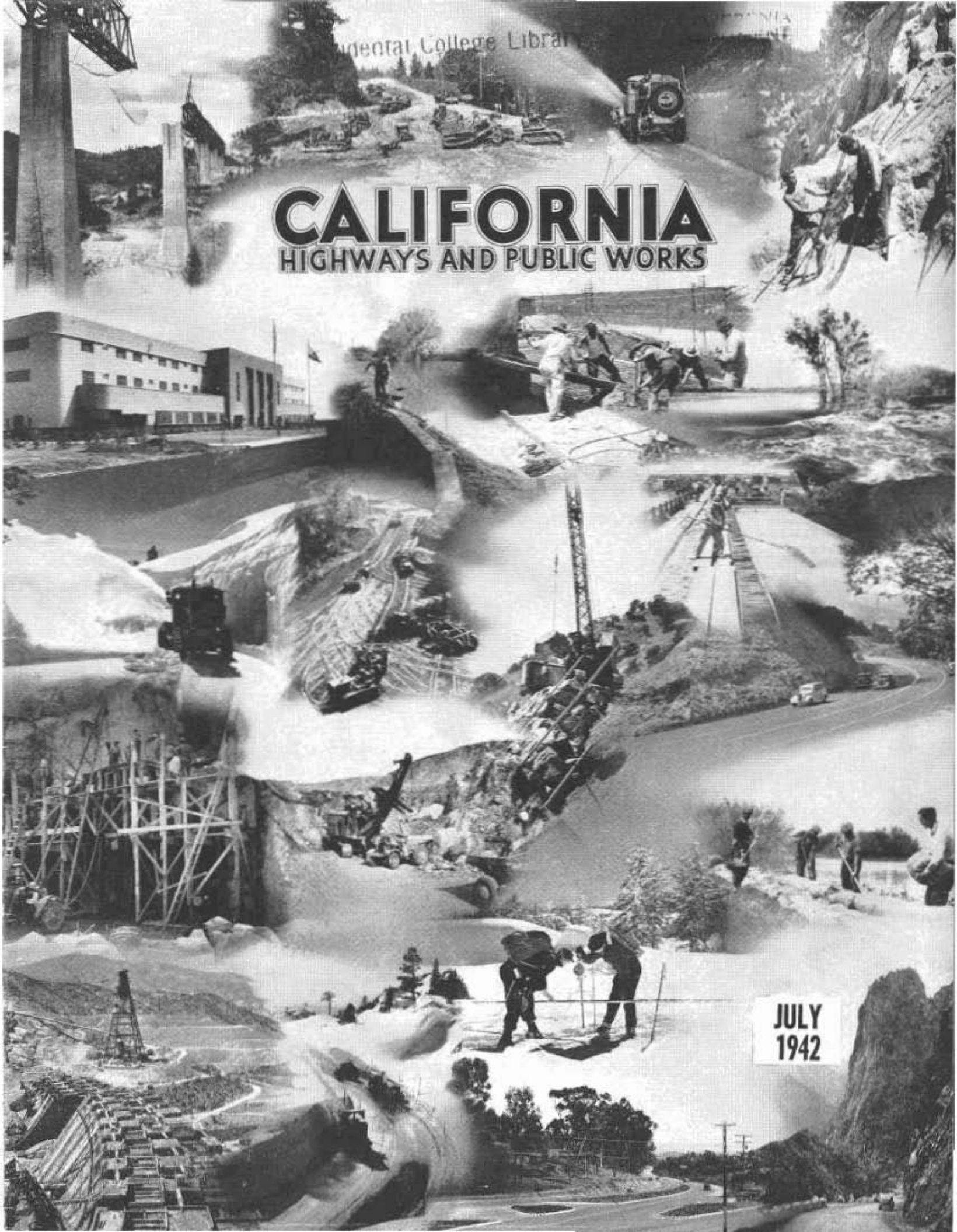

CALIFORNIA
HIGHWAYS AND PUBLIC WORKS

JULY
1942

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

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

FRANK W. CLARK, Director C. H. PURCELL, State Highway Engineer J. W. HOWE, Editor K. C. ADAMS, Associate Editor

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Congress Votes $39,019,000 For Central Valley Power Project and Irrigation Features

VICTORY has been achieved by the California State administration led by Governor Culbert L. Olson in its long and at times discouraging fight in Congress to have included in the Interior Department Appropriation Bill for 1943 fund allocations for transmission lines, canals and a steam plant at Antioch as integral units of the Central Valley Project.

On June 29th, the House of Representatives approved Senate amendments to the bill adding $4,178,250 for these purposes and the following day the Senate passed and sent to the President the measure which appropriates a total of $39,019,000 for expenditure on the Central Valley Project for the next fiscal year.

The Congressional action was hailed by Frank W. Clark, Director of Public Works and chairman of the California Water Project Authority as another victory for the people of this State over opposing power interests. Approval by the House of Senate amendments provides initial appropriations of $3,723,000 for transmission lines required if Shasta Dam power is to be distributed under public ownership; $200,000 for the proposed steam plant at Antioch and an additional $250,000 for the Friant-Kern and Madera canals.

Governor Olson made a personal appeal to President Roosevelt for these items. The House passed the amended bill by a vote of 192 to 141 after Majority Leader McCormack of Massachusetts told the members the President favored the appropriations as necessary for the war program. State Engineer Edward Hyatt and his assistant, Raymond Matthew, representing the Water Project Authority, and Northeutt Ely, Washington representative of the Authority, had much to do with the successful outcome of the fight.

The Interior Department Supply Bill as prepared by the Bureau of the Budget carried a total appropriation of $48,769,000 for construction work on the Central Valley Project for the fiscal year 1943. This amount was reduced to $34,840,750 by the Subcommittee of the House of Representatives' Appropriations Committee and the committee report was approved by the House.

Central Valley Project Monies Appropriated

The Interior Department Appropriation Bill for 1943, as approved by Congress, carries an appropriation of $39,019,000 for continuation of construction of the Central Valley Project, the main items of which according to the budget estimate as modified by House and Senate Committees are as follows:

Shasta Dam and Power Plant	$24,783,000
Keswick Dam and Power Plant	6,000,000
Transmission Lines	3,723,000
Steam Plant	200,000
Friant Dam	1,625,000
Friant-Kern and Madera Canals	1,260,000
Contra Costa Canal	1,260,000
Miscellaneous	100,000

The House committee report not only eliminated an estimate of $5,000,000 for installation of a steam-electric power plant near Antioch, California, and an estimate of $7,000,000 for continuing construction of transmission lines from the Shasta and Keswick hydroelectric plants to Antioch, but also had the effect of repealing appropriations amounting to $3,723,000 previously made for the construction of the transmission lines. At the same time the House increased the item of $200,000 for the Contra Costa Canal to $1,000,000 and added $1,000,000 for construction of the Friant-Kern Canal.

In commenting on this action the Senate Appropriations Committee report declared:

"This action by the House does not appear to be justified by the testimony presented to the committee and can not be construed in any other way than as the adoption of a policy which contemplates that all power, both firm and fluctuating, generated at Shasta and Keswick shall be sold when produced to but one customer, which is the Pacific Gas and Electric Company. A majority of this committee believes that this is an unsound public policy because:

"(1) The acts of Congress authorizing the construction of Central Valley Project, the total cost of which is now estimated as $264,990,000, contemplates the return to the Treasury of the greater part of its costs through sales of power;

"(2) To obtain maximum revenues from that source the Bureau of Reclamation should be in a position to deliver the power to the best obtainable market and to more than one customer. When transmitted to such point or points, said bureau should be able to make such power firm by the construction of an auxiliary steam plant.

"The committee recognizes that the Congressional policy respecting the Central Valley Project was adopted during a period of profound peace and that our country is now engaged in a desperate struggle for its existence. Everything must yield to winning the war, but any action taken to insure victory should not be of a character which will prevent a prompt return to the power plan heretofore established for the Central Valley Project."

The Senate Committee then recommended an appropriation of $200,000

(Continued on page 13)

Survey Party Adapts Radio Device

By R. S. BADGER, District Construction Engineer

TRAFFIC noises have become a serious interferenece with efficiency of survey operations conducted beside arterial highways and may even threaten the accuracy of data called out to the recording engineer amidst a confusion of sounds caused by speeding vehicles.

In cross-section work adjacent to a highway and under average conditions, the sections are taken at distances as great as 250 feet each way from the instrumentman. The bench marks, set on the earlier surveys, were placed under conditions that permitted two "setups" between bench marks which were placed 1,000 feet apart.

The noise of present day traffic now effectively drowns out the voice of the levelman in calling to a recorder when the latter is not more than 125 feet away, and similarly in the case of data, called back to the chainman, it is difficult for the recorder to hear the figures accurately.

Inefficiency and uncertainty result, rendering it necessary to make three "setups" between 1,000 foot bench marks, where formerly two were needed. There is still much difficulty experienced in readily hearing all data called out and consequent delays.

Recorder and chainman in foreground with levelman in distance

LISTENING AID USED

Proving that necessity is truly the mother of invention, a survey party of Highway District VI has successfully overcome these difficulties. A device has been used to permit the recorder to keep up with the chainman and rodmen at all times, and still hear without difficulty, the rod readings called by the levelman.

The device is a "listening aid," commonly used by radio service men to aid them in detecting noises in radios. It consists of two radio tubes, some small A and B batteries and a universal microphone set in a small box together with about 300 lineal feet of rubber covered wire.

When in use the "listening aid" is suspended from any light standard or tripod near the levelman, so that he may speak into it. From this box the weather-proofed wire leads along the surface of the ground and connects with the earphone headpiece, worn by the recorder. To take up the drag of the wire behind him, it is lightly clamped to his belt with no resultant pull of the wire, reaching from his belt to the earphone.

"Listening aid" suspended from flag standard to receive levelman's calls

RECORDER HEARS PLAINLY

As he keeps up with the work of the chainman, so that he can easily hear the data called out by him, he can also plainly hear the rod reading which the levelman calls into the microphone at the other end of the wire.

There is a distinct advantage in the recorder being able to see the operations of the rodman and chainman, but the principal gain lies in

(Continued on page 18)

Snow removal crews meet on Sonora Summit. District IX snowplow in foreground; District X plow in distance

Dynamite and Snowplows Conquer Frozen Stretches of Sonora Pass

By C. E. BOVEY, District Maintenance Engineer

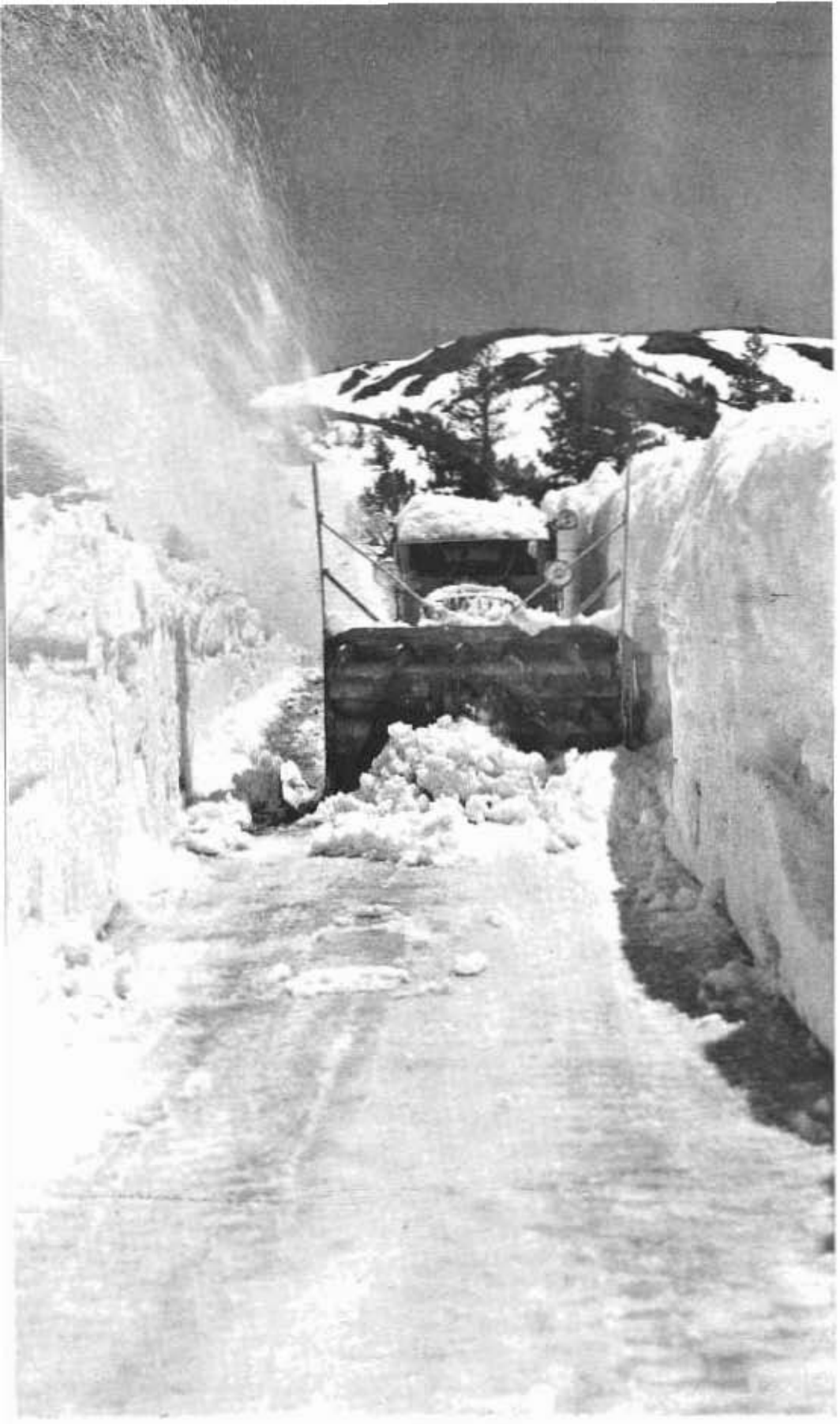
ALTHOUGH midsummer weather now prevails throughout the larger part of California, with old Sol pouring out radiant heat in all his glory, winter lingers on in the high Sierra Nevada in the vicinity of Sonora, Ebbetts and Carson passes. The fields in the valleys have shed their spring-green cloak for one of summer browns and yellows, but in the high regions the green cover is barely discernible on those portions of the mountain slopes not covered with a deep mantle of snow. There, Spring is just beginning. Temperatures seldom reach 60 degrees during the day and drop to freezing, or near-freezing, during the night.

Each year, beginning early in May, the District X office is beset with letters, telegrams and telephone calls inquiring as to when the mountain highways will be open to traffic. At Silver Lake on the Carson Pass Highway, Route 34, at Lake Alpine on the Ebbetts Pass Highway, Route 24, and at Brightman Flat and Kennedy Meadow on the Sonora Pass Highway, Route 13, are many summer homes, camp sites of various organizations, and numerous resorts which do a thriving business during the vacation season. Home owners, organization officials, resort owners, vacationists, and last but not least, the followers of Isaac Walton, all eagerly await the first opportunity to visit their favorite mountain haunts which they have not seen since the first heavy snow storms of the preceding fall.

Normally, snow removal operations are so scheduled that the roads are open to these locations by Memorial Day, May 30th. When the snow pack is near normal, this is no small chore, particularly on the Carson Pass Highway where the snow lies deeply drifted for mile after mile. Woe unto the Maintenance Department of District X if the highways are not open to these places on that day.

The members of the maintenance crews eagerly await the word to start plowing operations even though they know they will work long, hard hours, double shifting whenever necessary to meet the planned schedule. The hard-packed, deeply drifted snow removed in the Spring is entirely different from the soft, flaky snow encountered during the regular winter plowing.

In past years, plowing was resumed immediately after Memorial Day and continued until the highways were open throughout their lengths. Cold weather at the higher elevations retarded the melting of the snow and further increased the difficulty of plowing operations. The presence of ice layers made it necessary to do considerable blasting before the plows could make efficient headway. Often the snow pack averaged from four to



BEFORE

This photograph shows snowplow bucking drifts on Sonora Summit

six feet in depth and up to 20 feet in certain drifts, particularly at the Carson Spur, on Red Lake Grade, and in Blue Canyon, the latter being on the Sonora Pass Highway.

Normally, all three passes are opened about June 10th to June 15th. Approximately one month is required for such opening. Public demand has in past years required the starting of spring snow removal on approximately May 15th. In normal years, this is too early for economical operation. The snow pack at that time is deep, and the weather very cold, which, together, make plowing operations very difficult. It has been the opinion of those in charge of this work that much would be gained by delaying the start of such operations approximately three weeks. The melting of snow during that interval with the advent of warmer weather would greatly reduce the amount of work involved and make it possible to open these highways in less time and at considerably reduced expense, as compared to earlier opening.

This year, due to the war and the consequent loss of revenue, difficulty in obtaining equipment and repair parts, and even man power, it was considered poor policy to follow the usual program. It was therefore planned to delay the starting of snow removal operations for a period of several weeks. Dame Nature interfered with the planned schedule by depositing an unusually heavy snowfall during the latter part of April and early May, increasing the pack by the end of May to over twice that of the preceding year. This, of course, caused further delay in the snow removal activities. The mountain lovers and enthusiasts who normally besiege the Division of Highways with requests for immediate opening were sympathetic and reasonable in their attitude toward this program, realizing that it was in keeping with the general war effort.

This year the plows were started on the Carson Pass and Ebbetts Pass highways on June 16th, one month later than last year. This procedure paid excellent dividends as the results proved that the later starting was more economical. In spite of a much heavier snow pack, the opening of the Carson Pass Highway, Route 34, required only nine shifts of the rotary snow plow as compared with 38 for the preceding year. Only two plow shifts were required on the Ebbetts

Pass Highway, Route 24, as compared with 22 in 1941.

The Ebbetts Pass was opened on June 26th and Carson Pass on June 28th, two and three weeks, respectively, later than the opening dates of last year, notwithstanding the fact that plowing operations were suspended for approximately ten days after reaching Silver Lake and Lake Alpine. If operations had been continuous, an earlier opening would have resulted. Delayed starting does not result in a correspondingly later opening as considerably faster progress can be made. The cost of opening Ebbetts Pass Highway was only 12 per cent of that of last year, and Carson Pass, only 24 per cent. Some saving was also effected in the maintenance of the traveled way on both routes. The later opening permitted considerable drying of the roadbed, with the result that less damage was caused to the traveled way. Thus the delayed plowing has effected a real saving.

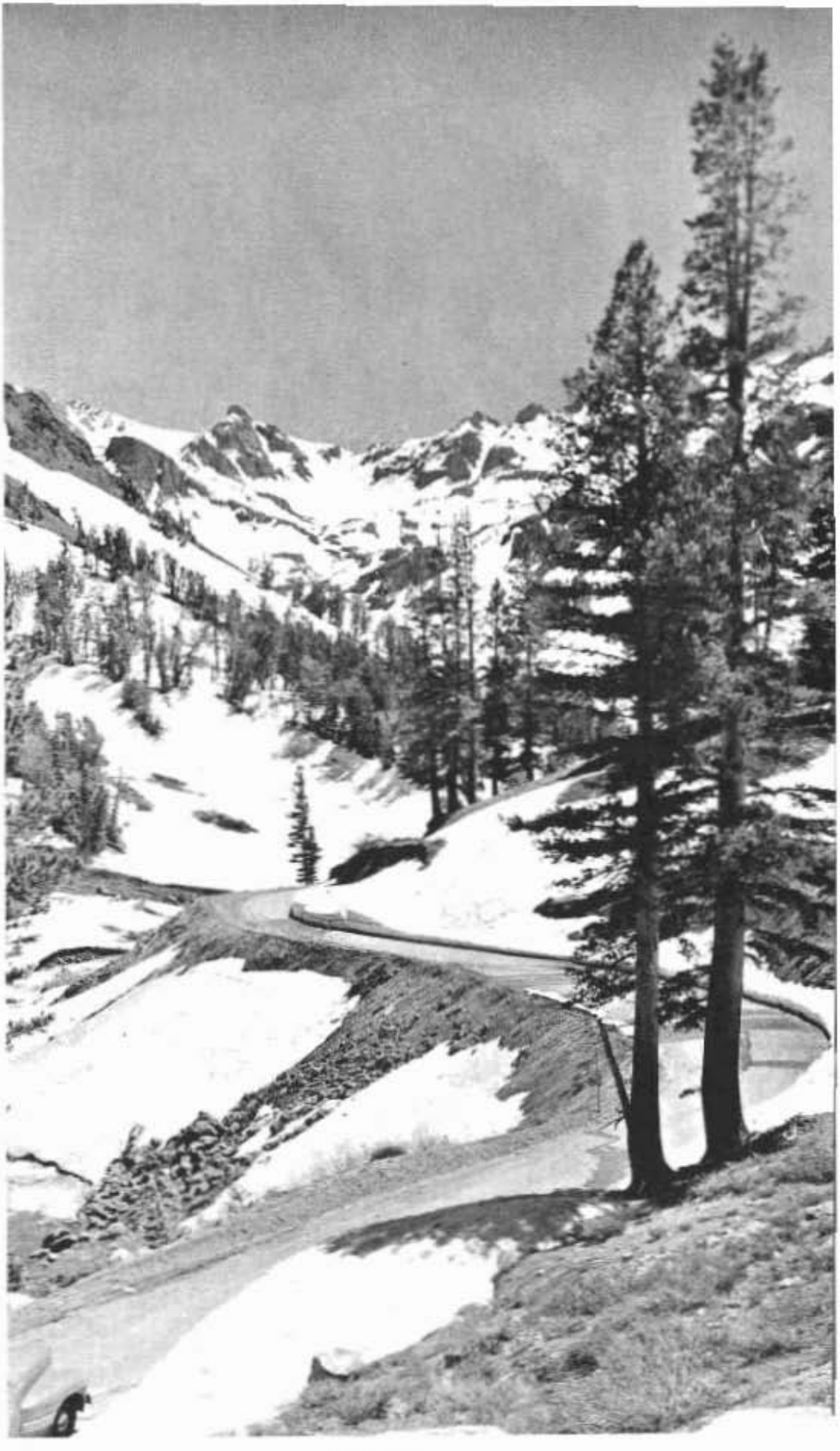
The highway over the Sonora Pass was opened to traffic on June 19th. This very early opening, considerably in advance of that of the other two passes, was made possible by Paramount Pictures, Incorporated, which company paid for the entire cost of opening the Sonora Pass Highway to within 1.8 miles of the summit.

Driven out by the heavy snow storms of last Fall, Paramount officials were anxious to return with a cast and crew of more than 200 persons to resume shooting the snow scenes required in the filming of Ernest Hemingway's "For Whom the Bell Tolls," a story having as a background the recent Spanish civil war. Paramount scouts, after having made an exhaustive search covering all of the Western States, found that the famous Blue Canyon on the west side of the Sonora Pass was the ideal spot for the filming of this picture.

The camera crew followed the Snogo up the steep mountain grade shooting scenes for the picture while the snow was still flying from the rotary plow. During the early morning hours the members of the cast were more than glad that the script required the wearing of fur-lined jackets and ear muffs.

Sonora Pass, gateway to the famous pioneer mining district of Bodie and vicinity, is traversed by State Highway Route 13, the limits of which are at Route 4 at Salida and Route 23 at

(Continued on page 13)



AFTER

This photograph shows Sonora highway after snowplow had passed

Snow was packed so hard on Sonora Pass Highway that it had to be dynamited before plows could work. Upper—Blowing Pack. Lower—Plow makes headway

One-in-a-Million Wrong-Way Driver Compels Added Barriers on Freeway

By N. W. REESE, District Traffic Engineer

WHEN California's first Freeway, the Arroyo Seco Parkway, was constructed between Los Angeles and Pasadena, little precedent existed for the design of such highways. It is true that two such highways had been built in the East, but these had not been in operation long enough to determine the practicability of some features of their design.

The engineers who designed Arroyo Seco Parkway tried to incorporate every known safety feature to provide for the average driver. However, topographic and right of way considerations restricted the full development of design which might otherwise have been possible in more open territory.

The restrictions mentioned above precluded the use of a full clover-leaf design for interchange of local and through traffic at the few intersections on the Freeway. Instead, access facilities to the main cross streets were provided by "On" and "Off" ramps for traffic entering or leaving the Freeway. Most of these ramps were constructed 24 feet in width.

Regardless of all precautions taken, however, to render accidents impossible, there have been a few motorists who have attempted to enter the Freeway on these "Off" ramps, thus being forced to make a very difficult turn in order to proceed in the normal direction of traffic, or in a few instances, have proceeded in the wrong direction and thus, sooner or later, have come into conflict with some other motorist.

While the number of these offending drivers has been very small, the consequences of such a movement are very likely to prove serious. In one case, a collision resulted in a fatality.

ONE-IN-A-MILLION RATE

While the collision rate on the Arroyo Seco Parkway is not high when measured on the basis of accidents per million vehicle miles (the unit used as a State-wide yardstick), the accidents which have occurred there have received wide publicity.

Our figures show that not more than one motorist in one million who

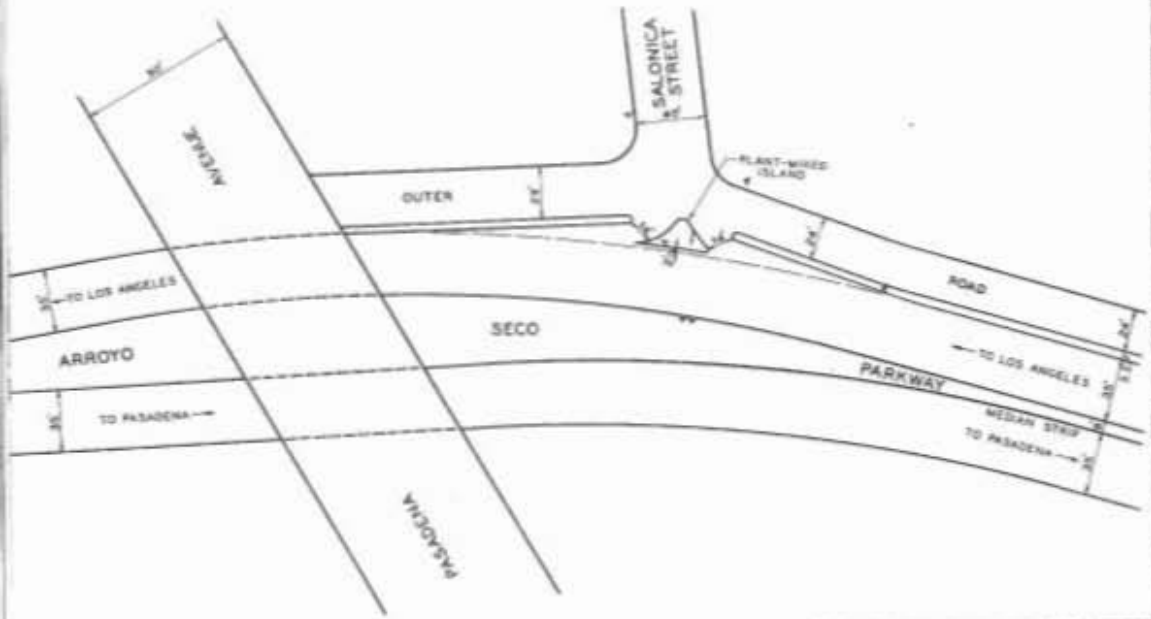
(Continued on page 20)

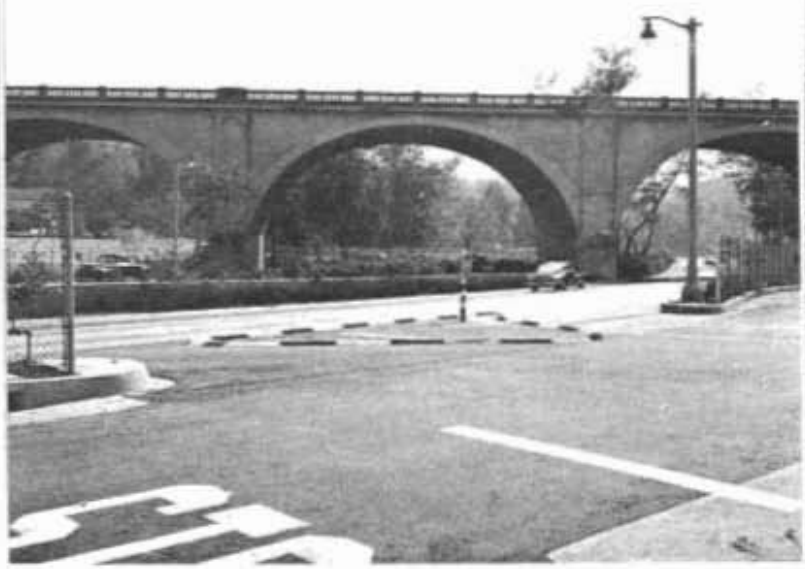
Traffic hazards created by drivers entering Arroyo Seco Parkway by way of an exit ramp will be greatly reduced by treatment pictured above

C-4-5

Upper-Exit ramps protected by long raised islands to prevent left turn onto Parkway. Center right—Construction work. Lower left—Los Angeles bound connection at Salonica Street. Lower right—"No Left Turn" marker reminds careless drivers

C-4-3





New Traffic Signal Dispatcher Possessed of Human Abilities

By A. E. SIMMONS, Assistant District Traffic Engineer

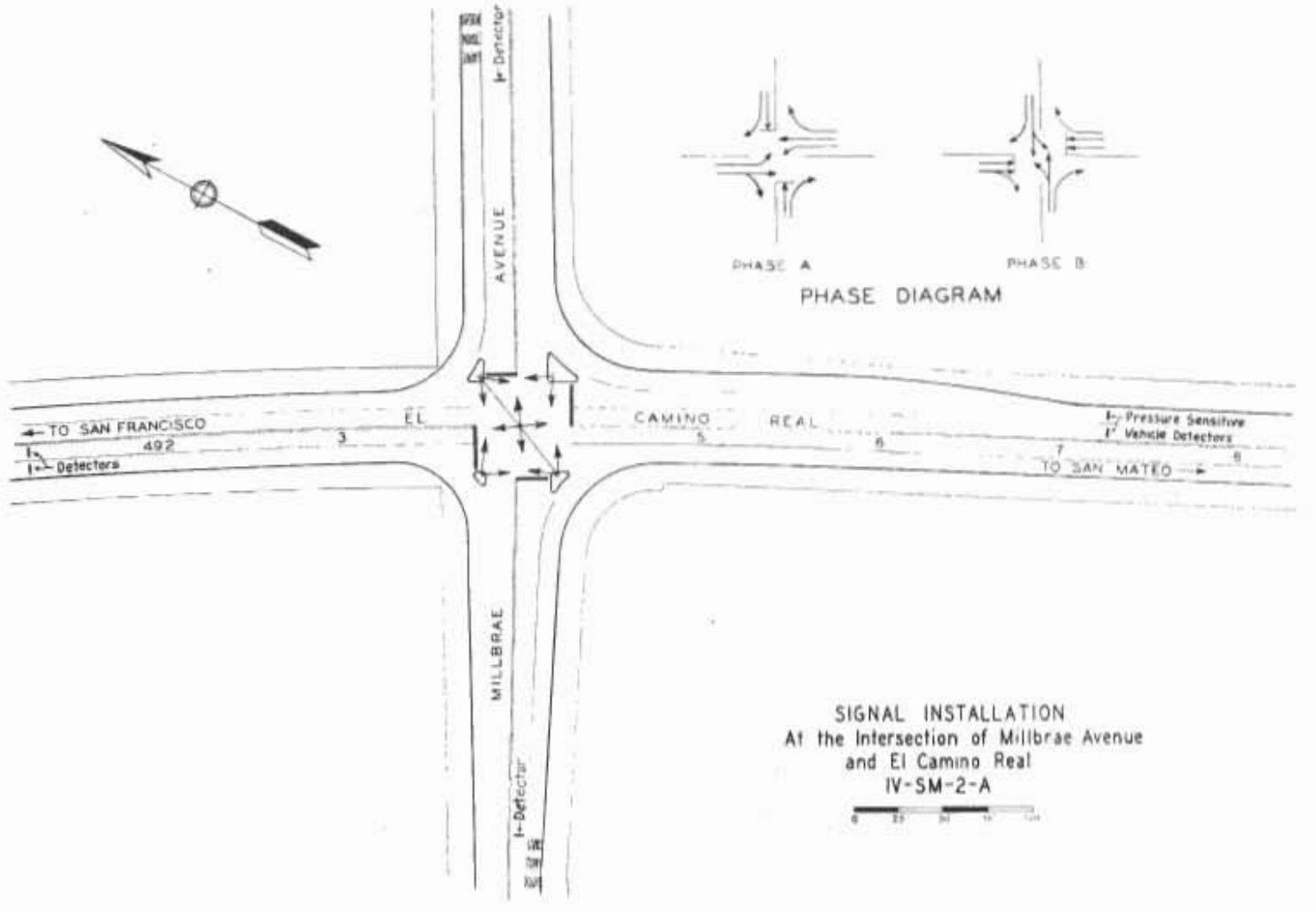
A TRAFFIC signal dispatcher that can add, subtract, remember and practically think, is the Traffic Engineer's answer to the problem of dispatching vehicles through the modern congested intersection.

Formerly a fixed time type of controller or dispatcher has been used to control traffic under these conditions, one which changes its signals in a predetermined fixed total time cycle and the divisions thereof. It is readily apparent that the fixed time cycle is not entirely satisfactory for constantly varying traffic demands. As is frequently the case with fixed time signals, the heavy traffic flow is stopped when little or no traffic is crossing from the opposing lanes.

Various types of control devices have been developed to alter the cycle lengths to predetermined patterns in an attempt to fit the traffic demands, but at the best, this method is just a guess as to the needs of the various arteries.

An improvement over the fixed time control has been available and in use for some time. This controller is ac-

Northbound traffic on U. S. 101 proceeding under regulation of new traffic signal dispatcher in Millbrae



tuated by vehicles crossing detectors placed in the traffic lanes approaching the intersection. The controller is so designed that continuous traffic on an artery will retain the right of way up to a certain maximum period, even with a demand from the cross street. Without any cross street demand the artery would have a continuous right of way until an actuation was received from the cross street traffic. The cross street would then hold the right of way as long as there was a continuous traffic flow up to a certain maximum time, or until a demand was made by the artery.

This was a step in the right direction, but unfortunately the controller was so designed that only during the green period were the vehicles crossing the detectors able to adjust the right of way period. If one or a dozen vehicles cross the detector during the red period, the same amount of time was allotted during the following green period. In certain instances this arrangement was not entirely satisfactory, and demonstrated the need for a type of controller that would function when actuated by vehicles crossing the detector during the red period.

FLEXIBLE DISPATCHER

The manufacturers being aware of the limitations of the above type controller, made a thorough study of the situation. A dispatcher that is really flexible has been developed. This new type dispatcher not only provides for adjustment of the signal intervals by vehicles approaching on the green and red intervals, but in addition, provision is made for adjustments of signal intervals by the number of vehicles, the density of vehicles, and the waiting time of vehicles at the intersection. As a matter of fact, there are 14 separate adjustments on each of the two signal phases. The dispatcher actually has the ability to memorize.

The dispatcher has a *memory* built into it. For instance, if a vehicle approaching the intersection passes over the detector at the instant the green light changed to amber, the dispatcher will clear all the traffic on the opposing artery. Then, remembering that there was a car on the other artery that did not clear the intersection on the previous period, the dispatcher will (actually) assign the right of way to the waiting vehicle without any additional actuation.

INTRICATE PROCESS

Model 1022 is a two phase full-actuated dispatcher for the operation of traffic signals on a plan which automatically adjusts itself to, and takes fullest advantage of, the instantaneous variations in traffic volume, relative densities of traffic on the two phases and the total elapsed time between actuation and assignment of the right of way.

Account is taken of every vehicle approaching the intersection, whether it be on the green period or the red period and all of the timing intervals of the dispatcher are affected and modified accordingly. The dispatcher is so designed that it automatically balances the known car seconds of

delay in the street having the red light, against the car seconds of delay which would result were moving traffic of known density and spacing to be stopped on the street having the green light. By this process of automatic and continuous balance it is possible not only to eliminate all unnecessary delay but materially to reduce the total delay at the intersection.

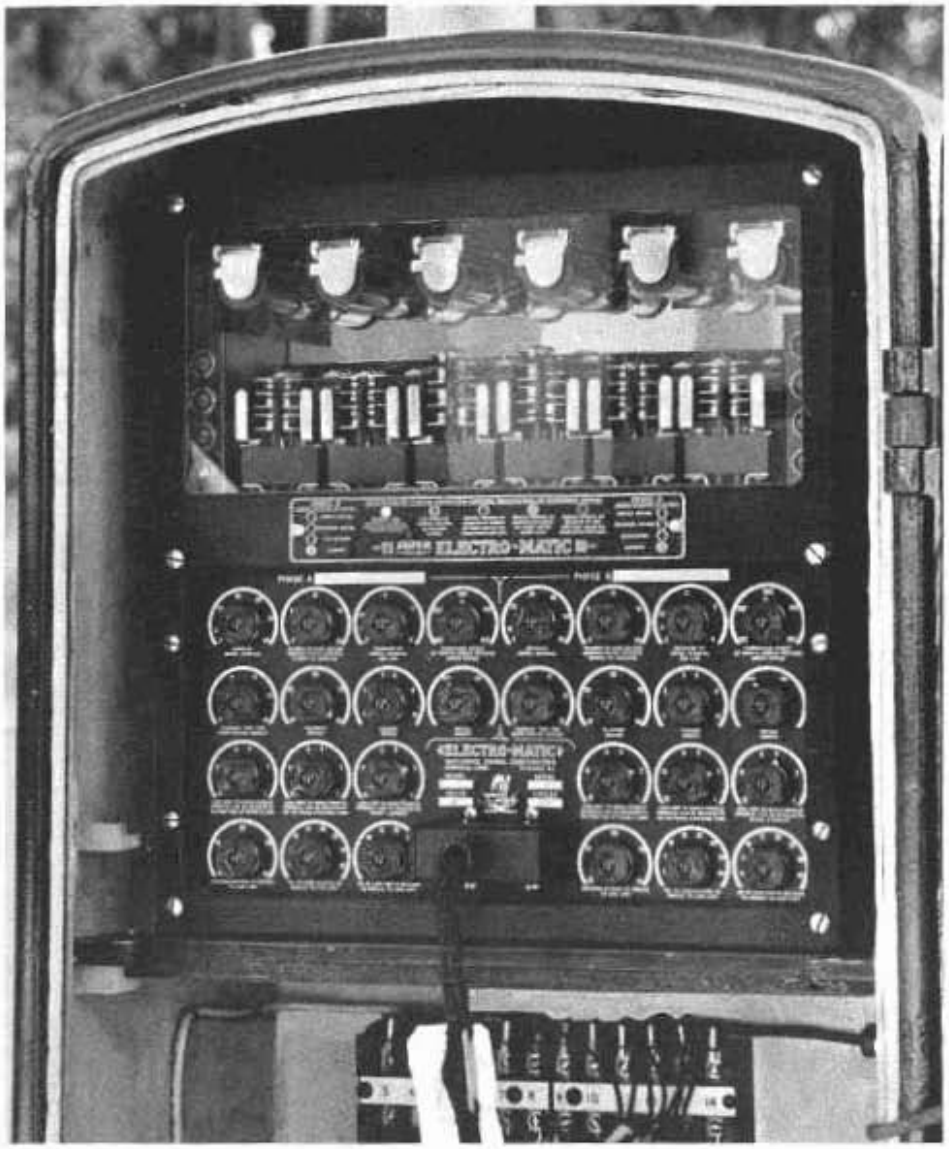
Since a complete record is kept of the vehicles at the intersection including not only the number of the vehicles but also their position with respect to each other, this dispatcher is adapted ideally to the handling of platoons of vehicles. The dispatcher has been designed with the intent to expedite efficiently and smoothly the through movement of platoons of vehicles, without physical interconnection, at a series of intersections controlled by model 1022 dispatchers.

INITIAL INTERVALS

There is set up on the dispatcher, by means of a dial for each phase, the total number of vehicles which should be expected to clear on each phase. Since the dispatcher keeps a continuous record of the number of vehicles which have been stopped when the signal is red, it can determine the number of additional vehicles which will have to be cleared through the intersection on the next green light. An additional increment of green period will be given every vehicle which has been stopped at the intersection in excess of the number of vehicles which can be cleared on the minimum green period. This increment per car is adjustable on the dial panel of the dispatcher for each phase.

VEHICLES PASSAGE INTERVAL

Under light traffic conditions the right of way on a particular phase will be held as long as there are any cars between the detector and the intersection as they will be calling for a full Vehicle Passage Interval. Upon the expiration of a Vehicle Passage Interval the dispatcher can yield to the other phase if there is a car waiting there. Under intermediate and heavy traffic conditions, the right of way may be taken away from the vehicle by other impulses recorded in the dispatcher. If the right of way is taken away from a vehicle without allotting it a full Vehicle Passage Interval that vehicle will be remembered and at the next opportunity in the cycle the right of way will again be shown to the vehicle.



Close-up view of new traffic signal dispatcher which controls traffic automatically

In order to indicate just how the dispatcher is handling the traffic, that is to say, whether the right of way is transferred by traffic density, or by traffic delay or waiting time, or by some other of the various dispatcher functions, a series of 13 indicator lights are visible from the front of the dispatcher. By watching these indicator lights flash, it is possible to see just what the dispatcher is thinking and actually doing about the distribution of the right of way.

The working parts of the dispatcher consist mainly of interconnected relays operating in conjunction with static timing circuits. The actual timing of the various circuits is measured by the length of time required for a timing condenser to reach a predetermined voltage when supplied with a direct current voltage through a variable resistance controlled by the front panel knobs. When the timing condenser reaches the correct voltage, an electrical circuit is completed through a gaseous discharge vacuum tube to operate the various dispatcher relays.

INSTALLED AT MILLBRAE

The recent installation of this new type dispatcher at Millbrae Avenue and El Camino Real (U. S. 101) in San Mateo County has met with considerable favor. Actual checks at the intersection show that the amount of vehicle delay on any of the traffic legs is very small.

Diner: "Are you the young lady who took my order?"

Waitress: "Yes, sir."

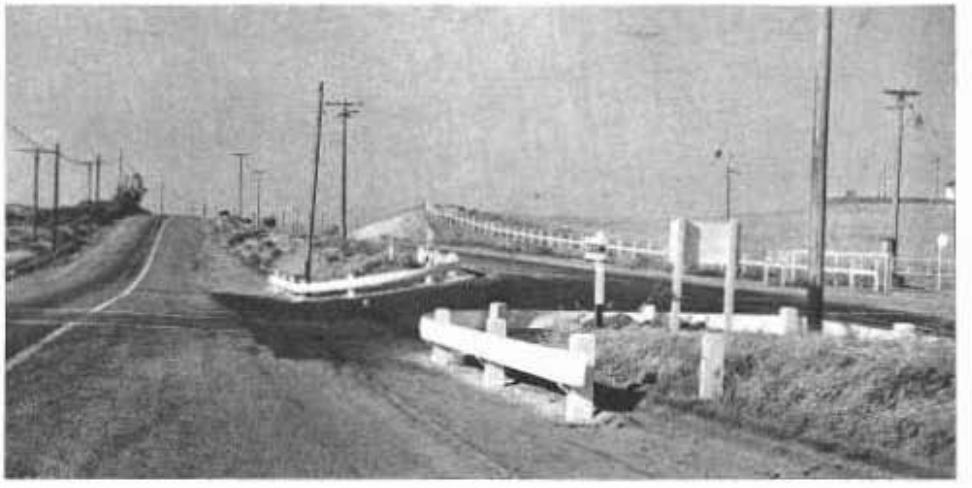
Diner: "Well, you're looking fine. How are your grandchildren?"

Metal Guard Rails Replace Curbs

By HARLAN PERDEW, District Traffic Engineer

EFFECTIVENESS of metal guard rails at road intersections as an aid to traffic control has been definitely established by the Division of Highways. Their superiority over concrete curbs and double stripes with plant-mixed bars in areas where highways are subjected to seasonal sand drifts has been conclusively demonstrated.

On an important highway project recently completed, metal guard rails obtained before priorities on critical materials went into effect, were installed at intersections for the first time in the history of the department. The highway in question traverses a section of Central California in which the soil is primarily fine sand with occasional vegetation. During certain periods of the year strong winds are prevalent in this district and cause frequent sand drifting.



Guard rail fabricated at factory for curve and difference in elevation of two roadways

21 OPENINGS IN STRIP

The project on which the guard rails were used is a four-lane highway with a 30-foot undeveloped division strip. During its construction 21 openings were provided in the division strip within a distance of approximately 4½ miles. Several of the openings were unpaved and other paved ones were so wide as to make control of traffic very difficult.

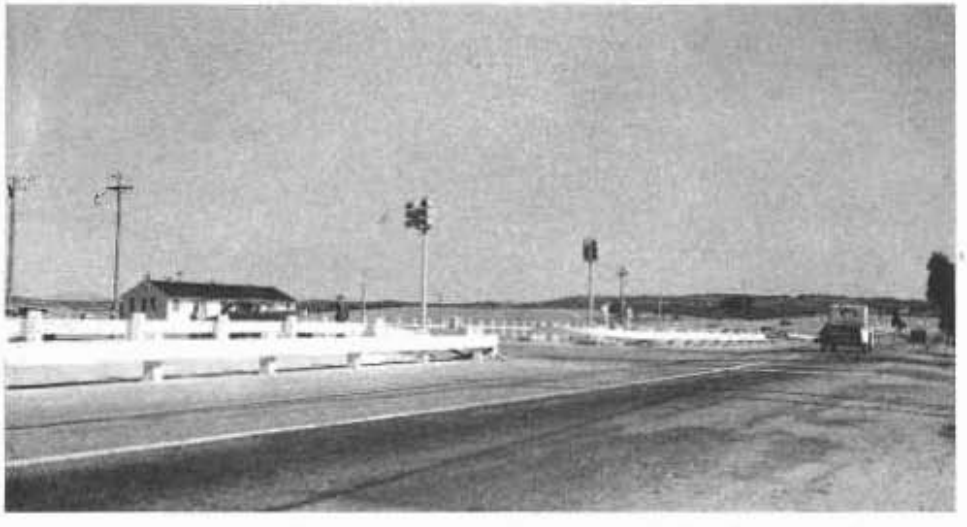
The original plan for the improvement provided for the closing of 12 of the openings and establishment of more positive traffic control at the remaining openings. Most of the major openings were from 80 to 100 feet in width.

THREE METHODS PROPOSED

As an aid to traffic control, it was decided to restrict the width of these openings. Three methods were discussed for accomplishing this: namely, double stripes with plant-mix bars, concrete curbs and guard rail. The double stripes and bars were eliminated as having insufficient positive control. Concrete curbs would have provided the positive control, but with drifting sand it was felt that the curbs would frequently be entirely covered necessitating considerable maintenance and reducing the effectiveness thereof. The guard rail, it was decided, would permit the sand to blow clear of the openings without reducing the effectiveness of barrier.

After installation it was found that the metal guard rail used had other advantages that far exceeded those which originally justified its use. These advantages were as follows:

1. Installation was simple and maintenance costs will be minor.
2. The center of the rail is 19 inches above the pavement and is visible to motorists at all times. This is particularly important for vehicles negotiating a turn as the rail can be followed without loss of visibility to the driver.
3. Intersections are more definitely defined to both day and night traffic. The white guard rail at night stands out from a dark background and is visible for several hundred feet from the intersection.
4. It is anticipated that the guard rail will prove to be safer than curbing as there will be less tendency to collide with it and in case of a collision the resiliency of the metal rail will prevent serious accident.



Turning movements restricted by use of metal guard rail at intersection where two roadways are at same level

Congress Votes $39,019,000 to Carry on Central Valley Project

(Continued from page 1)

to complete all the engineering work necessary in preparation for the construction of the Antioch steam plant.

The committee also recommended that the "Secretary of the Interior and the Pacific Gas and Electric Company immediately enter into a contract, for the duration of the war and a reasonable time thereafter, for the complete pooling of all public and private power facilities which will result in delivering the greatest amount of power to war industries in the least possible time and with the greatest economy in the use of critical and strategic materials. Any such contract should provide for recapture, without prejudice, of any advantages which temporarily may accrue to either party."

The Senate report also declared: "* * * in order to make certain that a fixed policy is not to be abandoned by failure of appropriate funds to carry it into effect, it is recommended that the $3,723,000 heretofore appropriated for the Central Valley Project transmission system be restored to the bill.

"* * * The breakdown of the sum contained in the bill for the Central Valley Project as passed by the House earmarks $1,000,000 for the construction of the Friant-Kern Canal. In order to make available additional lands for the production of foods, fiber, rubber and other materials to meet war needs it is recommended that this allocation be increased to $1,250,000 and that the entire amount be available for construction of both the Friant-Kern and Madera canals to advance supplemental water service to highly productive lands under each of said canals badly in need of more water."

The effect of this action was to take the million dollars specifically earmarked by the House for construction of the Friant-Kern Canal and make it and an additional $250,000 available for construction on either or both the Friant-Kern and Madera canals.

Representatives of the Water Project Authority appeared before both House and Senate committees and vigorously supported appropriations for both the irrigation and power features of the Central Valley Project as set up in the President's Budget. The authority also filed statements and data with both committees in support of the appropriations.

Following action by the Interior Subcommittee of the House Appropriations Committee eliminating funds for the transmission line and Antioch steam-electric plant, President Roosevelt personally addressed a letter to Senator Carl Hayden, Chairman of the Interior Subcommittee of the Senate Appropriations Committee pointing out the importance of these funds to the ultimate success of the project.

Governor Culbert L. Olson actively entered the fight for restoration of the funds as did George Sehlmeyer, Master of the State Grange, who made a trip to Washington to appear before the Senate Appropriations Committee in support of the Central Valley Project appropriations. Many cities and organizations throughout the Central Valley passed resolutions and wired their Washington representatives urging that adequate funds be provided, not only for the irrigation features of the project, but for the transmission line and steam-electric plant at Antioch as well.

Opposition to the power features of the project came from Pacific Gas and Electric Company representatives who appeared and filed statements before both the House and Senate committees.

TURNPIKE HISTORY

The word "turnpike"—given toll roads—originated from the early American and English custom of blocking toll roads with pikes or poles, according to the Automobile Club of Southern California. When the toll was paid, the pike was turned aside. The first turnpike road was built in 1793 between Philadelphia and Lancaster, Pennsylvania, and was known as the Lancaster Turnpike. It was 62 miles in length and also was the first macadam road in the United States.

Dynamite and Snowplows Conquer Sonora Pass

(Continued from page 5)

Sonora Junction. This highway crosses the summit in Sonora Pass at an elevation of 9,624 feet, being the second highest highway crossing in the State highway system, exceeded only by Tioga Pass, 9,941 feet. This pass lies between Sonora Peak, elevation 11,429 feet, on the north, and Leavitt Peak, elevation 11,575 feet, on the south. The boundary line between District IX and District X is at the summit of Sonora Pass. The highway on both sides of the pass is on steep and winding grades, rising in the west from the foot of the grade at Kennedy Meadow, elevation 6,300 feet, a distance of 3,300 feet in nine miles, and descending on the east slope to Leavitt Meadow, elevation 7,152 feet, a drop of approximately 2,500 feet in a distance of eight miles. Scenery on this 17-mile section is extremely spectacular. Many world travelers have proclaimed the rugged grandeur of Sonora Pass to be unsurpassed, not excluding in their consideration the world-famous European Alpine scenery.

Snow removal operations on the approaches to the pass are difficult, due to the steep and winding grades, the heavy snow pack, and the low temperatures. Plowing was started this year at Strawberry, elevation 5,240 feet, 37 miles west of Sonora Pass, on May 14, three weeks later than last year. Baker Station, at the foot of Sonora Pass, was reached May 19 and operations temporarily suspended. On May 27 an attempt was made to open the highway to the head of Blue Canyon, approximately two miles west of the summit. The work was suspended on the second day during a blinding snow storm while still one mile short of the goal. After an interval of 11 days, operations were resumed, this time with the summit of the pass as the goal. Six days were required to reach the summit, and an additional two days for widening through the deep cuts. In the meantime, the plow from District IX was clearing the eastern slope. As a result of excellent timing, these two plows met on June 17 on the boundary between the two Districts.

Old Man Winter was finally conquered and a veritable Mecca made accessible to the sportsman, nature lover and tourist until some time next fall when the forces of nature will again combine to put the high Sierra to sleep.

Establishing The Oil Content For Dense Graded Bituminous Mixtures

By F. N. HVEEM*

PROBABLY the first and most frequent question which the bituminous paving engineer is required to answer concerns the quantity of binder which would be most satisfactory when mixed with a given aggregate. In the early years engineers relied on personal experience and usually decided on the proper amount of asphalt by visual inspection of the mix. Many rule of thumb guides have been employed ranging from appearance and "feel" of an asphaltic concrete mix to the "wormy crawl" and chocolate brown color thought to identify a proper oil mix. More scientific procedures include stain tests, proportioning by void ratio, and a number of formulas usually based on the sieve analysis of the aggregate.

Among the formulas probably the best known is the McKesson-Frickstad developed for the oil mix type of pavement. Several modifications of the McKesson-Frickstad formula have been developed in the Western States among which are the New Mexico, Nebraska and Wyoming Formula, etc.

State of California — Division of Highways — Materials & Research Dept.

TABLE OF SURFACE AREA EQUIVALENTS

Table 1 — 10 Sieves			Table 2 — 7 Sieves			Table 3 — 6 Sieves			Table 4 — 4 Sieves			Table 5 — 4 Sieves			Table 6 — 3 Sieves		
Sieve No. Pass.	Ret.	Con-stant	Sieve No. Pass.	Ret.	Con-stant	Sieve No. Pass.	Ret.	Con-stant	Sieve No. Pass.	Ret.	Con-stant	Sieve No. Pass.	Ret.	Con-stant	Sieve No. Pass.	Ret.	Con-stant
270*		300															
200	270	200	200		260	200		260	200		260	200		260	200		260
100	200	120	100	200	120												
50	100	60				50	200	90	50	200	90						
30	50	30	30	100	46							30	200	72			
16	30	16				16	50	22									
8	16	8	8	30	18				8	50	17				8	200	45
4	8	4	4	8	4	4	16	6				4	30	9			
3/8	4	2	3/8	4	3	3/8	4	2									
3/4	3/8	1	3/4	3/8	1½	3/4	3/8	1½	3/4	8	2	3/4	4	2	3/4	8	2

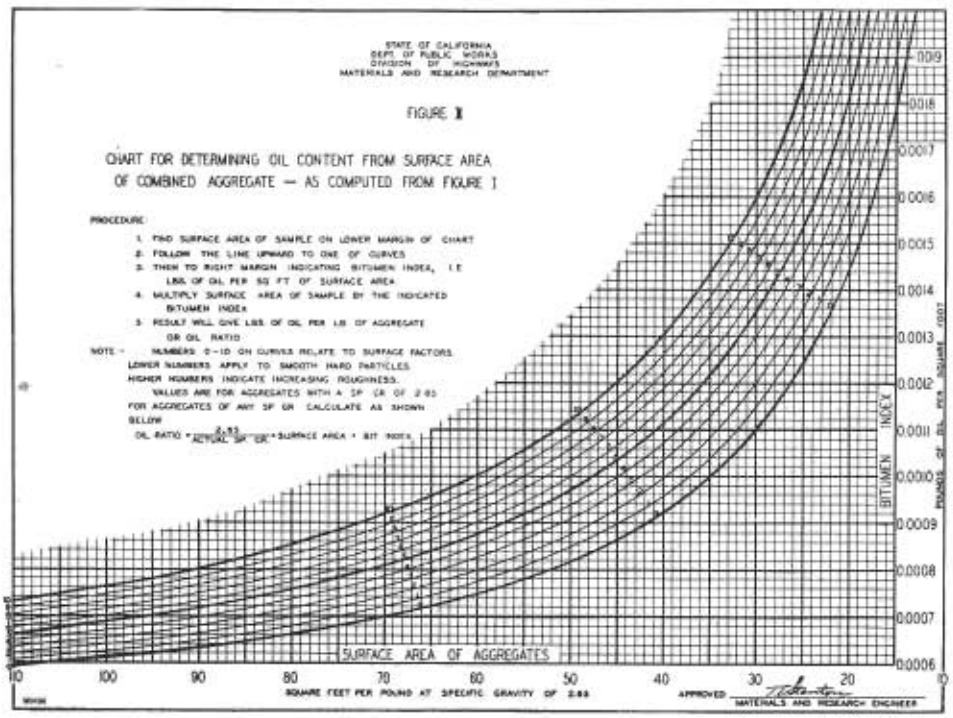
* Silt remaining in suspension and removed by elutriation.

Note: Value shown in Tables 2, 3, 4, 5, & 6 for passing #200 sieve applies to average dust. Will be in error for some materials.

APPLICATION: Use table according to number of test sieves used. Reducing number of sieves will reduce accuracy. By sieve analysis determine the amount of each size of aggregate. Express in terms of per cent of total. Multiply the per cent of each size by the constant given for that size. The constant is the equivalent area in sq. ft. of one pound of material of that size. Add results and total will represent surface area of the entire sample in terms of square feet per pound.

In California the procedure followed for the past 10 years is the Surface Area Method.[1]

Most engineers have long been aware that the optimum quantity of asphalt bears no consistent relation to the volume of voids in the mixture and the rather widespread application of methods based on the surface area of the aggregate indicates that the quantity of asphalt is more nearly related to the superficial surface area than to any other simple factor. For example, the surface area method as used in California has been reasonably satisfactory and can be expected to give quite close approximations in the hands of experienced engineers. Nevertheless, any preliminary estimation of asphalt based on surface analysis alone has possibilities for error and it has been evident for some time that improvements or additions to the



* Senior Physical Testing Engineer, Materials and Research Department, California Division of Highways.

[1] "Role of the Laboratory in the Preliminary Investigation and Control of Materials for Low Cost Bituminous Pavements" by Thos. E. Stanton, Jr., and F. N. Hveem, presented at the Fourteenth Annual Meeting of the Highway Research Board, December, 1934.

method are desirable; first, in order to make the method more universally applicable and second, to reduce the time and experience required.

SURFACE AREA METHOD

A brief summary of the surface area method is as follows:

Hypothesis. The quantity of asphalt required to bind particles of mineral aggregate together to form a stable paving mixture will bear some relation to the superficial surface area of particles to be covered; although the quantity can not be calculated as a direct simple function of surface area alone.

The determination is complicated by other factors which may be analyzed as follows:

Internal friction is the major element contributing to bituminous pavement stability and as asphalt is a lubricant, that property serves to limit the quantity which can be used without destroying the stability of the mixture. Lubrication effects depend upon the roughness of the solid surface as well as the thickness and viscosity of the lubricating film and any predetermination of the optimum binder content must take into account both surface area and the character of the particles. The surface area method involves the calculation of surface area through the use of constants assigned to the various particle sizes as determined by standard testing sieves. **(See Table 1).** After having calculated the surface area it is then necessary to determine the bitumen index or the quantity of asphalt required to cover one unit of available surface. It was found that the bitumen index or film thickness must vary as an inverse function of the surface area indicating that in order to form a stable mix a *group* of small particles must be coated with a thinner film than can be used on a group of large particles. This relationship is shown by the shape of the curves in **Figure 1.**

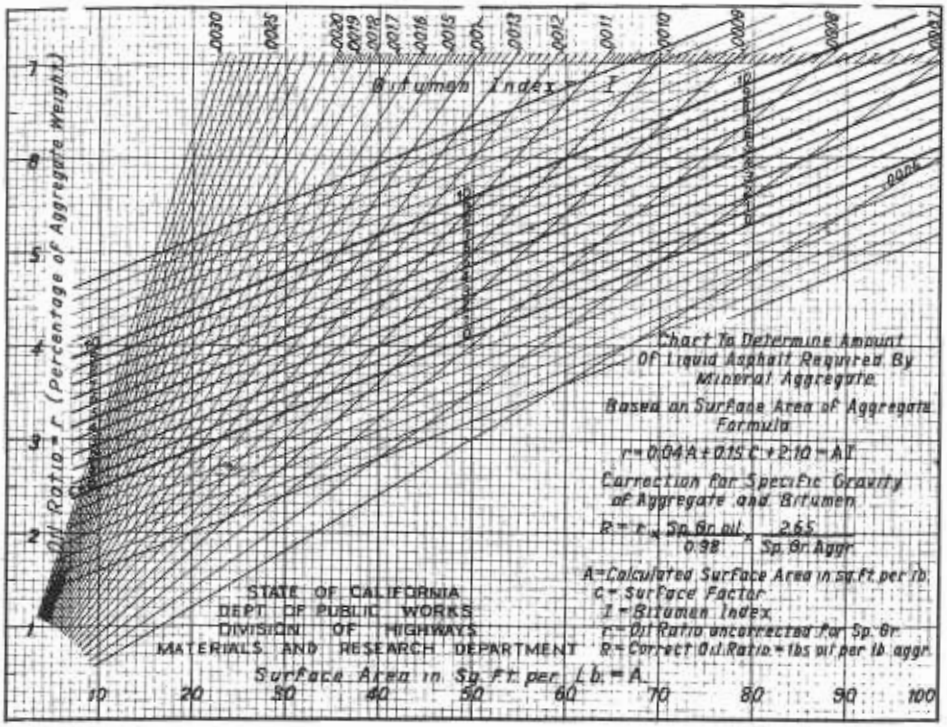
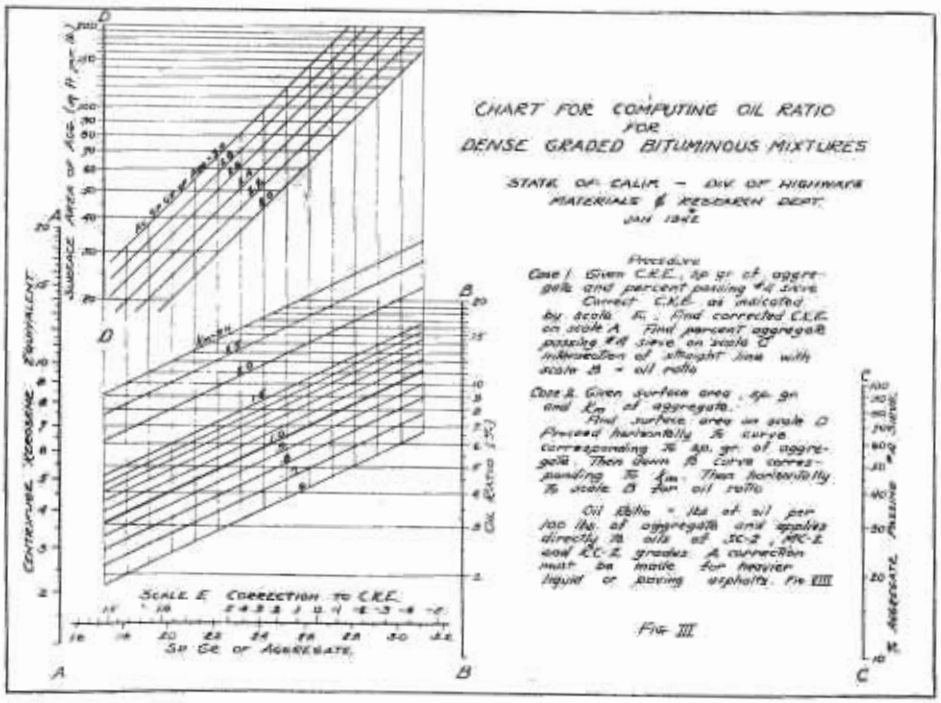


FIGURE II



The oil ratio is then determined from the combination of *assumed* surface factor and *calculated* surface area using chart, **Figure 1.** The product of the bitumen index and surface area value represents the oil ratio after corrections have been made for specific

AGGREGATE GRADATION

In addition to this variable caused by differences in aggregate graduation, an allowance must be made for the character of the particle surface. This means that rough irregular particles have a greater surface area and are less easily lubricated than smooth polished grains. Therefore, a thicker film of oil or asphalt can be used on particles of crushed lava or sandstone than will be tolerated by particles of quartz or chert. These differences are covered arbitrarily by the series of curves shown on **Figure 1.** The lower curves apply to particles with a smooth glassy surface and the higher curves apply to particles of increasing roughness. The essential operations are covered by the notations on **Table 1** and on the Chart, **Figure 1,** and consist of the following steps: sieve analyses of the aggregate, calculation of the surface area, selection of the surface factor curve corresponding to the particle roughness. The bitumen index is then determined from the combination of *assumed* surface factor and *calculated* surface area using chart, **Figure 1.** The product of the bitumen index and surface area value represents the oil ratio after corrections have been made for specific

gravity of both asphalt and aggregate. This relationship is shown also by chart, **Figure II,** where the surface factor curves are straight lines and the oil ratio may be read directly.

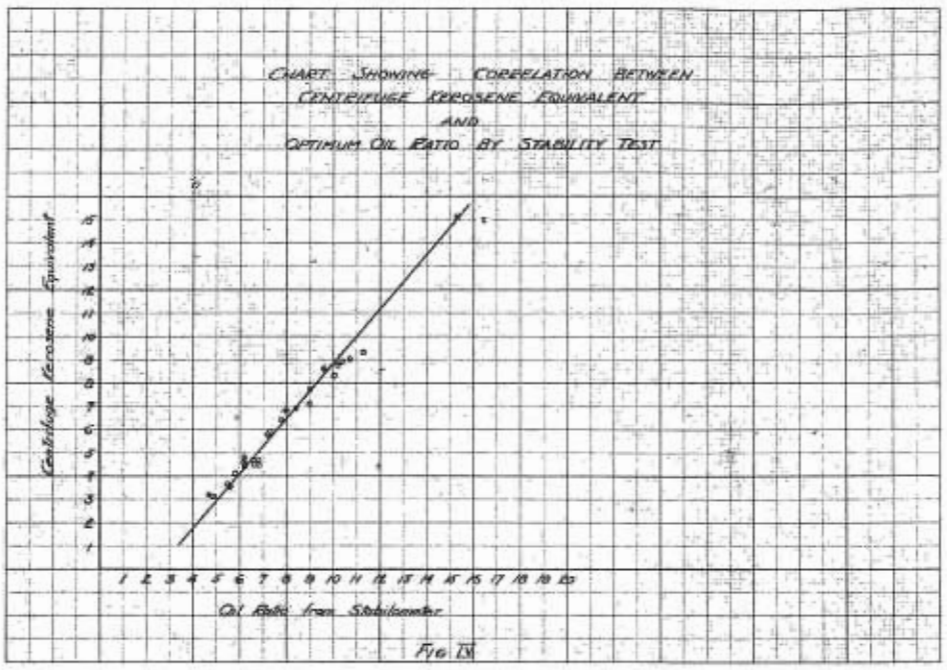
SIEVE ANALYSIS

The accuracy of the foregoing method of determination therefore rests on the sieve analysis and the ability of the engineer to select a surface factor curve which is appropriate for the particular aggregate. This operation presents some difficulties to the inexperienced engineer or to the laboratory not equipped with a stabilometer or other means for actually measuring the degree of lubrication in the mix. Furthermore, while particle roughness may be approximately classified by inspection, true absorption of the aggregate is difficult to evaluate without tests and it is well known that many oil mixtures become dry and display a tendency to ravel subsequent to construction, even though apparently containing sufficient oil when first mixed. Many bituminous paving engineers have realized that some accurate method is needed for anticipating absorption of oil on the road. In California this difficulty was to some extent met in the laboratory by adding additional oil to samples after a preliminary drying period. In Utah Mr. Levi Muir has long employed an absorption test but as this procedure engenders considerable delay in the handling of tests, a method has been developed and is described herewith which requires the use of only simple equipment to give a rapid approximation of the ultimate absorption capacity of the aggregate and which also can be used for predetermination of the oil content without preliminary sieve analysis.

CENTRIFUGE KEROSENE EQUIVALENT

It has long been realized that a logical step from the calculation of the surface area would be the development of some means for accurately measuring the superficial surface area *or surface capacity* of irregular particles without the need for time-consuming sieve analysis and calculations which at best give only approximate results.

About 10 years ago it was found that the oil or asphalt requirement of filler dust could be closely estimated by observing the height to which a limited quantity of kerosene would be drawn through a column of dust



placed in a glass graduate. Attempts were made to apply the procedure to graded sands up to 10 mesh but results were not completely consistent; however, this does not mean that the possibilities were completely explored.

It can also be shown that very good results are obtainable by selecting a closely screened fraction of sand and coating to a uniform film thickness with liquid asphalt; this method called the "Funnel Test" was used for over a year in the California Laboratory and has the advantage of requiring no special equipment but does require sieve analysis and from one to two hours to complete the operation. It has been dropped in favor of the more rapid method described below.

One common factor stands out in all the more promising experiments and trials: It is evident that any determination based on the use of a standard liquid **must develop conditions wherein the particles are covered by a film of the liquid without any excess being held in the voids between the particles.**

KANE METHOD

During the course of these studies a related method was reported by one of the field engineers, Mr. C. V. Kane, then Resident Engineer for the California Division of Highways. Kane's method consisted of saturating an aggregate with gasoline and then draining off the excess through a 200 mesh sieve at room temperature. A chart was developed for translating the quantity of gasoline retained in the sample to the equivalent optimum oil ratio of the aggregate. However, when this procedure was investigated in the laboratory it was soon found that it was applicable only to a limited variety of materials and gradations and it was also evident that the errors were due to the gasoline not draining out of the small voids in dense graded mixtures. Pursuing the idea that the liquid must be removed from the voids or pores in the aggregate, centrifuging was resorted to; first, using a standard centrifuge operating at a speed equivalent to 1,000 times gravity as prescribed for the centrifuge moisture determination on soils.

After a number of trials and adjustments a test procedure was developed which appears to have excellent correlation with the stability test and consequently with field experience. In order to provide a medium free from immediate evaporation losses, ordinary kerosene is used to saturate a sample of aggregate. By a series of trials the speed of the centrifuge was reduced to give a force equivalent to 400 times gravity. It became clearly evident that a nice proportionality must be maintained between the viscosity of the liquid used and the force employed to remove the excess from the voids in the sample. The surface capacity of an aggregate is composed of three factors; namely, surface area which varies with gradation, variation due to roughness of the particle surfaces, and variation due to true porosity or absorption into the parti-

cles themselves. Therefore, the speed of the centrifuge must be adjusted so that a proper relation will be maintained between the film of kerosene on the surface of the particles and the quantity absorbed within the particles.

Briefly then, the procedure consists of saturating a representative fraction of the aggregate passing the No. 4 sieve with kerosene and then centrifuging for two minutes under a force equal to 400 G. The quantity of kerosene retained by the sample has been designated "The Centrifuge Kerosene Equivalent."

For those interested in the theoretical considerations involved, the following brief discussion including some of the mathematical relations may be of interest.

DEVELOPMENT OF THE METHOD

The limiting condition for extended increase of bitumen content in a paving mixture is the loss of stability in the mixture. Therefore, using stabilometer tests to determine this limit the relation between the optimum oil ratio and surface area was reinvestigated using a variety of aggregates in a number of gradations. This study indicated the desirability of revising the surface factor curves formerly used with the surface area method; and as the original group of 10 curves had been found insufficient to cover the entire range from very smooth to highly absorbent aggregates, a new system has been established to permit unlimited expansion and is based on the use of a new surface factor designated as "K."

This relationship is shown on chart, **Figure III**, and is so arranged that the value of $K = 1.0$ represents the average most-frequently-encountered aggregate which has little, if any, absorption and is equivalent to the older surface area curve No. 4, **(See Fig. I)** which, after years of experience, has seemed to be most frequently used for the common run of aggregates encountered in California. Hard trap rock, dense basalt, crushed granite or crushed hard limestone are some of the types represented by $K = 1.0$. Aggregates of increasing porosity or surface roughness are covered by high values of K, while particles having smoother and more polished surfaces are indicated by values less than 1.0. The entire relationship is then shown by chart, **Fig. III**, which, with calculated surface area corrected for specific gravity and the correct selection of the factor "K" to indicate the surface texture and porosity of the particles, permits an accurate determination of the oil ratio or weight of liquid asphalt required per unit weight of aggregate.

OPTIMUM OIL RATIO

Experiments with the Centrifuge Kerosene Equivalent have also demonstrated that there is an excellent direct correlation between these values and the optimum oil ratio as determined by stabilometer tests on trial mixtures. This relationship is shown on chart, **Figure IV.**

From these two relations it is possible to develop a mathematical expression for the optimum oil ratio in terms of the C.K.E., the percentage of aggregate passing a No. 4 sieve, and the average specific gravity of the aggregate.

Neglecting the specific gravity temporarily for simplification:

The relation between optimum oil ratio and the surface area of the aggregate as shown on **Figure III** can be expressed by the following formula:

$$\text{Oil Ratio}_{mix} = K_m \times .0067 \times \sqrt{SA_{mix}} \qquad (a)$$

when K_m = Surf. Constant of the entire mix *

SA_{mix} = Surf. area of the entire mix

The relation between optimum oil ratio and C.K.E. as shown on chart, **Figure IV,** may be expressed by the formula:

$$\text{Oil Ratio}_{pass\ no\ 4} = \frac{0.85 \text{ C.K.E.} + 2.5}{100} \qquad (b)$$

Equation (a) applies to any part of the aggregate mixture, so writing it for the passing No. 4 we have:

$$\text{Oil Ratio}_{pass\ no\ 4} = K_f \times .0067 \times \sqrt{SA_{pass\ no\ 4}} \qquad (c)$$

where K_f = surf. constant for the passing No. 4 aggregate

$SA_{pass\ no\ 4}$ = surf. area of the passing No. 4 aggregate

Combining equation (c) with equation (b):

$$\frac{0.85 \text{ C.K.E.} + 2.5}{100} = K_f \times .0067 \times \sqrt{SA_{pass\ no\ 4}} \qquad (d)$$

Since the surface area of the aggregate retained on the No. 4 sieve is small compared to the surface area of that passing the No. 4, we may write the following approximate relation:

$$SA_{pass\ no\ 4} = \frac{SA_{mix} \times 100}{\%\text{ passing No. 4}} \qquad (e)$$

* Surface factors are designated as K_c, surface constant for the coarse aggregate retained No. 4; K_f, surface constant for the fine aggregate passing No. 4; K_m, surface constant of any given combination of coarse and fine aggregate. Further values could be individually assigned to any fraction of the aggregate as desired.

It has been found by experience that except for rare cases where a fine aggregate passing the No. 4 sieve is blended with coarse aggregate of greatly different surface characteristics the surface constant for the entire mix K_m is not significantly different from that for the material passing the No. 4 represented by K_f.

So substituting K_m for K_f

and $\frac{SA_{mix} \times 100}{\%\text{ passing No. 4}}$ for $SA_{passing\ no\ 4}$

in equation (d) and solving for K_m we have:

$$K_m = \frac{0.85 \text{ C.K.E.} + 2.5}{100 \times .0067 \sqrt{\frac{SA_{mix} \times 100}{\%\text{ Passing No. 4}}}} \qquad (f)$$

Substituting this in equation (a):

$$\text{OilRatio}_{mix} = \frac{(0.85 \text{C.K.E.} + 2.5)\sqrt{.0067 SA_{mix}}}{100 \times .0067 \sqrt{\frac{SA_{mix} \times 100}{\%\text{ passing No. 4}}}}$$

Simplifying:

$$\text{Oil Ratio}_{mix} = (0.85 \text{ C.K.E.} + 2.5) \sqrt{\frac{\%\text{passing No. 4}}{100}} \qquad (g)$$

From this we see that the oil ratio may be estimated from the C.K.E. and the amount passing the No. 4 sieve as long as the *character* of particles smaller than No. 4 are similar to the particles retained on the No. 4.

If the specific gravity of the aggregate is materially above or below 2.65 a correction must be applied to the C.K.C. An alignment chart (See Scales A, B, & C on chart, Fig. III) has been constructed corresponding to formula g) with a specific gravity correction scale appended at the bottom of the sheet.

The second installment of this article will appear in the August issue of this magazine.

Public Works Man Is Lexington Survivor

From the calm and security of a desk in the Accounting Department of the Division of Highways in Sacramento to the flaming, shell-ridden deck of the aircraft carrier Lexington in the Coral Sea is the unforgettable transition experienced by Robert Zaniboni in the space of a few months.

With 16 shipmates, Zaniboni was trapped in a compartment of the Lexington when exploding gasoline fumes set the crippled craft ablaze after she had survived deadly Japanese air attacks. Zaniboni was the only one of his group to emerge alive.

California Highway Commission Appoints L. L. Penfield Secretary

EQUIPPED with three and one-half years of efficient State service in important posts and long experience as a business executive, L. L. Penfield of San Francisco assumed the duties of secretary of the California Highway Commission on July 1st. Mr. Penfield succeeds Walter T. Ballou, who resigned to join the secretarial staff of Governor Culbert L. Olson.

Mr. Penfield made an enviable record as Executive Secretary of the California Commission at the Golden Gate International Exposition on Treasure Island, to which position he was appointed by Director of Public Works Frank W. Clark, chairman of the commission, in January, 1939. He directed the State's participation in the Exposition, managing 18 State buildings and 28 departments and supervising the employment of some 500 persons. Mr. Penfield's voluminous official report on the California Commission's exposition activities attracted widespread attention.

Winding up the affairs of the commission, Mr. Penfield turned back to the State Treasurer accruals, credits and money totaling $575,000.

When Mr. Penfield completed his work for the California Exposition Commission he was appointed Executive Secretary-Treasurer of 1A District Agricultural Association which staged the first annual Grand National Live Stock Exposition at the Cow Palace in San Francisco. This exhibition over a period of eight days returned revenues amounting to $132,000.

Born in Buffalo, New York, November 4, 1904, Mr. Penfield came to Sacramento with his parents 25 years ago. After attending Sacramento,

L. L. PENFIELD

San Francisco and Los Angeles schools he returned to New York for further studies.

He entered the employ of Pratt and Lambert, an international concern, in technical research work as a chemist and was trained in production methods, cost accounting, purchasing, personnel, analytical routine and creative procedures. He was transferred to a subsidiary company and placed in charge of the production department of the Mathews Paint Co., in Los Angeles in 1927. Thereafter he was Superintendent of Production for the North American Paint and Chemical Co., and was made Manager of the General Paint Corporation's Beverly Hills Branch in 1936.

Gasoline Rationing Affects Traffic on Recreational Roads

HIGHWAY traffic in Atlantic seaboard States has declined sharply since gasoline rationing went into effect, according to early, scattered counts reported to the Public Roads Administration, Federal Works Agency, by highway departments in eight States.

Travel on roads to recreational areas showed the greatest effect of rationing. Only about a third as many cars, for example, rolled over Connecticut's Merritt Parkway each of the first two Sundays after gasoline rationing, compared with the corresponding Sundays a year ago. Traffic volume for the first full week after rationing was about 40 per cent of that a year earlier.

Traffic on all "recreational roads" for which counts were reported was equally light.

Reports from Maine, Connecticut, Rhode Island, New York, Pennsylvania, New Jersey, and the Carolinas indicate that total traffic on rural roads the first two full weeks since rationing was 55 to 65 per cent of the volume the corresponding week a year ago.

Counts on U. S. 13 and 40 immediately north of their junction in Delaware indicate that not only are fewer automobiles traveling, but they are making shorter trips, Public Roads officials say. Fifty-three cars with Delaware license plates were found on May 21st this year for every 100 that appeared a year ago, but only 27 with out-of-State plates for every 100 counted last year. Total traffic at night after 10 o'clock was 90 per cent of a year earlier.

Survey Party Adapts Radio Device to Defeat Traffic Noises

(Continued from page 2)

readily hearing the data called out by the chainman and levelman, with no time consumed in repeating calls.

While simple, the device has saved many mistakes in recording data and has very considerably increased efficiency and eased the strain of working beside main-line traffic.

By the use of this "listening aid," rod readings, called in a low voice by the levelman, could easily be heard over the drone of several planes from a nearby air base, the noise of a passing freight train, and the din of an Army truck convoy at the same time.

A hand signal was given by the note-keeper to indicate to the levelman that the rod reading had been received.

The survey party to whom credit should be given for applying this radioman's equipment, consisted of C. F. Oliphant, W. L. Goss, H. W. Porter, R. M. Cooley, J. J. Grant and J. G. Sprague.

Public Is Urged To Protect Watersheds From Fire Hazards

THE war confronts California with the toughest over-all fire problem to be found in the United States. It intensifies the already dangerous fire hazards within our forests and watersheds, not only because of acts of sabotage and incendiarism by enemies, but also through the acute and growing shortage of manpower and the difficulties of obtaining much needed additional equipment.

The California State Council of Defense, Division of Forestry and the State Board of Forestry and cooperating agencies are trying to meet this shortage in various ways:

1. By building up an auxiliary force, for use in emergencies, of high school and college students who will be trained in fire fighting techniques.
2. By organizing farm workers as volunteer firemen.
3. By using prison labor.
4. By recruitment from any and all other sources.

Kenneth I. Fulton, Director of Natural Resources, on behalf of the California Division of Forestry, urges the public to be extra careful with cigarettes, camp fires, and automobiles, but also to report fires to the State rangers or other constituted authority. The Division of Forestry is relying upon the press as the chief means of educating and urging the people to help in preserving their own natural resources.

Transportation Vital

I am deeply concerned as to the consequences of the diminishing supply of private and commercial motor vehicle transportation. It is certain that unless stringent steps are immediately taken to conserve the life of vehicles, and particularly their tires, we will soon be faced with a tragic shortage of highway transportation essential to the war effort.

THOS. H. MacDONALD
Commissioner U. S. Public Roads Administration

Robert H. Root New Assistant Director of Public Works

APPOINTMENT of Robert H. Root of Sacramento as Assistant Director of the Department of Public Works, is announced by Frank W. Clark, Public Works Director. Mr. Root succeeds Franz R. Sachse, who resigned last month to accept a commission in the United States Air Force.

For the past nine months, Mr. Root has been a member of the State Board of Control, which position he resigned. He was formerly manager of the Capital Lumber Co. of Sacramento and manager of the Material Dealers' Association.

Born in New York, Mr. Root attended grade schools in Pennsylvania and in 1916 enlisted in the British Army, serving until the United States entered the war, when he was transferred to the A. E. F. He is a member of Post 61 of the American Legion, Sacramento.

Following the war, Mr. Root resumed his studies in England and came to Sacramento in 1921. He is past president of the Junior Chamber of Commerce of Sacramento, past State Director of the California Junior Chamber of Commerce and Past President of the 20-30 Club of Sacramento.

ROBERT H. ROOT

Last Bucket of Concrete Poured at Friant Dam

IN marked contrast to the ground breaking ceremonies, less than three years ago when 40,000 people gathered to witness the start of work on Friant Dam, the final cubic yard of concrete was placed in the dam on June 16th without fanfare.

Friant Dam, the fourth largest concrete structure in the world, was built as a part of the Central Valley Project. R. B. Williams, construction engineer, in a report to R. S. Calland, district engineer of the United States Bureau of Reclamation, said 2,130,480 cubic yards of concrete had been poured in the dam.

Pouring of the final bucket of concrete does not mean that the dam is complete. Because of the lack of priorities for materials, spillway gates and outlet valves can not be installed at this time.

Ground was broken for Friant Dam on November 5, 1939. The first bucket of concrete was poured on July 29, 1940. During the construction period a California record for the amount of concrete poured in one month was set in August, 1941, when 228,769 cubic yards was placed.

Friant Dam impounds the San Joaquin River about 20 miles northeast of Fresno. A straight gravity type dam, it is 320 feet high, 3,430 feet long at the crest and 265 feet wide at the base.

Millerton Lake, the reservoir created by the dam, has a capacity of 520,00 acre-feet of water. It will be used to control flood waters of the San Joaquin River and provide an irrigation supply for lands in Madera, Fresno, Tulare, Kings and Kern counties. Irrigation water will be diverted through the Friant-Kern Canal, extending 160 miles south to Bakersfield and the Madera Canal, running north to the Chowchilla River.

Highway Bids and Awards for the Month of June, 1942

HUMBOLDT COUNTY—Between Loleta and Salmon Creek, about 2.7 miles to be resurfaced with plant-mixed surfacing on gravel base. District 1, Route 1, Section G. Contract awarded to Mercer, Fraser Co., Eureka, $39,545.

LOS ANGELES COUNTY—Between Carson Street and Center Street, about 3.8 miles to be graded and paved with asphalt concrete and Portland cement concrete. District VII, Route 168, Section A,L.Bch. Griffith Co., Los Angeles, $375,218; Oswald Bros., Los Angeles, $439,628; United Concrete Pipe Corp., Los Angeles, $493,335. Contract awarded to Sully Miller Contracting Co., Long Beach, $359,015.

LOS ANGELES COUNTY—At the intersection of Atlantic Blvd. and Olive St., a traffic signal system to be furnished and installed. District VII, Route 167, Section A. Johnny Walker, Los Angeles, $8,250; C. D. Draucker, Inc., Los Angeles, $8,355. Contract awarded to Econolite Corp., Los Angeles, $7,538.

LOS ANGELES COUNTY—At the intersection of Atlantic Blvd. and Compton Blvd., a traffic signal system to be furnished and installed. District VII, Route 167, Section A. Econolite Corp., Los Angeles, $7,350; Johnny Walker, Los Angeles, $7,900. Contract awarded to C. D. Draucker, Inc., Los Angeles, $7,219.

MENDOCINO COUNTY—Between Flynn Creek and Navarro, about 1.9 mile to be graded and surfaced with road-mixed surfacing. District I, Route 48, Section C. Guerin Bros., So. San Francisco, $88,823. Contract awarded to John Burman & Sons, Eureka, $57,357.

MONTEREY COUNTY—Two pedestrian crossings to be constructed, one over and one under Route 56 and the tracks of the Southern Pacific Railroad at Fort Ord. District V, Route 56, Section I. Harry J. Oser & Peter Sorensen, Redwood City, $89,341; Granite Construction Co., Watsonville, $84,879. Contract awarded to Dan Caputo, San Jose, $77,939.

SAN DIEGO COUNTY—A composite concrete and timber bridge across Campo Creek at Campo to be constructed and approximately 0.2 mile of roadway approaches thereto to be graded and surfaced with bituminous surface treatment. District XI, Route 200, Section D. R. E. Hazard & Sons, San Diego, $42,948; R. L. Oakley, Pasadena, $46,253. Contract awarded to Geo. J. Bock Co., Los Angeles, $31,230.

SAN DIEGO COUNTY—At Mission Valley Road across Pacific Highway and the tracks of the A.T.&S.F. Ry in the city of San Diego, a reinforced concrete overcrossing on timber piles together with ramps and approaches to be constructed. District XI, Mission Valley Road. Byerts & Dunn & W. J. Disteli, Los Angeles, $507,472; R. E. Hazard & Sons, San Diego, $526,718; Carlo Bongiovanni, Los Angeles, $541,219; United Concrete Pipe Corp. & A. S. Vinnell Co., Los Angeles, $569,358; Oberg Bros. & Oscar Oberg, Los Angeles, $575,616. Contract awarded to Griffith Co., Los Angeles, $499,708.

SAN DIEGO COUNTY—Across Seventh St. Channel in National City, two reinforced concrete bridges to be constructed. District XI. The Contracting Engineers Co., Los Angeles, $48,801; Oberg Bros., Los Angeles, $49,244; R. L. Oakley, Pasadena, $53,218. Contract awarded to Bent Co., Los Angeles, $44,921.

SAN MATEO COUNTY—Between Fifth Avenue in San Mateo and the north city limits of Redwood City about 6.4 miles to be repaired by placing imported borrow and surfacing with plant-mixed surfacing. District IV, Route 68, Section S.M.,C.Bmt. A. J. Raisch, San Jose, $143,135; L. C. Smith, San Mateo, $160,725; Marshall S. Hanrahan, Redwood City, $218,810. Contract awarded to Union Paving Co., San Francisco, $138,515.

SANTA CRUZ COUNTY—Between Watsonville and Rob Roy Junction, about 7.8 miles to be surfaced with armor coat. District IV, Routes 32, 56, Section Wat.,B.D. Paul J. Tyler & Parish Bros., Sacramento, $63,032; L. A. Brisco, Arroyo Grande, $73,457. Contract awarded to Walter J. Wilkinson & H. B. Scott, Watsonville, $55,904.

SHASTA COUNTY—At points between one and four miles south of Redding, four bridges to be constructed and two bridges to be widened. District II, Route 3, Section A. J. P. Brennan, Redding, $97,082; Harry J. Oser & Peter Sorensen, Redwood City, $114,499. Contract awarded to Kiss Crane Service, Berkeley, $72,796.

SISKIYOU COUNTY—Between Cougar and Macdoel, about 24.2 miles to be repaired by placing imported borrow and plant-mixed surfacing. District II, Route 72, Section B. J. A. Casson Co., Hayward, $163,035; W. P. Powell, Los Angeles, $176,007. Contract awarded to Poulos & McEwen, Sacramento, $151,651.

SOLANO COUNTY—Between 0.5 mile east of Vallejo and Benicia Arsenal, about 6.2 miles to be graded and surfaced with asphalt concrete on crusher run base. District X, Routes 7, 74, Section FG, B, Ben. Piazza and Huntley & J. M. Ruddy, San Jose, $697,391. Contract awarded to Paul J. Tyler & Parish Bros., Sacramento, $543,330.

SOLANO COUNTY—Between Junction with Route 74 near Flosden and the Walnut Street entrance into Mare Island, about 2.2 miles to be graded and paved with Portland cement concrete and plant-mixed surfacing on Portland cement concrete base. District X, Route 208, Sections B,A. Fredericksen & Westbrook, Sacramento, $224,779; Chas. L. Harney, San Francisco, $285,773. Contract awarded to Heafey-Moore Co., Oakland, $217,125.

VENTURA COUNTY—Near Oxnard, an area to be graded and surfaced with plant-mixed surfacing. District VII. Byerts & Dunn & N. Moore, Los Angeles, $236,485; A. S. Vinnell Co., Alhambra, $249,718; Bert Calvert & S. Edmondson & Sons, Los Angeles, $277,518; Oswald Bros., Los Angeles, $317,518; W. E. Hall Co., Alhambra, $338,103. Contract awarded to Vido Kovacevich, South Gate, $210,628.

YUBA COUNTY—Between Morrison Xing and Camp Beale, about 3.8 miles to be graded and surfaced with crushed gravel base and plant-mixed surfacing. District III, Route 3, Section A,B,Camp Beale. Marshall S. Hanrahan, Redwood City, $245,883; Fredericksen & Westbrook, Sacramento, $247,187; A. Teichert & Son, Inc., Sacramento, $251,339; Basich Bros., Torrance, $268,010. Contract awarded to Hemstreet & Bell, Marysville, $238,866.

Freshman: "I must apologize for my dancing. I'm a little stiff from badminton."

Co-ed: "Why should I care where you're from?"

Wrong-Way Driver Compels Barriers

(Continued from page 7)

travels on the Parkway has been involved in an accident of any consequence, but in order to protect the one million from the one, traffic engineers of the Division of Highways, after considerable investigation and study of the problem, set about developing a means of controlling these erratic drivers.

As a consequence, islands, or neutral areas, of various shapes were designed and constructed with bituminous plant mix material. This construction consisted of applying on the surface of the pavement raised, rounded strips, 9 inches wide and 2 or 3 inches high.

RAISED BARS USED

These strips were in some cases supplemented by raised bars placed within the neutral area and outlined by plant mix strips. These were usually placed to restrict the width of exits on the "Off" ramps so as to limit the travel area to one lane for offbound traffic only.

The creation of these neutral areas also provided a location in many instances for "Stop" signs where better visibility would be afforded, and also the placement of "One Way-Do Not Enter" signs in a more prominent location.

These neutral areas took various shapes and were installed only after exhaustive tests on the ground to determine exactly where they should be constructed for the proper warning and control of traffic. The plant mix bars and strips are painted alternately black and white and are very conspicuous.

GLASS BEADS

In addition, at some locations where it was deemed advisable, spherical glass beads were sprayed onto the wet painted surfaces and these at night reflect considerable light and outline the restricted areas in strong relief. The great advantage of this type of construction is that it is inexpensive to install and to remove or revamp if studies show that there is need for doing so.

The public reaction to these corrective measures has been quite favorable, and the results are being closely watched.

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