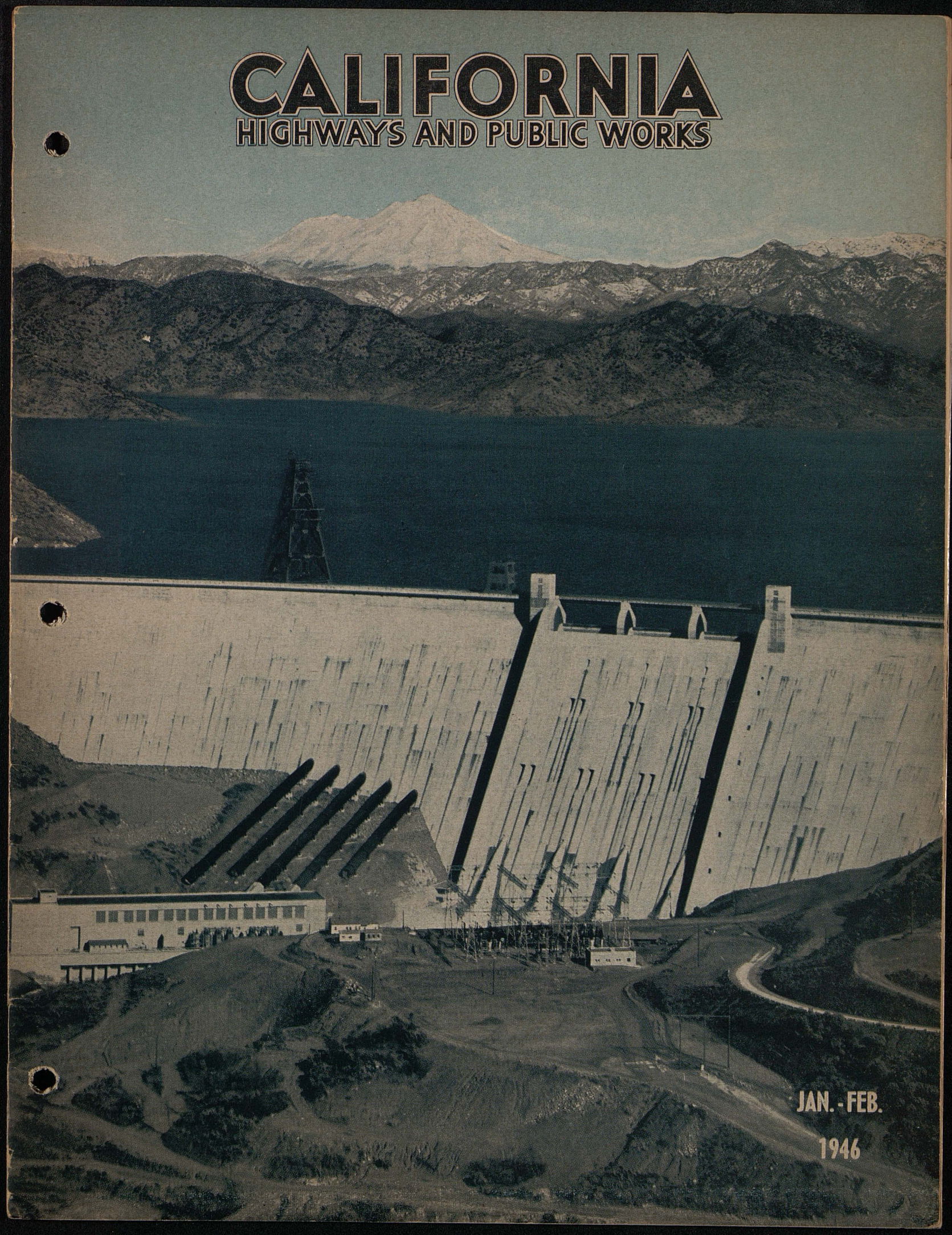
CALIFORNIA

HIGHWAYS AND PUBLIC WORKS



JAN. - FEB.

1946

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways, Department of Public Works, State of California [PRINTED IN U.S.A.]

C. H. PURCELL, Director | GEORGE T. McCOY, State Highway Engineer | K. C. ADAMS, Editor

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Postwar Highway Projects Advertised at the Rate of Nearly $2,000,000 a Week

By GEO. T. McCOY, State Highway Engineer

SINCE the close of hostilities of World War II, the engineering staff of the California Division of Highways has been carrying forward to the contracting stage the preliminary work accomplished during the war years in making surveys; in preparing plans, specifications, and estimates; and in acquiring rights of way for construction projects to be undertaken in the postwar period. This preliminary work for the postwar State highway program was conducted simultaneously with the prosecution and completion for the Federal Government of Federal Access Road and Flight Strip programs totaling more than $32,000,000 in construction costs.

The California postwar State highway construction program totals $115,000,000. This amount includes projects which are planned for advertising, bid opening, and contract award during the first three postwar years. Construction of these projects is to be financed from accumulated and anticipated revenue of the State gas tax and motor vehicle fees and from apportionments to California of Federal funds authorized under the Federal Aid Highway Act of 1944.

The initial program for the first postwar year amounts to $40,000,000.

V-J Day was August 14, 1945, and on October 29th the Public Roads Administration approved California's Federal Aid program and portions of the Federal Aid Urban Program. Immediately thereafter, on November 9th, the Division of Highways published the first call for bids on construction of postwar projects. Between that date and January 31, 1946, advertisements for bids have been published at a rate of nearly two million dollars a week. Advertisements during these 12 weeks have included 48 State highway projects, totaling estimated construction costs of $20,529,600.

Bids on the first seven of the postwar projects were opened on November 28th and 29th. By the end of January bids had been opened on 42 of the 48 projects and the total of low bids received amounted to $19,872,100 as compared with the $19,648,900 total of engineers' estimates.

The net overrun amounted to $223,200 which is 1.14 per cent of the total engineers' estimates. Twenty of the 42 low bids were under the department's estimates and 22 were over. The percentage of savings on the 20 bids under the estimates ranged from 0.53 per cent to 25.65 per cent, six being greater than 10 per cent under.

By January 31st, 37 contracts, involving $19,098,000 had been awarded; bids were rejected on three projects; and 2 projects involving $353,300 were pending award.

If satisfactory bids continue to be received it is planned to place State highway projects under construction at a rate of approximately $2,000,000 per week until the entire $40,000,000 initial program is in the hands of the construction industry.

During the second and third postwar years, it is planned that advertising for bids and award of State highway construction contracts will keep pace with each year's Federal aid apportionments as they become available on July 1, 1946 and 1947. California's regular Federal aid and urban Federal aid apportionments amount to approximately $17,000,000 each year, which with State matching funds insure yearly State highway construction programs of at least $34,000,000.

In addition to the State Highway Program in California, the early postwar years will see a well rounded $25,000,000 program of county road improvement financed from the $15,000,000 in Federal funds apportioned to California for Federal aid secondary roads during the first three postwar years and the $12,000,000 appropriated by the 1945 session of the State Legislature for the use of the counties in matching the Federal aid secondary funds. The State enactment providing these matching dollars stipulated that 87½ per cent of the Federal aid secondary apportionment be used for improvement to county roads.

In accordance with rulings of the Public Roads Administration the Division of Highways is administering these funds. The County Highway Aid Act requires the counties to submit programs for desired county road improvement to the Division of Highways within six months after September 15, 1945. Of the 58 counties in California, 33 have submitted programs and of these 33, 18 county programs have been formally recommended to the Public Roads Adminis-

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Harrison R. Baker Is Reappointed to State Highway Body

REAPPOINTMENT by Governor Earl Warren of Harrison R. Baker of Pasadena to be a member of the California Highway Commission was confirmed by the Senate of the State Legislature on January 18. Originally named to the post on September 14, 1943, Mr. Baker won a three-year term when the newly-appointed highway commissioners drew lots for staggered tenures of office.

For 17 years a member of the Pasadena Planning Commission, a past president of the Pasadena Realty Board, president of the Davis-Baker Company and the Davis-Baker Insurance Agency and one of four men credited with promoting the famous Arroyo Seco Parkway between Los Angeles and Pasadena, Mr. Baker for many years has been an ardent booster for good roads. During the last three years he has devoted much of his time to State highway matters.

NEW DEVICES AID IN MAINTENANCE WORK

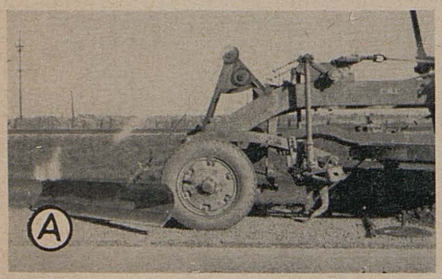
By CARL F. LIND, Assistant Highway Engineer

ALTHOUGH maintenance work was severely curtailed during the war, both by lack of material and scarcity of labor, this fact proved to be an incentive in the development of time-saving and labor-saving devices and equipment.

For the most part, ideas for new developments in maintenance equipment are born directly in the field in the minds of those men who are constantly handling and working with the equipment and who can directly see the shortcomings of that equipment.

To develop better equipment and acquire new ideas is not only directly beneficial to themselves in performing maintenance tasks in an easier and more efficient manner, but is also an indication of their alertness in recognizing inefficiencies and overcoming them. The name of the employee who originally proposed or worked out a given idea is not always known, nor is a record available of all worthwhile developments. However, a brief description of the more recent developments is of interest.

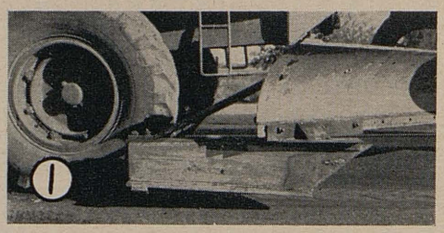
To Maintenance Superintendent F. R. Garrison of District III is credited the suggestion for a blade attachment for the front end of motor graders. This moldboard attachment, **Photo A,**



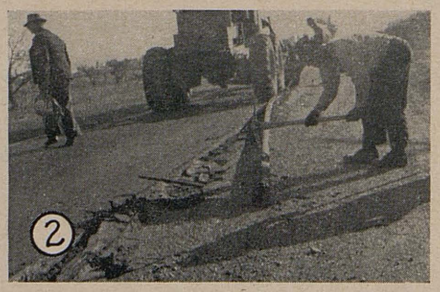
is used for spreading roadside cover material on penetration type oil surface treatments. In previous operations the front wheels of the motor grader were run in the oil ahead of the blade, thereby tracking oil and causing a weak spot in the seal.

At the termination of the construction of an asphaltic or Portland cement concrete pavement, it has been customary to allow timber header boards to remain in place. After several years, however, it is desirable to remove the old header boards and for this task Maintenance Superintendent L. D. Craig of District II designed a motor grader-attached device, **Photo 1.**

This attachment, bolted to the right end of the moldboard of a heavy grader, consists of a section of channel

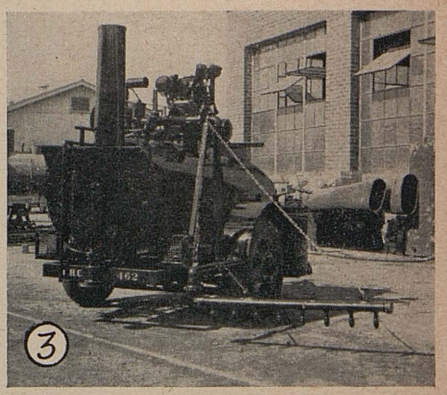


iron several feet in length and having an 8-inch depth of web. The forward edge of the channel section is cut to slope to the rear and base of the device and the flanges of the channel are set so as to extend outward from the assembly. The channel section is so positioned that the rear end is slightly higher than the front, which imparts the lifting action necessary to loosen and raise the header board when the web of the device is forced between the side of the header board and the vertical edge of the pavement, and the lower flange of the channel section is brought up under the lower edge of the header. As the grader moves forward, the header board, **Photo 2,** is raised four or



five inches above its original position from which point it can be easily removed with a bar or pick.

Emulsion kettles are not usually equipped with spreader boots, but are intended for use with hand sprays. In numerous instances, boots have been constructed to operate six to eight spray jets directly behind the kettle. To facilitate operations, a swivel joint connection, **Photo 3,** was designed and



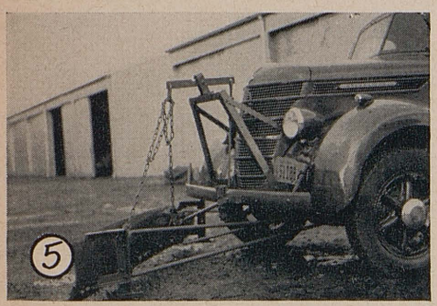
built by Headquarters Shop to provide for bar spraying, either behind the unit or on an offset.

The operator of the hand spray formerly had to sit or stand on the frame or tank while the kettle was being towed at a slow speed. A rear platform, **Photo 4,** fitted with railing, was

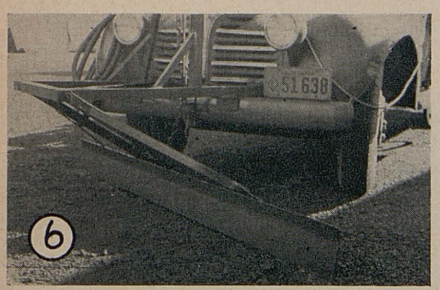
added to the rear of the kettle by forces of District VI to afford safer operation and better control of the spray unit.

On many sections of highways, it is constantly necessary to remove rocks from the roadway by patrol maintenance. The operation of removing rocks from the pavement with a light snowplow is not necessarily new, but during the past emergency it was impossible to obtain light plows or to subject those on hand to the rigors of rock removing.

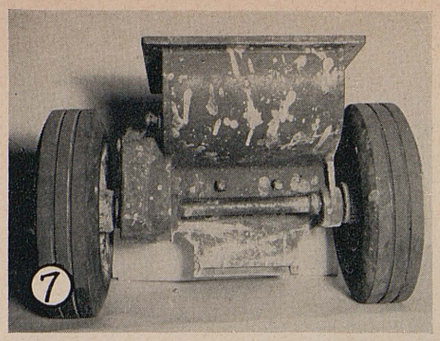
District I forces successfully built a front end truck-mounted rock removing plow using an old section of bumper type guard raid for a moldboard and a grader blade as a cutting edge. This plow, **Photo 5,** was so coupled that when the dump body of the truck was lowered, it rested on a lever which raised the dozer blade off the pavement and thus permitted normal operations of the truck, but when the body was raised, the weight of the plow caused it to lower and ride on the pavement on shoes.



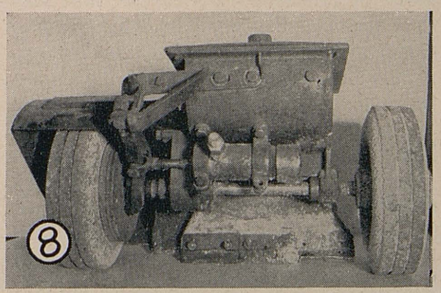
Under the supervision of Equipment Superintendent W. H. Pierce, then of Shop 2, a light plow, **Photo 6,** mounted on the front end of a truck was devised from materials on hand. This plow was raised or lowered by means of a hand-operated system of blocks.



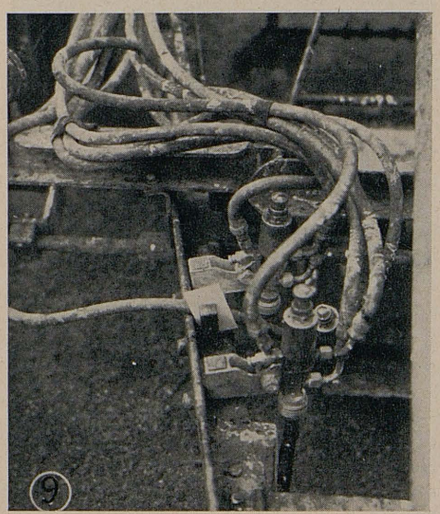
The first development in a mechanically controlled bead dispensing machine for use on dashed traffic striping was an air lift arrangement whereby the entire machine was completely raised from the pavement surface, **Photo 7,** thus stopping the flow of beads. Headquarters Shop further improved the machine by the installation of an air operated clutch, **Photo 8,**



which controlled the bead dispensing mechanism simultaneously with the lacquer control apparatus. Gates were also installed whereby beads could be applied to one or more stripes at a time. This operation previously required separate machines.



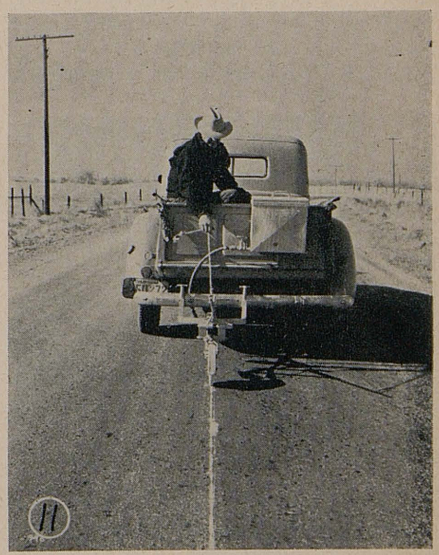
Under the supervision of Equipment Superintendent W. B. Cannon of Shop 7, a system for holding the spray guns on traffic striping machines, **Photo 9,** was developed whereby each spray gun is held separately by a clip sliding over



a square peg. When not in use, the spray guns are placed at the side of the paint spray rig. Before using the clips, it was necessary to drain the paint lines when changing from white to yellow lacquer, or if this were not done, to remove the paint guns, which required approximately 15 minutes labor. With the present arrangement, the nozzles may be instantly moved to any position.

A further development in traffic striping was the improvement of the

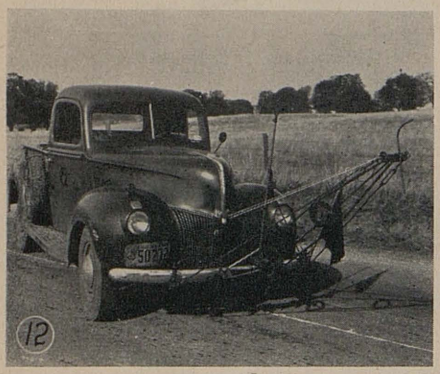
so-called "Dribble" Line Marker by Headquarters Shop in conjunction with M. A. O'Brien of Headquarters Office. This device, **Photos 10 and 11,** is used for applying a narrow temporary traffic stripe, approximately ½-inch wide, on newly placed surfacing to serve until the regular stripe is placed. It consists of a small wheel and paint container attached to the rear of, and trailing from a truck which



also has a guide pointer, **Photo 12,** mounted on the front bumper. Paint dripping onto the rotating trailing

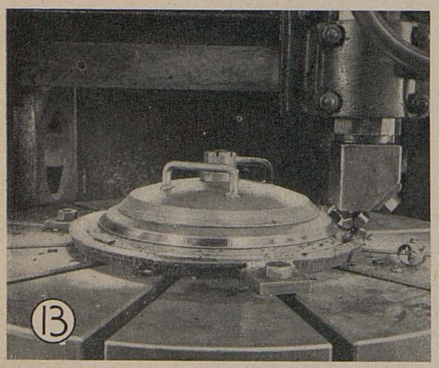
wheel leaves a satisfactory temporary line.

The original type of scarifier was fitted with discs made of a medium carbon steel and intended for agricultural purposes, but would not stand up for any length of time when used to scarify hard, abrasive surfaces. The discs for these scarifiers were sharpened by pressure between two rolls; however, when hard or heat treated alloy steel discs were introduced to meet the new requirements, the rolling machine would not produce a satisfactory even cutting edge, since the harder material

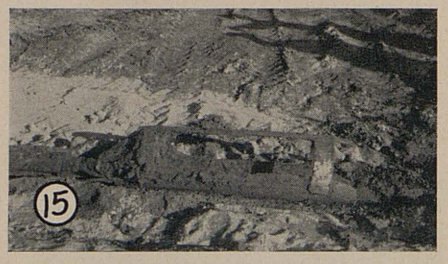


would not flow in the rolls and occasionally the discs split or chipped.

An edge grinding machine was successfully developed to sharpen the new type of discs and is now employed to do this disc reconditioning in the various district shops. At Headquarters Shop where a large boring mill is available, the resharpening of these hardened discs is accomplished by cutting their edges with an especially made cutting tool having a stellite facing, **Photo 13**. This method of reconditioning requires 50 per cent of the time for reconditioning each disc as compared to the grinding method. The reduction in diameter of the discs by cutting their edges is not sufficient to make any material difference in their life.



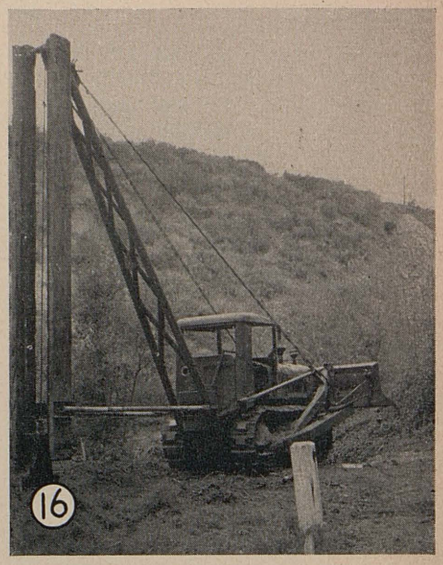
A tractor-powered culvert cleaning spoon, **Photos 14 and 15**, was a development of District VI's forces, and was first successfully used in Maintenance Superintendent Clyde Johnson's territory. This spoon is metal with an open top, about 10 inches in diameter and 36 inches to 48 inches in length, and has sharpened forward cutting edges. It is attached to the rear of a small tractor by a pipe 30 to 50 feet long with a cable for added strength and flexibility. The tractor operates the spoon by forcing it into the plugged culvert



and, after filling, the spoon is retracted, whereupon it is rolled over and dumped. Muddy or sticky material necessitates emptying the spoon by hand with a shovel. Two 6-inch x 6-inch timbers are placed at the culvert entrance to guide the spoon into the culvert. District IV forces have also used commercial type of sewer cleaning rods successfully to clear clogged culverts.

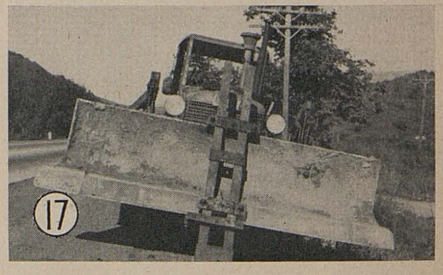
Cleaning culverts with the spoon is, of course, controlled by the grade of the culvert, by the fall of the inlet or outlet, and by fences, trees, or brush within the limits of the cleaning operation.

A portable tractor-mounted pile driving rig, **Photo 16**, was developed in District V by Maintenance Superintendent K. Mendenhall for driving rails used in the construction of wire fence bank protection and erosion control. A 17-foot boom was bolted to the drawbar back of the tractor. Two cables were fastened from the top of the boom to the dozer arm on either side of the tractor and the boom was raised or lowered by raising or lowering the dozer blade. The hammer guides were



made of 4-inch x 6-inch x 16-foot timbers fastened to 3-inch x 12-inch x 16-foot stiffeners. The lower end of the leads were then strut-braced to the drawbar of the tractor. A 500-pound hammer was operated by means of the tractor's power control unit.

Another tractor-mounted device developed by Superintendent Mendenhall, was the trench cutting tool, **Photo 17**, attached to the dozer. This was merely an assembly of two rails clamped to the dozer blade and having a flat cutting edge welded to the lower end. The tractor-mounted trencher

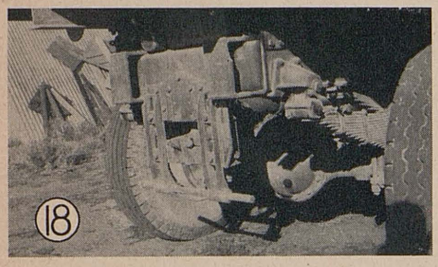


was successfully used in cutting narrow trenches across the shoulder in the installation of subgrade drains.

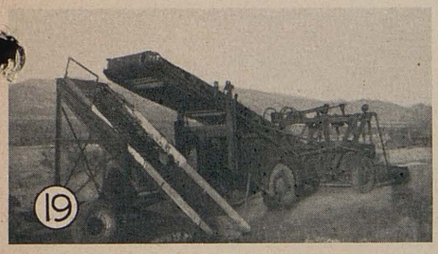
The coupling bars generally furnished by the manufacturers of screening spreaders are designed to clamp to the rear cross member of the frame of medium sized dump trucks. This cross member on the frame on large

trucks, such as are used for snow removal operations during winter, are generally too high above ground level to permit the direct attachment of the coupling bar. Shop 9, therefore, designed and built special brackets, adjustable in height, braced forward to the main frame, to accommodate the coupling bar supplied with the spreading equipment.

Shop 11 under the supervision of Equipment Superintendent R. J. Carlisle constructed a gravity flow screening unit, **Photos 18 and 19**, to be towed



and used behind a self-propelled force feed belt loader. It has removable screens fitting in frames of angle iron and may be equipped with a coarse screen at the top and used as a grizzly to eliminate oversize aggregate. For



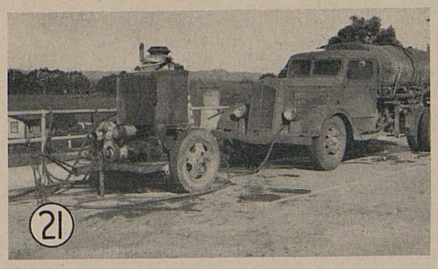
elimination of both oversize and fines, a smaller mesh screen is inserted in the frame below the top screen. Material after screening is left in separate windrows and the waste can easily be removed with a blade.

To facilitate the painting of the under side of the San Francisco-Oakland Bay Bridge (a constant and continuous operation) traveling scaffolds over 60 feet in length, **Photo 20,** have been suspended permanently under and at right angles to the line of the main bridge. These scaffolds, or painting bridges, are suspended from rollers riding on the top surface of the lower chord of the main bridge, and are propelled by means of hand-operated cranks at either end which must be operated simultaneously in order to produce an even travel of the scaffold.

"Road haze," a detrimental film or coating thrown from the pavement by

traffic, has been effectively and economically removed from the superstructure of bridges with a small portable steam outfit similar to that used in the cleaning of automobiles, **Photo 21.** Considerable areas of sound paint are uncovered in this manner, without damage or abrasion, thus eliminating the more costly sand blasting operations.

Previous shoulder weed spraying had been accomplished by means of a boom mechanism devised by Maintenance Superintendent Charles Harby, then of District XI, supporting the necessary hoses leading to the spray bar. E. S. Whitaker, Assistant Landscape Engineer of Headquarters Office, then devised the all-metal boom construction now used in roadside spraying. Construction of the lower portion of the boom of light-weight metal,



eliminates the dangerous and unwieldy system of hoses. A 180-degree lateral and 90-degree vertical movement of the boom is obtained through three Chicksan swing joints. The operator sits facing sideways in the truck cab with the door removed, allowing full vision and verbal communication between the spray bar operator and the truck driver. A by-pass valve at the pump permits constant agitation

(Continued on page 28)

Ford A. Chatters New Secretary Highway Body

WITH a background of experience as a legislator, leader for years in goods roads movements and newspaper publisher, Ford A. Chatters of Lindsay has been chosen by the California Highway Commission to be its secretary, a post that has been vacant since the advent of Governor Earl Warren's administration, due to wartime restrictions on highway building.

Announcement of Chatters' appointment was made by C. H. Purcell, Director of Public Works and chairman of the commission. Purcell said that in view of the extensive postwar highway program which has been undertaken by the State the commission requires the services of a liasion officer between the Highway Commission and State, county and city officials and members of the Legislature in carrying out the postwar highway construction program.

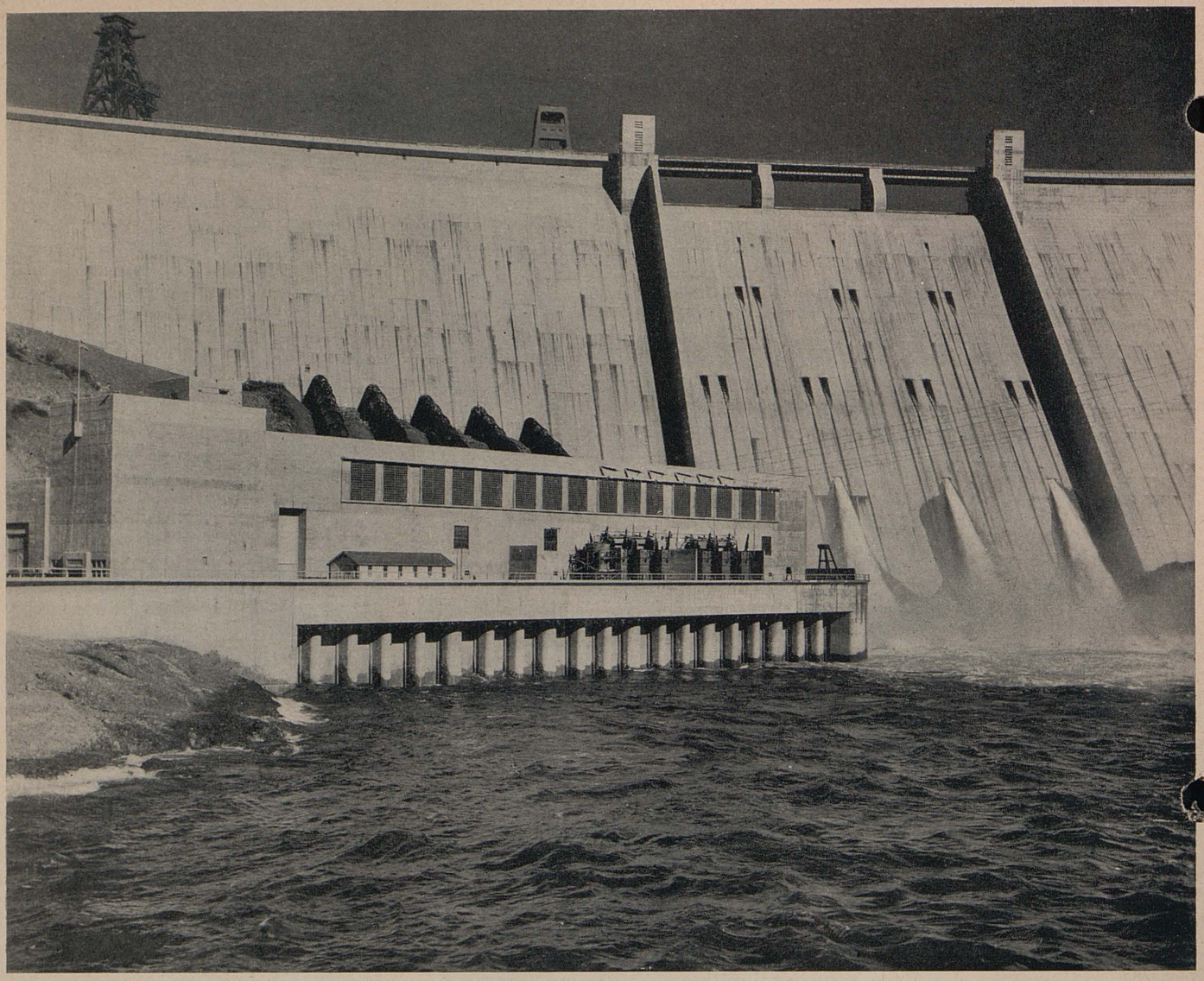
Members of the commission, Purcell said, have informally approved the selection of Chatters and will officially install him at its next meeting on February 20th and 21st.

Chatters, who is a member of the State Personnel Board, will resign from that office to devote his time to his new duties.

As a member of the Assembly of the Legislature during the 1933-35 sessions, Chatters, in 1933 took a prominent part in formulating highway legislation and served as a member of the Assembly Committee on Roads and Highways during the 1935 Session, working closely with the Division of Highways during his terms as a legislator.

Prior to his appointment on the Personnel Board, Chatters was a member of the State Board of Education. As a newspaper publisher since 1916 in Lindsay, Chatters has taken an active part in highway promotion. He was secretary of the Orange Belt Scenic Highway Association. While in the Legislature he also was a coauthor of the Central Valley Project Act.

Chatters, who publishes the Lindsay *Gazette,* is a past president of the California Newspaper Publishers' Association and Past Commander of Lindsay Post 28, American Legion.



Between December 29th and January 4th, water releases from Shasta Reservoir through the power plants and the four 102-inch flood control valves now installed were increased from 5,400 second-feet to 26,000 second-feet. This photo shows flood control valves in operation

Shasta Reservoir Operated for Flood Control

SHASTA Reservoir, major unit of the Central Valley Project, as operated by the U. S. Bureau of Reclamation, in the opinion of officials of that agency and the office of the State Engineer, is proving its effectiveness in the control of floods on the Sacramento River.

The peak flow of the Sacramento River near Red Bluff was 78,000 second feet on December 27th, which is about 60 per cent of the estimated peak flow that would have passed that latitude without Shasta Reservoir. Between December 22d and January 6th, there was detained for the first time 760,000 acre-feet of flood runoff in Shasta Reservoir, increasing the total storage therein from 2,520,000 acre-feet on the former date to 3,280,000 acre-feet on the latter date.

The present constructed capacity of Shasta Reservoir is 3,700,000 acre-feet which will be increased to 4,500,000 acre-feet when the three drum gates, each 28 feet in height and 110 feet in length, are installed on the crest of the dam. Releases from Shasta Reservoir through the power plants and the four 102-inch flood control valves now installed were gradually increased from 5,400 second-feet on December 29th, the amount passing through the power plants, to 26,000 second-feet on January 4th. This maximum rate of discharge was continued until January 12th when the quantity in storage had been reduced to 3,190,000 acre-feet which will provide 510,000 acre-feet of storage space available to retain subsequent flood flows. When the additional fourteen 102-inch flood control valves and the drum gates are installed, maximum flood control storage volume and releases can be increased

(Continued on page 36)

CALIFORNIA MISSIONS

By KENNETH C. ADAMS, Editor

Mission Santa Cruz
September 25, 1791

IN 1774, Father Francisco Palou, faithful friend and biographer of Fr. Serra, accompanied a surveying expedition from Monterey toward San Francisco. Returning, the party crossed the San Lorenzo River, near the present City of Santa Cruz, on December 11th of that year, and with prophetic vision Fr. Palou recorded in his diary:

"We reached the San Lorenzo River, which is quite large and has a deep bed; its water reached to the stirrups. * * * This site is suitable, not only for a pueblo, but even for a city, for it lacks nothing that is necessary, having good land, water, pasture, firewood and timber, all at hand in abundance, and close to the beach of Monterey Bay."

Fr. Palou strongly recommended to Fr. Serra that the location was an ideal spot for a mission. Junipero was not to live to see the founding of Mission Santa Cruz. This Franciscan station was established under the regime of his successor, Fr. Fermin Francisco de Lasuen. Fr. Lasuen took a personal pride in the selection of the site and recorded: "On August 28, 1791, the day of Saint Augustina I said Mass, and raised a cross on the spot where the establishment is to be. Many Gentiles came, old and young of both sexes, and showed that they would gladly enlist under the Sacred Standard, thanks be to God."

FIRST CONVERTS ARRIVE

However, Fr. Lasuen was not to be present at the dedication of the new mission. He was called to Monterey on pressing duties and the ceremonies were directed by Ensign Hermengildo Sal, acting commandant at the Presidio of San Francisco, who arrived at Santa Cruz on September 22, 1791, accompanied by Fathers Isidro Alonzo Salazar and Baldomero Lopez of Mission Santa Clara, who were destined to be the first missionaries at the new station.

On September 24th, neophyte Indians brought from Santa Clara were set at work by the padres building a rude shelter in which High Mass was to be celebrated the following day. The Indian chief, Sugert, came with some of his followers and asked to be made the first converts, and Ensign Sal agreed to act as godfather. Cows, oxen, steers, horses and mules contributed by the Missions of Santa Clara, San Carlos and San Francisco had arrived the day before.

Fathers Salazar and Lopez formally founded the mission on Sunday, September 25th and at the same time Ensign Sal took possession of the site in the name of His Majesty, the King of Spain. The site was about 500 yards from the San Lorenzo River in the shadow of the mountains and towering redwoods.

MISSION GROWTH RETARDED

Before long several buildings and a church had been erected. The first Santa Cruz Mission was but a temporary structure and later was moved a short distance to higher land. In December, 1791, the resident padres reported that they had baptized 87 persons, celebrated six Indian marriages and buried an Indian child.

"We have enclosed a place for cattle, sheep and horses," wrote Fr. Lopez. "We have brought the water to the mission, and we have fenced the orchard. The tools used at this mission belong to other missions, and we shall return them when we receive those which the King is going to send. We brought with us four candlestick of brass, a painting of our Lady of Sorrow, and an image of our Father St. Francis."

Santa Cruz Mission had one of the lovliest sites of all the Franciscan stations in California. The soil was fertile, the climate ideal, the Indians willing converts. And yet Santa Cruz never became a large or very prosperous mission. The padres attributed the failure of their dreams for a great mission to the fact that the Villa Branciforte, which was to become the present city of Santa Cruz, was established just across the river from them and was populated by settlers drawn from the lowest dregs of Mexican society.

EVIL OF VILLA BRANCIFORTE

The visitor to the Santa Cruz of today, one of the most attractive cities in the west and famed far and wide as a summer resort, will find it difficult to visualize the Villa Branciforte from which it grew and of which no trace of its unsavory existence remains.

Mission Meccas

California's famous old missions with their historical and romantic background annually attract thousands of visitors. Twenty-one Franciscan missions were founded by the Reverend Fray Junipero Serra and his colleagues, extending from San Diego to Sonoma. On his way north from San Diego, Father Serra and the mission padres who came after him followed a course which became known as El Camino Real, "The King's Highway." El Camino Real retains to this day its original name and is designated U. S. 101. Along this highway and short distances from it, the founding padres established their missions. U. S. 101, the old "King's Highway," now extends from the Mexican border into nothern Washington.

Present day State highways lead to all the mission sites. Now that the war is ended, California looks forward to again welcoming tourists from all over the world. With the resumption of normal automobile travel, it is believed that the missions will be popular meccas for visitors to the Golden State.

Anticipating this traffic, the Division of Highways is publishing in California Highways and Public Works brief histories of the missions with directions on how to reach them over State highways. For the purpose of this series, the missions are taken up in the order of their locations from south to north, rather than in the sequence of their founding.

This is the ninth of the series.

From Original Etching by H. Chapman Ford

This reproduction of an old etching shows what Mission Santa Cruz looked like in the days when the founding padres resided there

When Fr. Palou saw in this delightful spot an ideal place for a mission and "for a pueblo, even for a city," he could not foresee that the city he envisioned would turn out to be the Villa Branciforte, which brought so much grief to the mission fathers and shame to itself.

Santa Cruz Mission started out with great promise. The padres were inspired by the beauty of their surroundings.

"One can see them," writes H. A. van Coenen Torchiana, "standing on the hill, looking down upon the San Lorenzo River, lined with a great variety of deciduous trees, flowing through the small, lovely valley towards the west, or gazing towards the deep blue Bay of Monterey, on the opposite side of which the San Carlos mission and presidio were situated, and admiring the glorious sunsets over the Pacific Ocean. Then again they may have walked up the rock-strewn canyon of the upper San Lorenzo, its slopes covered with evergreens, and its audible waters boiling and tumbling in their steep descent over high boulders. We can not but hope that they knew and loved the small grove of Sequoia Sempervirens now owned as a public park by the County of Santa Cruz and situate only six miles up the gorge of the San Lorenzo from the mission site. No wonder Padres Isidro Alonzo Salazar and Baldomero Lopez, detailed by the Presidente as the first missionaries, considered themselves fortunate indeed. With all the joyous enthusiasm of religious zeal, they looked forward to their task at the lovely Mission of the Holy Cross, so favorably situated."

PADRES' HOPES DASHED

Alas, these high hopes were to be dashed and disillusionment was to come with the founding of Villa Branciforte.

However, the first few years were happy and busy ones. On February 27, 1793, the padres laid the cornerstone of the new mission church on the new and higher site. More than a year was required to build the edifice. The adobe walls were five feet thick. The front was of masonry and the foundation walls up to three feet in height were of stone, the rest of adobe.

The church was dedicated on May 10, 1794. The ceremonies were impressive. Father Tomaz Pena came down from Santa Clara for the event and Commandant Hermengildo Sal and several friars made the trip from San Francisco presidio. Indian neophytes and troops participated. The following day Mass was celebrated in the new church.

Building activities increased. A flour mill and granary and a house for looms were erected. The last two sides of the square of the mission buildings were completed in 1795. Progress was rapid up to 1797. And then came the founding of Villa Branciforte on July 24, 1797.

From this date on the histories of Mission Santa Cruz and the Villa Branciforte, named in honor of Miguel de la Grua Talamanca Marques de Branciforte, Viceroy of Mexico, are so closely interwoven as to make them one. The villa was established to gratify the conceit of the viceroy and over the protests of Fr. Presidente of the Missions Lasuen.

CHANGE IN MISSION AFFAIRS

So great was the change in mission affairs that we find Fr. Manuel Fernandez writing as early as January, 1798, that "everything was in a bad way; that 189 neophytes had deserted, leaving only 30 to 40 to do all the work; that the land was overflowed and only half of the planting done; that the livestock were dying; that a dead whale on the beach was attracting an unusual number of wolves and bears, and that the establishment of the Villa Branciforte added to the general despondency."

Five years earlier, Governor Don Diego de Borica had ordered secularization of the missions and the attempt to force self-government upon the Indians at Mission Santa Cruz brought much grief to the padres. The neophytes simply were not capable of ruling themselves or doing much for themselves.

Experiments with villas in Mexico had failed and conditions at the pueblos of San Jose and Los Angeles were anything but satisfactory.

In 1796, Fr. Salazar wrote to the Viceroy:

"The two towns formed twenty years ago have made no advancement. The people are a set of idlers. For them the Indian is errand boy, vaquero and digger of ditches—in short, general factotum. Confident that the Gentiles are working, the settlers pass the day singing. The young men wander on horseback through the rancherias soliciting the women to immorality."

SETTLERS BAD INFLUENCE

And Fr. Jose Senan at the same time went on record, saying:

"In Alta California the pueblos hardly deserve the name, so formless and embryonic is their state. The cause is scant relish for work on the part of the settlers. One is more likely to find in their hands a deck of cards than the spade or plow. For them the Gentile sows, ploughs, reaps and gathers the harvest. Debased, moreover, by the bad example of his white associates, the Gentile continues in the darkness of heathenism, when from distant rancherias many are won to the fold of the Holy Church."

Villa Branciforte was laid out on high, level land in what now is East Santa Cruz and a bridge was built across the San Lorenzo River to connect it with the mission. On May 12, 1797, nine colonists with their families, 17 persons in all, arrived. Torchiana says that the colonists, "recruited in Guadalajara from the vagabond type and undesirable classes, arrived in a pitiful condition at Monterey on the little ship Concepcion, which had sailed from San Blas. Their health was poor and they were destitute in body and soul, while some of them were diseased before they started."

Governor de Borica repeatedly tried to get a higher class of colonists, but with no success. He finally found it necessary to issue an order that no colonists should leave Branciforte without permission and violation of this decree was punishable by confinement in the stocks.

CONSTANT FRICTION

There was constant friction between the mission padres and the settlers. The priests considered that the villa was trespassing upon the lands and rights of the Indians. Nevertheless, they continued their activities in behalf of their wards and by 1800 had increased their livestock to 2,354 head. They were increasing the number of

This is Old Mission Church, erected on the site of the original Mission Santa Cruz

baptisms and adding to the mission building. In 1810, a large house had been constructed for widows and girls and except for constant trouble with rowdy settlers, affairs at the mission were fairly tranquil up to October, 1812, when Father Andres Quintana was found dead in bed. Murder was not suspected until later and then it required two years of investigation to determine that the friar had been strangled to death by a group of Indians and his body carried to his room and placed in bed. Nine or ten Indians were convicted of the crime and punished. Some died in jail.

In 1818 Monterey was raided by Argentine privateers and looted. Fearful that the pirates would cross the bay to Santa Cruz Mission, Father Olbes fled with his flock to Santa Clara. In his absence the mission was despoiled of everything that had not been buried by men working under direction of Comisionado Joaquin Buelna. The pirates could have done no worse.

SHIPS COME TO TRADE

With the coming in 1825 of Governor Echeandia, Mission Santa Cruz, as were the other California missions, was doomed. For more than a decade before that the mission had been compelled to furnish food and clothing to the Mexican troops, unpaid since inception in Mexico of the revolt against Spain. Santa Cruz Mission survived an attempt to suppress it in 1823 and the missionaries were forbidden to trade with vessels anchoring in Monterey Bay. In 1827 Santa Cruz was officially declared a port of entry and thereafter many ships stopped there and traded with the mission.

On August 22, 1834, Ignacio del Valle took charge of the mission as administrator under Governor Figueroa and on September 15th, Fr. del Real gave up his station. An inventory dated December 1, 1835, placed a value of $31,931 upon the mission and its property.

By 1842, the Santa Cruz Mission community was entirely broken up, the treasures and possessions of the mission had disappeared, the station was united with Branciforte, which de Valle in 1835 had named Pueblo de Figueroa, and the two communities were known as Pueblo de Santa Cruz. Father del Real remained as parish priest until 1844. Historian Bancroft says there is no record that any priest served the mission between 1844 and 1853, but Ernest de Massey, traveler and author, wrote that he called upon the padre in the mission in 1850. In 1853, the Rt. Reverend Jose Sadoc Alemany became Archbishop of San Francisco and revived Santa Cruz as a mission station, sending there Fr. Sebastian Filoteo.

This historical marker designates the site of Mission Santa Cruz founded in 1791

Santa Cruz Mission was returned to the Catholic church as represented by Archbishop Alemany and to his successors in trust by President James Buchanan on September 2, 1859.

In January, 1857, an earthquake crumbled the front wall of the mission building. Fr. Benito Capdevilla launched plans for rebuilding and on July 5th the cornerstone of the new church was laid and the structure itself completed a year later. The old mission gradually disappeared and the church of today, with many recovered treasures of the past, occupies part of the original site.

Visitors to Mission Santa Cruz coming from the north have the choice of several routes out of San Francisco to San Jose or Los Gatos, notably the Skyline Boulevard and El Camino Real, U. S. 101, thence over State Route 5 to Santa Cruz. From San Jose the motorist will follow Route 5 through charming Los Gatos and over the scenic mountain highway to Santa Cruz.

Visitors coming from the south will leave U. S. 101 at Salinas, go northwest through Castroville to Watsonville and thence 19 miles to Santa Cruz.

Mission visitors from the San Joaquin Valley will turn west at either Chowchilla or Califa and follow Route 32 west to Gilroy, thence westerly to Watsonville and then 19 miles north by west to Santa Cruz.

Santa Clara de Assisi
January 12, 1777

FOUNDED on January 12, 1777, Mission Santa Clara de Assisi today occupies the last of three sites chosen for it by its old padres. Originally established in the vicinity of Alviso near the Guadalupe River at a place called by the Indians Socoisuka, the mission was so severely damaged by floods in 1779 that it was removed in 1780 to a point just south of the Southern Pacific depot in Santa Clara. Here it remained until 1818. It had weathered the earthquake of 1812, but a second great temblor in 1818 so wrecked its buildings that it was reconstructed on its present site.

Fr. Junipero Serra had been desirous of founding Santa Clara years before the first mission was dedicated, but differences with Governor Neve and Captain Rivera y Moncada had delayed the event. The latter was stirred to action in September, 1776, when he received a letter from Viceroy Bucareli of Mexico in which the Viceroy clearly indicated that he believed Mission Santa Clara already had been founded.

Upon the receipt of this communication, Rivera hastened to make plans for the new station. Church goods and livestock were sent from San Francisco and from Mission San Carlos and Rivera followed with Fr. Pena. The site formally was claimed and dedicated and construction of buildings began at once.

MARAUDING NATIVES

At the outset, there were clashes with Indians of the vicinity who, having had their first taste of beef, developed such an appetite for it that they raided the mission corrals and stole cattle. Captain Moraga and a force of soldiers were sent for by Fr. Pena and the marauding natives were captured and punished, several being killed in combat.

Nevertheless, spiritual affairs progressed and by the end of the year a total of 67 baptisms had been recorded.

Following the floods of 1779, the padres began work on a new church, the cornerstone of which was laid with impressive ceremonies on November 19, 1781. The edifice was completed in 1784 and on May 15th of that year, Fr. Serra, assisted by Fathers Palou and Pena, proudly dedicated it in the presence of Governor Fages and Captain Moraga.

FATHER SERRA GROWS FEEBLE

This dedication was rather a sad one for the venerable Fr. Serra, Presidente of the Missions. He had made a farewell tour of his beloved Franciscan stations, fearing that his end was approaching. Indeed, at Mission San Gabriel the padres had been alarmed lest he die there before finishing his tour. The little Indian boys who served him at the altar while he was celebrating holy Mass at San Gabriel went to their padres with tears in their eyes and said: "The old Father wants to die."

However, Fr. Serra, past 70 years of age, made the long trip over the Mission Trail, arriving at San Carlos in January, 1784. The Fathers of Santa Clara had invited him to attend the dedication of their new church, the date of which had been fixed for May 16th. So Fr. Junipero began the arduous journey north on April 30th.

As he intended to dedicate the new house of worship on his return trip, he did not tarry at Santa Clara, but went

Little remains of Mission Santa Clara depicted here in the heyday of its prosperity

From Original Etching by H. Chapman Ford

Santa Clara University and this imposing church now occupy the site of the original Mission Santa Clara de Assisi

on to San Francisco, where he was received on May 4th by the faithful Fr. Palou. A few days later he was informed that Fr. Jose Murguia died on May 11th before he could witness the dedication of the church he had built and made the most imposing of any church building in California at that time.

Fr. Serra arrived at Santa Clara on May 15th and in the afternoon of that day he blessed the church and the following day, Sunday, he sang the High Mass and preached with exalted fervor. After holy Mass he confirmed all who had been prepared.

DEATH OF FATHER SERRA

The vigor of Fr. Serra rather surprised Fr. Palou and he suggested they return to San Francisco. But Junipero said he felt his strength failing and expressed a desire to prepare for death by making the last retreat at Santa Clara.

"Fr. Serra made the spiritual exercises for some days," Fr. Palou wrote, "and then he made a general confession, or repeated the one he had made at other times, while he shed many tears. Mine were not fewer, as I thought that this might be the last time we should see each other."

Completing his retreat, Fr. Serra returned to Mission San Carlos where, as we know, he passed to his reward.

Fr. Noboa succeeded Fr. Murguia at Santa Clara and his industry, coupled with the excellent soil and climate which the mission enjoyed, made Santa Clara second only to Mission San Gabriel in the amount of agricultural crops produced.

PROSPEROUS MISSION

In 1790, Santa Clara stood third in the number of converts and in 1800 it had the largest population of any of the Franciscan stations—1247.

Just three years before the establishment of the Mission San Jose de Guadalupe, on June 11, 1797, the eastern shores of San Francisco Bay were so little known that the missionaries at Santa Clara petitioned the commandante at San Francisco for permission to go into these lands in search of converts. They pointed out in November, 1794, that on account of a drought of that year and consequent shortage of food it would not be a difficult task to persuade the Indians in the unknown country to come to the mission.

Their request was refused, the commandante declaring that the country was "almost unknown, the natives perverse and the adventure too hazardous."

At the height of its prosperity in 1800 and for several years thereafter, the padres had considerable trouble with Indians at the missions and soldiers frequently were sent out to bring

in runaways and rebellious natives. In May, 1805, the priests had quite a scare. A story was brought to them that the Indians who had not been converted were planning a general massacre. A hurried call for help was sent to Monterey and San Francisco and troops hastened to Santa Clara from both presidios. However, an investigation proved that the wild yarn had been spread by certain neophytes who had hoped to escape floggings for misdoings by frightening the padres.

ATHLETIC PADRE

In between alarms during the troublesome decade following 1800, the priests found time in August, 1802, to consecrate with elaborate ceremonies a grand high altar brought from Mexico.

During this period, Fr. Viader, a powerful and athletic padre at Santa Clara gained no little renown. One night in 1814 he was attacked by a huge Indian known as Marcelo and two companions. The priest bested his three antagonists in a terrific rough and tumble fight and then forgave them. Marcelo became one of the Father's most devoted friends and followers.

The neophyte population in 1820 was 1357 and the mission possessed 5024 cattle, 722 horses and 12,060 sheep. By 1827, the population had reached its highest total of 1464. After that year the number of neophytes began to decrease and harvests of agricultural crops had dropped.

Fr. Viader's term of service with the California missions ended in 1833 after 40 years of missionary work and he retired to Mexico. He was succeeded by Fr. Francisco Garcia Diego, prefect of the Zacatecan friars, who later was to become the first bishop of California.

DECLINE OF MISSION

Santa Clara went through the same troublesome period following the advent of Governor Echeandia in 1835 that beset the other Franciscan missions and finally was secularized in 1837. Old Mission Santa Clara records reveal that in 1839-40 two-thirds of its cattle and sheep had vanished. By 1832 the neophyte population had been reduced to 1125, in 1834 it was 800 and at the end of the decade it had dwindled to about 290. The fall of this splendid missionary station was rapid.

A portion of the ancient adobe walls of Mission Santa Clara, which have been preserved down through the years

George Wharton James says that in July, 1839, a party of Indians called Yozcolos, doubtless after their leader, attacked neophytes guarding the Santa Clara wheatfields, killing one of them. The natives were pursued and their leader killed. The head of Chief Yozcolos was placed on a pole and this act seems to have discouraged attacks for some time.

"In December of the same year," says James, "Prado Mesa made an expedition against gentile thieves in the region of the Stanislaus River. He was surprised by the foe, three of his men killed, and he and six others wounded, besides losing a number of his weapons. This Indian success caused a great alarm, and a regular patrol was organized to operate between San Jose and San Juan Missions for the protection of the ranchos. This uprising of the Indians was almost inevitable. Deprived of their maintenance at the missions, they were practically thrown on their own resources, and in many cases this left them a prey to the evil leadership of desperate men of their own class."

RUIN COMPLETED

When Governor Micheltorena in March, 1843, ordered the missions returned to the padres, the friars at Mission Santa Clara endeavored to reassemble their flocks and herds, but found that they had been entirely dissipated by civil government authorities. Micheltorena's efforts to help the missions proved in vain.

The ruin of Santa Clara was completed under Governor Pio Pico. An inventory ordered by Pico placed a valuation of $16,173 on the mission and its property. On November 29, 1777, the pueblo of San Jose had been founded and there was constant friction between the padres and the town officials. As late as 1845 we find the resident missionaries complaining that the Indians had been demoralized by whiskey furnished them in the pueblo.

Mission Santa Clara became a parish church with Fr. Real in charge and in 1846 he was authorized to sell certain mission lands to pay debts and support himself. Settlers took possession of the mission but Padre Real obtained an eviction order.

On March 19, 1851, Santa Clara College was established in the old mission buildings. The college grew so rapidly that the mission structures were entirely renovated and enlarged so that little of the old church remains. In 1861-62 when restoration work was in progress the nave of the mission was allowed to remain, but later it was necessary to remove it. The reception room of the college today is a part of the old cloisters. Two of the three original mission bells remain.

The olive tree in the center foreground was planted by the padres when Mission Santa Clara was founded

Mission Santa Clara is in the city of that name three and one-half miles north of San Jose on U. S. 101. It is easily reached by mission motorists coming either from the south or north. Visitors from the San Joaquin Valley may follow State Route 32 from Chowchilla or Califa west to Gilroy, then north 9 miles to Morgan Hill, thence 20 miles north to San Jose. Or the route from the valley may be from Stockton by State Route 5 to Livermore, thence over Route 108 to Mission San Jose and south through Milpitas to Santa Clara or San Jose.

The mission is on the main street car line from San Jose to Santa Clara.

Next—Mission San Jose de Guadalupe and Mission San Francisco de Assisi.

HAMILTON P. PENN DIES SUDDENLY

At the moment that the annual convention of Associated Equipment Distributors in session in Chicago was installing F. B. McBath of Portland, Oregon, as his successor as president of the organization, Hamilton P. Penn, 51, widely known in the heavy construction machinery industry and State highway department circles throughout the country, died suddenly on Thursday, January 31, in the Edgewater Beach Hotel in Chicago.

New Sacramento River Bridge at Rio Vista Built at Cost of $727,858

By J. O. JAHLSTROM, Bridge Construction Engineer

REPLACEMENT of critical bridges on the State Highway System with structures capable of carrying legal loads and of adequate roadway width is one of the vital problems in the building of State highways to satisfactory modern standards.

The new Sacramento River bridge at Rio Vista, which was opened to traffic January 12, 1946, has been for years on the critical bridge list. The substandard roadway width, 18 feet 4 inches on the concrete portion and 20 feet 8 inches on the timber approach together with deterioration of the timber in the "A" frame trusses placed this structure among the top group of bridges needing replacement after the war emergency. The bridge was posted for speed in 1938 and had to be reposted for both load and speed in 1942 due to the weakened condition of the "A" frame trusses.

In 1944 the decay of the timber had reached such an extent that it was feared the bridge could not safely carry traffic until it could be rebuilt after the war. The increased importance of this bridge to the war effort made it imperative that the timber approach be reconstructed as soon as possible. This bridge is the only crossing over the Sacramento River on a through route south of the city of Sacramento. Failure of the bridge would have caused a long and costly detour of traffic.

OLD BRIDGE BUILT IN 1918

The old bridge was built in 1918 by Sacramento and Solano Counties at a cost of $261,238. In 1921 the bridge was taken over by the State when Route 53 was taken into the State Highway System.

Replacement of the east approach was required in 1927 due to flood damage to the short span timber trestle.

The reconstructed approach consisted of 41 40-foot "A" frame timber spans supported on five pile bents. Piles were treated Douglas Fir, 80 to 85 feet in length with 40 feet of penetration into the river bed. The work was completed in 1928 at a cost of $70,221.

Since 1928 the State has spent a total of $185,000 on repairs and improvements to the old bridge.

Various designs were made for the new approach. Steel stringer spans on concrete piles were considered at first. This design offered the advantages of fast construction and economy of cost. A serious disadvantage was the relatively short spans that would have been necessary in this type of design. The Sacramento River carries a large amount of drift and debris and a bridge at this location if built with short spans, particularly on pile bents, would be in danger of being destroyed.

DRIFT HAZARD REMOVED

A few years ago the present timber approach had such an accumulation of debris lodged against it that several spans were pushed downstream to such an extent that the bridge was closed to traffic. Each year, during periods of high water, the State maintenance crews stand by and remove the accumulations of drift that lodge against the present bridge.

A design was finally adopted that eliminated the hazard of drift and which would also fit in with the design of an entire new bridge for this crossing.

The final design is for 180-foot steel truss spans on concrete piers with steel pile foundations. The work completed at this time consists of seven truss spans of the proposed new bridge and seven 40-foot steel beam spans on timber pile bents. The short beam spans provide a connection between the new steel truss bridge section and the concrete section of the old bridge until such time as the new bridge can be fully completed. Under wartime restrictions it would have been impossible to secure the necessary material and equipment for the movable span of the new bridge.

The Sacramento River at this point is an important river arterial. Dur-

F. W. PANHORST NOW DIRECTOR OF A. S. C. E.

AT its annual meeting in New York January 14 and 15, the American Society of Civil Engineers elected Frederick W. Panhorst, Bridge Engineer of the California Division of Highways, a director of the society. Mr. Panhorst was elected an associate member in 1923 and member in 1933. For the last three years he has been chairman of the local membership committee for this area. In 1944 he was elected to the executive committee of the structural division; on which western representation has been rare. Mr. Panhorst is Past President of the Sacramento Section of the society.

Born in Andrain County, Missouri, Mr. Panhorst graduated from the University of Illinois in 1915, where he received his B.S. in civil engineering and later his C.E. degree. His early experiences included land surveying, mine surveying, construction of railroad bridges and mill building design. Two years after graduation from college, he came west as a naval architect for the Puget Sound Navy Yard in Bremerton. Later he return to the M. K. & T. R. R. as an assistant bridge engineer. In 1920 he went to Anaconda, Montana, where he designed several complete copper smelting plants for the Anaconda Copper Company for construction in South America. From 1921 to 1927 he was in charge of construction of several large bridges for the State of Washington.

Mr. Panhorst came to California in 1927 as Construction Engineer for the Bridge Department of the Division of Highways. In 1931 he was appointed Acting Bridge Engineer and has been Principal Bridge Engineer since 1936. He is an active member of the Structural Engineering Association of Northern California.

ing the war the number of bridge openings has been less than for the immediately preceding years. The amount of river traffic is better realized from the fact that 468 openings were required in one month last year. The proposed new deep water ship channel to Sacramento will undoubtedly increase the river traffic emphasizing further the importance of this bridge which must provide not only good highway but also good river traffic facilities.

The trusses of the new bridge are of the Warren type with verticals. The feature of the design is the appearance of the bridge as one continuous truss. The spans are alternately anchor and suspended spans, the symmetrical arrangement being provided by false members in the top chord at the ends of the cantilever arms of the anchor spans. This symmetry of design was effected by providing sliding pin assemblies at the connection of the suspended spans to the cantilever arms of the anchor spans.

TRUSS MOVEMENTS

Normally the movement due to expansion and contraction of trusses is taken care of at one end of a truss. This requires a fixed and an expansion shoe bearing at each pier. In this bridge the truss movements are taken care of at the panels where the sliding pins are located. Expansion joints in the concrete deck are provided at the pin panel points. With this design only one truss bearing shoe is required, effecting a large economy not only in truss bearings but also in the concrete piers.

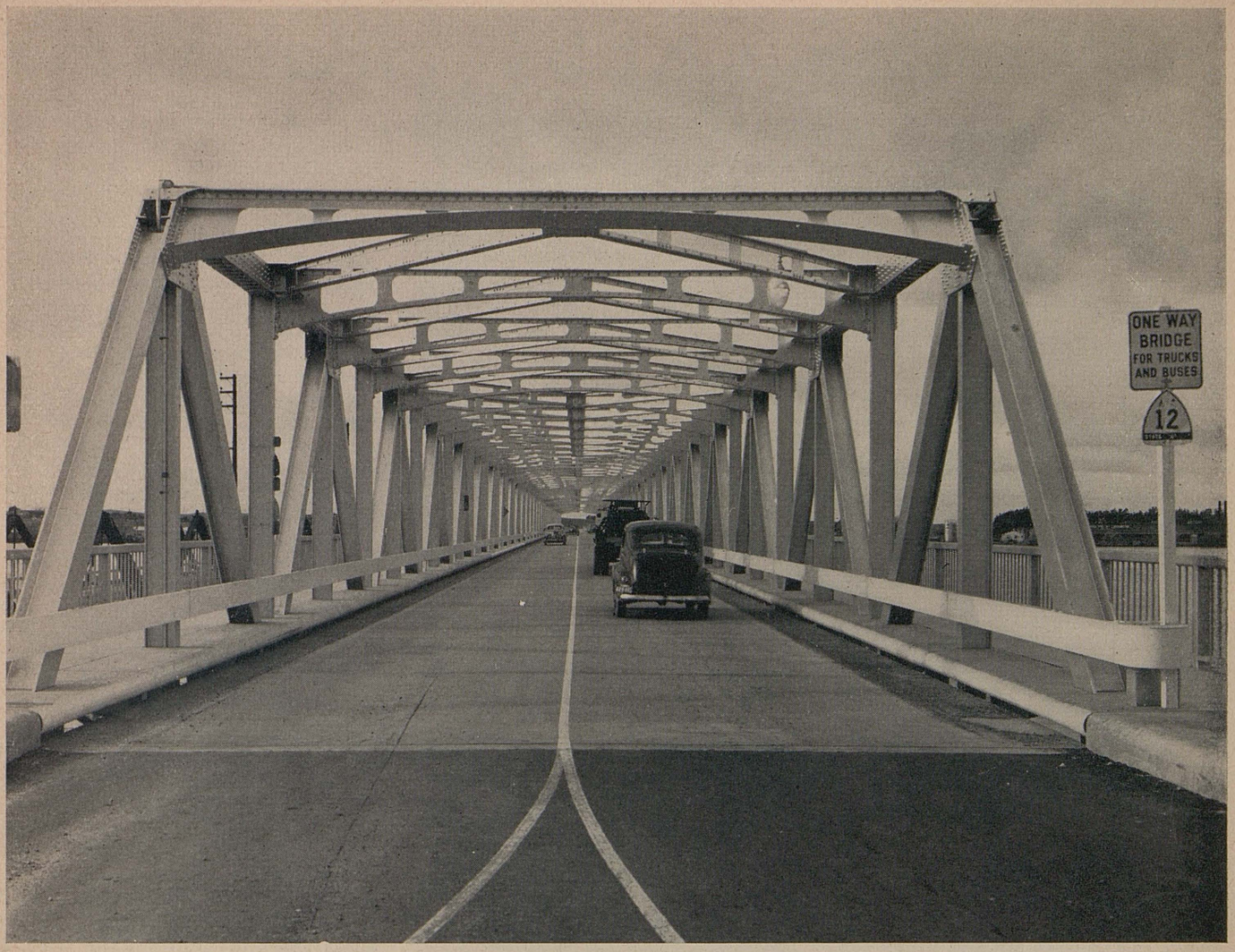
The bridge piers consist of two circular concrete shafts connected with a web wall near the top. The concentric columns have an 8-foot diameter at the base, 5 feet at the bottom of the webwall, tapering to 4 feet 6 inches at the top. The footing block is 14 feet in diameter and 12 feet in thickness with a 9-foot tremie seal. The piers are an economic and well balanced design enhancing the general appearance of the bridge.

Truss details were designed with the basic idea of economy and appearance. The arched portals, K type lateral bracing, use of rolled sections and the triangular motif give the trusses a simple and graceful outline of good appearance yet of economical proportions throughout.

An S20-12 live load was used in the design of the bridge. Allowable unit stresses were: concrete 1,000 psi, steel 18,000 psi and $n = 10$.

The clear roadway width of the new bridge is 26 feet compared with

This photograph shows the striking contrast between the new and the old highway bridge across the Sacramento River at Rio Vista



A 26-foot roadway on the new Rio Vista Bridge allows ample room for passing traffic

20 feet 8 inches on the old bridge. The new bridge has two 4-foot sidewalks. There were no sidewalks on the old bridge.

In the construction of the piers a heavy steel sheet pile cofferdam was used for each pier shaft. Guide frames for the sheet piles were steel, pre-fabricated and held in position by temporary timber piles driven inside the cofferdam area. Sufficient cofferdam material for two complete piers was furnished which enabled the contractor to carry out a successful substructure program.

INGENIOUS METHOD

The contractor used a rather ingenious method in driving the steel H piles. A steel pipe, slightly larger than the steel H pile, was used as a guide for the piles. To locate the pile accurately, a coordinate frame arrangement was attached to the top of the sheet piles. The pipe was set for several feet in the sandy bottom and held in place by the frame at the top. The steel H pile was then placed inside the pipe and driven to grade by means of a specially constructed steel H pile follower.

Conventional methods were used in the erection of the structural steel. Timber piles framed into towers supported the steel during erection. A delay in steel shipment slowed up the work for several weeks. Except for the delay in steel delivery, rapid progress was made in the steel erection. Several spans were put up in less than a week per span.

An interesting feature of the bridge is the full length scuppers for deck drainage. This clear opening was provided by stopping the steel curb plate 4½ inches above the concrete roadway surface.

The vertical surfaces of the curbs and skid girders facing the roadway are painted white for better visibility at night. Other steel areas have an aluminum finish coat, the lustre of which sets off distinctly the steel members and details.

The major quantities of work were:

Structural excavation	2,500	cu. yds.
Class "A," footing block concrete	1,015	cu. yds.
Class "A," structural concrete	2,090	cu. yds.
Structural steel	3,285,000	lbs.
Steel piles (406)	19,040	lin. ft.
Reinforcing steel	320,000	lbs.

The contract for the bridge was awarded to Lord and Bishop and A. Teichert and Son, Inc., for the bid price of $727,858. Erection of the structural steel was sublet to J. H. Pomeroy and Co. Work was started on November 29, 1944, and completed on January 25, 1946.

ANGELES CREST HIGHWAY

By J. D. GALLAGHER, Associate Highway Engineer

This is the fourth in a series of articles on Highways of California by Mr. Gallagher.—Ed.

THE ANGELES CREST

That section of the San Gabriel Range of the Sierra Madre between the Verdugo Mountains and San Gabriel Canyon has long been a recreational area for the few who would venture into its rough and rugged isolation. Lying to the north of the foothill towns of Pasadena, Monrovia, Azusa and Glendora, these timbered mountains separate the fertile area east of Los Angeles from the arid Mojave Desert on the north.

This territory is a portion of the Angeles National Forest which comprises a total of 645,000 acres of these southern mountains. A large part of the area is 4,000 feet or more in elevation with many peaks reaching altitudes of between nine and ten thousand feet. For many years the section was largely inaccessible except by foot or horseback. The only roads of a public nature to this potential recreational area were 12-foot Forest Service trails constructed for fire protection purposes. Approach to these trails could be made only from the northerly or desert side of the mountains.

On the southerly side a few more or less primitive roads had been constructed up various canyons but they would dead-end when construction operations became difficult. Such roads extended into the Arroyo Seco at Pasadena, Santa Anita Canyon north of Sierra Madre and into the larger San Gabriel Canyon. The only real access from the south was by means of the narrow, steep and crooked toll road from Altadena to the top of Mt. Wilson and thence via a 26-mile narrow road built under a joint agreement between Los Angeles County and the U. S. Forest Service from Mt. Wilson via Red Box, Barley Flat and Chilao Flat to Buckhorn Flat. Although this route led through the Pasadena playground, because it was narrow and crooked, and the toll portion was operated under one way controls, relatively few motorists made use of it.

ANGELES CREST HIGHWAY

In 1929, the Division of Highways began construction on a projected State highway through this scenic area. The proposed routing involved development to State highway mountain standards from the Foothill Boulevard at La Canada through the upper Arroyo Seco into the higher elevations behind Mt. Wilson and on to Big Pines Camp. Similar development was projected, from connection with the Foothill Boulevard at Azusa up the San Gabriel Canyon through the Los Angeles County playground at Crystal Lake Park to a connection of the two highways on the northeasterly side of Mt. Islip. The new routing through the Forest was dubbed the "Angeles Crest Highway" and, when complete, the crescent between La Canada and Azusa will cover a distance of about 65 miles.

The first contract in 1929 covered the grading of 2.7 miles up the canyon from La Canada. This was followed in 1930, 1931, and 1933 by additional grading contracts which carried the highway 10.5 miles farther past Colby Canyon, to the Mt. Wilson Road at Red Box. Additional contracts for building bridges across La Canada and Fern Canyons were carried on simultaneously and contracts for oiling the roadbed surface followed the grading. During the depression years of 1931-32 and -33 the contract construction was supplemented by the work of free labor camps which were operated for unemployed men.

GRADE BUILT TO ISLIP SADDLE

In 1935 the State established a prison labor camp for construction operations on the nearly 20 miles from Red Box to Mt. Islip. This prison camp construction was continued at the higher elevations of the route until the operations were suspended in 1942 as unessential to the war effort. The first camp was established at Angeles Crest about 14 miles northeast of La Canada. A second camp was built at Chilao Flat and the Angeles Crest camp was later moved up to Cedar Springs. The highway constructed by the men from these camps is located at elevations from four to over seven thousand feet. At the time work was suspended the grade had been built to within less than a mile of Islip Saddle.

A small mileage of the route easterly of Red Box was constructed by the Public Roads Administration with U. S. Forest funds.

It is anticipated that when operations are resumed construction will push on to the east down the Swartout Valley through Big Pines Camp to a connection with the Lancaster Cajon Pass highway in San Bernardino County. It is also planned to complete, as soon as possible, the connection on the four miles between Islip Saddle and the San Gabriel Canyon highway at Crystal Lake Park. The latter proposed unit will close the circuit on this mountain highway between La Canada and Azusa.

SAN GABRIEL CANYON ROAD

Construction of the San Gabriel Canyon Highway under cooperative agreements between the State and the U. S. Forest service has been in progress concurrently with the Angeles Crest development.

Glib narration of the completion of one contract after another and of the eight years of prison labor work is not, however, indicative of the magnitude and difficulties encountered in building of this mountain highway. The grading on all sections was heavy rock construction with excavation quantities running into hundreds of thousands of cubic yards per mile and station yards of overhaul reaching more than a million for each of many miles.

For instance, on the contract for the four miles between Colby Canyon and Red Box the excavation totaled well over nine hundred thousand cubic yards and required more than 5,000,000 station yards of overhaul. In addition to the large quantities, the material was largely rock, as evidenced by the fact that, between Cedar Springs and West Islip Saddle, 80 per cent of the material had to be blasted.

Just westerly of Islip Saddle, where the line passed around a southerly shoulder of Mt. Williamson it was

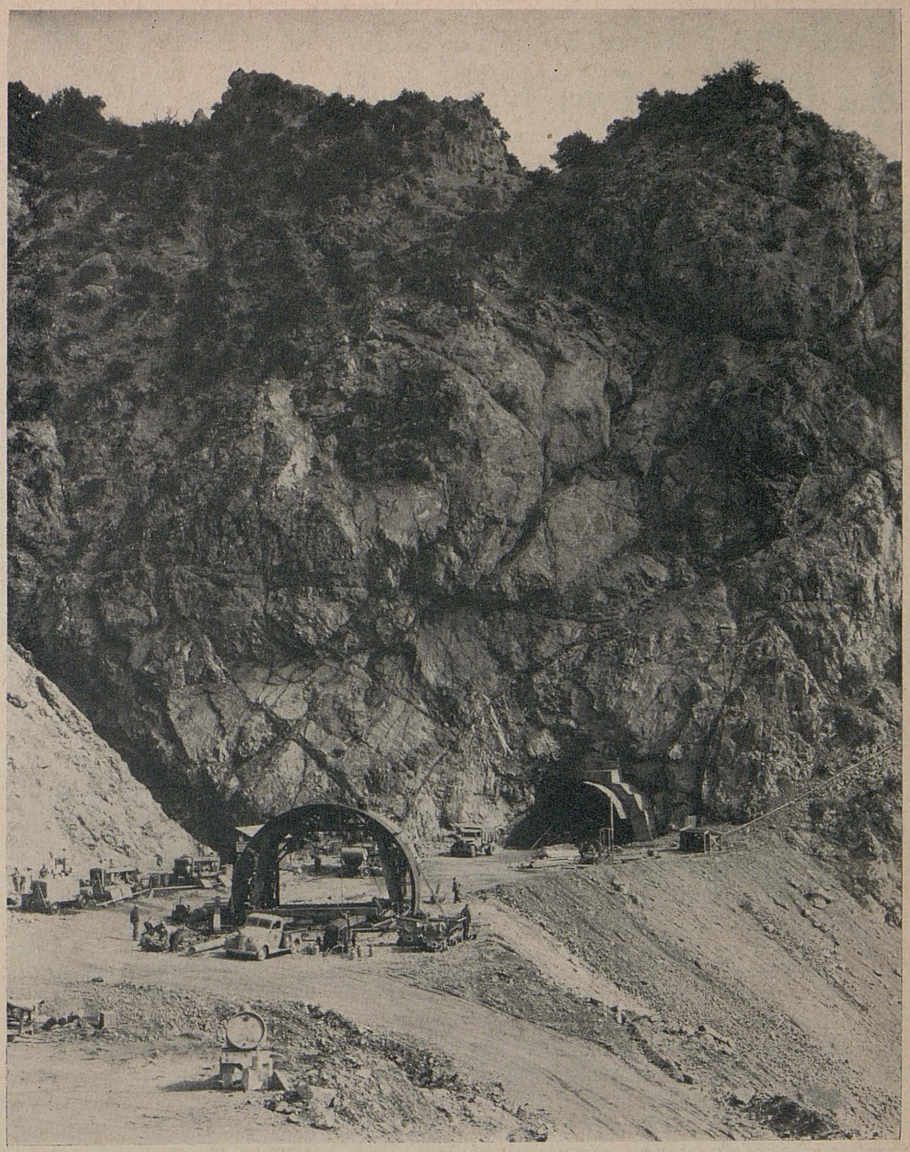
necessary to bore two tunnels through precipitous portions of the mountainside. To avoid building construction roads around the tunnel sites, a small pilot drift nine feet wide and ten feet high was rapidly bored at the crown of Tunnel No. 1. Air lines and drilling equipment were passed through this drift and excavation immediately started on the No. 2 bore. Thus it was possible to conduct full dimension operations on the two tunnels almost simultaneously.

During the period of building the Angeles Crest, difficulties other than those presented by construction were encountered. The historical storms of December, 1937, and March, 1938, which spread destruction throughout Southern California, did not spare the Angeles Crest from damage. At the lower elevations of the route the torrential rains washed tons of brush and debris down almost every depression, clogging drainage structures and backing up water behind the fills with the result that water washing across the road badly eroded many fill slopes and in some instances washed out the fill completely. An expenditure of $112,800 was required to restore the damaged portions of the roadway on 17 miles between La Canada and Tujunga Saddle; $140,900 was expended for erosion control and repair of storm damage easterly of Red Box.

PICTURESQUE PLACE NAMES

When the War Production Board's order to cease operations was received in 1942 construction had been completed on more than 35 miles from La Canada to Islip Saddle. During the 13 years between 1929 and 1942 the Division of Highways expended $3,177,000 on construction of the Angeles Crest Highway. In addition to this sum, the cost of the work performed by the Public Roads Administration for the U. S. Forest Service amounted to $887,600.

Interesting phases of the Angeles Crest Highway include the picturesque place names which have been given to the many features of the terrain. Such names as "Pinyon Flats," "Horse Flats," "Mt. Disappointment," "Buckhorn Flats," and "Chilao Flats," "Cloudburst Summit," "Fern Canyon," and "Cedar Springs" all seem to give a tang of the frontier to these mountains. The name "Red Box" is more prosaic, as this label came from the large box in which the Forest Service kept its fire-fighting tools and equipment.



Concrete tunnel lining form in course of construction for portal of tunnel No. 1 (in background) through Mt. Williamson on Angeles Crest Highway

While the desert side of the San Gabriel Range has always been rough, wild, and isolated, there have been a few rugged individualists who called it home. Near the Chiloa campgrounds, the Angeles Crest Highway passes through the property of one of these hardy frontier men—the Newcomb Ranch. This 160-acre ranch was homesteaded in 1878 by Lewis Newcomb, and is the only privately owned land in this part of the Angeles Forest. Because of his knowledge of the passes and trails, many of which he first located and constructed, he was appointed one of the first forest rangers in the country, when the National Timberland Reserve was organized.

Two More States Pass Gas Tax Protective Acts

Kentucky and Pennsylvania, in the November 6th election of last year, joined the growing list of States which are safeguarding their highway revenues by constitutional amendments which prohibit the use of motor vehicle taxes for nonhighway purposes.

The successful campaign in Pennsylvania was under the sponsorship of the Pennsylvania Good Roads Association whose public education activities for this amendment resulted in a vote of almost seven to one for its enactment.

Postwar Highway Projects Advertised at the Rate of Two Million Dollars a Week

(Continued from page 1)

State Highway Engineer George T. McCoy and Assistant State Highway Engineer Fred J. Grumm have attended many meetings of the Joint Fact-Finding Committee on Highway Streets and Bridges. Left to right: Mr. McCoy, Senator Randolph Collier, Chairman, and Speaker of the Assembly Charles W. Lyon, Member, and Mr. Grumm

tration for their approval. The remaining 15 are in various stages of processing and review.

The Division of Highways has made an extensive study and appraisal of the 14,000-mile State Highway System and its current physical condition and capacities in the light of present and estimated traffic. From this study, it has developed that correction of the critical deficiencies of State highway facilities will require expenditures in the amount of $695,000,000 for construction, reconstruction and freeway development.

The projects included in the postwar program were selected as those most needed in a start towards correction of these critical deficiencies.

The $115,000,000 postwar program calls for construction and reconstruction of about 600 miles of State highways, approximately 180 new bridges, and 150 highway and railroad grade separations. The majority of grade separation structures are units in freeway development. The total estimated cost of bridges and grade separation structures will account for about one-fourth of the total program expenditures.

The program as adopted by the California Highway Commission is flexible and may be expanded by addition of other critical projects should revenues exceed present estimates.

For this first postwar year the Highway Commission approved an initial partial program totaling $40,000,000 in estimated construction cost. The projects in this initial program were selected from the total program and included the most critical, for which preparation of plans and right of way acquisition were sufficiently advanced for early advertising. In addition to such projects from the postwar program, there are included a number of bridge reconstruction jobs, which, under California statutes are specifically financed from Diesel tax funds.

This initial program provides for construction of approximately 200 miles of State highway on both primary and secondary roads, located in both urban and rural areas and distributed throughout both northern and southern sections of the State. There are included five railroad grade separations and 48 highway grade separation structures, most of the latter being units of freeway development in the urban areas of San Francisco, Los Angeles and San Diego. The program also includes 80 new bridges, which together with the grade separation structures comprise about ten million dollars of the $40,000,000 total for the first postwar year.

(Continued on page 30)

A. M. Nash Returns To Headquarters In Sacramento

CONTINUING the steady advancement that has been his in the Division of Highways since he entered State service in January, 1920, as an engineering draftsman, A. M. Nash has returned to Headquarters in Sacramento as Engineer of Surveys and Plans of the division. Since September, 1942, Mr. Nash has been District Engineer of District I with headquarters at Eureka.

Mr. Nash has been succeeded as Distract Engineer by George F. Hellesoe, Senior Highway Engineer, who was transferred from District IV in San Francisco.

In January, 1924, when District X was organized, Mr. Nash was employed there in field and office work until 1934 when he came back to Headquarters as Assistant Office Engineer. He filled this post and later that of Assistant Engineer of Surveys and Plans until February, 1942, when he was transferred to District IV in San Francisco as Assistant District Engineer.

Mr. Hellesoe joined the Division of Highway in April, 1918, after service in the army in World War I and with the Alaskan Engineering Commission in Alaska. He served the old U. S. Bureau of Public Roads in Colorado from 1920 to 1925 and returning to California served as District Maintenance and District Construction Engineer from 1920 to May, 1931, when he became Senior Highway Engineer in District I. In July, 1939, he was transferred to District IV, San Francisco, going from there to his new position at Eureka.

San Francisco-Oakland Bay Bridge Peak Traffic Creates Problems

AN outstanding fact in the operation of the San Francisco-Oakland Bay Bridge in 1945 was the high intensity of traffic, especially during the period following the discontinuance of gasoline rationing. Even under the wartime gasoline restrictions during the first 7½ months of the year, the traffic was at a high level; but on August 15th it increased literally overnight from 61,000 to 71,000 vehicles a day. A new peak for a single day's business was reached on October 15th, the day Admiral Halsey's Third Fleet arrived in San Francisco Bay, when 78,646 vehicles crossed the bridge.

The heavy traffic of itself created a problem on the bridge because of its increased concentration during peak hours. The difficulties of handling the traffic, however, have been accentuated by other factors, the most serious being the large number of vehicles which become stalled on the bridge. About a third of these are automobiles out of gasoline. At least another third are in mechanical difficulty requiring tow service. Tire trouble, miscellaneous difficulties and mishaps account for the remainder.

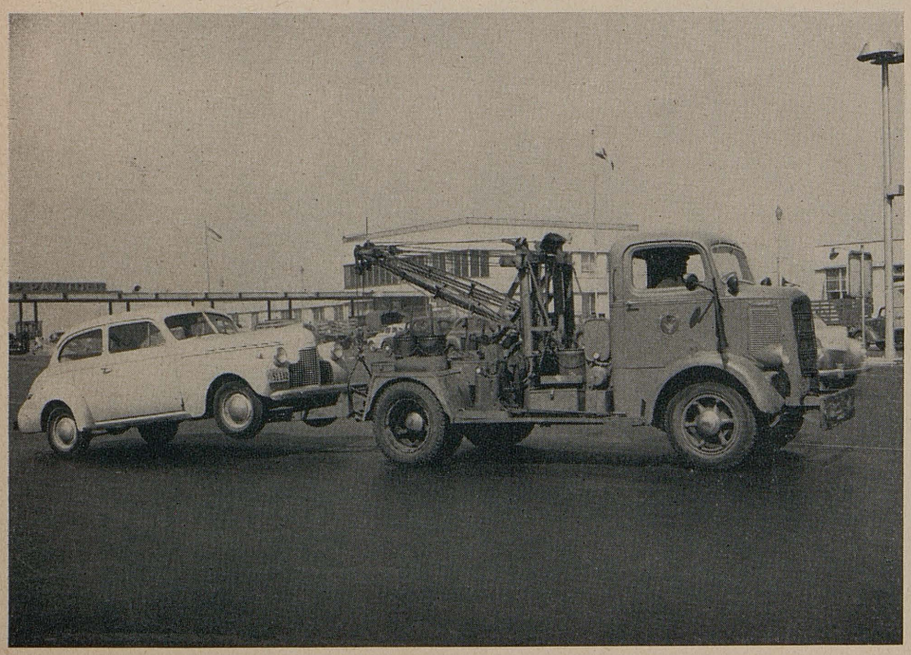
Upholstery fires are just one of the many reasons for calling for emergency service

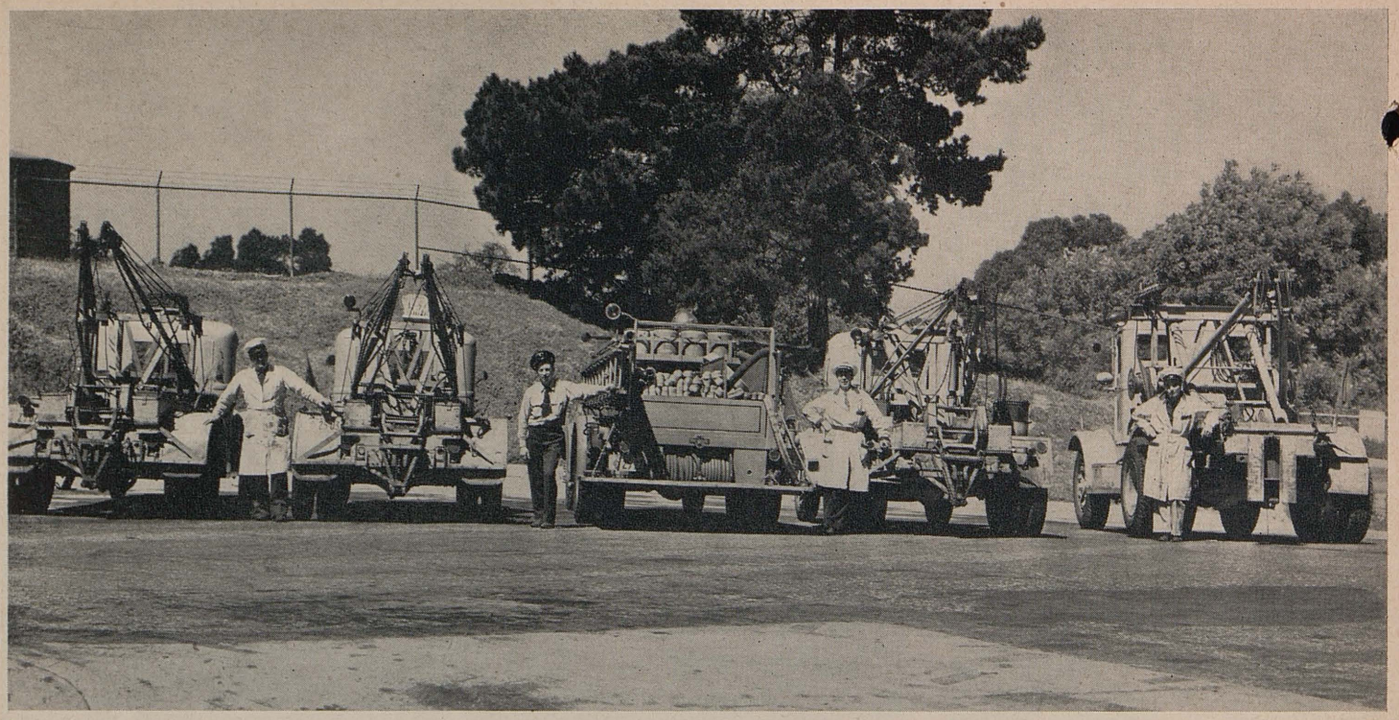
The bridge maintains an emergency service 24 hours a day to serve vehicles in distress. Until a few months ago the equipment for this service consisted of a fire truck, a heavy tow truck and three light tow trucks. To meet the needs resulting from the large increase in traffic, three additional tow trucks were ordered in October and delivery is expected as soon as automobile production conditions will permit. In the meantime, the service has been augmented by the use of four pickup trucks assigned to patrol the upper deck during the evening peak hours and equipped to furnish gasoline, change tires, or render other assistance short of towing. These extra trucks have aided materially in reducing traffic congestion and delays.

Other steps to improve the emergency service are under way, including the installation of radio equipment in the tow trucks to provide more rapid communication. Plans for enlargement of the Toll Plaza are progressing and construction of the additional facilities will be started in the near future.

In spite of the great increase in traffic, the Bay Bridge has continued to maintain a low accident record.

Cradle attachment on light tow truck provides quick hook-up for automobile towing





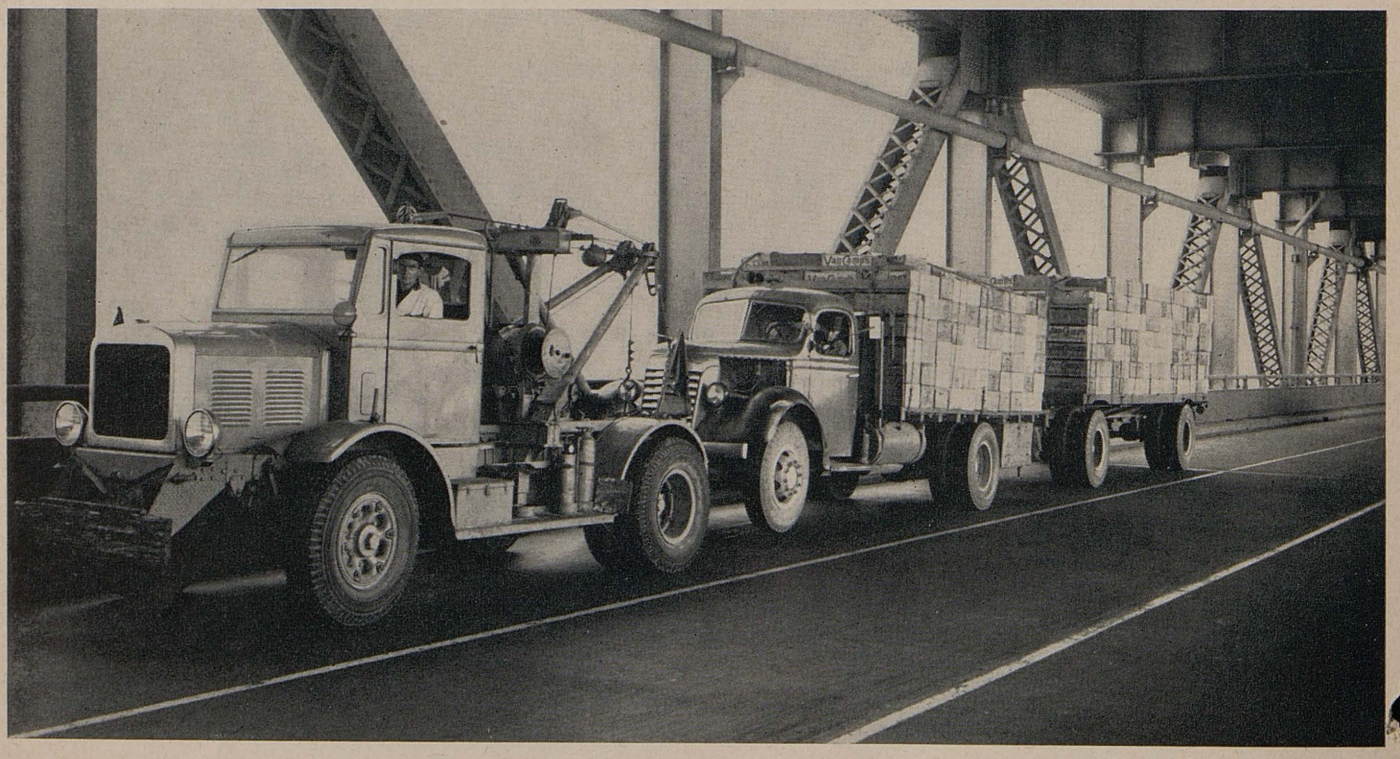
Four tow trucks and a fire fighting truck. These emergency units are ready day and night to serve patrons in trouble on the Bay Bridge

The heavy traffic on the bridge has created a public demand for a second bridge across the bay. Preliminary engineering investigations for such a bridge have been authorized and ordered by the California Toll Bridge Authority and are now in progress.

As in the preceding years of war, maintenance and operation of the Bay Bridge were handicapped in 1945 by the continued shortage of personnel. Toward the close of the year, however, this situation was relieved to some extent by the return of a number of former employees who had been absent

(Continued on page 36)

Four wheel drive heavy tow truck renders tow service to heavily laden truck and trailer on Bay Bridge



Bridge Maintenance Practice On California Highway System

By MERLE E. FISCHER, Associate Bridge Engineer

THERE are 4,636 bridges on the California State Highway System omitting culverts. Of this number 3,142 are built of steel and concrete, 1,394 of timber or steel with timber approaches and 100 are steel bridges with timber deck systems. The estimated value of these bridges exclusive of State-owned toll bridges is $125,000,000.

The protection of this investment and the maintenance of the bridges in such condition that they will best serve the traveling public is a duty of the Bridge Department of the Division of Highways. Within the Bridge Department, maintenance work is handled directly by the Maintenance and Research Section. Methods of repair and maintenance as developed and field tested by this section over a number of years have included several practices that are worthy of note and should be of interest to the engineers and construction men engaged in this work throughout the Country.

There will be no attempt made to enumerate all maintenance problems encountered, but the more important features of the work, with illustrations, will be covered in a series of articles, of which this is the eighth. It deals with Expansion Detail Failures.

ALMOST troublesome and costly item in the maintenance of bridges is the repair of a failed expansion detail. Expansion joint failures arise not only from movements due to temperature changes, but from pier and abutment movements resulting from scour and settlement and, in some cases, by earth pressures against the abutments and piers.

Provisions for expansion on structures within the State Highway system may be classified into four types as follows:

1. **Rollers or rockers.**
2. **Sliding plates (2- and 3-element setups).**
3. **Building paper, asbestos packing or other light material.**
4. **Sliding granite or marble blocks.**

With but few exceptions, the standard roller or rocker assemblies used on the larger and heavier structures give little or no trouble when movements are kept within the limits of design of the assembly. There have been instances, however, where unexpected pier movements occurred because of the pressure of the approach fill on one side of the pier. Where these movements exceed the limits of the assembly, damage to the rockers occurs. Repairs are made by jacking the structure free of the rockers and moving the bearing plates to new positions. This is sometimes difficult to do first, because the designer has often failed to provide means for jacking the structure and second, because the pier top is sometimes not constructed with sufficient width to allow for a great deal of shifting of the masonry plate. If the masonry plate is shifted too close to the edge of the pier, there is the ever-present danger of the pier top spalling.

CUMBERSOME ROCKERS

One small but important problem encountered when jacking a structure of this type is how to pick up the weight of the rockers in order to move the masonry plate. These rockers are usually very heavy and cumbersome, as may be seen in **Picture No. 1.** In this particular assembly, holes were drilled and tapped in the rockers and sole plate. The holes in the rockers may be seen in the photo. Short steel straps connected the rockers to the sole plate, and in jacking the structure the rockers were lifted at the same time. Although handled without too much difficulty in this instance, provisions to allow the raising of the entire assembly should be incorporated in the design.

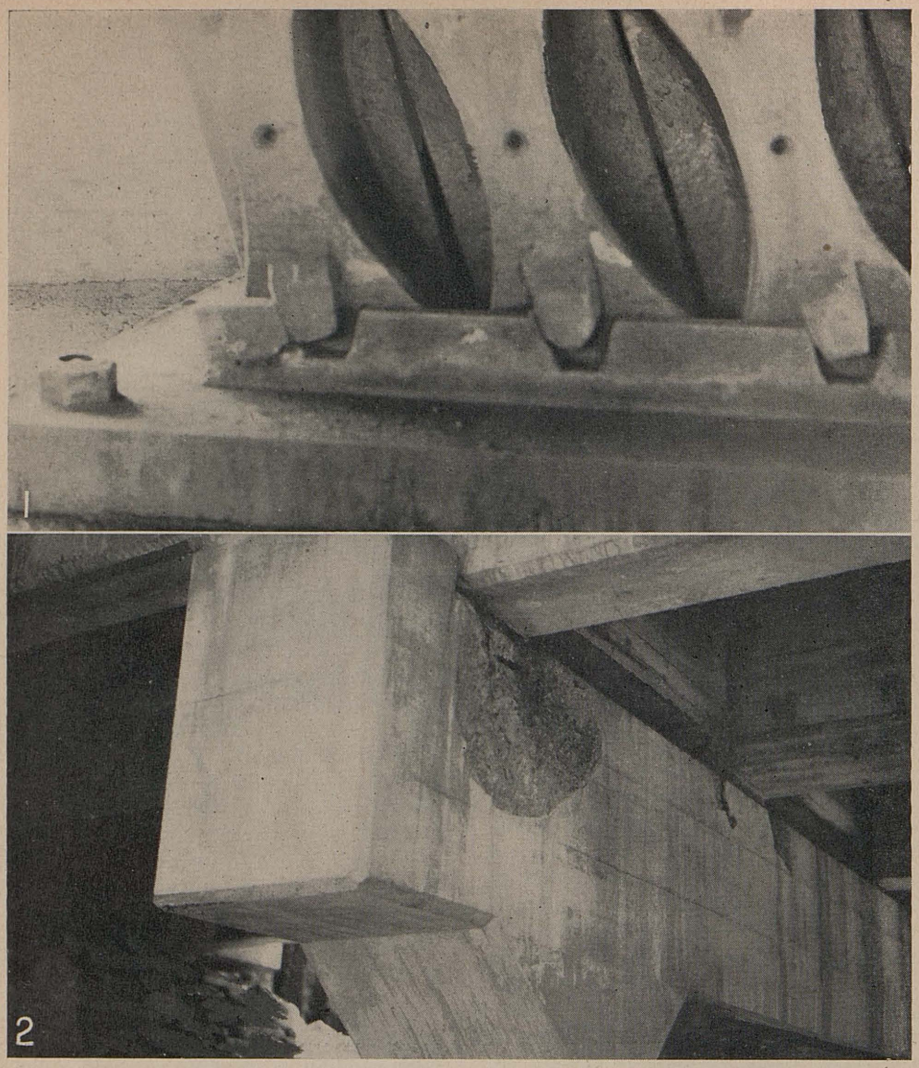
The use of steel or bronze expansion plates for concrete girder structures, a standard type of construction in the 20's and 30's, is the cause of considerable trouble in many structures. Inaccurate placing of the plates or improper placing of the concrete results in the spalling of the edges and sides of the cap or bridge seat. Freezing of the plates does not cause trouble if the cap is properly reinforced under the bearings. However, in the usual failures found, the cap was not properly reinforced and spalling resulted.

A specific example of the results of improperly placed concrete may be seen in **Picture No. 2.** The concrete was carelessly allowed to be built up above the sliding plane resulting in the spalling shown. This spalling generally starts in a small way, as may be seen under the far girder, and continues to progress to the size shown under the near girder. In some instances, not in evidence here, the girder bearings are found to be too long. Girder deflection results in edge bearing and subsequent similar spalling of the edges of the cap.

INTERESTING PROBLEM

The Bear River Bridge on State Highway Route 3 south of Wheatland presented an interesting problem. The structure consists of 57-foot, 5-inch reinforced concrete, two-girder spans with a total length of 690 feet. It was built in 1915. Sliding plate expansion joints were provided at the ends of every third span. These plates froze and because of weaknesses in design of the bearings considerable spalling of the concrete resulted.

Picture No. 3 shows a view of the flexible piers that were installed at one of the joints in 1921. Since failure occurred at the bearing seat, the existing pier was rendered useless unless a great deal of extra work was done. By putting in the extra wall piers, it was not necessary to put in any shoring. This type of joint was used on the two higher piers. At the locations where the piers were not as high, the existing pier was widened out at the top, the girders were notched the same as for the flexible walls and steel rockers were placed. No further troubles have developed since.



Upper—Damage to expansion assembly resulting from excessive pier movements. Lower—Spalled areas under expansion plates

During the past 10 years it has been the practice to place 1/16-inch asbestos packing between S. A. E. No. 64 leaded bronze expansion plates. Such provisions for expansion were usually placed on concrete structures of spans up to about 40 feet. Recently the Materials and Research Laboratory made an investigation of the condition of the packing material. Of the various structures investigated and from the actual removal of the packing from one, it was concluded that when properly installed, packing of the type used in constructions of the nature described may be expected to function indefinitely.

BRONZE PLATES HOLD UP

There was no evidence of any tendency for the packing to work from between the plates nor was there any evidence of deterioration other than the relatively small amount of abrasion. The bronze plates that were inspected were in excellent condition and there was no abrasion of the metal as the plates had not contacted each other.

As an example of the membrane type of joint, **Picture No. 4** shows the underside of a concrete girder and slab resting on a spandrel bent of a concrete arch bridge across the Kern River near Bakersfield. The bond between the two concrete surfaces had been broken by placing a membrane between them. The membrane layer developed the weak plane desired but the top surface of the cap was so irregular that when contraction occurred, concentrated pressure points were set up. The subsequent breaking up of the concrete is plainly seen in the photo.

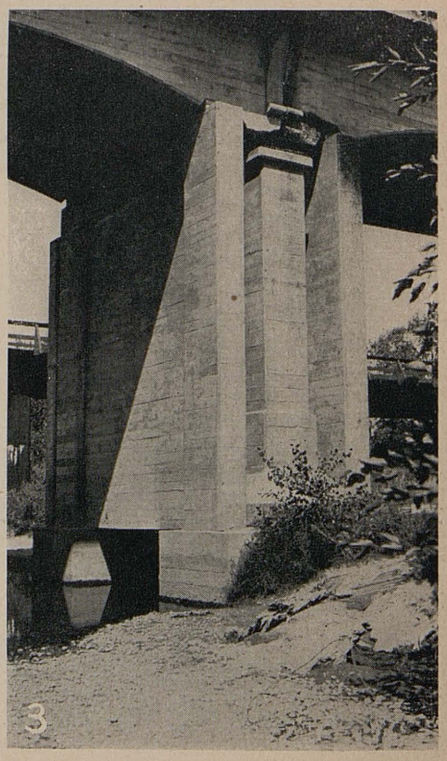
Spalling has also occurred from a lengthening of the deck. **Picture No. 5** shows a part of the diaphragm over the same bent which has been broken off from movement of the slab. The reinforcing bars have been exposed in both cases. Repairs to date have consisted of the placing of a timber bent adjacent to the existing concrete bent to support the deck. The rate of progressive failure, i.e., a general shattering of the concrete, has greatly diminished since the construction of a new bridge paralleling this old structure in a divided highway setup. The structure is still in use for northbound traffic and extensive repairs will, undoubtedly, have to be made in the next few years.

COMMON FAILURE

Picture No. 6 shows an expansion failure which is commonly found in several types of joints. The structure is a reinforced concrete through girder built in 1915, and consists of eight 50-foot spans. The expansion joints consist of marble blocks 150 feet apart. Failure of this joint was progressive, it being first noticed in 1938 after 23 years of satisfactory service. Trouble developed to such extent that within a year, it was necessary to place supplemental supports under the girders.

Picture No. 7 shows the repaired joint. In making the repair, it was

Flexible piers added on Bear River Bridge



found that the reinforcing steel was not only poorly placed, but was in a rusted condition because of moisture entering through the cracks. The main tension steel in the bottom of the girders, being several inches short, did not properly reinforce the ends of the girder. The haunch of the column was not adequately reinforced and it could not furnish proper support for the ever-increasing amount and weight of truck traffic.

Rupture occurred by excessive diagonal tension or shear in the girder and haunch, which developed from failure of the marble expansion blocks to function. The repair cost was approximately $450 per joint. However, these repairs were made under very favorable conditions with the channel dry and the structure only 12 feet above the ground line. Under other less favorable conditions, the cost per joint could easily have been several times this amount.

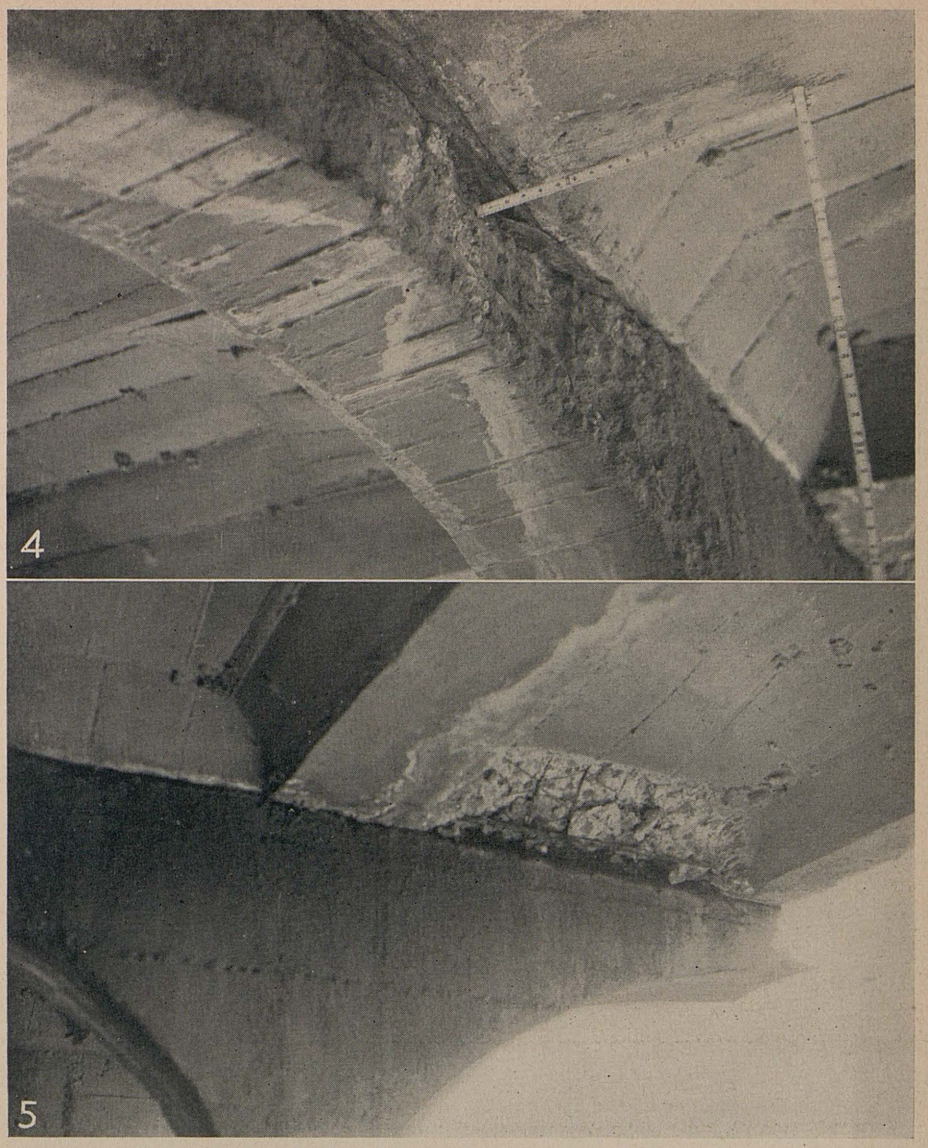
NEW DESIGN TENDENCY

Numerous early-day concrete structures were constructed without any provisions for expansion. Instances are on record of such structures ranging in length from 20 feet to 216 feet, in which no particular difficulties were encountered although they are situated in regions subject to temperature changes ranging through more than 90 degrees.

There is a tendency in design today to lengthen the distance between expansion joints in order to reduce to a minimum the difficulties encountered. There is no set rule on how far apart joints should be. This will depend upon the type of structure, whether or not it is on flexible piers, what the approaches are, and the temperature ranges likely to be encountered.

Not all troubles are encountered in the supports. Taking satisfactory care of the movements in the deck of a structure also leads to many interesting problems.

In general, it has been the practice to armor the edges of deck joints usually consisting of angles anchored to the concrete. Normally used are 2-inch x 2-inch x $\frac{3}{8}$-inch angles with 1-inch x $\frac{1}{4}$-inch hooked anchor straps. Experience has shown that, in time, the constant impact on the joint loosens the armor, the expansion joint material falls out and an unsightly and troublesome condition develops. The anchor straps are often broken. The repair of a joint of this type is costly



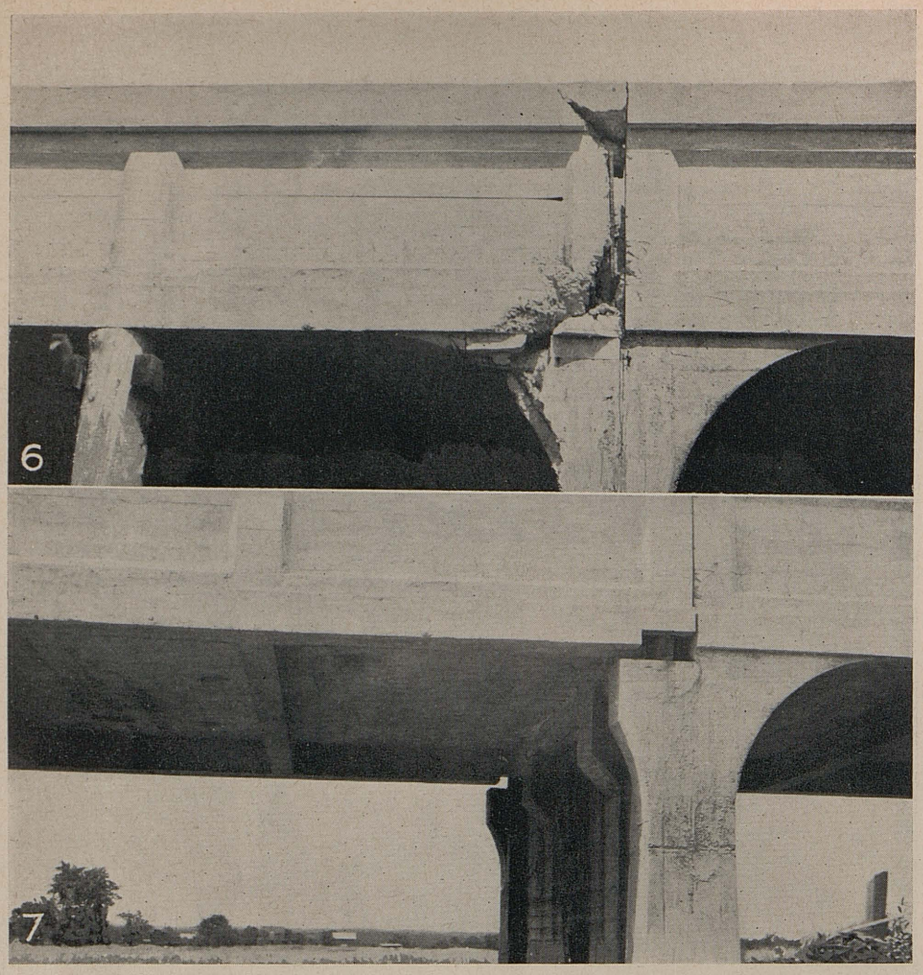
Failure of membrane type of joint due to contraction (above) and expansion (below)

and unless repairs are made immediately, the concrete not only becomes badly shattered but a hazardous traffic condition may develop. The minimum cost of repairs has run around $300 per joint.

CAUSE OF SPALLING

A few jobs have been constructed leaving the usual three-fourths-inch expansion joint open and leaving the armor protection off altogether. The plans called for a one-inch radius edger finish, the approximate natural spalling radius found on existing structures, but experience has shown that a worn out standard edger is usually used and not too much attention is given to such an apparent minor detail. Spalling results when an edging tool having less than one-inch radius is used; the joint becomes rough and impact stresses are stepped up. The opening is too small, rocks become lodged and dirt soon collects. Leaving the edges of a deck slab unarmored is no longer considered advisable.

A type of armored joint used on the Sacramento River Bridge at Redding and consisting of a channel equal to the depth of the slab may be seen in **Picture No. 8.** A deviation from the normal method of anchoring the armor has been used. Anchors consist of short sections of channels placed vertically and welded to the web of the armor channel. Note the breaks in the concrete slab exactly conforming to the section of the anchor channels. The slab has broken away



Upper—Samson Slough Bridge bearing failure. Lower—Same structure after repair work

from these anchor sections because the ends are too close to the surface. The channel has worked loose, the joint has failed badly, and it is very noisy under traffic.

WHAT CAN HAPPEN

Picture No. 9 shows what can happen to the cover plate type of joint. Trouble develops in this type of joint due to the use of too thin a plate. Dirt accumulates under the plate and the wedging action due to repeated expansion causes it to curl upward. The joint in general, becomes noisy. Failure of the particular joint shown occurred because the approaches to the steel truss span were constructed of timber. Shrinkage of the timber stringers and cap caused a general lowering of the deck leaving one edge of the plate unsupported.

It is impractical for a maintenance crew to continually keep the approach jacked to grade. Failure to maintain deck grade results in failure of the joint. The repair of a failed joint such as this one, sometimes requires complete removal and recasting of the assembly. The cover plate is also burned off and welded in place on the fixed span leaving the joint open. Not all such failures are attributable to structures having timber approaches. There have been numerous failures on structures having concrete or steel approaches but the damage is not always so great.

A very large percentage of these failures have been repaired by cutting off the cover plate as above because of an objectionable clanging every time a car travels across the joint. Joints as much as two inches have been left open with no ill effects.

TYPICAL EXAMPLE

The sketch **Figure (1)** shows the repair of a typical cover plate type of deck joint. The structure consists of a short timber trestle approach with the main spans of steel truss construction. Longitudinal movements occurred closing the joint and shrinkage of the timber stringers caused unequal deck elevations.

Because the fixed end of the cover plate was on the timber spans the assembly did not break up as in the previously discussed failure. However, the cover plate curled up and the concrete slab on the truss span spalled. Here the overhanging ends of the timber stringers were cut off, the slab on the timber span cut back and a structural Tee section was placed adequately anchoring the Tee to the reinforcing steel in the deck. The slab was also thickened for greater strength. When available, the Tee is cut from a 15-inch WF beam. The opening can be maintained for a number of years by burning off the Tee as required. If a 2-inch open joint is left subsequent movements amounting to seven inches can be accommodated before the joint becomes completely closed.

STOCK MOVEMENTS

The arguments advanced for the necessity of cover plates on joints one to two inches wide are that small animals such as sheep, may be injured in such openings. Present day conditions would seem to demand that movement of such stock except by truck on heavily traveled roads be not permitted; however, certain key locations might require provisions for such movements.

On roads where traffic is not too heavy and the movement of stock is more necessary and frequent, cover plate joints may be a satisfactory solution. In such cases, plates three-fourths inches or more in thickness are not too heavy and anchoring details must be made comparable in strength and weight if maintenance troubles are to be minimized. The finger type of joint ordinarily used where openings are exceptionally wide, has resulted in a very satisfactory type of construction with minimum trouble and expense.

The tendency of a concrete approach slab to crawl is a common source of trouble at expansion joints. During the past few years, the approach timber trestles to several movable bridges have been redecked either with a concrete slab placed on top of an existing laminated deck, or by removing the timber deck and placing the slab on sheet metal or plywood sub-floors. These slabs have been provided with expansion joints every two or three spans with the joints being filled with expansion joint filler. A one- to two-inch open joint was left at the juncture of the trestle with the movable span.

JOINT CLOSURE

Within a year after the slabs were placed, the joint at the movable span closed due to movement of the concrete slab or a general movement of the entire trestle approach. In all places where this trouble developed, the approaches are over 400 feet in length, the piles are long, the structure is very flexible and has little resistance to longitudinal movements. In one redecking contract, it was necessary to open up the joint before the contract was even completed. It has been necessary to open up the joint twice more since completion of the contract.

Even though the substructure may be relatively stiff, the joint will eventually close because of the tendency of the slab to creep on a smooth sub-floor. Specification requirements for expansion joint materials are such that the load required to compress the material 50 per cent of its thickness of one-half inch or less shall not exceed 1,500 pounds per square inch and it shall return to 90 per cent of its original thickness within one hour. The writer has seen no expansion joint material that will return to 100 per cent of its original thickness after a period of use in the field. As a result the small crack left in the joint after one cycle of expansion and contraction gradually becomes filled with fine particles, closing the joint.

CREEPAGE PROBLEM

Repeated cycles during the course of a year's time results in a general slippage of the slab on the sub-floor and where there are long approaches to a movable span, this creepage becomes a serious problem. The movement can be reduced by reducing the number of joints allowing greater opening at less frequent intervals and providing means of opening up the joints as previously discussed.

The opening at the ends of the bascule leaves of the Sacramento River Bridge near Rio Vista gradually lessened. A slight settlement was noticed just beyond the end of the westerly abutment. It was thought at the time, that the levee was moving towards the channel or that the concrete approach slab was pushing on the abutment. Soundings were taken around the abutment and there was no evidence of scour. During a very hot spell in the month of June, the joint completely closed. It was necessary to raise the leaves for a boat and before the bridge could again be reopened to traffic a heavy truck had to be run out to the ends of the leaves to force it down to its fully closed position.

CAVITY FILLED

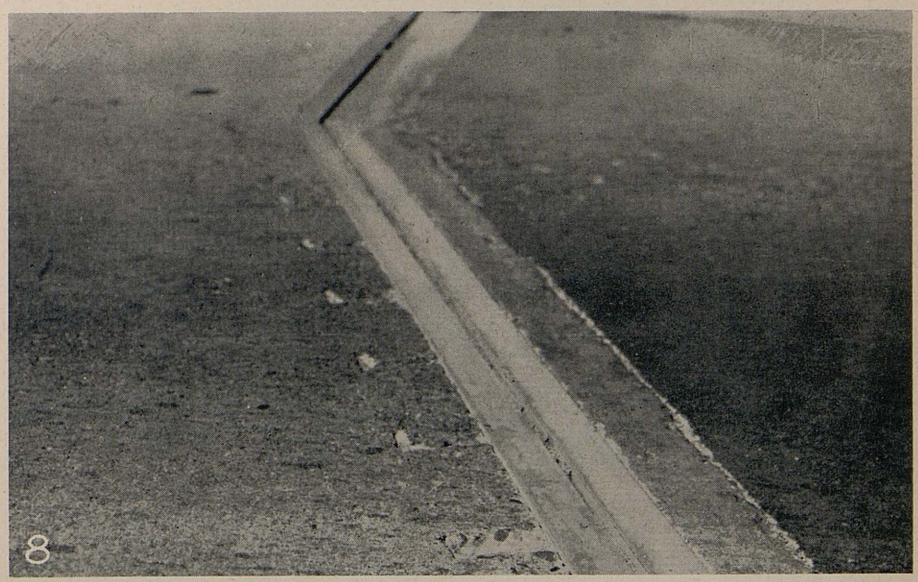
Steel was cut off; plates were removed where they could be, and the deck joint opened up. It was then decided to cut an opening across the approach concrete slab and fill with plant mix. A cut about one foot seven inches wide was made across the roadway. An exceptionally hot spell one week later caused no additional closing of the joint at the end of the leaves. However, measurements taken at the opening in the pavement with the temperature less than 65 degrees showed that the cut had closed one and one-eighth inches.

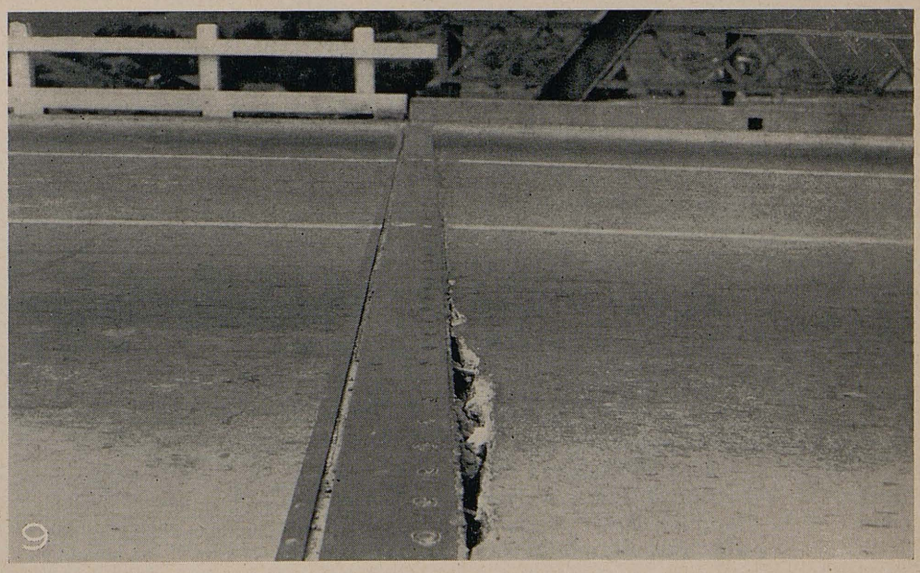
Measurements taken August 24th showed the joint further lessened to a total of three and one-half inches, proving that the expansion troubles were due to a crawling of the roadway slab. The pressure of the slab against the abutment undoubtedly caused it to move towards the channel, closing the joint. The cavity behind the abutment wall was filled by a pounding of the fill material accounting for the settlement at the end of the bridge. Consequently, the abutment never will move back to its original position.

CONCLUSIONS

The present trend of constructing concrete pavements without expansion joints will undoubtedly lead to difficul-

Upper—Failure of deck joint edge armor. Lower—Typical cover plate type of deck joint and subsequent failure





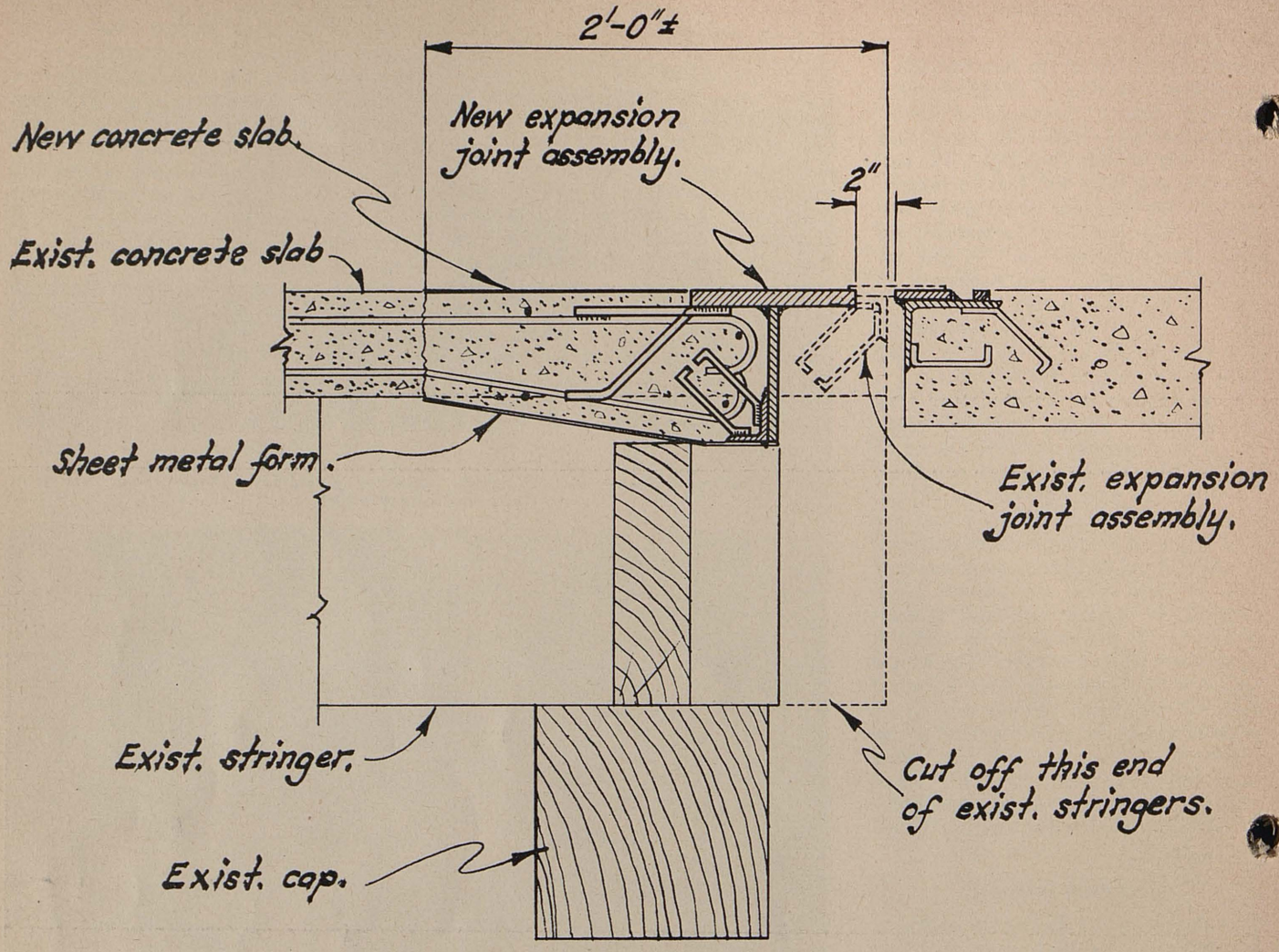


FIGURE 1

ties in maintaining proper openings at a draw bridge. Temporary corrective measures can be taken by placing Tee sections at the joints within the structure, but it is the writer's belief that further provisions must be made at the juncture of the approach slab with the ends of the structure.

Until recently, the details of expansion joint assemblies have been of a more or less common standard and not too much attention was paid to their proper functioning under the particular conditions or to maintenance in the field. With the advent of the continuous span structure, the number of deck openings have been materially reduced. It is contended that a further reduction in the number of expansion joints is altogether possible except for long span steel and concrete structures or movable spans.

Where joints are required, the following points should not be overlooked:

1—Possibility of large movements;

2—Necessary provisions for jacking with means of lifting the rockers or rollers at the same time;

3—Adequately reinforcing the edges of the concrete under the bearings;

4—Heavier design of edge armor combined with careful placing in the field.

"He said I was laconic."

"What does that mean?"

"I don't know, but, just to be on the safe side, I gave him a punch on the nose."

NEW DEVICES AID MAINTENANCE WORK

(Continued from page 5)

of the spraying material. The boom may be folded out of the way during traveling.

These newly developed devices have very materially aided in lightening the load of maintenance work, and have greatly reduced the amount of hand work and physical effort required in the performance of maintenance tasks. New ideas and new devices are always to be encouraged and it is anticipated that with the release of materials and expansion of highway work, many new methods and devices will be thought up

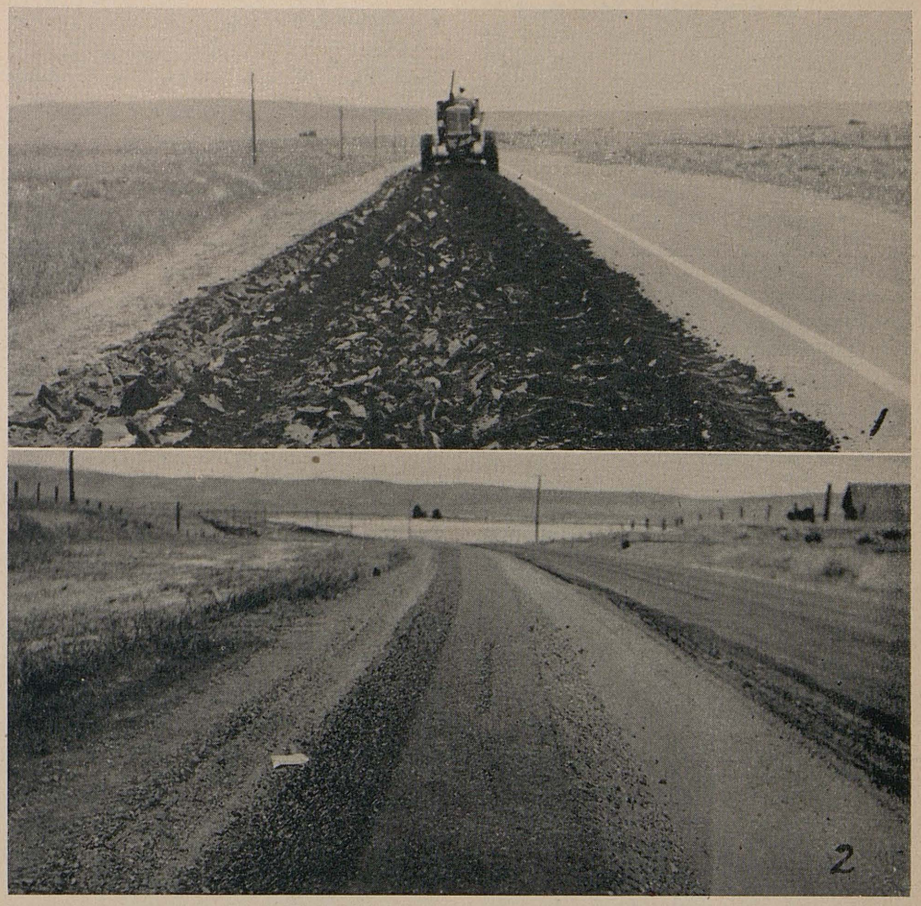
Modified Cement Treated Base Experiment Made in District II

By J. W. TRASK, District Office Engineer

THE general practice in District II has been to resurface an existing surface, which has deteriorated to such an extent as to require attention, with an additional increment of plant-mix material varying in thickness from 1 to 3 inches.

This method of rejuvenating the traveled way has, in most cases, been satisfactory. However, there have been some instances in which the correction did not function as expected, in that the original plant-mix surface became unstable when covered with an additional increment.

The exact cause of the failures is as yet unknown. However, in most cases each failure had two things in common; one, a high percentage of material passing a 200 mesh; two, a high moisture content. Apparently the additional increment prevented evaporation with subsequent instability of the original surface.



Upper—Original surface after scarifying. Lower—Windrow after processing

EXPERIMENT SUCCESSFUL

On Road II-Las-28-A, B between Nubieber Overhead and 8.3 miles east of Bieber the results of an additional increment were questionable. In order to provide a base that would not be susceptible to moisture content and that would carry heavy loads, it was decided to incorporate approximately 4 per cent of cement with the existing 3-inch plant-mix surfacing plus 3 inches of the existing base, to form a modified cement treated base, and place thereon a plant-mix wearing surface composed of 180 pounds per square yard open graded mix base course and a 60 pounds per square yard dense graded mix surface course.

Samples of material from the existing surface and base were submitted to the laboratory for testing with cement and the results were satisfactory.

SPECIFICATIONS

The specifications provided that the existing bituminous surface be thoroughly broken up by scarifying, discing or other means until it contained no particles that would not pass a one-inch laboratory sieve. This material was then to be spread uniformly over the area, and then the surface was to be scarified to a depth of 6 inches in such a manner as to leave an undisturbed plane of base material at a uniform depth. All material was then to be thoroughly mixed until a uniform mixture was obained. The loosened material was then to be formed in windrows, accurately shaped as to size and cross-section, to receive a uniform spread of cement.

In carrying out the operations of the contract, the contractor first scarified the existing oil cake, which broke into rather large pieces. This was then rolled with a sheepsfoot roller, disked, turned with a blade and pulverized with a mechanical mixer until all the oil cake was reduced to specified size.

The pulverized oil cake was then respread, and the material was scarified to a depth that would produce the required 6 inch compacted base. This material was then windrowed and pulverized with a mechanical mixer in order to break up any lumps of the existing base, and thoroughly mix the base and surfacing.

DUST OVERCOME

After dry mixing, there was no visual evidence of any oil cake. However, close inspection revealed that the oil cake had been coated with dust. Cement, which was shipped in bulk, was added by a distributor which made

a furrow in the top of the windrowed material and, at the same time, deposited the cement. The cement was spread to within a very small percentage of the amount required. The dry mix contained approximately 2.5 per cent moisture and sufficient water was added at the mixer to bring the water content to approximately 11 per cent in order to secure proper compaction. A road mixer was used to mix and make the initial spread of material. The material was then bladed to the proper width and thickness.

Compaction operations began immediately following the spreading operations. Compaction was secured by using a 12-ton, 3-axle type roller, and all compaction was completed within one hour after the mix was laid. The base was then trimmed by means of a self-propelled motor grader to the grade and section shown on the plans.

97 PER CENT COMPACTION

All material cut away by the blade was incorporated in the adjacent windrow of unmixed material. After trimming, the surface was rolled with a standard type, 2-axle, pneumatic tired roller. Water was applied during rolling as required, and the rolling continued until the base was smooth, closely knit and free from cracks and ridges. An average compaction of 97 per cent was secured.

Prior to laying the next lane, the existing lane was trimmed back to sound material, and the residue incorporated in the succeeding windrow. The joint was then washed with a spray to insure a satisfactory bond.

Immediately after finishing the base, it was covered with an asphaltic emulsion curing seal, and traffic was kept off until a satisfactory strength was secured. When traffic was turned over the base, it was necessary to apply sand, in order to keep tires from picking up the curing seal.

No detrimental results from the action of the traffic on the base have been noted, with the exception of spalling at the edges and some scaling. The small amount of scaling was corrected by applying additional asphaltic emulsion and sand.

The cement treated base averages 125 pounds per cubic foot and laboratory breaks range from 1,000 to 1,400 pounds in 7 days. Even 28 day breaks do not indicate that any substantial increase in strength can be expected. The exising oil cake and base, when mixed with cement, appears to take on the properties of concrete, in that transverse cracks appear every 15 to 25 feet with an average of approximately 20 feet apart.

Preliminary tests of fabricated samples at 100 degrees F. indicated a drop of approximately 30 per cent in strength, however, it is doubtful if the base will reach this temperature after the surfacing is placed.

It is too early to make any definite statement as to the durability of this base, but indications are that it will be satisfactory, and it will take another year to determine whether the results will justify any further work of this type.

The project was under contract to M. J. Ruddy & Sons and was under the general supervision of H. Clyde Amesbury, District Construction Engineer and under the direct supervision of C. I. Brown as Resident Engineer.

Freeway Development on Highways of California

As in all aspects of this ever-changing world, road and highway development has been subject to the processes of evolution.

The mud footpaths used by primitive man to and from his hunting grounds and other food sources, his water and fuel supplies, did not differ from the trails of wild animals with which he shared the vast forests, plains and hills of a young world. Through time, evolution of human desires and needs gave to the primitive paths increased importance. The camel, the horse, and oxen were domesticated to become beasts of burden and means of transport. The mud-packed trails became widened roads for commerce and war. Invention of the wheel and cart was followed by the constructed highway.

Seemingly, progress was slow but, as the centuries rolled along, came the Caesar's roads of stone, the corduroy of timber lands, the coach roads of England, France, and Spain, the military roads of the Georgias and the American turnpike.

Then came the automobile and highway development was accelerated as never before. During the past 40 years road construction has moved farther than in all the thousands of years preceding. In this country probably the most outstanding single development has been the 48 networks of State highway systems.

During the first two decades of State highway construction in California, when the cry was to get traffic out of the mud, activities were confined by statute to the building of rural roads. It was not until about 1931 that California law permitted expenditure of State highway funds for improvement of State routes through cities on a cooperative basis with the municipality.

The conception of spheres of responsibility for highway development was changing. In 1933 and 1935 the

(Continued on page 33)

Postwar Highway Projects Advertised at the Rate of Two Million Dollars a Week

(Continued from page 20)

The Division of Highways has made an excellent start in getting its postwar program under way and correction of some of the critical deficiencies in State highway facilities is now in progress. In the concentration of effort to advance the postwar program, however, the magnitude of over-all State highway deficiencies must not be forgotten and a long-range view of the problem must be held in mind.

Under anticipated State highway revenues from existing sources, needed correction of the $695,000,000 in critical deficiencies will require an estimated 30 years, a period which, under rapid present-day traffic changes, is far too long. If the problems of increasing traffic congestion are to be solved, means must be provided for speeding development of the State Highway System.

Highway Bids and Contract Awards for December 1945 and January 1946

December 1945

CONTRA COSTA COUNTY—At Antioch Bridge, a structure formerly used as toll house to be moved to new location for use as scale house. District X, Route 11, Section A. Contract awarded to M. A. Jenkins, Sacramento, $4,167.

KERN COUNTY—Across Los Angeles Aqueduct and Cache Creek, between 3.5 and 4.5 miles west of Mojave, two bridges to be constructed. District IX, Route 58, Section G. Fred D. Kyle, Pasadena, $101,202; The Tanner Construction Co., Phoenix, Arizona, $104,509; C. B. Tuttle, Long Beach, $107,-224; Spencer Webb, Los Angeles, $117,430. Contract awarded to E. W. Elliott Construction Co., San Francisco, $93,612.

KERN COUNTY—Between Cameron and Mojave, about 7.2 miles to be graded and plant-mixed surfacing to be placed. District IX, Route 58, Section G. The Tanner Construction Company, Phoenix, $227,765; Heuser, Garnett & Hensler, Glendale, $239,-766; Basich Brothers Construction Co. & Basich Brothers, Alhambra, $249,364; Oilfields Trucking Company, Bakersfield, $261,-824; A. F. Heinze, Alhambra, $302,383; E. W. Elliott Construction Company, San Francisco, $314,520; Louis Biasotti & Son, Stockton, $323,093; Norman I. Fadel, North Hollywood, $332,728. Contract awarded to Gunner Corporation, Pasadena, $211,964.

MENDOCINO COUNTY—About 25 miles south of Garberville, a reinforced concrete arch bridge across Rock Creek to be constructed. District I, Route 1, Section J. J. D. Proctor, Inc., Richmond, $111,618. Contract awarded to Fred J. Maurer & Son, Eureka, $83,607.

RIVERSIDE COUNTY—Between Mira Loma and 2.5 miles west of Riverside, about 7.9 miles to be graded and surfaced with plant-mixed surfacing on cement treated base. District VIII, Route 19, Section A. Griffith Co., Los Angeles, $657,557; E. W. Elliott Construction Co., Lynwood, $664,958; Peter Kiewit & Sons, Los Angeles, $696,242; Rhoades Bros. & Shofner, Los Angeles, $698,-871; Guerin Bros., Los Angeles, $727,892; Matich Bros., Colton, $747,919; J. E. Haddock, Ltd., Pasadena, $761,533; Ralph A. Bell & A. F. Heinze, Monrovia, $777,758; Mittry Bros. Construction Co., Los Angeles, $789,513; Guy F. Atkinson Co., Long Beach, $842,350; Basich Bros. Construction Co. and Basich Bros., Alhambra, $942,231. Contract awarded to Geo. Herz Co., San Bernardino, $632,869.

SACRAMENTO COUNTY—On North Sacramento Freeway, between North Sacramento Viaduct and ½ mile east of Ben Ali, about 4.1 miles to be graded and paved with Portland cement concrete and freeway structures to be constructed. District III, Route 3, Section B. Chas. L. Harney, San Francisco, $1,789,033; A. Teichert & Son, Inc., and M. & K. Corporation, Sacramento, $1,839,526. Contract awarded to Guy F. Atkinson Company, South San Francisco, $1,683,674.

SACRAMENTO COUNTY—Across San Joaquin River about 5 miles north of Antioch, bridge fender to be repaired. District X, Route 11, Section C. M. A. Jenkins, Sacramento, $5,595; Pomeroy Sinnock, Stockton, $5,838. Contract awarded to H. F. Lauritzen, Pittsburg, $5,440.

SAN BERNARDINO COUNTY—Between Mulberry Street and Colton, about 9.8 miles to be graded and paved with Portland cement concrete. District VIII, Route 26, Section D, Ria. Matich Bros. & R. S. Crow, Colton, $1,403,865; H. Earl Parker & N. M. Ball Sons, Los Angeles, $1,432,751; J. E. Haddock Ltd., Pasadena, $1,452,538; Basich Bros. Construction Co. & Basich Bros., Alhambra, $1,477,221; Peter Kiewitt Sons Co., Los Angeles, $1,483,791; Guy F. Atkinson Co., Long Beach, $1,545,455; E. W. Elliott Construction Co., San Francisco, $1,549,833; Rhoades Bros. & Shofner, Los Angeles, $1,-568,118; Mittry Bros. Construction Co., Los Angeles, $1,569,666; Hubert H. Everist, Sr., San Francisco, $1,649,343; Warren Southwest, Inc., & Chas. G. Willis & Sons., Inc., Los Angeles, $1,651,974; Bressi and Bevanda Constructors, Inc., Los Angeles, $1,668,772; Morrison Knudsen Co., Inc., Los Angeles, $1,744,739. Contract awarded to Griffith Co., Los Angeles, $1,386,769.

SAN DIEGO COUNTY—Over Balboa Park Freeway at Date Street, Upas Street, and Quince Street in the city of San Diego, three reinforced concrete overcrossings to be constructed. District XI, Route 77. Harry L. Foster, San Diego, $164,265; Byerts & Dunn, Los Angeles, $167,830; E. B. Bishop, Orland, $184,350; Contracting Engineers' Co., Los Angeles, $210,948; Baruch Corp., Los Angeles, $213,983; Spencer Webb, Los Angeles, $216,989. Contract awarded to M. H. Golden Construction Co., San Diego, $155,183.

SAN DIEGO COUNTY—Between San Luis Rey River and 0.2 mile north of Aliso Creek, about 4.9 miles in length, existing highway to be widened and paved with Portland cement concrete and portions of existing pavement to be resurfaced with asphalt concrete. District XI, Route 2, Oceanside, C. Griffith Co., Los Angeles, $571,732; N. M. Ball Sons, Los Angeles, $578,838; Peter Diewitt Sons' Co., Los Angeles, $609,904. Contract awarded to Basich Bros. Construction Co. & Basich Bros., Alhambra, $557,229.

SAN DIEGO COUNTY—Across San Diego River in the city of San Diego, a reinforced concrete bridge to be constructed. District XI, Route 77. Byerts & Dunn, Los Angeles, $188,520; Oberg Bros., Inglewood, $191,070; M. H. Golden Construction Co., San Diego, $191,087; Griffith Co., Los Angeles, $198,733; E. B. Bishop, Orland, $218,-608; Spencer Webb, Los Angeles, $224,920; Guy F. Atkinson Co., Long Beach, $228,550; Contracting Engineers' Co., Los Angeles, $234,087; Macco Construction Co., Clearwater, $249,210; Baruch Corp., Los Angeles, $259,918. Contract awarded to Harry L. Foster, San Diego, $183,791.

SAN DIEGO COUNTY—About 1.7 miles east of Oceanside at San Luis Rey River and Keys Canyon Creek, two reinforced concrete girder bridges to be constructed. District XI, Route 77, Section G. M. H. Golden Construction Co., San Diego, $205,386; Haddock Engineers, Ltd., Pasadena, $239,897. Contract awarded to Spencer Webb, Los Angeles, $195,313.

SAN DIEGO COUNTY—One mile north of Oceanside, a structural steel overcrossing over the tracks of The Atchison, Topeka & Santa Fe Railway to be constructed. District XI, Route 2, Section C. Spencer Webb, Los Angeles, $88,386; Haddock Engrs., Ltd., Oceanside, $88,886; C. B. Tuttle, Long Beach, $89,987; Oberg Bros., Inglewood, $101,900; Basich Bros. Construction Co., Alhambra, $112,534; M. H. Golden Construction Co., San Diego, $113,225. Contract awarded to Fred D. Kyle, Pasadena, $87,848.

SANTA CLARA COUNTY—On Bay Shore Freeway, about 6 miles south of San Jose, a steel plate girder bridge to be constructed across Coyote Creek and a steel beam undercrossing to be constructed at Coyote Road. District IV, Route 2, Section E, Dan Caputo & Edward Keeble, San Jose, $307,067; J. H. Pomeroy & Co., Inc., San Francisco, $311,708; Carl N. Swenson Co., San Jose, $316,636; Chas. L. Harney, San Francisco, $319,805; J. D. Proctor, Inc., Point Richmond, $319,252; Fredrickson & Watson Construction Co., Oakland, $331,-523; Macco Construction Co., Oakland, $338,-844; Fred J. Maurer & Son, Eureka, $345.042; E. W. Elliott Construction Company, San Francisco, $361,850; Guy F. Atkinson Company, South San Francisco, $361,889; Pittsburg-Des Moines Steel Co., Mountain View, $369,912; Healy Tibbitts Construction Co., San Francisco, $388,391. Contract awarded to Earl W. Heple, San Jose, $274,758.

An Appreciation

"BOURNESIDE"
State Highway 1, at Hudson Hill
Bolinas, Calif.

5th January, 1946

Colonel John H. Skeggs,
2001 Van Ness Ave.,
San Francisco

Dear Colonel: I want to take this opportunity to bring to your attention the excellent work accomplished by the road crew, under Mr. Jack Barrett, working south out of Point Reyes Station.

I have resided over here for the past eight years (with the exception of the last two years which I have spent on active duty as a commissioned officer in the Army) and commuted daily to San Francisco.

Mr. Barrett and his crew have done an excellent job at all times, and especially of late when the highway has been flooded by high waters. Flares have marked every danger zone, along with other signs, and my friends have also remarked that we can immediately tell when we strike that part of the highway under the supervision of Mr. Barrett.

I feel that these men are also a part of our "unsung heroes" and for this reason I am drawing to your attention, sir, the excellent work they have accomplished under the most adverse conditions. A word of praise is very encouraging to them to keep up the excellent work they are doing.

I am, sir,

Yours very truly
HUGH H. SAMSON

SANTA CLARA COUNTY—On Bay Shore Freeway at Ford Road, about 6 miles south of San Jose, a structural steel undercrossing to be constructed. District IV, Route 2, Section E. Carl N. Swenson Co., San Jose, $72,450; Kiss Crane Co., San Pablo, $73,567; Chas. L. Harney, San Francisco, $77,145; Johnson, Drake & Piper, Inc., Oakland, $77,209; Dan Caputo & Edward Keeble, San Jose, $77,309; E. W. Elliott Construction Company, San Francisco, $79,580; Stockton Construction Co., Stockton, $79,937; J. D. Proctor, Inc., Point Richmond, $80,758; Fred J. Maurer & Son, Eureka, $83,261; George Pollock Co., Sacramento, $84,099; Fredrickson & Watson Construction Co., Oakland, $84,674; Macco Construction Co., Oakland, $95,586; Peter Sorensen, Redwood City, $105,739. Contract awarded to Earl W. Heple, San Jose, $65,031.

SANTA CLARA COUNTY—Between San Jose and 0.6 mile south of Ford Road, about 8.1 miles to be graded and paved with Portland cement concrete. District IV, Route 2, SJs,E. Fredrickson & Watson Construction Co., Oakland, $1,186,864; Union Paving Co., San Francisco, $1,191,844; The Utah Construction Co., San Francisco, $1,258,926; Guy F. Atkinson Company, South San Francisco, $1,292,054; Earl W. Heple, San Jose, $1,292,896; Chas. L. Harney, San Francisco, $1,331,015; Macco Construction Co., Clearwater, $1,349,487; Peter Kiewit Sons' Co. & Hubert H. Everist, Sr., San Francisco, $1,359,987; A. G. Raisch Co., A. J. Raisch Paving Company, & Harms Bros., San Jose, $1,391,748; E. W. Elliott Construction Company, San Francisco, $1,392,290; Morrison-Knudsen Company, Inc., Los Angeles, $1,529,-399. Contract awarded to N. M. Ball Sons, Berkeley, $1,178,869.

SOLANO COUNTY—Between Ulatis Creek and Midway, about 6.0 miles to be graded and paved with Portland cement concrete and bridges to be built across Horse Creek and Gibson Canyon Creek. District X, Route 7, Section Vac.D, N. M. Ball Sons, Berkeley, $576,219; Fredrickson & Watson Construction Co., Oakland, $683,235; Guy F. Atkinson Company, South San Francisco, $747,075; E. W. Elliott Construction Co., San Francisco, $743,131; Marshall S. Hanrahan, Redwood City, $560,396; Gunner Corporation, Pasadena, $613,882; M. J. B. Construction Co., Stockton, $618,237; Parish Bros., Benicia, $652,579; A. Teichert & Son, Inc., Sacramento, $663,645. Contract awarded to Fredrickson Bros., Emeryville, $527,735.

YUBA AND SUTTER COUNTIES—Across Feather River at Marysville and Yuba City, and in Sutter County over the Southern Pacific Railroad and at Sutter Street in Yuba City, a bridge, overhead crossing, undercrossing and approaches to be constructed. District III, Route 3, Section Mvl., Y. C. United Concrete Pipe Corp. & Ralph A. Bell, Los Angeles, $1,956,023; Clinton Construction Co. of California, San Francisco, $1,966,719; Pacific Bridge Company, San Francisco, $2,069,614; George Pollock Co., Sacramento, $2,099,016; Johnson, Drake & Piper, Inc., Oakland, $2,252,417; Guy F. Atkinson Company, South San Francisco, $2,357,155. Contract awarded to J. H. Pomeroy & Co., Inc., San Francisco, $1,879,340.

January 1946

FRESNO COUNTY — Between Calwa Overpass and Fresno, about 2.1 miles to be graded and paved with Portland cement concrete. District VI, Route 4, Section B, Fresno. J. E. Haddock, Ltd., Pasadena, $346,400; Gunner Corporation, Pasadena, $352,280; M.J.B. Construction Co., Stockton, $382,584; Louis Biasotti & Son, Stockton, $382,680. Contract awarded to Marshall S. Hanrahan, Redwood City, $337,722.

HUMBOLDT COUNTY—At Mad River, a steel girder and concrete girder bridge to be constructed and road approaches about 0.2 mile to be graded and surfaced with plant-mixed surfacing on imported base material. District I, Route 20, Section A. J. D. Proctor, Inc., Richmond, $220,559; Fred J. Maurer & Son, Eureka, $226,387. Contract awarded to Mercer, Fraser, Eureka, $204,868.

KINGS COUNTY—Between Fifth Standard Parallel South and 1.5 miles north, about 1.5 miles to be graded and surfaced with road-mixed surfacing. District VI, Route 125, Section D. George E. France, Visalia, $75,-989; Phoenix Construction Co., Bakersfield, $77,090; Milo A. Browne, Palo Alto, $82,128; J. Henry Harris, Berkeley, $82,152; Louis Biasotti & Son, Stockton, $84,490; Volpa Brothers, Fresno, $88,353; Combs Brothers, Bakersfield, $94,528; Brown, Doko & Baun, Pismo Beach, $96,996; J. E. Haddock Ltd., Pasadena, $104,716; Guerin Bros., South San Francisco, $118,135. Contract awarded to W. C. Railing, Redwood City, $70,408.

LASSEN COUNTY—Between 1.5 miles west of Bird Flat and Doyle, about 7.5 miles to be graded and surfaced with plant-mixed surfacing. District II, Route 29, Section D. Isbell Construction Co., Reno, $239,558; Marshall S. Hanrahan, Redwood City, $245,-117; H. Earl Parker and Clements & Co., Marysville, $246,943; A. R. McEwen, Sacramento, $247,901; Harms Bros., Sacramento, $249,910; R. A. Westbrook, Sacramento, $259,476; Louis Biasotti & Son, Stockton, $274,443; Parish Bros., Benicia, $279,227; Combs Bros. and A. A. Tieslau & Son, Berkeley, $286,461; E. B. Bishop, Orland, $289,-709; Frederickson & Watson Construction Co., Oakland, $305,369. Contract awarded to Utah Construction Co., San Francisco, $229,057.

LOS ANGELES COUNTY—On Santa Ana Parkway at Fourth Street in the city of Los Angeles, a reinforced concrete overcrossing to be constructed. District VII, Route 2. Oberg Bros., Inglewood, $132,716; Contracting Engineers Co., Los Angeles, $143,390; Spencer Webb, Los Angeles, $148,577; Guy F. Atkinson Co., Long Beach, $149,225; J. E. Haddock Ltd., Pasadena, $157,047; Mittry Bros. Construction Co., Los Angeles, $172,-188; Baruch Corp., Los Angeles, $181,448. Contract awarded to Byerts & Dunn, Los Angeles, $128,290.

LOS ANGELES COUNTY—On Santa Ana Parkway between Kearney and Soto Streets, about 1.6 miles to be graded and paved with Portland cement concrete and asphalt concrete. District VII, Route 2. Griffith Co., Los Angeles, $1,372,281; Guy F. Atkinson Co., Long Beach, $1,383,605; E. W. Elliott Construction Co., Lynwood, $1,457,-313; J. E. Haddock, Ltd., Pasadena, $1,586,-421. Contract awarded to Peter Kiewit Sons' Co., Los Angeles, $1,333,066.

LOS ANGELES COUNTY—On Santa Ana Parkway at Seventh Street in the city of Los Angeles, a reinforced concrete overcrossing to be constructed. District VII, Route 2. Oberg Bros., Inglewood, $222,418; E. B. Bishop, Orland, $228,826; Contracting Engineers Co., Los Angeles, $249,853; Guy F. Atkinson Co., Long Beach, $268,727; Spencer Webb, Los Angeles, $270,913; Baruch Corp., Los Angeles, $272,466; J. E. Haddock, Ltd., Pasadena, $273,018; Mittry Bros. Construction Co., Los Angeles, $291,616; Carlo Bongiovani, Hollywood, $299,769. Contract awarded to Byerts & Dunn, Los Angeles, $219,901.

PLACER COUNTY—Across East Street in the city of Auburn, a bridge to be constructed and incidental grading work to be performed. District III, Route 37. Kiss Crane Company, San Pablo, $65,706; A. Teichert & Son, Inc., Sacramento, $71,417; Chittenden & Chittenden, Auburn, $67,008; S. J. Amoroso Construction Co., San Francisco, $68,816; R. A. Westbrook, Sacramento, $71,683; M. J. Ruddy & Son, Modesto, $74,-424. Contract awarded to H. W. Ruby, Sacramento, $60,720.

PLACER COUNTY—In the city of Auburn, a reinforced concrete undercrossing to be constructed at Walsh Street. District III, Route 37. H. W. Ruby, Sacramento, $30,781; M. J. Ruddy & Son, Modesto, $31,-114; C. M. Allen, Fairfield, $34,253; Kiss Crane Company, San Pablo, $38,852; R. A. Westbrook, Sacramento, $39,554; S. J. Amoroso Construction Co., San Francisco, $40,273; da Roza & Billeter, Stockton, $41,-647; A. Teichert & Son, Inc., Sacramento, $42,797. Contract awarded to Wm. E. Thomas Construction Co., Tustin, $30,553.

PLACER COUNTY—In the city of Auburn, a steel beam span overhead crossing over the tracks of the Southern Pacific Company to be constructed. District III, Route 37. R. A. Westbrook, Sacramento, $98,988; S. J. Amoroso Construction Co., San Francisco, $101,551; Kiss Crane Company, San Pablo, $104,446; A. Teichert & Son, Inc., Sacramento, $105,162; Chittenden & Chittenden, Auburn, $106,870; E. B. Bishop, Orland, $118,360. Contract awarded to H. W. Ruby, Sacramento, $88,550.

SANTA BARBARA COUNTY—Between Hollister Wye and Fairview Avenue, about 3.7 miles to be graded and surfaced with plant-mixed surfacing and two reinforced concrete slab bridges to be constructed. District V, Route 2, Section Q. Griffith Company, Los Angeles, $587,259. Contract awarded to Dimmitt & Taylor, Los Angeles, $503,947.

SAN DIEGO COUNTY—About 6 miles west of Campo, across Campo Creek, a steel beam span bridge and approaches to be constructed. District XI, Route 200, Section D. M. H. Golden Construction Co., San Diego, $103,742. Contract awarded to Walter H. Barber, San Diego, $74,694.

SONOMA AND MARIN COUNTIES—Between one mile south of Petaluma and Ignacio Wye, about 11.9 miles to be graded, paved with Portland cement concrete and asphalt concrete on crusher run base, and bridges to be constructed across San Antonio and Novato Creeks. District IV, Route 1, Sections C,A. Macco Construction Co., Clearwater, $1,593,962; Chas. L. Harney and Piombo Bros. & Co., San Francisco, $1,598,-022; E. W. Elliott Construction Co., San Francisco, $1,666,771; Parish Bros., Benicia, $1,674,228; Frederickson & Watson Construction Co., Oakland, $1,810,217; Guy F. Atkinson Company, South San Francisco, $1,894,607; M.J.B. Construction Co., and Bressi & Bevanda Constructors, Inc., Stockton, $1,896,032; Hubert H. Everist, Sr., San Francisco, $2,115,357; A. Teichert & Son, Inc., Sacramento, $2,146,267. Contract awarded to A. G. Raisch Co. and Harms Bros., San Francisco, $1,555,096.

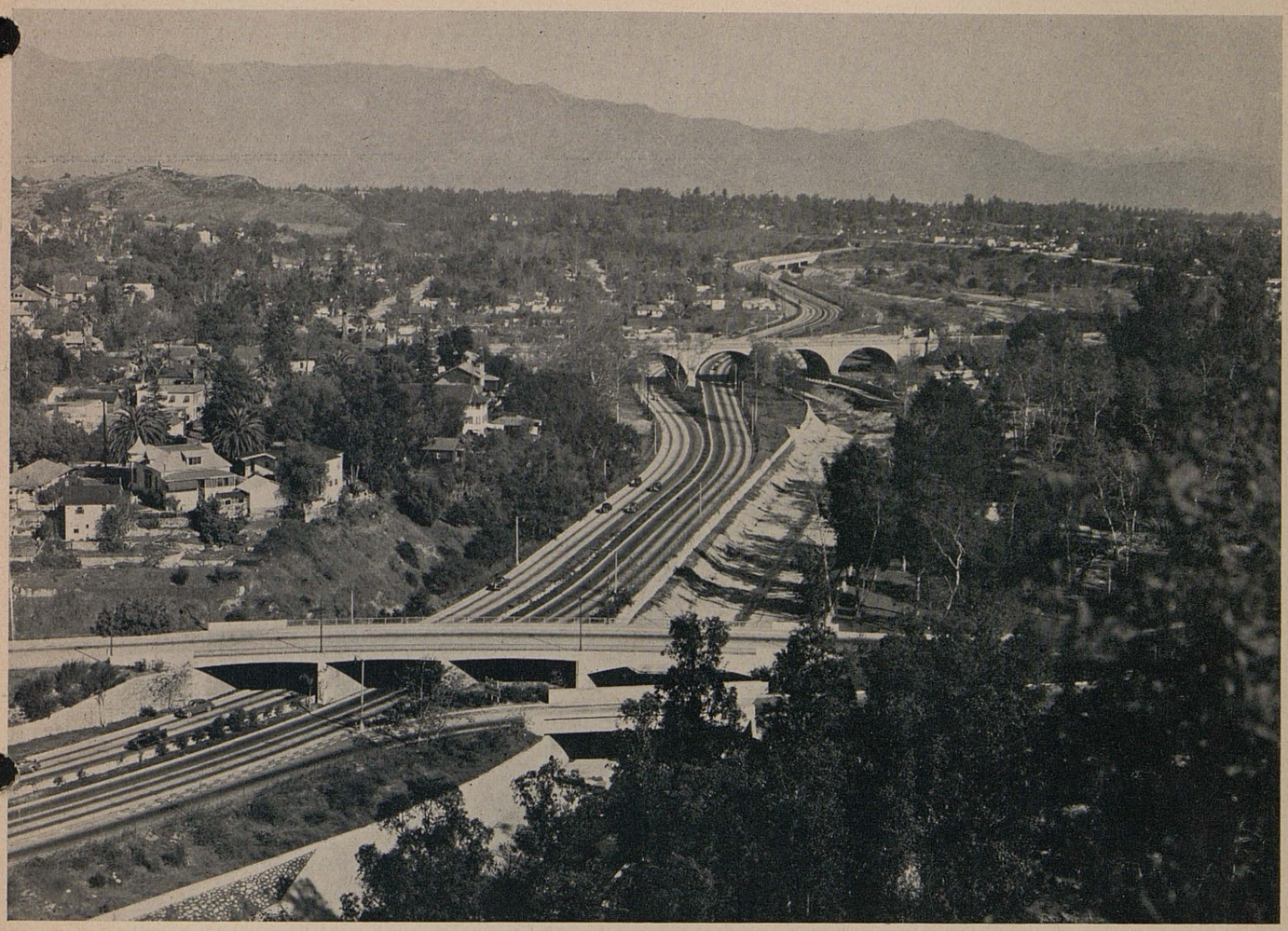
MONTEREY COUNTY—Between Santa Rita and 0.8 mile north of Crazy Horse Summit, about 8.4 miles to be graded, crusher run base and plant-mixed surfacing to be placed, and seal coat to be applied. District V, Route 2, Section J. Frederickson & Watson Construction Co., Oakland, $872,979; Harms Bros., Sacramento, $879,896; Chas. L. Harney & Piombo Bros. & Co., San Francisco, $886,782; Macco Construction Co., Clearwater, $926,822; Guerin Bros., South San Francisco, $947,561; Guy F. Atkinson Company, South San Francisco, $977,048. Contract awarded to A. Teichert & Son, Inc., Sacramento, $795,692.

SACRAMENTO COUNTY—Across Sacramento River at Rio Vista, portion of a bridge to be removed. District X, Route 53, Section C. J. D. Proctor, Inc., Richmond, $19,647; da Roza & Billeter, Stockton, $12,-275; Ocean Constructors, San Francisco, $20,030; Howard F. Lauritzen, Pittsburg, $20,989; Lord & Bishop, Sacramento, $21,-000; George Pollock Co., Sacramento, $11,-343; M. A. Jenkins, Sacramento, $21,363. Contract awarded to Kiss Crane Co., San Pablo, $9,450.

SOLANO COUNTY—Between Midway and 2 miles north of Dixon, about 6.1 miles to be graded and paved with Portland cement concrete, and bridges to be constructed across Sweeney Creek & McCune Creek. District X, Route 7, Sections D, I. A. Teichert & Son, Inc., Sacramento, $1,038,938; Frederickson & Watson Construction Co., Oakland, $1,123,-607; Harms Bros., Sacramento, $1,173,529; M.J.B. Construction Co. and Bressi & Bevanda Constructors, Inc., Stockton, $1,196,-942; Parish Bros., Benicia, $1,198,869. Contract awarded to Frederickson Bros., Emeryville, $1,035,012.

HIGHWAYS OF CALIFORNIA

(Continued from page 30)



Typical section of Arroyo Seco Parkway between Los Angeles and Pasadena

Legislature stipulated that the revenue from two and one-fourth cents of the gasoline tax be used for improvement to State routes through cities and to other streets of major importance and it became permissible to expend State highway funds anywhere on the State System in either rural or urban areas.

This shifting of responsibility to higher levels of government was not confined to California, or even to the States. The U. S. Bureau of Public Roads (now the Public Roads Administration) began a change in its rules and regulations by granting certain Federal Aid to urban projects. Recognition of these changing conceptions reached a new high at the Federal level with Congressional inclusion in the Federal Aid Act of 1944 of specific appropriation for urban Federal Aid improvement.

Traffic studies by the California Division of Highways made 12 and more years ago clearly indicated that, if the State Highway System was to approach the fulfillment of its purpose, adequate provisions would have to be made for the ever increasing volumes of traffic feeding to and from or through metropolitan areas.

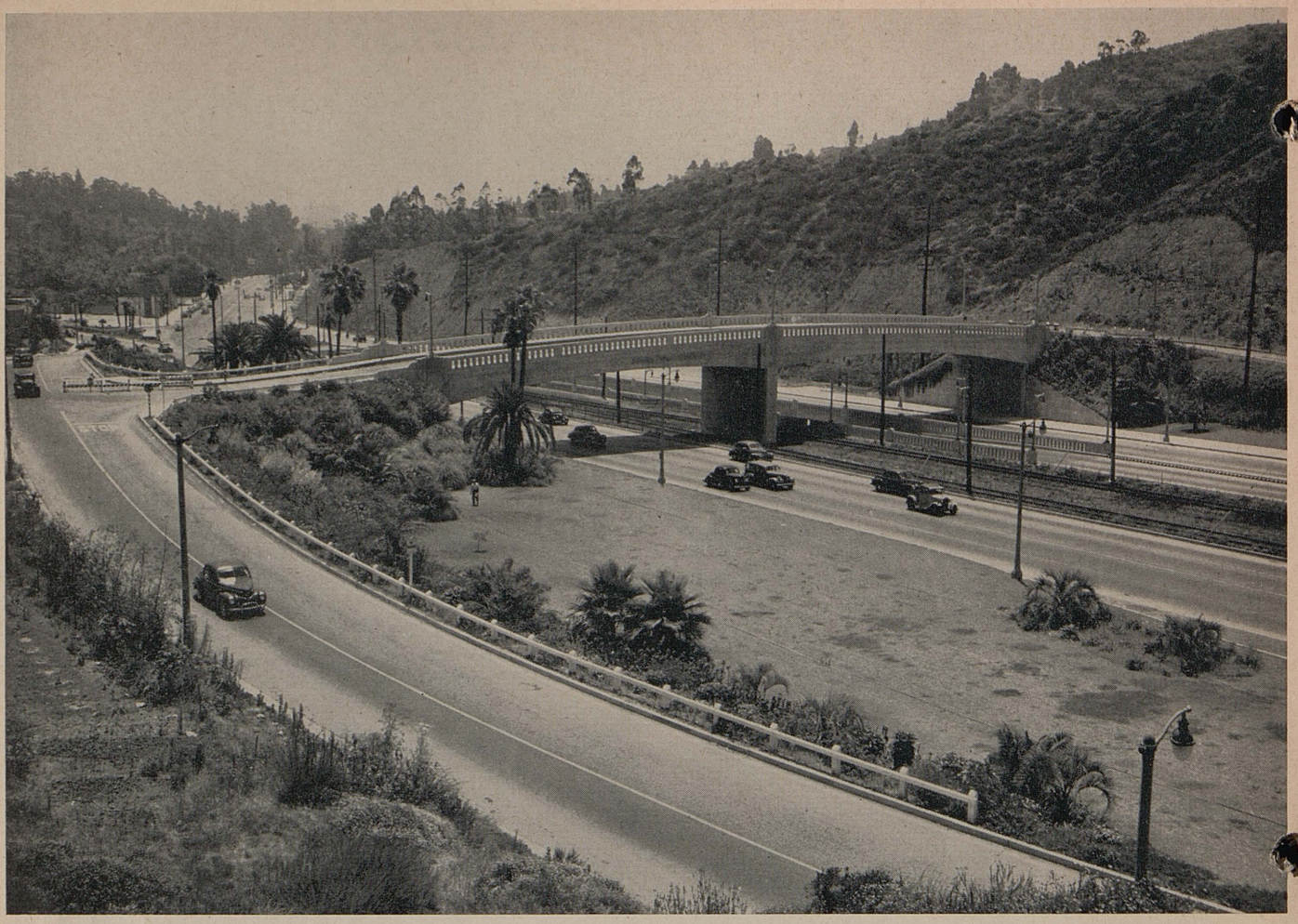
Besides the legislative changes permitting expenditures of State funds on urban extensions of State routes the most important implement toward provision of needed traffic facilities was the passage of 1939 of statutory provisions recognizing the "Freeway Principle" and providing the Highway Commission with the power to designate routes as freeways and to acquire the access rights of abutting property owners to such highways.

During the period of conversion from the old idea of rural State roads to the conception of a completely integrated system of urban and rural highways, the Division of Highways was laying plans for the provision of express-ways which would enable urban traffic to cut through the snarled congestion of cars feeding into metropolitan centers.

The first true freeway construction undertaken and completed on the State Highway System was that of the Arroyo Seco Parkway connecting Pasadena with downtown Los Angeles.

Ground was broken in South Pasadena on March 22, 1938, for the first Arroyo Seco contract and on December 30, 1940, the six-lanes of the nine-mile divided parkway were dedicated and opened to travel.

Construction was so designed, that even though the terrain of the Arroyo did not permit the building of conventional clover leaf interchanges, com-



Cahuenga Freeway will be carried into downtown Los Angeles to Aliso Street Bridge

pressed ramp types were used which eliminated left-hand turning for traffic entering or leaving the parkway. Accelerating and decelerating lanes were likewise provided. Elimination of cross-traffic was accomplished by overhead structures. The grade separation features required construction of 22 vehicular bridges, two pedestrian structures and two railroad bridges.

Of the five and three-quarters million dollars cost of that portion of the Arroyo Seco Parkway between Pasadena and the Los Angeles River, over one-and-a-half million dollars was expended for bridges. Construction of the paved Arroyo Seco flood control channel by the City of Los Angeles and the Federal government cost an additional $6,400,000.

Financing of the parkway was accomplished by cooperation between the State, cities of Los Angeles, Pasadena and South Pasadena, Federal Public Roads Administration, PWA and WPA.

The details of construction for other freeway projects in the Los Angeles area are similar to the story of the Arroyo Seco Parkway. The total development of these expressways will require some time, but it is planned that by the next three or four years the comprehensive plan for this metropolitan area will have reached a stage of completion which will serve traffic with some degree of adequacy.

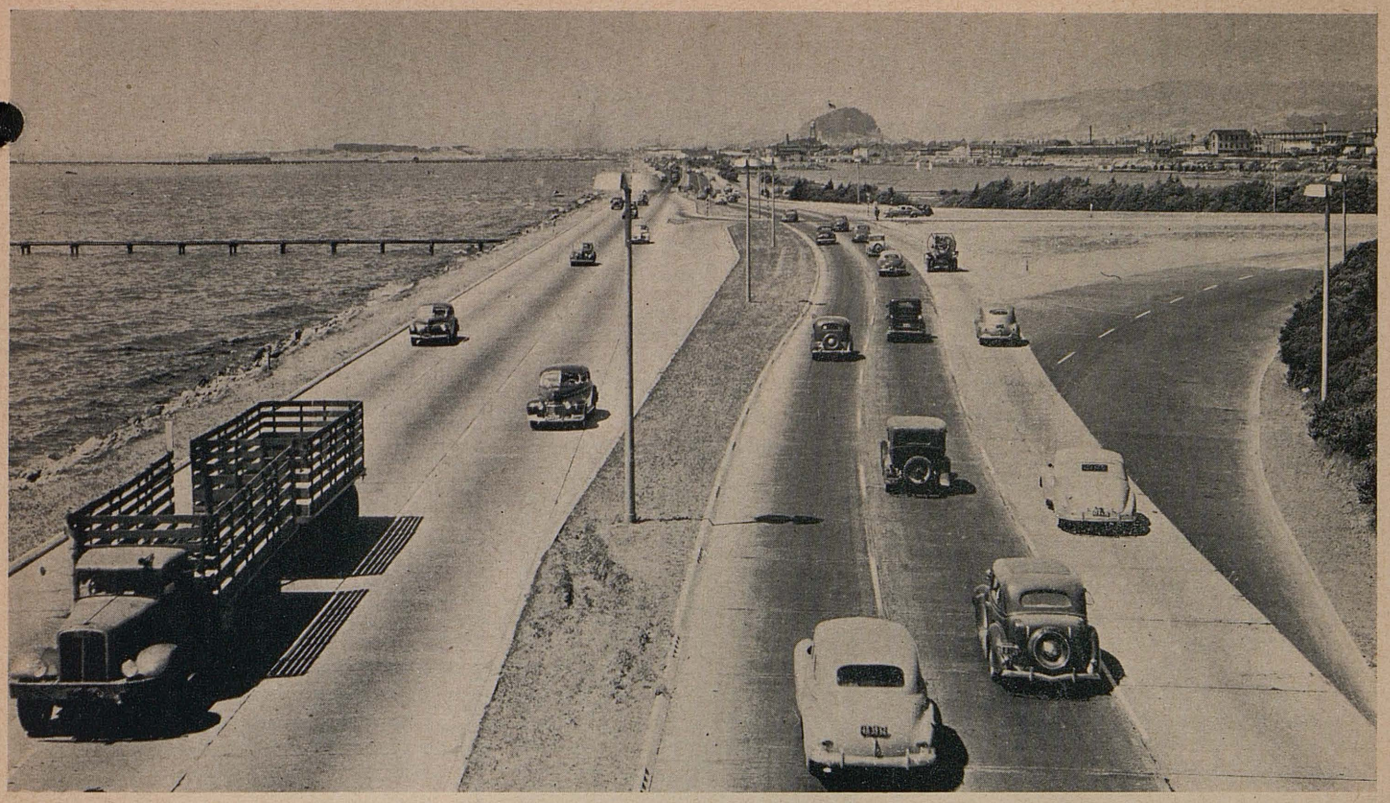
The extension of the Arroyo Seco Parkway through Elysian Park has been completed to Adobe Street. A portion of the Cahuenga Freeway has long been in service from Highland Avenue in Hollywood toward the San Fernando Valley. The Ramona Freeway which carries traffic easterly from the Aliso Street Bridge in downtown Los Angeles to Pomona, San Bernardino and Riverside, while not constructed to the standards of limited access used for the Arroyo Seco and Cahuenga Pass freeways, has been partially developed as an interurban arterial. The Olympic Freeway which will eventually serve as an expressway between the heart of Los Angeles and Santa Monica is being progressively completed to freeway standards by the City of Los Angeles with the financial cooperation of the State.

Plans are now complete for carrying the Cahuenga Freeway parallel to Sunset Boulevard into downtown Los Angeles to the Aliso Street Bridge. This expressway will be known as the Hollywood Parkway.

SANTA ANA FREEWAY

In addition to these five freeways feeding into the central Los Angeles metropolitan area there will be the Santa Ana Freeway which will carry U. S. 101 from the Aliso Street Bridge to Santa Ana and the Harbor Freeway which will extend southerly from the Arroyo Seco Parkway and parallel to south Figueroa Street to the Los Angeles Harbor.

In San Diego, construction is now beginning on development of the Balboa Parkway which will lead out of the city to the north through Balboa Park to a connection with the inland route to Riverside.



East Shore Freeway which will be extended to San Jose. This section is between Richmond and San Francisco-Oakland Bay Bridge

In the north, due to the phenomenal growth of traffic in the San Francisco peninsula area, it is imperative that the Bayshore Highway between that city and San Jose be converted as soon as possible into a six- and, in some instances, eight-lane freeway. This work was on the California Highway Commission's agenda in 1940 but was shelved after Pearl Harbor.

Since the first section of the Bayshore was opened to traffic in 1924, it has developed into one of the most important main-trunk highways in the State for through traffic to and from the southerly sections of the State, but particularly for the ever-increasing volume of express commuter-type of traffic between San Francisco and the residential urban areas on the peninsula. As the volume of traffic mounted, so did the accident rate until, compared with other four-lane highways in the State, it ranks among the highest in accidents per vehicle-mile.

Such undertakings as the original Bayshore Highway and its proposed conversion to a freeway, involving as they do expenditure of very large sums of highway funds, necessarily must be built under long-range programs.

Three units of the Bayshore Freeway are scheduled: (1) surveys, plans, and right of way acquisition from the Bay Bridge ramp at Fifth Street in San Francisco to the south city limits, 5.2 miles; (2) six lanes in width from the north city limits of South San Francisco to 0.3 miles south of the Southern Pacific underpass, 2.0 miles; and (3) six lanes in width between 0.3 miles south of the Southern Pacific Underpass to Peninsula Underpass in San Mateo, 6.6 miles. What might be termed a fourth unit is now under construction, a four-lane freeway on new alignment connecting the present southerly terminus of the Bayshore Highway at Santa Clara Avenue in San Jose with U. S. 101 at Ford Road, 8.1 miles to the south.

Another development of the freeway type delayed by the war was the East Shore Freeway between Richmond and San Jose. As early as 1940 the Highway Commission had planned to launch construction of the first unit in the 1941-43 budget, and more than a million dollars had been spent jointly by the State and the City of Oakland in the purchase of right of way for the new freeway through Oakland.

A considerable portion of the East Shore Freeway north of the Distribution Structure was constructed in the years before the war as the northerly approach to the Bay Bridge, but south of Oakland the project is still in the planning stage. Three units, however, are listed in the current postwar programs, **(1) six lanes from the South City Limits of Oakland to High Street, 2.9 miles; (2) six lanes from High Street to Sixth and Oak Streets, 3.3 miles; and (3) four lanes from the Junction of State Routes 14 and 69 through El Cerrito and Richmond, 1.9 miles.**

Benefits expected to be derived by construction of the East Shore Highway are:

(1) Adequate transportation between Oakland and valley points for agriculture and industry.

(2) A suitable trade route between Oakland and San Jose.

(3) An easier route to recreational areas.

(4) Alleviation of chronic congestion through Oakland. As many as 40,000 vehicles have been clocked in a single day on four-lane E. 12th Street, the present State Highway route.

Development of these proposed parkways is included as a major part of the Division of Highways $115,000,000 postwar construction program which was launched on November 9, 1945.

Shasta Reservoir Operated for Flood Control

(Continued from page 6)

to 1,300,000 acre-feet and 80,000 second-feet, respectively.

The excessive precipitation throughout the Sacramento River Basin during the months of November and December, 1945, averaged more than 150 per cent of normal and culminated in a flood of appreciable magnitude with high river stages prevalent in the Sacramento Valley from December 22d to January 10th. The Sacramento River Flood Control Project, over which the State Division of Water Resources exercises supervision of maintenance and operation, functioned without levee failure. Little Holland Tract and Liberty and Prospect islands in lower Yolo By-pass were inundated early in the flood. However, the State has flowage easements on these areas which permit the maintenance of substandard levees of sufficient height to provide protection only against low flood flows and high tides. The peak flow of the Sacramento River at Iron Canyon was 78,000 second-feet on December 27th. Peak flows at other locations in the Sacramento Valley included 80,000 second-feet on the Sacramento River near Chico; 40,000 second-feet on Sacramento River at Colusa; 51,000 second-feet in Sutter By-pass at Long Bridge; 48,000 second-feet on Feather River near Oroville; 22,500 second-feet on Sacramento River at Knights Landing; 68,000 second-feet on Sacramento River at Verona; 38,000 second-feet on American River at Folsom; 94,000 second-feet on Sacramento River at Sacramento; and 107,000 second-feet in Yolo By-pass at Lisbon. Water spilled over Moulton, Colusa, Tisdale, Fremont and Sacramento weirs into by-pass channels, although it was not necessary to open the movable gates on the crest of Sacramento Weir. The greatest flow released into project by-passes was that of 115,000 second-feet which entered the head of Yolo By-pass over Fremont Weir on December 30th.

The State Division of Water Resources directly maintains and operates flood control works constructed primarily for the protection or benefit of the project as a whole. These units comprise levees aggregating 90 miles in length, all by-pass channels, 50 miles of collecting canals and seepage ditches, three drainage pumping plants (2,000 h.p.), all nonnavigable river channels, five major flood control weirs, including one with a movable crest—crest lengths aggregate 14,325 feet—two sets of outfall gates, and numerous minor weirs, control structures, bridges, gaging stations and recorders.

The division also maintains and operates six radio water stage transmitters at strategic locations on Sacramento River at Iron Canyon (122 miles distant from Sacramento), Sacramento River at Ord Ferry, Feather River near Oroville, North Fork American River at Rattlesnake Bridge, South Fork American River at Coloma and San Joaquin River near Vernalis for use in obtaining timely forewarning of flood flow conditions to enable the prompt dissemination of information essential to the maintenance of flood control works. Water stages at these untended gaging stations are automatically transmitted hourly to the division office at Sacramento. These transmitters are of particular value when telephone and telegraph communication may be interrupted by storm. From the information so received it is possible to forecast the stage, magnitude and time of arrival of a particular flood crest essential for the protection of the populated areas in the lowlands. Similar radio broadcasts from automatic stage transmitters on the Kaweah River at McKay Point near Visalia and Kings River at Piedra east of Fresno are also received at Sacramento, 168 miles and 203 miles, distant from Sacramento, respectively.

In Memoriam

William Henry Rockingham

THE Division of Architecture, Department of Public Works, deeply regrets the sudden death of William Henry Rockingham early of the morning of January 5, 1946, at the age of 57 years.

"Bill," as he was known to his friends and associates, was in State service for 25 years and at the time of his death held a very important key position with the division in the capacity of Principal Mechanical and Electrical Engineer having charge of a large group of mechanical, electrical, and civil engineers. His responsibilities related to the design and installation of all heating, plumbing, lighting, ventilating, refrigerating, water supply, roads, drainage, sewer, and power systems; secure site and topographic surveys; conduct rate surveys; and make and check property descriptions.

Born in Inverness, Province of Quebec, Canada, July 29, 1888, he received his early education at Fort Bragg and Elk Grove, California, attended Polytechnic College of Engineering in Oakland, and graduated from the University of California in engineering in 1915.

He is survived by his wife, Winifred G., daughters, Phyllis Jean and Mrs. Paul W. Ayres, Jr., and his granddaughter Paul Anne Ayres.

San Francisco-Oakland Bay Bridge Peak Traffic Creates Problems

(Continued from page 22)

on military leaves. The painting program has been especially retarded during the last few years and it is planned to expand operations on this phase of maintenance as soon as possible.

The financial condition of the bridge continues to be excellent, as would be expected from the large volume of traffic which uses it.

The bridge staff is exerting itself to furnish the best possible service to the public and to maintain and operate the bridge in such a manner that it will perform efficiently its function as the principal highway connection between the cities on the east and west shores of San Francisco Bay.

State of California

EARL WARREN, Governor

Department of Public Works

Headquarters: Public Works Building, Twelfth and N Streets, Sacramento

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