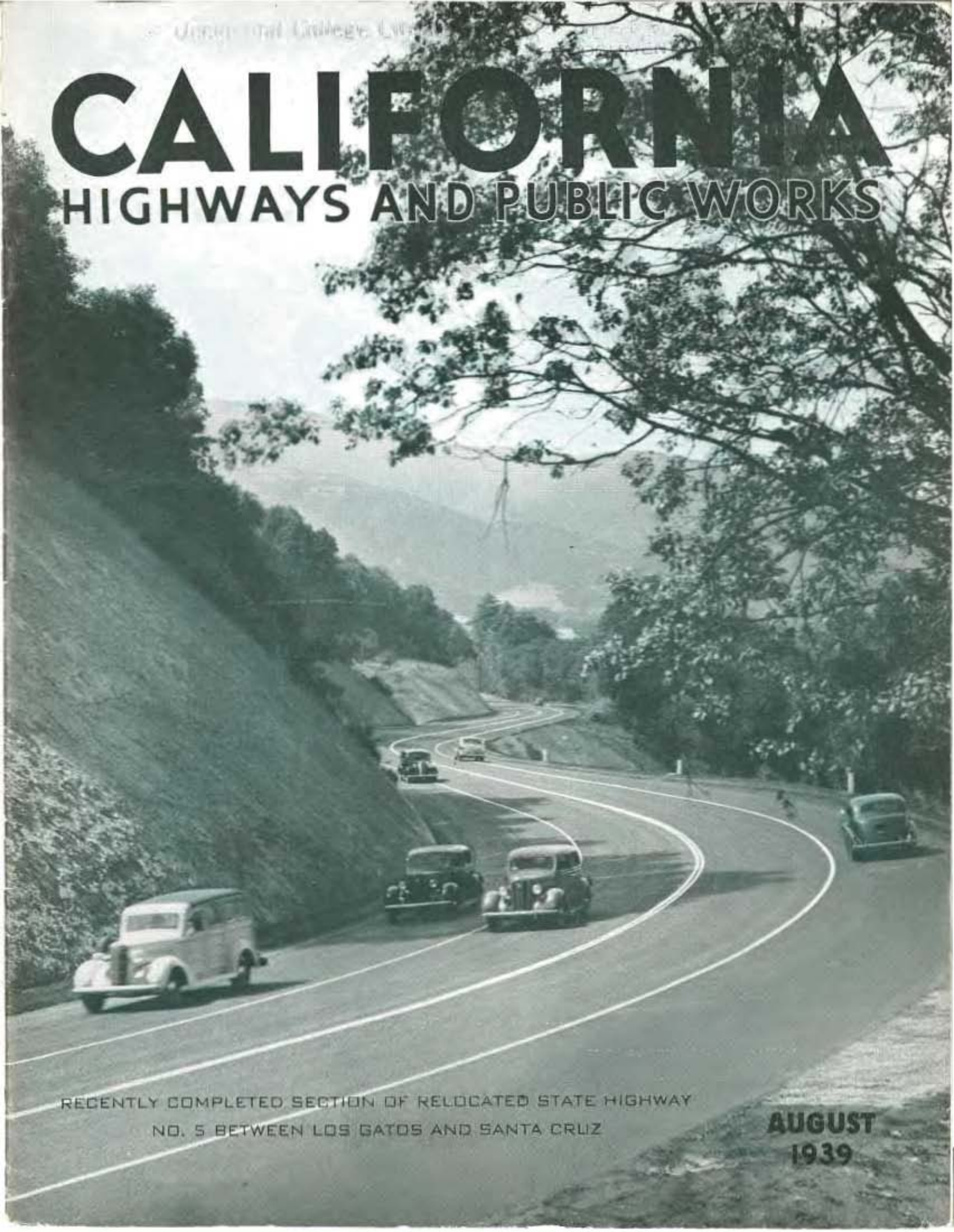
CALIFORNIA
HIGHWAYS AND PUBLIC WORKS



RECENTLY COMPLETED SECTION OF RELOCATED STATE HIGHWAY NO. 5 BETWEEN LOS GATOS AND SANTA CRUZ

AUGUST
1939

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

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

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Revised Budget Approved for Construction of Major Highway Projects During This Biennium

DIRECTOR of Public Works Frank W. Clark released on July 3d for publication the revised State highway budget for the current biennium which began July 1, 1939, and comprises the 91st and 92d fiscal years.

This budget, adopted by the California Highway Commission, is a revision of the one prepared by the former Highway Commission which was submitted to Governor Olson on January 7, 1939. While few changes have been made in the totals of funds needed for highway purposes as set up in the former budget, quite a number of changes were made in the list of projects in various counties.

The amount available in the new biennial budget after statutory deductions are made for major highway projects to be constructed throughout the State is approximately $28,000,000. This sum is allocated to some 200 items or projects of highway improvement as recommended by the Highway Commission after extensive studies and hearings and approved by Governor Culbert L. Olson.

The entire sources of revenue available for the construction, maintenance and operation of State highways to meet the situation set forth above are:

SOURCES OF REVENUE

1—The 3-cent gas tax from which the counties receive 1 cent, incorporated cities, ½ cent, and the State Highway Department 1½ cents.

2—One-half the net revenues of motor vehicle fees after providing for the maintenance of the Motor Vehicle Department and California Highway Patrol.

3—The use fuel tax, or Diesel tax, available only for bridge construction.

4—Regular Federal aid appropriated for the fiscal years 1940 and 1941 by Congress.

Funds Inadequate

In a recent address at the dedication of a realigned section of the Los Gatos-Santa Cruz Highway, Director of Public Works Frank W. Clark said:

"The State of California finds itself today in a somewhat difficult position with respect to its nearly fourteen thousand miles of State highways. This State, having been one of the first to undertake the task of providing its citizens and its thousands of visitors with facilities for motor travel, has created for itself a reputation throughout the nation for the quality and extent of its highway system. The steady improvement of this system which has been effected during the past quarter century has contributed immeasurably to the expansion of motor vehicle use both commercial and private.

"At the present time we are confronted with an ever-increasing volume of highway usage by individuals who demand that these facilities for travel be improved to even higher standards of safety and convenience.

"To meet these demands, however, funds available for the purpose have become increasingly inadequate. This circumstance is illustrated by the fact that for the next two years it is estimated that the total sum available for major construction projects will not exceed $28,000,000 whereas a conservative estimate of the amounts required at the present time to modernize the existing highway system in accordance with current traffic requirements would total $511,010,200.

Administration and special study costs for the next biennium are fixed at $3,600,000. The sum of $18,200,000 is set aside for highway maintenance, an increase of nearly $2,000,000 over the past biennium due to increasing maintenance costs resulting from excessive damage to the highways and to the reduction of Federal aid apportionments.

One-half cent gasoline tax allocations to cities is set at $16,000,000.

Estimated highway revenues from the gas tax, motor vehicle fees, use fuel tax, and Federal aid total $80,200,000. After deductions for administration and special study costs, the one-half cent allocated to cities and for highway maintenance, there will remain a balance of available funds for other purposes amounting to $42,400,000.

Distribution of this $42,400,000 to various purposes provided by statutes to the north and south county groups and to primary and secondary roads, shows the amount that will be available for major construction, not including minor improvements and betterments to be $28,000,000.

A serious situation confronting the State in the allocation of funds is the bridge problem. Through the addition to the State Highway System of some 6800 miles of county roads, by the Legislature in 1933, the State took over in excess of 1000 bridges, many of which, built in the early days, are of light construction and inadequate for present-day loads.

BRIDGES REQUIRE $11,000,000

About 400 of these bridges have been posted for limited loads and speeds because they are structurally inadequate to safely support legal loads. Many have reached the stage where reconstruction is imperative to assure a safe operation of vehicles. They are beyond maintenance operations.

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Hydraulicking Highway Cut 210 Feet Deep Through Mountain Completed. 10,748,000 Cubic Yards Moved

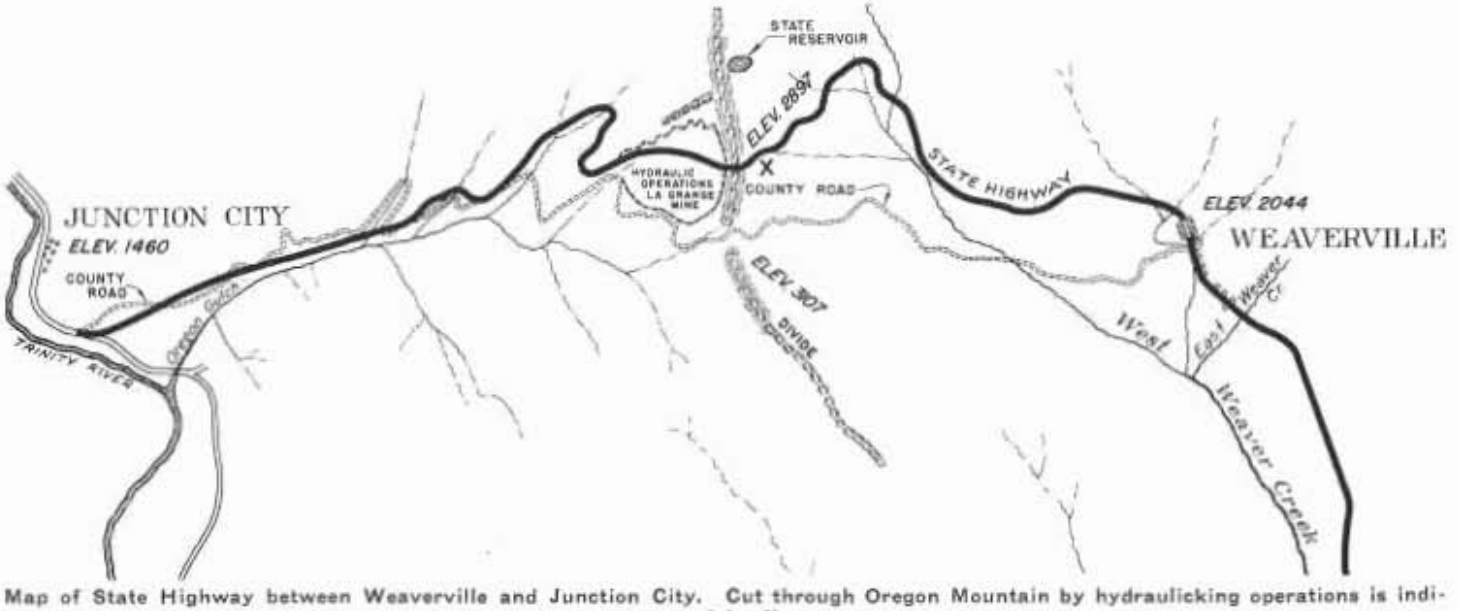
By F. W. HASELWOOD, District Engineer

STRICTLY according to a schedule set up in 1933, the hydraulic excavation of 10,748,000 cubic yards for a deep highway cut through the summit of Oregon Mountain in Trinity County was completed on June 30, 1939.

When the cut and the approaches to it from Weaverville and Junction City are completed early in 1940, by the crews of Convict Camp 25, the word "finis" will have been written to one of the longest stories involving highway routing.

The State Highways Act of 1915 contained this language: "An extension connecting the interior and coast trunk lines in Northern California through Trinity and Humboldt counties, by the most direct and practicable route." It was not until April 29, 1932, that the Highway Commission decided that this language definitely meant an extension of the existing county seat lateral from Weaverville, rather than a route from Douglas City, seven miles east of Weaverville, along the Trinity River to Junction City.

Two previous articles in California Highways and Public Works, one in the May issue of 1934 and the other in the May issue of 1935, discussed the problems placed on the highway engineers by this decision and the unique methods employed to solve them.



Map of State Highway between Weaverville and Junction City. Cut through Oregon Mountain by hydraulicking operations is indicated by X.

This article heralds the completion of a highway construction operation bold in its conception, unique in its execution and wholly effective in its solution of the difficult problem of securing a satisfactory high standard road with low maintenance cost through the barrier presented by Oregon Mountain.

The first survey over the mountain from Weaverville to Junction City was 10.5 miles long. It offered many severe handicaps to construction, to traffic and to maintenance, among which, as recited in engineering reports, were excessive distance, tortuous alignment on long sustained grades with no prospect of future improvement, deep cuts in unstable formations and a road on shady north slopes through a heavy snow area.

THROUGH THE MOUNTAIN

Out of the necessity of providing "the most direct and practicable route" came the conception of a road through the mountain rather than over it. From 1862 to 1918 the hydraulic mining operations of the LaGrange mine, involving the movement of 100,000,000 cubic yards, had actually removed a large part of Oregon Mountain, although the saddle through which the road would pass to take advantage of the mine excavation was still intact. Likewise, on the north slope of the mine west of the

View of hydraulic giant working on highway excavation in Oregon Gulch. White dash line shows highway grade through cut at summit.

View from summit of Oregon Mountain looking down over proposed highway grade indicated by white line. Hydraulic giant at work in circle.

summit and in motion on the tilted bedrock plane, was a loose mass of several million cubic yards of non-gold-bearing earth and rock. This slide was one of the reasons for the suspension of mining operations in 1918.

If this slide were removed and a deep cut were made through the mountain, the advantages would be a saving in distance, a reduction in the amount of adverse grade and a road on the sunny slope in stable formation throughout.

Quite obviously, no method heretofore employed in highway construction could be used for such a project, since the initial guesses on the quantity to be moved ranged from ten to twenty million cubic yards. A study of hydraulic mining costs revealed that material had been moved for as little as 2 cents per cubic yard and that there were many operations where the cost did not exceed 2.5 cents.

WATER SYSTEM ACQUIRED

The LaGrange Mine had originally been operated by water from Stuarts Fork and Rush Creek, tributaries of the Trinity River, conveyed through 29 miles of flume, ditch, tunnel and syphon. This conduit was then out of order and would have required an excessive sum for restoration. Fortunately, the LaGrange had acquired an auxiliary system known as the Sweepstakes, which secured water from the drainage areas of East and West Creeks. This system of about 12 miles in length, consisted of six miles of 30-inch riveted steel pipe and six miles of ditch and flume. It could be restored to deliver about 35 second feet for a nominal sum.

The LaGrange equipment available for use consisted of five hydraulic giants from 7- to 9-inch nozzles, much hydraulic pipe ranging from 26 to 15 inches in diameter, and considerable miscellaneous equipment and fittings. On top of this the LaGrange was willing to lease the Sweepstakes system, its water rights and equipment for the period required to complete the excavation for a highway cut. In addition, the LaGrange would provide free use of all of their holdings, including dumping rights in Oregon Gulch and West Weaver Creek.

$100,000 ALLOCATED FOR ROAD

In the budget for the biennium beginning July 1, 1933, $100,000 was allocated for the road from Weaverville to Junction City. It was not until late in November, 1933, that final details were worked out with the LaGrange and approval was received to proceed with the work.

Unfortunately, this delayed authorization required construction of a 3,750,000-gallon reservoir in the wettest period of the year, so that actual hydraulic operations were delayed until February 28, 1934, with a loss of half the seasonal runoff.

The first setup of the giant on the tilted bedrock plane on the north side of the mine, with the intention of following this plane as far as possible through the cut. The plane was followed for several hundred feet but was eventually lost under hard, overlying masses that were not in motion, could not be cut with water and therefore did not need to be removed.

When work was started it was the conclusion in the district that from 10,000,000 to 12,500,000 cubic yards would have to be removed. When hard stable masses were found above the bedrock plane, the lower estimate was accepted as more probable.

NEW TECHNIQUE LEARNED

It was necessary for the engineers to learn a new technique in discussing excavation, such as duty, per cent of carry, static and kinetic head and

Partially graded highway approaching hydraulic cut through Oregon Mountain from west. The cut is 2000 feet wide, 2500 feet long, 210 feet deep at top.

Roadway in Oregon Gulch built with hydraulic tailings. Log cribs, fence and brush were used to control deposit of tailings.

other terms common to hydraulic mining. To a miner, the duty of water means the number of cubic yards of material removed per miner's inch in 24 hours. The per cent of carry was better understood by engineers, and references were generally in terms of the ratio of cubic yards of solids removed to the cubic yards of water used.

The regulating reservoir of about 18,500 cubic yards capacity was constructed at elevation 3445. The high point of the road grade in the cut is 2897.

OPERATION OF GIANTS

Water was discharged into the reservoir from the 30-inch steel pipe through a Parshall measuring flume by which a continuous record of the flow was kept. Discharge was through a hand-operated gate through an open ditch leading to the penstock that served the giants. Static heads of from 120 to 263 pounds per square inch were available for the giants, but these heads were frequently reduced by allowing the penstock to be only partly full. Generally, the kinetic or operating head at the giant ranged from 99 to 204 pounds per square inch.

Giants with nozzles from 7 to 9 inches in diameter were used. The operating period with a full reservoir ranged from 1.5 to over 3 hours, depending on the number of giants operated and the rate of inflow. This rate varied during the operating period from 1 to 36 second feet, the latter being the capacity of the Sweepstakes supply system.

The rate of flow through the giants varied with the head and the size of nozzle. Flows at the rate of 50 to 55 second feet were common. With 55 second feet of water being discharged through a 9-inch nozzle, the velocity is 126 feet per second. With the 7- and 8-inch nozzles, velocities up to 170 feet per second have been recorded.

The hydraulic season at the start of the operation was from October 15 to July 15 and was subsequently reduced by agreement and by statute to from December 1 to July 1. The purpose of this limitation is to prevent pollution of the water in the Trinity River during a specific period. Actually, the lack of water from July to December provides the same limits of the operating season.

Experienced monitor men or pipers, many of whom had worked in the LaGrange, were employed to operate the giants. During most of the operating season, night shifts were employed as no water could be wasted. Electric searchlights provided the illumination. Telephone connection was provided from the giants to the reservoir and to the intake on East Weaver where a caretaker was stationed.

Spoil was discharged west into Oregon Gulch and east into West Weaver. During the work on the east side, it developed that better progress could be made by use of powder in the hard barrier that crossed the line of the cut. Consequently, a powder tunnel some 600 feet long was dug along centerline and grade, and in the tunnel and pockets excavated from it some 40 tons of 5 per cent powder were loaded. The resulting blast loosened great masses of material and, as the work proceeded, the waste channel cut back along the centerline of the tunnel.

One of the major uncertainties was the south side of the cut which was presumed to be all soft material consisting of clay, gravel and boulders in various proportions. It was assumed that this material would stand if sloped back so that the banks did not crumble from their own weight, but there was no certainty as to how it would behave.

Stripping of the south side began in May of this year. It soon developed that several hard formations were encountered, all sloping toward the centerline and being apparently faulted or uplifted portions of a cemented sand or gravel deposit. The existence of these formations limited the amount of stripping to be done and not only assured stability of the south slope but permitted completion of the stripping this season, an accom-

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Santa Monica Grade Separation Project Solves Coast Route Problem

By S. V. CORTELYOU, District Engineer

THE Colorado Avenue grade separation, in the city of Santa Monica, in Los Angeles County has been designed by the State Division of Highways and will be constructed during the next nine months under a cooperative PWA contract by the city for the purpose of relieving one of the most congested and hazardous intersections on the Roosevelt Highway along the coast, which is one of the most heavily traveled highway routes in the State.

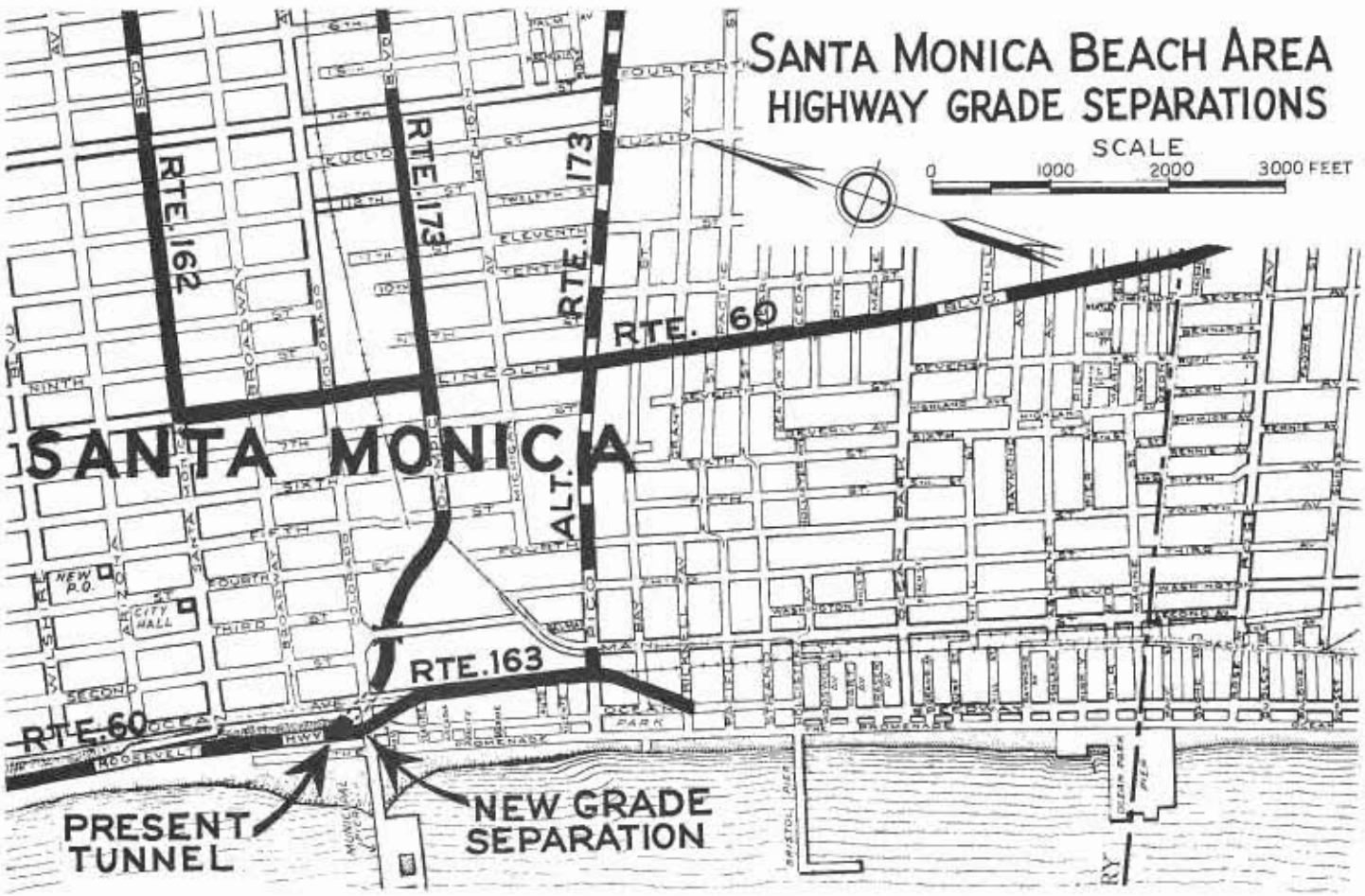
The volume of traffic at this intersection will increase very materially with the improvement of sections of the Coast Highway extending southeasterly from the Colorado Avenue intersection.

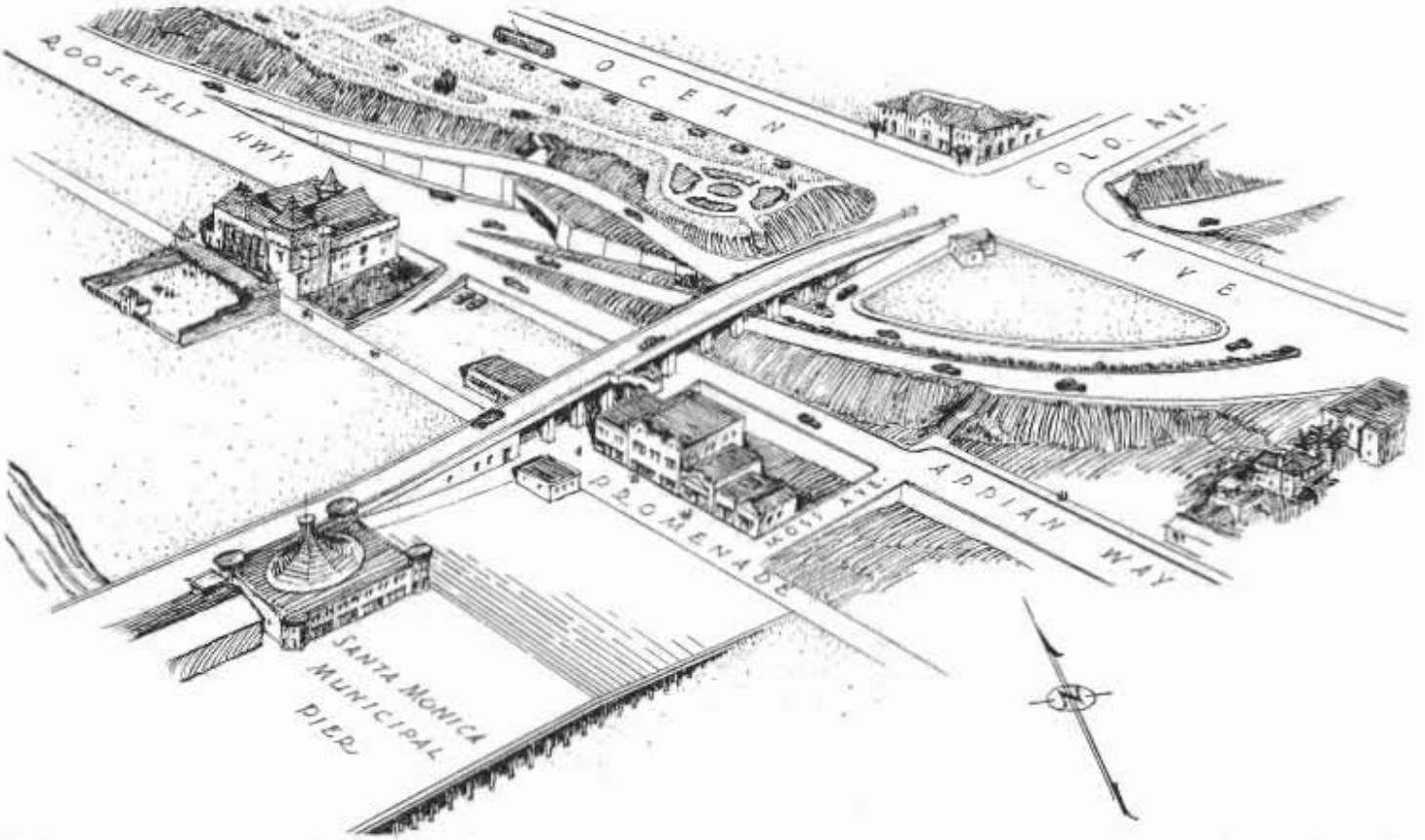
Officially known as State Highway Route 163, the highway closest to the ocean front runs southerly from Colorado Avenue to Venice. It was designated as a State highway route in 1933, and is officially described as extending "from Route 60 (Roosevelt Highway) at a point near Colorado Avenue in Santa Monica to a connection with Windward Avenue in the city of Los Angeles."

Its general purpose is to provide a highway closely following the ocean front from Santa Monica to the Venice area in the city of Los Angeles as Route 60 southerly from Colorado Avenue follows Lincoln Boulevard which is some distance inland.

The first State money available for the improvement of Route 163 was $100,000 set up in the State highway budget for the 1937-39 biennium.

The intersection of Colorado Avenue with State Highway Routes 60 and 163 is located at one of the most highly developed beach areas on the entire coast. Colorado Avenue is an important traffic street extending from the east city limits westerly and crosses Ocean Avenue as well as Routes 60 and 163 to the Santa Mon-





Sketch of Colorado Avenue grade separation project in Santa Monica showing 650-foot bridge structure carrying traffic to the municipal pier over the Coast Highway and several connections permitting free access to congested beach areas.

ica Municipal Pier. This pier affords landing facilities for the Santa Monica Yacht Harbor with its many pleasure boats and fishing barges, and provides an area for numerous amusement concessions.

Sunday crowds using these facilities during the summer months run from 25,000 to 30,000 persons, many of whom drive directly on to the pier with their cars. The fact that a large proportion of these cars must cross the Roosevelt Highway (Route 60) and also Route 163 has brought about a major traffic problem.

Much of the congestion was relieved by construction of a tunnel by the State in 1935 which carries Route 60 traffic under Colorado Avenue and Ocean Avenue to connect with Lincoln Boulevard and points southerly. To complete the solution of this traffic problem, the State in cooperation with the city of Santa Monica, the county of Los Angeles and the U. S. Public Works Administration is proposing to construct the Colorado Avenue grade separation.

The present project including the extension of the existing tunnel and appurtenant ramps and road connections will

1. Provide direct vehicular and pedestrian connection with the Santa Monica Municipal Pier via Colorado Avenue, by which traffic will be carried over Route 163, the Roosevelt Highway and the connection to Appian Way.

2. Permit an uninterrupted flow of traffic on the Roosevelt Highway across Colorado Avenue and Ocean Avenue to its connection with Lincoln Avenue.

3. Give access to the ocean front in the Ocean Park area to southbound traffic on the Roosevelt Highway via Ocean Avenue (Route 163) without crossing Colorado Avenue at grade.

4. Provide access (via Appian Way) from the Roosevelt Highway by connection which will pass under the Colorado Avenue Bridge to the highly developed beach area immediately south of Santa Monica Pier.

5. Permit a free interchange of traffic by means of suitable one way ramps and road connections between the major traffic arteries which converge in this small area.

To accomplish these results a reinforced concrete bridge having an overall length of 650 feet will be built along Colorado Avenue from Ocean Avenue to the pier. This structure will carry two traffic lanes and two four-foot sidewalks. The grade will be elevated sufficiently at the crossings of Route 163 and the Appian Way connection to permit these two roads to pass underneath.

A one-way two-lane ramp will carry southbound traffic on Roosevelt Highway wishing to continue southerly on Route 163, from a point near the present tunnel entrance, under the Colorado Avenue structure up to a connection with Ocean Avenue, whence it will follow southerly along Ocean Avenue and other connecting streets to the Ocean Park area.

From this same location near the tunnel entrance, a two-lane road will continue southerly along the ocean front, passing under the Colorado Avenue structure and connect with Appian Way and the beach area immediately southerly of the pier.

Northbound traffic on Ocean Avenue (Route 163), wishing to continue northerly along the Roosevelt Highway (Route 60) will use a two-lane ramp passing under the Colorado

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With roadway widened and curves eliminated convenient parking areas are provided on State Route 15 along the north shores of the Blue Lakes.

Lakes Highway Reconstructed

By J. C. BLACK, Associate Highway Engineer

THE Tahoe-Ukiah Highway, State Route 15, is rapidly developing into one of the most important cross laterals in the State Highway System. About fifteen miles east of Ukiah in Lake County this highway follows along the north shores of Laurel Del Lake and Blue Lake, widely known as the "Blue Lakes" for their beauty and recreational features.

Motorists will be pleased to know that the old narrow, winding highway along the lakes has been reconstructed and that the new road eliminates fourteen curves and 590 degrees of angle in a distance of two miles.

In order to secure a modern standard of alignment, it was necessary to construct the new road across several arms of the lakes. Soundings taken during the design period of the project indicated that suitable foundation could be obtained for the embankments across the lake arms if several feet of very soft mud and peaty matter was displaced. The soundings also showed that the stable foundation material sloped quite steeply downward from the lake shore and then flattened out to an approximately horizontal plane.

To accomplish the displacement of the mud it was proposed to begin the construction of the embankments by end dumping from the shore and, as the embankment built up, to extend the embankment out into the lake. It was believed that the weight of the new material would displace and push the soft material ahead of it and that the bottom of the new embankment would rest on stable material.

This method was followed during construction. The first embankment across a lake arm was constructed of material consisting of shale and clay. When the top of the fill had reached an elevation of about ten feet above the water line, the entire embankment slid into the lake.

Soundings taken in the lake showed that the embankment had displaced most of the mud and that a reef had been formed out in the lake. It appeared from these soundings that the reef would act as a support for a new embankment. The embankment was, therefore, reconstructed, using rocky material in the bottom portion. To insure maximum settlement the embankment was surcharged by depositing material above grade. This material was left in place for several days, and no additional settlement occurred.

After the experience obtained from the first fill construction, rocky material was used in the base of all of the other lake embankments except one. No rock was available for the fill between Station 96 and Station 99, and the fill failed the day following its completion. It was necessary to

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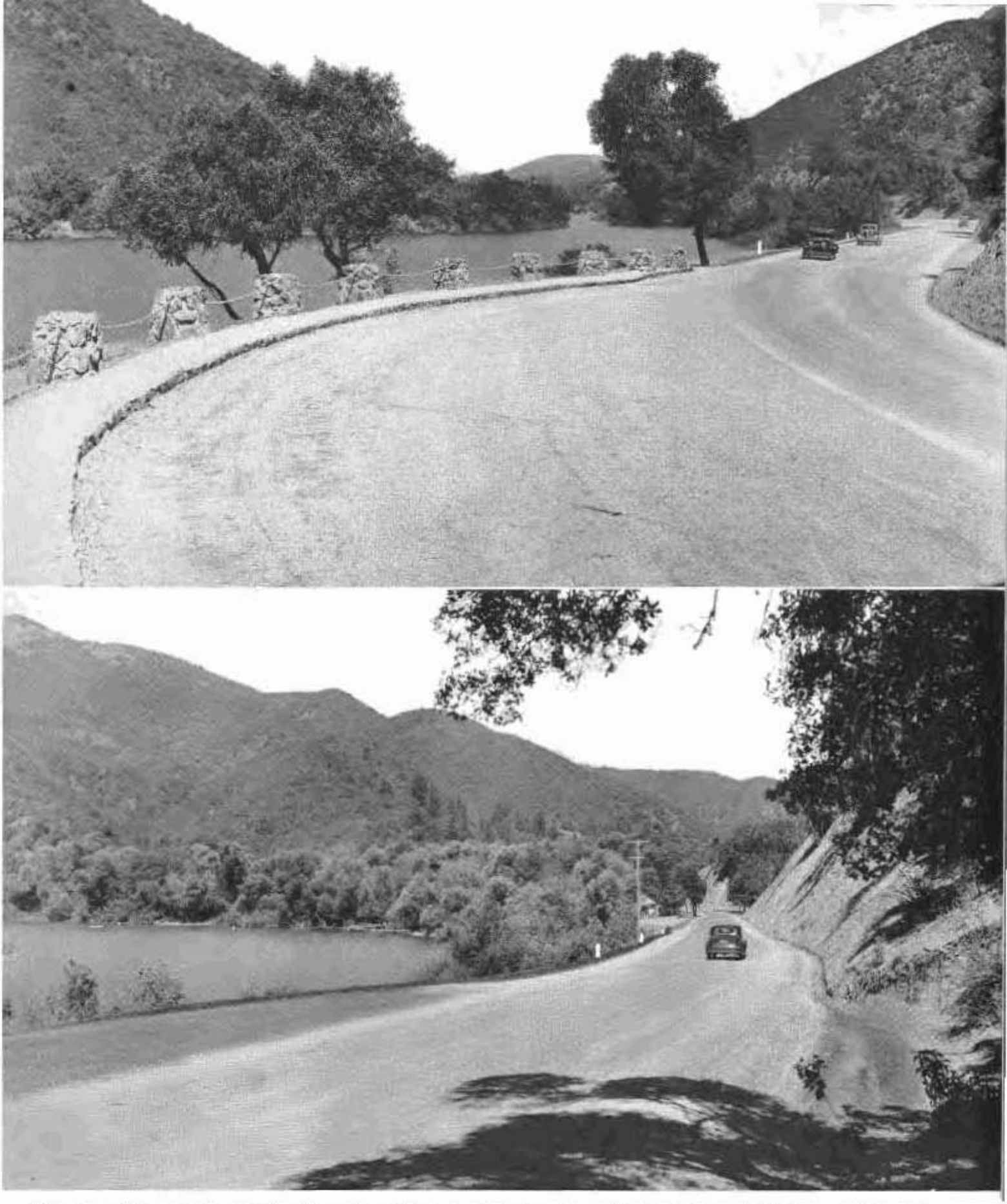


Two views of the recently reconstructed section of State Route 15 along the north shores of Laurel Del Lake and Blue Lake generally known as the "blue lakes" in Lake County. Fourteen curves were eliminated in a distance of two miles and parking areas constructed at vista points.

Bank Protection by Fence Types, Tetrahedrons and Jackstraws

By G. A. TILTON, Assistant Construction Engineer

The first installment of an article on bank protection and revetment published in the July issue of this magazine covered general conclusions of a state-wide survey made after the severe storm damage of December, 1937, and February-March, 1938. Class "A" revetment and facing types constructed on prepared bank slopes, were covered in that first installment. This concluding installment describes Class "B" fence types requiring no prepared bank slopes and Class "C" permeable flexible types including tetrahedrons and jackstraws. Newer and untested types developed subsequent to the 1938-9 storms are also described.

FENCE bank protection installations suffered varying degrees of damage along with all other types in the above mentioned storms. On streams with sand-silt beds subject to moderate scour, they were particularly successful where so located as to permit fulfillment of two prime functions.

The first function is that of a training jetty to direct the flow of a meandering stream and concentrate it away from the toe of a bank slope during the rising stage.

Fence types are limited in height and are generally over-topped at flood. It is at this stage that the second and more important function of fence types is performed. At overflow, scour diminishes on the front face of the fence and increases on the bank slope. With the current next to the bank on the outside curve of a stream flowing in a downward and diagonal direction, greatest scour occurs low down at the bottom of the bank. Fence types located at the toe of bank slopes tend to interrupt this downward flow and dissipate it in a horizontal direction over the top of the fence.

Steel Rail and Wire Fence (cable-connected)

This type of installation in double or triple rows consists of 30-foot 60-pound steel rails spaced 12 feet center to center and driven to a penetration of 20 to 24 feet. Rows of rails are spaced 5 feet apart and connected on the face and back with five ¾-inch wire cables and two widths of 58-inch galvanized woven wire. Between the rows of rails, a filler consisting of alternate layers of brush and rock, or rock only, is placed so that it will settle when scour occurs. Transverse cables tie the top of rails together.

Weakness in steel rail and wire fence was found to lie in its top-heaviness. The downward scouring flow on the bank back of the fence tends to undermine the installation and at the same time lodge debris and sloughing slope material against the back side, causing it to topple over streamward.

To correct this condition, improvements now provide for lateral spurs from the main fence to the bank slope at frequent intervals. For further stability, the top of the rail fence is anchored to the bank slope with ¾-inch cables and concrete blocks on 12-foot centers.

Improvement in the design also provides for a brush and rock fill wire mesh basket between the rows of rail fence that adjusts to scour intact.

Costs of the improved designs of steel rail fence with wire mesh at the time of this writing approximate $3.40 per lineal foot for a single row, $6 to $10 for double fence, and $13.20 per lineal foot for triple fence.

Iron Pipe and Wire Fence

The light types of pipe fence bank protection consist of 2 rows of pipe and wire mesh. Galvanized pipe 2 inches in diameter 10 feet long are spaced 5 feet center to center and driven to 5 feet penetration. Rows are spaced 5 feet apart, braced longitudinally and transversely with 2-inch pipe and faced with one width of 58-inch woven-wire mesh. Between the rows of pipe and wire mesh, alternate layers of rock and brush are placed so as to settle into scoured sections.

Improvements in the light-pipe fence design provide for horizontal lateral pipe braces across the top in place of lateral diagonal braces. The diagonal braces have a tendency to hold up the rock and brush backfill and prevent it from settling into scoured section. Fire breaks of rock, only, have also been found to be desirable at frequent intervals.

Timber Fence

Types of fence incorporating untreated timber proved generally unsatisfactory due to rotting at the ground line. For types that incorporate timber or piles, treated material is highly desirable.

PERMEABLE FLEXIBLE TYPES

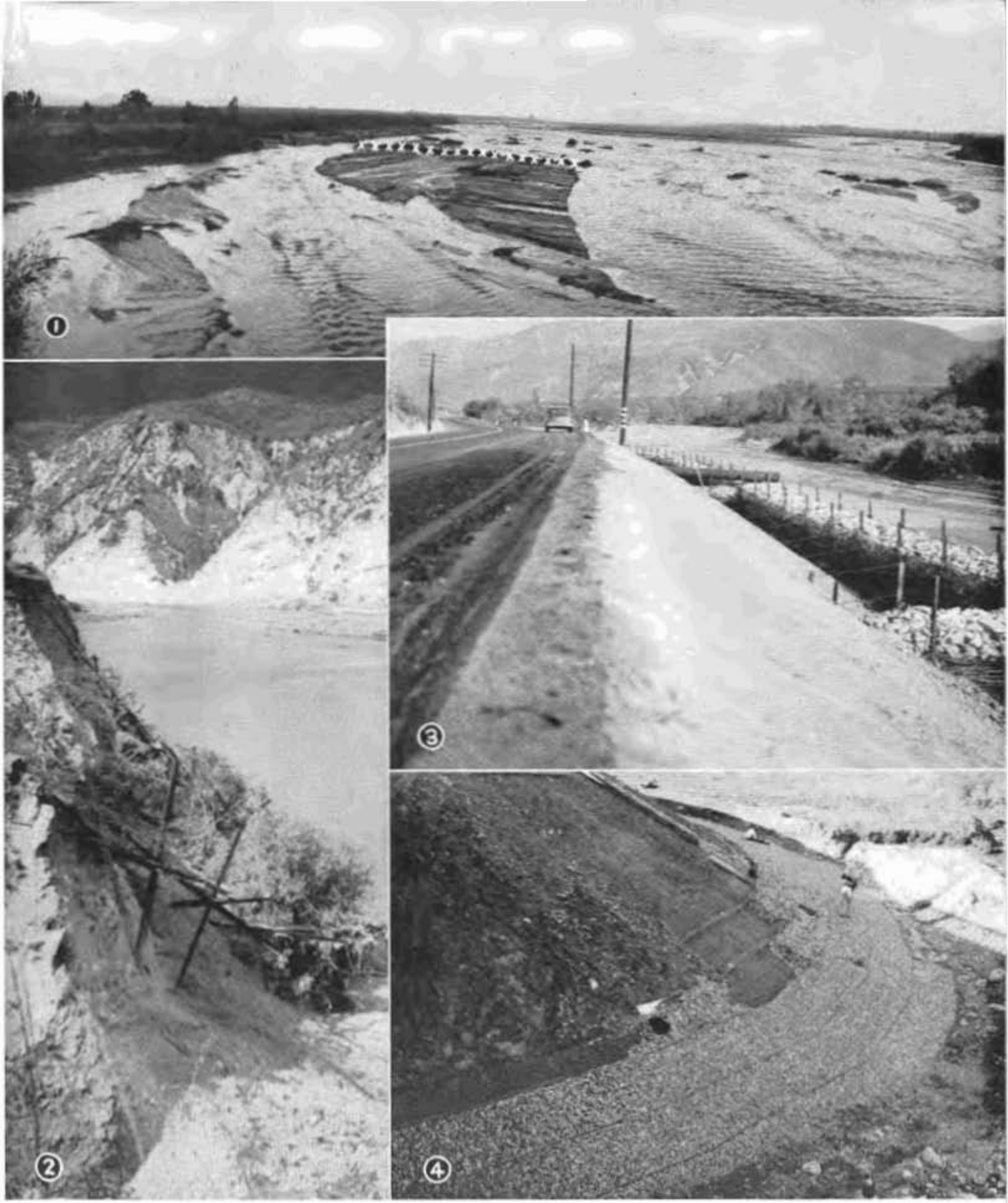
Steel Tetrahedrons

Cable-connected steel tetrahedrons and steel jackstraws evidenced sufficiently satisfactory service to warrant greater use.

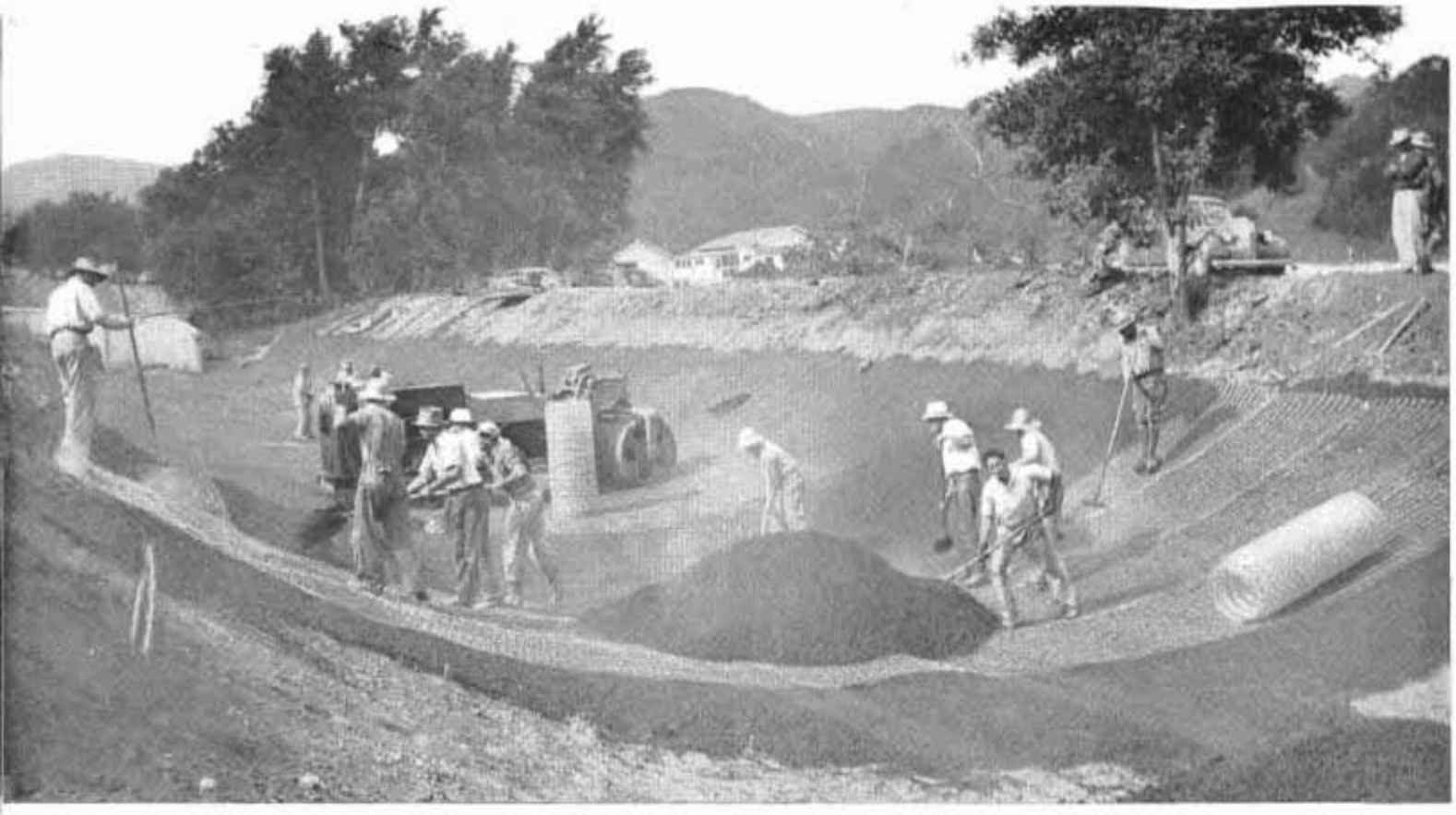
The primary function of the permeable type of bank protection, particularly when used as a jetty, lies in the collection of light drift and retardation of the stream velocity so as to cause deposition of a bar of sand and silt on the downstream side.

The jetties should be of sufficient height to cause formation of a bar deep enough to protect the toe of the bank slope.

Success of this type of bank pro-



Picture No. 1 shows bar formed below steel tetrahedron jetty indicated by X line. 2—Cable connected jackstraws used to stop bank erosion. 3—Steel rail and wire fence backfilled with rock and brush. 4—Wire mesh and rock mattress.



Placing reinforced concrete channel lining on Santa Clara River near Saugus in Los Angeles County.

tection is dependent upon the degree of permeability which in turn is affected by the size and amount of drift carried by the stream. Jetties with too great a solidity, tend to scour under the center and at the outer end.

The cost of 30-foot steel rail tetrahedrons approximates $120 to $125 each, or $4.10 per lineal foot of installation including anchors. The smaller 15-foot steel rail tetrahedrons average around $50 to $60 each, or $3.60 per lineal foot including anchors.

Concrete Tetrahedrons

Reinforced concrete tetrahedrons tend to settle rapidly in a sand-silt streambed and become increasingly ineffective.

Jackstraws

Jackstraws used as permeable jetties gave equally as satisfactory service as the steel tetrahedrons.

The successful use of steel jackstraws as an emergency bank-protection measure was outstanding. To stop or retard caving banks at flood periods, two or more jackstraws cabled together and anchored to safe ground are thrown over the bank into vulnerable spots. The result is a stub jetty pointing downstream that collects drift at toe of the slope; retards the downward flow along the bank, and retards further undermining of the bank. Use of the steel jackstraws for this purpose has proven so successful on one major stream in California that county authorities have adopted the plan of storing steel jackstraw members ready for quick assembly and placement where needed at flood periods. This plan is favored by the county over that of constructing permanent installations that may or may not be effective the following season where a wandering stream frequently changes its course.

Fifteen-foot jackstraws cost approximately $20 to $25 each, or $1.50 to $1.80 per lineal foot of installation, including anchors.

IMPROVED DESIGNS

At locations of vital importance where the sandy nature of the streambed is subject to deep scour at flood periods such as to preclude safe use of ordinary revetment types, a type has been developed that consists of a cutoff wall of steel sheet piling 32 feet long backstayed to the bank and supporting reinforced concrete slope paving.

Cost runs from $40 to $50 per lineal foot and is warranted only in the most important places.

Wire-Mesh Revetment

Several installations of wire-mesh revetment have been constructed to protect embankment slopes of bank-run rock. Wire mesh consists of No. 9-gauge galvanized chain-link fencing in 96-inch widths, tied together to revet the slope. The bottom is weighted down with 90-pound steel rails, and the mesh is anchored to the bank with ¾-inch steel bar reinforcement.

The above installations were constructed in 1938-9 and have not as yet had a real test.

Cost runs from 13¢ to 20¢ per square foot.

Rock Riprap

At locations where clean graded rock riprap proves to be the economical type and rock of only fair quality is obtainable, grouting of the lower portion of the riprap appears to merit further use.

In the light of the devastating 1937-8 storms in California, and considering the flashy peak flows of most California water courses, bank-protection measures are taking their place as one of the more important highway engineering considerations.

Vicar—"I never have christened a child so well behaved as yours."

Mother—"Well, you see, sir, for the past week I have been getting him used to it with my flower sprinkler."—*Answers.*

Members of the California Highway Commission, grouped about Director of Public Works Frank W. Clark seated in center are: (left) Lawrence Barrett, chairman; (right) Bert L. Vaughn. Standing, left to right, Secretary Byron N. Scott; Iener W. Nielsen; Amerigo Bozzani; L. G. Hitchcock.

Revised Budget of Major Project Allocation for Biennium Approved

(Continued from page 1)

It is estimated that $11,000,000 is necessary for reconstructing such unsafe bridges within the next few years, and the State is faced with a total expenditure of more than $30,000,000 to replace ultimately all of these inadequate structures.

Revenues derived from the use fuel tax or the Diesel tax assigned by statute to this purpose, are far from sufficient to reconstruct those bridges in immediate need of improvement. It was, therefore, necessary to make a substantial allocation to such bridge projects.

The allocations shown by counties in the tabulations on pages 14-16 totaling $33,471,172 also include right of way costs and one-quarter cent gasoline tax apportionments to cities where improvement projects within the city limits already are programmed.

A report has also been submitted by Director Clark to Governor Olson covering the work of the Division of Highways during the previous biennium which ended June 30, 1939.

The construction and maintenance work put under way between July 1, 1937, and June 30, 1939, totaled the sum of $75,621,400.

Construction		
Contracts	$31,508,700	
Miscellaneous day labor	3,200,100	
Day labor minor improvements	811,200	
Day labor betterments	942,300	
Prison labor construction	1,675,400	
Engineering	5,440,300	
Right of way	4,920,900	
Construction subtotal		$48,498,900
Day Labor Maintenance		
General maintenance	$9,927,400	
Replacements	3,758,300	
Major slide removal	4,648,700	
Buildings and plants	205,000	
San Francisco-Oakland Bay Bridge operation and maintenance	780,000	
Maintenance subtotal		19,319,400
One-quarter cent apportionments to cities for State highway routes in cities	[a]$7,803,100	
		$75,621,400

[a] Note.—An equal amount not included in this report was apportioned to cities for improvement to streets other than State highway routes.

The following tabulation gives the mileage and amounts provided for the various types of highway construction for which contracts were awarded:

Type	Miles	Amount
Grade and pavement	190.2	$7,755,800
Grade and plant mixed surface	221.8	4,728,700
Grade and road mixed surface	179.4	4,375,700
Oiled gravel surface	521.1	1,793,500
Untreated gravel surface	22.5	92,400
Graded roadbed only	85.0	2,348,800
Dust oiling	84.7	333,100
Shoulder treatment	84.4	61,900
Bridges and grade separations	(176)	9,515,100
Miscellaneous contracts		503,700
Total contracts		$31,508,700

This program was financed by State and Federal funds.

Major Project Allocations in Revised Budget for C

Items and amounts in parentheses indicate projects lie in two counties that will share the expenditure allocation.

County	Route	Location	Approximate mileage	Proposed expenditure for construction and right of way
Alameda	69	6th and Fallon to Fruitvale Avenue	2.4	$860,000
Alameda	107	Near Niles	1.0	111,000
Alameda	108	Sunol to Livermore (portions); Arroyo del Valle Creek		63,000
(Alameda-San Francisco)	5-68	San Francisco-Oakland Bay Bridge (see San Francisco)		(1,000,000)
Alpine	23	Centerville Bridge	0.3	35,000
Amador	97	Jackson Creek Bridge and Approaches	1.5	85,250
Butte	3	South Boundary to Biggs Road	7.4	81,000
Butte	3	Pine Creek to 0.1 mile north of North Boundary	0.5	21,000
Butte	3	17 Bridges between Marysville and Chico		22,500
Butte	87	Campbell Overflow Bridges and Approaches	0.2	18,700
(Butte-Glenn)	45	1 mile east Cherokee Canal to Sacramento River	10.0	75,000
(Butte-Yuba)	87	½ mile south to ¾ mile north Butte County Line (see Yuba County)	1.3	(150,000)
Calaveras	24	At Lime Creek	0.8	33,500
Calaveras	65	San Andreas to Angels Camp (portions)	3.4	171,350
Colusa	15	Long Bridge to Colusa	2.4	90,000
Colusa	15	3.4 miles east Williams to Long Bridge	2.4	25,000
(Colusa-Yolo)	50	Cache Creek Bridge northerly (portions)		75,000
Contra Costa	106	Muir Station to Junction Route 14 (portions)		65,000
Del Norte	71	Smith River Bridge and Approaches		270,000
El Dorado	11	Upper Truckee River Bridge and Approaches	0.3	42,500
El Dorado	11	2 miles east Phillips to 3 miles west Meyers	2.3	18,000
(El Dorado-Sacramento)	11	3½ miles east Folsom to 2 miles east Clarksville (see Sacramento)	5.5	(295,000)
Fresno	4	Fowler to Selma	5.0	204,000
Fresno	41	1 mile north to 1½ miles south Firebaugh; 2 canals (portions)	2.9	61,200
Fresno	41	Squaw Valley to Forest Boundary	3.0	153,000
Fresno	41	Boyden's Cave to Deer Cove	9.0	20,000
(Fresno-Madera)	125	San Joaquin River Bridge and Approaches	2.0	235,000
(Glenn-Butte)	45	1 mile east Cherokee Canal to Sacramento River (see Butte County)	10.0	(75,000)
Humboldt	1	North Scotia Bridge—Eel River	0.7	497,000
Humboldt	1	Robinson Ferry Bridge—Eel River	1.0	671,500
Humboldt	1	At Stegemeyer Bluff	0.4	10,000
Humboldt	1	Elks Creek Bridge near Miranda		51,000
Humboldt	46	Klamath River Bridge at Orleans		159,000
Humboldt	46	Weitchpec to Orleans (portions)		81,000
(Humboldt-Trinity)	20	Willow Creek to White's Bar (portion) (see Trinity County)		(240,000)
Imperial	12	Mountain Springs to Meyer's Creek Bridge	5.3	350,000
Imperial	26	Central Main Canal Bridge		15,000
Imperial	27	East Highline Canal to Gray's Well	24.5	250,000
Imperial	202	3 miles east Calexico to East Highline Canal	8.4	42,000
Inyo	23	Olancha to Cottonwood Creek	9.5	97,000
Inyo	23	3.3 miles north Alabama Gate to Independence	7.0	73,750
Inyo	23	2 miles south of Big Pine to Big Pine	2.0	34,850
Kern	4	Ft. Tejon to foot of Grapevine Grade (portion)		260,000
Kern	23	5 miles north Rosamond to Mojave	7.8	94,190
Kern	23	12 miles north Mojave to Ricardo	13.6	62,630
Kern	58	Keene to Cable (portions)	5.0	366,000
Kern	58	Bear Mountain Ranch easterly	5.0	20,000
Kern	125	Westerly boundary to northerly boundary	5.1	125,000
Kern	142	Beardsley Avenue to Southern Pacific Railroad		145,000
Kern	58	Route 143 to Sivert	7.1	165,000
(Kern-Tulare)	129	Bakersfield to Ducor (portions)		110,000
Lake	49	Putah Creek to Route 15 (portions)		102,000
Lake	15	Clover Creek and Middle Creek Bridges		31,500
Lassen	28	Pit River and Overflow Channels—Bridges		81,000
Lassen	29	Milford to Doyle (portions)	6.0	112,000
Lassen	73	Madeline to North Boundary (portions)	5.3	27,500
(Los Angeles-Ventura)	2	Ventura Boulevard; Calabasas to Conejo Grade (portions)		237,500
Los Angeles	2	Ventura Boulevard, Sepulveda to Topeka		126,500
Los Angeles	4	San Fernando Road, Pacoima Wash Bridge and Approaches		36,500
Los Angeles	2	East Cahuenga Boulevard, Highland to Barham (portions)		150,000
Los Angeles	60	Walnut Canyon to Winter Canyon (portions)	6.0	320,000
Los Angeles	23	Placerita Canyon to Solamint	3.5	350,000
Los Angeles	9	San Gabriel River Bridge Approaches		25,000
Los Angeles	205	Arroyo Seco Parkway (portions)		2,135,000
Los Angeles	26	Ramona Boulevard; Mission Road to West Covina (portions)		760,000
Los Angeles	26	Aliso Street separation at Mission Road		220,000
(Los Angeles-Ventura)	79	Castaic Junction to Santa Paula; Santa Paula and Piru Creek Bridges		300,000

Construction of Highways in 91st-92nd Fiscal Years

Items and amounts in parentheses indicate projects lie in two counties that will share the expenditure allocation.

County	Route	Location	Approximate mileage	Proposed expenditure for construction and right of way
Los Angeles	172	3d Street; East city limits to Repetto Avenue	1.7	$280,000
Los Angeles	175	Strawberry Street; Artesia Avenue; Alameda to Normandie (portions)		220,000
Los Angeles	162	Santa Monica Boulevard; La Brea to Fairfax (cooperative)		40,000
(Los Angeles-Orange)	166–174	Firestone-Manchester Boulevard (portions)		500,000
Los Angeles	61	Angeles Crest Highway; Cloudburst Summit to Mt. Islip		480,000
Los Angeles	161	Colorado Boulevard and El Modena; east city limits west		94,000
Los Angeles	156	Topanga Creek Bridge and Approaches		24,000
Los Angeles	165	Figueroa Street, 135th to 153d Street		32,500
Los Angeles	165	Figueroa Street, Gaffey Street to Wilmington Road		4,500
Los Angeles	166	Figueroa Street, Diamond to Second Street		334,000
Los Angeles	173	Olympic Boulevard (portions)		950,000
Los Angeles	159	Lankershim Boulevard; Bridge across Los Angeles River		220,000
Los Angeles	162	Rowena Avenue; Glendale Boulevard to Hyperion		32,300
Los Angeles	158	Sepulveda Boulevard; Ventura Boulevard to Gamut Street		258,500
Los Angeles	158	Sepulveda Boulevard; Gamut Street to Brand Boulevard		137,000
Los Angeles	159	Lankershim Boulevard; Burbank Boulevard to San Fernando Road		63,000
Los Angeles	157	Foothill Boulevard, at Cobalt		5,400
Madera	4	North Boundary to 2 miles south	2.0	47,000
Madera	4	Madera to ½ mile south Cottonwood Creek; Bridge	2.9	200,000
Madera	125	Friant-Madera Road to ½ mile north Kelshaw Corners	10.9	60,000
(Madera-Fresno)	125	San Joaquin River Bridge and Approaches (see Fresno County)	2.0	(235,000)
Marin	1	Grand Avenue in San Rafael to San Quentin Wye	1.6	869,000
Mariposa	18	Mariposa to 2.5 miles north	2.5	113,750
Mendocino	1	Outlet Creek to Reeves Creek	4.5	47,000
Mendocino	1	Crawfords Ranch to Ukiah; Robertson Creek	7.0	384,000
Mendocino	1	Haegneys to Bridges Creek Slide	1.1	99,000
Mendocino	16	Russian River Bridge		121,000
Mendocino	48	Flynn Creek to Navarro; Lazy Creek, Yorkville (portions)		101,500
Mendocino	56	Russian Gulch Bridge		172,500
Merced	4	Merced to Black Rascal Creek; Bear and Black Rascal Creek	1.5	254,500
Merced	4	South Boundary to 2.6 miles north	2.6	76,900
Merced	18	Merced to 5 miles east (portions)	5.0	80,000
Merced	32	7 Bridges east of Los Banos		46,000
Modoc	28	4 miles north Rush Creek to Pit River	7.7	280,000
Mono	40	East Boundary Yosemite Park to Gardisky's	2.5	68,000
Mono	96	Route 23 at Bridgeport to Nevada State Line		30,000
Mono	13	West Walker River Crossing to Route 23; 2 Bridges	2.3	75,050
Mono	111	4 miles south of Grant Lake to Grant Lake	4.0	69,850
Mono	13	Leavitt Meadow, Soda, Silver and Wolf Creeks		17,250
Monterey	2	South Boundary to Bradley; Salinas River Bridge	7.3	627,900
Monterey	2	2 miles south Greenfield to Soledad Bridge (portions)	5.0	198,300
Monterey	56	South Boundary to Sur River (portions)		80,000
Monterey	56	Big Sur River Bridge		51,500
Napa	102	Route 6 to Capell Valley	3.2	75,000
Nevada	37	Donner Summit to ¼ mile west of Donner Lake	1.0	36,000
Nevada	17	½ mile south to 1.7 miles north Rattlesnake Creek	2.2	131,000
(Nevada-Placer)	37	Hampshire Rocks to ½ mile west Soda Springs (see Placer County)	6.3	(75,000)
(Nevada-Placer)	38	Tahoe City to Truckee Wye (portions) (see Placer County)	14.6	(61,000)
Orange	184	Main Street Extension; Route 60 to Route 43; Newport Bay Bridge	6.4	200,000
Orange	43	Santiago Creek Bridge on Tustin Avenue		55,000
Orange	179	Through Garden Grove; Nutwood Avenue to Ninth Street	0.9	20,000
Orange	64	Route 2 to ½ mile easterly	0.5	47,000
(Orange-Los Angeles)	166–174	Firestone-Manchester Boulevard (portions) (see Los Angeles County)		(500,000)
(Placer-Nevada)	37	Hampshire Rocks to ½ mile west Soda Springs	6.3	75,000
Placer	37	Colfax Overhead to 0.7 miles north	0.7	55,000
Placer	17	Roseville to 0.6 mile east	0.6	17,500
(Placer-Nevada)	38	Tahoe City to Truckee Wye (portions)		61,000
Placer	39	Tahoe Wye through Tahoe City	1.0	15,000
Riverside	26	Junction Route 19 to 8th Street, Banning	5.8	213,025
Riverside	26	Banning to Junction Route 187	11.6	489,775
Riverside	19	Riverside to 3 miles west	3.0	231,000
Riverside	77	Temescal Canyon and Horse Thief Creek and Approaches	1.0	86,200
Riverside	64	10 miles west of Hemet	3.5	59,500
Riverside	64	½ mile east Junction Route 146 to Blythe	2.2	63,000
Sacramento	3	American River to North Sacramento at Underpasses		44,000
(Sacramento-El Dorado)	11	3½ miles east Folsom to 2 miles east Clarksville	5.5	295,000
Sacramento	11	Isleton to Walnut Grove	8.0	87,500
(Sacramento-San Joaquin)	53	Potato Slough to Mokelumne River and Bridge (see San Joaquin County)	5.0	(576,000)
San Benito	22	San Benito River Bridge		12,000
(San Benito-Santa Clara)	2	Sargent Overhead to 0.3 miles south Pajaro River; Pajaro River and S. P. R.R. Separation (see Santa Clara County)	1.9	(314,000)

Major Project Allocations Budgeted for Construction of Highways

(Continued from page 15)

Items and amounts in parentheses indicate projects lie in two counties that will share the expenditure allocation.

County	Route	Location	Approximate mileage	Proposed expenditure for construction and right of way
San Bernardino	26	Redlands easterly (portions)	1.6	$95,200
San Bernardino	9	Lytle Creek Bridge		25,000
San Bernardino	9	Malaga Grade Separation		15,000
San Bernardino	43	Santa Ana River Bridge		83,500
San Bernardino	190	Power House to Igo	3.0	106,400
San Bernardino	188	Mt. Anderson to Crestline	1.0	78,200
San Diego	12	West of La Mesa Overhead to El Cajon	4.6	284,000
San Diego	2	Las Flores Underpass to San Onofre Overhead	7.2	15,000
San Diego	195–78	Lake Henshaw to Santa Ysabel	7.9	501,500
San Diego	2	International Boundary to 1 mile north San Ysidro	2.9	203,000
San Diego	198	San Diego River Bridge at Lakeside		187,000
San Diego	199	Coronado Heights line change	0.5	32,500
San Francisco	56	Funston Avenue Approach to Golden Gate Bridge	1.5	255,000
(San Francisco-Alameda)	5–68	San Francisco-Oakland Bay Bridge		1,000,000
(San Joaquin-Sacramento)	53	Potato Slough to Mokelumne River and Bridge	5.0	576,000
(San Joaquin-Stanislaus)	110	Vernalis to Gates Road	7.6	140,000
San Joaquin	97	East of Clements to 1.5 miles north; Mokelumne River	1.5	103,300
San Luis Obispo	2	Miles Station Bridge and Approaches	1.5	295,200
San Luis Obispo	56	Santa Maria River Bridge		12,000
San Luis Obispo	56	Old Creek Bridge and Approaches	0.8	53,400
San Luis Obispo	56	Torro Creek Bridge and Approaches	0.5	45,500
San Mateo	68	South San Francisco to Burlingame-Structures		40,000
San Mateo	2	Broadway-Redwood City to South Boundary	4.5	511,800
San Mateo	56	Tunitas to Lake Lucerne (portions); San Gorgonio, Pompino, Pescadero Creek Bridges	6.0	340,000
Santa Barbara	2	Orella to Taliguas Creek; Refugio Creek	2.6	276,000
Santa Barbara	2	Zaca to 3 miles south; Zaca Creek	3.2	304,900
Santa Barbara	2	Eagle Creek and Dos Pueblos Creek and Approaches	1.2	153,600
Santa Barbara	2	Sheffield Drive to San Ysidro Road	1.2	235,000
Santa Clara	5	Oaks to Los Gatos	1.6	353,500
(Santa Clara-Santa Cruz)	5	Inspiration Point to The Oaks		100,000
(Santa Clara-San Benito)	2	Sargent Overhead to 0.3 miles south Pajaro River	1.9	314,000
Santa Clara	42	Austin Corners line change	1.3	115,000
(Santa Cruz-Santa Clara)	5	Inspiration Point to The Oaks (see Santa Clara County)		(100,000)
Santa Cruz	56	Watsonville to Rob Roy Junction	7.3	485,000
Shasta	3	Pacific Highway relocation at Shasta Dam	11.6	430,000
Shasta	3	Olney Creek Bridge		15,000
Shasta	3	S. P. Subway to Hill Street	2.0	123,000
Siskiyou	3	Bailey Summit to State Line	1.4	150,000
Siskiyou	72	Route 3 at Weed to 1.5 miles north	1.5	71,000
(Solano-Yolo)	6	North of Dixon to 1 mile east Davis; Putah Creek	7.8	385,500
(Solano-Sonoma)	208	Sears Point Toll Road payments		85,602
Sonoma	1	Walls to junction Stony Point Road	3.2	323,000
Sonoma	56	Russian Gulch line change and Bridge	0.8	61,000
Sonoma	56	Timber Cove Creek Bridge and Approaches	0.3	18,000
(Sonoma-Solono)	208	Sears Point Toll Road payments (see Solano County)		(85,602)
Stanislaus	4	South Approach Turlock Overhead	0.3	11,500
Stanislaus	4	Keyes to Hatch Crossing	6.0	321,250
(Stanislaus-San Joaquin)	110	Vernalis to Gates Road (see San Joaquin County)	7.6	(140,000)
Tehama	7	Proberta to Red Bluff Subway; Oat, Coyote and Red Bank Creek	6.2	270,000
Tehama	3	Red Bluff to 5 miles north; Dibble, South Fork Blue Tent Creek	5.0	270,000
(Trinity-Humboldt)	20	Willow Creek to Whites Bar (portions)		240,000
Trinity	20	Oregon Mountain and Helena to Weaverville (portions)	15.0	183,000
Tulare	4	Kings River Bridge to North Boundary	1.3	62,700
Tulare	10	West City Limits Visalia to Route 10	1.3	103,000
Tulare	135	Tule River Bridge and Approaches		22,000
(Tulare-Kern)	129	Bakersfield to Ducor (portions) (see Kern County)		(110,000)
Tuolumne	13	Keystone to Jamestown (portions)	4.0	50,000
Tuolumne	65	Columbia Wye to Sonora; Woods Creek Bridge	2.5	174,000
Ventura	2	Springville to Beetox (portions)	2.0	79,000
Ventura	60	Point Mugu to Little Sycamore Creek (portions)		185,000
(Ventura-Los Angeles)	2	Ventura Boulevard; Calabasas to Conejo Grade (portions) (see Los Angeles County)		(237,500)
(Ventura-Los Angeles)	79	Castaic Junction to Santa Paula; Santa Paula and Piru Creek Bridges (see Los Angeles County)		(300,000)
Ventura	2	Bluffs north of Seacliff		45,000
Yolo	6	West end Causeway Structure		75,000
Yolo	6	1 mile east of Davis to Swingle	3.0	200,000
Yolo	7	Woodland to Cache Creek	3.7	152,000
Yolo	90	Madison to Dunnigan (portions)	4.0	101,500
(Yolo-Solano)	6	North of Dixon to 1 mile east of Davis (see Solano County)	7.8	(385,500)
(Yolo-Colusa)	50	Cache Creek Bridge northerly (portions) (see Colusa County)		(75,000)
Yuba	15	0.3 mile west Bruce's Corners to Dry Creek	1.1	34,500
(Yuba-Butte)	87	½ mile south to ¾ mile north Butte County Line (see Butte County)	1.3	150,000

Planting and cultivating extensive right of way on Coast Route State Highway 56 with ice plant to prevent erosion.

Practical Roadside Development

By H. DANA BOWERS, Landscape Engineer

HIGHWAY landscaping has been the recipient of much criticism of a various and sundry nature, some of which has justification. It is to be noted, however, that the constant demand for improved roadside appearance, together with the apparent economic value of properly applied landscape features, is steadily becoming more noticeable in general highway construction.

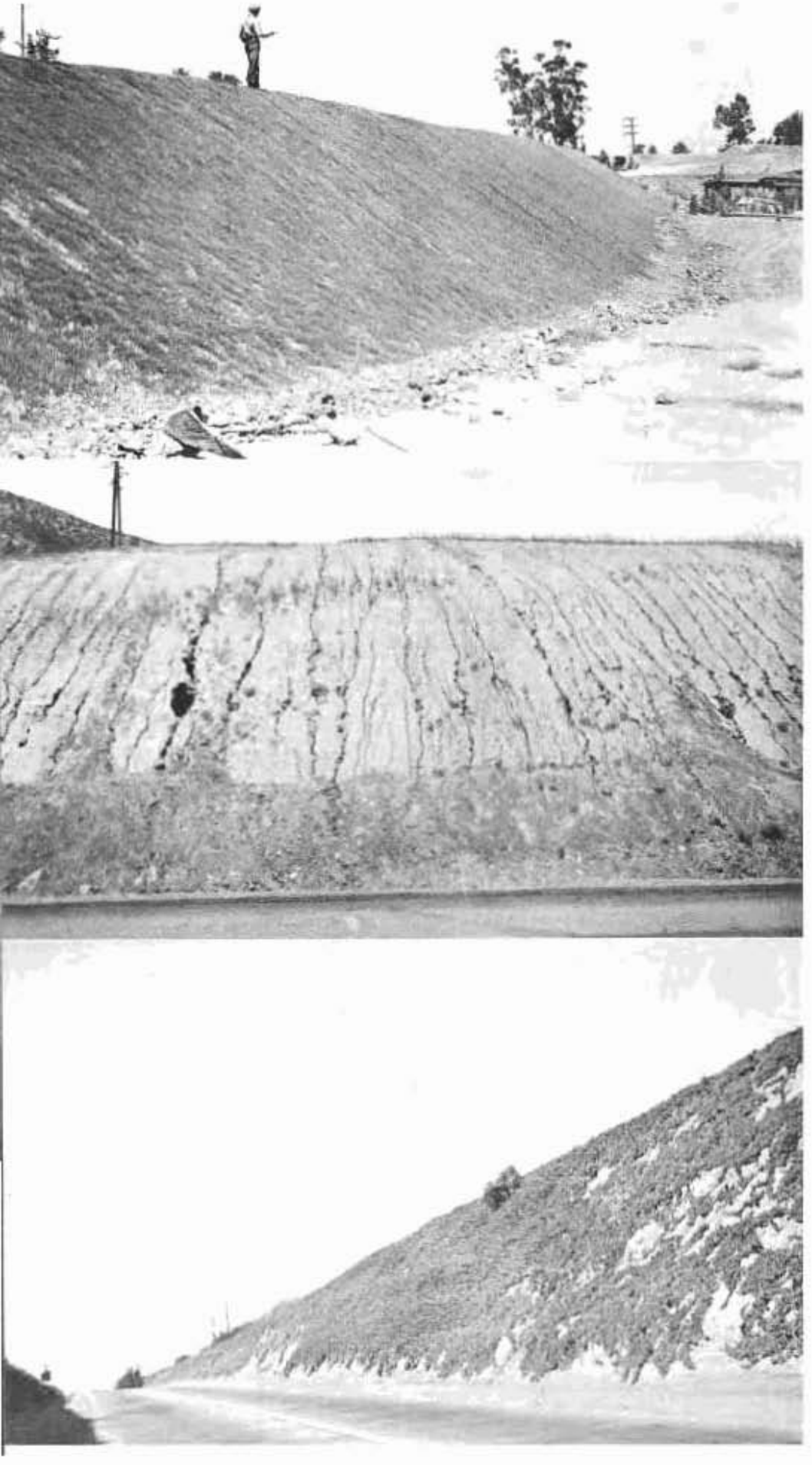
Following some ten years of trial, the original conception that roadside development, or "roadside beautification" as it was commonly termed and consisting principally of the planting of trees, shrubs and flowers, is gradually being discarded for the broader, more appropriate and practical concept of roadside development which strives for a more harmonious setting of a necessarily formal roadway into the contours of the landscape.

During the past years we have learned more of the physical and economic limitations of roadside development. We can not compare our State highways with parks or backyard gardens. The fact that Mrs. Jones has a most beautiful display of flowering peaches in her yard flourishing "with no care at all," is no criterion for their general use along roadsides. The same applies to wild flowers and many other varieties of plants. Nature designated certain locations and conditions for various types of growth. When deviations are made from these natural laws, unlimited maintenance not possible on the highway must be available, or these plants soon fade away.

The average commercial State highway can not be compared to State or Federal park roads, for strange as it may seem, even though we may deal with much the same class of people that use the park roads, the use of State highways is under entirely different conditions. It is not surprising to see a tourist mother bathe her baby or do the family washing in a State highway drinking fountain. Yet acts of carelessness such as these are a rarity in our Federal and State parks, probably because the majority of the people that visit these parks are not necessarily of a more appreciative nature and therefore more considerate of the efforts made for their convenience and pleasure, but because they are more impressed and familiar with the more obvious recreational facilities they encounter in a concentrated park development than on a landscaped highway.

The Division of Highways is continually requested both by private and civic bodies to increase activities in all phases of roadside development. Of course the opportunity to provide many types of roadside development is fully recognized. Beautiful picnic spots with sanitary conveniences, and small roadside parks, some with facilities for bathing and boating, could be developed. However, many of those making such requests have but little conception of the magnitude of such an undertaking and are aware of few of the problems and the expense involved.

There is the question, too, whether the State Division of Highways, whose duties are definitely pre-



New cut slopes on the Arroyo Seco Parkway in Los Angeles are grass seeded immediately to get a coverage protection against erosion by early rains. Center—One rain, the first of the season produced this extensive bank erosion. Bottom—Ice plant is protecting this previously badly eroded slope in Solomon canyon.

scribed by law, can properly engage in activities that are primarily a park problem. Mainly, however, the cost of continual cleanup and repair of damage, caused by a careless few, prohibits at the present time any ventures into such a field of roadside improvement.

In general, very little planting is or should be necessary where favorable conditions exist, for there natural coverage usually flourishes. We are often reminded of the fine planting work accomplished by many of the eastern states, but it should be remembered that the ample summer rainfall that prevails in the East makes irrigation seldom needed, whereas in this State plant life develops slowly unless constantly fertilized and watered. Even the use of native vegetation, under the most favorable conditions, is often discouraging and brings criticism because of the years required before any effect is evidenced.

In view of these facts, the Division of Highways has curtailed endeavors along the line of prolific and formal planting and is concentrating on the more basic principles of roadside improvement. It is not always necessary to "gild the lily," for after all we have a naturally beautiful landscape in California, and a road fitted to that landscape needs very little further adornment.

Principally we have one objective in the improvement of highway appearance and that is—harmony. A road blending into the natural contours and covered with endemic vegetation can evoke little criticism from a landscape viewpoint. Harmonious construction, however, is excellent in theory and looks well in the artist's sketch book, but it can easily be carried beyond practical limits. There is much involved in the construction of highways that is of more importance than appearance alone.

To consider that adequate and safe transport lanes can be provided without searring the landscape is futile. True, there is always a location, if

such is sought, which offers a minimum of scar, but considering the general terrain in this State, plus the demand for higher standards of alignment, grade and road width, some scar is inevitable and even the minimum is apt to be inharmonious.

Since the quest for harmony has an economic limitation, we must be satisfied to strike an agreeable medium and proceed on that basis. It then becomes a matter of sensible roadside landscaping to heal those scars, for if this is not done, any efforts or expense to which we may have gone during construction for the sake of harmony will have been wasted.

The practice of flattening and rounding cut-and-fill slopes which definitely make the road a part of rather than an addition to the landscape has an economic as well as an aesthetic value. An appreciable decrease in maintenance costs in many cases can result from such procedure. However, flattening alone is not sufficient to bring about this saving.

NECESSARY TO PREVENT EROSION

To expose a flat sterile surface to the elements only invites increased erosion. Although it is true that flat surfaces will revegetize more rapidly than steep surfaces, it is essential that some effort be made to aid nature in an early restoration by providing a seed bed of top soil for the protective cover that is so necessary.

In doing this we will have accomplished an important item of work and will have regarded a basic factor in our quest for harmony; namely, the laying of the ground work for the prevention of erosion and for improved appearances.

Often supplementary seeding of low growing grasses is necessary, depending upon the source and condition of the top soil used for the seed bed.

It is most important that the seed be germinated prior to the first rains in order to provide a cover for protection against early storms.

It is not always wise to depend upon the first rains sprouting a protective grass cover since they may be of such magnitude as to completely wash away the entire seed bed. It is apparent that every condition presents its own problem and must be dealt with accordingly.

One of the greatest advantages in the conservation of top soil, aside from the economy of preventing erosion, is the amazing rapidity with which it is possible to realize complete revegetation. The top few inches, or "seed coat," nearly always contain large quantities of seeds of endemic plant life. A natural and quick growth can be obtained in this way at small original cost and with no expensive follow-up cost for maintenance.

Blanketing a sandy slope with top soil spread from above with tractor equipment.

It may be truly said that more appropriate and practical roadside landscaping can be accomplished with a power shovel and a few trucks for one day than will be produced by planting and maintaining trees and shrubs over the same area for one year. Likewise a few more loads of dirt and a few more hours with grading equipment will do more to camouflage unnatural lines than several years of imported plant growth.

A structure will have a high aesthetic value if it truly represents the purpose for which it is built. This is demonstrated in the flowing and simplified lines of our bridges; beautiful because of their simplicity and lack of unnecessary adornment. The same line of reasoning, while probably not in so strict a sense, can be applied to roadside development. It is desirable, from an aesthetic standpoint, to accentuate the pleasing, or obscure the objectionable features of the landscape.

TWO PRACTICAL PROCEDURES

This should be accomplished in a simplified and natural manner either by proper road location and consideration of appearances and subsequent maintenance during construction, or by artificial planting, or by both as the conditions require.

The two basic requirements that govern equally an economic and aesthetic plan of highway landscape design may be listed in order of their importance and value as:

1. *Cross Section.* The original roadway cross section design represents the foundation upon which an economic-aesthetic landscape plan may be fabricated. Flat slopes properly treated solve the vegetation

Protective cover produced on sandy slope by seeded thin topsoil blanket.

problem which in turn solves the erosion problem, and the two combine to help solve an important maintenance problem.

In addition to its economic-aesthetic value, the flattened cross section has a definite worth and function as a traffic safety measure. Improved sight distance, shallow and broader drainage channels, elimination of slide debris and greater parking area represent a few of the safety advantages.

The cross section combined with the revegetation of construction scars affords the only method of returning the roadway, which in spite of its necessity violates the normal contours of the landscape to a more acceptable appearance in the natural setting and thus makes it the focus of a design for enhancing the charm of nature, instead of diminishing it.

TOP SOIL BLANKETS

2. *Protective Cover.* Newly exposed slope surfaces are sterile and slow to revegetize. *Constant erosion prohibits the establishment of protective cover by natural means.*

A fertile top soil blanket provides a natural growing condition, and vegetation whether imported or native is given a better chance for survival against the elements.

Whenever natural growth is removed, nature at once assumes the task of restoration, in harmony with the climate and species of the particular region. The operation is slow and more often without success where natural seed dissemination must reclaim a sterile or constantly disturbed surface, but it is comparatively rapid when the soil is not destroyed.

Even under the most favorable conditions natural revegetation is too slow to afford protection against excessive runoff or erosion. Obviously, then it becomes highly practical to supply the much needed protection by artificial means accomplished in a natural manner. By so doing results that would normally take several years may often be secured in one.

It is singular that these seemingly common sense principles of construction are being brought to the fore of late, not so much from an economic standpoint, as one might expect, but from the standpoint of roadside appearance. It would naturally appear that the reverse of this fact should be true.

Highway landscaping is often looked upon and tolerated as a necessary evil rather than a functional constituent of highway development. There is much of value aside from the aesthetic to be derived from highway landscaping. Unfortunately, inexperience in past procedure has tended to create a wrong interpretation of the work involved; however, we are now endeavoring to illustrate the practicability of properly applied economic-aesthetic roadside improvement in our landscaping projects.

A second installment of this article by H. Dana Bowers, landscape engineer of the Division of Highways will appear in a following issue of this magazine.

Fine Roads Await Motor Visitors to 1939 State Fair

WHEN Governor Culbert L. Olson greets the crowds at the State Fair in Sacramento this year, September 1 to 10, inclusive, they will find smooth, dustless roads and walks that have been practically repaved by the State Division of Highways.

Working with funds provided under an arrangement with the Department of Finance and the State Agricultural Society, the highway division added $15,575 in improvements to the roads and pathways of the fair.

The principal improvement consists of the reinforcement of all areas by the use of SC4 plant-mixed surfacing material, in most instances one inch compacted.

In weak areas two inches of the material was used in bringing to grade trenches which had settled and in patching potholes throughout the grounds preparatory to sealing.

In spots previously unsurfaced 3½ inches of road rock was added to native soil, thoroughly prepared, rolled and a prime coat of SC2 liquid asphalt added.

Patching of broken areas near the stables was another important improvement which the highway division took care of.

Following the patching and building a seal coat of emulsion was spread over the entire area at the rate of one-sixth of a gallon per square yard and sand applied.

C. W. Rust, Sacramento, who superintended the work, said that this surfacing provides pathways not injurious to footwear, gives a uniform appearance to the roadways and guards against the absorption of moisture during the winter months.

FINE HIGHWAYS TO FAIR

Millions of road miles will be covered by the hundreds of thousands of visitors who will wend their way to the eighty-fifth California State Fair.

Fair time gives the people of the State an opportunity to observe the great highway system which permits easy travel from every point in California to the Sacramento grounds.

Highways lead in from all directions and in every instance they are well paved, properly marked and safely patrolled.

In the last few years the improved highways have made possible transportation of stock and other exhibits from the most outlying sections and have been highly instrumental in building up the fair's huge list of displays.

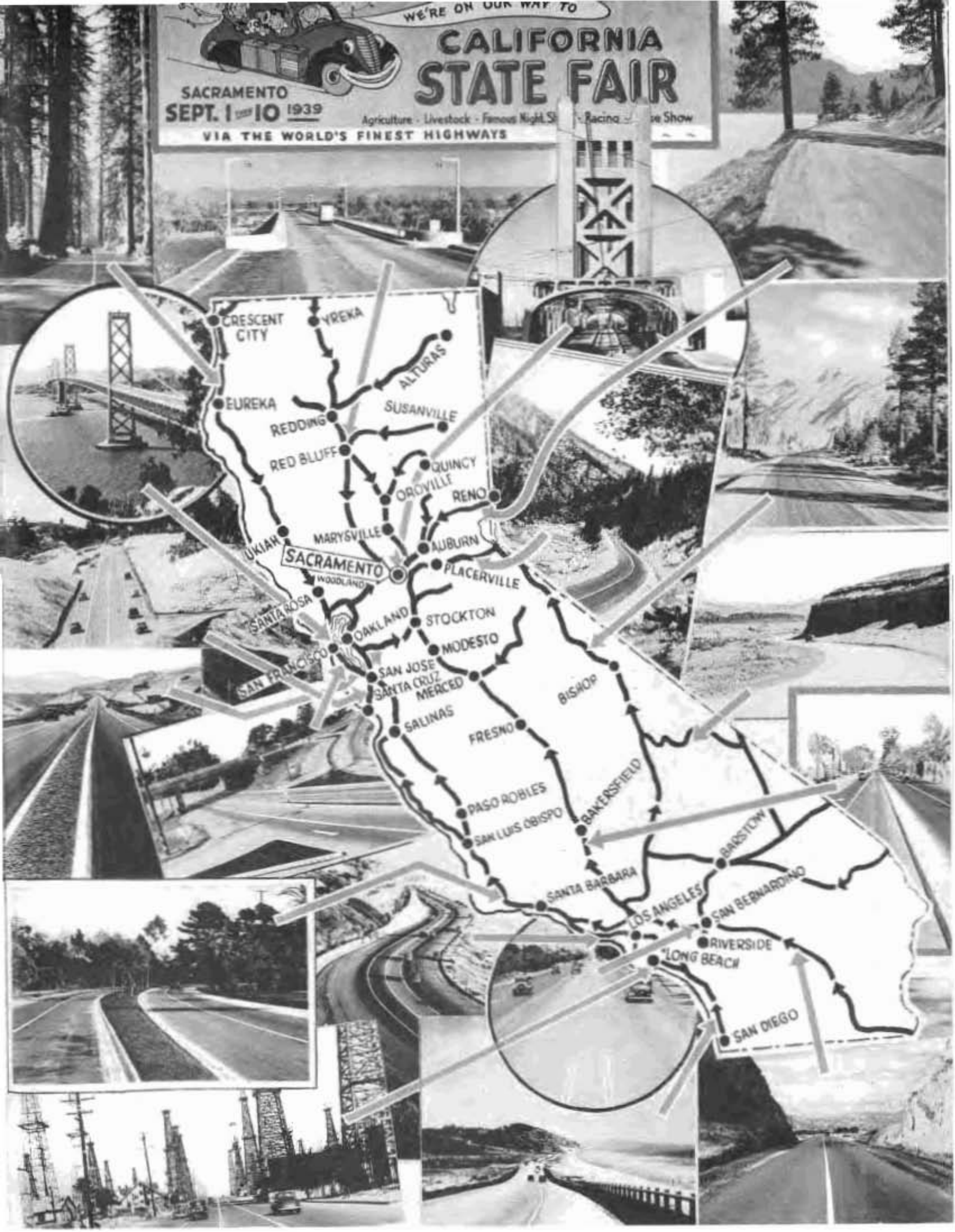
Sacramento is ideally situated as a fair center. There are direct arterials from the north, south, east and west, all in excellent condition.

The fair last year, under the direction of Secretary-Manager Robert Muckler, became first in the nation when nearly 640,000 persons passed through the gates. This year fair directors anticipated a crowd of 700,000 with an increasing use of the State's highways.

Stafford Goes to New Mexico

Harlowe M. Stafford, Supervising Hydraulic Engineer of the State Division of Water Resources, has accepted a position with the National Resources Committee as engineer in charge of the Pecos River Joint Investigation in New Mexico and Texas with headquarters at Roswell.

A complete study and report is to be made of the water resources, uses and requirements, flood problems, etc., as basis for a settlement by compact between the States of New Mexico and Texas. The job is expected to require two years of work and result in plans to effect maximum conservation and utilization of available Pecos River water resources.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SANTA CRUZ
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PASO ROBLES
BAKERSFIELD
SAN LUIS OBISPO
BARSTOW
SANTA BARBARA
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RIVERSIDE
LONG BEACH
SAN DIEGO

Link of Sierra-to-the-Sea Highway Improved Through Kings County

By C. F. OLIPHANT, Associate Highway Engineer

AN IMPORTANT link in the Sierra-to-the-Sea Highway, located in Kings County between 0.6 miles north of Armona and Hanford, was recently completed by the Union Paving Company of San Francisco at a cost of $102,176. The construction followed the old alignment with changes at each end of the project.

A right-angle turn near the westerly end of the project on the old road at the intersection of two county roads was eliminated by constructing a 1000-foot radius curve.

A new approach was made at the easterly end of the project to Seventh Street at the west city limits of Hanford, which street traverses the city to the east city limits.

This change allows traffic to pass through Hanford on a tangent without interference of the business section congestion or making sharp turns at city street intersections, as was the case on the old route.

The grades were raised through certain portions of the project to provide better sight distances at bridge crossings and to provide sufficient clearance for drainage purposes between the subgrade and the surrounding terrain.

The existing pavement was resurfaced with a minimum of two inches of asphalt concrete.

On portions where the grades were raised the new pavement is 7 inches thick with edges thickened to nine inches. It is 22 feet wide and bordered on each side with seven-foot oiled shoulders.

The asphalt concrete was mixed in a standard asphalt paving plant with a 3000-pound capacity pugmill.

An automatic batcher was successfully used on this project. This batcher had on previous jobs given inaccurate results, but by mounting the weigh box and automatic scales on a steel framework, which was not attached to the plant proper, nearly all the vibration from the plant to the scales was eliminated, thus remedying the trouble formerly experienced.

An important feature of the project was the construction of the P. C. C. recessed curbs for the islands which provided the channelization of the intersection at Lacey Boulevard.

This intersection is provided with sodium vapor lamp amber flashers and red reflectors which amply illuminate and indicate the curbs and channels.

Judge—"What is the defendant's reputation for truthfulness?"

Witness—"Excellent, your honor. I've known him to admit he had fished all day without getting a single bite."—*Annapolis Log.*

Improved section of highway near Hanford showing channelization of intersection at Lacey Boulevard which is provided with sodium vapor lamp amber flashers and red reflectors.

Portion of recently completed link of Sierra-to-Sea highway through Hanford which avoids business section congestion in city.

Hydraulicking Highway Cut 210 Feet Deep in Mountain Top Completed

(Continued from page 5)

plishment that appeared doubtful for a while.

There remain in the main summit cut to be removed by equipment about 92,000 cubic yards. The maximum depth of the equipment cut will be 60 feet. Some of the remaining material could be removed hydraulically, if it were blasted, but, since it is needed for fills at either end of the cut, such removal would not be economical.

The hydraulic cut is 2,500 feet long, 2,000 feet wide at the top and 210 feet deep. The bottom of the cut ranges from 50 to 250 feet wide. This extra width will eventually be reduced by weathering of the soft material in the high bank on the south side of the cut.

Little attempt was made to utilize the tailings for construction of embankments. However, by means of log cribs, brush and fence barriers, some 62,000 cubic yards of the tailings were utilized to build up the grade in Oregon Gulch down which the bulk of the tailings were washed. The actual area built up by control of the tailings was about 200 feet wide, 8 feet deep and 4000 feet long.

The 62,000 cubic yards is the quantity required for neat roadbed construction only, and, based on this quantity, the unit cost was 30 cents. On the built-up area adjacent to the road in Oregon Gulch, a growth of vegetation and trees is being promoted to provide resistance to erosion and to improve the roadside appearance.

Throughout the entire project there was a close coordination with the work of Convict Camp 25, from which 26 miles of road will have been completed early in 1940 when this project is finished. Equipment from this camp was working up to each end of the cut when the hydraulic work ceased.

The accompanying tabulation is a concise record of the rate of progress and of the results secured.

A total of 10,748,000 cubic yards of material was removed by the hydraulic operations in 5.5 years. The first giant was operated on February 28, 1933, and the last on June 30, 1939. During this period the total operating time, that is, the total time that water was flowing from the reservoir to operate one or more giants, was 8,196 hours.

During this time, 55,524,400 cubic yards of water passed through the giants. It will be noted that the average rate of excavation was 8,060 cubic yards per day or 1,310 cubic yards per hour operated. The average per cent of solids, or ratio of material moved was 19.3, and the unit cost of excavation was 2.47 cents per cubic yard.

Several benefits result from the deep cut through Oregon Mountain which could only have been accomplished by hydraulic methods.

The summit is 210 feet lower than could otherwise have been attained.

The distance between Weaverville and Junction City has been reduced 2.5 miles.

The road is on the sunny slope and in stable formation.

The character of the material encountered in the excavation is such that but two miles will require any base course of surfacing.

Although six years have been required for construction since the conception of the project, a similar length of time would have been required by any other method or any other route, since the hydraulic cut was actually finished before the roadway on either side, under construc-

Summary of Hydraulic Grading Operations on State Highway No. 20 Over Oregon Mountain

Year, Month	Days	Excavation, Cu. Yds.	C. Y. day	Unit cost, cents	Water C. F. S.	Water Cu. Yds.	Per cent solids	Hours operated	Cubic yards hour
1934—March	32	178,000	5,560	4.20	16.6	1,695,850	10.5	202.5	880
April	30	254,000	8,500	3.02	16.7	1,602,450	15.8	264.5	960
May	31	235,000	7,580	2.43	9.3	920,850	25.3	164.2	1,430
June	30	155,000	5,150	2.07	4.7	450,700	34.3	82.2	1,880
July	12½	18,000	1,440	2.54	1.5	60,590	29.7	11.7	1,540
Season	135½	840,000	6,200	2.92	10.9	4,730,440	17.8	725.1	1,160
October	1	2,000	2,000	3.27	2.9	9,400	21.3	1.8	1,110
November	30	256,000	8,530	1.97	5.4	519,040	49.2	88.6	2,880
December	31	200,000	6,450	2.41	7.3	714,150	28.1	103.4	1,940
1935—January	31	63,000	2,030	5.85	4.4	434,260	14.5	51.2	1,230
February	28	350,000	12,500	1.68	12.2	1,102,670	31.7	207.9	1,690
March	31	317,000	10,200	1.79	10.5	1,045,150	30.3	161.7	1,960
April	22½	700,000	31,100	1.04	25.3	1,822,150	38.4	322.9	2,160
May	31	933,000	30,100	0.96	32.5	3,225,670	28.9	542.3	1,720
June	30	224,000	7,460	2.15	16.7	1,606,520	13.9	278.8	800
July	14	23,000	1,650	5.67	5.8	260,520	8.8	47.1	490
Season	249½	3,068,000	12,300	1.55	13.5	10,739,530	28.6	1,805.7	1,700
October	15	11,000	60	3.97	0.5	25,600	3.9	0.8	1,250
November	30	10,000	330	3.00	0.5	50,300	19.9	11.4	880
December	31	27,000	870	8.67	1.3	131,370	20.5	34.9	770
1936—January	31	125,000	4,020	3.61	7.7	769,930	16.3	140.8	890
February	29	394,000	13,600	2.40	12.9	1,185,500	33.2	214.8	1,830
March	31	494,000	15,900	2.07	23.6	2,319,400	21.3	412.5	1,200
April	30	472,000	15,750	1.65	27.9	2,670,000	17.7	306.8	1,540
May	31	598,000	19,300	0.79	29.9	2,972,000	20.1	359.8	1,660
June	30	200,000	6,670	2.39	15.0	1,445,700	13.8	194.8	1,030
July	10	47,000	4,700	6.38	6.4	198,400	23.7	27.4	1,720
Season	268	2,368,000	8,840	1.99	13.7	11,767,730	20.1	1,704.0	1,390
October	15	2,000	130	2.62	0.3	12,100	16.5	2.0	1,000
November	30				0.1				
December	31	4,000	130	30.51	0.4	43,850	9.1	8.2	490
1937—January	31	2,600	85	7.50	0.3	25,410	10.2	4.5	580
February	28	3,400	120	12.05	0.3	27,220	12.5	4.8	710
March	31	188,000	6,060	4.57	3.8	381,070	49.4	72.5	2,590
April	30	165,000	5,500	4.60	16.5	1,586,070	10.4	301.6	550
May	31	538,000	17,400	2.10	32.6	3,232,370	16.7	404.6	1,330
June	26	277,000	10,700	2.68	23.7	1,971,370	14.0	298.3	930
Season	253	1,180,000	4,660	3.11	12.4	7,288,700	16.2	1,096.1	1,080
December	32	102,000	3,200	7.66	13.9	1,394,400	7.3	235.0	430
1938—January	31	187,000	6,020	5.20	12.7	1,260,500	14.8	157.4	1,190
February	28	80,000	2,860	10.11	8.3	741,300	10.8	102.3	780
March	31	255,000	8,230	3.49	15.6	1,551,800	16.4	233.1	1,090
April	30	522,000	17,400	1.69	26.3	2,518,600	20.8	386.7	1,350
May	31	432,000	14,000	2.20	33.1	3,286,630	13.2	497.1	870
June	30	284,000	9,460	3.84	30.2	2,860,220	9.9	421.4	670
Season	213	1,862,000	8,740	3.43	20.0	13,613,800	13.7	2,033.0	920
December	31	99,000	3,190	6.41	6.2	618,000	16.0	91.1	1,080
1939—January	31	88,000	2,840	7.30	4.3	430,500	20.4	52.4	1,680
February	28	77,000	2,750	7.12	4.3	386,500	19.9	47.2	1,630
March	31	230,000	7,420	3.04	18.0	1,779,500	13.0	225.3	1,020
April	30	496,000	16,500	1.86	25.7	2,468,700	20.1	267.3	1,860
May	31	292,000	9,400	2.19	12.5	1,244,630	23.4	136.0	2,140
June	30	148,000	4,930	3.33	4.8	456,370	32.4	65.1	2,270
Season	212	1,430,000	6,740	3.20	11.0	7,384,200	19.4	884.4	1,620
Grand totals	1,331	10,748,000	8,060	2.47	13.0	55,524,400	19.3	8,196.1	1,310

tion by prison labor, was completed.

The hydraulic operations were under the direction of Milan A. Senger until July, 1937, and since then under the direction of Harry L. Waste, Superintendent of Convict Camp 25.

As referred to in a previous paragraph the only remaining excavation work to be done at the summit is deepening of the cut an additional 60 feet. Crews from the convict camp are now doing that work. W. B. Little was resident engineer until July, 1935. R. L. Gerry succeeded him.

Newly paved portion of Orange Belt highway in Tulare County has 22-foot roadway with 17-foot shoulders on each side.

Improved Highway Through Exeter City

GRADING and paving with plant mix surfacing was completed on June 10, 1939, by Piazza and Huntley, Contractors, on an important link in the Orange Belt Highway, between the south city limits of Exeter and Venida Substation at the intersection of the Bakersfield-Gen. Grant Park road and the Visalia-Sequoia Park Highway.

The cost of this construction was approximately $59,800, financed jointly by the State and PWA Federal funds.

The new pavement is five-inch crusher run base with 2½-inch plant mix surfacing 22 feet wide. Seven-foot oiled shoulders border each edge of the pavement.

Through the city of Exeter the old grade was raised just enough to permit the placing of the pavement, while from the north city limits to the northerly end of the project the grade was raised enough to permit placing of needed drainage structures, in some instances from two to three feet.

In many places during storms the old road had been flooded, causing hazardous traffic conditions. The new grade prevents this possible flooding.

Approximately 45,300 cubic yards of imported borrow was used in raising this grade.

Bay Bridge Traffic Breaks Record; 1,093,502 Vehicles Cross in July

MORE than a million vehicles crossed the San Francisco-Oakland Bay Bridge in July. With a daily average of 35,274 vehicles, the total piled up last month by the Bay Bridge was 1,093,502, an all time high. This record shattering total was revealed yesterday in a report filed by Director of Public Works Frank W. Clark with Governor Olson, Chairman of the California Toll Bridge Authority.

The July figure showed a 48 per cent increase over the corresponding period of last year and a 22 per cent increase over June.

Revenues last month amounted to $466,771.30, 6 per cent increase over the preceding month, and a 21 per cent increase over July's totals of last year.

Number of vehicles to cross the bridge since it opened November 12, 1936, to August 1, 1939, is 25,063,024.

July's traffic was swelled by exposition-bound motorists, with 242,871 vehicles going to Treasure Island. Exclusive of these motorists, bridge traffic for July was 850,631, or an increase of 15 per cent over July, 1938. It was a drop from July, 1937, before the ferries cut their tolls, when 886,054 vehicles crossed the span.

Highest day of July was the fourth, with vehicles totaling 43,508. Lowest day was July 31, which had a total of 30,761 vehicles.

Last month's record traffic was attributed by Director Clark to a combination of factors, which included a highly stimulated travel season, due largely to the exposition, and to the recently reduced toll to 40 cents.

"It is still too early, however, to determine the exact effect of the reduced toll in its relation to increased traffic," Mr. Clark said.

July totals and comparative figures follow:

	July 1939	July 1938	June 1939	Total 1939	Total since opening
Passenger autos and auto trailers	1,011,424	669,438	803,846	5,423,842	23,131,514
Motorcycles and tricars	4,376	4,035	3,995	24,277	111,176
Buses	9,221	13,467	7,998	58,091	305,725
Trucks and truck trailers	44,850	35,952	47,735	322,348	1,082,247
Total vehicles	1,093,502	737,378	888,395	6,001,835	25,063,024
Extra passengers	346,905	241,163	302,140	1,961,716	6,710,351
Freight tons	56,016	43,750	61,999	421,883	1,333,013

DIVISION OF WATER RESOURCES

OFFICIAL REPORT

FOR THE MONTH OF

JULY, 1939

EDWARD HYATT, State Engineer

The Division of Water Resources, representing the Water Project Authority of the State of California has continued the compilation and analysis of data collected on lands in the San Joaquin Vally as provided for in an agreement between the Authority and the United States of America in connection with the Central Valley Project.

Work was continued on the preparation of folios of maps showing the topography, soil survey data and land ratings of lands adjacent to the San Joaquin River, and reports covering underground water conditions and supplies of lands adjacent to the river.

Also, as provided for in the agreement between the Water Project Authority and the United States negotiations were continued with public utility companies in connection with relocations of power and communication facilities for the completed Central Valley Project and the temporary relocations necessitated by construction activities. Studies were continued with regard to the disposal and distribution of power which will be available from the Shasta power plant, including the programming of additional facilities to provide for the absorption thereof in the market of northern and central California.

SPECIAL INVESTIGATIONS

Investigations and the preparation of reports on work for which applications have been made for allotments from the State Emergency Fund for the restoration of property, levees, flood control works, county roads and bridges damaged by the floods of the 1937-1938 winter season, were continued and 18 reports and recommendations were submitted to the Director of Finance pursuant to his instructions. No allocations of additional money were made by the Director of Finance for flood damage repair work and the total amount of outstanding allocations at the end of the month was $4,497,000.

The Division has performed, or is performing considerable of the work for which these allocations were made and the remainder is being done by the applicants under 160 contracts with the Department of Public Works. These contracts cover work which will cost $3,521,700, much of which has already been completed.

A progress report on studies made by the Division for the formulation of a coordinated State-wide plan of flood control was prepared. The Division also cooperated with the U. S. Department of War and Agriculture in flood control investigations.

FLOOD CONTROL AND RECLAMATION

Maintenance clearing in the Tisdale Bypass is now being carried on by WPA labor, a crew of about 50 men being so engaged. A WPA crew of about 25 men is engaged in cleaning and hand finishing on the east levee in connection with flood damage repair work recently completed.

WPA Work Project No. 10983 was started on July 18, 1939, clearing operations in the American River flood channel. At this date approximately 170 men are at work. For the period June 25 to July 22, 1939, a total of 9,604 man-hours were engaged on Projects No. 10612 and No. 10983.

SACRAMENTO-SAN JOAQUIN WATER SUPERVISION

Engineers from this office are constantly measuring diversions and return flows in the Sacramento and San Joaquin Valleys and maintaining rigid supervision over all diversions in order that as much waste as possible may be eliminated because of the extremely low flows prevailing this season.

Meetings of water users have been held at various points in the territory and the water shortage brought to their attention. Their aid has been enlisted to help in the conservation work and so far the response from the water users has been excellent. It is estimated that at this time had it not been for the work of this office and the local water users' committees, the flow into the Delta would have been approximately 350 second-feet less than at present. This increased flow has been sufficient to keep the salt water from encroaching on an additional 50,000 acres.

At present about 50,000 acres in the Delta area are affected due to water with a salinity content greater than 100 parts of chloride per 100,000 parts of water. It is expected that the Sacramento River will increase in flow beginning about August 15th when it is anticipated that rice water now impounded in the fields will be returned to the stream channels.

During the past week a 250-mile trip through the Delta area was made by representatives of the upriver water users and the State Engineer's office.

IRRIGATION DISTRICTS AND DISTRICTS SECURITIES COMMISSION

Oakdale Irrigation District has completed the installation of five irrigation pumps to supplement the water supply received from Melones Reservoir on Stanislaus River. A release of 500 second feet from Hetch Hetchy Dam is being made for use of Modesto and Turlock irrigation districts.

Anderson-Cottonwood Irrigation District application was approved for a first refunding issue of bonds, in the amount of $3339,000 for certification by the State Controller. East Contra Costa Irrigation District petition was approved for an agreement with Bank of America to borrow $45,000 to buy some of its own outstanding bonds.

SUPERVISION OF DAMS

Applications have been received for approval of plans and specifications for the construction of J. V. deLaveaga Dam in San Benito County and Independence Dam in Sierra County and for the repair or alteration of the Martin and Huot Dam in Sacramento County, Lake Spaulding Dam in Nevada County, Ross Reservoir in Calaveras County, Union Reservoir in Alpine County, San Diegulto Dam in San Diego County and Lower Blue Lake Dam in Alpine County.

WATER RIGHTS

During the month there were 52 applications filed, some of the more important of which are Application 9601 by James F. Collins of Los Angeles for the appropriation of 100 cubic feet per second from North Fork of Smith River in Del Norte County for the generation of power; Application 9614 by the McGeachin Placer Gold Mining Company, Sacramento, for 190 cubic feet per second and 2200 acre feet per annum storage from Humbug Creek and Shirttail Canyon in Placer County for mining purposes; Application 9621 by San Juan Gold Company of Downieville for 4,000 acre feet per annum storage from South Fork of Poorman Creek in Nevada County for mining purposes.

One of the spacious parking areas at interesting view points on the reconstructed Blue Lakes Highway in Lake County.

Lakes Highway Reconstructed

(Continued from page 8)

change the line so that the road could be constructed on a more solid foundation.

All of the embankments have now been in place for several months, and there is no evidence of settlement.

Another interesting feature of the construction was the occurrence and treatment of a large slide that occurred between Station 113 and Station 117 following a period of heavy rainfall that had lasted for several days. The slide occurred on a definite "slip-plane" of blue clay that was saturated with water from several small springs.

About 18,000 cubic yards of material were removed from this slide, and a trench was excavated to the depth of the "slip-plane" alongside the road; underdrains were placed; and the trench was backfilled with coarse rock. No further movement of the sidehill has been observed.

Every effort was made during construction to maintain the natural rustic beauty of the lake shores.

J. L. Conner & Sons were the contractors, and C. M. Butts was Resident Engineer.

Santa Monica Grade Separation Project Solves Coast Problem

(Continued from page 7)

Avenue bridge and over an extension of the existing tunnel to connect with the Roosevelt Highway about 850 feet northerly of Colorado Avenue. Other short road connections will be made between this ramp and Ocean Avenue along each side of the bridge structure.

The City of Santa Monica has received approval of a U. S. Public Works Administration grant of $199,387 toward the construction of the grade separation at Colorado Avenue and Route 163 as far south as Bicknell Street. This grant includes part of the costs of engineering and acquiring rights of way. The State and the county of Los Angeles are contributing toward the cost of construction and engineering. The city of Santa Monica is furnishing the balance of the cost of acquiring rights of way from the gas tax accruing to the city.

Plans have been prepared and construction engineering inspection will be handled by State forces. All contracts are being awarded by the city of Santa Monica. The State is cooperating with the city in acquiring the necessary rights of way.

Construction work accomplished to date includes the improvement of Ocean Avenue from Colorado Avenue to Pico Boulevard and some work on retaining walls which are part of the Colorado Avenue grade separation project, but which were let to separate contract.

The Ocean Avenue contract from Colorado Avenue to Pico Boulevard, which is 0.34 mile in length, consisted of widening to 84 feet between curbs and resurfacing, the plans for said work having been prepared by City Engineer Howard B. Carter. Bids for the Colorado Avenue structure and connecting roads were opened by the city on July 5, 1939, the low bid being $196,744.

Terms of the PWA grant provide that all work in connection with the project must be completed by April, 1940.

The Colorado Avenue grade separation structure will cost in the neighborhood of $200,000.

Highway Bids and Awards for the Months of June-July, 1939

BIDS AND AWARDS FOR JUNE

LOS ANGELES COUNTY—On Arroyo Seco Parkway between Avenue 50 and Avenue 58, four bridges to be constructed and approaches thereto surfaced with portland cement concrete, asphalt concrete and plant-mixed surfacing and about 0.6 mile of roadway to be graded and paved with portland cement concrete and asphalt concrete. District VII, Route 205, Section L.A. United Concrete Pipe Corp., Los Angeles, $199,342; Mittry Bros. Construction Co., Los Angeles, $200,328; Radich & Brown, Burbank, $204,023; Contracting Engineers Co., Los Angeles, $205,633; Griffith Co., Los Angeles, $209,203; J. S. Metzger & Son, Los Angeles, $211,543; W. E. Hall Co., Alhambra, $213,506; Carlo Bongiovanni, Hollywood, $214,966; Byerts & Dunn, Los Angeles, $215,846; Daley Corporation, San Diego, $223,652; C. O. Sparks & Mundo Engineering Co., Los Angeles, $230,753. Contract awarded to J. E. Haddock, Ltd., Pasadena, $191,601.20.

LOS ANGELES COUNTY—Between Anaheim-Telegraph Road and Rivera, 1.0 mile, shoulders to be widened and surfaced with plant-mixed surfacing, and portions of existing pavement to be resurfaced with asphalt concrete. District VII, Route 168, Section B. Griffith Co., Los Angeles, $7,073; W. E. Hall Company, Alhambra, $7,855; S. Edmondson & Sons, Los Angeles, $8,291; Oswald Bros., Los Angeles, $8,481. Contract awarded to J. E. Haddock, Ltd., Pasadena, $6,793.50.

RIVERSIDE AND SAN BERNARDINO COUNTIES—Between 0.1 mile south of San Bernardino County line and Colton, about 3.0 miles to be graded and road-mix surface treatment and seal coat to be applied. District VIII, Route 43, Section C,F,Colton. S. Edmondson & Son, Los Angeles, $71,347; Daley Corporation, San Diego, $72,919; Basich Bros., Torrance, $74,345; Griffith Co., Los Angeles, $75,104; V. R. Dennis Construction Co., San Diego, $75,245; J. E. Haddock, Ltd., Pasadena, $75,773; United Concrete Pipe Corp., Los Angeles, $79,262; Martin & Schmidt Contractors, Long Beach, $81,100; Oswald Bros., Los Angeles, $81,975; C. R. Butterfield-Kennedy Co., San Pedro, $83,288; R. E. Hazard & Son, San Diego, $87,065; Geo. Herz & Co., San Bernardino, $87,682; W. E. Hall Co., Alhambra, $88,970; A. S. Vinnell Co., Los Angeles, $89,524. Contract awarded to Matich Bros., Elsinore, $62,523.50.

SACRAMENTO COUNTY—Between one-half mile west of Snodgrass Slough and Glannvale, about 3.9 miles to be graded and surfaced with crusher run base and armor coat, and a timber bridge with concrete deck to be constructed. District III. Feeler road. Piazza & Huntley, San Jose, $68,845; Caputo & Keeble, San Jose, $69,456; Valley Construction Co., San Jose, $69,570; Lee J. Immel, Berkeley, $69,581; J. R. Reeves, Sacramento, $71,016; H. Earl Parker, Marysville, $71,521; Eaton & Smith, San Francisco, $74,091; Heafey-Moore Co. & Fredericksen & Watson Construction Co., Oakland, $74,239; A. Teichert & Son, Inc., Sacramento, $75,961; Pacific States Construction Co., San Francisco, $78,466; George Pollock Co., Sacramento, $83,165. Contract awarded to Hemstreet & Bell, Marysville, $64,795.20.

SISKIYOU COUNTY—Between Gazelle and Yreka, about 3.7 miles, roadmix surfacing and seal coat to be placed. District II, Route 3, Section B. Oranges Bros., Stockton, $9,456; Garcia Construction Co., Irvington, $9,653; Powers and Patterson, Alturas, $9,686; Young and Son Co., Ltd., Berkeley, $10,410; C. F. Fredericksen & Sons, Lower Lake, $10,714; A. A. Tieslau, Berkeley, $10,866; Lee J. Immel, Berkeley, $11,330. Contract awarded to E. B. Bishop, Orland, $9,385.50.

VENTURA COUNTY—Between Fillmore and Hopper Creek, about 4 miles road-mix surface treatment to be applied to shoulders and road approaches. District VII, Route 79, Section C. Basich Bros., Torrance, $7,227; J. E. Haddock, Ltd., Pasadena, $7,705; Griffith Co., Los Angeles, $8,583; A. S. Vinnell Co., Alhambra, $8,890; Matich Bros., Elsinore, $9,170. Contract awarded to Oilfields Trucking Co., Bakersfield, $6,589.75.

BIDS AND AWARDS FOR JULY

KERN COUNTY—Between Route 4 and Weedpatch, about 5 miles to be surfaced with plant-mix surfacing and road-mix surface treatment applied to shoulders. District VI, Route 140, Section C. Piazza & Huntley, San Jose, $17,713; A. Teichert & Son, Inc., Sacramento, $22,168. Contract awarded to Griffith Co., Los Angeles, $16,782.15.

LOS ANGELES COUNTY—Between Venice Blvd. and Santa Monica city limits, about 1.2 miles to be graded and paved with asphalt concrete and portland cement concrete. District VII, Route 60, Section L.A. Oswald Bros., Los Angeles, $102,456; J. E. Haddock, Ltd., Pasadena, $106,553; Radich & Brown, Burbank, $108,385; C. O. Sparks & Mundo Engineering Co., Los Angeles, $108,999; United Concrete Pipe Corporation, Los Angeles $118,846; R. M. Price, Huntington Park, $121,183. Contract awarded to Griffith Co., Los Angeles, $98,489.

MENDOCINO COUNTY—About 0.9 mile road-mix surfacing and seal coat. District I, Route 56, Section Major Streets, Ft. Bragg. Lee J. Immel, Berkeley, $8,590; Spaletta & Siri, Santa Rosa, $9,991. Contract awarded to Helwig Construction Co., Sebastopol, $6,598.

NAPA COUNTY—At the Napa State Hospital, about 1.1 miles to be graded and surfaced with imported base material and plant-mix surfacing and curbs and sidewalks to be constructed. District IV, Napa State Hospital. Granzotto & Angelus, Walnut Creek, $32,880; Chas. L. Harney, San Francisco, $34,653; Lee J. Immel, Berkeley, $35,267; Heafey-Moore Co., Fredrickson & Watson Construction Co., Oakland, $36,010; Pacific States Construction Co., San Francisco, $36,140; Granite Construction Co., Ltd., Watsonville, $36,267; N. M. Ball Sons, Berkeley, $36,954; Edward A. Forde, San Anselmo, $38,860. Contract awarded to A. G. Raisch, San Francisco, $32,237.50.

PLUMAS COUNTY—Between Greenville and Westwood Road, about 9.5 miles to be surfaced with imported borrow and road-mix surfacing. District II, Route 83, Sections B,C. C. F. Fredericksen & Sons, Lower Lake, $17,149; Oranges Bros., Stockton, $18,325; George Pollock Co., Sacramento, $20,573. Contract awarded to Harms Bros., Sacramento, $16,858.

PLUMAS COUNTY—Between Beckwourth and The Buttes, about 3.7 miles to be surfaced with imported borrow and penetration oil treatment and seal coat to be applied. District II, Route 21, Section G. Fredericksen & Westbrook, Sacramento, $12,866; Oranges Bros., Stockton, $13,920; Garcia Construction Co., Irvington, $14,506. Contract awarded to Harms Bros., Sacramento, $12,771.

SANTA CLARA COUNTY—Between Gilroy and Paradise Valley Road, about 3.9 miles, retread surfacing to be applied. District IV, Route 32, Section D. Caputo & Keeble, San Jose, $17,806; Granite Construction Co., Ltd., Watsonville, $18,788; Embleton-Schumacher Co., Albany, $19,495; Pacific Truck Service, Inc., San Jose, $19,527; Piazza & Huntley, San Jose, $19,620; Earl W. Heple, San Jose, $19,720; E. A. Forde, San Anselmo, $21,480. Contract awarded to L. C. Karstedt, Watsonville, $14,545.70.

SHASTA COUNTY—Between 2.5 miles west of Montgomery Creek and 2 miles east of Burney, about 9.9 miles, seal coat to be applied. District II, Route 28, Sections B, C, D. C. F. Fredericksen & Sons, Lower Lake, $7,527; Lee J. Immel, Berkeley, $7,537; Hemstreet & Bell, Marysville, $7,641; Powers & Patterson, Alturas, $8,004; A. A. Tieslau, Berkeley, $8,476. Contract awarded to Hayward Building Material Co., Hayward, $6,853.50.

TEHAMA AND LASSEN COUNTIES—Between Red Bluff and Janesville, about 30.8 miles, seal coat to be applied. District II, Routes 29, 83, 86. Granite Construction Co., Ltd., Watsonville, $26,982; C. F. Fredericksen & Sons, Lower Lake, $27,837; Lee J. Immel, Berkeley, $27,734. Contract awarded to Hayward Building Material Co., Hayward, $25,191.

TRINITY AND SHASTA COUNTIES—Between Weaverville and Clear Creek, about 15.2 miles, seal coat to be applied. District II, Route 20, Sections AB, A. Lee J. Immel, Berkeley, $10,775; C. F. Fredericksen & Sons, Lower Lake, $10,857; A. A. Tieslau, Berkeley, $11,000; E. B. Bishop, Orland, $11,050; Charles Kuppinger, Lakeport, $11,270. Contract awarded to Hayward Building Material Co., Hayward, $9,825.

STANISLAUS COUNTY—Between Modesto and Salida, about 5.5 miles, road-mix surface treatment to be applied to shoulders and plant-mix surfacing to be placed on road approaches. District X, Route 4, Section B. Oranges Bros., Stockton, $6,067; Piazza & Huntley, San Jose, $6,727; M. J. B. Construction Co., Stockton, $7,002. Contract awarded to S. M. McGaw, Stockton, ,5,737.50.

TULARE COUNTY—Between Camp Nelson and Quaking Aspen Meadows, about 9.5 miles, road-mix surface treatment to be applied to existing roadbed. District VI, Route 27, Section E. Oilfields Trucking Co., Bakersfield, $9,879; John Jurkovich, Fresno, $9,925. Contract awarded to Basich Bros., Torrance, $8,426.

TULARE COUNTY—Between Kansas Avenue and 3 miles west of Tulare, about 4.2 miles to be surfaced with plant-mixed surfacing. District VI, Route 134, Section A. Piazza and Huntley, San Jose, $9,677; L. A. Brisco, Arroyo Grande, $11,443. Contract awarded to Union Paving Co., San Francisco, $9,424.30.

Chief Petty Officer—The enemy are as thick as peas. What shall we do?

Officer of the Deck—Shell them, you idiot, shell them.

State of California

CULBERT L. OLSON, Governor

Department of Public Works

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

FRANK W. CLARK, Director of Public Works

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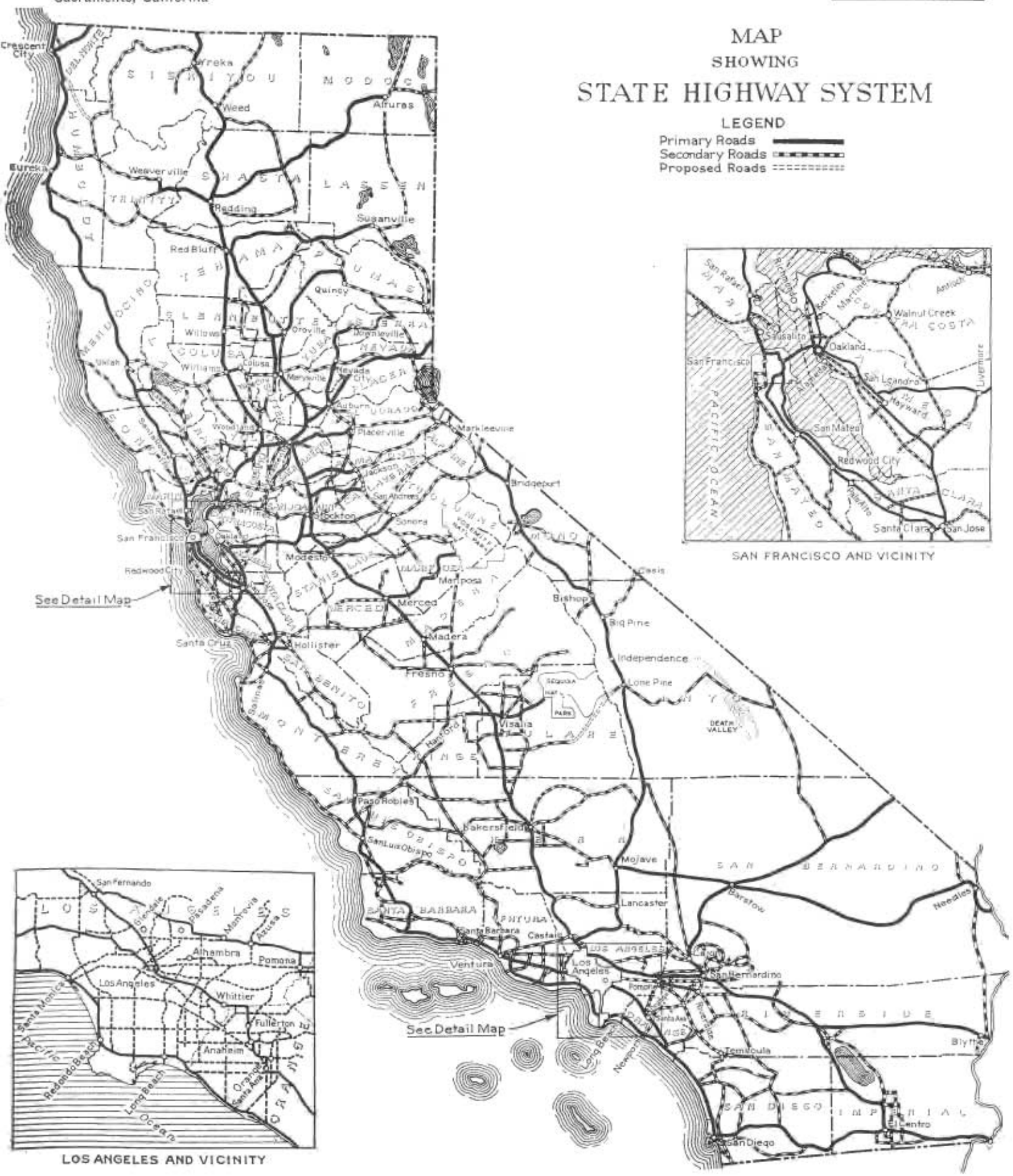
MAP
SHOWING
STATE HIGHWAY SYSTEM

LEGEND
Primary Roads
Secondary Roads
Proposed Roads



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