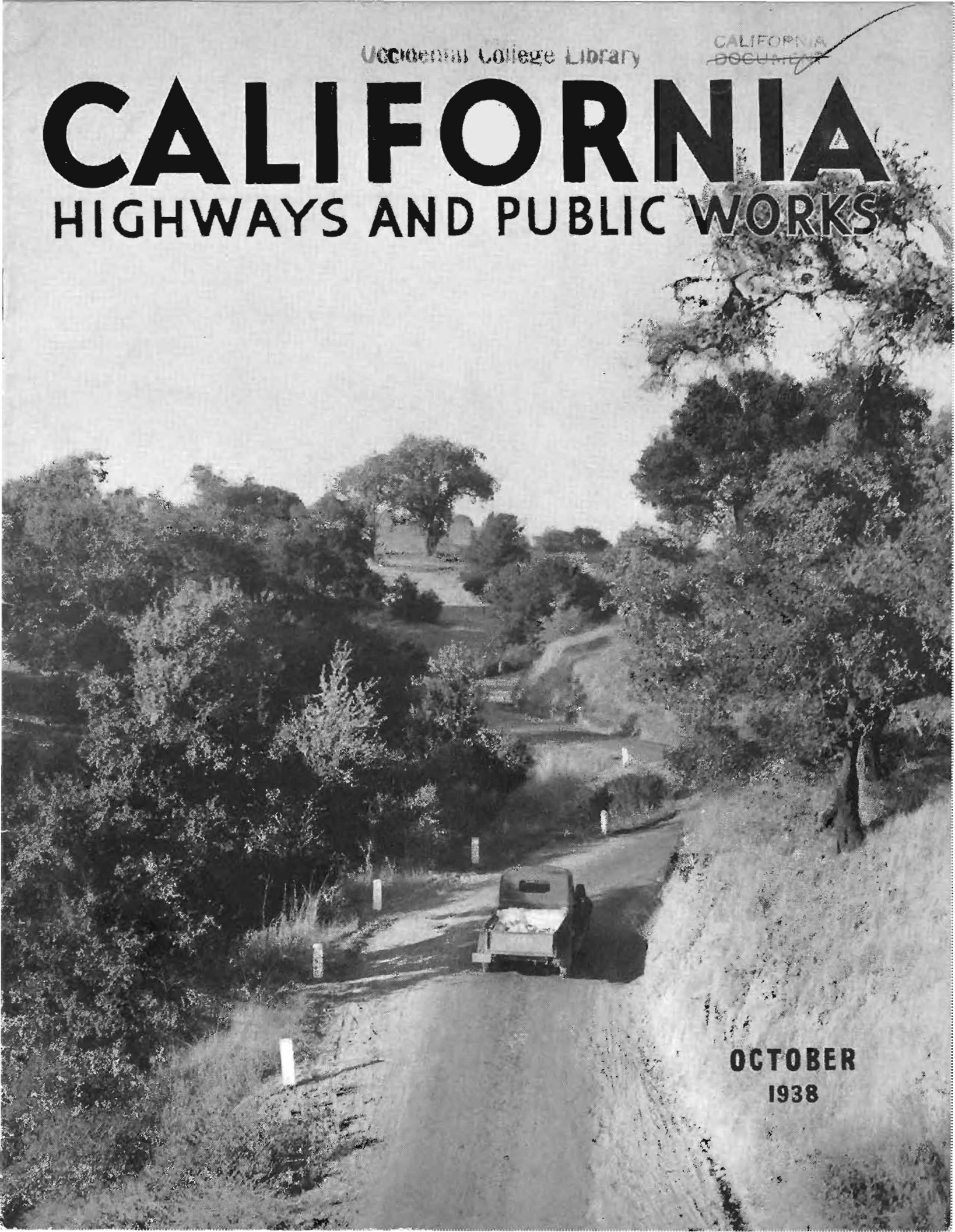
CALIFORNIA
HIGHWAYS AND PUBLIC WORKS



OCTOBER
1938

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

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

EARL LEE KELLY, Director C. H. PURCELL, State Highway Engineer JOHN W. HOWE, Editor K. C. ADAMS, Associate Editor

Published for information of the members of the department and the citizens of California

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

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

Vol. 16 OCTOBER, 1938 No. 10

Table of Contents

Cover Page—Narrow, Winding York Mountain Grade on State Route 33 Between Cayucas and Templeton in San Luis Obispo County. Lack of Funds Prevents Reconstruction.

Lack of Funds Prevents Needed Reconstruction of Bridges and Standardization of Highways

By LESTER H. GIBSON, District Engineer

Cost of Road Upkeep High in District V

ALL of the area in the counties of San Benito, Monterey, San Luis Obispo and Santa Barbara is included in District V of the Division of Highways. The first two counties are located in that portion of the State designated as Northern California counties in the allocation of highway funds and the latter two counties are in the southern group.

The Coast Range is the main mountainous section within the district, and along the Salinas River is the most extensive of valley section. Several important secondary highways traverse the Coast Range, connecting the coast with the interior valleys. Other secondaries connect these interior valleys with the San Joaquin Valley.

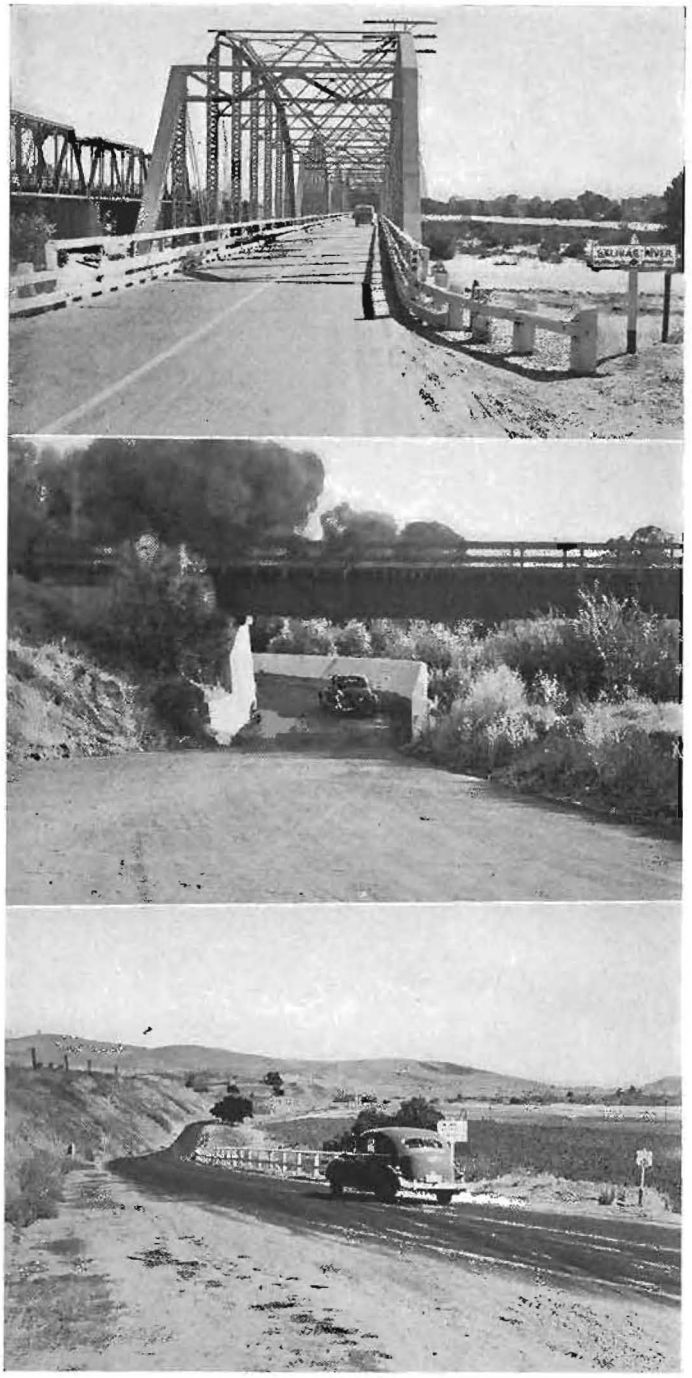
The roads in District V are located through a terrain classified from mountainous and foothill to valley, marsh, shoreline and desert. There are no road locations through the high elevation rugged mountainous passes, with the attendant expensive snow removal, nor has there been to date the costly storm damage experienced elsewhere in the State. However, a large proportion of the primary and secondary mileage lies through and along the Coast Range mountains and foothills, in a very unstable geological structure subject to slides and slip outs. This results in heavy expenditures for slide removal and roadbed stabilization under maintenance as well as adding greatly to the initial construction costs by reason of the necessary preventive measures employed.

The problem of protecting the exposed section of highway along the Salinas River and its tributaries, while not acute at the present time, is likely to result in the necessity for major expenditures in the future. At numerous locations the river is progressively cutting through deep silt banks toward the highway indicating the necessity for future protection or diversion works, or possibly some relocation. No allowance for such work has been included in the estimate of cost included at the end of this article.

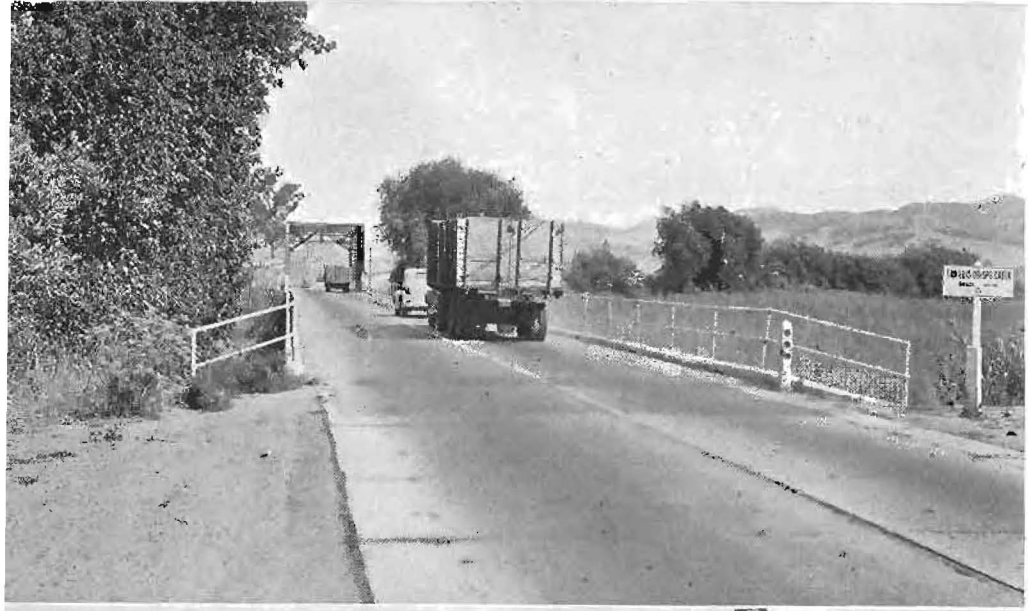
The main traffic artery in District V is El Camino Real (U. S. 101), which enters the district about 25 miles north of Salinas, follows south through the Salinas River Valley for a considerable distance, crosses the river five times, thence traverses the Santa Lucia mountains of the Coast Range at what is known as Cuesta Grade, and continues southerly, partly along inland valleys and partly adjacent to the coast line.

Another route which gives promise of carrying considerable tourist traffic is the one generally referred to as the Roosevelt Highway (State Sign Route No. 1). The portion between Carmel and San Simeon was completed in June, 1937, principally with convict labor. A large portion of the roadbed excavation between the above points is hewn out of precipitous cliffs following the shore line.

Exclusive of the mileage through incorporated cities, there are about 264 miles of primary and 782 miles of secondary road in District V. Adding the 44 miles within the 14 incorporated cities to the above makes a total of 1090 miles within



Top—Salinas River bridge, 18 feet wide, restricted, Monterey County. Center—Narrow undergrade crossing on curve, San Luis Obispo County. Bottom—Hazardous line and grade on U. S. 101.



Top—Narrow bridge restricted for speed and load on U. S. 101 south of San Luis Obispo. Center—Grade separation on "S" alignment over railroad at Oceano, with sharp curves, narrow road, and steep grades on Coast Highway south of Pismo Beach. Bottom—Narrow bridge, restricted for loading, on reverse curve alignment, over Old Creek, between Cayucos and Morro Beach, in San Luis Obispo County.

the district. The district's secondary roads include 464 miles which were added by legislative action during the 1933 session, at which time 6600 miles were added to the State Highway system throughout the State.

The following tabulation gives the segregation according to types of surface as well as the percentage of total mileage in the various types:

33 miles or 3% unimproved and unoiled earth and gravel roads.

163 miles or 15% oiled earth, inferior as to grade, alignment, width and drainage.

48 miles or 5% oiled earth roads on which resurfacing only is required.

40 miles or 4% graveled roads with light oiled surface.

381 miles or 35% intermediate type surfacing.

425 miles or 38% high type pavement.

Of the 425 miles shown as high type pavement, 175 miles or 41%, are narrow in width, only 4 and 5 inches in thickness, are deteriorating rapidly, and must be replaced soon. An additional 45 miles or 10% requires additional width to bring them up to present day needs.

A tabulation of district road mileage of more than two lanes follows:

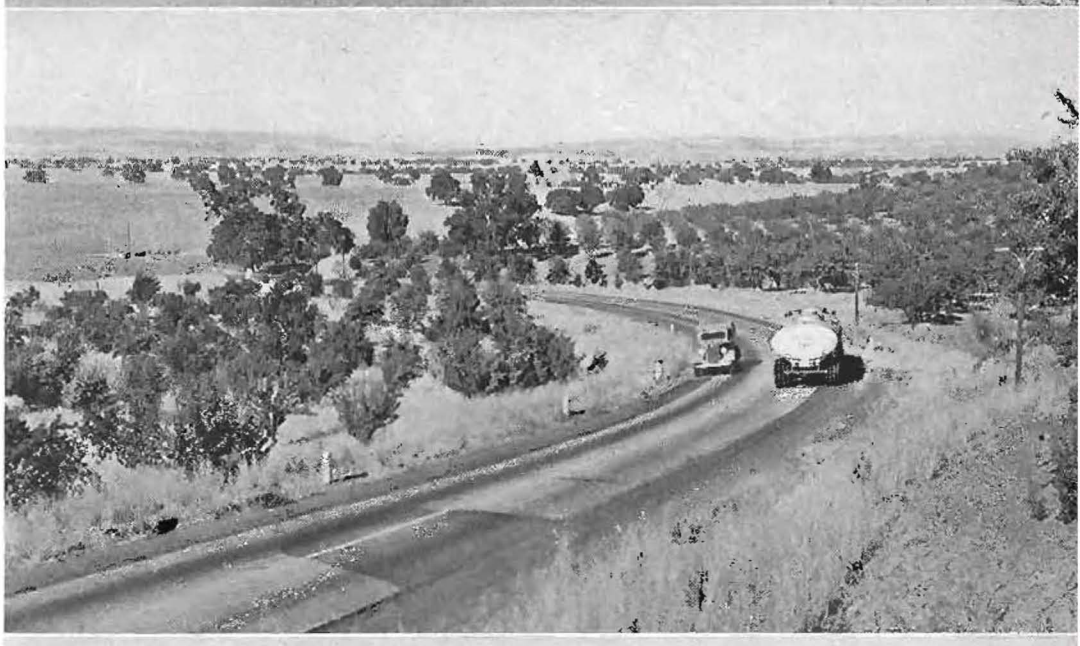
Rural	In Municipalities
3 lanes—11.718 miles	3 lanes— 8.444 miles
4 lanes— 7.852 miles	4 lanes—12.588 miles
6 lanes— 0.392 miles	6 lanes— 5.773 miles

Divided Highway

4-lane—3.812 miles which includes 3.282 miles for Cuesta Grade on U. S. 101 in San Luis Obispo County, that will be opened to traffic in November of this year.

Recently published results of a State-wide traffic count taken on July 10 and 11 indicate an increase of traffic of 3.3% throughout the State over the count taken in 1937. In this tabulation it is interesting to note that of the nine routes which lie wholly or partially in District V, all but three show increases over 1937 ranging from 0.94% to 15.47% on both Sunday and Monday counts.

Top—Narrow underpass, timber bridge, restricted sight distance on U. S. 101 Coast Route in Santa Barbara County North of Guadalupe. Center—Winding road, blind curves, on State Route 33, Cambria-Famoso lateral east of Paso Robles. Bottom—Sharp reverse curves on narrow alignment approaching a narrow bridge crossing the Salinas River in San Luis Obispo County.



Recent oil development and the expansion of the great acreages of perishable food products are responsible for a large increase in the amount of truck traffic during the past two years. This factor is one which makes it increasingly important to reconstruct some of the older pavement, particularly on U. S. 101, which carries these products on long distance hauls to the metropolitan areas and ports of San Francisco and Los Angeles.

It is believed that traffic on main artery U. S. 101 will show a greater increase on the completion of the relocation of Cuesta Grade, just north of San Luis Obispo, which has been a deterrent to traffic because of the combination of heavy grade, poor alignment and restricted width. The climatic and scenic advantages of this Coast route between San Francisco and Los Angeles, especially through the summer months, should make it increasingly popular when the bottleneck at Cuesta is eliminated.

The Roosevelt Highway is gaining in popularity as a tourist route from Northern California to Southern California and it is believed that if and when funds are available for a proper surfacing the scenic beauties will draw a considerably heavier traffic. This highway at the present time has a very light oiled surface using only the natural roadbed material and there is a crying need for adequate surfacing.

Within District V there are 21,270 lineal feet or 4.0 miles of bridges on primary and 29,830 feet or 5.6 miles of bridges on secondary routes. There are 8040 feet, or about 32% on primary and 5750 feet or 19% on secondary routes, of existing bridges which are restricted as to load and/or speed limit because of their structural condition.

The major portion of the unsatisfactory bridge structures on the secondary roads were constructed by the counties and included with the county

(Continued on page 17)

Extensive deep trenching for rock filling in drainage system made necessary to insure stability of big fill on realignment in Santa Cruz Mountains.

Los Gatos-Santa Cruz Project

OVERCOMING numerous problems presented by a rugged terrain and complicated geological formations, engineers of the Division of Highways and road contractors, with three finished links of the project behind them, are making rapid progress toward completion as a whole of the Los Gatos-Santa Cruz Highway.

At the present time, grading is going forward at three points on the final section of this ultramodern highway between Inspiration Point in Santa Cruz County and Oaks Road in Santa Clara County, a mile and five-eighths southerly of Los Gatos.

This job will cost approximately $180,000 per mile and will entail the excavation and disposal into fills of an estimated 2,200,000 cubic yards of earth and rock in a distance of 6¼ miles.

The Division of Highways expects the project to be ready for dedication to public service about July 1, 1939.

This particular stretch of highway comprises one of the most heavily traveled recreational highways in California, connecting the densely populated San Francisco and Peninsula areas with the scenic attractions and playground facilities of the Santa Cruz and Monterey coast lines.

How increasingly advantageous it will be to the thousands of pleasure seekers who used the existing obsolete highway may be judged from the fact that the traveled distance between Los Gatos and Inspiration Point will be reduced nearly two miles. The number of curves will be decreased from 132 to 20; total curvature will be 1118 degrees instead of 7700 degrees, and the present 75-foot minimum radius of curves will be increased to 500 feet. The average surface width of the new highway will be 46 feet as compared to the 20-foot existing roadway.

Of the 132 curves on the present road, forty have a radius of one hundred feet or less. The elimination of these traffic hazards alone is believed by the Division of Highways engineers to fully justify the cost of the relocation now being made.

REALIGNMENT BEGUN IN 1932

The first contract for the realignment of the Los Gatos-Santa Cruz Highway was let in 1932 and called for a four-lane highway through the heavy mountain sections where curvature is naturally limited, and a three-lane construction through the valleys and flats where easier curvature alignment could be secured. Contracts for additional improvements have been continuously under way since 1932. An important link in the undertaking was completed last year with the opening to traffic of the Scotts Valley reconstruction at the Santa Cruz end.

The Los Gatos-Santa Cruz Highway crosses over the ridge of the Santa Cruz Mountain spur of the Coast Range, which is the boundary between Santa Clara and Santa Cruz

counties. The hill slopes vary from moderate to steep, with general incline about 1200 feet per mile normal to the valley axis. From the standpoint of engineers and contractors the project presented many difficult problems.

The region through which the highway runs represents a series of geological periods and is structurally complex. About 1½ miles south of Los Gatos, a vast ridge or dyke of basaltic lavas cross cuts the country for miles in a northwest and southeast direction and is itself cut through by the erosion valley of Los Gatos Creek. At least two parallel major fault planes are crossed.

EXTENSIVE SOIL STUDY IS MADE

Surface conditions preclude the possibility of accurate determination of stratigraphic patterns in any continuous sequence; and generally, the decomposed top soils are in depths exceeding 20 feet. The dominant materials are shales and soft sandstones. In some locations, they are decomposed to known depths of 60 feet.

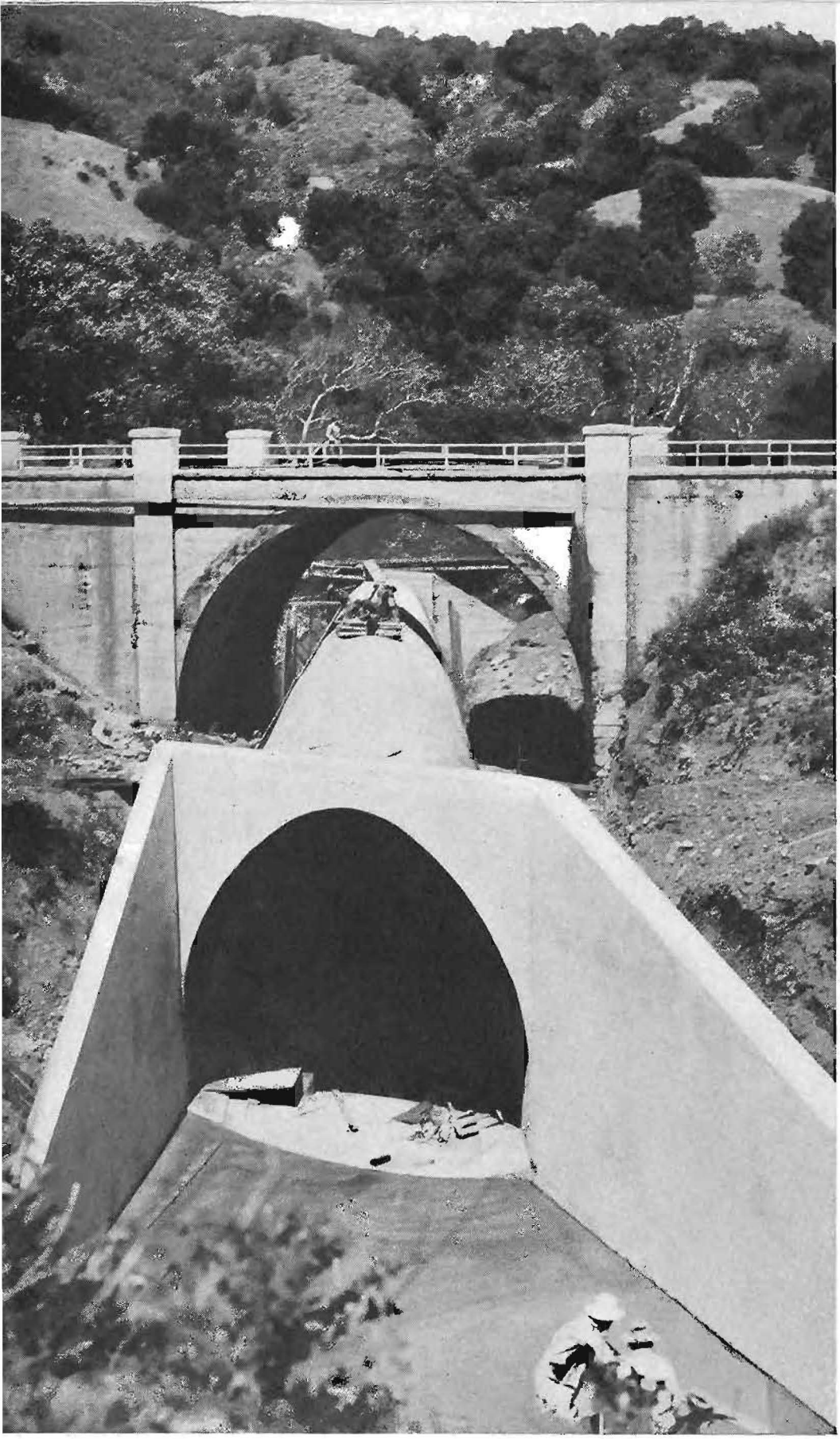
Extensive soil investigations were made by the Highway Research and Laboratory personnel of the Division of Highways before the present route was finally determined. Intensive subsurface studies of soil and geological formations were made at doubtful locations.

The value of this work both from a stability and future maintenance expense standpoint, can not be underestimated. In some cases it was possible to avoid areas of a dangerous character, as a result of the investigations; and in others, due to the knowledge gained of the underlying conditions, it was possible to design control measures to be installed during the construction procedure which we have every reason to believe will prove adequate.

BRIDGE PLAN IMPRACTICABLE

Many obstacles had to be overcome in the location of this highway. As an instance of this, it had originally been planned to cross Moody Gulch with a bridge. This gulch has been eroded out to considerable depth and bisects any logical location through this area, thus necessitating a crossing. An investigation of the foundation conditions disclosed the impracticability of designing an economical bridge at this location, and the entire location plan had to be

Mountainous area and geologic conditions of Los Gatos-Santa Cruz realignment present many fill and drainage problems. Picture shows clearing operations for large fill across deep ravine on new route which crosses line of existing highway seen near top of photograph.



Heavy reinforced concrete arch culverts are constructed under high fills where required water way is over 7 square feet. One such culvert as built under an old arch bridge is shown above. Both will be buried in the fill at that point on new route.

revised to provide the development of a line down into Moody Gulch to a point where its crossing by means of a deep fill would be possible.

The same foundation conditions which prevented the adoption of this bridge plan made necessary extensive control measures to insure the stability of this fill, but even this, added to the additional amount of distance necessary for development down into the gulch to make the required crossing, was many thousands of dollars cheaper than the most economical bridge design possible under the circumstances.

The territory through which this location passes has been highly developed with many subdivisions and improvements, with cabins, cottages and similar recreational improvements. Careful location was necessary to reduce to a minimum the conflicts with improvements of this nature and yet not sacrifice alignment or grade. A number of important recreational roads were crossed, where it was necessary to provide safe intersections. In one case of an important road of this nature, an overpass was designed to eliminate any possibility of future accidents.

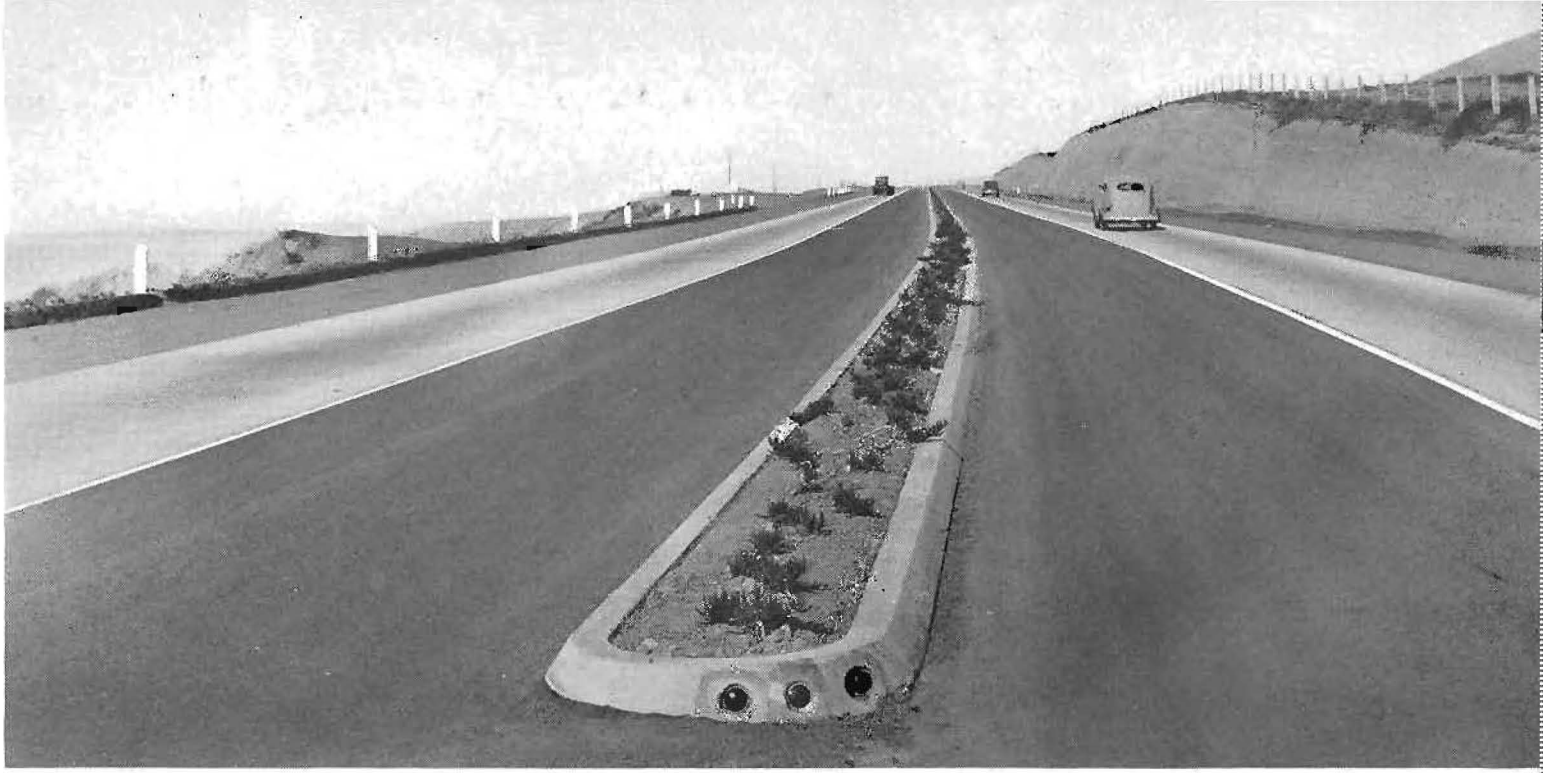
The present road, which was graded in 1915 and paved in 1922, is a 15 to 17 foot by 4½ inch, Portland cement concrete surface flanked by 1½ foot of 4 inch oil treated shoulders. The shoulder surfacing was added in 1929, 1930, 1931. The new highway will provide four lanes for traffic—two in each direction—with three-foot shoulders. Through one short radius curve of 500 feet at Moody Gulch, a center division strip will be provided.

SEEPAGE AND DRAINAGE PROBLEMS

Earth guard rails—mounds of earth built 1½ or 2 feet high on the fill shoulder edges—are being constructed on all fills. The top course of the subgrade will be selected roadway excavation topped with crusher run rock base and a wearing surface of bituminized crusher run base materials, roadmixed and compacted over the roadbed, shoulders, gutters, and roadside face of the guard rails.

Approximately 80,000 cubic yards of rock for trenching and fill treatment in Santa Clara County were secured from a quarry in the vicinity of Station 248 at the north end of the project. A total of 50,000 cubic yards of rock for similar use in Santa Cruz County was hauled a distance

(Continued on page 13)



Divided 4-lane highway on Coast Route with curbed and planted minimum dividing strip, dual type pavement with 12-foot interior and 11-foot exterior lanes.

Promoting Traffic Segregation

By FRED GRUMM, Engineer of Surveys and Plans

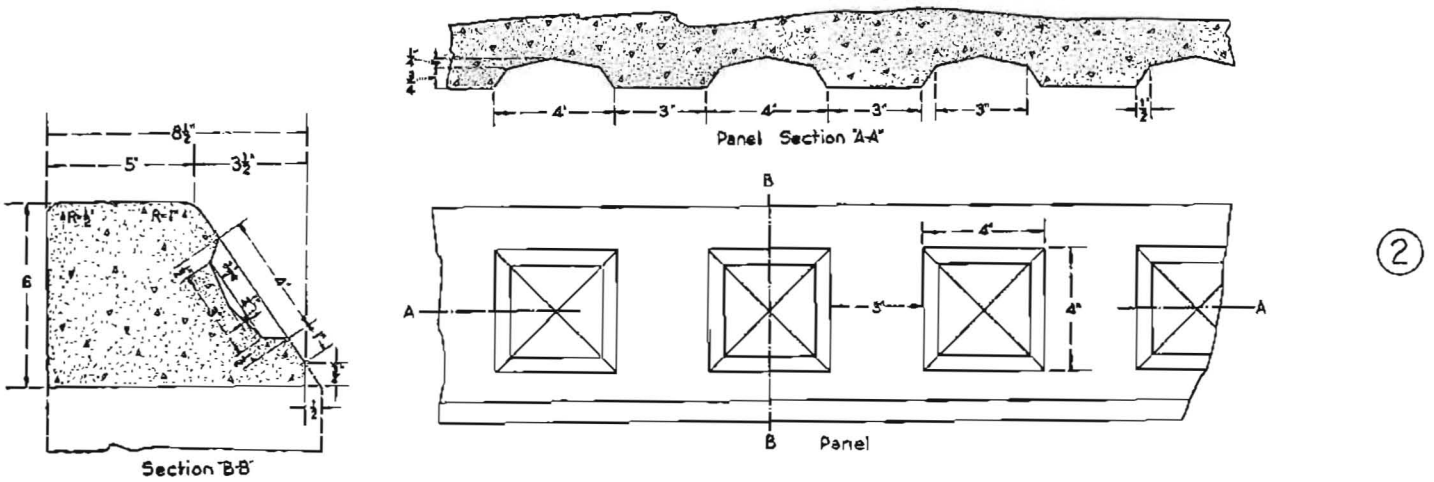
HIGHWAY ENGINEERS of the country are bringing to a point of general concurrence the results of their united effort to establish basic principles of highway design suitable for adoption under present-day requirements. The features of design to segregate paths of traffic in the interest of safety and comfortable operation, under the conditions of increasing speed tendencies and increasing volumes, have come under special attention. Changes in the highway for this purpose will probably be more apparent to the public than some other basic improvements such as in alignment and grade, which have been taking place more gradually.

In following the studies and reports on this subject it is natural to reflect on what part our own organization has taken in initiating design policies calculated to facilitate noninterference in safe travel on our highways, in supporting practices that conform with conclusions reached in authoritative engineering circles, and in planning and constructing as evidence of recognition of these present and future requirements.

Increasing pavement lane width is one of the elemental methods of assisting traffic segregation on the roadbed. About fifteen years ago the California state highway standard of ten-foot lane width was established. During the earlier years of this practice, the standard so established was generally adequate for the type of vehicle and speed encountered on highways at that time.

The provision for more adequate shoulders, (eight-foot width wherever practicable), became part of uniform design a few years later. With the treatment given the shoulders and with the flattening of side slopes, the efficiency of the pavement lanes was increased—a supplement to the effect of proper lane width. Results were appreciated by the traveling public, although the latter probably did not realize that for a long time it enjoyed a step in standards pioneered by but few other states.

This same enjoyment of ample roadway space led rapidly to the increase in rates of travel accompanied by steady increase in volume of traffic. Regardless of associated improvements in alignment and grade, traffic characteristics overreached the capability of ten-foot lanes to maintain sufficient segregation in respective lanes, especially with the introduction of larger amounts of the trucking element. As announced in the September, 1937, issue of "California Highways and Public Works," the State Highway Engineer put into effect an increase in width of pavement lanes. The eleven-foot width for pavement lanes was adopted as standard, with twelve feet for the passing lane where two or more lane widths are designated for each direction of travel. Incidentally, former practice was retained in specifying that minimum clear width on structures be two feet wider than each edge of uncurbed approach pavement. These standards, without further change, are complying with the recommendations now being promulgated for general practice by the American Association of State Highway Officials.



Recessed Curb Face for Curb Return or Island Section

Sketch of curb type with light reflecting panels.

Multi-Lane Highways

Extra lanes managed to provide for the further requirements of over-congestion on two-lane design during the period before high-speed tendencies and attendant accident rate brought conviction that the driver could not or would not move within safe limitations of conservatively designed facilities. Acceptance of assumption that the highway designer must extend his efforts to more fully counteract the harmful idiosyncrasies of the driver has, however presented additional problems. Their solution involves economic determinations as much as it does engineering technique.

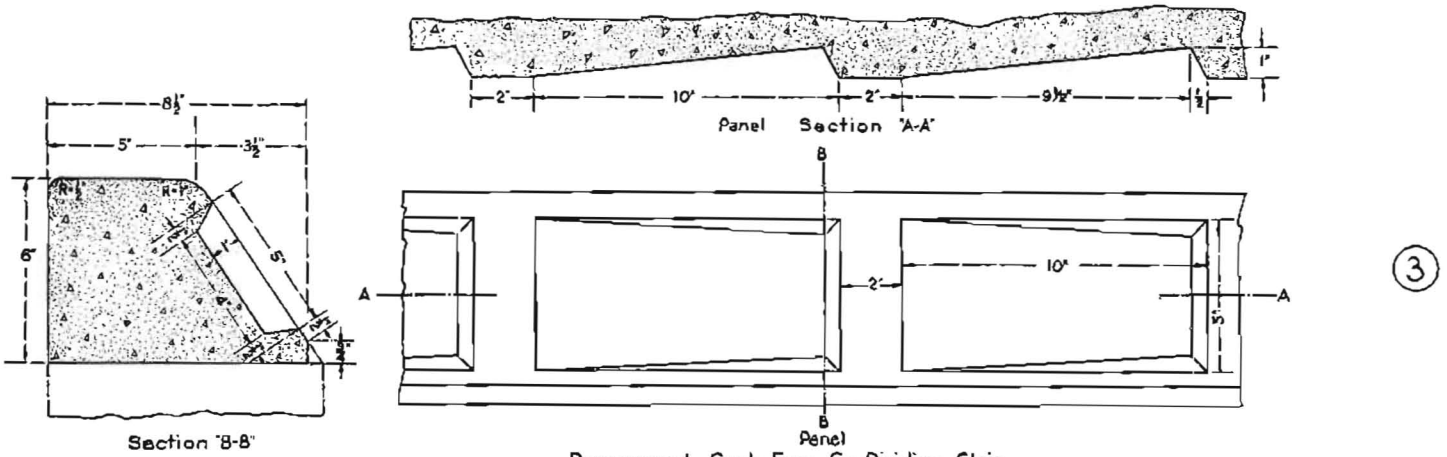
The three-lane highway design in California, is, for instance, a direct result of an effort to minimize outlay in providing for traffic volumes too dense for two lanes but not requiring four lanes. The three-lane road—which may be termed a divided two-lane highway—*more than doubles two-lane capacity and at reasonable cost.* It is adaptable to widening existing pavements and to new construction, whether or not there is expectation of later conversion to ultimate four-lane development. The potential hazard of cars operating on the middle lane limits its use to locations where safe passing sight distances obtain predominantly.

As now employed on California state highways, the three-lane design functions more safely and efficiently than the general public realizes. In California statistics the three-lane highways have a lower accident rate in side-swiping and head-on collisions than either two-lane or four-lane undivided highways.

Its efficiency in relieving congestion or readily segregating lines of traffic will be observed by anyone who has followed a heavily traveled two-lane pavement and sensed the immediate freedom of movement and dispersion of congestion as soon as the three-lane width is reached.

Proper three-lane design is not developed without careful study of future requirements, such as the ultimate conversion to four-lane divided roads. The economy in stage construction of three lanes is increased by selection of pavement types adaptable to greatest salvage value when the ultimate design is accomplished. Construction of two outside permanent pavement lanes with the central or less used passing lane having lower type surfacing gives the opportunity of converting the central lane into a dividing strip without appreciable loss when the permanent pavement lanes are symmetrically supplemented by two more lanes for a four-lane divided highway. Constructing the central lane of contrasting surface texture also serves an important purpose of defining respective lanes and of inducing use of the outer lanes except when passing.

Dividing highways of four or more lanes by neutral zones that separate opposing traffic movement is standard practice in this state. The design has been made a positive requirement with the undivided highway the exception that must in future proposals be justified by special conditions. We can not justify excessive outlay for dividing highways in limited speed zones where frequent crossings or intersections of city-street character re-



Recessed Curb Face for Dividing Strip

Sketch of curb type with light reflecting panels.

Divided 4-lane highway at Montecito with planted dividing strip and two parallel service roads separated from central roadway.

quire wide division strips for turning movements.

DIVIDED HIGHWAY PROJECTS

In the December, 1936, issue of this magazine, the divided highway problem in California was discussed at some length. We are reassured by subsequent progress that the policies indicated are still consistent with recommendations at large. Experience in our own state as well as elsewhere confirms the principles along which we have been working.

As more of the divided highway projects are undertaken, additional knowledge is gained of the many incidental items and considerations entering into correct construction. Collectively, they greatly increase the costs and difficulties of a divided highway program. We started our program on a conservative basis, anticipating the possibility of such adjustments. Although the divided highway program may now be considered in full swing it can proceed only as fast as the public can provide funds.

Granted sufficient funds, the Division of Highways can design and construct on any desired stretch a divided highway which would fully comply with current concepts. First there must, however, be adequate right of way. Reluctantly it is admitted that some of our projects, conservatively designed, have cost as much for right of way as for construction items. The division strip should be wide enough to properly treat intersections and cross-overs as well as to effectually divorce traffic streams from physical interference.

PLANTED DIVISION STRIPS

The division strip must be curbed or planted or treated to define and maintain respective roadways. In the localities where divided highways are most essential the maintenance of planting is often prohibitive, always a large perpetual expense. Structures must be proportionately increased in size, an expense not only for major structures but for the smaller drainage openings. When these things, together with a pavement and shoulders on good alignment and grade, have accomplished a facility for fast traffic, then there needs be provision for safely handling crossroads and for serving adjacent property with ingress and egress.

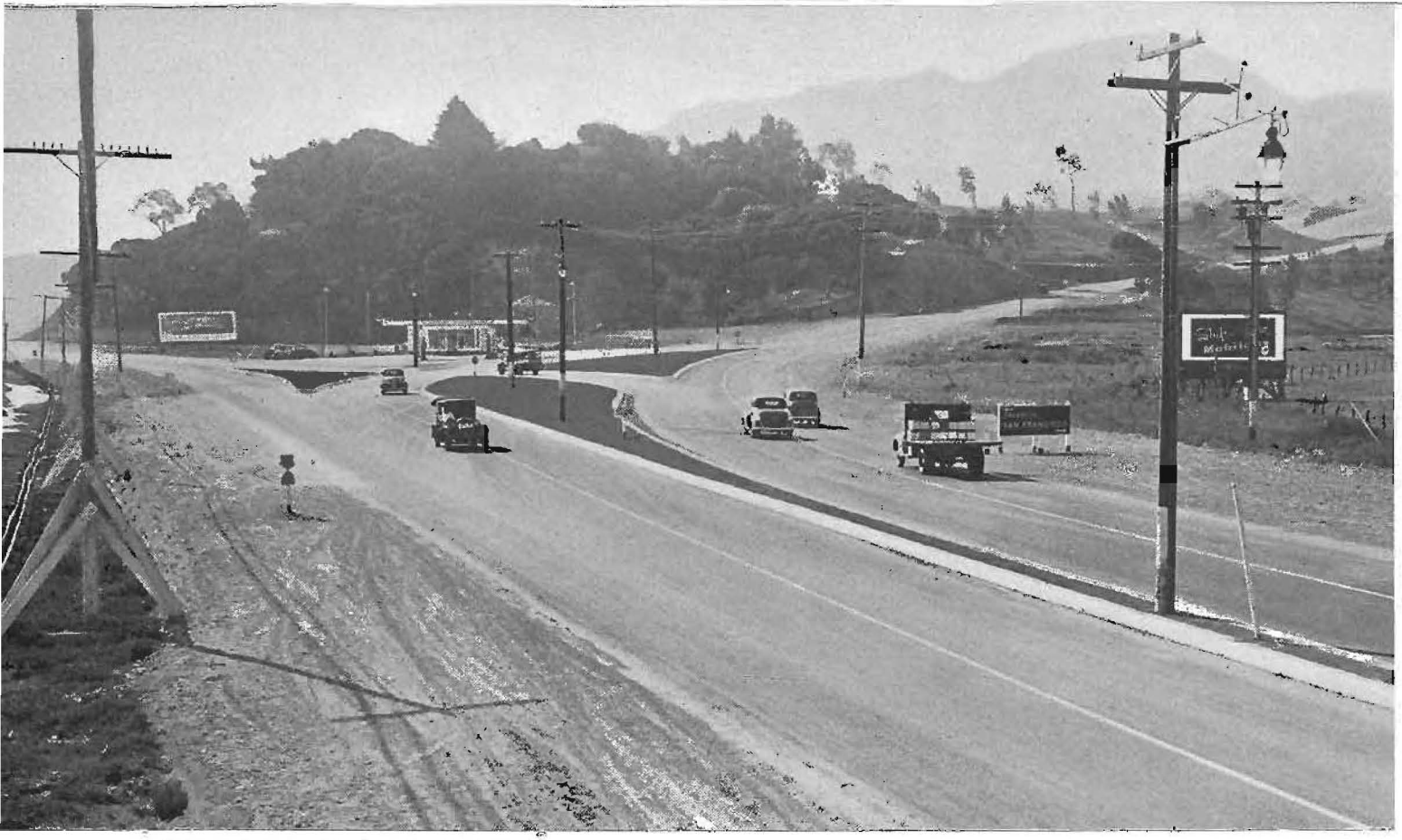
There are now on the State highway system about 120 miles of divided highways either constructed or under construction with curbs, wide separations, or raised or marked center strips. Plans prepared for projects now budgeted will bring this total to about 145 miles.

Many other miles of recent initial construction have been laid out on special design that requires only the addition of lanes to convert them into divided roadways. Most of this has been done within the past few years. In general it is the result of planning for improvements of an advanced nature without disastrously straining limited resources. The attainments may not be individually impressive. In the aggregate they indicate that an encouraging proportion of the State highways qualifying for this type of treatment has already been given attention.

DIVIDED HIGHWAY FACTORS

The width of dividing strip for divided highways determines many factors in the composite design. It influences the ultimate right of way requirement, the grading width and structure sizes, the type of treatment that would be applied to the center strip and the practical extent of turning movements at center strip openings.

To meet future needs in every respect, dividing strips 30 feet wide or more are desirable. On most of the roads rating four-lane capacity and therefore divided design, this would be prohibitive in cost of right of way, and in other cases would be prohibitive in cost of grading and even in physical limitations of roadbed stability. For practical economy, compromise widths must be accepted or it would be impossible to entertain an extensive program of dividing multilane highways.



Channelized "Y" type intersection of Waldo approach highway to Golden Gate Bridge and Coast Route to Sausalito in Marin County.

A four-foot width has been adopted as the minimum for separation strips. Six-foot width is a preferable minimum, this width incidentally being procurable when one ten-foot lane of an existing pavement is occupied by the dividing strip, with two feet of each side of that lane constituting part of adjacent twelve-foot traffic lanes. Separation strips twenty feet wide offer moderate protection between the two roadways as an intermediate stop-zone for crossing traffic With this or greater widths bordering curbs are not necessarily required.

SIX INCH CURB DESIGN

Curbs along dividing strips of limited widths are a necessary provision. The adopted curb design is six inches in height with face sloped on a batter of four inches in that height. The State has also developed and used a recessed curb design with light-reflecting panels that increase visibility at night and in fog. Without a distinctive color scheme that shows height and breadth of a plain curbed strip, there have been instances of overrunning the curb at night in belief it was only a pavement stripe.

Trial has been given to rolled, raised dividing strips, flush division spaces paralleled by double stripes, and flush division strips with embossed arrows placed diagonally across the strip. The latter type was developed in our Los Angeles district, originated for roadways where many openings required by developed adjacent property would destroy the usefulness of a narrow curbed strip. The raised arrows are painted white and the strip is bordered by double traffic stripe. The type is effective under special conditions and is relatively inexpensive in its construction and maintenance.

SEPARATING DIVIDED STRIPS

In some locations advantage can be taken of the topography to separate the two roadways by means other than the more conventional curbed plan. Using an existing two-lane pavement for one-way traffic, the other roadway for travel in the opposite direction may be constructed only approximately parallel thereto and not necessarily on the same grade plane except at crossings.

The width separating the roadways will depend on local conditions and width of right of way that can be procured. The investment on the original road can be retained and even though it may have been deficient in sight distance while carrying traffic in both directions, it will usually be found to be adequate in that respect when used for one-way traffic. Existing tree rows can be preserved by including them within the division strip. In such cases trees should be not less than about 12 feet from edges of pavement. A considerable mileage of divided road has been built in California by this method.

In the construction of divided roadways savings have been made by designing the inside lanes, used by the lighter and faster vehicles, for intermediate types of surfacing or for somewhat less thickness of permanent pavement types. The contrast in surface appearance of the two lanes is also a benefit in defining the lanes of travel.

Freeways and Parkways

Although divided highways are steps in this direction, California has not yet by law established the "Freeway" principle for the highways of the State. The necessity for the application of this principle, however, is imperative if the integrity, capacity and purpose of the major traffic arteries, especially in urban territory, is to be preserved.

Abutting property in such areas is rapidly developed to business or

semi-business purposes. This type of improvement induces traffic, creates stopping, parking and conflicting movements of vehicles. The improvement of the highway invites such adjacent development. Uncontrolled access from abutting property so developed, the movements of vehicles and volume of traffic induced thereby, quickly reduces the efficiency and capacity of the road. It returns again to its pre-improvement status—a congested local-service road.

The current method of financing State highway construction, maintenance and operation is by a tax on the road user. Abutting property does not contribute to the improvement of the road. In fact, it is compensated fully—usually at high prices because of increased valuation—for the right of way on which the highway improvement is made. Equitable treatment would require either a contribution by abutting property, proportional to benefits received from the improvement or a curtailment of the infringement on or destruction of a facility designed for a definite and necessary purpose and paid for by the user of this facility.

TWO PRESENT METHODS

Two means are at present available under the laws of the State and have been exercised in preserving the utility of several of our major highways. One is the acquisition of access rights from abutting property, limiting such access to definite and designated locations. The other is the acquisition of sufficient additional width of right of way to permit the construction of service roads fronting the property but separating from the central through roadway.

Access to the central roadway is permitted, again, only at definitely designated points where conflict may be eliminated. The latter method has proved to be the more feasible where frontage rights of property have already been established.

A section of this type of highway has been built at the southerly approach of State Highway Route 2 to Santa Barbara. Additional projects in the Bay area and in the metropolitan area of Los Angeles are under way. The Arroyo Seco Parkway, State Highway Route 205 between Central Los Angeles and Pasadena, has been designed and is being constructed for some seven miles of its length as a freeway. It is a six-lane divided central roadway with separated service roads where required. All cross-traffic will be eliminated by grade separation structures. Inlets and outlets with acceleration and deceleration lanes are provided at major highway connections. Appropriate landscaping is being planned.

Highway intersections

Highway intersections are critical and potential points of hazard. They are also prime factors in the interruption of free flow of traffic and reduction of the efficiency of the road. These influences are emphasized with increased volume and speed of traffic. Adequate design for safety and efficiency of the highway must, therefore, necessarily include the highway intersection.

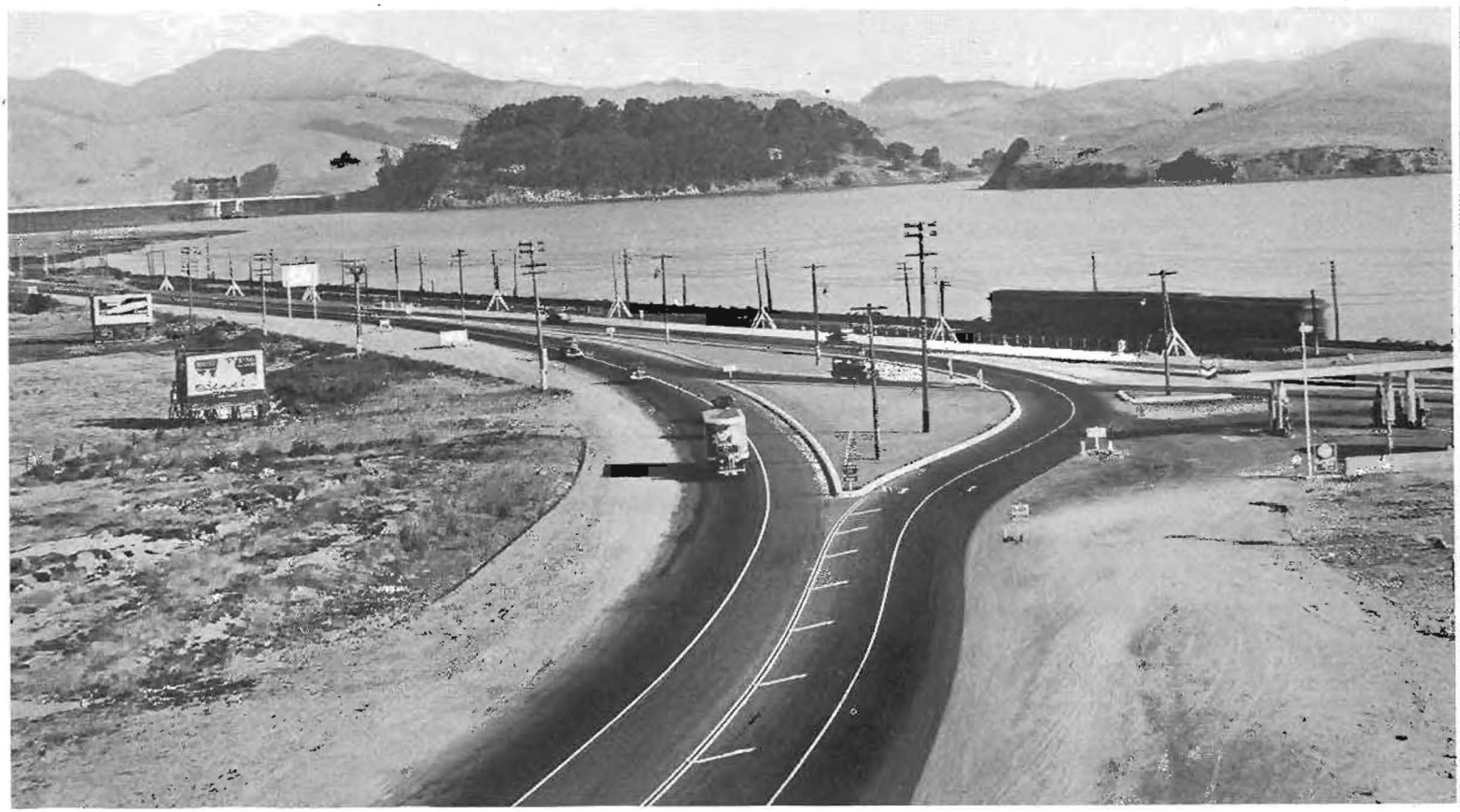
Separation of grades at intersections is the satisfactory and ultimate solution of this problem. But, again, the high cost of this method of treatment and limitation of funds, imposes a deferred program of this character.

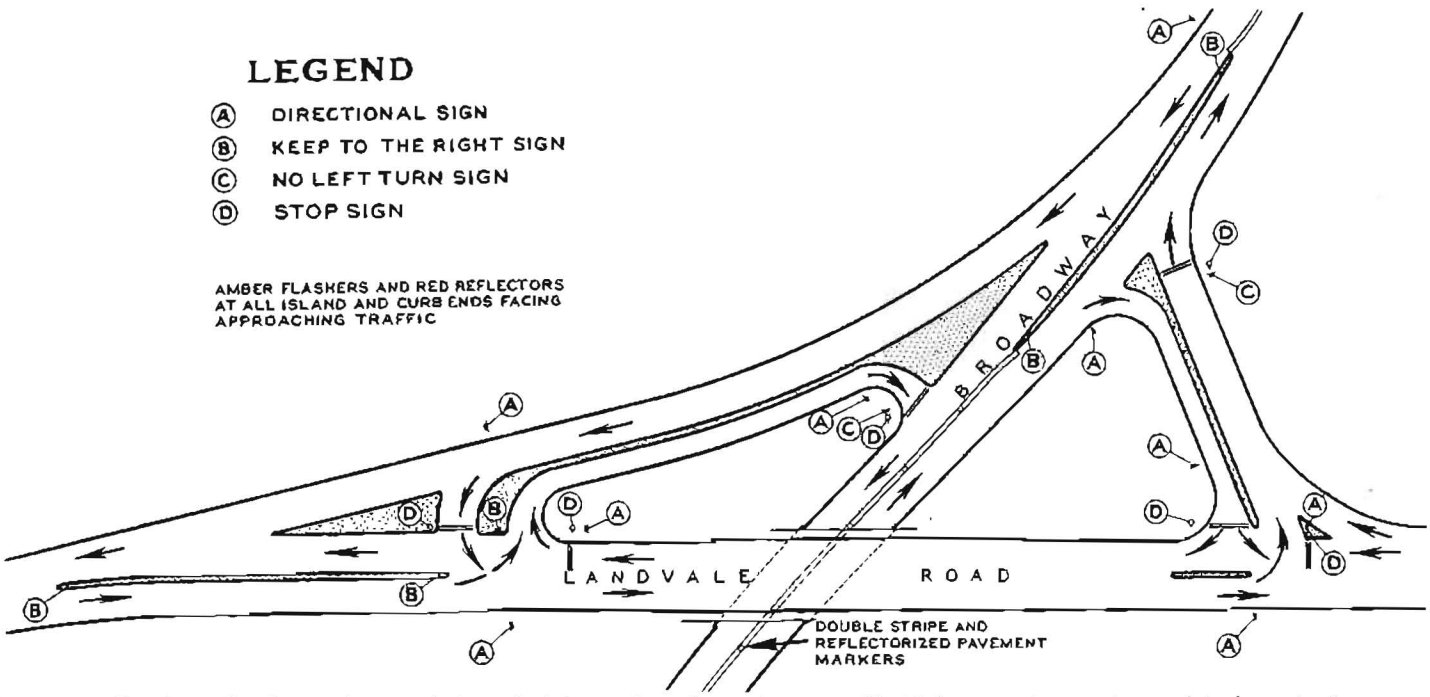
To meet this contingency, to provide some measure of protection pending the ultimate solution, to increase the capacity of the road without increasiug the hazard at these central points, the construction of "channelized" intersections at grade has been included in the program of better standards for State highways.

This treatment also offers a more satisfactory solution than do customary methods of control for those intersections where moderate traffic volume on one or more of the intersecting roads does not justify separation but still requires relief from hazard and congestion.

The design of "channelized" intersections is based on the principle of segregating traffic into directional lanes. It is accomplished by the in-

Another view, looking north, of channelized "Y" intersection of Coast Route to Sausalito and Waldo approach to Golden Gate Bridge.





Plan of traffic channelization and separated grade intersection of two heavy traffic highways where only partial clover leaf connections are possible.

stallation of traffic islands which define the lanes for the movement of vehicles in every desired direction. The design should be simple. The path which each vehicle approaching the intersection must take should be clearly and visibly defined so that it may be negotiated without hesitation.

INTERSECTION CHANNELIZATION

The Y type of intersection frequently presents a particularly hazardous situation especially where two heavy traffic roads in open country are involved. At such locations usually the area of conflict between different streams of traffic is large or extended. Wide paved surfaces unless defined, permit uncontrolled operation of vehicles adding to confusion. Proper design at such intersections will provide for uninterrupted flow of the major traffic streams and will subject only the minor streams to an intersecting crossing with stop control.

Several installations of this character have been made or are in the course of construction. The intersection of State Highway Route 1 with the main road out of Sausalito and the intersection of State Highway Routes 4 and 23 near Newhall Tunnel.

Usually sufficient right of way is acquired at the time of initial improvement to allow for ultimate development of separated grades.

Seldom, if ever, will the plan designed for one intersection be suitable for another site without revisions therein and conditions usually require a new design even though the type is similar. We are striving for simplicity in design, uniformity in the manner of directing traffic movements and avoidance of indirect leads that may be confusing.

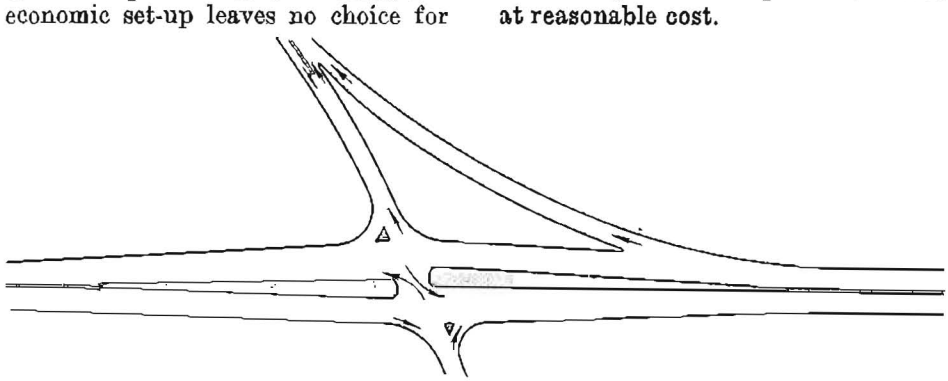
ADDITIONAL SAFETY FACTORS

Signing is an important factor in the intersection design. Preparation of the signing chart often discloses advisability of some revision in the design. The design is not complete without the traffic striping, reflector buttons, flashing lights and lighting.

Notwithstanding the assumption that the highway designer and constructor should do everything practicable to produce safe facilities, our economic set-up leaves no choice for him except to improve facilities progressively. By exercising ingenuity the engineer can economize but unless the design is also plainly understood and so utilized by the motorist the results are far from satisfactory.

Principles of separating highway lanes and of channelizing intersections are not universally understood by the motorist. With only a limited amount of construction of this nature in use it will take time to instill proper reaction to the new methods. When taught what to expect under these conditions the motorist will handle the facilities more efficiently and safely.

The motorist has not been given thorough instruction in the elemental principles of the highway design and as a result the engineer finds it difficult to provide foolproof facilities at reasonable cost.



Sketch of channelized intersection between heavy traffic highway and low traffic road.

Heavy grading work under way on Los Gatos-Santa Cruz realignment. Approximately 2,300,000 cubic yards of dirt will be moved.

Los Gatos-Santa Cruz Project

(Continued from page 6)

of 8 miles from Scotts Valley for foundation protection of fills.

Seepage and drainage had to be given special study. The average rainfall in this section is about forty inches annually, of which 23 inches are registered during the winter months. The maximum 24-hour rainfall is about 8 inches.

While the highway runs through mountainous region where there are no low level areas, there are stretches with soil mantle carrying heavy seepage. It is this condition that necessitated numerous construction precautions against seepage. Heavy gauge corrugated metal pipe culverts are used under high fills. The troublesome features of drainage are due to the spring and seepage areas caused by water impounded in the soil overlying stratas of shales and other dense materials.

Under high fills, heavy reinforced concrete arch culverts are being constructed on rock filled drainage foundations where the required waterway is more than 6 or 7 square feet. At one point on the present route, a reinforced concrete arch culvert has been built under an old arch bridge. Both the bridge structure and culvert will be completely buried in the fill at that point. Where a drainage area calls for a 24-inch circular area, a 30-inch diameter corrugated metal pipe is installed.

In addition to grading, excavating, and construction of fills and culverts, a job of no mean proportion is involved in the clearing of about 114 acres of redwood timber undergrowth and logged over sections of country. The cost of clearing along the right of way alone cost about $541 per acre.

Overhaul for the ordinary cut and fill balances is calculated at about 18,000,000 station yards. Along about 20 per cent of the line in the cuts the excavated material is suitable for fill up to subgrade elevation. On the balance of the route cuts and fills will have to be brought to a grade about 10 inches below subgrade elevation and suitable materials hauled in for topping. For practical purposes, calculations for balance and overhaul were made on the basis of rough grading to an elevation 1.35 feet below profile grade through the job. This allows 0.85 feet for select topping.

SEVERAL SLIDES ANTICIPATED

A swell factor of 5 per cent was applied to the whole excavation yardage. Through the forested areas top soil to a depth of several inches is full of forest litter and humus. In addition to the fill foundation trenching there is approximately 30,000 cubic yards of stripping of unsuitable material to use in heavy enbankments. The extensive sections of side hill filling also accumulate considerable loss to be covered by the shrinkage factor. On several locations excess clay is wasted on the upper side of gulch fills.

Several places in deep cuts are expected to fall or slide. This has been estimated at about 5 per cent of total excavation (about 100,000 cubic yards). An average overhaul of 15 stations is anticipated for slides, mak-

(Continued on page 28)

Galt Highway Realignment Eliminates 9 Curves on U. S. 99

By R. E. PIERCE, District Engineer

THE realignment of U. S. 99 in the vicinity of Galt has been completed and opened to traffic. This relocation eliminates the only poor alignment left on this important north and south highway between Sacramento and Stockton.

This improvement beginning on the present highway just north of the Southern Pacific Railroad, Ione branch, and crossing north of Galt, runs in a direct line southeasterly to a connection with the present highway at Jahant Corner on Cherokee Lane, 5 miles north of Lodi. The length of the new line is 4.98 miles, making a saving in distance of 0.57 mile over the present route.

The new line eliminates nine curves, ranging in radius from 368 feet to 3000 feet, having a total angle of over 371 degrees or more than one complete circle; while the new line has only two curves, one at each end of the change, with radii of 3000 and 5000 feet, and a total angle of less than 37 degrees.

The old bridge over Dry Creek is very narrow and with its curved approaches has long been a hazardous bottleneck. The new bridges, on the new location, of adequate width and with tangent approaches, will be appreciated by the traveling public. The Galt business district and the high school located on an "S" curve in the old highway are by-passed by the new line.

The grading and paving of this important improvement has been entirely completed, also the two bridges, built under a separate contract, over Dry Creek, construction of which was delayed by high water last winter.

As stated in a previous article, this project is planned for an ultimate two-way divided roadway, both as to right of way and location of the present pavement. This is accomplished in a right of way of 120 feet in width by placing the present pavement on an offset so that a 20-foot separation will be provided on the ultimately divided roadway.

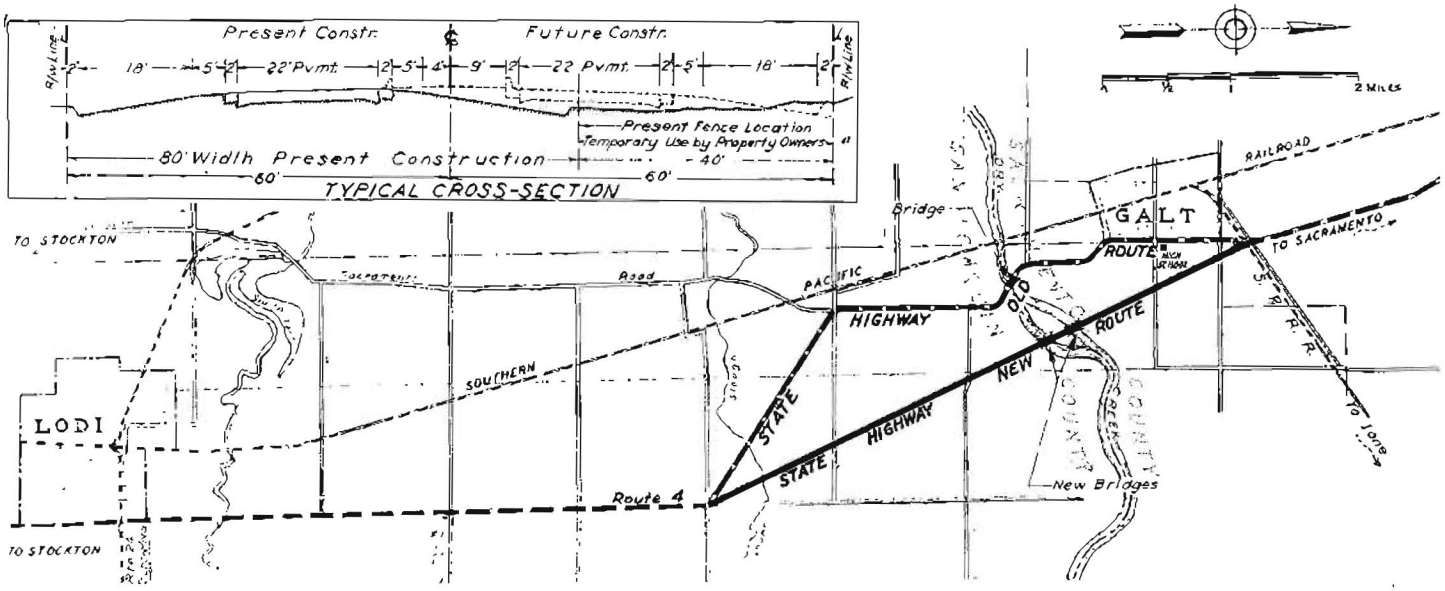
In order to avoid the appearance of an unbalanced right of way, the fences have been constructed so that the present pavement centers on an 80 foot strip on the westerly side of the right of way, the forty feet on the east being available for use by the adjacent property owners until such time as the highway is developed to its ultimate section.

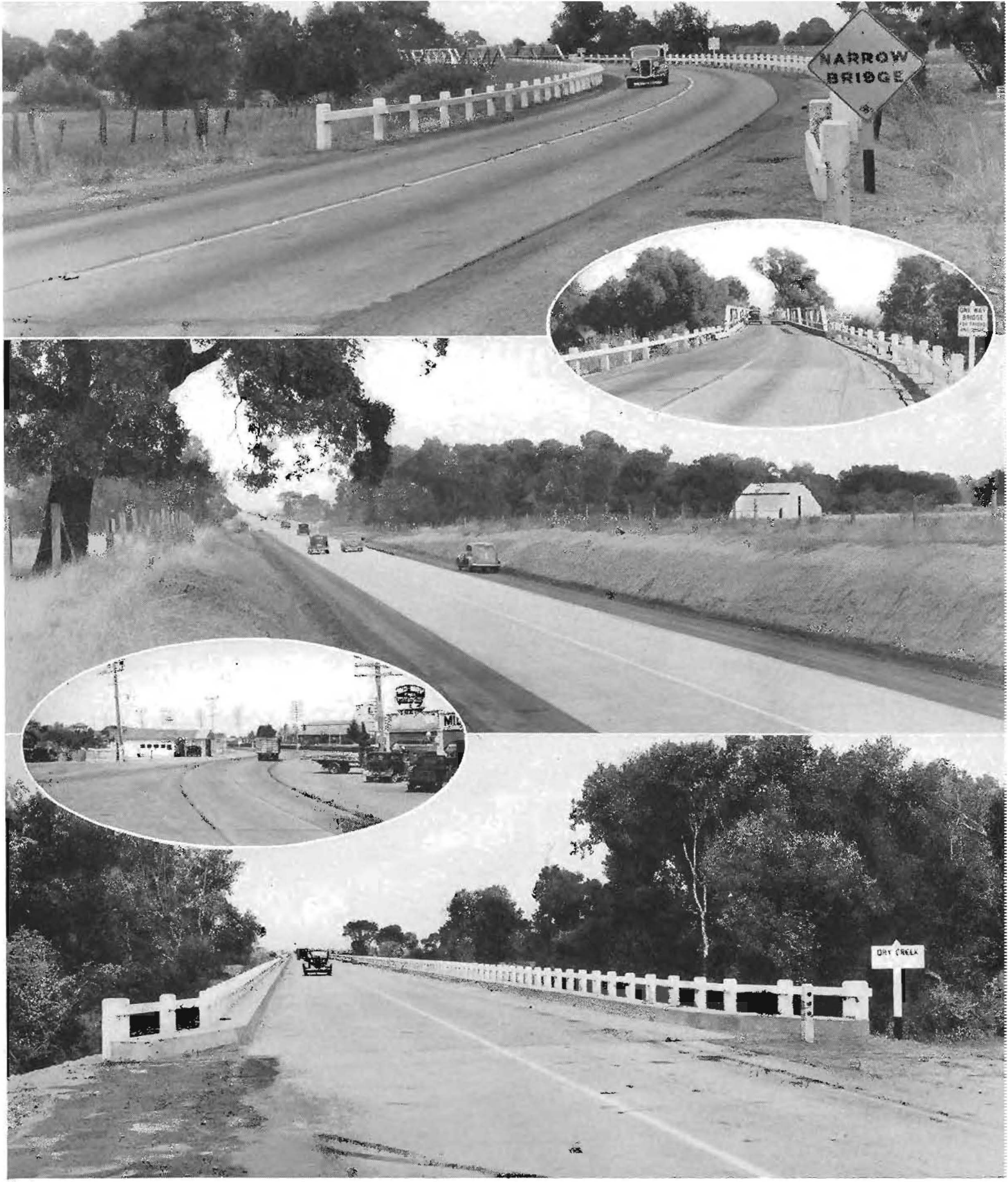
The grading in general is light. The adopted section called for finishing the subgrade 1.40 feet below the profile grade of the pavement and placing thereon a membrane seal consisting of 0.7 gallons per square yard of Grade "E" asphalt cement at a temperature of between 300° and 400° F. Upon this seal imported borrow was placed having a low shrinkage and high bearing and cementing values for greater stability.

The pavement placed in two strips, each 11 feet wide, was of class "B" Portland cement concrete; each strip was 0.55 foot thick upon the inside edge, to a point 2 feet from the outside where it increased uniformly to a thickness of 0.75 feet at the outside edge.

These two 11 foot sections are tied together by assemblies consisting of two ¾-inch round tie bolts, spaced four feet apart.

Expansion joints are spaced 60 feet apart with weakened plane joints 20





Features of the Galt realignment shown above are: Top and inset—Old, narrow Dry Creek bridge with curved approaches that constituted a traffic bottleneck. Center—Straight new 22-foot pavement with provision for four-lane divided highway. Inset shows old "S" curve through business section past high school. Bottom—New Dry Creek bridge.

New motorized mechanical float finisher. Front tank holds additional water supply.

feet apart. The usual dowels and supporting bars were used.

Featuring the concrete finishing work was the use of the new mechanical float finisher recently developed in Southern California. This mechanical float used here is the first motorized and improved unit to be placed on a major project. This machine works behind the tamping and levelling finishers, eliminating all hand float work except on joints and edges.

Several new developments have been incorporated in the suspension of floats and in the facilities for making adjustments of the floats. Motive power is supplied by a 60 h.p. engine, geared to a transverse drive shaft which transmits the power to a pair of wheels on each side of the machine. A water tank has been mounted at one end to provide additional water when it is required to form an even surface.

The mechanical float makes about six trips over the fresh concrete, following immediately behind the strike-off machine. Two mechanical tampers operate between the mechanical float and the paver, tamping and striking off the concrete.

On the first passes of the mechanical float the 8-inch roller is in contact with the surface, kneading the concrete and keeping the surface in an easily workable condition by bringing up fine portions of the mix. Meanwhile, the diagonal floats continually work the concrete back and forth from high to low spots.

On the final pass the roller is lifted and a cut-float at the rear of the machine lowered to the surface for the last strike-off. This procedure secured a very true, smooth-riding surface.

The pavement was cured by blanketing with heavy cotton mats, kept thoroughly wet for a period of seventy-two hours.

Between the two bridges across Dry Creek a fill about 500 feet long was built, protected by concrete slope paving on the ends and upstream face, and by broken concrete riprap on the lower face. Slope paving also protected the slopes at the other ends of the bridges.

The two bridges, the southerly one being 838 feet long and the northerly one 184 feet long, are of the slab type, placed on 3 pile bents; the piles were cast in place reinforced concrete in steel shells driven without mandrel.

On the grading and paving job Fredericksen and Westbrook were the contractors. A. K. Nulty was the resident engineer on the project for the State.

The contractor on the bridges was Lord and Bishop. Geo. W. Thompson handled the bridge contract.

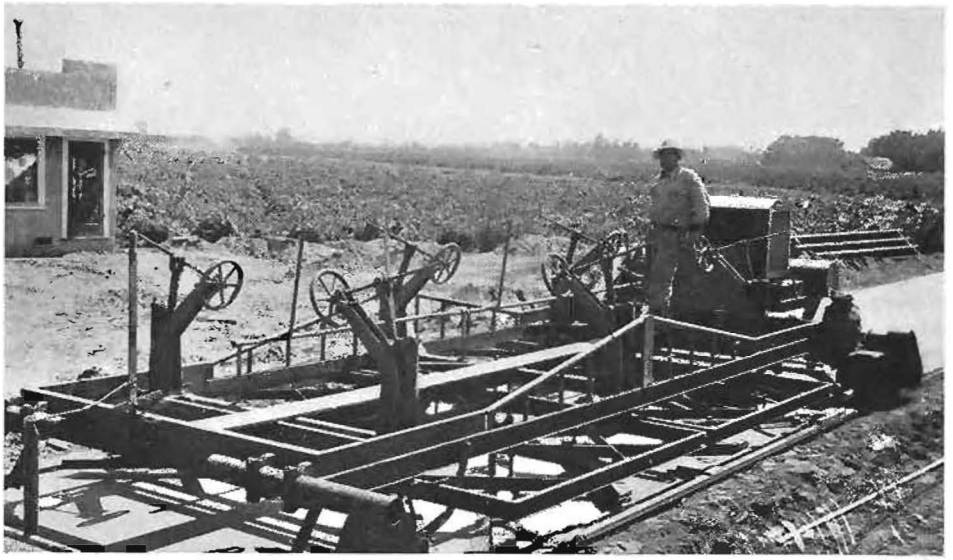
This new location by shortening distances, by-passing the narrow business street in Galt and with much improved alignment, should materially increase the safety and comfort to the more than 4000 cars traveling this road daily.

Law Compels Careful Driving in Wet Weather

Reminding motorists that summer is gone and winter rains are upon us, J. W. Vickrey, Safety Engineer of the Division of Highways stated that last year 350 accidents on rural State highways were charged to slippery pavements.

"Highway engineers are building non-skid pavements and traffic protection features into roadways but they can not control rain, snow, and frost. Slippery pavements are only as safe as the motorist who drives upon them.

"Many people think the forty-five mile speed limit means they can travel at this speed at all times but the Vehicle Code provides that no person shall drive at a speed greater than is reasonable or prudent having due regard for traffic conditions and the surface and width of the highway."



Rear view of mechanical float showing details of controls. Engine is 60 H.P.

Narrow Bridge on Coast Route in Santa Barbara County that carries heavy truck traffic. Lack of funds prevents reconstruction.

Cost of Road Upkeep High in District V

(Continued from page 8)

roads which were taken into the State Highway system in 1933. They have been maintained in as serviceable condition as funds would permit, but should be replaced with new structures at as early a date as possible to obtain the fullest use of these roads. In addition to the bridges with limited capacity, there are other bridges which are entirely too narrow for the traffic which they bear and are a distinct hazard.

There are forty grade crossings in the district subject to elimination. Accidents have occurred at several of these crossings and the only reason that some of them have not been eliminated is because of lack of necessary funds. Some of the existing grade separations, particularly on the secondary system, are entirely inadequate and should be replaced with new construction so as to eliminate dangerous approach alignment and grades as well as to provide suitable structures. It is considered that 14 grade crossings should be eliminated as priority improvements in this district at an estimated cost of $1,011,000.

There are four existing grade separations which are inadequate and which it is estimated would cost $195,000 to replace with new structures.

There are some sections of District V highways on which the maintenance costs are unduly high. The cause of this expensive maintenance can be attributed to the fact that the road surface is not up to a standard required by the amount of traffic that the highway carries. This condition is entirely due to lack of funds for necessary construction and will continue until sufficient moneys are provided to bring the roads to the required standard.

An estimate of the cost of improving the highway system in this district to a proper standard for the traffic it bears is given in the tabulation below:

Of the total 1090 miles of State highways in the district 734 miles or 67% require expenditures as follows:

671 miles—2 lane: New and reconstruction	$22,435,000
19 miles—3 lane to 4 lane: Reconstruction	995,000
39 miles—2 and 3 lane to 4 lane divided: Reconstruction	3,241,000
5 miles—Bridges and Railroad Separation: New and Reconstruction	4,771,000
Total	$31,442,000

District V was allocated $1,874,000 in the previous biennium and $2,159,000 in the current biennium for construction and reconstruction projects. Assuming an average budget of $1,000,000 per year, it is evident that it will require 32 years to bring the highways in this district to a condition adequate for present traffic.

If traffic continues to increase as it has in the past, a considerable proportion of the improvements included in the estimate given above based on past allocations will be inadequate long before the expiration of the 32 years required to finance them.

Governor Merriam Pilots First Train Across Bay Bridge

WEARING a brand-new trainman's cap, Governor Frank F. Merriam, chairman of the California Toll Bridge Authority, piloted the first electric train across the San Francisco-Oakland Bay Bridge Friday morning, September 23.

A Key System two-unit streamliner, the train started at 40th and Hollis Street and proceeded to the easterly foot of the bridge, where Governor Merriam boarded with his party. The Governor was accompanied by Chief Engineer C. H. Purcell, Bridge Engineer Charles E. Andrew, Engineer of Design Glenn B. Woodruff, Florence M. McAuliffe and Lloyd W. Dinkelspiel, counsel for the California Toll Bridge Authority.

Railroad officials, who, with newspapermen, were other occupants of the train, included: W. A. Worthington; C. R. Harding; A. T. Mercier; L. B. McDonald, vice presidents of the Southern Pacific; W. H. Kirkbride, chief Engineer; E. E. Mayo, assistant chief engineer; G. E. Gaylord, superintendent; F. E. Sullivan, train master, and E. J. Foulds, attorney, all of the Southern Pacific.

Key System officials were Alfred J. Lundberg, president; vice presidents William P. St. Sure, C. N. Anderson, Chester C. Vargas, S. G. Culver, Bruce Campbell; Frank Richards, general counsel, Andrew T. Haas, architect. I. S. Shattuck, traffic engineer for the Golden Gate International Exposition was also an observer.

The Governor was originally scheduled only to start the train as a ceremonious gesture. However, after a few brief instructions by Vice President C. N. Anderson in charge of operations for the Key System, the State's chief executive proved himself an able trainman and remained at the controls to guide the train and its 80 some passengers across the bay—the first time in history that a train ever crossed under its own power directly between San Francisco and the East Bay.

The trip proved the success of the bridge railroad constructed by the State Department of Public Works. Unanimous opinion of railroad experts and newspapermen was that the roadbed provided smooth and quiet operation; that the automatic cab control system was highly efficient and that the view from the train windows was unsurpassed.

Chief Engineer C. H. Purcell tersely summed up his inspection following the first test run. He reported: "The cab signal for the run indicated a permissible speed of 35 miles per hour and the train proceeded across the bridge in accordance with this prescribed signal indication. All facilities and equipment operated as intended."

It required approximately an hour to make the round trip over the bridge on the train's first run. This was due to frequent stops for inspection of expansion rails, and to permit newspapermen to photograph the train on the bridge.

It will require approximately 10 minutes after trains are in actual operation, to cross from the center of the San Francisco Bridge Terminal building to the easterly foot of the span.

Bay Bridge Traffic Shows Increase Over September 1937

A FIVE per cent increase in San Francisco-Oakland Bay Bridge traffic over that of a year ago was revealed yesterday by Director of Public Works Earl Lee Kelly from the September traffic report filed by State Highway Engineer C. H. Purcell. A total number of 740,622 vehicles crossed the bridge during last month, as compared to a total of 705,704 for the same period in 1937.

Due to changes in rate parities between the ferries and the bridge since the time of the bridge opening, this is the first time that a parallel comparison could be made between 1937 and 1938 and those for the current year. Other classifications of traffic also showed an increase over last year. Freight pounds were up 67 per cent, with a total of 107,886,750 pounds for September, 1938, as against 64,352,834 for the same month in the previous year. The number of trucks increased approximately 51 per cent with the comparitive figures of 37,684 for September, 1938, and 25,031 for September, 1937. Buses increased 39 per cent with 13,153 buses crossing the span last month and 9462 in September of last year. Traffic for September, 1938, averaged 24,687 vehicles a day—a drop of 389 vehicles from August.

High point of the month was on Saturday, September 24, when 33,762 vehicles crossed the bridge. This increase was due to the St. Mary's football game in Berkeley.

	Total September	*Total August*	*Total since opening*
Auto Trailers	1,473	1,848	27,772
Passenger Autos	657,611	693,297	15,571,167
Motorcycles	2,806	2,994	58,396
Tricars	1,003	1,167	18,293
Buses	13,153	13,432	207,185
Trucks	37,684	39,863	600,912
Truck Trailers	1,637	1,768	34,576
Toll Vehicles	715,367	754,369	16,518,301
Auto Passes	23,245	21,089	231,345
Truck Passes	2,010	1,905	22,315
Total Vehicles	740,622	777,363	16,771,961
Extra Passengers	233,561	244,728	4,027,469
Freight Pounds	107,886,750	111,016,500	1,482,654,409

After a few minutes of instruction, Governor Frank F. Merriam took over the controls, started the motor, and piloted across the San Francisco-Oakland Bay Bridge the first train in history to cross under its own power from Oakland to San Francisco. The Key System two-unit stream line is shown with Governor Merriam at the throttle and below, shaking hands with the Governor are railroad workers: (left to right) Martin Coyne, John Armstead and Fred Welsh.

A Graphic Presentation of the Traffic Safety Problem

By C. H. PURCELL, State Highway Engineer

TRAFFIC Safety in the broad sense in which it must be treated by the Division of Highways signifies the safe and orderly movement of traffic over an entire highway system—operating within its income.

While profoundly concerned that such movement shall be safeguarded against personal hazard to all engaged in it, frank recognition must be made of the fact that "safety" is a relative term and when combined with "traffic" the subject immediately becomes greatly complicated. This problem in solution calls for the practical adjustment of the several elements, which rightfully demand full consideration before a decision is made.

Any highway system is perfectly safe when there is no traffic, and likewise perfectly useless. Once traffic is introduced the highway system is never again perfectly safe; but, fortunately, we know that increased use does not necessarily bring relatively increased hazard. It is this knowledge that gives reasonableness to the effort that is being constantly put forth to increase the usefulness to traffic of the highway system and at the same time to lessen the hazard of accident.

The ultimate in traffic facilities so far as each individual is concerned would provide complete freedom of movement; a condition, of course, unattainable because of the conflict of interests among the millions of individuals who must be accommodated on the system. Nevertheless, because the highway system becomes more nearly satisfactory to traffic as freedom of movement with safety is assured, the promotion of traffic safety must be of a positive nature primarily, and negative only to the extent that adequate control demands such measures.

In its broader aspects traffic safety comprises many other things of importance in addition to relative freedom from danger to life and limb. Safety also means security, dependability. Complete interruption of traffic would eliminate all collisions between vehicles, but this interruption would in itself greatly damage traffic as such and could lead directly to great personal suffering.

The weakening or collapse of the highway system in any of its portions or its essential functions could be just as definitely disastrous to the safe and orderly movement of traffic as the failure through inadequate design, construction, or maintenance of any particular physical part.

In order that the maximum in traffic safety may be obtained from each highway dollar expended, those responsible for decision as to its use must have before them understandable data covering those basic conditions which will in general govern any final conclusions.

The main factors that will ordinarily weigh most heavily are:

1. The traffic served.
2. The service given.
3. The cost of service.

Accurate knowledge of these three factors is vitally essential, not alone for the proper and equitable allocation of maintenance and improvement funds but for protecting the very solvency of the system itself.

This information, to be of practical use, must be neither so general as to prevent the review of each administrative unit by section or route, nor yet so detailed that the major features are lost in the mass of lesser items.

In making such a statement there is no intention to convey the idea that a general knowledge of these three items alone is sufficient equipment for the successful operation of a highway transportation system. It is simply to emphasize the fact that reliable information on these major points must always be immediately available to give or deny support to proposals based upon other factors purely local or more specific in character, and to make possible the orderly pursuit of proper and far reaching policies.

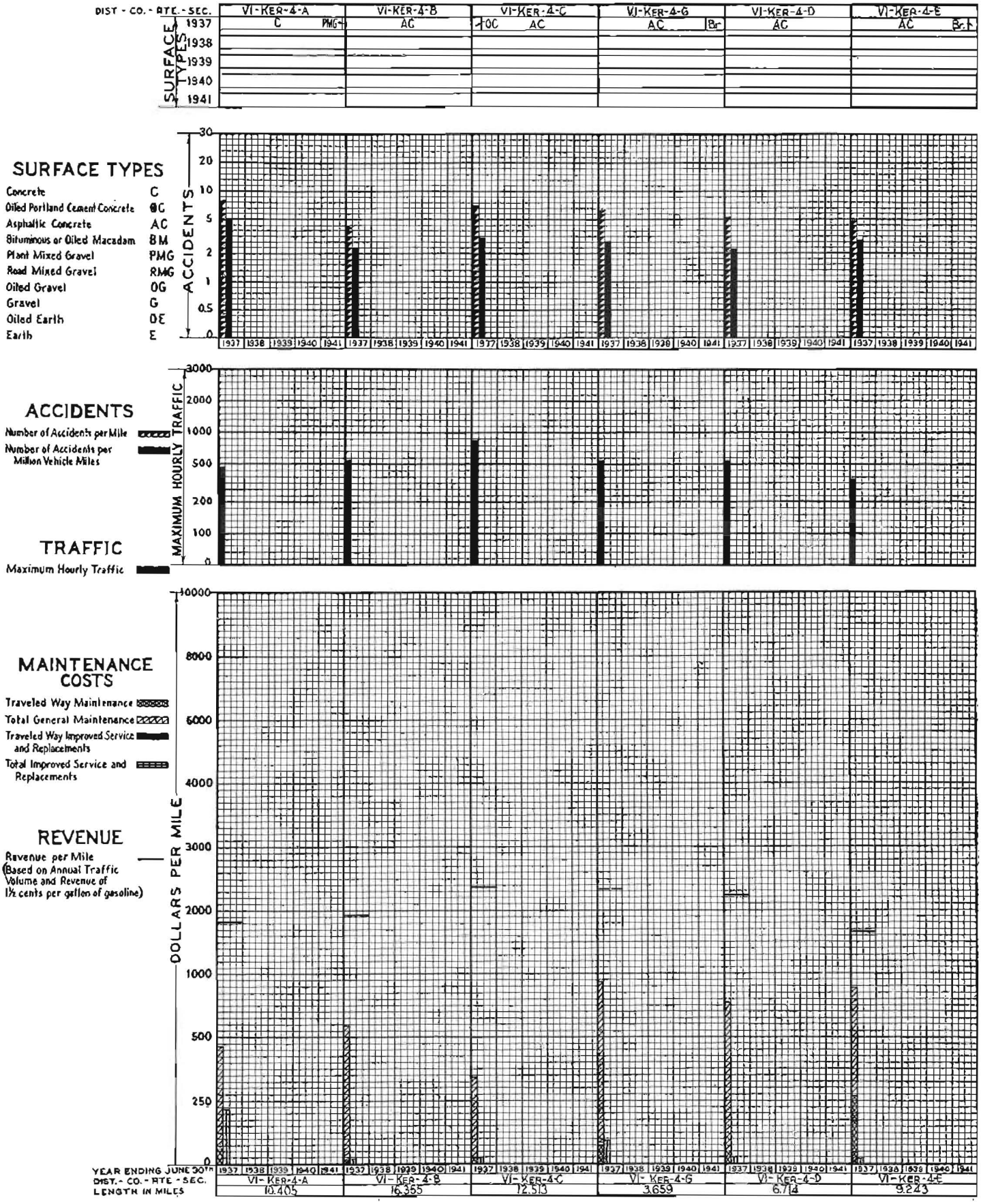
The type of chart shown on the adjoining page is an endeavor to graphically present these major factors in a convenient and usable manner. It covers portions of Route 4 (Golden State Highway) in Kern County.

Charts have been made covering the entire State highway system, showing each legislative route by individual administrative sections in order of occurrence along the route from beginning to end, with spaces provided for comparative showing of the various factors over a five-year period.

The traffic involved is indicated both as to total vehicle mileage for the entire year and the peak-hour traffic as disclosed during the annual summer traffic census. The total yearly traffic indication is contained in the line showing "revenue per mile," since one is a derivative of the other, each dollar of revenue representing roughly one thousand vehicle miles of travel.

The service rendered in terms of safe and orderly flow of traffic may be judged by reviewing the traffic accident rates in terms of concentration per mile of highway and in terms of actual hazard per million vehicle miles of travel. In addition, the class of service that is being provided for traffic at any point may be considered from the basis of both total and peak-hour volume with relation to the known lane width of any section or route, and the type of surfacing on the traveled way.

The cost of service rendered to traffic during any year under consideration is shown in terms of expenditures for both General Maintenance and Improved Service and Replacements. It will be noted that no attempt has been made to indicate service costs that might be chargeable to original and subsequent permanent investment. Any comparison on this



basis would necessarily be manifestly inequitable to traffic in many respects.

In common with all similar graphic aids, this remains simply an aid and presupposes always that those called upon to make use of it will have at their command the vitally necessary intimate knowledge of specific conditions, which can never be reduced to a point on a chart. Used in this manner, it can be of real assistance in facilitating the review of the many traffic safety problems which are constantly being faced by those responsible for their solution.

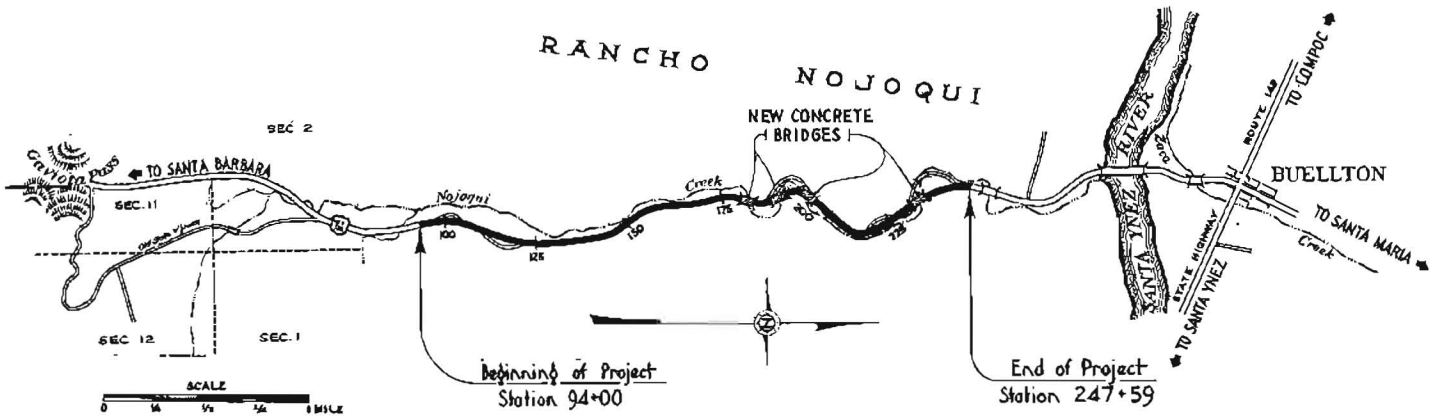
Realignment of Coast Route in Nojoqui Canyon Under Way

By J. C. ADAMS, Resident Engineer

FOR many years there has been a comparatively short section of State highway, U. S. 101, south of Buellton in Santa Barbara County, which has been badly in need of reconstruction. This need has been particularly evident since the reconstruction of the Nojoqui Grade over the Gaviota Pass immediately south of the Buellton section about three years ago. The increased speed possible on the new Nojoqui Grade as compared with the old highway made the sharp curves and reversals in alignment on the Buellton section doubly hazardous and the need for this improvement was also emphasized by the fact that the highway being studded with live oaks and various native shrubs, but the point of greatest beauty is about midway of the job near a private enterprise that utilizes the heavily wooded section for camp and picnic grounds. Considerable study was given this particular location so as to preserve the trees and natural beauties.

Landscape engineers and architects studied the proposed location in considerable detail with the result that the landscape suffered a minimum of damage.

Particular attention was paid to preservation of trees and other scenic attractions along the creek. Every tree was located upon a map and the final line was not selected until after intensive study in both field and office. As has happened in other relocations it is believed that this project will present greater scenic values after completion than does the present route and without sacrifice to the standard of construction. Two of the four bridges were planned in order to prevent the unsightly scars which would have resulted from otherwise necessary channel changes.



north of this section is on comparatively good alignment.

The Buellton section joins the northerly end of the Nojoqui Grade and extends northerly for 2.9 miles to connect with a former reconstruction about one mile south of the Santa Ynez River. The only logical location for the new alignment was down the more or less narrow Nojoqui Creek Canyon, and in order to bring the alignment up to a proper standard it was necessary to cross Nojoqui Creek with four bridges on account of the very winding course of that stream.

This section of the Nojoqui Creek Canyon is very scenic, the slopes

NINETEEN CURVES ELIMINATED

The new highway decreases the number of curves by 19 and the total delta from 907 degrees to 479 degrees. The number of curves of 700-foot radius or less is decreased from 21 to 0 and those of 1000-foot radius or less from 28 to 5.

The minimum sight distance on vertical curves has been increased from 340 feet to 825 feet, and the maximum grade of the new road is 4 per cent as compared with 6.19 per cent of the old.

To conform with present standards of alignment it was necessary to construct the new roadbed on portions of the Nojoqui Creek channel which compelled channel changes. Fill slopes adjacent to the channel changes are protected by selected rocky material from the cuts.

The center 22 feet will be paved with Portland cement concrete pavement 0.75 foot thick at the edges and 0.55 foot thick for the central 18 feet.

Supporting the pavement will be selected imported river borrow material with a minimum thickness of 6 inches and extending 1½ feet beyond the pavement edges.

Additional protection to the subgrade and pavement will be afforded by a Grade "E" seal of asphaltic membrane spread on the subbase.

Roadmixed oil shoulders of imported select river material and liquid asphalt, SC-2, and oil-mixed berms complete the roadway finish.

Anticipating heavy through traffic

These pictures show two bridge operations through the oak groves on Route 2 near Buellton where every care is being taken to preserve the trees and the natural scenic beauty of that section

New highway sector in Nojoqui Valley with gradual grade and easier curves cuts out many sharp turns and shortens distance.

and heavy trucking of produce from the local Santa Ynez and Lompoc farming districts, a system of detours was designed and included in the contract. The detours are surfaced 20 feet wide of oil-mixed river gravel. Connections from the detours to the existing portions of present road provide a two-way passageway for the convenience of traffic outside the limits of construction.

TRAFFIC DETOURS SEPARATED

The idea of separated detour traffic was followed throughout the length of the project with the exception of a short section at La Vega Park where a permanent scar to the landscape would have resulted by reason of detour construction. The hills in this section are covered with oak trees.

The construction of four reinforced concrete bridges was included in the general contract. Two of these bridges replace existing structures across Nojoqui Creek and the other two are located at La Vega Park where the new alignment eliminates a dangerous "S" curve on the old road.

Conforming to roadside improvement standards all oak trees outside limits of traveled way but inside side slope areas were saved. Wells were constructed around the trunks of the trees with native rock to protect the tree roots from suffocation.

Cut and fill slopes are to be covered with a seed cover of local top soil to promote the growth of vegetation. California poppy seed will be added with the top soil cover in an attempt to start a growth of these native perennials on the new slopes.

The Contractor, C. O. Sparks and Mundo Engineering Company, started operations in May of this year. The excavation yardage has been handled mostly with 13-cubic yard tractor-drawn carryalls and rooters. The grade work is approximately 85 per cent complete and paving operations will start during the first week in October. It is anticipated that the entire work will be completed by Christmas of this year.

The project is being financed from gas tax funds set up in the current budget for this biennium.

300 Billion Miles of Auto Travel Predicted for 1938

AMERICA probably will drive motor vehicles to a new record of 300 billion miles in 1938, according to Dr. L. I. Hewes, Deputy Chief Engineer, Bureau of Public Roads.

There are many interesting facts about highway transportation which Dr. Hewes thinks people in general should know.

For example, he says they should know that "the use of highways has increased about 73 per cent in 10 years, that many city street patterns are outmoded, and that traffic in the larger metropolitan areas of this country is becoming a dominant problem. They should know that in 1937 we had 4,255,296 motor trucks, with a total of about 7,200,000 rated tons capacity and that this tonnage capacity increased 20 per cent in the three preceding years, and now compares with about 105,000,000 tons of existing freight car capacity.

"It should be understood," he adds, "that city delivery and farm-use trucks are not directly competitive with railroad freight business; that, nevertheless, certain farm-to-market trucking such as for milk, live stock and eggs, is taking railroad freight business; that where origin-and-destination handling of any freight is important, truck use will continue to increase, but that truck use is conditioned by road congestion, and helps cause it; that increasingly more financial responsibility will be required of commercial truck operators such that ultimately, progressively higher licensing fees for trucks will carry along legitimate demands from owners for better truck-service roads, and especially for easier grades."

Pacific Electric Railway Company

Los Angeles, Calif.

Editor California Highways
and Public Works,
Sacramento, California.

Dear Sir:

Should greatly appreciate your placing my name on the mailing list of "California Highways and Public Works" so I may receive this valuable publication regularly.

I find the well prepared articles highly informative and educational, and wish to compliment your staff on maintaining such a high standard of constructive journalism.

Thanking you in advance, I am

Yours very truly,

L. H. APPEL,
Research Engineer,
Pacific Electric Railway.

Mack International Motor Truck Corporation

Sacramento

California Highways
and Public Works,
Sacramento, California.

Gentlemen:

Mr. C. G. Price, Mgr. California Door Company, Diamond Springs, California, requests that his name be placed on your mailing list to receive publications of "California Highways and Public Works." * * *

We are receiving the publication at this office and want to compliment you upon the very constructive work that you are doing.

Very truly yours,

W. V. MORGAN,
Mack International Motor Truck Corp.

University of Idaho

Moscow

Editor California Highways
and Public Works,
Sacramento, California.

Dear Sir:

We are writing to thank you for your courtesy in placing the University of Idaho Library on your mailing list to receive "California Highways and Public Works." We are very glad to receive it.

Very truly yours,

AGNES PETERSON,
Reference Librarian.

San Francisco, Calif.

California Highways
and Public Works,
Sacramento, California.

Gentlemen:

While visiting my brother, Jack F. Silver, manager of the Martinez office of the California State Automobile Association, I noticed the September issue of "California Highways and Public Works."

This publication is the most interesting one I have seen, and I will appreciate it if you will place my name on your mailing list.

Thanking you for your attention in this matter, I am

Yours very truly,

GEO. J. SIVERS,
1850 Jefferson Street,
San Francisco, California.

Revue Generale Des Transports

par

Air, Eau, Terre

23 Rue des Mathurins, Paris 8e.

Messrs. C. H. Purcell
and T. H. Dennis, Engineers,
Department of Public Works,
Sacramento, U. S. A.

Gentlemen:

We have the honor to acknowledge receipt of your letter of the 17th of August last, sending us illustrated articles for which we thank you.

Will you oblige us by accepting a regular exchange of your publication, "California Highways and Public Works," for our magazine "La Revue Generale des Transports?" If so, please send us issues of the months of July and August.

The same mail will bring you the July and August issues of our publication.

With our thanks we beg you, gentlemen, to accept our kindest regards.

HENRI MACE,
Director-Editor-in-Chief.

Yale University Bureau for Street Traffic Research

New Haven, Conn.

Editor California Highways
and Public Works,
Sacramento, California.

Dear Sir:

On pages 8 and 9 of the June issue of the California Highway Magazine there is an excellent series of pictures dealing with the new construction of the Bakersfield Grapevine highway, copies of which our bureau is anxious to have for its visual aids library.

* * * * *

During the academic year examples of such construction are exceedingly helpful to our students, and we would appreciate it very much if we might obtain copies of these illustrations. Be assured that credit will be given for the use of these pictures.

Thanking you so very much, I am

Sincerely yours,

BRYANT BURKHARD,
Research Assistant.

University of California

Department of Economics,
Berkeley, California.

California Department
of Public Works,
Sacramento, California.

Gentlemen:

I shall be glad to be put on your mailing list to receive copies of your publication, "California Highways and Public Works."

The material will be used in connection with University instruction.

I am, yours truly,

STUART DAGGETT,
Professor of Transportation.

The Atchison, Topeka and Santa Fe Railway Company

Los Angeles, California,

California Highways and Public Works,
Sacramento,
California.

Gentlemen:

Occasionally in the past I have had the opportunity of reading your Official Journal, and I find the publication to be very interesting and enlightening.

I would like very much to receive a copy regularly, and after reading, I would like to file them for future reference.

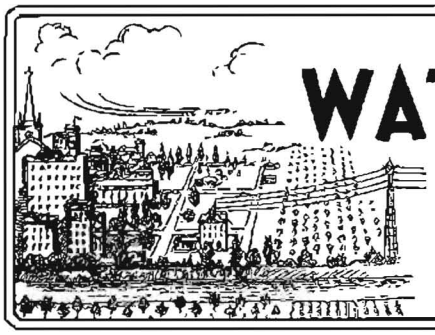
Thanking you in advance, I am

Yours truly,

(Signed) F. E. PAINTER,
Right of Way Agent,
The AT&SFRyCo.

Pedestrian (to passing motorist): "Hi, mister, I'm going your way."

Motorist: "So I see, but I'll get there before you do."



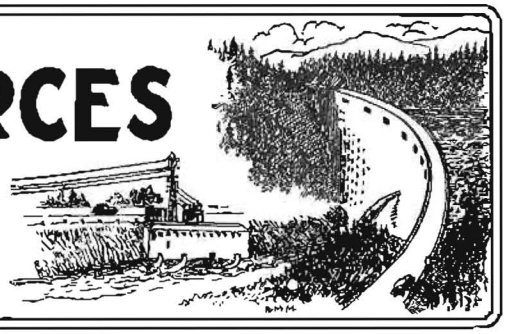
DIVISION OF WATER RESOURCES

OFFICIAL REPORT

FOR THE MONTH OF

September, 1938

EDWARD HYATT, State Engineer



FILING of applications for allotments from money appropriated to the Emergency Fund for the restoration of public property, levees, flood control works, county roads and bridges, damaged by floods of the 1937-38 winter season throughout the State, has continued. Investigations of these applications have been or are being made and 163 reports and recommendations have been prepared by the Division of Water Resources and State Reclamation Board and submitted to the Director of Finance. Governor Frank F. Merriam has approved allocations totalling $3,743,700 for flood damage repair work covered by these reports. The Division of Water Resources is performing some of the work for which these allocations were made and other work is being done by the applicants under contract entered into with the Department of Public Works.

Plans and specifications for all work being done under contract are checked and approved by the Division of Water Resources before work is commenced and all work supervised and inspected by representatives of the division. There are now in force 105 contracts for work which will cost $2,955,000. Several projects have been completed but most of them are still under construction or ready for the beginning of construction.

SACRAMENTO-SAN JOAQUIN WATER SUPERVISION

The rice fields are rapidly being drained and in a few instances the harvesting of the crop is under way. Harvesting of sugar beets is in full swing. Some water is still being applied to beans. This season there was in excess of 100,000 acres of rice irrigated from the streams and returned flow channels in the Sacramento Valley. In the same area there were irrigated also about 240,000 acres of general crops.

The flow of the Sacramento River at Sacramento is gradually increasing and by the end of this month will show a marked increase in flow. The lowest flow in the Sacramento River occurred near the end of August when the discharge dropped to about 4200 cubic feet per second. The flow of September 24th was about 6700 cubic feet per second. The flow of the San Joaquin River near the end of August was 2500 cubic feet per second and on September 24th was about 2200 cubic feet per second.

IRRIGATION DISTRICTS

Merced Irrigation District has requested approval of a project involving the concrete lining of eleven miles of main canal and the replacement of necessary bridges, structures and gates along the sections improved. The estimated cost of the work is $105,858. It will be financed by a grant of $47,636 from P. W. A. and the expenditure of $58,222 from district funds derived from power revenue. Only a small percentage of the 1200 miles of canals within the district have been concrete lined, but this improvement will be carried on as funds for the purpose are made available.

SUPERVISION OF DAMS

In view of the large amount of carry-over storage that will exist this season every effort is being made to put all dam structures into such an operating condition that excessive run-off may be cared for.

Construction is being actively pursued on North Fork, Suttenfeld, Charles Lee Tilden Park and Mad River Dams in order that they may be completed before the coming winter season.

WATER RIGHTS

Forty-two applications to appropriate were received during August; 4 applications were denied and 23 were approved. In the same period 4 permits were revoked and rights were confirmed under 4 permits by the issuance of licenses. Inspections preliminary to the issuance of license or revocation of permits were made during the past month in the Sacramento Valley.

COOPERATIVE FLOOD CONTROL

The Division of Water Resources has continued studies in cooperation with the U. S. Departments of War and Agriculture for the formulation of a coordinated statewide plan of flood control for the State of California. Conferences between state agencies have been arranged in order to work out a program for the harmonization of the plans of the interested agencies.

FLOOD CONTROL AND RECLAMATION

Routine maintenance on the flood control project has been carried on during this period, in preparation for high water this winter.

Application has been made for a P. W. A. grant of approximately $80,000 for project maintenance repair work on the Sacramento flood control project, under which a total of $182,000 will be spent if the application is granted. This work includes cleaning and improving canals, construction of bridges in the by-pass, repairing wave wash damage on the east levee of the Sutter By-pass, gravelling roads on top of levees, and repair of incidental flood damage.

Relief Labor Work

An average of 85 relief laborers have been employed in cleaning in the Feather River overflow channel during this period. Beginning in one week, 50 additional laborers will be employed in the Sutter By-pass from the S. R. A. transient camp in Sutter Basin.

Approval is expected of a W. P. A. application which was made to cover flood control work in District No. 2, containing the valley counties from the Delta north to Trinity County. This will permit the clearing of numerous flood channels.

Russian River Projects

Plans are under way for additional work on the Russian River Jetty with funds contributed by the Fish and Game Commission, County of Sonoma and County of Mendocino, totalling $55,500. An application has been made for a P. W. A. grant of $45,000 which, if allowed, will permit an expenditure of $100,000.

CENTRAL VALLEY PROJECT

Engineering studies in connection with the Central Valley Project have been continued under a cooperative agreement with the U. S. Bureau of Reclamation, with the Division of Water Resources representing the Water Project Authority of the State of California.

Negotiations have been continued with the public utility companies for the relocation of power and communication facilities.

Highway Bids and Awards for the Month of September, 1938

CONTRA COSTA COUNTY—Two undergrade crossings to be constructed under the tracks of Sacramento Northern Railway and under a county road at Ohmer Station and about 0.15 mile of roadway to be paved with Portland cement concrete. District IV, Route 106. Section C. Union Paving Co., San Francisco, $44,461; D. W. Nicholson, Oakland. $45,714; R. G. Clifford, San Francisco, $47,173; Heafey-Moore Co. & Frederickson & Watson Construction Co., Oakland, $47,877; P. J. Walker Company, San Francisco, $47,942; E. T. Lesure, Oakland, $58,492. Contract awarded to Macco Construction Co., Clearwater. $40,829.80.

CONTRA COSTA COUNTY—A reinforced concrete slab overhead crossing over the tracks of the A. T. & S. F. Railway Co. at Pinole, consisting of 11 thirty-four foot spans and two 25-foot 6-inch spans on reinforced concrete bents and abutments and approximately 0.4 mile of approaches to be constructed. District IV, Route 14, Section Pin., Her. Macco Construction Co., Clearwater, $97,133; Heafey-Moore Co., Fredrickson & Watson Construction Co., Oakland, $92,184; Chas. L. Harney, San Francisco, $101.779; Eaton & Smith, San Francisco, $102,431; Bates & Rogers Construction Corp., Oakland, $104,027; B. A. Howkins & Co., San Francisco, $110,141; R. G. Clifford, San Francisco, $110,427; Williams Bros. & Hass, Inc., & P. J. Walker Co., San Francisco, $114,374. Contract awarded to Union Paving Co., San Francisco, $86,263.50.

CONTRA COSTA COUNTY—Across the west branch of San Pablo Creek, about five miles west of Lafayette, a reinforced concrete arch culvert to be repaired. District IV, Route 75, Section A. C. C. Gildersleeve, Berkeley, $4,711; L. C. Seidel, Oakland, $4.357; Palo Alto Road Materials Co., Palo Alto, $5,387; R. G. Clifford, San Francisco, $5,424. Contract awarded to S. H. Von Gelder, San Francisco, $3,753.08.

HUMBOLDT COUNTY—Across Bridge Creek, about 19 miles north of Garberville, a reinforced concrete slab and girder bridge, consisting of five 24-foot spans on concrete pile bents and one 40-foot span on concrete bents with spread footings to be constructed about 0.15 mile to be graded and surfaced with plant-mixed surfacing. District I, Route 1, Section C. Robert McCarthy, San Francisco, $39,658. Contract awarded to E. E. Smith, Eureka, $31,604.

HUMBOLDT COUNTY—Between Benbows and one mile north of Dean Creek, about 0.4 mile to be graded and surfaced with road-mix surfacing. District I, Route 1, Sections A, B. Hemstreet & Bell, Marysville, $85, 502; N. M. Ball Sons, Berkeley, $89,850; Claude C. Wood, Lodi, $92,699; M. J. Ruddy, Modesto, $99,983. Contract awarded to Poulos & McEwen, Sacramento, $84,635.20.

HUMBOLDT COUNTY—Reinforced concrete bridge at Whittemore Grove State Park, District I. Scheumann & Johnson, Eureka, $11,972; Fred J. Maurer & Son, Eureka, $13,036; E. E. Smith, Eureka, $11,850. Contract awarded to Claude C. Wood, Lodi, $10,572.

HUMBOLDT COUNTY—Across Old River, about two miles south of Fernbridge, a reinforced concrete bridge to be repaired. District I, Route 58, Section A. V. R. Scheuman and C. H. Johnson, Eureka, $8,925. Contract awarded to Ernest E. Smith, Eureka, $8,895.

LAKE COUNTY—Between Le Trianon and Scotts Valley road, about 2.1 miles to be graded and surfaced with untreated crushed gravel or stone and seal coat applied. District I, Route 15, Section A. Hemstreet and Bell, Marysville, $78,390; Fredericksen & Westbrook, Lower Lake, $79,264; N. M. Ball Sons, Berkeley, $81,937; Poulos & McEwen, Sacramento, $84,070; Larsen Bros. & Harms Bros., Sacramento, $89,621; J. R. Reeves, Sacramento, $106,493. Contract awarded to J. L. Conner & Sons, Monterey, $69,456.50.

LOS ANGELES COUNTY—Overhead crossing over the tracks of Southern Pacific Co. on Daly Street at Alhambra Avenue. District VII, Route 4, Section L. A. Gibbons & Reed Co., Burbank, $42,230; Dimmitt & Taylor, Los Angeles, $39,846; The Contracting Engineers Co., Los Angeles. $42,765; Carlo Bongiovanni, Los Angeles, $40,317; Baruch Corporation, Los Angeles, $40,220; W. E. Robertson, Los Angeles, $37,481; Fred E. Potts Co., Los Angeles, $37,239; J. S. Metzger & Son, Los Angeles, $38,500; Crow Bros. Construction Co., Los Angeles. $36,415. Contract awarded to J. E. Haddock, Ltd., Pasadena, $35.808.06.

LOS ANGELES COUNTY—Near Saugus, about 2.9 miles bank protection fence to be constructed. District VII, Route 23, Section H, A. Dimmitt & Taylor, Los Angeles, $22,283; Byerts & Dunn, Los Angeles, $24,020; Geo. J. Bock Co., Los Angeles, $24,202; Gibbons and Reed Co., Burbank, $29,378. Contract awarded to Griffith Co., Los Angeles, $18,535.

DISTRICT III, various locations, about 663 miles of traffic stripe to be applied. Awarded to Al W. Simmonds, Sacramento, $3,178.

LOS ANGELES COUNTY—Between 1.5 miles north of Azusa and San Gabriel River bridge, about 0.7 mile to be graded and surfaced with plant mixed surfacing. District VII, Route 62, Section A. R. L. Oakley, Pasadena. $137,813; Claude Fisher Co., Los Angeles, $170,533; Basich Bros., Torrance, $143.260; Oswald Bros., Los Angeles, $80,670; Warren Southwest, Inc., Los Angeles. $226,936; Shannahan Bros., Huntington Park. $156,181; United Concrete Pipe Corp., Los Angeles. $89,750; W. E. Hall & A. S. Vinnell Co., Alhambra, $170,145. Contract awarded to Lewis Construction Co., Los Angeles, $64,237.00.

LOS ANGELES COUNTY—On Ramona Blvd. near L. A. County Sheriffs Pistol Range, about 0.10 mile in length, drainage structures and Portland cement concrete pavement to be constructed on portions. District VII, Route 26, Section D. R. H. Travers, Los Angeles, $32,167; C. O. Sparks & Mundo Engineering Co., Los Angeles, $36,191; J. S. Metzger & Son, Los Angeles, $28,935; Dimmitt & Taylor. Los Angeles, $25,689; Oberg Bros., Los Angeles, $26,619; Geo. J. Bock Co., Los Angeles, $27,891; Claude Fisher Co., Los Angeles, $26,829; J. E. Haddock, Ltd., Pasadena, $29,099; Edward Green, Los Angeles, $33,828; Nick Perscallo, Los Angeles, $32,551; Oswald Bros., Los Angeles, $28,170; Rodich and Brown, Burbank, $32,265; Tomei Construction Co., Van Nuys, $26,970; Contracting Engineers Co., Los Angeles, $27,430; United Concrete Pipe Corp., Los Angeles, $27,641; C. F. Robbins, Los Angeles, $27,077. Contract awarded to G. O. Gartz, Los Angeles, $23,676.90.

MENDOCINO COUNTY—Between 0.3 mile north of Sonoma County line and Squaw Rock, about 0.2 mile to be graded and surfaced with plant-mixed surfacing. District I, Route 1, Section L. N. M. Ball Sons, Berkeley, $37,061; Hemstreet & Bell. Marysville, $40,743; Pacific States Construction Co., San Francisco, $47,645. Contract awarded to Hanrahan Company, Redwood City, $33,899.70.

NEVADA AND PLACER COUNTIES—Between Indian Springs and one mile east of Rainbow Tavern. 7 separate portions of construction totaling about 0.9 mile, consisting of 0.3 mile to be graded and road-mix surface treatment applied thereto, and channel changes and rip-rap to be constructed. District III, Route 37, Section A, F. Fredericksen & Westbrook, Lower Lake, $47,355; Independent Construction Co., Ltd., Oakland, $49.504; Pacific States Construction Co., San Francisco, $51,330. Contract awarded to Lee J. Immel, Berkeley, $47,291.

PLACER COUNTY -Approaches to Colfax grade separation, about 1.2 miles in length to be graded and surfaced with plant-mixed surfacing on crusher run base. District III, Route 37, Section B, Cfx, C. Hemstreet and Bell, Marysville, $50,179; Mountain Construction Co., Sacramento, $50,853: Pacific States Construction Co., San Francisco, $51,802; Independent Construction Co., Ltd., Oakland, $52,065; M. J. Ruddy, Modesto, $59,291. Contract awarded to Piazza and Huntley, San Jose, $46,491.80.

RIVERSIDE COUNTY—Across middle fork of San Timoteo Creek. about one mile northwest of Beaumont. A reinforced concrete slab bridge consisting of three 22-foot spans and two 17-foot 6-inch spans on concrete bents and abutments with steel pile foundations to be constructed and 0.8 mile to be graded and surfaced with plant-mixed surfacing. District VIII, Route 26, Section A. Oswald Bros., Los Angeles. $33,982; United Concrete Pipe Corp., Los Angeles. $38,150. Contract awarded to Byerts & Dunn, Los Angeles, $28,142.50.

RIVERSIDE COUNTY—At Whitewater River Bridge, an earth dike to be constructed and protected with slope paving. District VIII, Route 26, Section D. W. R. Shriver, Los Angeles, $14,567; R. E. Hazard & Sons, San Diego. $17,918; C. G. Willis & Sons & Chas. G. Willis, Los Angeles. $16,052; Dimmitt & Taylor, Los Angeles, $12,375; S. E. Edmonson & Sons, Los Angeles, $20,563; W. E. Robertson, Los Angeles, $14,099; J. S. Metzger & Son, Los Angeles, $17,360; Oswald Bros., Los Angeles, $12,557. Contract awarded to United Concrete Pipe Co., Los Angeles, $12,207.50.

SACRAMENTO COUNTY—An undergrade crossing under the tracks of the Southern Pacific Railroad about 4 miles northeast of Ben Ali Station and about 0.2 mile of roadway to be graded and paved

with Portland cement concrete. District III, Feeder road. Azevedo Construction Co., Sacramento, $82,466; J. R. Reeves, Sacramento, $83,593; Holdener Construction Co., Sacramento, $84,900. Contract awarded to Campbell Construction Co., Sacramento. $77,011.80.

SAN BENITO COUNTY—Between Paicines and Tres Pinos, about 0.8 mile slope protection to be constructed. District V, Route 119, Section E. Lee J. Immel, Berkeley. $18,304; Independent Construction Co., Oakland, $18,600; N. M. Ball Sons, Berkeley, $18,792; E. T. Lesure, Oakland, $19,110; L. C. Seidel, Oakland, $20,160; F. Kaus, Stockton, $22,668; Granite Construction Co., Watsonville, $22,737; Valley Construction Co., San Jose, $26,640. Contract awarded to Piazza and Huntley, San Jose, $17,640.

SAN DIEGO COUNTY—Between Oakley Ave. in La Mesa and Grossmont, about 2.1 miles to be graded and portions to be paved with Portland cement concrete and plant-mixed surfacing. District XI, Route 12, Section L.Msa.B. Claude Fisher Co., Ltd., Los Angeles, $212,944; David H. Ryan, San Diego, $233,251; N. M. Ball & Sons & H. E. Parker, Berkeley, $179,643; V. R. Dennis Construction Co., San Diego, $192,335; Daley Corp., San Diego, $172,450; Crow Bros. Construction Co., Los Angeles, $175,679; Macco Construction and R. E. Hazard & Sons, Clearwater, $180,657; Fredericksen & Westbrook, Lower Lake, $178,722; Basich Bros., Los Angeles, $197,993. Contract awarded to Griffith Co., Los Angeles, $162,930.30.

SAN DIEGO-IMPERIAL COUNTIES—Between Boulder Park and Mountain Springs, about 2.6 miles to be graded and road-mix surface treatment applied. District XI, Route 12, Section H.A. Jahn & Bressi Construction Co., Los Angeles, $330,551; Claude Fisher Co., Ltd., Los Angeles, $284,429; Daley Corp., San Diego, $254,756; Sharp & Fellows Contracting Co., Los Angeles, $269,244; V. R. Dennis Contracting Co., San Diego, $299,942; Oswald Bros., Los Angeles, $249,559; Griffith Co., Los Angeles, $284,293; R. E. Hazard & Sons and R. A. Bell, San Diego, $259,611. Contract awarded to A. S. Vinnell Co., Alhambra, $237,962.

SAN FRANCISCO—Between Lake Street and Golden Gate Bridge approach in the city of San Francisco, about 2.1 miles to be graded including about 1300 feet of reinforced concrete tunnel construction. District IV, Route 56, Section S. F. Fredericksen & Westbrook, Lower Lake. $750,315; Clinton Construction Co., San Francisco, $711,274; Eaton and Smith, San Francisco, $685,755; Bates & Rogers Construction Corp., Oakland, $758,599; R. G. Clifford, San Francisco, $817,763; MacDonald & Kahn Co., Ltd., San Francisco, $643,781; George Pollock Co., Sacramento, $774,466; David H. Ryan, San Diego, $665,061; Barrett & Hilp and Chas. T. Harney, San Francisco, $763,833; Union Paving Co., San Francisco, $657,626; Healey-Moore Co., Frederickson & Watson Construction Co., Oakland, $645,810.. Contract awarded to Macco Construction Co., Clearwater, $593,042.

SAN JOAQUIN COUNTY—On Moseley road between Terminous road and Peltier road, about 4.4 miles to be graded and surfaced with untreated crushed gravel or stone. District X, feeder road. Claude C. Wood, Lodi, $31,831; Louis Biasotti & Son, Stockton, $34,107; Piazza and Huntley, San Jose, $36,697; J. R. Reeves, Sacramento, $39,168; A. Teichert & Son, Inc., Sacramento, $42,914. Contract awarded to N. M. Ball Sons, Berkeley, $30,416.

SAN LUIS OBISPO AND SANTA BARBARA COUNTIES—About 35 miles east of Santa Maria, timber bridge across Cuyama River to be reconstructed, and west approach to be graded and surfaced with plant-mixed surfacing. District V, Route 57, Section B. Thorsten and Dahl, Los Angeles. $10,845; S. A. Cummings, San Diego, $14,428. Contract awarded to E. G. Perham, Los Angeles, $10,320.

SANTA CRUZ COUNTY—At Two Bar Creek, about one mile north of Boulder Creek, a multiplate corrugated metal pipe culvert to be installed and about 0.2 mile of roadway graded and surfaced, crusher run base and armor coat. District IV, Route 116, Section B. Granite Construction Company, Ltd., Watsonville, $15,691; L. C. Seidel, Oakland, $15,843; R. G. Clifford, San Francisco, $16,853; L. C. Karstedt, Watsonville, $17,969. Contract awarded to Peerless Welding Co., San Francisco, $13,810.

SIERRA COUNTY—At Downieville, across the north fork of north fork of Yuba River, a bridge consisting of one 120-foot steel truss span on concrete piers and two 40-foot concrete girder spans on concrete bents and approaches about 0.5 mile to be graded, surfaced with untreated crushed gravel or stone. District III, Route 25, Sections A, B. Paul J. Tyler, $99,666. Bid rejected—too high.

SISKIYOU COUNTY—Between Callahan and Fort Jones, about 5.6 miles road-mix surfacing to be placed and penetration oil treatment and seal coat to be applied. District II, Feeder road. Hemstreet and Bell, Marysville, $17,887; A. Soda and Son, Oakland, $21,125. Contract awarded to Garcia Construction Co., Irvington, $14,356.25.

In Memoriam

JOHN EDGAR STEWART

John Edgar Stewart, assistant highway engineer in Central Office, Division of Highways, passed away at his home in Sacramento on September 24th after an illness of several months.

Mr. Stewart was born in Virginia, October 7, 1878. He received his engineering education in Iowa State College, graduating in 1902 with a degree in civil engineering. Subsequent to his graduation he was employed for a period of three years as instructor in civil engineering in the Iowa State College.

From 1906 to 1913 Mr. Stewart worked in gauging and computing stream flows for the United States Geological Survey, after which he accepted a position with the Southern Pacific Railroad as an instrument man.

Mr. Stewart entered the employ of the Division of Highways in 1916 and remained in the highway service until his death. For many years he was associated with the staff of District III in charge of office projection and grade design.

Since 1933 he has been employed on the central office staff, much of his work having to do with Federal Aid projects.

The many friends who have been associated with John Stewart during his twenty-two years with the Division of Highways deeply regret his passing.

Los Gatos-Santa Cruz Project

(Continued from page 13)

ing 750,000 station yards additional to that given hereinbefore. Cut slopes have been designed with a view to slide prevention as far as is reasonable within the restraints of economy and good judgment. However, some slides have already occurred, others will. These slides are of the fall rather than the creeping type, and are due to weak, soft shale formation rather than unfavorable position of bedding planes.

The project is being carried on to completion by Colonel John H. Skeggs, District Engineer of District IV. The heavy excavation is being done by Healey-Moore Co. and Fredrickson-Watson Company, the contractor. A. M. Walsh is Resident Engineer for the Division of Highways.

U. S. Funds To Build Super-Highway

The Federal Government is supplying all of the money to build a 162 mile toll super-highway between Harrisburg and Pittsburgh, Pennsylvania, costing $58,000,000. Of this huge sum, $26,000,000 will be a direct grant from the Public Works Administration and $32,000,000 a loan from the Reconstruction Finance Corporation.

This super-highway, the first of its kind undertaken in the United States, will be a four-lane road following the roadbed of the South Penn Railroad, begun as a rival to the Pennsylvania Railroad between Harrisburg and Pittsburgh many years ago, but never finished.

Construction will be under the direction of the Pennsylvania Turnpike Commission.—*Highway Highlights.*

"And this is your bump of curiosity."

"Right, Professor. I got that by sticking my head in the elevator shaft to see if the elevator was going up. It was coming down."

STATE OF CALIFORNIA

Department of Public Works

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

FRANK F. MERRIAM.....Governor
HARRY A. HOPKINS.....Assistant Director

EARL LEE KELLY.....Director
EDWARD J. NERON.....Deputy Director

CALIFORNIA HIGHWAY COMMISSION

H. R. JUDAH, Chairman, Santa Cruz
PHILIP A. STANTON, Anaheim
PAUL G. JASPER, Fortuna
WILLIAM T. HART, Carlsbad
ROBERT S. REDINGTON, Los Angeles
JULIEN D. ROUSSEL, Secretary

DIVISION OF HIGHWAYS

C. H. PURCELL, State Highway Engineer
G. T. McCOY, Assistant State Highway Engineer
J. G. STANDLEY, Principal Assistant Engineer
R. H. WILSON, Office Engineer
T. E. STANTON, Materials and Research Engineer
FRED J. GRUMM, Engineer of Surveys and Plans
R. M. GILLIS, Construction Engineer
T. H. DENNIS, Maintenance Engineer
F. W. PANHORST, Bridge Engineer
L. V. CAMPBELL, Engineer of City and Cooperative Projects
R. H. STALNAKER, Equipment Engineer
J. W. VICKREY, Safety Engineer
E. R. HIGGINS, Comptroller

DISTRICT ENGINEERS

E. R. GREEN (Acting), District I, Eureka
F. W. HASELWOOD, District II, Redding
CHARLES H. WHITMORE, District III, Marysville
JNO. H. SKEGGS, District IV, San Francisco
L. H. GIBSON, District V, San Luis Obispo
E. T. SCOTT (Acting), District VI, Fresno
S. V. CORTELYOU, District VII, Los Angeles
E. Q. SULLIVAN, District VIII, San Bernardino
S. W. LOWDEN (Acting), District IX, Bishop
R. E. PIERCE, District X, Stockton
E. E. WALLACE, District XI, San Diego

SAN FRANCISCO-OAKLAND BAY BRIDGE

C. E. ANDREW, Bridge Engineer

DIVISION OF WATER RESOURCES

EDWARD HYATT, State Engineer, Chief of Division
GEORGE T. GUNSTON, Administrative Assistant
HAROLD CONKLING, Deputy in Charge Water Rights
A. D. EDMONSTON, Deputy in Charge Water Resources Investigation
R. L. JONES, Deputy in Charge Flood Control and Reclamation
GEORGE W. HAWLEY, Deputy in Charge Dams
SPENCER BURROUGHS, Attorney
EVERETT N. BRYAN, Hydraulic Engineer Water Rights
GORDON ZANDER, Adjudication, Water Distribution

DIVISION OF ARCHITECTURE

GEORGE B. McDOUGALL, State Architect, Chief of Division
P. T. POAGE, Assistant State Architect
W. K. DANIELS, Assistant State Architect

HEADQUARTERS

H. W. DeHAVEN, Supervising Architectural Draftsman
C. H. KROMER, Principal Structural Engineer
CARLETON PIERSON, Supervising Specification Writer
J. W. DUTTON, Principal Engineer, General Construction
W. H. ROCKINGHAM, Principal Mechanical and Electrical Engineer
C. E. BERG, Supervising Estimator of Building Construction

DIVISION OF CONTRACTS AND RIGHTS OF WAY

C. C. CARLETON, Chief
CLARENCE W. MORRIS, Attorney, San Francisco
FRANK B. DURKEE, Attorney
C. R. MONTGOMERY, Attorney
ROBERT E. REED, Attorney

DIVISION OF PORTS

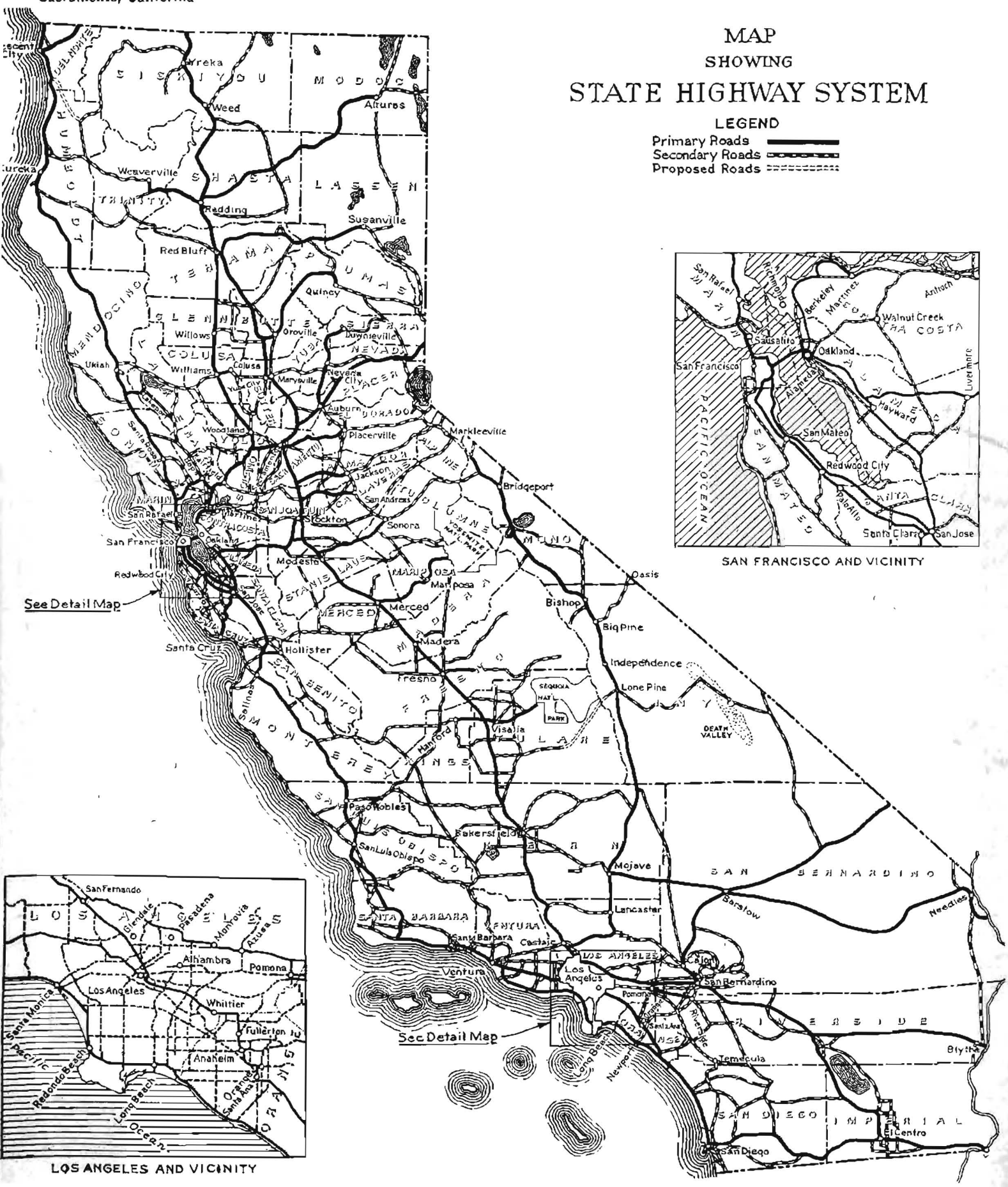
Port of Eureka—E. S. MACKINS, Surveyor

62651 10-38 17,700

printed in CALIFORNIA STATE PRINTING OFFICE
SACRAMENTO: GEORGE H. MOORE, STATE PRINTER

MAP
SHOWING
STATE HIGHWAY SYSTEM

LEGEND
Primary Roads
Secondary Roads
Proposed Roads



SAN FRANCISCO AND VICINITY

LOS ANGELES AND VICINITY