe highway construction, proper signal lights, proper enforcement of traffic laws, the speed or carelessness of the other fellow, bad weather conditions and so on. The truck driver who is honored for safe driving contends with all of these things. He contends with them 10 times or more as much as the average driver of a pleasure car.

The big part of the traffic safety problem must be in the driver. If that is so, the big part of traffic safety campaigns should have to do with drivers. Besides our study of traffic flows and engineering problems we need more and better studies of the differences between drivers who have accidents and drivers who do not have accidents.

If a number of accidents happen on a certain section of road, that section of road is studied carefully to see what is the matter. If the trouble is discovered, or any trouble is discovered, that piece of road is reconstructed to eliminate the danger. We do not carry out the same policy and theory as much as we should in connection with drivers. If a driver has a number of accidents, no special study is made of his or her makeup, to see what changes or safety measures should be taken.

It should be plain that, if some drivers can drive for 20 years without accidents on the same roads and under the same conditions that other drivers have frequent accidents, something about the drivers needs study—as much study as the construction of the roads and the accident prevention equipment and methods in use.

Mere knowledge of driving and vehicle construction and the vehicle code are not sufficient. It is almost certain that the "20 years safe driving" drivers would not be able to pass examinations on such subjects with higher grades than many drivers who have more than their share of accidents.

Of all the research that is going on now, to save lives and cure sickness and injury, there are many that cannot produce as much results as a research which would bring about—driverwise—a 10 percent reduction in traffic deaths and injuries. So, why not a serious and adequately conceived research into the driver cause of traffic accidents?

Santa Barbara News-Press

points of all the many scientific divisions of the Academy-Council.

"Great progress has been made over the last 20 years in the fields of highway and traffic engineering, enforcement and safety education," it was recently stated by Dr. T. W. Forbes, executive secretary of the committee, "and the death and injury rate per hundred million miles of travel has been very greatly reduced. However, due to increased mileage and exposure, the actual *number* of deaths and injuries has *increased* to such an extent that, on the basis of present estimates, 10 percent of the population of the United States may be expected to be killed or injured in highway accidents in a period of from 10 to 15 years.

"Thus, highway safety has become a critical social problem and leaders in this field are convinced that more information on the human phases of the problem is vital. For this reason there is a pressing need for research on a nation-wide scale in all of the scientific and engineering fields related to human behavior on the highway."

DRIVING SKILL

Do you take pride in your driving, or is it something you give no more thought to than washing dishes or watering the lawn? Take pride in your skill behind the wheel; that skill may help you to avoid trouble someday.

Retirements *from* Service

JAMES M. HODGES

ON MAY 1, 1932, James M. Hodges, Supervising Highway Engineer on the District VII staff, announced his retirement from state service.

Jim, as he is known throughout the State, started his highway service with



JAMES M. HODGES

District VII on December 28, 1914, as an axeman on one of the survey parties on the original survey for the "Old Ridge Route." From December 12, 1917, to August 1, 1919, during World War I, he was on military leave with the Army in France. Upon his return to civilian life, Jim advanced through the various survey party positions and was instrument man at the time he left District VII on May 18, 1920, when he resigned to accept out-of-state employment.

Jim returned to State Division of Highways service December 1, 1928, to accept a position as Resident Engineer in District VIII. When portions of Riverside County and Imperial County were relinquished by District VIII in 1933 to become a part of the new District XI with headquarters in San Diego, Jim, with other personnel on construction assignments in those areas, automatically became District XI employees.

On April 25, 1936, Jim transferred to Sacramento Headquarters Office where he worked for a period of five years on the office engineer's staff. On March 16, 1941, he became District Maintenance Engineer for District IX, with headquarters in Bishop, which position he held until August 1, 1947. On this date Jim transferred again to

... Continued on page 28

STANLEY McCULLOCH

Stanley C. McCulloch, Associate Materials and Research Engineer, retired on March 10th after 28 years of state service.

Mr. McCulloch was in charge of the Los Angeles Branch of the Materials and Research Department for the 26 years prior to his retirement.

Stanley was born on January 21, 1895, at Waukomis Garfield, Oklahoma. After graduation from the Waurika Oklahoma High School, he attended the Oklahoma Normal School. He subsequently attended the enlisted specialist school and spent time in the coast artillery officers training camp.

After a short time at teaching, a session in the Army, and periods with the Army Engineers and the Pacific Telephone and Telegraph Company, he started work for the California Highway Commission in January, 1924.

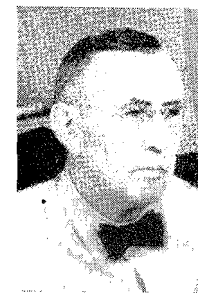
Stanley's first state assignment was in the drafting room of District III. He transferred to District VII in July of the same year (1924). After serving in District VII for two years, he transferred to the Materials and Research Department to open a materials sampling and inspection office at Second and Spring Streets in Los Angeles. That office, under Mr. McCulloch's supervision, became known as the Los Angeles Branch of the Materials and Research Department.

In 1942, Stanley and his group moved to the present location of the branch at 1523 East Firestone Boulevard. Since Stanley's retirement, that office is under the direct supervision of Bill Bennett.

Mr. McCulloch is well-known to state engineers in Sacramento and the districts; however, he was best known in the southern area, where his activities were almost entirely confined during the past 26 years. He plans to live near Indio.

J. B. HODGES

J. B. Hodges, who has been Office Engineer in District III for many years, retired on May 15, 1952, after 31 years of state service. Joe first worked for the Division of Highways in 1914 but took some time out to go to college,



J. B. HODGES

serve in the Army, and get a little outside experience before returning for good in 1922.

Joe worked several years for District VII in the Los Angeles area as an assistant resident and resident engineer on construction projects, before transferring to District II in 1930 as district construction engineer. His period of service in Redding was a little over five years, his transfer to District III having occurred in June of 1935.

Joe's work in District III began with an assignment as district office engineer. At that time, the duties of this position included supervision of all survey and plan activities. He was kept extremely busy and often spent many hours of his own time seeking information necessary to complete the design of a project to his satisfaction. As the work expanded, reassignments of duties were made and Joe was designated surveys and plans engineer and later again became district office engineer, the position he held at the time of his retirement.

Joe's many friends in the Division of Highways will miss him and join in wishing him enjoyment of the retirement years ahead.

WILLIAM H. EPPERSON

William H. Epperson, Supervising Mechanical and Electrical Engineer for the Division of Architecture, retired on April 4, 1952, after serving the State in various capacities for 21 years.

Bill Epperson, widely known and one of the most highly regarded members of the Sacramento-San Jose vicinities (for the past 50 years), first came to the division as a mechanical draftsman on December 26, 1917. At this time the division was known as the Bureau of Architecture, of the Department of Engineering.

Epperson is a native son of Durham, California, where he spent his early years helping his father in a general merchandising store. While there, he prepared for an engineering career by studying I. C. S. courses. After four years of service in the Navy, in which he attained the rank of fireman, first class, Bill found he had a liking for mechanical work. He was employed as an engineer by P. G. & E. Company, for whom he worked until he entered state service on December 26, 1917.

Enters Private Industry

Epperson served five months with the division, leaving on May 31, 1918, and returning February 7, 1919. He resigned from the division on January 24, 1923, to enter the private construction industry, in which field he was active until 1935, during which time he served as mechanical inspector in the construction of the Medico-Dental Building and the Fitzhugh Building, both in San Francisco. He started as mechanical engineer for the Pacific Gas and Electric Building, and wound up as the superintendent of the project. During his years in private industry, he served as superintendent on many building projects in the West. Among these were the El Tejon Hotel in Bakersfield, California, the Montevista Hotel in Flagstaff, Arizona, the New Hotel in Idaho Falls, Idaho, the Gov-

ernor Hotel at Bellingham, Washington.

On September 16, 1935, Epperson returned to state service as an associate mechanical engineer in the Mechanical Section of the Division of Architecture, in which capacity he served until 1939, when he was promoted to chief office building engineer, Department of Finance. In 1946 he returned to the Division of Architecture as senior mechanical engineer in time to supervise the rehabilitation of the State Fairgrounds, after occupation by the Army during World War II.

Wins Promotion

In 1948 he was promoted to supervising mechanical and electrical engineer and assigned to work as an assistant to Carl E. Berg, whom he succeeded in December of that year, as district construction supervisor of the Sacramento district. He was promoted by TAU to area construction supervisor in 1950, and served until November 1, 1951.

During the three years in which he headed the Sacramento area of the Division of Architecture, he supervised the erection of \$83,516,345 worth of construction at more than 40 different sites. This includes sites from Dorris and Tulalake to Porterville, including among other jobs, the erection of the Porterville State Hospital at Porterville, which is the largest single construction job ever undertaken by the Division of Architecture, the project consisting of the erection of an entire mental institution costing \$7,120,853. He also supervised the construction of the Deuel Vocational Institution at Tracy.

Supervised Capitol Annex

By far the greatest monument to the construction ability of Bill Epperson, however, is the new annex to the State Capitol, which was erected under his supervision. This building, one of the finest in the Country, is the only state capitol building in the United States known to have been erected within the original estimate, which is a matter of great pride to the Division of Architecture.

In preparation for retirement, Bill turned his area over to J. W. Cook in November of 1951, after which Ep-

UNDERGRADUATE WRITES

LOS ANGELES 48,
May 17, 1952

EDITOR

California Highways and Public Works

DEAR SIR: May I take this opportunity to thank you for placing my name on your mailing list. I am an undergraduate engineer in the College of Engineering, University of California, Los Angeles, and your excellent magazine keeps me informed of the engineering projects and problems found in actual practice. Already the first two issues I have received have helped me immeasurably in a report I was asked to write concerning the freeway system of the Los Angeles area. I am hopefully looking forward to future issues.

Yours truly,

CLAUDE BENEDIX

J. M. HODGES

Continued from page 27 . . .

Sacramento and worked until March 23, 1949, on the office engineer's staff.

He then returned to District VII as Assistant District Engineer in Charge of Surveys. This is the position which he held until the time of his retirement. Jim was responsible for the district materials staff and the District Hydraulics and Drainage Department, as well as the District Survey Department. In this position he had general supervision over an engineering staff of approximately 150 men, whose activities permeated to a considerable extent through all phases of the engineering work done by District VII.

person began a five-month special survey of mechanical work throughout the entire State under the immediate direction of D. C. Willett, Chief Construction Engineer. At the completion of this work, he formally retired from the Division of Architecture, but not from construction.

Mr. and Mrs. Epperson plan to reside in their cabin in Paradise, where Bill expects to build a mountainside home in his spare time in the next few years, after which he and Mrs. Epperson plan to divide their time between their home and such traveling as they may wish to do.

Late Fishing

High Sierra Passes Blocked to Anglers by Record-Breaking Snowfall

THE RECORD-BREAKING SNOW of the past winter will bar many High Sierra anglers from their favorite lakes and streams this year beyond the opening date of the fishing season, according to the California Division of Highways.

Some of the lofty mountain highways, which have been blocked by snow all winter, lead to many of the popular fishing and other recreational areas in the State, particularly in the region south of Lake Tahoe.

Understandably, the home and cabin owners, the resort operators and the campers join the fishermen in an annual plea to the Division of Highways to get the winter's accumulation of snow out of the way quickly so that they can reach their recreational haunts.

Tough Situation

Unfortunately, highway maintenance crews are up against a tougher situation than most people realize. This is particularly true in an abnormally heavy snow year like the present one, which has broken this century's records for total snow pack at any one time and total snowfall for the whole season.

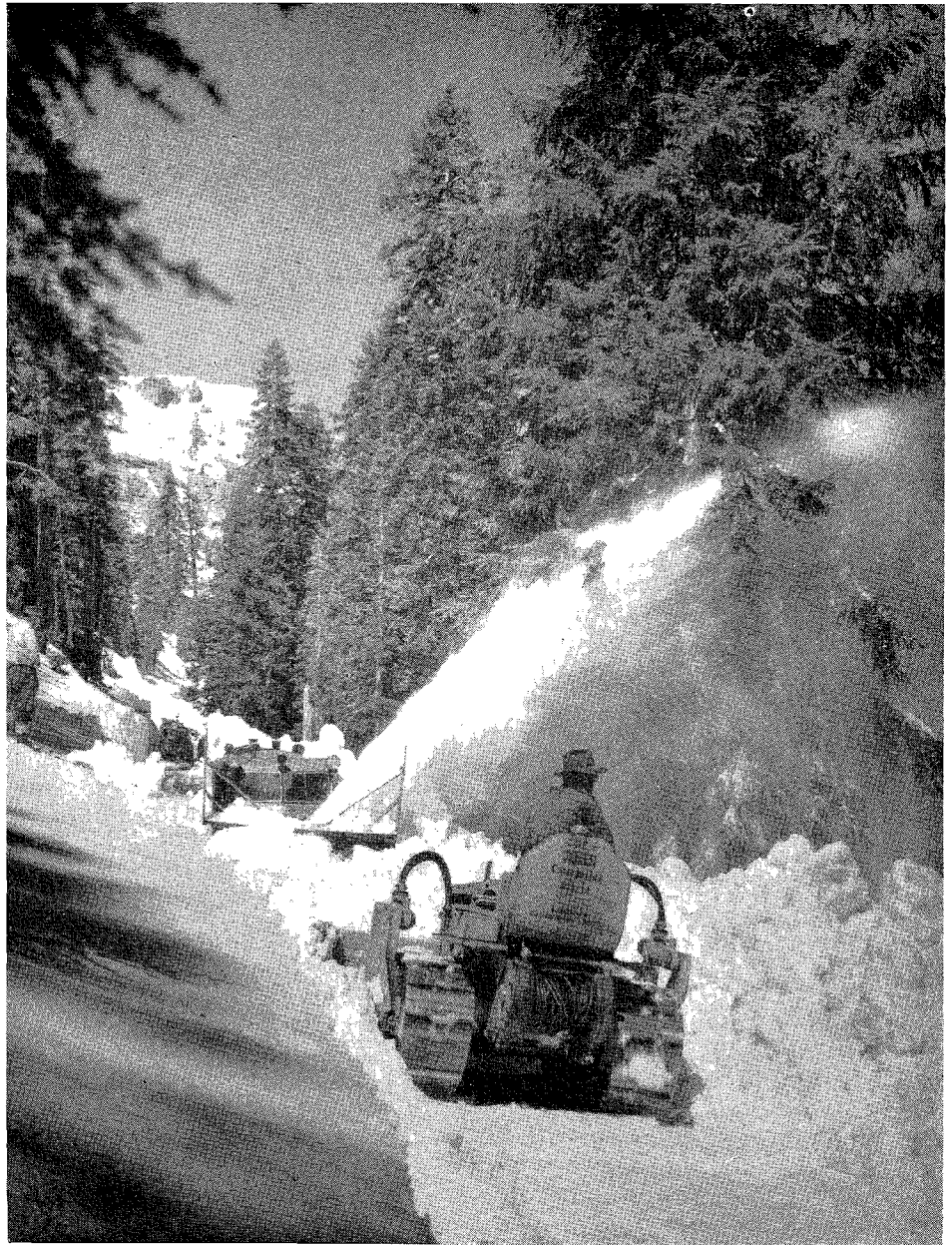
Spring may be busting out all over in the valleys, but in the high mountains an April shower may still be a snow-storm, the thermometer seldom reaches as high as 60 degrees during the day and drops to freezing or near freezing at night.

The most seriously affected area stretches from Lake Tahoe to the higher passes to the south—Carson, Ebbetts, Sonora and Tioga—all of which are snowbound and closed to traffic during the winter months.

In the Tahoe area and farther north the state highways across the Sierra are kept open all year, except under the severest storm conditions, such as the blizzards of last January.

Normal Openings

Sole exception to the "open all year" group of state highways in the Tahoe section is the portion of the west lake-

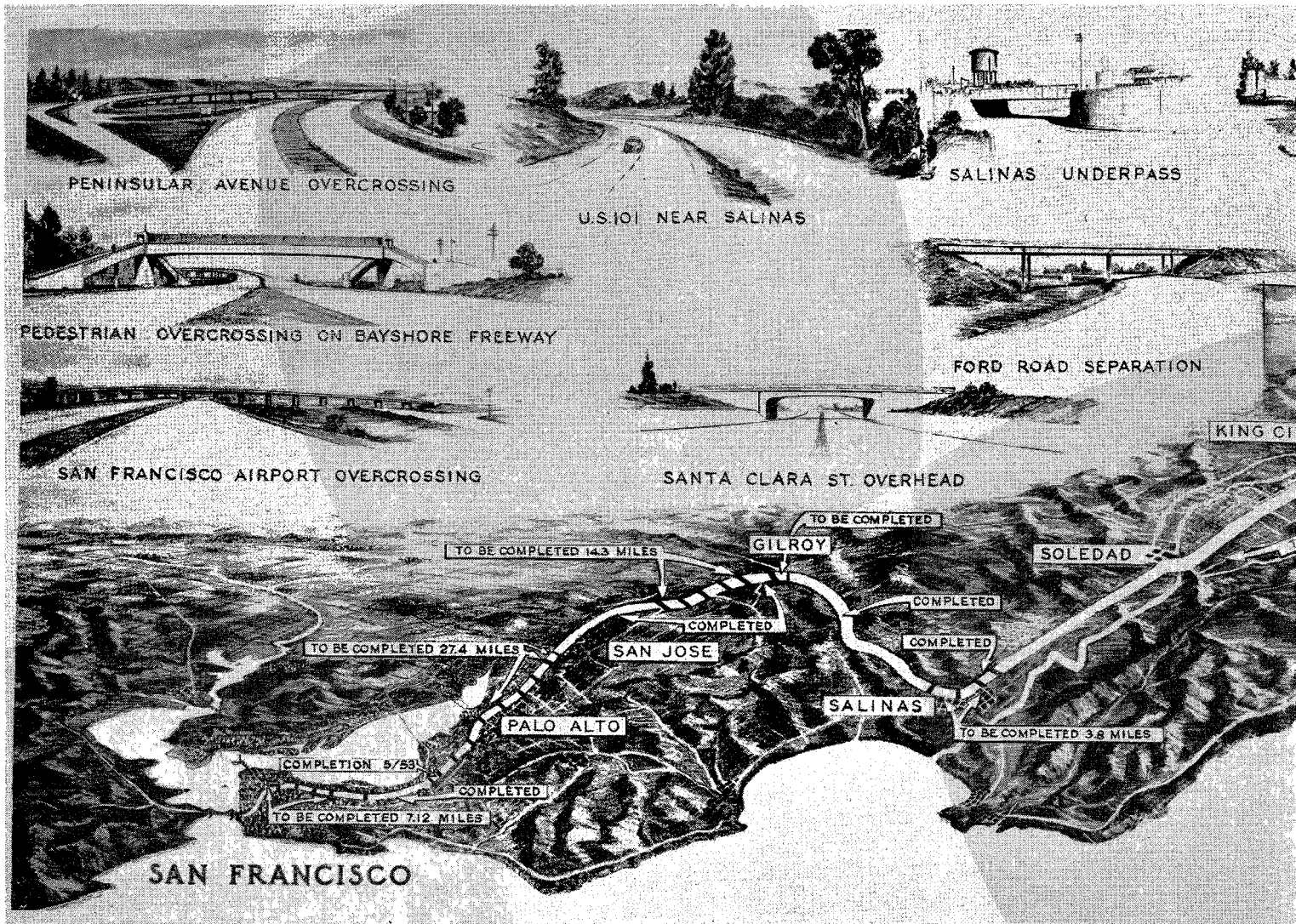


Some idea of the tremendous task facing the State Division of Highways in reopening the High Sierra passes in the spring and summer may be obtained from this picture, taken near the summit of Carson Pass during the latter part of May, 1951. The snow pack last year was far less than this year's abnormally heavy accumulation, the greatest in more than half a century. The tractor in the foreground is breaking up the icy crust and pushing the loosened snow to the rotary plow which propels it out of the roadway trench. Supplementary equipment, including a fuel truck (shown in the deep trench in the background), follow as the rotary plow inches its way toward Carson Summit.

shore highway between Richardson's and Bliss Park. This is avalanche country, which in 1935 claimed the life of a highway maintenance man. To open

this section before the slide danger is past would endanger the life of anyone driving over it, a risk which the

... Continued on page 49



IN AN ADDRESS before the twenty-eighth annual convention of the Mission Trails Association in Santa Monica on May 23d Highway Commissioner Harrison R. Baker, in reviewing improvements made on U. S. 101 which Father Junipero Serra and his padres mapped out 180 years ago when they were founding their string of missions, used the accompanying sketches by Van der Goes, Bridge Department, Division of Highways, to illustrate his talk.

Baker said in part:

"The California Highway Commission necessarily works and thinks in terms of our tremendous load of highway deficiencies. Of our nearly 14,000 miles of state highway, more than 11,000 are deficient in one or more respects—structurally, or from the stand-

point of safety, or, most glaring of all, because of inadequate traffic capacity. Your association is acutely aware of these deficiencies in the counties which you represent, and the Highway Commission appreciates and values your continued counsel in our effort to accomplish the most possible within the limits of legal requirements and available financing. You have helped to center public attention on the need for highway improvements, and you have been equally ready to center public attention on projects which have been completed and which enhance the pleasure of the motorist in following the "path of the padres."

"The opening this month of nearly four miles between Palm City and Chula Vista brings the Montgomery Freeway to completion from Palm

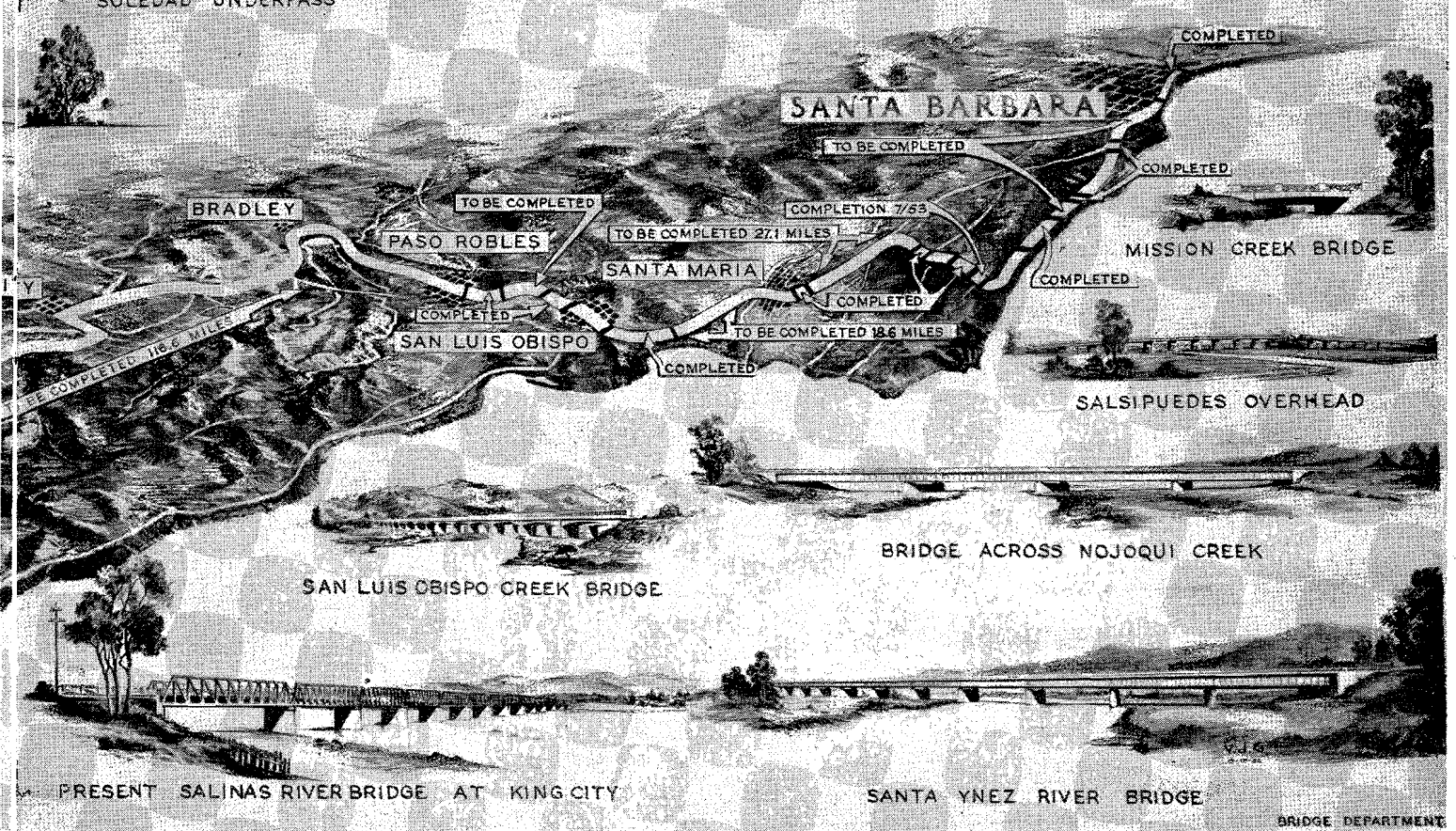
City to San Diego. North of the city, the widening of U. S. 101 from Del Mar to Encinitas has been provided for in the 1952-53 Budget.

Oceanside-Carlsbad Project

"Work is well under way on more than 11 miles of freeway which will eliminate bottlenecks in the Oceanside-Carlsbad area; several contracts are involved, including the widening of the bridge over the San Luis Rey River. They total nearly \$9,000,000. The most recent contract, on the section through Carlsbad, was awarded one month ago.

"Beginning in Orange County we enter the region of what is perhaps the most ambitious concentrated planning program of highway construction ever undertaken—the Los Angeles Metro-

STATE HIGHWAYS AND FREEWAYS SAN FRANCISCO TO SANTA BARBARA



politan Freeway network. A portion of this network is already in operation. One of its major units—the 10-mile Hollywood Freeway between the Civic Center and Vineland Avenue in the San Fernando Valley—has been completely financed, and construction is under way on the final sections between Western Avenue and Cahuenga Pass. By the end of 1953 the Hollywood Freeway should be completed.

Los Angeles Freeways

“In the meantime, work is under way on the short connection just east of the Civic Center which will link the Hollywood and the Santa Ana and Ramona Freeways; on the connection between the four-level distribution structure and the Arroyo Seco Parkway; on the Harbor and River Free-

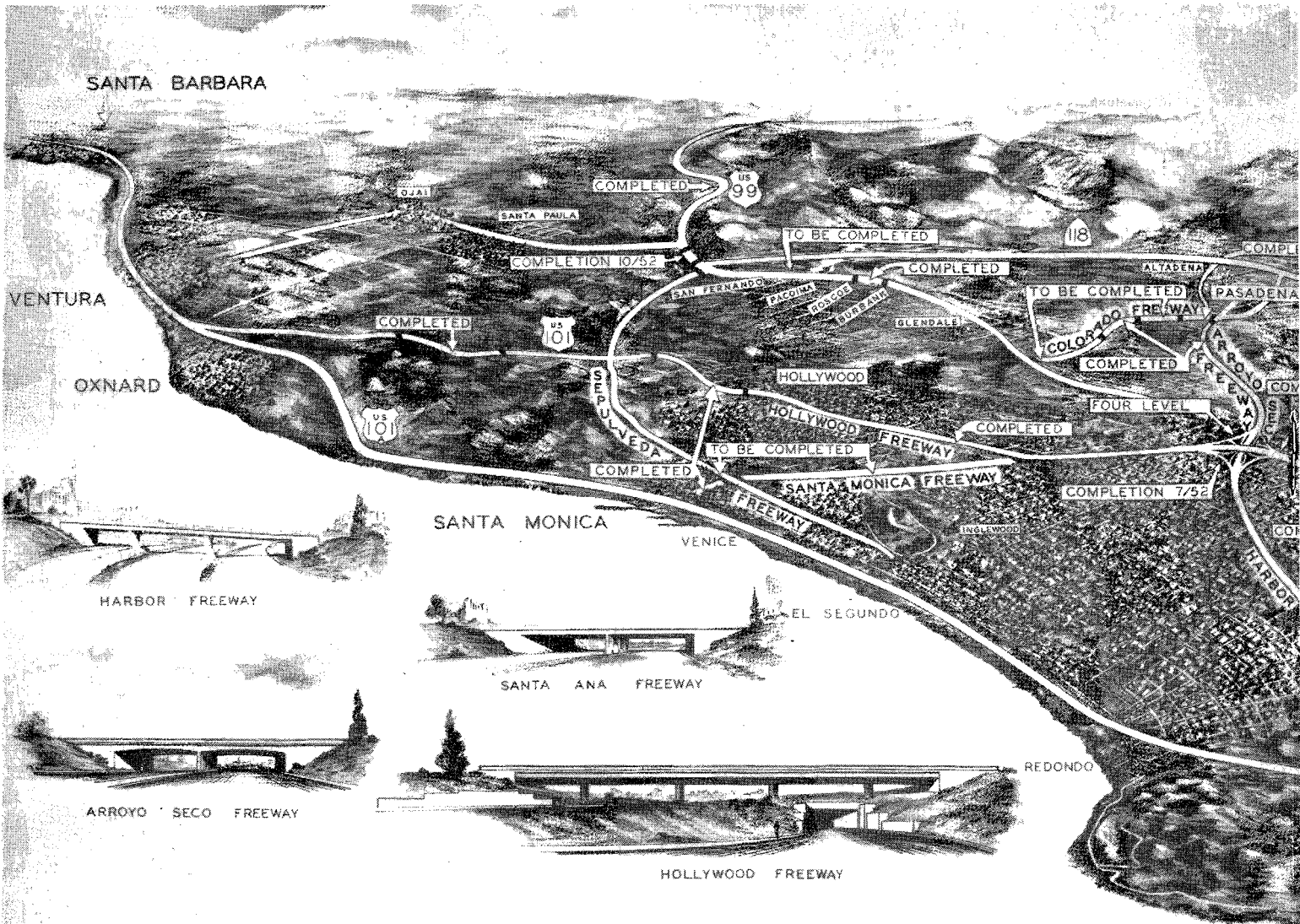
ways; and on the new Colorado Freeway Bridge.

“The Los Angeles Metropolitan Freeway System is important to your association in more ways than one. It not only enhances the visitor’s motoring pleasure and permits him to spend more time on recreation and less time battling traffic; also, because of its bold conception and well-designed construction it cannot help but serve as a tourist attraction in itself. Publications of national circulation have been asking increasingly for pictures and information about it. We may come to find in the next few years that the nucleus of the metropolitan freeway network, the four-level distribution structure, is one of our most famous Mission Trails landmarks.

In Ventura County

“In Ventura County, I am happy to report that construction is scheduled to begin this summer on the grade separation over the Southern Pacific main line tracks at Camarillo. This \$600,000 overhead will eliminate the last remaining grade crossing of U. S. 101 and the Southern Pacific main line between Los Angeles and San Francisco. Another Ventura County project was just completed a few weeks ago: the short but important four-lane divided section between the Santa Clara River Bridge and Montalvo.

“A little west of the Ventura County line in Santa Barbara County, construction is well under way on the 3½ miles of expressway west of Carpinteria which leads up to Ortega Hill.



SOUTHERN CALIFORNIA FREEWAYS

THE METROPOLITAN AREA OF LOS ANGELES AND

Gaviota Pass

"North of Santa Barbara, you will be particularly interested in the Gaviota Pass project which is now in full swing. In 1950 the Division of Highways started on a three-year program to improve the scenic eight-mile section from Gaviota north over Nojoqui Summit as a four-lane divided highway. The Nojoqui Summit portion was completed last fall. The section just south of it, from the north end of Gaviota Gorge to Las Cruces, is scheduled for completion in the next few months. The contract for the three miles northerly from the settlement of Gaviota was awarded April 1st and

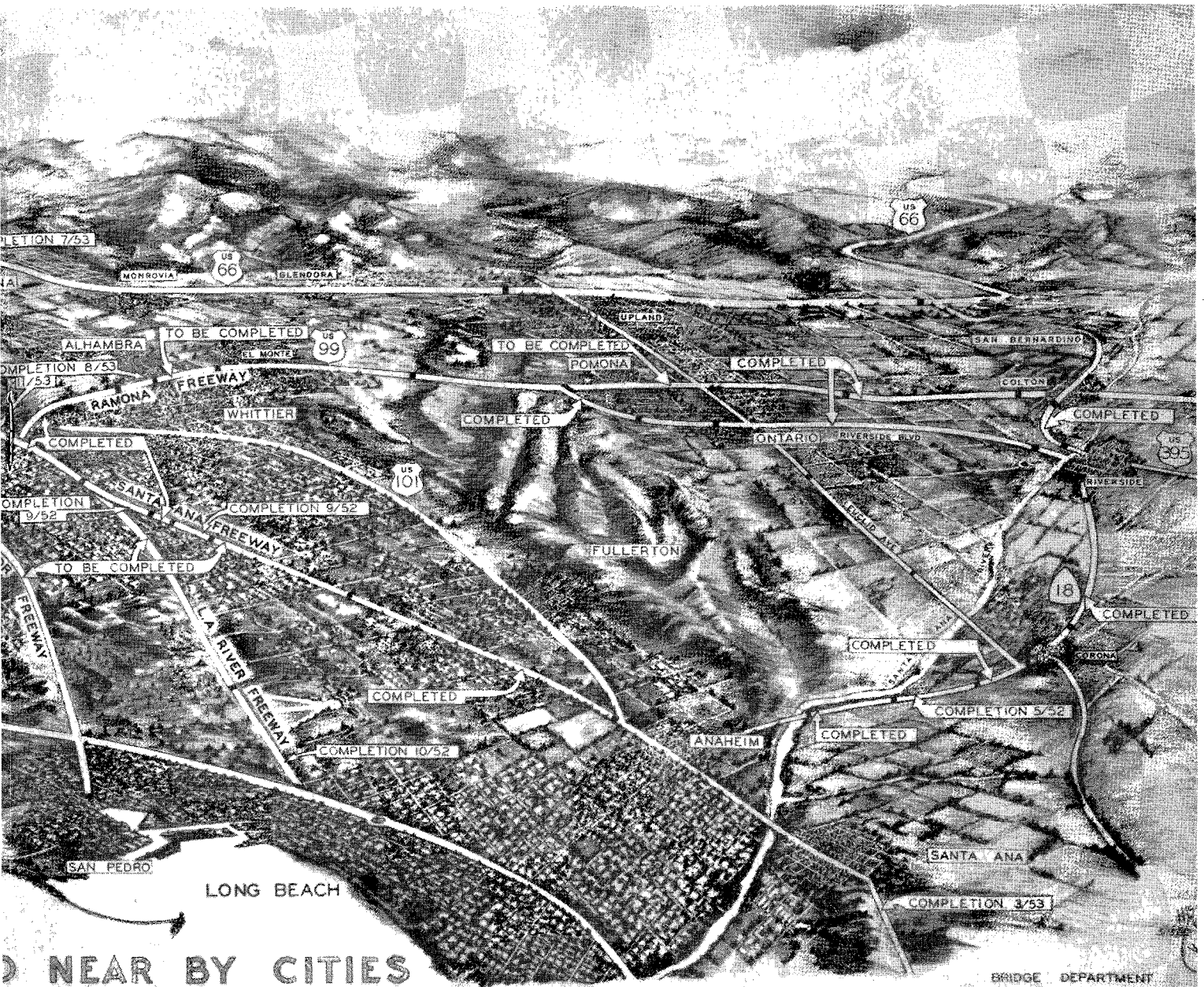
construction is under way. Meanwhile, work on the Gaviota tunnel, which was holed through in February, is in full swing. It is through this tunnel that the northbound traveler will pass on his journey along El Camino Real.

"As you know, the historic importance and interest of Gaviota Pass is inseparably linked with its topography. The steep, narrow defile which played a unique role in the conquest of California by Fremont could very well have been altered beyond recognition by excavation for a new roadway. Instead, the new roadway will go through the heart of the rock for 420 feet, and the historic integrity of the

gorge will be preserved. The south portal of the tunnel will be finished with a sandstone-colored stain so that it will blend in with the landscape as far as possible. Plans also included a parking area several hundred feet south of the tunnel. The bronze plaque which tells the story of the pass will be moved to the parking area for the edification of the traveler.

In San Luis Obispo County

"There is a good deal of progress to be observed in San Luis Obispo County, also. A good start is being made on the freeway through the City of San Luis Obispo, with several grade



separation structures under way. A contract for two more structures was awarded on May 6th.

"The four-lane divided construction between Atascadero and Templeton was completed last July. This expressway will be continued on through Paso Robles. Grading of the southerly six miles will be completed in August, and bids have been called on the remaining grading and on some of the surfacing. They will be opened on June 4th, which means that construction will continue on this project without interruption.

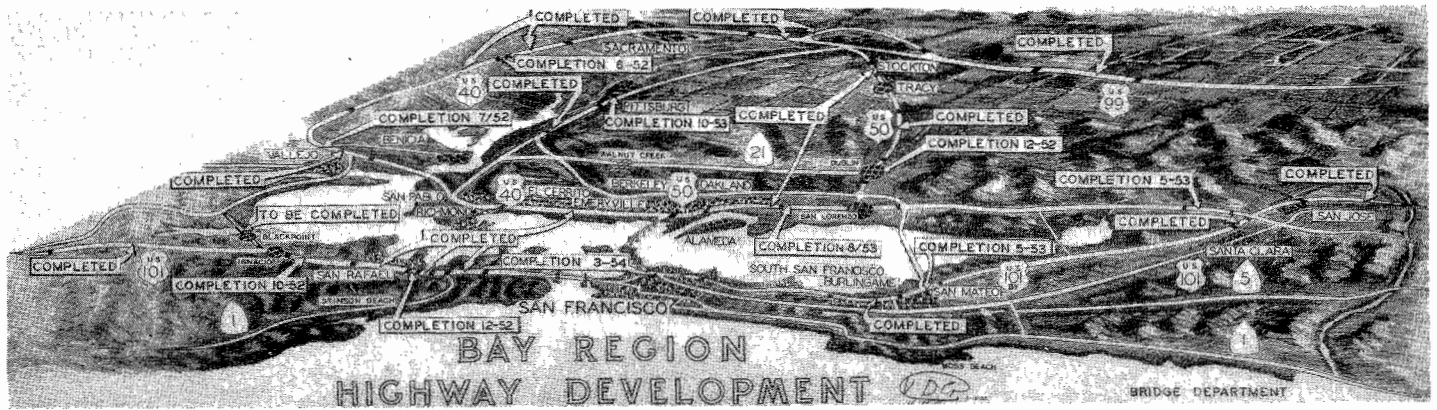
"A start has been made on the gigantic job of improving the long

stretch of U. S. 101 which follows the Salinas River through Monterey County. Two new lanes were completed last fall for 5.3 miles north from Chualar. The new roadway is being used while the old section is being brought up to modern standards; this contract has just got under way.

Salinas Freeway

"The long-planned freeway through Salinas is about to become a reality. Bids will be opened in Sacramento next Wednesday for 1.6 miles of grading, paving and structures north from Alisal Road, the first unit of this important project.

"In Santa Clara County, a large share of attention has been devoted to the southern end of the new Eastshore Freeway, but numerous other projects have been and are being carried on. The most recent ones have been the surfacing of five one-half miles of U. S. 101 in the vicinity of Gilroy and the widening and surfacing of a section just south of San Jose. Projects are also under way and budgeted which will improve Sign Routes 9 and 117, leading to Santa Cruz. The relocation of Sign Route 17 in the vicinity of Lexington Dam has just been completed.



Bayshore Freeway

"On the Bayshore Highway there is a good deal of activity under way in an attempt to remedy the congestion and accident situation during the necessary interval while freeway construction is pushed forward. Lights and signals are being installed, and traffic channelization projects are being constructed and planned. Meanwhile, construction is in progress on the extension of the freeway from the north to the south city limits of San Mateo.

"In San Francisco itself construction on the Bayshore Freeway north from Army Street is continuing. Bids were opened on May 14th on the initial grading and structures in the important section lying between Sixteenth and Seventh Streets.

"In the meantime we are proceeding at full speed on our present basis. The Highway Commission is continuing to lay the groundwork for future development by declaring additional miles of U. S. 101 and other highways as freeways, after concluding freeway discussions with the local governmental agencies concerned. This is done, of course, far in advance of actual construction. For example, during the past several months the commission has concluded freeway agreements and adopted routings of U. S. 101 for three miles through and near the town of San Miguel and for eight miles in Santa Barbara County between Buellton and Los Alamos. The mileage of declared—not constructed—freeway on the coast route between San Diego and San Francisco now amounts to 345 miles, or about 63 percent of the total distance.

Advance Planning

"Advance planning is particularly important in view of the need for highways built on freeway design standards, with a minimum of entrances, exits and turns at grade to impede the flow of through traffic. It is obvious that the earliest possible selection of the best and most economical route is not only essential to protect property values, but also to ensure orderly long-range community planning and to prevent costly misunderstandings.

"In considering the highway conditions from a state-wide view and from the view of U. S. 101 improvement you will recall that some 11,000 miles of the 14,000 miles of state highways are deficient in one respect or another, with the estimated cost of correction being about three billion dollars. Of the 550 miles of U. S. 101 from the Mexican border to San Francisco, some 420 miles are included in the list of current deficiencies, with estimated cost of correction being about \$259,000,000. This cost on U. S. 101 is the balance which will remain after the completion of \$21,000,000 worth of major improvements included in the 1952-53 Budget."

"FOLLOW THE LEADER" DANGEROUS GAME

Don't play "follow the leader" in traffic, warns the National Automobile Club. Just because the other fellow slipped through that stop sign or cut in on that other car is no indication that you can do so safely. When you indulge in such tricks you are taking these long chances that lead to a short life.

Restoring of Mission Bells Is Proposed

Restoration of the picturesque mission bells of El Camino Real, long a symbol of California to tourists, has been proposed to the Mission Trails Association.

"The bells are rapidly disappearing, either through vandalism or relocation of U. S. Highway 101," it was pointed out in a letter to Jack Daugherty, President of the Mission Trails Association, by E. E. East, Chief Engineer of the Automobile Club of Southern California.

Few of the original 450 bells erected along the El Camino Real from San Diego to Sonoma are still standing. And some of these were left along the old highway after the relocation of Highway 101, East said.

Designed by the late Mrs. Armitage S. C. Forbes, historian of old California, the first bell was erected in 1906 at the Plaza Church in Los Angeles.

Within a decade, the Mission Trails Association, then known as El Camino Real Association, had placed an average of one every mile along the historical route followed by Don Gaspar de Portola in 1769.

The original bells were donated to the Mission Trails Association by counties, chambers of commerce and civic groups, and maintained in Southern California by the auto club.

East said he discussed the replacing and relocation of the bells with some supervisors and other county officials, who indicated they would cooperate in restoring them.

Arch Falsework

Construction on Colorado Freeway
Bridge Over the Arroyo Seco

By H. R. LENDECKE, Resident Engineer, and
C. H. KNIGHT, Assistant Resident Engineer

THE NEW Colorado Freeway in Pasadena will be carried across the famous Arroyo Seco on massive concrete arches which will rank among the largest in the world. Of the three sets of twin-arch ribs the longest spans a distance of 302 feet between spring lines, rises 120 feet above the bottom of the Arroyo and will support a deck measuring over 100 feet in width. Each of the twin ribs in this span is 24 feet wide and varies in thickness from three feet at the crown to five feet at the haunch.

Untried Methods

Constructing an arch of such proportions made it seem desirable to adopt new untried methods which in turn presented many unique problems. Twin arches with as much as 38 feet between them further complicated the problem, but immediately suggested the idea of movable centering.

Working with this idea, materials on hand and the need for maintaining adequate space for movement of heavy equipment under the falsework, Contractor Guy F. Atkinson Company planned and designed their arch centering. Its description herein will be confined to the center (302-foot) span. In brief the substructure of the centering consists of four steel towers with steel column bents adjacent to the piers. Each tower has six legs built up from 12-inch and 14-inch bearing piles and X-braced with light steel angles. Each tower leg is supported on a concrete footing pad resting either on timber piles or disintegrated granodiorite bedrock. To allow for lowering the towers each leg was set up nine inches on four 2-inch screw jacks. Grout pads were then placed between the column bases and the concrete footings.

Rolled I-Beams

Supported directly by the towers are longitudinal 36-inch by 230-pound to 300-pound rolled I-beams spliced



Detail showing 2-inch screw jacks which have been partially lowered. 100-ton hydraulic jack at right carried column load while screw jacks were being lowered. Grout pads which had been placed between the column bases and the concrete footings during concrete placing operations have been removed.

rigidly together with bolted connections. The slope of each beam follows the general slope of the portion of the arch next to it. These I-beams, in turn, support 12-inch by 53-pound bearing piles used as purlins. Built up from the purlins are timber stringers, blocking, camber strips made of bent 4 x 6s, 2 x 6 joists and finally the plywood soffit forms.

The sequence of concrete placing operations was set up by the State in the contract plans to minimize movement of the centering and thereby eliminate construction stresses. A section 80 feet long at the crown was poured first, followed by the haunches and alternate intermediate sections on each side. To allow for shrinkage of the concrete the final "key" pours

were made after a curing period of 10 days from the next to last pour. During the placing operations careful measurements were made of all settlements and lateral movements. In addition strain gauge measurements were made on the tower legs to determine the distribution of the concrete load during placing operations.

Design Fully Adequate

In general the results of these measurements indicated that the falsework design was fully adequate. Settlements in the soffit due to deflection of the I-beams and compression in the tower legs reached a maximum of 1¼ inches, within one-eighth inch of the predicted amount. Lateral movement at the tops of the towers never exceeded three-eighths inch and fluctuated

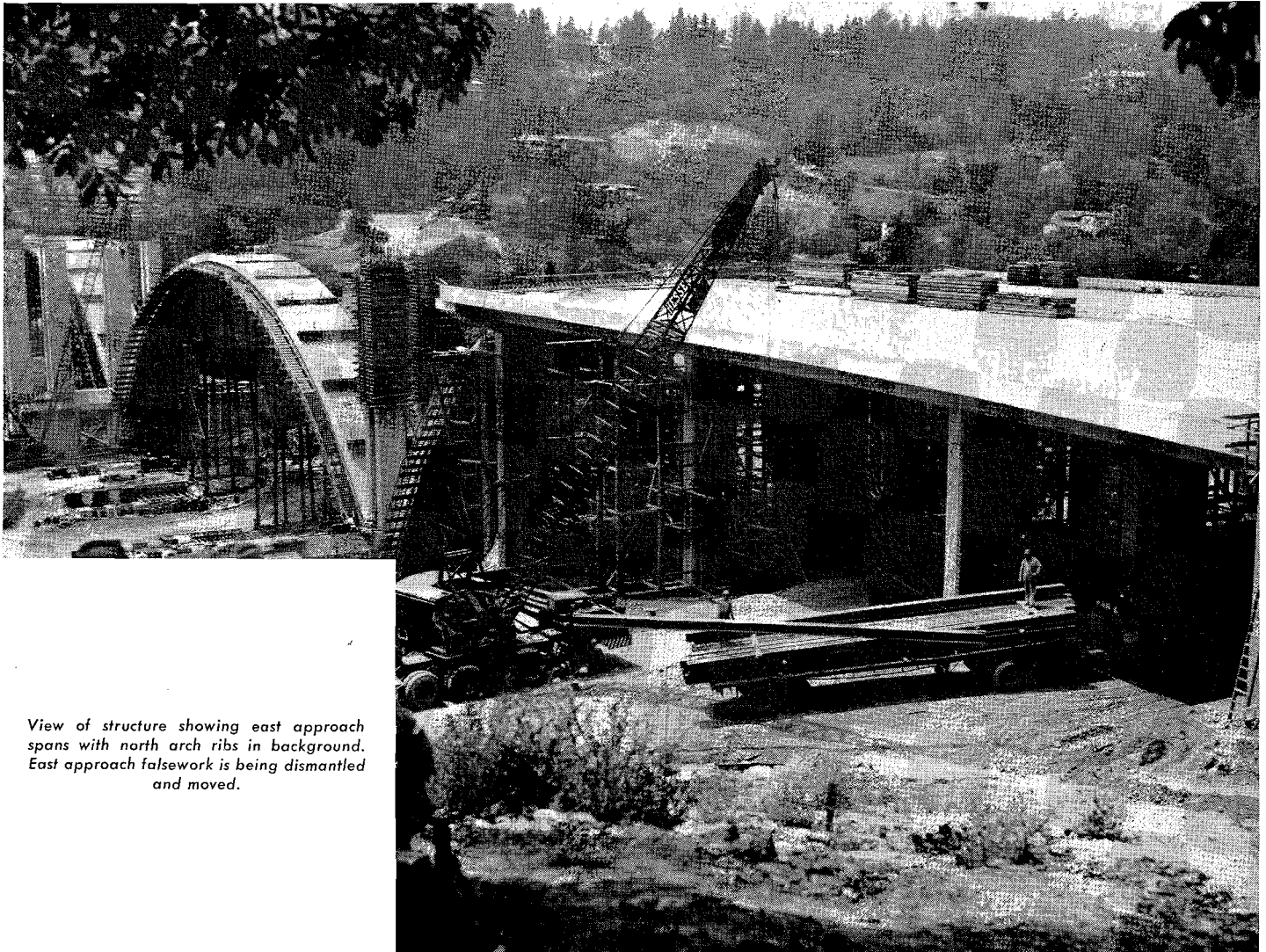
in a manner that indicated temperature changes as the primary cause. Results of the strain gage readings showed that the concrete load of each section placed was carried almost entirely by its adjacent towers, i.e., there was no appreciable shifting of the load into the far towers.

After the "key" sections of the arch were poured a curing period of 21 days was required before the centering could be lowered. This allowed the concrete to acquire its design strength of 3,200 pounds per square inch.

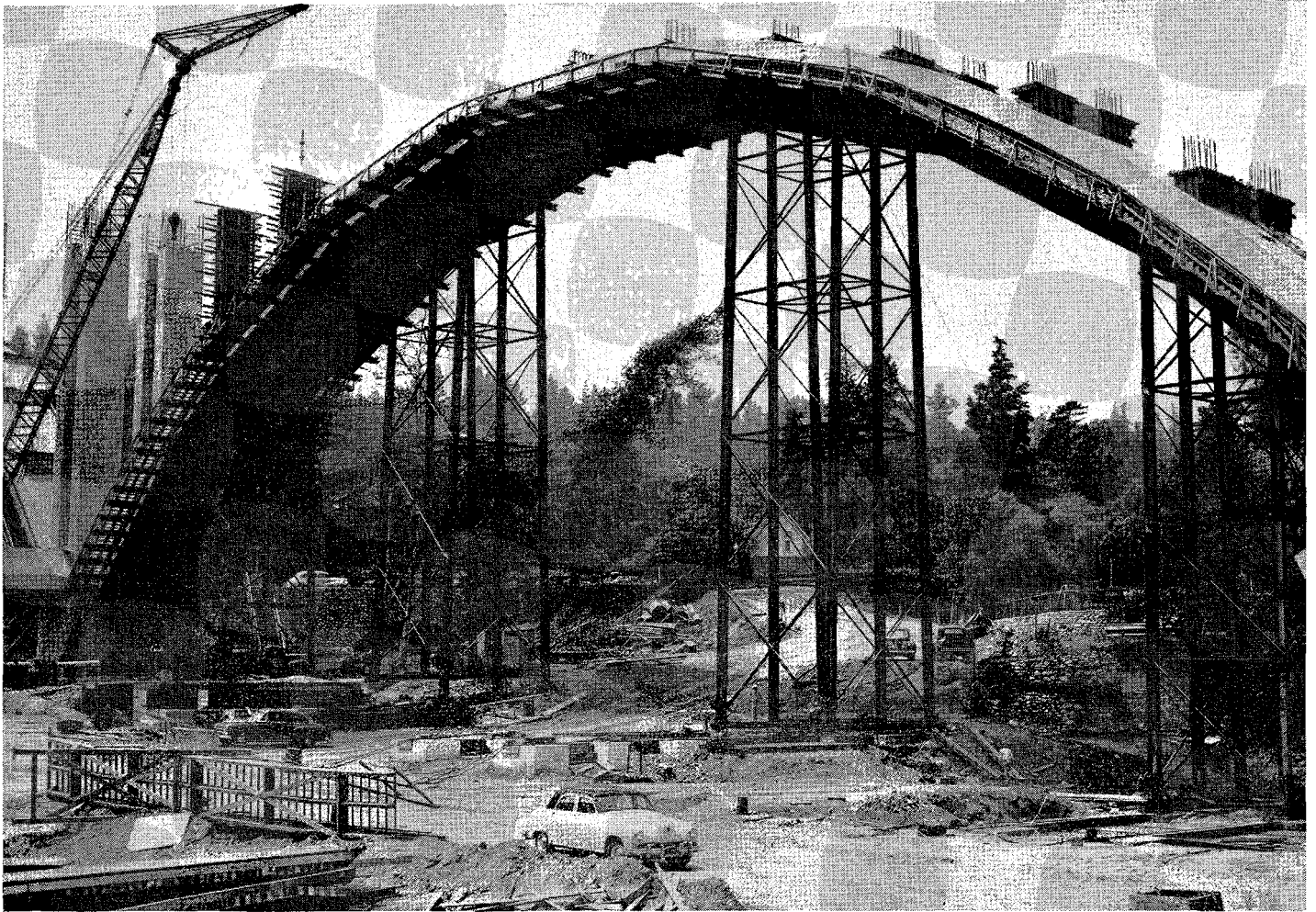
Lowering Operations

Lowering operations began with chipping out the grout pads between the column bases and the concrete footings. Attempts were then made to lower the towers by means of the 2-

inch screw jacks alone. This proved impracticable because of the difficulty in keeping the load on each leg evenly distributed among the four jacks with the result that the jacks would freeze up. To alleviate this situation, knee brackets were welded on the outside corner tower legs. Under each of these brackets a 100-ton hydraulic jack was placed to carry the load while the screw jacks were being lowered. Jacks had to be lowered approximately two inches before all the plywood soffit had broken loose from the concrete. The towers were then lowered an additional two inches until the two lateral steel "skid beams" rested on 4 x 12 greased planks. Meanwhile, greased skidways had been constructed joining the north rib falsework footings to the south rib footings.



View of structure showing east approach spans with north arch ribs in background. East approach falsework is being dismantled and moved.



Over-all view of arch centering after completion of north arch rib. Entire falsework will be skidded as a unit onto adjacent footing pads for use in construction of south arch rib. Note skidways joining north and south footings. Picture also shows the extensive safety measures taken by construction of access stairs and walkways. Space between 36-inch I-beams spanning between towers was covered with planking to insure safety of workmen.

Method of Moving

Actual moving of the centering was accomplished as follows: For each tower two sets of six-part nine-sixteenths-inch cables were strung between pulleys fixed at one end to pile cut-offs used as "dead men" and at the other end to the tower leg. The free end of each cable was wound on a winch fixed to the tower leg. A gear ratio of 24 to 1 on the winches with six runs of cable netted a mechanical advantage of 144 to 1, thus enabling the winches to be operated by hand. In this way careful control could be exercised over the relative movement of the towers. This was essential inasmuch as the entire centering had to swing on an arc as well as move laterally due to a divergence of the two ribs.

At the time of this writing the movement of the first span had not yet been

completed. Thus far the tendency has been for tension to build up in the cables as they are drawn in and then for the towers to move suddenly a distance of from two to three inches. On reaching the south footings the towers will be jacketed up by means of the same hydraulic jacks described previously. The top of the superstructure will then have to be partially stripped and built up again with new blocking and camber strips to the grade and alignment of the south rib.

F. W. Panhorst, Assistant State Highway Engineer (Bridges), is in charge of the design and construction of this project. Local administration of the State's contract with Guy F. Atkinson Company is under the general supervision of J. W. Green, Southern Representative for the Bridge Department. H. R. Lendecke is the Resident

Engineer for the Division of Highways. W. T. Colwell of Guy F. Atkinson Company was in charge of the falsework design while R. K. Boyd, project manager for the contractor, was in charge of its erection.

THE PENINSULA

Do you know the correct name of the peninsula on which the City of San Francisco is located?

The California Section of the State Library reports that from 1869 until 1950 the peninsula was known as the San Francisco Peninsula. In 1950 an attempt was made to change the name to the Santa Cruz Peninsula.

When considerable opposition developed a U. S. Commission on Geographical Names adopted the name "The Peninsula" for official use on maps and other purposes.

In Orange County

First Section of F.A.S. Arterial Highway to Beach Completed

By H. SPRENGER, Road Commissioner, Orange County

ONE OF THE most heavily congested routes of the state system in Orange County is U. S. 101, Alternate, or Coast Boulevard as it is known locally. This congestion spreads with diminishing intensity to the lateral roads which feed the coastal route. Harbor Boulevard, a county road, F. A. S. Route 742, which feeds into Newport Beach through Costa Mesa, and Huntington Beach Boulevard, F. A. S. Route 627, a state highway, are among the feeder routes most affected.

These feeder roads are taxed to their capacity on days of "good" beach weather. They parallel each other and are four miles apart. It has always been the contention of Orange County that if there were more of these arterial routes to the coast, the traveling public could select the route which would bring it closest to its destination on the coast and thus reduce travel along the coast. A further effect of additional

routes would, of course, be to reduce traffic on existing feeder routes.

The Wright-Brookhurst Route (F. A. S. Route 747), just completed, seemed an ideal one for relieving the present congestion on two of the main feeder routes of this county to the coast since it lies midway between these routes, and it will, when completed, traverse the entire distance from the new freeway (the Santa Ana Parkway) to the Pacific Ocean.

Corridor County

Orange County may be termed a "corridor" county inasmuch as traffic through it originates in the large densely populated districts of the Los Angeles metropolitan area which lies outside the county. In point of time, these districts have moved, in some instances, hours closer to the beach recreational areas through the construction of the Santa Ana Parkway. While

the "farm to market" and small local community service of F. A. S. construction are important, neither purpose can be fully accomplished as long as local county roads are used by this "through" traffic seeking to avoid the congested state system. Wright-Brookhurst is but a single move in an over-all scheme which will ultimately be needed to completely solve the county's traffic problems.

The economy of the territory served is as varied and mixed as any in this county. Along the southerly portion are many producing oil wells. Here also are to be found the famous bean lands of this county, which account for the production of a substantial portion of all the limas produced in the Country. Along the northerly section of the route are hundreds of acres of the world famous valencia orange groves. Lying between these districts, and scattered through them to some

Looking southerly along Wright Street toward intersection of Balsa Avenue.





Upper—Looking northerly along Brookhurst Street, showing grade crossing with Southern Pacific Railroad branch line to Anaheim. Lower—Looking northerly along Brookhurst Street toward Cerritos Avenue intersection.



extent, are many acres devoted to alfalfa, truck farming, permanent pasture and cattle feeding lots, dairies, poultry and rabbits.

Economy Being Changed

Slowly at first but now at a more accelerated rate the economy of this farming area is being changed by the tremendous population growth of Southern California. The orderly development of residential areas which now accompanies real estate subdivi-

sions is to be found with increasing frequency in the area served by the route, along with the scattered clusters of older homes and "acre" places of several years ago. The improvement does not serve any large community along the 8.86 miles which it now traverses but many experienced observers believe that much of the area may eventually be transformed into an unbroken residential section.

In this project no unusually difficult problems were encountered either in

design or construction. However, what is considered a design innovation of this county in two-lane construction was introduced into the Wright-Brookhurst project. Our standard design for the primary and F. A. S. systems consists of a traveled way of two 12-foot lanes surfaced with from two to three inches of plant-mix asphalt; shoulders are eight feet in width and surfaced with road oil mix of native material. Since it was believed that the

... Continued on page 43

ROADS—AND THE RIGHT OF WAY DEPARTMENT

By EARLE R. BUNKER, District Right of Way Agent

PREFACE

WE ARE builders of roads. We are shapers of destiny, for the stories of roads are the stories of history. Sandy roads, muddy roads, roads of stone, cobblestone, asphalt, concrete; straight roads and crooked; bad roads and good roads.

A hundred thousand slaves rolled huge stones over hot, sandy roads to build the north-peering pyramids and caravans laden with silks and other precious things filed westward across the forbidding Gobi to Bagdad and Aleppo. A Macedonian carved roads and empires from the Hellespont to the Indies and One who was lonely and heavily laden heroically trod a cobbled road to a place called Golgotha. Paved roads echoed to the tread of conquering legions, and in turn to the padded footsteps of their barbarian conquerors spewing out of the forbidding north; and a virgin, with a fortune in gold and jewels, could travel alone and unmolested over the road of the Great Kahn that stretched over a thousand miles across the steppes.

The sparks that flew from flying hooves on the road to Concord and Lexington lighted the fire from which was forged a great nation; and a tumbrel, rumbling over cold and hopeless cobblestones carried a bewildered queen to her doom. An humble priest lovingly placed his missions under smiling skies along El Camino Real that skirted the western sea and in the muddy and bloody roads of the Wilderness a cause was lost. Beyond the Father of Waters the plodding covered wagons marked the fertile plains with roads that heralded the approach of an empire and the crack of a scout's rifle from a sand spit in the Arickaree toppled the chief who led the last, futile charge to stop those encroaching roads.

Yes, history is woven with the woof and warp of roads. Roads that for centuries have slowly and inexorably extended westward across three continents. Along these roads empires have risen and fallen. Whatever story is told, whether this idea or that wins or loses, the surge of mankind from East to West has never stopped. The setting sun has beckoned man across rivers, deserts and oceans from the beginning of time.

THE WEST

We now are at the shore of the western sea. Civilization, as we are pleased to call it, has circled the globe. The sun in the West still calls—but to what? Another continent thousands of miles away across the vast Pacific—a continent teeming with races whose beginnings are lost in antiquity. There are no new lands to the west to explore and populate.

The westward urge will move man from the old East to the new West until the latter, too, becomes old. The physicists apply the theory of equipartition of energy to molecules and universes. It also applies to man. Unless some catastrophe intervenes the race of man will move westward until it can move no further. It will then distribute itself more or less equally over the face of the earth. But that is too far away in time to consider; we are concerned with roads.

CALIFORNIA

The rutted wheel tracks of the covered wagon scarred the level plains and ground hazardous routes through mountain passes. They were made and remade across shifting sands of heart-breaking deserts. The explorer and the scout and the trapper led the way.

Thousands, then tens and hundreds of thousands followed. Villages, towns and cities sprung into being. These haphazard roads had to suffice until the railroad started moving west from the Atlantic seaboard.

The 1850 census of California was about 100,000 persons, a surprising percentage of which were those "ladies of easy virtue" that were naively identified by the Spanish appellation of "mala vida."

The engineer took over from the scout and the trapper. He tied this sprawling, expanding empire together with railroads and telegraph. He built them through forbidding mountain ranges, over seemingly impassable rivers, canyons and deserts. Through

roads for horse-drawn vehicles became secondary in importance. They appealed only to the occasional adventurous soul. Every railroad station became a focal point for the wagon roads that radiated out to the homesteads of the newly arriving settlers. As the country became more populated, the farmers might harrow and drag the road a couple of times a year. This for their and their neighbor's occasional trips "to town." Perhaps, too, they might realize a slight return by way of credit on taxes due. If farmers' or cattlemen's journey was of any length, they would leave the team in the livery stable in town and take the train. That would be a red-letter day, long remembered and discussed.

At the turn of the century California had grown to a million and a half! Two million more came in the next 20 years.

ERA OF AUTOMOBILE

Came the automobile. Its rapid acceptance and development produced the most profound economic development since the advent of steam power. No longer was the individual limited to "hay burners" and train schedules. With an auto, one could go anywhere—if there was a road! The more the demand grew for autos, the greater was the clamor for more roads—through roads—good roads. This demand and clamor have never been met or satisfied.

The engineer was called again. Bonds were voted, 18 million dollars, an enormous sum—but it wasn't quite enough. Then 12 million more (this would surely finish the program!). Then 40 million more were voted! With this money, the engineer graded and drained existing roads. He built bridges and culverts. Some roads were oiled, some paved, and what wonderful roads! The best were concrete—15 feet wide and four inches thick. They had a minimum radius of 40 feet on center line. Some had superelevation that permitted them to be traveled at full

speed—40 miles an hour! The engineer's work would be finished, except for maintenance, when this network was completed. We would have all the roads we would ever need—so we all thought.

Road Was the Thing

Everybody wanted roads, so who cared if that fence had to be moved back a bit or if the contractor needed some sand out of that hill off there a ways through that field? Sometimes, perhaps, the engineer would pick up a few blank deeds at the local emporium and have them signed by the residents as he went along with his work. Seldom was he challenged for invading someone's property rights. After all, the road was the thing.

In the two decades after 1920 the population of California increased by 3,700,000. In the next 10 years it increased very nearly that same amount. The westward urge of the centuries continues, not only unabated but augmented.

The motor car changed from a luxury or a convenience to a necessity. Mild winters permitted year-round use of motor vehicles. Phenomenon piled on phenomenon with bewildering rapidity. People kept coming to California. The percentage of motor vehicles to population grew daily. Farmers, manufacturers, merchants, in fact nearly every commercial enterprise found use for cars and trucks.

What a Change

But the roads? The engineer had not finished his job as he had anticipated. When the bond money was expended, a tax on gasoline was put into effect. The roads that had been built for convenience and sightseeing became arteries of commerce in addition. They had to be widened and straightened.

The next phenomenon was the most painful—every road that the engineer had built was dotted with towns, villages, cities; the open road was lined with gasoline stations, restaurants, motels (a phenomenon in itself), markets, and countless, endless merchants of this and that, all hopefully pleading for the travelers' dollar, all intertwined with signs, and billboards, big and little, entreating, crying, imploring and directing to here and there and all hopelessly snarling and confusing and slowing the ever-increasing traffic.

Problems Increase

No longer could the engineer move the fence back and widen the road. He had to move buildings, gas stations, and all the multifarious enterprises and mare's-nests that cluttered the roadside. He found that every structure, Class A or maverick, was a gold mine (potential, of course) and to his amazement almost every foot of lush alfalfa patch or barren alkali flat was, by some mysterious transmutation, "business frontage," according to the owner. The engineer found that the widening and straightening of a road was not confined to design and construction costs, but in addition it was necessary to buy property and move improvements that were in the way. He tried entirely new alignment of some roads only to find that the ubiquitous roadside development inevitably and immediately followed.

Because of their small value in comparison to the benefits and convenience of a road, property rights had long been quiescent but now the story was different. The complexity of these rights and the difficulty of evaluating them plus the indeterminacy of human behavior were matters foreign to the engineer. He solved the problem by turning that work over to trained agents. So there came into being the Right of Way Department.

THE RIGHT OF WAY DEPARTMENT

The Right of Way Department grew slowly. In an engineering organization, the advent of this new department was generally viewed as the third handle on a wheelbarrow would be. It became one of the few havens for political payoffs in the rising tide of civil service reform. A politician just couldn't design and build roads, but anybody could be a right of way agent.

Then came the first forward step: the department was placed under civil service. The unfit and inept fell by the wayside. On the other hand the organization is today dotted with agents rating high in ability, authority and esteem, who started as political appointees. In fact, the department owes its present organization and effectiveness to the aggressiveness and untiring effort of its chief who started with an obscure (but not for long) political appointment as right-of-way agent.

AGE OF FREEWAYS

The next milestone reached was the development and expanding of freeways. Not only right of way was affected, but the entire concept of public roads was fundamentally altered. Main roads were to be built to serve traffic, not abutting property. The engineer, who might have admitted that the Right of Way Department had graduated from the "third-handle" class to that of "necessary evil," now recognized a full partnership. He couldn't build roads until the right of way was clear and often couldn't even design them until right-of-way cost analysis determined the most economic location. Many joint studies had to be made to determine a location that would balance traffic requirements and construction and right-of-way costs against allotted funds.

Right-of-way costs pyramided from a relatively few thousands of dollars a year to tens of millions a year. Right-of-way costs now absorb about one-third of the total sum allotted for new construction and are greater than total state highway expenditures in most states. And the demand for new and better roads is far from being met, much less satisfied.

ADDITIONAL PERSONNEL

This huge increase in expenditures required a proportional increase in personnel—not just anybody—trained men were needed. There weren't any. So the next forward step was made. A civil service classification of junior real property agent was set up, the only requirement being graduation from college. The written examination was basically an aptitude test and the oral interview served to screen out all those who did not have the necessary physical and personal characteristics essential to the successful right-of-way agent. At the conclusion of World War II, a particularly virile group of these beginners were attracted. They were hired and put through educational training courses where they learned to use the tools of the profession. This program has been eminently successful. This group now comprises the major part of the right-of-way personnel. They are young, aggressive, and fascinated by the work, by the diversity of knowledge they must have

and by the ingenuity required to solve abstract problems of property rights and personalities. As time goes on more and more of the responsibilities of the Right of Way Department will fall on their capable and willing shoulders.

RESPONSIBILITIES

The work of the Right of Way Department is twofold. It is our job to see that the necessary lands and rights are available when required for construction of highway projects. Equally important, we are charged with the responsibility of seeing that the rights of the property owners and the State are equally protected. Inexorably woven into this task is the field of public relations. The property owner we deal with has probably his first and only direct contact with the State. When the transaction is complete, his opinion, good or bad, will be evinced in his words and actions. His experience with one state department can easily influence his opinion on all state offices. It is therefore incumbent upon us to conduct ourselves accordingly. We must use the tools of our profession carefully, reasonably and equitably.

MANY TOOLS OF PROFESSION

There are many tools of our profession; the Constitutions of the United States and of the State of California are the first. Then come the laws of the Legislature, the Civil Code, the Code of Civil Procedure, the codes relating to highways, various related laws pertaining to taxation and governmental procedures. Then there are the decisions of the courts applying and interpreting these laws. There are the laws and procedures relating to real property, its transfer, encumbrancing, estates, divorces, trusts, et cetera. There are the policies and procedures of the Department of Public Works, the Highway Commission, the Director of Public Works and the State Highway Engineer. There are the matters of highway financing, programs, projects, surveys, maps, plans, studies, public utilities, construction and maintenance methods and procedures. There are techniques of appraising, psychology, public relations, salesmanship.

To do our work properly, we must have a fundamental, workable knowledge of these subjects. We must continually study and use all of these tools. Superficiality will not do. When we couple this knowledge with sound experience we are right-of-way agents.

A SELLING JOB

The last tool of salesmanship is probably the most effective of all. It is here we weld knowledge with accomplishment. While we buy properties, we are not purchasing agents. We are salesmen. We must, first, be sold on our work so that we, in turn, can sell it to others.

We must sell the public generally and the property owner specifically on the State Highway System, on the safety, efficiency, and necessity of the roads we are building.

We must sell the property owner on the particular improvement planned, its necessity and the betterment that it embodies as a part of the highway system. He should be shown the plans and profiles and should receive an explanation as to the necessity of the various features.

We should show the owner how his property is affected, both as to alignment and grade; if access is taken, the way we have planned to provide or substitute other access. The owner must be made to understand the full import of what the taking of access means. He should be fully informed as to any detriment his property suffers, as well as to any benefits that accrue to it.

RELATIONS WITH LANDOWNER

We should discuss with the owner all his problems, frankly and thoroughly. We should use our experience and ingenuity to satisfactorily solve these problems. He should be fully informed as to what items are compensable and what are noncompensable. We should advise the owners of the legal obligations, requirements, and procedures, and the method of reaching value by means of an appraisal should be thoroughly discussed.

When the owner and the State are mutually informed as to each other's requirements and as to the effect on the owner's property, we are then in a

position to make a sound, equitable offer. This offer is based on the appraisal, together with any modifications or requirements that are justified from the discussions. We should always keep in view the basic concept of "just compensation." This applies with equal force to both parties, the State and the owner. The State is required to pay on the basis of market value, no more, no less. The completed transaction should conclusively exhibit that that condition has been fulfilled.

JUST SETTLEMENTS

We realize that our tools are not keen. For example, the personal equation of either the agent or property owner cannot be evaluated so their actions and reactions can be predetermined. We do know, however, from long experience and sincere effort that the indeterminacies and inaccuracies of our tools do produce a workable, practical method of acquiring property. The end result, in the vast majority of cases, is a just settlement between the State and the citizen.

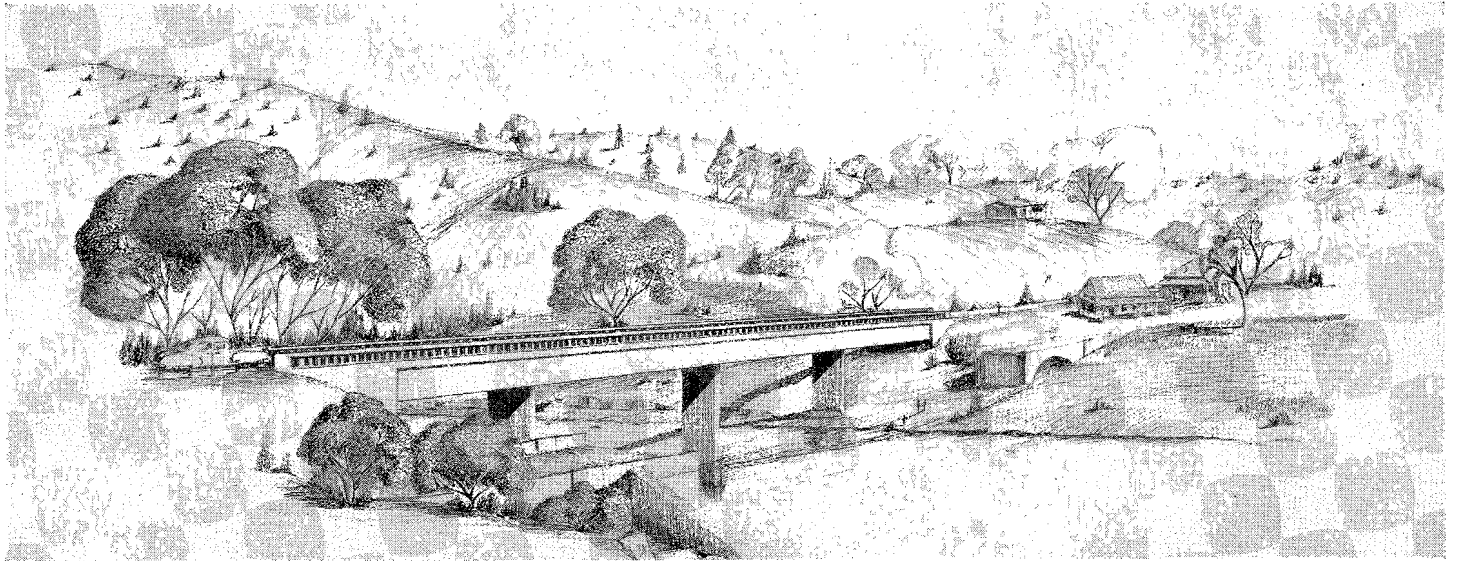
And so we acquire property. We believe that we are doing a good job, for out of each 100 parcels acquired last year, less than five were obtained by condemnation. This includes friendly condemnations against cities, counties and other public agencies where charters require eminent domain proceedings. Also included are stipulated judgments where the State and the property owners reach an agreement after the action is at issue. The property is turned over to the engineer that he may build roads that were not even dreamed of a generation ago! Roads that the millions of people here now and the millions to come will travel, we hope, happily, expeditiously and safely.

We cannot foretell the future. We do know that when we build roads we are building the framework of history, but only time will reveal the completed structure. We can only hope that the roads we are building will add to the happiness and progress of the generations that follow.

LOOKING AHEAD

Driving an automobile is something like playing chess; you have to plot your movements ahead of time if you want to avoid trouble. But driving also requires instantaneous decisions and constant alertness.

New Bridge Over Stanislaus River at Melones to Be Constructed



This drawing by the Bridge Department of the California Division of Highways shows how the planned new Stanislaus River bridge at Melones will look to the motorist traveling northwest from Sonora. The settlement of Melones is at the far end of the bridge, where the Golden Chain Highway (Sign Route 49) starts its climb over Carson Hill toward Angels Camp. Abutments of the former bridge, which was built in 1911 and collapsed January 25, 1952, may be seen upstream from the proposed new structure. The two main spans of the new bridge measure 115 feet each. It will have a total length of 365 feet, about 65 feet longer than its predecessor, and will have a roadway 26 feet wide between curbs, instead of the former 18 feet.

THE NEW bridge over the Stanislaus River at Melones will be located about 125 feet downstream from the 30-year-old structure which collapsed last January, and will be of reinforced concrete box girder construction, longer and wider than the old bridge.

Plans for the new bridge have been completed by the State Division of Highways, and bids have been called.

The new downstream location will permit straighter approaches, according to engineers of the Division of Highways. The roadway will be 26 feet wide between curbs, instead of the 18-foot width of the deck on the old bridge. The new bridge will be about 65 feet longer than the old, and its deck will be several feet higher above the river.

Since the old bridge collapsed, traffic between Angels Camp and Sonora has used a detour over county roads and the Parrott's Ferry Bridge, about two and a half miles longer than the state highway (Sign Route 49) route. The detour will continue in use during construction of the new bridge and approaches, and will continue to be maintained by the Division of Highways.

In Orange County

Continued from page 39 . . .

eventual traffic load would exceed the capacity of this design and thus necessitate widening, consideration was given to future widening costs in the preparation of the initial design. It was decided that instead of constructing a shoulder inferior to the traveled way, uniform base and surface material would be used under the entire roadway width of 40 feet. Thus no part of the present improved width would be disturbed by a widening project. Not only did state and federal representatives approve this design for Wright-Brookhurst but they recommended that it be incorporated in the design for the next F. A. S. project which roughly parallels, some four miles easterly, a portion of the Wright-Brookhurst route to the coast.

Thanks are due to all of the state representatives who worked so closely in cooperation with the county to bring the project to a successful conclusion. Day by day handling of the plans and construction engineering was left to county personnel, and its cost

was paid from county funds. In this connection, however, the county used its own testing laboratory exclusively in making the tests required. Thus it is the first F. A. S. job for which this can be said. The economics effected are sufficient, on the whole, we believe, to justify the cost of establishing the laboratory.

GOOD DRIVERS

The best automobile drivers are those who drive in a relaxed position, at a moderate speed, with the car always in perfect control. The California State Automobile Association points out that excessive speed can be a highway menace. Take it easy—you'll get there almost as fast, without regrets.

AVOID SPEEDING TO APPOINTMENT

Whether you are driving recklessly just for the thrill of it or to get to an appointment on time, one slight mistake will bring disaster. Before speeding to make an appointment, remind yourself that it is better to arrive a little late than not to arrive at all.

Early Days

Minutes of First Highway Commission
In 1911 Make Interesting Reading

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

THE EDITOR of this magazine started me on this idea of looking up historical data in the original minutes of the California Highway Commission. He asked me one day if at any time the commission had adopted a brand, or a mark, to be placed on property belonging to the California Highway Commission. In delving through the old records, I got very interested in a lot of things that were done when the act creating the California Highway Commission went into effect.

Looking up historical data is always fascinating. You run across so many things that were done in such a manner so different from what we are doing today. You think of all the difficulties our forefathers had in bringing civilization to its present state of development; difficulties which we would call difficulties today were nothing to the men of the former generations. They had no up-to-date machinery—"Up-to-date," as we call it today—and they went ahead and did things, accepted things, adopted rules and regulations that still stand, and yet we wonder how they did it.

Commission Created

In 1911, there was an advisory board to the Engineering Department of the State of California. The State Engineer was Nathaniel Ellery, and three members of this Advisory Board were appointed, under laws passed by the State Legislature, to form the first California Highway Commission. They worked under a resolution which was adopted by the Advisory Board of the Engineering Department, as follows:

"Resolved, That the appointed members of this board, to wit: Messrs. Charles D. Blaney, Burton A. Towne, and N. D. Darlington, be, and they are hereby appointed a committee to be known and designated as the California Highway Commission, with the jurisdiction and powers following, to wit:



Austin B. Fletcher, first California State Highway Engineer.

(1) To take charge of the entire matter of the construction and acquisition of a system of state highways in and for the State, as and in the manner provided by law, at a cost not to exceed the sum of \$18,000,000, under and in pursuance of the act of the Legislature of the State of California, approved March 22nd, 1909, and known as the State Highway Act, and to do and perform as fully and completely as may be done by any part, or representative, or committee of this Advisory Board, every act and thing that may be requisite to be done and performed in connection with the highways of the State of California, or that ought to be done and performed under the said State Highway Act.

(2) To do and perform every act and thing in and about the premises that a committee of this board may be lawfully authorized to do for and on behalf of this board; and to have full charge and control of the acquisition and construction of the laying out and building of a system of such highways.

(3) To report from time to time to this board their actions and proceedings and to submit to this board for determination such matters as the law requires this board to act upon; and to superintend the work and operations of the highway engineer whose appointment is provided for by the act of the Legislature of the State of California, approved April 8th, 1911.

(4) To perfect such organization as they may deem necessary to carry on with celerity and efficiency the work to be done in the matter of acquisition and construction of the said system of state highways, and under the said State Highway Act; and generally to do all and singular every act and thing that may be necessary for the due, speedy and efficient performance of all that may be required under the said State Highway Act, and under the said act of the Legislature of the State of California, approved April 8th, 1911."

First Meeting

The first meeting of the California Highway Commission was held in Sacramento on August 9, 1911. The three members of the committee met on that day with Charles D. Blaney acting as temporary chairman. On a motion by Mr. Towne, seconded by Mr. Darlington, W. R. Ellis was chosen secretary of the commission. Again, on a motion of Mr. Blaney, seconded by Mr. Darlington, Burton A. Towne was duly elected chairman. The commission was told by George Radcliffe, who was the Superintendent of the State Capitol Building, that they had been assigned Room 118 in the State Capitol Building as a temporary office. Then, without going into a lot of typewritten record, it merely states that a discussion of the statutes relating to the duties and functions of the Advisory Board of the State Engineering Department was held and the commission held a conference with His Excellency Hiram W. Johnson, Governor. The commission adjourned subject to the call of the chairman.

Nine days elapsed before the commission met again on August 18th. At that time, Mrs. A. L. Harrison was elected stenographer for the commission. The matter of addressing letters to boards of supervisors, civic bodies, automobile clubs, and newspapers, was informally discussed, but no further business appearing, the commission adjourned.

Second Meeting

On August 21st the commissioners met again in Sacramento and went over the initial minutes of the commission, and then proposed that a letter be sent to all boards of supervisors by the commission, asking for certain information. And they discussed another letter to be sent to boards of trade, chambers of commerce, automobile clubs, newspapers, etc., and finally decided upon the type of letter to be sent to all the boards of supervisors of all the different counties in the State.

There seem to be no records in Sacramento regarding which was the best road and which was the best way to get from one town to another, so the commission asked all of the supervisors to send a complete map of their respective counties, drawn to a scale of one-half inch to the mile, and indicate thereon the route, or routes, most desired for such a highway system. And would they furnish all the additional data of the population and assessed value of all towns, and other data valuable under the circumstances. The commission also sent a copy of this letter to all the various civic bodies and newspapers in the State, and, nothing else to be done, it again adjourned.

Letters to Press

On September 7th, the commission had decided upon the form of letters and it instructed the secretary to have prepared, at once, letters to all newspaper editors in California, and enclosed therewith a copy of the letter to the different boards of supervisors already agreed upon, and, according to the minutes, that is all that was done on September 7th.

On September 8th, the commissioners met again and talked of the minutes that had preceded to see that they were in correct order, and then they ordered themselves to go into a session with the Attorney General in accordance with an appointment made with him. By this time, A. B. Fletcher of San Diego had been appointed Highway Engineer. Mr. Fletcher and the secretary were directed to draw up forms of applications for positions under this commission and to have the same printed in the proper manner and in sufficient quantities; and the secre-



R. M. Morton, who succeeded Mr. Fletcher as State Highway Engineer.

tary was informed that he must send these applications to all the applicants, with a proper letter of instruction.

The commission decided that it should subscribe to *Good Roads, Better Roads, Engineering Record* of New York, and *Engineering News* of New York, and adjourned to 2.30 p.m. It met again that afternoon and had a rather informal discussion regarding the location of permanent offices. It decided to meet with the Attorney General on September 13th, and at 5 o'clock p.m. adjourned.

Seek Larger Quarters

On September 9th, the commissioners again met at 11 o'clock a.m. and had decided that the quarters assigned them in the Capitol Building were much too small for their growing organization, and passed a resolution that the headquarters should be in San Francisco. Inasmuch as they also wanted to see the Governor, they made a date to see him that afternoon at 2 o'clock, and it was so ordered and an adjournment was then taken until that time. At 2 o'clock that afternoon Mr. Fletcher, the Highway Engineer, and all members of the commission met in conference with His Excellency, Governor Johnson. They talked about this resolution that they had passed that morning regarding the removal of their offices to San Francisco, and it was submitted to the Governor. At his suggestion the secretary was instructed to write a letter to the Attorney General to find out if these things could

be done legally. To get further weight behind them, they decided that they should meet with the entire Advisory Board and the Governor in the Executive Chambers on September 14th, so the secretary was directed to make such arrangements and to notify the several members of the Advisory Board, the Board of Control, the State Controller, and the State Treasurer, and they adjourned.

Meet With Governor

On September 14th, they met in the Executive Chambers with the Governor, and with the other members of the Advisory Board of the Department of Engineering. Governor Johnson; State Engineer N. Ellery; President of the Lunacy Commission, Dr. F. H. Hatch; the honorable Board of Control; State Treasurer Edward Roberts; State Controller A. B. Nye; and Highway Engineer Fletcher, were present, along with the members of the commission. State Controller A. B. Nye proposed a resolution that they should sell \$400,000 worth of state highway bonds as authorized by the act of the Legislature and approved by a majority vote of the electors at an election held on November 6, 1910. This motion was duly seconded and passed and is made a part of the records.

The Governor then read the resolution adopted by the commission on September 9th regarding the establishment of the headquarters of the commission in San Francisco. A discussion ensued—so says the record. It seems by that time everybody had changed his mind and everybody was against the contemplated removal to San Francisco, and thought that the commission headquarters should stay in the State Capitol. So that afternoon the commission met again and rescinded the motion of a previous meeting and decided that headquarters would remain in Sacramento.

Buy Automobile

There were a couple of other meetings at which apparently not very much was done, but on September 26th the commissioners had reached the point where they thought they should have an automobile. So by unanimous agreement it was resolved to purchase a Locomobile automobile.

This was of the seven-passenger, six-cylinder type, equipped, for the gross sum of \$5,000, delivered in Sacramento.

And again the matter of procuring permanent offices was taken up, and it was decided to communicate with the Forum Investment Company, owners of the Forum Building in Sacramento, regarding office space.

On September 27th, Mr. Fletcher, the Highway Engineer, submitted a memorandum about the early work of the commission and cited the different statutes that made it a legal body, and then proceeded to make a number of suggestions. One was about the "board" meetings (he probably meant the Highway Commission meetings) and about preliminary inspection trips. He also had a suggestion as to the form of organization and the duties of the Highway Engineer and the secretary. Mr. Fletcher also put in for what he thought would be a sufficient office force for the headquarters, and also suggested a nucleus of the force of each division office.

There was also the question of legal advice. Mr. Fletcher wanted a right-of-way attorney employed as soon as possible so that as soon as they began taking over roads the matters of rights of way could be cleared; and he also suggested that a number of geologists be employed to look up the information concerning deposits of road materials and oil wells. The last of the suggestions was for a standardization of forms, or rules, for the matter of building highways, such as widths of rights of way, grades, minimum radius, etc.

Highway Districts

Part of Mr. Fletcher's idea was that the State should be divided into at least seven divisions. He stated that the location of these offices should be chosen very carefully, since they should also serve as maintenance offices for the future. Then he suggested that one division office might be established at once in the headquarters of the commission at Sacramento. The commission approved all of the ideas, and adjourned.

On December 6, 1911, the first delegation appeared before the California Highway Commission. The present



C. C. Carleton, first attorney for the California Highway Commission.

commission can look back and find out that the idea of holding formal meetings, or open meetings, started a long, long time ago, for on this date a Solano County group appeared and submitted maps and solicited an appointment by the commission to visit Solano County and to inspect their proposed routes.

Public Hearings

This idea of appearing before the California Highway Commission still prevails, and on a Thursday morning, usually the third Thursday in each month, the commission holds what it calls a public hearing in which anybody is welcome to come before it and lay their problems before the commission. Groups which wish to appear before the commission are asked to write for an appointment and to tell why they wish to appear or what matter they wish to take up, so that ample time can be assigned them for their appearance on these mornings.

On December 7, 1911, the first legislator appeared before the commission on state highway matters. The minutes show that Senator Chandler appeared that day. The minutes do not show what he talked about, nor what county he was representing. (He was from Fresno County.)

The commissioners decided that various furniture dealers be notified to submit bids for furniture for use in their new offices in the Forum Building, and on that date voted that Charles C. Carleton, an attorney, be hired for the sum of \$2,500 per year, beginning November 10, 1911, to serve at the pleasure of the commission, and the same was thereby ratified.

Mr. Carleton retired as head of the Division of Contracts and Rights of Way of the Department of Public Works on March 1, 1949, after 38 years of continuous service as an attorney for the highway end of the State of California.

Well, you can see that by this time the commission was really getting into stride. It had a highway engineer. It had a secretary to the commission. It had a stenographer. It had hired a lawyer, and it had adopted a resolution that it should get \$400,000 worth of bonds sold as quickly as possible.

Salaries Fixed

On the next day, the commission met again and on the recommendation of the Highway Engineer, it set up a tentative schedule of salaries for employees of the Highway Engineer's Department. A division engineer, which is akin to the present district engineer, had a salary of \$250 a month, and it ranged down to where an ax-man was to get \$50 a month. By this time several people had applied to the commission for employment, and the Highway Engineer was instructed to communicate with them and send them its form of application to see about their background and ability to hold a position.

Districts Established

On December 9th, the Highway Engineer presented a map entitled, "An Outline Map of California," and it showed the seven divisions which he had set up, with their headquarters. Division I was at Willits (it is now Eureka); Division II was at Redding (it is still there); Division III was at Sacramento (this was changed to Marysville, when Division X at Stockton was established to ease the work on one of the larger districts in the State); Division IV was set up in San Francisco, Division V at San Luis Obispo, Division VI at Fresno, and Division

VII at Los Angeles, and they are all still in those locations. Since that time, four new districts have been added. District VIII is at San Bernardino; District IX at Bishop; District X at Stockton; and District XI is at San Diego.

It would seem that the first choice of the Highway Engineer didn't turn out so far wrong. Over the years, and with the growth of the Highway System of the State of California, it was found that the districts as originally set up were quite too large for one district and that was the reason for the addition of the four extra districts.

By this time the commission was beginning to receive communications from good-road enthusiasts from all over the State. Records show that communications came from Sacramento, Los Angeles, Santa Cruz—well, from practically every place in the State. The secretary was instructed to reply to all of them saying that the commission would not be able, on account of the pressure of official duties, to comply with the various requests for hearings until the forepart of the next year.



This road in Sacramento County was typical of many which confronted the first California Highway Commission in 1911.

That afternoon the commission opened bids for the furniture for its new offices, and after looking over all of the bids, it decided that revised bids should be taken under advisement because they eliminated the item regarding rugs and carpets. This was done

with the consent of all the bidders, and there were four of them, and that afternoon they voted in seven different men as division engineers.

Really Getting Started

By this time four months had gone by, but the commission was making good progress toward its permanent organization. It had its seven district engineers, and had decided where the seven districts were going to be located, and were really beginning to function. Nine days later, on December 18th, it met again and approved all of the minutes that had gone before and read four more communications from different places regarding different things that pertained to the commission's work. The commission also ordered the secretary to make a contract with the Sunset Telephone Company for the installation of a telephone service in the new offices.

In the interim, the commission had gone to San Francisco, pursuant to resolution, and had examined the furniture tendered by the different furniture dealers, and also had called on W. J. Sloane Company at its San Francisco store regarding rugs. Also, on this date, the commission hired a Miss Helen Simonton of Berkeley as a stenographer to start in on January 1, 1912.

This picture with title was used in early highway bond issue campaign.



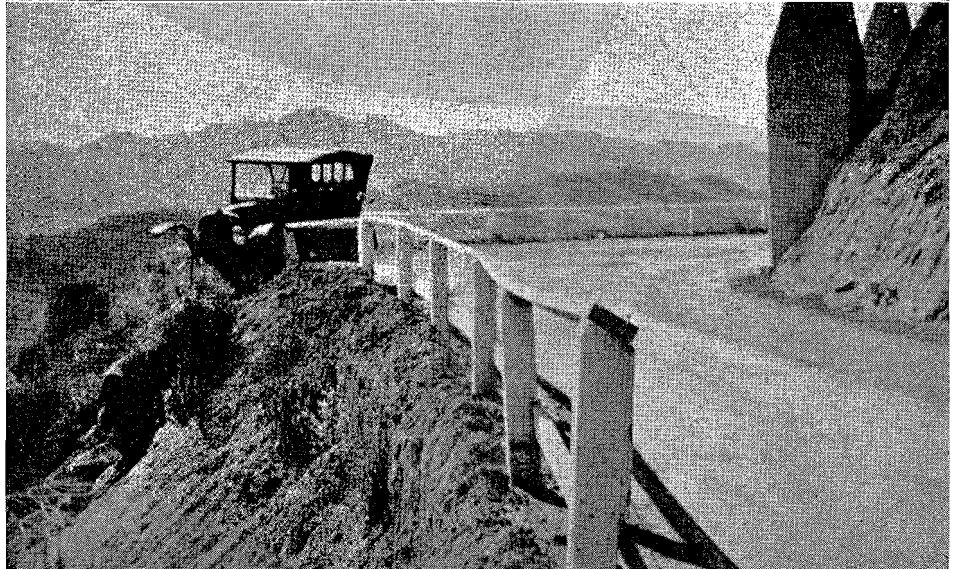
Geologists Employed

The next day, on December 19th, the commission decided to employ seven geologists to determine the location of deposits of road materials available for highway construction, and to report to the Highway Engineer. They suggested that Mr. Blaney, one of the commissioners, arrange with Dr. J. C. Branner for the selection of the seven geologists, and for them to appear before the commission early in January. It also was voted at that time that the Highway Engineer should have a secretary. This secretary was to investigate for the commission the cost and available supply of various materials, supplies, etc., and was to serve subject to the pleasure of the commission. On this date, the commissioners also asked the State Board of Control to allot \$15,100 to pay the salaries of the different people the commission had hired, and the office rent and travel expenses, etc.

Location of Highway Routes

On December 20th the commission proceeded to consider, in executive session, the location of highway routes in various sections. Nothing is said in the minutes as to what routes were discussed, nor what decision had been reached. Recess was taken at noon and at 2 o'clock that day the commission met with the Advisory Board of the Department of Engineering. That meeting was evidently a little short, as at 3.30 p.m. the commission reconvened in regular session. On January 4, 1912, the commission decided that it should have an office in the Union Oil Building in Los Angeles, and Commissioner Darlington was empowered to make all arrangements necessary to secure four or five rooms on the ninth floor of that building. Commissioner Blaney was empowered to enter into an agreement with the owners of the Rialto Building in San Francisco for the lease of some rooms on the fifth floor to be used for the headquarters of Division No. 4.

On January 6th, a number of persons appeared before the commission. It seemed to be the start of a regular parade of people to Sacramento to talk to the commissioners either about



In the lower picture is shown a section of the Ridge Route, U. S. 99, before gas tax funds modernized this mountain highway as shown above.

positions or about roads. Most of these people who appeared on this date were geologists who had been recommended by Dr. Branner.

Engineering Equipment

At this meeting the Highway Engineer was authorized to request bids for such engineering equipment as he should consider necessary for the office at headquarters and for the several division offices.

On that date also, the highway engineer was authorized to request bids for four automobiles—one to be delivered to each of the following division offices: San Francisco, San Luis Obispo, Fresno, and Los Angeles. It was specified that these were to be five-passenger cars, touring type, "each fully equipped with windshields, tops, B Presto-lite tank, Klaxon horns, Weed tire chains for all wheels, and four-inch tires all around, one extra casing, two extra inner tubes, one tire cover, and one set tire brackets."

... Continued on page 59

Late Fishing

Continued from page 29 . . .

division cannot take or allow others to take.

During normal years the Carson, Ebbetts and Sonora Pass routes have been cleared of snow between June 10th and 15th, with plowing operations getting under way around May 15th. Even with the snow pack down to normal this is no small chore, especially on the Carson Pass Highway where snow lies deeply drifted mile after mile and the side slopes are high and precipitous; and on Sonora Pass where the approaches to the summit are steep and winding.

Although it is the custom in years of normal snowfall to get the roads open as far as the fishing meccas of Lake Alpine and Silver or Twin Lakes by Memorial Day, highway crews say that it would be wishful thinking on the part of fishermen to expect these areas to be open by the start of the fishing season on May 30th this year. Most probable opening date will be around July 1st, unless a warm rain or unusually hot weather moves it ahead. In fact, if the weather turns uncooperative, as it has had a habit of doing this year, even getting some of these roads open by July 4th could prove to be a very difficult operation.

Problem of Plowing

Highway maintenance men point out that plowing hard-packed, deeply drifted snow at elevations ranging from 7,000 to 10,000 feet is entirely different from pushing aside the soft, flaky stuff that most people know. With temperatures hovering in the forties and fifties during the day and dropping to below freezing at night, plowing is a tough job; tough on equipment, tough on men and tough on highway maintenance budgets. The progress of the snowplow is like the action of a huge battering ram; a round of charging into the snow and ice until it can go no farther, retreating, waiting for a crew to set and explode a charge of dynamite, then ramming the plow ahead once more. Often it is necessary to work large tractors with bulldozers on the top of the pack and ahead of the plows to break up the icy mass and shove it back to a rotary

plow which then throws the loosened snow out of the roadway trench.

Although Mother Nature can, at times, be quite contrary, she can also help the snow removal crews. A continued period of mild weather, with a hot sun eating at the snow pack, can accomplish in a month a snow removal operation which could not in a similar length of time be completed with man-made equipment.

No Time Gained

Experience of the Division of Highways has shown that even if the wear and tear on equipment and the expenditure involved were disregarded, little or no time is gained in an early start. The snow-covered routes are kept under observation, and the equipment crews start work at the strategic time when only a few critical points require major clearing and only moderate depths remain over most of the routes.

In the relatively light snow year of 1941, for example, plowing on Carson and Ebbetts Pass highways started on May 19th. It required 38 working shifts of 12 hours each to open Carson Pass, and 22 shifts for Ebbetts Pass. The following year, despite a heavier pack of snow, the crews needed only nine shifts on Carson Pass and two on Ebbetts—simply because they started later, on June 16th. In 1941, it took them 11 days to reach Silver Lake on the Carson Pass Highway; with the later start in 1942, it took them only three days.

Cost Is Factor

Cost-conscious engineers also point to the effect on the road surface of early plowing. A slightly later opening permits the highway to dry out more, and consequently to take less of a beating from the heavy snow removal equipment. Thus, early and expensive snowplow operation may mean more chuckholes later in the vacation season, and with less money in the depleted maintenance budget to make repairs.

A large proportion of highway maintenance men are enthusiastic fishermen themselves. They have observed that an abnormally heavy pack of snow means high water and resultant poor fishing early in the season. On the other

In Memoriam

ROBERT L. WING

Robert L. Wing, Supervising Hydraulic Engineer, of the Division of Water Resources, died on April 3d at Indio where he was recuperating from an attack of virus influenza. He had resided at 2736 Curtis Way, Sacramento.

Wing graduated from Stanford University in 1921 and accepted an appointment as county engineer of Santa Clara County in that same year. From 1922 to 1924 he was assistant engineer for the Southern Pacific Company on construction of a second track over the Sierra Nevada. From 1924 to 1927, he was assistant engineer for the California Division of Engineering and Irrigation, now the Division of Water Resources. For a period during 1928 and 1929 he was assistant engineer for the Orange County Flood Control District and from 1929 to the time of his death was with the Division of Water Resources, advancing from associate hydraulic engineer to supervising hydraulic engineer. He served most of his time in state service on investigations of water resources and more recently on the preparation of the California water plan. For several years he was the State's representative in cooperative work with the U. S. Geological Survey on the mapping of California.

Wing was born at Palo Alto September 10, 1896. He was associate member of American Society of Civil Engineers, past vice president of Sacramento section of the society, past Grand Knight of Third Degree, Knights of Columbus, and Recording Secretary of Fourth Degree, Knights of Columbus Holy Name Society. He was a veteran of World War I, serving with the 23d Engineers, U. S. Army. He is survived by his widow, Dorothy; his son, David; his daughter, Theresa Ann, and his mother, Mrs. Marion C. Wing.

hand, the angler who can bide his time until later in the season will find sustained water levels and good fishing, particularly if he is a fly devotee. And he benefits as a taxpayer, also, in receiving more value for his highway dollar.

Emergency Repairs

Chili Bar Bridge Job Done Under Unusual Conditions

By A. L. ELLIOTT, Supervising Bridge Engineer

TOWARD the end of February, 1952, the maintenance superintendent, on his regular inspection, noticed a vertical sag and a lateral displacement in the upstream rail of the Chili Bar Bridge over the South Fork of the American River on State Route 93 between Placerville and Georgetown.

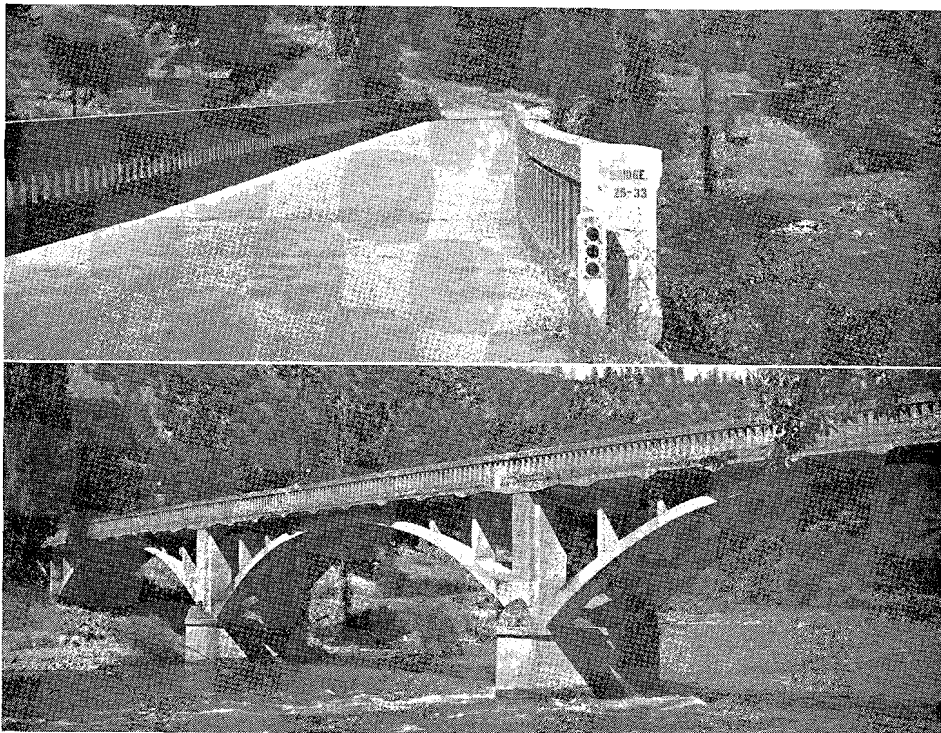
The Chili Bar Bridge is a heavy open-spandrel three-span concrete arch built by El Dorado County in 1922 and since included in the State Highway System. The bridge was originally set on a slate formation in which the bedding planes were nearly vertical. Being near the mouth of a narrow canyon, the stream velocities are high and the scouring action is severe. Over the years the pounding of the river gravel and the swift current of the water have worn away much of the slate underneath the center pier.

Bridge Department Acts

The Bridge Department moved its foundation exploration crew onto the job and five holes were drilled through the center pier and the footings to determine the quality of the concrete, as well as the condition of the foundations. Four of the five holes showed open space beneath the pier footing.

Vibration studies were also made on all three piers to determine if possible the relative foundation stability. The vibration studies did not indicate any differences in the three piers. This was interpreted to indicate that the center pier was still partially supported, although possibly only on a few points or large boulders.

As soon as the uncertain condition of the structure was discovered, the bridge was immediately posted for restricted loads of 10 tons per vehicle. School busses were required to unload the children and walk them across the bridge. These precautions were taken to forestall trouble which might result from the impending heavy run-off from this year's abnormal snow pack.



Upper—Looking along the upstream rail of the Chili Bar Bridge toward Georgetown. Note settlement evident in the rail and displacement upstream to the right. Lower—Downstream side of South Fork American River Bridge at Chili Bar. Pier in foreground in center of channel settled on the upstream end and rotated slightly upstream.

Load Restrictions

The restriction of the loads on the bridge caused a severe hardship to several companies who had many million board feet of lumber to be hauled out over this road before the spring run-off started. It was necessary that trucks loaded with lumber detour around through Coloma, a distance of about 20 miles. The lumber companies immediately became interested in what could be done to repair or strengthen the bridge. The day after the exploratory drilling was completed, the Chili Bar Bridge repair was declared to be an emergency by order of the Director of Public Works and bids were asked for the planned repairs. A contract was made with a contractor specializing in grouting work and he started moving

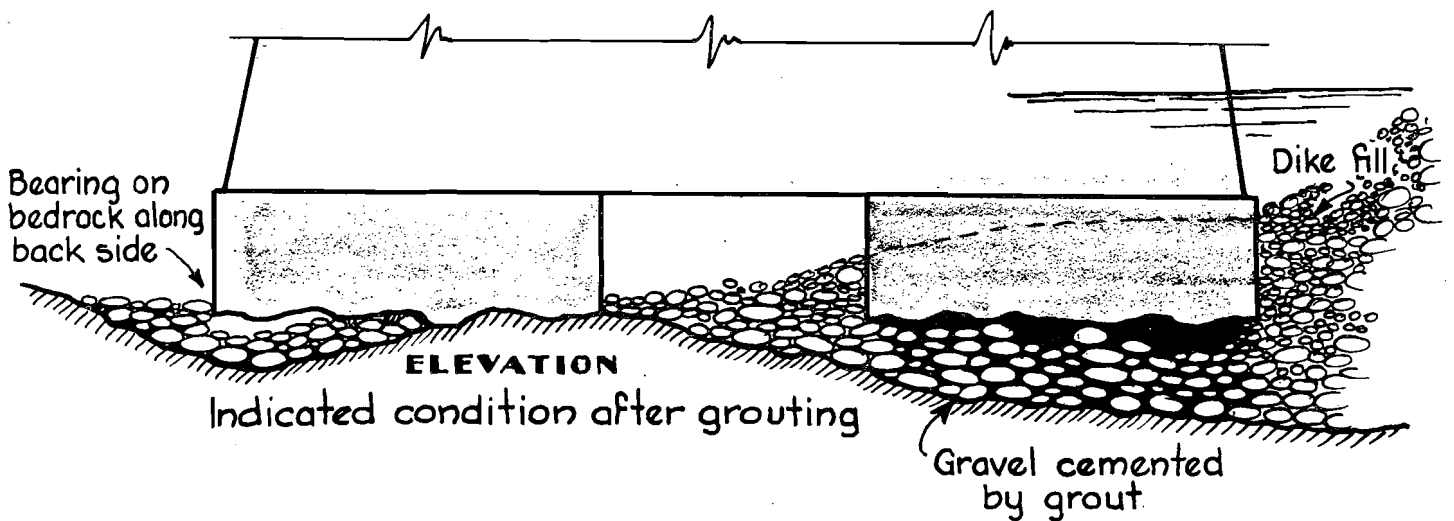
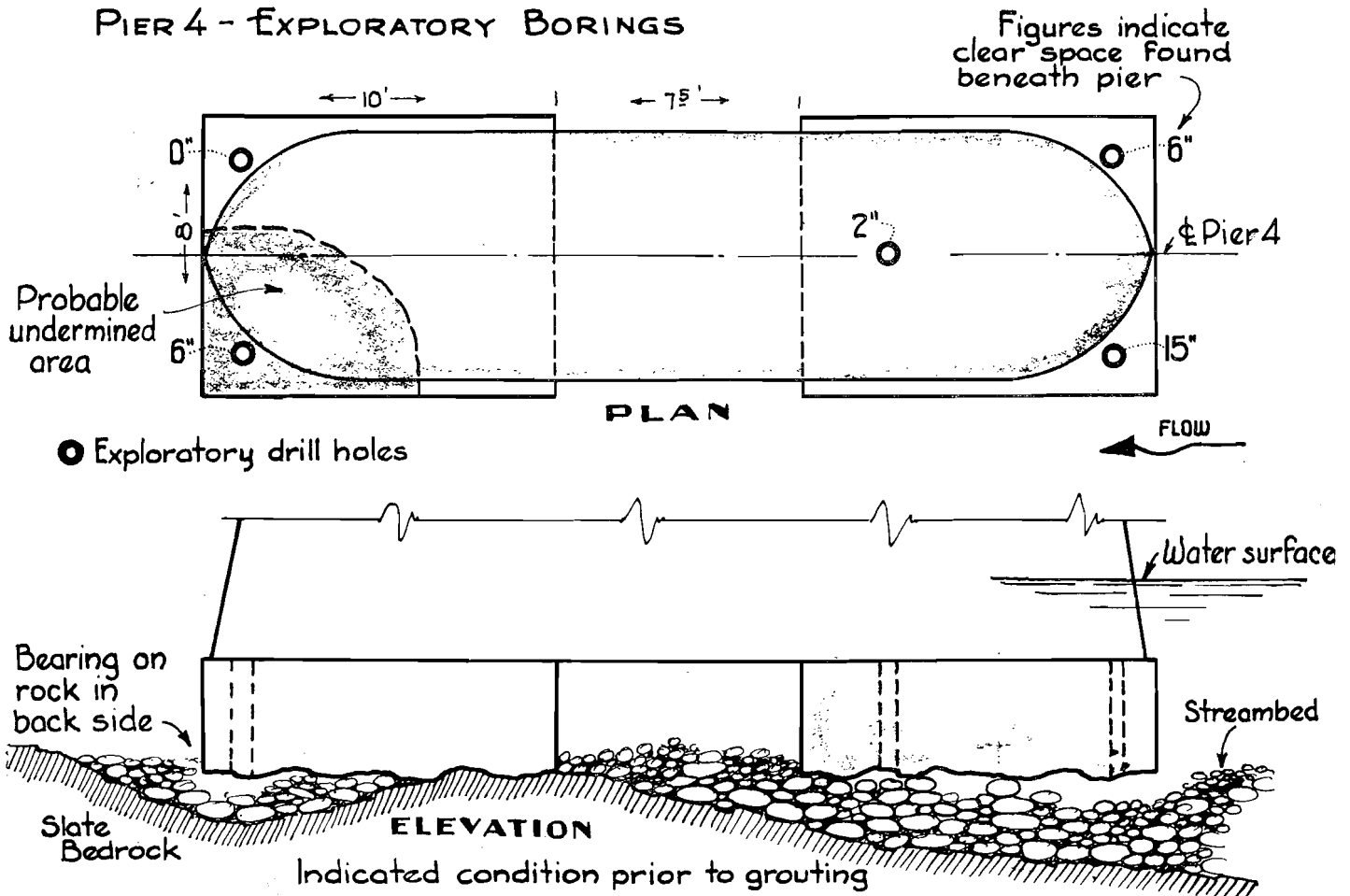
equipment onto the job the following day, Tuesday, March 11th.

Exploration had shown that the stream bed was washed down to below the bottom of the footing block in some places along the sides of the midstream pier. The plan of repair was to fill around the pier so as to confine the space beneath it and pump grout down through the exploration holes to fill the void, consolidate the gravel and provide support for the pier.

Access Dike Built

Accordingly the first step was to build an access dike out to the pier and fill around the pier with river sand and gravel from a nearby bar. Using a small drag-line and a truck, the material was end-dumped and bulldozed into position. By Friday night, March 14th, the

**SOUTH FORK AMERICAN RIVER - CHILI BAR
PIER 4 - EXPLORATORY BORINGS**



nose of the dike was out beyond the pier. On the downstream side, the dike had created a pool of still water around the pier itself.

Because of the susceptibility of the American River at this point to sudden rises as a result of rainfall run-off, advantage was taken of the reasonably good weather which prevailed and the work was carried on over the weekend.

River Rises

Saturday afternoon it started raining and almost immediately the river rose over a foot. The dike had to be raised 18 inches. Still the river was gaining and it looked as though the dike would have to be abandoned. Just at the last minute when the equipment was being taken out of the river—just like a story-book finish—the rain suddenly turned to snow. As though a blotter had been applied to the hills, the river stopped rising and then slowly fell back.

By Sunday night the dike was complete and a fill had been made around the pier completely encasing the upper half of it about five feet above the stream bed.

The plan for an emergency repair to hold the structure through the coming periods of spring high water contemplated the supporting of only the upstream footing of the pier. Borings had shown that the downstream footing was partially supported on solid rock, so it was felt that the downstream footing was not in any immediate danger.

River Is Confined

With the dike complete, the river was confined to a narrow channel through which it roared with four-foot high waves. The larger boulders obtained from the gravel bar were placed on the end of the fill, and they did remarkably well maintaining the nose of the dike against the force of the current.

Monday morning, grout was pumped into the three holes in the upstream footing until it came out through the gravel around the pier. Operations were then stopped so that the grout could set up.

The next day it started raining and the river rose. The jetty and the island around the pier were washed out. Thus, the operation had been com-

pleted just in the nick of time, less than 24 hours before the dike went out.

Long Drill Steel Obtained

Long drill steel was then obtained to drill through the grout so that more grout could be put in under pressure at a lower level. The elements again interfered and the passes over the Sierras were closed by snow. The only drill steel available, coming from Reno, was held up in the snow. The steel came through several days later and the three holes in the pier were drilled through again and more grout was forced through under the pier until it oozed through the gravel on the sides.

Core samples were taken through the pier and it was found that the gravel under the pier was completely consolidated down to bedrock. This completed the emergency repairs planned for the winter. It was felt that the foundation of the bridge was stabilized to the point where it would safely withstand the spring run-off. Next summer when the water is low, more extensive repairs will be undertaken to completely support and protect the center pier against future ravages of the stream.

Grouting Successful

After the core borings showed the grouting to be successful, the posting was removed and other restrictions suspended. Frequent checks are being made of the line, grades and general condition. Should anything develop, the posting will immediately be reinstated, or if necessary, the bridge will be closed.

The settlement and displacement have caused no structural damage to the arch as far as may be determined. Thus, it is not considered necessary to jack the structure back into its former position. Although the bridge is narrow, the volume of traffic is low so after some permanent strengthening of the pier footings this summer, the Chili Bar Bridge should be in service for many more years.

The work was done under the direction of the Bridge Department under an emergency contract prepared by District III of the Division of Highways. The contractor on the work was Ted Schwartz of Nevada City. The Resident Engineer for the Bridge Department was George S. Smith.

BRITISH CORRESPONDENT

THE YORKSHIRE PATENT STEAM WAGON CO.

Hunslet Leeds 10

April 11th, 1952

NORMAN H. HEGGIE, ESQ.

Assistant Physical Testing Engineer
Service and Supply, Headquarters,
State Highways Commission
Street Sweepers

DEAR SIR: I am the president of a British company making street sweepers which are not on the American market, and I was very interested to read your article in the publication *California Highways and Public Works*. The British and American designs of sweepers are dissimilar, particularly in the matter of lifting the sweepings into the body and in the method of attaching the broom fibres to the stock. The mileage you quote for your bristles on the whole agrees with that obtained in Great Britain, though the material to be lifted has obviously a bearing on the brush life.

The British method of fixing broom fibres is to set them in pitch rather than wind them on with a wire rope. I note that you have to soak certain bristles otherwise they break and I am wondering if this is a cause of short brush life although, I must admit that in this country, pitch-set bristles are usually kept wet by the more old-fashioned user as he claims that they do not become brittle.

A further point I would be interested in is the life of the vertical gutter broom. In this country we do not use this but use a horizontal gutter brush whose life is half that of the remainder of the brush. A further point which would be of interest is the life of your conveyor. In this country there are two schools of thought, one which uses a small conveyor and the other paddles. I should be interested to know how you get on, say, when you are sweeping up surface road grit after bituminous spraying with the conveyor type, as the bombardment effect of the grit must cause severe wear on the belting.

Yours sincerely,

(Signed)

L. H. RIDDELL

Highway Signs

National Joint Committee Studies
Uniform Traffic Control Devices

THE IDEA that "it's a small world" has been applied to so many fields of human activity that traffic engineers are not surprised to see highway signs made a subject for study and discussion by a subunit of the United Nations.

In the United States many highway *warning* signs are based on symbols (cross for "Cross Road," etc.), but on *regulatory* signs the message is usually expressed in words (No Left Turn, One Way, etc.). In many other parts of the world, the regulatory as well as the warning signs are set forth in symbols.

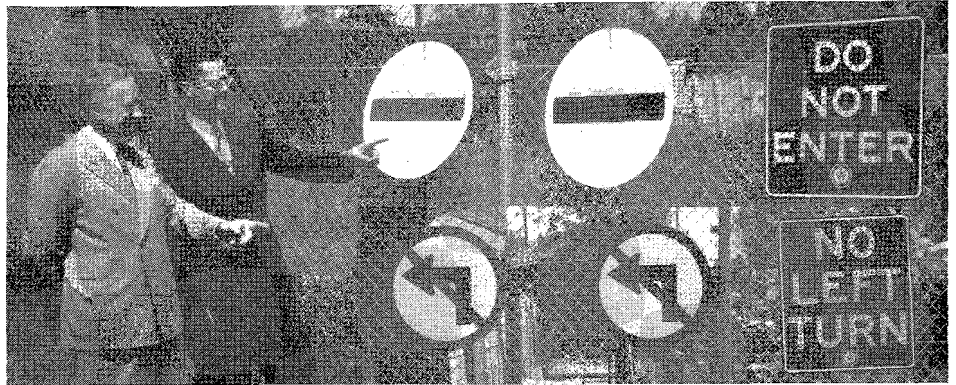
A National Joint Committee on Uniform Traffic Control Devices, cooperating with a group of United Nations experts on road signs and signals, recently devised a tentative proposal for regulatory traffic signs based on symbols. Tests of the effectiveness of these proposed signs have been conducted in various parts of the Nation, to provide the U. N. group with a basis for further discussion.

The chairman of the Joint Committee is H. E. Hilts, Deputy Commissioner of the U. S. Bureau of Public Roads. Tests in California have been conducted under the supervision of Chief Engineer J. W. Johnson of the California State Automobile Association, and Dr. Donald S. Berry, Assistant Director of the Institute of Transportation and Traffic Engineering, University of California, two of the experts on the Joint Committee.

The California Division of Highways has cooperated in the research in this State in testing the suggested symbolic designs for the following regulatory signs:

1. No Passing
2. Do Not Enter
3. No Left Turn
4. Speed Limit

The test was intended to compare the effectiveness of two symbolized signs, designed in different color combinations, and the presently used California standard. (One set of symbolized



Upper—Two members of the national Joint Committee on Uniform Traffic Control Devices examine two of the proposed international traffic signs—shown alongside their California counterpart—which are the subject of current research suggested by the United Nations. The men are J. W. Johnson (left), Chief Engineer of the California State Automobile Association, and Dr. Donald S. Berry, Assistant Director of the Institute of Transportation and Traffic Engineering, University of California. The bar on the disk-type sign at the extreme left is in red; on the center sign, it is in black. Lower—The proposed symbolized sign for "No Left Turn" makes use of a left-turning arrow with a diagonal bar across it (the bar is red on the left-hand sign, black in the middle one). A diagonal bar is widely used on traffic signs in many countries to mean "no." Tests of the relative effectiveness of the signs were conducted May 22d at the State Fairgrounds in Sacramento as part of a series of tests throughout the Nation.

signs used red, white and black, and the other used black and white only.)

Each group of three signs was placed at the end of a long straightaway, and the observers were driven toward them. The observers made their own recording, on specially prepared forms, to show:

A. Target value of each sign — which caught the observer's attention and was recognized as a traffic sign from the greatest distance, although the message may not be discerned.

B. Which sign first conveyed the intended regulatory message.

C. Which sign the observer prefers.

The information gathered in the California test, which took place at the State Fairgrounds in Sacramento, was tabulated but not analyzed. The data were sent to the Joint Committee on Uniform Traffic Control Devices for analysis and for use in further study.

Meanwhile, the Traffic Department of the California Division of Highways is following the research into symbolized signs with interest to see if the tests and the subsequent studies produce any suggestions which may lead to the improvement of the standardized California highway sign system.

PRAISE FOR ROAD CREWS

GREEN VALLEY LAKE

State Division of Highways
San Bernardino, California

DEAR SIR: I would like to express my appreciation for the fine job done by your road crews in the San Bernardino Mountains this winter and the courteous treatment and help they have afforded. It is rather amazing to drive such clear roads and see the amount of snow which has had to be handled. It has been necessary for us to be at Green Valley Lake every weekend, so again we thank you.

THE WORTH RUNQUISH FAMILY

THE VULNERABLE PEDESTRIAN

Two out of five persons killed in automobile accidents in the United States are pedestrians, says the California State Automobile Association. In some localities the proportion is even greater. Nearly all pedestrian accidents involve injuries. Keep from getting hurt while you're on foot, by using the crosswalks and walking with the traffic signals.

HISTORY OF UNITED STATES NUMBERED HIGHWAYS

By M. A. O'BRIEN, Highway Signing Supervisor

This is second of two installments of an article by Mr. O'Brien.

THE FOLLOWING policies have been established by the American Association of State Highway Officials regarding the numbering and marking of U. S. highways:

1. The executive committee of the American Association of State Highway Officials shall have full authority to review the U. S. numbered road system and the numbering and marking thereof, to make additions, changes, extensions, revisions, or reductions in said road system and to revise the numbering or marking thereof.
2. Before approving any addition, change, extension, revision, or reduction in the U. S. numbered road system, or the numbering or marking of any U. S. numbered road, the executive committee shall consult the state highway department of the state or states through or within which such addition, change, extension, revision, or reduction is located.

National Policies

3. The state highway department, by a favorable vote on the adoption of this program and policy, agrees and pledges its good faith that it will not erect U. S. markers on any road or take down or change the U. S. markers on any road without the authorization, consent, or approval of the executive committee of the American Association of State Highway Officials, notwithstanding the fact that the changes proposed are entirely within that state.
4. No additional road shall be added to the U. S. numbered road system, and no existing U. S. road shall be extended except where there is a definite showing of an



North and south U. S. routes are odd numbered as shown above.

adequately improved highway carrying an established and necessary line of interstate traffic not otherwise provided for by existing U. S. routes and for which traffic adequate service cannot be provided by state route numbers. Extension of present U. S. numbered routes may be made only when the proposed extension is in the general direction of the present route.

Proposed extensions shall not be made when, to do so, it is necessary to duplicate U. S. routes already established, unless the duplication is for a short distance and the routes then diverge, ending in different terminal points.

5. No new U. S. route located wholly in one state shall be established. U. S. routes, less than 300 miles in length, theretofore established and located wholly in one state, shall be eliminated either by consolidation with other U. S. routes or by reverting to state routes, as rapidly as the state highway department and the Executive Committee of the American Association of State Highway Officials can reach agreement with reference thereto.

First Markers in State

At the time the U. S. Highway System was approved and adopted, the road signing activities in California were carried on by the two major automobile clubs; the California State Automobile Association placed signs in the 45 northern counties and the Automobile Club of Southern California provided service in the 13 southern counties. This work was undertaken on state highways, county roads, and city streets entirely at the expense of the membership of these two clubs.

A search of the records of the California State Automobile Association and Automobile Club of Southern California show that the first markers were placed in California during the month of January of 1928. In the northern area, markers were erected on U. S. 40 from Berkeley to the Nevada state line while in the southern area, U. S. 101 was being signed from Los Angeles to San Diego. Following the marking of U. S. 40, signs were then installed on U. S. 99. This work was coordinated with the signing activities of the Automobile Club of Southern California. The signing of U. S. 101 followed during the summer months in 1928. The two automobile clubs informed the writer that when the U. S. markers were placed, all the old style diamond-shaped directional signs were removed and the new black on white rectangular-shaped signs were provided. Following the signing of U. S. 101, markers were then placed on U. S. 66 and U. S. 91.

State Takes Over

Between the years 1928 and 1934, there was very little activity in the signing of U. S. highways in California. Between these dates the Uniform Manual of Traffic Control Devices was published which set forth certain standards in the marking and positioning of U. S. route markers and arrows.

When the Division of Highways undertook the responsibility of signing for the highways in 1934, it was deemed advisable to review the signing of these routes and bring the signing in conformance with the recently adopted standards. Accordingly, surveys were made of all the major highways, and U. S. routes were completely marked including signing through cities which, in some cases, had been omitted in 1928. Since that time, of course, additional U. S. highways have been approved by the American Association of State Highway Officials and there are now 23 U. S. highways completely signed in California with a total length of approximately 5,958 miles.

On State Sign Routes

Since the U. S. highway numbering system can only be applied to the interstate highways, it was found desirable to mark local routes of travel with a system of state

numbered highways, customarily referred to as state sign routes. The sign routes provide a marking system for those highways which are intrastate. Accordingly, meetings were held by the representatives of the two automobile clubs and the maintenance engineer to devise a numbering system for other California highways. A route marker now known as the "bear shield," was adopted from a wide range of designs submitted. The present route marker was adopted as it resembled the miner's spade and displayed a grizzly bear taken from the California Bear Flag.

In selecting numbers for the state sign routes, a numerical system following the U. S. Highway System was adopted. All routes that follow a more or less north and south direction were given odd numbers; the east and west routes were given even numbers. In order to avoid, as far as possible, any claims of partiality between the north and the south, the smaller numbers were evenly divided between these

two areas. State Sign Route 1 was assigned to the coast route between Las Cruces in Santa Barbara County to Westport in Mendocino County. This route traverses both the north and south portions of the State. After this number was used, the next odd and even numbers were assigned in pairs; i.e., 2 and 3 were given to the south, and 4 and 5 to the north, etc. An effort was made to have the numbers increase for north and south routes as you proceed from west to east.

In selecting numbers for the state sign route system, numbers given to existing U. S. highways were purposely omitted so that there would be no duplication. The marking of state sign routes began in the fall of 1934 and has been progressive through the intervening years.

At the present time there are 76 state sign routes in California with a total of 7,486 miles.

This is a state sign route marker located on State Sign Route 89 bordering Lake Tahoe.



Cost Index

California Highway Construction
Prices Down 8.4 Percent First Quarter

By RICHARD H. WILSON, Assistant State Highway Engineer

H. C. McCARTY, Office Engineer

JOHN D. GALLAGHER, Assistant Office Engineer

TABULATION of contracts awarded for California State highway construction during the first quarter of 1952 revealed a decline in the average unit prices of the principal contract items which resulted in a drop from the previous quarter of 8.4 percent in the California Highway Construction Cost Index. The index for the first quarter of the year was 224.8 (1940=100) which is 20.6 points below the 245.4 of the fourth quarter of 1951.

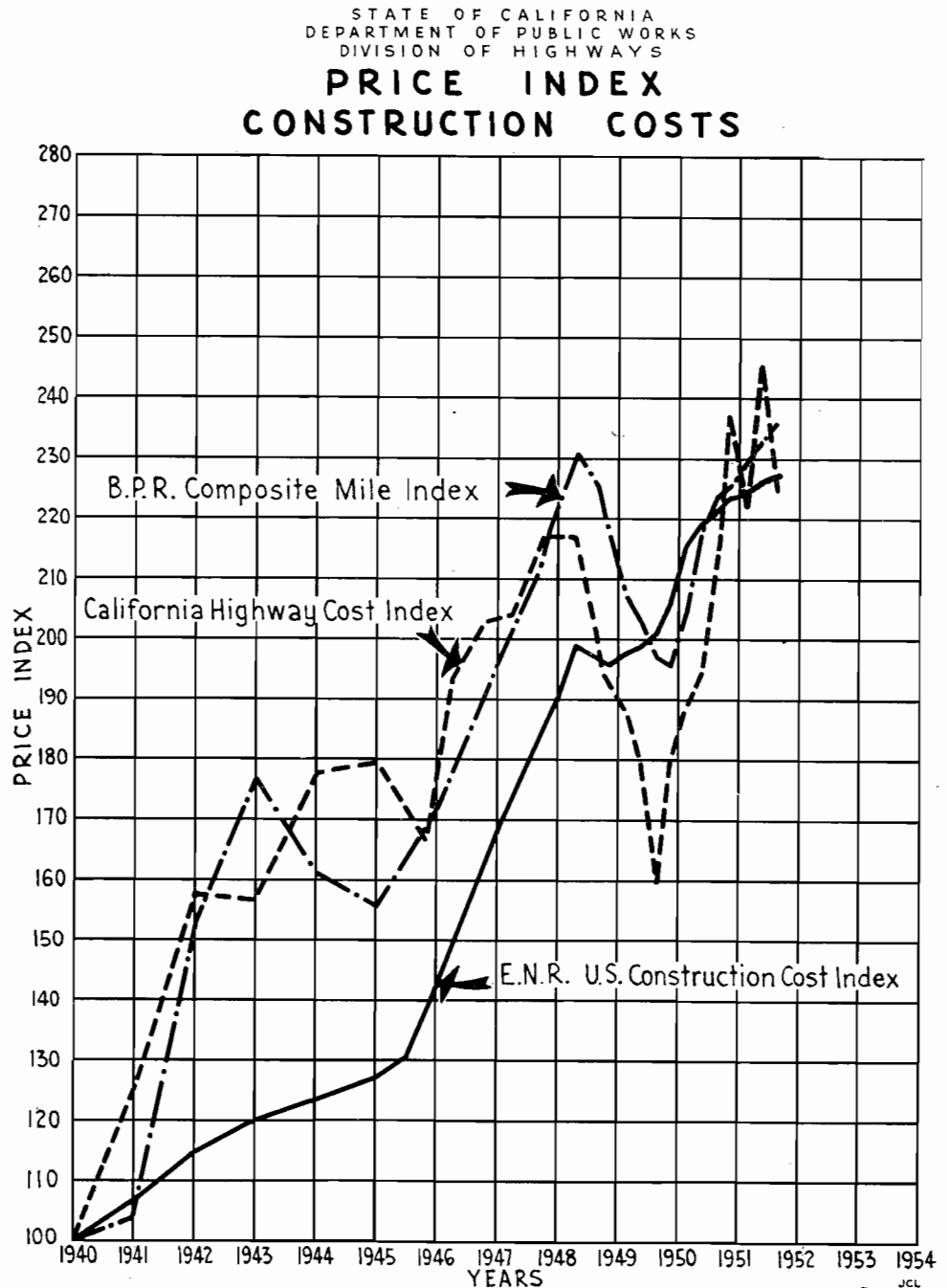
Lack of Stability

The rise and fall of highway construction costs during the past year as reflected in the California Index indicates a current lack of stability in trends. From a seven-year low in the first quarter of 1950, when the index had dropped to 160.0, there began a steady rise which continued through the second quarter of 1951 to reach 238.3. During the third quarter of 1951 there was a 6.9 percent drop in the index back to 221.9 and then during the last quarter of the year a rise to an all-time high of 245.4, and now comes the 8.4 percent drop back to 224.8.

While the up and down movements in highway construction costs in the past nine months may reflect uncertainty on the part of some bidders with regard to the immediate future, it is our opinion that a firm downward trend will not occur for some months.

Steel Situation

The steel situation does not portend any drop in prices even though available tonnage should become more adequate. Announcement by the Wage Stabilization Board on March 13th of its approval of the Construction Industry Commission's policy for 1952 of a 15-cent-an-hour increase over the 10 percent formula adopted last August will probably be followed by



increases in construction costs. Contemplated expansion of health and welfare plans in the construction in-

dustry with employer contributions of 7½ cents per hour indicate still additional increases in costs.

The large volume of construction projects programmed by federal, state, and local governments coupled with planned expansion in private industry is likely to prevent noticeable reduction in costs from acute competition. However, the California Division of Highways has no complaint on the score of lack of bidders. Few state highway projects attract less than four or five bidders and as high as 16 bids have been received on one project at recent openings.

Competition May Be Factor

While the California Highway Construction Cost Index dropped 8.4 percent during the first quarter of 1952, it is felt that this may be due to local conditions and to competition between contractors for projects to be awarded early in the construction year. The Engineering News-Record Construc-

tion Cost Index, reaching 227.0 in the first quarter of 1952, continues a steady upward trend on a national scale, as does the Bureau of Public Roads Composite Mile Index which was 236.2 in the first quarter of 1952. Bureau of Public Roads figures indicate that excavation was the only major item which showed any drop in 1951; concrete pavement, reinforcing steel and structural concrete all reached 20-year peaks in 1951 as did the Composite Mile Index, with its trend still upward.

Examination of average contract prices for state highway work shows them to be uniformly lower during the first quarter of 1952, with the exception of concrete pavement. Nevertheless we are still of the belief that the peak of the inflationary spiral has not been reached and that it will be many

months or possibly a year before a firm downward trend may be evident.

CALIFORNIA HIGHWAY CONSTRUCTION COST INDEX

Period	Index 1940=100	Change from previous period	Change from 1948	Change from 1st qtr. 1950
1940	100	-----	-----	-----
1941	125.0	+25.0%	-----	-----
1942	157.5	+26.0%	-----	-----
1943	156.4	-0.7%	-----	-----
1944	177.8	+13.7%	-----	-----
1945	179.5	+1.0%	-----	-----
1946	179.7	+0.1%	-----	-----
1947	203.3	+13.1%	-----	-----
1948	216.6	+6.5%	-----	-----
1949	190.7	-12.0%	-----	-----
1950 (1st qtr.)	160.0	-10.5%	-26.1%	-----
1950 (2d qtr.)	180.0	+12.5%	-16.9%	+12.5%
1950 (3d qtr.)	189.2	+5.1%	-12.7%	+18.3%
1950 (4th qtr.)	194.8	+3.0%	-10.1%	+21.8%
1951 (1st qtr.)	215.4	+10.6%	-0.6%	+34.6%
1951 (2d qtr.)	238.3	+10.6%	+10.0%	+48.9%
1951 (3d qtr.)	221.9	-6.9%	+2.4%	+38.7%
1951 (4th qtr.)	245.4	+10.6%	+13.3%	+53.4%
1952 (1st qtr.)	224.8	-8.4%	+3.7%	+40.5%

CALIFORNIA DIVISION OF HIGHWAYS

AVERAGE CONTRACT PRICES

	Roadway excavation, per cu. yd.	Crusher run base, per ton	Plant-mix surfacing, per ton	Asphalt con- crete pavement, per ton	PCC pavement, per cu. yd.	PCC structures, per cu. yd.	Bar reinforc- ing steel, per lb.	Structural steel, per lb.	
1940	\$0.22	\$1.54	\$2.19	\$2.97	\$7.68	\$18.33	\$0.040	\$0.083	All projects
1941	0.26	2.31	2.84	3.18	7.54	23.31	0.053	0.107	
1942	0.35	2.81	4.02	4.16	9.62	29.48	0.073	0.103	
1943	0.42	2.26	3.71	4.76	11.48	31.76	0.059	0.080	
1944	0.50	2.45	4.10	4.50	10.46	31.99	0.054	0.132	
1945	0.51	2.42	4.20	4.88	10.90	37.20	0.059	0.102	
1st Half, 1946	0.41	2.31	4.00	4.54	9.85	37.38	0.060	0.099	Federal aid projects only
2d Half, 1946	0.39	2.27	4.12	5.04	12.39	49.84	0.079	0.142	
1st Half, 1947	0.48	2.62	4.52	6.46	12.41	47.03	0.080	0.133	
2d Half, 1947	0.54	2.39	4.02	6.48	11.58	50.15	0.089	0.123	
1st Half, 1948	0.56	2.45	4.42	4.91	13.37	49.51	0.094	0.145	
2d Half, 1948	0.52	2.64	4.80	7.00	14.01	49.08	0.103	0.131	
1st Quarter, 1949	0.49	2.48	4.54	5.70	11.84	48.11	0.089	0.113	
2d Quarter, 1949	0.43	2.91	4.63	4.06	11.74	48.63	0.083	0.110	
3d Quarter, 1949	0.41	2.40	5.05	4.60	11.53	45.35	0.080	0.093	
4th Quarter, 1949	0.43	2.55	3.78	3.50	12.66	44.54	0.078	0.092	
1st Quarter, 1950	0.34	2.22	3.65	3.74	-----	40.15	0.077	0.081	All projects
2d Quarter, 1950	0.40	2.13	4.48	3.74	10.86	43.03	0.080	0.105	
3d Quarter, 1950	0.41	2.32	4.25	5.50	10.91	44.34	0.093	0.131	
4th Quarter, 1950	0.42	2.81	4.64	4.61	12.55	43.18	0.098	0.120	
1st Quarter, 1951	0.45	3.07	4.06	5.22	11.71	46.38	0.103	0.206	
2d Quarter, 1951	0.63	3.88	4.56	4.63	12.93	51.50	0.105	0.166	
3d Quarter, 1951	0.56	2.88	4.59	3.90	12.41	46.14	0.107	0.165	
4th Quarter, 1951	0.66	2.91	5.66	4.89	12.71	49.38	0.105	0.169	
1st Quarter, 1952	0.56	3.25	4.88	4.77	14.25	47.46	0.094	0.152	

HIGHWAY DEFINITIONS—RIGHT-OF-WAY TERMS*

Right of Way—A general term denoting land, property, or interest therein, usually in a strip, acquired for or devoted to a highway.

Fee Simple—An absolute estate or ownership in property including unlimited power of alienation.

Acquisition or Taking—The process of obtaining right of way.

Partial Taking—The acquisition of a portion of a parcel of property.

Remainder—The portion of a parcel retained by the owner after a part of such parcel has been acquired.

Remnant—A remainder so small or irregular that it usually has little or no economic value to the owner.

Easement—A right acquired by public authority to use or control property for a designated highway purpose.

Slope Easement—An easement for cuts or fills.

Drainage Easement—An easement for directing the flow of water.

Sight Line Easement—An easement for maintaining or improving the sight distance.

Planting Easement—An easement for reshaping roadside areas and establishing, maintaining, and controlling plant growth thereon.

Scenic Easement—An easement for conservation and development of roadside views and natural features.

Abandonment—Cessation of use of right of way or activity thereon with no intention to reclaim or use again for highway purposes. (Sometimes called vacation.)

Right of Access—The right of ingress to a highway from abutting land and egress from a highway to abutting land. (See control of access.)

Highway Development Right—The right of owners to make changes in abutting property uses, which, if exercised, would be inconsistent with present and future highway needs.

Riparian Rights—The rights of an owner of water-fronting lands in the

bed, banks, accretions, water, access, moorage, and related items.

General Benefit—Advantage accruing from a given highway improvement to a community as a whole, applying to all property similarly situated.

Special Benefit—Advantage accruing from a given highway improvement to a specific property and not to others generally.

Direct Compensation—Payment for land or interest in land and improvements actually acquired for highway purposes. (Sometimes called direct damages.)

Severance Damages—Loss in value of the remainder of a parcel resulting from an acquisition. (Sometimes called indirect damages.)

Consequential Damages—Loss in value of a parcel, no portion of which is acquired, resulting from a highway improvement.

Just Compensation—A full and fair equivalent for the loss sustained by the owner as a result of taking or damaging of private property for highway purposes.

Donation—The voluntary conveyance of private property to public ownership and use, without compensation to the owner.

Dedication—The setting apart by the owner and acceptance by the public of property for highway use, in accordance with statutory or common law provisions.

Negotiations—The process by which property is sought to be acquired for highway purposes through discussion, conference, and final agreement upon the terms of a voluntary transfer of such property.

Eminent Domain—The power to take property for public use with just compensation therefor.

Condemnation—The process by which property is acquired for highway purposes through legal proceedings under power of eminent domain.

Inverse Condemnation—The legal process by which a property owner

may claim and receive compensation for the taking of, or payment for damages to, his property as a result of a highway improvement.

Right of Immediate Possession—The right to occupy property for highway purposes, after preliminary steps for acquisition have been taken and before final settlement.

Right of Survey Entry—The right to enter property temporarily to make surveys and investigations for proposed highway improvements.

Right-of-Way Strip Map—A plan of a highway improvement showing its relation to adjacent property, the parcels or portions thereof needed for highway purposes, and other pertinent information.

Parcel Plat—A map of a single parcel of property or portion thereof needed for highway purposes, showing the boundaries, areas, the remainder, improvements, access, ownership, and other pertinent information.

Setback Line—A line outside the right of way, established by public authority, on the highway side of which the erection of buildings or other permanent improvements is controlled.

Roadside Control—The public regulation of the roadside to improve highway safety, expedite the free flow of traffic, safeguard present and future highway investment, conserve abutting property values, or preserve the attractiveness of the landscape.

Zoning—The division of an area into districts and the public regulation of the character and intensity of use of the land and improvements thereon.

Roadside Zoning—The application of zoning for roadside control.

Market Value—The highest price for which property can be sold in the open market by a willing seller to a willing purchaser, neither acting under compulsion and both exercising reasonable judgment.

Highest and Best Use—The most productive use, reasonable but not speculative or conjectural, to which property may be put in the near future.

* Adopted by the American Association of State Highway Officials, January 1, 1952.

Right-of-way Appraisal—A determination of the market value of property including damages, if any, as of a specified date, resulting from an analysis of facts.

Right-of-way Estimate—An approximation of the market value of property including damages, if any, in advance of an appraisal.

Title—The evidence of a person's right to property or the right itself.

Title Search—An investigation of public records and documents to ascertain the history and present status of title to property, including ownership, liens, charges, encumbrances, and other interests.

Title Opinion—An analysis and interpretation of a title search concerning present ownership, encumbrances, clouds on title, and other infirmities.

Abstract of Title—A document showing the condensed history of the title to property, containing portions of all conveyances or other pertinent instruments relating to the estate or interest in the property, and all liens, charges, encumbrances, and releases.

Certificate of Title—A document based on a title search stating that title or interest in property is vested in a designated person and showing outstanding liens, charges, or other encumbrances.

Guarantee Title—A title, the validity of which is insured by an abstract, title, or indemnity company. (Sometimes called insured title.)

Torrens Title—A certificate of title issued by a public authority under a system wherein all deeds and documents affecting real property are registered.

Conveyance—A written instrument by which a title, estate, or interest in property is transferred.

Deed—A duly attested written instrument, under seal, conveying real property or interest therein.

Warranty Deed—A deed containing covenants by the grantor, for himself and his heirs, to the grantee and his heirs, to warrant and defend the title and possession of the estate conveyed.

Quitclaim Deed—A deed conveying, without warranty, any title, interest, or claim which the grantor may have in the estate conveyed.

Early Days

Continued from page 48 . . .

Fletcher Purchasing Agent

At the same meeting, on January 6th, the Highway Engineer reported that he had bought certain supplies, and from the names of the companies furnishing them it would seem that they were drafting supplies of different kinds, and filing cases. The commission ratified his actions in doing such. It also voted that on this day it would grant audiences to eight different groups on January 24th, and on this same day there is a list of 12 to 15 communications which were ordered filed. The commission also appointed the Highway Engineer to act as purchasing agent of the commission as far as his department was concerned, in addition to his other duties, this to be done until such time as the purchasing agent was appointed. And on January 6th, we also have record of the first communication regarding the Castaic Ridge Road, and Commissioner Darlington was requested to take up the matter with the writer and report to the commission later.

Those Autos Again

On January 8th the commission reconvened at 9 a.m. and opened bids from different automobile dealers. There was a bid from the Franklin Automobile Company for \$2,200 each for 25 h.p. four-cylinder cars, and \$3,000 each for 38 h.p. six-cylinder cars. The commission also had a bid from Don Lee, agent for the Cadillac automobile, for four cars for \$8,632.40. Each Cadillac would cost \$2,158.10. These figures were for four-cylinder, 32 h.p. cars. The commission decided that it would take the matter under advisement, and then Mr. Blaney was requested to go to San Francisco and get competitive bids, in quadruplicate, for one, two, three, and four automobiles delivered in San Francisco. These were to be for Cadillac, Franklin, Chalmers and Hudson cars, and equipment to cover at least "glass front, B Presto-lite

Option—A written agreement granting a privilege to acquire property or interest therein at a fixed price within a specified period.

tanks, with a good windshield, a speedometer, large Klaxon horn, one extra four-inch casing, two extra inner tubes, one tire cover, one set of tire irons, a top, four-inch tires all around, and two pairs of Weed chains."

And another piece of business transacted on January 8th was that the geologists assigned to the different divisions of the State would be paid \$100 per month and their reasonable expenses of travel and subsistence. A recess was taken until 2 p.m.

That afternoon the commissioners listened to a group from Yreka representing Siskiyou County regarding roads, and called it a day. On January 9th they listened to two different people regarding roads in Trinity County and in Yolo County and then recessed until 2 p.m. In the afternoon they voted that the office hours of the California Highway Commission at the Sacramento Headquarters would be from 8.30 a.m. to 5 p.m. each week day, and from 8.30 a.m. to 12 noon on Saturdays, and that all division headquarters would be open from 8 a.m. to 5 p.m. each day, and from 8 a.m. to 12 noon on Saturdays.

Up to now, the commissioners had been interested in the expansion program a bit, so they decided they were going to do something about their Division Office at Redding and at San Luis Obispo. So the Highway Engineer was empowered to enter into negotiations at both places.

(To Be Continued)

ARMSTRONG NUGGET

The Armstrong Nugget, sold to the First National Bank of Baker in Oregon during the gold rush days of the 1860's for about \$500, is reported by the National Automobile Club to be now the central attraction in the bank's gold display and to be valued at close to \$3,000.

NIGHT DRIVING TIPS

When you drive at night take it easy and reduce your speed. Keep your headlights and windshield clean so you can see better, and be constantly alert for pedestrians. Night driving is hazardous at best and takes extra skill and special caution.

Spectroscope

Continued from page 10 . . .

spectrographic operation and a reference to charts for percentage values of all elements desired. That time, however, is in the dim future.

The Spectrograph

The spectrograph, of course, involves the photographic recording of the spectrum of the thing under observation. The excitation of spectral lines in this type of procedure may be by flame, electric arc or electric spark. An extensive investigation of a spectrum of metals generally requires the arc. If the light from the arc between two iron electrodes with a sample of unknown material between them is passed through a narrow slit of the spectrograph and refracted by a quartz prism, lines which are images of the slit can be photographed. The lines will be located at places corresponding to characteristic wave lengths associated with material in the source of light. Iron which has a complex spectrum will predominate, but metals in the sample will be represented too. The density of the line on the photographic film is proportional to the quantity of material producing the line, all other conditions being constant. Maintaining these conditions constant, even when referring to a standard, is not so easily done in most cases.

Spark Excitation

Operators of spectrographic instruments usually resort to spark excitation of the spectra to get the lines from nonmetallic elements. The exciting energy is higher and in some cases produces better defined lines with such elements as carbon, silicon, boron, etc.

It is not within the scope of an article of this kind to discuss the details of technique or the theoretical aspects of spectroscopy. However, since the advent of the atomic bomb many people have become conscious of the structure of the atom and nearly everybody has the conception of an atom as being a nucleus of neutrons and protons surrounded by electrons. The electrons are located in layers or orbits around the nucleus. According to current theories, if an atom is activated by any

State Highway Vacuum Cleaner

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film in order to get adequate coverage of the vacuum cleaner in operation. He was very enthusiastic regarding what the vacuum cleaner would do in removing trash from the highways in an efficient and economical manner, and considered it a very good subject for television.

To indicate the wide spread of publicity that will be given the film, the National Broadcasting Company has informed us of its showing on several television programs, including "Newspaper of the Air," "World Digest," "Industry on Parade," and the Dave Garroway Show titled "Today—Today." The first showing was Wednesday evening, May 7, on KNBH, Channel 4, in Los Angeles.

means of excitation such as thermal or radiant energy, electrons may move away from the nucleus to what we may term a different energy level. The limitations of this movement are due chiefly to the structure of the atom which prevents chaotic energy disturbances and allows only certain discrete increases in energy. The return of an electron to its normal position or from one location to another is accompanied by radiant energy or light. This is the light that shows up in the spectra in definite places. The more orbits from which an electron may pass to another orbit, the more complex the spectrum, provided the exciting energy is sufficient to activate the more secluded electrons. This explains why high energy excitation increases the number of lines in the spectra of many elements from that observed in simple incandescence.

If a series of spectrographs could be made to follow the progressive nuclear fission of Plutonium or Uranium 235, we should, undoubtedly have the most interesting spectral record in history. In other words, if we could follow the spectral phenomena in an atomic bomb explosion we could expect some unusual results. The barrier of technical difficulties to such a recording will probably preclude its taking place in any satisfactory manner.

Erosion Control

Continued from page 24 . . .

for assistance in justifying the cost of erosion control. If we consider that an unprotected slope would probably lose one-fourth the quantity of soil that the Oceanside slope did during a storm of equal intensity and that it would cost one-fourth as much to clean up the slough, it would only take seven storms of that intensity to equal the cost of slope protection. Then, since soil loss continues indefinitely on an unprotected slope, the cost of cleaning up slough thereafter would be a constant expense and, since it could have been prevented, an economic waste.

The cost figures for slope protection used in this discussion are not necessarily representative of the costs of slope protection on a state-wide basis. Bid prices for slope preparation run from about \$0.05 to \$0.15 per square yard, and the cost of straw, spread and rolled into the slope will average about \$60 per ton. The average cost appears to be in the neighborhood of \$0.13 per square yard.

Travel in Utah Not Restricted by Floods

The Utah State Road Commission has advised the California Division of Highways that flood conditions are not interfering with travel in Utah.

While the flood caused by the unusually high spring run-off is a very serious problem in certain areas, these areas are the lowlands and affect a comparatively small section of the state. With few exceptions, all highways and roads are being kept open. In isolated cases where a small section of a highway has been temporarily closed, alternate routes have been designated. The flooded area in no way prevents travel to any of the state's tourist attractions. This flood condition is only temporary and as soon as it is over, any damage to the roads will be quickly repaired.

HIGHWAY BIDS AND AWARDS

April, 1952

CONTRA COSTA COUNTY—Between Willow Road and First Street in Rodeo, about 0.7 mile, existing pavement to be widened with plant-mixed surfacing on cement treated base. District IV, Route 14, Section B. Parish Bros., Benicia, \$69,861; O. C. Jones & Sons, Berkeley, \$79,546; J. Henry Harris, Berkeley, \$80,336. Contract awarded to Lee J. Immel, San Pablo, \$64,717.10.

CONTRA COSTA COUNTY—In the City of El Cerrito at the intersection of San Pablo Avenue with Manila Avenue-Bay View Avenue, a traffic signal system to be furnished and installed. District IV, Route 14. L. H. Leonardi Electric Construction Co., San Rafael, \$3,599; Hall Sloat Electric Co., Inc., Oakland, \$3,986; Underground Electric Construction Co., Oakland, \$3,995. Contract awarded to R. Flatland, San Francisco, \$3,425.

COLUSA COUNTY—At High Ditch and Wilkins Slough, about 18 and 21 miles south of Colusa, existing bridges to be repaired and approaches to be graded, imported base material to be placed thereon and bituminous surface treatment to be applied. District III, Route 88, Section A. Rice Bros., Inc., Marysville, \$23,245; R. G. Clifford & C. O. Bodenhamer, Berkeley, \$25,100; O'Connor Bros., Red Bluff, \$31,780. Contract awarded to Charles S. Moore & Robert R. Murdoch, Oakland, \$20,949.25.

FRESNO COUNTY—On Blackstone Avenue between Olive Avenue and Shields Avenue in and near the City of Fresno, traffic signal system to be revised and highway lighting to be furnished and installed at one intersection; traffic signal systems and highway lighting to be furnished and installed at five intersections; all six traffic signal systems to be interconnected; and highway lighting to be furnished and installed at six intersections. District VI, Route 125, Section Fre., C. Howard Electric Co., Gilroy, \$60,812; R. Goold & Son, Stockton, \$61,625; Robinson Electric, Fresno, \$62,742; Paul R. Gardner, Ontario, \$63,744; L. H. Leonardi Electric Construction Co., San Rafael, \$65,323; Dale Electric, Fresno, \$68,535. Contract awarded to Westates Electrical Construction Co., Los Angeles, \$57,790.

IMPERIAL COUNTY—Between the south city limit of Brawley and 1.1 miles west of Brawley, about 1.7 miles of divided highway to be graded, imported subbase material to be placed, cement treated base to be constructed, and surfaced with plant-mixed surfacing and a reinforced concrete slab bridge to be constructed across New River. District XI, Route 26, Section Brw., H. Ralph B. Slaughter & E. C. Young, San Fernando, \$367,187; Cox Bros. Construction Co., Stanton, \$431,667; Norman I. Fadel, North Hollywood, \$495,317. Contract awarded to Basich Bros. Construction Co., N. L. Basich & R. L. Basich, Garvey, \$354,024.30.

INYO COUNTY—Portions between Kern County line and Dunmavin, a net length of about 17.6 miles, portions to be graded and surfaced with plant-mixed surfacing and untreated rock base, bituminous surface treatment to be applied to shoulders on portions and a "Class B-single" seal coat applied to other portions. District IX, Route 23, Section G, H. G. W. Ellis Construction Co., North Hollywood, \$141,809; Oilfields Trucking Co. & Phoenix Construction Co., Inc., Bakersfield, \$168,373; Flickinger & Welker, Inc., Los Angeles, \$173,040; Ball & Simpson, Berkeley, \$211,719. Contract awarded to Rice Brothers, Inc., Marysville, \$129,956.60.

KINGS AND TULARE COUNTIES—Between one mile north of Corcoran and three-fourths mile south of Kings-Tulare County line, about 4.2 miles to be graded and paved with plant-mixed surfacing on cement treated base. District VI, Route 135, Sections B, A. M.J.B. Construction Co., Stockton, \$368,462; Volpa Brothers, Fresno, \$382,219; Oilfields Trucking Co. & Phoenix Construction Co., Inc., Bakersfield, \$385,253; Ralph A. Bell, Monrovia, \$387,348; Harms Bros., Sacramento, \$483,946. Contract awarded to Baun Construction Co., Fresno, \$360,290.

LAKE COUNTY—At Lucerne Creek and at Deer Creek, about 8.5 miles and 9 miles east of Upper Lake, two reinforced concrete box culverts to be constructed. District I, Route 15, Section B. C. W. Peterson, North Hollywood, \$27,391; Pike & Hill, Carey Bros. & Bailey, San Rafael, \$28,739; R. G. Clifford & C. O. Bodenhamer, Berkeley, \$28,787; Ted Schwartz, Grass Valley, \$28,799; H. H. Anderson, San Leandro, \$29,555; Bos Construction Co., Oakland, \$29,671; M. C. Baldwin, Watsonville, \$29,940; Nomellini Construction Co., Stockton, \$30,210; Al Erickson & Co., Napa, \$31,484; R. E. Hertel, Sacramento, \$31,894; O'Connor Bros., Red Bluff, \$34,035; B. S. McElderry, Berkeley, \$36,325. Contract awarded to A. A. Edmondson, San Fernando, \$21,246.50.

LOS ANGELES COUNTY—City of Los Angeles, on Santa Ana Freeway, from Los Angeles Street to Lyon Street, highway lighting and illuminated sign system to be furnished and installed; existing street lighting systems to be modified and conduit for fire alarm system to be installed. District VII, Route 2. Electric and Machinery Service, Inc., South Gate, \$36,516; Newbery Electric Corp., Los Angeles, \$36,815; Fischbach and Moore, Inc., Los Angeles, \$37,345; Westates Electrical Construction Co., Los Angeles, \$38,042. Contract awarded to Ets-Hokin & Galvan, Inc., Wilmington, \$35,660.

LOS ANGELES COUNTY—In the City of Pomona, between Hamilton Boulevard and west city limits (portions), about 0.7 mile in length, existing roadway to be surfaced with asphalt concrete. District VII, Route 26. Match Brothers, Colton, \$32,284; W. E. Hall Construction Co., Alhambra, \$33,263; Vido Kovacevich Co., South Gate, \$33,945; Griffith Company, Los Angeles, \$34,705; J. E. Haddock, Ltd., Pasadena, \$34,888; George Herz & Co., San Bernardino, \$34,979; Warren Southwest, Inc., Torrance, \$35,453; Ralph J. Laird, La Verne, \$35,525; E. L. Yeager Co., Riverside, \$40,321. Contract awarded to R. A. Erwin, Colton, \$30,350.

LOS ANGELES COUNTY—In the City of San Gabriel, between west city limits and east city limits, about 1.2 miles, the existing pavement to be widened with untreated rock base and the existing pavement and newly constructed untreated rock base surfaced with plant-mixed surfacing. District VII, Route 77. Warren Southwest, Inc., Torrance, \$55,733; Griffith Company, Los Angeles, \$58,785; J. E. Haddock, Ltd., Pasadena, \$60,808; W. E. Hall Construction Co., Alhambra, \$66,895; George Herz & Co., San Bernardino, \$68,884; Pacific Rock & Gravel Co., Monrovia, \$74,306. Contract awarded to Vido Kovacevich, South Gate, \$55,732.50.

LOS ANGELES COUNTY—In the City of Los Angeles on Santa Monica Boulevard, between Seward Street and Gower Street, about 0.6 mile, the upper portion of existing pavement to be removed and plant-mixed surfacing placed. District VII, Route 162. Griffith Company, Los Angeles, \$17,744; Vernon Paving Co., Los Angeles, \$18,256; Schroeder & Company, Sun Valley, \$18,969. Contract awarded to G. J. Payne Company, Inc., Los Angeles, \$16,740.

LOS ANGELES COUNTY—On Santa Ana Freeway, over San Gabriel River, two miles east of Downey, a reinforced concrete girder bridge and approach embankments to be constructed. District VII, Route 166, Section A. O. B. Pierson & P. D. Ware, Paramount, \$483,571; Oberg & Cook, Gardena, \$486,652; J. E. Haddock, Ltd., Pasadena, \$495,571; Tumblyn Company, Bakersfield, \$498,718; MacDonald and Kruse, Sun Valley, \$502,850; A. Teichert & Son, Inc., Sacramento, \$535,054; Guy F. Atkinson Company, Long Beach, \$543,058; C. B. Tuttle Co., Long Beach, \$546,489; W. J. Disteli, Los Angeles, \$557,274. Contract awarded to United Concrete Pipe Corp., Baldwin Park, \$477,545.

LOS ANGELES COUNTY—Between Anaheim-Telegraph Road and Garvey Avenue, about 4.1 miles, plant-mixed surfacing to be placed over existing pavement on a portion of the project and a portion to be widened with imported subbase material and untreated rock base and plant-mixed surfacing placed over the new base and existing pavement.

District VII, Route 167, Sections A, MonP. Warren Southwest, Inc., Torrance, \$179,004; J. E. Haddock, Ltd., Pasadena, \$189,506; Griffith Company, Los Angeles, \$189,952; Pacific Rock & Gravel Co., Arcadia, \$193,625; M. S. Mecham & Sons, South Gate, \$194,965. Contract awarded to Vido Kovacevich Co., South Gate, \$175,487.

LOS ANGELES COUNTY—Over Los Angeles River Freeway, at Artesia Street in Long Beach, a reinforced concrete bridge to be constructed, and about 0.3 mile of approaches to be graded and surfaced with plant-mixed surfacing. District VII, Routes 167, 175. R. M. Price Co., Altadena, \$437,645; Guy F. Atkinson Company, Long Beach, \$444,638; MacDonald and Kruse, Sun Valley, \$501,759. Contract awarded to J. E. Haddock, Ltd., Pasadena, \$404,707.80.

LOS ANGELES COUNTY—On Lakewood Boulevard across flood control channel, at Del Amo Boulevard, a reinforced concrete box culvert to be constructed. District VII, Route 168, Section A. E. G. Perham, Los Angeles, \$53,137; Service Construction Co. of Southern California, a Corporation, Burbank, \$54,173; Thomas Construction Co., Fresno, \$57,337; N. M. Saliba Company, Los Angeles, \$59,762; Vido Kovacevich Co., South Gate, \$63,099; Stuckey and Carroll Construction Co., El Monte, \$73,624. Contract awarded to Concrete Construction Service, Inc., Gardena, \$48,912.

LOS ANGELES COUNTY—On Manchester Boulevard, in the City of Inglewood, between Crenshaw Drive and Van Ness Avenue, about 0.8 mile, existing shoulders to be excavated, imported base material and untreated rock base placed, and the roadway to be surfaced with plant-mixed surfacing. District VII, Route 174. Vido Kovacevich Co., South Gate, \$59,263; Vernon Paving Co., Los Angeles, \$61,457; C. O. Sparks, Inc., and Mundo Engineering Co., Los Angeles, \$64,065; Griffith Company, Los Angeles, \$65,709; Oswald Bros. Co., Los Angeles, \$67,851. Contract awarded to Warren Southwest, Inc., Torrance, \$56,387.

MADERA AND MERCED COUNTIES—Across Fresno River at Madera and over the tracks of the Santa Fe Railway near Merced, two existing steel bridges to be cleaned and painted. District VII, Routes 4, 18, Sections D, A. D. Zelinsky & Sons, San Francisco, \$16,761; D. E. Burgess Co., San Francisco, \$20,511; J. S. Morris Co., Berkeley, \$22,680; R. W. Reade & Co., Berkeley, \$23,302; Klaas Brothers, Los Angeles, \$23,784; J. P. McGuire Painting Co., San Jose, \$24,894; Deemer & Deemer, San Francisco, \$27,200; Nels P. Christensen Painting Co., Santa Barbara, \$49,488; Gaytan & Leihar, Los Angeles, \$66,420. Contract awarded to H. C. McKern, San Jose, \$12,135.

MARIN COUNTY—At San Pedro Road, near the north city limits of San Rafael, about 0.9 mile of state highway to be constructed together with cross roads and road approaches; imported subbase material, crushed rock base, Portland cement concrete pavement and plant-mixed surfacing to be placed and a reinforced concrete slab bridge (undercrossing) to be constructed. District IV, Route 1, Section A. A. G. Raisch Co., San Rafael, \$196,309; Granite Construction Co., Watsonville, \$209,471; E. A. Forde Co., San Anselmo, \$210,103; Thomas Construction Co., Fresno, \$219,473; Parish Bros., Benicia, \$226,175; Al Erickson & Co. and Huntington Bros., Napa, \$231,855. Contract awarded to Brown-Ely Co., Contractors, Corte Madera, \$183,225.25.

MENDOCINO COUNTY—Across Indian Creek, about 5 miles northwest of Boonville, a reinforced concrete box girder bridge to be constructed, and approaches about 0.21 mile in length, to be surfaced with road-mixed surfacing and seal coats applied thereto. District I, Route 48, Section B. Tumblyn Co., Bakersfield, \$127,629; R. G. Clifford & C. O. Bodenhamer, Berkeley, \$142,858; E. A. Forde Co., San Anselmo, \$156,104; O'Connor Bros., Red Bluff, \$158,377; Bos Construction Co., Oakland, \$158,384; D. M. Sandling, San Pablo, \$158,411; Eaton & Smith, San Francisco, \$169,768. Contract awarded to Transocean Engineering Corp., San Lorenzo, \$117,771.10.

MENDOCINO COUNTY—Across Russian River and over the tracks of the Northwestern Pacific Railroad Co., about 1.4 miles south of Hopland, two existing steel bridges to be cleaned and painted. District I, Route 1, Section L. D. Zelinsky & Sons, San Francisco, \$22,769; R. W. Reade & Co., Berkeley, \$23,272; J. S. Morris Co., Berkeley, \$23,330; Klaas Bros., Los Angeles, \$33,286; D. E. Burgess Co., San Francisco, \$34,134; J. P. Carroll Co., Los Angeles, \$51,074. Contract awarded to Ken Thurston, Santa Rosa, \$17,980.

MENDOCINO COUNTY—At two locations between Boonville and 0.9 mile east of Shearing Creek, about 1.3 miles, to be graded and surfaced with road-mixed surfacing on cement treated base. District I, Route 48, Sections B, A. C. W. Peterson, North Hollywood, \$155,811; Harms Bros., Sacramento, \$157,784; Gordon H. Ball and San Ramon Valley Land Co., Berkeley, \$166,140; Close Building Supply, Inc., Hayward, \$167,808; Claude C. Wood Co., Lodi, \$172,840; J. Henry Harris, Berkeley, \$207,154. Contract awarded to Arthur B. Siri, Inc., Santa Rosa, \$130,008.

MENDOCINO COUNTY — Across Mill Creek, about 11 miles northwest of Boonville, a portion of a bridge to be repaired. District I, Route 48, Section B. Ted Schwartz, Grass Valley, \$16,990; D. M. Sandling, San Pablo, \$20,828; Bos Construction Co., Oakland, \$21,088; Charles S. Moore & Robert R. Murdoch, Oakland, \$21,355; R. G. Clifford & C. O. Bodenhamer, Berkeley, \$21,882; Al Erickson & Co., Napa, \$23,068; James H. McFarland, San Francisco, \$25,311; Laredon Construction Co., Los Angeles, \$27,313; Tumblin Co., Bakersfield, \$31,240. Contract awarded to R. E. Hertel, Sacramento, \$15,892.

MENDOCINO COUNTY — Across Big River about 12.4 miles south of Fort Bragg, a steel plate girder bridge and timber railing to be cleaned and painted. District I, Route 56, Section D. R. W. Reade & Co., Berkeley, \$8,336. Contract awarded to J. S. Morris Co., Berkeley, \$7,920.

MONTEREY COUNTY—Between Chualar and Spence Underpass about 5.2 miles, to be surfaced with plant-mixed surfacing on cement treated, imported base material and seal coats applied. District V, Route 2, Section B. Granite Construction Co., Watsonville, \$397,712; Fredrickson & Watson Construction Co., Oakland, \$407,701. Contract awarded to Rice Brothers, Inc., Marysville, \$379,848.85.

MONTEREY COUNTY—Across Salinas River, at King City, an existing steel truss bridge to be cleaned and painted. District V, Route 2, Section F. J. P. Carroll Co., Los Angeles, \$29,400; D. Zelinsky & Sons, San Francisco, \$38,717; H. C. McKern, San Jose, \$39,214; R. W. Reade & Co., Berkeley, \$44,133; Klaas Brothers, Los Angeles, \$45,600; Deemer & Deemer, San Francisco, \$47,220; J. P. McGuire, Painting Co., San Jose, \$47,962. Contract awarded to J. S. Morris Co., Berkeley, \$27,777.

ORANGE COUNTY—On Ortega Highway, portions between Zaza Creek and Fernwood Creek, eight cattle passes to be reconstructed. District VII, Route 64, Sections A, B. Hubbs Equipment Co., Colton, \$88,345; Thomas Construction Co., Fresno, \$95,000; N. M. Saliba Company, Los Angeles, \$103,870; E. F. Grandy, Laguna Beach, \$105,008; E. S. & N. S. Johnson, Fullerton, \$105,356; E. G. Perham, Los Angeles, \$109,835; Walter H. Barber & H. R. Breeden, La Mesa, \$111,515; C. W. Peterson, North Hollywood, \$124,890. Contract awarded to Arthur A. Johnson, Laguna Beach, \$87,036.

ORANGE COUNTY—On Santa Ana Freeway, between 0.25 mile westerly of Los Angeles Street and Orangewood Avenue, about 1.2 miles, roadways for a 4-lane divided highway with frontage roads and interchange connections to be graded and surfaced, with Portland cement concrete pavement on cement treated subgrade and plant-mixed surfacing on untreated rock base and two grade separation structures to be constructed. District VII, Routes 174.2; Sections A, D. MacDonald & Kruse, Sun Valley, \$770,778; A. Teichert & Son, Inc., Sacramento, \$772,693; Winston Bros. Company, Monrovia, \$785,957; Guy F. Atkinson Co., Long Beach, \$808,750; J. E. Haddock, Ltd., Pasadena, \$825,272; Griffith Co., Los Angeles, \$861,700. Contract awarded to Webb & White, Los Angeles, \$764,976.75.

PLUMAS AND LASSEN COUNTIES—Between Beckwourth Pass and Route 29, about 4.2 miles, to be graded and surfaced with plant-mixed surfacing on cement treated base and a railroad overhead to be constructed. District II, Route 21, Sections G, A. H. Earl Parker, Inc. & Harms Bros., Sacramento, \$428,939; Richter Bros., Oroville, \$451,476; A. Teichert & Son, Inc., Sacramento, \$454,619; Granite Construction Co., Watsonville, \$465,702. Contract awarded to Eaton & Smith, San Francisco, \$407,251.80.

RIVERSIDE COUNTY — At the intersection of Routes 19 and 194, about 15 miles east of the City of Riverside, existing roadbed to be widened and surfaced with plant-mixed surfacing. District VIII, Routes 19, 194, Sections D, C. George Herz & Co., San Bernardino, \$13,035; Match Bros., Colton, \$13,055; R. A. Erwin, Colton, \$13,412. Contract awarded to E. L. Yeager Co., Riverside, \$11,621.50.

SACRAMENTO COUNTY—At the intersections of Auburn Boulevard with Fulton Avenue and Watt Avenue, full traffic-actuated signal systems and highway lighting to be furnished and installed and channelization to be constructed. District III, Route 3, Section B. R. Goold & Son, Stockton, \$43,994; Grason Electric Co., Sacramento, \$44,371; Howard Electric Co., Gilroy, \$44,751; R. Flatland, San Francisco, \$45,870; Reliable Elevator Works, Sacramento, \$46,510; Underground Electric Construction Co., Oakland, \$49,131. Contract awarded to L. H. Leonardi Electric Construction Co., San Rafael, \$39,711.

SACRAMENTO COUNTY—At the intersections of Auburn Boulevard with Fulton Avenue and with Watt Avenue, channelization to be constructed. District III, Route 3, Section B. Brighton Sand & Gravel Co., Sacramento, \$26,868. Contract awarded to A. Teichert & Son, Inc., Sacramento, \$24,438.50.

SACRAMENTO-PLACER COUNTIES—Between Sylvan School and Roseville, about 2.9 miles, existing borders to be trenched and surfaced with plant-mixed surfacing on untreated rock base. District III, Route 3, Sections B, A, A. A. Teichert & Son, Inc., Sacramento, \$54,129; O'Connor Bros., Red Bluff, \$58,428; Brighton Sand & Gravel Co., Sacramento, \$65,220; J. R. Reeves, Sacramento, \$66,775. Contract awarded to McGilvray Construction Co., Sacramento, \$52,819.

SAN BERNARDINO COUNTY—Between Lytle Creek and west city limits of San Bernardino, about 0.3 mile, to be widened and resurfaced with plant-mixed surfacing and installing highway lighting system. District VIII, Route 9, Section C. Match Bros. & Match Bros. Paving Co., Colton, \$20,074; R. A. Erwin, Colton, \$20,861; E. L. Yeager Co., Riverside, \$23,566. Contract awarded to George Herz & Co., San Bernardino, \$18,396.09.

SAN BERNARDINO COUNTY—In the City of San Bernardino at the intersection of Highland Avenue with Waterman Avenue, traffic signal system and highway lighting to be furnished and installed and signal systems to be interconnected. District VIII, Route 190. Paul R. Gardner, Ontario, \$5,233; Harry F. Brewer, Long Beach, \$5,567; C. D. Draucker, Inc., Los Angeles, \$6,574. Contract awarded to Fischbach & Moore, Los Angeles, \$5,173.

SAN BERNARDINO COUNTY—Across Etiwanda-San Devaine Flood Control Channel, about 8 miles east of Ontario, a reinforced concrete girder bridge to be constructed. District VIII, Route 26, Section D. Stuckey & Carroll Construction Co., El Monte, \$132,139; O. B. Pierson, Bellflower, \$136,481; George Herz & Co., San Bernardino, \$137,520; Dimmitt & Taylor, Monrovia, \$138,998; E. L. Yeager & Co., Riverside, \$139,642; John Strona, Pomona, \$140,832; K. B. Nicholas, Ontario, \$143,208; Thomas Construction Co., Fresno, \$148,176; J. E. Haddock, Ltd., Pasadena, \$151,176; E. S. & N. S. Johnson, Fullerton, \$153,130; Hubbs Equipment Co. and Baker Construction Co., Colton, \$153,138; C. B. Tuttle Co., Long Beach, \$157,545; N. M. Saliba Co., Los Angeles, \$173,367; Byerts & Sons and Geo. K. Thatcher, Los Angeles, \$210,513. Contract awarded to Lars Oberg, Los Angeles, \$126,004.

SAN BERNARDINO COUNTY — Between Los Angeles County line and Ontario, about 2.1 miles, the existing roadbed to be resurfaced with plant-mixed surfacing. District VIII, Route 26, Section C. Vido Kovacevich, South Gate, \$44,056; Match Bros., Colton, \$45,742; R. A. Erwin, Colton, \$46,110; E. L. Yeager Co., Riverside, \$47,446;

J. E. Haddock, Ltd., Pasadena, \$47,623; Griffith Co., Los Angeles \$48,895; Warren Southwest, Inc., Torrance, \$50,768; Vernon Paving Co., Los Angeles, \$52,706. Contract awarded to George Herz & Co., San Bernardino, \$43,989.

SAN BERNARDINO COUNTY—Between Barstow and Daggett, about 8.1 miles, the roadbed to be widened and portions resurfaced with plant-mixed surfacing. District VIII, Route 58, Sections Bsw, E, F. Vernon Paving Co., Los Angeles, \$101,711; Rice Brothers, Inc., Marysville, \$104,949; Griffith Company, Los Angeles, \$109,448; Oilfields Trucking Co. and Phoenix Construction Co., Inc., Bakersfield, \$109,870; R. A. Erwin, Colton, \$109,915; A. Teichert & Son, Inc., Sacramento, \$129,825; Frederickson & Kasler, Sacramento, \$131,336; G. W. Ellis, Construction Co., North Hollywood, \$137,305. Contract awarded to Peter Kiewit Sons Co., Arcadia, \$92,618.

SAN DIEGO COUNTY—Across San Diego River in the City of San Diego, portions of an existing steel plate girder bridge to be cleaned and painted. District XI, Route 2. Geo. C. Puntun, Chula Vista, \$19,143; Acme Maintenance Engineering Company, Montebello, \$26,830; Gaytan & Leiber, Los Angeles, \$38,400. Contract awarded to H. W. Kirch & Co., Vista, \$12,800.

SAN DIEGO COUNTY—Between 2.2 miles south of Carlsbad and Buena Vista Creek, about 4.4 miles in length, constructing graded roadbeds; surfacing the freeway with Portland cement concrete pavement on cement treated subgrade; surface frontage roads, ramps and intersecting streets and roads with plant-mixed surfacing on cement treated base and on selected material; and applying seal coats thereto; and constructing two reinforced concrete bridges; and overhead over the tracks of the A. T. & S. F. Rwy, a pedestrian undercrossing and six grade separation structures. District XI, Route 2, Section B. A. Teichert & Son, Inc., Sacramento, \$2,281,380; Griffith Co., Los Angeles, \$2,331,662; Peter Kiewit Sons Co., Arcadia, \$2,392,533; J. A. Payton & Bent Construction Co., Los Angeles, \$2,412,698; Daley Corp., San Diego, \$2,433,928; Clyde W. Wood & Sons, Inc., W. J. Disteli, R. E. Hazard Contracting Co. & C. G. Willis & Sons, San Diego, \$2,454,606; Ball & Simpson & Earl Parker, Inc., Berkeley, \$2,497,640; Guy F. Atkinson Co., Long Beach, \$2,526,218; Cox Bros. Construction Co. & Allison Honer Co., Santa Ana, \$2,532,000. Contract awarded to Bressi & Bevanda Constructors, Inc., North Hollywood, \$2,238,685.50.

SAN FRANCISCO COUNTY—On Park Presidio Boulevard, between Lake Street and Golden Gate Bridge viaduct, highway lighting and sign lighting systems to be modified. District IV, Route 56. L. H. Leonardi Electric Construction Co., San Rafael, \$16,670; Ets-Hokin & Galvan, San Francisco, \$17,221; R. Flatland, San Francisco, \$17,447; Manning & Whitaker, Inc., San Francisco, \$17,548; Abbott Electric Corp., San Francisco, \$21,950; George F. Brayer, San Francisco, \$28,455. Contract awarded to H. S. Tittle Co., San Francisco, \$13,178.

SAN JOAQUIN AND STANISLAUS COUNTIES—Between junction with Route 41 and 6.5 miles west of Modesto, about 7.9 miles, to be surfaced with plant-mixed surfacing on untreated rock base. District X, Route 110, Sections A, A, B. A. Teichert & Son, Inc., Sacramento, \$255,574; Oilfields Trucking Co. & Phoenix Construction Co., Inc., Bakersfield, \$257,258; Clements & Co., Hayward, \$296,185; Munn & Perkins, Modesto, \$298,000; Granite Construction Co., Watsonville, \$315,000; M. J. B. Construction Co., Stockton, \$336,239; Harms Bros., Sacramento, \$341,184; G. W. Ellis Construction Co., North Hollywood, \$348,734. Contract awarded to M. J. Ruddy & Son, Modesto, \$254,129.40.

SAN MATEO COUNTY—Between 25th Avenue and 41st Avenue, in the City of San Mateo, about 1 mile, to be widened with imported subbase material and cement treated base and surfaced with plant-mixed surfacing on existing pavement and cement treated base. District IV, Route 2. Frank W. Smith, Inc., San Mateo, \$85,541; J. Henry Harris, Berkeley, \$94,854; McCammón-Wunderlich Co. & Freeman Paving Co., Palo Alto, \$97,693; Clements & Co., Hayward, \$101,711. Contract awarded to L. C. Smith Co., San Mateo, \$78,957.40.

SAN MATEO COUNTY—On Bayshore Freeway, between Colma Creek and Broadway, about 5.1 miles, to be resurfaced with plant-mixed surfacing. District IV, Route 68, Section SSF, F, Mlb, Burl.

Eaton & Smith, San Francisco, \$262,226; Leo F. Piazza Paving Co., San Jose, \$274,975; Chas. L. Harney, Inc., San Francisco, \$278,673; Clements & Co., Hayward, \$281,712; The Lowrie Paving Co., Inc., San Francisco, \$284,885; J. Henry Harris, Berkeley, \$293,951; Guy F. Atkinson Co., South San Francisco, \$295,910; Fredrickson & Watson Construction Co., Oakland, \$299,222; Granite Construction Co., Watsonville, \$302,547; McCammon-Wunderlich Co. & Freeman Paving Co., Palo Alto, \$319,828; The Fay Improvement Co., San Francisco, \$324,268. Contract awarded to L. C. Smith Co., San Mateo, \$245,718.75.

SANTA BARBARA COUNTY—Between Gaviota and Gaviota Gorge, about 3.2 miles to be graded and surfaced with plant-mixed surfacing on cement treated base, a reinforced concrete bridge to be widened and another to be superelevated. District V, Route 2, Section E. Eaton & Smith, San Francisco, \$1,247,777; A. Teichert & Son, Inc., Sacramento, \$1,326,244; J. E. Haddock, Ltd., Pasadena, \$1,394,802; Granite Construction Co., Watsonville, \$1,436,601. Contract awarded to Clyde W. Wood & Sons, Inc., North Hollywood, \$1,200,700.

SAN MATEO COUNTY—Between the north city limits and 0.1 mile south of the south city limits of San Mateo, about 2.6 miles to be graded and paved with Portland cement concrete pavement on cement treated subgrade and separation structures to be constructed. District IV, Route 68, Section SM, C. Peter Kievit Sons Co., Arcadia, \$1,683,481; Chas. L. Harney, Inc., San Francisco, \$1,683,693; Eaton & Smith, San Francisco, \$1,691,438; Guy F. Atkinson Company, South San Francisco, \$1,732,764. Contract awarded to Piombo Construction Co., San Francisco, \$1,673,277.80.

SANTA BARBARA COUNTY—Portions between 1.7 miles east of Buckhorn Creek and 0.5 mile east of Clear Creek, about 0.4 mile to be graded by widening five curves, and guard railing to be installed. District V, Route 57, Section B. R. C. Downer, Reno, \$32,770; Thomas Construction Co., Fresno, \$39,147; C. W. Peterson, North Hollywood, \$40,563; Granite Construction Co., Watsonville, \$47,261; Valley Paving & Construction Co., Inc., Pismo Beach, \$49,285. Contract awarded to Hermreck & Easter, Santa Maria, \$29,983.50.

SANTA BARBARA COUNTY—Over San Roque Canyon in the City of Santa Barbara, an existing steel bridge to be cleaned and painted. District V, Route 80, Nels P. Christensen Painting Co., Santa Barbara, \$19,328; Gaytan & Leihar, Los Angeles, \$19,764; J. S. Morris Co., Berkeley, \$19,940; J. P. McGuire Painting Co., San Jose, \$24,403. Contract awarded to Klaas Brothers, Los Angeles, \$14,700.

SANTA CLARA COUNTY—Between Ferguson Road and 5 miles east of Gilroy, about 2 miles to be surfaced with plant-mixed surfacing on untreated rock base over the existing surfacing, and shoulders to be constructed. District IV, Route 32, Section A. Browne and Krull, Hayward, \$92,122; Granite Construction Co., Watsonville, \$95,778. Contract awarded to Fredrickson & Watson Construction Co., Oakland, \$82,827.60.

SANTA CRUZ COUNTY—Across Fall Creek, about 6.4 miles north of Santa Cruz, a timber bridge to be repaired. District IV, Route 116, Section A. R. G. Clifford and C. O. Bodenhamer, Berkeley, \$16,929; Bos Construction Co., Oakland, \$19,764; Barton Construction Co., Oakland, \$21,040; James H. McFarland, San Francisco, \$25,694; Granite Construction Co., Watsonville, \$26,308. Contract awarded to Charles S. Moore & Robert R. Murdoch, Oakland, \$15,353.

SANTA CRUZ COUNTY—Between Boulder Creek and Waterman Gap, about 4.7 miles to be surfaced with plant-mixed surfacing on imported base material. District IV, Route 116, Sections A, B. Clements & Co., Hayward, \$325,676; J. Henry Harris, Berkeley, \$352,053; Leo F. Piazza Paving Co., San Jose, \$368,725. Contract awarded to Granite Construction Co., Watsonville, \$257,943.

SISKIYOU COUNTY—Across Oak Flat Creek, 6.9 miles west of Happy Camp, a reinforced concrete bridge to be constructed. District II, Route 46, Section A. B. S. McElderry, Berkeley, \$41,420. Contract awarded to A. A. Edmondson, San Fernando, \$31,904.

SOLANO COUNTY—Between 2.5 miles north of Vacaville and Midway, about 2.5 miles, borders, shoulders and base to be constructed of untreated rock base and the central portion of the roadbed to be surfaced with plant-mixed surfacing. District X, Route 7, Section D. Fredrickson Bros., Emeryville, \$125,216; Harms Bros., Sacramento, \$130,209; Parish Bros., Benecia, \$155,040; J. Henry Harris, Berkeley, \$160,120. Contract awarded to A. Teichert & Son, Inc., Sacramento, \$122,748.

SONOMA COUNTY—Across Russian River and Austin Creek at Guerneville and about 7.2 miles west; two existing steel bridges to be cleaned and painted. District IV, Route 104, Sections B, A. J. S. Morris Co., Berkeley, \$21,080; Deemer & Deemer, San Francisco, \$24,000; Bill Reid Painting Service, Sacramento, \$27,434; D. Zelinsky & Sons, San Francisco, \$26,000. Contract awarded to R. W. Reade & Co., Berkeley, \$19,743.

TRINITY COUNTY—Across Big French Creek, 27 miles west of Weaverville, a reinforced concrete bridge to be constructed. District I, Route 20, Section D. Tumblin Co., Bakersfield, \$34,650; James H. McFarland, San Francisco, \$35,915; Al Erickson & Co., Napa, \$36,881; Ted Schwartz, Grass Valley, \$36,950; B. S. McElderry, Berkeley, \$37,780; R. G. Clifford and C. O. Bodenhamer, Berkeley, \$38,060; H. H. Anderson, San Leandro, \$38,511; Bos Construction Co., Oakland, \$39,715; R. E. Hertel, Sacramento, \$44,610; Nomellini Construction Co., Stockton, \$44,850; O'Connor Bros., Red Bluff, \$45,700. Contract awarded to Laredon Construction Co., Hollywood, \$33,100.

TRINITY COUNTY—Across South Fork of Trinity River, 22.2 miles west of Hayfork, the superstructure of an existing steel truss bridge to be removed and to be replaced with a superstructure consisting of revised structural steel girders and a new timber deck. District I, Route 35, Section A. A. C. Johnson & Sons, Eureka, \$60,444; Bos Construction Co., Oakland, \$61,957; B. S. McElderry, Berkeley, \$64,822; Judson Pacific-Murphy Corp., Emeryville, \$66,206; LeBoeuf-Dougherty Contracting Co., Richmond, \$68,606; Commercial Construction Co., Marysville, \$77,172. Contract awarded to Laredon Construction Co., Los Angeles, \$50,990.

TULARE COUNTY—Between Tulare Airport and Tagus, six overcrossings to be constructed, portions of a roadway for a divided highway, connecting roads, frontage roads and approach ramps to be graded and imported base material and plant-mixed surfacing to be placed on designated ramps, connecting roads and frontage roads. District VI, Route 4, Sections B, Tul. F. Griffith Co., Los Angeles, \$903,904; C. K. Moseman, Redwood City, \$965,113; Ralph A. Bell, Monrovia, \$974,611; Guy F. Atkinson Co., South San Francisco, \$1,017,186. Contract awarded to Gordon H. Ball and San Ramon Valley Land Co. and Trewhitt, Shields & Fisher, Fresno, \$857,980.60.

VENTURA COUNTY—On Ventura Boulevard at the Montalvo Truck Scales, about 0.5 mile to be graded and surfaced with plant-mixed surfacing on cement treated base. District VII, Route 2, Section C. Contract awarded to Baker & Pollock, Ventura, \$35,949.70.

F. A. S. County Routes

EL DORADO COUNTY—Between Chiquita and 2.1 miles southeasterly, about 2.1 miles to be graded, imported base material to be placed and bituminous surface treatment to be applied. District III, Route 1099, C. V. Kenworthy, Stockton, \$114,063; Joe Vicini, Placerville, \$125,626; Cecil L. Moore, San Leandro, \$134,580; Ball & Simpson, & T. E. Irving, Berkeley, \$146,106; M. W. Brown, Redding, \$146,674; T. M. Montgomery, Auburn, \$152,251; Claude C. Wood Co., Lodi, \$162,748; Huntington Bros., Napa, \$190,476. Contract awarded to C. W. Peterson, North Hollywood, \$104,305.

MENDOCINO COUNTY—On Willits-Fort Bragg Road, between 10 miles west of Willits and 6.9 miles west of Willits, about 3.1 miles to be graded. District I, Route 982, John Burman & Sons, Eureka, \$107,780; Cecil L. Moore, San Leandro, \$128,990; H. A. Christie Co., Inc., Ukiah, \$129,306; W. H. O'Hair Co., Colusa, \$130,820; Gordon H. Ball and San Ramon Valley Land Co., Berkeley, \$136,865; Huntington Bros., Napa, \$137,177; Harms Bros., Sacramento, \$146,210; C. V. Kenworthy, Stockton,

\$151,659; T. M. Montgomery, Auburn, \$164,863; Arthur B. Siri, Inc., Santa Rosa, \$166,000; Transocean Engineering Corp., San Lorenzo, \$171,496; McCammon-Wunderlich Co., Palo Alto, \$186,777; Humboldt Constructors, Inc., Eureka, \$197,712; C. W. Peterson, North Hollywood, \$214,186. Contract awarded to Macal Improvement Co., Inc., Antioch, \$102,261.50.

STANISLAUS COUNTY—On Santa Fe Empire and Gear Road between one mile south of Empire and Monte Vista Road, about 7.6 miles, a portion to be surfaced with plant-mixed surfacing on untreated rock base and a portion to be widened with untreated rock base and resurfaced with plant-mixed surfacing. District X, Routes 912, 914, M. J. Ruddy & Son, Modesto, \$139,037; Harms Bros., Sacramento, \$166,803. Contract awarded to United Concrete Pipe Corp., Baldwin Park, \$125,124.50.

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ALAMEDA COUNTY—Between Castro Street and San Lorenzo Creek, about 0.7 mile in length, a six-lane divided highway on portions to be graded and surfaced with plant-mixed surfacing on cement treated base; existing pavement to be widened on other portions and surfaced with plant-mixed surfacing on cement treated base and on existing pavement; street connections and transitions to be graded and surfaced with plant-mixed surfacing on existing pavement and on various types of base; miscellaneous drainage structures to be constructed and highway lighting and traffic signal facilities to be furnished and installed, to provide a six-lane divided highway. District IV, Route 5, Fredrickson & Watson Construction Co.-M & K Corp., Oakland, \$294,580; Close Building Supply, Inc., Hayward, \$294,843; Lee J. Immel, San Pablo, \$299,083; Silva Brothers, Hayward, \$310,627; J. Henry Harris, Berkeley, \$331,895. Contract awarded to Chas. L. Harney, Inc., San Francisco, \$288,336.80.

BUTTE COUNTY—Between 3.8 miles north of Oroville Wye and 20th Street in Chico, about 14.9 miles, to be graded and portions surfaced with plant-mixed surfacing on untreated rock base and a highway lighting system to be installed. District III, Route 3, Sections B, C, Chc. H. Earl Parker, Inc., Marysville, \$795,706; Eaton & Smith, San Francisco, \$844,488; Guy F. Atkinson Co., South San Francisco, \$851,331; McCammon-Wunderlich Co., Palo Alto, \$856,808; Harms Bros., Sacramento, \$903,514; Fredrickson Bros., Emeryville, \$909,030; B. J. Ukropina, T. P. Polich, Steve Kral, Baldwin Park, \$944,072; Ball and Simpson, Berkeley, \$1,078,434; Granite Construction Co., Watsonville, \$1,238,378. Contract awarded to Richter Bros., Oroville, \$694,774.

CONTRA COSTA COUNTY—At the Southern Pacific Railroad crossing in Danville, about 0.2 mile, turnout lanes to be constructed of plant-mixed surfacing on cement treated base material and seal coat applied. District IV, Route 107, Section A. Lee J. Immel, San Pablo, \$14,455; O. C. Jones & Sons, Berkeley, \$15,974; John B. Paroline, Morgan Hill, \$16,171; J. Henry Harris, Berkeley, \$16,341. Contract awarded to J. R. Armstrong, El Cerrito, \$11,680.04.

GLENN COUNTY—Across Stony Creek, about 0.8 mile north of Orland, the existing concrete arch bridge to be widened. District III, Route 7, Section C. Bos Construction Co., Oakland, \$62,264; R. E. Hertel, Sacramento, \$77,383; B. S. McElderry, Berkeley, \$84,438; O'Connor Bros., Red Bluff, \$105,008. Contract awarded to R. G. Clifford and C. O. Bodenhamer, Berkeley, \$60,624.

IMPERIAL COUNTY—Between 1.5 miles west of Coyote Wells and 0.5 mile west of Plaster City, about 5.2 miles, road-mixed surfacing to be placed over existing surfacing and seal coats applied. District XI, Route 12, Sections A.B. Slaughter and Young, Julian, \$53,006; Verne MacArthur, La Crescenta, \$54,455; Clyde W. Wood & Sons, Inc., North Hollywood, \$56,903; Oilfields Trucking Co. and Phoenix Construction Co., Inc., Bakersfield, \$58,036; Basich Bros. Construction Co., N. L. Basich and R. L. Basich, Garvey, \$61,139; R. P. Shea Company, Indio, \$65,440; Einer Bros., Inc., Escondido, \$73,473. Contract awarded to Marks Brothers Construction Co., El Cerrito, \$49,673.20.

INYO COUNTY—Between the south city limits of Bishop and Texaco Corners, about 1.5 miles to be widened, imported subbase material and untreated rock base to be placed and plant-mixed surfacing to

be placed over new base and existing surfacing. District IX, Routes 23, 76, Sections Bis, E.A. Basich Bros. Construction Co., N. L. and R. L. Basich, Garvey, \$152,912. Contract awarded to G. W. Ellis Construction Co., North Hollywood, \$148,868.30.

KERN COUNTY—Between 0.8 mile and 4.3 miles east of Mojave, about 3.5 miles of roadway to be graded, imported subbase and base materials to be placed, and surfaced with plant-mixed surfacing. District IX, Route 58, Section A. R. R. Hensler, Sun Valley, \$164,220; G. W. Ellis Construction Co., North Hollywood, \$169,696; Volpa Bros., Fresno, \$176,898; Osborn Co., Pasadena, \$212,636. Contract awarded to Oilfields Trucking Co. and Phoenix Construction Co., Inc., Bakersfield, \$159,456.15.

KINGS COUNTY—Between east city limits of Corcoran and the A. T. & S. Fe railroad crossing, Tulare branch, two bridges to be widened and about 2.6 miles of highway to be resurfaced with plant-mixed surfacing. District VI, Route 134, Section A. Baun Construction Co., Fresno, \$52,081. Contract awarded to Griffith Co., Los Angeles, \$49,118.50.

PLACER COUNTY—City of Roseville, at the intersection of Vernon Street with Riverside Avenue-Douglas Street, Judah Street, Grant Street and Lincoln Street, traffic signal system with highway lighting and channelization to be furnished and installed and constructed at one intersection, traffic signal system and highway lighting to be furnished and installed at two intersections, and traffic signal system to be modified at one intersection. District III, Routes 3, 17. Reliable Elevator Works, Sacramento, \$21,668; Underground Electric Construction Co., Oakland, \$22,222; L. H. Leonardi Electric Construction Co., San Rafael, \$22,336; R. Flatland, San Francisco, \$23,165; Howard Electric Co., Gilroy, \$24,551. Contract awarded to R. Goid & Son, Stockton, \$21,182.

LAKE COUNTY—Between 0.4 mile south of Lower Lake and 0.3 mile north of Cache Creek, about 1.7 miles to be graded and surfaced with imported base material (cement treated) and a seal coat applied thereto. District I, Route 49, Sections B,C. Close Building Supply, Inc., Hayward, \$194,292; Eaton and Smith, San Francisco, \$197,812; Huntington Bros., Napa, \$206,194; Harms Bros., Sacramento, \$210,058; O'Connor Bros., Red Bluff, \$222,701. Contract awarded to Arthur B. Siri, Inc., Santa Rosa, \$183,152.

LOS ANGELES COUNTY—At the intersections of Verdugo Road with Maple Street and with Acacia Avenue and Colorado Street with Louise Street, in the City of Glendale, traffic signal systems and highway lighting at two intersections and traffic signal system at one intersection. District VII, Routes 61, 161. Harry F. Brewer, Long Beach, \$16,789; C. D. Draucker, Inc., Los Angeles, \$16,833; Fischback and Moore, Inc., Los Angeles, \$17,936. Contract awarded to Westates Electrical Construction Co., Los Angeles, \$15,628.

LOS ANGELES COUNTY—On Colorado Freeway in the City of Pasadena, between Orange Grove Avenue and Holly Street, about 0.3 mile to be graded and paved with plant-mixed surfacing and construction of a reinforced concrete box girder overcrossing. District VII, Route 161. J. E. Haddock, Ltd., Pasadena, \$253,761; Fredericksen & Kasler, Sacramento, \$265,013; Clifford C. Bong & Co., Arcadia, \$269,760; J. A. Thompson & Son, Contractors, Inglewood, \$280,542; Warren Southwest, Inc., Torrance, \$299,173; Oberg Bros. Construction Co., Inglewood, \$332,891. Contract awarded to Guy F. Atkinson Company, Long Beach, \$234,479.

KINGS-TULARE COUNTY—Furnishing and installing highway lighting systems between one mile north of Corcoran and ¾ mile southeasterly of the Kings-Tulare County line. District VI, Route 135, Sections B.A. Dale Electric, Fresno, \$7,580; L. H. Leonardi Electrical Construction Co., San Rafael, \$8,228; Robinson Electric, Fresno, \$8,956. Contract awarded to R. O. Ferguson Co., Visalia, \$6,772.39.

MERCED COUNTY—Across Merced River, about 1.2 miles north of Livingston, a slab and girder bridge of reinforced concrete and structural steel to be widened. District X, Route 4, Section D. Chas. L. Harney, Inc., San Francisco, \$412,728; Tumblin Co., Bakersfield, \$425,853; Granite Construction Co., Watsonville, \$431,774; Guy F. Atkinson Co., South San Francisco, \$437,690; Trewwhitt, Shields & Fisher, Fresno, \$459,818; B. J. Ukropina, T. P. Polich, Steve Kral, Baldwin Park, \$469,323; Macco Corp., Para-

mount, \$481,167; Nomellini Construction Co., Stockton, \$506,905. Contract awarded to C. K. Moseman, Redwood City, \$390,609.50.

MONO COUNTY—Between 4.4 miles north and 5.0 miles north of Coleville, about 0.6 mile of roadway to be graded, surfaced with bituminous surface treatment and a seal coat applied thereto. District IX, Route 95, Section A. Bishop Engineering and Construction Co., Bishop, \$39,200; Harms Bros., Sacramento, \$43,849. Contract awarded to Robert C. Downer, Reno, Nev., \$36,119.

RIVERSIDE COUNTY—Between Indio and Black Butte, about 11.1 miles, plant-mixed surfacing to be placed over existing roadbed and seal coat applied; and about 55 miles of seal coat to be applied to existing surface. District XI, Route 64, Sections H,L,B,C,D. G. W. Ellis Construction Co., North Hollywood, \$203,428; Peter Kiewit Sons' Co., Arcadia, \$231,782. Contract awarded to Basich Bros. Construction Co., N. L. Basich and R. L. Basich, Garvey, \$193,754.

RIVERSIDE COUNTY—In the City of Corona, between Ontario Avenue and north city limits, about 2.7 miles to be resurfaced with plant-mixed surfacing. District XIII, Routes 77, 193. R. A. Erwin, Colton, \$69,968; E. L. Yeager Co., Riverside, \$72,006; Matich Bros., Colton, \$74,025. Contract awarded to A. Teichert & Son, Inc., Sacramento, \$59,623.

RIVERSIDE COUNTY—Lemay Creek and Rockhaven Creek, 1.3 miles northwest and 1.8 miles southeast of Aguanga, a reinforced concrete cattlepass and pipe culvert to be constructed. District VIII, Route 78, Section A. Thomas Construction Co., Fresno, \$23,319; H. R. Breeden, Compton, \$23,809; Eimer Bros. Inc., Escondido, \$23,977; E. S. and N. S. Johnson, Fullerton, \$26,758; E. L. Yeager Co., Riverside, \$29,631. Contract awarded to E. G. Perham, Los Angeles, \$19,557.50.

SACRAMENTO COUNTY—Under the tracks of the Southern Pacific Co. at B Street and Elvas Wye, in and near the city of Sacramento, two underpasses to be constructed. District III, Route 98. B. J. Ukropina, T. P. Polich, Steve Kral, Baldwin Park, \$916,821; A. Teichert & Son, Inc., Sacramento, \$927,886; Lord & Bishop, Sacramento, \$932,632; C. K. Moseman, Redwood City, \$945,989; Peter Kiewit Sons Co., Arcadia, \$990,881; Williams & Burrows, Inc., and Carl N. Swenson Co. Inc., San Jose, \$992,697; Guy F. Atkinson Co., South San Francisco, \$996,951; George Pollack Co., Sacramento, \$1,035,183. Contract awarded to John C. Gist, Sacramento, \$914,182.

SAN FRANCISCO AND ALAMEDA COUNTY—On San Francisco-Oakland Bay Bridge, upper deck painting scaffold (traveler) and track to be constructed. District IV, Route 68. Judson Pacific-Murphy Corp., Emeryville, \$229,745; California Steel Products Co., Richmond, \$241,877; Moore Dry Dock Co., Oakland, \$269,915; Kyle Steel Construction Co., Vernon, \$280,605; Chas. L. Harney, Inc., San Francisco, \$299,800; American Bridge Division, United States Steel Co., San Francisco, \$344,750. Contract awarded to Herrick Iron Works, Oakland, \$209,800.

SAN JOAQUIN COUNTY—Across Stanislaus River, about 7 miles south of Manteca, and across Middle River, about 12 miles west of Stockton, two existing steel bridges to be cleaned and painted. District X, Routes 4, 75, Sections A,A. D. Zelinsky & Sons, San Francisco, \$30,981; Klaas Brothers, Los Angeles, \$36,365; D. E. Burgess Co., San Francisco, \$37,224; J. S. Morris Co., Berkeley, \$37,650; John P. McGuire, San Jose, \$41,394; R. W. Reade & Co., Berkeley, \$43,404. Contract awarded to H. C. McKern, San Jose, \$22,776.

SAN LUIS OBISPO COUNTY—In the City of San Luis Obispo, at Grand Avenue and Buena Vista Avenue, two reinforced concrete bridges to be constructed and streets to be graded and surfaced with plant-mixed surfacing on imported base material. District V, Route 2, Fredericksen & Kasler, Sacramento, \$217,288; Granite Construction Co., Watsonville, \$219,243; Madonna Construction Co., San Luis Obispo, \$284,902. Contract awarded to Thomas Construction Co., Fresno, \$207,126.75.

SISKIYOU COUNTY—Between Dunsmuir and Big Canyon, about 4.3 miles to be graded and surfaced with plant-mixed surfacing on cement treated base. District II, Route 3, Section A. Fredrickson & Watson Construction Co., Oakland, \$1,128,009; B. J. Ukropina, T. P. Polich, Steve Kral, Baldwin Park,

In Memoriam

EUGENE NORMAN SAWTELLE

Eugene Norman Sawtelle, 59, employed by the Division of Water Resources for over 27 years, passed away on November 6, 1951, after a short illness. At the time of his death Mr. Sawtelle was in charge of a unit of delineators in the division's Bryte office, in connection with the state-wide water resources investigations. He leaves his widow, Grace Elliott Sawtelle, and a daughter, Rosemary.

\$1,133,023; H. Earl Parker, Inc., and Harms Bros., Sacramento, \$1,143,156; Ball & Simpson, Berkeley, \$1,164,521; Granite Construction Co., Watsonville, \$1,166,665; Peter Kiewit Sons' Co., Arcadia, \$1,239,901; McNutt Brothers, Eugene, Ore., \$1,359,736; L. A. and R. S. Crow, El Monte, \$1,437,692; McCammon-Wunderlich Co., Palo Alto, \$1,990,743. Contract awarded to A. Teichert & Son, Inc., Sacramento, \$1,048,738.50.

SOLANO COUNTY—Between Carquinez Bridge and Vallejo Wye, about 0.8 mile of existing roadbed to be reinforced with untreated rock base, surfaced with plant-mixed surfacing and seal coats applied. District X, Route 7, Section F. Lee J. Immel, San Pablo, \$81,601; J. Henry Harris, Berkeley, \$87,404; O. C. Jones & Sons, Berkeley, \$90,648; Harms Bros., Sacramento, \$90,847. Contract awarded to Parish Bros., Benicia, \$80,166.40.

YOLO COUNTY—Across Sacramento River at Knight's Landing, for cleaning and painting a bridge. District III, Route 87, Section A. R. W. Reade & Co., Berkeley, \$8,676; D. E. Burgess Co., San Francisco, \$11,435; D. Zelinsky & Sons, San Francisco, \$13,850; Bill Reid Painting Service, Sacramento, \$13,877; R. A. Luther, Hayward, \$14,474. Contract awarded to Judd Co., Inc., Oakland, \$7,866.

F. A. S. County Projects

YUBA COUNTY—Between 5 miles east of Browns Valley and 0.9 mile east and between 7 miles east of Stanfield Hill and Frenchtown Road, about 2.8 miles to be graded, imported borrow placed and penetration treatment and seal coat applied. District III, Route 526. H. Earl Parker, Inc., Marysville, \$114,433; O'Connor Bros., Red Bluff, \$124,243; J. Henry Harris, Berkeley, \$126,917. Contract awarded to Richter Bros., Oroville, \$104,967.

GLENN COUNTY—Between State Route 7 and 4.6 miles east, about 4 miles south of Willows, imported base material to be placed over existing roadbed. District III, Route 1121. Huntington Bros., Napa, \$59,720; W. H. O'Hair Co., Colusa, \$59,844; Browne & Krull, Hayward, \$60,900; Volpa Bros., Fresno, \$62,120; M. J. Ruddy & Son, Modesto, \$62,896; A. Teichert & Son, Inc., Sacramento, \$64,940; Eugene G. Alves, Pittsburg, \$68,050; Harms Bros., Sacramento, \$71,212; Claude C. Wood Co., Lodi, \$74,520; O'Connor Bros., Red Bluff, \$76,020. Contract awarded to Lefever & Bing, West Sacramento, \$57,240.

SAN JOAQUIN COUNTY—On Pacific Avenue, between 5-Mile House and Calaveras River, about 2.4 miles, to be graded and surfaced with plant-mixed surfacing on untreated rock base. District X, Route 543. S. M. McGaw Co., Inc., Stockton, \$187,121; Claude C. Wood Co., Lodi, \$191,435; Karl C. Harmeling, Stockton, \$202,738. Contract awarded to A. Teichert & Son, Inc., Sacramento, \$163,718.15.

EARL WARREN
Governor of California

FRANK B. DURKEE
Director of Public Works

HIGHWAY COMMISSION

HARRISON R. BAKER Pasadena
H. STEPHEN CHASE Sacramento
JAMES A. GUTHRIE San Bernardino
F. WALTER SANDELIN Ukiah
CHESTER H. WARLOW Fresno
CHARLES T. LEIGH San Diego
R. C. KENNEDY, Secretary Sacramento

DIVISION OF HIGHWAYS

GEO. T. McCOY State Highway Engineer
R. M. GILLIS Deputy State Highway Engineer
CHAS. E. WAITE Assistant State Highway Engineer
EARL WITHYCOMBE Assistant State Highway Engineer
F. W. PANHORST Assistant State Highway Engineer
J. W. VICKREY Assistant State Highway Engineer
R. H. WILSON Assistant State Highway Engineer
F. N. HVEEM Materials and Research Engineer
GEORGE F. HELLESOE Maintenance Engineer
E. T. TELFORD Engineer of Design
DON G. EVANS Construction Engineer
H. B. LA FORGE Engineer of Federal Secondary Roads
L. V. CAMPBELL Engineer of City and Cooperative Projects
EARL E. SORENSON Equipment Engineer
H. C. McCARTY Office Engineer
J. C. YOUNG Traffic Engineer
J. C. WOMACK Planning Engineer
J. P. MURPHY Principal Highway Engineer
F. M. REYNOLDS Principal Highway Engineer
E. J. SALDINE Principal Highway Engineer
I. O. JAHLSTROM Principal Bridge Engineer
STEWART MITCHELL Principal Bridge Engineer
E. R. HIGGINS Comptroller

Right of Way Department

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

District IV

B. W. BOOKER Assistant State Highway Engineer

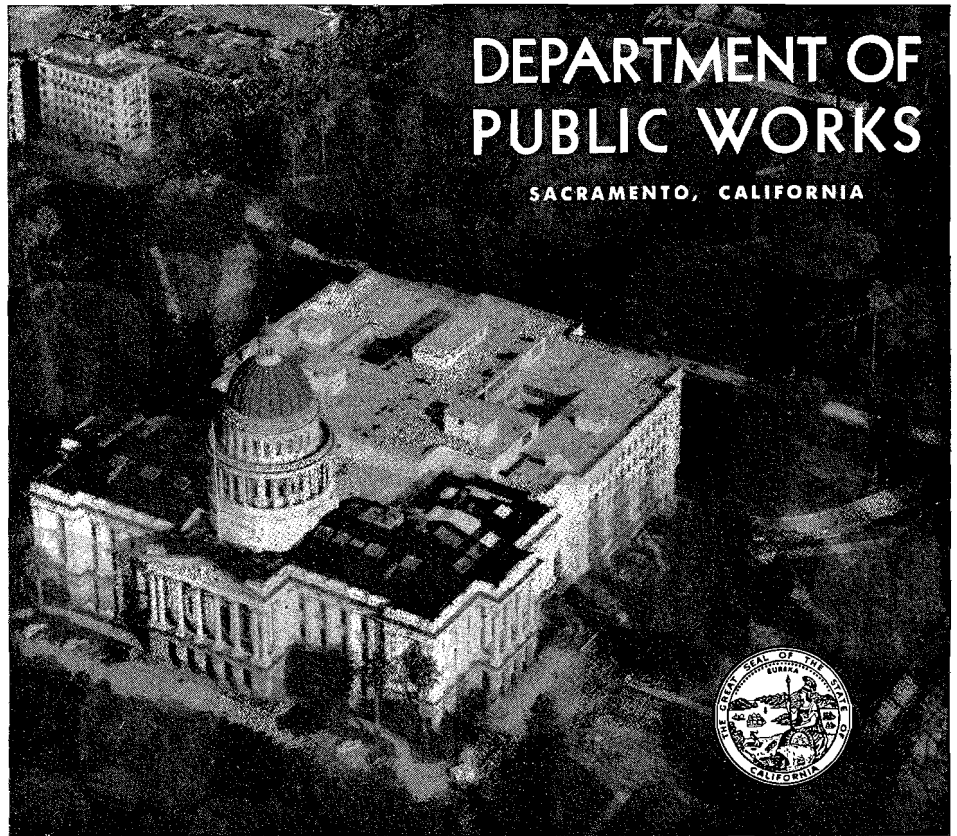
District VII

P. O. HARDING Assistant State Highway Engineer

DIVISION OF HIGHWAYS

District Engineers

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



**DEPARTMENT OF
PUBLIC WORKS**

SACRAMENTO, CALIFORNIA



**DIVISION OF CONTRACTS AND
RIGHTS OF WAY**

Legal

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

**DIVISION OF SAN FRANCISCO
TOLL CROSSINGS**

NORMAN C. RAAB Project Design Engineer

DIVISION OF WATER RESOURCES

A. D. EDMONSTON State Engineer, Chief of Division
G. H. JONES Assistant State Engineer, Sacramento
River Flood Control Project, Supervision of Safety
of Dams, Sacramento-San Joaquin Water Supervision
T. B. WADDELL
Assistant State Engineer, Water Resources Investi-
gations, Central Valley Project, Irrigation Districts
GORDON ZANDER Assistant State Engi-
neer, Water Rights and Water Quality Investigations
MAX BOOKMAN
Supervising Hydraulic Engineer, Los Angeles Office
HENRY HOLSINGER Principal Attorney
T. R. MERRYWEATHER Administrative Assistant

DIVISION OF ARCHITECTURE

ANSON BOYD State Architect
H. S. HUNTER Deputy Chief
ROBERT W. FORMHALS
Administrative Assistant to State Architect
EARL W. HAMPTON Supervisor of Contract Architects

Administrative Service

W. K. DANIELS Assistant State Architect, Administrative
WADE O. HALSTEAD
Principal Estimator of Building Construction
CARLETON PIERSON Supervising Contracts Writer

Planning and Design Service

P. T. POAGE
Assistant State Architect, Design and Planning
A. F. DUDMAN Principal Architectural Designer
CARL A. HENDERLONG
Principal Mechanical and Electrical Engineer
C. L. IVERSON Chief Architectural Draftsman
WALTER E. LORD Supervising Specifications Writer
JAMES A. GILLEM Supervisor Area III (Los Angeles)

Construction Service

D. C. WILLETT Chief Construction Engineer
F. A. JOHNSON Principal Structural Engineer
JOHN S. MOORE General Construction Supervisor
NATE W. DOWNS
Supervising Engineer of Maintenance and Operations

Area Construction Supervisors

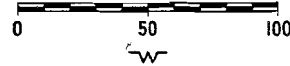
THOMAS M. CURRAN Area I, Oakland
J. WILLIAM COOK Area II, Sacramento
FRANK R. AUSTGEN Area III, Los Angeles

**Area Structural Engineers,
Schoolhouse Section**

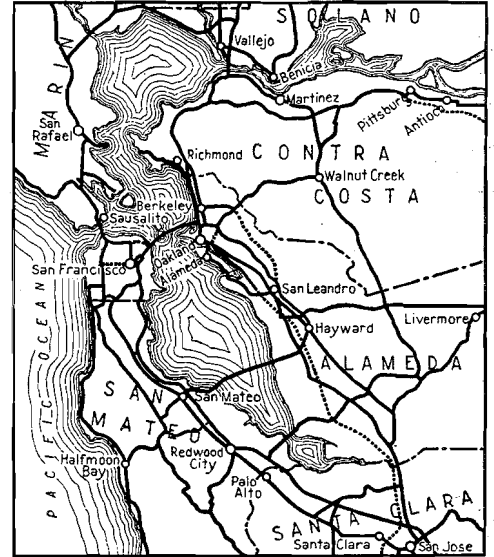
C. M. HERD Area I, San Francisco
M. A. EWING Area II, Sacramento
H. W. BOLIN Area III, Los Angeles

CALIFORNIA STATE HIGHWAY SYSTEM

SCALE IN MILES



SAN FRANCISCO AND VICINITY



LOS ANGELES AND VICINITY

