

CALIFORNIA

HIGHWAYS AND PUBLIC WORKS

CALIFORNIA
DOCUMENT

Spring in Capitol Park

Official Journal of the Department of Public Works
MARCH 1935

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\$16,000,000 Saving for California Taxpayers In Governor Merriam's Highway Unification Plan

By **FRANK F. MERRIAM**, Governor of California

ANY public undertaking that calls for an expenditure by the taxpayers of an amount in excess of \$180,000 a day for nineteen years surely must have a very important bearing on the basic interests and welfare of the people.

In any event, such was the daily cost, from 1914 to 1933, to State, county, and municipal taxpayers for the construction and maintenance of highways, roads and streets in California representing the huge total for the nineteen-year period of \$1,265,000,000. The highways, roads and streets called for an expenditure by the State of \$384,000,000; by the counties of \$467,000,000, and by the cities of \$414,000,000.

Some of these costs have been unnecessary, or have been excessive, through a duplication of effort and through the use of costly methods and equipment by road departments.

To remedy this condition, and at the same time to provide for a more effective and satisfactory development coordination of highways, roads, and streets, I have submitted a plan to the State Legislature calling for a unification of the State and county highway systems and for doubling the amount of State funds allotted to cities for street purposes.

Adoption of this plan, on the basis of avail-

able estimates, will effect a saving to California taxpayers of approximately \$16,000,000 during the next two years.

All are agreed that coordination and consolidation of governmental functions is desirable both in the interests of efficiency and

economy. Proposals are being earnestly advocated for the consolidation of the State's 58 counties into larger political subdivisions; some advocating that not more than five counties be organized, while others believe the number should be fifteen or sixteen.

The exact manner of reducing the number of counties is important only as it has a bearing on the results to be obtained, but it has been estimated that a merging of the counties, with the subsequent elimination of manifold duplications of effort, services and expenses, would save the taxpayers \$30,000,000 in two years.

And while I am not seeking at this time to bring the problem of county consolidation before the Legislature—even though I appreciate the advantages of such an arrangement—it is worthy of note that the highway unification program now before the Legislature would save an amount equal to one-half the total savings to be accomplished by reducing the number of counties.

There is, of course, considerable opposition

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GOVERNOR FRANK F. MERRIAM

Blasting 100,000 Cubic Yards of Solid Rock Per Mile on Feather River Job

By PERRY R. LOWDEN, Assistant District Construction Engineer

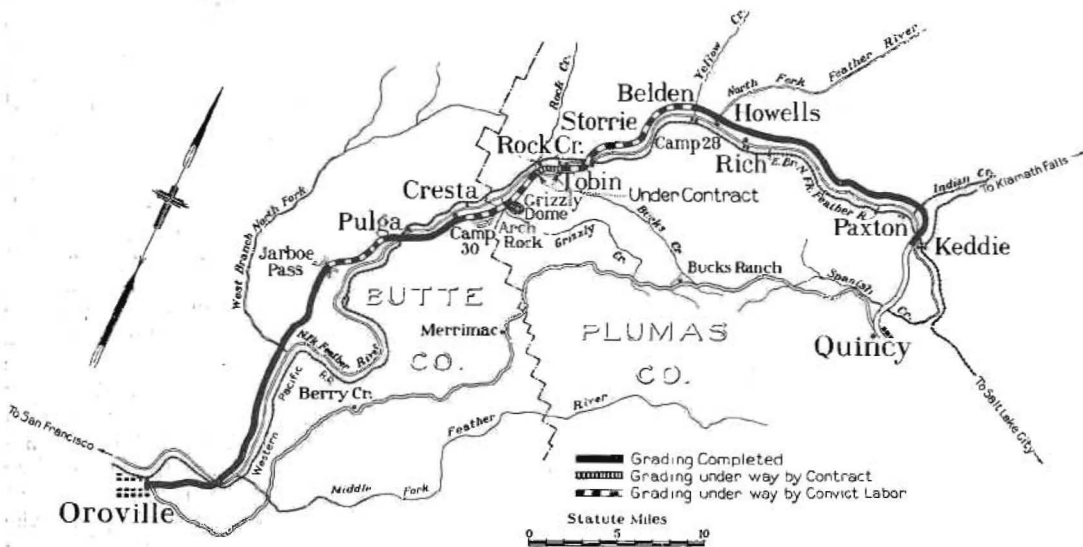
THE general public and the Division of Highways are watching with much interest and anticipation, the progress of the highway grading projects in the Feather River Canyon.

The Feather River Highway connects Oroville and Quincy, county seats of Butte and Plumas counties; and is a part of an interstate route connecting with U. S. 40 at Reno, Nevada. It is 78 miles long, and a preliminary estimate placed the cost of grading and

of excavation. One contract for grading 2.5 miles between Storrie and Rock Creek is due for completion in July.

The remainder of the grading is to be done by the two convict camps which started the work in 1928. To date these camps have moved 4,328,000 cubic yards in completing 43.3 miles.

In addition, six bridge contracts have been completed, and one for a bridge across the North Fork at Tobin is in progress. Two



structures at \$7,075,000. At this time the work is organized with the objective of completing the grading between Oroville and Keddle, seven miles from Quincy, during the summer of 1936. The apparent final cost of grading and structures for the 77.75 miles is \$6,900,000.

Work was started on both the Oroville and Keddle ends in the spring of 1928 and has been prosecuted steadily since that date.

SIX GRADING CONTRACTS

There have been six grading contracts covering a total length of 14.3 miles and involving the movement of 1,456,800 cubic yards

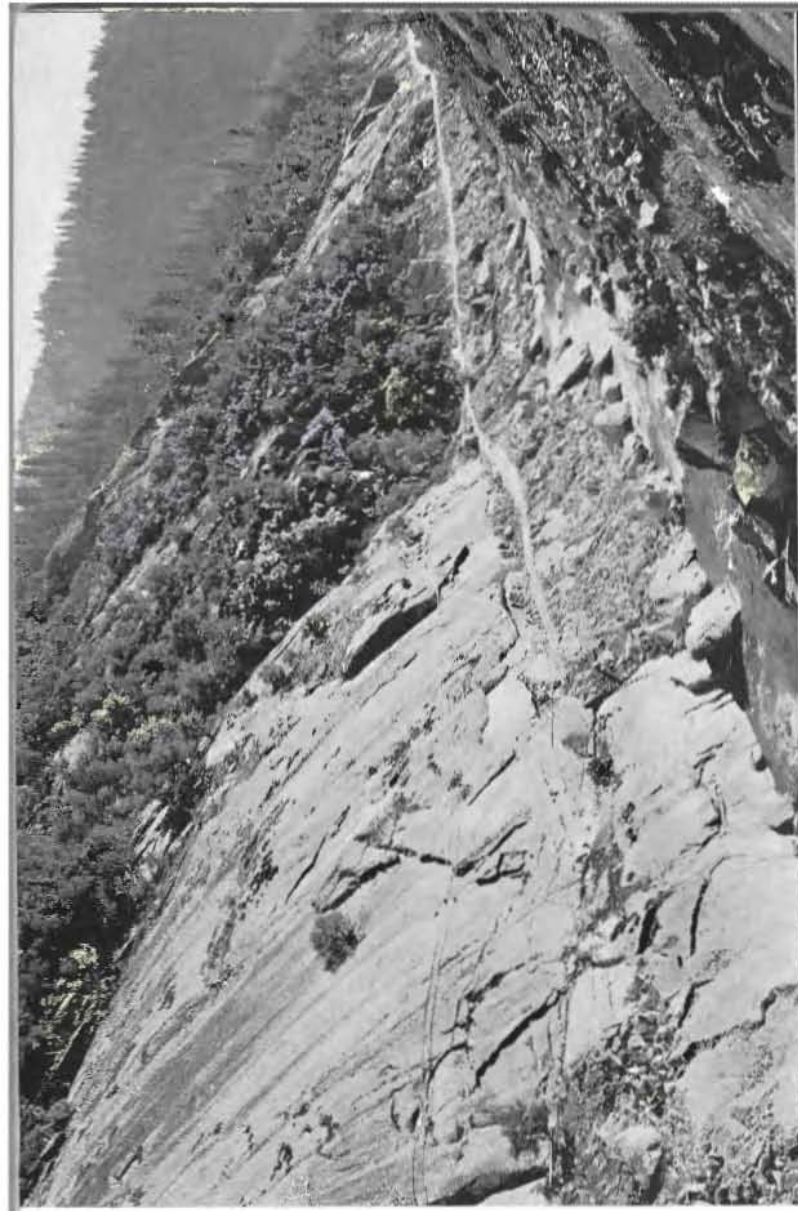
other bridges across the North Fork, one at Storrie and one at Rock Creek, are yet to be built by contract.

The present contract for 2.5 miles between Rock Creek and Storrie will permit access to bridge sites at Rock Creek and Storrie at either end. The construction of these bridges is planned in 1935, to permit access to the adjacent sections which will be graded by convict labor.

GRANITE DOMES ENCOUNTERED

All of the work done to date has been on the 70.75 miles between Oroville and Keddle. There remain twelve miles to be constructed

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GREAT GRANITE DOMES of Feather River Canyon are being blasted and tunneled by highway engineers. The top picture shows the end of grading at Arch Rock where drilling operations begin. The upper line across the rock is a 4-inch airline for supplying the jackhammers. The other lines provide footholds for the men. Lower left photo shows 9 by 14 foot heading of tunnel No. 1. Outline for the completed tunnel is shown on face of portal. At lower right, men are loading drill holes on steep bare slope.

Model Built to Scale Visualizes Proposed Salinas Grade Separation

By H. D. STOVER, Designing Engineer, Bridges

MODELS properly constructed are a direct aid in the designing of bridges, towers, buildings, dams and various structures.

From the structural designer's standpoint, models serve primarily as a check on the analysis of stresses. Due to the increasing demand that designers visualize the functions of a structure as a whole and that the plan is such that the finished structure has a pleasing appearance and the proper proportions for the materials of construction selected, the use of models have increasing value.

In the city of Salinas, State Highway Route 2 (U. S. 101) crosses the main line and yard tracks of the Southern Pacific Railroad at grade. The crossing is in a built up section of the city at the intersection of North Main and Monterey streets. The State highway route comes into Salinas over North Main Street and turns into Monterey Street just after crossing the railroad tracks.

SPECIAL PROBLEMS INVOLVED

The construction of a grade separation in this congested business area, presents many special problems that must be satisfactorily solved for all parties concerned, such as relocation of approach roads; providing for proper sight distances for the safety of traffic; proper location of stop signs and traffic signals; providing the best possible access to property adjacent to the subway, etc.

It appeared advisable therefore to construct a model of the proposed grade separation as was done, with many resultant benefits, in the case of other grade separations, such as the Lincoln-Culver Boulevard separation on Route 60 in Los Angeles County, and the crossing of Route 9 over the tracks and yards of the Atchison, Topeka and Santa Fe Railroad in San Bernardino city.

MODEL ON DISPLAY

The placing of this subway model on display in the city of Salinas will also enable the property owners and business firms located adjacent to the proposed structure to actually visualize the conditions that will result from

the completed structure, clearly bringing out certain advantages to be gained and showing property frontage that will be affected.

Also the populace of the city will be able to visualize the advantage of having the traffic separated from the present crossing at grade, thereby eliminating the costly delay that local and through traffic is subjected to, as well as providing a plaza and parked area and eliminating the unsightly view of the railroad yards. The display of this model will enable the people of the city to comprehend readily what only a few would understand from a study of plans and blueprints of the project.

CONSTRUCTED TO SCALE

The model is three and one-half feet by eight feet in size and is constructed to a scale of one inch to fifteen feet, or a ratio of one to one hundred and eighty. The base of the model consists of a main outer frame having two inch by three inch side pieces with one inch by three inch cross pieces, and an inner frame sawed to the shape of the subway walls and having cross pieces set a varying depth to form the roadway depression.

The top is a sheet of $\frac{1}{8}$ inch ply wood cut to fit around and through the subway frame, giving an unbroken, smooth surface to the subway and surface streets. The sidewalk level is built up of two layers of heavy cardboard. The surface textures, painted sandpaper represents grass and a thin application of plaster, stippled and painted, represents bare ground.

PHOTOGRAPHIC SURVEY MADE

The steel girder span carrying the railroad was modeled entirely of cardboard.

Electroliers and traffic-stop signs are of lead cast in a plaster mold.

Photographic survey was made of the site and the colors of all buildings noted. From these photographs, the miniature buildings are reproduced by sawing blocks of wood to shape and architectural ornaments are pieces of cardboard glued to the wood, the whole colored the same as the prototype buildings.

The model was constructed by Junior Designing Engineer of Bridges, T. K. May.



MODEL AND PHOTOGRAPHS picture the safety and traffic aspects of the proposed grade separation and subway improvement in the City of Salinas where a railroad crosses the intersection of the State highway and Main Street. The model, at top, shows the present dangerous grade intersection replaced by a wide subway with the railroad carried across on a girder bridge and a parked area separating traffic. Present conditions are shown in the photographs.

Survey Shows 7,802,000,000 Vehicle Miles Traffic on State Highways in 1934

By C. H. PURCELL, State Highway Engineer

THE Division of Highways has just completed an exhaustive traffic survey of the roads and streets of California made during the year 1934 which reveals that the total annual motor travel in the State is 16,600,000,000 vehicle miles, of which 47 per cent occurs on State highways, 11.5 on county roads and 41.5 on city streets other than State highways.

The report of this survey is the most comprehensive collection of State traffic statistics yet compiled. It represents a year's work and the employment of 14,000 checkers and statisticians in field and office, supervised by the Maintenance Department of the Division of Highways.

The survey was accomplished through financial aid from the Federal Civil Works Administration and the State Emergency Relief Administration.

REPORT IN THREE VOLUMES

The report of this work recently made to Governor Frank F. Merriam by Director of Public Works Earl

Lee Kelly is in three volumes covering six related studies including a series of county and major city traffic-flow maps constituting the most complete and up-to-date road maps of California.

The field covered by the survey includes the amount and location of motor vehicle traffic and its outstanding characteristics, the extent of the public thoroughfares and their classification upon the basis of traffic, the relationship between governmental costs for highways and those for other purposes, and highway

costs in terms of traffic. To reach this goal, six related studies were made.

Traffic counts were made on January 14 and 15, March 25 and 26, and July 1 and 2, 1934, at 2560 stations throughout California upon all classes of roads, 1334 of which stations were located outside of cities and 1226 stations within 51 cities which represented

84 per cent of the urban population of the State.

6,000,000 license numbers were recorded and the residence of owners traced to chart the origin of traffic. More than 100,000 automobiles were checked on the make of car, its age, and its gasoline consumption.

TRUCK TRANSPORTATION CHECKED

Trucking on highways was thoroughly investigated, as were expenditures and revenues of State, county, and municipal governments for the period of 1914 to 1933, especially in relation to highways.

Except for cities and counties where suitable records were available, the entire

road and street mileage of the State was logged. Type and width of surface were recorded, together with pertinent data on structures and drainage. This compilation is the most accurate mileage record thus far prepared for California.

An intensive study of trucking was made between March 15 and June 30, and approximately 32,400 drivers were questioned as to their operations. The movement of agricultural products over the roads and railroads of the State was determined, particularly the



C. H. PURCELL

Streets and Roads Total 95,957 Miles

(Continued from preceding page)

movement into the cities of San Francisco and Los Angeles. Expenditures and revenues were compiled for State, county, and municipal governments for the period 1914 to 1933.

HIGH LIGHTS OF SURVEY

Some of the high lights developed by the survey follow:

State highways outside of cities carry $\frac{3}{4}$ of all traffic outside of cities. State highways inside cities carry $\frac{1}{4}$ of all city traffic.

State highway within cities of California have $\frac{1}{18}$ of the mileage within the cities and carry $\frac{1}{4}$ of the traffic.

Of the total annual vehicle mileage in California, 55.6 per cent occurs within cities. The remaining 44.4 per cent of California's traffic flows outside of cities and $\frac{3}{4}$ of this rural traffic moves on roads of the State highway System.

EXPENDITURES COMPARED

The aggregate expenditures for vehicle regulation and highways since 1914 and since 1929 are given for comparison as follows:

	1914-1933	Per cent
State	\$384,000,000	30.4
Counties	467,000,000	36.9
Cities	414,000,000	32.7
	\$1,265,000,000	100.0
	1929-1933	Per cent
State	\$185,000,000	35.1
Counties	147,000,000	27.9
Cities	195,000,000	37.0
	\$527,000,000	100.0

Vehicle regulation and highway expenditures per vehicle mile in 1933 by the three governmental units were as follows:

State	\$0.0046
Counties0126
Cities0040
Average0053

95,957 TOTAL MILEAGE

The total road and street mileage in California is 95,957 miles, of which 13,605 miles are State highways, 65,130 miles are county roads, and 17,222 miles are city streets other than those in the State highway system.

The State Highway System has 8,984 miles of high and intermediate type of surfacing. The city system has 11,427 miles, and the counties, 11,116 miles.

Approximately one-third of all the road mileage in California is of high type or intermediate type surface, which classification embraces Portland cement concrete, asphaltic concrete, oil mix and oil macadam pavements.

TRUCKS ON INCREASE

California passenger vehicles number 1,712,000 and freight vehicles, 288,409. Vehicles in California from other States in 1934 totaled 326,000.

While registration of passenger cars was decreased by the depression, truck and trailer registration is increasing.

The average motor vehicle in California in 1934 consumed 601 gallons of gasoline. This is 68 gallons more per car than was consumed ten years ago. Passenger cars averaged 15.2 miles per gallon of gasoline; trucks averaged 10.64 miles.

One fourth of the passenger cars and trucks on the roads are more than seven years of age. The passenger cars average approximately 7250 miles a year, the trucks 9900 miles.

Expenditures for all governmental units combined and for various purposes for the 20-year period, expressed as a percentage of the total expenditures, are as follows:

	Per cent of total expenditures
Vehicle Regulation and Highways	15.8
Education	27.9
Public Protection and Benefit	35.9
General Government	8.8
Debt Service	11.6
	100.0

SOURCES OF REVENUE

The sources of revenue for all three branches of government—State, county, and municipal—for the last 20 years are as follows:

Source	Per cent of total
General Tax	58.1
Miscellaneous Revenue	17.4
Vehicle Operation Taxes	5.2
Federal Aid	0.8
Other subventions and grants (from general tax)	5.8
Sale of Bonds	12.7
	100.0

California's annual agricultural production approximates 17,000,000 tons, all of which

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Unification Plan Eliminates Road Tax

(Continued from page 1)

to the plan I have proposed; and I entertain no criticism of those who disagree with me. It is any one's privilege to oppose, as it is mine to favor, this program.

In this proposal appears the old obstacle that confronts every attempt to change existing procedure or to economize. Which is to say, generally speaking, that we are opposed to taxes which we are required to pay, and are reluctant to favor economy in the administration of projects in which we have a direct interest.

The unification of highways as proposed in the budget I submitted to the State Senate and Assembly contemplates certain definite, specific advantages—as I have said—both from the standpoint of economy and efficiency.

Contrary to popular belief, the State's three-cent gasoline tax does not pay all the costs of constructing, improving and maintaining highways. This tax is divided between the State, the counties and the cities, one cent being allocated to the counties, a quarter of a cent to the cities, and the balance to the State.

ELIMINATES ROAD TAXES

From its share of the gasoline tax money, the State pays the entire cost of the California highway system over which flows the bulk of all traffic, outside the cities. For the construction and maintenance of the lesser-used county highways, county supervisors augment gasoline tax funds by levying taxes, special assessments and by issuing bonds—all payable by common property taxpayers.

Such road charges against home, farms and all real estate, as well as personal property, will be eliminated by adoption of the highway unification program.

Careful study of the whole problem has convinced me that the present gasoline tax is adequate to pay highway costs in California, provided the highways are consolidated under one central administration.

Hence, I have caused to be submitted to the Legislature certain proposed measures declaring all county roads to be State highways and calling for expenditure by the State of the highway funds now allocated to the several counties.

DOUBLES FUNDS TO CITIES

This plan calls for the same allotment of funds and for no reduction in the employment of workers now engaged in work on county roads.

Likewise, it is proposed to double the quarter-cent allocation of gasoline funds to the cities.

Such an increase in street funds available to the cities on the basis of their automobile registration will immediately provide for needed improvements and at the same time will benefit the city taxpayer by reducing the amount he is required to pay for the extension and upkeep of city streets.

Furthermore, provision is contained in the unification program for payment by the State, out of gasoline tax funds, of existing county highway bond interest and redemption, of special assessments and other obligations now representing such a heavy burden upon owners of real estate.

Counties of the State have heretofore issued highway bonds which will require principal and interest payments this year of \$6,731,675. Under the plan submitted to the Legislature, county bonds for highway purposes not only will be unnecessary, but will be prohibited, and as soon as the counties retire their present indebtedness, county taxes now levied for the retirement of such indebtedness will be eliminated.

COUNTY CITIZENS EMPLOYED

The special assessment evil in rural districts will be automatically abolished.

Under the proposed plan, rural road agencies will be established for road petitions and men will be employed from the county in which road work is required. County road equipment and stations, wherever needed, will be operated by the State. The duplication of overhead and middleman costs in the present county system of road building—now calling for excessive expenditures—will disappear.

Unless the proposed plan is approved, the sums borrowed from the State by the counties under the Relief Bond Act of 1933 must be repaid, beginning in 1938, thus necessitat-

Where the Extra Load Should Be Shouldered!



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ing either additional county taxes or a reduction in county road work. Adoption of the unification plan will make such repayments unnecessary and will assure uninterrupted work on roads now included in the county system.

Provision for doubling the amount of gasoline tax money allocated to cities will add \$3,000,000 a year to be expended upon city streets other than State highways. The major-

ity of State highways within cities were taken over by the State in 1933 and are now being brought up to requisite standards.

THIRTY PER CENT SAVING POSSIBLE

As such improvements are made in highways traversing city territory the resultant decrease in expenditure for this purpose will allow increasing funds for regular street improvement.

It is estimated that the State can maintain

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Plan Doubles Gas Tax Funds to Cities

(Continued from page 9)

and improve county highways at a saving of approximately 30 per cent under present costs, and that increased efficiency in highway operations will represent further advantages.

An example of the improvements and added benefits that may be expected from coordination of all our highways is afforded by the results that followed taking over by the State highway department of more than 6600 miles of county roads in 1933. Investigation by State engineers of these roads revealed the fact that more than 600 of the 1935 bridges in the county road system were in such condition as to necessitate immediate repairs and improvements for the protection of life and property.

This work was accomplished promptly under State management.

The State Department of Public Works is now completing a survey financed by the Federal government, and costing \$500,000, which will give California citizens an accurate and valuable compilation of facts relative to all aspects of highway construction, maintenance and costs.

HIGH COUNTY EXPENDITURES

Information already available from this survey shows that the counties, during the period from 1914 to 1933, spent almost \$100,000,000 more on county highways than the State spent on the State highway system. The report likewise shows that the county roads, while costing so much more than the State highways, actually carry only a little more than 11 per cent of the State's automobile traffic.

The bulk of the approximately half-billion dollars spent by the counties in the last 19 years for roads has come from the pockets of owners of real estate and personal property.

In virtually all of its aspects the road measures proposed in the budget must be regarded as tax relief recommendations. And while adjustments in other brackets of our system of taxation have necessitated certain additions or an effort to obtain revenue from new sources, the highway unification program not only calls for no increase whatsoever, but provides for a substantial reduction in local taxation.

STATE HAS FINE RECORD

The highway program of the State of California over a long period of years has established a record which the Federal government authorities and the officials of other States regard with admiration. Our engineers and other department personnel have done fine work and earned universal respect for their efficiency and for the general economy of their construction and maintenance operations.

The services of this splendid corps will be made immediately available to the several counties if the consolidation program is approved.

Broadly speaking, San Francisco County will be unaffected with respect to county roads, as San Francisco is a consolidated city and county, but San Francisco would obtain street funds exactly double the amount now apportioned to the combined city and county.

And in Los Angeles County, for instance, where automobile registration is heaviest, the 43 incorporated cities in that county would receive a tremendous addition to their available street funds.

TAKES BURDEN FROM TAXPAYERS

Summed up, the unification plan provides for extensive savings in actual costs and, hence, a resultant reduction in local taxation. The plan would shift to the State, without any additional cost to any group of taxpayers, a burden now borne by owners of real estate and personal property. It would extend needed relief in many special assessment districts and would assume the obligation for county road bond interest and redemption payments.

Objections to the plan arise mostly from local bodies who, with understandable pride in their own accomplishments and communities, prefer to maintain existing conditions.

If benefits are to be obtained, however, we should approach this question from the standpoint of the greatest good for the greatest number. Close scrutiny of the program as now pending in the Legislature will demonstrate the fact that such benefits will be assured if the plan is adopted without substantial modification.

U. S. Tests Indicate Day Labor Costlier Than Contract Jobs

UNDER the regulations prepared by the U. S. Bureau of Public Roads governing Federal emergency highway construction, provided for by the National Industrial Recovery Act, one project in each State was to be selected at random to be done by force account, or day labor. The purpose was to provide a basis for comparison of the relative merits of contract and day labor construction on public work.

This test was arranged as a result of insistent demands from various sources that all Federal emergency highway construction be done by day labor on the claim that it could be done cheaper by this method than by contract. Results of the test, according to a statement by Thomas H. MacDonald, chief of the Bureau of Public Roads, testifying at a recent hearing conducted by the House roads committee, are showing an average of 30 per cent in favor of the contract method of constructing highways. Ninety per cent of all projects reported, he stated, show an advantage in favor of the contract system. This bears out the results of investigations conducted by the Associated General Contractors of America on specific projects as work progressed, which indicated the costs of day labor were running high.

In the course of his testimony before the House roads committee Mr. MacDonald makes acknowledgement of the important services rendered by contractors in carrying out the emergency highway program. "I pay sincere tribute to the spirit of the State highway departments and to the contractors on the whole, in the administration of, and compliance with the laws. It would be surprising to you, I believe, to know how few complaints have reached the bureau of unfair treatment of labor by contractors or by State highway departments, either as to wages or as to the classification of the different groups." Answering an inquiry as to contractors' profits Mr. MacDonald declared "the contractor's profit, as a general proposition, has been almost non-existent ever since the depression began, and there is a considerable question in my mind whether we have paid fair prices."—*Southwest Builder and Contractor.*

So live that you won't shudder every time a red cap drops your grip.

TIN CENTAURS

By Tom T. Ness

When ancient legends we absorb
We learn that Cyclops had one orb—
A baleful eye in mid-forehead,
Inspiring mortal awe and dread.
Another bit of fantasy
Evolved the queer Acephali;
A race of headless men, they were—
Devoid of brains, one might infer.

And yet, today, within our ken,
There is a breed of brainless men.
We also know there is no dearth
Of one-eyed ogres on our earth.
At night the terror-striking twain
Haunt almost every auto lane.
When darkness dims the moon and stars,
Ride headless men in one-eyed cars.

SURVEY SHOWS 7,802,000,000 VEHICLE MILES TRAFFIC ON STATE HIGHWAYS IN 1934

(Continued from page 7)

moves over highways to a greater or less extent. Approximately 5,000,000 tons during the year were delivered from farm to railroad in the county of production and 12,000,000 tons moved by truck to canneries, packers, market centers, or to remote rail shipping points.

Approximately 1,500,000 tons moved to Los Angeles and San Francisco markets. Of the total tonnage received at the Los Angeles market, 83 per cent came by truck, and two-thirds of that to San Francisco moved in by truck.

HIGHWAY BUILDING A "DYNAMIC RESPONSIBILITY"

Only about 5 per cent of all American rural roads are well paved—about 160,000 miles. Of the busiest roads, the main State highway systems which carry upwards of two-thirds of all traffic, about one-half are still mud or dust roads.

Such facts as these led the Committee on Post Office and Post Roads to make this statement to Congress: "Highway construction is a dynamic and continuing responsibility. Highways either grow worse or better. They can not stand still with 25,000,000 vehicles in daily operation * * *. With over 30,000 deaths and 750,000 injuries each year from automobile accidents, the elimination of traffic hazards must receive not only continuous but better attention."—*Exchange.*

Automatic Radio Invention of Engineer Ingersen Broadcasts Flood Warnings

THE STATE OF CALIFORNIA is now operating a series of automatic radio stream gage transmitters in connection with flood control and watermaster service activities of the Division of Water Resources.

The use of these radio stream gage indicators serves the public interests in California in a very vital respect. During major flood conditions advance information on the rapid fluctuations of streams on which they are installed make them of paramount importance in the saving of life and property. In the watermaster activities the saving of water and crops and the protection of individual water rights of major importance. It is believed that no higher character of use of radio on land can be made than to protect the citizens of the State from potential flood hazards and to assure an equitable distribution of water.

Following an actual demonstration of the use of one of the devices the State Engineer's office installed a series of these transmitters to determine their adaptability to the division's work, with the result that a total of thirteen radio stations along the streams of California have been installed. The apparatus is semi-portable in character, and is readily installed in the standard stream gaging station instrument shelter houses at the points most desired during the course of the season.

SIGNALS STREAM HEIGHT

The radio transmitters, entirely automatic in operation, at frequent intervals send out a signal indicating the gage height of the stream at the moment. The signal is received in the State Engineer's office in Sacramento.

The fluctuations of stream flow in the major rivers contributing to the potential flood hazards in the valleys can be observed directly and accurately many hours in advance of the time when the crests of the high water would reach critical points on the valley floor. By means of this advance information a better, safer, and more satisfactory operation of the various flood control and relief structures along the river can be accomplished.

Without this new medium of radio communication, it is necessary to set up an elaborate

system of telephone, automobile, and other facilities to obtain the important data of the stream flow in advance of the time of arrival of the flood crests at critical points. Such manual dependence often breaks down during the course of major rainstorms and flood flows and the desired information at best is sketchy.

AIDS IRRIGATION WORK

The problem of efficiently distributing irrigation waters in the adjudicated stream systems in the State is greatly aided with the use of the radio stream indicators. Usually the transmitters are installed on the stream above diversions, at a point which is relatively remote or inaccessible. The watermaster, by listening in at frequent intervals during the day, can be informed of the fluctuations in the water supply to the irrigated area, and his time is therefore spent along the lower reaches of the stream where he is most needed to give many water users their due and proportional share of that supply.

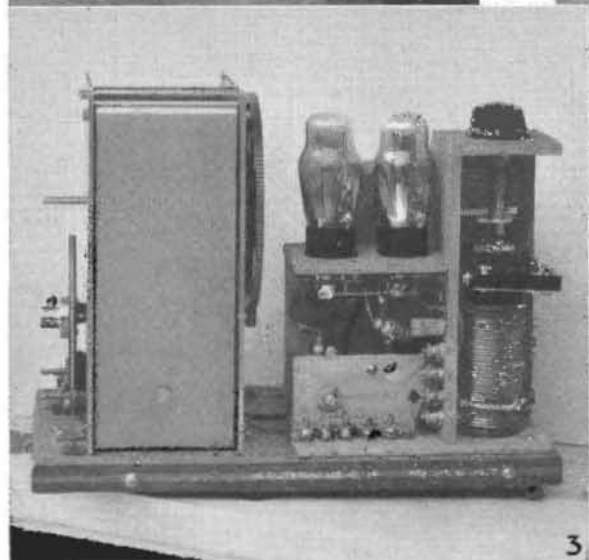
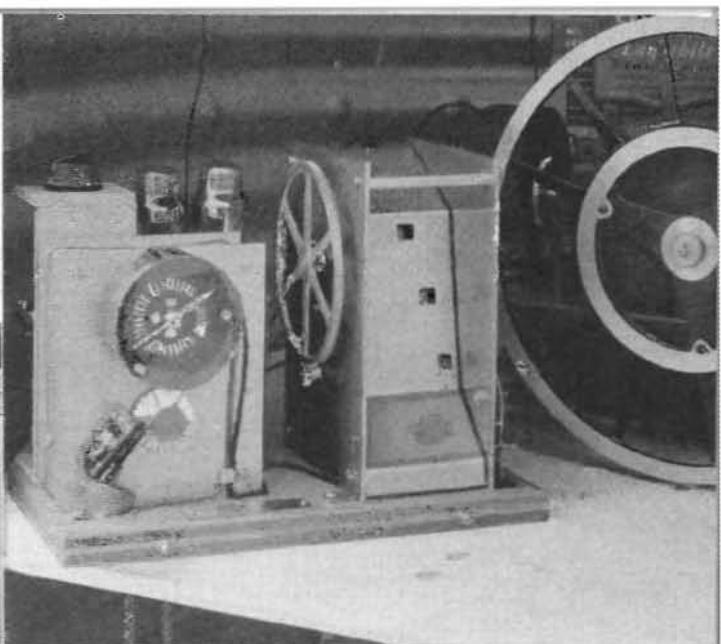
Without the radio indicator it would be necessary for the watermaster to make a daily trip to the head of each stream in his jurisdiction to first determine his supply before he could make an accurate distribution of flows into the various dependent diversions. Aside from the saving of time and traveling costs, many instances can be pointed out where the timely indication of a sudden fluctuation of supply at the head of irrigation resulted in very material savings in water and of crops.

These automatic radio stream gage indicators are made possible by the use of a unique automatic keying device which was originally developed privately in 1931 by Associate Hydraulic Engineer Irvin M. Ingerson. Letters patent cover the apparatus.

OPERATED BY KEYING DEVICE

The automatic keying device consists of a series of commutators that are so arranged as to "key" the radio transmitter to give a signal that is the accurate gage height of the stage of the water at the time of transmission. For instance, a gage height of 7.42 feet would be listened to as being seven short dashes, at one-

(Continued on page 29)



ON GUARD in little shelter houses along 13 California streams is this Ingerson automatic radio stream gage signal apparatus that sends out warnings of flood dangers. Front and rear views of the gage keying device and transmitter are shown in pictures 1 and 2 and inventor Irvin M. Ingerson, associated hydraulic engineer of the Division of Water Resources is shown with the installation in No. 4.

States List 23,192 Road Projects for \$1,699,021,390 of President's Work Fund

IN HIS message to the Congress January 4, 1935, President Roosevelt said:

"This new program of emergency public employment should be governed by a number of practical principles: (a) All work undertaken should be useful * * * affords permanent improvement. (b) Projects should be undertaken on which a large percentage of direct labor can be used. (c) The projects undertaken should be selected and planned so as to compete as little as possible with private enterprise * * *.

"This work will cover a wide field, including * * * improving existing road systems and in constructing national highways designed to handle modern traffic and in the elimination of grade crossings * * *."

9467 PROJECTS READY

Reports from State highway departments to the Association of State Highway Officials indicate that 9467 road projects on Federal aid and State road systems, estimated to cost a total of \$691,534,310, are in a stage which would permit them to be quickly put under contract and 13,725 additional projects totaling over \$1,000,000,000 can be put under construction within one year.

The former projects are classified as follows: 1756 grade separation projects, estimate cost, \$184,314; 161 highway intersections, \$20,240,000; 4645 highway construction projects, \$332,153,000; 621 routes through cities and city by-passes, \$72,530,000; 2285 weak and narrow bridges to be improved, \$86,457,000.

AVAILABLE WITHIN A YEAR

Projects that can be put under contract within one year are reported as follows: 2302 grade separations, estimate cost \$277,567,500; 182 highway intersections, estimate cost \$27,312,500; 6087 highway construction projects, estimate cost \$447,513,580; 1118 highways through cities and city by-passes, estimate cost \$131,202,800; 3041 weak and narrow bridges, estimate cost \$129,131,700.

California projects listed number 1243 with a total estimated cost of \$135,078,000. They are divided as follows: for early construction, 410 projects, cost \$36,378,000; available for

contract within a year, 833 projects, cost \$98,700,000.

California projects for early construction are classified as follows: 150 grade separations, \$24,678,000; 4 highway intersections, \$1,100,000; 115 highway construction projects, \$6,000,000; 11 routes through cities and city by-passes, \$2,000,000; 130 weak and narrow bridges to be improved, \$2,600,000.

Projects reported by California available for contract within a year are: 577 grade crossings, \$72,000,000; 4 highway intersections, \$1,100,000; 105 highway construction projects, \$20,000,000; 17 routes through cities and city by-passes, \$3,000,000.

CALIFORNIA RANKS FIFTH

For immediate construction other western States report the total number of projects and estimated cost as follows: Arizona, 66 projects, cost \$9,065,500; Colorado, 380, cost \$13,830,000; Idaho, 62, cost \$3,577,000; Montana, 82, cost \$7,225,000; Nevada, 291, cost \$1,942,500; New Mexico, 67, cost \$3,735,000; Oregon, 58, cost \$9,000,000; Utah, 121, cost \$5,735,000; Washington, 160 cost \$12,402,000; Wyoming, 39, cost \$2,800,000.

The largest volume of available work reported by any State is \$61,350,000 for 1008 projects in Pennsylvania. New York is second, reporting 453 projects estimated to cost \$51,700,000. Ohio is third with \$45,400,000 for 686 projects, Wisconsin fourth with \$44,590,000 for 298 projects and California fifth with \$36,378,000 for 410 projects.

MEET PRESIDENT'S DEMANDS

In publishing the projects listed by the States, the American Association of State Highway Officials says:

The building of these roads would meet the policies of Public Works expenditures demanded by the President, for they are:

1. Useful—affording permanent improvement.
2. Over 80 per cent of the outlay goes to wages.
3. The projects are planned and fit into a definite system of highways.
4. Do not compete with private enterprise.

Three Feather River Tunnels Under Way

(Continued from page 2)

before through traffic can make use of any of this road. Of this, 5.6 miles are between Belden and Storrie. Construction of these remaining sections will require the excavation of 1,377,000 cubic yards of material.

On the four mile section across Arch Rock and Grizzly Dome, there are over 600,000 cubic yards of solid granite. The location of this section is along the south side of the canyon on the opposite side of the river from the Western Pacific Railroad. The bare, hard, granite surfaces extend from the water's edge on slopes ranging from 38° to 60° and to heights of 1000 to 2000 feet.

Some vegetation has found a foothold in the crevices, and there are occasional areas of blocky granite where trees of fair size are growing. Over a considerable portion of these areas men are able to walk by following the crevices, and where this is impossible, ropes must be used for support while a trail for the drilling crew is constructed.

CONSTRUCTING THREE TUNNELS

Included in the work on this section are three tunnels which are to be constructed to provide for a 24-foot roadway and a 2-foot walk on each side. These tunnels are to be constructed at locations where heavy cuts are impracticable due to the amount of excavation required and the difficulty of removing this mass of material without filling the river channel.

Tunnel No. 1 on the westerly end of the Arch Rock section 33 miles east of Oroville, is 265 feet in length. Tunnel No. 2, 0.7 of a mile farther east is to be driven for 165 feet almost under that famous slab of granite known as Arch Rock. Tunnel No. 3, 400 feet long, will carry the highway through Grizzly Dome, a huge dome-shaped mass of bare granite which rises precipitously for over a thousand feet above the river just east of the mouth of Grizzly Creek, 34.6 miles east of Oroville.

All of the work remaining, with the exception of the two bridges, is to be handled by the two convict camps now working, one at each end of this section. Camp 30, located near Cresta, 31 miles east of Oroville, works 150 convicts and employs 85 free men. Three 1½ cubic yard Diesel power shovels are used

RIBBON OF WHITE

At break of day we motored away
With a jest and a lilt of song.
No thought gave we to that ribbon of white
Dividing the traffic from left to right,
As we merrily motored along.

Through a bank of fog at eventide
Our steps we retraced that night.
With landmarks gone, and we alone,
How thankful then for that ribbon of white—
A light to guide us home.

At Life's glad morn, we, careless and free,
No thought for landmarks, we;
But when shadows fall, at Death's drear
night,
Faith in our God is the "ribbon of white"
That leads to Eternity.

—Mabel Miller Freeman,
In California Federation News.

at this camp. Camp 28, located near Rich, 53 miles east of Oroville and 24.75 miles west of Quincy, works 90 convicts, 45 free men and two 1½ cubic yard Diesel shovels. Free labor supervises the work of the convicts, operates and maintains equipment and does other skilled work required.

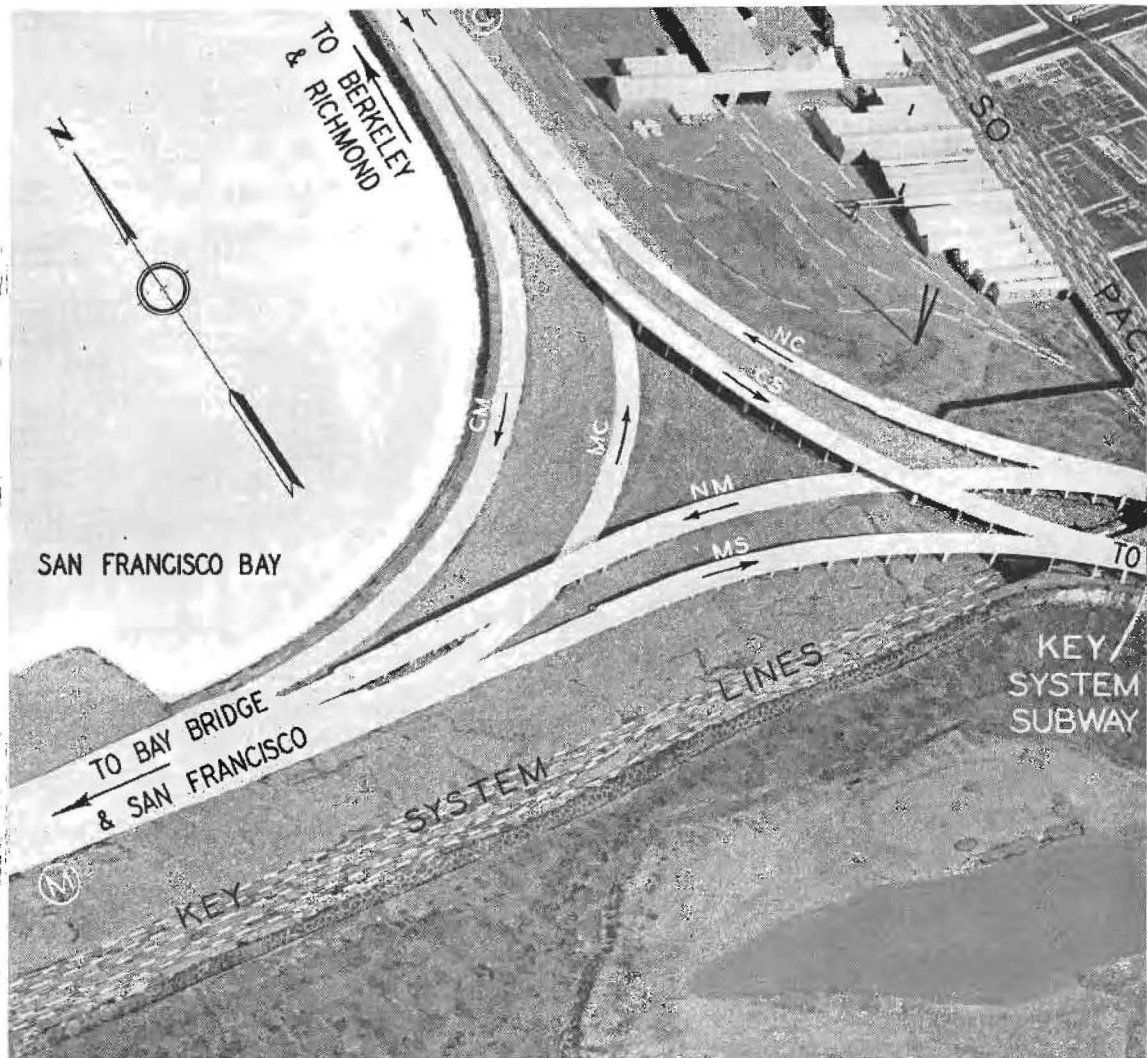
DETOUR BUILT IN RIVER

One of the greatest problems on the lower section which is being handled by Camp 30, is the difficulty of access for any large force. In order to provide for the operation of the several shovels, a pioneer trail must be constructed well in advance. The tunnels present a serious obstacle. To avoid waiting several months while the first tunnel was being driven, a detour was constructed by building a fill entirely in the river.

Although this fill will be taken out by high water, it has permitted the advance of the drill crews and the head shovel to Tunnel No. 2, where a detour is being constructed in the same manner. Tunnel No. 3, which is approximately one mile beyond Tunnel No. 2, presents a more serious problem. A detour is impracticable and all equipment must pass through the tunnel to reach the work beyond.

Compressors have been set up on the railroad right of way, the air is piped across the river, and work has been started on a 14'x14'

(Continued on page 30)



"N"—North twin structure. "S"—South twin structure. "A"—Southerly branch of East Shore Highway approach. "AN"—Travel from "A" line to north structure. "SA"—Travel from south structure to "A" line. "SB"—Travel from north structure to "C" line. "CS"—Travel from "C" line to south structure. "NM"—Travel from north structure to mole approach. "MC"—Travel from mole approach to "C" line.

Distribution Structure as Planned for Oakland

By P. O. HARDING, Senior Bridge Field Engineer

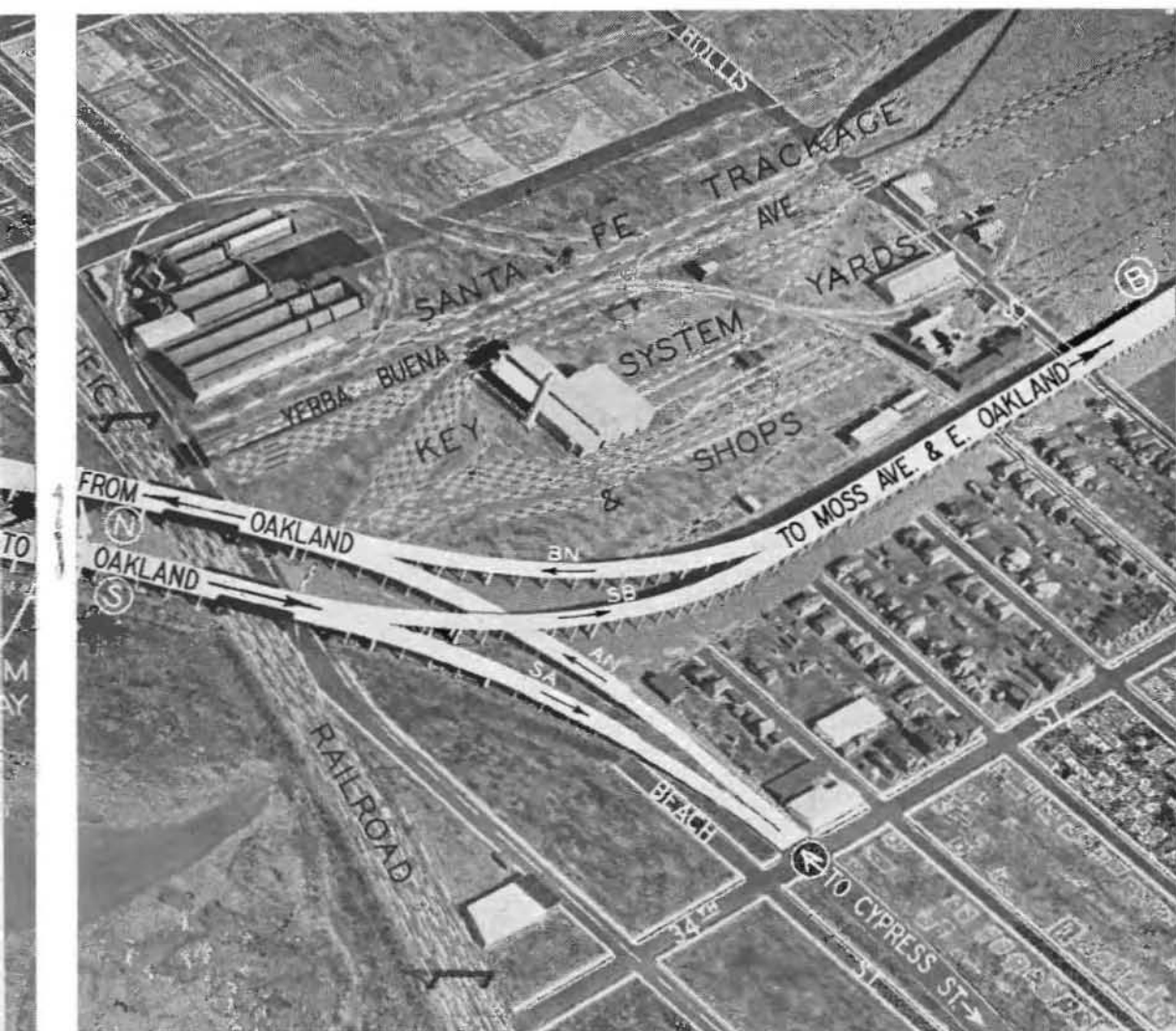
BIDS will be taken, at an early date, for a portion of the East Bay highway approach system of the San Francisco-Oakland Bay Bridge, on what is commonly termed the "Distribution Structure," the name implying the function of the structure, together with its connecting roadways.

A plan view of the Distribution Structure has the appearance of two octopi engaged in a mortal combat, but its function in the distribution, and segregation of motor vehicle traffic to and from the East Bay area will be much simpler than a first glance at the structure would indicate.

The approaches to every major bridge serving metropolitan areas have presented individual problems, the solution of which has been influenced by certain controlling factors peculiar to that particular project.

DIFFERENT APPROACH PROBLEMS

The San Francisco-Oakland Bay Bridge, for example, presents entirely different approach problems at its two ends. Generally speaking, the San Francisco downtown district is "journey's end" for the mass of users of the bridge, the San Francisco business district being a focal point of destination. The bridge enters almost the heart of the city high in the air, and the approach problem is one of getting



ghway. "B"—Central branch approach. "C"—Northerly branch of East Shore Highway. "M"—Mole or main line
 re. "SB"—Travel from south structure to "B" line. "BN"—Travel from "B" line to north structure. "NC"—Travel
 h structure to mole approach. "MS"—Travel from mole approach to south structure. "CM"—Travel from "C" line

Oakland Approach System of Bay Bridge

down into downtown San Francisco, where any number of city streets shortly lead the motorist to ultimate destination.

The East Bay approach problem is one of distance, collection, and distribution. Here the bridge structure at its easterly end terminates two miles from shore in the shallow water and tide flats, and the approaches assume the nature of arterials functioning as a collection system tapping a vast residential area, yet connecting with and becoming a part of the State highway system.

FUNDAMENTALS INVOLVED

The original problem of locating the East Bay approach system required by the Recon-

struction Finance Corporation, and later adopted by the Legislature as official approaches to the bridge, involved two fundamental considerations:

1. Tapping the East Bay area so as to serve the thousands of daily users of the bridge, who, through tolls, pay off the millions of dollars invested in the project.

The guide in this phase of the problem was a detailed origin and destination traffic survey, made under the supervision of Lester S. Ready, consulting engineer, by the California Railroad Commission technical staff, and generally reported in the Hoover-Young report of August, 1930.

Viaducts Make 16 Grade Separations

(Continued from preceding page)

2. So locating the approach arterials that they would ultimately become portions of State highway through routes.

A guide in this phase of the problem was the public demand for an East Shore industrial highway extending between San Jose and Richmond, comparable to the Bayshore Highway now nearing completion between San Jose and San Francisco on the west side of the bay. There was also public demand for the westerly extension of State highway Route 5 through Oakland, in the general vicinity of Moss Avenue, which had become a commonly used route of travel—not because it was originally planned as such, nor because it was suited for heavy travel, but because of the lack of any traffic artery through this section of Oakland.

LOCATION OFFICIALLY ADOPTED

After comprehensive economic studies had been made, the official approach system adopted in the East Bay area was the extension easterly as far as 38th and Market Street of the east and west main bridge approach as a part of State highway Route 5, and the adoption for immediate construction of the East Shore highway from Seventh and Cypress Street in Oakland, to and connecting with Ashby Avenue in Berkeley. The Distribution Structure is located at the intersection of these two important State highway routes.

In these days of automatic telephones, automatic elevators and escalators, automatic cafeterias, and even automatic traffic signals, an automatic separator, segregator, director, and distributor of motor vehicle traffic has its place in the modern scheme of development of this country.

There have been a number of designs for segregating traffic at intersecting important cross highways, those most commonly known being the traffic circle where the intersecting highways cross at grade, and the cloverleaf, where they cross at separated grades.

The braided crossing in Marin County, a special design in District IV, Division of Highways, described in December, 1930, issue of "California Highways and Public Works," was one treatment of this subject meeting a special condition for segregating the main

highway traffic of the Redwood Highway from traffic serving close-by Marin County towns.

PROVIDES GRADE SEPARATIONS

The Distribution Structure for the East Bay highway approach system to the bridge, however, not only provides highway grade separations for all its cross roadways of highway traffic, but also provides grade separation for the main line steam trains of both the Southern Pacific and Santa Fe Railroads, and for the suburban electric lines of both the Southern Pacific Company and the Key System totaling in all 16 grade separations.

The Key System has, for many years past, crossed the Southern Pacific and Santa Fe tracks in this vicinity, by means of a subway, which precluded from the start any serious consideration of any subway design for the Distribution Structure. It also forced any traffic circle design overhead.

Such a traffic circle design was considered, with approximate inside radius of 200 feet, but the economic time loss in 1940, compared to the present structure, capitalized at 7 per cent, amounted to more than three-fourths of a million dollars, based on an average time value of one cent per vehicle minute, which is a value considerably below that used in similar analyses elsewhere in the country. This figure did not include any capitalized vehicle operating costs, which further favored the present design.

CLOVER LEAF REJECTED

A semi-clover leaf design was also considered, which showed capitalized vehicle operating costs, based on 1940 estimated traffic, of more than one-half million dollars in favor of the present structure, this being exclusive of any time differences, which also favored the design decided upon.

The accompanying photograph of a model, constructed under the supervision of the City Engineer of Oakland, Walter Frickstad, shows the design adopted, and clarifies at a glance many of the questions and answers to the numerous phases of this problem.

It will be noted that there are twin structures crossing the numerous railroad tracks in the vicinity, for convenience in analysis designated as "N" (North) and "S" (South).

Approach Planned to Accommodate 29,800 Cars per Day in 1940

(Continued from preceding page)

For similar convenience in designation, the southerly branch of the East Shore highway terminating under the official bridge approach system at Seventh and Cypress Streets in Oakland, has been called the "A" line. The Central Branch, terminating at 38th and Market Streets, of the legislative bridge approach system, has been designated the "B" line. The northerly branch of the East Shore highway, officially terminating at Ninth and Ashby in Berkeley, has been called the "C" line, and the main approach to the west has been designated the "M" (mole or main) line.

COMBINATION MARKINGS

For the various connecting roadways of the Distribution Structure itself, a combination of two letters indicates both the roadway and the direction of travel upon that roadway. For example, "AN" indicates the roadway and the direction of travel from the "A" line to the north structure, "SB" the roadway and direction of travel from the south structure to the "B," or central approach line, etc.

A careful analysis of local bridge traffic alone, indicates that the "A" line, or southerly approach, will carry approximately 47 per cent, the "B" line, or central approach, approximately 28 per cent, and the "C" line, or northerly approach 25 per cent of the total bridge traffic. The "M" line naturally carries 100 per cent of this traffic, which has been estimated by Mr. Ready at 10,000,000 vehicles per year, or roughly, 30,000 per day, in 1940.

The preceding figures exclude the local traffic of the East Shore highway, which has been estimated at 10,000 per day in 1940, also a smaller amount of local traffic between the "B" and "C" lines, central and north approaches, respectively.

The north and south twin structures represent the segregating units of distribution, which will be put to the most severe test during the peak hour of travel. All traffic on each of these structures is in the same direction.

JOB OF SEGREGATING LANES

Approximately 45 per cent of this traffic will be straight through traffic, and 55 per cent, or 860 vehicles per peak hour, will require segregation in the form of weaving

ESTIMATE OF TRAFFIC

Assuming a return to normal business conditions by 1940, combined bridge and local traffic is approximately estimated on the Distribution Structure as follows:

Line	To and From	Ultimate No. of Traffic Lanes	Vehicles per Day	Vehicles Peak Hour
"A"	Downtown Oakland, Alameda	6	24,000	2,260
"AN" and "SA"		3	12,000	1,130
"B"	Residential Oakland, Piedmont, East Oakland	4	9,400	880
"BN" and "SB"		2	4,700	440
"C"	Emeryville, Berkeley, Albany, Richmond	6	18,400	1,730
"NC" and "CS"		3	5,500	520
"CM" and "MC"		3	3,700	350
"M"	San Francisco-Oakland Bay Bridge	10	29,800	2,800
"NM" and "MS"		3	11,200	1,050
"N" and "S"	Twin Structures	5	16,700	1,570

from one inner lane to an adjacent inner lane within the 500 foot length of the structure. This hourly rate is equivalent to an average of 14 per minute, which may reach 20 per minute at times during the rush hour.

This means (taking the "S" structure for example) that approximately eleven vehicles from the "C" line destined for the "A" line must segregate themselves with respect to nine vehicles per minute from the "M" line, destined for the "B" line. Diagrams show that with all vehicles moving in the same direction, it will be impossible to cause anything more than a momentary slowing of traffic in the segregating lanes, for far heavier traffic than that anticipated for the year 1940.

Minimum radius curves of 1000 feet, and maximum grades of 4 per cent up and 5 per cent down, have been used in the design.

Detailed structural design and construction is under the supervision of C. E. Andrew, Bridge Engineer for the San Francisco-Oakland Bay Bridge. General control features of design, as affected by the highway approach requirements to the bridge, are under the jurisdiction of Colonel Jno. H. Skeggs, District Engineer, District IV, San Francisco.

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.

EARL LEE KELLY.....Director

JOHN W. HOWE.....Editor

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

Vol. 13

MARCH, 1935

No. 3

More Highways Needed

California, as often has been said, is proud of its State highway system, and of those other roads that have been improved by counties and cities to meet the ever increasing demands of motorists. Other progressive states also have reason to congratulate themselves because of their achievements.

And yet, taking the country as a whole, there are four times as many cars per mile of good road as there were in 1915.

In other words, motor vehicles are increasing in number more rapidly than the hard-surfaced highway program is going forward. Today's improved roads are at least six times busier than they were 20 years ago; for not only are there more cars per mile, but an average car is operated more miles per day.

Automobile ownership increased 1,000,000 vehicles in 1934, in this country; but road construction lagged in most localities. * * *

While the more advanced States have given thoughtful attention to their chief arteries of traffic, main highway systems the country over are only about one-half complete. Instead of durable surface there is found mud, or dust, or sand. Only about 5 per cent of America's rural roads are well paved.

Highway building, like highway maintenance, is a continuous activity. Convenience, comfort, economy demand the perpetuation of this policy; and there is another consideration—traffic safety. Congested roads are subject to accidents. Moreover, one phase of boulevard making that must receive a large measure of attention henceforth is grade separation.—*Pasadena Star News.*

3,500,000 Acre-feet of Water Storage in South Coastal Basin

THE release is announced of Bulletin No. 45, "Geology and Ground Water Storage Capacity of Valley Fill," issued by the Division of Water Resources. This bulletin is one of a series on the hydrology of South Coastal Basin and is the result of about three years field and laboratory work, the laboratory being maintained at Pomona College through courtesy of that institution. The bulletin is by Rollin Eckis under the general direction of Deputy State Engineer Harold Conkling.

A major feature of the investigation has been a determination of the drainable voids in the valley fill. In the bulletin is a map showing contours of equal voids in the entire area and a tabulation showing the estimated water in storage below the water table of January, 1933.

THIRTY-FIVE BASINS STUDIED

South Coastal Basin divides into 35 basins, which were separately studied. It is estimated that in the next 50 feet below the before mentioned water table there are 3,500,000 acre-feet of water.

It is found that void space in alluvium as it occurs in South Coastal Basin is smaller than generally supposed. In some basins the void space is only about 5 per cent, while the maximum basin is about 12 per cent. Most basins run from 7 per cent to 10 per cent.

Problems connected with water rights and water supply in South Coastal Basin encounter difficulties in their solution because a great deal of the information is underground.

DEPENDS ON DRAINABLE VOIDS

A very important matter is to determine how rapidly are the water resources of the various basins being depleted. The easiest method for such an estimate is to calculate the change in underground storage from year to year. This depends on the drainable voids in the underground material.

A change of five feet in the water table may represent a much greater change in storage in one basin than in another because the drainable void space differs between the two basins.

MOTOR VEHICLE DEATHS INCREASE

A 15 per cent increase in motor vehicle fatalities—the largest in a single year in the history of the State—was reported for 1934 by the California Highway Patrol.

J. F. Craemer Brings Wide Experience to New Office of Assistant Director

JUSTUS F. CRAEMER, recently named Assistant Director of Public Works, with headquarters at Los Angeles, entered upon his new duties not only with an extensive knowledge of the State highway system but with a rather impressive record of public service in general.

As a newspaper man, with an intense interest in public affairs, he had the opportunity, over many years, of contact with State officials and a close-up view of the problems of State government.

From the inception of the State highway system, he was an active supporter of expansion adequate to the needs of the State. Recognizing the economic and social importance of a system of good roads, he gradually became familiar with the engineering and administrative problems of the highway department, so that when he came to occupy an official position in the organization he was by no means strange to the duties of the office.

BROAD RANGE OF ACTIVITIES

His equipment for an administrative office was, however, considerably beyond anything suggested by a thorough study of highway problems. Public service had occupied a large part of his time and energy for many years. A newspaper publisher and orange grower of Orange, California, he nevertheless found time for a surprising range of other activities.

As a former member of the board of directors of the State Agricultural Society, he was actively concerned with the management of the State Fair for a period of years. He is credited with having conceived and promoted the Western States Exposition which featured the State Fair at its diamond jubilee celebration in which five western States and the Republic of Mexico participated.

LEADER IN NEWSPAPER WORLD

In newspaper activities he has taken a conspicuous part for many years. His capacity for organization has won him frequent recognition in press circles as a result of which he has served in the presidency of the National Editorial Association and the California Newspaper Publishers Association,



JUSTUS F. CRAEMER

having been one of the organizers of the latter body. His activities contributed much toward bringing the National Editorial Convention to California in 1926 and again in 1932. He has been vice president of the California Press Association for many years.

The State Chamber of Commerce also provided him with a field of activity in which he served as a member of the board of directors and as chairman of the Southern California Council.

RESIGNED AS SECRETARY

Last year, at the beginning of the campaign for the governorship, he became private secretary to Governor Merriam and performed the onerous duties of that position during the primary and general election campaigns. He resigned that post in December of last year. He has been assigned by Director Earl Lee Kelly to Los Angeles where he will be in close touch with the ever growing needs of southern California.



By means of the large number of relief employment laborers assigned to irrigation districts throughout the State, much necessary maintenance work, heretofore deferred for lack of funds, has been done. This work has included rebuilding of structures and enlargement of canals, and has put the systems generally in excellent shape for the 1935 season.

Information from all parts of the State indicates that most districts which depend for irrigation upon direct diversion of natural flow from streams will be well supplied with water for the 1935 season, and that a full season's irrigation is assured in those districts having storage reservoirs.

DISTRICTS SECURITIES COMMISSION

An order has been issued by the Commission validating refunding bonds of the Palmdale Irrigation District. The principal amount of the bonds validated is \$222,500 which by agreement with the bondholders is to be exchanged for the entire \$445,000 of district bonds now outstanding.

Orders of approval were issued by the Commission as follows:

1. Beaumont Irrigation District—For an issue of refunding bonds in the amount of \$150,000 to secure a loan from RFC. With this loan the district is to retire its outstanding bonds amounting to \$205,100.

2. Merced Irrigation District—For an issue of refunding bonds in the amount of \$8,600,000 to secure a loan from RFC with which to retire its outstanding bonds of \$16,190,000. Also order approving plan of readjustment under the Federal Bankruptcy Act.

3. Santa Fe Irrigation District—For an issue of refunding bonds in the amount of \$394,500 to secure an RFC loan with which to retire its outstanding bonds of \$686,000.

4. Lindsay Strathmore Irrigation District—For the expenditure of \$6,500.

5. Oakdale Irrigation District—For the expenditure of \$13,624.56.

FLOOD CONTROL AND RECLAMATION

SERA Relief Work.

The SERA relief projects under the direction of this Division continued the work of clearing flood

channels. During the period January 23d to February 16th, a total of 46,975 man-hours was worked. Except in the Tisdale and Sutter By-passes, where no work was done during the period, the weather interfered very little with the work. The total man-hours of relief labor worked to date are as follows:

	<i>Man-hours</i>
Federal Transient Service, Upper Sutter By-pass	6,278
Federal Transient Service, Tisdale By-pass	2,989
Federal Transient Service, Lower Sutter By-pass	15,490
SERA Project No. 35-B14-27, American River	59,815
SERA Project No. 58-B14-15, Feather River north of Marysville	50,347
SERA Project No. 58-B13-35, Feather River south of Marysville	28,356
SERA Project No. 57-B14-4, Sacramento By-pass	9,472
SERA Project No. 35-B14-222, leveling spoil bank, American River	4,658
SERA Project No. 51-B-13-10, Bear River	778
Federal Transient Service, seepage canal	630
SERA Project No. 35-B14-40, Mokelumne River	7,376
Total	186,189

An SERA Project, No. 51-B13-10, has been sponsored by Reclamation District No. 1001, for clearing the overflow channel of the Bear River, and this Division is cooperating in the work to the extent of furnishing supervision, use of tools, and truck. The foreman and truck driver are furnished by us, but are paid by District No. 1001. This project provides for the use of 22,000 man-hours of relief labor, and work was commenced on February 12, 1935. Several other additional projects have been applied for, one of which has been approved, involving clearing work in the Butte Slough By-pass. This work will be commenced as soon as additional men are available, or upon completion of some of the other projects.

DAMS

Applications were approved for the construction of the Guadalupe dam of the Santa Clara Valley Water Conservation District on February 18th; the Mad River Dam of the City of Eureka on February 11th and the Mount Stoneman dam of the Folsom State Prison on February 5, 1935.

Application for the repair of Phoenix Reservoir of the Pacific Gas and Electric Company was approved on January 21, 1935.

The construction of the big Canyon Creek dam in

Engineers Studying Location Plans for Proposed Coyote Dam

(Continued from preceding page)

El Dorado County has been completed and an order authorizing use has been issued. The enlargement of the Lake Orinda Dam is completed. Authorization for use of the El Capitan Dam of the City of San Diego was issued on February 4, 1935. Repairs on the Antioch Dam are practically completed. Work on the Calero Dam of the Santa Clara Valley Water Conservation District is under way.

Progress is being made by this office in conjunction with a Consulting Board appointed by the State Engineer consisting of Dr. Geo. D. Louderback, Consulting Geologist; F. C. Herrmann and J. D. Gallo-way, Consulting Engineers, in investigating the site and review of the plans for the Coyote Dam of the Santa Clara Valley Water Conservation District.

Work is progressing on the timber facing on San Gabriel No. 2 Dam of the Los Angeles County Flood Control District and work on the San Gabriel No. 1 Dam is confined to the excavation of the cut-off trench.

Inspections during the past month revealed the fact that due to the heavy rains many of the reservoirs are either full or filling rapidly, some dams being observed under full load for the first time.

SACRAMENTO-SAN JOAQUIN WATER SUPERVISOR

The flow of the Sacramento River at Sacramento remained at about 20,000 second-feet in early February with an increase to about 35,000 second-feet in the middle of the month. On February 10th there were no samples from delta stations showing salinity greater than 9 parts of chlorine per 100,000 and at Bullshead Point at the lower end of Suisun Bay the salinity had dropped to 140 parts.

WATER RIGHTS

Supervision of Appropriation of Water.

During the month of January 23 applications to appropriate water were received, 26 were denied and 17 were approved. In the same period 10 permits were revoked and 5 passed to license.

Among the more important applications received were two to appropriate from San Luis Rey River in San Diego County for municipal purposes; one by Carlsbad Mutual Water Company and the other by the City of Oceanside.

FEDERAL COOPERATION—TOPOGRAPHIC MAPPING

The final sheets covering the Pentland and West of Tejon Hills Quadrangles in Kern County are now available and can be obtained at a cost of 10 cents each. These sheets were surveyed by the topographic branch of the U. S. Geological Survey in cooperation with the Division of Water Resources.

California Woman Suggests Need of a Highway Pledge

AMONG the letters recently received by Director Earl Lee Kelly, was one from Mrs. Queen Walker Boardman, a member of the Women's Community Service Auxiliary Committee of the Los Angeles Chamber of Commerce submitting a highway pledge and enclosing a copy of a letter to Governor Frank F. Merriam in which she urges its adoption as the "Official State Highway Pledge."

Mrs. Boardman wrote the Governor as follows:

March 8, 1935.

Governor Frank F. Merriam,
Sacramento,
California.

Dear Governor Merriam:

January 1st I resigned from all active committee work because of ill health. This does not mean I am no longer interested.

During my term as Chairman of Roadside Beauty for the Women's Auxiliary of Los Angeles Chamber of Commerce, I wrote the enclosed Highway Pledge. I am most anxious to see it become the Official State Highway pledge. Several States have adopted pledges.

I am writing Mr. John Austin and Mr. Earl Lee Kelly, seeking their support.

Thanking you for your cooperation and with good wishes,

Sincerely,

Queen Walker Boardman.

The pledge submitted by Mrs. Boardman reads as follows:

HIGHWAY PLEDGE

I pledge devotion to the Highways of our Country, to the preservation of their existing natural beauty and to the intelligent development thereof; that our highways may serve not only as arteries of the nation's commerce, but through their beauty bring peace and joy to those who travel them in their hours of leisure.

The Pentland sheet covers an area in the vicinity of Pentland and is done on a scale of 1:31,680 with a contour interval of 5 feet.

The West of Tejon Hills Quadrangle covers an area in the vicinity of Wheeler Ridge. It likewise is a cooperative sheet done on a scale of 1:31,680 with a contour interval of 5 feet.

New District X Office Building in City of Stockton is Formally Opened

THE NEW highway office building of District X in Stockton was formally opened on Thursday, February 28th, and the occasion was celebrated with a dinner given by District Engineer R. E. Pierce and staff to official guests at the Hotel Clark, followed by a dedicatory meeting and reception in the new building.

The dinner was attended by Director of Public Works Earl Lee Kelly; State Highway Engineer C. H. Purcell; Assistant State Highway Engineer G. T. McCoy; Chairman Harry A. Hopkins of the Highway Commission and Commissioners Timothy A. Reardon and Frank A. Tetley; Deputy Director of Public Works Edward J. Neron; State Architect G. B. McGougall and a large delegation of other members of headquarters' staff at Sacramento as well as District Engineers C. H. Whitmore from Marysville, R. M. Gillis from Fresno and L. H. Gibson of San Luis Obispo.

MEETING HELD IN BASEMENT

Despite a very inclement night several hundred folks gathered at the new headquarters to inspect the building and attend the meeting held in the spacious basement.

District Engineer Pierce opened the meeting with an address of welcome and introduced the group at the speakers' table which included Messrs. Kelly, Purcell, Hopkins, Neron, Reardon, Tetley, McCoy, Mayor Con. Frank of Stockton, Senator George M. Biggar of Covelo, and John Blake of Lodi, highway committee chairman, Central Valley Council, State Chamber of Commerce.

Other speakers during the evening included Senator Bradford S. Crittenden of Stockton, Superior Judge J. J. Trabucco of Mariposa County, Alexander Ross of Amador County and William Cox of Stanislaus County.

CALIFORNIA-SPANISH DESIGN

The new building, located at the northeast corner of Center and Rose streets is a reinforced concrete one story structure with a tile roof in the California-Spanish style. The basement extends under the entire building. There are eleven rooms in the building in addition to a public lobby, information room and stock room.

The heating is adequately cared for by a gas steam furnace, the smaller rooms with radiators, the larger rooms with radiators and forced draft for better distribution of heat.

For the hot weather season there is a water cooled air ventilating system, reaching all parts of the structure.

The building is on a lot approximately 150 feet square, which is one quarter of a city block.

The structure is 121 feet by 82 feet, leaving a parking area for employees' cars in the rear of the building, which will be graveled and surfaced.

ADEQUATELY PLANNED STRUCTURE

Since the district headquarters was moved from Sacramento to Stockton, a year and a half ago by Director Earl Lee Kelly, temporary quarters have been occupied in a local office building.

"This new building," said District Engineer Pierce, "makes the fifth place in which District X has done business since its formation in 1924, and it is the only one properly planned to adequately care for our various activities for which I wish to express my appreciation to State Architect McDougall and his staff.

"We feel that we are now definitely established and know that our employees are well taken care of in this splendid new structure."

In further celebration of the opening of the new district headquarters, the Stockton Rotary Club of which District Engineer Pierce is a member held their regular noon luncheon on March 6th in the basement of the building.

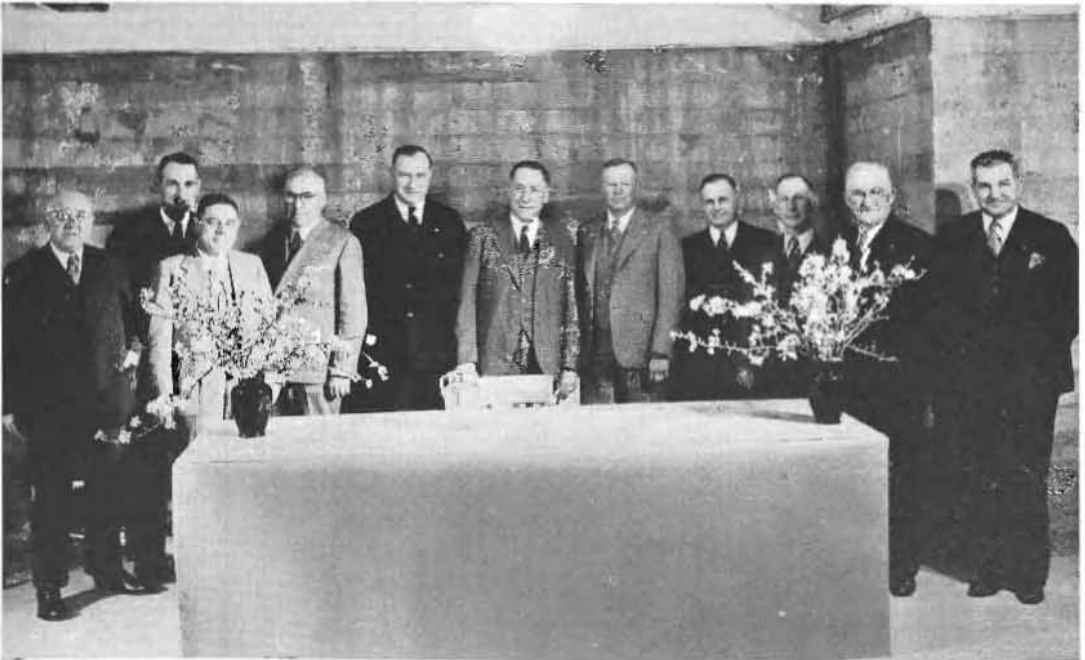
LICENSE FEE REVENUES SHOW GAIN OF \$341,331 OVER 1933

The Department of Motor Vehicles on February 8 cut a huge melon valued at \$5,444,198, representing that portion of license fees collected for the year 1934, which is apportioned equally between the Department of Public Works and the various counties.

Registrar Russell Bevans announced the apportionment is based upon fee-paid registrations for the year totaling 2,680,884. The sum apportioned is \$341,331 in excess of the apportionment of 1933 while fee paid registrations showed a gain of 43,966.



NEW DISTRICT HEADQUARTERS BUILDING in Stockton is a one story reinforced concrete structure 121 x 82 feet located at Center and Rose Streets. It has 11 office rooms in addition to a public lobby, information room, stock room and basement.



THE SPEAKER'S GROUP at the formal opening of the new building included (left to right) Highway Commissioner T. A. Reardon; Assistant State Highway Engineer, G. T. McCoy; Chairman H. A. Hopkins of the Highway Commission; State Highway Engineer C. H. Purcell; Director of Public Works Earl Lee Kelly; John Blake of State Chamber of Commerce; District Engineer R. E. Pierce; Con. J. Franke, Mayor of Stockton; Senator G. M. Biggar; Highway Commissioner Frank A. Tetley and Deputy Director of Public Works Edward J. Neron.

California Engineer Finds Germany Building 5000 Miles Express Highway

Ernest Zube, Junior Physical Testing Engineer with the Materials and Research Department of the California Division of Highways, took a leave of absence during the summer of 1934 to visit his aged parents in Germany. While on the trip, Mr. Zube took note of German road building and laboratory practice. The results of his observations are set forth in the following article. Special attention is called to the importance which the German road building agencies attach to laboratory studies and tests.

By ERNEST ZUBE, Junior Physical Testing Engineer

WHILE on a visit to Germany during the past year, I was afforded the opportunity of making some interesting observations regarding the road building and testing methods employed by that country. A number of highway laboratories were visited during the trip. With the hope that these observations may be of interest to those who work or ride on California highways, the following brief outline of the highway situation in Germany and notes on the various laboratories is given.

Germany, in area a little larger than California, with a population of about 65,000,000, has approximately 140,000 miles of highways. These highways in former years consisted mostly of water-bound macadam or some type of stone pavement. The ever-increasing automobile travel has made it imperative that these old roads be improved with some sort of smooth, wear-resistant surface. Consequently, the problem within the last few years has been one of improving and maintaining these roads, rather than one of new construction.

LIGHT SURFACE TREATMENT

A thin bituminous surface course placed over the well compacted macadam roads generally gives excellent results, and in some instances this wearing course is only about one inch in thickness. Penetration methods, emulsions and sheet asphalt (for city streets) are used extensively. Due to the fact that bituminous surfaces are still three to four times as expensive as in the United States, the improvements could not be carried out as might be desired and a light surface treatment is frequently the best that can be afforded.

Germany has no natural gas, and is compelled to manufacture its gas from the

destructive distillation of coal, and therefore coal tar, a by-product, is widely used for paving purposes. However, due to its tendency to become hard and brittle with age, this material is not considered as desirable as asphalt. Quite often the bituminous binder consists of a mixture of tar and asphalt.

Gasoline and tires are still quite expensive in Germany, and in order to stimulate further automobile travel, the government now has under construction a system of express highways, which are to serve as the main arteries between the larger cities. An important part of this plan is the policy of avoiding the close-together, congested communities.

BUILDING EXPRESS HIGHWAYS

At present, the building of these express highways (Autobahnen) is the most important work in German highway construction. The first unit (now under way) consists of approximately 5000 miles, of which about 1000 miles are finished. Hand labor is employed whenever feasible for the purpose of decreasing unemployment.

After the completion of this construction program, a large increase in automobile travel is expected, and it may be of interest to note that the total automobile registration in Germany in 1933 was double that shown in 1932 and 1934 shows a further substantial increase.

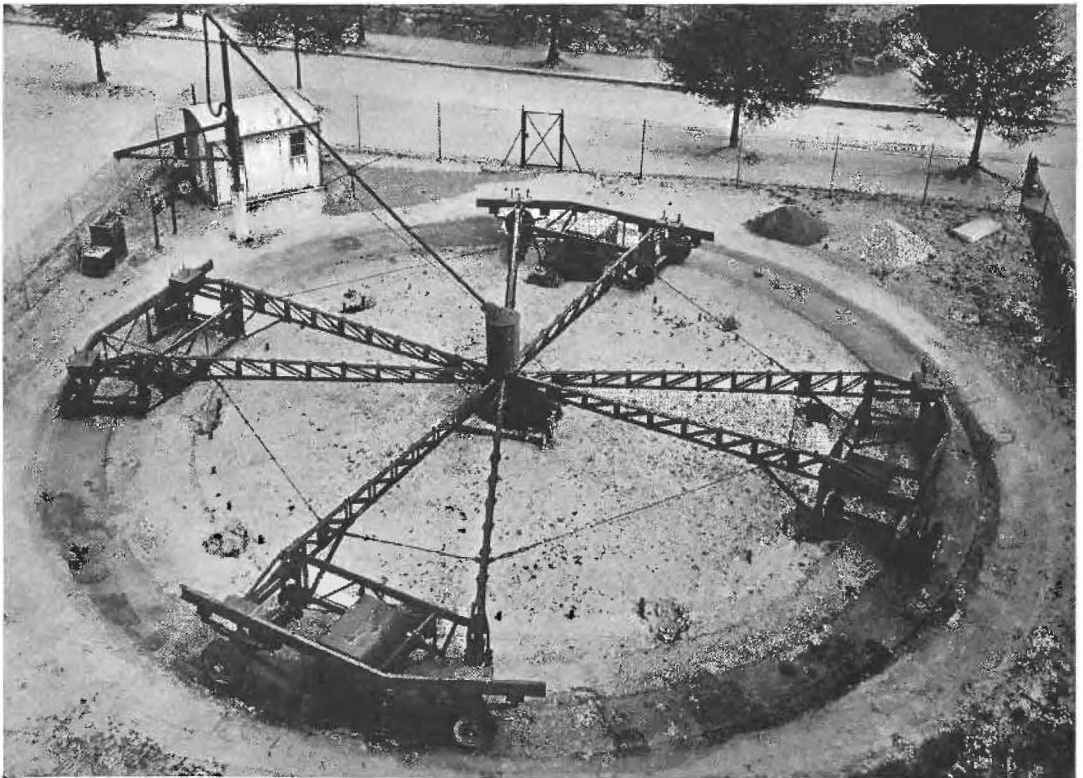
The new auto roads are being built for high speeds and the curves are designed for speeds up to 120 miles per hour. The typical cross-section shows a center lawn strip, 15 feet wide, with a pavement 25 feet wide, consisting of two traffic lanes on either side, bordered by shoulders.

These roads are being beautified by planting trees and shrubbery on the center strip and along the edges of the shoulders, species

(Continued on page 28)



GERMAN EXPRESS HIGHWAY under construction. This typical section provides for a center lawn strip 15 feet wide, with a pavement 25 feet wide, consisting of two traffic lanes on either side bordered by shoulders. Note the planting of trees and shrubbery on center strip.



ELABORATE TEST TRACKS equipped for the testing of road materials under conditions comparable to actual traffic are used by German highway laboratories. The track is about 70 feet in diameter, permitting a test road of from 6 to 10 feet wide. A side movement of the apparatus permits the wheels to cover the entire surface.

German Laboratories Using Test Tracks

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being selected that reflect light readily from the autos. The shrubbery on the center strip also tends to protect the driver from the glaring headlights of cars traveling in the opposite direction.

The pavement consists of either bituminous surfaces or Portland cement concrete. Due to frost action in the winter, great care is taken with the construction of the subgrade. A cross-section of one of these concrete roads consists of approximately 3 to 4 inches of gravel spread upon the subgrade, 5 inches of rather porous lean concrete, a six-inch course of a little better grade of concrete, followed by a 3-inch surface course, with a wire mesh between the last two courses. The bituminous surfaces are constructed either on a lean Portland cement concrete base or on a Telford base, and are designed according to the void theory, attempting to produce a minimum of voids (2% - 4%).

The express highways will be absolutely free from grade crossings and intersections—viaducts or subways being provided to permit a continuous fast and safe travel. Elaborate systems are worked out for the crossing of highways (braided intersections) to permit the transfer of a machine from one highway to another. The roads will also be illuminated, and experiments are being carried on at present with five different systems of lighting.

The pavement in the smaller cities still consists mostly of some type of stone pavement; in fact, a modern pavement within these century-old surroundings might be somewhat incongruous. In the larger cities and suburbs, where a considerable amount of horse drawn vehicles are still encountered, sheet asphalt or asphaltic concrete, with a maximum aggregate up to $\frac{3}{8}$ " is constructed. A close, dense wearing course is necessary to prevent any damage caused by the digging action of the horses' hoofs.

Several special processes, such as rolling with corrugated rollers, etc., are used to prevent slippery surfaces on sheet asphalt. Stone pavement, consisting of small hewn granite blocks, 2 to 3 inches square, laid in arch shaped courses, is also used a great deal. This presents a smooth, nonskid and satisfactory pavement for motor vehicle traffic.

TREE-LINED ROADS

Almost without exception all existing roads are lined with trees, and roughly split rocks, painted white, about 16 inches high, are set along the edges of the shoulders for guidance.

The chief means of transportation in Germany is still the government owned railroad, which in a spider web fashion covers the entire country; and the railroad station in the larger cities is an important and frequently a pretentious building. The resulting numerous grade crossings and the large number of daily trains make it necessary to have crossings protected by gates tended by gatemen.

While traveling in Germany, one is impressed with the multitude of bicycles, which, ridden by all types of people, frequently present a rather amusing sight, at least to a stranger. The traffic officer in directing traffic considers bicycles on a par with automobiles. Some highways include a separate strip for bicycle traveling.

TEST TRACKS FOR MATERIALS

The materials intended for road building purposes are investigated very thoroughly and subjected to a good many tests. Quite often the proposed method and material is tried out in test tracks which duplicate actual conditions. The slogan seems to be "**Foresight is better than hindsight.**"

Besides the government testing laboratory at Berlin, there are at least a dozen university laboratories, with highly trained personnel, entrusted with the testing of road building materials. In addition to the routine testing of samples, extensive research programs are carried on by the laboratories.

My itinerary in Germany took me through Bremen, with its old city hall, built almost a hundred years before the discovery of America, up the historic Rhine to the University of Karlsruhe. The laboratory, directed by Professor Dr. Raab, is equipped with quite an elaborate test track for the testing of road materials under conditions comparable to actual traffic. The track is about 70 feet in diameter, permitting a test road of from 6 to 10 feet wide; a side movement permits the wheels to cover the entire surface.

Next the university laboratory of Stuttgart, which is under the direction of Professor Dr. Neumann, was visited. The Stuttgart labora-

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Stanton Making Brave Fight for Recovery from Severe Illness

Philip A. Stanton, member of the California Highway Commission and former Speaker of the Assembly has been making a long, brave fight against a serious illness that afflicted him just before Thanksgiving and has kept him confined to bed in his home in Anaheim.

He has passed through several critical periods when the doctors feared his heart would be unable to stand the great strain but his indomitable will pulled him through on each occasion.

As he entered the third month of his illness his condition improved and recently he has been able to sit up and receive short visits from his intimate friends who are hopeful of his ultimate recovery.

Commissioner Stanton has always taken a keen interest in the State highway system and during his service in the Legislature gave valuable aid in the early efforts to organize a department that has put California in the front rank of highway development in the nation.

He has taken a most active part in the work of the Highway Commission and until his illness rarely missed a meeting.

AUTOMATIC RADIO BROADCASTS FLOOD WARNINGS

(Continued from page 12)

second intervals (easy to count), then a pause, then four dashes, then a pause, and then two dashes. The call letters of the station are also automatically "keyed." The keying device is operated by a weight-driven clock and by a float on the water surface in the gage well. This apparatus also is equipped with time switches which "turn on and off" the radio transmitter at any desired predetermined intervals.

The radio transmitter is a simple quartz crystal controlled oscillator using dry batteries entirely for both the filament and plate circuits. The signal is, in radio parlance, known as an i.c.w. signal (interrupted continuous wave) which can be received by any oscillating receiver covering the particular transmission frequency. Signals have been received satisfactorily at distances as great as 300 miles.

Through cooperation with the United States



PHILIP A. STANTON

Geological Survey four transmitting channels have been allocated to this new type of service with the call letters of KIDD. In most instances installations have been made in standard U. S. G. S. gage houses at remote points where there is otherwise no medium of satisfactory communication. District Engineer H. D. McGlashan of the U. S. G. S. in San Francisco is cooperating with the State Engineer's office.

GRADE CROSSING FATALITIES SHOW A SLIGHT DECREASE

Eight fewer people were killed in crossing accidents in California in 1934 than in 1933, the report of the Railroad Commission shows. But at that, 161 more people than should have been so killed were listed as crossing fatality victims, that figure being the 1934 total of such deaths.

The improved showing of last year, slight as it was, is credited by the commission's transportation engineer to such increased safety measures as separated grades, wig wag signals and gates. The showing is an automatic argument in favor of further extension of those measures, particularly grade separation.—*Palo Alto Times*.

Three Feather River Bores Scheduled for Completion by 1936

(Continued from page 15)

heading. The men working on this job have to go to and from work along the railroad tracks, crossing the river in boats. It is planned to have this pioneer bore, which will be large enough to allow a shovel to be run through, completed by the time the lead shovel has worked its way to that point, or about September 1 of this year.

PRESENTS HERCULEAN TASK

All of this work is scheduled for completion in 1936. One and a third million cubic yards of solid rock excavation, 865 feet of 28' tunnel, together with all the clearing, drainage structures, masonry retaining walls and finishing required on 12 miles of highway is a fair-sized assignment to attempt to complete within the time being allowed.

A brief summary of the work done and the costs for the first eighteen months of the present biennium might well be used to illustrate the work which is being done by these camps. Since July 1, 1933, the convict forces have built 11½ miles of road, moving 1,555,956 cubic yards of material, of which 1,400,000 cubic yards were solid rock. Five hundred forty tons of explosives were used, or 0.77 pounds per cubic yard; 415,250 lineal feet or over 78 miles of holes were drilled in rock at the rate of 60 feet per day per jack-hammer, for an average cost of 30½ cents per foot. For each foot of drilling, 3¼ cubic yards of rock were broken, the cost of drilling amounting to 9 cents per cubic yard.

The total cost of this excavation, including a proportionate share of the camp setup and cost of supervision, has amounted to \$0.53 per cubic yard. Considering the hardness of the rock and the many obstacles encountered, among which the close proximity of railroad, high voltage power lines and telegraph wires are not the least, this cost is quite reasonable.

TUNNELING THROUGH GRANITE

Work has only recently been started on the tunnels. A heading 14x9 feet has been driven at Tunnel No. 1. This work was completed early in March, and the tunnel crews are now working on the heading for Tunnel No. 3. A five-foot round was drilled and mucked each day. The hard granite appears to be ideal for a tunnel. It drills and breaks very well and stands without timbering.

SNOW FIGHTERS THANKED FOR KEEPING ROADS OPEN

Company 905
Civilian Conservation Corps
Camp Rincon F-130
Azusa, California.

January 27, 1935

Highway Department,
State of California,
Los Angeles, California.

Gentlemen:

The commissioned personnel and the enrolled personnel of this company truly appreciate the work that Foreman Charles Ward has been doing this winter in regard to keeping the San Gabriel Highway open, during and after the many rains which caused numerous land-slides on the road. Because of Mr. Ward's efforts, this company has been able to get through and get its supplies without interruption or delay and the over 200 members of this company do appreciate his efforts.

Yours truly,

(Signed) GEO. A. ANDERSON,
1st Lt. Air-Res., Commanding,

Tahoe City, California.

January 24, 1935.

Mr. C. H. Weeks,
Maintenance Sup't.,
Division of Highways,
Truckee, California.

Dear Mr. Weeks:

I wish to thank you for your courtesy in opening the road to the school. The P. T. A. held a meeting today, and the members all expressed their appreciation. Also, not only do we enjoy the convenience of being able to use cars, but we feel secure against fire now that the hydrants are available and the fire apparatus accessible.

With deepest gratitude, I remain

Sincerely yours,

(Signed) BLISS McGLASHAN HINKLE.

In order to maintain the scheduled rate of progress in these two convict camps in view of the harder rock encountered, there are now in operation thirteen air compressors having a total rated capacity of 4065 cubic feet of air per minute. These operate 35 jack-hammers on the grade and four drifters in the tunnel headings. Other equipment in daily use in these camps consists of 24 four-yard dump trucks, several 50 and 30 h.p. Diesel tractors with bulldozers, scrapers and graders.

At Camp No. 30, Ed Rawson is Superintendent, and G. M. Webb is Resident Engineer. At Camp No. 28, W. B. Stout is Superintendent, and E. E. Ward is Resident Engineer.

Pavement Experiments Made in Berlin

(Continued from page 28)

tory also has a circular test track available for testing purposes, and a number of research investigations, such as influence of filler material, adsorptive qualities of aggregate, colloidal composition of asphalts, determination of friction between different types of pavement, and many others, are conducted. Dr. Neumann visited our California State Laboratory in 1930, and is a staunch advocate of employing California construction methods in Germany.

My next stop was Munich, where in connection with the International Road Congress of 1934 an exhibit, "The Street" ("Die Strasse") was held. The evolution of roads, beginning with an excavated portion of an old Germanic plank road built about 1000 B. C., and examples of various periods up to the present were shown in pictures, graphs and models.

To me, one of the most interesting parts of the exhibit was the one entitled: "Testing and Investigation of Road Building Materials." All types of apparatus for the chemical and physical testing of materials, together with good and inferior samples of road surfaces were exhibited.

TIRE FRICTION TESTED

Considerable equipment for determining the tire friction and slab vibrations of different pavements was shown, together with the test results. A special section dealt with the investigation of soils. A number of laboratories had exhibits of apparatus, and with the aid of pictures and charts demonstrated to the engineer and layman the importance of the subsoil in the construction of highways.

Also very interesting was an electrically operated model showing the different proposed lighting systems for the new express highways. By pressing a button, one can view in sequence the illumination of the road by daylight, then in the slowly approaching darkness the illumination by automobile headlights, followed by the various contemplated stationary lighting systems.

A visit was next made to the laboratory of the University of Dresden, which is under the direction of Professor Geissler. Here investigations relating to the cohesive qualities of asphalt, fineness of filler materials, and an

extensive experiment on the breakdown values of emulsions were being conducted.

In Berlin three laboratories were visited. One, the laboratory of the University, directed by Professor Dr. Schenk, has been conducting comprehensive experiments for determining the resistance offered to skidding by different types of pavement; an investigation of the possibilities of impregnated wooden blocks for base courses was in progress. A circular and a straight test track were part of the facilities of this laboratory.

The laboratory of the city of Berlin, under the direction of Dr. Herrmann, has control of the city pavement design. Berlin's bituminous surfaces consist mostly of sheet asphalt or a fine asphaltic concrete mixture, similar to our Type "C" surface, and were in excellent condition.

A test being conducted on a sample of asphaltic concrete, similar to our Type "A," containing 10 per cent filler, 5.1 per cent asphalt, gave at room temperature a compression value of 800 pounds and a tension of 350 pounds per square inch. The laboratory makes extensive use of a sandblast to predetermine the wearing qualities of bituminous and cement concrete surfaces.

The State Soil Laboratory in Berlin, with Baurat Ehrenberg in charge, was an excellently equipped institution. Soil investigations, not only for road building but also for bridges, dams, etc., are carried on.

EXHAUSTIVE TESTS AT UNIVERSITY

The last place visited was the university laboratory of my home town, the "Free City of Danzig," under the direction of Professor Hoepfner. The testing of road building materials is performed there for the eastern section of Germany, which is separated from the rest of Germany by the Polish Corridor.

Here I familiarized myself with the routine testing, which in addition to our methods, includes special determinations such as brittle point, stiffness point and drip point for bituminous materials; also compression, tension and elongation, permeability, penetration, sand blast and abrasion for the wearing course. An investigation relating to viscosities of bituminous substances at different temperatures had been carried on.

Highway Bids and Awards for the Month of February

ALAMEDA, CONTRA COSTA AND SANTA CLARA COUNTIES—Furnish and apply Diesel oil to roadside vegetation at various locations about 75.5 roadside miles, in District IV. Lee J. Immel, Berkeley, \$3,270; Palo Alto Road Materials Co., Ltd., Palo Alto, \$2,490. Contract awarded to Hayward Building Material Co., Hayward, \$2,060.

AMADOR, STANISLAUS, CALAVERAS AND TUOLUMNE COUNTIES—Applying Diesel oil to roadside vegetation over a distance of about 189.3 roadside miles. District X. Hayward Building Material Co., San Jose, \$2,963; Tiffany Const. Co., San Jose, \$2,937; Lamb's Transfer Co., Long Beach, \$3,224; J. B. Breen, Sacramento, \$3,286; Lee J. Immel, Berkeley, \$3,324. Contract awarded to Sheldon Oil Co., Suisun, \$2,851.05.

FRESNO COUNTY—Timber bridge 1.6 mile south of Wly. Bdy. between Los Banos and Firebaugh. District VI. Route 41, Section M. Contract awarded to Rexroth & Rexroth, Bakerfield, \$5,488.

INYO COUNTY—Between 1.8 mile and 6.9 mile south of Fish Springs School, 0.9 mile grade, surf. with salvaged material and bit. treat. in District IX, Route 23, Section B. Cogo & Rados, Los Angeles, \$13,942; Kennedy Construction Co., Oakland, \$15,844; Donald C. Follis, Glendale, \$14,821. Contract awarded to Tiffany Construction Co., San Jose, \$13,911.50.

LOS ANGELES COUNTY—Grade and pave with A.C. or P.C.C. between State Street and Los Angeles Street. District VII, Route 168, Section A. Griffith Co., Los Angeles, \$107,143; Mundo Engr. Co., Los Angeles, \$109,142; Geo. R. Curtis Pav. Co., Los Angeles, \$110,956; Southwest Pav. Co., Los Angeles, \$109,570; Oswald Bros., Los Angeles, \$109,814; United Conc. Pipe Corp., Los Angeles, \$116,162; L. A. Paving Co., Inc., Los Angeles, \$117,626. Contract awarded to Sully-Miller Constr. Co., Long Beach \$107,081.30.

LOS ANGELES COUNTY—Widen R.C. bridge across Malibu Creek, 10 miles north of Santa Monica. District VII, Route 60, Section A. Lynch-Cannon Eng. Co., Los Angeles, \$27,854; Byerts & Dunn, Los Angeles, \$27,065. Contract awarded to R. R. Bishop, Long Beach, \$25,270.

LOS ANGELES COUNTY—Between Pier Avenue and Sepulveda Boulevard, 0.8 mile, grade and P.C.C. Pave. District VII, Route 175, Sections Rdo. B. Man B. and Hm R. P. J. Akmadzich, Los Angeles, \$55,769; J. E. Haddocks, Ltd., Pasadena, \$52,405; L. A. Paving Co., Inc., Los Angeles, \$55,192. Contract awarded to J. L. McClain, Los Angeles, \$48,889.80.

MADERA COUNTY—Between Coarse Gold and Hawkins School, about 3.7 miles to be graded. District VI, Route 125, Sections C, D. A. Teichert & Son, Inc., Sacramento, \$126,888; Peninsula Paving Co., San Francisco \$136,375; Fredrickson & Watson Constr. Co., Fredrickson Bros., Oakland, \$134,098. Contract awarded to Mittry Bros., Constr. Co., Los Angeles, \$123,144.80.

MADERA COUNTY—In City of Madera, 1.5 mile, grade and A.C. pavement. District VI, Route 4, Section Mad. A. Teichert & Son, Inc., Sacramento, \$66,105; Valley Paving and Construction Company, Fresno, \$61,847; Hanrahan, Wilcox Constr. Co., San Francisco, \$64,857; Fredrickson & Watson Constr. Co., Fredrickson Bros., and Jones & King, Oakland, \$64,190. Contract awarded to Union Paving Co., San Francisco, \$61,785.50.

MERCED, MARIPOSA AND STANISLAUS COUNTIES—Applying Diesel oil to roadside vegetation over a distance of about 147.6 roadside miles. District X. Hayward Building Material Co., Hayward, \$2,517; Lamb's Transfer Co., Long Beach, \$2,559; Sheldon Oil Co., Suisun, \$2,643; Lee J. Immel, Berkeley, \$2,758. Contract awarded to Tiffany Const. Co., San Jose, \$2,517.50.

MONTEREY COUNTY—R.C. bridge across Malpaso Creek, 9 miles south of Monterey. District V, Route 56, Section H. M. B. McGowan, Inc., San Francisco, \$23,646; Lynch Cannon Engineering Co., Los Angeles, \$32,472; Harry J. Oser, San Francisco, \$31,353; F. C. Amoroso & Sons, San Francisco, \$32,874; L. C. Seidel, Oakland, \$28,414; C. W. Caletti & Co., San Rafael, \$26,913; Bodenhamer Construction Co., Oakland, \$29,-

936; Albert H. Siemer and John Carcano, San Anselmo, \$24,549; B. A. Howkins & Co., San Francisco, \$27,835. Contract awarded to Thos. J. Doyle & Theo. Johanns, San Francisco, \$23,737.

ORANGE COUNTY—In Laguna Beach between Cypress Street and south city limits 1.1 mile, grade and P.C.C. Pave. District VII, Route 60, Section C and Lgn. B. Dimmit & Taylor, Los Angeles, \$136,542; Daley Corp., San Diego, \$125,839; Griffiths Co., Los Angeles, \$139,287; Sharp & Fellows Contr. Co., Los Angeles, \$134,891; Mundo Engineering Co., Los Angeles, \$145,277; Oswald Bros., Los Angeles, \$148,975. Contract awarded to J. E. Haddock, Ltd., Pasadena, \$123,729.50.

RIVERSIDE COUNTY—Between 1 mile east of Beaumont and Whitewater, 16.8 miles, grade, P.C.C. pave portions and oil treat Cr. Gr. or St. (plant mix) surface portions. District VIII, Route 26, Sections B, C & D. B. G. Carroll, San Diego, \$141,286; Oswald Bros., Los Angeles, \$142,634; Geo. Herz & Co., San Bernardino, \$149,320; Mittry Bros. Construction Co., Los Angeles, \$168,858; Griffith Co., Los Angeles, \$182,159; Mundo Engraving Co., Los Angeles \$167,897; So. Calif. Roads Co., Los Angeles, \$193,061; United Conc. Pipe Corp., Los Angeles, \$160,349; Fredrickson & Watson Constr. Co., & Fredrickson Bros., Oakland, \$207,582. Contract awarded to Matich Bros., Elsinore, \$139,893.60.

SAN BERNARDINO COUNTY—Asphalt emulsion treatment to existing oil treated shoulders, from Sierra Avenue to Riverside Avenue, 3.8 miles. District VIII, Route 26, Section D. Geo. Gardner & Sons, Redlands, \$2,596; E. L. Yeager, San Bernardino, \$2,399; H. E. Cox & Son, Pasadena, \$2,882. Contract awarded to Geo. Herz & Co., San Bernardino, \$2,231.

SAN DIEGO COUNTY—On Hill Street between Wisconsin Avenue and 8th Street, 1.1 mile, grade and Bit. Tr. Cr. Gr. or St. surface. District XI, Route 2, Section Ocn. Griffith Co., Los Angeles, \$14,775; R. E. Hazard Contracting Co., San Diego, \$14,950. Contract awarded to Southwest Paving Co., Los Angeles, \$11,165.

SAN JOAQUIN, STANISLAUS, CALAVERAS, AMADOR, TUOLUMNE AND MARIPOSA COUNTIES—Apply Diesel Oil to roadside vegetation over 199.7 roadside miles, in District X, various routes and sections. Hayward Building Material Co., Hayward, \$3,169; Tiffany Const. Co., San Jose, \$3,668; Helwig Const. Co., Sebastopol, \$3,849; Lee J. Immel, Berkeley, \$3,980. Contract awarded to Sheldon Oil Co., Suisun, \$3,257.10.

SHASTA COUNTY—At north entrance to Redding, 0.9 mile, grade and pave. District II, Route 3, Section B & Rdg. Fredrickson & Watson Construction Co., Fredrickson Bros., Oakland, \$112,335; Peninsula Paving Company, San Francisco, \$114,431; C. W. Cafetti & Co., San Rafael, \$115,476; Hanrahan Wilcox Corp., San Francisco, \$118,570; Dunn & Baker, Klamath Falls, \$126,976; George Pollock Co., Sacramento, \$125,518; J. F. Knapp, Oakland, \$119,827; A. Teichert & Son, Inc., Sacramento, \$113,750. Contract awarded to T. M. Morgan Paving Co., Los Angeles, \$92,485.18.

SOLANO AND SAN JOAQUIN COUNTIES—Apply Diesel oil to roadside vegetation, at various locations for a distance of about 129.9 miles. District X. Hayward Building Material Co., Hayward, \$2,932; Volpa Bros., Fresno, \$3,318. Contract awarded to Lee J. Immel, Berkeley, \$2,459.46.

SONOMA, MARIN, NAPA AND SOLANO COUNTIES—Furnish and apply Diesel oil to roadside vegetation at various locations about 133.2 roadside miles, in District IV. Hayward Building Material Co., Hayward, \$4,560; Lee J. Immel, Berkeley, \$4,446; Basalt Rock Co., Napa, \$4,370; Helwig Construction Co., Sebastopol, \$4,427. Contract awarded to Chas. Kuppinger, Lakeport, \$3,971.

SUTTER COUNTY—Border construction in Yuba City, between W. P. Railroad and Pacific Highway, 0.5 mile. District III, Route 15, Section Y.C. A. Teichert & Son, Inc., Sacramento, \$2,435. Contract awarded to Hemstreet & Bell, Marysville, \$2,295.

YUBA COUNTY—Crusher run base and bituminous surface treatment, in Marysville, between Buchanan Street and Tahoe-Ukiah Highway. District III, Route 15, Section Mvl. A. A. Teichert & Son, Inc., Sacramento, \$5,717. Contract awarded to Hemstreet & Bell, Marysville, \$5,063.

First Nurse—There's a patient in my ward that hasn't made love to me.

Second Nurse—One of mine is in a state of coma, too.

STATE OF CALIFORNIA

Department of Public Works

Headquarters: Public Works Building, Eleventh and P Sts., Sacramento

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 EARL LEE KELLY.....Director
 JUSTUS F. CRAEMER.....Assistant Director
 EDWARD J. NERON.....Deputy Director

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 C. S. POPE, Construction Engineer
 T. H. DENNIS, Maintenance Engineer
 F. W. PANHORST (Acting), Bridge Engineer
 L. V. CAMPBELL, Engineer of City and Cooperative Projects
 R. H. STALNAKER, Equipment Engineer
 E. R. HIGGINS, Comptroller

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 F. W. HASELWOOD, District II, Redding
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 S. V. CORTELYOU, District VII, Los Angeles
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 R. E. PIERCE, District X, Stockton
 E. E. WALLACE, District XI, San Diego
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 Eleventh and P Streets, Sacramento, California

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A. D. EDMONSTON, Deputy in Charge Water Resources Investigation
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 H. M. STAFFORD, Sacramento-San Joaquin Water Supervisor
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 CLARENCE W. MORRIS, Attorney, San Francisco
 FRANK E. DURKEE, General Right of Way Agent
 C. R. MONTGOMERY, General Right of Way Agent

DIVISION OF PORTS

Port of Eureka—William Clark, Sr., Surveyor
 Port of San Jose—Not appointed

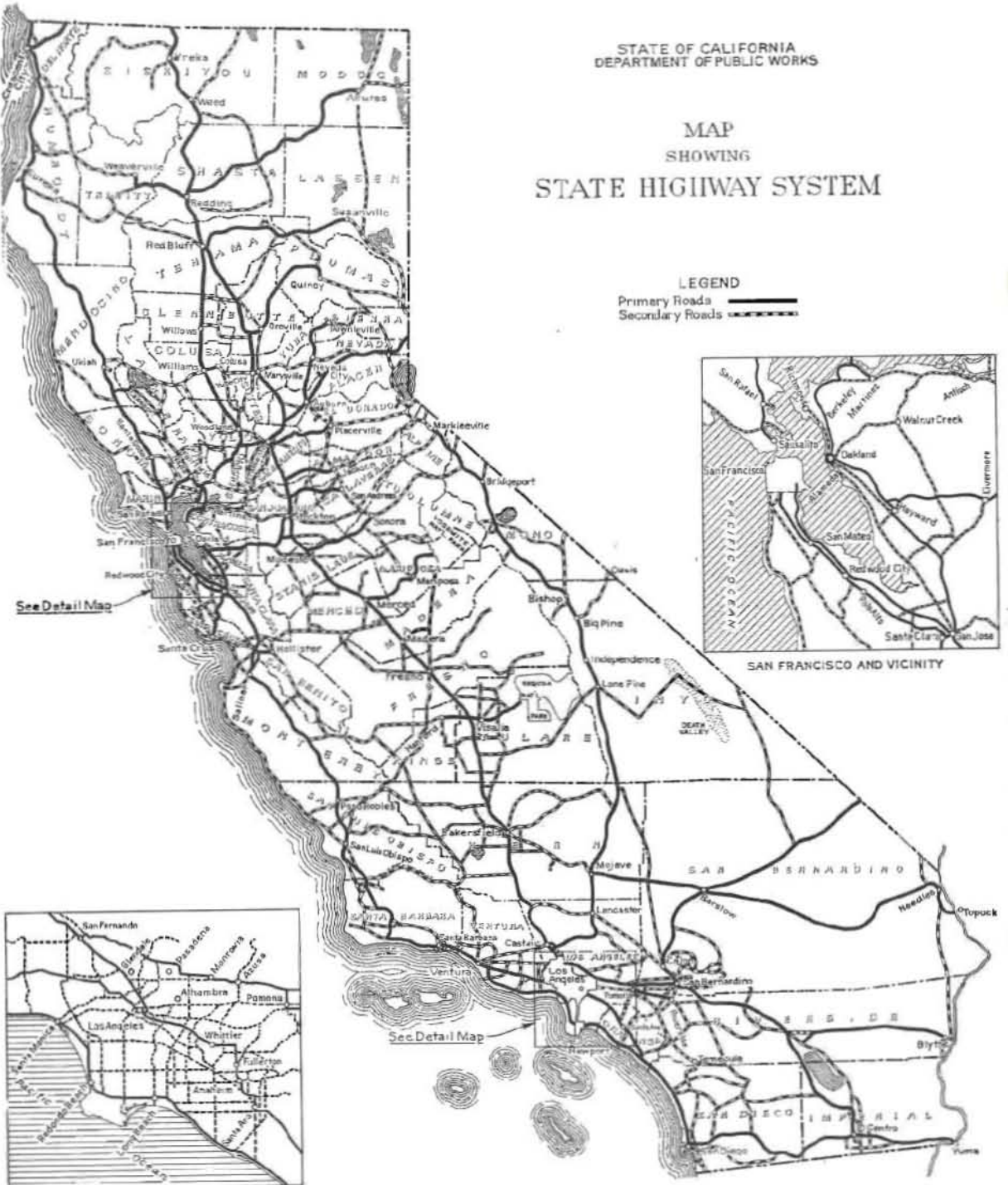
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS

MAP
SHOWING
STATE HIGHWAY SYSTEM

LEGEND
Primary Roads ———
Secondary Roads - - - - -



SAN FRANCISCO AND VICINITY



See Detail Map

See Detail Map



LOS ANGELES AND VICINITY