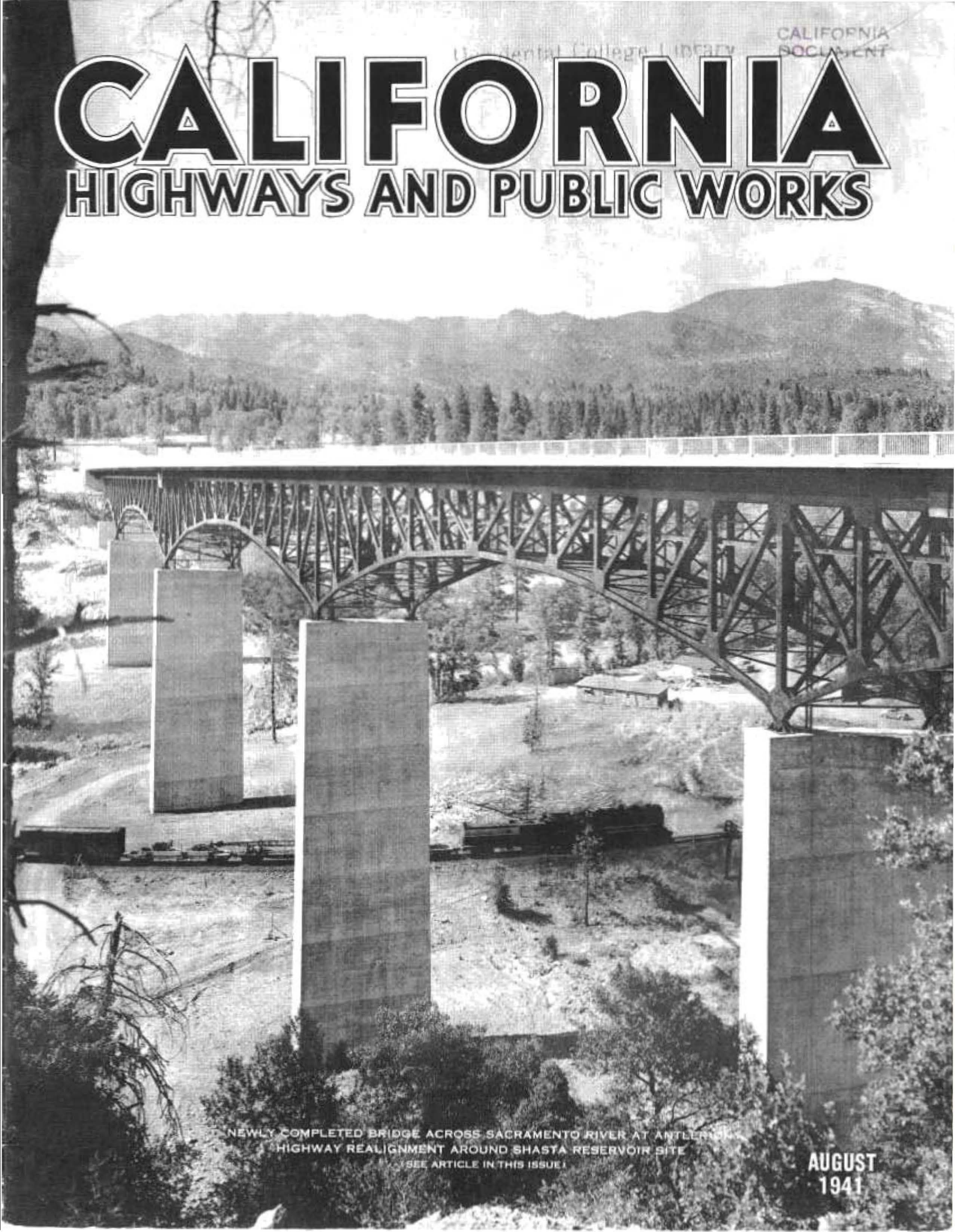
CALIFORNIA
HIGHWAYS AND PUBLIC WORKS



NEWLY COMPLETED BRIDGE ACROSS SACRAMENTO RIVER AT ANTLERS
HIGHWAY REALIGNMENT AROUND SHASTA RESERVOIR SITE
(SEE ARTICLE IN THIS ISSUE)

AUGUST
1941

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

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

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Antler Bridge

UNIT COMPLETED IN RELOCATION AROUND SHASTA RESERVOIR SITE

By F. W. PANHORST, Bridge Engineer

THE completion of the Sacramento River Bridge at Antler in Shasta County early this month marks an important step in the fulfillment of the task of relocating approximately 16 miles of State Highway in the Sacramento, Pit, and McCloud River canyons made necessary by the construction of the Shasta Dam near Kennett. A combination highway and railroad bridge across the Pit River is scheduled for completion next Spring.

The contract for the construction of the bridge at Antler, amounting to $680,000, was one of the major Division of Highway contracts concerned in the highway relocation work. The other contracts covered the grading and surfacing of the entire stretch of new highway. Funds for the work were supplied jointly by the United States Bureau of Reclamation and by the State of California. Approximately 75 per cent of the cost of the bridge was borne by the Bureau of Reclamation with the State supplying the balance.

BUILT ON CURVE

The bridge is a steel deck structure, 1,330 feet in length, on concrete piers and abutments. The roadway is on a 5,000-foot radius curve compounding into an 850-foot radius curve about 80 feet north of the south abutment. The entire structure is on a descending vertical curve of –2.5% grade at the south end and a –4.25% at the north end. The roadway width is 50 feet and two 2-foot 6-inch sidewalks are also provided.

There are five major spans: two of 189 feet, two of 252 feet, and the central span which is 273 feet long. The 273-foot span consists of a 147-foot truss supported by two 63-foot cantilever arms. A steel stringer approach span at each end of the structure is supported by the abutment and the 42-foot cantilever arm.

The pier heights vary considerably, the tallest being 172 feet above footing grade. The piers are 8 feet wide by 40 feet long at the top and the sides are battered ¼-inch per foot to provide a pleasing appearance.

They are of cellular construction, using 18-inch walls and interior ribs throughout. Varying amounts of reinforcing steel in these walls provide for the differences in stress at the proper points. All piers are founded on rock.

Three of the piers extend down below river level and required concrete foundations poured under water. Construction joints are provided in the pier shafts at 20-foot intervals; a horizontal distribution girder, or "floor," being located at these points. Piers are battered ¼-inch to 12-inch for appearance.

As the ultimate water level in the Shasta Reservoir will practically submerge the main piers, openings are provided at various points in the pier walls and floors to permit the free passage of water. This procedure not only eliminates hydrostatic pressure on the pier walls but adds considerable "mass" or "inertia due to weight of fluid" to resist earthquake forces, discussed later.

IMPORTANT CONSTRUCTION FACTORS

Next to structural safety, a fundamental requirement, smooth deck surfaces and good railing appearance are probably the two most important factors to the motorist. Considerable care was taken, therefore, to insure good results in the completed structure, as follows:

(1) A railing and gutter profile was established for each side of the bridge, using long 1,400-foot vertical curves to give a smooth change of superelevation over the structure to fit approach alignment.

(2) Truss deflections due to full dead load were carefully computed, and elevations determined for each truss panel point to fit an "unloaded" profile. This "unloaded" profile is the final profile, plus the anticipated deflection under dead load.

(3) The fabricating shop subpunched, or sub-drilled, all main truss connections, then completely assembled each truss in a horizontal position in the shop, placing each top chord panel point in its correct relative position to fit the "unloaded" profile.

(4) All truss joints were then reamed to full size, and all members match-marked for erection.

(5) Trusses were then erected at the bridge site in any desired order as correct position was secured simply by jacking the trusses into shape until all truss connections were fair. No field drilling of these connections was allowed.

(6) The concrete deck was then poured in any order to suit the contractor's working schedule. This was an important feature, as pouring a deck slab uniformly from one end of a structure to the other is much less costly than requiring short individual pours over various parts of the bridge.

DECK IS "CUT LOOSE"

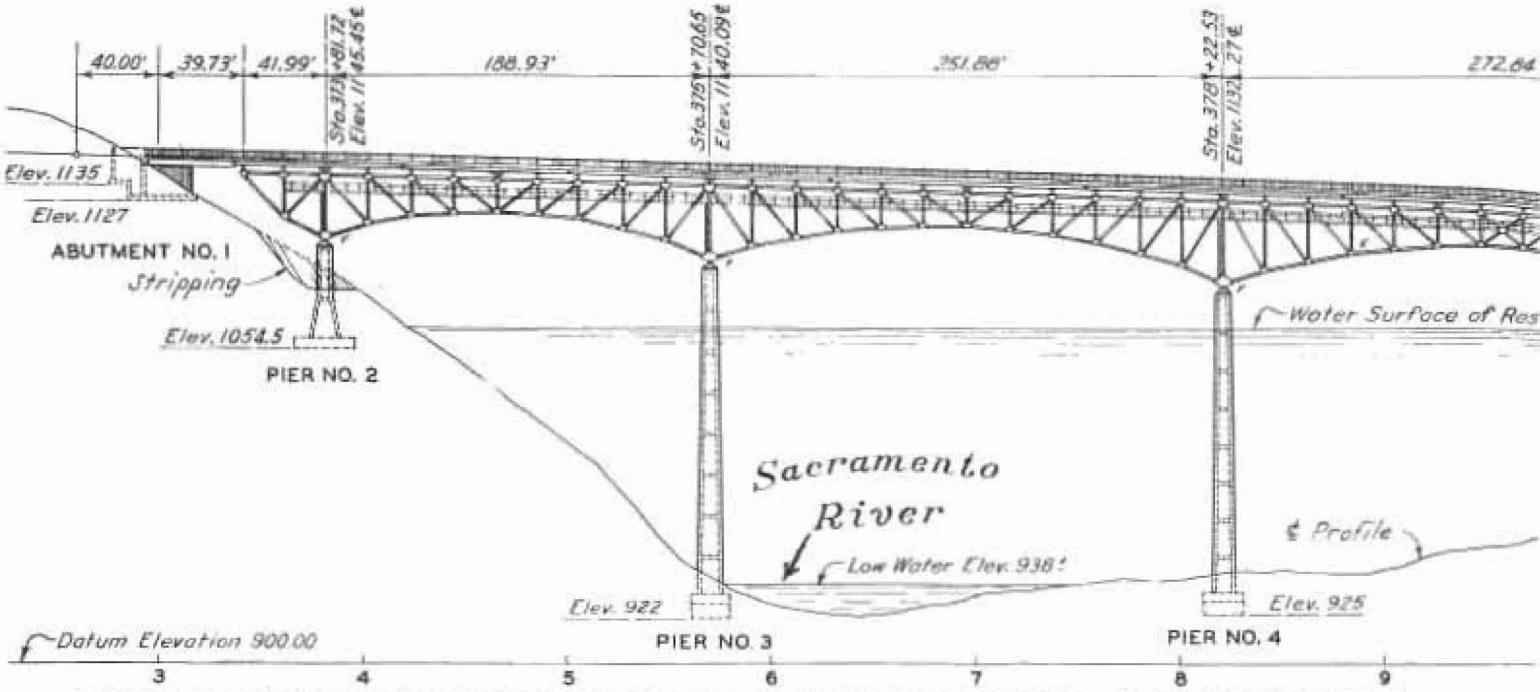
To prevent participation of the concrete deck slab in resisting stress set up in the trusses by the weight of the slab, as it would surely do if rigidly attached, the deck has been literally "cut loose" by introducing small expansion joints in the stringers approximately 100 feet apart. This is of no consequence to actual strength of truss members, but has a pronounced effect upon deflection of the trusses. As accurate truss-deflections can be determined only if the slab is prevented from taking direct stress, this procedure is essential to secure a smooth deck.

It is most important in constructing a concrete deck to anticipate accurately the deformation of the various members involved, as correcting a rough or wavy deck after construction is a difficult and costly process.

To eliminate deflection stresses from the piers, temporary expansion rollers were used at the tops of all piers. Upon completion of the deck slab and upon a suitable day of average temperature, the truss shoes were grouted into permanent position.

ROTATING TYPE JOINTS

Piers were arranged so that the four main piers on either side of the central span are supported longitudinally by anchor piers of comparatively low height located high up on



OUTLINE SKETCH OF 1,330-FOOT STEEL AND CONCRETE BRIDGE ACROSS SACRAMENTO RIVER CANYON AT ANTLER ON HIGHWAY RELOCATION AROUND SHASTA RESERVOIR SITE

the canyon walls. The main trusses are pin connected to the tops of all piers. A suspended span in the central 273-foot span, with provision for expansion at one end, establishes a symmetrical truss layout, continuous over three supports on each side of this span. Trusses are then fully "indeterminate" only over the center support of the group, the "degree of indeterminacy" diminishing toward the two outer supports of the group, becoming fully "determinate" at these supports and beyond.

In order to support the main piers in a longitudinal direction, the trusses were attached to the pier tops by a rotating type of joint that will transmit horizontal shear, but no bending movement. The elimination of a moment connection is important as a rigid type of connection would practically double the temperature stresses in trusses and piers set up by horizontal deflection of the piers.

Transversely, the four high piers must provide their own stability. No temperature stresses exist in this direction, but wind and earthquake forces are quite severe. Analysis of the effect of "wave action" of the reservoir water due to earthquake forces was made. This "wave action" effect refers to the oscillating motion set up by an earthquake, and should not be confused with surface "waves" due to wind or tide. Extensive research and model experimentation has been done in this field by the U. S. Reclamation Bureau at Denver, Colorado. The department is indebted to the Reclamation Bureau for the use of these studies.

TRUSSES BEND AROUND CURVE

Trusses were bent horizontally at two points between each pier rather than at the piers, to fit the horizontal curve of the bridge. A number of advantages result from this:

1. The eccentricity, or overhang, of deck stringers relative to the trusses is but one-fourth that produced by bending the trusses only at the piers. This eliminated additional steel in the floorbeams located between bend lines.

2. Bending moment in the truss is very low at the bend line due to the continuous truss layout. These bend lines occur at approximately the quarter points in the span where the dead load moments are practically zero.

Truss joint stresses are correspondingly low, and the torque resulting from these stresses is greatly reduced. While it is true that the torsional stresses set up at the bend lines must be transferred along the trusses to the piers, stresses are so low as to require no additional metal in the main trusses to resist them.

A newly developed alloy steel was used in the trusses, with 50 per cent greater tensile strength and five times as rust resisting as ordinary structural steel. Its excellent corrosive resistence permitted minimum sections of ½-inch thickness, while the additional strength available resulted in large savings in weight of metal.

The truss member design represents a considerable departure from previous construction. All members consist of a 14-inch beam section, supplemented when necessary on the compression members with 15-inch or 18-inch channel sections shop welded to the beam flanges. No stay plates or lacing bars, formerly considered indispensable to truss members, were used. This not only reduces shop fabrication, but eliminates excess metal not directly participating in stress resistance.

As truss members are perfectly smooth and accessible for painting, maintenance costs will be materially reduced.

ECONOMICAL "T" SECTIONS

Bracing members were made from structural tee sections obtained by splitting wide flange beam sections at the rolling mill when hot. These sections became available fairly recently and have proven very economical, reducing weight and eliminating shop fabrication.

Truss-shoes are built-up assemblies of rolled steel plate, shop-welded together to form a rigid unit. Alloy steel was used, resulting in a strength

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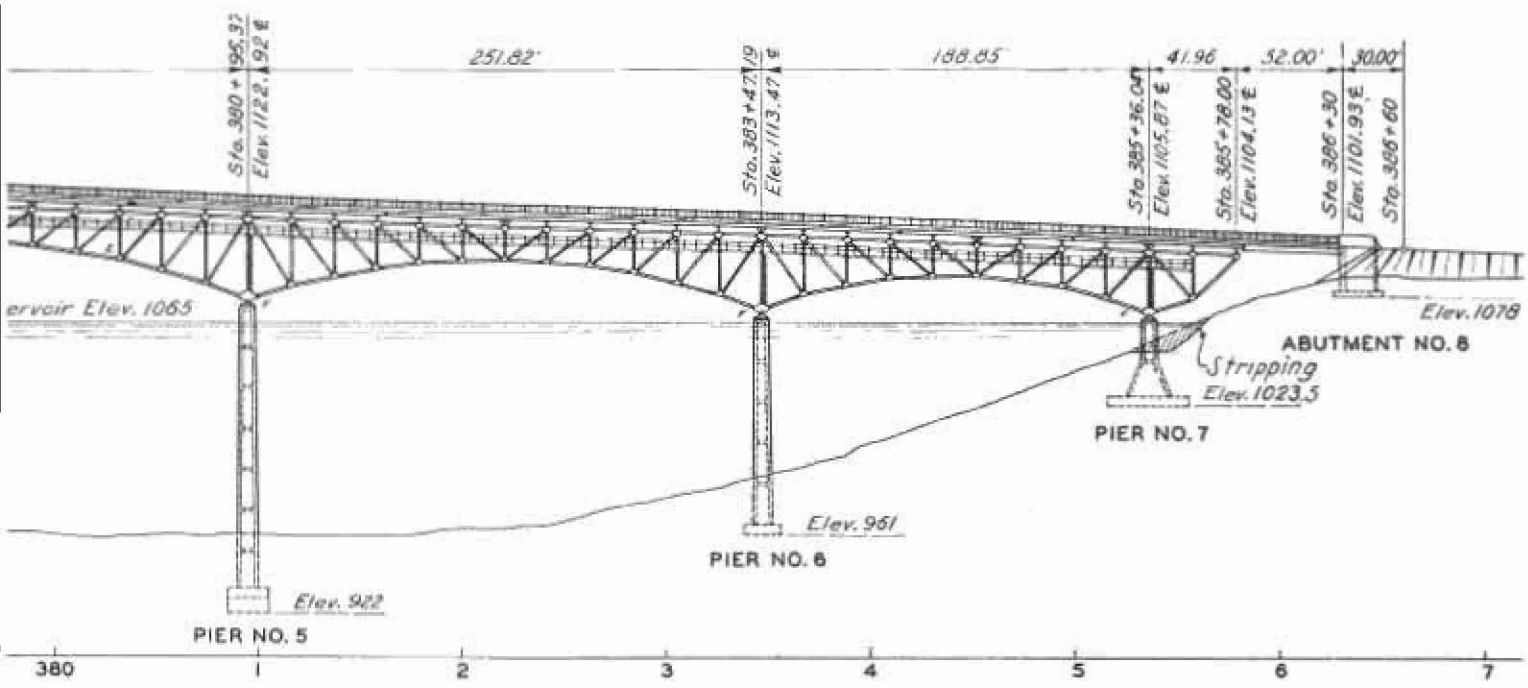


View of 50-foot roadway of Antler Bridge built on 850-foot radius curve to carry relocated 4-lane divided highway

Relocation

ALL-YEAR YOSEMITE HIGHWAY IS NOW COMPLETED EAST OF MARIPOSA

By R. E. PIERCE, District Engineer

INDEPENDENCE DAY, 1941, saw traffic for the first time using the newly constructed relocation for 1.9 miles easterly from historic Mariposa. This change eliminates the last section of the original narrow, low standard alignment of the All-year Yosemite Highway, State Sign Route 140.

The following data indicates the great improvement made by this relocation.

	Old Route	New Route
Length, miles	2.103	1.945
Curves less than 500 ft. radius	1	0
Curvature, total degrees	2014°01'	349°43'

This makes a difference of more than 1664 degrees in favor of the new route, or nearly 5 complete circles; while the new route has less than 1 complete circle.

	Old Route	New Route
Total number of curves	37	8
Minimum radius	2-100	1-500
Roadbed width	21 ft.	28 ft.

Referring to the map, it will be seen that the resulting improvement was obtained by running northerly from Charles Street in Mariposa, thus avoiding the right angle turns imposed on the traveling public, due to following existing streets in the town.

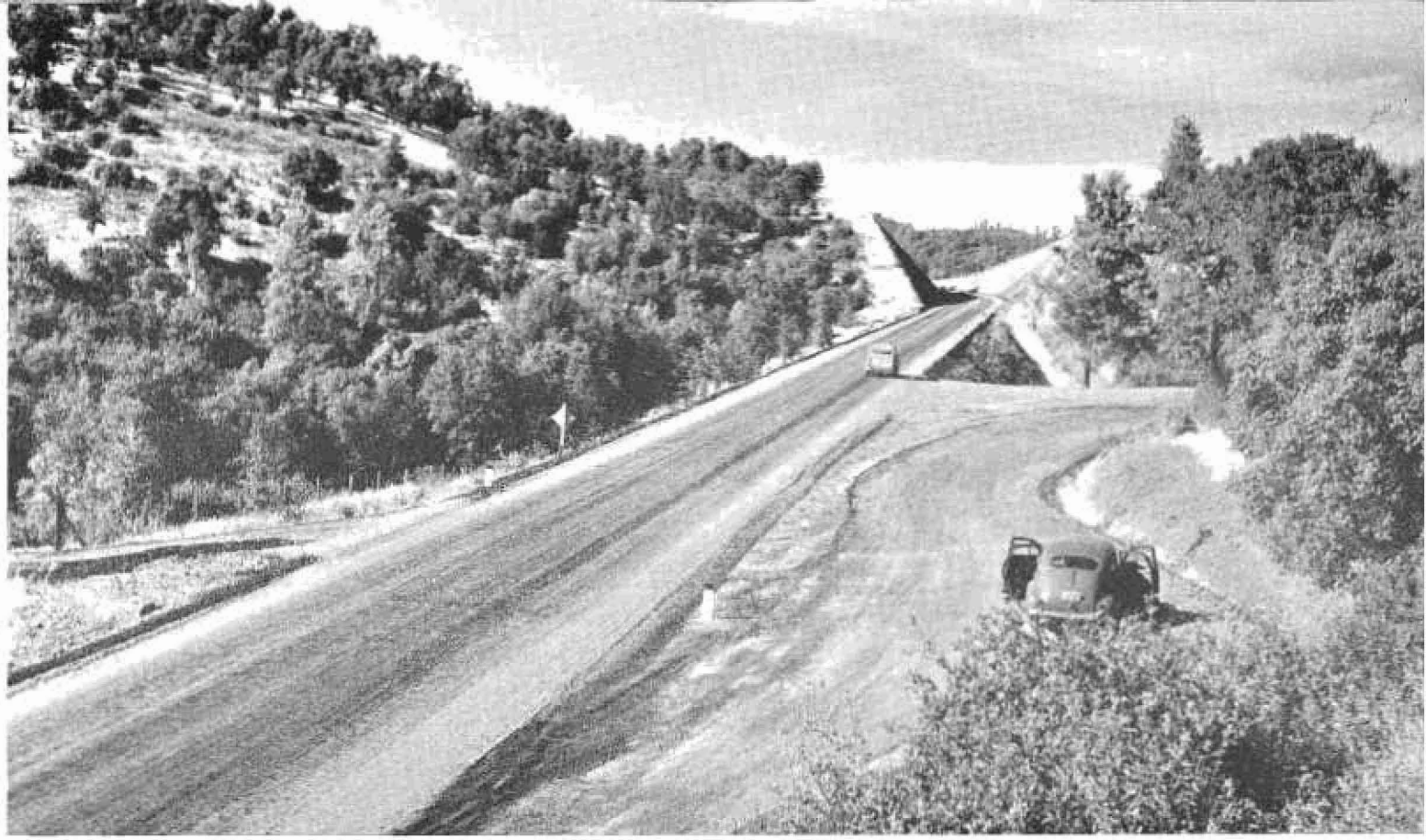
The balance of the improved alignment is secured by more favorable topography and by some rather heavy grading.

In addition to shortening State Sign Route 140 by 0.158 mile, there is also a distance of 0.55 mile of State Sign Route 49 eliminated due to the new junction of the two routes about 0.5 mile north of Mariposa, instead of in the town as formerly.

This recent improvement of the All-year Yosemite Highway from Mariposa easterly was allotted $85,346. The contract was awarded on May 2, 1940, the date for completion falling on October 11, 1940. However, after the grading was completed and most of the rock surfacing was on the grade, the contractor abandoned the job, which was taken over by the bonding company.

By this time, the rainy season had begun; hence the job was closed down and work was not resumed until May of this year.

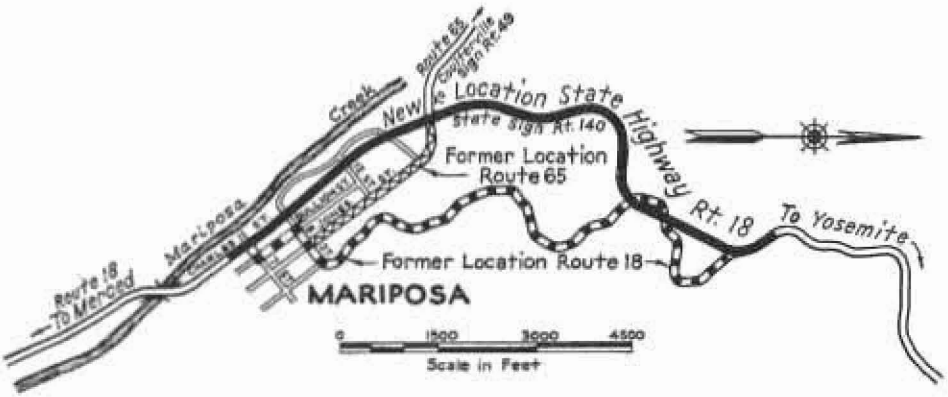
New All-Year Yosemite Highway relocation goes straight through Mariposa obviating right hand turns of old route on city streets



Long, straight stretches characterize new highway which has only 8 curves compared to 37 on old route

The principal items in this contract were: 111,000 cubic yards of roadway excavation; 12,700 tons of gravel base; 5,800 tons of mineral aggregate (road mix surfacing), and 1,852 lineal feet of 8 to 48 inch corrugated metal pipe for culverts.

The Town of Mariposa founded during the "Gold Rush" period has a unique relic in its courthouse. Erected in 1852, it has been used continuously since that time for the same purpose, and is said to be the oldest courthouse in continuous use in California.



Highway Relocation Bridge Across Shasta Reservoir Site Completed

(Continued from page 2)

and ductility equal to that secured in the main truss. The largest truss shoe is approximately five feet square, 2½ feet high, and supports a load of more than 2,000,000 pounds.

Temperature variations of 20 to 120 degrees Fahrenheit produce a total movement of nine inches at the one expansion joint in the truss system. A sliding "finger" type of joint was used in the deck slab, featured by a locking device that anchors it rigidly to the deck to prevent noise and vibration due to passing vehicles. The joint is self-cleaning, in that rubbish and dirt can not collect in the openings, but are pushed off by movement of the bridge.

Construction was started on the substructure in March 1940, and was completed in October 1940. The steel erection was started in late September 1940 and was completed in February 1941. A total of 75 inches of rain fell during this period, greatly hampering the erection procedure.

The concrete roadway was completed early in June 1941 and shortly afterwards the contractors on the adjacent highway grading work were permitted to use the bridge. Public traffic will be routed over the new bridge upon completion of the surfacing on the new highway relocation.

The new structure with its 50-foot roadway replaces the old narrow concrete bridge at Pollock which had only a 21-foot roadway. Inasmuch as it

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Los Angeles WILL GET NEW BUILDING TO HOUSE STATE HIGHWAY OFFICES

THE NEW State Building to be erected in Los Angeles, for which contracts were awarded by Director of Public Works Frank W. Clark July 19, will be located on the east side of Spring Street between First and Second Streets.

The building will be three stories in height with a full basement and a penthouse of considerable size rising above the central portion. Situated near the Civic Center, this building, designed by State Architect Anson Boyd, will be in character with the nearby buildings presenting a dignified, modernized-classical exterior.

"For many years," said Director Clark, "the Division of Highways has been in very cramped quarters in the present State Building and it has become necessary to erect a new building in order that the division may properly function. Under the terms of the contract, the building will have to be finished within 200 working days."

HOUSE THREE DIVISIONS

In addition to the Division of Highways, local offices of the Division of Architecture and Division of Water Resources of the Department of Public Works will occupy the new structure, together with offices for the director.

The Division of Highways will occupy the first and second floors and the two other divisions will be located on the third floor until such time in the future as the Highway Division may be obliged to again expand its quarters.

"Additional personnel of the legal staff of the Department of Public Works will also be accommodated in the new building," said Director Clark. "At the present time the greater portion of the legal work required by the Los Angeles Division of Highways district must of necessity be handled in our Sacramento headquarters. This does not add to the facility with which the department can conduct the tremendous amount of highway work in this section of the State.

CONFORMS WITH CITY PLAN

"In preparing the design for the new building, our architect engineers have made every effort to have the structure conform with the general civic center plan being developed by the City of Los Angeles. Governor Olson and I have endeavored to cooperate with the municipal authorities in making any new State Building fit in with the general civic center scheme.

"It was for this reason that a year ago we agreed to dispose of the site which had been secured for the new State Building on Bunker Hill between Hill and Olive Streets and Court and Temple Streets to an agency of the city government and instructed our division architect to prepare new plans for a building to be erected on the Spring Street site in close proximity to the City Hall."

SIMPLE AND PRACTICAL

A maximum of window areas with an economical column spacing is the State Architect's aim to be accomplished with simple materials and an avoidance of unnecessary detail. Pleasing concrete textures will take the place of elaborate mouldings and breaks.

From the entrance lobby of unusual interest to the penthouse structure, the building, with its 62,000 feet total area, has been planned for its practical functions.

In the basement is provided a small assembly room with a commission room adjoining. Like the rest of the building, this room is to be air conditioned and illuminated by fluorescent light. The remainder of the basement will be occupied by storage and file rooms, blue-printing department, and boiler and machine rooms. A freight elevator is off the service corridor and a service road running to it connects with an alley in rear.

From the entry on the first floor a vestibule serves the stairway to the assembly room and a telephone room for use of the public and contractors at bid openings.

The entrance lobby will have a terrazzo floor and marble steps. Elevator doors will be of figured capomo, an inexpensive hardwood from Mexico and Central America resembling bleached Honduras mahogany. The use of aluminum and stainless steel has been avoided due to the Government's need for these materials.

The public lobby leads off the elevator lobby with a counter and glassed information booth connecting to the permit engineers' space. A corridor leads from the lobby to the director's suite, consisting of a reception room, secretary's space with counter, director's office, assistant director's office, conference and committee room and foyer to the conference room, storage and washroom.

ACOUSTIC PROVISIONS

Down the corridor is also the maintenance engineer's and accounting department's pay roll and cashier's office and files.

Lavatories are located at the intersection of the corridors near the front lobby. Off the rear corridor is the testing laboratory and outdoor advertising office and offices of the hydraulic engineer, district materials engineer, city and cooperative projects, assistant office engineer and a large stenographic room. Ceilings of acoustical material will protect the building against noise and clatter.

On the second floor is a large elevator lobby and waiting room with counter for the general drafting room. Off this lobby a corridor connects to title search offices, and right of way department. The general drafting room occupies an entire wing of the building. Occupying portion of the east wing is the State Highway Engineer's offices and district engineer's offices, a reception room and secretary's office and offices of construction engineer's department, district office engineer, right of way agents, attorneys and a conference room.

The third floor houses the bridge department, traffic department, and Division of Water Resources, as well

New State Highway office building for Los Angeles designed by Division of Architecture of Department of Public Works

as the Architectural Division offices and a rest room.

In the penthouse, in addition to a recreation or assembly room, are elevator-machinery room, air-washer room and stairway which also leads to a roof deck. This space will provide a recreation area for the employees. It also connects to the rear stairway.

Provisions have been made for a fourth floor addition in the future, which can be anchored to the present building by uncovering the steel stubs on the roof and concrete poured to the desired height for an additional floor. The penthouse construction is such that it is removable and the boiler room chimney top and all can be moved up another story. The site provides ample space for future additions and this has been considered in the design of the building.

The planning is a result of devising a scheme which will be elastic, lending itself to changes in partitions from time to time. The Highway Department's special requirements developed the shape of the building. The requirements presented something of a problem as the function and interrelation of departments had to be carefully considered to insure convenience, efficiency and economy.

CODE FOLLOWED BY ROAD SIGN COLORS

Colors of road signs follow a definite code.

Warning signs are always yellow, except the advance railroad crossing sign, which is circular and white, with black letters. Yellow signs are of two types. Some are diamond shaped and used to indicate need for going slowly due to a permanent hazard, such as a curve, narrow bridge, grade, and similar conditions. Other yellow signs are rectangular and show need for proceeding with caution because of a cross road, slide area, school zone, and other possible but not necessarily constant hazards.

"Stop" signs are the only ones with a red background. Other regulatory signs and direction types are square or rectangular with black and white colors. U. S. route number signs are shield-shaped, the California route number signs are formed like an acorn.

United States and State route number signs are planned so that odd numbers represent the north-south routes and even the east-west.

Tourist: What a quaint little village! Truly one-half the world is ignorant of how the other half lives.

Native: Not in this village, mister, not in this village.

Highway Relocation Around Shasta Reservoir

(Continued from page 5)

will be inundated by the lake backed up by Shasta Dam, the old bridge at Pollock will be abandoned after traffic is routed over the new bridge with its deck 210 feet above the low water level of the lake.

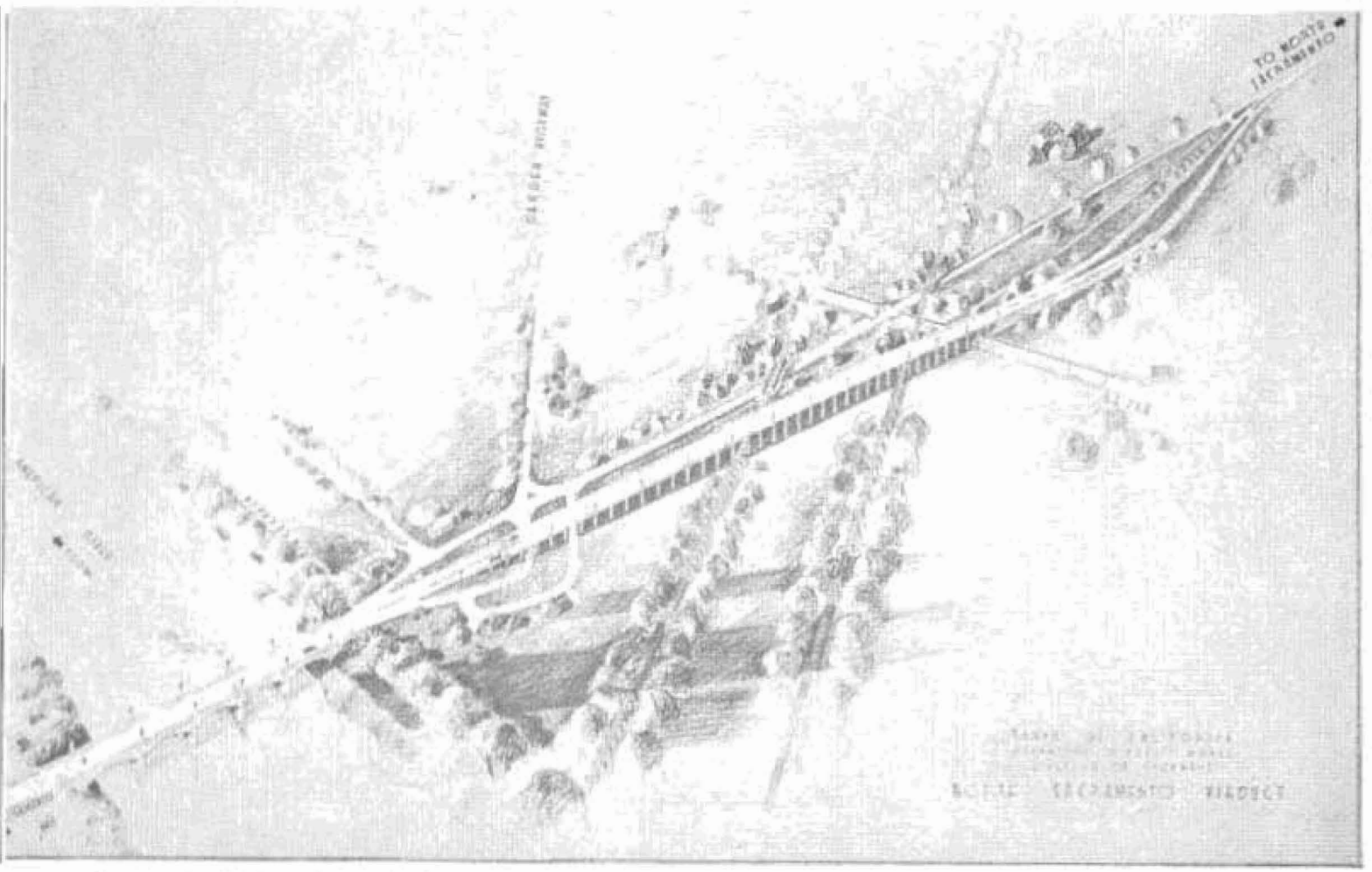
Telephone and telegraph cables are carried across the bridge under the roadway deck.

Mr. Charles R. Poppe is Resident Engineer for the State on this project. The structure was designed by the Bridge Department under the direction of the writer, L. C. Hollister, Design Engineer and Glenn L. Enke, Associate Bridge Engineer.

The United Concrete Pipe Corporation of Los Angeles was the contractor, having been awarded the contract by Director of Public Works Frank W. Clark on their bid of $672,046, the lowest of seven bids received.

Young Father—In your sermon this morning you spoke about a baby being a new wave on the ocean of life.

Minister—That's right. Do you think a fresh squall would have been more correct?



Sketch of 1,496-foot viaduct for 4-lane highway now under construction across American River overflow between Sacramento and North Sacramento

Viaduct

GROUND-BREAKING STARTS CONSTRUCTION ACROSS THE AMERICAN RIVER OVERFLOW

CONSTRUCTION of the half million dollar viaduct across the American River connecting Sacramento and North Sacramento was begun July 8 following ground-breaking ceremonies held at the easterly end of the project.

A program of speech making, participated in by Sacramento County and City and North Sacramento officials, the U. S. Army, and representatives of chambers of commerce and civic organizations of both cities, preceded the turning of the first spadeful of earth by Director of Public Works Frank W. Clark. Immediately following that event the contractor, Earl W. Heple, of San Jose, who will construct the viadnet at a cost of $528,136, set heavy equipment to work on the project.

Secretary of State Paul Peek represented Governor Culbert L. Olson, and Captain M. P. Hart of McClellan Field, representing Lt. Colonel John W. Clark, spoke for the Army. Captain Hart said that McClellan Field was particularly interested in the viaduct because it would constitute an important unit in the West Coast National Defense Program.

Other speakers were Assemblyman Edward J. Cain of Sacramento, who made the opening address; Mayor Tom B. Monk of Sacramento; Mayor Elwood Miller of North Sacramento; President William Rutherford of the North Sacramento Chamber of Commerce; Dr. R. N. S. Cook, President of the Sacramento Chamber of Commerce; and Clarence Champlin, Sacramento Board of Supervisors.

The proposed project will make a true all-year highway north on Route U. S. 99 and east on U. S. 40, as well as between the two cities by obviating the necessity of closing the road at times each winter due to flooding by overflow waters of the American River.

The new structure will start about 300 feet north of the American River bridge and will rise by easy vertical curves at a maximum rate of 6.2 per cent to a height of more than 50 feet above ground.

It will clear the railroad trestle by 28 feet to provide for future raising of the tracks, which are now below the extreme flood plane established by the State Reclamation Board engineers.

Connections will be made at the end of the American River bridge and at the south limits of North Sacramento. An off-ramp connection will be made to the Garden Highway and bottom lands passing under the

structure so that cars will not have to cross opposing traffic.

The viaduct will be of reinforced concrete with the exception of the steel railing and expansion details. It will be 1,496 feet long, consisting of 36 spans each 41 feet long with 10-foot cantilever spans at each end of the bridge.

The bridge deck will have an overall width of 65 feet, consisting of a 6½-inch slab supported on 11 shallow girders each one foot wide. The depth of the superstructure will be only 3 feet 8 inches, which was an important consideration in providing clearance for the railroads with a minimum rise.

The viaduct will provide four traffic lanes on two 25-foot roadways, separated by a 4-foot dividing strip and in addition two sidewalks each 4 feet wide. An open type steel railing will permit an unobstructed view from the deck and harmonize with the structural features of the bridge. The deck will be lighted by 20 incandescent luminaires.

Approximately one year will be required to complete the structure and approach work.

In the first two months of 1941 legislative sessions in the New England states, 825 bills were introduced affecting highway users and the highway transportation industry. Connecticut led with 320; Massachusetts, 261; Maine, 117; New Hampshire, 58; Vermont, 37; Rhode Island, 32.

Weekly incomes of more than half the car owners in the United States are less than $30 in normal times, states the American Petroleum Institute. Almost three-quarters of all the car owners have incomes of less than $40. Only 12 per cent have an income of more than $60 a week.

Director Frank W. Clark breaks ground for new viaduct, assisted by Assemblyman E. J. Cain (left) and Secretary of State Paul Peek

Argentina Highway Network Will Cost $225,000,000

Argentina plans an improved network of roadways which will form an important part of the International Pacific Highway which is to extend eventually from Fairbanks, Alaska, to Buenos Aires.

Advices received by the Automobile Club of Southern California state that the National Roads Board of Argentina has submitted to the federal government a program involving a national outlay of 900 million pesos ($225,000,000). This sum, which will be expended over a period of 14 years, represents an increase of 585 million pesos over the originally announced plan.

Preference will be given to appropriations for roads linking Argentina with its neighboring republics. The new program allocates 45 million pesos for completion of the route connecting Argentina with northern Bolivia; 41 million pesos for a road from Buenos Aires to Mendoza and the Chilean border; and 27 million pesos for a highway through the Chaco to Clorinda, opposite the Paraguayan capital of Asuncion.

Also planned are widespread road construction and improvements in the southern territories of Argentina, as well as important inter-provincial roads. The plan contemplates an expenditure of 354,521,284 pesos ($88,315,160) in the federal capital and Buenos Aires province.

274 Billion Miles On Necessity Trips

Authoritative figures recently compiled show that 96 per cent of the passenger automobiles in use in the United States are engaged in necessity driving. Private owners drove 274 billion miles on 15 billion necessary trips in 1940—mileage more than ten times that of any other form of transport, and over five times that of electric and steam trains, buses, and airlines combined.

Over half the year's total automobile mileage, and in excess of three-fourths of the individual trips, were for purposes connected with earning a livelihood or closely related economic pursuits, surveys disclose.

Realignment REDUCES GRADES AND CURVES ON 101 SOUTH OF SAN LUIS OBISPO

By E. J. L. PETERSON, District Office Engineer

WORK is under way on the realignment of the Coast Highway U. S. 101 in San Luis Obispo County, at Miles Station halfway between San Luis Obispo and Pismo Beach.

The new alignment includes elimination of the present narrow posted bridge over the San Luis Obispo Creek and replacement of a section of poor alignment and grades where the accident rate is comparatively high.

The volume of traffic over this section varies from 4,000 to 7,500 vehicles per day. During the summer months, on holidays and week ends, when there is a particularly large volume of recreational traffic, the volume has been found to exceed 10,000 vehicles per day.

The following tabulation will indicate a comparison of the standards of the old with the new highway:

	Old Highway	New Highway
Number of curves (1,000 foot radius or less)	4	0
Minimum radius	600 feet	1500 feet
Total curvature	250 degrees 15 min.	126 degrees 32 min.
Maximum grades	6%	4.78%
Length	1.668 miles	1.489 miles

The saving in distance is 0.179 Miles.

This project is one and one-half miles in length and consists in general of constructing a reinforced concrete bridge with a 26-foot roadway over San Luis Obispo Creek and grading a 36-foot roadbed and placing plant-mixed surfacing 22 feet wide by 0.25 foot thick. The surfacing is placed on a crushed rock base 6 inches thick over the full width of the roadbed with 1.25-foot selected material sub-base. The 7-foot shoulders will receive a Class "B" seal coat.

The improvement was divided into two parts, contracts being let in August 1940, one for the bridge construction, awarded to Dan Caputo of San Jose, California, and the other for the road construction let to Gibbons & Reed of Burbank, California.

The new location lies easterly of the present road and, where San Luis Obispo and Ontario Creeks are crossed, the old channels had been filled with soft black sand, a black and blue peaty clay having a moisture content of 40 to 60 per cent and varying in depth from 10 to 70 feet.

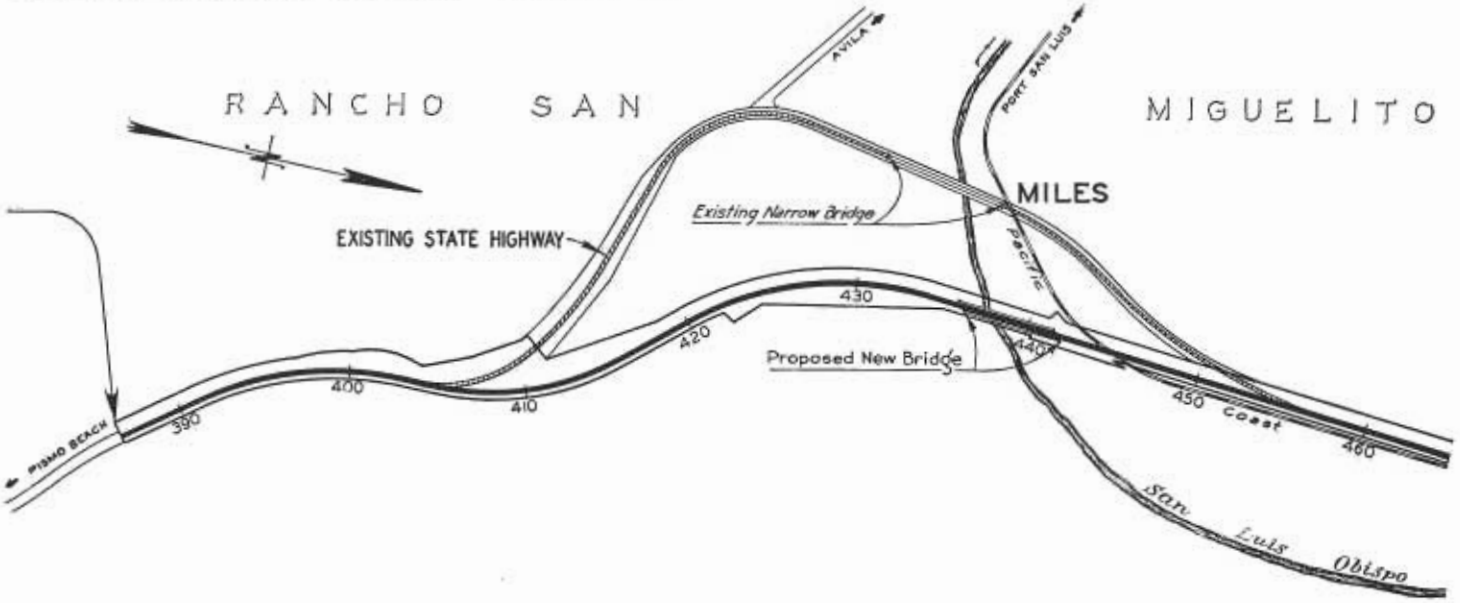
These areas required special foundation treatment to support the superimposed loads to be placed thereon by the highway embankments which vary up to 70 feet in height. Stabilization of the foundations at these locations was accomplished by constructing vertical sand drains to permit the escape of ground water as pressure was applied to the surface in placing the embankment.

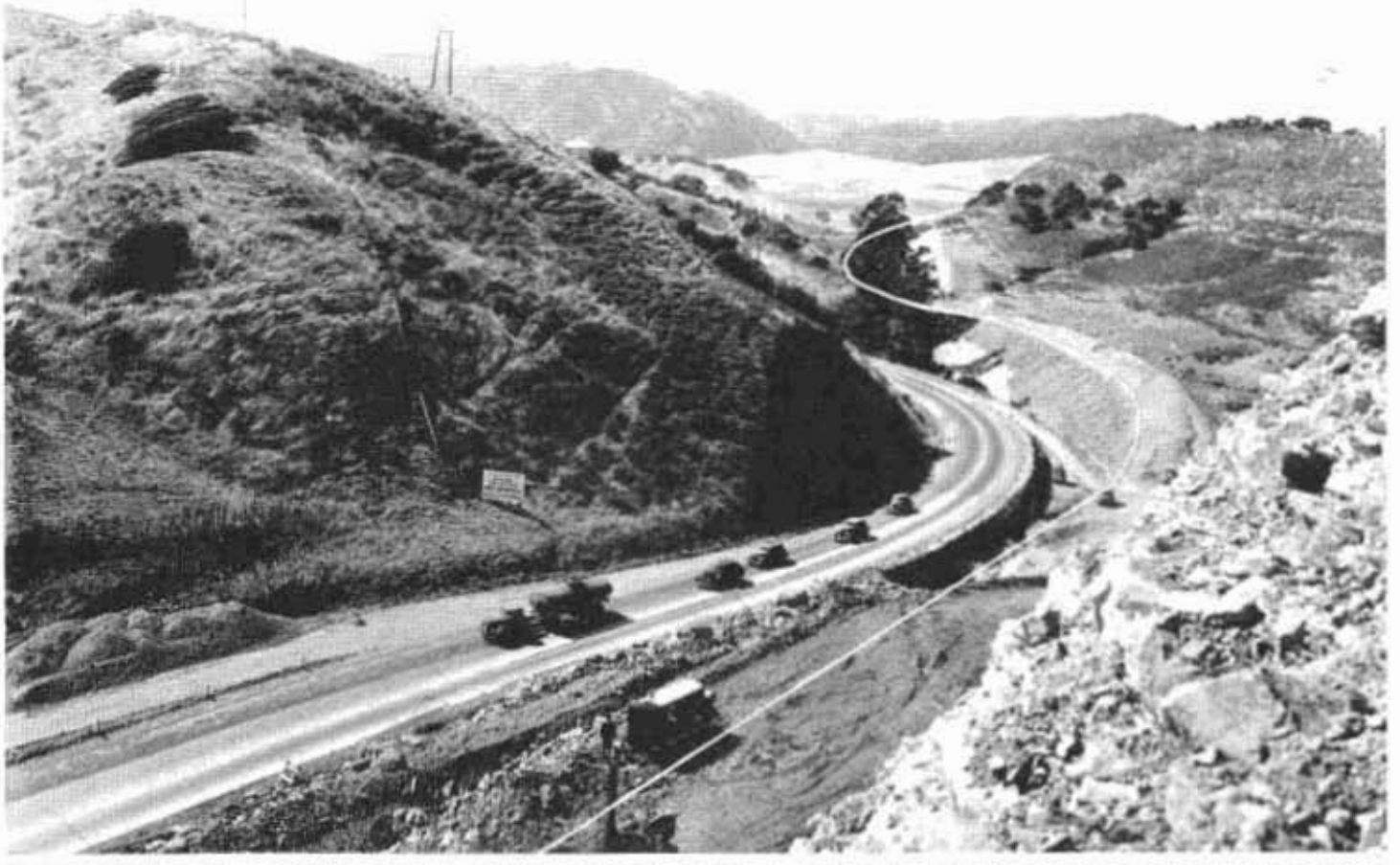
At San Luis Obispo Creek 22,700 lineal feet of drains were constructed by drilling wells 26 inches in diameter through the clay formation, varying in depth from 8 feet to 68 feet spaced on 14-foot centers parallel to centerline and 10-foot centers at right angles to centerline.

At Ontario Creek 20,000 lineal feet of drains were constructed by drilling wells 18 inches in diameter varying in depth from 10 feet to 55 feet, spaced on 12-foot centers parallel to centerline and at right angles to centerline.

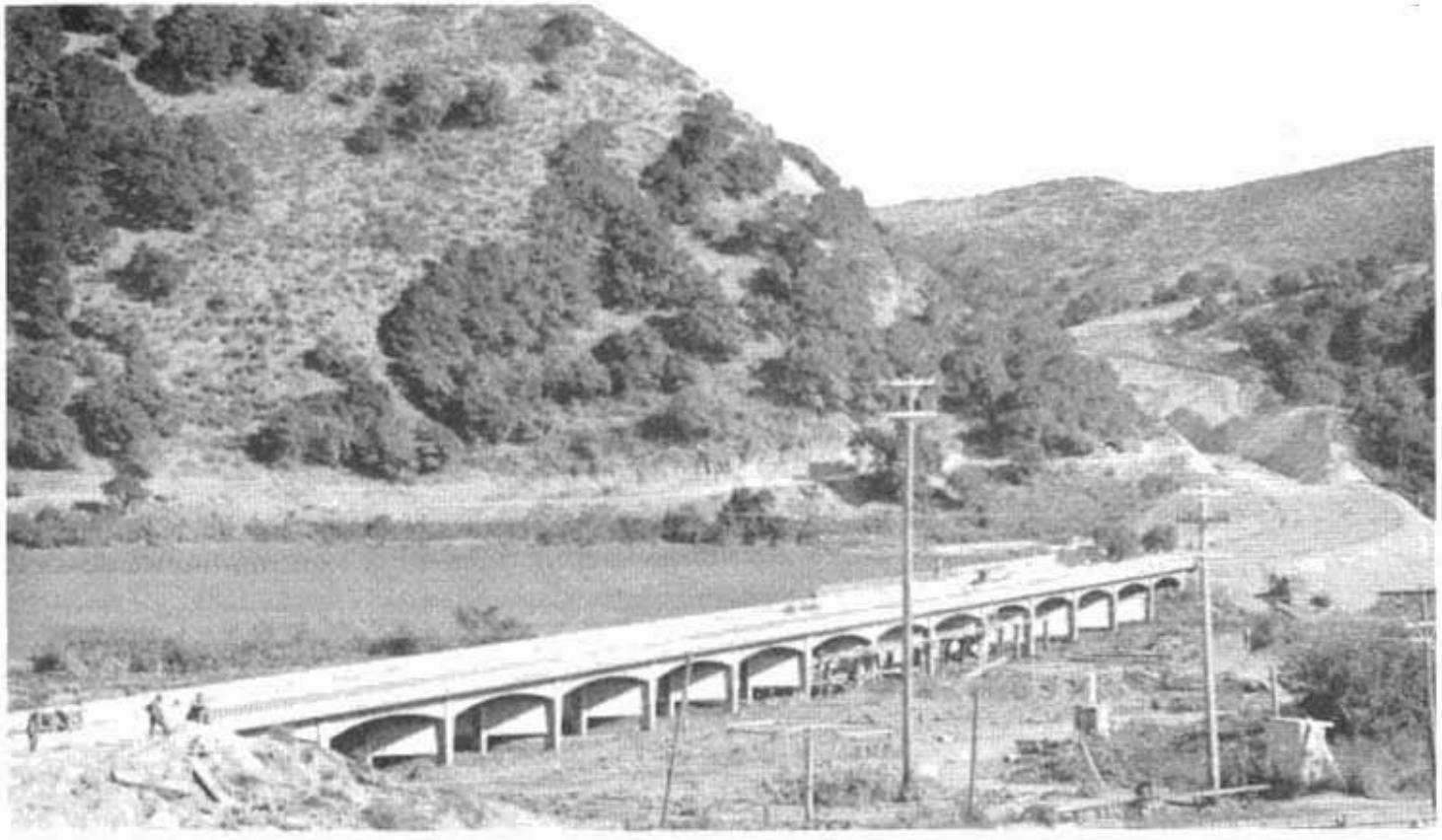
The material excavated from the drains was removed from the embankment areas and placed immediately adjacent to the fills as toe support.

In order to clean the wells of sediment before backfilling, clear water was pumped into the wells and removed by suction pump which carried away the silt and sediment.





Scenes on realignment construction of U. S. 101 south of San Luis Obispo. Top picture shows bridge being built and rough grading near San Luis Obispo Creek. Below—White line indicates new route compared with existing grade



New concrete bridge over San Luis Obispo Creek is 570 feet long with 26-foot roadway supported on 15 piles

This process was continued until all the sediment was removed after which the wells were backfilled with clean sand.

SAND BLANKET PLACED

A 2-foot sand blanket was placed over the entire area to provide a drainage outlet from the sand drains.

In order to permit consolidation of the foundation material and to obviate lateral displacement, the embankments were placed in uniform layers to a maximum height of 5 feet in any one week. Upon completion the embankments were overloaded to an average height of 8 feet.

Existing bridge is an old, narrow through-truss steel structure

This overload was permitted to remain in place for a period of two or three months after which the material was removed and used to flatten the fill slopes, except for the embankment at Ontario Creek where the overload material consisted of the base rock which was stockpiled on the top of the embankment.

The mineral aggregate for the base rock is being obtained by crushing the harder shale in a cut near the south end of the project.

The total cost of the project is estimated at approximately $250,000. The Resident Engineers for the State are U. J. Ele, for the bridge and V. E. Pearson for the road construction.

She: "Henry, dear, we've been going together now for more than ten years. Don't you think we ought to get married?"

He: "Yes, you're right—but who'll have us?"

Pavement CONSTRUCTION DEPARTMENT PRESENTS REPORT ON RECORDS AND PROGRESS IN 1940

Publication of the following annual report by the Construction Department of the Division of Highways, giving details of pavement construction in 1940, is eagerly awaited both by contractors and State engineers connected with the various projects, who evince a keen competitive interest in the records of average daily concrete yardage, strength per square inch, per cent variation in cement control, asphalt tonnage, and roughness index per mile.

By EARL WITHYCOMBE, Assistant Construction Engineer

THE WINTER of 1940-1941 was the most severe from the standpoint of rainfall that California has experienced for the past 50 years or more. As a result of this severe wet season failures in the older pavements have been accelerated but it is noted with considerable satisfaction that the more recent construction is comparatively free from distress from this cause.

Without question, the corrective measures taken in planning and during construction to overcome the inherent weaknesses in the support afforded the roadbed by the underlying native soils have in a large measure been responsible for the effectiveness of the later pavements. It would appear that the large expenditures made for the importation of selected soils or gravels to blanket unsatisfactory soils and build up the pavement subgrades are returning large dividends both in the reduction of maintenance and in the uninterrupted use of the highways by the traveling public.

Automatic proportioning has proved sufficiently successful to continue to use it in the new Standard Specifications for both asphalt concrete and Portland cement concrete pavement. This requirement is mandatory on all but small projects involving less than 3,000 tons of asphalt concrete or 1,500 cubic yards of Portland cement concrete.

PORTLAND CEMENT CONCRETE

Construction Methods

During 1940 little change was made in the methods of proportioning or laying of concrete pavements from those in use during the previous year.

Of the 21 projects constructed, 20 were of Class "B" concrete design, using five sacks of cement to the cubic yard, and only one project was of Class "A" with six sacks. A finer grading of fine aggregate has been designed for use in 5-sack concrete to improve its workability. Bulk cement was little used in the season's work.

Expansion joints three-quarters inch thick are generally placed at 120-foot intervals, with intermediate weakened plane joints. The former practice was to place weakened plane joints at 20-foot intervals, but this is now being shortened to 15 feet.

Redwood board is now being commonly used for expansion joint filler where climatic conditions are not too severe. The redwood is specially selected, clear, light-weight material with a requirement that the oven-dry weight shall not exceed 25 pounds per cubic foot.

The use of Portland cement concrete as a base course for a bituminous top was somewhat extensive on city projects during the past season, 5-sack concrete being generally used for these bases.

Construction Records

The maximum *average daily output* for Portland cement concrete pavement per 8-hour day was on Contract No. 27XC3, road VII-L.A-175-A, Main Street to Central Avenue, Oswald Brothers, the Contractors, averaged 462.7 cubic yards per day, with W. D. Eaton as Resident Engineer, and C. J. McCullough, Street Assistant. The average daily output for the entire State during 1940 was 374.3 cubic yards compared to 381 cubic yards in 1939.

The *average compressive strength* of Class "B" (5-sack) concrete at 28 days was 4,204 pounds per square inch in 1940, compared to 3,740 pounds in 1939, an increase of 12.4%. Only one contract had Class "A" concrete, being a PWA project on Olympic Boulevard, VII-L.A-173-L.A, which had an average compressive strength of 4,100 pounds.

The highest average compressive strength during 1940 was 4,915 pounds for Class "B" concrete on Contract No. 211VC1, road XI-S.D-12-L.Msa,B,ECj, on El Cajon Avenue, La Mesa to Sunshine Street, V. R. Dennis Construction Company, Contractor, L. H. Williams, Resident Engineer, and B. F. Moore, Street Assistant.

The record for *cement control* was made on Contract 011GC1, road XI-S.D-S.D, Washington Street, 5th Avenue to 9th Avenue, where the average variation was 0.3%. V. R. Dennis Construction Company was also the Contractor on this project, with C. R. Hagberg, Resident Engineer, and L. B. Munro, Street Assistant. The average variation for the State during 1940 was 0.93%, compared to 0.58% in 1939.

The record for *surface smoothness* was made on Contract 211VC1, above referred to, with an average roughness index of but 4.1 inches per mile. The average smoothness for the State in 1940 was 7.4 inches per mile, compared to 5.8 inches for 1939.

ASPHALT CONCRETE

Construction Methods

All of the 1940 season's work was laid with asphalt having a penetra-

(Continued on page 16)

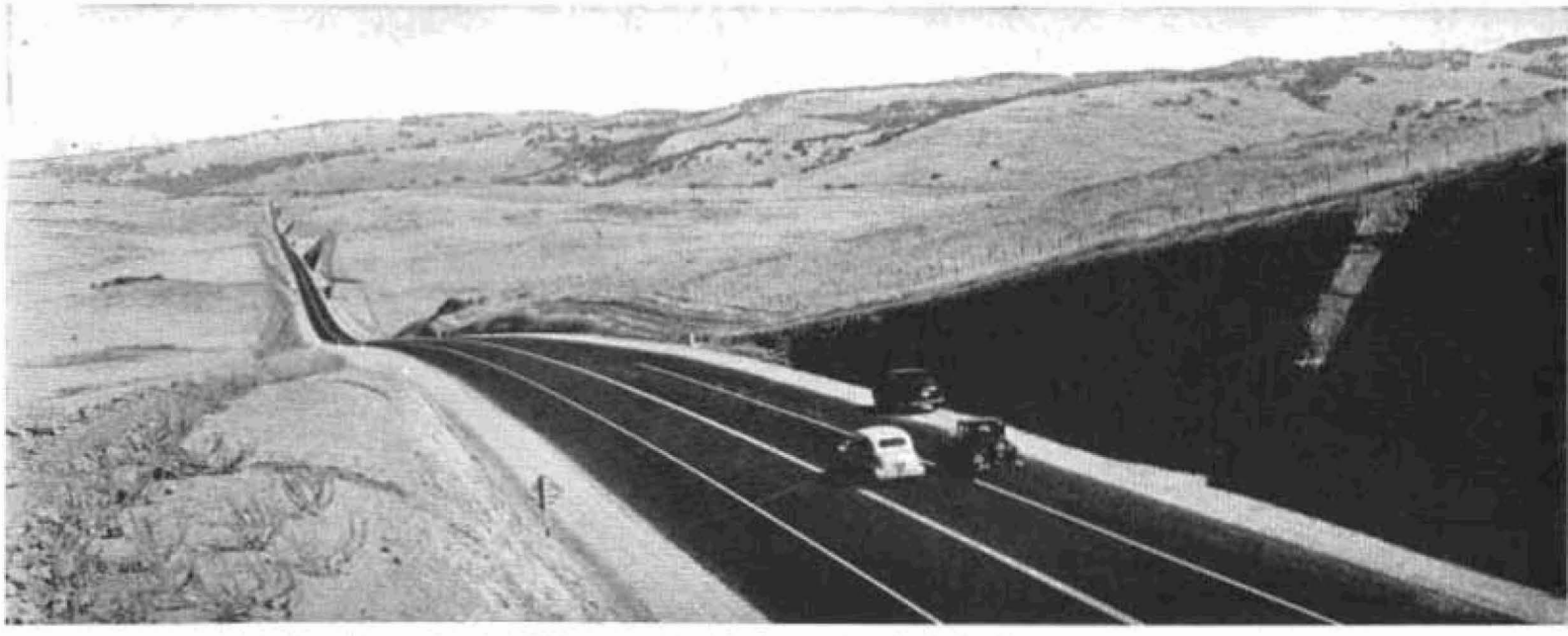
Sepulveda Boulevard in Los Angeles has two 17-foot lanes of asphaltic concrete and two 12-foot lanes of Portland cement concrete

PORTLAND CEMENT CONCRETE PAVEMENT RECORDS FOR 1940

Location	Contractor	Resident Engineer	Street Assistant	Average cu. yds. laid per 8-hour day	Average strength, 28 days, lbs. per sq. in.	Per cent average daily variation in cement	Roughness index inches per mile
Route 5—Santa Clara St.	A. J. Raisch and Earl W. Heple	H. S. Payson	G. L. Beckwith	457.3	3542	0.53	7.3
At El Camino Real and University Ave.	Union Paving Co.	H. S. Payson	H. A. Hart	217.5	4495	.80	10.9
Lake St.—Golden Gate Bridge Approach	Union Paving Co.	T. E. Ferneau	H. A. Hart	244.6	4170	1.33	6.9
Santa Ana River Bridge Approach	Vido Kovacevich	B. N. Frykland	H. D. Johnson	256.4	4303	.41	6.8
E. Third St., Indiana St.—Repetto St.	State Forces (WPA)	F. B. Cressy	M. A. Wood	435.0	3950	.55	17.7
Sepulveda Blvd., Gamut Pl.—Ventura Blvd.	Griffith Company	E. L. Seitz	E. C. Daniels	441.4	4368	1.51	11.7
Olympic Blvd., Beverly Glen Blvd.—Pontius Ave.	Basich Bros.	E. A. Parker	A. W. Carr	369.1	3835	1.01	4.6
Arroyo Seco Pkwy., Ave. 58—Fairfield Ave.	Radich & Brown	R. J. Hatfield	C. L. Aisthorpe	430.9	4148	.55	13.0
El Modena Ave., Colorado Blvd., N. Figueroa St., and La Loma Rd.	Claude Fisher Co.	C. P. Montgomery	C. L. Gildersleeve	312.9	4745	1.56	16.3
Olympic Blvd., Pontius Ave.—Bundy Dr.	Basich Bros.	E. A. Parker	R. E. Deffebach	452.7	4100	...	5.6
Arroyo Seco Pkwy., Ave. 40—Ave. 50	J. E. Haddock	R. J. Hatfield	H. D. Johnson	448.8	3974	.31	9.9
Arroyo Seco Pkwy., Ave. 26—Ave. 22	J. E. Haddock	R. D. Thorson	R. Deffebach	358.8	4330	1.27	6.1
Arroyo Seco Pkwy., Ave. 35—Ave. 40	Nick Perscallo	G. E. Farnsworth	R. E. DeGroff	371.4	4392	.65	6.0
Arroyo Seco Pkwy., Ave. 35—Ave. 25	J. E. Haddock	R. D. Thorson	R. Deffebach	263.0	4355	1.50	7.7
Main St.—Central Ave.	Oswald Bros.	W. D. Eaton	C. J. McCullough	462.7	3893	.80	10.2
Arroyo Seco Pkwy., Grand Ave.—Fair Oaks Ave.	Griffith Company	C. P. Montgomery	H. D. Johnson	307.4	4493	.40	5.6
Los Angeles County Line—Timber School	Griffith Company	F. A. Read	W. T. Lamb	392.3	3825	1.19	4.8
Merced—Black Rascal Creek	Marshall Hanrahan	A. N. Lund	E. D. Bulton	383.7	4265	1.00	6.0
South Approach, Turlock Overhead Xing	Union Paving Co.	J. C. Witherell	R. K. Wells	135.5	4415	1.21	6.8
El Cajon Ave., La Mesa—Sunshine St.	V. R. Dennis Const. Co.	L. H. Williams	B. F. Moore	406.2	4915	.70	4.1
Washington St., 5th Ave.—9th Ave.	V. R. Dennis Const. Co.	C. R. Hagberg	L. B. Munro	165.9	3305	.30	12.5
			Averages	374.3	4204	0.93	7.4

ASPHALT CONCRETE PAVEMENT RECORDS FOR 1940

Location	Contractor	Resident Engineer	Street Assistant	Average tonnage laid per day	Average stability of surface mixture in %	Average relative gravity of surface mixture in %	Roughometer index, inches per mile
Route 5—Santa Clara Street	A. J. Raisch and Earl W. Heple	H. S. Payson	H. A. Hart	423.6	37.3	95.6	11.5
At El Camino Real and University Ave.	Union Paving Co.	H. S. Payson	G. L. Beckwith	470.9	47.1	93.3	19.4
Proberta—Red Bluff	Piazza & Huntley and J. P. Brennan	M. Fredericksen	R. L. Barkwell	698.7	37.9	89.5	13.1
Arcola School—Madera	Piazza & Huntley and Trewhitt-Shields	F. W. Howard	F. B. England	724.8	44.0	92.7	8.1
Kingsburg—1.9 mi. Southerly	Piazza & Huntley	F. W. Howard	L. Tresidder	663.8	40.2	91.6	12.4
Highway School—Visalia	Piazza & Huntley	C. F. Oliphant	P. A. Boulton	700.3	41.0	93.8	10.4
Lincoln Blvd.—Venice Blvd., Santa Monica	Griffith Company	C. N. Ainley	A. W. Carr	503.7	31.2	94.8	15.9
Pico Blvd.—Bicknell Ave.	Oswald Bros.	H. J. Fallal	R. C. Porter	265.0	36.0	94.5	21.1
Sepulveda Blvd., Gamut Pl.—Grand Blvd.	Oswald Bros.	E. L. Seitz	R. Malone	574.3	32.0	95.3	25.4
Sepulveda Blvd., Gamut Pl.—Ventura Blvd.	Griffith Company	E. L. Seitz	P. F. Green	579.3	35.0	92.6	13.4
Olympic Blvd., Beverly Glen Blvd.—Pontius Ave.	Basich Bros.	E. A. Parker	A. W. Carr	402.6	33.0	93.5	15.6
Arroyo Seco Pkwy., Ave. 58—Fairview Ave.	Radich & Brown	R. J. Hatfield	H. J. Fallal	419.0	39.3	92.0	15.4
El Modena Ave., Colorado Blvd., N. Figueroa St., La Loma Rd.	Claude Fisher	C. P. Montgomery	C. E. Abbott	382.6	---	92.0	19.1
Colorado Blvd., El Modena Ave.—Townsend Ave.	C. H. Johnston	C. P. Montgomery	Ed Delancy	552.5	---	---	23.9
Olympic Blvd., Pontius Ave.—Bundy Dr.	Basich Bros.	E. A. Parker	A. W. Carr	626.4	---	---	14.9
Arroyo Seco Pkwy., Ave. 40—Ave. 50	J. E. Haddock	R. J. Hatfield	R. E. Schott	547.2	36.0	92.8	11.5
Colorado Blvd., Maywood Ave.—Broadway	Oswald Bros.	F. A. Read	J. R. Rubey	416.7	---	---	31.1
Arroyo Seco Pkwy., Ave. 35—Ave. 40	Nick Perscallo	G. E. Farnsworth	V. O. Sheff	470.2	38.8	93.9	17.1
Arroyo Seco Pkwy., Ave. 35—Ave. 26	J. E. Haddock	R. D. Thorson	R. E. Schott	486.7	47.0	91.4	14.5
Arroyo Seco Pkwy., Ave. 26—Ave. 22	J. E. Haddock	R. D. Thorson	R. E. Schott	461.0	43.0	94.2	12.9
Main St.—Central Ave.	Oswald Bros.	W. D. Eaton	C. J. McCullough	558.2	39.0	94.4	16.3
Arroyo Seco Pkwy., Grand Ave.—Fair Oaks Ave.	J. E. Haddock	C. P. Montgomery	H. D. Johnson	504.4	31.0	---	18.5
South Approach, Turlock Overhead Xing	Union Paving Co.	J. C. Witherell	R. H. Wells	105.9	29.0	---	20.3
On N. Wilson Way	S. M. McGaw	E. L. Craun		380.5	12.0	94.3	84.0
El Cajon Ave., La Mesa—Sunshine St.	V. R. Dennis Const. Co.	L. H. Williams	C. R. Hagberg	611.4	38.2	92.4	23.3
Rosecrans St., Lytton St.—Canon St.	Griffith Company	R. C. Payne	S. M. Templeton	643.7	41.7	92.5	16.7
Barnett Ave. and Rosecrans St., Miramar Rd.—Torrey Pines Reservoir	R. E. Hazard	F. D. Pearce	J. F. Jorgensen	331.8	42.0	93.3	26.1
			Averages	541.0	37.4	93.0	14.9



U. S. 50 realignment east of Folsom paved with plant-mix surfacing in 22- and 23-foot widths

BITUMINOUS TREATED SURFACES—RECORDS FOR 1940

Plant Mix

Location	Contractor	Resident Engineer	Roughness Index Inches per mile
Crawford Ranch—Ukiah	Fredericksen & Westbrook	C. M. Butts	44.2
Outlook Creek—Reeves Creek	Marshall Hanrahan	C. M. Butts	41.9
Stronghold—Oregon State Line	Harms Bros. and N. M. Ball Sons	G. Sundman	56.6
3.7 mi. N. of Rush Creek Bridge—Pit River	Harms Bros. and N. M. Ball Sons	H. K. Ward	36.3
Red Bluff—6 mi. N.	Jones & King	E. J. Peterson	13.4
Central Valley—Shasta Summit	Jones & King	H. B. Milner	9.3
At Berg and Lomo	Hemstreet & Bell	R. I. Nicholson	40.3
4 mi. S. of Fagan—Biggs Rd.	Piazza & Huntley	J. C. Womack	21.2
3.7 mi. E. of Folsom—2! mi. E. of Clarksville	Hemstreet & Bell	J. W. Corvin	24.8
1.5 mi. S.—1.5 mi. N. of Rattlesnake Creek	Hemstreet & Bell	W. G. Remington	58.0
Pine Creek—Sugar Creek	Claude C. Wood	F. E. Wilson	20.8
Hampshire Rocks—Soda Springs	J. R. Reeves	W. G. Remington	13.8
2.7 mi. E. of Williams—Colusa	Hemstreet & Bell	H. O. Ragan	26.9
Isleton—Walnut Grove	Jones & King	H. O. Ragan	24.6
Oaks Road—Los Gatos	Heafey-Moore & Frederickson-Watson Co.	A. Walsh	23.8
Myrtle Ave., San Rafael—San Quentin Wye	Chas. L. Harney	W. A. Rice	14.4
Near Wyatt's Cor. and Yenni Ranch—0.6 mi. E. of County Line	E. A. Forde	E. Carlstad	19.0
2.5 mi. N. of Cloverdale	Heafey-Moore & Frederickson-Watson Co.	E. W. Heberling	27.5
Niles—Farwell	Piombo Bros. & Co.	F. W. Montell	30.2
Saratoga—Los Gatos	Caputo & Keeble	A. Walsh	23.5
Southerly Boundary—Bradley	Hemstreet & Bell	V. E. Pearson	12.1
2 mi. S.—3 mi. N. of Greenfield	Jones & King	F. C. Weigel	21.6
Jonata Park—Zaca	Guerin Bros.	H. J. Doggart	13.1
0.5 mi. E. of El Capitan Creek—Orella	R. E. Hazard & C. Crow	J. C. Adams	8.9
San Juan Rd., 2.2 mi. E.—4.9 mi. E. of Pajaro	Granite Construction Co.	H. J. Doggart	16.0
Route 143—Sivert	Basich Bros.	D. G. Evans	25.1
At Firebaugh	A. Teichert & Son	R. Windele	17.4
Placerita Canyon—Solamint	N. M. Ball Sons	M. L. Bauders	26.7
Brent's Junction—Liberty Grade	J. E. Haddock	E. L. Seitz	26.5
Los Angeles County Line—Timber School	Griffith Company	F. A. Read	16.7
San Juan Capistrano—0.5 mi. E.	A. S. Vinnel & Co.	C. L. Gildersleeve	13.2
E. Third St., Indiana St.—Repetto St.	State Forces (WPA)	F. B. Cressey	61.9
Rosamond—Mojave	R. E. Hazard & Sons	C. M. Rose	11.7
9 mi. N. of Lone Pine—Independence	Basich Bros.	F. R. Pracht	10.9
Olancha—Cottonwood Creek	Basich Bros.	F. R. Pracht	14.2
Mojave—Ricardo—4.5 mi. W. (Por)	G. W. Ellis	C. M. Rose	13.0
1.7 mi.—2.5 mi. E. of Valley Springs	L. Biasotti & Son	A. K. Nulty	5.7
1 mi. S. of Jackson Creek—2 mi. S. of Ione	Fredericksen & Westbrook	A. K. Nulty	6.1
Ione—2 mi. S.	Fredericksen & Westbrook	A. K. Nulty	5.8

Road Mix

4 mi. N. of Lake City—Ft. Bidwell	Poulos & McEwen	H. B. Milner	41.5
Cedarville—4.6 mi. S.	Harms Bros.	B. Barry	20.1
Lake Leavitt—Rager's Corner	Isbell Construction Co.	C. A. Potter	21.7
2 mi. E. of Phillips—3 mi. W. of Meyers	Lee J. Immel	R. I. Nicholson	23.6
Butte City—Cherokee Canal	Oilfields Trucking Co.	R. E. Nicholson	69.7
Yosemite National Park—Lake Ellery	Isbell Construction Co.	J. N. Stanley	61.1
3.3 mi. S. of Poso Creek—Poso Creek	George E. France	D. G. Evans	33.0
At Norco	Matich Bros.	E. A. Bannister	16.5
Mt. Andreson—Crestline	Matich Bros.	E. A. Bannister	34.1
Big Pine Airport—Big Pine	Basich Bros.	F. R. Pracht	12.9
At Grant Lake	Isbell Construction Co.	J. N. Stanley	118.4
West Walker River—Route 23	Basich Bros.	H. F. Caten	50.2
1.7 mi. S.—6.7 mi. S. of Shoshone	Roland T. Reynolds	F. R. Pracht	23.7
3 mi. W. of Blythe—Ash St., Blythe	Daley Corporation	F. D. Pearce	93.1
Donner Summit—2 mi. Easterly	Fredericksen & Westbrook	E. L. Miller	106.7
		Average	49.2

(Continued from page 13)

tion greater than 70. For the interior valleys, the tendency has been to hold the penetration down to the minimum permissible.

The use of a coarser sand and less filler dust than was formerly the practice has given a mixture that is considerably easier to manipulate. This, coupled with the general use of lesser amounts of sand, has resulted in a surface of considerably more open texture, which adds to the safety feature of its riding qualities.

The open texture surfaces are more difficult to hold intact in adverse weather and the light application of emulsified asphalt seal coat becomes more important. An application of not to exceed one-quarter gallon per square yard of surface is specified,

Colorado Blvd. Divided Highway in Los Angeles County paved with 2-inch asphaltic concrete on 6-inch Portland cement concrete base

but rarely exceeds one-sixth gallon. On the closer textures, this has been reduced to one-twelfth gallon by using the mixing type emulsion and cutting back with equal parts of water. Very uniform applications have been made with the use of atomizing sprays. No cover is used on this type of seal and traffic is permitted to use the road soon after application.

Construction Records

The highest *average daily output* of asphalt pavement tonnage was placed on Contract 26TC1, VI-Mad-4-A, between Arcola School and Madera where about 725 tons were placed by Piazza-Huntley and Trewhitt-Shields, Contractor; F. W. Howard was Resident Engineer, and F. B. England, Street Assistant. The average daily output for the entire State was 541 tons in 1940, compared to 561.8 tons in 1939.

The highest *stability of surface mixture* was obtained on Contract 24TC3, IV-SC1-2-A,PA, with an average of 47.1%, Union Paving Company being the Contractor, H. S. Payson, Resident Engineer, and G. L. Beckwith, Street Assistant. The average for the entire State was 37.4% for 1940, compared to 32.4% in 1939.

The *densest surface mixture* was placed on Contract 04TC8, IV-SC1-68-B,SJs, Route 5 to Santa Clara Street, where the average relative specific gravity was 95.6%. Raisch & Heple was the Contractor, H. S. Payson, Resident Engineer, and H. A. Hart, Street Assistant. The State average was 93.0% in 1940, compared to 93.8% in 1939.

The record for *surface smoothness* was secured on Contract 26TC1, VI-Mad-4-A, Arcola School to Madera, where the average roughness index was 8.1 inches per mile. The Contractor was Piazza-Huntley and Trewhitt-Shields, with F. W. Howard as Resident Engineer and F. B. England, Street Assistant. The average for the entire State in 1940 was 14.9 inches per mile, compared to 18.8 inches in 1939.

BITUMINOUS TREATED SURFACES

During 1940 the plant-mix type of oiled surface greatly predominated other types, about 72% of the 220 miles of plant-mix and road-mix types being plant-mix.

Spreading machines were used on several of these projects in lieu of the blade work which had been specified in the past. Under adverse conditions of weather or traffic the spreading machines offer certain very definite advantages.

Construction Records

Excellent results were obtained on several plant-mix projects as regards riding qualities. The record for surface smoothness, 5.7 inches per mile, was obtained on Contract 210TC7, X-Cal-24-B, east of Valley Springs by L. Biasotti & Son, Contractor, with A. K. Nulty, Resident Engineer. Two neighboring contracts with the same engineer had averages of 5.8 and 6.1 inches per mile. The average for the entire State for plant-mix surfacing in 1940 was 23.1 inches per mile, compared to 26.2 inches in 1939.

The record for surface smoothness for road-mix type was made on Contract 29VC3, IX-Inv-23-C, Big Pine Airport to Big Pine, where 12.9 inches per mile was obtained by Basich Bros., Contractor, with F. R. Pracht, Resident Engineer. The average for the entire State for 1940 was 49.2 inches per mile, compared to 31.9 inches in 1939. The increase in roughness is largely due to the use of materials in place containing large aggregate which is not conducive to the building of smooth surfaces.

Realignment under construction at Pajaro River Crossing of U. S. 101. Arrow points to old one-way bridge on existing road

Coast Road

A NEW FOUR-LANE LINK AND BRIDGE AT THE PAJARO RIVER

By H. S. PAYSON, Resident Engineer

THE BOUNDARY between Highway Districts IV and V is marked by the Pajaro River where U. S. 101 crosses the line between Santa Clara County and San Benito County.

The old highway bridge across this river was constructed at a period when highway standards were much inferior to those required to meet present-day traffic demands. The roadway width of the old bridge is only 18 feet 8 inches, and the design critical for present loading standards.

The budget for the 91st-92d fiscal years provided funds for replacing this structure with one of modern design and for necessary approach roads to connect with the present road on both sides thereof.

After considerable preliminary studies a location for the structure was decided upon about five hundred feet upstream from the old structure, and road approaches 2.63 miles long on new alignment provided.

The new road and bridge is of four-lane, divided highway design, beginning near the Prunedale Junction in San Benito County in District V and extending northerly to the overhead structure over the main line of the Southern Pacific Railroad north of Sargent in Santa Clara County in District IV.

STRATEGIC DEFENSE ROAD

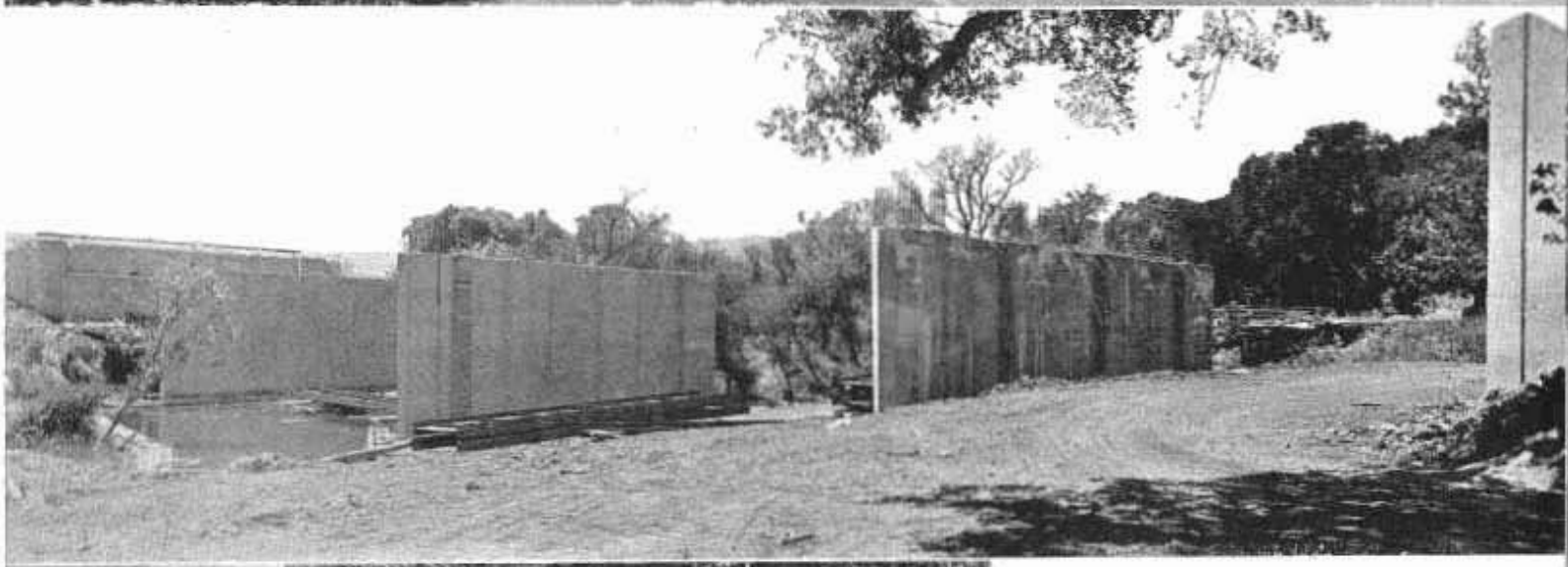
This highway is a part of State Highway Route 2, Sign Route U. S. 101, and carries a preponderant volume of traffic between San Francisco and Los Angeles, as well as being of strategic value as a part of the National Defense System.

In the design of this link of a major highway artery, provision was made for present-day safety and future traffic needs by providing long sight distances, easy grades and long radius curves. The old alignment contained 10 curves with a minimum radius of 300 feet for a total curvature of 245 degrees. This has been reduced in the new alignment to four curves having a minimum radius of 1,021 feet for a total curvature of 138 degrees.

6-FOOT DIVISION STRIP

The center division strip separating traffic lanes will be six feet wide, containing raised median bars painted white. The surface will be three-inch

(Continued on page 32)



At top—Existing narrow bridge across Pajaro River. Center—Three wide concrete piers ready for steel erection. At bottom—Large steel girder floated into position on rafts preparatory to raising with power crane

State Fair

A MODEL EXHIBIT OF DEPARTMENT OF PUBLIC WORKS IS ONE OF THE FEATURES

MOTORISTS from the four corners of the State soon will start their march on Sacramento as the California State Fair throws open the gates of the Eighty-seventh Annual Exposition on August 29th for a 10-day run through September 7th with bigger and better entertainment, exhibit and racing features promised.

In preparing the Eighty-seventh Annual Exposition, fair directors anticipate a record crowd of 800,000, to top the paid attendance of 713,625 chalked up at last year's show.

The number of fine highways which serve Sacramento from all sides make the State Capital an ideal location for the annual fair which consistently attracts larger crowds to greater and finer shows.

PUBLIC WORKS EXHIBITS

Charged with the construction, maintenance and administration of the 14,000-mile highway system is the Division of Highways which is the largest agency of the Department of Public Works under whose auspices and supervision comprehensive and realistic exhibits have been prepared showing the work of its three divisions—Highways, Water Resources and Architecture.

The exhibits will be presented in a large space on the mezzanine floor of the main building.

The highway exhibit will consist of a diorama showing developments in the construction and improvement of highways from the ox cart days to the modern freeway. Miniature figures of early period autos are seen struggling over narrow, winding dirt roads in one section. A following section shows wider, smoother surface roads with pavement widths from 15 to 20 feet, better standards of alignment and three and four lane pavements. The final scene presents a section of ultra-modern, divided superhighways with wide separation strips, grade separations, at intersecting major highways and paralleling service roads of the freeway principle of design.

Above the diorama, which is 44 feet in length, will be three mural paintings of transportation scenes of the early Spanish period, the Gold Rush days and the multi-lane restricted-access boulevards of today.

In addition to these exhibits there will be moving pictures of construction, maintenance, and operation scenes on the highways and freeways.

The Division of Water Resources plans to have an actual working model of Shasta Dam with water running over the spillway and pouring from the outlets of the powerhouse. Other models will show the various water measuring devices in operation.

The reservoir behind Shasta Dam will be shown at about average eye level with realistic scenic backgrounds and moving pictures of construction work at the dam.

The Division of Architecture exhibit will consist of photographs of many large State buildings that have been constructed and sketches of others proposed for erection in the course of the $12,000,000 program for this biennium.

OUTSTANDING ENTERTAINMENT

First presented in a small San Francisco hall in 1854, the California State Fair has grown from a modest exhibition to what is announced as the "Nation's premiere State fair, the west's foremost live stock show, and the outstanding agricultural show of the United States."

The main attraction of the entertainment features is to be a brilliant musical revue presented by celebrated stars and chorus of beautiful girls on a streamlined miracle stage before the grandstand. Outstanding singers and comedians of radio, stage and screen and nationally famous bands will provide nightly entertainment and dancing. The fair will also present this year on September 2d the Sacramento Municipal Symphony Orchestra in a concert of classical music under the direction of the conductor, Willem Van den Burg.

In the agricultural building, more than 35 counties will exhibit large areas of choice fruits, vegetables, grains, nuts, wines, minerals and ores.

In all competitive events winning contestants will share more than $182,500. Purses to be won at the horse races amount to more than $53,700 with a top purse of $5,000 for the Governor's Handicap, annual race classic, and top money of $2,000 in the State Fair Occident Stake for harness horses. Judges at the horse show will award $20,000.

The Future Farmers of America, members of the 4-H clubs and other junior farmer organizations will hold their own fair in the $500,000 group of buildings opened for them last year. The Future Farmers band will play for the annual live stock parade when the State's finest beef and dairy cattle, horses and goats pass in review before the grandstand.

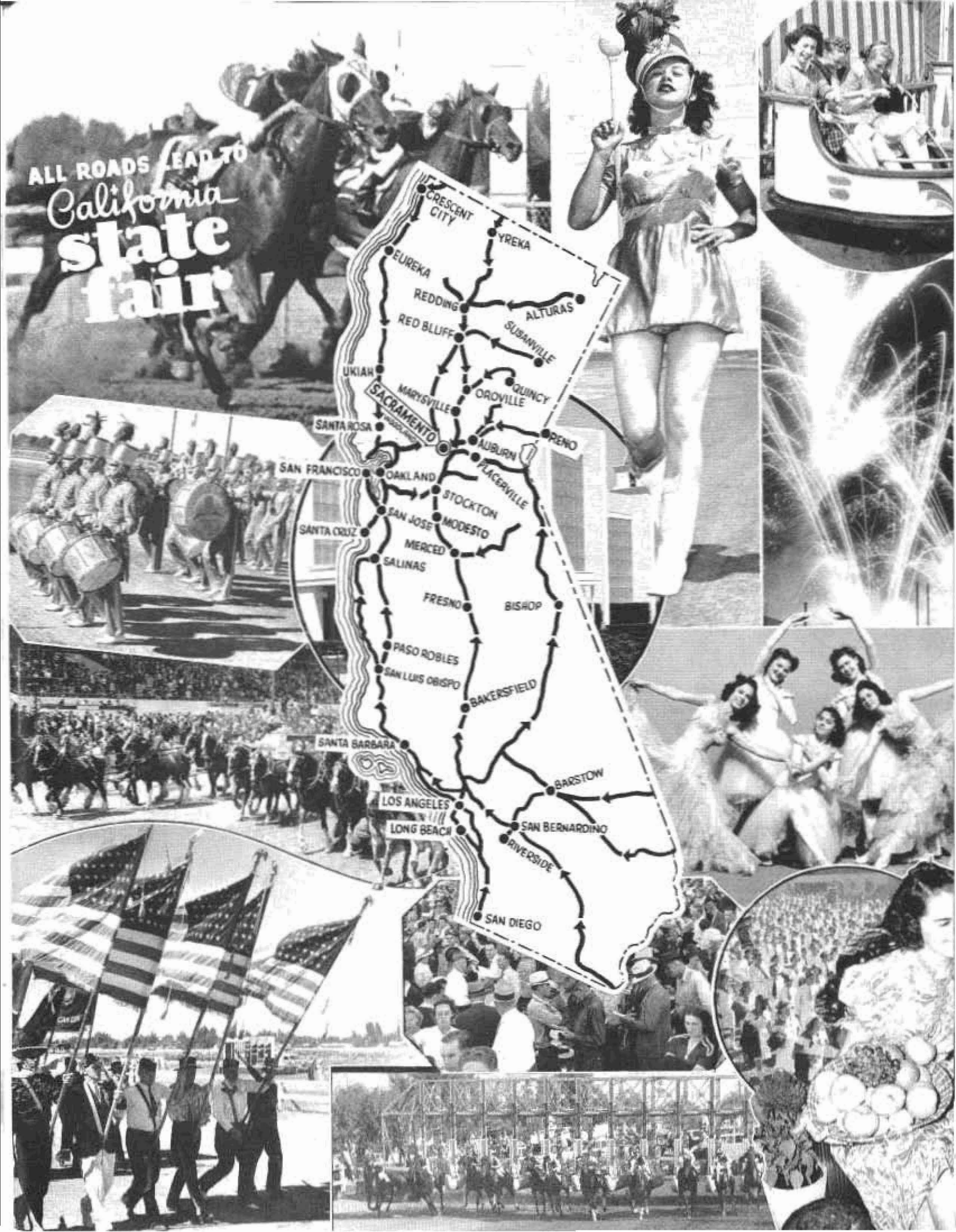
TWO NEW BUILDINGS

The 1941 Fair will see the opening of two new buildings, the Hall of Flowers and the Press Radio Building, both removed from Treasure Island and reconstructed on the fair grounds. In the green latticed Hall of Flowers, fair visitors will see a huge exposition of California-grown flowers, shrubs and ornamental plants. In the landscaped gardens surrounding the building, the Shasta Cascade Court from Treasure Island has been reconstructed with a stage, landscaping and garden.

Acquisition of the buildings by the fair organization was made possible through the cooperation of Governor Culbert L. Olson, Chairman Frank W. Clark of the California Commission for the Golden Gate International Exposition and State Director of Finance George Killion.

In the field of arts and education there will be the second annual North American Salon of Pictorial Photography with entries from all over the world, an exhibition of oil paintings and water colors by living professional California artists and more than 10,000 educational and vocational exhibits in the Education Building.

Mother—Now, Junior, be a good boy and say "Ah-h-h," so the doctor can get his finger out of your mouth.


ALL ROADS LEAD TO
California
state
fair
CRESCENT CITY
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EUREKA
REDDING
ALTURAS
RED BLUFF
SUSANVILLE
UKIAH
QUINCY
MARYSVILLE
OROVILLE
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SAN LUIS OBISPO
BAKERSFIELD
SANTA BARBARA
BARSTOW
LOS ANGELES
LONG BEACH
SAN BERNARDINO
RIVERSIDE
SAN DIEGO

New Four-Lane Link and Bridge at Pajaro River

(Continued from page 18)

plant-mix 46 feet wide, and the shoulders will be road-mix, three inches by seven feet wide.

The project is divided into two contracts, one for the road work and one for the bridge over Pajaro River. The road work in both counties is being handled by District IV and the structure by the Bridge Department.

The principal items of road work are as follows:

194,000 cu. yds. Excavation
3,000,000 sta. yds. Overhaul
27,000 cu. yds. Imported Borrow
11,000 tons Plant-Mix Surfacing
22,000 lbs. Reinforcing Steel
200 cu. yds. Class "A" Portland Cement Concrete
174 ft. 90" Multi-plate Corrugated Metal Pipe
4,700 ft. Various Corrugated Metal Pipes.

Heafey-Moore Co. & Fredrickson & Watson Construction Co. of Oakland are the contractors.

The new bridge project consists of constructing a four-span, concrete-deck, steel-girder bridge, having an overall length of 340 feet, supported on reinforced concrete piers and abutments. The spans are 52, 88, 110 and 90 feet.

The principal items of the bridge contract are as follows:

2,100 cu. yds. Excavation
337,000 lbs. Reinforcing Steel
447,000 lbs. Structural Steel
2,244 cu. yds. Portland Cement Concrete
6,570 lin. ft. Treated Douglas Fir Piles.

C. W. Coletti & Company of San Rafael are the bridge contractors.

No unusual features of construction were encountered except that both contractors were delayed by the very unusual heavy and continuous rainfall the past winter. The resultant heavy runoff washed out some of the bridge contractor's sheet piling.

The grading of the roadway was performed by D8 Caterpillar Tractors and Le Tourneau Carryalls of 14 to 20 cubic yard capacity on the short hauls and a 2½ cubic yard Northwest shovel and trucks on the longer haul.

The bridge contract is under the direction of I. T. Johnson, Resident Engineer.

The grading and surfacing contract is under the direction of H. S. Payson, Resident Engineer.

Present indications are that both contracts will be sufficiently advanced to be open to traffic late in September.

Traffic on State Toll Bridges Showed Large Increase in July

TRAFFIC on the three State-owned toll bridges continued at a high level throughout the month of July.

For the San Francisco-Oakland Bay Bridge the daily average was 53,755 vehicles, representing an increase of 9 per cent over July, 1940.

On the Carquinez Bridge the traffic was 14,612 vehicles per day, indicating a gain of 77 per cent over the same month of the previous year.

The Antioch Bridge, with a daily average of 862, showed an increase of 48 per cent over the record for July, 1940.

The vehicular traffic for July on the San Francisco-Oakland Bay Bridge and the Carquinez and Antioch bridges is tabulated below:

	San Francisco-Oakland Bay Bridge	Carquinez Bridge	Antioch Bridge
Passenger autos and auto trailers	1,503,264	413,852	22,503
Motorcycles and tricars	4,682	1,726	82
Buses	34,274	5,994	193
Trucks and truck trailers	87,071	31,165	3,836
Others	37,118	242	106
Total vehicles	1,666,409	452,979	26,720

Gas Tax Outrunning Population

Since 1930 gasoline-tax payments by the American public have shown an increase 18 times as great as the Nation's gain in population, statistics released by Federal Government agencies reveal.

During the decade ending in 1940 the country's population increased from 122,775,046 to 131,669,275, or 7.2 per cent. Gasoline taxes jumped from $494,683,000 in 1930 to $1,150,000,000 in 1940, gaining 132 per cent, or a rate of increase 18 times as great as population growth.

An all-time record was established by motorists in California during the first six months of 1941 when they consumed more than 1,000,000,000 (one billion) gallons of gasoline.

Prize Bridge Presentation

A picturesque celebration to be held Saturday, September 13th, at 10 a.m. at the Orleans Bridge over the Klamath River in Humboldt County on State Sign Route 96 will mark the presentation of a bronze plaque by the American Institute of Steel Construction. The event is being held under the auspices of the Redwood Empire Association, County Supervisors, and the Eureka Chamber of Commerce.

The presentation ceremonies will include the placing of the plaque in a prominent spot on the bridge structure, announcing the fact that the bridge won the design contest for 1940 for the most beautiful steel bridge costing less than $250,000 completed in that year. The presentation address will be made by W. T. Norris, a representative of the Steel Institute and there will follow a venison barbecue luncheon, Indian ceremonial dances, and a fishing and casting contest on the Klamath River, where the steelhead will be running.

A young widow put up a costly monument to her late husband, and inscribed upon it, "My grief is so great that I can not bear it." A year or so later, however, she married again, and feeling a little awkwardness about the inscription, she solved the difficulty by adding one word to it, "alone."

Schooner Gulch Spanned by a Modern Bridge

THERE has recently been completed, on the site of one of Mendocino County coast's most historic spots on State Highway 56 a bridge of modern design which brings up to date the saga of Schooner Gulch.

To those who may be interested in early Californians and what they did, there is faintly discernible, to the west of the new structure, the old stagecoach road. Here early day stagecoaches passed over the all but forgotten wagon trail and its water level bridge bent on delivering passengers and mail to the many thriving lumber towns along the coast.

On the banks of the stream and overlooking the millpond were numerous shanties.

BUILT OWN SHIPS

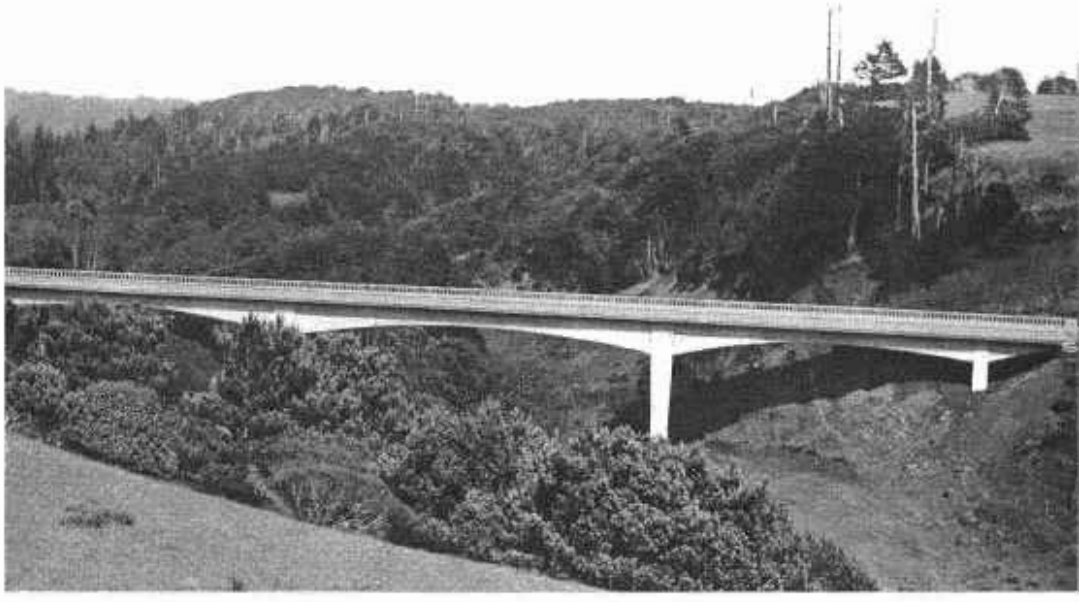
Within the small harbor afforded by the stream's mouth, schooners were built to carry lumber from neighboring mills to California's budding seaports. From this modest ship building industry the name Schooner Gulch was derived.

As stagecoach gave way to power driven vehicles, and modern machinery was introduced, the low level bridge proved too frail and collapsed under the load of a steam donkey engine. A temporary bridge was then erected farther upstream until a high level redwood trestle on concrete pedestal footings could be constructed. This trestle which had been condemned as unsafe for modern traffic prior to the start of construction was replaced by the present structure.

The new bridge is of continuous reinforced concrete girder design, consisting of one 120-foot span, two 96-foot spans, and two 25-foot cantilever spans on concrete bents. A clear roadway width of 26 feet is provided. Girder depths vary from 6 feet to 11 feet 6 inches for the main span and from 5 to 11 feet 6 inches for side spans.

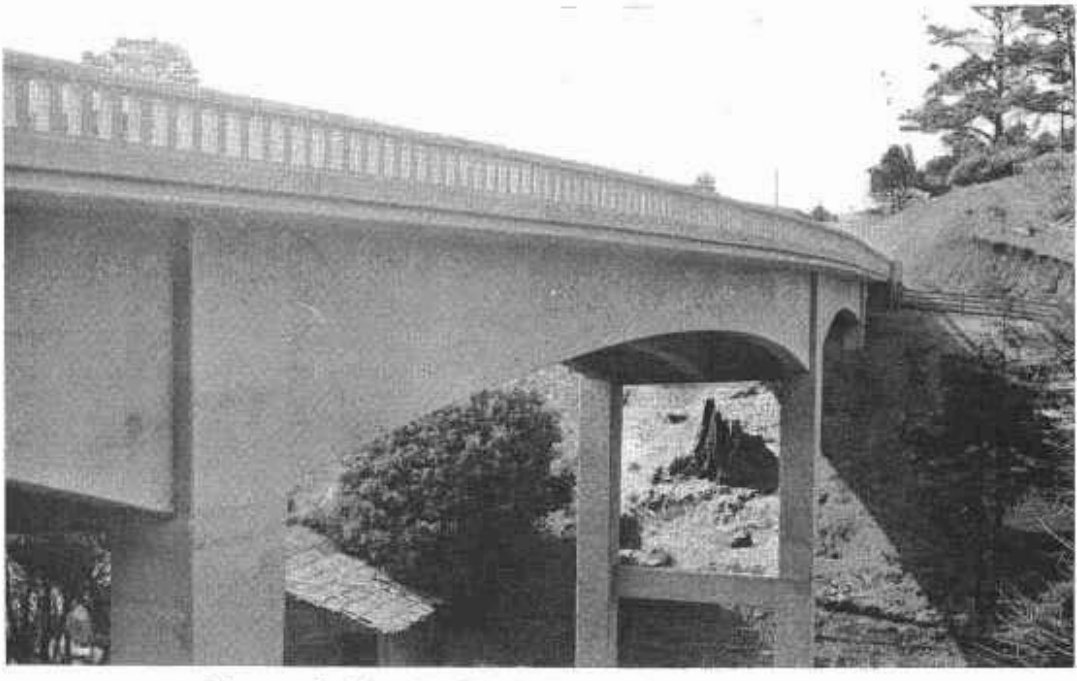
Of unusual interest was the design which provided that girders for the main span, south side span, and south

(Continued on page 24)



Side view of Schooner Gulch bridge shows simplicity of design

Curvature of structure conforms to 800-foot radius center line



Close-up of girders in which torsion steel was used

Highway Bids and Awards for the Month of July, 1941

ALAMEDA COUNTY — Between 2.9 miles and 10.8 miles east of Mission San Jose, about 2.7 miles to be surfaced with crusher run base and armor coat. District IV, Route 108, Section A. Piazza & Huntley, San Jose, $21,670; E. A. Forde, San Anselmo, $26,946; Marshall S. Hanrahan, Redwood City, $36,806. Contract awarded to Lee J. Immel, Berkeley, $20,564.

BUTTE, YUBA, COLUSA, SUTTER, YOLO AND GLENN COUNTIES—At various locations, about 50 miles, seal coat to be applied. District III. C. F. Fredericksen & Sons, Lower Lake, $37,784. Contract awarded to Hemstreet & Bell, Marysville, $32,224.

DEL NORTE COUNTY—Remove existing bridge across Smith River about ten miles north of Crescent City. District I, Route 71, Section A. W. S. Selvage, Eureka, $7,500. E. E. Smith, El Cerrito, $7,-790; Fred J. Maurer & Son, Eureka, $14,-000; Kiss Crane Service, Berkeley, $7,555. Contract awarded to Frank George, Bakersfield, $3,900.

DEL NORTE COUNTY—Between one mile south and two miles north of Crescent City about 0.7 mile to be graded and surfaced with imported borrow and armor coat applied. District I, Routes 1,71; Sections B, A. Mercer, Fraser Co., Eureka, $25,532; Parish Bros., Sacramento, $28,294. Contract awarded to J. L. Conner & Sons, Calistoga, $22,482.

EL DORADO, YUBA, NEVADA AND PLACER COUNTIES—At various locations about 34 miles in length, seal coat to be applied. District III, Fredericksen & Westbrook, Sacramento, $35,056. Contract awarded to Hemstreet & Bell, Marysville, $27,349.

FRESNO-MADERA COUNTIES — Between Herndon Avenue and 1.6 miles north of San Joaquin River, about 4.1 miles to be graded and bituminous surface treatment applied. District VI, Route 125, Sections C, A. Piazza & Huntley, San Jose, $103,-615; Healey-Moore Co. & Fredrickson & Watson Construction Co., Oakland, $113,-268; N. M. Ball Sons, Berkeley, $117,272; Claude C. Wood and W. C. Watson, Lodi, $123,777. Contract awarded to Fredrickson Bros., Emeryville, $99,692.

GLENN COUNTY—At Walker Creek about 1.6 miles east of Willows, a reinforced concrete bridge to be constructed and about 0.1 mile of roadbed to be graded and surfaced with plant-mixed surfacing. District III, Route 45, Section A. Contract awarded to C. C. Gildersleeve, Berkeley, $28,893.

HUMBOLDT COUNTY—At Rohnerville Curve and at Fernbridge, grading and surfacing with plant-mixed surfacing, about 0.4 mile. District I, Route 1, Sections F, G. John Burman & Sons, Eureka, $16,422; J. L. Conner & Sons, Crescent City, $17,469. Contract awarded to Mercer, Fraser Co., Eureka, $14,332.

LAKE COUNTY—Across Middle Creek and Clover Creek near Upper Lake, two reinforced concrete bridges to be constructed and about 0.27 mile of roadbed to be graded and seal coat applied. District I, Route 15, Sections A, B. Contract awarded to Louis Biasotti & Son, Stockton, $38,718.

LOS ANGELES COUNTY—At the intersection of Bishops Road and N. Figueroa Street, two reinforced concrete bridges having overall lengths of approximately 103 feet and 135 feet to be constructed. District VII, Route 165, Los Angeles. Nick Perscallo, Los Angeles, $58,864; Oberg Bros., Los Angeles, $59,176; Carlo Bongiovanni, Los Angeles, $63,333; J. S. Metzger & Son, Los Angeles, $67,451; W. J. Disteli, Los Angeles, $68,458. Contract awarded to Contracting Engineers Co., Los Angeles, $51,836.

LOS ANGELES COUNTY—Across Ramona Blvd. at Pomeroy, Cornwell and Soto Streets in the City of Los Angeles, three reinforced concrete overcrossings to be constructed. District VII, Route 26. J. E. Haddock, Ltd., Pasadena, $252,295; Ralph A. Bell, San Marino, $276,521. Contract awarded to Nick Perscallo, Los Angeles, $227,920.

LOS ANGELES COUNTY—On Figueroa Street over Amador Street and Solano Avenue in the City of Los Angeles, two bridges to be constructed. District VII, Route 165. J. S. Metzger & Son, Los Angeles, $56,927; J. E. Haddock, Ltd., Pasadena, $65,757; Carlo Bongiovanni, Hollywood, $63,656. Contract awarded to Oberg Bros., Los Angeles, $54,590.

MADERA-MERCED COUNTIES — Between 0.5 mile north of Ash Slough and Dutchman Creek, about 4.4 miles to be graded and a portion paved with portland cement concrete and a portion surfaced with plant-mixed surfacing on crusher run base. District X, Route 4, Sections C, A. Healey-Moore Co. & Fredrickson & Watson Construction Co., Oakland, $159,272. Contract awarded to M. J. B. Construction Co. & F. Kaus, Stockton, $154,926.

PLACER COUNTY—Between Baxters and Hampshire Rocks, about 2.9 miles to be surfaced with plant-mixed surfacing. District III, Route 37, Sections D, E, F. Hemstreet & Bell, Marysville, $23,971. Contract awarded to Hayward Building Material Co., Hayward, $22,215.

PLACER COUNTY — Between Homewood and Tahoe City, about 1.6 miles to be surfaced with plant-mixed surfacing. District III, Route 38, Section A. Hayward Bldg. Material Co., Hayward, $15,040. Contract awarded to Independent Construction Co., Oakland, $9,592.

SAN LUIS OBISPO COUNTY — At Trout Creek, 1½ miles east of Santa Margarita, a reinforced concrete slab bridge to be constructed, about 0.2 mile of roadway to be graded and bituminous surface treatment applied. District V, Route 58, Section A. Trewhitt-Shields & Fisher, Fresno, $26,677; Brown, Doko & Baun, Pismo Beach, $32,635. Contract awarded to Dan Caputo, San Jose, $25,817.

SANTA BARBARA COUNTY—Between Jonata Park and Zaca, about 2.7 miles, seal coats to be applied to roadbed, gutters, dike faces and road approaches. District V, Route 2, Section D. Brown, Doko & Baun, Pismo Beach, $5,264. Contract awarded to L. A. Brisco, Arroyo Grande, $4,578.

SONOMA COUNTY—At Russian River, two miles west of Guerneville, a reinforced sidehill viaduct extension to be constructed. District IV, Route 104, Section A. C. C. Gildersleeve, Berkeley, $19,844; A. Soda & Son, Oakland, $20,480. Contract awarded to Louis Biasotti & Son, Stockton, $17,688.

Bids and Awards for June, 1941

SOLANO-YOLO COUNTIES—Between South Fork Putah Creek and one mile east of Davis and between Swingle and Yolo Causeway, about 4.6 miles to be graded and paved with portland cement concrete. District III, Route 6, Sections A,EA. Healey-Moore Co., Fredrickson & Watson Construction Co., Oakland, $349,390; A. Teichert & Son, Inc., Sacramento, $351,844; A. G. Raisch, San Francisco, $357,818; N. M. Ball Sons, Berkeley, $361,971. Contract awarded to Fredericksen & Westbrook, Sacramento, $347,675.

YOLO COUNTY—Between Woodland and Cache Creek about 4.5 miles in length to be graded and surfaced with plant-mixed surfacing on existing pavement and new cement treated base. District III, Route 7, Sections Wd,B. Healey-Moore Co.-Fredrickson & Watson Construction Co., Oakland, $145,-149; A. G. Raisch, San Francisco, $155,476; Piazza & Huntley, San Jose, $156,665; Hemstreet & Bell, Marysville, $161,868. Contract awarded to A. Teichert & Son, Inc., Sacramento, $142,424.

Schooner Gulch Spanned by a Modern Bridge

(Continued from page 23)

cantilever span were to be curved to conform to an 800-foot center line radius. For this innovation, torsion steel was provided in girders in addition to the usual stirrups.

The structure, one of many built or being planned for this region, has been placed on what will be the ultimate alignment for the coastal highway. Connections from the bridge to the existing highway are temporary.

The bridge and approaches were built under contract with Harold Smith, of St. Helena, at a cost of approximately $70,000.

Work has been started on a highway across the Isthmus of Panama which will connect Colon with Panama City. This new road between the Caribbean and the Pacific Ocean will be only a little over 50 miles long and will be the shortest transcontinental route in the world.

The United Commercial Travelers are advocating the painting of all school buses red, white and blue, arguing that it not only has a real patriotic appeal, but it will also provide additional safety.

First awards of the London Transport Medal for Bravery were presented recently. One was to a bus driver, who during a raid entered a burning garage and single-handed drove out numerous burning trucks amid falling bombs.

State of California

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Department of Public Works

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