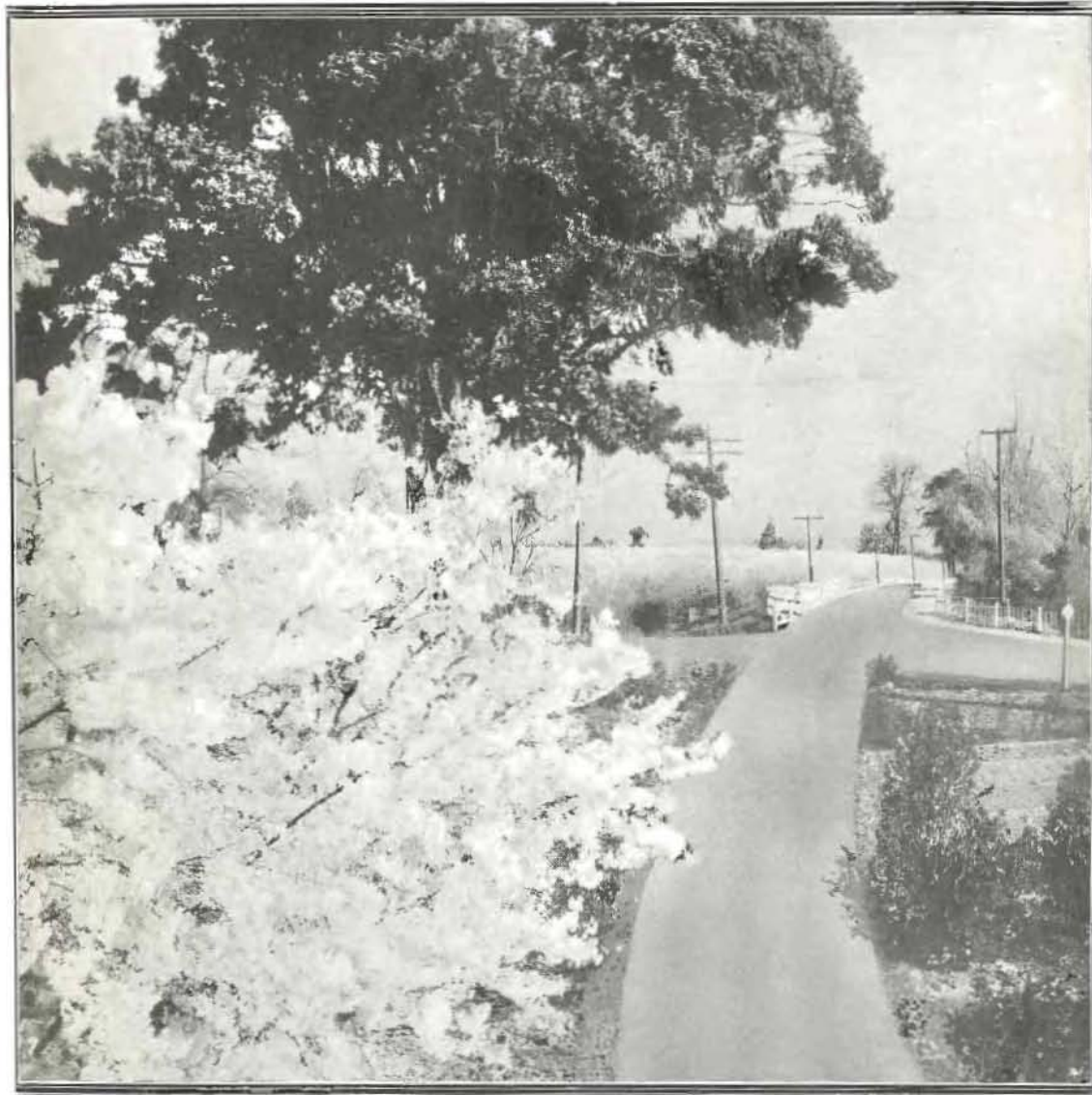


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# California Highways and Public Works



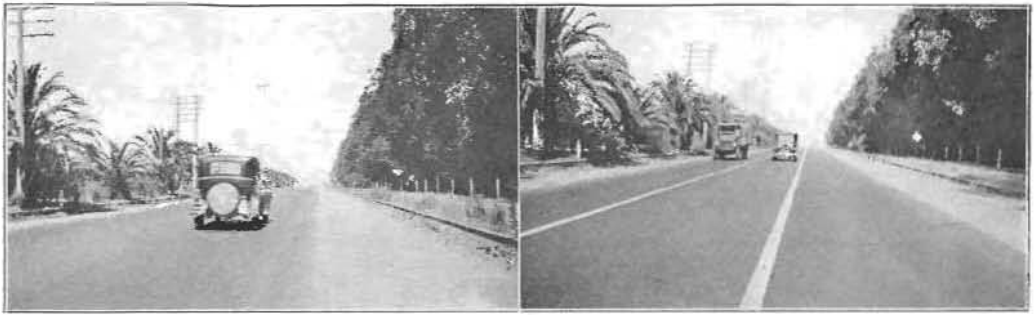
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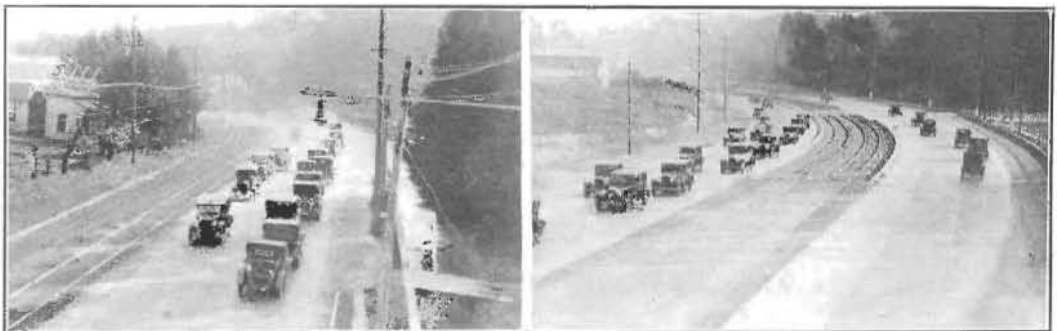
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# California Highway Expenditures As Compared With Other States

By C. H. PURCELL, State Highway Engineer

**T**HE large sum of money raised for highway purposes through the tax upon gasoline has received widespread attention in California. The need for heavy expenditures for highways if California is to maintain its position among the "better roads" states has received less attention. To accomplish this the funds derived from the present financing system must be carefully conserved and economically expended to assure the proper maintenance, reconstruction and construction of new highways on the present system and necessary roads that may be added.

Comparative state highway expenditure data recently compiled from the 1928 edition of the "Statistical Abstract of the United States," published by the United States Department of Commerce, and from records of the accounting department of the Department of Public Works, State of California, shows California's past and proposed road expenditures to be low in comparison with similar expenditures in other states.

The outstanding fact is that California has been spending considerably less on her state highways than the average in other representative groups of states. Even with the increased funds from the 1-cent gas tax, which are now available, California will continue to expend much less per car for state highway transportation service than the other states herein referred to.

For the purpose of comparison, several representative northeastern, southeastern and western states have been so grouped that the total area of each group is approximately equal to the area of California. The northeastern group of states comprises New York, Massachusetts, Connecticut, New Jersey, Delaware, Pennsylvania and Ohio. The southeastern group of states comprises Florida, Georgia, South Carolina and North Carolina. The western group comprises Oregon and Washington. Average total road expenditures for the period of 1925 to 1927 inclusive for each group have been compared with similar expenditures in California.

The comparison for each of the sections is shown below in tabular form (for the period from 1925 to 1927, inclusive):

East and California		
	Eastern group	California
Land area in square miles.....	155,564	155,652
Estimated population, 1928.....	38,252,000	4,556,000
Motor vehicle registration, 1927	6,798,715	1,693,195
State highway mileage (Dec. 31, 1926) .....	42,665	6,582
Population per mile of state highway .....	895	692
Number of motor vehicles per mile of state highway.....	160	257
Number of people per car.....	5.6	2.7

Annual Expenditures		
	Eastern group	California
Average annual state highway expenditures per capita .....	\$4.44	\$3.37
Average annual state highway expenditures per car .....	25.00	9.06
Average annual state highway expenditures per mile .....	3,933.43	2,331.21

South and California		
	Southern group	California
Land area in square miles.....	192,821	155,652
Estimated population, 1928.....	9,416,000	4,556,000
Motor vehicle registration, 1927	1,325,503	1,693,195
State highway mileage (Dec. 31, 1926) .....	23,274	6,582
Population per mile of state highway .....	406	692
Number of motor vehicles per mile of state highway.....	57	257
Number of people per car.....	7.1	2.7

Actual Expenditures		
	Southern group	California
Average annual state highway expenditures per capita.....	\$7.02	\$3.37
Average annual state highway expenditures per car .....	49.88	9.06
Average annual state highway expenditures per mile.....	2,840.94	2,331.21

West and California		
	Western group	California
Land area in square miles.....	162,442	155,652
Estimated population, 1928.....	2,489,000	4,556,000
Motor vehicle registration 1927	629,155	1,693,195
State highway mileage (Dec. 31, 1926) .....	7,753	6,582
Population per mile of state highway .....	320	692
Number of motor vehicles per mile of state highway.....	81	257
Number of people per car.....	4.0	2.7

Actual Expenditures		
	Western group	California
Average annual state highway expenditures per capita.....	\$7.44	\$3.37
Average annual state highway expenditures per car .....	29.45	9.06
Average annual state highway expenditures per mile.....	2,389.91	2,331.21

The preceding figures show total expenditures including maintenance and new construction.

The comparison shows that up to the present time the expenditure for state highways



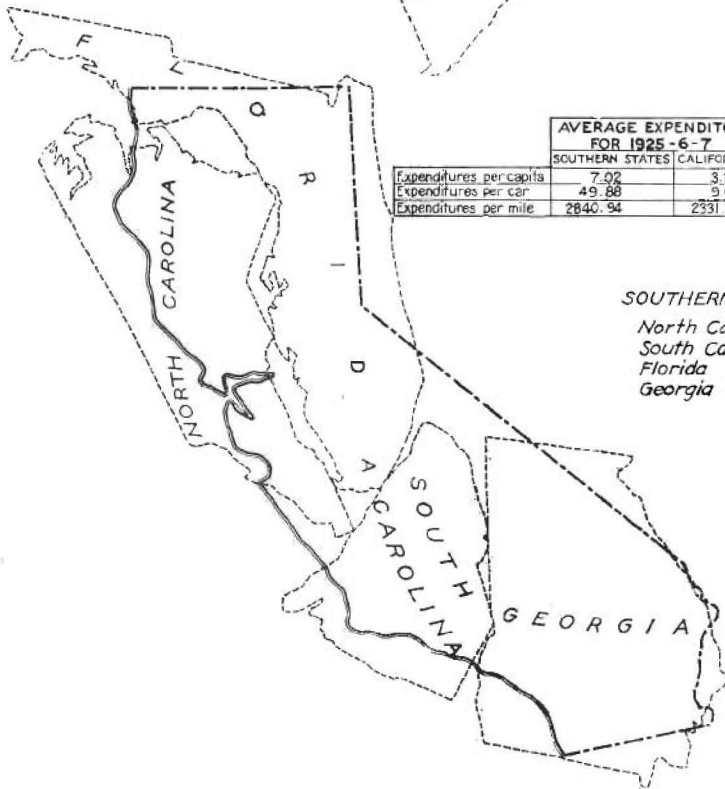
	AVERAGE EXPENDITURES FOR 1925-6-7		ESTIMATE FOR 1929	
	EASTERN STATES	WESTERN STATES	CALIFORNIA	CALIFORNIA
Expenditures per capita	4.44	7.44	3.37	6.59
Expenditures per car	25.00	29.45	9.06	17.72
Expenditures per mile	3983.49	2389.91	2331.21	4559.67

**EASTERN STATES**

- Massachusetts
- Connecticut
- New York
- New Jersey
- Delaware
- Pennsylvania
- Ohio

**WESTERN STATES**

- Washington
- Oregon



	AVERAGE EXPENDITURES FOR 1925-6-7		ESTIMATE FOR 1929-CALIFORNIA	
	SOUTHERN STATES	CALIFORNIA	CALIFORNIA	CALIFORNIA
Expenditures per capita	7.02	3.37	6.59	
Expenditures per car	49.88	9.06	17.72	
Expenditures per mile	2840.94	2331.21	4559.67	

**SOUTHERN STATES**

- North Carolina
- South Carolina
- Florida
- Georgia

in California has averaged less per mile, less per car and less per capita than in the three widely separated representative groups of states compared in the table.

The 1-cent gas tax which was authorized by the Legislature in 1927 will enable California to increase her highway expenditure. With the funds derived from the 1-cent gas tax, California's annual expenditure per capita will be increased to \$6.59 and her annual expenditure per car will be increased to \$17.72. Even with this increase in funds California will continue far lower than the expenditures of the other states referred to herein.

Statistics of the past year's highway activities in all states indicate that the total state highway expenditures in the United States in 1928 of \$1,300,000,000 included an increase devoted principally to maintenance, of \$100,000,000 over the total expenditure of 1927. This indicates that the unit of expenditures under "East," "South" and "West" of the tables will increase subsequently but it must be noted that the proposed per capita and per car expenditure in California during the coming fiscal year are less than the unit expenditure in the other two groups prior to 1927, with one exception. The one exception is that the annually proposed expenditure per capita in California is \$6.59 as compared with the previous expenditure of \$4.44 per capita in the eastern group of states.

In the consideration of highway revenue, traffic needs as compared with the need of traffic of a few years ago must be taken into consideration. Big factors in highway expenditures of today as compared with those of the earlier period are the cost of better alignment and wider rights of way; the heavier and wider pavements now laid; the increasing number of grade separation structures; wider bridges; and the many devices now incorporated into highways to safeguard and accelerate travel that were either unknown or considered unnecessary in the early days of highway building, when traffic was not as heavy as it now is.

### STRIPING THE HIGHWAYS

A report has been made from the various districts as to the mileage of pavements which will require striping. It is planned to have all sections of pavement of 20-foot width or more divided into 10-foot lanes. In foggy sections, or where there is danger to traffic, a stripe will be placed along the edge of the pavement. Very favorable comment has been received on those sections of highway where the edges of the pavement have already been so marked. The stripe will be in place before the next winter season to secure the most benefit from the expenditure.

## Select Typical Highway Sections For Beautification

Plans for the beautification of typical roadside sections along the state highway system are fast taking form.

Sections in the Sacramento Canyon, and in the vicinity of Roseville, La Honda, Salinas, Serra, and near the Yolo Causeway, as well as a section just south of Merced, have been selected for development as typical sections for roadside beautification. In District VIII different types of trees which thrive under desert conditions are being planted and we are looking into the possibility of improving roadsides along the desert roads with such flowers and shrubs as will grow in that climate. Some fifteen or twenty maintenance stations have also been selected and arrangements are being made for plantings to beautify these places.

In this connection it is interesting to note that California is one of only nine states in the Union with a definite roadside beautification and landscaping campaign under way, financed as legal maintenance expenditures or from special funds. The only other state in the west committed to this program is Oregon, according to data gathered by the California State Automobile Association.

However, the transformation of roadsides by setting out trees, shrubs, and vines, and planting flowers and grasses has developed into a widespread movement in many parts of the country. States ranking with California and Oregon in this work are Oklahoma, Missouri, Michigan, Pennsylvania, Connecticut, Massachusetts and Rhode Island.

In California this phase of highway work is receiving more attention each year. There are some 600 miles of roadsides where trees have been planted, as the work has been under way for a number of years. In addition to this, many of the counties have forestry departments that are taking a decided interest in roadside beautification and are doing systematic planting.

It is believed that nation-wide stimulus will be given to this work as congress last year recognized roadside tree planting as a proper object for federal aid funds. According to Thomas H. McDonald, chief of the bureau of public roads, the amendment to the federal highway legislation providing for participation in planting along the roadside is a forward step and one which will receive the full and earnest support of the bureau.

# Governor Young Enunciates Policy of State Highway Extensions

The following message dealing with the policy to be followed in making extensions to the state highway system was transmitted by Governor C. C. Young to the state legislature:

EXECUTIVE  
DEPARTMENT

STATE OF CALIFORNIA

March 12, 1929.

*To the Members of  
the Senate and the  
Assembly:*

In the message transmitted to you at the opening of the present legislative session, and again in the message accompanying the budget, there was discussed the importance of our state highway system to the prosperity and growth of California. In these messages the following statement was made relative to the inclusion of new roads in the state system:

At this time it will be necessary to establish some policy relative to the inclusion of new roads within the state highway system. There is a certain "orphan" section of highway which, by error in description, by oversight, or through other fault, was not included in the state system when the parent roads were designated as state highways. This probably should be annexed to the present system at once. It comprises about five miles. Put aside from this I am very doubtful whether other additions can be made just now without disrupting our entire highway program.

There are certain other roads, now a part of county highway systems, that are largely devoted to state rather than local uses. These roads clearly have prior rights to become a part of the state system, when that system is expanded. The question now is as to when such transfer should take place. I would suggest to the Director of Public Works that during the next two years he make a comprehensive traffic study of those county highways in California

## TELLS IMPORTANCE OF NEW ROAD POLICY

By C. C. YOUNG,  
Governor of California.

The resolution adopted by unanimous vote in both houses of the legislature, dealing with extensions to our highway system, in my opinion is the most important contribution that that body could make to our state highways. It establishes a policy and constitutes a precedent by which future additions to the state highway system must depend upon their ability to qualify for a place in that system upon the basis of merit as determined by and after expert study and investigation.

The legislature is to be congratulated upon its willingness to put the ultimate benefit of the state highway system before the very natural desire of its members to see, included in the system, at this time, roads in which they are particularly and immediately interested.

The resolution not only provides a proper policy to govern extensions to the state highway system, but it also assures a progressive correction of the present unbalanced mileage of the secondary road system in the northern and the southern districts as set up in the Breed bill. This lack of mileage balance constituted a source of irritation and complaint in the south.

The resolution should and will promote state unity and state-wide support in the future and continued development of our highway system.

The appreciative thanks of the people of California are due those organizations and individuals through whose able and loyal efforts this happy result was accomplished.

which now serve as arterial highways, or of routes not now in the state system of probable arterial value, to determine what roads should be added to the system, and the order in which they should be added as determined by state use and traffic needs, together with an estimate of the probable time when such roads can be included in the state system without imposing an impossible burden on that system.

No governor should be asked or expected to sign a bill providing for the extension of the state highway system, except upon recommendation of the Department of Public Works—a recommendation in its turn based upon a careful study of traffic requirements and highway use, in line with the broad general policy of long-time planning. Any other plan will break down our program of highway construction and will favor of political expediency rather than of safe and business-like procedure. Whatever policy may be adopted must be based on traffic and not political pressure.

### POLICY FOR INCLUSION OF NEW ROADS

Having thus recognized that there are unquestionably roads which should be added to the state system, and having suggested a study of these roads during the next two years, it becomes necessary to adopt a policy which at the earliest possible moment may afford relief to those localities where county roads, due to the large volume of state traffic using them, have in effect become state roads, thus throwing an undue maintenance burden upon the counties in which these roads lie. It is only

(Continued on page 17.)

# Resolution Is Important Step Forward

## TEXT OF RESOLUTION

Below is the text of the concurrent resolution introduced by Senator Handy, chairman of the Senate Committee on Roads and Highways, and by Assemblyman Jespersen, chairman of the same committee in the Assembly; passed by unanimous vote of both houses.

WHEREAS, It appears that some highways not now in the state highway system are carrying a volume of state traffic that far exceeds the local traffic carried on said roads, thus placing upon the counties in which these roads are located an undue and heavy maintenance burden; and

WHEREAS, A preliminary investigation by the California Highway Commission and Department of Public Works indicates that there is at the present time a decidedly greater mileage of such roads in the south, as compared with those in the north, carrying this excessive state traffic; and

WHEREAS, An executive message was transmitted to the Legislature under date of March 12 in which was suggested certain underlying principles to be observed in the inclusion of new secondary roads within the state highway system; now therefore, be it

*Resolved by the Assembly, the Senate concurring,* That the principles enunciated in said executive message be observed in the inclusion of new roads within the state highway system, and that the California Highway Commission and the Department of Public Works be, and they are hereby directed to observe the following principles in the inclusion of new roads within the state highway system.

1. Additions shall during the next two years be made to the present secondary highway system, totaling between 10 and 12 per cent of existing state highway mileage, said mileage to be added in the ratio of not less than three or four miles in the south to one mile in the north.

2. For budgeting purposes this mileage shall be included as a part of the state highway system by the California Highway Commission when the necessary surveys are completed; *provided, however,* no money be expended on same until they have been finally included in the system by legislative act.

3. There shall be no change in the present statutory division of secondary highway funds; and, be it further

*Resolved,* That the California Highway Commission and the Department of Public Works be and they are hereby directed to make a careful study of the state highway system to ascertain and determine routes not now in the system which, either by reason of the large volume of state traffic that they are now carrying, or by reason of the relief that they would afford to heavy traffic upon present state highways, or as highways serving as important interstate links, might properly be included and added to the state highway system; and be it further

*Resolved,* That this study shall, in accordance with the above mentioned executive message, include an investigation into the engineering, economic and traffic facts involved in the matter; that a comprehensive

report shall be made to the forty-ninth Legislature embodying such recommendations as the investigation may disclose as proper and a recital of such facts as may have been taken into account; that this investigation shall begin not later than May 1, 1929, and that this report shall be completed and made public not later than August 1, 1930, and that pending the adoption of such report authority be hereby given to the California Highway Commission to take into consideration for its next budget such roads as it is thus designating and bringing to the attention of the Legislature at its next session.

By B. E. MEEK,

Director of the Department of Public Works

THE resolution represents an agreement between the varying opinions of the north and south relative to the additions of new roads to the state highway system.

Opinion in the north has been consistently against any considerable addition to the state highway system until further progress is made in completing the roads to which the state is now obligated. The north has felt that the distribution of the same amount of money now allotted to secondary roads in the north over a larger mileage than is now in the north's secondary system would only serve to delay needed construction and improvements of present state highways.

The resolution protects these northern roads in their money allotments. At the same time sufficient leeway is left to permit the inclusion in the northern system of such roads as may obviously be now performing the service of state highways and entitled to a place in the state system.

The mileage in secondary highways in the southern group of counties is 525 as compared with the secondary mileage of 1778 in the north. In the south the situation has also developed that a number of county roads are now carrying a large volume of traffic of a statewide character and a relatively small volume of local traffic. The extent of this traffic is such that it makes it difficult and in some cases impossible to maintain an adequate surface upon this road. This situation has resulted in placing upon the counties in which these roads are located a heavy and at the same time an unfair maintenance burden.

The resolution permits the inclusion of such roads as investigation may show are now carrying a preponderate state traffic, and in a

(Continued on page 10.)

# The Semi-Annual Traffic Count

**P**ARAPHRASING the well known words of Diamond Jim Brady that "Those that has 'em, wears 'em" to "Those that has 'em, drives 'em" was amply corroborated by the traffic census taken at various stations throughout the state on January 13 and 14. With the weather generally unfavorable, the returns still indicate a healthy increase over last year's count for a similar period.

Substantial gains were noted in the main north and south interstate connection and recreational routes. The increase in the latter type is of particular interest, typifying the initiation of a new form of recreation. These routes are, in the main, feeders to the high Sierra passes which are usually closed by snow a short distance above the foothills. However, the gradual improvement of these routes to the snow line elevation places the invigorating sports of winter within a few hours' drive of the valley areas. The growing popularity of this movement is well attested by the 4 per cent increase over last year's count, which itself represented a 51 per cent advance over that of the previous year.

The present count is in line with the policy initiated in 1920 as a means of determining not only traffic service, but also the allotment of construction and maintenance expenditures, as well as type and design of road section. At its inception 103 stations were selected as expressive of the traffic flow, which number has since been increased to some 836 stations.

Consecutive counts are taken over two-day periods bi-yearly between the hours of 6 a.m. and 10 p.m. Sunday and Monday are usually selected as typifying the daily variation; the seasonal being obtained by taking the count during the mid-month periods of January and July.

In the count vehicles are segregated in hourly periods over the following classifications: Passenger cars, light trucks (loaded and empty), heavy trucks (loaded and empty), horse-drawn vehicles, trailers, buses and foreign cars, that is cars registered outside the state. In the present census in the vicinity of large population centers an account was registered of the directional flow of traffic. In some instances this variance in direction was in the proportion of 75 per cent and 25 per cent. However, the relation for the full day count was in most cases approximately equal.

This information is very important, as it plays a direct part in the establishment of road widths which are predicated on peak hour traffic.

As a matter of interest, certain salient points have been selected on the various routes for the purpose of comparing counts taken this year on January 13 and 14 with those taken in 1928 over a similar period. The present census, based on the locations enumerated, show the following increases:

	For Sunday Pct.	For Monday Pct.
Main north and south routes.....	+12	+ 7
Laterals between inland and coast routes.....	+ 6	+ 6
Interstate connection routes.....	+20	+ 6
Recreational routes.....	+ 4	+ 5
Miscellaneous.....	+ 4	+ 8
Average of all routes.....	+ 8	+ 4

Route No.	Sunday		Monday	
	Gain Pct.	Loss Pct.	Gain Pct.	Loss Pct.
1. San Francisco to Oregon line.....	4	--	10	--
2. San Francisco to San Diego.....	11	--	6	--
3. Sacramento to Oregon line via Marysville.....	--	--	--	4
4. Sacramento to Los Angeles (Valley Route).....	--	1	1	--
5. Stockton to Santa Cruz via Oakland.....	11	--	5	--
6. Sacramento to Woodland Junction.....	--	15	--	10
7. Tehama Junction to Benicia.....	--	1	7	--
8. Ignacio to Cordelia via Napa.....	--	13	--	3
9. San Fernando to San Bernardino.....	20	--	20	--
10. San Lucas to Sequoia National Park.....	--	2	10	--
11. Sacramento to Riverton via Placerville.....	--	14	--	17
12. San Diego to El Centro.....	78	--	20	--
13. Salida to Sonora.....	--	--	--	1
14. Albany to Martinez.....	--	9	3	--
15. Route 1 near Calpella to Grass Valley.....	2	--	--	18
16. Hopland to Lakeport.....	2	--	16	--
17. Roseville to Nevada City.....	2	--	--	17
18. Merced to El Portal.....	22	--	--	4
19. Route 9 west of Claremont to Riverside.....	8	--	--	8
20. Redding to Route 1 near Arcata.....	6	--	26	--
21. Route 3 near Richvale to Quincy.....	51	--	58	--
22. San Juan Bautista to Route 32 via Hollister.....	--	1	--	4
23. Sanger to Bishop.....	39	--	30	--
24. Route 4 near Lodi to Valley Springs.....	--	24	--	2
25. Nevada City to Downsville.....	77	--	29	--
26. San Bernardino to El Centro.....	44	--	28	--
27. El Centro to Yuma.....	13	--	--	1
28. Redding to Nevada Line via Alturas.....	32	--	15	--
29. Red Bluff to Nevada Line via Susanville.....	58	--	29	--
31. San Bernardino to Jean.....	14	--	22	--
32. Route 4 near Califa to Route 2 at Gilroy.....	8	--	29	--
33. Route 4 near Bakersfield to Paso Robles.....	15	--	10	--
34. Route 4 near Arno to Pine Grove.....	--	3	--	3
37. Auburn to Colfax.....	28	--	--	37
43. San Bernardino to Big Bear Lake.....	91	--	--	15
44. Boulder Creek to Redwood Park.....	32	--	32	--
47. Orland to Chico.....	--	--	32	--
48. McDonalds to Wendling.....	27	--	10	--
49. Calistoga to Lower Lake.....	--	1	--	--

(Continued on page 24.)



## Interpreting the Traffic Census

By T. H. DENNIS, Maintenance Engineer

THE purpose of the maintenance organization is to serve traffic. To fulfil this obligation the highways must not only be preserved in the best condition, but information as to the rate of development of traffic must be collected so that expansion of transportation facilities will be just ahead of traffic needs. With this end in view the maintenance department has made a special study of the traffic problem during the past two years.

While traffic counts taken each year in January and July provide records of existing traffic, any worthwhile recommendation requires an approximate determination of the traffic capacity of two, three, and four lane pavements, also an estimate of the probable increase in traffic on any given section of road.

On every heavily traveled road there is a period in the morning and late in the afternoon when travel is heaviest. Our analysis of actual hourly records for all sections of the state showed that for nearly 90 per cent of the stations the traffic during the peak hour was from 9 to 11 per cent of the total traffic from 6 a.m. to 10 p.m. For practical purposes the peak hour traffic may therefore be accepted as 10 per cent of the 16-hour count.

The next step was to determine the volume of traffic which might use the highway during the peak hour without undue interference. This quantity is influenced by a number of variables, such as condition of the road, alignment, intersections, range in braking distances, percentage of fast and slow vehicles, personal equation of each driver, etc. It is evident, therefore, that any figure adopted must be based on arbitrary assumptions. In making such assumptions in our study, consideration has been given to records of actual performance, experience and observation. There are shown three tables which give the basic assumptions. Table I shows the number of vehicles which can pass over a single traffic lane at uniform rates of speed. In this table full braking distance is provided between each vehicle. The capacities shown permit 100 per cent safety for each vehicle.

Table II shows what may be considered as the maximum capacity of a single traffic lane with all vehicles uniformly spaced and traveling at a uniform speed. No allowance is

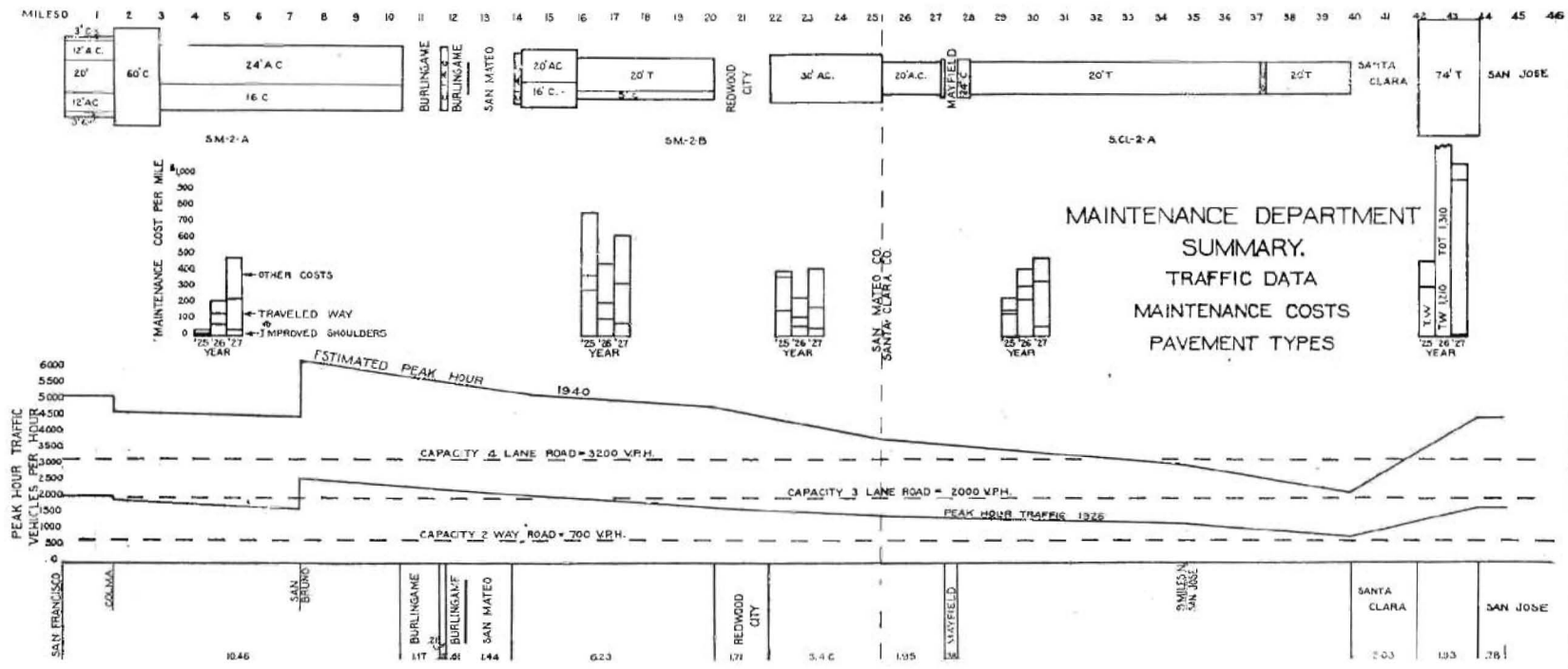
made here for braking distance. Table III is a combination of Tables I and II and represents an average volume at given uniform speeds. The capacities shown in these three tables are working capacities on the assumption that the opposite lane of the roadway is filled so there is no opportunity for passing and all vehicles are thus held at the speed of the slowest vehicle in the line.

The planning for pavement width to care for the estimated future traffic requires that the traffic capacity be taken at some definite figure. The range of driving speeds and other factors is so great that practical working capacities vary widely. At the expense of police control, increased danger of accidents and of delay, expense and inconvenience to users of the highways, traffic of 2000 vehicles per hour may be passed over a single lane roadway at twenty to twenty-five miles per hour. However, a single vehicle traveling at a speed of two miles per hour would reduce the capacity of our single lane to 330 vehicles per hour. At fifty miles per hour it is theoretically possible to pass 2400 vehicles per hour over this single lane in the same direction.

Alignment, gradient, proportions of light and heavy traffic, weather, driving conditions, and the personal equation of different drivers all enter into the question of establishing a guide for the proper economical planning of roads for maximum service. The maintenance department has carefully considered these different phases of the problem in the light of traffic records and actual field conditions, and has arrived at the following capacities for the purpose of determining the width of pavement necessary to care for the estimated traffic in 1940:

	Vehicles per hour
Two-lane roadway .....	700
Three-lane roadway .....	2000
Four-lane roadway .....	3200

These are considered to be the peak hour traffic figures and represent 10 per cent of the traffic for the sixteen-hour period from 6 a.m. to 10 p.m. This volume of traffic will permit fast traffic to travel at 40 miles per hour and provides for sufficient safe passing space for that purpose. It provides for a safety factor of about 30 per cent, that is: Traffic on a two-lane roadway can be increased to 1000 vehicles



per hour without serious delay. An explanation of the method of arriving at those figures is given below:

#### For Two-lane Road.

Rate of traffic flow, with minimum delay, was determined under the worst and also the best combination of vehicle spacing and speeds. Graphs No. 1 and No. 2 were worked up to show these conditions. These graphs show the relative positions of the vehicles on a mile of two-lane roadway at each second of a minute interval of time.

Graph No. 1 shows a number of fast and slow vehicles equally divided as to direction of travel. At zero time vehicle No. 2 is just

in position to turn out to pass No. 1 and Vehicles No. 3, No. 4 and No. 5 are spaced at the closest interval so that no delay results as they continue their uniform speed. At the forty-eighth second, vehicles No. 2 to No. 5, inclusive, have completed their passing. At these speeds one-half mile of road is required to complete the passing without delay. In the meantime a similar spread of vehicles can be approaching from the opposite direction on the other lane with their passings complete in the same time interval. Vehicles No. 6 and No. 16 were then spotted at a spacing to give the least possible delay. It will be noted that these two vehicles must reduce speed at the fifty-eighth second because vehi-

TABLE I—MINIMUM CAPACITY—ONE LANE

Miles per hour	(1) Braking distance (feet) (safe all grades to 6 pct.)	(2) Reaction time in seconds	(3) Reaction distance plus 17 ft. (from table II)	Spacing of cars, sum of (1) and (3)	Cars per mile	Capacity per hour
2	0.6	1.000	31.7	32.3	163.5	32.7
10	12.5	1.000	31.7	44.2	119.5	1195
15	28.0	.938	37.6	65.6	80.5	1207
20	50.0	.875	42.6	92.6	57.0	1140
25	78.0	.812	46.8	124.8	42.3	1057
30	112.0	.750	50.0	162.0	32.6	978
35	153.0	.688	52.3	205.3	25.7	900
40	200.0	.625	53.7	253.7	20.8	832
45	253.0	.562	54.1	307.1	17.2	774
50	312.0	.500	53.7	365.7	14.4	720

TABLE II—MAXIMUM CAPACITY—ONE LANE

Miles per hour	Velocity feet per second	Reaction time in seconds	Reaction distance in feet	Reaction distance plus 17 feet	Cars per mile, one lane	*Capacity per hour
2	3.0	1.000	14.7	31.7	166.6	333
10	14.7	1.000	14.7	31.7	166.6	1666
15	22.0	.938	20.6	37.6	140.4	2106
20	29.3	.875	25.6	42.6	123.9	2478
25	36.7	.812	29.8	46.8	112.8	2820
30	44.0	.750	33.0	50.0	105.6	3168
35	51.3	.688	35.3	52.3	100.9	3531
40	58.7	.625	36.7	53.7	98.3	3932
45	66.0	.562	37.1	54.1	97.6	4392
50	73.3	.500	36.7	53.7	98.3	4915

\*Number cars passing given point.

TABLE III—AVERAGE CAPACITY—ONE LANE

Miles per hour	Cars per mile, 40 pct. of maximum, Table II	Cars per mile, 60 pct. of minimum, Table I	Cars per mile	Spacing, feet	Capacity
2	66.6	98.1	164.7	32.0	329
10	66.6	71.7	138.3	38.2	1383
15	56.2	48.3	104.5	50.5	1567
20	49.6	34.2	83.8	63.0	1676
25	45.1	25.4	70.5	74.9	1762
30	42.2	19.6	61.8	85.4	1854
35	40.4	15.4	55.8	94.6	1953
40	39.3	12.5	51.8	101.9	2072
45	39.0	10.3	49.3	107.1	2218
50	39.3	8.6	47.9	110.2	2395

cles on the opposite lane prevent free passing. The addition of a single additional vehicle at any point will cause additional delay. This graph shows minimum delay and speed conditions which require maximum distance for passing. Twenty-four passings are made by 12 machines in the minute interval on the mile of road. The rate is 340 vehicles per hour.

Graph No. 2 shows a more nearly normal spread of fast and slow vehicles under the best passing conditions; 16 passings are made by 28 machines per minute on the mile of road. The rate of flow is 1035 vehicles per hour. The average rate of flow shown by the two graphs is 688 vehicles per hour.

### Three-lane Road.

Under the best conditions a three-lane road is capable of carrying twice the capacity of a two-lane road, or 2000 vehicles, as the center lane is available alternately for fast traffic from either direction and the average speed would, therefore, be considerably higher than that of the slow vehicles. The inner lane is available to full capacity for 40 mile per hour traffic, or 2072 vehicles, with a minimum of possibly 10 per cent additional on each of the outside lanes, or a total of 2500 per hour. It is considered that 2000 vehicles per hour during peak hours would be a reasonable capacity.

### Four-lane Road.

With four-lane traffic, under proper police regulation, the outside lanes carry the slow moving traffic and the inside lanes the fast traffic. Under these conditions the two inside lanes will carry 4144 vehicles at 40 miles per hour, according to Table III. With a minimum of 10 per cent additional for the slow traffic on each of the outer lanes, a peak hour traffic of 5000 vehicles should be possible under well controlled conditions and our assumption of 3200 as a working basis is considered a comfortable peak capacity.

Consideration was also given to rate of traffic increase. This is dependent on increase in population, increase of vehicles in proportion to population, increase in traffic from outside the state, and increased use of vehicles as the highways are improved. For our purposes, after analysis of existing data in the above respect, it seemed reasonable to assume that the increase in traffic would continue at the present rate of nearly 9 per cent annually for the next 12 years without extreme change. Traffic assumptions as of 1940 were worked out on an average of 9.6 per cent annually over the 1926 count.

## RESOLUTION IS IMPORTANT STEP FORWARD

(Continued from page 5.)

ratio that will tend toward establishing a balance between the secondary highway mileage north and south.

It will be noted that the resolution is confined to secondary highways. Primary highways are not affected by it. Under the Breed bill the secondary highway funds are divided on a 50-50 basis between the north and south. The resolution affirms this distribution.

The resolution also protects the highway system against an undue inflation of mileage by limiting the inclusion of new roads in the next two years to from 10 to 12 per cent of the present mileage in the state highway system.

As far as the present administration is concerned, we feel that this resolution is most important in that it marks the definite establishment of the principle that additions to the state highway system shall follow, and not precede, an expert study by the state road building authorities of roads proposed for inclusion in that system. It means the end of the designation of state highways with necessary engineering knowledge. It marks a contribution to the highway system of California as important as was the substitution of the pay-as-you-go plan for the costly system of payment through bond issues. I feel that the Legislature will perform a very signal service for the state in the adoption of this resolution.

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CONNECTICUT—Accident reports for several years indicate that less than 4 per cent are due to defects in the vehicle.

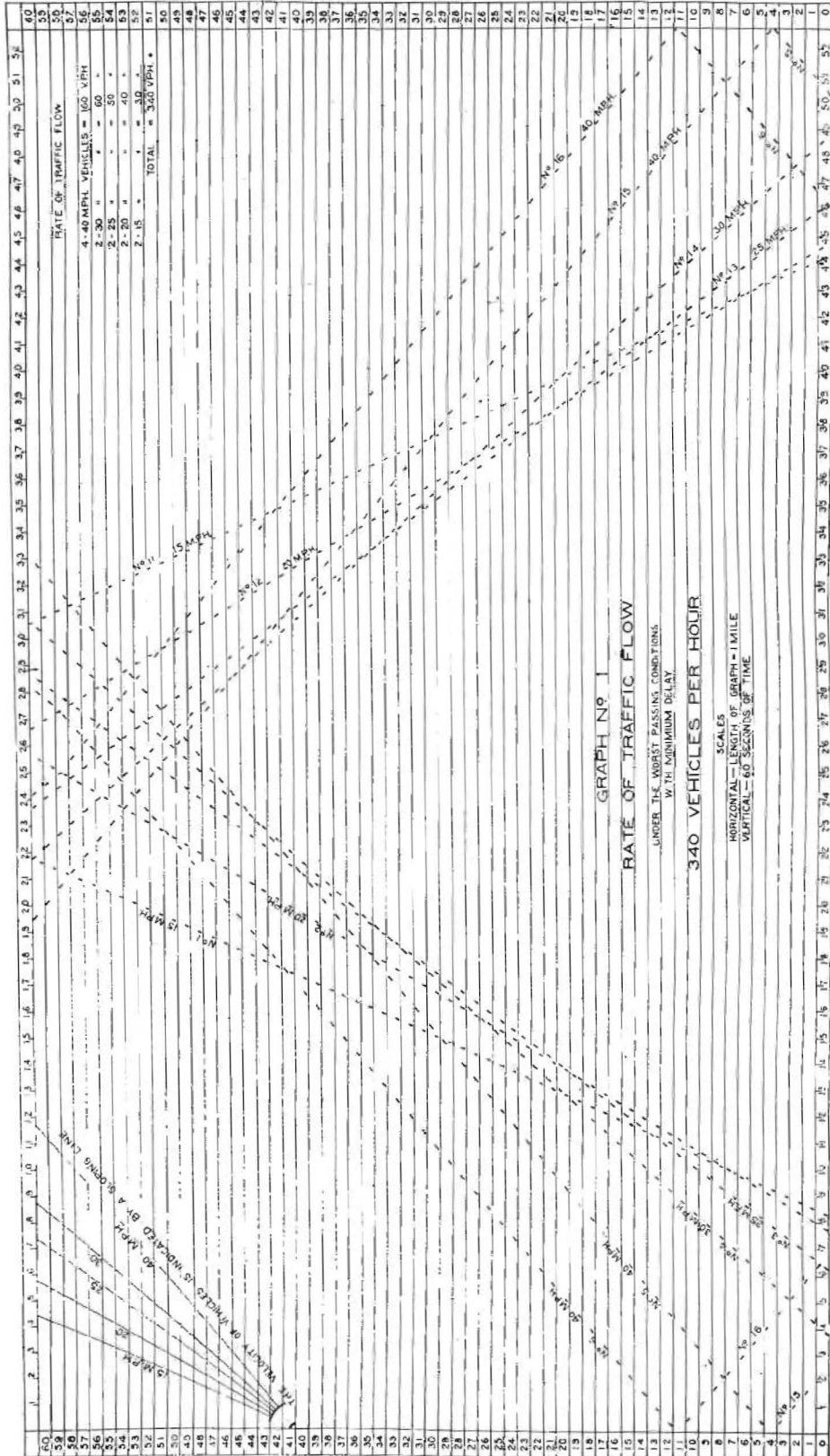
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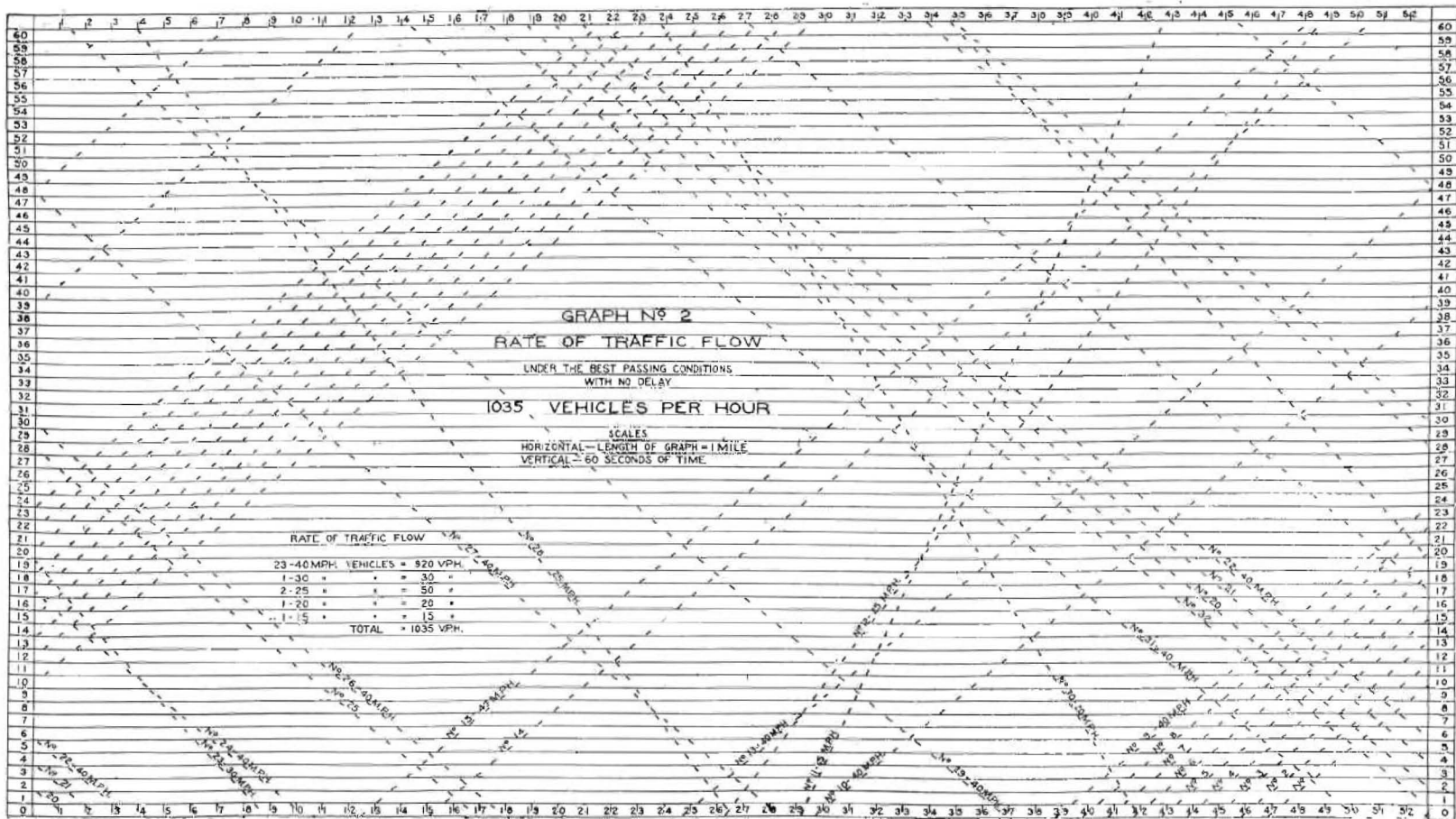
VERMONT—Snow removal service last winter was extended over 1702 miles of state highways, or slightly less than one-half the mileage.

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The information developed was applied in a practical manner, as shown by the accompanying typical chart. This chart shows the 1926 peak hour traffic; the estimated peak hour traffic of 1940, and the annual maintenance costs per mile of the various types of pavement, as well as the pavement and shoulder widths on a given section of highway.

Similar charts have been prepared for the entire state highway mileage and represent a summary of pavement types, maintenance costs and traffic records and needs, which makes this information easily available for analysis in connection with planning improvement in the work of the maintenance department.





## Fighting Floods With Sacked Concrete

By C. H. WHITMORE, District Engineer

**S**HIVELY BLUFF in Humboldt County on the Redwood Highway has been the source of extreme trouble either from slides or from the wash of the Eel River on the embankment side of the roadway.

The spring of 1928 found the roadway at this point washed out until two cars could not pass. (Shown in picture 46.)

Embankment quantities were computed and it was found that about 8500 cubic yards of material were necessary to fill out the roadway to its standard width, and a study of the cut side revealed the fact that probably 100,000 cubic yards would have to be moved to get the roadway to a cut section which would be safe. This would also open up a new face, probably 100 feet high, which would cause many new slides.

Various methods of repair were considered but finally it was decided to refill the embankment which had been washed out and protect it against the river which rises, in flood times, about 25 feet and carries very heavy drift.

As the season was getting late, the proposition of filling the embankment and slope paving was abandoned in favor of sacked concrete rip rap, as high water might be expected at any time and with the use of the latter method, the fill and the rip rap protection could be brought up at the same time.

Accordingly, a trench was dug about two feet deep in bed rock at the cross-sectioned toe of fill, the first sack laid lengthwise, and the second row placed crosswise, to render better stability to the footing. The third row, as well as the balance of the rows for the entire height, was placed lengthwise again or parallel to the grade.

Previous experience has shown that a better bond can be secured by lapping the sacks to approximately half their width, which gives about a 1:1 slope to the finished wall.

The wall should be brought up in sections and as the concrete is mixed comparatively wet, the handling of the sacks promotes a kneading action which brings a film of grout to the outside of the sack, promoting a permanent bond between sacks when laid. When a row has become set, before the succeeding row is placed, a trench about eight inches wide, dug immediately behind the "cold" row, should be filled with green concrete.



Top view, highway as washed out; middle view, the first tier of sacked cement, view of sacked embankment; filling in back of the sacks; lower view, the widened highway.

Slope boards should be constantly employed to keep the slope true to line and care must be exercised to keep the rows from working out as wheeling over them tends to "mush" them towards the outside. Changes in slope tends to create knuckles which might cause trouble later when the green fill settles.

Two mixers were set up on grade, and a hopper built immediately below the mixer where two men load sacks with concrete, tie them and shoot them to the wheelers and placers below by means of troughs. From this point they are wheeled in wheelbarrows to the point of placing. This is accomplished on top of two-inch boards laid on the newly placed sacks.

The fill was brought up with the assistance of a team and Fresno. At this point the concrete work was shut down until the embankment was caught up.

This rip rap was 370 feet long and 25 feet high, being "toed in" to the old ground on either end.

Five hundred and fifty cubic yards of concrete were mixed and placed at a cost of \$9.50 per cubic yard. One cubic yard covers approximately 2.7 square yards of surface so the cost per square foot is \$0.35.

The sand and gravel was hauled from a river bar by a  $1\frac{1}{2}$  cubic yard truck and dumped at the mixers close enough so that it would be shoveled directly into the skip, proportioning by shovel counts, so no wheelbarrows were necessary. Material was loaded from the bar from a one-man gravel plant consisting of a small hoist and bucket which dragged the material up a runway and dumped into a loading box so there was no lost time for the trucks.

About 20 to 25 cubic yards per mixer per day should be averaged, depending on the amount of mechanical trouble.

Mixing water was furnished from a pipe line and small pump set on the river bank.

Ordinary small grain, potato or small sugar sacks which have an open mesh are used. Sacks are tied with wire and tied close to the concrete so that a maximum rise per sack may be obtained when they are placed in the row.

This rip rap has stood over the winter and has two small slips in it, both of which would not have happened had the above directions been followed more closely. However, high water has been above these slip points twice with no damage to the work, and the slips can be repaired at nominal cost.

This work was designed and construction supervised by Richard H. Wilson, District Maintenance Engineer.

## Grade Crossing Accidents Show Decrease in 1928

There were 2179 grade crossing accidents in California during 1928, according to a report just compiled by the Transportation Division of the Railroad Commission. This was an increase of nearly 25 per cent over 1927, when there were 1740 accidents, and a still greater increase over 1926, when there were 1217 accidents.

The number killed in grade crossing accidents in 1928 was 165, as against 194 in 1927, and 139 in 1926. The injured numbered 732 in 1928, as against 763 in 1927, and 629 in 1926. It is apparent, therefore, that while there were more accidents in 1928 than in 1927, the death rate and the number of injured was less than in the previous year.

These figures must be considered, the report points out, together with the figures for the motor vehicle registration during the same years. The total number of all motor vehicles registered in California in 1928 was 1,822,262, while in 1927 it was 1,702,639, and in 1926 it was 1,610,770.

Los Angeles County, which has the largest number of motor vehicles registered, as well as the largest number of grade crossings, of any county in the state, led in grade crossing accidents, and in killed and injured therefrom. The figures are as follows: Number of accidents in 1928 was 843; number of killed 48; injured 285. In 1927 there were 759 accidents, 64 killed and 294 injured. In 1926 there were 422 accidents, 47 killed and 314 injured.

Alameda County was second in the statistics with 562 accidents in 1928, in which 23 were killed and 107 injured. In 1927 there were 295 accidents, with 20 killed and 129 injured, while in 1926 there were 207 accidents, 10 killed and 79 injured. Santa Clara County was third with 123 accidents in 1928, with 9 killed and 29 injured. San Joaquin County had 66 accidents in 1928; Fresno had 56 accidents; San Bernardino County had 55; Orange County, 46; Tulare County, 31; Kern County, 30; Sacramento 47; and other counties recorded accidents in approximately the ratio of their population.

Approximately 27 per cent of the grade crossing accidents during the last three years resulted from vehicles running into standing or moving trains.

The increase of accidents during the last two years, occurring on double track crossings is apparently due to the growing tendency of impatient drivers to proceed over crossings as soon as the first train has cleared, without knowing whether or not a train is approaching on the second track, with the result that the vehicle is struck by a second train from the opposite direction.

Suggestions are made for the installation of a special signal announcing the approach of a second train at double track crossings, for the purpose of reducing these accidents.

A large percentage of the accidents occurred at grade crossings protected by wig-wags and also by human flagmen.

More than 75 per cent of the grade crossings in the state are now protected only by crossing signs, and that the crossings protected by human flagmen or wig-wag signals are the more important ones, and carry a considerable volume of vehicular traffic.

December is the month of most accidents, while May has the least. October shows the largest num-

(Continued on page 23.)



## New Signs Reduce Hazard at Road- Railroad Crossings

PENDING the completion of the program of the California Highway Commission for the elimination of railway grade crossings upon the state highway system, plans have been perfected by which the hazard of remaining grade crossings will be greatly reduced.



Plans for a new system of marking grade crossings have been perfected by T. H. Dennis, Maintenance Engineer, acting under the direction of C. H. Purcell, State Highway Engineer. The new devices are now being given their first tryout.

For the most dangerous crossings where there is a large train movement, the crossings are to be marked with Neon signs set from poles over the center of the highway with a 14-foot clearance. These signs are visible in a level country for 3 miles and can be easily read at a distance of 1500 feet. They bear the familiar warning R X R, where the railroad crosses at right angles with the highway a two-faced sign is installed immediately above the crossing. Where the highway turns to cross the railroad the sign is installed before the turn with a line and arrow indicating its



direction. These signs bear two large letters with the "X" 36 inches in height. The sign itself is 3 feet, 6 inches in height by 8 feet in length.

For crossings where the train movement is not so large a railroad sign 10 feet in length by 3 feet in height is being tried out. This is illuminated by reflected lights, and is visible for a long distance. It is installed approximately 400 feet from the crossing. Where the highway bends to cross a railroad, the point where the road turns is marked by an arrow, which is in its turn illuminated by reflected lights.

A third plan which is yet to be tested out provides for the better illumination of railroad grade crossings by spot lights, attached to neighboring poles.

### Stanton Named as Committee Chairman

T. E. Stanton, material and research engineer of the Division of Highways, has been appointed chairman of the newly created western section of the committee on materials, American Association of State Highway Officials.

Other members of the committee are as follows: N. M. Finkliner, engineer of materials, State Highway Commission, Salem, Oregon; Raymond Harsch, materials engineer, bureau of highways, Boise, Idaho; Levi Muir, Jr., materials engineer, State Road Commission, Salt Lake City, Utah.

In making the appointment, Mr. Mattemore, chairman of the general committee on materials, wrote Mr. Stanton as follows:

"The question of active participation of the Western States in the work of the committee on materials has given us some concern in the past. We feel that these states should be actively represented on our committee, but recognize that due to the distance it is seldom possible for any of the members to attend the meetings of the committee. It was for the purpose of stimulating interest in our work that the western section was organized, the idea being that this section could meet as a unit from time to time for the purpose of discussing methods of tests and specifications with special reference to conditions in the West."

After centuries of use of the left hand side of streets for traffic, Australia has decided to follow the United States and adopt the right hand side. The change will involve an expenditure of \$2,100,000, since the government will have to change thousands of signals.

Detroit has a new plan for sidewalk zoning. Sidewalks on the chief shopping avenue are marked off into three lanes—one for northbound pedestrians, one for southbound, and an inside lane where window-shoppers can loiter as much as they like. At street intersections painted footprints direct people into the right lane of traffic. The plan was first installed for the Christmas shopping season, and met with such success that it is to be adopted permanently. The experiment has resulted in greater ease and speed, as well as greater safety for bundles, purses, and persons.

## CALIFORNIA HIGHWAYS AND PUBLIC WORKS

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

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

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Eleventh and P Streets, Sacramento, California.

## English Bumpy But Better than We Could Do in German

Letters regarding California's highways pour into the office of the California Highway Commission from all parts of the world. Here is one recently received from Königsberg, Prussia:

Königsberg i/ Pr, 12th of January 29

The State Highway Commission,

Sacramento, California

U. S. A.

Dear Sirs,

Elaborating a research on the economical efficiency of new highways for motoring, which are to be built in East Prussia, I lack materials about the rentability of such highways in U. S. A., which are known the bests the world over.

I should be very much obliged to you for communicating me the experiences you made in your state about this matter, namely: american motor highways were they built to open regions of great picturesque beauty and to be visited by tourists? did their construction cause the foundation of new settlements (towns, villages, hotels) still in prosperity? what is the sort of construction which gave the best effects and how elevated were the costs? and finally: who gave the money to construct them and what may be considered as the principal advantage they gave to the country?

If their are books or printed artikles about the question, please, indicate me the title and where I can get them. You will render a great service to my work so useful for the development of this country by answering my questions. My professor at the Commercial academy of Königsberg, Mr. Rogowski, will be very grateful to your precious concurrence.

Trusting to receive as soon as possible your kindly reply I am with my hearty thanks

Yours truly

[Name omitted]

Samlandweg 8

Königsberg i/ Pr

Germany

### LITIGATION SETTLED

On August 1, 1928, bids were opened for constructing an overhead crossing of the Southern Pacific Railroad tracks at Sargent in Santa Clara County. After the contract was awarded and before the contractor could start work, the property owners secured an injunction to prevent the construction of the overhead crossing. After long drawn litigation in the courts the matter has now been satisfactorily adjusted and it is expected that the contractor will start work immediately.

NEW MEXICO—Reconstruction of all state highway curves to make them safe at 35 miles per hour has been ordered. Curves designed for slower speeds are considered traffic hindrances requiring immediate attention.

## GOVERNOR YOUNG ENUNCIATES POLICY OF STATE HIGHWAY EXTENSIONS

(Continued from page 4.)

fair and proper that this situation be corrected through a gradual expansion of our secondary road system.

Accordingly I would suggest that by resolution the Legislature direct that a study of this problem be immediately begun in order to determine:

(1) Roads not now in the state highway system, which, in the opinion of the California Highway Commission and the Department of Public Works, should properly be included in it;

(2) The extent to which there is a lack of balance which prevents a well-ordered and unified system, and the manner in which such lack of balance may be corrected;

(3) A study of the state highway system, which will give information regarding the cost of bringing the system up to a stage where traffic on our highways is adequately and economically served;

(4) The extent to which highways may be added in the next two years to the state system without unduly jeopardizing existing and future maintenance and construction funds; and

(5) Some method by which these maintenance and construction funds may as soon as possible be made available for the new roads that may be added to the state system.

I think we would all agree that, considering the many hundred miles of unimproved and undeveloped roads in our existing state highway system, we should not add new roads to that system in any careless or haphazard way. I think we would agree that before a road is added a traffic and economic study should determine its necessity, and a survey as to rights of way, grades, economy of construction, and the like, should determine its location.

I think we would also agree that new roads should not be added more rapidly than they can be adequately cared for. Money spent on these new roads can be expended only on the theory that they are more immediately important to the state than other roads in the existing system whose development might thereby be postponed. I am of the opinion that the California Highway Commission and the Department of Public Works are justified in their belief that at the present time a mileage increase of approximately 10 to 12 per cent, or between 650 and 800 miles, is about all the system can safely stand.

### NECESSITY OF EQUALIZING SECONDARY MILEAGE

I think we would agree that in developing our highway system we must do justice to all sections of the state. The Breed law, in allocating gas tax funds, proportioned the amounts given to primary roads in the northern and the southern portions according to the primary mileage in these two sections, these being roads of state-wide interest and importance. For the secondary roads, however, an equal amount of funds was given to the north and to the south. I believe that the best interests of the state will be served by maintaining this equality of allotment.

However, the present highway system as built up during previous administrations included only 525 miles of secondary roads in the southern counties as against 1778 miles in the north. This means that whereas the north has 1778 miles over which to spread its allotment of secondary highway funds, the south has only 525 miles on which to use an equal allotment, thus requiring that, until this lack of balance is adjusted by taking in other roads which may qualify for a place in the state system, there must be an uneven development of the secondary system in the two ends of the state.

No one, I am sure, would wish to disturb the equal allotment of funds to northern and to southern secondary roads. It is obvious, therefore, that an unsatisfactory condition will exist until the present great disparity in secondary mileage is reduced. The Highway Commission assures me that on the basis of preliminary investigations it is also obvious that, in the 10 to 12 per cent increase referred to above, they must of necessity recommend the addition of three or four times as much mileage in the south as in the north. This addition will be confined to the secondary system and by so doing it will more nearly equalize the secondary mileage in the state.

### UNDISPUTED FAIRNESS OF SOUTHERN POSITION

I have noted certain newspaper accounts which would seem to indicate that it is proposed to change the present equal allocation of funds to northern and to southern secondary roads. Nothing can be further from the facts, since neither south nor north seeks to disturb this wise provision of the Breed law. The only change suggested is a rather generous increasing of the 525 miles of southern secondary roads until they shall more nearly approach in extent the 1778 miles of secondary roads in the north.

Fortunately no one wants to precipitate a conflict between the two ends of the state. The

south is not asking for a single dollar additional for the construction or reconstruction of its secondary road system. It is asking, however, for an increased secondary mileage over which to spread the allotment which it now receives; and I have yet to meet a friend of good roads, in the Legislature or out of it, who considers this an unreasonable request. It is not right that, with practically equal traffic and almost equal area, one end of the state should continue to have nearly three and one-half times as much secondary mileage as the other; and that the latter, owing to this limited mileage, must continue to convey its equal traffic so largely over locally maintained county roads.

On one point, however, I must reiterate what I have already quoted from my biennial message, that we must see to it that no extensions whatever shall be made to the state highway system except after careful study and survey on the part of our highway engineers. To do otherwise would be to include roads which afterwards we might all regret, just as we now regret hundreds of miles which without sufficient study were long ago unwisely included in our present highway system. Having made this mistake once, we must not make it again. Even for the roads which are included we must make certain of the engineering data which shall make each of them the very best road possible for the community which it serves. The Highway Commission and Department of Public Works have indicated that they are prepared to commence this work at once, thus assuring that the necessary new secondary roads shall be promptly added. I thoroughly approve of this, and also approve of the ratio by which it is proposed to begin the correction of the very indefensible disparity of secondary mileage in the two ends of the state.

Nevertheless, while this disparity is gradually being corrected, the study as proposed must ultimately include every road in every section of the state whose probable right to a place in the state system can be demonstrated. Thus from time to time other roads will be added, both north and south, until our secondary highway systems is complete. This, when finally brought about, must be only through the admission of roads on which such adequate study has been made, and whose right to a place in the secondary highway system can not be disputed.

#### PROMPT INCLUSION OF NEW ROADS INSURED

It only remains to discover a method by which, when new roads are recommended to the Legislature for adoption into the system,

these roads may share in construction and maintenance funds as speedily thereafter as possible. In other words, if these roads are not formally adopted until the next legislative session, how can they be included in the highway budget made just previous to the beginning of that session?

While it might be questioned whether authority can be delegated to a highway commission actually to "adopt" new roads into the system without legislative ratification, the Highway Commission can at least, after proper study, submit these to the Legislature and include them in its proposed highway budget, thus making certain that they can be cared for as state highways two years from next July.

By this procedure no time will be lost in providing for the construction and maintenance of the new roads thus to be taken into the system. The highway budget for the present biennium is already made up, but these roads will go into the next budget, will be recommended in my next biennial message, and beyond the shadow of a doubt will be formally ratified by the next Legislature. Meanwhile, with entire justice to every section of the state, we shall have established the principle that roads shall be added to our highway system, not through political pressure, but as the result of an impartial, unbiased study of our highway needs. This will also give to the members of the Legislature supporting data for the roads in which they are interested and which they may hereafter seek to have added to the system.

#### BASIC PRINCIPLES FOR HIGHWAY CONSTRUCTION

I feel very strongly that the time is now ripe, and the opportunity here, to formulate a policy and establish a precedent that will govern future additions to the state highway system upon the basis of their ability to qualify as of state importance. This policy and precedent may be tersely stated as providing that expert study by state authorities must precede, rather than follow, the inclusion of roads into the state highway system.

In conclusion, permit me to call your attention to the fact that our major highway problems have been solved in a substantially satisfactory manner, with the exception of the method by which additions to the state highway system shall be made. The greatest contribution that this Legislature can make to our highway system is to formulate a policy of highway extension that will give to the system its necessary and proper measure of protection.

(Continued on page 19.)

# The Designation of Sizes of Crushed Rock and Gravel

By A. R. WINSLOW, Assistant Construction Engineer.

THE method of designating sizes of crushed rock and gravel is far from satisfactory and a campaign of education at this time, with the view of later modifying the method, is desirable.

Occasionally one hears crushed rock referred to as "2½" rock," "¾" rock," "screenings," etc. These expressions are concise but they are neither definite nor uniform for whereas "2½" rock" usually means a mixture of stones of various sizes of which the stones that will just pass through a ring two and one-half inches in diameter are the largest, "¾" rock" usually refers to a mixture in which the stones that will pass a three-fourths-inch ring are of the medium size.

Some commercial plants have their bins numbered and the product of the plant is referred to by the number of the bin from which it is taken. Such a number system has a significance to those acquainted with the particular plant to which it applies but there is a lack of uniformity among plants both as to screen sizes and as to the manner of numbering of bins, and the number system of any one plant is not indicative of the products of other plants. Furthermore it does not provide for changes in screen sizes that may be made from time to time.

In specifications, the customary way of expressing the size of crushed rock or gravel is by giving the diameters of the largest and smallest stones in the mass, or rather the diameter of the holes of a screen which will just pass the largest stones and the diameter of the holes of a screen which will just retain the smallest stones. The dimensions are given in inches, halves and quarters. Dimensions expressed in this manner are somewhat cumbersome. They could be simplified by substituting decimal fractions for the common fractions.

If decimal fractions are substituted they should be carried only to the nearest tenth of an inch and the decimal point should be dropped. 2½" size would then become 25 size and 1" size would become 10 size. Mixed stones ranging between these sizes would be known as 10-25 stone, the smallest size always being given first. In practice the hyphen

between the 10 and the 25 would be dropped, and the stone would be referred to as 1025 stone. By this system mixed stone ranging from ½" to 2" would be known as 520 stone, and crusher run stone which passes a 2" screen would be known as 020 stone.

While these expressions have not quite the brevity of bin numbering, they have the advantage of fixing definitely the limits of sizes and they are sufficiently brief so that the same expressions would be used in conversation as in specifications. Note, too, the simplification of the specifications with this system as compared with present specifications. During the period of introduction a brief general clause would of course be required in specifications to define the system of measurement but from there on each reference to size would be somewhat as follows:

#### PROPOSED SPECIFICATIONS

"All material shall be fifteen twenty-five (1525) crushed rock."

#### PRESENT SPECIFICATIONS

"All material shall be crushed rock which shall pass a screen with circular opening two and one-half inches (2½") in diameter, and shall be retained on a screen with circular openings one and one-half inches (1½") in diameter."

### GOVERNOR YOUNG ENUNCIATES POLICY OF STATE HIGHWAY EXTENSIONS

(Continued from page 14.)

I feel that a program outlined in a concurrent resolution, embodying by reference what I have tried to express in this message, is one in which friends of good roads all over California can join. I feel also that this is a most happy time for the formulation of these principles, since at this particular time our action will not jeopardize the interest or delay the improvement of any road in any section of the state.

Respectfully submitted.

C. C. YOUNG,  
Governor.

# Revised Edition of Standard Specifications

FOLLOWING previous practice of periodically issuing a new edition of the Standard Specifications for highway and bridge construction, a revised edition is now on the press and will be available for distribution in a short time.

For the convenience of contractors and engineers who are familiar with the 1927 edition, the changes which will appear in the revised edition dated January 1929 are outlined below. This summary is necessarily brief and for more complete information reference is made to the full text.

In the division devoted to general provisions, there has been added to section 1 definitions of the terms the "Director of Public Works" and "Division of Highways."

Section 4, Article (c) dealing with alterations has been expanded to fix the responsibility with the contractor for promptly filing claims for additional compensation due to change in character of work and allows ten days time for filing such claims. A new Article (d) has been added to Section 4 incorporating a latent condition clause similar to that contained in the Standard Government Form of Contract in use by the U. S. Bureau of Public Roads. Article (f) relative to construction and maintenance of detours provides that the state will bear the entire expense of constructing and maintaining detours except that detours used exclusively by the contractor for hauling shall be constructed and maintained by him; also that the state will have authority to regulate the contractor's hauling over a public detour.

In Section 5, Article (b), Plans, provides for waiver of approval of plans for cribs, cofferdams, false work, centering, etc., and places responsibility on the contractor for successful construction of the work when approval of such plans is waived. The requirement that the contractor furnish stakes necessary for staking out the work has been omitted from Article (g), Lines and Grades, and in the future stakes will be furnished by the state.

A new Article (a) has been added to Section 6 entitled "State Furnished Materials" relative to the contractor's responsibility for the care and unloading of materials furnished by the state. This article is identical with the

section now appearing in the Special Provisions covering the same matter and will be omitted from them in the future. The Special Provisions will contain only a statement of the materials to be furnished by the state and the points of delivery.

The graded deval abrasion test has been eliminated from Article (d), Special Methods of Tests, as that test has been abandoned in determining the acceptability of road material. Section 7 (e), Public Convenience and Safety, has been rewritten to provide that in so far as practicable the state will assume all costs of maintaining traffic. It provides that the state will defray the expense of flagmen and guards required to direct and control traffic and such special signs as may be required; however, any flagmen or guards stationed to protect the work or to watch working equipment shall be paid for by the contractor.

A new paragraph has been added to Section 8 (e) incorporating an "Act of God" clause, relieving the contractor from responsibility for delay in completing the work due to certain causes enumerated in the specifications beyond his control.

The amount retained on progress estimates has been reduced to 10%.

In the division relating to construction details a new article (e) has been added to Section 11, Earthwork, to provide that the state will pay for grading construction roads to permit access to the lower portions of high fills in order that they may be compacted. The payment clause provides that grading work will be measured in excavation and the clause providing for payment in embankment has been eliminated. The payment clause for structure excavation has been rewritten to clarify the intent in regard to payment for backfill. Payment for backfill at culverts, retaining walls, and other structures except bridges is made at the contract price for structure excavation; that is, the quantity of structure excavation to be paid for is the quantity excavated plus the quantity back-filled. In the case of bridges over 20' clear span no allowance is made for backfill and the contractor must absorb the cost of backfill in the price paid for the excavation.

The article on embankment has been expanded to provide that adobe material shall

be placed in the bottom of fills and that embankments shall be constructed in 8" layers and thoroughly compacted by rolling and watering. Cases where embankments are constructed from rock excavation and of sand are also covered. A clause has also been added that no rocks larger than 6" in size may be placed in the upper 2' of embankments. The articles on borrow excavation have been rewritten to provide that payment for imported borrow shall also include the necessary haul and that no allowance will be made for haul of imported borrow. The article on overhaul has been revised to provide for the contractor submitting a bid for overhaul as has been our practice for some time.

Section 12 on subgrade has been rewritten; however, the requirements of the specifications have not been changed except that subgrade for macadam surfacing shall be prepared as specified for asphalt and concrete pavement.

A paragraph has been added to Section 13, on shoulders, requiring that they be rolled when adjacent to pavement.

A new section numbered 14 has been added for finishing roadway. This section is the same as the one included in the Special Provisions for work now advertised and provides for including an additional item in the bid scheduled.

Section 16, Untreated Crushed Gravel or Stone Surfacing, provides that all material shall be crushed and if gravel is used that portion passing a screen with openings  $\frac{1}{4}$ " greater than the maximum crusher opening during normal crusher operation shall be wasted and not used in the work. The payment clause has been amended to omit the provision that additional binder would be paid for as extra work and requires the contractor to furnish binder without additional pay.

A new Section 17 has been added for oil treated crushed gravel or stone surfacing.

The section formerly entitled "Waterbound Macadam Base Type B" has been entitled "Crusher Run Base" in the new edition; otherwise, the specifications remain identical with the former.

The section on side forms provides that all forms shall be cleaned and restored to their original condition before being used a second time. It requires the use of side forms for macadam and provides that for macadam and asphalt concrete paving work the timber side forms be left in place.

New paragraphs have been added to the section on Waterbound Macadam Base requiring the use of side forms which shall be left in place after the surfacing is completed, also

providing for testing and truing up the surface before rolling the broken stone.

The section on bituminous macadam surface includes an additional size rock from  $\frac{3}{4}$ " to  $\frac{1}{2}$ " designated key rock for filling after the first application of bituminous binder; screenings from  $\frac{1}{2}$ " to  $\frac{1}{4}$ " are to be used for filling after the second application of bituminous binder. A new paragraph has been added to provide for testing and truing up the broken stone to insure a smooth riding surface.

The asphalt concrete specifications permit the use of coarse aggregate containing up to 15% of particles which show a loss in the Los Angeles Rattler in excess of 55%. They provide that no mixture shall be spread when the atmospheric temperature is below 40° F., nor during rainy weather. The use of automatic spreading and finishing machine is required as has been specified during the past year. The laying of the base course is limited to a distance of not more than one mile before it is covered with the surface course. A provision has been included requiring one ten-ton tandem roller and sufficient eight-ton tandem rollers to provide one roller for each 1200 square yards of pavement laid per day, and that rolling shall continue until the pavement has a relative specific gravity of not less than 92% of the specific gravity of the combined aggregates. A new section has been added entitled "Asphalt Concrete Leveling Course" using material graded from 1-14" down. This mixture is to be used as the lower course on resurfacing work where thin layers are required, and provides a mixture with more large aggregate, less fine aggregate and less asphalt content than the Type "A" surface mixture. The sections for asphalt concrete surface, Type "D," and asphaltic surface, Type "E" (Mastic) have been omitted.

The section on Portland Cement Concrete pavement has undergone some rearrangement of text in the first few articles. Pavement is specified to be laid in strips 10' wide without additional payment for such part width construction; this requirement eliminates the longitudinal weakened plane joint. A new specification for expansion joint filler has been included, together with the requirement that backing plates be used in the installation of expansion joints. This provision is similar to the specifications included on recent concrete pavement work. The material specifications for the joint filler has been made a separate section—No. 63. An impervious membrane method of curing has been included to permit the use of the Hunt process for curing bridge decks and where it may be specifically permitted.

## Highway Patrolmen Commend Striping In State Roads

The California Association of Highway Patrolmen adopted the following resolution at a meeting held in San Jose on March 30th:

Whereas, The California Association of Highway Patrolmen is an organization composed of traffic enforcement officers especially detailed on the public highways of this state to guard said highways against traffic offenders who endanger the life and property of law-abiding citizens, and

Whereas, This Association unites with any agency that initiates movements or adopts policies that will promote the safety of the motorists on the public highways against the danger of automobile accidents and thus prevent the loss of life and property, and

Whereas, The Board of Public Works of the State of California has seen fit to paint lines on dangerous curves and over hills on various state highways under its supervision, and

Whereas, It is known to the members of the California Association of Highway Patrolmen that the presence of said lines on the highways assists and guides the automobile drivers traversing said highways and thus prevents or tends to reduce the number of automobile accidents, now, therefore, be it

*Resolved*, That we, the members of the California Association of Highway Patrolmen, do hereby highly commend the Board of Public Works of the State of California for its good work in helping to minimize the number of accidents on our highways, and we sincerely hope that its efforts will continue unabated.

### CALIFORNIA ASSOCIATION OF HIGHWAY PATROLMEN,

FRANK J. DUNCAN, President,  
By John Sansone, Secretary.

### THE MEN WHO MAKE THE ROADS

O, Brothers, when you motor out  
In double fours of flivvers,  
To lamp the landscape round about  
And agitate your livers,  
The while your gas-consumer flies,  
O'er beaten trails and byways;  
Oh, breathe a prayer and bless the guys  
That built the bloomin' highways.

Be mindful of their lowly lot,  
They rarely ride as you do.  
You drive nice cars, but they do not—  
At least a very few do.  
And life would be a dreary hike  
If it were not for fellows like  
The ginks that give us highways.

—C. Wiles Hallock, in  
*Western Highways Builder*.

As part of the matriculation examination in English, the entering students were asked to write a brief definition of their conception of a self-made man. One young lady wrote as follows:

"A self-made man is like a self-made cigarette—a lot of Bull wrapped in a transparent cover."

### ALONG THE FEATHER



The above concrete culvert was built by men in a prison camp near Oroville, now engaged in building the Feather River lateral to the state highway system.

### PROTECTING AGAINST FIRE

The maintenance department organization has been busily engaged in getting the roads in as good shape as possible for the increase in travel which is coming with good weather. Several outfits are engaged in spraying Diesel oil along the roadsides and will have several hundred miles of roadside protected from fire hazard by this means within the next two or three weeks.

A pupil was having trouble with punctuation and was being called down by the teacher.

"Never mind, sonny," said the visiting school board president, consolingly, "it's foolish to bother about commas. They don't amount to much, anyway."

"Don't they?" replied the teacher, turning to the president. Then calling to one of the pupils she ordered the boy to write on the board this sentence: "The president of the board says the teacher is a fool."

"Now," she continued, "put a comma after 'board' and another after 'teacher'."



## REVISED EDITION OF STANDARD SPECIFICATIONS

(Continued from page 21)

The section on concrete structures has been materially revised. The articles on cofferdams and caissons, forms and false work, concrete deposited under water, construction methods, bonding, curing, and the various surface finishes have been completely rewritten. A paragraph has been added permitting the use of diatomaceous earth up to three pounds per sack of cement in structure concrete.

The section on timber structures has been completely rewritten and specifications included for Douglas fir, southern yellow pine, redwood, cedar and yellow pine.

The specifications for concrete permit the use of aggregate containing up to 15% of particles which show a loss in the Los Angeles rattler in excess of 55%. A paragraph has been added providing that the contractor shall defray the cost of sampling and testing cement sampled directly from the car when he neglects to arrange with the cement company to set aside sealed bins or rooms from which samples may be taken by the state.

The specifications for mesh reinforcement for use in reinforcing second story pavement over the edges of the old base have been amended to omit the requirement that the cross-sectional area of the longitudinal members equals 70% of the cross-sectional area of the corresponding methods of bar reinforcing.

The section on rubble masonry has been rewritten to be more complete than the former section.

The section on reinforced concrete pipe culverts has been rewritten to conform with the tentative Standard Specifications adopted by the Joint Concrete Culvert Pipe Committee.

A specification for plain concrete pipe has been added to the section on vitrified clay pipe and a strength requirement has been included.

The section on timber piles and preservative treatment of timber and piles has been completely rewritten.

The section on underdrains includes cement concrete tile and provides that perforated metal pipe shall be manufactured of metal conforming to the requirements of the first alternative for corrugated metal culverts.

The section on guard rail provides for concrete posts as well as timber posts and omits the requirement that timber posts be dipped.

In the section on paint and painting, the specifications for turpentine have been revised

to include gum turpentine, wood turpentine, and turpentine substitute. The article on drier contains specifications for both a straight oil drier and Japan drier. A new article has been added containing a formula for guard rail paint.

The specifications for asphaltic road oil calls for an asphalt content of 94% plus. The specifications for fuel oil provide for two grades, light fuel oil to contain from 50% to 60% asphalt, and heavy fuel oil to contain from 60% to 70% asphalt.

## GRADE CROSSING ACCIDENTS SHOW DECREASE IN 1928

(Continued from page 14.)

ber of serious accidents, and June the least. Saturday has more accidents of any day of the week, and Sunday the least. The greatest number of accidents occur between five and six p.m. and the least number between four and five a.m., during the 24 hours.

Some interesting facts have been developed by the Transportation Division of the Railroad Commission in its tabulation and study of grade crossing and other accidents involving common carriers in California in 1928, made by Joseph G. Hunter, Chief of Division.

The railroads have expended \$3,000,000 under the direction of the Railroad Commission in crossing protection devices, the maintenance of which costs approximately \$800,000 per year. Notwithstanding this expenditure of money, accidents occur at many grade crossings, protected with the most improved automatic signal devices. Of the 2179 grade crossing accidents in 1928 there were 917 at crossings protected only by signs of different types, while 538 occurred at crossings protected by automatic wig-wags.

"Trying to beat the train" across the grade crossing, accounted for a large proportion of these accidents. Driving past other automobiles standing at the crossings, and being struck by a train or electric interurban car, accounted for 10 persons killed, and 28 persons injured.

The report calls attention to a growing tendency of drivers to be impatient at grade crossings, and to hasten upon the crossing with disastrous results. Adoption of the recommendations of the "Hoover Committee," making it a misdemeanor to drive over a grade crossing when the warning signal is in motion, and granting authority to the State Highway Commission to designate crossings where all vehicles must stop, is favored by the Commission's transportation Engineers.

Liza and Fannie were discussing their Sunday night dates.

"Yes, mum, I done had me a neckin' party last night."

"Neckin' party? Law, chile, them is out of style. They done had them 4000 years ago."

"Four thousand year ago?"

"Sure, my mammy done told me the Bible says that King Solomon took the Queen of Sheba into the banquet hall and he fed her wine and nectar."

So live that you wouldn't be afraid to sell the family parrot to the town gossip.—*Troy Times*.





**Route 32. Route 2 Near Gilroy to Route 4 Near Califa**

Station	January, 1928		January, 1929	
	Sun.	Mon.	Sun.	Mon.
Hollister, junction with route 22	802	374	878	416
Pacheco Pass at Merced-Santa Clara County Line	978	371	1,025	428
East of Los Banos at junction county road to Dos Palos	447	376	1,125	820
Califa	1,008	439	514	344

**Route 33. Paso Robles to Route 4 Near Bakersfield**

Paso Robles, east of city	1,005	914	1,147	928
Paso Robles, one-quarter mile east of city	618	488	617	501
Lost Hills, intersection of Main street	218	233	355	372

**Route 34. From Route 4 Near Arno to Pine Grove**

Twin Cities, junction route 4	304	282	254	186
West of Ione, junction county road to Michigan Bar	188	119	162	143
North of Jackson, junction route 65 to Placerville	634	461	617	471
Pine Grove, east of town	232	120	289	149

**Route 37. Auburn to Nevada Line Near Verdi**

Auburn, east of city	1,376	1,155	1,368	647
Colfax, east of city, junction Nevada City road	392	200	703	332
Truckee, east of city, junction route 38 to Nevada	119	48	340	104

**Route 43. San Bernardino to Big Bear Lake**

Foot of Waterman grade	966	350	1,401	222
Pinerest, junction county road to Arrowhead Lake	176	30	497	59
Running Springs Park, junction City Creek road	57	No count	299	37
West end of bridge over Big Bear dam	55	18	268	57
One mile from end of route 43, junction county road to Pine Knoll	85	30	109	36

**Route 44. Boulder Creek to Redwood Park**

Boulder Creek at park line	373	239	493	315
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**Route 47. Orland to Chico**

Orland, junction with route 7	595	490	738	819
Chico, west of city	1,077	834	906	229
Hamilton City, at Union High School	376	179	No count	

**Route 48. McDonalds to Wendling**

McDonald, junction route 1	113	104	148	112
Wendling, 3 miles west of town	233	168	288	177

**Route 49. Calistoga to Lower Lake**

North of Calistoga at foot of grade	863	237	321	239
Lower Lake, junction Kelseyville and L. L. road	321	345	200	234
Middletown, junction Cobb Mtn. road	493	408	640	519

**Route 51. Santa Rosa to Schellville**

Santa Rosa, east of city	2,461	1,782	2,044	1,768
Schellville, junction route 8	712	342	766	360

**Route 52. Alto to Tiburon**

Belvedere, junction	1,439	862	1,136	883
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**Route 53. Fairfield to Lodi**

Denverton, at overhead crossing	345	152	109	199
Rio Vista bridge	996	895	888	809
Walnut Creek bridge	246	252	630	557
Thornton, intersection county road	755	553	604	477
Lodi, north of city	931	869	727	927

**Route 55. San Francisco to Spring Valley Dam**

At swimming pool	10,191	1,865	7,925	1,274
Junction with county road to Colma	7,152	977	4,936	476
Junction with county road to Belmont at earth dam	3,740	427	2,551	270

**Route 57. Santa Maria to Freeman via Bakersfield**

Station	January, 1928		January, 1929	
	Sun.	Mon.	Sun.	Mon.
Santa Maria, north of city at junction route 2	108	61	165	65
At San Luis Obispo-Kern County line	106	284	122	67
Maricopa, west of city	423	247	323	296
Bakersfield, 1 mile east of city limits	2,827	1,931	1,733	2,235
Bakersfield, 10 miles east at Country Club road	1,040	130	497	171
Bodfish, at intersection route 57 with county road to Caliente	77	75	116	76

**Route 58. Mojave to Topoc**

Barstow, north of city at junction county road	207	209	250	248
Daguerre, junction Arrowhead trail	285	267	435	385
Vicinity Amboy	128	148	141	183
Needles, west of city limits	416	206	681	411

**Route 60. El Rio to San Juan Capistrano**

Santa Monica, 500 feet west of Santa Monica Canyon	16,035	2,940	11,548	2,583
Lomita	6,997	5,717	9,859	6,318
Seal Beach, at Los Angeles-Orange County Line	10,182	5,714	13,880	6,092

**Route 63. Big Pine to Oasis**

Big Pine, junction route 23			102	131
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**Route 64. Mecca to Blythe**

Desert Center	97	85	88	97
Blythe, S. D. A. quarantine station	336	150	255	184

**Route 65. Auburn to Sonora (Mother Lode Highway)**

Auburn to wire bridge	156	88	168	68
Placerville, northwest of city, junction Georgetown road	97	78	323	246
El Dorado, south of city	203	106	220	123
Central House	357	258	336	328
North of Jackson, junction route 34	748	330	695	683
South of San Andreas, at Sheep Camp	1,962	418	1,439	446
West of Sonora, junction county road south to Jamestown	219	135	406	206

**Route 65. Manteca to Route 5 Near Mossdale School**

Mossdale, junction route 5	1,728	388	1,949	1,121
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**Route 68. San Francisco to Burlingame**

San Bruno, junction with route 2 to San Francisco	5,866	3,372	1,726	1,424
North city limits of South San Francisco	6,202	4,603	6,703	4,062

**Route 71. Crescent City to Oregon Line**

Crescent City north of maintenance yard	526	480	654	579
At Oregon-California line	179	71	263	136

**THE NEXT BUDGET**

The district engineers have been requested to submit a schedule of dates for advertising the projects included in the budget for the next biennium. These schedules are now being reviewed for the purpose of adopting a program of advertising, which will place the projects under construction at the time of year when weather conditions are most favorable and also when there will be the least interference with traffic.

A man who was wanted by the police had been photographed in six positions, and the picture sent in to the state police. In a few days headquarters received this from a small-town chief: "I duly received the pictures of the six miscreants wanted. Five of them have been captured and we are on the trail of the sixth."—*Earth Mover*.

# Progress Reports From the Counties

## BUTTE COUNTY

The graveling of the surface between Butte Creek and Biggs Road on the Willows-Biggs Highway, recently completed by contract, is being further improved with additional surfacing of crushed rock. This work is preparatory to oil treating the surface to be done during the biennium beginning July of this year.

## DEL NORTE COUNTY

Parker Schram Company, who have the contract for constructing the bridge over Smith River, approximately nine miles west of Crescent City on the Crescent City-Grants Pass Highway, are making good progress with the erection of the steel. About three-fourths of the steel work is now erected and it is expected that the bridge will be opened to traffic about the middle of May.

The two J. E. Johnston contracts on either side of the Klamath River in Del Norte County, have been practically shut down during the winter except for the crushing and stock piling of surfacing material. It is expected that the work will again be started about the middle of April or the first of May.

## EL DORADO COUNTY

Plans and estimate are ready for a grading project between Bay View Rest and one mile north of Eagle Falls, on a portion of the Truckee-Meyers National Forest Highway.

The work will consist of improving and revising the grade and alignment and widening the present 12- to 16-foot road to a 24-foot roadbed.

The road traverses the rugged slopes overlooking Emerald Bay of Lake Tahoe, and the quantities of construction are extremely heavy.

Traffic will be carried through construction at all times and the only inconvenience to the public will be the slowing of travel between the limits of the work.

## FRESNO COUNTY

The new bridge over the San Joaquin River at Herndon is being painted and surfaced and construction of approaches is well under way.

Surfacing from Coalinga westerly on Route 10 has been started by a state crew under Foreman Gaston.

Grading work on the approaches to the new San Joaquin River bridge at Herndon has been completed and it is expected that paving will start at once.

Bids for surfacing, with oil-mix the seven miles west of Coalinga, on the Sierra-to-the-sea lateral, will be received April 10th. State forces are surfacing the county-built portion of this road to the Monterey County line under Foreman J. H. Williams.

## GLENN COUNTY

The five miles of roadway grading between Logandale and Willows, and which D. McDonald is under contract to build, is expected to be completed in April.

The grading, which is entirely to the west of the present pavement, is being done to permit of an ultimate 40-foot pavement on this route. No inconvenience has been experienced by traffic while the

grading has been under way, as the existing pavement has been left clear and open at all times to the public.

A gravel subbase, preparatory to the construction of a concrete pavement, is planned to be laid about the middle of this year.

A contract let in December, 1928, to E. B. Skeels for the building of a three-span reinforced concrete bridge across Quint Canal, about four miles east of Willows, on the Willows-Butte City Highway, is completed and was opened to traffic on March 18.

## HUMBOLDT COUNTY

Bids for the grading of the site for the District I office and shop buildings at Eureka, were opened February 14, and the contract has been awarded to Henry Padgett of Fields Landing. The contractor started work the first of March.

Bids were received March 15th for the construction of the new bridge over Mad River, approximately four miles north of Arcata. The new bridge is to consist of two 150-foot steel through truss spans and 400 feet of trestle approach.

## KERN COUNTY

Grading work is in progress on C. W. Hartman's contract from Maricopa easterly on Route 57.

Force, Currihan & McLeod are making good progress on their contract for grading and surfacing from Bakersfield to the mouth of the Kern River Canyon on Route 57.

Paving work is well under way from Wasco to Famosa on the Cholame Lateral by the Valley Paving & Construction Company.

The Valley Paving Company has completed half of their contract for paving from Wasco to Famosa on the Cholame Lateral.

Force, Currihan & McLeod are making rapid progress on their contract for grading and oil-mixed surfacing from Bakersfield to the mouth of the Kern River Canyon on Route 57.

Culverts and grading work are well under way on C. W. Hartman's contract for grading and surfacing 12 miles on Route 57 between Maricopa and Bakersfield.

## LAKE COUNTY

The grading of a 24-foot highway between Clear Lake Oaks and Abbot Mine, which is being built by convict labor forces, is progressing satisfactorily, and will be completed about June.

Construction of 10.6 miles of grading and surfacing with oil treated crushed stone between Lucerne and Clear Lake Oaks, by Von der Hellen, Pierson & Logan, the contractors, is progressing according to schedule.

The expected date for completion of the work is October.

## MADERA COUNTY

A. W. Kitchen has completed his contract for the construction of bridges over Ash and Berenda sloughs on the Pacheco Pass Highway and C. W. Wood has secured the contract for approaches and surfacing.

Bridges and approaches over Ash and Berenda sloughs have been completed and there will be no more detours necessary during high water on this section of the Pacheco Pass Highway.

The paving plant of Hanrahan Company at Berenda was burned down on March 20th. The contractor

started immediately to rebuild the plant for the completion of the work.

### MARIPOSA COUNTY

Widening and realigning of the Yosemite all-year highway from Mariposa to Briceburg has been practically completed by state forces. Surfacing will start at once.

Basich Bros. Construction Company is starting surfacing on their contract in Mariposa County.

Widening and straightening of the Briceburg Grade on the Yosemite All-year Highway has been completed by state forces and surfacing is being placed.

Basich Bros. have completed grading work and bridges on their contract on the Mariposa road and have started surfacing.

### MENDOCINO COUNTY

The narrow road along the steep bluffs of the South Fork of the Eel River, approximately five miles north of Lane's Redwood Flat, is being widened and straightened to a standard width roadway by state forces, and it is expected that approximately two miles of this narrow road will be eliminated before the heavy tourist traffic begins.

### MERCED COUNTY

Shoulder widening by maintenance forces from Los Banos Westerly on the Pacheco Pass Highway is making this road safer and more attractive to the motoring public.

### NEVADA COUNTY

Resumption is expected soon of the grading between Indian Springs and Soda Springs. The contractors, Callahan Construction Company, were compelled to suspend the work last November on account of heavy falls of snow.

When the work is resumed, all possible speed will be made with a view to completing the construction by the latter part of summer of this year.

Approximately one and one-half months work remains to be done to complete the grading and crushed stone surfacing between Donner Lake and Truckee. Adverse weather conditions caused a suspension during the winter. The contractors, Mathews Construction, expect to finish the work by the middle of May.

Construction will soon commence between Nevada City and Washington Road of 11.7 miles for grading of a roadbed 24 feet wide and surfacing with five inches thick, 20 feet wide, crusher run base with oil treated surface.

This road is a unit of the Tahoe-Ukiah Highway, and will connect Nevada City with a county road leading to the town of Washington on the South Yuba River.

The work will occupy approximately one year to complete.

### PLACER COUNTY

It is planned to surface with bituminous macadam the present road between Auburn and Colfax. Work will begin the early part of May and will continue to about the first of October.

The work proposed is that of building up the irregularities of the present surface with bituminous macadam surfacing and grading of shoulders.

Construction will be permitted only one-half width at a time, allowing the other half of the road free to traffic.

The grading of the approaches to the Weimar overhead crossing of the Southern Pacific Railroad is complete on the south side. Included in the contract for this work is the grading of the Bowman overhead

crossing approaches and the surfacing; also grading and surfacing of the Weimar separation approaches, with bituminous macadam. The contractors, Fredrickson & Watson Construction Company and Fredrickson Brothers, are making every effort to complete the work on schedule.

### SACRAMENTO COUNTY

Plans and estimate are ready for a proposed improvement of the State Highway between Ben All and Sylvan School. A 30-foot concrete pavement between Ben All and Del Paso and a 20-foot concrete pavement between Del Paso and Sylvan School, is planned.

The work is expected to be contracted for in July and it is estimated that the road will be eight months under construction.

### TULARE COUNTY

Contractor C. W. Wood has completed his contract for concrete shoulders from Goshen Junction to Oakdale School on Route 10.

Placing of premixed oiled surfacing has been started by Contractor Fred W. Nighbert on the section of the Sierra-to-the-sea Highway between Three Rivers and Sequoia Park.

Two miles of pre-mixed oil surface have been placed by Contractor Fred W. Nighbert on Route 10, connecting with the General's Highway in Sequoia National Park.

State forces have started building a masonry wall at a narrow point on Route 10 near Three Rivers, to widen the roadway and protect traffic.

## Record of Bids and Awards

**AMADOR COUNTY**—Between Drytown and Amador City, 2.8 miles of grading. Dist. X, Rt. 65, Sec. B. C. G. Willis & Sons, Inc., Los Angeles, \$111,912.50; Ariss-Knapp Co., Oakland, \$122,193; C. R. Adams, Oakland, \$104,936.20; S. H. Palmer Co., San Francisco, \$102,074.30; J. P. Holland, Inc., San Francisco, \$99,591.90; Geo. Mitchell, Huntington Park, \$124,304.50. Contract awarded to J. P. Holland, Inc.

**CALAVERAS COUNTY**—Between 2 miles and 4 miles south of Mokelumne Hill, 2.2 miles grading. Dist. X, Rt. 65, Sec. A. Mankel and Staring, Sacramento, \$81,502.80; Jasper-Stacy Co., San Francisco, \$73,527.90; Heafey-Moore Co., Oakland, \$73,811.90; Gobler Const. Co., Los Angeles, \$48,773.10; Ariss-Knapp Co., Oakland, \$75,517.60; J. P. Holland, Inc., San Francisco, \$58,293.27; R. Norman Murdoch, Oakland, \$58,684.60; C. R. Adams, Oakland, \$49,990.10; C. G. Willis & Sons, Inc., Los Angeles, \$64,537.90; John F. Collins, Stockton, \$54,968.40; S. H. Palmer Co., San Francisco, \$57,209.60; Schelling and Schelling, Burbank, \$51,842; Lord & Bishop, Oroville, \$76,573.50; Fredrickson & Watson Const. Co., and Fredrickson Bros., Oakland, \$51,337.60; Larsen Bros., Sonoma, \$48,397.50; A. J. and J. L. Fairbanks, South San Francisco, \$48,997.80; E. C. Coats, Sacramento, \$79,295; G. E. Finnell, Sacramento, \$69,070; The Adams Co., Angels Camp, \$59,965; Young Bros., Berkeley, \$56,097; Isbell Const. Co., Fresno, \$85,965; Tiffany, McReynolds, Tiffany, San Jose, \$55,340.20.

**CONTRA COSTA COUNTY**—Through Pinole and Hercules, 3.3 miles to be graded and paved with Portland cement concrete and bituminous macadam. Dist. IV, Rt. 14, Sec. A. Jack Casson, Hayward, \$175,591; J. P. Holland, Inc., San Francisco, \$172,595.75; Prentiss Paving Co., San Jose, \$159,905.05; E. B. Skeels, Roseville, \$173,956; Central Construction Co., Oakland, \$178,634.25; Fredrickson & Watson Const. Co., Fredrickson Bros., Oakland, \$160,465.80. Contract awarded to Paving Co., San Jose, \$159,905.

**CONTRA COSTA COUNTY**—Widening reinforced concrete bridge across Rodeo Creek in the town of Rodeo. District IV, Rt. 14, Sec. B. R. F. Ragland, San Francisco, \$6,338; Edward G. Hart, San Francisco, \$8,280; Samuel C. Rogers, Richmond, \$5,610; McDonald and Maggiora, Sausalito, \$7,997.40. Contract awarded to Samuel C. Rogers.

**HUMBOLDT COUNTY**—Bridge across Mad River, 4 miles north of Arcata. Dist. I, Rt. 1, Sec. 1. Mercer Fraser Co., Eureka, \$79,418; Smith Bros. Co., Eureka, \$82,534.20; M. B. McGowan, San Francisco, \$76,974; H. C. White, Sanger, \$79,938; Butte Construction Co., San Francisco, \$76,948.40. Contract awarded to Butte Construction Company.

**HUMBOLDT COUNTY**—North and south of Pepperwood, about 1.7 miles to be surfaced with standard road surfacing, crushed gravel or stone. Dist. I, Rt. 1, Sec. D. Smith Bros., Eureka, \$5,250; William C. Elsemore, Eureka, \$5,404. Contract awarded to Smith Brothers.

**HUMBOLDT COUNTY**—Grading the site for District Office and shops at Eureka. Dist. I, Henry Padgett, Fields Landing, \$3,389; Delose C. Kemp, Crescent City, \$3,827; W. C. Elsemore, Eureka, \$3,560; Mercer-Frazier Co., Eureka, \$4,272; Smith Bros., Eureka, \$3,907; Englehart Paving and Construction Co., Eureka, \$4,717. Contract awarded to Henry Padgett.

**KERN COUNTY**—Between Wasco and Pamosa, 8.9 miles to be graded and paved with asphalt concrete. Dist. VI, Rt. 33, Sec. D. C. W. Hartman, Bakersfield, \$198,769; Steele Finley, Santa Ana, \$199,773.50; Valley Paving & Const. Co., Visalia, \$179,992; Warren Const. Co., Oakland, \$189,341; Force, Currihan & McLeod, Oakland, \$182,792; A. Teichert & Son, Sacramento, \$198,401.70; Hanrahan Company, San Francisco, \$194,640; J. F. Johnston, Stockton, \$198,028. Contract awarded to Valley Paving Co.

**KERN COUNTY**—Between 7 miles north of Ricardo and Freeman, 10.3 miles to be graded and surfaced with oil treated crushed gravel. Dist. IX, Rt. 23, Sec. D. Braun, Bryant & Austin, Culver City, \$130,046; G. W. Ellis, Glendale, \$103,281.70; Bartlett & Mathews, Pasadena, \$133,734; Southwest Paving Co., Los Angeles, \$122,279. Contract awarded to G. W. Ellis.

**KERN COUNTY**—Between Mojave and 7 miles south of Cinco, 9.9 miles grading and surfacing with oil treated crushed gravel. Dist. IX, Rt. 23, Sec. B. Southwest Paving Co., Los Angeles, \$104,934; Isbell Construction Company, Fresno, \$145,262; Hall-Johnson Co., Alhambra, \$126,714; Basich Brothers Const. Co., Los Angeles, \$127,538; Bartlett & Mathews, Pasadena, \$92,949.40; A. J. Grier, Oakland, \$135,307; G. W. Ellis, Glendale, \$118,111; Braun, Bryant & Austin, Culver City, \$118,068; Tiffany-McReynolds, Tiffany and McDonald, San Jose, \$118,312; Gibbons and Reed Co., Burbank, \$144,354. Contract awarded to Bartlett & Mathews, Pasadena.

**LOS ANGELES COUNTY**—Between 1 mile north of Kellys and 1 mile north of Sandbergs, 6.1 miles to be paved with bituminous macadam. Dist. VII, Rt. 4, Sec. C. Sully-Miller Contracting Co., Long Beach, \$109,290; A. J. Grier, Oakland, \$114,790; C. W. Hartman Construction Co., Bakersfield, \$112,915; Gibbons & Reed, Burbank, \$165,155; Helderer Const. Co., Sacramento, \$105,290. Contract awarded to Gibbons and Reed.

**LOS ANGELES COUNTY**—For furnishing material and labor in connection with the reconstruction of pipe lines and irrigation systems between Glendora and Claremont. Dist. VII, Rt. 9, Sec. I, J. and C. E. R. Davison Const. Co., Monrovia, \$9,405.25; Thomas Haverly Co., Los Angeles, \$10,155.40. Contract awarded to B. R. Davison Const. Co.

**LOS ANGELES COUNTY**—Between Glendora and Claremont, moving buildings from state highway right of way. Dist. VII, Rt. 9, Sec. I, J. and C. Doyle McMillin, Whittier, \$6,573; Star House Movers, Inc., Los Angeles, \$8,490; W. C. Cline, Upland, \$9,061; C. H. Basore, Pasadena, \$8,598. Contract awarded to Doyle McMillin, Whittier.

**MERCED COUNTY**—Between Bradley and RR King and the east county boundary, 13.1 miles, hauling and spreading gravel. Dist. VI, Rt. 18, Sec. A. J. P. Collins, Stockton, \$6,790; John G. Chigris & Pfitri Sutsos, San Francisco, \$9,700; Basich Bros. Const. Co., Los Angeles, \$9,700; W. C. Colley, Coalinga, \$8,633. Contract awarded to J. P. Collins of Stockton.

**NEVADA COUNTY**—Nevada City to 1 mile west of Washington Road, 11.7 miles grading and surfacing with oil treated crusher run base. Dist. III, Rt. 15, Sec. C. Arris-Knappe Co., Oakland, \$287,003; Robinson-Roberts Co., Los Angeles, \$360,040.50; Healy Tibbitts Const. Co., San Francisco, \$367,818; Nevada Contracting Co., Fallon, Nevada, \$317,424; Wren & Greenough, Portland, \$303,329; Raggio & Saitoris, San Francisco, \$345,780; E. C. Coates, Sacramento, \$281,331; Isbell Const. Co., Fresno, \$371,370; Marsh Bros., & Gardiner, San Francisco, \$368,381.80; Twohy Bros. Co. and J. F. Shea, San Francisco, \$247,118; Guy F. Atkinson, Portland, \$357,333; Schuler & McDonald, Oakland, \$384,121; Mathews Const. Co., Sacramento,

\$359,727; Guy F. Pyle and Ernest C. Hall, Eugene, Oregon, \$361,117; Helderer Construction Co., Inc., Sacramento, \$277,880; D. A. Foley Const. Co., Los Angeles, \$210,576; T. E. Connolly, San Francisco, \$365,559; Hemstreet and Bell, Marysville, \$316,840; Geo. Mitchell Co., Huntington Park, \$332,842; C. R. Adams, Oakland, \$263,482; A. Teichert & Son, Sacramento, \$233,942. Contract awarded to C. R. Adams of Oakland.

**SACRAMENTO COUNTY**—Between North Sacramento and Del Paso Park, 1.8 miles to be graded and paved with asphalt concrete. Dist. III, Rt. 3, Sec. B. McGillivray Const. Co., Sacramento, \$60,755; A. Teichert & Son, Sacramento, \$54,794. Contract awarded to Clark and Henry Const. Co., San Francisco, \$53,602.

**SAN DIEGO COUNTY**—Across Pine Valley Creek, 16 miles east of Alpine, reinforced concrete girder bridge and approaches to be graded. Basich Bros. Const. Co., Los Angeles, \$54,959.75; Chas. & F. W. Steffen, San Diego, \$62,471.35; deWaard & Son, San Diego, \$53,123; Linderman & Dueker, Inc., Harbor City, \$48,852; John Simpson & Co., Los Angeles, \$53,933; McWilliams & Ritchey, Los Angeles, \$72,875; R. H. Downer, San Diego, \$61,160.80; Whipple Engineering Co., Monrovia, \$51,291.75; E. S. Johnson, Pasadena, \$49,921; Oberg Bros., Los Angeles, \$67,272.65. Contract awarded to Lindermann & Dueker of Harbor City, California.

**SAN LUIS OBISPO COUNTY**—From Arroyo Grande to Pismo Beach, 3.28 miles to 20- and 30-foot Portland cement concrete pavement. Dist. V, Rt. 2, Sec. E. Cornwall Construction Co., Santa Barbara, \$132,712; J. P. Knapp, Stockton, \$135,350; Prentiss Paving Co., San Jose, \$133,312; M. J. Bevanda, Stockton, \$139,618. Contract awarded to Cornwall Const. Company.

**SAN LUIS OBISPO COUNTY**—Maintenance Shop Building and truck shed, pump house and oil house. Dist. V. W. J. Smith, San Luis Obispo, \$17,397; Theo. M. Maino, San Luis Obispo, \$18,690. Contract awarded to W. J. Smith.

**SANTA BARBARA COUNTY**—Between Benham and 2 miles south of Carpinteria, 1.2 miles grading and paving with Portland cement concrete and bituminous macadam. Dist. V, Rt. 2, Sec. G-H. Chas. W. Wimmer, Santa Barbara, \$98,551; G. T. Malcolm, Walnut Creek, \$102,566; Sam Hunter, Santa Barbara, \$103,416; S. H. Palmer, San Francisco, \$118,297; McWilliams & Ritchey, Los Angeles, \$122,042; John C. Gist, Arcadia, \$98,029; Nelson & Sloan, Chula Vista, \$87,728; The Callahan Const. Co., Los Angeles, \$93,446; J. G. Donovan & Son, Los Angeles, \$94,499; Bert Calvert, Los Angeles, \$92,757; M. J. Bevanda, Stockton, \$91,757; Schelling & Schelling, Burbank, \$92,228; McCray Co., Los Angeles, \$85,874.70. Contract awarded to McCray Company.

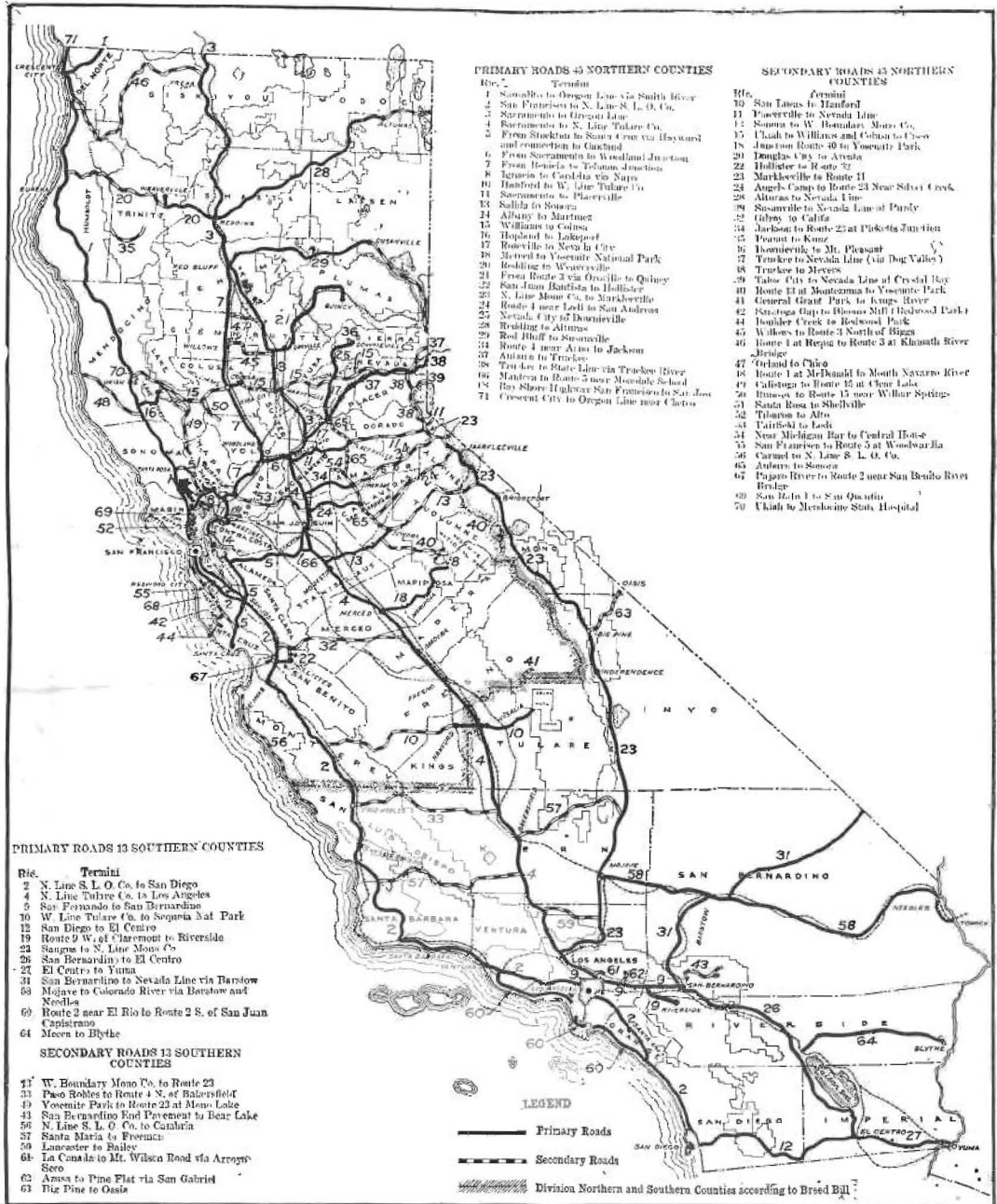
**SHASTA COUNTY**—Repairing bridge across Sacramento River about 1 mile east of Redding. Dist. II, Rt. 28, Sec. A. Lord and Bishop, Oroville, \$34,500; M. B. McGowan, San Francisco, \$31,564; J. P. Brennan, Redding, \$32,318; Stephenson Const. Co., San Francisco, \$33,153; R. B. McKenzie, Gerber, \$33,136. Contract awarded to M. B. McGowan of San Francisco.

**SISKIYOU COUNTY**—At Spring Hill near Mt. Shasta City, 0.7 of a mile of grading. Dist. II, Rt. 3, Sec. A. H. J. Kennedy and Daniel Boyles, Oakland, \$49,500; Mathews Const. Co., Sacramento, \$36,559; A. J. & J. L. Fairbanks, South San Francisco, \$41,367; G. E. Finnell, Sacramento, \$36,764; Southern Oregon Const. Co., Klamath Falls, \$35,764; C. F. Adams, Oakland, \$38,682; J. P. Brennan, Redding, \$31,418; J. P. Compton, McMinnville, Oregon, \$50,611; Young Bros., Berkeley, \$28,771; Schelling & Schelling, Burbank, \$39,202; Jones & Stacy, Newhall, \$40,200; Dunn and Baker, Klamath Falls, \$40,391. Contract awarded to Young Bros. of Berkeley.

**SOLANO COUNTY**—Westerly boundary and 1½ miles west of Cordelia, 2.3 miles grading and bituminous macadam pavement. Dist. X, Rt. 8, Sec. A. Tieslau Brothers, Berkeley, \$87,911.70; Mankel and Staring, Sacramento, \$91,748.50; G. E. Finnell, Sacramento, \$93,655.75; J. E. Johnston, Stockton, \$92,798; Fredrickson & Watson and Fredrickson Bros., Oakland, \$87,802.46; E. B. Skeels, Roseville, \$95,895. Contract awarded to Fredrickson & Watson.

**TUOLUMNE COUNTY**—Between 1 mile northwest of Shaw's Flat and the Sonora-Columbia road, 1.6 miles of grading. Dist. X, Rt. 65, Sec. A. E. N. Noble and Edgar Noble, Marysville, \$17,459.90; Wm. C. Colley, Coalinga, \$24,251; Mankel & Staring, Sacramento, \$28,512; G. E. Finnell, Sacramento, \$23,082; Gannon & McCarty, Stockton, \$21,906; D. C. Pollis, Compton, \$19,411.75; Lily Willard & Biasotti, Stockton, \$22,001; Larsen Bros., Sonoma, \$41,983; The Adams Co., Angels Camp, \$27,900. Contract awarded to E. N. and Edgar Noble of Marysville.

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



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