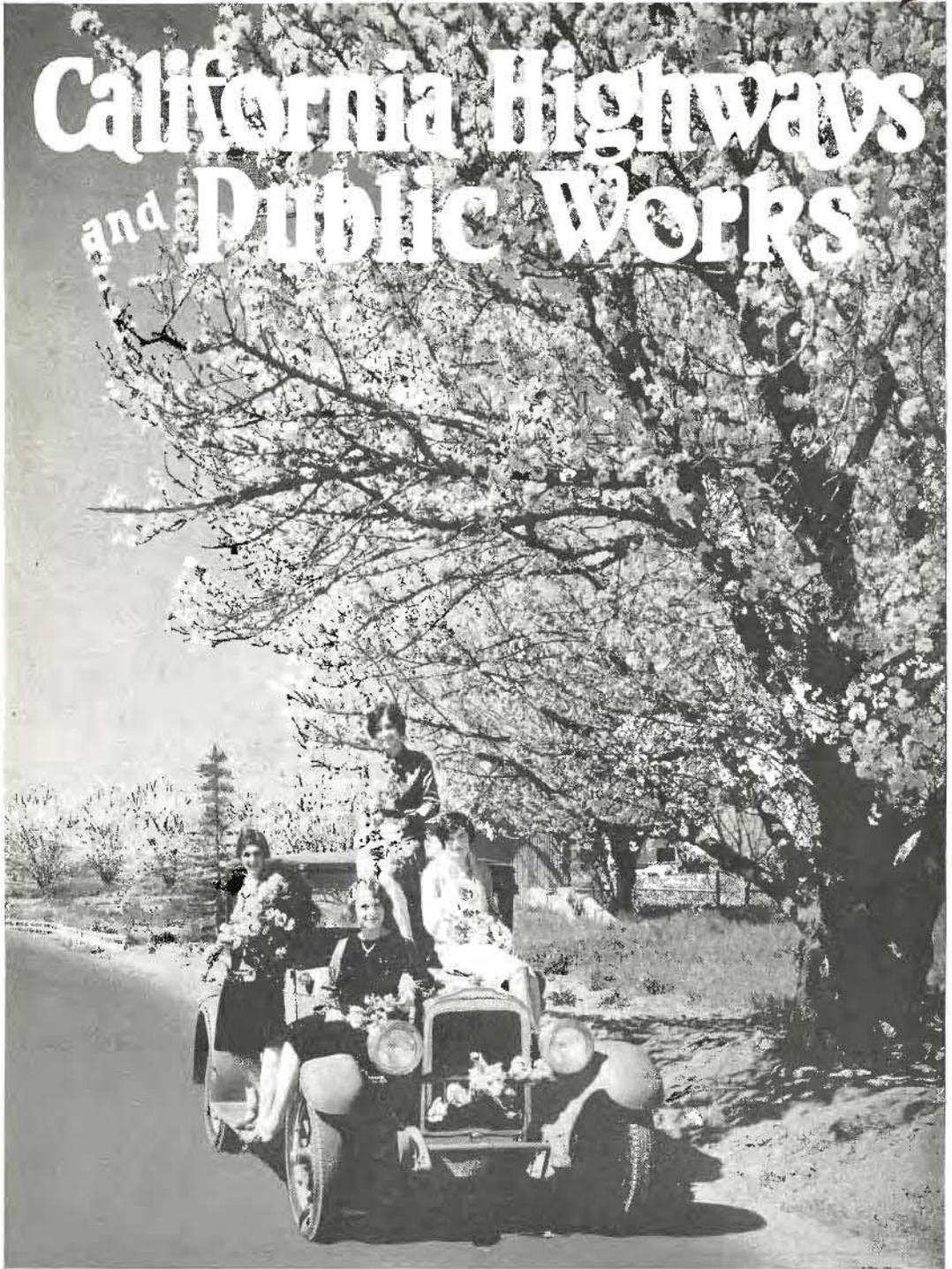


# California Highways and Public Works



Official Journal of the Department of Public Works

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State of California

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# The Maximum Conservation of Water With Reference to the California Plan

By EDWARD HYATT, State Engineer

**W**ATER is indispensable to human existence and in a large section of the world is the limiting natural resource; that is, the extent to which life can be sustained is or will be determined by the amount of usable water. It follows that in such localities the most complete possible use of the supply provided by nature is of vital importance, and does at the present time or will in the future transcend all other factors.

Where water occurs plentifully with respect to human needs a region is denoted humid and where insufficient, arid, with an intermediate and more or less indeterminate classification of semiarid. Under these criteria eastern United States is termed humid and the western part arid or semiarid, the dividing line being approximately at the 99th meridian, which passes somewhat west of the center of Kansas. The state of Kansas has made allowance for the dissimilar water supply conditions within its borders by enacting a different water code for the area west of the 99th meridian from that in force in the eastern half of the state.

The seventeen states lying partly or wholly west of the 99th meridian have, therefore, come to be considered the arid or irrigation states, which include North and South Dakota, Kansas, Nebraska, Oklahoma, Texas and all states west of those named. An association of the State Engineers of these seventeen irrigation states is actively functioning on matters pertaining to water, water rights, irrigation, reclamation and similar items of common interest. These so-called arid states include 60 per cent of the land area of the United States, 50 per cent of the farm lands and 91 per cent of the total irrigated area, as well as 19 per cent of the total popu-

lation and 24 per cent of the farm population of the country.

By reason of scarcity of supply, the problem of water conservation assumes a more compelling aspect in the west than in eastern or middle western United States, and the greatest progress looking toward its complete use has been made in the arid states. This discussion will deal mainly with conservation accomplishment and future plans in the

west and be illustrated by investigations under way in California, which has gone the farthest in the way of state-wide water plans. However, it is thought that the principles and methods hereinafter enumerated will in large degree be applicable to similar studies and development in other parts of the United States.

If maximum conservation is to be achieved, it naturally follows that the most complete possible utility must be made of existing water supplies for all useful purposes. Before approaching the purely technical phase of the study, therefore, the engineer should have a clear conception of fundamental consideration such as all present and future beneficial uses of water in the region under investigation, their

relative importance and amount, whether consumptive or nonconsumptive, degree of interference one with another, and legal or commonly accepted priorities, if any.

There are many and varied uses to be considered in a conservation program, including methods of regulation to prevent damage by water itself, such as flood control, which is usually so important in any study that for the purposes of the investigation it is considered a use. The known services fall into some five general classes as follows:

First—Consumptive, which includes municipal,



EDWARD HYATT, State Engineer.

stock, industrial, irrigation and some forms of mining and milling.

Second—The extraction of energy inherent in water by reason of its relative elevation, in which class are hydro power, including both hydroelectric and hydromechanical, and hydraulic and some other forms of mining.

Third—Use of the buoyancy of water for transportation purposes, consisting of all forms of navigation.

Fourth—Its utility as a scenic attraction and by reason of fish life maintained. This class consists of recreation and commercial fishing.

Fifth—The control of water to prevent damage; flood regulation, salinity control, and drainage. Salinity control, perhaps peculiar to California, consists in furnishing fresh water to hold back saline encroachment from the ocean and bays. Drainage is a concomitant of irrigation or of farming wet lands.

The thirteen uses listed may not all occur in a given region or state, however, they all do exist in California. Interference between different types may exist as between hydro power and irrigation, or navigation and other purposes, and must be taken into account.

The relative legal position of the divergent uses should also be known. On navigable streams and lakes the paramount right of the United States to regulate in the interest of navigation is unquestioned.

Subject to the superior right of the United States in the interest of navigation, most of the western states have by statute or administrative rule recognized certain relative priorities of water rights. Ten states have covered this by law. Domestic and municipal purposes are always first, irrigation generally second and other uses third, although in some cases stock watering comes in class one or two, and in one state mining is in class two under certain conditions. The Colorado River compact between the seven states comprising the drainage basin of that river, defines "domestic use" as including household, stock, municipal, mining, milling, industrial and other like purposes, but excludes the generation of electrical power.

The first step toward designing a solution of the problem is the collection and analysis of the engineering data, the critical feature of which is the water supply. From existing streamflow and rainfall data extended in time and location by standard engineering methods, an estimate of the location, amount and method of occurrence of the total water crop is obtained. In nearly all instances it is found that the bulk of the water occurs at a different time of year from the season of greatest use, therefore conservation inevitably hinges on storage, both seasonal and cyclic. Reservoir sites are often; if not usually, the controlling item in the conservation of a

stream's waters. Therefore, reservoir sites are located and searchingly analyzed as to adequacy, cost and yields through the dry cycles which will determine the economic size and yield. It is not generally possible to capture for use more than 60 to 80 per cent of the mean discharge of a stream, even with unlimited reservoir capacity, which is often further limited by lack of favorable dam and reservoir sites.

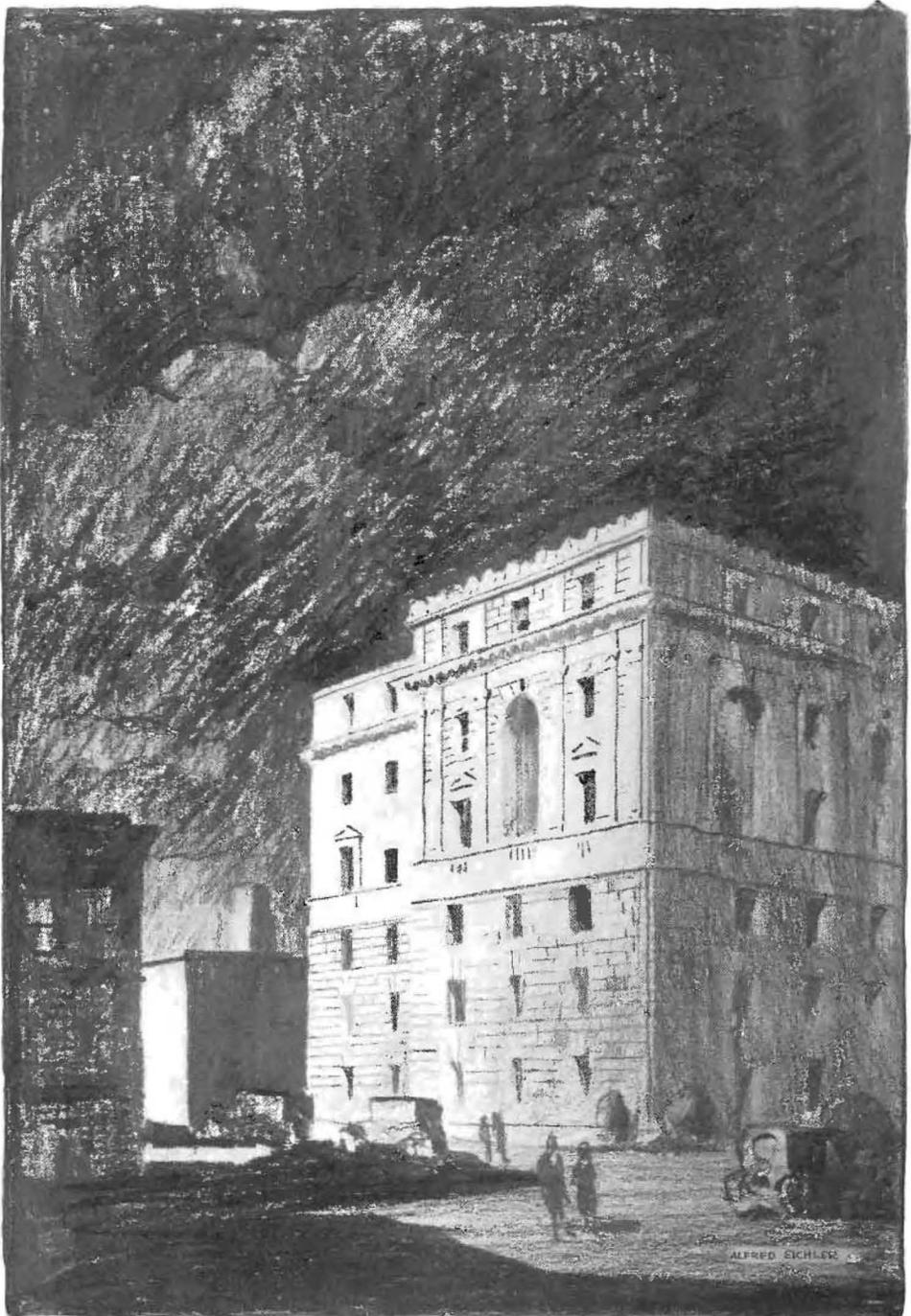
The question of adequacy of sites for dams of great height and large storage capacity is assuming more and more importance and is leading to the enactment of laws requiring state supervision of dams in the interest of safety. This is a necessary step in order to reassure the public as regards the building of these structures of great potential danger and thus clear the way for the conservation program.

Concurrently with the water supply investigation a thorough study of present and future water needs should be carried out, which will include all of the uses heretofore listed in so far as they exist in the region under investigation. In irrigation states, such as California, over 90 per cent of the water consumptively used is for irrigation. It follows, therefore, that any development program in an arid state will revolve mainly around irrigation, giving due consideration, however, to all other purposes. A determination should be made of the arable lands of the state and of the amounts of water needed for their proper cultivation. This requires a classification of all such lands, which, while necessarily of a reconnaissance nature, is based upon soil, topography, climate, location and upon economic factors.

Knowing the amount, location and feasible yield of the total water supplies, the present usage being made therefrom; the amount, location and irrigation needs present and future of the arable lands, and the similar demands for other purposes, physical data is available for trial studies which will result in a comprehensive plan for utilization. Usually it will be found that the water is furnished by nature not only irregularly as to time, but also irregularly as to location. In other words, some areas will possess a surplus over and above their present and future needs and others be deficient either now or for future development. This inequality of location is in fact, one of the principal reasons why state direction and planning are necessary for if there were sufficient water for all purposes private development could proceed in accordance with economic laws, or if the

(Continued on page 17.)

— *Scenic Glimpses of State Buildings* —



View of the annex to the State Building at the Civic Center in San Francisco.

# Construction Records Made During 1929 On California State Highway System

By EARL WITHEYCOMBE, Assistant Construction Engineer

**A**N ANALYSIS of the construction jobs on the California state highway system reveals in an interesting manner the progress that is being made in building better highways in this state. The following are outstanding facts and records that tell the story of construction progress during 1929:

## PORTLAND CEMENT CONCRETE

Record for smoothness—Resident Engineer, C. N. Ainley; contractor, Griffith Co.; between Santa Ana and Anaheim in Orange County.

Record for average concrete strength—Resident Engineer, H. B. Lindley; contractor, Matich Bros.; line change west of San Clemente in Orange County.

Record for cement control—Resident Engineer, F. R. Baker; contractor, T. M. Morgan; between Shasta River and Gazelle in Siskiyou County.

Record for daily yardage—Resident Engineer, C. A. Potter; contractor, Fredrickson & Watson; between Ben Ali and Sylvan School in Sacramento County.

## ASPHALTIC CONCRETE

Record for smoothness—Resident Engineer, C. T. Schultz; contractor, Peninsula Paving Co.; between Chualar and Salinas in Monterey County.

Record for best hand finished job—Resident Engineer, M. C. Fosgate; contractor, Hollywood Paving Co.; between Alto and Sausalito in Marin County.

Record for density of pavement surface—Resident Engineer, C. T. Schultz; contractor, Sam Hunter; between Stony Creek and Tecolote Creek in Santa Barbara County.

Record for stability of pavement surface—Resident Engineer, M. C. Fosgate; contractor, Hollywood Paving Co.; between Alto and Sausalito in Marin County.

Record of production—Resident Engineer, C. T. Schultz; contractor, Peninsula Paving Co.; between Chualar and Salinas in Monterey County.

## SUMMARY OF 1929 PAVEMENT CONSTRUCTION

Riding quality was improved on both types of hard surface pavements over that of the previous year.

The outstanding accomplishments of the season's work were the reduction in roughness and the increase in average daily production of both portland cement concrete and asphaltic concrete mixtures.

The best machine finished asphaltic concrete project averaged but three and one-half inches of roughness per mile greater than the best portland cement concrete project.

The record average daily production of portland cement concrete pavement has been increased to 361.6 cubic yards. This figure is obtained by considering each start of the mixer as a day's run and represents approximately 90.4 per cent of the maximum output that could have been secured had there been no delays.

The high daily average of asphaltic concrete tonnage has been increased to 790.7 which represents 72 per cent of the maximum obtainable without delays.

## PORTLAND CEMENT CONCRETE PAVEMENTS

*Mix.*—The maximum density method of proportioning coarse aggregate with the amount of fine aggregate governed by the resulting voids in the coarse aggregate and with a definite amount of excess for workability, constitutes the method of design of mixtures. The amount of cement is held uniformly to six sacks per cubic yard of concrete actually placed. As an experimental section, a day's run of concrete on one of the larger jobs of last season's construction was proportioned with but 4.83 sacks of cement to the cubic yard in an attempt to produce a compressive strength of 3500 pounds per square inch at 28 days.

The average for a series of casts made from this mix was 3690 pounds or 84.4 per cent of that produced from the same job with six sacks of cement to the cubic yard.

*Design.*—Panels are uniformly 10 by 20 feet with thickened longitudinal edges. Provision for expansion is made at 60-foot intervals and under special conditions at 40 feet. The intermediate joints are of the weakened plane type. A double line of one-half inch square deformed marginal bars is placed around all sides of the panel and held in place, four inches from the edge, by steel chairs driven into the subgrade. One end of all longitudinal steel is extended through the joint and fitted with a sleeve to serve as a dowel. Three additional three-quarter-inch round dowels are provided at expansion joints with provision for expansion at the ends of the dowels and the steel.

*Construction.*—Central proportioning by weighing each of the coarser aggregates, above and below the one and one-half-inch screen size, and the sand in separate boxes was uniformly practiced during the past season.

All construction was in 10-foot widths with the exception of one project where, for the convenience of traffic, 20-foot construction was permitted with a weakened plane longitudinal joint. The slab was poured from the side with an extension boom on the mixer.

It was definitely proven in last season's construction that delayed finish resulted in smoother riding surfaces, and this is being practiced on all subsequent work. Nearly all jobs have increased production to the point where two finishing machines or two heavy longitudinal floats are necessary in order to secure compaction, and delayed finish is secured by maintaining the maximum interval between the two machines or the floats, as the case may be.

Pavements are opened to traffic, following an 8-day watering period, on the basis of strengths developed by beams cast and broken in the field.

*Result of Tests.*—The average compressive strength of pavement concrete during 1929 for the entire state was 3930 pounds per square inch. This represents 24 projects. Of these 24 projects, 17 were selected by headquarters representatives to cast a special series of 10 to 15 cylinders for 28-day comparisons. The average strength from the job cylinders for these projects was 3940 pounds per square inch, as compared to 4365 pounds average on the basis of the casts made by headquarters.

Of the jobs selected for casting by headquarters, seven were selected by the laboratory for coring. The laboratory cores, after being corrected for height and age, show an average compressive strength of 4894 pounds per square inch, the corresponding headquarters casts show 4401 pounds, and the field casts show 3848 pounds per square inch. Assuming that the cores represent the true strength of the concrete in the pavement it would appear from this analysis that the headquarters casts represent but 90 per cent of the actual strength of the concrete and the field casts, but 79 per cent.

In the past it has been the practice to include in the 6-inch by 12-inch cylindrical cast a true representation of all the aggregate contained in the pavement mixture. It was questionable whether the maximum size aggregate, two and one-half-inch material, did not unduly influence the resulting strength in a cylinder of such dimensions, and it was later proven by our own investigations that such was the case. It then became a question as to the advisability of increasing the dimensions of the specimen to take care of the maximum size of rock or uniformly eliminating from the material selected for casting, all of the aggregate above a certain screen size. To increase the size of cylinders would have resulted in discarding a considerable portion of our field and laboratory equipment. It has been decided to screen the mixture on a one and one-half-inch square mesh prior to casting in order to secure uniformity. The early results from this method are exceptionally encouraging.

#### ASPHALTIC CONCRETE

*Mix.*—Since the latter part of the 1929 construction season mixtures are being designed and controlled by means of the stability test of the mortar content. The fine aggregate for a project is selected prior to the letting of the contract by means of relative stability values and often a convenient source of sand that would otherwise be rejected on the basis of specification requirements for sieve analysis is accepted if these stability values are satisfactory. This method has resulted in a wider use of local materials with a consequent greater economy in the price per ton of the mixtures in place.

Samples are taken at two-hour intervals during the operation of the plant, screened through the 10-mesh sieve while yet warm and submitted daily to the laboratory for a stability test. A rational use of this stability value is attempted at all times. Realizing the danger of sacrificing the qualities in the resulting pavement that prolong its useful life, no attempt is made to secure unreasonably high stability values.

Imported filler is not used in either base or leveling course mixtures but is maintained at approximately 8 per cent of the total dry mixture for the surface course.

*Design.*—Black base construction, on new subgrade, has come into more general use during the past season. Base course varies from four to five inches in center thickness, according to local conditions, and surface course is uniformly two inches in thickness over the full width. The outer edges of the pavement are uniformly thickened to nine inches corresponding to the portland cement concrete section. A subbase of natural cementing material is used under the pavement where local soil conditions are unfavorable for subgrade.

*Construction.*—Some hand finish was permitted on work during the past season but this type is rapidly being abandoned for the superior machine-finished work.

Mixing plants are now being manufactured and in use on state work with a capacity of nearly three

times that of the plants in general use a few years ago. The use of such plants has been made possible largely by the increase in capacity for handling tonnage on the street with machine methods. These plants have not as yet been brought up to their normal capacity for the duration of the job, but the delays can be attributed largely to the plant rather than to street operations. The maximum tonnage secured in eight hours on state work to date is slightly more than 1100 tons.

#### TABLES

The usual yearly summary of the hard surface pavements is tabulated by types for the entire state and includes all projects constructed during the 1929 season. A yearly comparison by districts of hard surface pavements is tabulated with comparisons of state averages.

Roughness records of bituminous macadam, plant oil mix, road oil mix and armor coat built by construction funds are shown in tabulated form. These records of the lighter types of pavements are not to be assumed as being truly representative of the results being obtained by any of the individual districts as time did not permit the securing of records of all of these types of projects constructed.

Detailed figures on 1929 construction records will be found on pages 20-24.

### "SAY IT WITH INK"

James F. Collins, State Director of Professional and Vocational Standards, gives the above advice to contractors.

Practically all complaints filed with Collins against contractors under the contractors' registration law, have resulted from misunderstandings and disagreements under verbal contracts. The director says:

"There is altogether too common practice in the construction industry in California of carrying on the business through verbal contracts. It is obviously impossible to bring the information affecting a controversy between contracting parties to a basis upon which a decision can be rendered when the memories and personal interpretations of the contracting parties is all that is available for evidence.

"This menace to efficient and harmonious settlement of disagreements between contractor and client, or between contractor and subcontractor, will exist until the construction industry brings itself to a business-like method of contracting, whether it be for big or little undertakings."—*California Constructor*.

"I didn't begin with askings.

I took the job and I stuck;

And I took the chance they wouldn't,

And now they're calling it luck."

—*Kipling*.

Mother—"Why did you strike your little sister?"

Young Bobby—"Well, we were playing Adam and Eve, and instead of tempting me with the apple, she ate it herself."—*Vancouver Province*.

"What do you do?"

"I keep house, scrub, scour, bake, wash dishes, cook, do the laundry, iron, sew."

And the census-taker listed her: "Housewife—no occupation."—*Boston Transcript*.

# The Modern El Camino Real

By COLONEL JNO. H. SKEGGS, District Engineer

**C**OULD the old mission padres of early California history see today the modern El Camino Real replacing the original winding, dusty trail which they trod on foot or rode on the back of the slow-moving donkey, it is difficult to state which would seem the more miraculous to them—the myriads of swift self-propelled vehicles slipping by, or the smooth wide roadway stretching ahead mile after mile in long, straight courses, varied with graceful curves. It was lovely in



View looking east toward Sunnyvale-Saratoga road intersection where important line change begins.

the simple beauty of those historic days, but they would find it hardly less beautiful now, and far more magnificent.

The transition from the crooked trail of Mission times to the present stately highway has been slow but steady and in keeping with the demands of the day. After the trail came the crooked wagon road, later straightened into the more or less rectangular county road with a definite, though narrow right of way. With the advent of the automobile came the need for a smooth surface, and the metal surfaced county highway anticipated these first demands, after which short stretches of pavement in the vicinity of the larger cities and towns were required.

Throughout the entire progressive movement the "Kings Highway" has retained its identity as being not only the most historic but the most important artery of the state. Latest traffic counts show that this is yet consistently the most heavily traveled state road in California.

Of first rank in importance on this highway is that section from San Francisco to San Jose. Locally, this section of the El Camino Real has assumed the name of the Peninsula Highway. For years it was the only through artery serving the Peninsula and San Francisco, and of passing interest Contract No. 1 under the California Highway Commission in 1912 and 1913 was let for constructing that portion of this road from South San Francisco to Burlingame in this section.

The parallel building on the Peninsula of the Skyline Boulevard, Route 55, which was started in 1923, and the Bayshore Highway, Route 68, commenced in 1924, somewhat contrary to expectations has failed to halt the steadily increasing traffic on Route 2, the Peninsula Highway. This is due to the rapidly growing urban settlements along the Peninsula, many towns showing an increase in population of over 100 per cent in the last ten years.

From reconstruction funds allotted in the budgets of the past and present biennium, construction of the 14-mile section from Palo Alto to Santa Clara is now in progress. This extends approximately from the Santa Clara County line at San Francisquito Creek in Palo Alto to Scott Lane in Santa Clara, and passes through in succession the towns of Palo Alto and Mayfield (now combined as Palo Alto), Mountain View and Sunnyvale.

This section calls for three important line changes: one about one mile beyond the heart of Mayfield, some 3000 feet in length; one at



View showing the new abutments for widening the San Francisquito Creek 60-foot span arch bridge from present 30-foot to completed 76-foot roadway width.

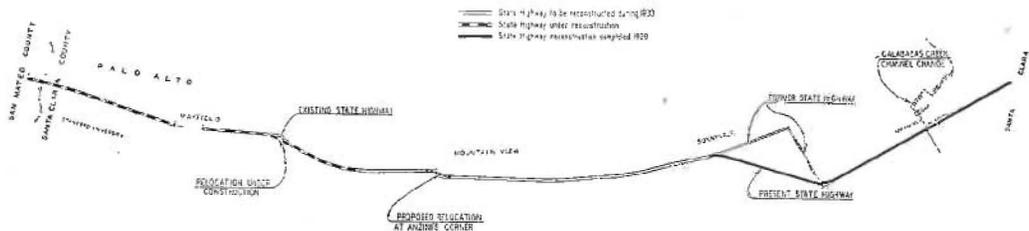
Anzini's Corner, about 2000 feet in length; and one from Sunnyvale to Butcher's Corner, about 1.8 miles long and saving 0.6 mile distance over the previous location. This 14-mile section is now located with a maximum grade of 1 per cent and a minimum radius curve of 2000 feet.

In brief, the proposed construction calls for utilization of the present 20- to 24-foot width pavement in resurfacing with Type "A" asphalt concrete and widening with asphalt concrete, and concrete over compacted rock base to a 40-foot paved width through Palo Alto; the balance being paved to a 40-foot width of 8-inch to 10-inch thickness of concrete. The roadbed width for the above pavement is approximately 60 feet throughout on a 100-foot right of way. From Mayfield on to Santa Clara the present 20-foot width pavement is to be resurfaced with asphaltic concrete and widened to a completed 30-foot pavement width with 8-inch to 10-inch thickness

tion on a 30-foot width roadbed in the original 66-foot county right of way. All but the last half mile of this was constructed under contract in 1914 of 4-inch Portland cement concrete, with 1½-inch topeka top and 3-foot rock shoulders on either side. The same type of construction was placed on the last half mile by state forces in 1918 and 1920.

The present contract called for placing of 4-inch to 5¼-inch thickness of asphalt concrete over the original 20-foot pavement, widening 10 feet on one side only, with 8-inch to 10-inch thickness Class "A" concrete.

A line change of special importance was made from Sunnyvale to Butcher's Corner. This resulted in a saving of 0.6 mile distance and eliminated two right angle turns with 260- and 300-foot radii. This new location, 1.8 miles in length with 100-foot right of way, was paved with 3 ten-foot strips of 8-inch to 10-inch concrete over a 4-inch compacted rock base.



Map showing the modern El Camino Real from Palo Alto to Santa Clara.

concrete. The graded roadbed width is to be 50-feet in general, on a 100-foot right of way.

Due to the interurban nature of this highway, right of way problems present difficulties as serious and almost as costly and difficult as those of construction. About 320 ownerships are involved in right of way negotiations in this piece of highway.

For convenience in construction, this 14-mile stretch from Palo Alto to Santa Clara has been divided into three sections—4.4 miles of which, from Sunnyvale to Santa Clara, having been completed in December, 1929. Another section 4.7 miles in length from Palo Alto to San Antonio Road is now under construction, and the center link of 4.9 miles will shortly be advertised.

The 4.4-mile portion of the Peninsula Highway between Sunnyvale at Saratoga Road intersection and Scott Lane in the City of Santa Clara was constructed under Contract 04EC5. Bids for this work were received on May 22. Work was commenced June 8 and completed December 26, 1929.

Previous to the above contract, this road had been constructed to a 20-foot paved sec-

tion on this project were somewhat complicated, the line change alone involving some 22 ownerships and costing, exclusive of moving buildings and improvements, in excess of \$86,000. The total number of ownerships involved was 62.

At Sunnyvale-Saratoga Road intersection, it was necessary to move one commercial garage building 75 feet by 100 feet, two service stations and all fixtures, a cafe, and one residence. Three thousand trees had to be removed. It was necessary to go to condemnation with but one property owner on the entire 4.4 miles of right of way negotiation.

This section is in the heart of a rich territory wholly occupied by orchards and intensively cultivated fields merging into urban settlements. Many interesting features were presented in construction of special siphons for irrigation systems which the new location literally cut in two.

A particularly interesting combined right of way and construction problem presented itself in changing the channel of Calabazas Creek. The original channel of this creek extended easterly and was within the right

## Progress Report on Bay Bridge Borings

THE State Department of Public Works has made public the following statement regarding the borings in San Francisco Bay in connection with the proposed San Francisco-Oakland Bay crossing. The results of holes drilled to date on three different lines are tabulated herewith.

### Sixteenth street line.

This line of holes, being numbers 18, 19, 20 and 21, on the map, starts opposite Sixteenth street in San Francisco and crosses to Alameda at a point approximately 8000 feet south of the Alameda Mole.

Rock was found only at boring No. 21, the hole nearest the San Francisco side, at a depth of 292 feet below mean low water. This line has been abandoned as being impractical on account of the great depth to rock.

### Pier No. 34 line.

This line of holes, being numbers 1, 2, 3, 4, 5, 6, 7, 9, 11 and 17, starts at Pier No. 34 in San Francisco and crosses to a point on the Alameda shore about 1200 feet south of the Alameda Mole. In the hole just off the end of Pier No. 34 rock was found at a depth of 223 feet below mean low tide. Holes 5, 6 and 7 at an approximate distance of 2800 feet from the pier line and on Rincon Reef showed rock at 44, 49 and 50 feet, respectively. At a point 1600 feet from the pier line rock was encountered at 110 feet below water. Hole No. 1, 6800 feet from the end of Pier 34, encountered rock at 293 feet below low tide. The remaining holes on this line were stopped at a depth of around 300 feet without encountering rock.

### Goat Island line.

This line of holes extends from Pier 22 in San Francisco to Goat Island and thence to the Oakland shore near the Key Route Mole and are holes numbers 8, 12, 22, 23, 24, 25 west of Goat Island and holes 13, 14 and 16 east of Goat Island. At the end of Pier 22 rock was encountered at a depth of 163 feet below tide. At 3500 feet off Pier 22, rock was encountered at 140 feet, and holes 150 feet east and 200 feet west of hole 23 found rock at a depth of 127 and 143 feet, respectively. These holes are numbers 23, 24 and 25. Hole No. 12, located 2000 feet west of Goat Island, encountered rock at a depth of

158 feet. Hole No. 10, 600 feet off Goat Island, encountered rock at a depth of 87 feet. Hole No. 16, located 600 feet east of Goat Island, found rock at a depth of 217 feet. Hole No. 13, located 1500 feet east of Goat Island, struck hard material at 190 feet, but was jetted to 270 feet below high tide. Hole No. 14 penetrated largely sand to a depth of 323 feet.

It is expected that borings will be completed by July 1st, and the final report of preliminary borings made to the Bay Bridge Commission shortly afterwards.

The map herewith shows the location of the holes and the material encountered at the bottom of each boring. The State Department of Public Works, Division of Highways, wishes to emphasize the fact that this is simply a preliminary statement of progress.

The final report when complete will be made to the San Francisco Bay Bridge Commission for such action as it may deem best.

The San Francisco Bay Bridge Commission was appointed jointly by President Hoover and Governor Young, the President naming Mark Regua as chairman and Rear Admirals L. E. Gregory and W. H. Standley, representing the Navy, and Colonel G. D. Pillsbury and Major E. E. Daly, representing the Army. Governor Young named Senator A. H. Breed, Professor O. D. Marks of Stanford University, George Cameron of San Francisco, C. H. Purcell, State Highway Engineer.

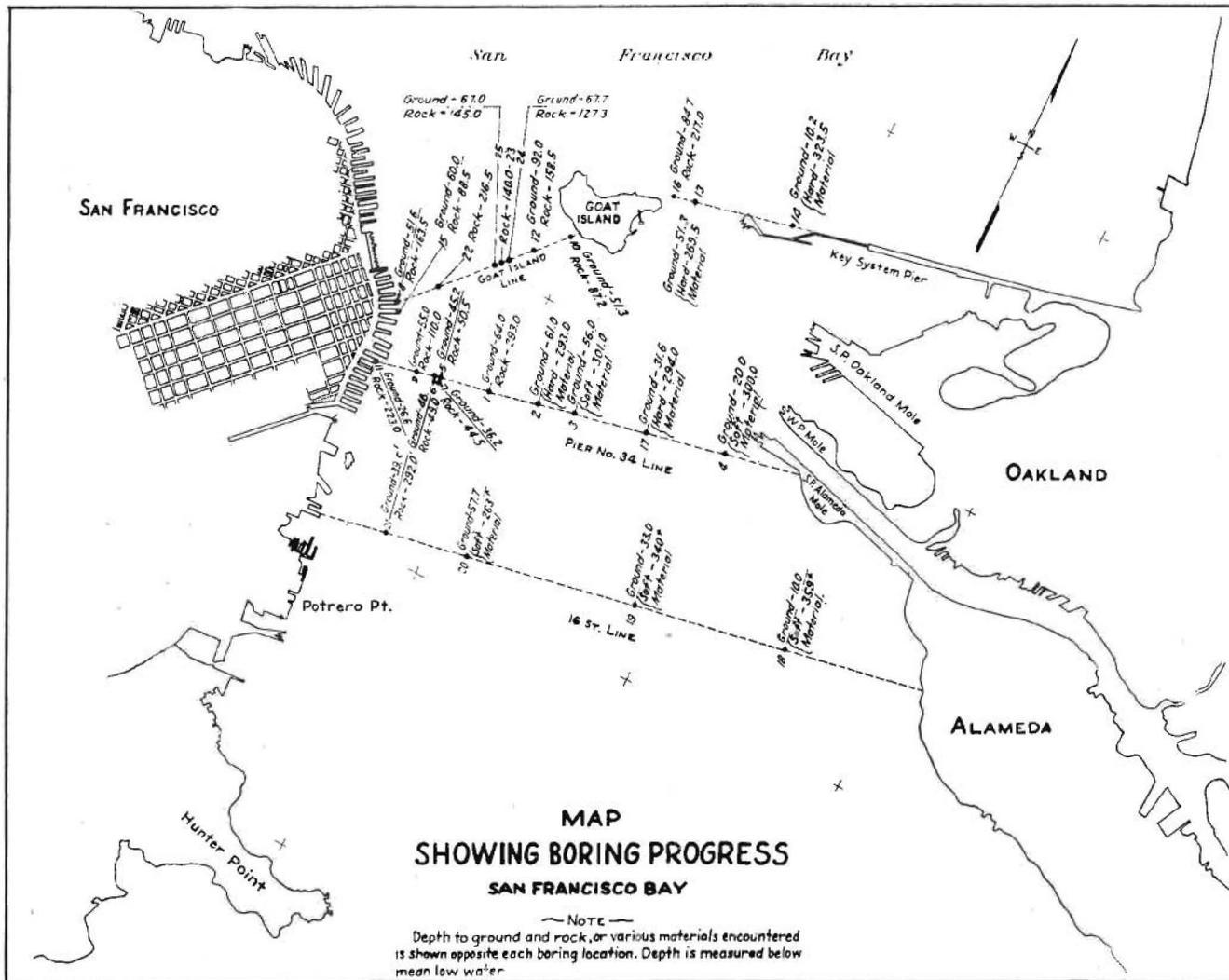
Funds for the borings are being supplied by the city and county of San Francisco and the State Bridge Authority, which was recently organized under the Toll Bridge Laws, passed by the last Legislature.

With the receipt of the report by the San Francisco Bay Bridge Commission, it is expected that an early meeting of the commission will be held and the subject fully discussed. From present indications this meeting of the commission should take place some time in July or August.

The teacher was giving the class a lecture on gravity.

"Now children," she said, "it is the law of gravity that keeps us on this earth."

"But, teacher," inquired one small child, "how did we stick on before the law was passed?"—*Hercules Record.*



# Welcoming Nonresident Car Owners to Tour in California

By FRANK G. SNOOK, Chief of the Division of Motor Vehicles

**F**EW STATES in the Union are as liberal toward the driver of the nonresident or out-of-state car as California.

California permits all nonresident cars from every state to remain here six months without securing a California license if the motorist takes out a nonresident permit within ten days from the time he enters the state.

Many states require the visitor from other states to secure a license almost as soon as he arrives. Other states have a "reciprocity" arrangement which gives the visiting motorist the same length of time to secure a license as is given in the state from which he comes.

If a visitor indicates his intention of staying in California less than ten days he is not even required to secure a visitor's permit. However, if he stays longer than ten days without getting such a permit, he is required to get his California license immediately.

Even this is no hardship, comparatively speaking, as California's license fee of \$3 for passenger cars is the lowest in the country. In some states the fee runs as high as \$50 and \$60 annually.

Our liberality toward the out-of-state motorist is bearing fruit in a constantly-increasing tourist crop. Already the 1930 season gives promise of being a record-breaking one. During the first three months of the year visitors' permits were issued to 15,800 cars, and what is still more gratifying we issued California licenses during this period to 31,141 out-of-state motorists, indicating that large numbers of these visitors like California well enough to make it their home.

Few people realize, possibly, the big part the Division of Motor Vehicles plays in welcoming these visitors and in assisting to make their respective visits pleasurable. They receive almost their first impression of California at our border or "courtesy" stations where our officers register them and issue visitors' permits to them.

We are striving constantly to instruct these nonresidents in our laws for their own protection as well as the protection of the people of our own state. Our hardest task is to acquaint them with the regulations governing registration. These regulations are,

necessarily, somewhat strict for the automobile thief is constantly at work moving cars from one state to another and knows every weakness in the registration laws.

In general, we require the following from the prospective nonresident registrant:

1. Proof that the applicant's car has been registered properly in his own state. The certificates of registration and title are generally regarded by us as sufficient to establish this. In the absence of certificate of ownership or title, a notarized bill of sale is required.

2. Proof that the applicant has permission of the legal owner (if there be one) to register the car in California and that all prior claims of any other character against the car have been satisfied. This means written permission from the lien holder, usually obtainable by a telegram.

We have little trouble with the rank and file of the nonresidents, most of them being able to furnish us readily with proof that is satisfactory. Most of them recognize that while these regulations are somewhat stringent they protect the registrant as well as the public. We find that the registrant who kicks is very likely to be the registrant who is trying to "put something over."

California system of registration is recognized as one of the finest in the United States. The "pink" certificate is regarded everywhere as indisputable evidence of ownership of the car. This is one of the reasons why crooks are constantly figuring out schemes for breaking down our system knowing that if they can obtain our certificates they will have a better chance to dispose of their ill-gotten gains.

Another angle of the nonresident situation that gives us much trouble is that matter of licenses for operators. During the last few years California has been building up a rather stringent system of licensing operators, the aim being to weed out the unfit and to increase the general standard of drivers.

At present all applicants for an original license must submit to an examination of their general fitness to drive and a new section of the law permits the division to give examinations every two years to all operators.

The application of our laws to the nonresident has been a matter requiring con-

(Continued on page 16.)

# The Science of Mechanical Ventilation

By CARL A. HENDERLONG, Assistant Engineer, Division of Architecture

MODERN methods of heating and ventilating assembly halls and theaters require considerable study. It is the purpose of this article to describe in a brief nontechnical way, the methods used to provide suitable heating and ventilating for theaters and also to describe the system as laid out for the new Assembly Hall at Chico which follows closely modern theater practice.



CARL A. HENDERLONG.

This new Assembly Hall is, in reality, identical in construction to a theater; contains a full size stage and has a seating capacity of 1500 persons.

Most of us are occasionally patrons of the theater. Perhaps some, in moving their feet around under the seats, have kicked against the ventilator, or mushroom as it is technically called, and wondered just what its function was.

As will be shown later, the problem of satisfactory theater ventilation is mostly an example of cooling, even in the winter time with the air outside being around the 40-degree mark.

A number of people congregate for entertainment in a cold room. The room soon becomes hot, often uncomfortably so. This results from the heat given off by the occupants. An adult at rest, gives off in bodily heat, approximately 450 B.t.u. per hour. A B.t.u. or British thermal unit, is the heat necessary to raise one pound of water one degree Fahrenheit.

In a theater or assembly hall of average construction containing 1500 seats, if filled to capacity or nearly so, the amount of heat given off by the occupants would be more than sufficient to heat the room well above 70 degrees Fahrenheit with outside temperature 40 degrees, provided no outside air were introduced. In fact, an overheated and uncomfortable condition would soon be produced.

It thus becomes apparent that some method of cooling is necessary, virtually at all seasons of the year. Many of us will perhaps recall some of the theaters of a few years ago. Lack of mechanical ventilation of any kind made even the most enjoyable of shows at times rather depressing. Thirty to fifty cubic feet of air per person per minute is now accepted by the Engineering Fraternity, as a satisfactory amount of air for proper ventilation of theaters.

Some of the eastern states require mechanical ventilation for all theaters, halls or in any crowded place of assemblage. There is no such ventilating code in California. Theater owners, however, realizing that the satisfactory patronage of their shows required adequate provision for ventilation, have in the main, installed such systems.

The Assembly Hall now under construction at the Chico State Teachers College, has a seating capacity of 1500. This requires that not less than 45,000 cubic feet of air per minute be supplied into the building for proper ventilation and cooling. This large volume of air must be introduced into the building without drafts of any kind and also in a way so as not to interfere with the architectural scheme of decoration and design. The ventilating fans and other equipment must also operate noiselessly or nearly so, since any apparent noise would be objectionable to the theater performance.

There are two systems in common use for the introduction of the fresh air into the building: one known as the downward or overhead system requiring the air to be introduced at the ceiling through grilles of openings, and the other the upward system, which supplies air through mushrooms located under seats. A mushroom, as it is called, is nothing more than a bell-shaped top placed over a cast iron or steel sleeve 6 inches to 9 inches in diameter, which sleeve is in turn connected to the air duct or plenum space below the floor of the theater. Raising or lowering of the bell regulates the amount of air passing through it. The former system required refrigeration for cooling the air in hot weather while fairly satisfactory results are obtained with only air washers for cooling if the upward system is used.

When expense of installation and operation is not an important factor, refrigeration and the downward system produces by far the most satisfactory results. With properly designed equipment, it is perfectly possible to maintain a temperature of 70 degrees Fahrenheit and 40 degrees humidity in the theater at all times, even though it may be 110 degrees in the shade outside. Since the cost of an adequate refrigerating system for cooling such a volume of air

(Continued on page 34.)

How One Traffic  
Officer Helped

Thanks For These  
Kind Words

Best Safety Rule  
Is "Obey the Law"

## Clippings, Letters and Comment

Running Time is  
Cut In Half

Registration and  
Fee Figures For  
California

Urges Good Roads  
Across Continent

### Dealing With State Highways

#### Traffic Officer Helps Mother and Babies.

This letter comes from Oroville:

Motor Vehicle Dept.,  
Sacramento, Cal.

Dear Sirs:

I wish to compliment you on the speed cops of Butte County. I wish to say we have, to my judgment, real gentlemen here. The other day while motoring from Oroville to Gridley, I picked up a tack in my tire and was stalled with three little babies, from four years to nine months old.

I could have changed the tire alone, but I wish to state that I certainly appreciate the help which I received from our speed cop, and I wish to send my thanks into you for helping to maintain such gentlemen. Perhaps there are quite a few complaints sent in about all of them, and I do not feel that a few compliments and thanks sent in will hurt them, especially the ones of this district.

Yours truly,

Mrs. E. L. Johnson and babies,  
Oroville, California.

#### Thanks For These Kind Words.

This letter comes from F. Z. Lee of Los Angeles:

Today I saw a copy of your magazine CALIFORNIA HIGHWAYS AND PUBLIC WORKS and I was very agreeably surprised at wonderful amount of information contained in it. Too, the very attractiveness of it puts it on a high class as a magazine.

I would certainly like to get the magazine and would appreciate your putting my name on the mailing list for the publication.

If the February number is available I would be very glad to get it. It has a very useful map on the back cover.

#### Best Safety Rule Is "Obey The Law."

Floyd G. Yoder, member of the Orange County unit of the California Highway Patrol writes as follows in the April issue of *The Police Blotter*, publication of the Orange County Peace Officers' Association:

YOU are responsible! YOU who read, write and sometimes think. YOU who operate an automobile.

YOU who have occasion to ride in one, and YOU who find it necessary at times to cross the street or walk upon the highway. Just YOU few mentioned above. Those who do none of these things can not be held responsible, and need not cringe at the finger of accusation.

Death—the cold, final word, *death*, uttered 2100 times over the bodies of automobile victims in this state of YOURS during the year 1929. Thirty-two thousand and some odd injured. Many of them cripples for the remainder of their days.

How can this all happen in one short year, happen before your very eyes, happen to your friends and loved ones, and what did YOU do about it? WHAT ARE YOU GOING TO DO ABOUT IT IN THE FUTURE?

Two thousand one hundred killed. There they lie side by side in our imaginary lane of graves stretching for one and one-half miles. What's in the picture? Why the cause? Simply this: "man's inhumanity to man," our indifference to the rights and cares of others. Remember this, every time you see or hear of an accident, *one or more persons are responsible*. The automobile itself is not a thing of death. The human element behind that automobile is alone responsible.

There is no other calamity that could strike this or any other state that would exact 10 per cent of the toll of lives taken by our road rudeness without arousing the entire citizenry to aid, assistance and preventive action.

Someone asked, "What can I do about it?" It is a singular fact that a little over 50 per cent of accidents are accompanied by a violation of the California Vehicle Act. You can therefore—OBEY THE LAW. That will cut the accident rate by one-half. Extend to your fellow man on the highway the same courtesy and consideration you extend to him on the sidewalk or in the elevator and you will cut the other half to a surprisingly low figure.

#### Road Cuts Running Time More Than Half.

The *Calxico Chronicle* in a recent issue has the following to say:

Yesterday I traveled over 30 miles of the state's oiled highway in Chuckawalla Valley between Blythe and Mecca.

The state engineers solved the question by adding a small amount of gravel to the native material—which is mostly sand—and then adding oil. The result is a road which for all practical purposes is equal to a paved highway. The running time for the 94 miles between Mecca and Blythe is now 2½ hours. Before the state took over the road the minimum time for the trip was 6 hours.

## Registrations And Fee Figures Given For State.

Although California ranks second in the United States in the number of motor vehicles in use, it is tenth in total amount of registration fees paid, according to the United States Department of Agriculture figures.

New York leads in the number of motor vehicles registered with 2,263,259, and also is first in registration fees with \$38,293,313.

California is second in vehicles registered with 1,974,341, but collects less than one-third of the registration fees of New York, with \$10,489,068. Until recently New York had no gas tax, which may account for its high registration fee. Pennsylvania is second to New York in registrations, with \$29,264,695, but is fourth in the number of automobiles registered.

In addition to more than \$10,000,000 in registration fees, Californians pay over \$30,000,000 in gas taxes in the state. However, the gas tax is general now throughout the United States, varying from 2 to 6 cents a gallon. California pays 3 cents a gallon, which is a little below the average for the nation.

\* \* \* \* \*

## Urges Good Roads Across Continent

The following letter has been received from Sam S. Porter of San Diego, one of the foremost enthusiasts in good road construction in California:

San Diego, California, March 20, 1930.

Governor C. C. Young  
Sacramento, California

My Dear Governor:

Have been reading, for some time now, dispatches re the unemployment condition. Am of the belief that the building of more county, state and national highways would tend greatly to solve the question of the unemployed.

In building hard surface roads across our continent, one from the Atlantic to the Pacific for the southern states, one from the Atlantic to the Pacific through the heart of our United States, and one from the Atlantic to the Pacific for our extreme northern states, would not only give employment to the majority out of work but would stimulate business industry through materials to an extent, I believe, far beyond our fondest expectations.

Personally, I believe that the building of good roads will absolutely relieve the labor question. It not only gives the real laboring man employment, but will give many a professional man, work, such as engineers, superintendents, draughtsmen, etc. Such work will consume, with a multitude of men employed, vast amounts of foodstuffs, it will use divers kinds of machinery, plows, scrapers, steam shovels, tractors, camp outfits, etc., as well as oil, asphalt, sand, rock and cement; and to me the *strength* of it all is that no section of our country would be getting an over-production of anything, but something that is bound to benefit all.

Business men everywhere should boost the crusade for employment of labor on road building. I believe it will mean the greatest relief for the unemployed a condition which is to be deplored; it will also help to maintain a national wage scale—which would mean a higher standard of living for the wage earner.

Good roads everywhere mean increased travel and a

community that is not easy of access and that can not be reached by innumerable feeders, in the shape of good roads branching in every direction, will find itself isolated.

With our nation, our states, our counties, our cities, all in the mood and our citizens clamoring for more and better roads, we should not relax. "More and better roads" should be our slogan. Good roads make good business. If we could just keep up a united stand while the people are in the humor, and all put our best efforts into getting road building started right away and with *no further delays*, what a blessing it would be throughout the United States.

Of course, I realize perhaps the public should be advised some in advance on this subject and too much can not be said in favor of good roads. The press is a moulder of public opinion and can help much; but *those* who have the *power* to *place* and *push* in the world we should try to reach.

A few good points for good roads: Good roads stimulate production. Good roads would mean better service at less cost. The save of wear and tear on conveyances, the speedier transaction of business and many other advantages.

By the building of good roads we are not producing anything that will be a drug on the market. Analyze the great good that will come to any royal citizen by virtue of good roads. They will help keep the motor owner out of the mud and dust if he can drive over a good, modern paved highway. Our country is alive with auto owners. Is it possible now for people of moderate means as well as wealthy people to enjoy the use of an automobile, and they are constantly moving about. And it has been the experience of towns and counties that have developed their highways, that business has been stimulated and all have profited thereby. So what it will do for a community it will do for a county, a state, or our great nation.

As we build paved roads transforming our dirt roads into smooth dustless 365 day a year boulevards we must of necessity stretch our purse strings and help pay, but it will be worth it, and we should encourage good roads. Already our national highways are doing wonders and they should be supported by everyone. There should be an even greater movement in the United States in favor of all good road projects.

Good roads must be back of the business battle line.

In this connection an unknown author has aptly said: "Roads rule the world—not kings nor congresses, nor courts, nor ships nor soldiers. The road is the only royal line in democracy, the only legislature that never changes, the only court that never sleeps, the only army that never quits, the first aid to the redemption of any nation, the exodus from stagnation in any society, the call from savagery in any tribe, the high priest of prosperity, after the order of Melchisedec, without beginning of days and end of life. The road is umpire in every war, and when the new map is made, it simply pushes on its great campaign of *help, hope, brotherhood, efficiency and peace.*"

I believe Chambers of Commerce in every progressive city in the United States should support a movement for good roads across our continent. I realize good roads mean work—constant work—and real cooperation, and that the citizens would be *behind our government* for a movement of this kind that would benefit so many of our good people.

With good wishes, believe me,

Cordially and sincerely,

SAM S. PORTER,  
The San Diego Hotel.

## Progress Made on Feather River Lateral

By H. S. COMLY, District Engineer

WHEN the final decision was made on the route of the Feather River Highway early in 1928, the so-called North Fork Route being selected, steps were taken at once to get the work under way. In March, 1928, two field location parties were organized, and the location surveys commenced at the two ends of the route. These surveys were followed by the construction of two convict camps in the months of May and June, and active work commenced on construction at both points about the first of July, 1928. One of these camps was established about 8 miles northeast of Oroville, at the center of a 7-mile section from the crossing of the Feather River upstream, while the other one was installed about a mile down the river from the station of Paxton, in Plumas County, at the center of an 8-mile section, extending from Spanish Peak to a connection with the county road between Quincy and Westwood.

The general scheme of work proposed was to construct the 69-mile section between Oroville and the above county road connection, leaving the 9-mile section from that point to Quincy for the last construction, as traffic is served by a fair road on that section at the present time. Meanwhile, during the construction of the above mentioned 69-mile section, the state has and will maintain the existing county road direct from Oroville to Quincy, which traverses the ridge between the North Fork and the Middle Fork of the Feather River. This road is closed by snow for five or six months of the year as a usual thing, but with the improvements made on it since the state has maintained it, handles traffic very well during the remainder of the year.

The entire length of the proposed construction between Oroville and Quincy is 78 miles, and the total cost of the work was estimated at approximately \$7,000,000 in 1925, this estimate being based on a highway with a graded roadway 20 feet wide and a crushed rock surface 18 feet wide. The estimate was based on what information was available from old surveys which were made on a low standard of alignment, grade and width, several years before, and for this reason it was necessarily approximate. During the succeeding years our standards of alignment and grade

have become much higher. However, based on estimates made on our present location surveys, on which the higher standards are used, and construction costs to date, it does not appear at this time that the above mentioned figure will be materially exceeded unless a wider standard of road is adopted on the remaining work.

Included in the 78 miles of construction are 14 bridges from 40 to 700 feet in length, and four railroad grade separations, the cost of these structures being included in the above mentioned estimated total cost.

During the past 21 months, since the inception of the work, 17 miles of highway have been graded and 4.5 miles surfaced, at a total expense of \$995,000. Also, the bridge across Indian Creek, in Plumas County, has been constructed at a cost of \$30,000, and the large bridge across the Feather River, 4 miles northeast of Oroville, is now under construction, and when completed, about September 1st, will have cost \$170,000. The total expenditure at this time, therefore, including the amount which will be expended in completing the last named bridge, is \$1,195,000. The above mentioned work is distributed as follows:

Construction by convict camp number 16, at Paxton, of 6.5 miles of graded highway at a cost of \$430,000. The Indian Creek bridge was also built by this camp at an expense of \$30,000, making the total expenditure on this section \$460,000.

Construction of 6 miles of graded highway by convict camp 17, located 8 miles northeast of Oroville, at an expense of \$395,000.

Construction of a graded highway with crushed rock surfacing from Oroville to the Feather River crossing, 4.5 miles, at a cost of \$170,000.

Feather River bridge, 4.5 miles northeast of Oroville, 700 feet in length, at an expense of \$170,000.

In addition to the above mentioned accomplishment, plans are now completed on a 2-mile section of highway just south of Pulga, about 35 miles northeast of Oroville, and this work is just being advertised for contract. In connection with this section, plans are now being prepared by the Bridge Department for a bridge across the Feather River at the northerly end of the section, and it is expected that this work will be placed under contract in the near future. This grading project is estimated to cost \$325,000, and the bridge \$150,000. Including these two projects,

which are budgeted in this biennium's program, and the total expenditure to date given above, the funds which have been expended or are directly obligated, for the construction of this highway amount to \$1,670,000.

When these projects are completed, 19 miles, or approximately 25 per cent of the road will have been graded and 4.5 miles of this length will have been surfaced, and there will, therefore, remain approximately 59 miles to be graded and 74 miles to be surfaced. The surfacing of the 14.5 miles of highway which will have been graded but not surfaced, will cost about \$100,000, so that the entire cost of these 19 miles will be \$1,770,000, or approximately 25 per cent of the total estimated cost. These 19 miles include some of the heaviest construction on the route and two of the most expensive bridges, but they also include some of the lightest construction on the road, so they represent a fair average of the entire construction, but if anything, the remainder of the work will be somewhat heavier in cost.

It is proposed to continue the work with the two convict camps and it is expected that these two camps will complete the sections they are now on and move to new locations, as indicated on the map, in the late summer of this year. Camp 16 will engage in the construction of a 10-mile section from the mouth of the East Branch to Spanish Peak, at the westerly end of their present work. Camp 17 will engage in the construction of the 7-mile section from the end of their present work to a point in Dark Canyon, about 2 miles south of the Big Bend road. In general, it is proposed to contract all of the work between the work covered by these two camps, that, from Dark Canyon to East Branch, a distance of approximately 31 miles, of which 29 miles has not as yet been directly obligated for construction. The 9-mile section from the connection to the county road east of Paxton to Quincy will also be constructed under contract, according to present plans. The future prosecution of the construction of the 38 miles which it is proposed to contract and of the remainder of the convict work on this road will depend upon the rate at which funds become available for the work.

In preparation for the future prosecution of the work, three large location parties are now at work in the canyon, completing the surveys. It is expected that all location surveys will be completed late this summer or early in the fall. To date, 48 miles of location surveys have been completed, and 30 miles remain to be made.

## *U. S. Reclamation Board Aids in Water Study*

**C**LEARING the way for early completion of investigations into California's coordinated water program, with a view to securing definite action on the project at the next session of the State Legislature, Governor Young announced today that the United States Reclamation Bureau will undertake an immediate economic study of the water conservation plan.

The Reclamation Bureau inquiry, designed chiefly to determine the physical and financial feasibility of the proposed plan for conservation and full utilization of Sacramento-San Joaquin Valley waters, will be carried on under a cooperative agreement initiated by Governor Young with the United States Department of the Interior. It will supplement the work of army engineers, now investigating navigation and flood-control phases of the problem, and the study of the Hoover-Young Water Commission.

Governor Young announced that the Secretary of the Interior has approved a \$25,000 deficiency appropriation as the federal government's share in cost of the investigation, which will be matched by a similar state allotment.

"I am very gratified at this new evidence of the earnest desire of the national administration to assist California in working out a satisfactory solution of our water problem," Governor Young declared, in announcing enlistment of the Reclamation Bureau's aid.

"We now have the effective cooperation of the branches of the federal government most directly concerned, namely, War Department, Federal Power Commission and Bureau of Reclamation. It is hoped and anticipated that under the program laid out and with the assistance of these federal offices and the various commissions functioning, a full report can be presented to the California Legislature, which will convene in January of next year. It was most important, in connection with the full investigation, that certain studies relative to irrigation and reclamation phases be made by or in cooperation with the Reclamation Bureau. This is now assured."

The Reclamation Bureau survey, it was announced, will bear on the following points:

The character and urgency of the requirements for water to be used for irrigation purposes.

The available water supply.

(Continued on page 26.)

## CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official journal of the Division of Highways of the Department of Public Works, State of California; published for the information of the members of the department and the citizens of California.

Editors of newspapers and others are privileged to use matter contained herein. Cuts will be gladly loaned upon request.

B. B. MEEK ..... Director  
 GEORGE C. MANSFIELD ..... Editor

Address communications to California Highways and Public Works, P. O. Box 1103, Sacramento, California.

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MAY, 1930

No. 5

### State Building at Santa Barbara is Highly Commended

The Division of Architecture of the Department of Public Works has been honored by the following award made by the Community Arts Association:

#### The Community Arts Association

Plans and Planting Branch

Presents

Honorable Mention

Among the Best Examples of

#### Civic and Commercial Architecture

Erected in Santa Barbara, California

in 1929

to

Auditorium  
 State College  
 Building

State of California  
 Owner

State Architects

Architect

Judge

W. C. Chambers

Chas. H. Clancy

Ed. Philip St. John

J. W. Kennedy  
 February, 1930

The automobile license plates in Pennsylvania, which bear no more than five characters, display many amusing combinations. Among the odd ones are "123-Go," "MA" and "PA," "US," "OH," "4U2" and "U2," which is attached to the hearse of an undertaker in Chambersburg.

## WELCOMING NONRESIDENT CAR OWNERS TO TOUR IN CALIFORNIA

(Continued from page 10.)

siderable tact and judgment on the part of our officials. In general, it has been our practice to permit the nonresident having a driver's license from another state to proceed unmolested.

If he has no such license or comes from a state where no license is required he must take the examination. We feel this is just for in the interests of safety we are entitled to know whether he can drive well enough to measure up to our standards.

There are a number of states, notably those in the south, where there are no requirements of any kind for driving a motor vehicle. Our officers are furnished with lists showing the requirements in every state.

These lists show also the date of expiration of registrations in all states and other information necessary to the officer in dealing with the nonresident.

The value of the tourist crop in dollars and cents can not be estimated. It unquestionably runs into the millions of dollars every year. It is the constant endeavor of the Division of Motor Vehicles and its subsidiary bodies to do everything possible to make these visitors feel at home.

### THE ROAD

By HILAIRE BELLOC

The road is one of the great fundamental institutions of mankind. We forget this because we take it for granted. It seems to be so necessary and natural a part of human life that we forget that it ever had an origin or development, or that it is as much the creation of man as the city and the laws.

Not only is the road one of the greatest human institutions because it is fundamental to social existence, but also because its varied effect appears in every department of the state.

It is the road which determines the sites of many cities and the growth and nourishment of all.

It is the road which controls the development of strategies and fixes the site of battles.

It is the road which is the channel of all trade and, what is more important, of ideas.

In its most humble function it is a necessary guide without which progress from place to place would be a ceaseless experiment; it is a sustenance without which organized society would be impossible; thus, and with those other characters I have mentioned, the road moves and controls all history.

"You know, automobiles are making people lazy."

"They are, are they? Say, did you ever see the pedestrians trying to get across the street at a busy corner?"

## THE MAXIMUM CONSERVATION OF WATER WITH REFERENCE TO THE CALIFORNIA PLAN

(Continued from page 2.)

region were so arid that the available water had been or could be completely utilized under private auspices no other agency would be needed.

Assuming this condition of relative surpluses and deficiencies, a searching engineering analysis should be made to devise the best technical and economic method of solution. The area of surplus becomes the subject of an intensive study to determine the true amount of exportable water, and in this connection the state investigation must assume ultimate development within said region as it would be poor policy to export water from one area to another for the same use to the material detriment of the first. The present and ultimate supplemental needs of the deficient areas are also ascertained, and then it becomes an economic question as to whether or not exportation can be planned and carried out at a cost which will be justified by the benefits received. It will be found at once that certain supplies of water can not be regulated or captured without excessive costs, which may be on account of wide irregularity of occurrence, lack of suitable reservoir sites or of geographic or topographic location which would require transmission conduits of great length.

In developing a plan for maximum ultimate use, however, the engineer is not entirely limited to present day values, since the accomplishment of the total plan will probably take generations and values can reasonably be anticipated to increase in this time. In California water sells as low as  $37\frac{1}{2}$  cents an acre-foot in some agricultural localities and in others, under somewhat similar conditions, as high as \$30 an acre-foot. Certainly the lower figure will increase rapidly with future development.

In such a plan reservoirs can be made to serve a wide utility of purposes. Conservation reservoirs of large capacity located in the foothill regions of a stream channel are approximately at the dividing line between the valley and the mountain watershed. Such reservoirs will permit hydroelectric power, mining, and such incidental agricultural and other uses as occur in the mountain regions to proceed unrestricted with but negligible inter-

ference, as the released and returned waters will be reregulated by the storages below the upper users and made available for municipal, irrigation, industrial and other services in the usual manner below the foothill reservoirs.

The reregulated waters are passed through a power house at the foot of each dam under a schedule of diversion which will produce the maximum power revenue obtainable, subordinate, however, to the requirements for irrigation and other uses. During the early years of the irrigation development the demand for these purposes will be small and the diversion schedules can fit closely with the power demand curve and under this condition many of the large foothill storages proposed in California will produce sufficient by-product power revenue to carry the greater part of the fixed charges of the respective projects. As the irrigation demand increases the character of the power will change from firm to secondary and this revenue will materially decrease.

This is all predicated upon the theory that power generation at the foothill reservoirs is secondary to their other uses, which is commonly accepted as a state policy, as power is obtainable from other sources, while water is not. The development of hydroelectric power in the mountain watershed above will usually increase the utility of the foothill storage as the latter is the residuary legatee of all waters stored upstream for nonconsumptive use in the watershed.

A reservoir of sufficient capacity may also be used to a material degree for flood control. Flood control and other uses may seem to be difficult of reconciliation in a single storage due to the fact that to serve flood control alone the reservoir space is reserved for that purpose, while to accomplish the other intents it is ordinarily filled as quickly as possible, and many engineers believe that these uses can not be combined except through the medium of open ports in the dam which dedicates the storage space above the ports to flood control and the space below to other purposes. An intensive study of flood flow characteristics has, however, led to the conclusion that the use of reservoirs for flood control is compatible to a marked extent with that for other services.

Knowing the seasonal characteristics of rainfall and runoff on a given drainage basin and stream, it is possible to design a method of holding a predetermined amount of storage space in reserve through the flood season for equating of the peaks, and after the flood

danger has definitely passed to allow the reserved space to fill and permit the reservoir to perform full service thereafter for other uses. While the power head is decreased during the flood season, by passing the larger amounts of water available at that time of year through a lower head, the loss in power output can be kept to a minimum.

Thus in California, at least, a single reservoir of large capacity may serve all or any of the following uses; domestic, municipal, irrigation, industrial, navigation, flood control, mining, salinity control and hydro power. Navigation would be benefited by released water from the reservoir increasing the depth in the channels during the period of low flow, and salinity encroachment would be held back by the outflow of fresh water. The design of the transmission and distributary works to effect delivery of water from the areas of surplus to the areas of deficiency is carried out along standard engineering lines.

Coordination of the water supplies and uses to form a plan for maximum conservation on the above basis then requires, as is apparent to any hydraulic engineer, intensive scientific and engineering analyses on the basis of the most complete obtainable basic data. With such an ultimate plan laid out the next step is to specify the proper economic order in which the various units should be constructed, as it is axiomatic that units should not be built but reasonably in advance of their need. Interest charges on unused works, resulting from too optimistic estimates of the progress of colonization, are one of the chief sources of embarrassment to irrigation projects in the west today.

Assuming the best possible progressive engineering plan devised the whole field of economics is opened up as to what are the benefits to be anticipated from its execution, the proper rate of development of units of the project, the financing and the equitable allocation of costs among all beneficiaries, including the state and the federal governments. The state and the United States should be expected to participate in the costs on the bases of state-wide and nation-wide benefits to be derived under existing state and national policies or as the same may be reasonably expected to be modified in the future. There will be an undoubted state-wide value in that the cities and industrial areas in non-agricultural regions will benefit from increased markets, commerce and transportation, and the national government will be directly aided by whatever is done in the

interest of navigation and flood control and also by the reclamation of land.

The legal phase of the problem must not be slighted as it may contain insurmountable obstacles. Water being an elusive subject, erratic in flow and difficult of measurement, often flowing underground, water law has become equally obscure and difficult and is one of the most fruitful fields of litigation. A thorough legal analysis of the proposed plan, leading up to the conclusion that it is legally and judicially capable of execution, and a reliable estimate of what water rights, rights of way and attendant litigation will cost, both in time and money, is a necessary item in the final cost estimate.

Having carried through such an investigation and produced an answer to each of these items in its proper sequence, a complete physical plan will be available, also a decision as to the immediate units justified if any; a conservative estimate of the cost of the projects recommended, also the anticipated financial benefits to all interests. If the benefits do not justify the cost, construction should be deferred until values and necessities have increased to the required point. If the cost is found reasonable, immediate execution should proceed more or less independently of the amount of the estimate, since no justifiable cost is too large to provide for future growth and development of a state and to prevent retrogression in areas already overdeveloped as regards water supply.

An investigation roughly along the lines heretofore indicated has been under way in California since 1921. The whole history and progress of this state, as with the others in the west, has been and is bound up with the use of its water supplies. From about 1900 on, as the unregulated summer flow of the streams became exhausted, it had become more and more realized that water was not unlimited and that unless properly conserved the growth of the state would be limited thereby. Many areas, large and small, were expanding irrigated areas beyond the dependable water supply, some by over-optimistic estimates based on the records or estimates of flow of a few wet years, but more by pumping from underground sources a greater amount than the replenishment thereto. In one section of the San Joaquin Valley some 20,000 irrigation pumping plants have in the last four years drawn from the underground storage an estimated net amount of 2,000,000 acre-feet in excess of the recharge in the same period. Irrigation diversions on the

rivers tributary to San Francisco Bay have so reduced the fresh water inflow that a delta area of some 400,000 highly productive acres has been seriously threatened by the incursion of salt water from the bay itself. It is beyond the power either of the people in the San Joaquin Valley and southern California, whose underground supply is insufficient, or of the delta area to remedy conditions facing them. These and similar conditions of shortage appeared in a great many places in California between 1900 and 1920, and were accentuated by the series of dry years commencing in 1917. These conditions especially led to the desire for a state-wide investigation and plan for complete utilization of water resources and the rehabilitation of areas facing abandonment of irrigation.

This investigation will have cost by the end of the current year approximately a million dollars, exclusive of stream gaging, topographic mapping and soil surveys. Water and land resources were first classified. From the stream flow data collected under the direction of the United States Geological Survey and the United States Weather Bureau rainfall records, an estimate of the 50-year mean run-off for each stream in the state was prepared. To carry this out for the entire area necessitated evolving new methods of technical attack to enable mass production.

As to precipitation data there were available 277 rainfall station records over ten years in length, many of which were of much greater time. The average or mean annual rainfall was obtained for each station. The total rainfall for a season at any station in per cent of its annual mean, was termed "The Index of Seasonal Wetness" for that year. The indices of wetness for each station for the period were plotted as mass diagrams, showing the accumulated departure from the mean, then by superimposition these diagrams were compared to define the various areas in the state having the same general precipitation characteristics. This established 26 precipitation divisions.

The state was then divided for purposes of study into 140 drainage basins, each basin being either a major drainage or a group of minor drainages. Streamflow records were available at 200 regular U. S. G. S. stations for varying periods up to a maximum of 28 years, and in addition fragmentary records at about 300 additional stations. From these data rainfall run-off curves were plotted and by superimposition critically compared both geographically and by types. Through these

comparisons the characteristic shapes of the curves both geographically and by type were closely determined and it was possible to extend the run-off curves to streams on which there were no actual flow measurements. By these methods rainfall run-off curves were completed for each of the 140 drainage basins in the state. Applying the indices of seasonal wetness in the 26 precipitation divisions to the rainfall run-off curves in the 140 drainage basins the value of the seasonal run-off for every drainage area in the state for the full 50-year period was estimated.

Mass diagrams of run-off were drawn for each area. These were plotted as accumulated run-off in per cent of variation from the annual mean, thereby producing a graph which gives all of the desired information in but a fraction of the space required by the usual mass curves. Irrigation draft lines were then prepared, being plotted in identical units and on the same scales as the mass diagrams. Superimposing the draft lines on the mass diagrams, the utilizable flow of the drainage basin with any given storage capacity was obtained, corrected for evaporation.

The location and amount of the irrigated and irrigable lands of the state were determined and a duty of water fixed for each of 16 agricultural divisions.

Special research was carried out with regard to possible flood control by reservoirs in combination with other uses. The probability of flood discharge for each stream was first calculated, followed by a compilation day by day for the years of record on certain selected streams to determine methods of flood control and their degree of interference with the purposes to be served. It was found that flood occurrence on these streams had controlling and limiting factors, which were as far as possible reduced to graphical representation. A method of flood control operation was devised, depending upon the rainfall to date and other factors. This analysis took much time and effort to complete and is of an intricate technical nature, and was recently issued in printed form.

Underground water studies in various sections of the state were also carried out in greater detail than ever theretofore attempted, and a technical method of evaluating the movement of water underground evolved.

Upon the basis of these engineering studies a preliminary plan for the conservation of the water resources of California was designed. The early units of the plan contemplated re-

## Detailed Figures on 19

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## PORTLAND CEMENT

District	County	Route	Section	Location	Miles	Contract	Contractor
II	Shastyou	3	B	Shasta River-Gaule	7.68	22TC1 22EC1	T. M. Morgan
II	Siskiyou	3	A	Near Weed and Mt. Shasta	0.87	22EC2	Mathews Construction Co.
III	Placer	3	A	Audora Subway-Lincoln	1.56	03EC3	Fredrickson & Watson
III	Sacramento	3	B	Ben Ali-Sylvan School	8.05	23TC1	Fredrickson & Watson
IV	Sonoma	1	C	Santa Rosa-Willowbrook	11.40	04EC1	E. Paul Ford
IV	Contra Costa	14	A	Through Pinole and Hercules	0.45	04TC2	Frentas Paving Co.
IV	Santa Clara	2	A	Sunnyvale-Santa Clara	4.60	04EC5	N. M. Ball
V	San Luis Obispo	2	E	Arroyo Grande-Pismo	3.28	05FC1	Cornwall Construction Co.
V	Santa Barbara-Ventura	2	H, G	2 miles S. of Carpinteria-Berham	1.20	05FC2	McCray Co.
V	Santa Barbara	2	J	Ortega Hill-Montecito	0.31	05FC5	Cornwall Construction Co.
V	San Luis Obispo	2	D	Cuesta-15 1/2 miles S. of Santa Margarita	1.85	05FC6	M. J. Bevanha
VI	Fresno-Madera	4	C & A	Herndon-Tharsa	1.90	06SC4	Hanrahan Co.
VI	Madera	4	B & C	Beronda King-Califa	4.59	26EC1	Valley Paving & Const. Co.
VII	Ventura	60	A	Hueneme Road-Little Sycamore Creek	11.60	07VC1	Jahn & Bressi Const. Co.
VII	Los Angeles	60	A	Little Sycamore Canyon-Solstice Canyon	11.46	07VC4	Sander Pearson
VII	Orange	2	B	At Irvine	0.72	07FC7	Steele Finley
VII	Orange	2	D	Santa Ana-Anaheim	4.90	07FC8	Griffith Co.
VII	Orange	2	A	West of San Clemente	0.19	07FC9	Matich Bros.
VII	San Diego	12	D, E, F	Pine Valley-Kitchen Creek	7.78	07CS1	Basich Bros. Const. Co.
VIII	Orange	2	A	Serra-San Juan Capistrano	0.71	27FC1	Matich Bros.
VIII	San Bernardino	19	A & B	Ontario-Pomona	2.50	08FC5	Matich Bros.
VIII	Imperial	26	F & C	El Centro-Brawley	9.78	08CS1	R. E. Hazard Contr. Co.
VIII	San Bernardino	26	A	San Bernardino-Santa Ana River	1.77	28VC2	Geo. Herz & Co.
X	San Joaquin	5	B	Santa-San Joaquin River	3.34	210TC1	C. W. Wood

## PORTLAND CEMENT

VI	Tulare	4	D	Plaza Garage-Oak Grove School	2.03	06FC2	C. W. Wood
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District	County	Route	Section	Location	Miles	Contract	Contractor
IV	Marin	1	B	Alto-Sausalito	3.31	04EEC1	Hollywood Paving Co.
IV	Santa Clara	2	A	Sunnyvale-Santa Clara	2.75	04EC5	N. M. Ball
IV	Marin	1	B	In San Anselmo	0.56	24EC1	A. G. Raiboh
V	Santa Barbara	2	I & G	Stony Creek-Teolotele Creek	3.42	05FC3	Sam Hunter
V	Monterey	2	B	Chualar-Salinas	10.30	25EC1	Peninsula Paving Co.
VI	Madera	4	B	Madera-Berenda Xing	7.42	05EC2	Hanrahan Co.
VI	Kern	33	D	Wasco-Famosa	8.00	06XC1	Valley Paving & Const. Co.
VI	Merced	4	C	Merced-Northerly	0.06	26EE2	Valley Paving & Const. Co.
VII	Los Angeles	9	I	San Dinas Ave.-Ramona Ave.	1.40	07FC3	Griffith Co.
VII	Los Angeles	9	I, J, C	Glendora-Claremont	5.50	07FC5	Griffith Co.
VIII	Imperial	26	B, C, D	0.7 mile S. of Kane Springs-Arroyo Salada	13.30	08FC2	R. E. Hazard Contr. Co.
VIII	San Bernardino-Los Angeles	9	A, D	Claremont-Cherry Ave.	10.39	08FC4	Steele Finley

# 29 Construction Records

see page 6)

## CONCRETE PAVEMENT

Resident Engineer	Street Assistant	Average strength of concrete at 28 days pounds per square inch.	Average strength, 90-day cast, pounds per square inch.	Ratio of average strength to special cast in per cent.	Average yardage laid per day.	Average daily variation in cement in per cent.	Roughometer index of roughness in inches, per mile.	Type of equipment used		District
								Mixer	Finisher	
F. R. Baker	A. Bigelow	3,445	4,468	77	271.4	0.34	10.6	Koehring 27 E.	2-Ords.	II
G. H. Webb	C. C. Harden	3,553			90.7	1.28	17.4	Rex 12 E.		II
J. D. Greene	C. E. Woodin	4,944	5,070	98	252.4	0.95	6.8	Footc 27 E.	2-Ords.	III
C. A. Potter	E. J. Peterson	4,371	4,189	104	381.6	0.69	7.8	Footc 27 E.	2-Ords.	III
W. A. Rice	E. Carlstad	4,279	4,743	90	296.7	1.05	7.3	Koehring 27 E.	2-Ords.	IV
F. E. Sorenson	L. G. Marshall	4,297	4,726	92	208.8	1.01	10.6	Footc 27 E.	2-Ords.	IV
C. F. Price	A. D. White	4,118	4,209	98	277.9	1.61	9.5	Koehring 27 E.	2-Ords.	IV
T. W. Voss	J. S. Peterson	4,356	4,706	93	226.6	0.93	9.0	Koehring 27 E.	1-Ord.	V
E. W. Taylor	N. S. Hamilton	3,881			193.6	1.43	8.4	Koehring 27 E.	1-Ord.	V
C. T. Schultz	W. G. Remington	3,183			171.5	2.27	6.0	Koehring 27 E.	1-Ord.	V
T. W. Voss	J. S. Peterson	3,275			195.9	0.98	8.3	Koehring 27 E.	1-Ord.	V
R. S. Badger	J. M. Farrell	3,570	3,982	90	296.1	1.16	8.8	Footc 27 E.	1-Ord.	VI
W. T. Rhodes	P. A. Boulton	3,505	4,057	86	254.7	1.37	7.0	Koehring 27 E.	1-Ord.	VI
C. N. Ainley	W. T. Lamb	3,881	4,765	81	293.6	0.84	7.1	Koehring 27 E.	1-Lakewood	VII
A. N. George	C. J. McCullough	3,995	5,128	78	273.8	0.72	7.4	Ransome 27 E.	1-Lakewood	VII
W. J. Calvin	J. A. Korner	4,278	4,328	99	148.2	1.02	10.7	Rex 21 E.	1-Lakewood	VII
C. N. Ainley	W. T. Lamb	3,976	4,307	92	308.0	0.57	4.4	Koehring 27 E.	1-Ord.	VII
H. B. Lindley	T. A. Roseberry	5,238			160.5	0.18	10.2	Rex 27 E.	1-Lakewood	VII
J. M. Luekey	C. J. McCullough	3,670	3,793	97	248.9	1.16	6.9	Rex 27 E.	1-Lakewood	VII
H. B. Lindley	T. A. Roseberry	5,044			236.3	0.77	11.2	Rex 27 E.	1-Lakewood	VII
J. M. Hollister	J. F. Knapp	3,639	4,562	86	141.2	0.81	4.9	Rex 27 E.	1-Lakewood	VIII
R. C. Payne	R. B. Millard	3,456	3,280	105	293.1	0.86	11.8	Koehring 27 E.	1-Lakewood	VIII
J. M. Hollister & R. C. Payne	P. W. Ball	3,892			211.8	1.00	8.8	Footc 27 E.	1-Ord.	VIII
G. R. Hubbard	F. M. Parrish	4,149	3,832	108	231.5	0.72	9.0	Footc 27 E.	2-Ords.	X

## CONCRETE SHOULDERS

F. N. Hveem	F. O. Brown	3,642			112.5	0.62		Footc 27 E.	1-Ord.	VI
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## CRETE PAVEMENT

Resident Engineer	Street Assistant	Type of finish by miles		Average tonnage laid per day.	Average relative sp. - 90-day greater of surface mix in per cent.	Average stability of surface mix in 4 pounds.	Roughometer index of roughness in inches per mile		Type of equipment used		District
		Hand	Machine				Hand finish	Machine finish	Mixing plant	Finisher	
M. C. Fosgate	R. A. Westbrook & P. O. Harding	3.31		254.8	98.0	9,500	20.4		Madsen		IV
C. F. Price	R. A. Westbrook		2.75	394.4	94.9			13.0	Madsen	1-Ord.	IV
M. C. Fosgate	D. N. Sapp	0.56		137.3	97.3		23.6		Geiger		IV
C. T. Schultz	J. C. Adams & R. W. Beckes		3.42	310.9	98.2	2,863		12.6	Geiger	1-Ord.	V
C. T. Schultz	E. D. Davis		10.30	790.7	96.4	3,668		7.9	Geiger	2-Ords.	V
P. L. Wilcox	P. A. Boulton		7.42	455.6	97.4	4,925		8.2	Geiger	1-Lakewood	VI
H. B. LaForge	J. A. Whyte		8.90	539.0	96.2	2,160		8.4	Union Tank & Pipe Co.	1-Ord.	VI
R. S. Badger		0.06					23.4		Geiger		VI
W. D. Eaton	H. D. Johnson		1.40	280.3	94.9	3,913		17.8	Madsen	1-Ord.	VII
W. D. Eaton	H. D. Johnson		5.50	682.6	95.3			12.8	Totman	1-Ord.	VII
A. Wallace & J. M. Hollister	E. A. Bannister & C. Foreman		13.50	444.2	96.4	2,921		20.2	Madsen	1-Ord.	VIII
H. O. Ragan	T. B. Landers		10.39	553.8	98.0			19.8	Madsen	1-Ord.	VIII

YEARLY COMPARISONS BY DISTRICTS

District	Miles constructed										Average compressive strength, pounds per square inch, 28 day age										Average roughness, inches per mile									
	1924	1925	1926	1927	1928	1929	1924	1925	1926	1927	1928	1929	1924	1925	1926	1927	1928	1929	1924	1925	1926	1927	1928	1929						
I	9.9	6.6				4.080					8.6	3,340	4,080			3,453														
II	1.6	1.6				4,055					9.6	3,435	4,055			3,190														
III	0.6	0.6				3,435					1.1	3,250	3,435			4,449														
IV	4.3	7.7	7.2	10.3	4.6	10.0	6.6	6.5	37.2	2.0	37.4	3,205	4,070	4.145	4,410	4,735	3,600	3,945	3,561	4,169	15.9	10.5	10.5	7.5						
V											10.0	3,205	3,945	3,960	4,410	4,735	3,600	3,945	3,561	4,169	15.9	10.5	10.5	7.5						
VI	8.0	8.6	44.6	37.2	2.0	37.4	3,205	4,070	4.145	4,410	4,735	3,600	3,945	3,561	4,169	15.9	10.5	10.5	7.5	9.6	8.1	9.6	7.0							
VII	12.5	12.5	3.0		4.8						14.0																			
VIII																														
IX																														
X	13.0	9.0	0.5								3.2	2,680	4,400	4,214	4,510	4,235	3,980	3,980	4,169	15.9	10.5	10.5	7.5	9.0						
State	61.1	51.5	55.3	54.0	83.6	102.4	3,150	4,311	4,214	4,510	4,235	3,980	3,980	4,169	15.9	10.5	10.5	7.5	9.6	8.1	9.6	7.8	8.2							

PORTLAND CEMENT CONCRETE PAVEMENT

ASPHALTIC CONCRETE PAVEMENT

District	Miles constructed										Average roughness, inches per mile													
	1924	1925	1926	1927	1928	1929	1928	1928	1928	1928	1928	1928	1928	1928	1928	1928	1928	1928	1928	1928	1928	1928	1928	1928
I																								
II																								
III																								
IV																								
V																								
VI																								
VII																								
VIII																								
IX																								
X																								
State	26.6	16.3	47.7	25.7	12.2	7.6	37.2	4.0	63.6	30.1	35.2	34.1	25.2	14.6	30.9	14.7	30.9	13.6	30.9	14.7	30.9	13.6	30.9	

BITUMINOUS MACADAM

District	County	Route	Section	Limits	Length in miles	Contract	Contractor	Resident Engineer	Street Assistant	Roughometer index of roughness, inches per mile	District
I	Humboldt	1	I	Mill Creek-Little River	5.92	21TC3	Hestey-Moore Co.	E. A. Wolfe	R. C. Hagberg	47.2	I
III	Yuba	3	A	Dry Creek-Morrison's Xing	1.44	23HC1	J. E. Johnston	J. D. Greene	E. R. Czekowicz	62.5	III
III	Placer	3	A	Roseville-1/2 mile N. of Andora Subway	1.40	23HC1	J. E. Johnston	J. D. Greene	E. R. Czekowicz	58.5	III
III	Placer	37	A & B	Bowman & Weimer	1.65	03TC3	Fredrickson & Watson	A. R. McEwen	W. L. McFadden	66.9	III
III	Placer	37	A & B	Auburn-Colfax	13.80	03TC4	C. W. Wood	J. N. Bidwell and J. N. Greene	R. R. Czekowicz	49.6	III
IV	Marin	1-69	C & A	San Rafael-San Quentin	2.97	04WC1	Ganfield, Farrar & Carlin	M. C. Fosgate	D. N. Sapp	37.0	IV
IV	Contra Costa	14	A	Through Pinole and Hercules	1.74	04TC2	Preniss Paving Co.	E. E. Sevenson	L. G. Marshall	31.3	IV
IV	Sonoma	8	A & B	Fairville-Vineburg Jct.	7.28	04TC3	A. Teichert & Son	P. O. Harding	E. Carstad	35.1	IV
IV	San Mateo	68	A	San Francisco South San Francisco	3.25	04TC1	H. W. Kohl	H. S. Payson	C. I. Largent	42.6	IV
IV	Marin	52	A	At Alto	0.65	04CN1	Graudfeld, Farrar & Carlin	M. C. Fosgate	D. N. Sapp	42.7	IV
IV	Santa Clara	5	A	Napa Wye-Solano County Line	2.81	04TC3	Fredrickson & Watson	P. O. Harding	E. Carstad	34.4	IV
V	San Benito	5	B	1 1/2 miles N. of Eschmanns San Juan	2.41	03TC1	W. H. A. Donnanville	K. E. Adams	G. A. Ullom	52.2	V
V	San Benito	35	B	1 1/2 miles N. of Eschmanns San Juan	2.41	03TC1	A. Teichert & Son	H. E. Cooper	G. A. Ullom	44.0	V
V	San Luis Obispo	33	B	1 1/2 miles W. of Shafter East Boundary	15.83	03XC1	A. Teichert & Son	H. E. Cooper	G. A. Ullom	44.0	V
V	San Luis Obispo	33	B & C	San Luis Obispo-City Reservoir	1.00	05TC4	Artes-Kearny Co.	P. E. Johnson	G. A. Ullom & E. F. Carter	68.5	V
V	San Luis Obispo	33	B	San Luis Obispo-City Reservoir	1.00	05TC4	M. J. Revardita	J. C. Adams	T. C. Peterson	48.0	V
V	Santa Barbara	2	E	Los Alamos-1/2 mile North	1.83	07TC1	Geo. Mitchell Co.	R. D. Kinsey	T. A. Resberry	51.8	VII
VII	Los Angeles	4	E	N. City Limits of Los Angeles-Newhall Tunnel	0.66	07FC6	Gibbons & Reed	R. D. Kinsey	T. A. Resberry	60.0	VII
VII	Los Angeles	4	C	1/2 mile N. of Kelly's-1/2 mile N. of Sandberg's	1.98	07FC6	Gibbons & Reed	R. D. Kinsey	T. A. Resberry	60.0	VII
X	Solano	8	A	W. Boundary-1/2 mile W. of Cordoba	2.24	010BC8	Fredrickson & Watson	E. L. O'Connell	R. H. Lepp	62.5	X

PLANT OIL MIX

District	County	Route	Section	Limits	Length in miles	Contract	Contractor	Resident Engineer	Street Assistant	Roughometer index of roughness, inches per mile	District
III	Placer	17	A & P	Roseville-Rocklin	2.46	08FC4	J. E. Johnson	E. J. Peterson	H. L. Townsend	42.9	III
VI	Kern	57	E & C	Bakersfield-11 miles East	10.95	06XC3	Forco, Corrigan & McLeod	E. J. Peterson	C. L. Harkins	34.2	VI
VI	Fresno	10	F	8 miles E. Patched Jet-Costlinga	5.50	06CN1	Tieslau Bros.	E. N. Hyman	C. L. Harkins	30.9	VI
VI	Tulare	10	F	Three Rivers-Sequoia National Park	5.73	06CN1	F. W. Nighbert	F. N. Hyman	C. L. Harkins	37.2	VI
VIII	San Bernardino	58	G & H	4 miles W. of Hector-2 miles W. of Argos	13.95	08VC4	Allied Contractors, Inc.	G. E. Malcom	M. P. McDonough	27.4	VIII
VIII	San Bernardino	31	H & J	Yermo-Dunn	20.59	08VC3	Dillon & Boies	J. M. Holges	R. M. Lindsey	23.0	VIII
VIII	San Bernardino	58	F & G	Daggett-4 miles W. of Hector	21.41	08VC3	Dillon & Boies	O. B. Brinkerhoff	F. H. Richardson	16.4	VIII
VIII	Riverside	64	C & D	9 miles W. of Hopkins Well-Black Butte	21.93	08VC1	Geo. Herz & Co.	Howard Noble and E. A. Bannister	W. Ford	7.5	VIII
IX	Kern	23	B	Mojave-7 miles S. of Cinco	9.85	09VC8	Bartlett & Mathews	S. C. Riley		28.7	IX
IX	Inyo	23	L	Dias Lake-Alabama Gate	8.40	09VC1	Southwest Paving Co.	H. M. Hansen		18.8	IX
IX	Inyo	23	K	Cottonwood Creek-Dias Lake	10.32	09VC2	G. W. Ellis	H. M. Hansen		13.0	IX
IX	Inyo	23	J	Olaucha-Cottonwood Creek	9.30	09VC1	Southwest Paving Co.	V. E. Pearson		22.3	IX
IX	Kern	23	B	7 miles S. of Cinco-Cinco	7.26	09VC5	Southwest Paving Co.	W. Mathews		21.9	IX

ROAD OIL MIX

IX	Inyo	23	B & C	Tinnamaha Dam-Big Pine	6.71	99CS1	Montfort & Armstrong	J. N. Bidwell		8.7	IX
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ARMOR COAT

II	Shastya	3	C	Klamath River-Ore. Line	14.15	22LC1	Jack Casson	R. C. Tumelty		42.4	II
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## THE MAXIMUM CONSERVATION OF WATER WITH REFERENCE TO THE CALIFORNIA PLAN

(Continued from page 19.)

lieving existing emergencies, particularly supplying water to areas which have already overdrawn the present supply. In southern California there was proposed the importation of Colorado River water in a manner which is now under intensive study by the Metropolitan Water District of that area. In the Sacramento and San Joaquin valleys, otherwise known as the Great Valley, the plan contemplated storage of water in the northern watersheds, surplus to the ultimate future needs of that area, and its transportation to the deficient lands of the San Joaquin Valley several hundred miles to the south. In devising the transmission system a gravity canal was at first considered, but was found to be prohibitive in cost. From a diversion on the Sacramento River at the proper elevation to afford gravity delivery to the southern end of the San Joaquin Valley would require a canal very nearly 1500 miles in length, which would be in mountain or foothill country almost its entire distance. As a substitute a plan of allowing the water stored in the Sacramento Valley to flow after release down the Sacramento River to the delta area and to be pumped therefrom into the San Joaquin Valley, was investigated and found to present a superior solution. In this set-up the channel of the San Joaquin River would be used as a conduit and by a system of dams and pumping plants the Sacramento River water would be forced up the San Joaquin River against its grade to the desired elevation. This arrangement was found to be vastly cheaper than the gravity lay-out, both in capital and annual costs, and it also had many other advantages, such as more dependable water supply, elasticity of operation and freedom from legal and water right difficulties.

This engineering plan has not yet been completed in all of its details, but the conception has been presented. By-product power will be realized to its fullest extent and irrigation, saline control, navigation and flood control will be accomplished as an effect of its execution, as well as the furnishing of water for other purposes.

One item in the ultimate plan of interest is the construction of a dam or barrier across Carquinez Straits in San Francisco Bay, some miles below the junction of the Sacra-

mento and San Joaquin rivers. Various sites for such a dam were explored, varying from one to two miles in width and in water depth from 100 to 50 feet or less. After a thorough study it was decided that such a structure could be built, but at a cost of about \$50,000,000. Its construction is a necessary item ultimately. It would eliminate the salt water menace and would make possible the transfer of water into the San Joaquin Basin with a minimum of loss; however, it is not indispensable to such transfer for many years, as the salinity problem in the agricultural delta could be controlled by the wastage of sufficient fresh water to hold the salt water from the bay at a predetermined point.

The physical plan has taken fairly definite shape, and many of its main cost items are known. However, until the last year no study had been made nor conclusion reached as to its economic or legal feasibility, method of financing, nor of obtaining the necessary federal consent and justifiable participation. At the present time the completion of the engineering work is being carried out, as well as the economic and other items. Determination of the value of such a gigantic proposal is indeed a difficult matter and requires the combined services of engineers, economists, agriculturalists, attorneys, financiers and statesmen.

The technical studies, while of the greatest magnitude, are the most definite and susceptible of determination, the economic answer being far more difficult to get at with a reliable degree of accuracy. Such studies are proceeding, however, and it is expected that a conclusion as to the feasibility of the project or certain units thereof will be reached within a year. After taking all benefits into account if the plan is feasible, legal, financial and political plans for carrying it out will next come under study.

There is great public interest in California in this suggested plan, and general acceptance of the idea that the conception is sound and will come about in later years, if not at once. Great pressure is being exerted for an early start by the areas undergoing reduction in cultivated areas on account of lack of water. The state and the national governments have appointed commissions to investigate and report upon the whole subject and it is receiving wide attention from legislators, financiers, business men, farmers and considerable attention even from larger cities. The magnitude of the proposed work is illustrated by the cost estimates, which range from \$100,000,000 with the fewest number of units suggested to over

\$700,000,000 with the maximum which have been recommended for early consideration.

If such a plan is carried out under the direction of the state itself, and it does not seem possible for any other agency to successfully accomplish it, other questions of a state or political nature arise. California climatically and geographically is separated into several divisions. The northwest coast area with 25 per cent of the water supply of the state and only 2 per cent of the agricultural lands has no water problem and little interest in the situation. The Great Central Valley, with approximately 13,000,000 acres of land and 37,000,000 acre-feet of mean annual water supply, will require such a plan for its development, and it has furnished the main support for the investigations to date. Southern California with 20 per cent of the land and only 1 per cent of the water supply has more than half the population and the assessed valuation of the entire state and is undergoing a water shortage of such severity that relief is imperative. This section plans to import water from the Colorado River at a cost in the neighborhood of \$300,000,000. It is apparent that a conservation plan, carried out under state auspices, and partly or wholly by state bond issue, must assist all portions of the state in need and not be local in character. It is also apparent that to recommend a plan, sound from the engineering and economic standpoints, which will also properly take into account the various sections of the state in such a way as to be satisfactory to the voters of the entire state who must ultimately pass upon it, is indeed a problem of the first magnitude, which can be solved only by the cooperative and constructive efforts of all concerned. Wide vision, sound business judgment and complete and accurate information are essential to the success of such an undertaking.

#### U. S. RECLAMATION BOARD AIDS IN WATER STUDY

(Continued from page 15.)

The means for conserving available water.

The means for conveying and distributing water to and over areas of deficient water supply.

The ability of lands to contribute to the cost of development.

The physical and economic feasibility of the plan.

The units of the plan worthy of first consideration.

## Statistical Story Of U. S. Highways Is Told in Booklet

A statistical story of the growth of highway systems in the United States and in the world is recited in *Highways Handbook*, recent illustrated publication by the Highway Education Board.

"The building of the modern highway system," says Thos. H. MacDonald, chairman of the Board, in a brief introduction, "has no counterpart in the public works of any nation.

"The construction of the Panama Canal was a task of large magnitude; its completion a great national achievement; yet large as it was the contribution of the federal government alone to the construction of highways far outmeasures it, and the part of the federal government in the program of road improvement has been relatively small. The greater part of the work has been done by the states and their subdivisions.

"The story of this great constructive work wants no elaboration. The bare figures of miles built and money invested are impressive beyond need of added emphasis; and it is such an unembroidered story that is told by the facts and figures presented in this booklet."

Data and information used in the booklet are from government tabulations, the Board says, the United States Bureau of Public Roads and the automotive division of the Bureau of Foreign and Domestic Commerce being the principal sources of supply. The 97 pages of the handbook, the first comprehensive grouping of highway statistics into one volume, are divided into ten chapters, each treating of a separate phase of the subject.

One chapter is devoted to a general summary, an itemization of interesting features in connection with the subject. What is the longest paved road in the world; what state has the largest highway mileage; what is the shortest road and the most narrow street; what is the proportion of the United States highways to the rest of the world? These and a hundred other pertinent questions are answered in the section on "milestones."

For the student, the book is a treasure trove. Tables giving total road mileage, road income, and expenditures, and other related data, by years, by types, by states and by counties appear frequently in the booklet. The total road expenditure for 1928, for instance, was \$1,423,870,273, which is broken up into various subdivisions covering construction, maintenance, administration, purchase of equipment and bond interest.

Of the total 1928 highway income of \$1,566,946,170, 20 per cent was derived from motor vehicle fees, 18 per cent from gasoline taxes, 5 per cent from federal aid, 17 per cent from bonds, 27 per cent from general taxes and 13 per cent from miscellaneous funds. General taxes fall 2 per cent short of covering the cost of maintenance alone.

In the table on total mileage and total mileage surfaced, it is disclosed that of the 3,016,281 miles of rural roads in the United States, 69 per cent is under the supervision of local authorities, or those other than state and federal officials.

Average automobile receipts for highway improvement have increased steadily from year to year, the booklet shows, despite or perhaps because of the growing number of automobiles. In 1919, with a registration of 7,566,446 vehicles, the average receipts per

(Continued on page 31.)

Progress of Water  
Resources Study



Progress in Flood  
Control and Rec-  
lamation

## Review of April Activities

In the

### Division of Water Resources

EDWARD HYATT, Chief of Division

Adjudication of  
Water Rights



Report on Dam  
Inspections

### WATER RESOURCES INVESTIGATION

#### SAN JOAQUIN VALLEY

*Land Classification and Crop Survey.*—All field and office work including mapping of land classification is complete. All field work and office compilations on the crop surveys are complete. Map delineating cropped areas yet to be made.

*Ground Water Investigation.*—A geological and hydrographic study of ground water storage reservoirs was initiated during the month. These studies will determine the location and capacity of these reservoirs and also the rate of absorption of surface applications. These items are very important in the distribution and utilization of the run-off of San Joaquin Valley streams south of San Joaquin River because they have important bearing on the size and operation of surface storage reservoirs for maximum utilization of the water resources of the southern San Joaquin Valley.

*Main Supply Canals.*—A paper location and field reconnaissance and cost estimates have been completed for all gravity canals from Feather River to Kern River and from American River to Mendota on the San Joaquin River. A location survey and preliminary cost estimates of Canal from Kings River to Kern County have been completed. The survey for a higher location of a canal from the San Joaquin River to Kings River which would deliver water to Kern River by gravity is 50 per cent complete.

#### SACRAMENTO VALLEY

*Water Supply.*—Estimates of the run-off of Sacramento River at Iron Canyon, Sacramento River at Kennett, Feather River at Oroville, Yuba River at Smartsville, Butte Creek, American River at Folsom and American River at Van Trent as would be impaired by ultimate upstream use in the mountain and foothill areas have been completed. Maps have been prepared showing the location of these mountain and foothill users.

*Land classification.*—Land classification and crop survey have been completed in the Sacramento Valley. This covered an area of 8,000,000 acres. The area covered in the past month includes lands in the foothill area along the west side of the valley from Vacaville to Redding together with lands in the northern end of the valley in Shasta and Tehama counties. Summaries have been prepared in the office of both crops and land classification by counties, together with summaries for irrigation and reclamation districts.

*Water Requirements.*—A study is now under way to determine the gross duty and consumptive use of water in the Sacramento Valley.

*Surveys.*—Additional surveys of the Fairview dam site on the Trinity River and complete surveys of the Camp Far West dam site and reservoir site on the Bear River have been made. A test pit has been started at the Iron Canyon dam site and bids have been called by the U. S. Engineer's office for three test tunnels at the Kennett dam site.

*Engineering Advisory Committee.*—An inspection trip was made by the Engineering Advisory Committee during the past month to dam sites on the Feather, Yuba and Bear rivers. This committee consists of the following engineers: F. C. Herrmann, J. B. Lippincott, Fred H. Tibbets, J. D. Calloway, Walter L. Huber.

*Geologic Examinations of Dam Sites.*—Geologic examinations and reports have been made by a geologist of dam sites on the Feather, Yuba and Bear Rivers.

#### SALINITY INVESTIGATIONS

During the past month the work on salinity investigations has been devoted entirely to office studies and analyses of the data collected during the past year. Substantial progress has been made on the analyses of the relation of salinity to stream flow and tidal action. Every effort is being made to complete the program of office studies and obtain final conclusions as to the behavior of salinity and complete the preparation of a report thereon by the middle of this coming summer.

Thirty-two regular salinity observation stations are being maintained continuously, covering the entire tidal basin of the upper bay and delta region. Samples are being taken and analyzed every four days at these stations. In addition, the drainage water at eight stations on several of the islands in the delta is being sampled and analyzed every four days.

#### SALT WATER BARRIER INVESTIGATION

Work on the salt water barrier investigation during the past month has been chiefly concentrated on an intensive survey of the industries within the area affected by the salt water barrier. The field work on the industrial survey was actually started on March 14 and has been prosecuted diligently since that date. A printed questionnaire which has been carefully prepared is presented to each industry by a personal representative from the State Engineer's office and the data are filled in on this questionnaire by the executives and engineers of the various industries. Thus far the industrial survey has been confined to the upper bay area including Contra Costa, Solano, Sonoma and Marin counties. It is possible that the survey will be carried at a later time into Alameda County. Work

has also been started on a survey of the agricultural development in the delta area. This survey will be extended into the marsh land and upland area tributary to the Suisun and San Pablo bays to include all of the agricultural area which may be affected by the proposed barrier.

On March 28 the Engineering Advisory Board on the Salt Water Barrier investigation, consisting of C. E. Grunsky, Thomas H. Means, George A. Elliott, A. Kempkey, Chas. D. Marx, C. T. Leeds, Geo. A. Atherton, met in the State Engineer's office in Sacramento and carefully reviewed the program of work and the operations and studies under way. A field trip was made by boat on March 29 inspecting all of the proposed barrier sites.

A cooperative investigation has been continued during the past month by the Department of Public Health, Bureau of Sanitation on an intensive study of sewage pollution and industrial waste and their effect on the proposed barrier. The State Fish and Game Commission of the Department of Natural Resources has continued work on their cooperative investigation of the fishing industry and the relation of the barrier thereto.

#### NAPA COUNTY INVESTIGATION

The water resources investigation of Napa County which is being carried on in cooperation with the county, is well under way. Permanent recording stations have been installed on Conn Creek at the mouth of the Canyon, and on Napa River near St. Helena and near Napa by which a continuous record of the flow of the streams at those points will be made available. Frequent measurements are being made also on Conn Creek at various points between the Canyon mouth and the confluence with Napa River for the purpose of ascertaining to what extent this is a rising or a losing stream, i. e., to what extent it is a contributor or a drain of ground water. And in order to ascertain the effect of stream flow, rainfall and diversions upon the ground water some eighty wells have been selected, scattered throughout the Napa Valley, in which frequent readings of water level will be taken.

#### SANTA CLARA INVESTIGATION

The investigation of water resources in Santa Clara County carried on in cooperation with the Santa Clara Valley Conservation District is also well under way. Stream gaging stations with continuous flow recorders have been established on Stevens, Alamos, Los Gatos, and Guadalupe creeks and occasional measurements are being made on those streams to ascertain the percolation in the stream channel at various sections. The fluctuation of ground water levels is being observed at approximately 240 wells.

## FLOOD CONTROL AND RECLAMATION

#### MAINTENANCE OF SACRAMENTO AND SAN JOAQUIN DRAINAGE DISTRICT

Maintenance work on the flood control project has been mostly routine during this period. Preparations have commenced for irrigating the willow planting along the east levee of the Sutter By-pass. The drainage pumping plants along the Sutter By-pass levee have been in operation a considerable portion of the time.

The Dutton Dredge Company's dragline excavator has completed the enlargement of the West Intercepting Canal, and is now engaged in cleaning and enlarging the canals in the pumping plant No. 3 system.

A dragline machine operated by Robert P. Easley has completed cleaning the ditches of the No. 1 pumping system and is now proceeding to clean the main drainage canal from pumping plant No. 2 to Gilsizer Slough.

Repairs have been made to the flume crossing of the Sutter-Butte Canal Company over the West Intercepting Canal where it has been enlarged, and a new bridge is being constructed on the Wadsworth ranch made necessary on account of enlarging the West Intercepting Canal.

#### FLOOD CONTROL PROJECT MAINTENANCE BANK PROTECTION

All of the ten tree and steel retards on the right bank of the Feather River near Nicolaus have been completed. This work was undertaken in cooperation with the county of Sutter and was done under contract with the Pacific Coast Construction Company.

The eight current retards on the right bank of the Sacramento River below Knights Landing in Reclamation District No. 730 have been completed.

The cooperative work of bank protection on the left bank of the Sacramento River opposite Rio Vista, in cooperation with Brannan Island Reclamation District No. 2067 is practically complete. The work consisted of depositing rubble rock, maximum size 10 inches, along the bank for a distance of about 3000 feet, and approximately 2000 tons were placed.

Request has been made for cooperation with the Sacramento River West Side Levee District in the construction of three retards on the right bank of the Sacramento River, three miles below Colusa, at an estimated cost of \$8,100.

#### SACRAMENTO FLOOD CONTROL PROJECT

The work of by-pass clearing has been resumed. A force of approximately twenty-five men is working out of Sutter City in the Butte Slough By-pass, and the Robbins camp has been reopened with a crew of about thirty men. A. Mitchell is proceeding with clearing 100 acres under contract, which work is approximately 25 per cent complete. Preparation is being made to establish a camp of about twenty-five men on our floating equipment in the southern part of the Sutter By-pass.

The five contracts for clearing timber in the Feather River overflow channel above Marysville are continuing and are about 80 per cent complete. During the past period the timber surveys in this area have been completed.

In connection with the West Intercepting Canal, which was recently completed by the California Debris Commission, we are doing miscellaneous work in connection with various right-of-way agreements, consisting of fence and bridge construction, leveling spoil bank, and caring for irrigation and drainage.

A number of reports have been prepared on applications for the Reclamation Board.

#### RUSSIAN RIVER JETTY

Repairs to the gas shovel have been completed and the quarry work has been discontinued pending the completion of additional length of timber construction on the jetty. The driving crew and equipment have been organized and commenced work on March 31 with a crew of ten men.

#### SALINAS RIVER CHANNEL

A conference was held in the Attorney General's office on April 8 with Mr. Leon French, Colonel Bennett and a number of representatives of the various sporting organizations, in regard to securing right of

way for this channel. The matter is not yet clear, but a number of means were suggested. An attempt will be made to get this work under way as soon as possible. Examination of the site of the work and the immediate vicinity was made on April 13.

#### NAVARRO RIVER JETTY

As a preliminary to the completion of plans for this work, an examination of the site was made on April 8. It is planned to have the work under way some time during June.

## DAMS

### APPLICATIONS RECEIVED FOR APPROVAL OF DAMS BUILT PRIOR TO AUGUST 14, 1929

39 applications were received for approval of existing dams during this period bringing the total of such applications to 615. There remain about 70 dams for which applications have not been received. The great majority of these owners have been reached and with very few exceptions have expressed their willingness to file. Most failures to file have been due to ignorance of the law and every effort is being made to reach all owners.

### APPLICATION FOR APPROVAL OF PLANS AND SPECIFICATIONS FOR CONSTRUCTION

Dam	County	Owner	Estimated cost
Allen	Sutter	Preston School of Industry	\$10,120
Lake Loveland	San Diego	Southern California Water Supply Company	490,258

The Lake Loveland project is located on the upper reaches of the Sweetwater River in San Diego County. The purpose of this dam is to store 27,700 acre-feet of water for municipal, domestic, irrigation and industrial uses. It is to be a concrete arch with variable radius, 183 feet in height.

Consultants have been retained to review the plans for the Chatsworth project of the city of Los Angeles. This board consists of: J. B. Lippincott, Consulting Engineer of Los Angeles; Prof. Chas. D. Marx, Consulting Engineer, Leland Stanford Jr. University; Prof. John P. Buwalda, Consulting Geologist of the California Institute of Technology.

### PLANS APPROVED FOR CONSTRUCTION

Dam	County	Owner	Estimated cost
Chenery	Contra Costa	California Water Service Company	\$300,000
Rock Creek	El Dúrcado	Arthur Rasor	2,900

### PLANS APPROVED FOR ALTERATIONS OR REPAIRS

Dam	County	Owner
Malibou Lake	Los Angeles	Malibou Lake Mountain Club

*e. Inspections* have been made on almost all privately owned dams situated in the lower altitudes, and are now being extended to dams at about 5000 feet elevation, which is the practical limit of accessibility. These are in the nature of preliminary investigations and a final inspection will be made after an analysis of each dam has been made in the office.

Arrangements have been made with the larger owners looking toward handling of each owner's dams by the same inspector as far as possible. This will eliminate duplication and tend to create better cooperation with all parties concerned.

## WATER RIGHTS

### ACTION ON APPLICATIONS TO APPROPRIATE WATER

During the month of March there were received 37 applications to appropriate water. Six applications were canceled, and 16 were approved. Fifteen permits were revoked.

Field work in connection with the inspection of projects under permit was recommenced on March 31 after the usual winter cessation of such activities. A revision of methods in this phase of the work has made possible a considerable reduction of effort and expense. By careful study of the annual progress reports and by letters to permittees in doubtful cases, inspections are avoided unless the project is abandoned or actually ready for license. Whereas, formerly approximately 25 per cent of all pending permits were inspected annually, this year less than 10 per cent of the pending permits will be inspected. Permits were hitherto inspected on an average of at least twice before disposed of by revocation or license, whereas, under the present system, at least three out of each four inspections result either in license action or revocation, thus disposing of the case.

### PIT RIVER INVESTIGATION

The routine field work of the Pit River investigation was continued throughout the month. Staff gages were installed in the gravity ditches throughout the area to obtain an accurate record of diversions during the 1930 season. A snow survey along the several snow courses within the area was made on April 1st.

### ADJUDICATIONS

*Shasta River (Siskiyou County)*: This case has been submitted to the court, except for the Long Bell Lumber Company's Exception relative to the water rights on Beaughan Creek. This latter matter is still pending, awaiting action by the exceptors' attorney in securing a settlement of the points involved by an agreement among the water users.

*Whitewater River (San Bernardino and Riverside Counties)*: The Whitewater River adjudication proceedings are pending in the Superior Court of Riverside County, by consent of all parties in interest, awaiting developments in regard to the proposed All American Canal from the Colorado River, the construction of which, if assured, will probably eliminate the remaining issues and open the way for a decree without further trial.

*North Cow Creek (Shasta County)*: Submission of the final referee's report is being withheld pending negotiations now in progress which, if successful, will settle one of the important issues in the case out of court.

*Oak Run Creek (Shasta County)*: Case pending in court awaiting entry of a decree in the North Cow Creek proceedings. A stipulation for consent judgment contingent upon the confirmation of certain findings in the North Cow Creek case has been signed by all parties in the Oak Run Creek case, and this stipulation is now before the court.

*Clover Creek (Shasta County)*: Case pending in court and will be set on the calendar for hearing on the referee's report at an early date.

*Butte Creek (Siskiyou County)*: This matter is pending in the Superior Court, awaiting action by the parties involved.

*Emerson Creek (Modoc County)*: The Emerson Creek Court Reference proceedings were terminated

by a court decree entered by the Superior Court of Modoc County, on March 25, 1930. This decree established the water rights to the extent of 24.65 cubic feet per second, owned by twelve parties for irrigation and domestic use on approximately 1900 acres of land.

The Emerson Creek case was referred by the Superior Court of Modoc County on April 1, 1927. Engineering data were collected in the field throughout the 1927 season, and a tentative schedule of allotments was administered by a water master during the 1928 season. On March 19, 1929, at a meeting of the parties involved, a stipulation for consent judgment fixing a schedule of allotments, based upon the results of the trial distribution of 1928, was presented to and adopted by the water users. The court decree was entered in accordance with the provisions of this stipulation.

*Los Alamos Creek (Santa Barbara County):* A stipulation for consent judgment has been signed by a majority of the water users and is now being circulated among the remainder of them.

*Davis Creek (Modoc County):* A stipulation for consent judgment was submitted to the water users at a meeting held at Davis Creek on March 18. The stipulation was signed by all parties present, with the exception of two, and is now being circulated among nonresident water users.

*Mill Creek (Modoc County):* A proposed schedule of distribution for the 1930 season was submitted to and adopted by the water users at a meeting held on March 18. This schedule will be administered by a water master during the 1930 season, as a trial allocation of the waters of the stream.

*Deep Creek (Modoc County):* The Deep Creek case was referred to the Division by the Superior Court of Modoc County on March 22, 1930, under the procedure provided for in section 24 of the Water Commission Act. This case involves the rights of some 20 parties to the use of the waters of Deep Creek in Surprise Valley, Modoc County, for irrigation and domestic purposes on approximately 1200 acres of land. Field work on the investigation was begun on March 23, 1930, and is being conducted in conjunction with the water master service on the various streams in Modoc County.

#### WATER DISTRIBUTION

*Davis, Emerson, Mill, Owl and Soldier Creeks (Modoc County):* Water master service was begun on these streams for the 1930 season on March 19, and involves the distribution of water for approximately 11,000 acres of land.

*Little Shasta River (Siskiyou County):* Water master service commenced on April 1st for the 1930 season. An area of approximately 5000 acres of land is covered by the distribution of the waters of this stream.

*Pit River (Modoc County):* Water supervisor service was commenced on Pit River on April 1, 1930. This service consists of the supervision of all diversions from Pit River in Big Valley, in accordance with an agreement entered into by the Big Valley Water Users with the object of conserving water by the elimination of wastage through keeping the parties posted as to water supply conditions and causing them to divert in rotation during the critical period of the season. The resident engineer in charge of the Pit River investigation has been appointed Pit River Water Supervisor and will carry on the distribution work in conjunction with the Pit River investigation. Supervision will be maintained over diversions supplying water for the irrigation of approximately 10,000 acres of land.

### IRRIGATION, WATER STORAGE DISTRICTS

During the month construction work in progress in the Banta-Carbona, El Dorado, Oroville Wyandotte, Thermalito and West Stanislaus irrigation districts was inspected and conferences were held with officials of the first two districts named above. Visits of inspection were made to the Woodbridge, West Side and Hollister irrigation districts and to the proposed Richvale and Rio Seco irrigation districts. The Richvale and Rio Seco irrigation districts are located in Butte County and comprise 19,700 acres and 8000 acres, respectively, of rice lands now served by the Sutter-Butte Canal Company.

A number of proponents and opponents for the organization of the proposed Feather and Sutter irrigation districts located in the Sutter-Butte area and comprising 45,000 acres and 25,000 acres of land, respectively, visited the office and presented their views regarding the formation and organization of these districts.

The compilation of irrigation district financial and economic data has been continued through the present month.

*California Bond Certification Commission.*—The California Bond Certification Commission approved the private sale of \$2,500 par value of bonds of the West Side Irrigation District for construction work necessary in the development of the project; also, private sale of bonds of the Banta Carbona irrigation district in the amount of \$6,000 par value and approval of expenditures by this district in the amount of \$5,760 for the development of the project.

Approval of change of plans was granted the El Dorado Irrigation District.

### WATER RESOURCES COMMISSIONS

The fourth meeting of the Joint Legislative Committee and the Hoover-Young Commission considering the water resources of California convened at the Municipal Auditorium, Oakland, California, at 10 a.m. on April 8. The session continued throughout April 8 and 9.

The fifth meeting of the Joint Legislative Committee and the Hoover-Young Commission, called as an emergency meeting at Hotel Oakland at 10 a.m., April 16, presented and discussed with Dr. Elwood Mead, Commissioner of the United States Bureau of Reclamation, the water resources problems of California.

A newspaper writer in the *Chicago Tribune* has the following to say about the practice of driving through traffic signals:

"When the President rides out on business, he rides through traffic signals, and the citizens who recognize him lift their hats if he isn't past and gone before they can uncover. But of recent years, in New York and Chicago anyway, this privilege of riding through traffic has been accorded all local dignitaries above the rank of bailiff of the municipal court and to a great variety of visiting orchestra leaders, ecclesiastics, flag pole sitters and channel swimmers, so perhaps it shouldn't count as a distinctive presidential prerogative here."

# MOTOR VEHICLE DIVISION REPORTS

FRANK G. SNOOK, Chief

### ACCIDENT FIGURES ARE COMPILED

The annual report of motor vehicle accidents has been completed for the year 1929 by the Bureau of Research, Statistics and Traffic Safety. There were 26,921 accidents reported to the division for the year 1929, resulting in death to 2,244 persons and injury to 35,443. This is an increase of 368 deaths, or 19.6 per cent over 1928. It is estimated that approximately 20 per cent of this increase, representing from 73 to 74 deaths, is statistical, due to the improved authenticity of reports.

Provisional figures received to date for January and February indicate a probable decrease under the corresponding period of 1929. In view of the fact that an increase of over 10 per cent is apparent for the United States during the same period this year, according to information received by the California Highway Patrol, it appears that the accident situation has been somewhat improved in California.

### SUSPEND LICENSES FOR JUDGMENTS

Since January 1, the Division has been busy acting upon certified copies of judgments sent to us in accordance with the provisions of section 73 (g), which makes it mandatory upon the division to suspend any operator's or chauffeur's license and all registration certificates and license plates of any person who fails to satisfy a judgment rendered against him for property damage or personal injuries caused by an automobile within 15 days after same has become final. To date 141 cases have been reported. Suspension of licenses has been made in 51 cases, which affected 59 persons. The remaining number are being worked on, and as soon as they are complete as to form formal notices will be sent the judgment debtors.

### ARREST CAUSES ARE CLASSIFIED

During March the California Highway Patrol established night patrols in Napa, Sacramento, Marin, Alameda, Placer, Merced and Fresno counties. Throughout the state the officers stopped 17,170 vehicles, and arrested 5221 persons. Those arrested were charged as follows:

Reckless driving.....	129
Drunken driving.....	74
Speeding.....	347
Faulty lights.....	3550
Rules of the road (not including above noted violations).....	445
Miscellaneous violations.....	560
Truck violations.....	116

The total fines reported were \$26,965.55, and the officers covered 481,681 miles of highway in their patrol work.

### REGISTRATION FEE COLLECTIONS

The total registration fees collected for the first quarter of the calendar year 1930, are \$8,006,260.59, and cover the registration of the following number of vehicles:

Automobiles and commercial vehicles under 3000 pounds.....	1,742,030
Pneumatic trucks.....	66,978
Solid trucks.....	13,837
Pneumatic trailers.....	27,161
Solid trailers.....	8,200
Motorcycles.....	6,934

In addition to the above, 29,365 automobiles and trucks, 3720 trailers, and 776 motorcycles have been registered under exempt license plates.

For the first quarter of 1930, nonresident motorists secured 15,800 nonresident permits. This number is almost doubled by the nonresident motorists who have applied for California registration, which totals 31,141.

### INFORMATION SOUGHT FROM RECORDS

Proof that the records of the division are a great source of information is given in the fact that during January and February, 16,057 letters were received, requesting information on 24,114 registrations. These requests were received from police departments, commercial businesses, collection agencies, insurance and finance companies, attorneys and individuals. Now that our files are complete this bureau's work will increase greatly for the next two or three months.

### NEW TRAFFIC OFFICERS NAMED

Following are appointments to various counties:

GLENN COUNTY—L. R. Linville.

NEVADA COUNTY—Edward C. Hunt.

PLACER COUNTY—Irvin D. Elliott and G. C. Herring.

SACRAMENTO COUNTY—O. R. Latta.

SAN MATEO COUNTY—Louis E. Rinkel.

## STATISTICAL STORY OF U. S. HIGHWAYS IS TOLD IN BOOKLET

(Continued from page 26.)

car were \$8.68, while ten years later, with a registration in excess of 24,000,000 automotive vehicles, the average income per car was \$25.63.

A chapter on federal aid operations, falls second in the booklet, while separate chapters are allotted to the state highway systems, and to county and local activities.

World highway mileages afford a vivid comparison of the growth of automotive transportation in the United States, statistics for 137 nations and autonomous countries being presented.

A chapter on highway uses offers an interesting study, while another on uniform warning and direction signs, portrayed in colors, gives the signs recommended for use by the American Association of State Highway Officials.

Chapters on highway films available, on bibliography, and finally on organizations interested in highway development complete the study, with an explanatory note outlining briefly the activities of the Highway Education Board.

According to the Ohio Farm Bureau Mutual Automobile Insurance Company, automobile drivers between the ages of 18 and 20 are the greatest hazard to traffic. This finding was made on an examination of 2000 traffic accidents.

"I advertised that the poor would be welcome in this church," said the minister; "and after inspecting the collection I see that they have come."

## THE MODERN EL CAMINO REAL

(Continued from page 7.)

of way approximately 35 feet north of and parallel to the center line for a distance of 0.6 mile before joining Campbell Creek, which flows to the north. This channel was discontinued and filled up, giving a full 12-foot shoulder width with flat slopes to or near the right of way line. Through agreement with the property owners a new channel was extended almost due north from the highway about  $\frac{1}{4}$  mile, at which point it empties into a deep borrow pit from which material was taken to fill the original channel along the highway. Approximately 700 feet beyond this borrow pit a levee extending in a northeasterly direction was thrown up for a distance of 1650 feet, at which point it was directed southeast for 740 feet, this point being approximately 2000 feet north of the highway about half way between Calabasas and Campbell creeks. From this point, in a northeasterly direction, a new channel was cut across to a junction with Campbell Creek approximately 3000 feet north of the highway. During the summer months Calabasas Creek is dry, but in the rainy season water flows down the new channel to the borrow pit, it now acting as a reservoir which tends to replenish the supply of ground water to adjacent property. During heavier rains this reservoir overflows and is contained within the levees around the low-lying contiguous land. This results in a deposit and gradual upbuilding of light silt—a feature desired by the property owner. In time of excessive flood the water finds outlet through the new channel beyond. Most of the water settles and is conserved. The silt deposit each spring is plowed into the heavy soil with entirely beneficial results. The past season saw a deposit of several inches. Thus the state was relieved of further responsibility in maintaining 0.6 mile of Calabasas Creek, and was enabled to obtain a highway of standard section with adequate provisions for future widening. This work was done under Day Labor Work Order under informal bid contract by N. M. Ball of Porterville, who was also the general contractor on this section between Sunnyvale and Santa Clara. C. F. Price was the resident engineer. Construction cost of this section was approximately \$227,000.

The second section of this 14 miles now under construction extends from 1000 feet north of the county line at San Francisquito Creek in San Mateo County to San Antonio

Road in Santa Clara County. This has a net length of 4.36 miles though it has a gross length of 4.74 miles, there being an exception of 0.38 mile through the town of Mayfield.

This project extends through the combined City of Palo Alto and Mayfield. The details, both as to right of way and construction, are rather involved due to present structures, city pavement, curbs and sidewalks, and intersecting streets. Several improvements in alignment are being effected by acquisition of right of way largely on one side in acquiring the new 100-foot width without discarding any of the original right of way. One such change extends from the beginning of the project for a distance of 0.7 of a mile, removing reverse curves and unsightliness from alignment, and provides for widening the 60-foot span arch bridge over San Francisquito Creek bridge on one side only to a 76-foot roadway width including one 6-foot sidewalk.

Two other slight changes are effected at curves in the vicinity of Yeguas Creek to make it necessary to widen the structure on one side only, and the approach to the important county road intersection at San Antonio avenue near the end of this project.

A more important revision in location is made about  $3\frac{1}{2}$  miles from the beginning of this job, where a 300-foot radius curve is eliminated. From a right of way standpoint, this change involves a heavy expenditure, including moving of buildings, in settlement with one party only, "Mammy's Shack," of more or less local fame.

The original pavement was constructed to a 20-foot width of 5-inch waterbound macadam with 1 $\frac{1}{2}$ -inch topeka top and 3-foot oil macadam shoulders, though through the town of Mayfield, 6-inch concrete, 24 feet in width, was placed, under contract in 1914, excepting the first 1400 feet which was placed this same year by state forces. The present contract calls for 4 $\frac{1}{2}$  inches of Type "A" asphalt concrete surface laid in two courses over the present pavement, widening over 6-inch compacted rock base to 40-foot width, with 8-foot shoulders from the beginning of the project to Mayfield. Through Mayfield, excepting the 0.38-mile business district, 40 feet of 8-inch to 10-inch concrete in four 10-foot strips is being placed over a 4-inch compacted rock base. The balance of the project includes about one mile of 8-inch to 10-inch thickness of concrete, 30 feet wide, and one mile of 4 $\frac{1}{2}$ -inch asphalt concrete Type "A" in two courses on present 20-foot pavement and 10-foot width of 8-inch to 10-inch thickness

Class "A" concrete over 4-inch compacted rock base on the left side.

Right of way involved 103 ownerships out of which 6 suits were necessary, one of which is a friendly suit against Stanford University, this being the only legal way title could be obtained. The widening of right of way through the town of Palo Alto was facilitated by the abandonment and removal of the tracks of the Peninsula Railway Company for approximately two miles. The removal of these tracks from the highway right of way is the result of negotiations carried on with the railway company over a period of six years or more, and is considered an achievement of note, for it is felt that there is no justification for the location of an electric railway inside a state highway right of way.

It is necessary to carry all traffic through this job since the only detours available are Palo Alto streets, which would require through traffic to cross twice at grade the main line of the Southern Pacific Railway, where over 70 fast trains pass daily. The completion date for this contract between Palo Alto and San Antonio Road is September 12, 1930. Contract allotment is approximately \$311,000, which includes the construction of the San Francisquito Bridge for which a special allotment of \$20,000 had been budgeted. Hanrahan Company of San Francisco is the contractor, and C. F. Price the resident engineer.

The final and center link of this 14-mile section from Palo Alto to Santa Clara is 4.89 miles in length without exceptions and extends from San Antonio Avenue to Sunnyvale.

This project involves but one line change—that at Anzini's Corner—where it is proposed to replace the existing 400-foot radius curves reversing on 135 feet of tangent, with two 200-foot radius curves, reversing on 350-foot tangent. It is planned to make park areas of the two triangular pieces of property between the old and the new locations at this change. The present pavement was constructed 20 feet in width in 1913 and 1914, and consists of a 1½-inch topeka top over a 5-inch water-bound macadam base for the first 2¾ miles of this section, the balance being a 1½-inch topeka top over a 4-inch concrete slab.

The present plans are for a graded roadbed 50 feet in width, a pavement 30 feet in width throughout in a full 100-foot right of way. A 4½-inch asphalt concrete Type "A" surface laid in two courses will be placed on the existing 20-foot pavement throughout, excepting through the line change at Anzini's Corner, where a 30-foot width of 8-inch to 10-inch thickness concrete is to be placed over a 4-inch

compacted rock base. Widening is to be effected from the beginning of this project to the line change at Anzini's Corner on the left side, approximately one mile in length, by placing a 10-foot strip of concrete Class "A" 8 inches to 10 inches thickness over a 4-inch compacted rock base. Beyond the line change for the balance of the project, this widening of similar construction will be on the right side of the existing pavement.

This strip of highway passes through the town of Mountain View, where city lots of 25-foot frontage are involved. Due to this fact, 155 parcels and owners must be dealt with. Right of way negotiations also involve the moving of about 40 buildings, some half dozen service station pump installations and many irrigation conduits, in addition to about 20 ornamental gate posts and columns and the usual fence.

The construction contract will call for removing and replacing about 8000 feet of concrete or iron irrigation pipe from 8 inches to 12 inches in diameter, widening Stevens Creek 20-foot span arch bridge on both sides to a completed 76-foot roadway width, and replacing the Permanente Creek 12-foot span arch, which was built by the county in 1899, with a concrete box to be constructed inside the present arch to give full 76-foot roadway width.

A good detour is available for the entire job during construction; but, due to the heavy urban local settlement, this is not considered practicable; so it is planned to carry full traffic through the job during construction.

Right of way negotiations for this section are progressing nicely, and it is expected that it will be advertised shortly.

It is expected that the public will be enjoying the fully reconstructed and otherwise modern improved El Camino Real, between Palo Alto and Santa Clara, not later than the spring of 1931.

#### AIN'T IT THE TRUTH

"When you find a public official who pleases everybody, there will be a glass plate over his face and he will not be standing up."

A backwoodsman one day found a mirror which a tourist had lost. "Well, if it ain't my old dad," he said as he looked in the mirror, "I never knew he had his pitcher took."

He took the mirror home, stole into the attic to hide it, but his actions did not escape his suspicious wife. That night, while he slept, she slipped up to the attic, and found the mirror. "Hm-m," she said, looking into it. "So that's the old hag he's been chasin'."—*The Dravo Bulletin*.

## THE SCIENCE OF MECHANICAL VENTILATION

(Continued from page 11.)

runs into a considerable amount and also since the Assembly Hall will be unused during the warmest summer weather due to the vacation period, the installation at the Chico College has been designed to use the upward system.

To force the air into the building, large fans or blowers are utilized. The installation at Chico contains four such fans, one supplying air to the main floor and another supplying air to the balcony. One main exhaust fan removes the air from the seats under the balcony and also from grilles in the ceiling over the balcony and main floor. The other fan is a small one for separate ventilation of the motion picture projection room. This air is removed from the building through ornamental plaster grilles located in the ceiling over the balcony and main floor, and also through metal grilles located in the portion of the ceiling under the balcony. Removal of air from the space occupied by the seats under the balcony is very necessary, otherwise, this space would tend to become pocketed with dead air. The exhaust air is subsequently discharged to the outside. To create a slight pressure in the theater, the capacity of the exhaust fan is somewhat less than the supply fans. The slight pressure is necessary to prevent cold draughts from entering from the outside when the theater doors are opened.

To cool and change the air, a saturating or cooling type air washer is provided. This piece of equipment serves the double purpose of cooling and washing the air removing about 95 per cent of the dirt in suspension. The fresh air, entering the building through the fresh air intake, is drawn through the washer by the fans and then discharged over heaters to the plenum space under the main balcony floor, and enters the building through mushrooms located under the seats. The air washer consists essentially of a number of spray nozzles, a metal housing and water tank, and a pump to recirculate the water. There is also provided in the air washer a number of staggered plates, called eliminator plates, designed to separate the air from any water or spray after it has passed through the nozzles. The spray nozzles are similar in construction to the type of nozzle used for lawn sprinkling. The washer for the Chico Assembly Hall is to be equipped with 156 nozzles and the pump circulates 520 gallons per minute. The air, passing through the fine mist-like spray created by the nozzles, is cooled by evaporation much the same as a water bag, hung on the outside in moving air, keeps the contents cool although the air surrounding it may be exceedingly warm. This apparent phenomenon is caused by extraction of heat by evaporation and is made possible by the fact that air has two temperatures, a dry bulb temperature which is the temperature one observes on the ordinary thermometer, and a wet bulb temperature. The wet bulb temperature is obtained by covering the mercury bulb with a small piece of cloth which is then moistened with water and whirled or placed in moving air of the same temperature until the reading becomes stable. Unless the air is saturated with moisture, as for instance a fog, the wet bulb temperature is always lower than the dry bulb. The difference between the two indicates the relative humidity.

Recent research by the United States Bureau of Mines and the United States Bureau of Public Health, in conjunction with the American Society of Heating and Ventilating Engineers, has shown that there are

three important factors which go to make up the effective temperature or create a comfortable feeling; namely, dry bulb temperature, wet bulb temperature and air motion. The first two have already been described. Air motion, an example of which is the ordinary desk fan, gives a feeling of coolness although it does not lower the temperature of the air surrounding it. This coolness is caused by increased evaporation of moisture on the surface of the skin, lowering the temperature; furthermore, the lower the humidity of the air of corresponding temperature, the greater the feeling of coolness due to increased evaporation. Air of high humidity is saturated with moisture and in such a state, air motion is of little or no importance in so far as cooling is concerned. That is the reason one reads of numerous fatalities following an eastern heat wave where a temperature of only 90 degrees Fahrenheit is accompanied by high humidity. It has been determined that 70 degrees Fahrenheit and 40 per cent humidity produces the greatest feeling of comfort to the normal person at rest.

As a rule, California enjoys low humidity, or dry air, especially so in the interior valleys. This provides fairly satisfactory cooling of the air by the washer method. A temperature of 100 degrees Fahrenheit at 20 per cent humidity, a condition common in the summer time in the interior valleys, is far more comfortable than 90 degrees and 70 per cent humidity common in the eastern states.

With a saturating type washer and cooler such as is to be installed at Chico, air entering the washer at 100 degrees Fahrenheit and 20 per cent humidity, would leave the washer and enter the Assembly Hall at about 60 degrees Fahrenheit, saturated with moisture. Expansion of the air after it enters the room, caused by bodily and external heat, raises the temperature slightly and lowers the humidity. Thus a comfortable condition is maintained in the building.

If it were not for the enormous amount of cold air forced into the building for ventilating requirements, very little heating would be necessary. To heat this cold air in the winter time, necessary heaters are provided similar in construction to the ordinary steam radiator, only many times larger. A metal casing is provided around the heaters and the air is forced through by the fan or blower. Steam for supply to the heaters is obtained from the central heating plant of the college at a pressure of 75 pounds per square inch and reduced to 10 pounds by a pressure reducing valve. The air passing through the heaters is warmed to approximately 70 degrees Fahrenheit. Inasmuch as the balcony tends to become warmer than the main floor, due to the ability of heat to rise, separate heaters are provided for the balcony and main floor.

To prevent overheating, due to fluctuation of temperature outdoors, a system of temperature control is provided. Two thermostats are provided, one for the balcony and one for the main floor. A thermostat is a small sensitive device about 4 inches high and 2 inches wide mounted on the inside wall of the theater, usually placed approximately 5 feet above the floor. It works on the well-known principle of metal to expand or contract due to changes in temperature. Thus this principle is used to actuate a small valve in the thermostat controlling the supply of compressed air to the diaphragm operated valves in the steam supply to the heaters. Compressed air is furnished by a small compressor in the fan room and is used as the motive force to operate the diaphragm valves. Thus, if the room becomes too warm, the thermostat located in the theater shuts off the steam and if the room becomes too cold, it opens the valves to admit steam to the heaters.

## State Highway Progress Reports

### IMPERIAL COUNTY

*San Bernardino-El Centro Route*—Rapid progress is being made on the A. M. Peck Company paving contract from Brawley to a point four miles west of Westmoreland. The Westmoreland end of this project was completed first to offer the least inconvenience to traffic.

*El Centro San Diego Route*—R. E. Hazard has started work on pavement widening and resurfacing from Dixieland to Seeley. A contract has been awarded to Rasich Bros. for paving from Myers Creek bridge to three miles west of Coyote Wells.

*El Centro-Yuma Route*—A. M. Peck Company has started work on the drainage and irrigation structures between El Centro and Holtville. A 20-foot pavement will be constructed on this project.

### LOS ANGELES COUNTY

A contract has been awarded to Ben F. Dupuy for oiling shoulders on the Roosevelt Highway between the westerly boundary of Los Angeles County and Santa Monica.

The contract for a line change immediately north of the Newhall Tunnel has been awarded to McCray Co. This contract is approximately one mile in length and is on much better alignment than the present highway. It is expected that this contract will be completed next June.

The first contract on the La Canada-Mt. Wilson Highway for grading 2.6 miles of roadbed was awarded to H. W. Rohl Company on August 14th. Work is rapidly nearing completion and it is expected that this contract will be completed by June 15th.

The second contract on the La Canada-Mt. Wilson Highway for grading 1½ miles of highway was awarded to T. M. Morgan Paving Company on January 27, 1930. This extends northerly from the end of the H. W. Rohl contract. This contract will probably require more than a year to complete.

A contract for paving the Newhall Alternate with Portland cement concrete, 30 feet wide, has been awarded to Jahn & Bressi. Grading of this section has just been completed by Le Tourneau & Lindberg. The new location is on greatly improved alignment and eliminates Saugus, Newhall and the Newhall Tunnel from the Ridge Route. This section is 8.6 miles long. Paving will probably be completed by next September.

A contract for grading and paving a line change near Liberty School, four miles west of Calabasas, was awarded to the Will F. Peck Company January 18, 1930. This line change eliminates several bad curves and improves the grade. Grading work is now in progress. It is expected that this contract will be completed next August.

A contract for grading a 38-foot roadbed on the first section of the Alternate Ridge Route from Castaic School to Canton Creek was awarded to H. E. Doering, von der Hellen and Pierson on February 25, 1930.

This section is 7 miles in length and will probably require more than a year to complete.

Surveys are in progress on the rest of this route which will be a saving of more than seven miles in distance over the present Ridge Route.

### LOS ANGELES-VENTURA COUNTIES

A contract for oil mix shoulders between Calabasas and Conejo Summit has just been completed by the Southwest Paving Company. There is now a 24-foot width of surfaced highway the full length of this contract.

### ORANGE-LOS ANGELES COUNTIES

A contract for oiling shoulders between Galivan and Irvine and from Fullerton to Leffingwell Ranch in Los Angeles County has been awarded to G. M. Duntley.

### ORANGE COUNTY

A contract for widening the roadbed between Sunset Beach and Newport the entire width of the 90 to 100-foot right of way, and the placing of an additional 10-foot strip of Portland cement concrete has been awarded to the Macco Construction Company. When this work is completed the pavement will be 30 feet wide for the entire distance. It is expected that this work will be completed by next September.

### RIVERSIDE COUNTY

*Riverside-Ontario Route*—A contract has been awarded to Matich Brothers for the construction of the pavement of the undergrade crossing under the Union Pacific tracks at Wineville. The railroad bridge work is practically completed.

### SAN BERNARDINO COUNTY

*Old Trails Highway*—Contractors Gist and Bell have completed the grading contract from Alray to the Summit of Cajon Pass and the road has been opened to traffic. This improvement is over a new location on which the alignment has been improved and the distance materially shortened. This improvement will reduce the accident toll on this road and afford a new sense of security to the motorist driving over it. When weather conditions become favorable the road surface will be oil treated.

The New Mexico Construction Company are laying plant mixed oil treated surfacing on their two contracts extending from two miles west of Argos to six miles east of Amboy.

**Arroyohead Trail**—The George Herz Company is making substantial progress in laying oil treated surfacing on their contract from Barstow to Yermo.

**Crest Route**—Lewis Construction Company has started clearing the right of way on their grading contract between four miles west of Running Springs Park and Squirrel Inn. They plan to clear and burn all the brush immediately to avoid the fire hazard which would occur if the brush were burned later in the season.

A contract has been awarded to W. H. Rohl Company for grading from the Pass between Devils Canyon and Waterman Canyon, a distance of two miles down Waterman Canyon. This project will eliminate most of the heavy grades and switch backs in the upper end of Waterman Canyon. The clearing has been done and actual grading started.

#### SAN DIEGO COUNTY

A contract for grading the Rose Canyon road between Balboa avenue and Torrey Pines road was awarded on August 13th to the R. E. Hazard Contracting Company. This section is 5.4 miles long and is to be a 46-foot graded roadbed. It is expected that this contract will be completed by June 1, 1930.

A contract for 4.5 miles of 38-foot graded roadbed between La Posta Creek and Miller Creek on the San Diego-El Centro Highway was awarded on May 27th to the Nevada Contracting Company. It is expected that this contract will be completed next June.

A contract for grading 2.9 miles of 36-foot roadbed from Kitchen Creek to La Posta and paving with 20 feet by 7 inches Portland cement concrete was awarded on June 25th to Basich Bros. This section is on the San Diego-El Centro Highway. Rough grading is completed and concrete paving is now in progress. It is expected that this contract will be finished by June 15, 1930.

A contract for grading a 30-foot roadbed between Miller Creek and Tecate Divide on the San Diego-El Centro Highway was awarded to Monarch & Breen on August 17, 1929. This work is rapidly nearing completion and should be finished by May 15, 1930.

A contract for oiling the shoulders on various stretches aggregating approximately 35 miles between San Diego and Myers Creek Bridge on the San Diego-El Centro Highway was recently awarded to the Gilmore Oil Company.

Another contract for oiling the highway shoulders between Oceanside and the Orange County line has been awarded to G. M. Duntley.

#### VENTURA COUNTY

A contract has been awarded to California Road Oil Service Company for oiling shoulders from Camarillo to Ventura and from Ventura to Sealiff.

#### IMPROVEMENTS THROUGH APRIL AWARDS

**RED BLUFF-SUSANVILLE LATERAL**—Reinforced concrete girder bridge 105 feet long across the North Fork of the Feather River at Chester in Plumas County. This bridge consists of three 35-foot spans on concrete pile bents, and is located within the limits

of the grading and surfacing project now under way on this road between Morgan Springs and Lake Almanor. Contract awarded to A. T. How of Santa Rosa for \$10,990.

**PACIFIC HIGHWAY**—In Yuba County, paving through Wheatland with Portland cement concrete 0.9 of a mile. Grading of roadbed 36 feet wide and paving 20, on realignment, eliminating the right-angle turns in this town. Contract awarded to C. W. Wood of Stockton for \$31,296.

**MOTHER LODE COUNTRY**—On this lateral in Calaveras County a reinforced concrete girder bridge across Calaveritas Creek is being built. This is situated about 3 miles south of San Andreas. Contract awarded to George J. Ulrich Construction Company of Modesto for \$18,037.

#### COMPLETION OF CONTRACTS

**RED BLUFF-SUSANVILLE LATERAL**—Contract for surfacing with untreated crushed gravel or stone and stockpiling screenings between Susanville and two miles west of Milford in Lassen County, covering 19.4 miles, and at an approximate cost of \$48,000, has been completed and accepted. Hein Bros. & Chittenden of Napa were the contractors.

**OROVILLE-QUINCY LATERAL**—Contract for grading roadbed and placing crushed rock surfacing between Oroville and the Feather River in Butte County, distance about 4.1 miles, at an approximate cost of \$181,400, has been satisfactorily completed and accepted. Arris-Knapp of Oakland were the contractors.

**CARMEL-SAN SIMEON HIGHWAY**—Construction of a bridge across Villa Creek on this highway in Monterey County, at an approximate cost of \$20,000, has been accepted. H. C. Whitty of Sanger was the contractor.

**COAST ROUTE**—Contract for constructing a graded roadbed and placing asphalt concrete pavement between Chualar and Salinas for about 10.3 miles in Monterey County, at an approximate cost of \$262,300, has been satisfactorily completed and accepted. Peninsula Paving Company of San Francisco was the contractor.

**REDWOOD HIGHWAY**—Contract for constructing a bridge across San Antonio Creek on this highway on the Marin-Sonoma County line, at an approximate cost of \$20,000, has been completed and accepted. McDonald & Maggiora of Sausalito were the contractors.

**VALLEY ROUTE**—Contract for grading roadbed and placing asphalt concrete pavement between southerly Tulare County boundary and Pixley has been accepted. The Valley Paving Company of Visalia was the contractor.

**SAN BERNARDINO-BARSTOW ROUTE**—Contract for the construction of a bridge in San Bernardino County near Cajon Station at an approximate cost of \$13,100, has been accepted. Pittman & Hippenstiel were the contractors.

#### HIGHWAY BIDS AND AWARDS For Month of April

**CALAVERAS COUNTY**—Reinforced concrete girder bridge across Calaveritas Creek, about 3 miles south of San Andreas, consisting of one 60-ft. span on

concrete piers and six 30-ft. spans on concrete bents and abutments with rubble masonry wing walls. Dist. X, Rt. 65, Sec. B. Peter McHugh, San Francisco, \$21,131; Fredrickson & Watson Const. Co., Oakland, \$20,917; M. B. McGowan, San Francisco, \$22,185; O. G. Ritchie, San Jose, \$20,523; N. M. Ball, Porterville, \$21,079; Jacobs & Pattiani, Oakland, \$20,868; Geo. G. Wood, Fresno, \$18,826; Bodenhamer Const. Co., San Diego, \$19,659. Contract awarded to George J. Ulrich, Modesto, \$18,037.

**LOS ANGELES COUNTY**—Between the westerly boundary and Santa Monica, about 26.5 miles to have heavy fuel oil furnished and applied to shoulders. Dist. VII, Rt. 60, Secs. A, B. California Road Oil Co., Los Angeles, \$11,326; G. M. Duntley, Los Angeles, \$10,258; Gilmore Oil Co., Los Angeles, \$11,148. Contract awarded to Ben L. Dupuy, Los Angeles, \$10,081.

**MODOC COUNTY**—Two timber bridges, one across North Fork of Pit River about 3½ miles NE. of Alturas, and one across Shields Creek channel change about 4 miles NE. of Alturas. Dist. II, Rt. 28, Sec. C. M. B. McGowan, San Francisco, \$16,772; R. B. McKenzie, Red Bluff, \$15,402. Contract awarded to Smith Brothers Company, Eureka, \$13,875.

**PLUMAS COUNTY**—Reinforced concrete girder bridge across the North Fork of the Feather River at Chester, consisting of three 35-ft. spans on concrete pile bents. Dist. II, Rt. 29, Sec. A. M. B. McGowan, San Francisco, \$14,624; J. P. Brennan, Redding, \$12,263; R. B. McKenzie, \$12,968. Contract awarded to A. T. Howe, Santa Rosa, \$10,990.60.

**SANTA BARBARA COUNTY**—Buckhorn Creek to second crossing, Cuyama River, about 15.1 miles in length, apply heavy fuel oil on roadbed. Dist. V, Rt. 57, Sec. B. Bradley Truck Co., Santa Maria, \$4,397; Ben F. Dupuy, Los Angeles, \$4,629; A. Teichert & Son, Inc., Sacramento, \$6,215. Contract awarded to Gilmore Oil Co., Ltd., Los Angeles, \$4,185.72.

**SANTA BARBARA COUNTY**—Between Elwood overhead crossing and Goleta, and between Carpinteria and Rincon cutoff, about 65.5 miles oiling. Dist. V, Rt. 2, Secs. G, I, K, H. Seaside Oil Co., Summerland, \$1,366; Gilmore Oil Co., Los Angeles, \$5,988; California Road Oil Service Co., Los Angeles, \$4,867. Contract awarded to Bradley Truck Co., Santa Maria, \$4,130.

**SAN BERNARDINO COUNTY**—Between Barstow and the Kern County line, about 37.5 miles in length, furnishing and spreading fuel oil on roadway. Dist. VIII, Rt. 58, Secs. A, B, C, D. Gilmore Oil Co., Ltd., Los Angeles, \$8,430; Leonard C. Pulley, Long Beach, \$8,861; Basalt Rock Co., Inc., Napa, \$8,957; California Road Oil Service Co., Los Angeles, \$8,957; Ben F. Dupuy, Los Angeles, \$10,969. Contract awarded to G. M. Duntley, Los Angeles, \$8,047.20.

**SAN DIEGO AND IMPERIAL COUNTIES**—Various locations comprising about 35.4 miles in all, to have heavy fuel oiling applied to shoulders. Dist. VII, Rt. 12, Secs. B, C, D, E, F, G, H, A. California Road Oil Service Co., Los Angeles, \$23,031. Contract awarded to Gilmore Oil Co., Los Angeles, \$22,165.40.

**YUBA COUNTY**—Through Wheatland, about 0.9 of a mile to be graded and paved with Portland cement concrete. Dist. III, Rt. 3, Sec. A. Basich Brothers Construction Co., Los Angeles, \$33,441; Mathews Construction Co., Sacramento, \$35,604. Contract awarded to C. W. Wood, \$31,296.50.

The red light is the place where you catch up with the driver who passed you at fifty miles an hour eight or nine blocks down the line.—Detroit News.

## WATER APPLICATIONS AND PERMITS

Applications for permit to appropriate water filed with the State Department of Public Works, Division of Water Resources, during April, 1930.

**MENDOCINO COUNTY**—Application 6615. Hooper Bros., Valley Oaks Ranch, Ukiah, for 1.5 c.f.s. 10 acre-feet from unnamed winter drainage creek tributary to East Branch of Russian River to be diverted in Sec. 26, T. 16 N., R. 12 W., M. D. M., for irrigation purposes. Estimated cost \$1,000.

**LAKE, NAPA, YOLO and SOLANO COUNTIES**—Application 6616. Karl Brehme of 1201 Hobart Bldg., San Francisco, for 200 c.f.s. and 100,000 acre-feet from Putah, Pope, Capel, Elicura creeks tributary to Sacramento River to be diverted in Sec. 25, T. 8 N., R. 2 W., M. D. M., for industrial and domestic purposes. Estimated cost \$3,900,000.

**CONTRA COSTA COUNTY**—Application 6617. John Fleuti, Moraga, for 0.016 c.f.s. from (1) Grizzly Creek, (2) unnamed spring tributary to Walnut Creek to be diverted in Sec. 15, T. 1 S., R. 2 W., M. D. M., and Sec. 10, T. 1 S., R. 2 W., M. D. M., for domestic purposes. Estimated cost \$1,000.

**SAN BERNARDINO COUNTY**—Application 6618. Los Angeles Council of Camp Fire Girls, 1107 Security Bldg., Los Angeles, for 1/32 c.f.s. from Santa Ana River, to be diverted in Sec. 10, T. 1 N., R. 1 E., S. B. B. & M., for recreational purposes. Estimated cost \$1,000.

**SISKIYOU COUNTY**—Application 6619. John A. Foss, Hamburg, for 2 c.f.s. from Caroline Creek tributary to Klamath River to be diverted in Sec. 14, T. 46 N., R. 12 W., M. D. M., for irrigation purposes.

**YUBA COUNTY**—Application 6620. David N. Jones, c/o Steel and Lingenfelter, Marysville, for ½ c.f.s. from Dry Creek tributary to Bear River to be diverted in Sec. 34, T. 15 N., R. 6 E., M. D. B. & M., for irrigation and domestic purposes (50 acres). Estimated cost \$1,000.

**EL DORADO COUNTY**—Application 6621. Spicky Polish Corp., 1401 Third St., San Francisco, for 1 c.f.s. from White Rock Creek tributary to South Fork American River to be diverted in Sec. 32, T. 11 N., R. 11 E., M. D. M., for industrial purposes.

**LOS ANGELES COUNTY**—Application 6622. Cienega Springs Water Co., c/o R. B. Bidwell, Glendora, for .025 c.f.s. from tunnel to spring tributary to Big Dalton-San Gabriel Watershed to be diverted in Sec. 22, T. 1 N., R. 9 W., S. B. B. & M., for domestic purposes.

**SAN JOAQUIN COUNTY**—Application 6623. L. F. Grimsley, Est. Joseph Geiger, deceased, P. E. Holt & Anderson Orchard Co., a California corporation, c/o Neumiller & Ditz, 605 Bank of Italy Bldg., Stockton, for 2.56 c.f.s. from Calaveras River tributary to San Joaquin River, to be diverted in Sec. 4, T. 2 N., R. 9 E., M. D. M., for irrigation purposes (204.69 acres).

**SAN JOAQUIN COUNTY**—Application 6624. Raymond T. McGurk & C. H. McGurk, c/o Neumiller & Ditz, Bank of Italy Bldg., Stockton, for 2.91 c.f.s. from Calaveras River tributary to San Joaquin River to be diverted in Sec. 33, T. 3 N., R. 9 E., M. D. B. & M., for irrigation purposes (233 acres).

**LOS ANGELES COUNTY**—Application 6625. Geo. H. Letteau, 305 Security Bldg., Los Angeles, for

0.29 c.f.s. from 7 springs at head of Mint Canyon tributary to Santa Clara River Watershed to be diverted in Sec. 31, T. 6 N., R. 13 W., S. B. M., and Sec. 1, T. 5 N., R. 14 W., S. B. M., for irrigation and domestic purposes (230 acres).

**EL DORADO COUNTY**—Application 6626. United States, El Dorado National Forest of Placerville, for .0019 c.f.s. from Hemlock Creek tributary to Upper Echo Lake to be diverted in Sec. 35, T. 12 N., R. 17 E., M. D. M., for domestic purposes. Estimated cost \$250.

**EL DORADO COUNTY**—Application 6627. United States, El Dorado National Forest of Placerville, for .005 c.f.s. from Hemlock Creek tributary to Upper Echo Lake to be diverted in Sec. 35, T. 12 N., R. 17 E., M. D. M., for domestic purposes. Estimated cost \$200.

**TRINITY COUNTY**—Application 6628. J. O. Gillice of Weaverville for (a) 50 c.f.s., (b) 100 c.f.s. from (a) Cedar Creek, (b) Horse Linto Creek tributary to Trinity River to be diverted in Sec. (a) 29, T. 7 N., R. 6 E., H. B. & M., and Sec. (b) 8, T. 7 N., R. 6 E., H. B. & M., for mining purposes. Estimated cost \$150,000.

**RIVERSIDE COUNTY**—Application 6629. O. J. McMahan, c/o Frazier M. Sallee, San Jacinto, for 0.12 c.f.s. from unnamed stream to be diverted in Sec. 4, T. 7 S., R. 3 E., S. B. B. & M., for irrigation and domestic purposes (10 acres to be irrigated). Estimated cost \$2,000.

**SAN JOAQUIN COUNTY**—Application 6630. City of Stockton, Stockton, for 200 c.f.s. and 65,500 acre-feet per annum from Calaveras River tributary to San Joaquin River to be diverted in Sec. 31, T. 4 N., R. 11 E., M. D. B. & M., for power purposes (2550 h.p.).

**SAN JOAQUIN COUNTY**—Application 6631. City of Stockton, Stockton, for 50 c.f.s. and 90,000 acre-feet per annum from Calaveras River tributary to San Joaquin River to be diverted in Section 31, T. 4 N., R. 11 E., M. D. B. & M., for municipal purposes. Estimated cost \$1,500,000.

**TULARE COUNTY**—Application 6632. C. W. Gray of Hollywood, for .0012 c.f.s. from Mosquito Creek tributary to East Fork Kaweah River to be diverted in Sec. 16, T. 17 S., R. 31 E., M. D. M., for domestic purposes. Estimated cost \$350.

**RIVERSIDE COUNTY**—Application 6633. Wm. R. Peeler of 1701 S. Grand Ave., Los Angeles, for .0025 c.f.s. from spring tributary to Lake Elsinore to be diverted in Sec. 25, T. 6 S., R. 5 W., S. B. B. & M., for domestic purposes. Estimated cost \$500.

**EL DORADO COUNTY**—Application 6634. Wm. B. Parker of Placerville for 0.27 c.f.s. from Emigrant Ravine Creek tributary to Hangtown R. Webber Creek, South Fork American River to be diverted in Sec. 4, T. 10 N., R. 11 E., M. D. M., for irrigation purposes (22 acres). Estimated cost \$50.

**SISKIYOU COUNTY**—Application 6635. Buzzard Hill Mine, Inc., c/o L. J. Rowland, manager, Happy Camp, for 12.5 c.f.s. from Independence Creek tributary to Klamath River to be diverted in Sec. 32, T. 15 N., R. 7 E., H. M., for power and domestic purposes. Estimated cost \$10,000.

**SISKIYOU COUNTY**—Application 6636. Buzzard Hill Mine, Inc., c/o L. J. Rowland, manager, Happy Camp, for 0.05 c.f.s. from Independence Creek tributary to Klamath River to be diverted in Sec. 32, T. 15 N., R. 7 E., H. M., for irrigation and domestic purposes. Estimated cost \$2,000.

**SISKIYOU COUNTY**—Application 6637. Buzzard

Hill Mine, Inc., c/o L. J. Rowland, manager, Happy Camp, for 0.25 c.f.s. from Independence Creek tributary to Klamath River to be diverted in Sec. 32, T. 15 N., R. 7 E., H. M., for mining purposes. Estimated cost \$10,000.

**MODOC COUNTY**—Application 6638. John Miller, Lake City for 1.65 c.f.s. from Mill Creek tributary to Upper Lake to be diverted in Sec. 36, T. 44 N., R. 15 E., M. D. B. & M., for irrigation and domestic purposes (115.2 acres).

**MODOC COUNTY**—Application 6639. W. J. Hays, Mrs. Nannie Daniels, G. M. Warrens and Mrs. C. H. Darst, Lake City, for 3 c.f.s. from Mill Creek tributary to Upper Lake to be diverted in Sec. 36, T. 44 N., R. 15 E., M. D. B. & M., for irrigation and domestic purposes (252 acres).

**MODOC COUNTY**—Application 6640. Simon Bennett, Cedarville, for 1.35 c.f.s. from Mill Creek tributary to Upper Lake to be diverted in Sec. 36, T. 44 N., R. 15 E., M. D. B. & M., for irrigation and domestic purposes (160 acres).

**MODOC COUNTY**—Application 6641. Grove Wimer, Lake City, for 1 c.f.s. from Mill Creek tributary to Dry Alkali Lakes, to be diverted in Sec. 35, T. 44 N., R. 15 E., M. D. M., for irrigation purposes (15 acres). Estimated cost \$100.

**MENDOCINO COUNTY**—Application 6642. Murphy & Yarbrough, c/o H. S. Stocker, Ukiah, for 1 c.f.s. from Forsythe Creek tributary to Russian River, to be diverted in Sec. 16, T. 16 N., R. 12 W., M. D. M., for irrigation and domestic purposes (121.2 acres). Estimated cost \$800.

**BUTTE COUNTY**—Application 6643. H. D. March, Chico, for .5 c.f.s. from spring tributary to Little Butte Creek to be diverted in Sec. 30, T. 22 N., R. 3 E., M. D. M., for power purposes. Estimated cost \$2,000.

**BUTTE COUNTY**—Application 6644. H. D. March, Chico, for .5 c.f.s. from spring tributary to Little Butte Creek to be diverted in Sec. 30, T. 22 N., R. 3 E., M. D. M., for irrigation and domestic purposes (70 acres). Estimated cost \$2,000.

**LAKE COUNTY**—Application 6645. Martin Judge, Jr. and Co., Crocker First National Bank Bldg., San Francisco, for 250 c.f.s. and 175,000 acre-feet per annum from North Fork Cache Creek tributary to Cache Creek to be diverted in Sec. 4, T. 14 N., R. 6 W., M. D. M., for industrial and domestic purposes. Estimated cost \$3,000,000.

**LAKE COUNTY**—Application 6646. Martin Judge, Jr. and Co., Crocker First National Bank, Bldg., San Francisco, for 175,000 acre-feet per annum from North Fork of Cache Creek, tributary to Cache Creek to be diverted in Sec. 4, T. 14 N., R. 6 W., M. D. M., for irrigation purposes (50,000 acres). Estimated cost \$1,000,000.

**SISKIYOU COUNTY**—Application 6647. Buzzard Hill Mine, Inc., c/o L. J. Rowland, manager, Happy Camp, for 2.75 c.f.s. from Buzzard Creek tributary to Klamath River to be diverted in Sec. 4, T. 15 N., R. 7 E., H. B. & M., for power purpose (68.7 h.p.). Estimated cost \$2,000.

**SISKIYOU COUNTY**—Application 6648. Buzzard Hill Mine, Inc., c/o L. J. Rowland, manager, Happy Camp, for .25 c.f.s. from Buzzard Creek tributary to Klamath River to be diverted in Sec. 4, T. 15 N., R. 7 E., H. B. & M., for mining and domestic purposes. Estimated cost \$2,000.

**SAN DIEGO COUNTY**—Application 6649. Southern California Water Supply Co., c/o F. M. Faude, vice president, Loveland Engineers, Inc., 1010 Bank

of Italy Bldg., San Francisco, for 18.6 c.f.s. and 40,000 acre-feet per annum from Sweetwater River tributary to San Diego Bay to be diverted in Sec. 17, T. 16 S., R. 2 E., S. P. B. & M. Storage in T. 17 S., R. 2 E., S. B. B. & M., for irrigation and domestic purposes (5000 acres). Estimated cost \$1,500,000.

**EL DORADO COUNTY**—Application 6650. Florence D. Smith, 219 Kentucky St., Petaluma, for .001 c.f.s. from Winifred Spring tributary to Fallen Leaf Lake to be diverted in Sec. 13, T. 12 N., R. 17 E., M. D. B. & M., for domestic purposes. Estimated cost \$125.

**VENTURA COUNTY**—Application 6651. Chester F. Robbins, 468 E. Main St., Ventura, for 1.00 c.f.s. from Middle Fork of Lockwood Creek tributary to Lockwood Creek, Piru Creek, to be diverted in Sec. 20, T. 8 N., R. 21 W., S. B. B. & M., for irrigation and domestic purposes (80 acres). Estimated cost \$2,000.

**PLACER COUNTY**—Application 6652. Bear River Water and Power Co., c/o J. L. Rollins, manager, Colfax, 111,020 acre-feet per annum from Bear River tributary to Feather River to be diverted in Sec. 22, T. 15 N., R. 9 E., M. D. B. & M., for power purposes (4250 h.p.). Estimated cost \$2,500,000.

**SANTA CLARA COUNTY**—Application 6653. Mrs. A. F. Cochrane, c/o Louis O'Neal, First National Bank Bldg., San Jose, for 0.025 c.f.s. from Coyote River tributary to San Francisco Bay to be diverted in Sec. 11, T. 9 S., R. 3 E., M. D. M., for irrigation purposes (51 acres).

**SANTA CLARA COUNTY**—Application 6654. Mrs. A. F. Cochrane, c/o Louis O'Neal, First National Bank Bldg., San Jose, for 0.22 c.f.s. from Coyote River tributary to San Francisco Bay to be diverted in Sec. 11, T. 9 S., R. 3 E., M. D. M., for domestic purposes. Estimated cost \$250.

**SANTA CLARA COUNTY**—Application 6655. Mrs. A. F. Cochrane, c/o Louis O'Neal, First National Bank Bldg., San Jose, for 0.22 c.f.s. from Coyote River tributary to San Francisco Bay to be diverted in Sec. 13, T. 9 S., R. 3 E., M. D. M., for irrigation purposes (18 acres). Estimated cost \$1,500.

**SANTA CLARA COUNTY**—Application 6656. Mrs. A. F. Cochrane, c/o Louis O'Neal, First National Bank Bldg., San Jose, for 0.12 c.f.s. from Coyote River tributary to San Francisco Bay to be diverted in Sec. 11, T. 9 S., R. 3 E., M. D. M., for irrigation purposes (9½ acres).

**SAN LUIS OBISPO COUNTY**—Application 6657. Dr. O. M. Polin, c/o J. D. McGregor, Gibson-Drexler Bldg., San Luis Obispo, for 1.78 c.f.s. from well tributary to San Luis Obispo Creek, to be diverted in Sec. 10, T. 31 S., R. 12 E., M. D. M., for irrigation purposes (131 acres). Estimated cost \$20,000.

**LOS ANGELES COUNTY**—Application 6658. William H. Cruzan, Rt. 1, Box 110, Saugus, for .5 c.f.s. from 3 springs, tributary to Mint Canyon, Santa Clara River, to be diverted in Sec. 4, T. 5 N., R. 14 W., S. B. B. & M., for mining purposes. Estimated cost \$26,000.

**EL DORADO COUNTY**—Application 6659. U. S. El Dorado National Forest, c/o Edwin F. Smith, supervisor, Placerville, for .0027, or approximately 1800 gals. per day, from unnamed stream tributary to Upper Echo Lake to be diverted in Sec. 35, T. 12 N., R. 17 E., M. D. M., for domestic purposes. Estimated cost \$150.

**BUTTE COUNTY**—Application 6660. A. H. Dakin, Magalia, for 49 c.f.s. from Empire Creek tribu-

tary to West Branch of North Fork of Feather River to be diverted in Sec. 20, T. 23 N., R. 4 E., M. D. B. & M., for mining purposes. Estimated cost \$300.

**RIVERSIDE COUNTY**—Application 6661. J. O. Blackburn, Hemet, for 3000 gallons per day from Bee Canyon Spring tributary to San Jacinto River to be diverted in Sec. 12, T. 5 S., R. 1 E., S. B. B. & M., for irrigation purposes. Estimated cost \$3,000.

**RIVERSIDE COUNTY**—Application 6662. Lucile Mann Morris, Keen Camp, for 8 miner's inches, or .2 c.f.s., from spring tributary to San Jacinto River to be diverted in Sec. 8, T. 6 S., R. 4 E., S. B. B. and M., for irrigation purposes (20 acres). Estimated cost \$1,100.

**SAN BERNARDINO COUNTY**—Application 6663. Otto E. Kanka, Lucerne Valley, for 20 miner's inches, or .5 c.f.s., from unnamed spring tributary to Mojave Desert to be diverted in Sec. 10, T. 3 N., R. 1 W., S. B. B. & M., for irrigation and domestic purposes. Estimated cost \$3,000.

**SUTTER COUNTY**—Application 6664. James R. Young, Cranemore, for 1.94 c.f.s. from Sacramento River tributary to Suisun Bay to be diverted in Sec. 14, T. 13 N., R. 1 E., M. D. B. & M., for irrigation purposes (154.97 acres). Estimated cost \$5,000.

Permits to appropriate water issued by the Department of Public Works, Division of Water Resources, during April, 1930.

**ORANGE COUNTY**—Permit 3458, Application 5304. Issued to San Juan Water Co., Los Angeles, April 2, 1930, for 2000 acre-feet per annum from San Juan Creek in Sec. 23, T. 8 S., R. 8 W., S. B. M., for domestic purposes.

**MENDOCINO COUNTY**—Permit 3459, Application 6544. Issued to Robert B. Finn, Mill Valley, April 5, 1930, for .025 c.f.s. from unnamed creek tributary to South Eel River in Sec. 21, T. 19 N., R. 12 W., M. D. M., for domestic purposes. Estimated cost \$450.

**MARIPOSA COUNTY**—Permit 3460, Application 6041. Issued to William Winsell, Nipinnawasee, April 15, 1930, for 500 gal. per day from Chowchilla Creek in Sec. 18, T. 5 S., R. 21 E., M. D. M., for domestic purposes. Estimated cost \$1,200.

**MARIPOSA COUNTY**—Permit 3461, Application 6139. Issued to Chris W. and Ebba W. Jeppeson, Romona, April 15, 1930, for .0031 c.f.s. from Chowchilla Creek in Sec. 18, T. 5 S., R. 21 E., M. D. M., for domestic purposes. Estimated cost \$1,200.

**SIERRA COUNTY**—Permit 3462, Application 6503. Issued to United States Tahoe National Forest, Nevada City, April 17, 1930, for 0.04 cubic foot per second from unnamed spring in Sec. 1, T. 20 N., R. 12 E., M. D. M., for domestic and recreational purposes. Estimated cost \$100.

**LASSEN COUNTY**—Permit 3463, Application 6324. Issued to Lester F. Totten, Bieber, April 21, 1930, for 2 acre-feet per annum from unnamed stream in Sec. 16, T. 36 N., R. 11 E., M. D. M., for stock watering. Estimated cost \$350.

**INYO COUNTY**—Permit 3464, Application 6532. Issued to H. M. White, Independence, April 28, 1930, for 0.002 c.f.s. from small unnamed spring in Sec. 10, T. 13 S., R. 34 E., M. D. M., for mining and domestic purposes. Estimated cost \$50.

**YUBA COUNTY**—Permit 3465, Application 6543. Issued to Wallace James Stanford, Wheatland, April 28, 1930, for 0.67 c.f.s. from Dry Creek in Sec. 34, T. 15 N., R. 6 E., M. D. M., for irrigation and domestic purposes on 100 acres. Estimated cost \$3,500.

**LOS ANGELES COUNTY**—Permit 3466, Application 6548. Issued to Isaac Wiskerson, Palmdale, April 28, 1930, for .025 c.f.s. from Granite Springs in Sec. 24, T. 6 N., R. 14 W., S. B. M., for irrigation and domestic purposes on 2 acres. Estimated cost \$400.

**SIERRA COUNTY**—Permit 3467, Application 6433. Issued to J. B. Harris, Downieville, April 29, 1930, for 0.125 c.f.s. from two unnamed springs in Sec. 32, T. 20 N., R. 10 E., M. D. M., for power purposes. Estimated cost \$500.

**GLENN COUNTY**—Permit 3468, Application 6562. Issued to William F. Linton, Orland, April 30, 1930, for 0.81 c.f.s. from unnamed stream in Sec. 8, T. 21 N., R. 3 W., M. D. M., for irrigation and domestic purposes on 5 acres. Estimated cost \$400.

**TRINITY COUNTY**—Permit 3469, Application 6149. Issued to C. M. Salyer, Salyer, April 30, 1930, for 80 c.f.s. from Cedar Flat Creek in Sec. 24, T. 6 N., R. 5 E., H. M., for mining purposes.

### DAM APPLICATIONS, APPROVALS AND PLANS

Applications for approval of dams built prior to August 14, 1929, filed with the State Department of Public Works, Division of Water Resources, during the month of April, 1930.

**AMADOR COUNTY**—Original Amador Dam No. 472. J. W. Bullock, Amador City, owner; ambursen, 28 feet above streambed. Situated on Amador Creek tributary to Mokelumne River in Sec. 34, T. 7 N., R. 10 E., M. D. M., for storage purposes for debris use. Estimated cost \$17,500.

**AMADOR COUNTY**—Ludekins Dam No. 475. Ludekins Brothers, Pine Grove, owner; earthfill, 18 feet above streambed with a storage capacity of 8 acre-feet. Situated on Grass Valley tributary to Main Creek in Sec. 34, T. 7 N., R. 12 E., M. D. M., for storage purposes for debris use. Estimated cost \$2,000.

**CALAVERAS COUNTY**—San Mateo Produce Dam No. 495. California Lands, Inc., San Francisco, owner; earth and rock fill, 8 feet above streambed with a storage capacity of 60 acre-feet. Situated on an unnamed creek tributary to Calaveras River in Sec. 4, T. 3 N., R. 10 E., M. D. M. Estimated cost \$20,000.

**CALAVERAS COUNTY**—Salt Springs Valley No. 496. The California Company, Inc., Stockton, owner; earthfill, 53 feet above streambed with a storage capacity of 19,170 acre-feet. Situated on Rock Creek tributary to Littlejohn Creek in Sec. 16, T. 2 N., R. 11 E., M. D. M., for storage and diversion purposes for mining and irrigation use. Estimated cost \$100,000.

**EL DORADO COUNTY**—Rupley Dam No. 463. A. J. Rupley, Placerville, owner; earthfill, 12 feet above streambed with a storage capacity of 2 acre-feet. Situated on Webber Creek tributary to American River in Sec. 11, T. 11 N., R. 10 E., M. D. M., for storage purposes for irrigation use.

**HUMBOLDT COUNTY**—North Fork Dam No. 201. California Barrel Company, Arcata, owner; wood, 22 feet above streambed with a storage capacity of 20 acre-feet. Situated on Long Prairie Creek tributary to North Fork Mad River in Sec. 12, T. 6 N., R.

2 E., H. B. & M., for storage purposes for logging use. Estimated cost \$10,000.

**LASSEN COUNTY**—Hog Flat Dam No. 236. Lassen Irrigation Company, Standish, owner; rock and earthfill, 18 feet above streambed with a storage capacity of 8000 acre-feet. Situated on Hog Flat tributary to Susan River located in Sec. 20, T. 30 N., R. 10 E., for storage purposes for irrigation use. Estimated cost \$10,000.

**LASSEN COUNTY**—Lake Leavitt Dam No. 236-2. Lassen Irrigation Company, Standish, owner; earthfill with a storage capacity of 14,000 acre-feet situated on Alkali Lake Basin tributary to Susan River in Sec. 15, T. 29 N., R. 13 E., M. D. M., for storage purposes for irrigation use. Estimated cost \$30,000.

**LASSEN COUNTY**—McCoy Flat No. 236-3. Lassen Irrigation District, Standish, owner; rock and earthfill, 14 feet above streambed with a storage capacity of 18,000 acre-feet, situated on Susan River in Sec. 23, T. 30 N., R. 9 E., M. D. M., for storage purposes for irrigation use. Estimated cost \$17,500.

**LOS ANGELES COUNTY**—Shea Dam No. 777. R. P. Shea, Los Angeles, owner; arch 15 feet above streambed with a storage capacity of 15 acre-feet. Situated on an unnamed creek tributary to Antelope Valley Creek in Sec. 17, T. 7 N., R. 14 W., S. B. M., for storage purposes for recreation use. Estimated cost \$12,000.

**LOS ANGELES COUNTY**—Kewen No. 5 Reservoir Dam No. 2. City of Alhambra, Alhambra, owner; earthfill, 22 feet above streambed with a storage capacity of 15 acre-feet. Situated on Mill Creek tributary to San Gabriel River in Sec. 33, T. 1 N., R. 12 W., S. B. M., for storage purposes for municipal and other uses. Estimated cost \$67,627.

**MODOC COUNTY**—Webb Flat Dam No. 160. Peter Gerig, Bieber, owner; earthfill, 5 feet above streambed with a storage capacity of 100 acre-feet, situated on an unnamed drainage tributary to Egg Lake in Sec. 7, T. 41 N., R. 7 E., M. D. M., for storage purposes for stock water use.

**MODOC COUNTY**—McGinty Dam No. 131. X. L. Land and Cattle Company, Alturas, owner; earthfill, 16 feet above streambed with a storage capacity of 340 acre feet. Situated on an unnamed drainage tributary to Goose Lake in Sec. 30, T. 46 N., R. 13 E., M. D. M., for storage purposes for irrigation and domestic use.

**MONTEREY COUNTY**—San Carlos Dam No. 644. Rancho San Carlos, Inc., Monterey, owner; rockfill, 15 feet above streambed with a storage capacity of 150 acre-feet. Situated on Yarzas Creek tributary to Carmel River in Sec. 18, T. 17 S., R. 2 E., M. D. M., for storage purposes for recreation use. Estimated cost \$13,500.

**NAPA COUNTY**—Gordon Valley Dam No. 14. City of Vallejo, Vallejo, owner; earthfill, 92 feet above streambed with a storage capacity of 10,000 acre-feet. Situated on Gordon Valley Creek tributary to Suisun Creek in Sec. 19, T. 6 N., R. 2 W., M. D. M., for storage purposes for municipal use. Estimated cost \$300,000.

**NAPA COUNTY**—Distributing Reservoir Dam No. 7-2. City of Napa, Napa, owner; gravity, 35 feet above streambed with a storage capacity of 28 acre-feet. Located in Lot 21, Imrieville, for distribution purposes for municipal use.

**NEVADA COUNTY**—Floriston Dam No. 305-2. Crown-Willamette Paper Company, San Francisco, owner; crib, 18 feet above streambed with a storage capacity of 11.15 acre-feet. Situated on Truckee River

in Sec. 30, T. 18 N., R. 18 E., M. D. M., for diversion purposes for power use.

**NEVADA COUNTY**—Swamp Angel Dam No. 306. Swamp Angel Mining Company, Arroyo Grande, owner; arch, 20 feet above streambed. Situated on Steep Hollow tributary to Bear River in Sec. 12, T. 16 N., R. 10 E., M. D. M., for storage purposes for debris use. Estimated cost \$4,500.

**NEVADA COUNTY**—Boulder Brook Dam No. 310. D. L. Jungck, Berkeley, owner; arch, 5 feet above streambed with a storage capacity of 30 acre-feet. Situated on Boulder Brook tributary to Bear River in Sec. 32, T. 14 N., R. 8 E., M. D. M., for storage and diversion purposes for irrigation use. Estimated cost \$5,000.

**RIVERSIDE COUNTY**—Lake Norconian West Dam No. 820-A. Rex B. Clark, Norco, owner; earthfill 9 feet above streambed with a storage capacity of 500 acre-feet. Situated on no stream in Sec. 12, T. 3 S., R. 7 W., S. B. M., for storage purposes for recreation use.

**RIVERSIDE COUNTY**—Lake Norconian South Dam No. 820-B. Rex B. Clark, Norco, owner; earthfill, 13 feet above streambed with a storage capacity of 500 acre-feet. Situated on no stream in Sec. 12, T. 3 S., R. 7 W., S. B. M., for storage purposes for recreation use.

**SACRAMENTO COUNTY**—Daily Dam No. 452. Geo. O. Kyburz, Folsom, owner; earthfill, 13 feet above streambed. Situated on an unnamed draw tributary to Alder Creek, for storage purposes for stock watering use.

**SAN BERNARDINO COUNTY**—Los Serranos Dam No. 808. Davidson Investment Company, Long Beach, owner; earthfill, 12 ft. above streambed with a storage capacity of 110 acre-feet. Situated on no stream in Sec. 22, T. 2 S., R. 8 W., S. B. M., for storage purposes for irrigation use.

**SAN DIEGO COUNTY**—Green Dam No. 835. West Missouri Power Company, Escondido, owner; earthfill, 19 feet in height with a storage capacity of 8.4 acre-feet. Situated on no stream, for storage purposes for irrigation use. Estimated cost \$2,000.

**SAN DIEGO COUNTY**—Lemon Grove, Larger Dam No. 56-7. La Mesa, Lemon Grove and Spring Valley Irrigation District, La Mesa, owner; earthfill, 30 feet above streambed with a storage capacity of 15 acre-feet. Located in Sec. 25, T. 16 S., R. 2 W., S. B. M., for storage purposes for irrigation use.

**SAN DIEGO COUNTY**—Lemon Grove, Smaller Dam No. 56-8. La Mesa, Lemon Grove and Spring Valley Irrigation District, La Mesa, owner; earthfill, 30 feet above streambed with a storage capacity of 15 acre-feet. Located in Sec. 30, T. 16 S., R. 1 W., S. B. M., for regulating purposes for irrigation use.

**SAN MATEO COUNTY**—Crocker Dam No. 616. Provident Securities Company, Hillsborough, owner; earthfill, 35 feet above streambed with a storage capacity of 34 acre-feet. Situated on South Branch of Sanchez Creek tributary to San Francisco Bay. Located in San Mateo Rancho, for storage purposes for irrigation use.

**SAN MATEO COUNTY**—Notre Dame Dam No. 619. College of Notre Dame, Belmont, owner; earthfill, 40 feet above streambed. Situated on Belmont Creek for storage purposes for irrigation use.

**SANTA CLARA COUNTY**—Losse Dam No. 623. Vivian Losse Blair et al., Sunnyvale, owners; concrete. Situated on Stevens Creek tributary to San Francisco Bay in Sec. 3, T. 7 S., R. 2 W., M. D. M., for diversion purposes for irrigation use.

**SANTA CRUZ COUNTY**—Gilroy Dam No. 15. City of Gilroy, owner; concrete, 8 feet above streambed. Situated on Uvas Creek tributary to Pajaro River, for diversion purposes for municipal and domestic use. Estimated cost \$2,000.

**SHASTA COUNTY**—Burney Creek Dam No. 221. Mrs. Ednah M. Black, San Francisco, owner; earthfill 11 feet above streambed with a storage capacity of 670 acre-feet. Situated on Burney Creek tributary to Pit River in Sec. 32, T. 36 N., R. 3 E., M. D. M., for storage purposes for irrigation and reclamation use. Estimated cost \$10,000.

**YUBA COUNTY**—Horse Valley Dam No. 332. Turner & Rabe, Comptonville, owner; arch, 25 feet above streambed. Situated on Horse Valley Creek tributary to Willow Creek, in Sec. 35, T. 19 N., R. 25 E., M. D. M., for storage purposes for debris use.

Application for approval of plans and specifications for construction or enlargement of dams filed with the State Department of Public Works, Division of Water Resources, during the month of April, 1930.

**LOS ANGELES COUNTY**—Mulholland Dam No. 6-17. City of Los Angeles, Los Angeles, owner; gravity arch, 191 feet above streambed with a storage capacity of 7437 acre-feet situated on Weid Canyon in Sec. 3, T. 1 S., R. 14 W., S. B. M., for storage purposes for municipal use.

**SAN DIEGO COUNTY**—Lake Loveland Dam No. 840-3. Southern California Water Supply Company, San Francisco, owner; arch, 183 feet above streambed with a storage capacity of 27,700 acre feet. Situated on Sweetwater River in Sec. 17, T. 16 S., R. 2 E., S. B. M., for storage and diversion purposes for municipal and other uses. Estimated cost \$490,258. Fees paid \$2,951.29.

**SUTTER COUNTY**—Allen Dam No. 1-12. Preston School of Industry, Waterman, owner; buttress, 21 feet above streambed with a storage capacity of 2½ acre-feet, situated on Downes or Ione Ditch in Sec. 27, T. 6 N., R. 10 E., M. D. M., for storage purposes for domestic use. Estimated cost \$10,120.

Plans and specifications for the construction or enlargement of dams approved by the State Department of Public Works, Division of Water Resources, during the month of April, 1930.

**BUTTE COUNTY**—Lake Madrone Dam No. 342-2. Geo. C. Mansfield and Duncan C. McCallum, Oroville, owner; ambursen, 27 feet above streambed. Situated on Berry Creek tributary to Feather River in Sec. 27, T. 21 N., R. 5 E., M. D. M., for storage purposes for recreation use. Estimated cost \$20,000.

**EL DORADO COUNTY**—Rock Creek Dam No. 465. Arthur E. Razor, Georgetown, owner; earthfill, 30 feet above streambed with a storage capacity of 34.2 acre-feet. Situated on Rock Creek tributary to South Fork American River in Sec. 34, T. 13 N., R. 11 E., M. D. M., for storage and diversion purposes for domestic, irrigation, mining and recreation use. Estimated cost \$2,000.

Colored Parson—"Now kin enny ob yo' sinners tell me why the lion didn't eat Dan?"

Nobody answered.

"Wal, ah'll tell yer bunch of unbelievers," he yelled; "twas cos most o' him was backbone, an' the rest was grit."

**STATE HIGHWAYS IN CALIFORNIA SHOWING THE PRIMARY AND SECONDARY ROAD SYSTEMS AND THE DIVISION OF THE STATE UNDER THE BREED BILL.**



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