



CALIFORNIA

HIGHWAYS AND PUBLIC WORKS

*View of Mt. Shasta from U.S. 99 near Castella.
Sacramento River in foreground*

Official Journal of the Department of Public Works
MAY · 1938

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

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

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Published for information of the members of the department and the citizens of California.

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Address communications to California Highways and Public Works, P. O. Box 1499, Sacramento, California.

Vol. 16

MAY, 1938

No. 5

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CONSTRUCTION STARTS RELIEVING CONGESTION NEAR SAN RAFAEL AND BREAKING BAD BOTTLENECK

By JNO. H. SKEGGS, District Engineer

THE STEADY increase of traffic between metropolitan San Francisco and the Redwood Empire, particularly the vacation resorts along the Russian River, together with the change in characteristics of traffic flow resulting from construction of the Golden Gate Bridge, has made it necessary to provide greater capacity on U. S. Route 101 in the vicinity of San Rafael.

Before the opening of the bridge, the limited capacity of the ferries governed the flow of traffic more than the capacity of the highway approaches. Now it is not necessary for miles of cars to patiently await their turn for the ferry at Sausalito and the need for highway development to remove congestion en route is more pronounced.

CONGESTION NEAR SAN RAFAEL

Studies show conclusively that the most constricted section of this only artery between the Golden Gate Bridge and Santa Rosa is from Ignacio through San Rafael.

Improvement of other sections might be economically sound, as they might be on many other sections of highway throughout the State, but with the limited funds available, betterment of the most congested portions must come first. Accordingly, this project utilizes all funds available in removing and relieving the worst constrictions.

Earlier commencement of work had been planned, but postponement was unavoidable because of the necessity of awaiting assurance that federal aid would be forthcoming, without which the improvement could not be made.

SUNDAY TRAFFIC 18,000

Traffic on this seven mile stretch of two-lane pavement between Ignacio and San Rafael reaches an intensity of 1700 cars for a one hour period with a sustained flow of 1250 or more per hour over an eight hour period.

Sunday traffic in June and July approximates 18,000 vehicles per day and even week day traffic often exceeds the comfortable carrying capacity of a two-lane highway.

Obviously, more lanes are essential and as the existing pavement is in good condition and, in general, on good alignment, the present project consists of widening to three lanes, with four lanes to be provided where sight distance is limited. This will provide opportunity for passing, resulting in greater capacity and will



JNO. H. SKEGGS

make travel safer by eliminating the tendency of vehicles moving in groups to "bunch up"—a common cause of accidents.

DIVIDED ROADWAY PLANNED

Immediately north of Ignacio the Black Point Cutoff diverts considerable traffic and the existing two-lane pavement from there north has sufficient capacity for the present. However, for 0.4 mile north of the wye a third lane will be added, and to provide a faster get-away and space

for safe adjustment of speeds, the pavement will be widened to 50 feet for three-quarters of a mile south of the wye.

It is planned that eventually a divided roadway will be constructed and, as the terrain does not lend itself to dual roadways separated by appreciable horizontal or vertical distances, the roadbed will be constructed to a width sufficient to permit two 23-foot pavements with seven-foot shoulders and a four foot center division strip.

The excess excavation resulting from widening the major cuts for present requirements enables this ultimate grading width to be done at a very small additional cost. Permanent landscaping can now be done as funds become available.

At St. Vincent's Hill, midway between Ignacio and San Rafael, the existing curves will be flattened to a minimum radius of 1500 feet. This change, together with widening and lowering the roadbed, entails 87,000 cubic yards of excavation, most of it to be sliced from present slopes which rise over 100 feet above grade. The balance of the 273,000 cubic yards of excavation is distributed throughout other widening and the new roadway within San Rafael.

SECTION IN SAN RAFAEL

Maximum congestion occurs in San Rafael where numerous intersecting streets, stop signals, grade crossings of railroads, etc., prevent free flow of traffic and a mere widening of the present highway would not satisfactorily improve conditions. Correction demands an unobstructed freeway and its selection requires vision and caution in order that the improvement be of permanent benefit.

Intensive studies of possible satisfactory routes showed that all converge near a common point in the north central part of San Rafael.

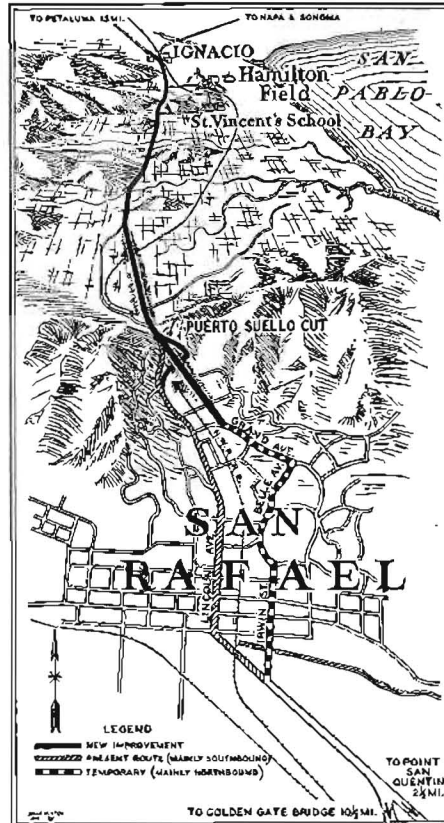
Proper development of any of these routes entails major structures and expenditures greater than can be made with funds now available. However, by fully improving a new half mile section from the north city limits to Grand Avenue from which point one of the future routes can be continued, the congestion will be alleviated and a start made on complete elimination of the constriction.

ALTERNATE ROUTE PROVIDED

During peak periods (Sundays and holidays), northbound through traffic will be routed via Irwin Street, Belle Avenue, and Grand Avenue, and southbound traffic will continue to use the present highway. At times of extreme peak travel, however, it will be possible to utilize both routes for traffic in the same direction. The addition of this temporary route necessitates minor improvement of Belle and Grand Avenues.

To enable present and future traffic from west of the railroad to safely reach the highway to the north, it will be carried under the new section of highway by a new 1000 ft. connection and allowed to merge with other traffic at the north limits of the city.

The new section of highway cuts through built up portions of the city for several blocks and a service road will be constructed on the east side



Perspective sketch of Ignacio-San Rafael project.

View taken from side of present highway looking northward through Puerto Suello Pass at northerly city boundary. Dotted line shows position of proposed extension southward in to San Rafael.

to enable the highway to function as a freeway. As this section lies adjacent to the railroad, no service road is necessary on the other side.

CONSTRUCTION DETAILS

Numerous widths of pavement result from the use of both three and four-lane sections, the several short line changes, the division (or provision thereof), of certain portions of the four-lane pavement, full utilization of the existing 20 foot Portland cement concrete pavement and the several two-lane roads.

Altogether there will be nearly six miles of Portland cement concrete widening strips constructed to widths of 11, 13, 15, and 22 feet and almost three miles of asphalt concrete pavement, 0.33 ft. thick, in widths of 11, 13, 15, 17, 30, and 50 feet.

Surfacing of the new section of highway, together with its service road, the Lincoln Avenue connection, and Belle and Grand Avenues, all within San Rafael, will consist of 0.21 ft. of plant mix.

Subbase for all pavement will consist of one-half foot of selected material to be obtained from a suitable deposit near the north end of the project. Three-foot shoulders of this material will be constructed throughout.

Approximately 15 per cent of the cost of the work will be involved in





View taken from top of cut through the saddle at Puerto Suello on westerly side of highway looking southward. Section shown in dotted line represents approximately that portion of reconstruction through San Rafael.

the widening of six existing bridges and the construction of an underpass as a part of the Lincoln Avenue connection. Clearing and demolition of numerous buildings on the new right of way within San Rafael add to the varied work involved and altogether

there are 70 contract items.

The time limit of 150 working days will make this improvement a fast moving job, requiring double shifting and careful coordination by the contractor. Particularly difficult, will be the maintaining of heavy summer

traffic throughout the length of the project.

Bids were opened April 27th and the work will soon proceed under the supervision of District Construction Engineer E. G. Poss, and Resident Engineer W. A. Rice.

MODOC HIGHWAY COMPLETED

By MATHEW FREDERICKSEN, Resident Engineer

A NEW 10-mile unit of State Highway between Hot Creek and Alturas, in Modoc County, on U. S. Highway 299, has been completed. This unit was particularly significant in that it was the last remaining unimproved portion on this State route.

Aside from affording transportation facilities to a large agricultural section and access to a widely known recreational area, U. S. Highway 299 is of interstate importance in that it directly affords connections with two states—Nevada to the east and Oregon to the north.

The old existing road replaced by the

the new unit, was characteristic of rural roads as existed prior to the advent of motor transportation. Through years of maintenance work and betterment contracts, since the inception of the route into the State Highway System, a fair surface had been obtained, but lack of drainage required reworking of this surface once or twice a year. The other characteristics, however, rendered the section wholly inadequate and unsafe for present-day needs and requirements.

The new alignment consists of long tangents and long radius curves. The grades were designed to insure ample sight distance, and with a roadway

section that will expedite snow removal. All of these features were designed and planned to yield safety and economy to its users.

An important feature of the project was the use of local deposits of pit-run gravel for the base course. These deposits, characteristic of the eastern area of the Cascades, are irregular in area, shallow in depth, and are found at random locations, but they usually have the characteristics that make them suitable for base construction. Aggregate from the deposits was crushed and graded for the top plant-mixed bituminous surface.

(Continued on page 27)



Here is an excellent view of one of many Cuesta grade curves now being eliminated.

Progress on Cuesta Grade

By B. W. BOOKER, District Construction Engineer

THE August, 1937, issue of California Highways and Public Works included an article describing the reconstruction of Cuesta Grade on the coast highway (U. S. 101). The contract was awarded on May 26, 1937, and construction was just getting well started at the time the article appeared in print.

A description of the preliminary investigations and construction planned as a result of these investigations was given in detail in the previous article.

It is interesting at this time to comment on the items of principal importance which were covered in the previous article and to draw some conclusions as to the effectiveness of the preliminary investigations in accomplishing the purposes planned. The major items of interest which come under this heading follow:

Progress—Construction operations were started on June 15, 1937, and

have been confined to date to grading, drainage and contingent items. At the present time, in spite of a three months' shut down due to an unusually severe winter, the roadbed items listed above are approximately 85 per cent complete, the entire project 66 per cent complete and the job about 3 per cent ahead of schedule. This is considered to be satisfactory progress in view of the difficulties of construction, involving movement of a considerable portion of the excavation from the top of the cuts to the bottom of adjacent fills. The maximum vertical movement of this nature was from 150 feet above grade to 200 feet below grade with the added difficulty of having to cross traffic en route.

The maximum output on roadway excavation was 150,000 cubic yards per month working two shifts with 2½ cubic yard shovels and four 9 by 12 cubic yard carry-alls supplemented by the necessary trucks and bull-dozers.

The excavation of fill treatment trenches, which are 90 per cent complete to date, also served to retard progress in the early stage of the construction.

Present indications are that the project will be finished about the middle of September, approximately one month earlier than the date for completion.

Traffic—In spite of the construction difficulties involved in carrying traffic through a job of this magnitude there have been no traffic delays of any importance to date. When the severity of the storms of last winter is given due consideration, this is an achievement which speaks well for the planning and execution of the work.

Slides—The preliminary estimate of quantities comprised 915,000 cubic yards of neat roadway excavation and included a supplemental item of 90,000 cubic yards for slide contingency.



Construction scenes on Cuesta Grade. Upper—Looking south from Station 216. Note slide in upper left with roadbed cut below. Center—Heavy grading equipment in operation. Lower—Unloading top of slide at Station 210. Grade of finished road is 25 feet below existing road. This project presented Division of Highway engineers with many backfilling, cribbing and fill treatment problems.



Looking south from existing Cuesta Grade. Metal crib and wattles adjacent to railroad just south of overhead.

At this writing with 85 per cent of the excavation completed and the winter storms over, it appears that there will be approximately 200,000 cubic yards of slide removal and prevention work necessary over and above the neat roadbed quantities or an over-run of 110,000 cubic yards. This represents less than 10 per cent of the total preliminary estimated quantities and is ample justification for the time spent on preliminary investigations when the character and magnitude of the work are considered.

Many of the slides have been in the nature of mud flows in thick strata of top soil that occur in concentrated deposits in the original formation. These occur as breaks of limited area in the face of the cut bank and are treated by effecting drainage and cupping out the slide down to the tight material.

Several more extensive slides occurred necessitating flattening the slopes, taking the weight off the top by benching and correcting drainage by capping springs and placing sub-surface drains.

Fill Treatment—Two types of fill treatment were employed which will be briefly described. Both methods were designed by Mr. O. J. Porter of the Testing and Research Laboratory and are worthy of a separate article devoted entirely to their discussions.

The method employed generally throughout the project on major fills

having poor foundation, was to excavate a trench with draglines and bulldozers through the mucky material with laterals and cross trenches along lines determined by the preliminary borings. The trenches varied from ten to twelve feet in width with side slopes varying according to the material and degree of saturation. The trenches were backfilled with gravel to a depth of four to five feet and a perforated pipe placed in the rock trench in most cases. The rock was then covered with straw and then backfilled with the trench spoil. Excess muck unsuitable for roadway fill was wasted into fill struts at the base of the roadbed fill.

The only departure from the above method was to vary the location and extent of the trenches to follow the seepage encountered while the excavation was in progress.

A DIFFICULT PROBLEM

The excavation of the fill treatment trenches presented a difficult problem due to the flow of the saturated material into the open trench, particularly on side hill cutting. This was overcome, in the most obstinate cases, by digging a sump at the upper end of the trench, draining the water from the sump and excavating the trench in short sections from the lower end and backfilling immediately behind excavation.

In order to place fill treatment at the Station 250 fill, it was necessary to construct a sump as described

above and strip the mucky material for the entire area between slope lines in the canyon floor down to tight material before the drains were placed. Approximately 43,000 cubic yards of saturated blue muck were excavated and placed in a fill strut extending to the west canyon wall.

DRAIN FILL FOUNDATION

The second method of draining saturated fill foundations was employed only at Station 175, in School House Draw. The highway traverses a flat open draw 650 feet in length along highway centerline on a maximum centerline depth of fill of 60 feet. Test borings showed the foundation to consist of a crust of from 8 to 10 feet of porous shale particles overlaying a 50 to 60 feet depth of plastic to semiplastic clay.

It was considered impractical to stabilize the foundation by the previously described method on account of the depth of trenches necessary and the grade required for the out-fall ditches. Sand piles were therefore studded throughout the foundation area and connected by a system of drains at the approximate level of the original ground. The piles were formed by driving a hollow seamless mandrel 70 feet long and 16 inches in diameter through the clay strata and filling the opening with sand as the mandrel was withdrawn. 300 of the sand piles were placed in the fill foundation and paid for as extra work under the contract.



Looking south from Station 172. New Cuesta Grade construction ready for fine grading.

NO SLIP OUTS OF FILLS

The most important point in connection with the fill treatments is that practically all of them have functioned as planned. There have been no slip outs of fills throughout the job excepting in one small fill where no fill treatment was provided. The settlement of fills has been nominal, the maximum amount of 2 feet occurring in School House Canyon with no indication of upheaval of areas adjacent to the fill.

The total quantities of fill treatment placed will closely approximate the estimate made from the preliminary investigation.

FILL TREATMENT RECORD

A record of fill treatment placed and recorded flow of drainage from the fill treatments follows:

Station	Length of trench	Seepage Flow, Gallons Per Minute		
		Maximum before rain	Maximum after rain	Present
159+80-----	190	0	0	0
163+89-----	200	0	0	0
167+25-----	250	0	6.0	0.9
175± (School House)	Sand Piles	0	15.5	0
192+65-----	260	10.4	20.3	16.2
203±-----	820	1.4	15.8	13.9
214±-----	600	5.0	23.7	15.8
220±-----	700	6.2	71.6	31.2
229+82-----	420	6.2	48.0	39.0
249+90-----	700	11.0	62.4	20.8
257+00-----	320	8.2	44.5	11.6
263±-----	375	4.2	12.4	5.0
282+85-----	280	10.2	17.2	10.2

Metal Crib. The construction completed to date includes two metal cribs. The first, adjacent to the overhead being constructed across the Southern Pacific tracks, is 150 feet long and from 9 to 26 feet in height.

Cuesta Overhead superstructure. Note streamlined Daylight Limited in background.

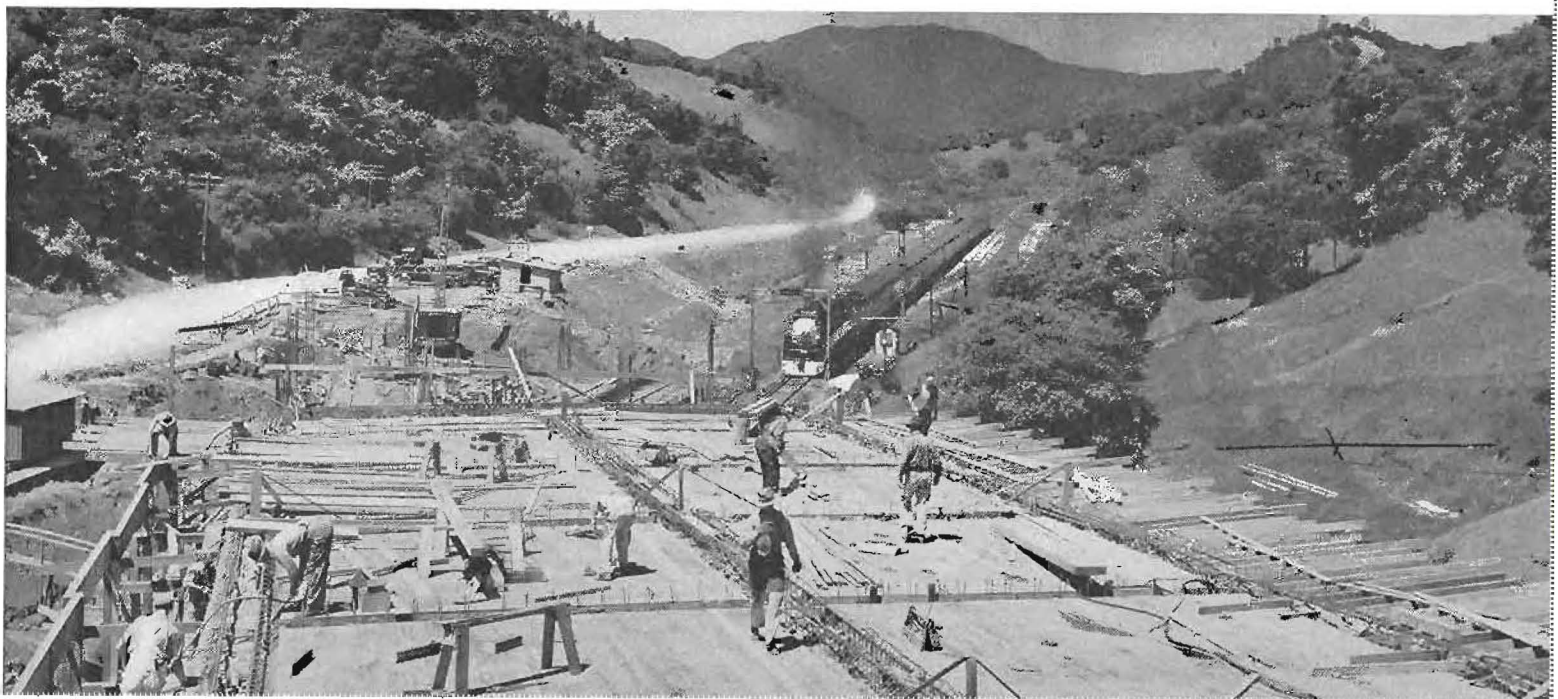
It was designed to retain the fill adjacent to the railroad and to effect a reduction in the required length of structure.

The second crib, 600 feet long and from 6 to 21 feet in height, makes it possible to construct a light fill over an old slide area with less danger of overload than would be possible if the fill were constructed entirely of earth.

Standard methods of construction were employed on both cribs with backfilling placed in 6-inch to 12-inch layers and compacted with pneumatic tampers.

Wattles. The fill slopes above the railroad washed badly during an early winter storm and muck was deposited to a depth of 6 inches over the tracks. Willow wattles were placed on the slopes consisting of bundles of second growth willows at

(Continued on page 28)





Where Bay Bridge trains will enter and leave the easterly end of the span.

BUILDING BAY BRIDGE RAILROAD

BY THE early part of 1939 a three-quarter century old custom around San Francisco Bay will have been altered.

For the picturesque ferry boats which for decades have carried passengers between metropolitan Oakland and San Francisco will be replaced by smooth running electric trains plying across the San Francisco Bay Bridge.

Both Key System and Interurban Electric (Southern Pacific) will operate trains across the span at an average saving to passengers of 15 minutes.

Trains will operate directly from Alameda, Berkeley and Oakland to the terminal in San Francisco.

This structure, facing Mission Street and extending within the vicinity of Beale and Second Streets, will be longer than the Ferry Building, and will bring 50 per cent of the daily commuter traffic to within walking distance of their destination in San Francisco.

REINFORCED CONCRETE TERMINAL

Street cars will loop in front of the terminal over an elevated ramp. The ramp will have three tracks, with a capacity of four cars each.

The terminal is a reinforced concrete structure to be faced with granite. To date, all structural concrete in the building units has been placed up to and including the track

floor, the highest floor elevation in the project.

Above the track floor the side walls and roof slab are within 20 per cent of completion. All steel framing over the train shed, with the exception of the east unit, has been erected, and the only steel construction for the viaduct remaining to be placed is that over South First and South Fremont streets.

TRAINS 63 SECONDS APART

Because the Bay Bridge railroad will of necessity handle as many as 17,000 passengers one way at a twenty minute period over one track, close headway schedules will be required. Ten-car trains will run as

close as 63 seconds apart. By way of comparison, New York subway trains have a 90-second headway.

To assure maximum safety and efficiency, the most complete automatic interlocking and signal system has been designed.

Replacing the old system of manually operated levers will be a trim control board, six and a half feet long and four feet and three inches high, designed so that the operator may sit before it as he would at a high-topped desk. Engraved on the face of the board is a track diagram with a signal knob or button placed at the entrance of each "route."

To "set up a route" the operator has only to press the signal knob at the entrance to the route and the completion knob at the exit to the route.

CONTROL BOARDS

Such a control board will be installed in the San Francisco Terminal. The design on this board will show the six tracks over which bridge trains will roll to discharge and pick up passengers. On it will be indi-

cated the 36 track switches and 40 wayside signals which comprise the interlocking plants of the terminal and viaduct.

A similar board will be placed in the high signal tower now completed in the Oakland yards situated just opposite the Toll Plaza. It will differ only in respect to its diagram which will show a design of the yards comprising the storage tracks and the mainline tracks. The Oakland interlocking plant controls 36 track switches and 62 wayside signals.

Each train has its corresponding numeral or letter (numeral for Interurban Electric; letter for Key System) identified on the board. When the train leaves either terminus the operator presses the proper button identifying the train to the operator at the other terminus.

TERMINAL NOISE ELIMINATED

Trains will loop into the San Francisco Terminal from the bridge over a viaduct, so insulated as to eliminate noise to the greatest possible degree.

The trains will leave and enter the

lower deck of the bridge at a point west of and paralleling the truck and "off" vehicular ramps.

East and westbound trains will share a common viaduct between the bridge and Clementina street at which point the viaduct separates to form a gigantic loop which will encompass the approximate equivalent of seven city blocks. San Francisco-bound trains from this connection take an easterly to westerly curve into the Terminal.

All foundations for the viaduct are practically completed, as is the neat work on the piers. The concrete crossing over Harrison is finished, and other crossings are rapidly nearing completion.

On the bridge proper, the trains will ply over two tracks on the south side of the lower deck, paralleling the truck lanes.

105,000 RAILROAD TIES

California redwood has been selected for the ties. On the bridge proper the ties are laid directly on the stringers, after the steel had received two coats of inertol.



Trains will leave the westerly end of the bridge over a viaduct paralleling the truck and "off" vehicular ramps.



The San Francisco Terminal, facing Mission Street, showing the center unit well under construction. Street car ramp in the foreground. East and west units not visible.

Each tie is dapped at either end. Ties are marked according to their position on the road-bed and enter the dapping machine in precise relation to the order in which they will be laid on the bridge. The depth of the dap is determined by the stringer, which has been previously surveyed, and upon this depth is also determined the elevation of the track. Depths vary from one-quarter inch to one and one-quarter inch. The dap in most cases is eleven inches wide.

A total of 150,000 ties or approximately 7,000,000 board feet of California redwood comprise the tie order for the Bay Bridge railroad. This is said to be the largest individual order made on the Pacific Coast in a decade.

On the bridge proper all ties have been laid to the center of Span W1-W2, and tracklaying operations

on the bridge are in an easterly to westerly direction.

TONS OF RAILS

The running rail is a 90 pound rail, in 39-foot sections. The guard rail is a 90 pound relay. On the main bridge and San Francisco loop the running rails will have a total gross tonnage of 1830; the guard rails, 1315 and the contact rail (to be used by the Key System only) a gross tonnage of 1400 pounds.

The Key System, which now operates on 600 volts, will continue to do so over the bridge. The Interurban Electric will continue to operate on 1200 volts as at present over a catenary system.

An approximate total of 400,000 spikes weighing 160 tons will be used for the tracks on the main bridge alone.

Trim steel catenary bridges painted aluminum, are replacing the timber trolley poles used by the trains at

present. Erection of the catenary bridges has been completed.

RAPID PROGRESS

In the East Bay yard, a major portion of the trackwork has been placed, and the connection with the easterly end of the bridge has been made.

Opening of the Port of Oakland Highway approach to the bridge is expected early in June. The viaduct of this highway, which passes over the yards and the main highway approach to the Toll Plaza, was constructed in conjunction with the railroad project.

The Bay Bridge railroad system, reputed to be the longest electric over-water railroad in the world, is another project built by the State Department of Public Works under the direction of Earl Lee Kelly. C. H. Purcell is chief engineer, Charles E. Andrew, bridge engineer and Glenn B. Woodruff, engineer of design.



Trains will roll in the San Francisco Terminal over six tracks arranged in pairs. This view of the elevated track level also shows the roof steel just erected.



This view looking down the East Bay Crossing shows ties and tracks in place.

OUTDOOR ADVERTISING

By JIM M. CALL, Supervising Inspector

SINCE the Outdoor Advertising Act became effective, more than four years ago, inspectors engaged in its enforcement have traveled over half a million miles attending to the displays which come within its scope. Some 200,000 displays have been viewed and approximately 30,000 violation notices have been issued.

Several thousand minor or technical infractions have been corrected through cooperation by advertisers, obviating necessity of citation. Countless small structures and signs were removed by owners during the first six months of the act's existence, this period having been allowed by legislature for organization and to acquaint the public with the nature and purpose of the measure.

About 25,000 paper or metal "snipe" signs have been removed by the inspectors, in conjunction with the Streets and Highways Code which provides for immediate removal of encroachments without notice. "Snipes" are miscellaneous small signs, announcing current local attractions, that pay no fee. Approximately 10,000 displays (not including quarter cards placed by candidates for public office) have been removed by State forces as a result of violation notice service.

50,000 EXEMPT DISPLAYS

Twenty-four thousand displays were under permit during 1937. Some 50,000 displays are being legally maintained exempt from permit payment. Of the latter, perhaps 5000 have been caused to conform to the location and copy provisions of the act through service of violation notices and personal contact.

All abandoned, unsightly, improperly located and other nonconforming displays have either been removed and destroyed or corrected. There is of course the usual run of violations but less than 2 per cent of these are of the location provisions. The majority of notices are necessitated through failure on the part of display owners to secure permits before

installing displays. However, by a thorough study of conditions and careful programming of surveys of highways upon which the greatest number of displays exist, the inspectors are able to locate violations promptly.

Owners are therefore rapidly learning that it is much more economical to obtain permits before placing displays than to risk losing them through error or misunderstanding after receiving citations.

During the latter part of 1937 steps were taken to enforce regulation of the illumination provisions. This necessitated night surveys which have proved very successful and little if any opposition has developed.

LACK OF COOPERATION

The most difficult obstacle in enforcing these provisions is lack of cooperation on the part of operators employed to place lighted signs. Owners have on occasion failed to correct violations immediately upon receipt of notices due to installation of a violation in the same vicinity, subsequent to citation of their signs, which has not been viewed by an inspector.

Naturally it is the desire of operators to sell the sign the customer fancies. In doing so they are sometimes careless about regulations, without intent to violate. Prospective sign purchasers should avoid buying displays which might require alteration or perhaps removal, until they have reviewed the terms of the act.

Another serious problem is that of abuse of the fee exemption as it applies to "for sale" or lease advertising. Compliance on the part of realtors and others interested in this type of display could be greatly improved.

Exemption is afforded only to signs of this type which are used exclusively to advertise the sale or lease of the property upon which they are located. Such a display as "This and Other Property for Sale" may not be considered exempt from payment.

TWO SIGN CLASSIFICATIONS

Every advertising structure should conform to the location, strength and copy provisions; every sign to the location and copy provisions.

There are but two classifications of displays:

ADVERTISING STRUCTURE:

When artificial support, such as poles, posts, angle irons, guy wires, or braces embedded in the ground or attached to the sides or roofs of existing structures such as barns, sheds, fences or trees, is necessary, the display is classed as an advertising structure, the annual fee for which is \$1.00.

ADVERTISING SIGN: One which may be pasted, glued, nailed, tacked or similarly affixed flat against the side or roof of a building, or to a tree, fence, post, rock, bush, or similar support which was not primarily placed for the purpose of displaying advertising. All displays, painted directly upon existing natural or artificial features of the landscape, are also classified as signs, the annual fee for which is \$.25.

EXEMPT DISPLAYS

Permit applications need not be filed for payment of exempt displays. However, these displays may not be placed or maintained nearer than 300 feet from the point of intersection of highway or highway and railway right of way lines, unless the property upon which they are to be installed or are maintained is subdivided into blocks and lots, or unless their installation will not decrease visibility at an intersection.

Subdivisions consisting of lots in excess of 20,000 square feet of area may not be recognized in the application of permissible location regulations. Neither structures nor signs may be placed upon or attached to public highway right of way fences nor may they encroach upon or overhang public highway rights of way.

It is not uncommon to observe four to eight small (1 by 1 foot) "for

A	SAMPLES OF PERMISSIBLE COPY FOR ADVERTISING SIGNS	LODI AND SAN JOAQUIN VALLEY POINTS A GOOD ROUTE TO FRESNO AND BAKERSFIELD THIS ROAD	L
B	Visit MT. LASSEN on highway 00	to PALMDALE via Imperial Valley and El Centro FIRST ROAD	J
C	LAKE TAHOE INN on highway 00-15 miles from Truckee Boating-Fishing-etc.	To GARDEN SPRINGS HOTEL At Oakdale-One Mile Ahead	K
D	If you want the SAN MATEO BRIDGE -this road	MOUNT EDEN VIA ALMOND GROVE AND BIG LAKE First Road Right A Good Route to Sunset Valley Points	L
E	SAN MATEO BRIDGE Don't miss it! BRIDGE CAUSEWAY LONGEST IN THE WORLD A Convenient way to San Joaquin Valley Points and Los Angeles	for BIG Foot of the Hill MEADOWS A PLEASANT WAY TO SAN DIMAS 48 to 50 Miles	M
F	HOTEL SENATOR 5 MILES TAKE "M" STREET BRIDGE RIGHT TURN ON 12TH STREET	A GOOD ROUTE TO GEORGETOWN VIA GILROY STAGE LINE also to BOONVILLE and ALTURAS	N
G	FOREST HILLS CAMP FIRST ROAD	Big Bear Ranch 1/2 mile ahead - to right VIA ARLINGTON AND LYONS GAP	O
H	A good way to JOHNSTOWN BADGER PASS PRUNEDALE PALM SPRINGS MODOC and San Francisco	HOOPERVILLE - 1 MILE AHEAD a convenient way LEFT ROAD to PASO ROBLES	P

sale" signs on a short highway frontage. Although substitution of a larger sign structure at each end of the frontage would be more expensive, it is believed that the resulting improvement in appearance of the property would balance the expenditure.

SOURCES OF REVENUE

Although fee exempt displays outnumber those requiring number plates two to one, regulation of them must be financed from the "Supervision of Outdoor Advertising Fund." There are but three sources of revenue to support the fund: Annual Advertising Structure and Advertising Sign fees; the license fee, \$50 payable annually but which may be prorated on a monthly basis depending upon the time of the applicant's entry into the Outdoor Adver-

tising Business; collection of fines imposed by courts and collected under this act, any violation of which is a misdemeanor.

It follows, then, that regulation of any increase in the number of payment exempt displays may only be financed through collection of fees on a corresponding increase in the number of displays requiring permit number plates. No revenue is derived from exempt displays under either the license or permit provisions.

"Snipe" signs present a task for the Outdoor Advertising Section that could readily be disposed of through cooperation on the part of firms and individuals. This type of advertising is a "hold-over" from horse and buggy days. At a ten-mile gait the driver's undivided attention could be given them; on stopping to give old

Dobbin a blow, the driver could size up a candidate, decide on a brand and read the printer's label. It is different now. Except to hitch hikers and the occasional horse-drawn vehicle driver an array of bills or cards is just a blur.

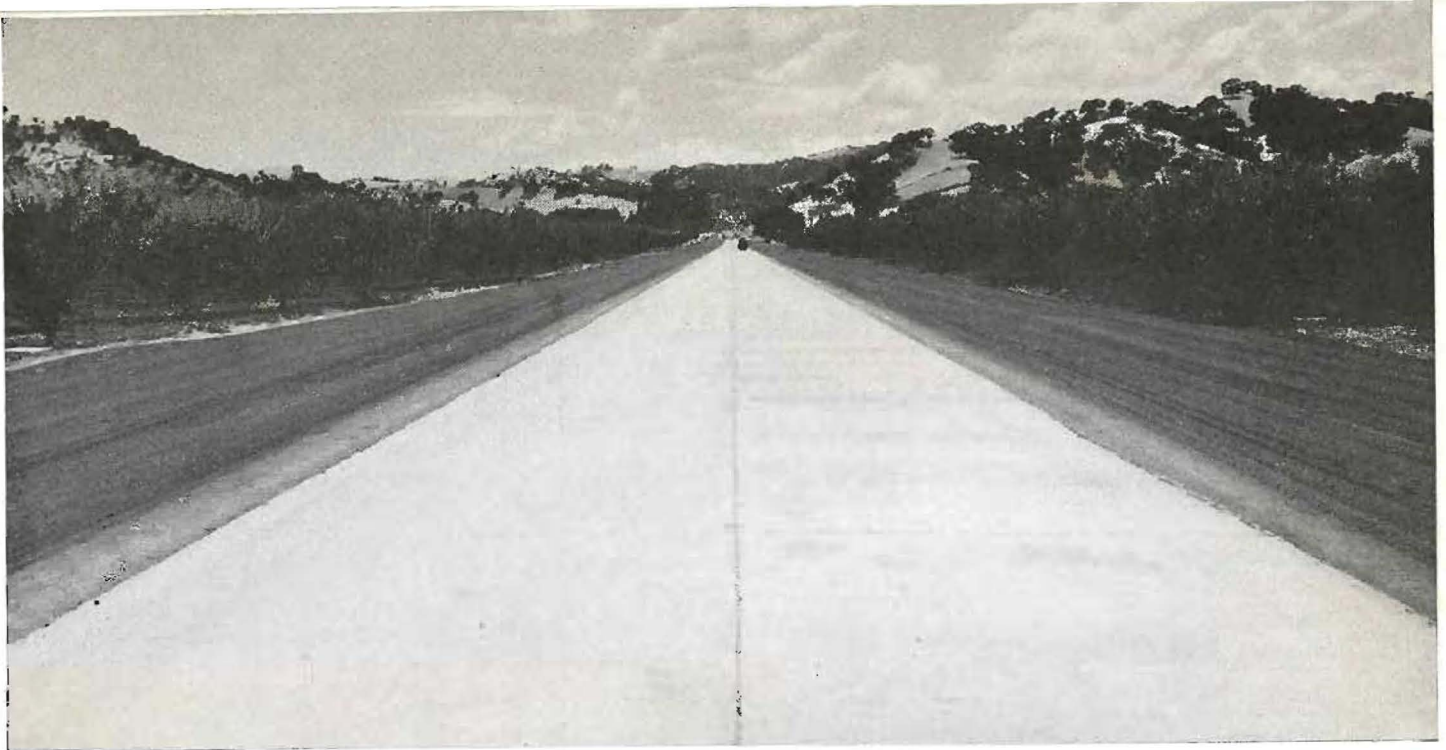
Permits may be granted for "snipe" signs designed and located in accordance with the provisions of and regulations under the act. Violations are only waste, however, and continued violations may result in prosecutions. The Outdoor Advertising Section plans strict adherence to its enforcement policies.

Advertisers are, in general, refraining from placing structures which might create traffic hazards. However, many continue to place signs which attempt to direct traffic, in violation of the Vehicle Code. As a guide to those interested in installation of displays containing directional data, types of permissible displays, and a facsimile of a print containing regulations, are shown in accompanying illustrations. Signs designed in accordance with the samples, properly installed, will conform to the provisions and regulations of the Outdoor Advertising Act and the Vehicle Code.

The existence of the Outdoor Advertising Act is generally known and its effectiveness is appreciated by those interested in highway construction and maintenance as well as by the pleasure motorist. The Outdoor Advertising Section with offices at Room 301, Public Works Building, 12th and N streets, Sacramento, California, and Room 805, State Building, Los Angeles, California, will gladly assist advertisers and others interested in administration of the act.

Will Advertise S. F. World's Fair

More than 2,500,000 California automobiles will carry the San Francisco World's Fair slogan on license plates in 1939, according to Governor Frank F. Merriam. With more automobiles registered than any other State or political subdivision in the world, California plans to make these plates an important factor in supporting the western States travel drive, which aims to make 1939 the greatest travel year in the history of the west. With a blue background and gold lettering, blue and gold being the exposition colors, the plates will carry the inscription on top: "California World's Fair '39".



Section of 20-foot Portland cement concrete pavement in Solano County near Vacaville.

CONSTRUCTION PROGRESS AND PAVEMENT RECORDS FOR 1937

By EARL WITHYCOMBE, Assistant Construction Engineer

STRENGTHENING of the foundation for the roadbed and pavement continued to be given primary consideration during the 1937 construction season in California. Results obtained with the various measures adopted in 1936 and continued throughout 1937 are exceptionally promising. The treatment of embankment foundations has in nearly every case proven successful in the severe test of the past winter, during which many failures occurred in older work.

Few locations within the State afford a native material throughout the entire length of the project which would be considered suitable for subgrade under our present standards, and selection of soils for the immediate subgrade is being practiced on nearly every pavement project. Wherever possible, suitable subgrade material is selected within the limits of the project, the only added expense involved being sometimes the additional haul.

Portland Cement Concrete

CONSTRUCTION METHODS

During 1937, the Johnson drag finisher was improved in design, and was used in finishing the project with the record smoothness for the season. This project has a reading of 3.5 inches per mile, which is but 43 per cent of the average for the year, and is the lowest average roughness of any pavement yet recorded since California adopted measures to rate surface smoothness.

The drag finisher consists primarily of a 20-foot frame from which are suspended two 18.5-foot lengths of floatboard crossed under the center of the machine. On three sides of the intersection are mounted V-sections of floatboard, two transverse and one longitudinal, with ready adjustments to the overhead frame. At the opposite end of the frame from the longitudinal V-section is mounted an 8" roller. The drag finisher is reversible

and is operated in both directions without turning. Ordinarily, six trips over the pavement are sufficient for finishing. The steel shod cut-float is used for the final finish and practically all of the cutting necessary consists of shaving off the material pushed up in the joint edging operations. The uniformity in surface smoothness on a concrete pavement finished by this method is quite remarkable.

GRAPHS OF PAVEMENTS

Through the courtesy of the Los Angeles County Road Department, graphs were taken of the surface obtained on typical pavements finished by the usual standard methods and by the use of the drag finisher. Their roughness measuring equipment records the variations of the middle point of a ten-foot length of pavement from a straight line between the two end points as shown by accompanying typical sections of the graphs.

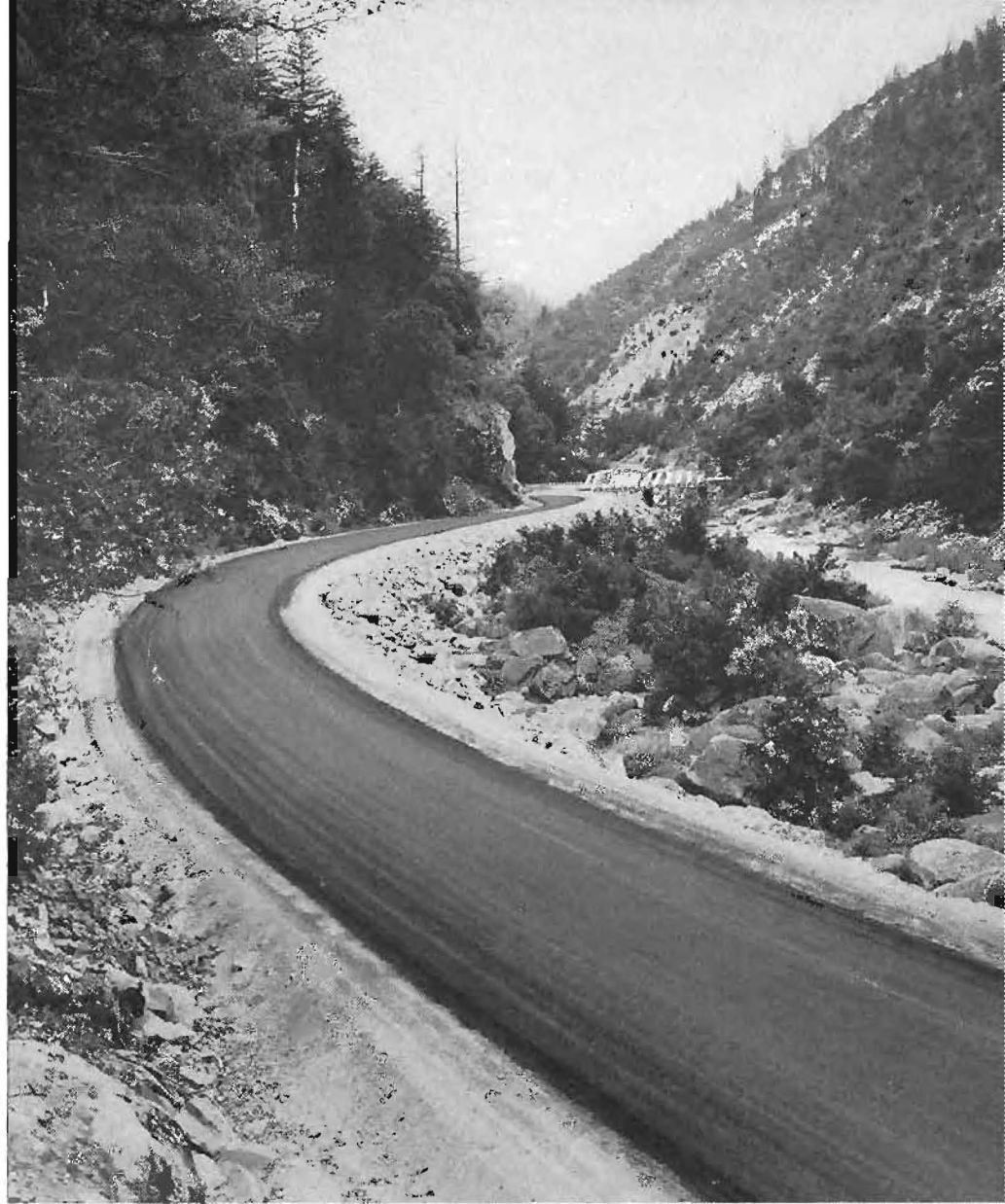
Three trips are made over each pavement lane to indicate the roughness along the center line of the lane and along each quarter point line. The upper set of three readings shown in the illustration was taken on a project finished by standard methods with a roughometer reading of 8.4 inches per mile, and the lower set of three readings was taken on a section finished by the drag finisher with a roughometer reading of but 3.3 inches per mile.

Recent improvements in the construction of finishing machines has made the requirement of more than one machine unnecessary for maximum productions, and future specifications are being revised in this respect.

Joint construction and intervals between joints remain the same as heretofore with $\frac{1}{4}$ -inch width of pre-molded joint material at 60-foot intervals and weakened plane transverse joints at 20-foot intervals. No positive method has yet been perfected to hold the expansion joint filler normal to the pavement surface throughout the finishing operations. Constant vigilance is necessary to accomplish this result, and failure to observe these precautions results in early failure of the pavement in the immediate vicinity of the expansion joints.

(Continued on page 17)

Feather River Highway completed last summer boasts this excellent stretch of roadmix surface.



This is 42-foot plant mix surface on Marin County approach to the Golden Gate Bridge.

PORTLAND CEMENT CONCRETE PAVEMENT RECORDS FOR 1937

Location	Contractor	Resident Engineer	Street Assistant	Average cu. yds. laid per 8-hour day	Average strength, 28 days, lbs. per sq. inch	Per cent average daily variation in cement	Roughness Index, inches per mile
Rocklin—Loomis	Basich Bros.	J. D. Greene	R. B. Vernon	423.7	4919	0.73	6.0
1/2 mi. W. of Soda Springs—Donner Summit	Fredericksen & Westbrook	W. G. Remington	H. S. Hart	422.6	4277	.91	11.0
Agnew Underpass—San Jose	A. J. Raisch & E. W. Heple	C. F. Price	F. D. Booth	346.2	3846	1.28	15.3
Bradley—6 mi. S. of San Ardo	Peninsula Paving Company	H. J. Daggart	S. N. Isham	326.7	4322	.43	8.5
Biola Junction—Herndon	Union Paving Company	F. W. Howard	R. M. Cooley	440.0	3708	.69	6.1
Belmont Circle—Biola Junction	Hanrahan Company	F. W. Howard	J. G. Sprague	385.2	4540	1.06	5.3
Fenwick St.—Terra Bella St.	C. O. Sparks & Mundo Engr. Co.	W. J. Calvin	E. C. Daniel	333.6	4602	.51	8.4
Monterey Park—Pomona	Griffith Company	R. J. Hatfield	F. L. Everitt	455.8	4740	.70	5.7
Playa St.—Washington Blvd.	J. E. Haddock	G. E. Farnsworth	G. H. Lamb	428.5	4784	.50	10.4
Atlantic Ave., 68th St.—Olive Street	United Concrete Pipe Corp.	F. B. Cressy	J. R. Rubey	304.0	5548	.65	12.9
Jct. of Whittier and San Gabriel Blvds.	J. E. Haddock	L. F. Phillips	G. H. Lamb	311.0	5264	.67	5.3
Center St.—Firestone Boulevard	Matich Bros.	F. B. Cressy	G. H. Lamb	429.8	4619	.28	5.4
Lakewood Blvd.—Norwalk Road	Sully-Miller Company	W. D. Eaton	F. L. Everitt	413.1	5443	.72	7.2
Norwalk—Miraflores	C. O. Sparks & Mundo Engr. Co.	E. A. Parker	H. D. Johnson	380.0	4133	.81	8.2
Firestone Blvd., through Downey	Sander Pearson	W. L. Welch	G. H. Lamb	326.7	4963	1.26	5.6
Hampshire Ave., Coast Blvd.—Garfield St.	J. E. Haddock	W. D. Eaton	H. D. Johnson	465.7	5813	1.54	3.3
Newport Beach—Laguna Beach	Geo. R. Curtis Co.	L. R. McNeely	H. D. Johnson	455.2	4669	.88	7.9
Center St.—Placentia Ave.	Oswald Bros.	F. B. Cressy	A. W. Carr	276.0	4334	1.10	5.2
Newbury Park—Conejo Creek	Mittry Bros.	W. I. Templeton	J. Fleharty	801.0	4452	.57	8.5
Colton—Waterman Avenue	Oswald Bros.	J. M. Hollister	B. Nelson	279.7	4180	1.47	8.3
1 mi. W. of Vacaville—0.7 mi. E.	Fredericksen & Westbrook	G. R. Hubbard	R. H. Lapp	411.8	3417	.65	13.3
Carquinez Bridge—0.9 mi. N.	Union Paving Co.	G. R. Hubbard	E. W. Ray	314.2	5438	1.09	17.9
El Cajon Ave., Texas St.—Euclid Ave.	Daley Corporation	W. T. Rhodes	E. C. Dodson	382.0	4618	.77	9.2
Las Flores Underpass—1 mi. S. of San Onofre	David H. Ryan	J. F. Taylor	F. Cimmino	456.7	4703	.42	7.7
Oceanside—Las Flores Underpass	Wood & Bevanda	L. H. Williams	L. B. Munro	350.9	4568	.83	9.1
Averages				396.0	4470	.81	8.2

ASPHALT CONCRETE PAVEMENT RECORDS FOR 1937

Location	Contractor	Resident Engineer	Street Assistant	Average tonnage laid per day	Average stability of surface mixture in %	Average relative gravity of surface mixture in %	Roughness Index, inches per mile
Willows—Artols	N. M. Ball Sons	J. C. Womack	J. G. Mehren	745.6	42.7	91.3	8.2
Artols—Orland	Union Paving Company	J. P. Murphy	J. G. Mehren	723.2	35.6	92.2	10.0
San Jose—Coyote	Jones and King	C. F. Price	E. W. Herlinger	793.9	42.1	93.0	14.6
San Mateo—Redwood City	Basich Bros.	F. W. Montell	E. W. Herlinger	805.0	45.0	93.7	11.7
1 mi. N. of Rincon Creek—Carpinteria	Heafey-Moore Co.	J. C. Adams	F. C. Weigel	341.0	32.6	97.0	17.4
Miramar Ave.—Olive Mill Road	J. E. Haddock	J. C. Adams	S. N. Isham	371.6	42.5	95.9	13.0
Belmont Circle—Biola Junction	Hanrahan Company	F. W. Howard	H. Porter	543.0	32.5	93.5	13.1
Biola Junction—Herndon	Union Paving Company	F. W. Howard	E. Thomas	564.0	34.0	97.6	11.8
10.5 mi. S. of Bakersfield—Grove St.	Griffith Company	D. G. Evans	W. M. Nett	417.1	39.9	94.3	12.3
Marengo St., Cornwall St.—Lord St.	Oswald Bros.	C. N. Ainley	E. C. Daniel	483.2	35.0	95.2	10.3
Azusa—Claremont	Geo. R. Curtis Company	E. L. Soitz	W. E. Melcher	469.2	20.0	96.4	18.9
Fenwick Street—Terra Bella St.	C. O. Sparks & Mundo Engr. Co.	W. J. Calvin	E. C. Daniel	238.4	28.3	---	33.8
Wilmington Blvd.—Alameda Street	United Concrete Pipe Corp.	F. R. Pracht	A. W. Carr	612.0	38.4	95.3	15.0
Polyhi Court—Stanley Avenue	Sully-Miller Company	W. D. Eaton	A. W. Carr	535.4	34.3	94.2	19.6
Atlantic Blvd.—New Avenue	Geo. R. Curtis Company	C. P. Montgomery	A. W. Carr	510.0	40.0	94.9	12.0
Cerritos Ave., Firestone Blvd.—Telegraph Ave.	Geo. R. Curtis Company	W. F. Axtman	W. E. Melcher	464.3	33.4	95.1	14.0
Norwalk—Miraflores	C. O. Sparks & Mundo Engr. Co.	E. A. Parker	A. W. Carr	472.5	33.3	94.7	18.3
Newbury Park—Conejo Creek	Mittry Bros.	W. I. Templeton	A. W. Carr	269.1	41.0	91.6	22.7
Pyle Road—Telegraph Road	Griffith Company	W. I. Templeton	W. A. Norman	483.7	37.0	95.8	12.9
Camarillo State Hospital	Griffith Company	W. I. Templeton	W. A. Norman	277.0	40.0	---	86.3
Colton—Waterman Ave.	Oswald Bros.	J. M. Hollister	W. Ford	352.1	33.0	---	20.6
Del Mar—Ercinitas	Griffith Company	R. C. Payne	L. E. Crayne	529.2	30.6	96.0	25.0
Oceanside—Las Flores Underpass	Wood and Bevanda	L. H. Williams	L. B. Munro	513.3	44.8	92.8	12.4
Main St., Division St.—32nd St.	V. R. Dennis Company	F. D. Pearce	M. H. West	368.1	43.4	98.0	30.1
Averages				530.0	36.0	94.6	15.6

BITUMINOUS TREATED SURFACES, RECORDS FOR 1937

Location	Contractor	Resident Engineer	Roughness inches per mile
Plant Mix			
Sapp Creek—Pepperwood School.....	Hemstreet & Bell.....	D. J. Stout.....	18.5
Beatrice Overhead Crossing—Eureka.....	Hemstreet & Bell.....	H. C. Amesbury.....	20.5
1.4 mi. W. of Hot Creek—Alturas.....	Hanrahan Company.....	M. Frederickksen.....	18.2
Route 3—1.5 mi. E. of Dales.....	A. Teichert & Son.....	J. C. Young.....	28.9
Shasta—Redding.....	D. McDonald.....	H. K. Ward.....	30.0
Westwood—Coppervale.....	Union Paving Company.....	C. A. Potter.....	73.4
Donner Grade—E. end Donner Lake.....	Pacific States Const. Co.....	J. W. Corvin.....	39.6
Waldo Point—Golden Gate Bridge.....	Macco Construction Company.....	H. S. Payson.....	25.5
Broadway Tunnel—2 mi. W. of LaFayette.....	Granfield, Farrar & Carlin.....	W. A. Rice.....	49.6
Camelia St.—San Pablo Avnue.....	Union Paving Company.....	L. G. Marshall.....	23.4
2 mi. W. of LaFayette—Walnut Creek.....	Union Paving Company.....	W. A. Rice.....	42.5
1.2 mi. E.—3.0 mi. E. of Petaluma.....	Peter J. McHugh.....	E. Carlstad.....	13.9
¼ mi. S. of Strathmore—Valencia St., Eastwood Ave.— Cairns Corner.....	N. M. Ball Sons & Larsen Bros.....	C. F. Oliphant.....	33.0
Calabasas School—Brent Jct.....	C. O. Sparks & Mundo Engr. Co.....	W. J. Calvin.....	40.1
Azusa Avc.—San Gabriel River Bridge.....	A. S. Vinnell Company.....	C. R. Montgomery.....	13.0
Center Street—Firestone Blvd.....	Match Bros.....	F. B. Crossy.....	15.7
Lakewood Blvd.—Norwalk Road.....	Sully-Miller Co.....	W. D. Eaton.....	31.7
Carolina Ave.—Yorba Linda.....	C. O. Sparks & Mundo Engr. Co.....	H. J. Fallal.....	26.3
Dowling Ave.—Linda Vista Street.....	A. S. Vinnell Company.....	L. B. Lindley.....	23.7
Newbury Park—Conejo Creek.....	Mittry Bros.....	W. I. Templeton.....	32.7
At Snow Creek.....	Oswald Bros.....	E. A. Bannister.....	29.5
Beaumont—2 mi. westerly.....	Oswald Bros.....	J. M. Hollister.....	17.1
Carquinez Bridge—0.9 mi. northerly.....	Union Paving Company.....	G. R. Hubbard.....	74.4
Los Banos—10.5 mi. easterly.....	Louis Biasotti & C. C. Wood.....	A. K. Nuffy.....	20.1
Sandía—Alamo River.....	George Ellis.....	J. F. Taylor.....	20.8
Calexico—3.1 mi. easterly.....	R. E. Hazard & Sons.....	C. R. Hagbert.....	20.2
Lake Hodges—Escondido.....	R. E. Hazard & Sons.....	L. E. Liston.....	7.5
Harasthy Street—Barnett Street.....	V. R. Dennis Co.....	B. F. Moore.....	78.0
Oceanside—Las Flores Underpass (por.).....	Wood and Bevanda.....	L. H. Williams.....	24.1
Average.....			28.6

Road Mix

Trinidad—McNeil's Ranch.....	Poulos and McEwen.....	E. L. Miller.....	35.7
Howell—¼ mi. S. Keddie.....	Hayward Bldg. Material Co.....	C. Brown.....	19.8
Sulphur Creek—Boulder Creek Hill.....	Guy F. Atkinson Company.....	P. F. Green.....	35.4
Viola—Forest Boundary.....	Fredericksen & Westbrook.....	G. Sundman.....	35.0
Farallone City—Rockaway Beach.....	Granfield, Farrar & Carlin.....	H. A. Simard.....	12.6
Route 68—N. City limits of San Jose.....	Basich Bros.....	C. F. Price.....	34.4
Agnew Underpass—San Jose (por.).....	Raisch & Heple.....	C. F. Price.....	51.2
2½ mi. E.—¾ mi. E. of Monolith.....	Young and Son.....	D. G. Evans.....	33.3
Box Springs—3 mi. E. of Moreno.....	Oswald Bros.....	E. A. Bannister.....	16.8
Mountain Pass—Nevada State Line.....	Geo. Pollock Company.....	C. V. Kane.....	57.5
2.5 mi. W. of Java—0.5 mi. E. of Java.....	Basich Bros.....	G. E. Malkson.....	33.5
Between Amboy and 17 mi. E. (por.).....	Basich Bros.....	G. E. Malkson.....	36.9
Conway Summit—1 mi. W. of Bodie Road.....	Isbell Construction Co.....	J. N. Stanley.....	12.8
4 mi. S.—1.7 mi. S. of Fish Springs.....	Basich Bros.....	M. W. Ellis.....	45.4
Bishop—Owens River.....	Basich Bros.....	R. E. Raley.....	41.9
Near Inyokern.....	Basich Bros.....	R. V. Murray.....	46.5
1.2 mi. SE.—1.7 mi. NW. of Rodemacher.....	Basich Bros.....	R. V. Murray.....	28.7
Mammoth Lake—Route 23, Casa Diablo Hot Springs.....	Oswald Bros.....	F. R. Pracht.....	23.7
Vernalis—Gates Road.....	Basich Bros.....	A. N. Lund.....	15.3
Stoddard Springs—McCoy Saddle.....	Beerman, Jones & Maestretti.....	E. W. Ray.....	39.2
Mulberry Avenue—Calipatria.....	R. E. Hazard & Sons.....	J. F. Taylor.....	34.2
2.5 mi. E. of Rincon—Rancho Cuca.....	R. E. Hazard & Sons.....	I. W. Littlefield.....	34.5
Average.....			31.6

Miscellaneous Types

Menlo Country Club—Woodside.....	Union Paving Co.....	A. Walsh.....	161.8
Waldo Point—Golden Gate Bridge.....	E. A. Forde.....	W. A. Rice.....	28.3
Spence Street—Downey Road.....	C. F. Robbins.....	A. W. Hoy.....	72.6
Average.....			65.7

(Continued from page 15)

Construction Records

One outstanding project holds the record for 1937 for maximum aver-

age daily output, strength of concrete, and surface smoothness. Contract 07XC3, road VII-Ora-171-A, Hnt B, on Hampshire Avenue between Coast Boulevard and Garfield Street, established an average

output of 465.7 cubic yards of concrete per day, an average compressive strength of 5813 pounds per square inch, and an all-time record was made on surface smoothness

(Continued on page 24)

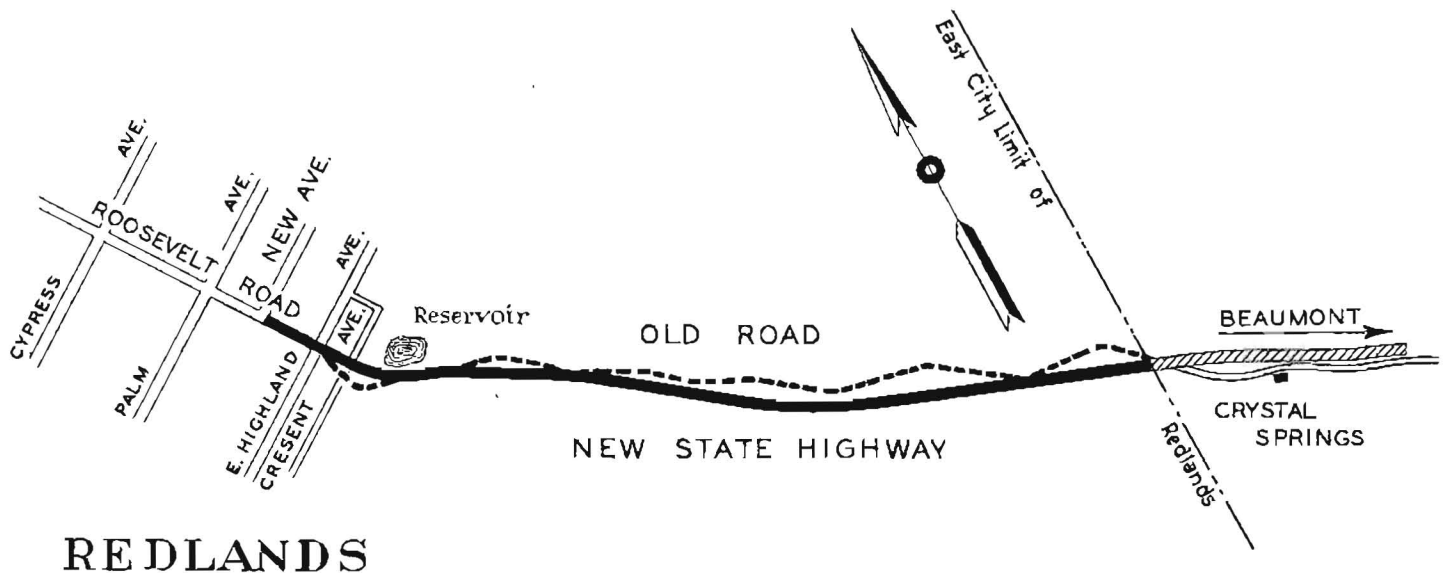
Highway Between Redlands and Crystal Springs to Be Realigned

By A. EVERETT SMITH, Assistant Highway Engineer

IN LINE with recent improvements on State Highway Route 26, a project will soon be under way from New Avenue in Redlands easterly to Crystal Springs, a distance of two and thirty-six one-hundredths of a mile. Bids were opened for this project on April 21. Claude Fisher

Avenue, some seven hundred feet, the new construction will follow the existing traveled way along Roosevelt Road. From Highland Avenue to the eastern terminus, new alignment will be used throughout. Along the west end of the project, for the convenience of public traffic, a detour will be constructed and surfaced with road mix

of Redlands city limits. This portion will be graded to rough grade only at this time. It is, however, designed to modern standards of alignment and will eventually be used to eliminate the sharper curves in the Crystal Springs Canyon. Approximately ninety-four thousand cubic yards of roadway excavation is to be moved,



REDLANDS

submitted the low bid. This is a link in the Los Angeles to Imperial Valley highway.

The project beginning at New Avenue extends easterly through Reservoir Canyon, and continues on up Crystal Springs Canyon to Crystal Springs. This is an especially delightful portion of highway. It is here that the west bound traveler leaves the desert roads behind and suddenly finds himself swinging down the pleasant Crystal Springs Canyon. A little farther and he has passed the Redlands City Reservoir and immediately, without previous warning, is in the midst of fragrant orange groves.

NEW ALIGNMENT

From New Avenue to Highland

surface treatment. Along the balance of the work, traffic will be permitted to use the existing road during construction.

From the beginning of the project to the east city limits of Redlands, approximately four thousand, four hundred cubic yards of Class "B" Portland cement concrete will be used in constructing two lanes of pavement, each eleven feet in width and approximately one and eight-tenths miles in length. This pavement is to be bordered with road-mix surface treated shoulders to a minimum width of eight feet on each side.

Most of the material for roadway embankment will be obtained from the portion of the project that lies east

involving some five million station yards of overhaul.

THIRTY-EIGHT FOOT ROADBED

Facilities for adequate drainage will be supplied by placing corrugated metal pipes, and reinforced concrete box culverts.

The highway is to be constructed in general to a thirty-eight foot roadbed width, so designed as to be suitable for ultimate use as a one-half section of a four lane highway with a central dividing strip.

When complete, this new highway will present a two lane pavement with wide surfaced shoulders, all constructed to modern standards. The alignment will be greatly improved and will have a minimum radius of curvature of one thousand feet.



Proposed improvement of East approach to Redlands. Dotted lines show new alignment through valley below Crystal Springs.

The new highway will replace an old bituminous macadam pavement that is very rough and is fast giving way under the heavy automobile and truck traffic to which it is subjected. The old road has numerous sharp curves with inadequate sight distances, making driving slow and hazardous. Here, as was the case on

other sections of this route before improvement, the lighter and faster vehicles form long lines of traffic behind

Proposed project at the east entrance to Redlands. Dotted lines show new alignment eliminating steep and dangerous curves.

the big slow moving trucks where sight distance, due to outmoded alignment, is inadequate for safe passing. This improvement will greatly facilitate traffic movement and will eliminate another section on this route where this particular type of difficulty has been encountered to a serious extent.



STATE SURVEYS ITS SNOW CROP

By FRED H. PAGET, Associate Hydraulic Engineer

SNOW surveys are conducted annually by the Division of Water Resources to gage the area, depth and density of the California snowpack. From this snowpack will come the water necessary during the following summer for crop irrigation, power generation, mining, manufacturing and municipal needs; as well as for navigation requirements, salinity prevention, and a multiplicity of smaller uses.

While man can not regulate or control the release of water stored in the mountain snowpack, he can, if he knows the amount that will be at his disposal, arrange ahead of time an intelligent program to get the full benefit of this water as it is released by the forces of nature. It is to get this advance knowledge that the snow surveyors each spring trek into the snow covered mountains to measure and gage the snow crop.

HEAVY SNOW PACK

Few people fully appreciate the immensity of the water storage capacity provided by the snow fields which reach from the Tehachapi on the south to Mount Shasta on the north, covering an area of approximately 17,000 square miles, as the rainy season in California closes and the irrigation season begins.

On April 1st of this year some 33 million acre feet of water were held stored in the Sierra snowpack as compared to 4 million acre feet total storage in the man-made reservoirs of this same region. Outranking many times in volume the man controlled water supply and even more advantageously placed as regards distribution and elevation, it is extremely important to have an accurate measurement made annually of this most valuable water crop.

Since 1929 the California Cooperative Snow Surveys have been in operation. Each year many organizations, including private corporations, public utilities, municipalities, irrigation, water storage, and municipal districts, as well as governmental agencies—State and Federal—unite under the leadership of the Division

of Water Resources to make the annual measurements.

NETWORK OF SNOW COURSES

During the summer months, under the guidance of the Division, the necessary preparatory work is done. New snow courses are laid out and old ones cleared of encroaching brush and young trees; the use of existing cabins is arranged for or new ones built, while snow measuring equipment in each area is put in good shape and new men are instructed as to its use.

A network of snow courses covers each watershed, each snow course representing a surrounding area varying in extent according to topographic conditions. The snow course as a rule is laid out in the shape of a cross large enough to allow of about 20 samples being made at 50-foot intervals, both ends of each line being permanently marked with a yellow and red snow course marker spiked to a convenient tree, high enough to be above the deepest snow of a severe winter.

TAKING OF SAMPLES

A sketch map showing the location of the sampling points with relation to the markers is carried by each snow survey party. At each sampling point shown on the map a measurement must be made. Using a hollow steel or aluminum tube with sharp teeth along the lower cutting edge a sample is cut from the snowpack, from the surface to the ground beneath, in much the same manner as an apple is cored. The depth of the snow is noted from graduations on the outside of the tube and then the tube with its core of snow is withdrawn and weighed on special spring scales so calibrated that the amount of water in the snow is indicated directly by the reading of the scales. An average of the twenty samples taken at each snow course irons out any inequalities due to uneven ground or drifted snow.

The snow surveyors, men of sound physique and stout heart, travel from 10 to 30 miles a day, depending upon their schedule, the condition of the weather and the state of the snow. Shelter cabins for stops and emergen-

cies as a rule are available at 12-mile intervals. These are equipped with a bed, a stove and a table, and stocked ahead of time with fuel, food and bedding.

SOME HARDSHIPS

Primitive though the comforts of the shelter cabins are, they are much to be preferred to a night in the open such as was the unhappy lot of two of our snow surveyors who last year lost their way in the gloom of an early evening snow storm. Jammed together into their one sleeping bag in a shallow depression in the snow, sheltered by a clump of pine trees they holed up to wait for dawn. Fortunately the weather was not extremely cold and beyond having to put up with rather cramped quarters, a mild pang of hunger or two, and the difficulty of getting their feet back into frozen boots excavated from under a foot of freshly fallen snow, they came through in good shape.

Backtracking after daylight they found where they had missed the turnoff and an hour later they were enjoying a good hot breakfast in the shelter cabin they should have reached the evening before.

This year 150 men took part in the main survey of the snowpack. On skis or webbed snow shoes according to their personal choice, those parties entrusted with the longer trips into the more isolated regions started out on March 23d, and the last man reported back on April 8th.

BEAR STEALS GRUB

The routine reports of their trips included delays on account of storms, snow blindness and equipment trouble. Cabins in some instances were crushed in by the unusually heavy snow. Grub caches rifled by unscrupulous hunters were reported, and in the Kern River watershed a bear, with a hunger for fattening food, clawed his way through one end of a shelter cabin, and after devouring most of the grub supply and spoiling the rest, forced his way out through the other end. The snow had flattened the weakened

(Continued on page 24)



1



2

1. Taking snow sample. Tube is held vertically and started down at position indicated on sketch map of snow course.

2. With weight applied to driving wrench the tube is rotated and forced down through snow to ground below.

3. Tube with its snow core is weighed to determine water content of snow.

4. Snow measurements completed, survey crew starts for home as storm begins.



3



4

Secondary Improvement

By W. L. McFADDEN,

IN 1933 the Legislature added to the State Highway System, one hundred sixty-seven miles of secondary roads in Imperial County. Of this mileage only seventy-four miles had been previously surfaced, and the existing surfacing was generally, at that time, badly in need of repair, or abandonment and realignment. The remaining ninety-three miles were unsurfaced, and were made passable by flooding alternate sections to overcome the dust and ruts.

The natural material, with the proper amount of moisture, made a fair road for light travel, but was not suitable for heavy truck hauling, and when dry, was very dusty. After even a slight rainfall, such as the valley experiences, it was necessary to use tractors to tow wagons and trucks on all unsurfaced roads.

FARM TO MARKET ROADS

This was the existing condition of the major portion of these roads when taken into the State Highway System five years ago. In order to properly serve the increasing traffic load of these secondary highways, which are chiefly farm-to-market roads, and upon which the agricultural areas depend for communication and transportation, the Division of Highways has set up a stage construction program

The program consisted of constructing, as soon as possible, with the funds available, low cost bituminous type surfaced roads. This construction consists of bringing the roads to proper grade and alignment, improving the base by importing suitable material, the repair of irrigation facilities to prevent their damaging the roadbed with moisture in the future, and surfacing the roadbed with plant or road mix bituminous treated gravel.

While this type of construction can not be expected to carry the heavy truck traffic for any length of time without high maintenance costs, it will probably serve its purpose until



Before and after pictures of secondary highways in Imperial County. These views show sections of the same roads prior to improvement and following regrading and surfacing.

Highway ent

Associate Highway Engineer

funds are available to construct the higher types of pavement, and will at that time serve as a suitable base which is essential because of the unstable soil conditions encountered in the valley.

CONSTRUCTION PROBLEMS

It has been possible to improve the secondary system in the Imperial Valley to its present stage only by utilizing, to the fullest extent, the local materials available. Adverse soil conditions, seepage water from adjacent irrigation facilities and the long distances from the source of supply of the ordinary road construction materials, have been some of the problems to meet and overcome with the limited funds available for road construction. Nearly all of the aggregate used in the oiled surfacing, and for improving the base on which the surfacing is placed, has come from the ancient beach line which parallels the valley on the east.

The completion, the latter part of January, of the improvement on the four miles between Brawley and Calipatria, provides a dustless and mudless surface on the entire State Highway System in the valley.

THIRTEEN MAJOR HIGHWAYS

Since 1933, the Department of Public Works, through the Division of Highways, has completed thirteen major projects, expending a total sum of approximately \$785,700, in the improvement of one hundred twenty-eight miles of highway. The average cost per mile has been approximately \$6,200.

Recent traffic counts have shown that travel on some of these roads that have been improved, has increased from one hundred to one thousand cars per day. This increase indicates the advantage to the valley traffic of such improvement, and additional surfacing or paving will be added as required in order to properly provide for the traffic.



Hard to believe, but true. Views of old and new secondary highway in Imperial County.

Bay Bridge Traffic Increases

AN INCREASE in daily traffic on the San Francisco-Oakland Bay Bridge of 1,523 cars over the previous month was announced by State Director of Public Works Earl Lee Kelly from a report of April traffic figures for the span, filed by State Highway Engineer C. H. Purcell. During last month 23,118 vehicles per day crossed the bridge.

Total number of vehicles for April was 693,547 as against 669,431 vehicles for March. Total collections for April were \$367,996.88, as compared to March figures of \$348,235.23.

Comparative figures and totals follow:

	Total April	Total March	Total since opening
Passenger Autos -----	645,603	617,244	12,383,228
Auto Trailers -----	892	595	20,165
Motorcycles -----	2,247	1,895	44,073
Tricars -----	1,077	1,061	12,883
Trucks -----	31,719	36,878	442,924
Truck Trailers -----	1,244	1,172	26,634
Buses -----	10,765	10,586	144,491
Total Vehicles -----	693,547	669,431	13,074,398
Extra Passengers -----	188,120	166,045	2,897,624
Freight Lbs. -----	74,814,670	68,607,331	1,001,537,020

State Surveys Its Snow Crop

(Continued from page 20)

cabin to earth by the time the boys arrived and the blankets were a mass of ice. Tired as they were there was nothing else to do but take up a few notches in their belts and slog on twelve miles more to the next cabin.

At Sacramento the snow survey reports are segregated as to watersheds and by a systematic procedure the snowpack in each watershed is appraised and forecasts of run-off are made. During the past few years most of the forecasts have had an accuracy of better than 10 per cent while many are much closer than that figure.

For the Sierra as a whole this year's snowpack is well above normal and in most watersheds heavier than any measured during the nine years that snow surveys have been made. A tabulation of all the snow survey measurements together with forecasts of flow from 14 watersheds are contained in the Snow Survey Bulletin issued by the Division of Water Resources on April 11th. Copies of this bulletin may be had from the Division upon request.

Motorways Plan for South

The 1937 traffic survey of the Los Angeles metropolitan area made by the Automobile Club of Southern California presented as the logical solution to Los Angeles County's acute congestion and accident problems, proposes a network of new intersection-free divided motorways exclusively for motor vehicles across the metropolitan area. These would continue on upper story levels through specially designed parking and office buildings in business districts, and on bridges across existing streets.

Other recommendations include prohibiting curb parking on all commercial streets and highways and developing off-street parking facilities, restricting curb parking on residential streets, removing all street railways within a reasonable period of time, establishing an adequate motor bus system with off street terminals, and separating grades of commercial street intersections wherever practical.

PAVEMENT RECORDS

(Continued from page 17)

of 3.5 inches per mile, with the use of the Johnson drag finisher. J. E. Haddock, Ltd., was the contractor, W. D. Eaton, the resident engineer, and H. D. Johnson, street assistant. It is indicated on later work that the Johnson drag finisher is capable of producing a surface smoothness superior to that produced on this project.

The average daily concrete pavement output for the entire State during 1937 was 396 cu. yds., compared to 386 cu. yds. in 1936. The average compressive strength for Class "A" concrete pavement laid during 1937 was 4470 pounds per square inch, as against 4550 pounds in 1936. On Contract 610TC10, road X-Sol-7-C,Vac,D, Class "B" concrete was placed, having a strength of 3417 pounds.

The average surface smoothness for the State during 1937 was 8.2

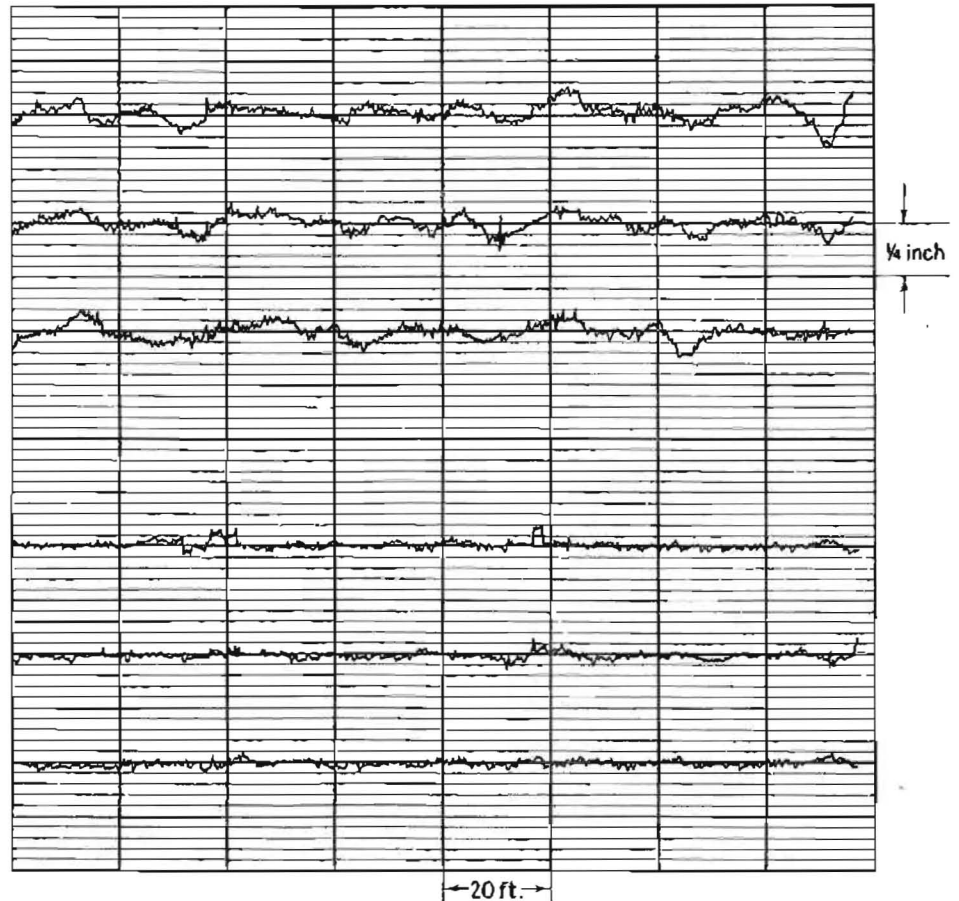
inches per mile compared to 12.1 inches in 1936.

The record for cement control was made on Contract 87XC25, road VII-L.A-168-A,B, Center Street to Firestone Boulevard, with an average variation of 0.28 per cent. Matich Bros. were the contractors, F. B. Cressy, resident engineer, and G. H. Lamb, street assistant. The average variation in cement control for 1937 was 0.81%, compared to 0.85% in 1936.

Asphalt Concrete

CONSTRUCTION METHODS

During the 1937 season, an experimental section was constructed on Contract 66VC5-86VMC1, road VI-Ker-4-C,Bkd, from 10.5 miles south of Bakersfield to Grove Street, using asphaltic cement of a much higher



GRAPHS OBTAINED BY LOS ANGELES COUNTY ROAD DEPARTMENT



Example of 20-foot asphalt concrete lane with concrete curbs and earth dividing strip in Montecito, Santa Barbara County.

penetration than the usual standard of 40 to 60. 2540 lineal feet of surface was laid with 70 to 80 penetration asphalt, 2350 lineal feet with 110 penetration, 2635 lineal feet with 160 penetration and 3910 lineal feet with 90-95 road oil.

It was necessary to revise the rolling procedure on the sections in which the softer grades of asphalt were used, but this did not materially complicate construction methods, and the surface smoothness of the experimental sections compares favorably with the standard sections.

Since the use of asphaltic cement of higher penetrations is increasingly evident in asphalt concrete pavement construction, the department is adopting ranges of 71 to 85, 86 to 100, and 101 to 120 penetration, for future work.

Compensation in the asphalt content is being made for the asphalt-ene as indicated in the petroleum ether solubility test, and this correction has resulted in a uniformity in mixtures that was impossible to obtain under former methods. These corrections will be continued with the softer grades of asphalt.

Construction Records

The maximum daily output of asphalt concrete, and the highest average stability of surface course mixtures were obtained on Contract

AN APPRECIATION

Dept. of Public Works,
Sacramento, Calif.

Attention Superintendent;
Highway Maintenance Service:

It is with great pleasure that I compliment you for the marvelous work you have done for the motorists of this State and the training of your personnel.

To prove the above statement, this day about 100 yds. west of the west terminal of the Broadway Tunnel, my automobile caught fire. It was only through the help of one of your courteous maintenance men, Mr. J. A. Peirano, that my car was saved from a total loss.

I tried to compensate Mr. Peirano for his service but he flatly refused to accept.

If all organizations had their men trained to be as obliging as you have, wouldn't we be living in a better world?

A Most Grateful Motorist,

Sincerely,

AVARON DAVIS
1535 Scenic Ave.,
Berkeley, Calif.

84TC13-64TC32, road IV-S.M-2-S.
M,Bmt,B,S.Car,Rdw.C, from San Ma-

teo to Redwood City. An average of 805 tons of asphalt concrete were laid per eight-hour day, and the average stability of surface course mixtures was 45%. Basich Bros. were the contractors, F. W. Montell the resident engineer, and E. W. Herlinger, the street assistant. The average daily output for the State during 1937 was 550 tons, compared to 447 tons in 1936. The average stability of surface mixture was 36% during 1937.

The densest surface mixture was placed on Contract 86TC4, road VI-Fre-4-C, Biola Junction to Herndon, in which the average relative specific gravity was 97.6%. Union Paving Company was the contractor, F. W. Howard, the resident engineer, and E. Thomas, the street assistant. The State average was 94.6%, compared to 94.3% in 1936.

The record for surface smoothness was secured on Contract 03TC1, road III-Gle-7-B, Willows to Artois, in which the average roughness was 8.2 inches per mile. N. M. Ball Sons were the contractors, J. C. Womack the resident engineer, and J. G. Mehren, the street assistant. The average smoothness for the State was 15.5 inches as compared to 14.7 inches per mile in 1936.

A slightly greater mileage of plant-mix surface was laid in 1937 than in previous years, there having been constructed 120 miles of this type

(Continued on page 28)



ENGINEERING studies for negotiations and contracts in connection with the construction and operation of the Central Valley Project have been continued by the Division of Water Resources, representing the Water Project Authority of the State of California, under a cooperative work agreement with the U. S. Bureau of Reclamation.

During the month studies were made of the general plans for the Shasta Dam and Miles 4 to 12 of the Contra Costa Canal and approval of these plans was given by the Water Project Authority.

The Bureau of Reclamation opened bids on April 11 for a diversion tunnel and temporary relocation of the Southern Pacific Railroad at the Shasta dam site. Announcement has also been made by the Bureau that bids for another eight miles of the Contra Costa Canal will be opened on May 20 and that the bids for the construction of the Shasta Dam will be opened on June 1.

Work has continued and good progress is being made on the construction of the Contra Costa Canal and the Government Camp for Shasta Dam. The first four miles of the canal are more than 65% completed and the buildings for the Government Camp are practically completed.

IRRIGATION DISTRICTS

Late storms and high water conditions have delayed somewhat the opening of the irrigation season, but in many of the districts water has been turned into the canals. The heavy snow pack in the mountains assures an ample supply of water for most areas during the coming summer. Seepage and high ground water have given some trouble in the cultivation and planting of crops and plans for supplemental drainage are being investigated in certain districts.

SUPERVISION OF DAMS

Two applications were received during April, namely for Fairmount Park Dam

DIVISION OF WATER RESOURCES

OFFICIAL REPORT
FOR THE MONTH OF
April, 1938

EDWARD HYATT, State Engineer

in Riverside County and McCarty Dam in Calaveras County. Within the month Bonita Canyon Dam in Orange County, Gene Wash Dam in San Bernardino County and O'Shaughnessy Dam in Tuolumne County have been completed and will be ready for approval at an early date. There has been satisfactory progress made on the work at Bean Hollow Dam in San Mateo County and North Fork Dam in Santa Clara County, and the work at Copper Basin Dam in San Bernardino County is very nearly completed.

WATER RIGHTS

Supervision of Appropriation of Water

Seventeen applications to appropriate water were received during March, 6 applications were denied and 8 applications were approved. In the same period 4 permits were revoked and the rights under 6 permits were confirmed by the issuance of licenses.

Field work for the year 1938 involving the investigation of projects under permits and licenses began on April 11th. There are 288 cases listed for investigation as compared with 233 last year and 259 in 1936. Visits will be necessary to all except 5 counties of the State.

SACRAMENTO-SAN JOAQUIN WATER SUPERVISION

Field work has commenced and at present consists of visiting all points of diversion to insure that records of operations will be kept during the coming season. Discharge measurements are being made of the larger plants which are at present in operation. Due to the abnormally heavy rainfall during the past winter, it will be some time before all of the smaller plants along the rivers are in operation.

CALIFORNIA COOPERATIVE SNOW SURVEYS

During the last week of March and the first week of April, the main annual snow survey was conducted throughout the Sierra from the Klamath to the Kern.

Engaged on this work were 150 men who took part in the survey, working from 40 centers strategically located to give access to the entire area with a minimum of travel.

FLOOD CONTROL AND RECLAMATION

Maintenance of Sacramento Flood Control Project

During this period there were no extremely high stages in the channels of the flood control project, but during the entire interval the stages remained relatively high for this time of the year, and for most of the period they remained above bank full stage. As a result of this extremely unusual condition, excessive seepage is causing damage to land bordering the Sacramento and Feather Rivers, particularly to the orchards. The drainage plants of the Sutter By-pass were operated continuously throughout the month and miscellaneous maintenance work has been carried on. Water has been spilling into the by-passes through Colusa, Tisdale and Fremont weirs during practically the entire period.

Relief Labor Work

During this period about 50 relief laborers have been employed in clearing the right-of-way for State-Federal levee construction on the left bank of the Sacramento River from Meridian to Butte Slough. About 25 WPA men have been engaged in miscellaneous work on other parts of the project. All by-pass and overflow channels have been covered with water so that clearing with relief labor could not proceed.

Sacramento Flood Control Project

Construction has been completed on five timber bridges in the Dry Creek project near Wheatland.

Emergency Levee Repairs

Work has been continued in making repairs to levees in Glenn, Shasta, Butte and Tehama Counties under Executive Order No. E 177, and at this date approximately \$75,000 has been expended. In early April it was found necessary to do some further work at Robinson Bend on the Feather River, due to the excessive bank erosion at low water stage. A set-back levee was constructed 1400 feet long, and about 2000 tons of Oroville cobbles were used to protect the bank.

Emergency Levee Protection and Repair

The levee breaks on the Paradise Cut in San Joaquin County have been closed and all emergency protection work on the San Joaquin River in San Joaquin County has been discontinued, except at a point downstream from the Santa-Carbona Irrigation District intake. Bank erosion is continuing at this place in a manner which may endanger the levee during the rise expected from the melting snows.

Highway Bids and Awards for the Month of April, 1938

Modoc Highway Project Completed

(Continued from page 3)

ALAMEDA COUNTY—East approach to the San Francisco-Oakland Bay Bridge between the distribution structure and University Avenue, about 3.3 miles redwood curbs to be constructed, a water supply line installed and shoulder widening and parking areas to be constructed and a penetration oil treatment applied thereto. District IV, Route 5,69, Section Oak., Emv., Ber. Underground Construction Co., Oakland, \$24,833; L. C. Seidel, Oakland, \$25,848; Lee J. Immel, Berkeley, \$25,429; M. J. Lynch, San Francisco, \$28,023; Chas. L. Harney, San Francisco, \$32,116; A. Soda and Son, Oakland, \$30,392; Eaton & Smith, San Francisco, \$33,822. Contract awarded to Williams Bros. & Haas, Inc., San Francisco, \$23,642.18.

GLENN COUNTY—Elk Creek Road, between 7 miles west of Willows and 10.5 miles west of Willows, about 3.5 miles to be surfaced with gravel base and road-mix surfacing and shoulders to be constructed. District III, Feeder road. Claude C. Wood, Stockton, \$17,448; E. A. Forde, San Anselmo, \$17,996; N. M. Ball and Sons, Berkeley, \$18,471; Poulos and McEwen, Sacramento, \$18,834; Oilfields Trucking Co., Eakersfield, \$19,259; Fredericksen & Westbrook, Lower Lake, \$19,544; Harms Bros., Susauville, \$19,634; C. W. Calletti & Co., San Rafael, \$21,746; Helwig Construction Co., Sebastopol, \$22,382; Hanrahan Co., San Francisco, \$22,518; E. B. Bishop, Orland, \$23,446. Contract awarded to Lee J. Immel, Berkeley, \$17,411.00.

IMPERIAL COUNTY—Furnishing and spreading gravel between four miles east of Imperial and 1 mile east of Brawley. District XI, Route 201, Section B. V. R. Denis Construction, San Diego, \$17,257; G. W. Ellis, Los Angeles, \$12,471. Contract awarded to R. E. Hazard & Sons, San Diego, \$10,983.90.

INYO COUNTY—At Independence, about 1.5 mile to be graded and roadmix surfacing applied. District IX, Route 23, Sections M, A. Vido Kovacevich, South Gate, \$19,792. Contract awarded to Basich Bros., Torrance, \$19,877.10.

KERN COUNTY—Between southerly boundary and 5 miles north of Rosamond, about 8.3 miles to be graded and plant-mixed surfacing to be placed. District IX, Route 28, Section A. V. R. Dennis Construction Co., San Diego, \$59,912; Claude Fisher Company, Ltd., Los Angeles, \$64,893; Basich Brothers, Torrance, \$64,922; Griffith Company, Los Angeles, \$65,150; R. E. Hazard & Sons, San Diego, \$66,129; Gibbons & Reed Co., Burbank, \$67,910; George R. Curtis Paving Co., Los Angeles, \$70,892; Piazza and Huntley, San Jose, \$71,871; Hanrahan Company, San Francisco, \$91,180; L. A. Paving Co., Los Angeles, \$119,772. Contract awarded to G. W. Ellis, North Hollywood, \$54,294.80.

LASSEN COUNTY—Between Nubleber and 8 1/2 miles northeast of Bieber, about 10.4 miles to be graded and surfaced with plant mixed surfacing. District II, Route 28, Sections A, B. J. A. Casson, Hayward, \$116,055; Larsen Bros. and Harms Bros., Sacramento, \$134,835; Hanrahan Co., San Francisco, \$151,989; Pacific States Construction Co., San Francisco, \$157,943; Union Paving Co., San Francisco, \$162,391; Claude C. Wood, Stockton, \$127,817. Contract awarded to Poulos and McEwen, Sacramento, \$106,534.90.

LOS ANGELES COUNTY—Undergrade crossing under tracks of S.P.R.R. near Hewitt Station and approaches to be constructed. District VII, Route 159, Section L.A. C. O. Sparks and Mundo Engineering Co., Los Angeles, \$184,986; Gibbons & Reed Co., Burbank, \$175,452; Claude Fisher Co., Ltd., Los Angeles, \$180,909; L. A. Paving Co., Los Angeles, \$198,618; Griffith Co., Los Angeles, \$190,493; Byerts & Dunn, Los Angeles, \$172,166; Winston Bros. Co., Los Angeles, \$188,247; Gates & Huntley, Los Angeles, \$215,431; John Strona, Pomona, \$169,890; United Concrete Pipe Corp., Los Angeles, \$183,057; Minnis and Moody and Werner and Webb, Los Angeles, \$179,741; J. E. Haddock, Ltd., Pasadena, \$181,415. Contract awarded to Oscar Oberg, Los Angeles, \$165,732.25.

MENDOCINO COUNTY—Between Henry Gulch and Westport Gulch, about 1.3 miles to be graded and penetration oil treatment applied. District I, Route 56, Sections A,B,C,D,F. Harold Smith, St. Helena, \$31,506; Chas. L. Harney, San Francisco, \$32,432; John Burman and Sons, Eureka, \$34,265; Valley Construction Co., San Jose, \$35,719; F. J. Maurer & Son, Inc., Eureka, \$35,764; Guerin Bros., San Francisco, \$38,443; Claude C. Wood, Stockton, \$41,483; Lee J. Immel, Berkeley, \$44,985; C. W. Calletti & Co., San Rafael, \$48,122. Contract awarded to Rock & Gravel Trucking Co., Oakland, \$23,449.90.

MENDOCINO COUNTY—Between 1/2 mile north of McCoy Creek and Piercy, about 1.5 miles to be graded and surfaced with untreated crushed gravel or stone surfacing. District I, Route 1, Section K. C. W. Calletti & Co., San Rafael, \$39,788; Chas. L. Harney, San Francisco, \$39,536; Young & Son Co., Ltd., Berkeley, \$91,411; N. M. Ball Sons, Berkeley, \$94,839; Hemstreet and Bell, Marysville, \$97,255; Fredericksen and Westbrook, Lower Lake, \$98,217; Contract awarded to Poulos and McEwen, Sacramento, \$82,550.

MONTEREY COUNTY—At Willow Springs Maintenance Station, a 12-man bunkhouse and appurtenances to be constructed. District V, Route 56, Section B. George Waters, Santa Maria, \$9,422; M. J. Murphy, Inc., Carmel, \$9,368; Theo. M. Maino, San Luis Obispo, \$8,740; F. C. Stolte Co., Pacific Grove, \$8,494; O. R. Ochs, San Luis Obispo, \$7,600. Contract awarded to Victor L and William B. Jacobson, Los Angeles, \$7,484.00.

SANTA BARBARA COUNTY—Between Gaviota Pass and Santa Ynez River, about 2.9 miles to be graded. Paved with Portland cement concrete and four reinforced concrete bridges to be constructed. District V, Route 2, Section D. Macco Construction Co. Clearwater \$299,709; J. E. Haddock, Ltd., Pasadena, \$285,923; Claude Fisher Company, Ltd., Los Angeles, \$280,633; Griffith Company, Los Angeles, \$290,954; Fredericksen and Westbrook, Lower Lake, \$297,165; United Concrete Pipe Corp., Los Angeles, \$308,684. Contract awarded to C. O. Sparks and Mundo Engineering Co., Los Angeles, \$278,535.90.

SANTA CLARA COUNTY—Between Coyote and Llagas Creek, about 10.9 miles to be graded and paved with asphalt concrete and a reinforced concrete bridge to be constructed. District IV, Route 2, Section B, Mg,H.C. Union Paving Co., San Francisco \$332,599; Chas. L. Harney, San

The work under the contract involved the excavating and handling of approximately 140,000 cubic yards of earth and rock, the placing of 68,000 cubic yards of gravel for base surfacing and the placing of some 18,000 tons of bituminous plant-mixed surfacing. This work involved the expenditure of approximately \$202,500.

No effort was spared by the contractor in the performance of the work under the contract. The expeditious manner in which the work was executed and the results obtained were greatly appreciated by all concerned, and particularly so by the motoring public. The major items of work were as a general rule conducted with three working shifts per day and with several operations in progress simultaneously.

The Hanrahan Company of San Francisco was the contractor with A. L. Gladney, as superintendent.

Francisco, \$387,343; A. J. Raisch, San Jose, \$362,865; Hanrahan Company, San Francisco, \$309,962; Griffith Company, Los Angeles, \$354,535. Contract awarded to Jones and King, Hayward, \$232,703.05.

SANTA CLARA COUNTY—Between Agnew Underpass and North San Jose Underpass, about 2.6 miles, curb dividing strip to be constructed. District IV, Route 68, Section B. L. C. Seidel, Oakland, \$24,295; Granite Construction Co., Ltd., Watsonville, \$22,726; Palo Alto Road Materials Co., Palo Alto, \$19,434; Chas. L. Harney, San Francisco, \$29,478; Piazza & Huntley, San Jose, \$21,495; U. Peira & Son, San Francisco, \$20,643; F. Kaus, Stockton, \$20,185; A. J. Raisch, San Jose, \$22,995; Valley Construction Co., San Jose, \$20,799; Parish Bros., Los Angeles, \$23,265; Earl W. Heple, San Jose, \$23,362; B. A. Howkins & Co., San Francisco, \$28,591; Lee J. Immel, Berkeley, \$21,958. Contract awarded to Harvey E. Conner, Redwood City, \$18,992.90.

SAN DIEGO COUNTY—In San Diego, between Barnett Avenue and Miramar Road, 9.7 miles to be graded and paved with Portland cement concrete and asphalt concrete. District XI, Route 2, Section S.D. Oswald Bros., Los Angeles, \$358,332; V. R. Dennis Construction Co., San Diego, \$354,005; R. E. Hazard and Sons, San Diego, \$376,221; Metropolitan Construction Co., Los Angeles, \$372,420; Griffith Company, Los Angeles, \$354,127; United Concrete Pipe Corp., Los Angeles, \$398,208; J. E. Haddock Co., Ltd., Pasadena, \$401,523; Daley Corp., San Diego, \$348,429. Contract awarded to David H. Ryan, San Diego, \$339,886.07.

SAN DIEGO COUNTY—Furnish and apply diesel oil to roadside vegetation at various locations, 68.9 miles. District XI, various locations. R. E. Hazard & Sons, San Diego, \$1,458; Consumers Oil Co., Los Angeles, \$1,066. Contract awarded to Square Oil Co., Los Angeles, \$1,037.50.



Air spade breaking bank and air tampers backfilling on Cuesta grade.

PROGRESS ON CUESTA GRADE

(Continued from page 7)

four foot centers staked with willows and set in trenches flush with the plane of the fill slope.

No further wash occurred during the heavy rains following this installation.

Surfacing. The road is to be surfaced with plant mix on crusher run base, divided four lane construction with four foot parting strip all on selected material subgrade.

Surfacing operations are expected to start about July first.

Mr. Vic Pearson is Resident Engineer on the project and the Metropolitan Construction Company is the contractor.

This is a Federal Aid Project, the total cost of which will amount to in excess of \$800,000.

CUESTA GRADE OVERHEAD

As a part of this project there is being constructed, under separate contract, a reinforced concrete overpass across the tracks of the Southern

Pacific Railroad approximately 0.25 miles north of the summit of Cuesta Pass. While the old road crossed over a railroad tunnel it proved impracticable to use the same crossing without sacrificing the high standard of alignment prevailing throughout the balance of the project.

Among the interesting features of the structure, which will consist of 10 spans varying in length from 32 to 59 feet and a total length of 465 feet, are the small angle between the road and the railroad, 22 degrees, which presented quite a design problem; a "rigid frame" type of design with girders and deck continuous over several spans; girders with a parabolic arch of pleasing appearance; two 25 foot roadways separated by a four foot curbed parting strip; and deep footings founded on rock.

The structure is being constructed by Contractor R. R. Bishop, at a cost to the State of \$90,000. Federal grade separation funds provide the financing.

Pavement Records

(Continued from page 25)

as compared to 82 miles in 1936. 109 miles of road-mix surface were placed in 1937 by this department, compared to 126 miles in 1936.

The record for surface smoothness of plant-mix, 7.5 inches per mile, was made on Contract 811XC4, road XI-S.D-77-B, Lake Hodges to Escondido; R. E. Hazard & Sons were the contractors and L. E. Liston, the resident engineer. The average roughness for the State in 1937 was 23.6 inches per mile as compared to 33.5 inches in 1936.

The record for smoothness of road-mix, 12.6 inches per mile, was made on Contract 84PWC5-04WC1, road IV-S.M-56-D, Farallone City to Rockaway Beach. Granfield, Farrar, & Carlin were the contractors and H. A. Simard, the resident engineer. The average roughness for the State in 1937 was 31.6 inches per mile as compared to 30 inches in 1936.

STATE OF CALIFORNIA
Department of Public Works

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

FRANK F. MERRIAM-----Governor

HARRY A. HOPKINS-----Assistant Director

EARL LEE KELLY-----Director

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CALIFORNIA HIGHWAY COMMISSION

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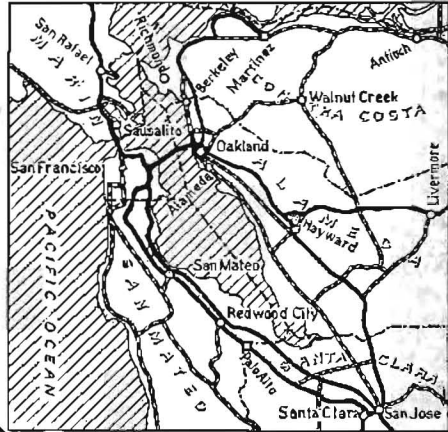
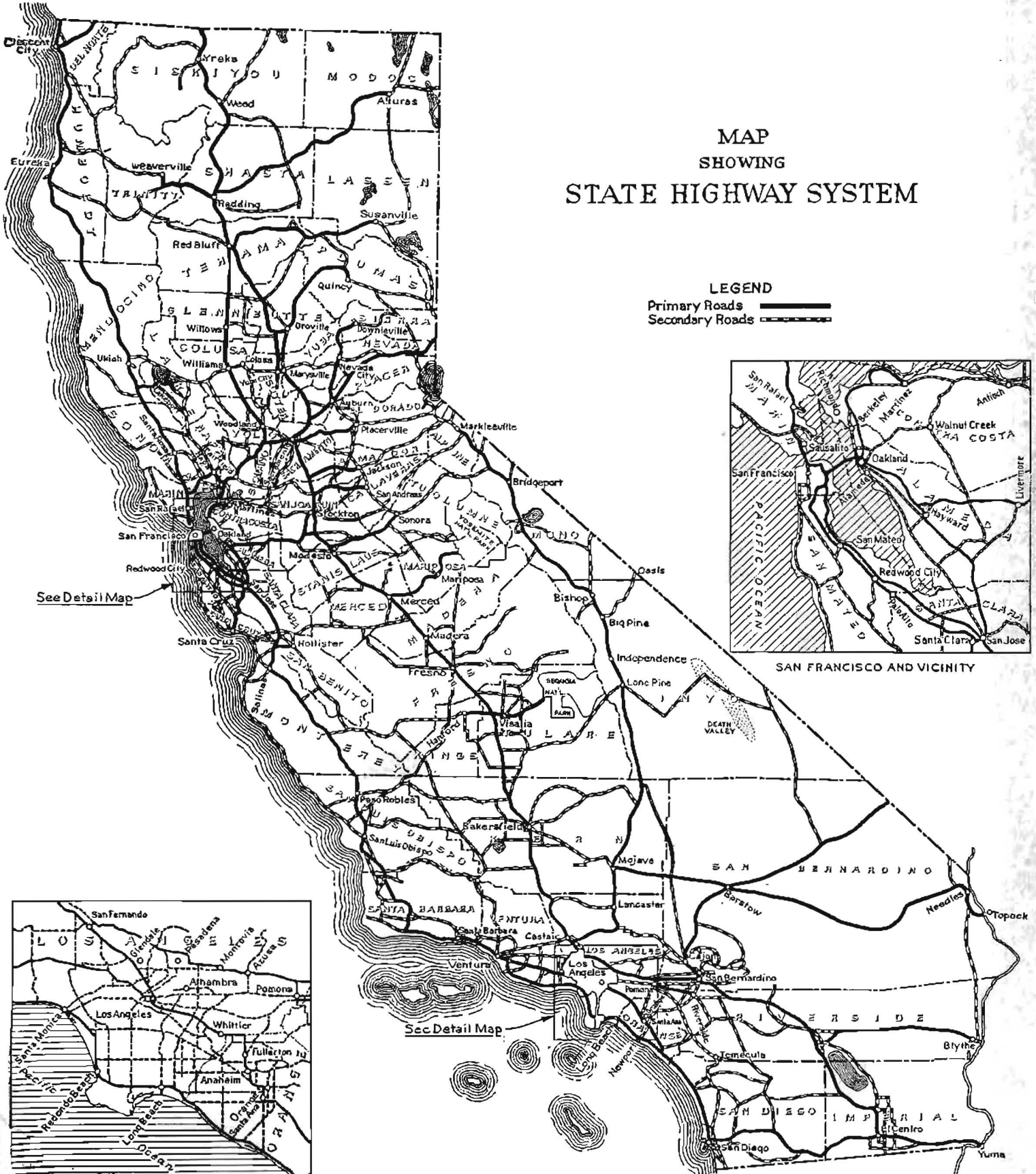
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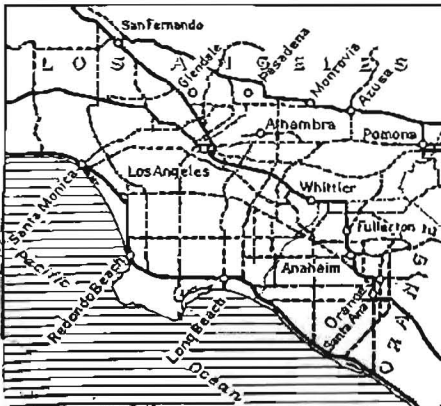
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 SHOWING
 STATE HIGHWAY SYSTEM

LEGEND
 Primary Roads 
 Secondary Roads 



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