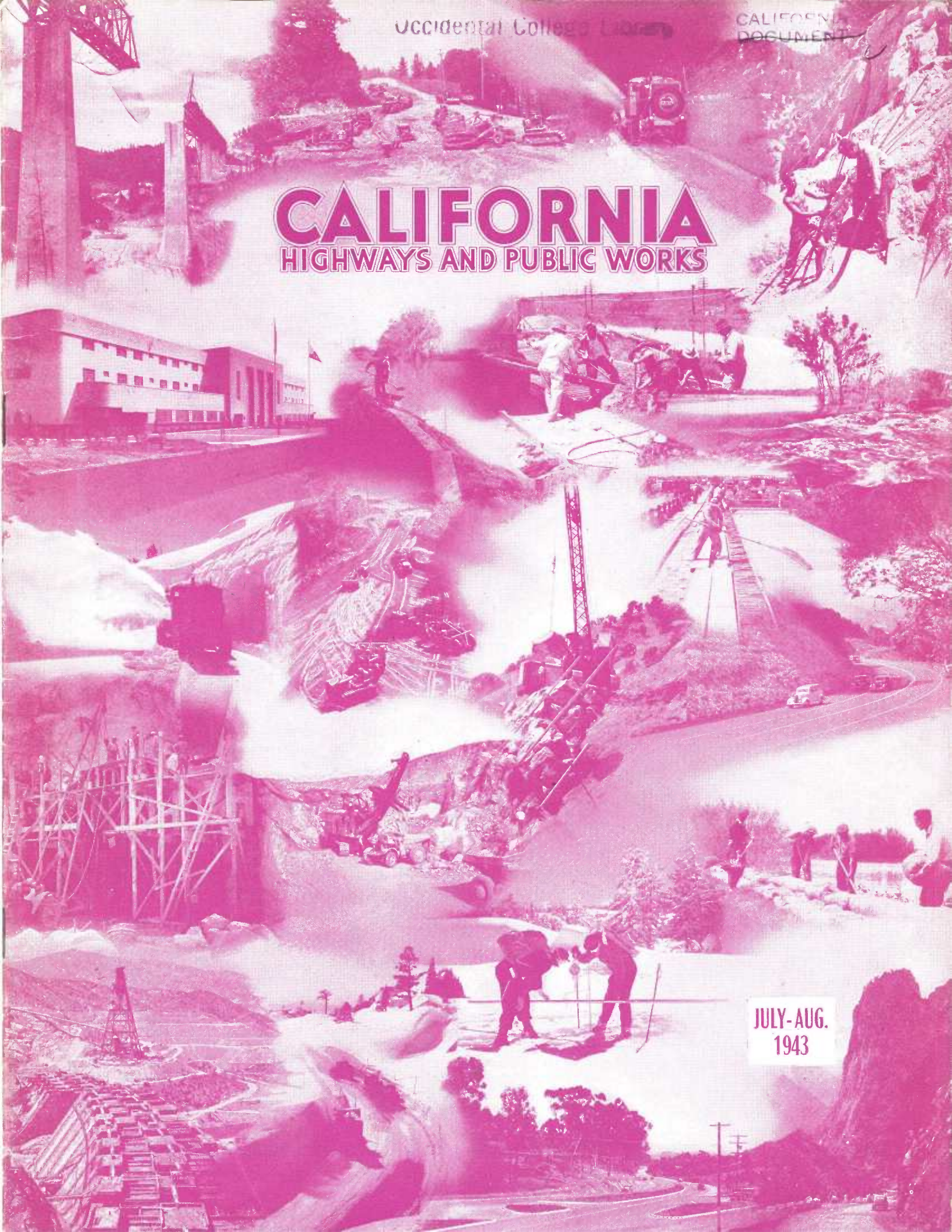

CALIFORNIA
HIGHWAYS AND PUBLIC WORKS

JULY-AUG.
1943

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways, Department of Public Works, State of California [PRINTED IN U. S. A.]

C. H. PURCELL, Director GEORGE T. McCOY, State Highway Engineer J. W. HOWE, Editor K. C. ADAMS, Associate Editor

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California Highway System Meeting Extraordinary Demands in Volume and Tonnage of Wartime Truck Traffic

CALIFORNIA'S highways are playing a major part in the war effort. Coincidently, the war is exacting a heavy toll from the State Highway System due to the ever-increasing heavy traffic generated by truck movements.

Road surfaces constructed to bear normal traffic have taken such excessive pounding in certain localities serving defense plants, shipyards and military and naval installations that the Division of Highways has had to expend in maintenance and repair alone since Pearl Harbor approximately $15,000,000.

Secondary rural routes in California known as feeder roads and which are the State's farm-to-market arteries have assumed great importance in the prosecution of the war.

PERSHING FORESAW IT

General Pershing once said: "The country road will be of tremendous value in time of war. The roads must be relied upon to obtain needed food supplies."

This prediction is fully borne out by records of truck haulage of food products in California to which must be added the huge movements of materiels for the Army and Navy.

Problems confronting the Division of Highways necessitate a determination of the part played by rubber-borne highway transportation in the present emergency and the contribution of highways to the war, with particular emphasis on California.

In many ways conditions in California differ from those prevailing in the majority of States. California, with an area of 159,000 square miles, is second in size only to Texas. Its population of 7,000,000 amounts to only 44 per square mile, as compared with 281 per square mile in New York; 220 in Pennsylvania; 141 in Illinois; 168 in Ohio; and 546 in Massachusetts.

Similarly, California with a total road mileage slightly in excess of 100,000 miles has only 0.6 of a mile of roads to square mile of area; while the other States referred to above all have from 3 to 3½ times that road density: New York being 1.9 miles of road to the square mile; Pennsylvania 2.0; Illinois 1.9; Ohio 2.0; and Massachusetts 2.1 miles per square mile.

TWO IMPORTANT FACTORS

These two factors mean that in California, with its more sparsely populated area and lesser road density, much of the highway traffic must travel considerably greater distances to and from destinations.

Another factor peculiar to California is the concentration of so large a percentage of population in three urban areas. Of the 7,000,000 people in this State, 5,000,000 (72%) live in urban communities and of this 5,000,000, 4,100,000 (82% of urban and 60% of total) are concentrated in the San Francisco, Los Angeles and San Diego metropolitan areas.

These three areas, where live 60 per cent of the State's total population, are all far from the interior portions of the State and far from each other. This situation means that these large centers are most dependent upon truck transportation, not only for food products, but industrially, for raw materials processed or fabricated in the plants situated there.

DEPENDENT ON ROADS

While American railroads are the backbone of long haul transportation, at the present their facilities are taxed to capacity in both lines and yards. The nation is, therefore, more dependent than ever upon highways for a large share of commercial transportation. Just how dependent California is on the truck medium of freight distribution may be made more impressive by presentation of a few figures.

In the matter of intra-State freight movement, that is freight whose origin and destination both lie within the borders of California, and which is transported by public carriers for tariff, the California Railroad Commission has assembled some most significant data. Of the total freight tariff of $157,000,000, paid during 1941 for this class, $105,000,000 or 66.8 per cent was paid for truck haul; steam railroads were second with 27.5 per cent ($43,200,000); express carriers third with 3 per cent ($4,740,000); electric railroads fourth at 1.4 per cent; and water-borne carriers last with 1.3 per cent. The 1940 figures for this same breakdown paralleled those of 1941 with 65.3 per cent for truck traffic and 28.5 per cent for railroads.

TRUCKS FREE TANK CARS

To repeat, these figures include only intra-State freight for which tariff was paid and do not include the probably greater volumes hauled on State roads and highways in trucks owned by the producer or manufacturer. These latter include not only such commodities as agricultural produce and livestock which invariably are transported some part of their travel by truck, but lumber and mineral products as well, particularly petroleum, which, under a recent directive by the Office of Defense Transportation designed to free tank cars, can not be transported by rail for a distance of less than 200 miles.

A specific instance of the tremendous amount of trucking which California highways are called upon to carry is that of the five billion pounds of market milk which are annually transported on rubber and most of which goes to the three metropolitan areas.

45,000,000 TONS OF PETROLEUM

The State Department of Agriculture estimates that California produces approximately 20 million tons of farm and ranch crops annually. The larger items of mineral products produced in this State in 1940 were estimated by the Bureau of Mines to total over 72 million tons. The largest

Intra-state freight tariffs paid to public carriers in 1941 totaled $157,000,000 of which 66.8 per cent was hauled by trucks

single mineral item, petroleum, accounted for nearly 45 million tons of this total. Miscellaneous stone, including aggregates, which, because of its low unit value, was almost entirely transported by truck, accounted for more than 23 million tons.

A large part of the trucking required to transport these materials is of direct necessity to the prosecution of the war.

As the trucking and automobile travel can not be accomplished without adequate road surfaces, it follows that the highways over which the trucks must travel are just as essential.

HIGHWAYS TAKE PUNISHMENT

On the basis of data accumulated by the Traffic Department of the Division of Highways, there are generated annually on the rural State Highway System of California approximately 1,267,000,000 vehicle miles of truck travel. The impact of this volume of trucking spells destruction to highway surfaces not given proper maintenance and periodic reconstruction.

Studies have shown that the determining factor in road deterioration is the continued repetition of impact from the axle loads of heavy trucking.

It has been noted during the past year that roads, which had carried traffic satisfactorily for a number of years and had been kept in good condition by normal maintenance, disintegrated rapidly when subjected to the unusual load repetitions of the heavy hauling in connection with military construction. This factor is one of sudden redistribution of traffic on State, county and city roads and streets in the vicinity of military and industrial establishments and on roads feeding to materiel sources. In many instances, roads basically designed for low traffic volumes are called upon to bear the repeated impacts of high volumes of heavy traffic.

The increase in truck traffic is indicated through reports of the Board of Equalization on receipts of their revenue from the operations tax on the gross income of trucking operators in California. These data show an increase in tax revenue of 33 per cent for 1941 over 1940 and an additional increase of 32 per cent for 1942 over 1941 with no increase in gross income operation tax rates.

The increase in tax revenues based on gross receipts of for-hire carriers may have been due, in part, to increased tariff rates and to higher load factors for these carriers.

This increase in a period of two years was accomplished without a very large increase in the number of truck units. Similarly bus line revenues have increased 300 per cent during the same period. In other words, the trucks and busses are carrying more and heavier loads with practically the same equipment and the destruction of road surfaces is accelerated by the multiplication of impacts from the increased number of heavier axle loads.

RUBBER-BORNE TRAFFIC

A few specific examples indicate the volumes of rubber-borne traffic. The Kaiser Ship Building Yards in the San Francisco Bay Area report that 50 per cent of their freight is received by truck and 85 per cent of their employees travel to and from work by automobile. A survey of the Emeryville industrial district also revealed that 50 per cent of the freight received and shipped is handled by truck and 90 per cent of the employees used cars for transportation. The Pacific Gas and Electric Company reports 40 per cent of their freight is received by truck and 99 per cent of their employees travel on rubber. In the livestock industry 75 per cent of shipments are made by truck. In 1941 the abattoirs in Stockton and South San Francisco shipped the equivalent of 67,000 carloads by truck.

Truck traffic on the State Highway System in 1942 was consistently above the level of 1939 and the maintenance of this high level is considered remarkable considering the restrictions placed on trucking. To some extent, this may be attributed to the fact that there are large areas of the State devoid of railroad communication and other areas where railroad facilities are not sufficient for wartime needs. At border quarantine stations, which are all remote from centers of production, truck traffic entering the State in 1941 was 11.3 per cent in excess of that for 1940. The comparable ratio for 1940 and 1942 was 12.4 per cent.

There is a rational explanation for truck traffic holding up as it has. Practically all goods moving either by rail or boat have a prior and subsequent movement by truck. There is an obvious increase in the goods being produced despite lessening production for civilian consumption. California is in the theater of war and there are great movements of commodities for purely military purposes.

RAPID AND EFFICIENT

Truck movements over long distances are virtually all made by "for hire" carriers, who generally speaking utilize truck and trailer combinations in their work. There were 47,551 trucks and 13,286 trailers engaged in this work last year in California. Long distance movements are exceedingly rapid and efficient. The schedule from San Francisco Bay points to Seattle is about 30 hours. Approximately 75 per cent of this truck movement is now made on government bill of lading.

The truck schedule from Ogden, Utah, to San Francisco is less than 30 hours. The truck run from San Francisco to Los Angeles has been long established but now goods are also moved from such places as Benicia to Los Angeles and San Diego, the schedule to the latter point being approximately 17 hours. There are also a number of short hauls which are frequent, such as hauls from Sacramento, Stockton and Tracy to San Francisco Bay. Loads between such depots may range from an average of 75 trucks and trailers daily to a peak of 200.

It is estimated the total tonnage of agricultural products will approximate 20,815,000 tons in 1943 as compared with 21,160,000 tons last year. Not all of this tonnage leaves the farm, but some 15,000,000 tons move and an attempt is to be made this year to move a greater amount off the farms than heretofore.

It is estimated that approximately two-thirds of the State production is moved by truck. This truck movement does not include some 5,000,000 tons of commodities delivered from farm to railroad in the county of production.

Possibly as much as 60 per cent of the freight handled by common carrier truckers is for the military authorities and the weights of individual shipments have increased from an average of 350 pounds to approximately 2,000 pounds.

In 1942 a total of 137,000 carloads of livestock was moved of which the equivalent of 102,000 carloads was moved by truck.

FREIGHT FOR WAR NEEDS

A trucking company with a territory extending from Yuba City in the north to Tulare in the south serves large cannery plants in the central part of the State. About 85 per cent of all their business is in connection with hauling agricultural products from the field to these canneries. Their longest haul is 185 miles. During January and February 1943, they had a special contract for hauling for the Army and Navy, amounting to 5,641,874 pounds of agricultural products, an average haul of about 225 miles.

A large milk producing and processing company in central California has a total of about 1,300 truck trailers and semitrailers of its own, of which 205 are heavy and used in long hauling. One of their contract haulers transports from Smith River, a non-

Thousands of tons of cement are being hauled by truck in large metal tanks as shown above

Truck and trailer combinations are carrying some 45,000,000 tons of petroleum products, largely gasoline for war uses

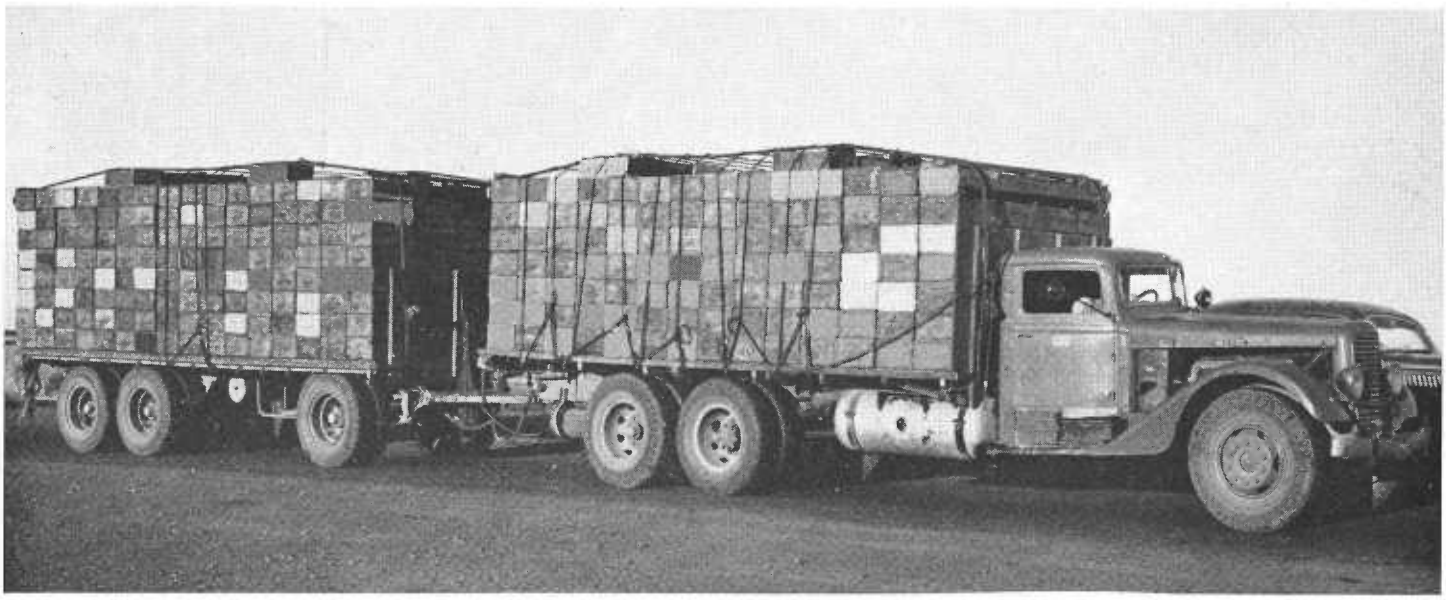
railroad point, in Del Norte County, to San Francisco, nearly 400 miles. Another one hauls from Ferndale in Humboldt County to San Francisco, a distance of 285 miles.

TRUCK AND TRAILER HAULS

Most of these long hauls are carried in large trucks and trailers with a total load of from 18 to 20 tons. The company's own fleet has increased 100 per cent since 1940 due to war conditions. It estimates that in 1942, about 20 per cent of its sales was to the Army. It estimates this year will be much higher.

Before the war approximately 27 per cent of California's gasoline moved directly from the refineries over the highways. The initial movement of the remaining 73 per cent of the total was apparently by rail or boat to warehouses, from which it was distributed over the highways.

The original order of the Office of Price Administration prohibiting the use of rail tank cars in transportation of gasoline or other petroleum products for distances of less than 100 miles, resulted in placing the burden of this extra transportation on tank truck facilities. Furthermore this order recently was amended to prohibit use of tank cars for hauls of less than 200 miles. Tank car equipment has been withdrawn from California for use elsewhere to such an extent that the bulk of petroleum products consumed within the State are being handled by motor truck carriers. Since gasoline tax levies in January and February, 1943, respectively, were only 27 and 24 per cent below the corresponding months in 1942, it is clear that there has been little if any decrease in the hauling of gasoline by truck. It must be remembered that a great deal of gasoline is also hauled for Army use.



It is estimated 12,000,000 tons of agricultural products are being moved to canneries by truck and trailer

TRUCKS DO THE MOST

The 1943 business of a large cement company with a plant in the eastern part of central California was handled between rail and truck as follows: Total haul by rail during first quarter of 1943, 107,583 barrels; hauled by truck, 211,740 barrels. Nearly 100 per cent was for the war effort.

In the coastal area of northern California, eight companies, which have a yearly production of 2½ to 30 million board feet of lumber per year with a combined output of 50 million board feet, are now hauling this amount by truck over the highways about 250 miles to the San Francisco Bay region, 96 per cent of the haul going directly into the war effort.

In the same region, four companies are hauling by truck a total of 360,000 board feet of logs per day from the woods to their mill. The hauls range from ten to fifty miles. Additional miscellaneous lumber products from this area, amounting to 10 million board feet will be hauled by truck this year to the San Francisco Bay district. In the Sierras of central California, from three mills a total yearly production of 190 million board feet of lumber will be hauled over highways during 1943, continuing during the war.

HIGHWAY SERVICE TRIPLED

Nearly three times as much truck hauling is being done by the lumber industry now compared to before the war.

In the north coastal region, 1,000 tons of chrome and manganese ore is hauled by truck from mines a distance of 85 miles to a War Production Board stockpile.

15,000,000 TONS HAULED

It is estimated that the total tonnage of rock, sand, and gravel delivered in northern California in 1942 was conservatively 15,000,000 tons. This was about double the production in 1941 and 85 per cent of the total was utilized for military and naval work. Approximately 35 per cent of the total production was delivered by truck.

California dairy products move almost entirely by truck. Fresh milk, cream, butter, and cheese comprise the dairy products group with milk alone accounting for 93 per cent of the total tonnage. Based on 1942 production figures, approximately 6 billion pounds of milk fat will be transported over California highways during 1943.

Truck receipts of butter, cheese, eggs, and dressed poultry at San Francisco during 1942 in the order named were 22,988,674 pounds, 11,427,594 pounds, 1,286,038 cases, and 9,520,248 pounds.

VAST FOOD PRODUCTS

Truck receipts for the same commodities at Los Angeles were: butter, 26,100,820 pounds; cheese, 7,273,470 pounds; eggs, 1,138,224 cases; dressed poultry, 10,433,274 pounds.

A California Department of Agriculture report shows the volume of fruits, nuts and vegetables hauled by truck passing through border inspection stations during 1942 from states of origin expressed in packages and estimated carload equivalents as follows:

Shipments of hay to Los Angeles in 1942 over State highways totaled 415,367 tons

	Packages	Carloads Equivalent	Percentage
Alabama	190		
Arizona	1,158,733	2,373	14.84
California	4,942,854	10,125	63.30
Colorado	6,881	14	.09
Florida	103		
Georgia	792	2	.01
Idaho	115,520	236	1.48
Mexico	1,354	5	.02
Nevada	28,493	58	.36
New Mexico	63,770	130	.82
Oklahoma	1,645	4	.02
Oregon	534,553	1,095	6.85
Texas	74,725	153	.95
Utah	175,999	360	2.25
Washington	703,714	1,442	9.01
Totals	7,809,326	15,997*	100.00

* 384 estimated carloads of watermelons not included.

During 1942, 147,634 cattle and calves were brought into the State by

(Continued on page 18)

Scene at intersection on East Shore Highway, Contra Costa County, where an electric monitor (in circle at left) governs through and turning movements on six lanes of heavy traffic watched by officer on bike shown in circle at right

45,000 Vehicles Per Day Controlled by East Shore Highway Crossing Signal

WITH the present development and perfection of traffic-actuated signals used in connection with highway channelization, the traffic officer at a busy intersection can sit on his bike and calmly watch traffic handle itself! And the traffic does handle itself—some turning right, some left, and still more going straight through—with all conflicting movements stopped without waving of arms and blowing of whistles.

The little "iron man," an electric installation located near the intersection does the job. All the driver has to do is stay in the proper traffic lane—right if he wants to turn right; left, which is marked, if he is turning left—and watch the signal.

When he crossed a certain spot on the pavement, a spot he did not see, the "iron man" made a note of him through one of his many "eyes" and in due course will give him a green light while he holds the other fellow with the red.

ALWAYS ON THE JOB

Twenty-four hours a day, three hundred and sixty-five days in the year, this procedure goes on at many heavily traveled intersections on California highways.

The engineers call it "channelization" and "traffic-actuated signals"—both of which it is.

Left-turn lanes, or "storage lanes," are provided by reducing the width of the traffic island or division strip, to permit an extra single lane in which vehicles can temporarily wait, out of the line of straight through traffic, until the controller, the "iron man," can get them through.

The right-turn lanes are frequently indented into the shoulder, to provide decelerating lanes, so that traffic will be out of the way while slowing down to make the turn when not stopped by a red light, while through traffic continues in the center lanes.

CONTROLLER IS ALERT

The controller is so arranged that it gives preference to heaviest movement and automatically changes if the heavy flow should suddenly change. And, believe it or not, the controller is influenced by the speed of traffic, so that if a lull or blank space occurs in a heavy, continuous stream of vehicles the controller will instantly put the vehicle through that has waited the longest; that is, it will give it the green light, sometimes so quickly the driver misses it if he is not watching carefully.

It is all very confusing to talk about but really quite simple, as shown in the accompanying pictures of East Shore Highway intersections in Contra Costa County where such installations handle as much as five thousand vehicles in one hour,

Traffic Signal Control is amplified by channelization islands and separate lanes for turning vehicles

and forty to forty-five thousand a day.

PEDESTRIAN GETS BREAK

At some intersections, particularly in the defense industrial area of the city of San Diego, where there is a heavy pedestrian traffic across heavily traveled streets, control buttons are placed so that the pedestrian is not obliged to wait unduly or jump and run to get across but can get a green light by putting a call through to the controller via the push-button.

Traffic controls at intersections of heavily traveled highways present a perplexing problem and rarely are identical conditions found to exist. There is something different at each intersection—something that requires a little different adjustment. Storage lanes may need to be a little longer; decelerating lanes may not be required; more signal indications may be needed or a slight change in position because of the effect of the afternoon sun; or a different arrangement of traffic islands may be advisable.

It all depends on the traffic pattern, how much turning left or right, the number and size of trucks and the physical conditions such as right of way width, approaching grades, speed of traffic and alignment at the intersection. But by making a proper balance of all the many influencing factors, traffic can be helped to handle itself until conditions compel the construction of a grade separation, when traffic can proceed without crossing the path of any other traffic.

Indentation of the median strip provides a waiting or storage lane for vehicles turning left and avoids holding up through traffic

Widening of U. S. 101 Eliminates Traffic Bottleneck in San Mateo County

By G. A. WILDMAN, Resident Engineer

UNDER a recently completed contract, which called for widening as well as resurfacing of the old pavement, one of the last serious bottlenecks on El Camino Real (U. S. 101) in the County of San Mateo, has been eliminated.

The contract,* 3.2 miles in length, covers that portion of El Camino Real between Charter Street, in Redwood City, on the north, and San Francisquito Creek, the county line of San Mateo and Santa Clara counties on the south, and passes through the town of Atherton and the city of Menlo Park.

Under previous contracts let over a period of several years the old highway had been widened and resurfaced both north and south of the recently completed section.

Under one contract let in 1930, San Francisquito Creek Bridge was widened and the highway was reconstructed to a width of 40 feet with 7-foot shoulders south of the bridge in Santa Clara County.

On the north, under a more recent contract through Redwood City, the traveled way was reconstructed to a width of 70 feet with 7-foot shoulders, giving three 11-foot traffic lanes each side of a 4-foot division, making an over-all width of roadway of 84 feet.

The same general plan of construction on the contract just finished was followed as in the case of the Redwood City project, except that in general the over-all width of the finished roadway is 88 feet, providing 7-foot shoulder areas with two 12-foot and one 11-foot traffic lanes each side of a 4-foot division strip.

The exceptions to the above were on sections where curbed islands were provided, with a maximum width of 28 feet for channelization; also through a portion of the city of Menlo Park, where the over-all width of the traveled way, including shoulder or parking area, was reduced to 84 feet, leaving 8-foot sidewalk areas.

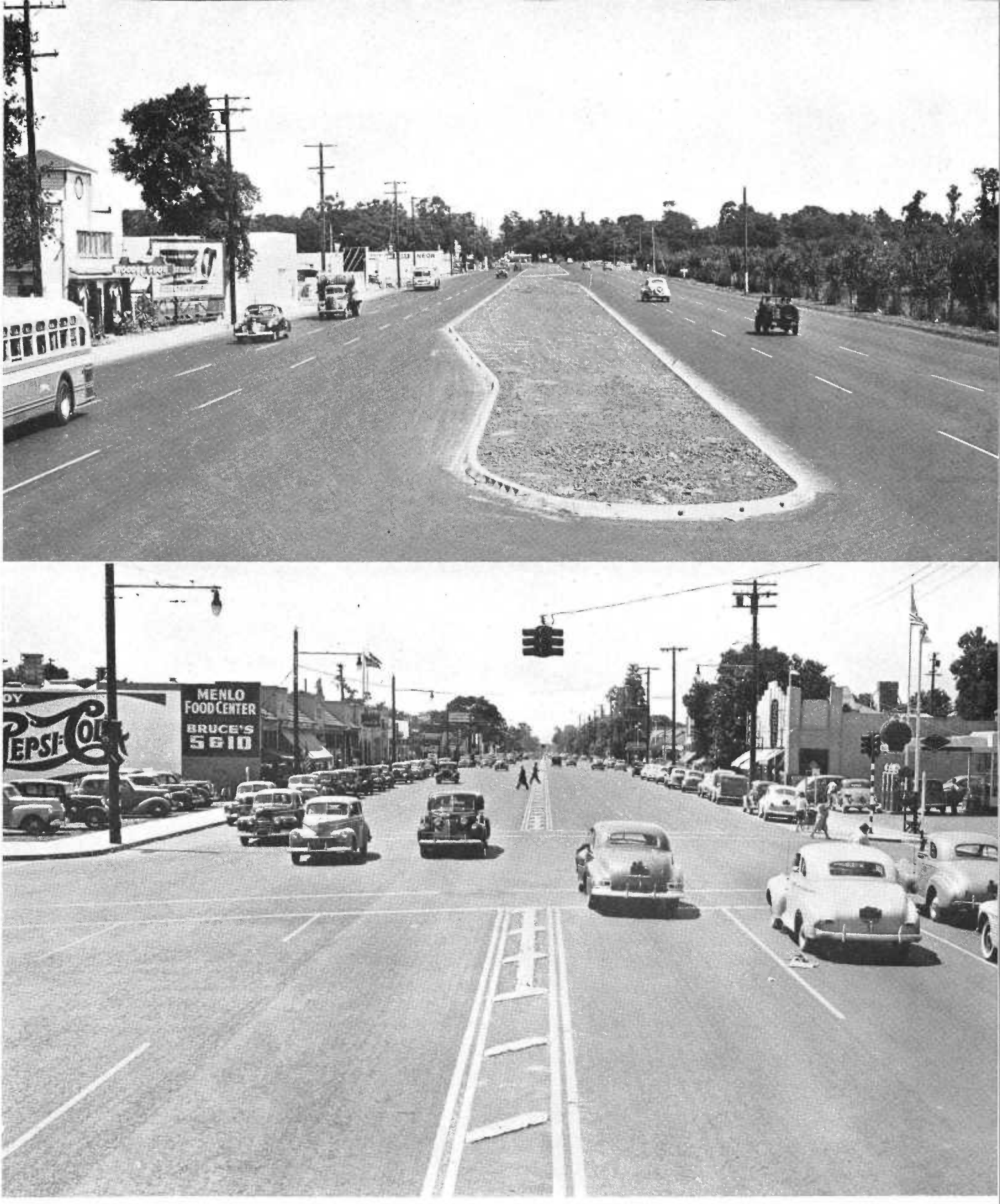
The history of the original construction and reconstruction of this portion of El Camino Real, obtained from various sources, is as follows:

Previous to 1912 or 1913 the traveled way consisted of a graveled roadbed, maintained during the dry seasons of the year by frequent sprinkling with

(Continued on page 12)

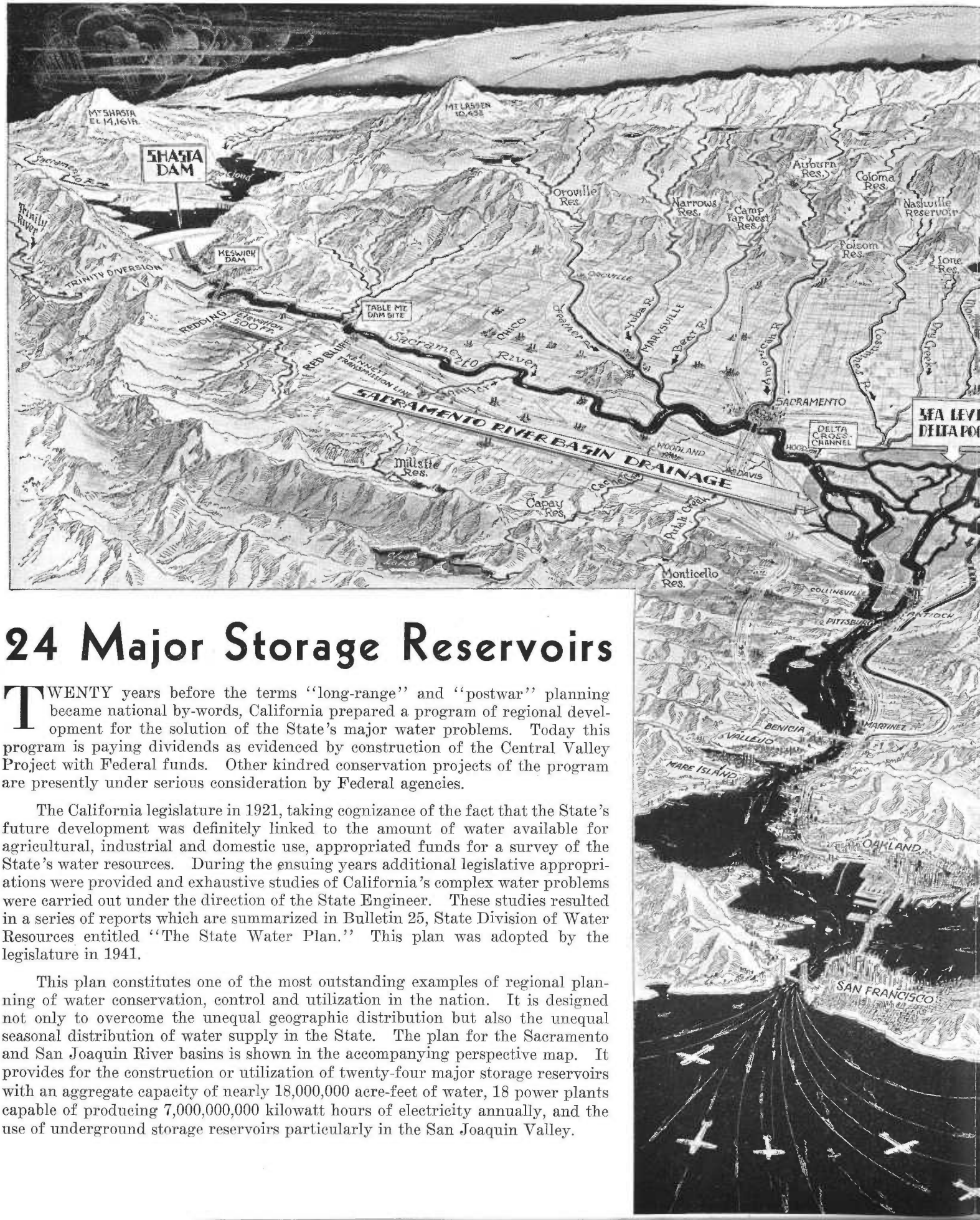
* This contract was awarded October 29, 1941, before Federal restrictions were placed on highway construction.

Typical view of widened section of U. S. 101 near Atherton providing a 6-lane divided highway



Top, improved section of U. S. 101 showing channelized division strip approaching Atherton. Below, widened avenue through Menlo Park

California's Water Plan for Deve



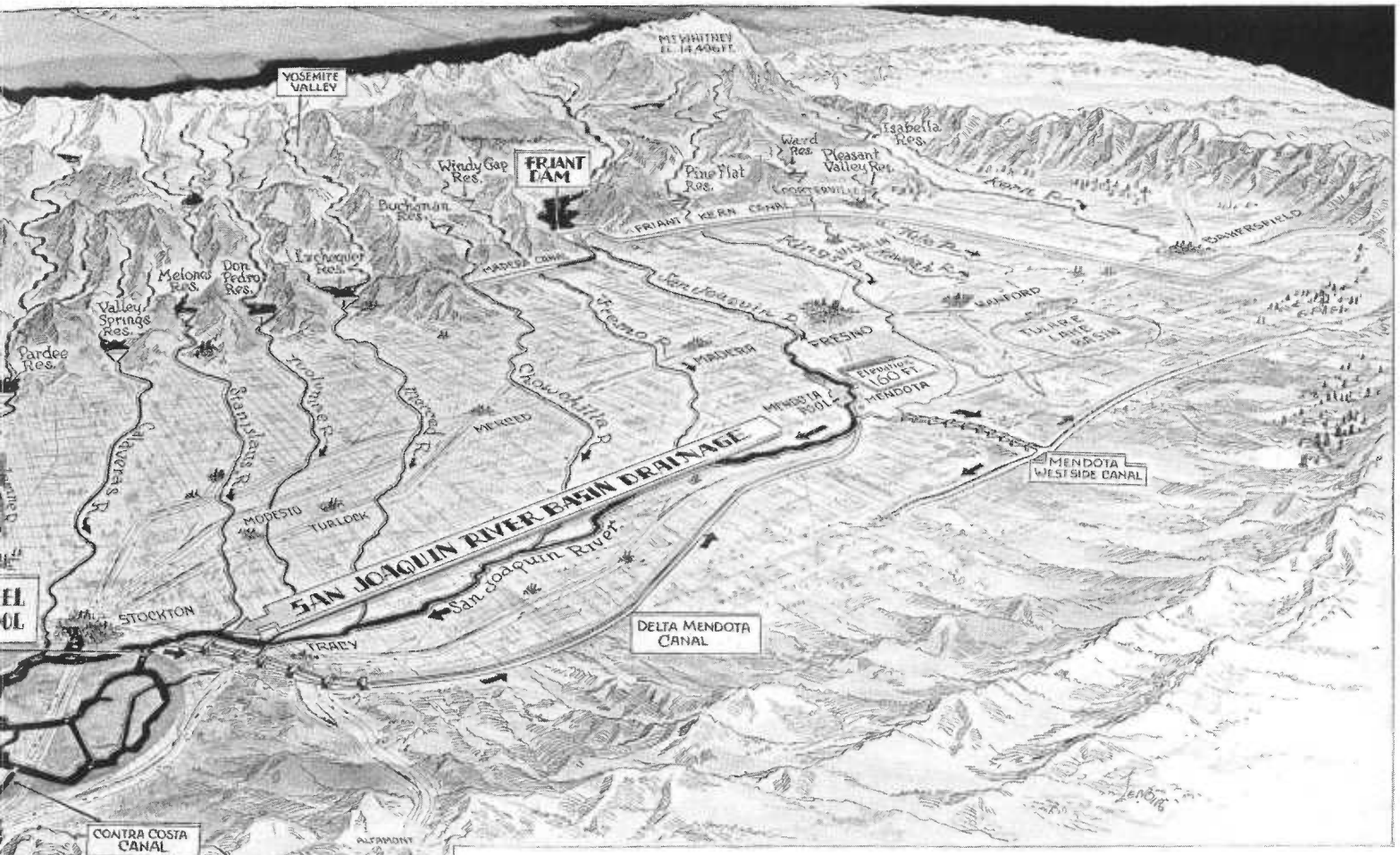
24 Major Storage Reservoirs

TWENTY years before the terms "long-range" and "postwar" planning became national by-words, California prepared a program of regional development for the solution of the State's major water problems. Today this program is paying dividends as evidenced by construction of the Central Valley Project with Federal funds. Other kindred conservation projects of the program are presently under serious consideration by Federal agencies.

The California legislature in 1921, taking cognizance of the fact that the State's future development was definitely linked to the amount of water available for agricultural, industrial and domestic use, appropriated funds for a survey of the State's water resources. During the ensuing years additional legislative appropriations were provided and exhaustive studies of California's complex water problems were carried out under the direction of the State Engineer. These studies resulted in a series of reports which are summarized in Bulletin 25, State Division of Water Resources entitled "The State Water Plan." This plan was adopted by the legislature in 1941.

This plan constitutes one of the most outstanding examples of regional planning of water conservation, control and utilization in the nation. It is designed not only to overcome the unequal geographic distribution but also the unequal seasonal distribution of water supply in the State. The plan for the Sacramento and San Joaquin River basins is shown in the accompanying perspective map. It provides for the construction or utilization of twenty-four major storage reservoirs with an aggregate capacity of nearly 18,000,000 acre-feet of water, 18 power plants capable of producing 7,000,000,000 kilowatt hours of electricity annually, and the use of underground storage reservoirs particularly in the San Joaquin Valley.

eloping the Great Central Valley



Irrigation for 10,000,000 Acres

Large capacity canals and pumping systems are planned to transfer this water from areas where a potential surplus exists to areas where supplies are deficient, with exchanges of water on the San Joaquin and Kern Rivers. It would furnish ample supplemental water for all domestic, municipal and industrial uses in the great Central Valley and the San Francisco Bay region and for the irrigation of 10,000,000 acres of land in those areas.

The storing of storm waters in these foothill reservoirs and their release, during the dry season will, (1) control floods, (2) improve navigation on the Sacramento River, (3) supply lands tributary to the streams down which they pass, (4) control salinity in the Sacramento-San Joaquin Delta, (5) supply the delta pool with surplus water which may be transferred to the San Joaquin Valley and San Francisco Bay region, and (6) produce large new sources of electric power.

Key to this master plan of water conservation and utilization is the natural storage basin at the confluence of the Sacramento and San Joaquin Rivers. It is an area, approximately 40 miles long and 25 miles wide, which lies at sea level and is crisscrossed by 500 miles of waterways. Into these waterways flows unused runoff from both river systems, averaging 31,000,000 acre-feet a year. Flood waters stored in the various proposed reservoirs can be fed through natural channels into this great natural pool as required and pumped from there into the San Joaquin Valley and other areas where supplies are needed. Importance of this delta storage is that when the water has reached this point all up-stream requirements have been met and the surplus water under normal circumstances would waste into the sea.

Backbone of the State Water Plan in the Central Valley Basin is the Central Valley Project, now under construction by the United States Bureau of Reclamation. This project was selected by the State as the initial unit of the State Water Plan for construction, but the entire plan is so integrated that other units may be added as the need arises.

Widening U. S. 101 Eliminates Bottleneck

(Continued from page 8)

water wagons to keep the dust down, and worked with horse-drawn blades and drags to keep the roadway in a more or less smooth condition. During the wet season the roadway was maintained by keeping the holes filled with additional gravel and occasionally bladed or dragged, thus maintaining a suitable roadbed.

FIRST PAVING IN 1913

The first construction involving any paving was done in 1913, and provided a traveled way 20 feet wide of 1½-inch asphalt concrete pavement on a 5-inch macadam base. The traveled way was widened to 30 feet in 1925.

The roadway thus provided gave satisfactory service for many years, but due to increased traffic, heavy hauling, and the widening of the highway at each end, the volume of traffic fed to this section has been so great that serious congestion resulted.

Under the recent reconstruction, additional right of way had to be provided; this was in the main acquired along the westerly side of the old right of way and varied in widths from 26 feet, at the beginning of the project, to 55 feet in the vicinity of the island areas provided for channelization.

The acquisition of new right of way was a big job in itself and presented several difficult problems. In the city of Menlo Park several large buildings, including a reinforced concrete theater, had to be moved or remodeled, and one large two-story brick building with a full basement was completely demolished and the basement backfilled.

EARTHQUAKE EFFECTS SHOWN

This building had been erected previous to the earthquake of 1906 and had apparently withstood the quake without any damage, yet when the wreckers started to tear down the walls it was evident that the earthquake had loosened the brick in the mortar as they were removed without any difficulty and came out very clean.

Between Station 557 and the beginning of the project at Redwood City—a distance of 12,590 feet—there is only one intersecting waterway. This is at Atherton Creek, a distance of 4,116 feet from the summit. Southward towards the end of the project there is a sag in the grade, the low point being at Station 590, elevation 58.54 feet and rising within a distance of 1,000 feet to an elevation of 72.52 feet, the top of the bridge deck at San Francisquito Creek.

STORM DRAIN INSTALLED

The flow line of San Francisquito Creek is at an approximate elevation of 46 feet, or only 12½ feet lower than the elevation of the highway at the low point of the sag. To drain this low sag and the street intersections on the westerly side of the highway in the business district of Menlo Park, a reinforced concrete pipe storm drain was placed starting at Santa Cruz Avenue, and running southward to empty into San Francisquito Creek, a distance of 4,200 feet. The diameter of the pipe varied from 15 inches at the beginning to 30 inches at the outlet.

LITTLE SHORING NEEDED

Very little shoring was necessary to support the walls of the trench, as the material excavated was of such a nature that it would stand nearly vertical, but as a precaution the contractor sloped the cut banks quite heavily and installed intermittent shoring during the progress of the excavation through the heavy cut sections.

Backfilling immediately around and over the pipe was done by hand. The material was placed in layers, jetting was permitted due to its sandy nature, but final compaction of each lift was done with a caterpillar tractor and sheepsfoot tamper. A caterpillar with bulldozer kept the backfill leveled up ahead of the tamping.

The roadway was widened each side of the old 30-foot asphalt concrete pavement, but mainly on the westerly side. New construction consisted of the removal of approximately 39,500 cubic yards of roadway excavation, the placing of 70,000 tons of imported borrow, and 43,000 tons of asphaltic concrete.

ASPHALTIC CONCRETE SURFACING

The imported borrow was placed to form a base 1 foot thick under 6 inches of asphaltic concrete on all widened areas. The thickness of the asphaltic concrete surfacing over the old 30-foot pavement varied, but the new grade was maintained at an elevation that would provide a minimum of 2 inches of new surface over the old. The shoulders, or parking strip areas, were surfaced with plant-mix, except through Menlo Park where concrete curb and gutters were placed. Asphaltic concrete or portland cement concrete surfacing was placed on the shoulder areas adjacent to the new curb and gutters.

The contract was awarded to the Union Paving Company of San Francisco on October 29, 1941, and approved on November 19, 1941. Actual work was started on December 2, 1941. Due mainly to the outbreak of war, the contractor was unable to obtain labor, materials and supplies as readily as was anticipated, and the job was not completed until June 15, 1943. C. L. Corson was general superintendent for the contractor, and A. W. Jagow was job superintendent.

All work was done under the direction of the Division of Highways and under the general supervision of District Engineer Jno. H. Skeggs of District IV, San Francisco. Resident Engineer H. S. Payson was in direct charge of the work preceding his death on December 25, 1942. The work was completed under the supervision of G. A. Wildman as Acting Resident Engineer.

Trucks Hauling Livestock

Tonnage of livestock hauled from farms to market via truck in 1942 again set an all-time record, according to reports forwarded to the Automobile Club of Southern California. Trucks delivered 62.8 per cent of cattle, hog and sheep tonnage, and surveyors estimate that it would have taken 830,000 railroad carloads to transport this volume.

Young Man: "I think two can live as cheaply as one."

Future Father-in-Law: "You can't edge into my family on that theory, young man. I'm willing to keep supporting my daughter, but you'll have to pay board."

Highway Committee Recommendations For Selection of Culvert Size and Type

By G. A. TILTON, Jr., Assistant Construction Engineer

FOREWORD

This is the ninth of a series of technical abstracts from a joint departmental review of culvert practice of the California Division of Highways by a committee composed of R. L. Thomas, Assistant Engineer Surveys and Plans; C. F. Woodin, Assistant Maintenance Engineer, R. Robinson Rowe, Assistant Bridge Engineer, and the writer.

In its most important conclusion, the committee found that the usual practice of designing culverts for a 10-year flood with unbalanced freeboards (height of parapets) was uneconomic, and proposes instead: that the culvert and its appurtenances be balanced without freeboard for a 100-year flood. A procedure is outlined to facilitate selection of the most economic combination for a particular site.

A balanced design providing for safe passage of the 100-year flood under head does not generally increase cost over the current practice of providing for the 10-year flood without head.

IT has been recommended in a previous article * that a culvert be designed to pass a 10-year flood without static head on crown of culvert at the entrance; and that the design of the culvert and appurtenances be balanced to avoid serious damage from head and velocity obtaining in a 100-year flood—noting that some exceptions to these rules would be discussed in a later article.

Application of these rules to the conditions at a particular site will result in a long list of alternative combinations of conduits and appurtenances which are hydraulically equivalent.

The more experienced the designer, the shorter the list of alternatives, many of which can be discarded at a glance as impractical or uneconomical. The combinations retained for consideration must then be compared as to cost and practicability before making a final selection.

The committee has suggested a procedure for (a) listing alternative combinations, and (b) discarding certain combinations as impractical—adding other principles which will assist in reducing to a minimum the number of combinations for which cost should be compared.

Current Practice

Although there have been notable attempts to use newer theories for larger culverts, most culvert design is still based on formulae equivalent to the first rule—that a 10-year flood pass without static head on crown of culvert at entrance. This is approximately equivalent to application of the Talbot Formula, which is used to some extent * (1) by 36 States. The A. A. S. H. O. (2) states the general rule: "In general, culverts shall be proportioned to carry the maximum flood discharge without head."

If the "maximum flood discharge" just reached the crown of the culvert entrance, so that flow would be "without head," then there would be no need for headwalls above that level, and parapets would serve only to retain the highway embankment. However, as reported by every maintenance man consulted by the committee, a large proportion of culverts are subjected to considerable head on the entrance, wherein parapets serve the further purpose of protecting the embankment from erosion.

Headwalls are overtopped much more often than endwalls and to a much greater degree (see Fig. 59a), suggesting that parapet elevation should not be determined arbitrarily, but from hydraulic study.

Application of the first rule alone ignores the opportunity for reduction of the culvert section below the entrance if there is a fair (supercritical) slope available.

It is a matter of common observation that the outlet is far from full when the entrance is just full. Actually, the water surface drops rapidly inside the entrance, and a large portion of the waterway is never utilized. In the case of a culvert selected by the first rule: increasing a slope beyond the supercritical slope does not increase capacity of the culvert.

For the past 20 years, solutions have been proposed by department engineers from time to time to correct the uneconomic practice, such as by the use of belled entrances to pipe culverts and tapered barrels in concrete boxes from entrance to outlet. For various reasons progress ended with experimental installations.

Balanced Design

As one step in the improvement of this practice, the committee proposed the second rule. Instead of constructing headwalls, endwalls and other facilities to arbitrary freeboards, the combination of culvert barrel and all appurtenances should barely satisfy for the 100-year flood (limiting flood) without any freeboard (see Fig. 59b).

The limiting flood has been designated the "design discharge" and has been given an approximate frequency of once in 100 years. It is an "ultimate capacity" of the system, beyond which there may occur still greater floods which will damage all parts of the system—perhaps destructively.

To be specific, balanced design is defined as that combination of conduit section, shape, texture and gradient with entrance and outlet appurtenances which will just pass a 100-year flood without interruption of traffic and without serious damage to structure, embankment or abutting property.

* California Highways and Public Works, September, 1942, page 10.

* Numerals in parentheses refer to bibliography at end of article.

To obtain such balance, the designer must know the stages and velocities at critical points of a trial layout and the durability of structure, embankment and natural channel where exposed thereto.

Computation of these items for a large number of culverts becomes a tremendous task. Tables are available for certain kinds of pipe and for short culverts, but the committee was unable to find any compact combination of tables and charts available to cover the design field applicable to the widely variable California conditions.

The formulae developed by the University of Iowa (3) after tests in cooperation with the Bureau of Public Roads (now the Public Roads Administration) were found applicable to all designs of the California Division of Highways. Since the tests in the Iowa experiments were limited to pipes up to 30 inches in diameter and concrete boxes up to 4 feet by 4 feet in size and 30.6 feet in length, any set of working tables or working charts to cover current practice requires extrapolation to six times the diameter and length of the test units, which is a reasonably small prototype-to-model scale ratio.

Balanced Design Procedure

The steps recommended for balanced design of culverts can be summarized briefly as follows:

(a) Determine from maps, highway records and field study: the basic data required for Chart A* and for application of at least one culvert formula, and for at least one field estimate of flood discharge.

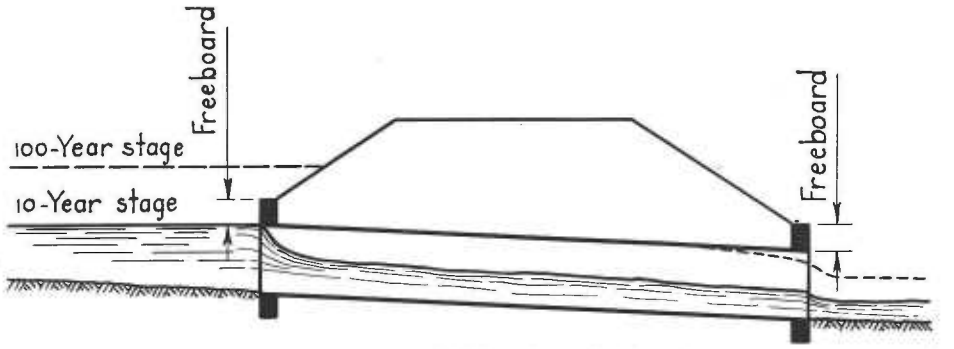
(b) Compute and compare discharges. If culvert formula leads to a waterway area, take the design discharge in second-feet at 15 to 18 times the area in square feet. Anticipate that recent high water marks may represent a flood of anywhere from 30 to 120 per cent of the 100-year flood. If differences are reasonable, select a weighted mean; otherwise, analyze the data and allow for the effect of unusual factors.

(c) By preliminary application of engineering factors (list follows) eliminate from further consideration any type which should not be used at the particular site.

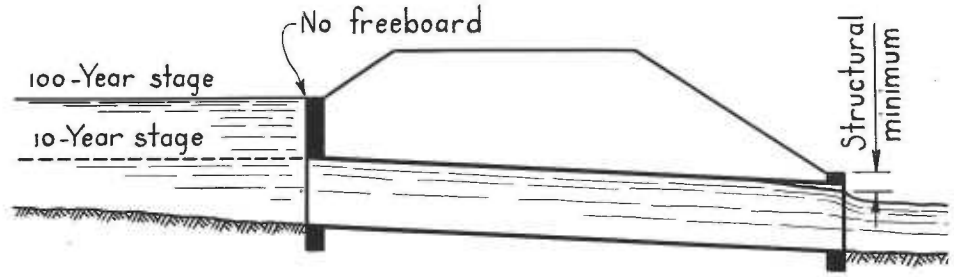
(d) Determine minimum sections by use of Chart D** for a 10-year flood, which may be taken at 55 to 65 per cent of the design discharge. Modify this minimum if required by items d'.

* See September, 1942, California Highways and Public Works.

** See November, 1942, California Highways and Public Works.



(a) Current Practice: Frequent flood just fills the entrance; equal freeboards, insufficient at entrance, excessive at outlet.



(b) Balanced Design: Infrequent flood submerges entrance; appurtenances fit this stage without freeboard.

FIG. 59. Comparison of controls for current practice and balanced design for free-outlet culvert on supercritical slope

d' For large free outlet culverts, the 10-year flood in second-feet should not exceed 10 times the rated waterway * of the section in square feet.

(e) Apply working charts or pertinent formulae to the minimum sections to determine head on the culvert, and compute the headwater stage. If this stage is too high, use the allowable stage and determine the cheapest conduit which will satisfy this restriction.

(f) Study conditions at the entrance with the help of profile or site plan and consider the effect of headwater pool on natural channel, upstream property and the highway embankment. For each design still being considered (2 or 3 at most) estimate the cost of reasonable protection without freeboard. As part of this step, it may be advisable to modify the tentative section selections.

(g) Establish grades or gradient of culvert flowline and estimate velocities at outlet for both the 10-year flood and the design discharge (100-year flood).

(h) Study conditions at the outlet and consider the effect of high velocity, eddies or other turbulence on natural channel, downstream property and the highway embankment. For each design, estimate the cost of reasonable protection—against nominal loss in 10-year floods and against serious loss in 100-year floods. Include energy-dissipator in estimate, unless it can be shown that maintenance charges after damage will be less expensive.

* See May-June, 1943, California Highways and Public Works.

(i) Estimate the annual cost, including anticipated maintenance, of each tentative balanced design of culvert and appurtenances. For the larger structures, this may include a credit for displaced embankment; for some box culverts there may be a credit for displaced subgrade and slab.

(j) Select the most economic combination, giving reasonable weight to the following engineering factors and departmental policies.

Engineering Factors

There are five principal engineering factors which should always be appraised before final selection is made:

(a) Character and stability of underlying foundation material on which culvert is to be laid.

(b) Nature and extent of lateral forces acting in the covering embankment.

(c) Effect of earth loads from high embankments.

(d) Effect of impact under shallow earth cover.

(e) Accessibility of culvert site.

In special cases, minor engineering considerations may be sufficient to determine type, such as:

(f) Salvage value where installations are temporary.

(g) Facility of extending existing culverts.

(h) Adaptability to jacking under pavements.

(i) Resistance to alkali, salts, and acids.

(j) Resistance to abrasive action of stone-laden stream flow on the invert.

(k) Desirability of eliminating endwalls by cantilevering extensions.

(l) Advantage of contracts, reflected in bids, of using one type of culvert throughout the contract.

Foundation and Earth Loading Conditions

The effect of earth loads on flexible and rigid culverts laid on yielding and unyielding foundations has been treated in detail in the seventh article of this series.*

Commercial culverts of both the flexible and rigid types are limited as to safe height of fill. Above such limitations it becomes necessary to design monolithic types to support the weight of the high over-fill.

Pipe culverts laid on excessively yielding foundations and culverts laid under embankments on sidehill are liable to lateral movement and should be of the type that best resists disarticulation. Flexible pipes in long lengths of heavy gage, with extra long collars have proven more satisfactory in such cases than short length sections of rigid types.

Accessibility of Culvert Site

For pioneer roads in mountainous country and similar inaccessible locations where deep gulches are encountered, the deciding factor in selection of type may be the speed with which the installation can be made and construction progress expedited. Long sections of the flexible type, light in weight, are readily adaptable to such locations.

* See March-April, 1943, California Highways and Public Works.

Departmental Policies

Selection of size or type of culvert may be finally determined by departmental policy such as:

(a) Adopted minimum size of culvert for maintenance purposes—for instance, minimum 18-inch pipe culverts under shallow fills or minimum 24-inch under high fills.

(b) Limitation of unproven types of culverts to experimental installations.

(c) Conformance with specification policies of participating governmental agencies.

(d) Conformance with national governmental dictates in critical periods.

Committee Recommendations

Summarizing its findings, the committee recommends generally that:

(1) Current practice in selection of size and type of culvert should be rationalized.

(2) With few exceptions, a balanced design of barrel and appurtenant structures will be the most economic combination.

(3) The balance should avoid all but nominal loss in 10-year floods and assure against interruption of traffic in a 100-year flood, without providing freeboard for greater floods.

(4) Design should achieve such balance by careful but simple and progressive steps, as outlined.

(5) While hydraulic requirements should never be overloooked and least annual cost is a strong argument, final choice should not be made without consideration of listed engineering factors and matters of policy.

(6) It should be recognized that each type of culvert enjoys advantages for some particular situation—smooth barrels for hydraulic efficiency, corrugated barrels for steep gradients, flexible pipe on yielding soils, monolithic sections for large waterways, arches under the highest embankments—but that the conflict of these advantages requires an open-minded examination of many other factors at each site.

LIST OF ARTICLES ALREADY PUBLISHED IN CALIFORNIA HIGHWAYS AND PUBLIC WORKS

August, 1942—Preliminary outline of articles.
September, 1942—Comparative Hydrology Pertinent to California Culvert Practice.
October, 1942—Debris Control at Culvert Entrances on California State Highway System.
November, 1942—Highway Culvert Location and Slope From a Review of California Practice.
December, 1942—Culvert Entrances and Headwalls on Calfornia Highway System.
January, 1943—Culvert Outlets and Endwalls on California Highway System.
February, 1943—Utilization of Siphon Principles in California Culvert Practice.
March-April, 1943—Earth Loading Factors Affecting Field Installations of Culverts.
May-June, 1943—California Adopts Waterway Ratings for Large Drainage Culverts.

Bibliography

(1) Determination of Waterway for Structures—V. W. Enslow in Convention Group meetings, 1942, p. 103 (A.A.S.H.O.)

(2) Specification 3.1.5, Highway Bridges, 1941 (A.A.S.H.O.)

(3) Flow of Water Through Culverts (Bulletin 1, University of Iowa, Studies in Engineering, 1926).

E. M. Maurer Retires as Superintendent of Maintenance

The retirement of Highway Maintenance Superintendent E. M. Maurer is announced by District Engineer E. Q. Sullivan of District VIII, San Bernardino.

"It was with extreme regret that we received the resignation of Mr. Maurer," said Mr. Sullivan. "Mr. Maurer resigned, having reached the age of retirement.

"I think there is no more able maintenance superintendent in the State service than Mr. Maurer, at the time of his resignation. He has been employed by the State for almost 25 years and has been Maintenance Superintendent for approximately 14 years. His assignments were first in the Imperial Valley and then on the desert, with headquarters at Barstow.

"Mr. Maurer preferred a desert assignment and was permitted to remain on the desert for this reason, though he had been offered what many consider to be more desirable assignments off the desert.

"It was hard to realize that Mr. Maurer had reached the age of retirement. He retained the spirit of youth and was active and highly efficient.

"All of the friends of Mr. Maurer in the State service wish him many years of health and happiness in his retirement."

Improved Saw For Cutting Concrete and Rock Specimens For Laboratory Inspection and Tests

By ALLEN NICOL and GEORGE POMEROY*

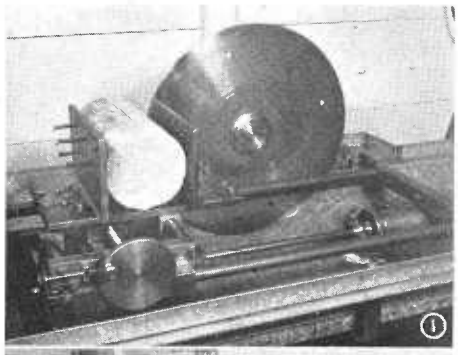
IN recent years, considerable research on concrete and concrete aggregates developed the need for an improved type of sawing equipment to prepare portions of specimens for examinations and tests. A small diamond saw, designed and made in the machine shop of the Materials and Research Department, had given satisfactory performance for the preparation of thin-sections of small (2″ maximum) pieces of rocks and concrete for petrographic studies. As the scope of investigational work increased, the need developed for sawing equipment of larger magnitude. It became necessary to saw large pieces of concrete pavement slabs, cores, and cylinders, as well as mortar bars of various sizes, large pieces of ledge rock, and gravel aggregates.

Experience with the small saw established several important features to be incorporated in a larger machine. Before plans were drawn, several inspection trips were made to firms and lapidarists to investigate the design and efficiency of sawing equipment already in operation. Many desirable features were observed, several of which were incorporated in the new machine. The less desirable features were avoided wherever possible.

Specifications for Proposed Equipment

The following requirements were set up for the new saw:

1. Capacity of the saw to accommodate not less than a 6″ x 12″ specimen.
2. The cutting disc to run in a mixture of kerosene and oil.
3. A clamp or vise to quickly and securely hold irregular shaped specimens.
4. The feed or pressure of the specimen against the cutting disc to be under complete control of the operator at all times, and to be variable at will. To accomplish this it was decided to use hydraulic pressure from the city water mains, a method so far as is known to the writers, never before used in this type of equipment.
5. The production of uninjured, smooth cut surfaces in a minimum of time.
6. Use of such materials as were in stock, or readily obtainable.



Construction of Machine

As constructed, the sawing element consists of a 20″ diameter diamond studded 14 gauge steel disc mounted on a ball bearing spindle, with a pulley on the other end belted to a $\frac{1}{3}$ horsepower electric motor. The speed of the cutting edge is 2200 feet per minute. It dips approximately 1″ into a mixture of 50 per cent SAE #20 oil and 50 per cent kerosene.

In making the saw, the edge is first rolled to a width of $\frac{1}{10}$″ and to a depth of $\frac{3}{64}$″; after which it is cross-cut each $\frac{1}{4}$″ of the circumference. The cross-cuts have a width of .028″ and a depth of $\frac{1}{32}$″. No. 60 mesh diamond chips are placed in the cross-cut slots, which are then lightly peened. After completing the diamond setting, the disc is re-rolled to force the metal firmly around the diamonds, but still maintaining the $\frac{1}{10}$″ width.

The saw is then mounted on the arbor of the machine, and with a medium grade carborundrum block in the specimen holder, the machine is operated with a light pressure to wear off the surplus metal, thereby exposing the diamonds in the cutting edge. As soon as the diamonds are exposed and start to cut the carborundrum block, the saw is ready for use.

The specimen holder consists of an adjustable vise. The jaws of the holder are made of $\frac{1}{2}$″ x 6″ x 4″ x 10″ long angle iron drilled and tapped for $\frac{5}{16}$″ standard set screws on approximately 1″ centers over the entire face. One jaw is stationary and the other adjustable over a range of 12″ in one-inch increments. The holder is mounted on a carriage sliding on round rods and travels in a direction at right angles to the axis of the saw arbor. This movement forward and back is obtained by water pressure in either end of a brass cylinder, one end being anchored to the frame of the machine, with the piston rod attached to the carriage. A cross adjustment is provided to regulate thickness of slices cut. One-inch

* Respectively Mineral Technologist, and Machinist and Instrument Maker, Materials and Research Department, California Division of Highways.

diameter cold rolled steel rods were used for the longitudinal ways of the carriage and the cross adjustment. These roads were held securely and parallel at the ends by insertion in one-inch holes drilled and reamed in 1″ by 1½″ rectangular cold rolled steel bars bolted to the cross members. Bronze blocks bored to 1″ were used as the sliding members.

Water pressure to operate the carriage is obtained from the city mains, with the utilization of full pressure, which seldom exceeds 40 pounds, for either advance or return movement of the carriage. Reduced pressure, usually 1 to 5 pounds is used during the sawing operation and is obtained by means of a pressure regulating valve. A specially designed rotary type valve in which both full and reduced pressures are controlled simultaneously is conveniently located for the operator. Gauges show both main line and reduced water pressures. The water cylinder is made 2½″ standard brass pipe having ordinary 2½″ pump leathers. The piston rod is ⅝″ diameter round bronze, with a maximum travel of 23″. The total pressure required for cutting is from one to five pounds per square inch on the piston, depending on the nature of the material.

Provision was made to lower the saw arbor to cut long specimens, thus enabling the work to pass over and clear the saw collars. On all smaller work the saw arbor is on a level with the center of the specimen. A suitable frame welded out of angle iron supports the working units. There is a sheet metal pan under and a splash hood over the saw.

The average time of setting up and cutting a 5″ diameter concrete specimen is less than four minutes. A similar 6″ diameter specimen can be cut in less than six minutes. This is at the rate of about 4 to 5 square inches per minute. The cutting rate for quartz crystal is two square inches per minute.

Slices as thin as $\frac{1}{32}$″ have been cut without difficulty when the material was sufficiently dense and sound not to break during the sawing operations. The cuts on all materials thus far have been smooth enough to polish without preliminary lapping. The feed control is instantly responsive to the will of the operator. Saw life has exceeded all expectations. In six month's operations over 5,000 square inches of surface have been cut in all kinds of material with little indication of total saw life. The saving of time in preparing specimens for study has been 300 per cent in some cases. The life of the saw and smoothness of the finish is no doubt largely attributable to the method of applying and controlling the feed and the design of the cutting edge.

The uses to which the new saw has thus far been put include the following:

Cutting 6″ diameter concrete cylinders of 12 inch length from end to end for visual examination. Also cutting slabs of various thicknesses. The prepared surfaces thus produced afford good means of ascertaining such features as water gain and voids, distribution of aggregate, bond, etc.

Cutting ends of concrete cores preliminary to capping for compressive strength test.

Obtaining smooth surface of concrete in suitable size for observation and study under binocular microscope.

Sawing concrete to expose unaltered areas or features that might otherwise be destroyed by breaking with hammer.

Sawing weather ledge rock or gravel aggregates for the purpose of studying the depth and extent of weathering, surface coating, internal structure, fractures, etc.

In addition to the above, the machine has on various occasions been used for cutting tops or bottoms off large bottles and other glassware; sawing pieces of thick plate glass; cutting fire brick to odd sizes and shapes, pieces of tile and porcelain, mortar bars and brickettes, etc.

In Memoriam

J. D. Greene

The death of John D. Greene, Associate Highway Engineer in Central Office, came suddenly on June 4, 1943.

Jack Greene was one of the old timers in California State highway construction. He first came to work for the California Highway Commission in February, 1912, as an instrumentman on survey parties and continued in that capacity until he entered the Engineer Corps of the Army in 1918. He served overseas in World War I and had attained the rank of Captain of Engineers at the time of his discharge in July, 1919. After termination of his military service he returned to California and for a period of six months was employed on State highway construction. From 1920 to 1926 he worked on highway construction for Sutter County and for the State of Nevada, returning again to the California Division of Highways in May, 1926, as a Resident Engineer in charge of construction projects.

Mr. Greene worked on construction in Districts IV, V, and X, but the greater part of his service was in District III.

In May, 1940, a heart ailment forced Mr. Greene to give up the more active duties of supervising construction in the field and he was transferred to headquarters, where he was employed on the staff of the Office Engineer until his death.

Mr. Greene's passing marks the loss to the Division of Highways of a most capable engineer who had served the State over a long period of years. True to his profession he has left behind him monuments of concrete and asphalt on some of the best highways in Central California, which will serve the traveling public for many years to come.

He was most popular among his coworkers and there are many of the younger construction men in the department who look back with pleasure to the training in the best of construction practice which they received while working under his supervision.

The Division of Highways extends sincere sympathy to Mrs. Greene and Jack's daughter, Mrs. Curtis Nelson.

Women Employed to Work on Highways

TWO women have recently been employed on highway work in District IX, working out of the Conway Summit Maintenance Station. These women are now assigned to guard-rail painting and will be gradually instructed in other lines of maintenance work for which they are physically capable and show an aptitude.

Women have been employed as census takers for many years during the mid-year and monthly traffic counts, and in District I have been used successfully as flagmen.

"In view of the remarkably efficient record made by women in what we usually considered man's particular field," said T. H. Dennis, Maintenance Engineer, "we have no doubt but what they will prove very helpful and satisfactory in our maintenance work. This type of outdoor work should have a particular appeal to women, and it is hoped that many of the other districts will be able to recruit women help, as the labor shortage is now critical.

California Highways Meeting Extraordinary Demands

(Continued from page 5)

Miscellaneous motor truck receipts at San Francisco in 1942 totaled 16,536 carload lots

trucks from Arizona, Colorado, Idaho, Nevada, Oregon, and Utah. During the same period, 94,431 sheep and lambs were delivered from the same states into Stockton, Los Angeles and South San Francisco, also 26,404 hogs and 3,509 mules.

In 1942, 74,467 carload lots of 38 important vegetables and fruits were unloaded in Los Angeles and of this amount 81.1 per cent was transported by trucks, 15.6 per cent by rail, 3.2 per cent by boat and .1 per cent by express.

During 1942, 24,853 car lots of 38 important fruits and vegetables were unloaded in San Francisco, 66.5 per cent by truck and 32.8 per cent by rail.

The motor truck receipts of Los Angeles during 1942 in car lot equivalents from California points alone totaled 57,877. These shipments originated in Blythe district, Coachella Valley, Imperial Valley, Inyo County, Lake and Mendocino counties, Humboldt district, Monterey and Santa Cruz, North San Francisco Bay district, Sacramento Valley, San Diego County, San Francisco Bay district, San Joaquin Valley, Santa Barbara, San Luis Obispo, and Los Angeles districts.

FROM OTHER STATES

During the same period, truck receipts of Los Angeles from Arizona, Colorado, Idaho, Massachusetts via San Francisco, Massachusetts via San Diego, Nevada, New Mexico, Oklahoma, Oregon, Texas, Utah, Washington, and origins not specified totaled 2,533 car lots, making a grand total of 60,410 car lots.

Motor truck receipts at Oakland during 1942 in car lot equivalents from California points amounted to 7,704. From out-of-State points the truck receipts in car lot equivalents were 149, making a total of 7,853.

Motor truck receipts at San Francisco in car lot equivalents in 1942 originating in the San Francisco Bay district, North Bay district, Lake, Mendocino and Humboldt counties, Sacramento Valley, San Joaquin Valley, Monterey and Santa Cruz counties, San Luis Obispo and Santa Barbara counties, Los Angeles, Coachella Valley, Imperial Valley, and San Diego, totaled 16,302. The truck receipts from out-of-State points totaled 234, making a grand total of 16,536.

Shipments of hay by truck to Los Angeles from the Antelope Valley, April through September, the first six months of the 1942-1943 season, were reported equivalent to 57,537 tons. Movement of hay by truck from Imperial Valley toward Los Angeles April through September, 1942, totaled 184,400 tons. Shipments from the San Joaquin Valley counties, Fresno, Kings, Tulare, and Kern were unusually heavy and brought the total to 415,367 tons hauled by trucks.

With the beginning of the war the truck industry had to assume an additional heavy burden in the movement of California produce, livestock, etc., because the railroads were devoting long and short hauls to military and navy materiel.

Highway Bids and Contract Awards for June and July, 1943

BUTTE, PLACER, SACRAMENTO, YOLO, COLUSA, GLENN, YUBA AND SUTTER COUNTIES—Repairing by applying a seal coat to various locations. District III. E. A. Forde, San Anselmo, $41,286; Louis Biasotti & Son, Stockton, $48,329. Contract awarded to W. C. Railing, Redwood City, $36,397.

BUTTE COUNTY—Across Pine Creek Overflows about 7 miles west of Chico, two reinforced concrete bridges to be constructed. District III, Route 47, Section A. James H. McFarland, San Francisco, $34,646; James B. Allen, San Carlos, $39,614; Wm. E. Thomas Concrete Construction Co., Sacramento, $40,090; Dan Caputo, San Jose, $44,870; J. S. Metzger & Son, Chico, $48,923; G. M. Carr, Santa Rosa, $47,201; Harry J. Oser & Peter Sorenson, Redwood City, $49,279; M. E. Whitney, Bakersfield, $49,920; Louis Biasotti & Son, Stockton, $50,146; J. P. Brennan, Redding, $51,257. Contract awarded to M. A. Jenkins, Sacramento, $33,926.

CALAVERAS COUNTY—Between San Joaquin Co. line and San Andreas, portions only, about 6.5 miles in length, to be repaired by placing untreated rock base and reconditioned by the road-mixed method. District X, Route 24, Sections A,B. Marshall S. Hanrahan, Redwood City, $59,570; Ted Watkins, Linden, $60,364; Louis Biasotti & Son, Stockton, $68,810; Claude C. Wood, Lodi, $69,980. Contract awarded to George French, Jr., Stockton, $47,778.

COLUSA COUNTY—Between Yolo County line and four miles south of Williams, portions only, about 9.7 miles to be repaired with plant-mixed material. District III, Route 7, Sections A,B. Hemstreet and Bell, Marysville, $60,475; McGillivray Construction Co., Sacramento, $61,445; J. A. Casson Co., Hayward, $62,430; Marshall S. Hanrahan, Redwood City, $69,735; A. Teichert & Co., Sacramento, $72,022. Contract awarded to Clements & Co., Hayward, $55,750.

CONTRA COSTA COUNTY—Between Muir Station and Christie Underpass, about 3.5 miles to be repaired with crusher run base and plant-mixed material. District IV, Route 106, Section A. Lee J. Immel, Berkeley, $76,286; A. J. Raisch, San Jose, $77,321; L. C. Smith, San Mateo, $78,225. Contract awarded to Piazza & Huntley, San Jose, $66,642.

CONTRA COSTA COUNTY—Between 1.9 miles east of Orinda Junction and 0.1 mile west of Walnut Creek, about 4.7 miles to be surfaced with plant-mixed surfacing. District IV, Route 75, Section A. Piazza & Huntley, San Jose, $71,543; A. G. Raisch, San Francisco, $73,170; Chas. L. Harney, San Francisco, $74,585; Lee J. Immel, Berkeley, $77,205; Parish Bros., Sacramento, $77,945; Granite Construction Co., Watsonville, $83,993. Contract awarded to Union Paving Co., San Francisco, $65,775.

CONTRA COSTA COUNTY—Between Walnut Creek and one mile north of Danville, about 5 miles to be repaired with crusher run base and plant-mixed material. District IV, Route 107, Section A. Union Paving Co., San Francisco, $76,775; Piazza & Huntley, San Jose, $78,146; J. A. Casson Co., Hayward, $78,845; A. J. Raisch, San Jose, $83,933; L. C. Smith, San Mateo, $88,749. Contract awarded to Lee J. Immel, Berkeley, $75,972.

CONTRA COSTA COUNTY—In the City of Richmond, on the west side of 14th Street between Shipyard and Cutting Blvd., a distance of about 0.4 mile, sidewalk areas to be graded; imported borrow to be placed and portland cement concrete sidewalks to be constructed. District IV. Contract awarded to Lee J. Immel, Berkeley, $3,381.

CONTRA COSTA COUNTY—Between Concord and 2.25 miles west, between Byron Junction and 1.5 miles west and between Old River and 1.8 miles west, about 5.6 miles to be repaired with plant-mixed material and a Class "C-Medium" seal coat. District IV, Route 75, Sections B,D. Piazza and Huntley, San Jose, $46,024; Louis Biasotti & Son, Stockton, $53,476. Contract awarded to Lee J. Immel, Berkeley, $44,815.

HUMBOLDT COUNTY—Between Arcata and Clam Beach, about 5 miles to be repaired with plant-mixed material and a seal coat. District I, Route 1, Section I. Clements & Co., Hayward, $44,332; Marshall S. Hanrahan, Redwood City, $46,980. Contract awarded to Mercer Fraser Co., Eureka, $41,530.

HUMBOLDT COUNTY—Portions between Trinidad and Little Red Hen, about 9.0 miles to be repaired with imported base material and armor coat. District I, Route 1, Section J. Mercer Fraser Co., Eureka, $151,537. Contract awarded to Marshall S. Hanrahan, Redwood City, $147,290.

IMPERIAL COUNTY—Between Trifolium Canal and 2 miles north of Sandy Beach Road, about 14.7 miles to be repaired by the road-mix method. District XI, Route 26, Sections B,C. Contract awarded to R. E. Hazard & Sons Construction Co., San Diego, $58,794.

IMPERIAL COUNTY—Across the Colorado River at Yuma, the existing bridge deck to be reconstructed. District XI, Route 27, Section B. H. L. Royden, Phoenix, Arizona, $26,166; Carlo Bongiovanni, Hollywood, $33,795; Ralph A. Bell, San Marino, $43,163. Contract awarded to Fred D. Kyle, Los Angeles, $21,947.

KERN COUNTY—About 39 miles east of Route 4 junction, a reinforced concrete slab bridge across Poso Creek to be constructed. District VI, Route 142, Section D. C. B. Tuttle, Wilmington, $21,203; Dan Caputo, San Jose, $22,765; James B. Allen, San Carlos, $22,992; M. E. Whitney, Bakersfield, $23,875; Robert R. Hensler, North Hollywood, $23,995; Rand Construction Co., Bakersfield, $24,630; Trewhitt, Shields & Fisher, Fresno, $25,120; Ralph A. Bell, San Marino, $26,575; James H. McFarland, San Francisco, $26,978; Fred D. Kyle, Los Angeles, $32,208. Contract awarded to F. Fredenburg, South San Francisco, $20,260.

MENDOCINO AND HUMBOLDT COUNTIES—At various locations between Riverview Ranch and 1.4 miles north of Pepperwood, about 8.1 miles to be repaired with armor and seal coats, and screenings to be furnished. District I, Route 1, Sections K, AD. Clements & Co., Hayward, $26,400; E. A. Forde, San Anselmo, $26,485. Contract awarded to Close Building Supply, Hayward, $26,011.

MONTEREY COUNTY—Between East Garrison and Route 117, about 4.7 miles to be graded and surfaced with armor coat on a crusher run base. District V, Hilltown Road. M. J. Ruddy & Son, Modesto, $115,551. Contract awarded to Granite Construction Co., Watsonville, $102,236.

PLACER AND YUBA COUNTIES—Portions between Lincoln and Wheatland, about 6.5 miles to be repaired with plant-mixed material. District III, Route 3, Sections B,A. Contract awarded to A. Teichert & Co., Sacramento, $45,844.

LOS ANGELES COUNTY—Between Los Angeles city limits and Ventura County line, portions only, a net length of about 4.4 miles to be repaired with plant-mixed material. District VII, Route 60, Sections A,B. Southwest Paving Co., Roscoe, $38,529; Griffith Co., Los Angeles, $41,710; Oswald Bros., Los Angeles. $43,170. Contract awarded to Schroeder & Co., Inc., Roscoe, $34,785.

LOS ANGELES COUNTY—The completion of a partially finished contract for construction of a portion of State highway between Macy Street and Indiana Street, portions of bridge and approaches to be constructed. District VII, Route 26, Sections LA,D. Southwest Paving Co., Roscoe, $133,997; Vido Kovacevich, Southgate, $144,236; Griffith Co., Los Angeles, $158,223; United Concrete Pipe Corp., Los Angeles, $168,9 Contract awarded to J. E. Haddock, Ltd., Pasadena, $130,784.

LOS ANGELES COUNTY—Across Los Angeles River and tracks of S. P. R. R. and Los Angeles Ry. at Figueroa Street in Los Angeles. District VII, Route 165. United Concrete Pipe Corp., Los Angeles, $120,697; Oberg Bros., Inglewood, $121,021; Griffith Co., Los Angeles, $126,804; W. J. Distelli, Los Angeles, $132,852; Contracting Engineers Co., Los Angeles, $142,777; Carlo Bongiovanni, Hollywood, $146,463; Ralph A. Bell, San Marino, $156,307. Contract awarded to A. S. Vinnell Co. & Engineers, Ltd., Alhambra, $120,568.

MENDOCINO COUNTY—Between 0.4 mile south of Wilson Creek and Sapp Creek, about 2 miles to be repaired with imported base material and armor coat. District I, Route 1, Section H. Contract awarded to Close Building Supply, Hayward, $34,372.

MARIN AND SONOMA COUNTIES—Between Ignacio and Sears Point, about 7.2 miles, existing roadbed to be widened with imported borrow and plant-mixed surfacing to be placed. District IV, Route 8, Section A,A. Parish Bros., Sacramento, $95,756; Lee J. Immel, Berkeley, $111, 801; Chas. L. Harney, San Francisco, $125,725; Fredrickson & Watson Construction Co., Fredrickson Bros., Oakland, $129,733. Contract awarded to A. G. Raisch, San Francisco, $93,688.

NEVADA COUNTY—Portions between Truckee and Nevada State line, about 1.1 miles to be repaired with plant-mixed material. District III, Route 38, Sections A,B. A. Teichert & Co., Sacramento, $10,460. Contract awarded to Hemstreet & Bell, Marysville, $7,840.

RIVERSIDE COUNTY—Between Corona and Riverside, about 4 miles to be repaired by placing plant-mixed surfacing over the existing bituminous surface. District VIII, Route 43, Section B. Vido Kovacevich, South Gate, $20,915; E. L. Yeager, Riverside, $22,937; M. W. Stanfield Co., Los Angeles, $23,170; Oswald Bros., Los Angeles, $23,728. Contract awarded to George Herz & Co., San Bernardino, $17,465.

SAN DIEGO COUNTY—Between Leucadia and Orange County line and between 4.8 miles southeast of Vista and San Luis Rey River Bridge, portions only, a net length of about 15.9 miles to be repaired with plant-mixed material. District XI, Routes 2 and 77, Sections B, Ocn, C, D; C,D. Lewis Construction Co., Los Angeles, $108,676; G. W. Ellis, North Hollywood, $117,795; Pacific Rock & Gravel, Los Angeles, $124,880. Contract awarded to Southwest Paving Co., Roscoe, $104,643.

SAN JOAQUIN COUNTY—Between Terminous and Mosely Road, about 5.0 miles to be repaired by grading and placing a seal coat on crusher run base. District X, Route 53, Section C. W. C. Railing, Redwood City, $69,762; Elmer J. Warner, Stockton, $73,300; J. A. Casson Co., Hayward, $60,170; E. A. Forde, San Anselmo, $72,200; Claude C. Wood, Lodi, $59,287; Lee J. Immel, Berkeley, $68,550; A. Teichert & Co., Sacramento, $73,170; Sierra Trucking Co., Inc., Reno, $73,305; Close Building Supply, Hayward, $74,380. Contract awarded to Louis Biasotti & Son, Stockton, $58,035.

SANTA BARBARA COUNTY—Between Castillo Street and Leadbetter Road in city of Santa Barbara, about 0.6 mile in length to be graded and paved with plant-mixed surfacing on crusher run base. District V, Basich Bros. Construction Co., Torrance, $53,198; L. A. Brisco, Arroyo Grande, $55,887; Brown Doko & Baun, Pismo Beach, $57,662. Contract awarded to Fredrickson & Watson Construction Co., Fredrickson Bros., Oakland, $44,763.

SANTA BARBARA COUNTY—Between Cebada Canyon and Buellton, about 13.6 miles to be graded and surfaced with plant-mixed surfacing. District V, Route 149, Section B,C. Calowell Construction Co., Long Beach, $336,694; Fredrickson & Watson Construction Co., Fredrickson Bros., Oakland, $343,336; W. E. Hall Co., Alhambra, $378,-150. Contract awarded to Griffith Co., Los Angeles, $302,948.

SANTA BARBARA COUNTY — Across Branch and Salisbury Canyons about 24 miles west of Maricopa, two bridges to be constructed. District V, Route 57, Section D. Flotation Systems, Inc., Los Angeles, $18,937; M. E. Whitney, Bakersfield, $19,-322; Bent Construction Co., Los Angeles, $20,216; Trewhitt, Shields & Fisher, Fresno, $20,501; C. B. Tuttle, Wilmington, $20,962; Dan Caputo, San Jose, $22,496. Contract awarded to Wm. E. Thomas Concrete Construction, Sacramento, $17,406.

SANTA CLARA COUNTY—Between 3½ miles east of Bells Station and Merced County line, about 2.8 miles to be repaired with crusher run base and armor coat. District IV, Route 32, Section C. Pacific Truck Service, Inc., San Jose, $24,412; W. C. Railing, Redwood City, $25,168. Contract awarded to Granite Construction Co., Watsonville, $23,855.

SHASTA AND SISKIYOU COUNTIES —Between Lamoine and Hilt Road, about 28.3 miles in length to be repaired with plant-mixed material. District II, Route 3, Section D,A,Dmr,M.Sha.,B,C. Contract awarded to Clements & Co., Hayward, $135,470.

SOLANO COUNTY—Between East City limits of Vacaville and Yolo County line, portions only, a net length about 10.8 miles to be repaired with plant-mixed material. District X, Route 7, Sections D,E. J. A. Casson Co., Hayward, $88,523; Phoenix Construction Co., Bakersfield, $88,747; A. Teichert & Co., Sacramento, $104,410; Louis Biasotti & Son, Stockton, $114,173. Contract awarded to McGillivray Construction Co., Sacramento, $86,878.

TEHAMA COUNTY—Reinforced concrete slab bridge to be constructed across South Fork of Dibble Creek about 3 miles west of Red Bluff. District II, Route 29, Section E. James H. McFarland, San Francisco, $4,963; Wm. E. Thomas Concrete Construction, Sacramento, $5,576; M. A. Jenkins, Sacramento, $5,762; Carlton C. Gildersleeve, Williams, $6,974; J. P. Brennan, Redding, $6,983; O'Connor Bros., Red Bluff, $7,321; Yancey Company, Sacramento, $11,081. Contract awarded to Jack Gilmore, Redding, $4,867.

VENTURA COUNTY—Route 60 between El Rio and Oxnard and Route 2 between North city limits of Ventura and Santa Barbara County line, portions only, about 7.5 miles to be repaired with plant-mixed material. District VII, Routes 60,2, Sections B,D,E,F,G. R. M. Price, Huntington Park, $60,915; Griffith Co., Los Angeles, $66,821; Vido Kovacevich, Southgate, $68,405; Oswald Bros., Los Angeles, $72,670; Basich Bros. Construction Co., Torrance, $76,960. Contract awarded to G. W. Ellis, North Hollywood, $60,315.

KINGS COUNTY—Between Houston Avenue (near Lemoore) and Hub, about 7.2 miles to be repaired by placing plant-mixed material and applying a seal coat. District VI, Routes 10, 125, Sections B,E. W. M. Stanfield Co., Los Angeles, $84,841; Phoenix Construction Co., Bakersfield, $73,342; Piazza and Huntley, San Jose, $77,727; Owl Truck and Construction Co., Compton, $89,790. Contract awarded to Warren Southwest, Inc., Los Angeles, $70,407.

EL DORADO COUNTY—Between Clarksville and Shingle Springs, about 5.2 miles to be repaired with plant-mixed material. District III, Route 11, Section A. A. Teichert & Company, Sacramento, $34,158. Contract awarded to McGillivray Construction Co., Sacramento, $33,846.

ALAMEDA COUNTY — Between Mountain House and Greenville, about 5.4 miles to be repaired with plant-mixed material. District IV, Route 5, Section E. Louis Biasotti & Son, Stockton, $47,305; J. A. Casson Co., Hayward, $47,690; Lee J. Immel, Berkeley, $48,410; Union Paving Co., San Francisco, $49,790; L. C. Smith, San Mateo, $53,984; Parish Bros., Sacramento, $57,680; Chas. L. Harney, San Francisco, $58,430; Marshall S. Hanrahan, Redwood City, $66,-470. Contract awarded to A. J. Raisch, San Jose, $41,054.

CONTRA COSTA COUNTY — Between northerly city limits of Richmond and Carquinez Bridge, portions only, about 9.7 miles to be repaired with asphalt concrete. District IV, Route 14, Sections A,Pin.,Her.,B. Louis Biasotti & Son, Stockton, $167,849; Lee J. Immel, Berkeley, $168,744; Piazza & Huntley, San Jose, $176,640; Parish Bros., Sacramento, $179,709; Union Paving Co., San Francisco, $188,699; Chas. L. Harney, San Francisco, $191,126. Contract awarded to A. J. Raisch, San Jose, $151,093.

FRESNO COUNTY — Between Merced County line and Firebaugh, portions about 7 miles in length to be repaired by the road-mix method and applying a seal coat. District VI, Route 41, Section M. A. Teichert & Co., Sacramento, $46,700; Phoenix Construction Co., Bakersfield, $50,205; Owl Truck and Construction Co., Compton, $53,190. Contract awarded to M. W. Stanfield Co., Los Angeles, $45,368.

KERN COUNTY — Between 6.6 miles northwesterly and 4 miles easterly of Mojave, portions about 8.2 miles in length to be repaired by the road-mix method. District IX, Routes 23,58, Sections B,AG. Basich Bros. Construction Co., Alhambra, $13,502; Oswald Bros., Los Angeles, $16,487; Arthur A. Johnson, Laguna Beach, $16,547; A. S. Vinnell Co., Alhambra, $17,633; Roland T. Reynolds, Anaheim, $21,734; Holman & Powell Paving Co., Los Angeles, $23,262. Contract awarded to Phoenix Construction Co., Bakersfield, $12,937.

LOS ANGELES COUNTY—Route 4 between Castaic Creek and Los Alamos Creek and Route 23 between Harold and Palmdale, portions only, a net length of about 9.8 miles to be resurfaced with plant-mixed surfacing. District VII, Route 4,23, Sections A,H,I & E. Southwest Paving Co., Roscoe, $95,433; Vido Kovacevich, South Gate, $99,848; R. J. Blanco, Los Angeles, $101,492; Basich Bros. Construction Co., Torrance, $102,750; Oswald Bros., Los Angeles, $113,010; Griffith Co., Los Angeles, $115,016; Pacific Rock & Gravel Co., Los Angeles, $136,230; Lewis Construction Co., Los Angeles, $139,118. Contract awarded to Schroeder & Co., Inc., Roscoe, $91,247.

SAN DIEGO COUNTY—Between Oceanside and Fallbrook, about 2.3 miles to be graded, portions to be surfaced with plant-mixed surfacing, bituminous surface treatment to be applied to other portions, and a reinforced concrete bridge to be widened. District XI, Routes 195,77, Section Oceanside, A,D. Basich Bros. Construction Co., Torrance, $127,567; Owl Truck & Construction Co., Compton, $139,645; Griffith Co., Los Angeles, $163,337; Calowell Construction Co., Long Beach, $175,660; Denni Investment Corp., Wilmington, $190,006; Rhoades Bros. & Shofner, Los Angeles, $222.-261; W. R. Dennis Construction Co., San Diego, $231,316; Bressi & Bevanda Constructors, Inc., Los Angeles, $240,244. Contract awarded to J. E. Haddock, Ltd., Pasadena, $127,251.

MONO COUNTY—Between McGee Creek and Crestview, portions, about 6 miles in length, to be repaired by placing road-mix surfacing over the existing bituminous surface. District IX, Route 23, Sections D,E. Phoenix Construction Co., Bakersfield, $10,-669; R. R. Hensler, North Hollywood, $11,-924. Contract awarded to Basich Bros., Torrance, $9,817.

KERN COUNTY — Between 13.5 miles south of Bakersfield and Famoso, about 16.7 miles of plant-mix surfacing to be placed. District VI, Route 4, Sections C,G,E. Union Paving Co., San Francisco, $111,204; Phoenix Construction Co., Bakersfield, $122,380; Basich Bros., Los Angeles, $124,282; J. E. Haddock, Ltd., Pasadena, $139,462; Brown, Doko & Baun, Pismo Beach, $139,739. Contract awarded to Griffith Co., Los Angeles, $104,387.

SAN MATEO COUNTY—On Industrial Way in South San Francisco, about 0.7 mile to be graded and surfaced with plant-mixed surfacing on crusher run base. District IV. L. C. Smith, San Mateo, $35,569; Chas. L. Harney, San Francisco, $36,707; Peter Sorenson, Redwood City, $40,879. Contract awarded to Union Paving Co., San Francisco, $32,331.

MONTEREY COUNTY — Portions between southerly boundary and King City, about 3.9 miles of plant-mixed surfacing to be placed. District V, Route 2, Sections I,H,G,F. Brown, Doko and Baun, Pismo Beach, $28,340; A. J. Raisch, San Jose, $33,-550; L. A. Brisco, Arroyo Grande, $35,193. Contract awarded to Granite Construction Co., Watsonville, $26,061.

ORANGE COUNTY — Between Galivan and Irvine, portions only, a net length of about 3.2 miles to be resurfaced with plant-mixed surfacing. District VII, Route 2, Section B. Pacific Rock & Gravel Co., Los Angeles, $27,673; Vido Kovacevich, South Gate, $29,389. Contract awarded to Sully-Miller Contracting Co., Long Beach, $22,555.

SANTA BARBARA AND SAN LUIS OBISPO COUNTIES—Between Santa Ynez River and San Luis Obispo, portions about 8.7 miles in length, plant-mixed surfacing to be placed. District V, Route 2, Sections D,C,B,F,E. L. A. Brisco, Arroyo Grande, $53,838. Contract awarded to Brown, Doko and Baun, Pismo Beach, $52,495.

TULARE COUNTY—At various locations totaling about 20.4 miles, plant-mixed surfacing to be placed. District VI, Routes 4, 10,133, Sections AF, B. A. Visalia. Griffith Co., Los Angeles, $146,798; Warren Southwest, Inc., Los Angeles, $151,358; George French, Jr., Stockton, $154,047; A. J. Raisch, San Jose, $156,479; Brown, Doko and Baun, Pismo Beach, $160,511; Basich Brothers, Torrance, $162,042; Pacific Rock and Gravel Co. & M. W. Stanfield Co., Los Angeles, $165,876; A. Teichert & Co., Sacramento, $174,492; A. S. Vinnell Co., Alhambra, $177,-095; J. E. Haddock, Ltd., Pasadena, $189,536; W. E. Hall Company, Alhambra, $207,282. Contract awarded to Piazza and Huntley, San Jose, $146,120.

SONOMA COUNTY—On Vallejo and Fresno Avenues, near Santa Rosa, about 0.9 mile to be graded and surfaced with plant-mixed surfacing on a crusher run base. District IV. Lee J. Immel, Berkeley, $45,520; A. G. Raisch, San Francisco, $46,513; Heafey-Moore Co., Oakland, $48,112. Contract awarded to C. M. Syar, Vallejo, $36,820.

MONTEREY COUNTY — Between Seaside Junction and North Reservation Boundary, about 4.7 miles to be graded and surfaced with armor coat on crusher run base. District V, Route 56, Section I. Granite Construction Co., Watsonville, $134,376; L. C. Karstedt, Watsonville, $153,597. Contract awarded to M. J. Ruddy & Son, Modesto, $119,485.

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