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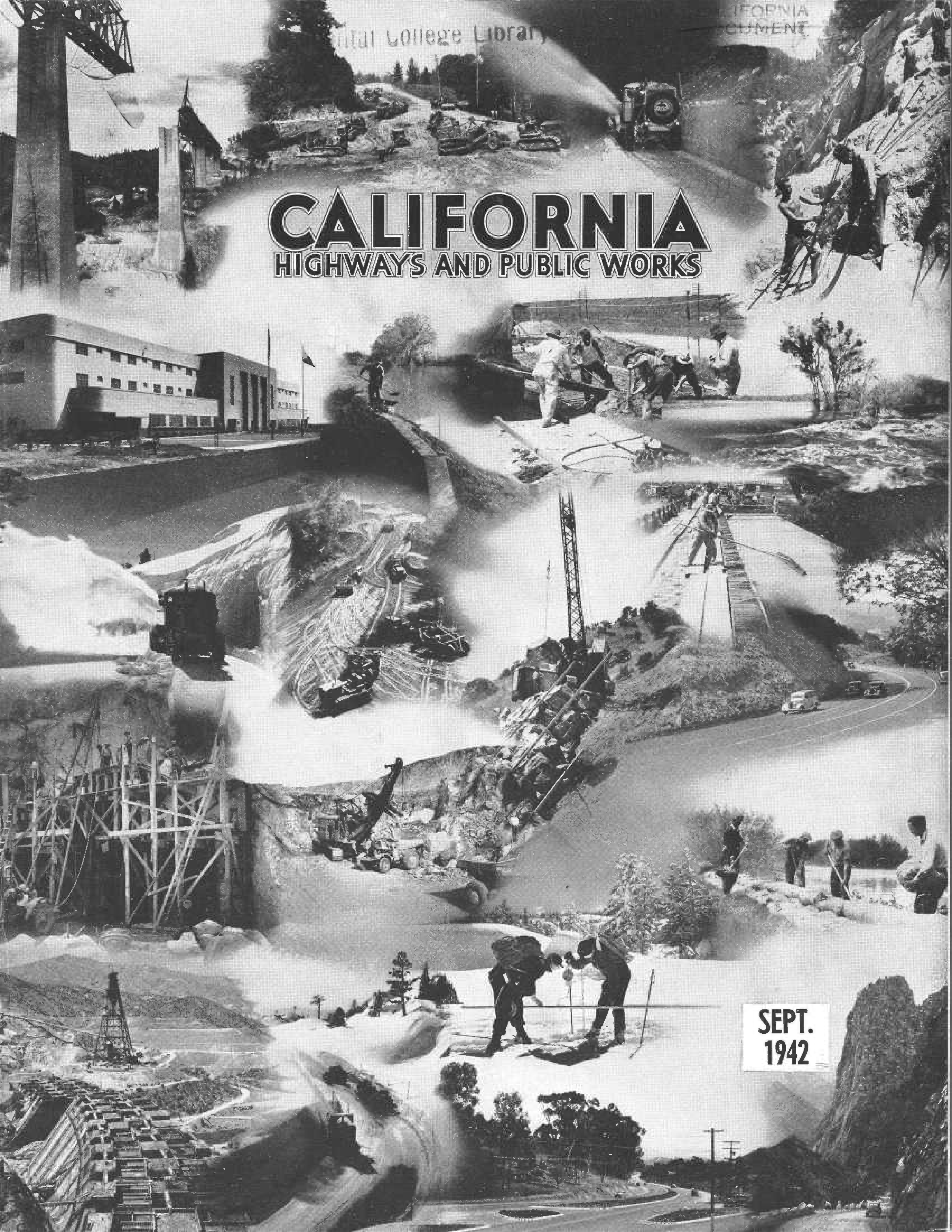

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CALIFORNIA HIGHWAYS AND PUBLIC WORKS

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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Procedure and Factors Governing Issuance of Overload Permits for Trucks Using State Highways

By STEWART MITCHELL, Assistant Bridge Engineer

IT IS closing time, and as the office force is leaving the phone rings. The engineer in charge answers and a voice says the Blank Trucking Company wants a permit to take an overweight load from Weaverville to Long Beach.

The information is offered that the movement is necessary because the armed forces or the Maritime Commission require it, that the gross weight of the vehicle is about so many tons and that the vehicle is loaded and ready to start.

The fact is emphasized that the trip must be made in connection with the war effort, with the evident conviction this is good and sufficient reason for granting the permit at once.

MORE DETAILS REQUIRED

The engineer begins to extract from the phone caller some needed information as to the type of vehicle, its axle weights, the distances between them and the number of tires on the heavy axles. Too often the information asked for can not be given in satisfactory detail and sometimes in only a very vague way.

The reason why this information must be obtained is patiently explained; how the safe load on a bridge varies with all possible combinations of axle weight and spacing, and how the highway surface can be damaged by too heavy a wheel load.

As the engineer talks, he is considering the available roads by which the trip can be made, which of them have weak bridges and which may have restricted clearances. He must decide upon the route before the final answer can be given.

VERY LITTLE DELAY

The problem is complicated, but all information and procedure has been systematized and if those who are asking about the possibility of getting an overload permit will cooperate to the extent of being able to give the engineer a few simple facts, the permit, if justifiable, can be obtained with very little delay.

First of all it should be understood that the United States Government is not requiring, and not even asking any State to permit heavier loads to operate over its highways than it considers are safe for the bridges and other road structures.

This will be evident from the fact the Office of Defense Transportation modified its Order No. 3 which originally conflicted with State Vehicle Laws, and did it in such language that made it plain there is no intention to supersede such laws.

However, the Federal Government, through the Council of State Governors, has requested that all States whose laws restrict the size and weight of vehicles to less than certain minimum amounts recommended by Commissioner Thos. H. MacDonald of the Public Roads Administration, revise these laws in accordance with his recommendations.

CALIFORNIA MORE LIBERAL

Many States have done this, but no action is necessary on the part of California since the provisions of its vehicle code are more liberal than the recommended restrictions and, in fact, are generally more liberal than those of the other States.

Formerly, the California Vehicle Code limited the gross weight of a vehicle by specifying a maximum axle load and a maximum gross weight for each of the common vehicle types. At the last session of the Legislature the law was changed so that gross weight is now restricted by axle load and by a formula which is applied to axle groups and to all vehicles or combinations of vehicles.

The formula permits the gross weight of the vehicle to be increased in proportion to the length of the wheel base conforming in as practical a manner as possible to the engineering laws which determine the safe load capacity of bridge structures. It is as practical a procedure as has been devised to allow a maximum gross load and still protect the public's investment in highways and bridges.

All possible conditions of axle arrangement, bridge type and condition, and vehicle operation, can not be covered in any practical manner by laws that are to be of general application. To try and do this would make it impractical to enforce the law. This fact is recognized and taken care of by the provisions that give the Department of Public Works power to cut down the legal load if the bridges or road surfaces are not up to standard, and power to increase the legal load if conditions and circumstances make it advisable to do so.

As a matter of practical procedure, the operation of heavier loads than the law specifies is governed by special permits which state the conditions under which a particular load can be moved over a designated section of highway and which fix the responsibility in case of any damage to structures.

REASONS FOR EXCEPTIONS

There are several good engineering reasons why it is sometimes possible to move heavier vehicles on the highway than are permitted by the general provisions of the law. The more important are:

1. **Certain bridges are of a type and span length that conform to the axle concentrations of a particular vehicle and may, in consequence, support a somewhat heavier gross load than the legal maximum without material encroachment on the normal factor of safety.**

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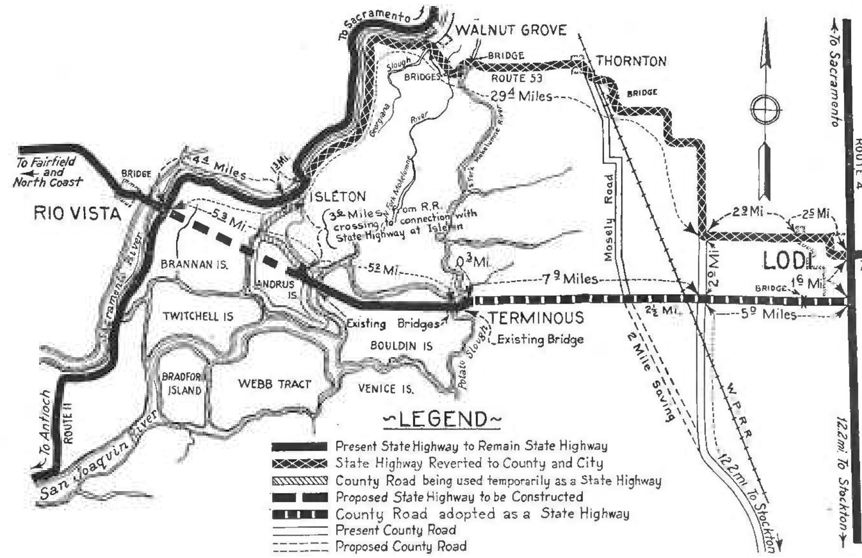
New Cut-off Between Rio Vista and Lodi Opened. Saves 10 Miles

By C. J. TEMBY, District Office Engineer

WITH the opening to traffic on July 25, 1942, of a portion of the Rio Vista-Lodi cut-off, it is possible for traffic, between Rio Vista and Route 4, in the vicinity of Lodi and Stockton, to save approximately 10.0 miles over the distance required to travel via the old route.

In addition to the great saving in distance, a much safer riding road is provided. A description of the old hazardous road via the levees, Walnut Grove, Thornton, and over the various bridges, and details of the proposed new alignment and grade were described in previous issues of this magazine. (See April, 1940, and April, 1941.)



There remains about five and one-half miles of the proposed cut-off between the Mokelumne River and the easterly end of the bridge across the Sacramento River, near Rio Vista, to be constructed. The surveys have been made for this portion of the cut-off, but due to the war program, it is doubtful whether this unit will be constructed for some time.

For traffic to use the completed portion of the new cut-off, it was necessary to make connections with the existing county road along the levee of Georgianna Slough, then on to Isleton connecting with the old State Highway. From Terminous to the connection with Route 4, near Lodi, the county road was adopted as a State Highway, but because of shortage of funds and the war situation, it has not been improved to the condition required or ultimately expected.

It was necessary because of the adjacent peat land, which is highly inflammable, to post signs informing the traveling public of the danger of fire and to caution them against throwing away matches and cigarette stubs. To date, since taking over this road, several fires have occurred along the roadbed in the vicinity of Terminous. As explained in the previous articles, the construction of the road is over agricultural lands of the rich delta islands of this area, and this particular road is over peat varying in depth from 20 to 45 feet.

Devices for measuring future settlements of the highway have been installed at the direction of the Testing and Research Laboratory in order to provide information of value for further use in projects such as this.

Excepting for the shortage of materials, equipment, and men, due to the war activities, no unusual difficulties were experienced in the construction of this latter unit of the road. The fill was made of sandy material dredged from the Mokelumne River and the surfacing was treated with liquid asphalt (RC-2) by the road-mix method for a thickness of four inches, compacted.

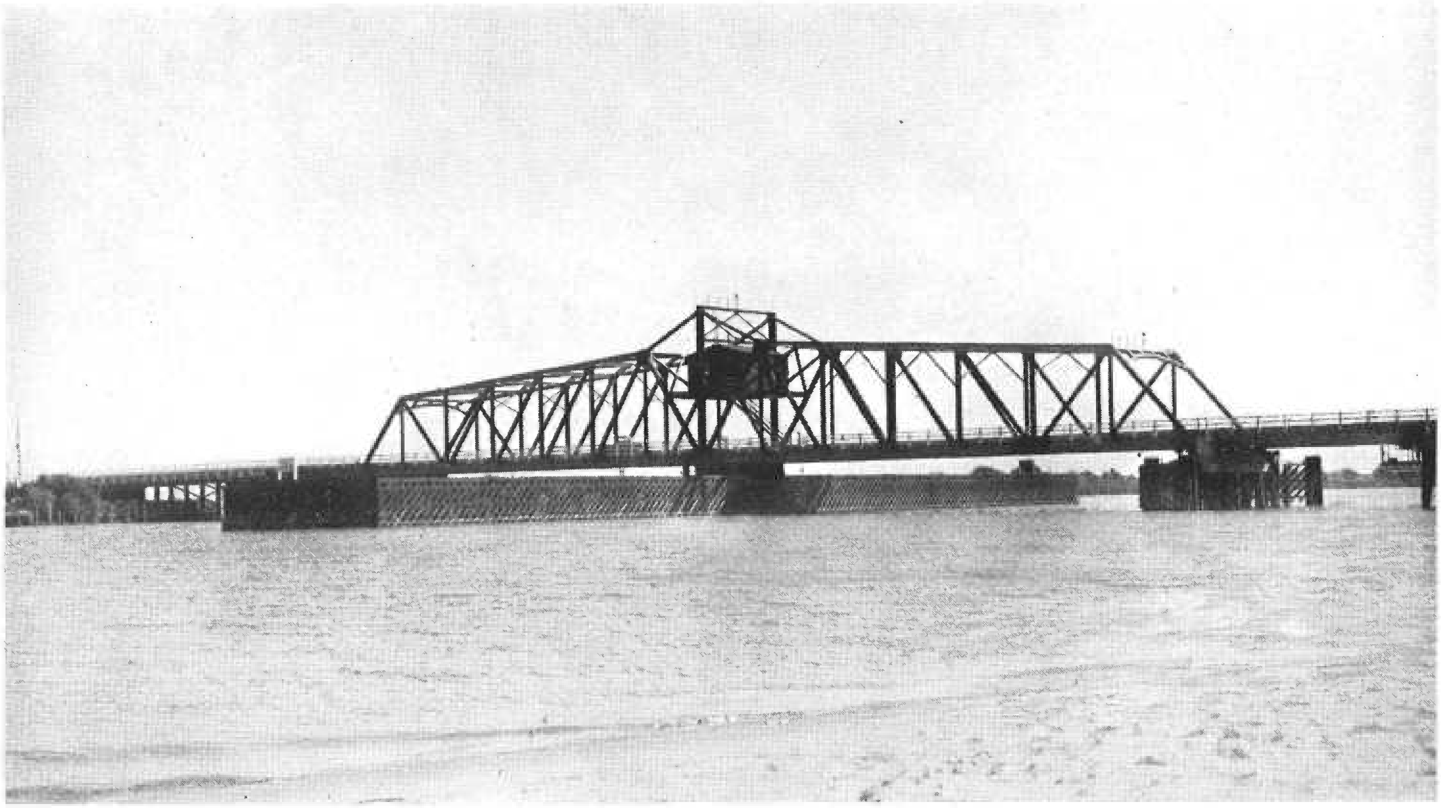
The Testing and Research Laboratory, as well as Central Office Construction Department were in constant touch with this job during its construction period. In general, the work was completed as designed, excepting for a few locations where settlements appeared to be more rapid than anticipated in the preliminary design, at which locations additional funds were provided and more fill material placed.

George R. Hubbard, Associate Highway Engineer, was Resident Engineer for the District and Clyde Wood was the contractor on the road project. C. C. Winters, Associate Bridge Engineer, was Resident Engineer for the Bridge Department on the Mokelumne River Bridge.

With the completion of this cut-off the old portion of the State highway from Lodi to the east end of the Isleton Bridge across the Sacramento River was reverted to Sacramento and San Joaquin counties, respectively.

For the through traffic using this portion of the highway it was fortunate indeed that the State had completed and opened this section of road at the time it did, for on July 26th, the day following the opening of this road, a heavily loaded truck of lumber struck the Miller's Ferry Bridge on the old highway route and caused the easterly end of the floor system to collapse, thereby placing this road out of service.

(Continued on page 18)



View of the new steel span drawbridge across the Mokelumne River on the recently opened Lodi-Rio Vista cut-off highway

New Lodi-Rio Vista cut-off highway looking East from the timber trestle approach to Mokelumne River Bridge

Four-Lane Divided Highway Reduces Traffic Hazard East of Redlands

By A. EVERETT SMITH, Assistant District Construction Engineer

ONE of the most dangerous portions of substandard alignment on the Los Angeles-Imperial Valley Highway remained until recently in the Crystal Springs area, adjacent to the East City Limit of Redlands. This is a part of the combined U. S. Highways 99 and 70. This route carries heavy trucking traffic and normally is subjected to a large volume of recreational and tourist traffic in addition to the more localized type of travel.

A particularly hazardous condition was present where grades were involved. This was due to the fact that heavily laden trucks traveling up grade were forced to shift to lower gears and proceed at greatly reduced speeds. Automobiles traveling in the same direction necessarily were forced to pass using the opposing traffic lane, or remain behind the slow moving trucks. Too often, they were tempted to pass without adequate sight distance, resulting in collisions, or near collisions.

As a step toward improving this section, a project has been completed by Dimmitt and Taylor, Contractors, for constructing a graded two-lane roadbed, in general parallel to the existing road. A dividing strip was left between the newly constructed east bound and the existing west bound dual lanes to produce a four-lane divided highway.

The existing two-lane pavement that was of substandard alignment when carrying opposing traffic is now subject to east bound traffic only. Thus by eliminating the factor for passing sight distance, necessary where there is opposing traffic, the alignment is satisfactory for present traffic conditions.

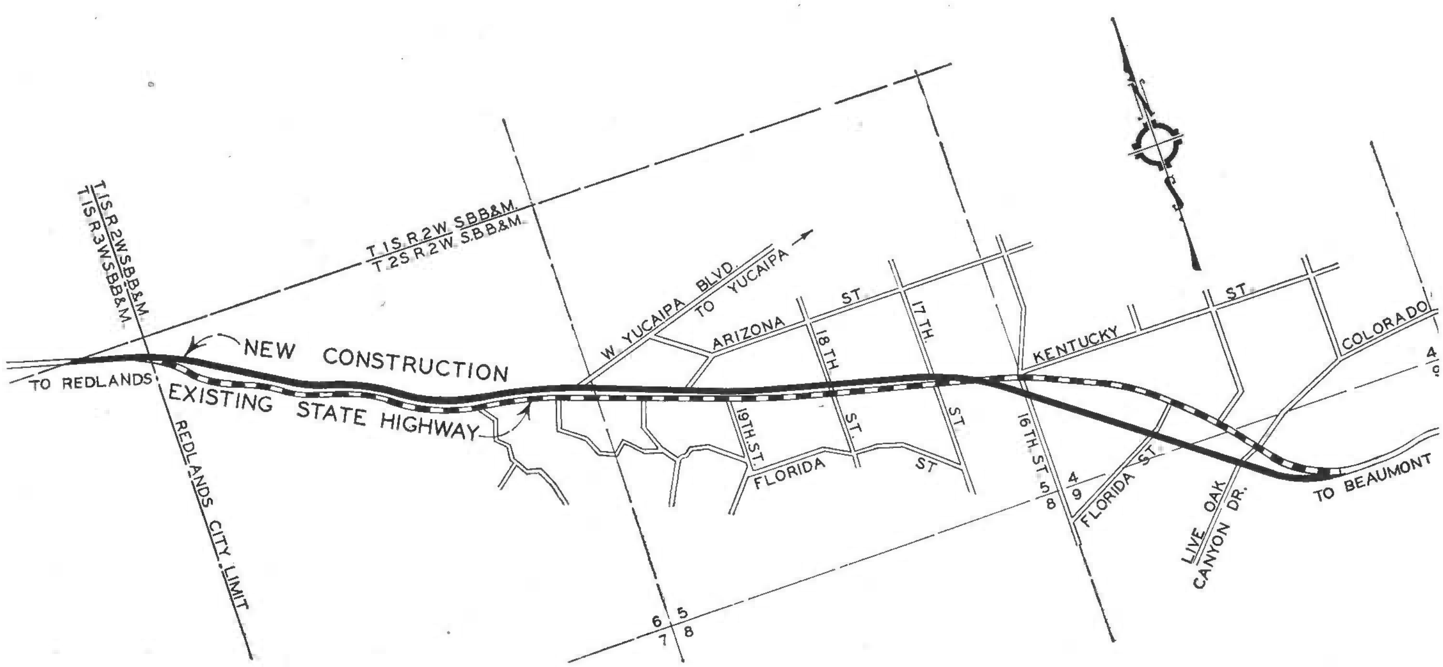
About one mile of the easterly end of the project is entirely on new location. In this portion a transition section is introduced, decreasing the roadbed width to a two-lane section at a point of adequate sight distance before merging into the existing two-lane pavement ahead.

A later contract was awarded to the contracting firm of Oswald Bros., consisting principally of constructing a cement treated base and placing a riding surface of asphalt concrete pavement over the project previously graded.

Cement treated base material was mixed in a mixing plant set up within the limits of the job. Mineral aggregate was obtained from sections adjacent to the roadbed near the plant location. After the aggregate was crushed to meet specification requirements, it was batched and mixed with water and approximately 7½ per cent of portland cement by weight of aggregate. A pugmill type mixer was used.

The mixture was hauled to the street in dump trucks and spread through a self-propelled mechanical spreading machine with a strike-off tamping screed. The spreader pushed the truck ahead of it while discharging. This operation was followed by a heavy three-axle roller for compaction. For surface consolidation a

(Continued on page 18)



Four-lane divided highway East of Redlands. New construction for dual West bound traffic lanes on left. Existing highway on right

View showing transition section where divided highway merges into two-lane existing highway ahead at end of project

Spreading cement-treated base material with self-propelled mechanical spreading machine which pushes truck discharging material ahead of it

Comparative Hydrology Pertinent to California Culvert Practice

By R. ROBINSON ROWE, Assistant Engineer, Bridge Department
and ROBERT L. THOMAS, Assistant Engineer, Surveys and Plans

As announced last month, this is the first of a series of technical abstracts to be published in future issues of California Highways and Public Works. These abstracts are taken from a joint departmental report of culvert practice of the California Division of Highways by a committee composed of Geo. A. Tilton, Jr., Assistant Construction Engineer; Clarence Woodin, Assistant Maintenance Engineer, and the writers. Appropriately, the series opens with comparative hydrology, demonstrating the necessity for divergence of California practice from that developed for other areas.

IN its humble way, a culvert is a grade separation structure, passing hydraulic traffic under highway traffic. Adequate way must be provided for each, but our procedure for estimating volumes of the two traffics has been distinctly contradictory.

On the one hand, vehicular traffic is recorded at regular intervals on all routes, to determine volume of traffic and trend. Probable traffic for some definite time in the future is estimated from present volume and trend; then, funds permitting, way is designed for such traffic. Frequency of peak traffic may be daily or weekly or seasonal; congestion during peaks is an inconvenient rather than a damaging consequence, even if traffic is double the estimate.

On the other hand, hydraulic traffic is not regularly recorded in advance. Some agencies collect hydrologic data on streams in which water is an asset but data is not assembled for water as a liability, except in a few flood-control districts. Few data are collected for either purpose on culvert-size streams.

Barring catastrophic changes in climate, construction of dams, or alteration of culture, hydraulic traffic has no trend, but it does have frequency. This frequency (or infrequency) is important in design and can not be determined by the most thorough survey of the site, at any one time or in any short period.

Congestion of waterway is more than inconvenient—it is destructive. Analogous to the queueing of impeded traffic is the ponding of obstructed water—which may damage embankments or private property. Analogous to a condition of traffic congestion that would enforce the detouring of vehicles through adjacent areas is the diversion of a flooded stream out of its banks and over the roadway—erosively. Analogous to the impulsive charging and weaving of impatient vehicles on a crowded roadway is the destructive surging and turbulence of impetuous water within and without the culvert.

The analogy fails when we predict the two traffics. From volume and trend, highway traffic can be predicted reliably for any given year in the immediate future. Hydraulic traffic can not be foreseen in the same way, as next year's flood may be a trickle or a deluge.

If basic data is available, we can estimate statistically the extreme flood which will occur, on the average, once in (say) 100 years, calling it a "100-year flood." Such a flood is just as likely to occur in 1943 as in 2042, but the odds are 99 to 1 against such a flood being equalled or exceeded in any particular year.

The term "100-year flood" may be applied to any statistical phase of a flood—its stage, duration, mean daily discharge, momentary peak discharge, etc. For culverts, the critical phase is the momentary peak. Hence in this paper we will define the "100-year flood" as the momentary peak discharge which will occur, on the average, once in 100 years. By the phrase "on the average," it is implied that all peaks could be ob-

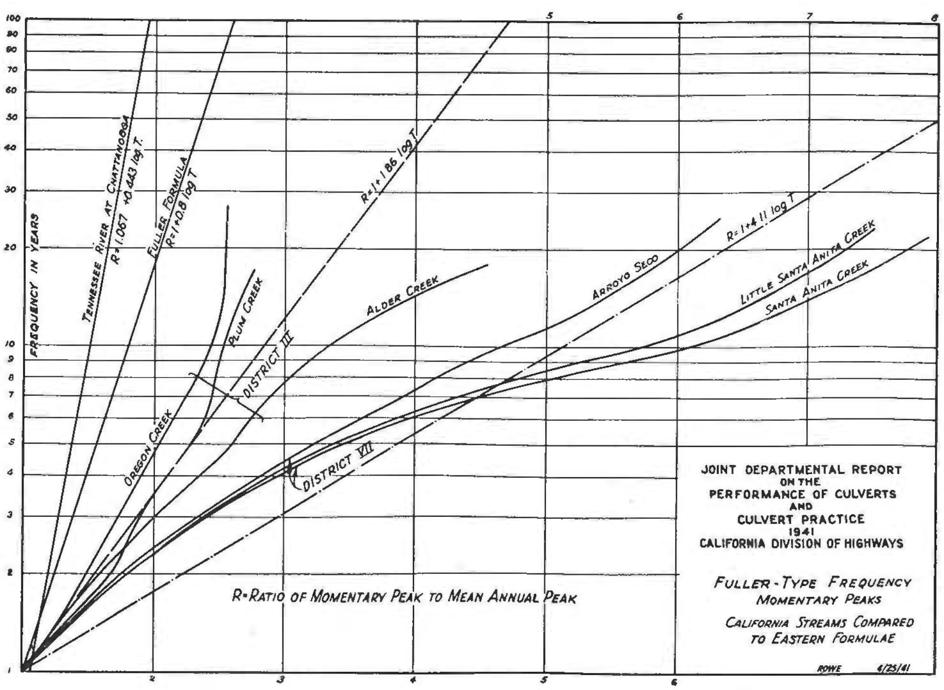


Figure 1. Comparison of eastern flood frequency with that of two regions in California

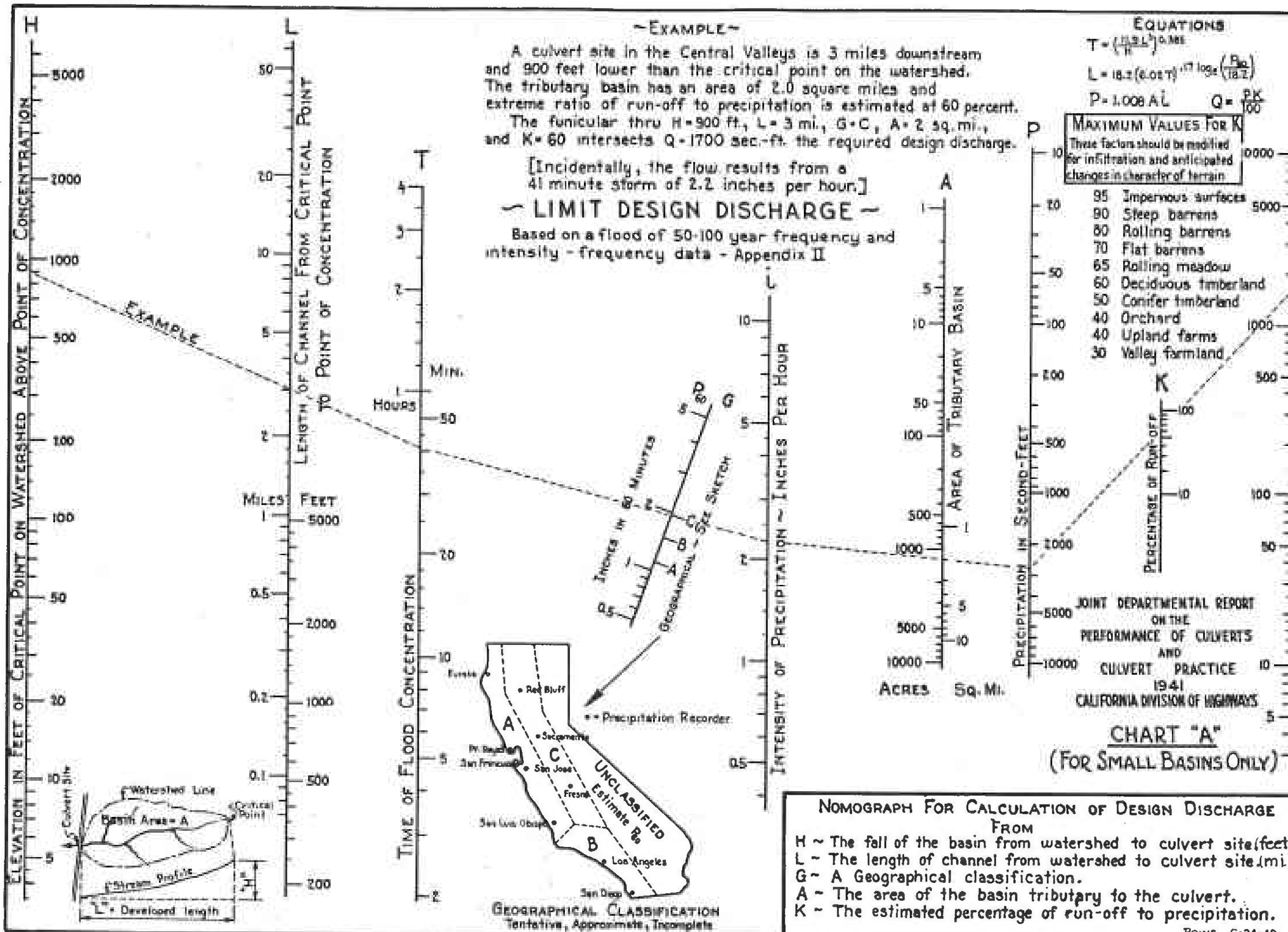


Figure 2. Chart A for calculation of "design discharge" by a new formula in nomographic form

served for a series of centuries and an average struck of century peaks. This is Fuller's concept (1)* applied to small streams.

The Fuller concept is adaptable to short records of culvert-size streams, as it appears to yield a simple exponential relationship between frequency and flood magnitude. The more advanced statistical procedures of Foster, Hazen, Goodrich, Harris and Slade (2)* may be nearer the laws of nature and chance, but these are not applicable to short records.

FLOOD FREQUENCY PLOTTED

This may be illustrated by reference to **Fig. 1.** On this chart, frequency in years is plotted to a logarithmic scale against momentary peak to a natural scale. For comparison of a number of streams, the unit of discharge for each stream is its mean annual peak so that the graph is nondimensional.

Fuller reasoned, from study of many eastern streams, that flood records plotted in this way should yield flat curves which would straighten as the record lengthened. Hence the slope of the lower part of the curve would permit an estimate of the ultimate straight-line variation, from which long-period floods could be predicted. Departure of the upper part of the curve from such a line only proved that the period of record was not a random sample.

Fuller established that curves of several streams in one climatic region had nearly the same slope, which led to the Fuller Formula: **$R=1+0.8 \log T$** where R is the ratio of the T-year flood to the 1-year flood.

Saville (2a) found that this formula could not be applied in another region (Tennessee Valley). He concluded that the data conformed closely to a straight-line plot (shown on **Fig. 1**) but that a flat curve would be better.

CALIFORNIA FREQUENCY

Also plotted on **Fig. 1** are flood data from 6 small California streams from two distinct climatic regions. The curves demonstrate an approximate law for each region, differing severely from each other and from eastern laws.

These streams were selected as the smallest for which there is a fair record (17-28 years) and negligible regulation. Basic data and deductions are shown in **Table I** (see next page), including the common statistical coefficients (2a).

The diversity of frequency may be illustrated by applying **Fig. 1** to four hypothetical streams for which the mean annual peak is 100 second feet. On the first, in Tennessee, a flood of 200 second feet (R=2) would occur, on the average, once in 128 years.

* Numbers in parenthesis refer to bibliography at end of article.

Table I. Frequency and statistical factors of 6 small California streams compared to eastern types

STREAM	Basin Area Sq. Mi.	Length of Record Years	Gage Elevation Feet	Mean Discharge Sec. Ft.	Annual Momentary Peak: Minimum Sec. Ft.	Annual Momentary Peak: Mean Sec. Ft.	Annual Momentary Peak: Maximum Sec. Ft.	Statistical Coefficients: Variation CV	Statistical Coefficients: Skew CS	Statistical Coefficients: Adjusted Skew CS	Statistical Coefficients: Pearson Skewness	Fuller's Constant R-1 / Log T	Ratio of 100-Year Flood: To Annual Flood	Ratio of 100-Year Flood: To 10-Year Flood
Eastern U. S.														
Fuller Ideal	--	20	--	--	661	1,000	2,041	0.347	1.53	2.00	0.69	0.8	2.60	1.44
Tennessee River	21,400	57	620	38,300	85,900	208,600	361,000	0.280	0.32	0.38	0.25	0.5	1.95	1.29
District III														
Plum Creek	6.8	17	4,100	8.1	33	230	635	0.823	0.64	0.97	0.55	1.70	4.40	1.63
Alder Creek	22.8	18	4,000	30.0	92	387	1,760	1.039	2.30	3.38	0.50	2.43	5.86	1.71
Oregon Creek	35.1	28	1,500	72.5	295	1,596	4,080	0.656	0.90	1.18	0.60	1.45	3.90	1.59
District VII														
Little Santa Anita	1.9	22	2,200	1.0	3	107	800	1.736	2.83	3.93	1.03	4.31	9.62	1.81
Santa Anita Creek	10.5	22	1,400	5.6	34	672	5,330	1.847	2.91	4.04	0.71	4.46	9.92	1.82
Arroyo Seco	16.4	25	1,400	9.6	81	1,366	8,620	1.431	2.51	3.38	0.44	3.57	8.14	1.78

In Fuller's region, the frequency would be 18 years; in District III* of California, 3.5 years; in District VII,* once in 1.75 years.

If, for each stream, we compute the 100-year flood, we find: in Tennessee, 195 second feet; in Fuller's region, 260 second feet; in District III, 472 second feet; in District VII, 922 second feet.

These deductions from **Fig. 1** should be considered illustrative, not quantitative. There may be areas in California, such as the north coast, where the Fuller Formula would apply with slight adjustment. There are other areas, such as the southern deserts, where the law must be more extreme than in District VII. As data are collected, hydrologic laws will be defined more precisely—both as to boundaries of regions and statistical constants. This has been started in District VII on a noteworthy scale (3).

MISCONCEPTIONS OF FREQUENCY

Before leaving the subject of frequency, there are a few points that require further explanation. One, in particular, is the probable frequency of recent floods observed at highway bridges and culverts.

Suppose, for illustration, we take a random group of 10,000 drainage basins in California, selected by some arbitrary rule—say those intercepted by the 10,000 largest cross-drainage highway culverts. Suppose also that we had observed the maximum annual flood at each of these culverts for 10 years. Suppose further that weather was random and noncyclic. Then it is probable that, of the 100,000 annual floods, 10,000 were 10-year floods or greater, 1,000 were 100-year floods or greater, 100 were 1,000-year floods or greater, etc.

On the average, 10 floods of 1,000-year frequency were experienced each year, somewhere in the group. But, of course, there were more than 10 in "wet years," less than 10 in "dry years." This is significant. Finding report or water marks of a recent flood of such infrequency, an engineer will be inclined toward over-design.

On the contrary, there is a possibility that some basin just missed the big storms, so that the maximum flood experienced in 30 years is only a 5-year flood. Here the reports and water marks will lead to under-design.

WEATHER CYCLE CONCLUSIONS

Weather cycles, whatever the cause, may also lead to erroneous conclusions as to frequency. Historical summaries (2b) recall that floods were general throughout California in the 10 climatic years 1862, 1868, 1879, 1881, 1890, 1907, 1909, 1915, 1916 and 1938. On the average, California experiences one general outstanding flood every 8 years, but intervals range from one year to 22 years.

Over-design probably followed the 4 floods in one decade, 1907-1916, just as under-design was the rule toward ends of the droughts of 1891-1906 and 1917-1937. To avoid generosity in current designs, following a new series of flood years, frequency studies must determine a normal expectancy.

NO FLOOD UPPER LIMIT

Fuller-type frequency has been criticized because there is no upper limit to floods. The curve for Santa Anita Creek can be extended to determine how often we can expect 50,000 second-feet to pass that way—once in 26,000,000,000,000,000 years. Both discharge and time are so remote as to be meaningless. If such a flood is even remotely possible, it doesn't matter if the curve lacks a limit.

On April 5, 1926, there was recorded (3) a fall of 1.03 inches of rain in 60 seconds at Opid's Camp, not far from the basin of Santa Anita Creek. Had it extended over the 10.5 sq. mi. of the basin, the fall would have been at the rate of 419,000 second feet.

Using conservative factors in application of unit hydrographs, this would have produced a peak of 50,000 second feet at the Santa Anita gage 13 minutes later.

Practically, then, we can not conceive of a limit flood. What may happen once in 26 quadrillion years

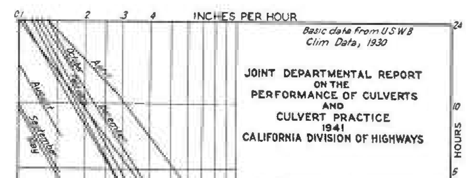


Fig. 3g. Precipitation intensity at Eureka

* State Highway Districts.

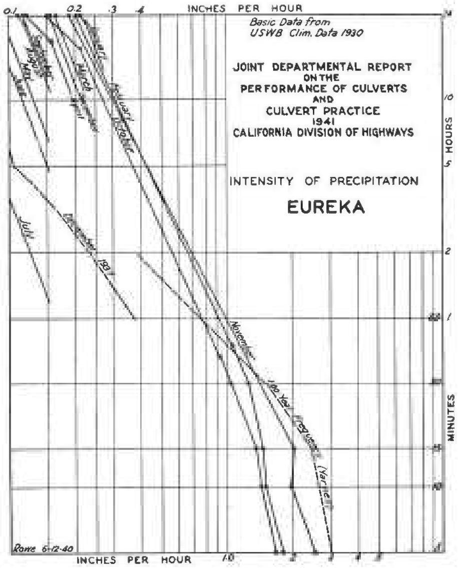


Figure 3a

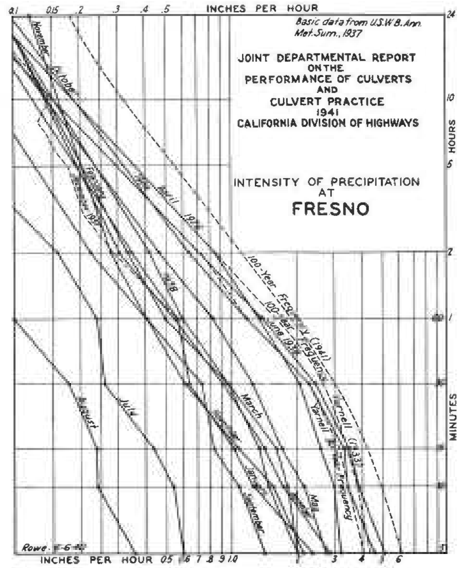


Figure 3b

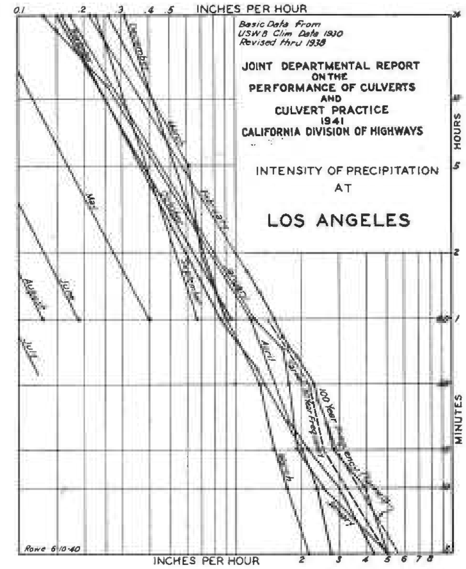


Figure 3c

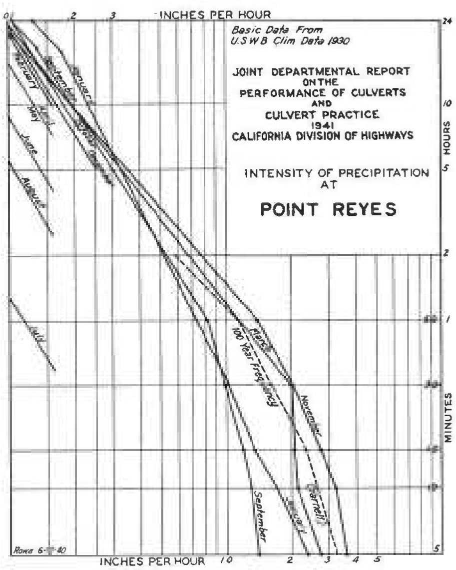


Figure 3d

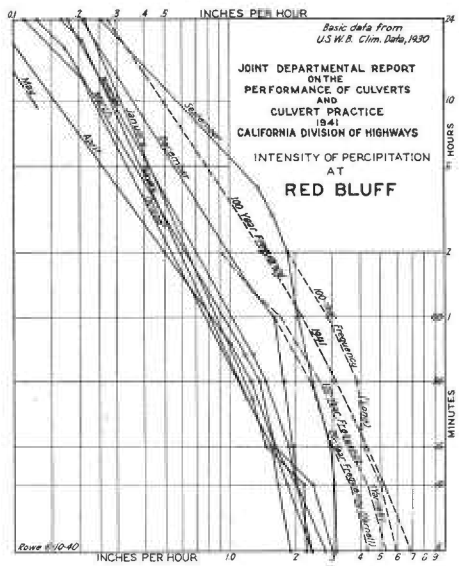


Figure 3e

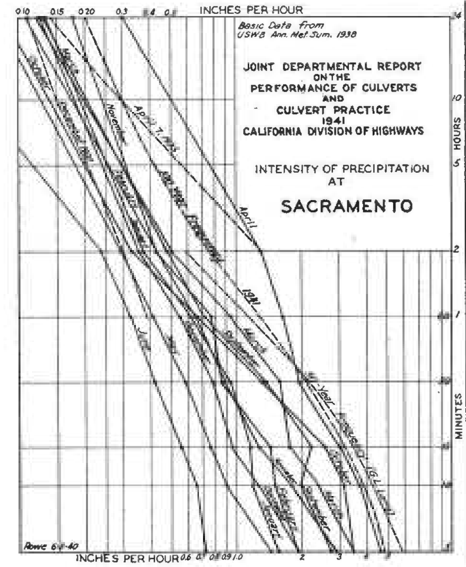


Figure 3f

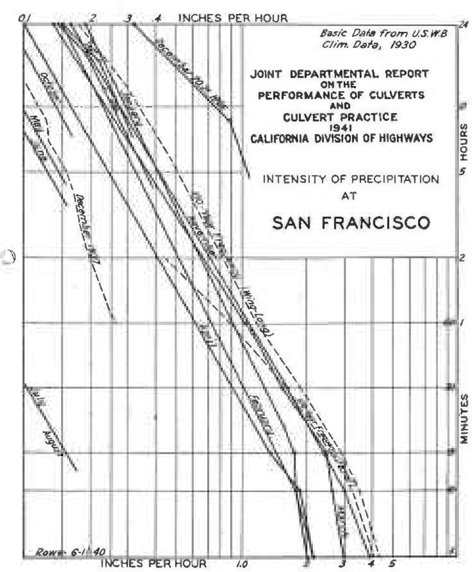


Figure 3h

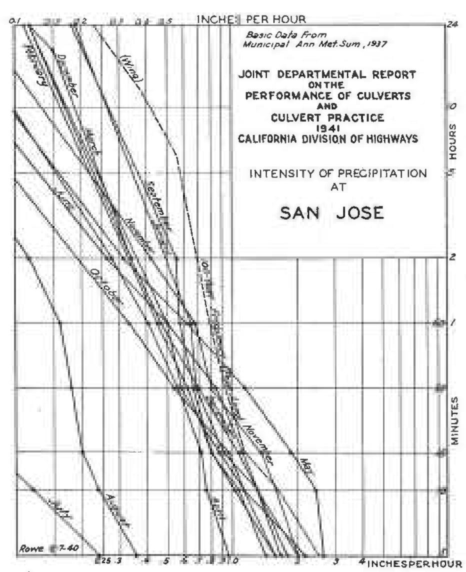


Figure 3i

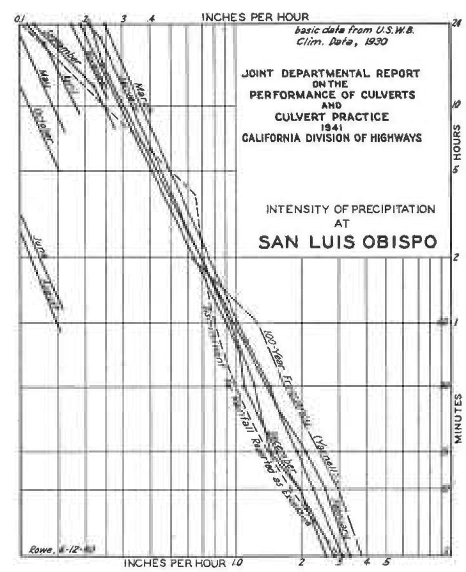


Figure 3j

Figures 3a to 3j. Maximum intensity of rainfall at gages shown may happen in 1943. The obvious impropriety of designing for such indefinite extremes has led to the conception of the "design flood."

"DESIGN FLOOD" ESTIMATES

If, for a certain site, we can estimate reliably the magnitudes of floods which should occur, on the average, with certain frequencies, we can select the flood of some one frequency as the "design flood" from principles of economy. We can estimate the damage likely to be caused by greater floods and compute the annual cost of this contingency. This should just equal the allowable annual cost of additional capital investment to provide waterway for the greater flood.

For large bridges, a separate study can be made for each site, to obtain maximum long-time economy. For culverts and small bridges, some rule-of-thumb is required. The Committee recommended two general rules:

(1) that a culvert just pass a 10-year flood without static head on crown of culvert at entrance; and (2) that design of culvert and appurtenances be balanced to avoid serious damage from head and velocity obtaining in a 100-year flood.

Of course there will be justifiable exceptions to any such rule, some of which will be discussed in a later article.

CULVERT FORMULAE

Designers in California use a wide variety of culvert formulae, it being common practice to apply at least two formulae for a check. Since most formulae include an arbitrary coefficient, the value of a check depends upon the experience and judgment behind the selection of coefficients.

The basic formulae were developed for railroad practice in eastern United States. **Fig. 1** demonstrates need of special adaptation for California practice. This has been done to a large extent, but not from the aspect of frequency.

The commonest culvert formulae are of the type $\mathbf{a}=\mathbf{CA}^n$ where **a** is the area of culvert section, **C** a coefficient depending upon climate, topography and units of area, **A** the area of watershed and **n** an exponent varying (by authors) from 0.5 to 0.8.

Talbot found $\mathbf{n}=0.75$ and gave rules for estimating **C**. Wadsworth (4) confirmed this for Sierra streams

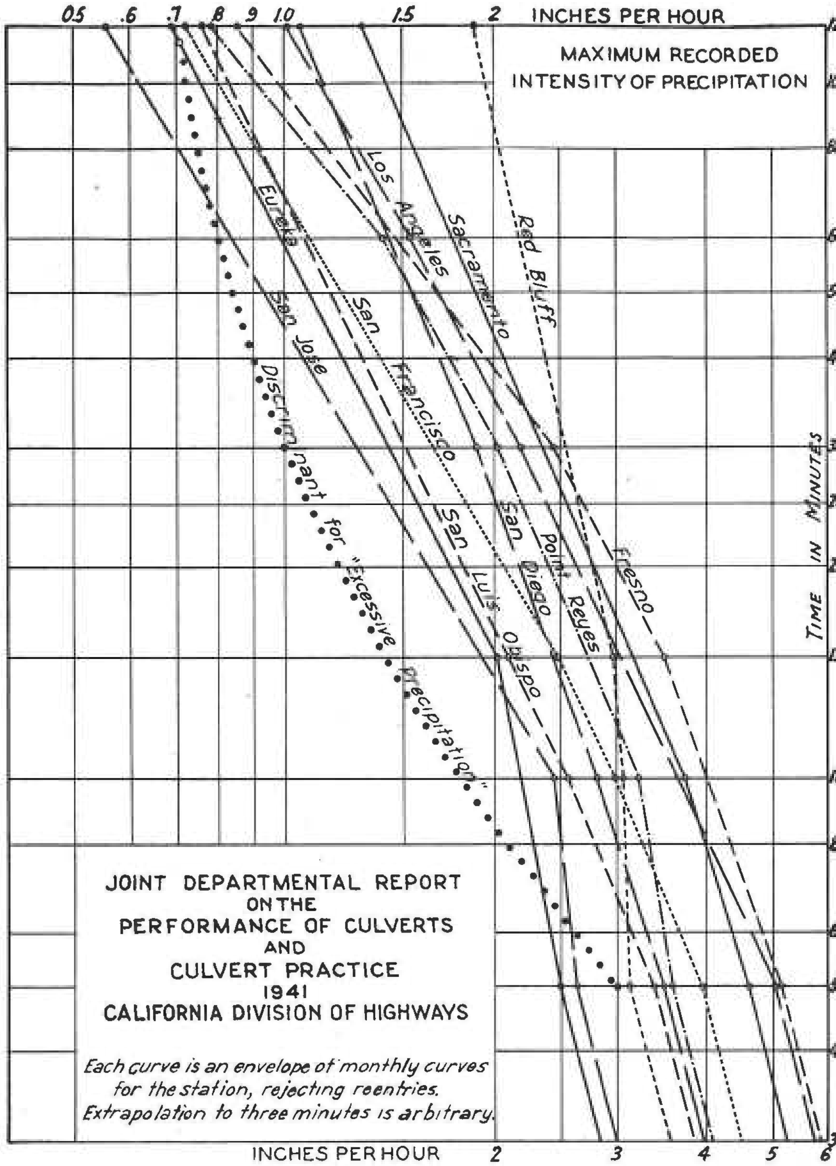


Figure 4. Maximum intensity of rainfall at ten California gages

in 1907; recent studies by the Bridge Department confirm it generally for northern California, but find $\mathbf{n}=0.70$ for southern California.

Several writers have analyzed Talbot's formula and found that it should pass a 10-year flood with an entrance velocity of 10 feet per second. Referring to the table, it is evident that a 100-year flood in Fuller's region would overload the culvert 44%; in District III of California, 64%; in District VII, 80%. In the latter case, velocity through the culvert (18 feet per second) may be tolerable, but protective appurtenances should be designed for head at entrance and turbulence at outfall. Hence, knowledge of the magnitude of 100-year floods will permit balance of designs based on Talbot's formula.

The Burkli-Ziegler formula ranks second in popularity. Procedures of this type, including a rainfall-intensity term, will gain precision with knowledge of rainfall-intensity frequency. For the present, that knowledge is limited to a few urban areas, but the tremendous expansion of precipitation-recorder installations a few years ago will soon be paying dividends.

FOR SMALLER AREAS

For small drainage areas, the Committee suggests comparative use of Chart A, **(Fig. 2)** to evaluate, from known effluent a judgment factor "k" which depends upon topography. The chart is a formula in nomographic form depending upon 4 measurable items (length and fall of channel from critical point on divide to site, mean rainfall-intensity for 60 minutes expected once in 100 years and area of tributary basin) to yield a design discharge (momentary peak once in 100 years).

Intermediate steps of the chart give the time of flood concentration for the basin and the mean intensity of precipitation for that concentration period. If hydrology for some particular region affords a more rational estimate of either of these factors, use of the chart may start from that point and continue through the other steps.

At the same time, **Chart A** can be used as a check method. For "k," the chart lists probable maximum values for certain types of topography. Minimum values may be smaller by 20 percentage points. For rainfall-intensity, the data now available are approximated for coastal and valley areas designated by letters **A, B** and **C** on a key map.

RAINFALL-INTENSITY

The most comprehensive study of rainfall-intensity frequency available is that by Yarnell (5). **Fig. 5** summarizes his 100-year frequency data for California, limited to 24-hour rainfall. For the rest of the United States, he determined like data for intense rains lasting 5, 10, 15, 30, 60, 120, 240, 480, and 960 minutes, but basic hydrology was inadequate for short-period intensities in California.

The 10 charts of **Fig. 3** were drawn in an attempt to approximate short-period intensity and are published for local interest. For each station there had been published (6) the cumulative maximum intensity of short-period precipitation by months. These were plotted by months on logarithmic scale as shown. For comparison, the lower part of the envelope of extreme intensity for each station has been forwarded on enlarged scale to **Fig. 4**.

All of these broken-line graphs show a tendency toward straight lines or very flat curves. Also the envelope curves seldom depart much from tentative frequency curves (7) shown in **Fig. 3** a-j, especially for the shorter periods. For periods typical of concentration times for culverts, it may be assumed that these envelopes are as close to 100-year expectancy as can now be foreseen.

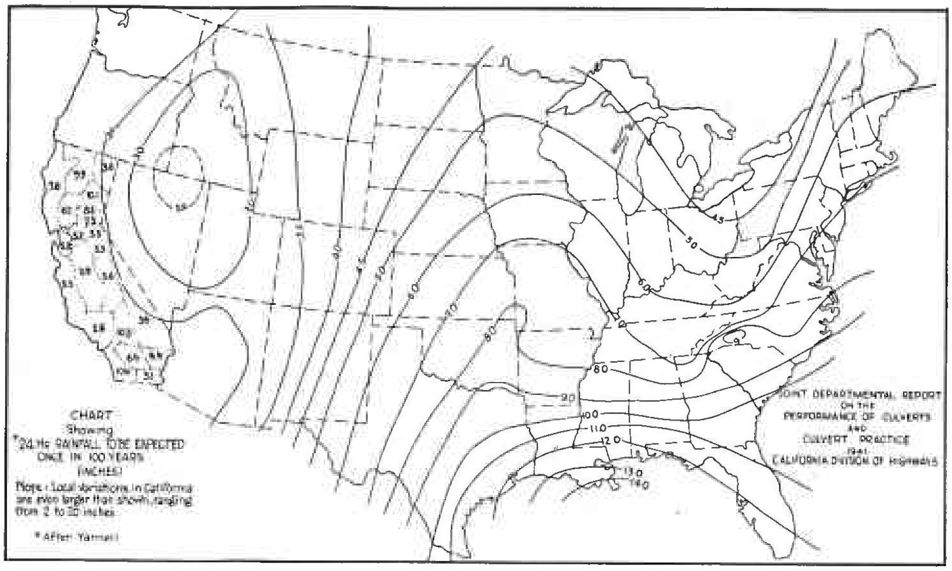


Figure 5. Rainfall intensity—Frequency variation in the United States

Comparing the curves of **Fig. 4**, it is noticeable that envelopes for San Luis Obispo, San Jose, San Francisco and Eureka form a group of low intensity. All of these and Point Reyes are located in Area A of **Chart A**, along the north coast, the Point Reyes curve approaching the group at its ends.

A mean line for this group is represented by Point A of Scale G on **Chart A**. Similarly the San Diego and Los Angeles envelopes are related, from which Point B was plotted for the south coast. The central valley stations were represented by Point C, although the grouping was divergent each way from intersections near the 30-minute storm.

While these deductions are loosely drawn, the basic data warrant no greater precision yet. Note on **Fig. 3-e**, for example, how differently the 100-year frequency was estimated by three independent investigators, using 27, 32 and 35 years of record respectively.

Following a general survey of available hydrology pertinent to culvert practice, it was concluded that:

1. **Run-off records are not and probably will not be available for culvert-size streams.**
2. **From records of somewhat larger streams, it may be deduced that natural laws for flood frequency in California differ materially from those for eastern United States. Particularly, the ratio of 100-year to 10-year (Fuller-type) flood may vary from 1.5 to 2.0 in California, as compared to ratios of 1.2 to 1.5 in the east.**
3. **Ordinary culvert formulae developed in the east should not be used in California without modification, and this modification will be far from uniform throughout the State.**
4. **In the past, modification has followed local experience. In the future, precipitation-intensity frequency will be available for rational modification. Tentative freqencies for limited areas warrant initiation of rational practice.**
5. **Designs should not depend entirely on hydrographic evidence of maximum recent flood, without consideration of the possible frequency or infrequency of that event.**
6. **As general rules, the Committee recommends (a) that culverts pass a 10-year flood without static head on crown of culvert at entrance, and (b) that designs be balanced for 100-year floods.**

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View of broken traffic line striping equipment in operation on State highway

Broken Traffic Line Striping Machine Developed at Headquarters Shops

By DONALD H. CLARK, Jr., Mech. Engr. Draftsman

THE April, 1942, issue of this magazine publicly announced the instructions of Director of Public Works Frank W. Clark to the Division of Highways for adopting an interrupted or broken, traffic line in place of the present continuous stripe. The present solid 4-inch line will be replaced with a 3-inch broken line, while our present 3-inch triple line stripes will remain this width but be broken instead of continuous.

The basis for the broken line will be a painted stripe 15 feet in length, with a break of 25 feet. The economy of the new stripe is self-evident, resulting in a minimum annual saving to the State in paint alone amounting to approximately $90,000.

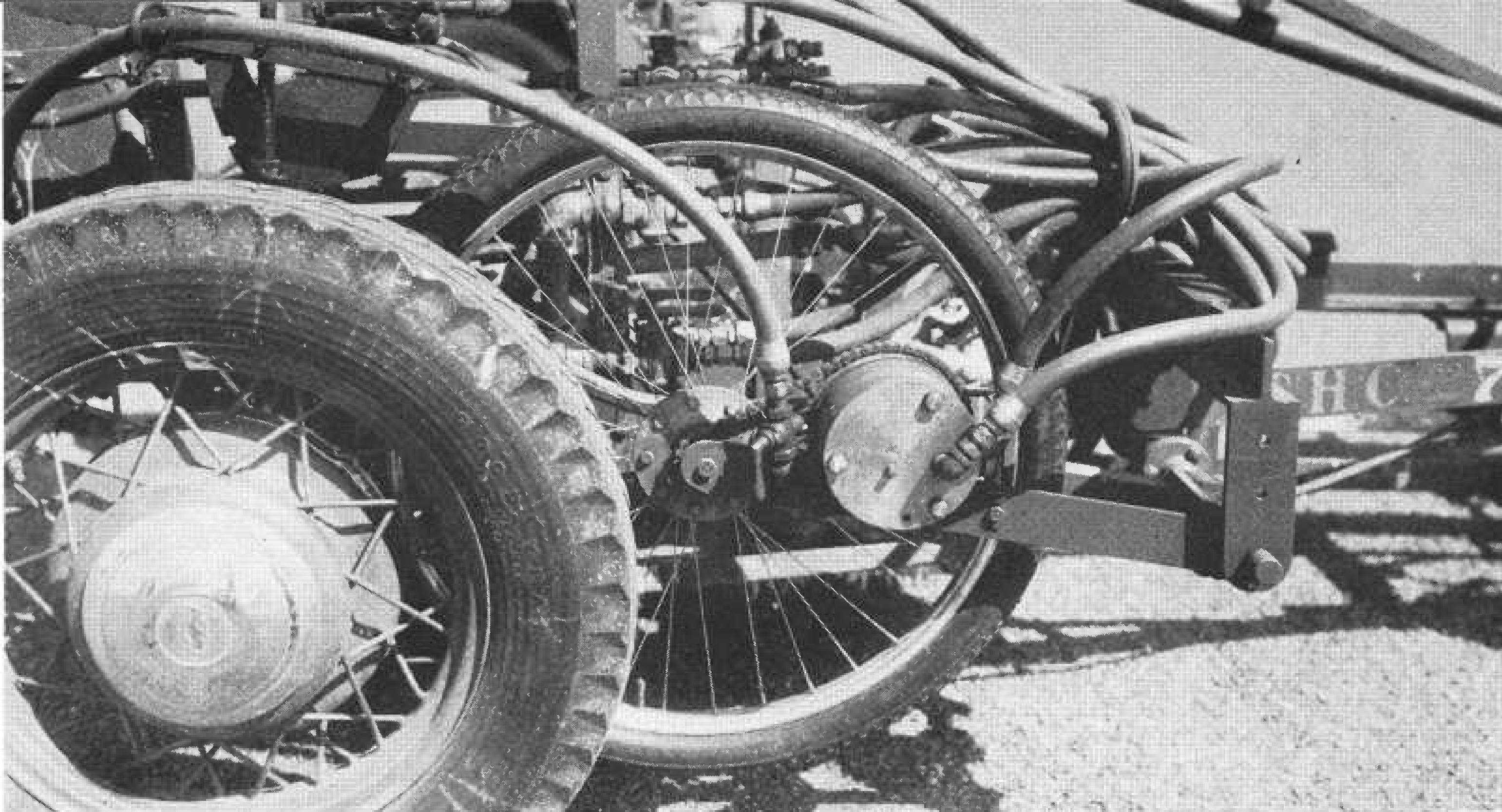
A considerable sum will also be saved by the elimination of the glass beads from the unpainted portions of the traffic stripe. The present 4-inch solid stripe requires 100 pounds of glass beads per mile at a cost of $30. These beads intensify the visibility of the painted lines and the elimination of 25 feet from the stripe in every 40 feet will amount to a saving of $18 per mile. Applying this to the mileage of beaded stripe now in existence will result in a minimum annual saving to the State of about $22,000 for beads alone. The saving in paint and beads will, therefore, amount to approximately $112,000 annually.

Up to the present time, utilization of the broken traffic line for marking highways is believed to be rather limited, even though there is a great saving in the amount of paint used. This may be due to the lack of adequate equipment to efficiently apply this type of traffic stripe.

With the extensive traffic line markings used on the highways in California, the Equipment Department believed that the need for an automatic machine to paint the interrupted stripes was imperative.

Upon inquiry and extensive correspondence, the New York State Department of Public Works gave valuable aid through Charles R. Waters, District Engineer. Their experiences in painting the broken line resolved into the development of an automatic machine, thereby substantiating our desire for this type of equipment. With the conditions prevailing today, the possibility of procuring commercially-made valves such as used by Mr. Waters seemed too uncertain to attempt a reproduction of the New York machine.

With these conditions being determined, the writer developed a new machine to automatically paint the interrupted traffic stripe and Head-



quarters Shop of the Division of Highways manufactured all basic parts which could not be procured from available supplies.

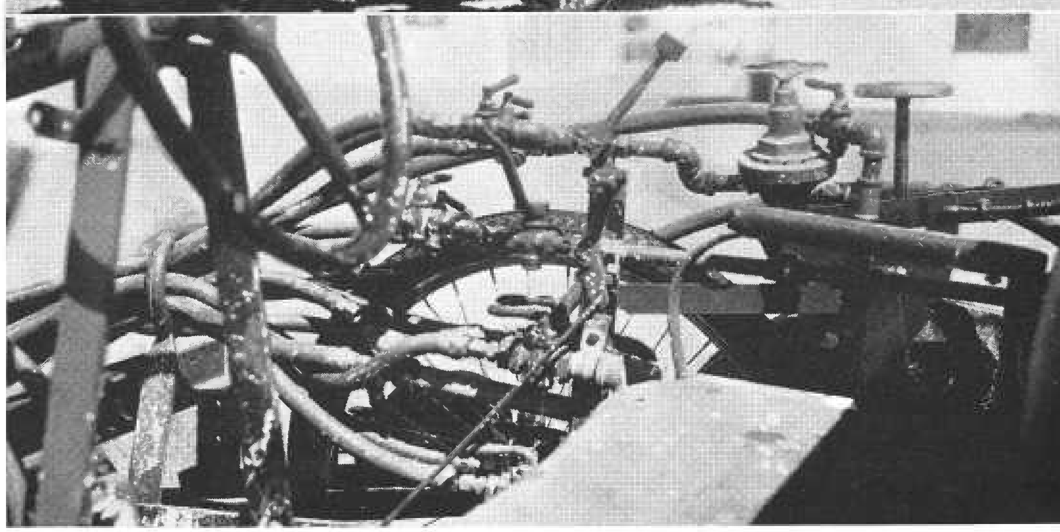
Fundamentally, the new device is an air-control attachment to be mounted directly on the paint striping machines now operated by the Division of Highways. The coordination and synchronization of the paint spray guns and the glass bead dispenser are accomplished by a rotary disc type of air valve, as illustrated in the accompanying photos. This valve is driven by a variable ratio mechanism so as to compensate for different field conditions, enabling the operator to maintain a cycle length of 40 feet and to restripe.

The outer ring of the rotary valve controls the compressed air supply to the paint spray gun actuating air ram, which in turn operates the needle valve to turn the spray on and off.

The inner disc contains the valve to control the air supply to the bead dispenser air lift which may be adjusted to the proper relationship with the outer disc to synchronize the application of the glass beads to the painted portion of the traffic stripe.

As the wheels of the dispenser are lifted clear of the road surface by the air lift, which was designed for the type of dispenser in use, they come in contact with a brake to stop the feeding of the beads at the end of the painted interval of the line.

(Continued on page 19)



Top—Bicycle wheel operates attached cylindrical interrupter valve. Center—Rear view showing bead applicator mechanism. Bottom—Paint and air controls to spray guns

July Traffic Study Count Shows 17.7 Per Cent Drop Below Last Year

By C. H. PURCELL, State Highway Engineer

THE 1942 annual traffic count taken on Sunday and Monday, July 12th and 13th, reveals a sharp reversal in the long continued upward trend in the volume of motor vehicle traffic on our highways. In contrast with the 1941 count, which recorded an increase of 10.8 per cent over 1940, we find that July traffic in 1942 has declined to a point 17.7 per cent below last year's record volume.

This decrease is not unexpected, since our regularly occupied monthly key stations show the downward trend as having begun in March of this year.

The decreases are found not only in every main group of routes but practically every one of the eighty individual routes which form the basis for these comparisons likewise shows losses in traffic carried.

The only exceptions where gains over 1941 were recorded for both Sunday and Monday are Routes 14 and 74 in Contra Costa and Solano counties, which gains undoubtedly were brought about by the large expansion of industrial activity in that area.

It will be noted that the largest decrease is recorded by the recreational group. While the routes which comprise this group serve recreational areas, the traffic which they carry is of course only partially concerned with recreation.

No change was made from the regular procedure of previous years in the manner of taking the count. Actual recording covers the 16-hour period from 6 a.m. to 10 p.m. for both Sunday and Monday. Traffic was segregated by hourly periods into the following vehicle classifications: California passenger cars, out-of-State passenger cars, buses, light trucks, heavy trucks, trailers drawn by trucks, trailer coaches, and other passenger car trailers.

Each year some minor changes in the census become necessary, such as the relocation, addition, or discontinuance of individual stations; but in every instance these are excluded when determining comparisons with the previous year, only those stations that were identical during both years being taken into consideration.

These comparisons for the various route groups are as follows:

PER CENT GAIN OR LOSS FOR 1942 COUNT AS COMPARED WITH 1941

	Sunday	Monday
All Routes	—20.23	—17.05
Main North and South Routes	—20.51	—18.91
Interstate Connections	—19.78	—14.70
Laterals Between Inland and Coast	—18.08	—12.76
Recreational Routes	—28.26	—25.04

The gain or loss of traffic volume for State Highway Routes 1 to 80 inclusive, which constitute the basis for the foregoing summary, is shown in the following tabulation:

Route	Termini	1942 Per cent gain or loss Sunday Gain	Sunday Loss	Monday Gain	Monday Loss
1.	Sausalito-Oregon Line		24.73		26.49
2.	Mexico Line-San Francisco		20.87		21.37
3.	Sacramento-Oregon Line		8.78		2.40
4.	Los Angeles-Sacramento		23.08		21.05
5.	Santa Cruz-Jc. Rt. 65 near Mokelumne Hill		20.86		12.89
6.	Napa-Sacramento via Winters		20.04		18.43
7.	Crockett-Red Bluff		16.18		10.80
8.	Ignacio-Cordelia via Napa		18.52		11.56
9.	Rt. 2 near Montalvo-San Bernardino		22.00		17.28
10.	Rt. 2 at San Lucas-Sequoia National Park		18.83		14.88
11.	Rt. 75 near Antioch-Nevada Line via Placerville		18.94		11.12
12.	San Diego-El Centro		15.77		20.56
13.	Rt. 4 at Salida-Rt. 23 at Sonora Jc.		39.81		35.34
14.	Albany-Martinez	6.78		17.70	
15.	Rt. 1 near Calpella-Rt. 37 near Cisco		21.31		10.90
16.	Hopland-Lakeport		25.34		22.55
17.	Rt. 3 at Roseville-Rt. 15, Nevada City		30.92		33.57
18.	Rt. 4 at Merced-Rt. 40 near Yosemite		32.94		36.80
19.	Rt. 2 at Fullerton-Rt. 26 at Beaumont		20.73		13.18
20.	Rt. 1 near Arcata-Rt. 83 at Park Boundary		25.17		17.76
21.	Rt. 3 near Richvale-Rt. 29 near Chilcoot via Quincy		27.72		25.67
22.	Rt. 56, Castroville-Rt. 29 via Hollister		31.90		25.49
23.	Rt. 4 at Tunnel Sta.-Rt. 11, Alpine Jc.		23.57		22.60
24.	Rt. 4 near Lodi-Nevada State Line		34.48		25.00
25.	Rt. 37 at Colfax-Rt. 83 near Sattley		20.61		27.70
26.	Los Angeles-Mexico via San Bernardino		17.67		13.20
27.	El Centro-Yuma		15.45		15.43
28.	Redding-Nevada Line via Alturas		26.07		19.82
29.	Peanut - Nevada Line near Purdy's		26.78		15.76
31.	Colton-Nevada State Line		15.55		18.74
32.	Rt. 56, Watsonville - Rt. 4 near Califa		31.00		25.33
33.	Rt. 56 near Cambria-Rt. 4 near Famoso		42.61		36.50
34.	Rt. 4 at Galt-Rt. 23 at Pickett's Jc.		35.47		24.64
35.	Rt. 1 at Alton-Rt. 20 at Douglas City		20.49		12.41
37.	Auburn-Truckee		36.40		33.49
38.	Rt. 11 at Mays-Nevada Line via Truckee River		39.00		39.31
39.	Rt. 38 at Tahoe City-Nevada State Line		38.95		41.75
40.	Rt. 13 near Montezuma-Rt. 76 at Benton		49.84		43.44
41.	Rt. 5 near Tracy-Kings River Canyon via Fresno		33.43		21.55
42.	Redwood Park-Los Gatos		36.83		27.20
43.	Rt. 60 at Newport Beach-Rt. 31 near Victorville		15.55		9.89
44.	Boulder Creek-Redwood Park		31.73		36.40
45.	Rt. 7, Willows-Rt. 3 near Biggs		18.23		34.46
46.	Rt. 1 near Klamath-Rt. 3 near Cray		27.68		38.59
47.	Rt. 7, Orland-Rt. 29 near Morgan		15.36		15.53
48.	Rt. 1 N. of Cloverdale-Rt. 56 near Albion		34.42		21.61
49.	Napa-Rt. 15 near Sweet Hollow Summit		23.96		22.00
50.	Sacramento-Rt. 15 near Wilbur Springs		31.11		25.52
51.	Rt. 8 at Schellville-Sebastopol		19.82		16.16
52.	Alto-Tiburon		7.74		11.74
53.	Rt. 7 at Fairfield-Rt. 4 near Lodi via Rio Vista		13.56		20.71
54.	Rt. 11 at Perkins-Rt. 65 at Central House		37.17		32.42
55.	Rt. 5 near Glenwood-San Francisco		37.01		38.00
56.	Rt. 2 at Las Cruces-Rt. 1 near Fernbridge		27.81		23.66
57.	Rt. 2 near Santa Maria-Rt. 23 near Freeman via Bakersfield		38.17		33.86
58.	Rt. 2 near Santa Margarita-Arizona Line near Topock via Mohave and Barstow		25.78		20.79
59.	Rt. 4 at Gorman-Rt. 43 at Lake Arrowhead		11.54		1.13
60.	Rt. 2 at Serra-Rt. 2 at El Rio		18.42		17.05
61.	Rt. 4 S. of Glendale-Rt. 59 near Phelan		19.78		19.91
62.	Rt. 171 at Northam-Rt. 61 near Crystal Lake		32.02		17.28
63.	Big Pine-Nevada State Line		4.92	5.56	
64.	Rt. 2 at San Juan Capistrano-Blythe		0.79	23.17	
65.	Rt. 18 near Mariposa-Auburn		33.06		33.43
66.	Rt. 5 near Mossdale-Rt. 13 near Oakdale		21.11		16.35
67.	Pajaro River-Rt. 2 near San Benito River Bridge		29.05		5.27
68.	San Jose-San Francisco		22.23		18.79
69.	Rt. 5 at Warm Springs-Rt. 1, San Rafael		4.32		5.59
70.	Ukiah-Talmage		9.28		8.76
71.	Crescent City-Oregon Line		54.78		53.01
72.	Weed-Oregon Line		51.21		52.94
73.	Rt. 29 near Johnstonville-Oregon Line		46.65		35.62
74.	Napa Wye-Cordelia via Vallejo and Benicia	13.95		15.80	
75.	Oakland-Jc. Rt. 65 at Altaville		13.37		3.50
76.	Rt. 125 at Shaw Ave.-Nevada State Line near Benton		38.75		20.01
77.	San Diego-Los Angeles via Pomona		14.02		2.29
78.	Rt. 12 near Descanso-Rt. 19 near March Field		34.34		20.71
79.	Rt. 2, Ventura-Rt. 4 at Castaic		21.13		9.71
80.	Rt. 51, Rincon Creek-Rt. 2 near Zaca		40.43		37.21

Sketch showing location of California State Maritime Academy at Morrow Cove near Vallejo and barracks and school buildings now under construction

Governor Olson Supplies Funds For Buildings At Maritime Academy Base

By ANSON BOYD, State Architect

WITH funds furnished by Governor Olson from his depleted Emergency Fund, the temporary shore base construction for the California State Maritime Academy is now being built along the beach at Morrow Cove about two miles east of Vallejo.

The wood frame barracks-type dormitories and instructional buildings can be seen taking shape against the dark background of the eucalyptus grove which lies just west of the Carquinez Bridge toll-house and overlooking Carquinez Straits.

BARRACKS UNDER CONSTRUCTION

The buildings will house the cadet companies of this State merchant-marine training school whose graduates with their rank of naval reserve ensign are in urgent demand as deck and engineer officers for the ships being launched daily from California's shipyards.

Included in this project for which the sum of $160,000 was allocated from the Governor's Emergency Fund are temporary barracks containing toilet and shower rooms in which the cadets, assigned four men to a squad room will live during the concentrated 16-month period of their training except during the two protracted cruises on the ship "Golden State."

To be constructed also is a T-head timber wharf, 200 feet in length along each leg, which is the home berth of this training-ship assigned to the State of California by the United States Maritime Commission, and which also provides for the ship's overhauling. Adjoining the dormitories and arranged around a small quadrangle facing the cove are a classroom and administration building, kitchen and mess hall seating 200 cadets and an engineering shop and instructional building, all of which are of minimum critical material, "duration" construction to house an urgency needed facility.

The program proposes the installation of water, gas, and electric power services which are scheduled, with the building structures, for completion during the latter part of September, 1942, and for which a high preferential priority was granted by the War Production Board, upon the request of the State Department of Public Works.

Central Valley Project Power Assured in 1944 by New Priorities

THE growing importance of Central Valley Project power to California's war production program was cited by Director of Public Works Frank W. Clark in announcing receipt of word from Washington, D. C., that new and higher priority ratings had been issued for Shasta and Keswick dams.

''These new priority ratings, assuring that Central Valley Project power will be on the line in 1944 come as welcome news to California,'' Clark said. ''When the Federal Government announced it was transferring two of the generators fabricated for the Shasta power plant to Grand Coulee, the future of the Central Valley Project appeared very uncertain.

NEW GENERATORS PROVIDED

''At the same time efforts of the power companies to block construction of the transmission lines for the project lead to great concern on the part of the State administration. This concern was so deep that Governor Olson made a trip to Washington especially to confer with Government officials and California Congressmen on the matter.

''Due in large part to the showing made by the administration, the appropriations for the transmission lines and steam electric plant were passed by the Congress. Now with the assurance that the generators will be on the line when the dams are completed, the Central Valley project can take its needed place in California's war effort.''

KESWICK COMPLETION CONTRACTED

In announcing the new priority ratings for the Shasta and Keswick plants, the War Production Board said that two large generators of 75,000 kilowatts each would be installed by January, 1944, and a third of the same capacity by March of that year. At Keswick two generators of 25,000 kilowatts each are scheduled to be in operation in May and June of 1944.

Close on the heels of the War Production Board announcement came word from Secretary of the Interior Harold Ickes that he had approved a negotiated contract for the completion of Keswick Dam. The Atkinson-Kier Construction Company which has been building the foundations of the dam was awarded an emergency change-order authorizing it to bring Keswick Dam up to full height and complete the powerhouse to the generator floor stage. Amount of the change order was $1,492,946.

Architecture Division Wins High Praise

At the last regular meeting of the Board of Directors of the San Diego Chamber of Commerce, the following resolution was unanimously approved:

"Be it resolved by the members of the Engineering Committee of the San Diego Chamber of Commerce

"That we endorse the current policy of the California State Division of Architecture of approving methods of design and construction of school buildings, that will within the recognized limits of safety and economy permit the use of available materials of construction nonessential to the war effort.

"That we wish to commend the personnel of the State Division Architects for their cooperation in conferring with, and advising school board representatives, architects and engineers, on details of design and construction that will accomplish the above,

"And that we believe much benefit can be gained by the publication and distribution of current approved methods of design and construction to persons responsible for the planning and design of school buildings, so

"Be it therefore resolved that it is our desire that this resolution be approved by the Board of Directors of the San Diego Chamber of Commerce and that copies be forwarded to the California State Division of Architecture."

Very truly yours,

SAN DIEGO CHAMBER OF COMMERCE,

(Signed) By John T. Martin, President.

Donors of Property For Access Road Thanked by State

THE Division of Highways reports that it has been granted gratuitously certain property, rights of way and road building material for the construction of a military access road in Kern County. In reporting the gift, State Highway Engineer C. H. Purcell said:

"In acknowledgment of the wholehearted cooperation of various parties to the gift the division extends its thanks and appreciation to the following for their part in furthering a vital war effort:

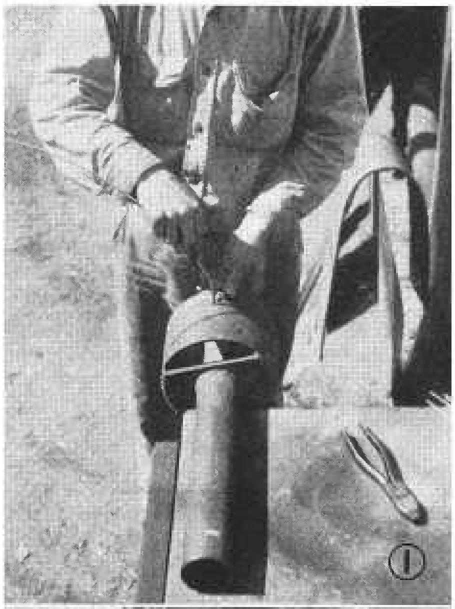
"Grace Canale, Nicholas Canale, Chanslor Canfield Midway Oil Company, Dorothy Fried, Julius Fried, General Petroleum Corporation, George Hay Corporation, Merritt Annex Oil Co., The Norwalk Co., Pacific Gas and Electric Co., Southern California Gas Co., Standard Oil of California, Sunset Western Railroad, The Texas Co., Tide Water Associated Oil, Union Oil, Western Water Co., Wilshire Annex Oil Co.

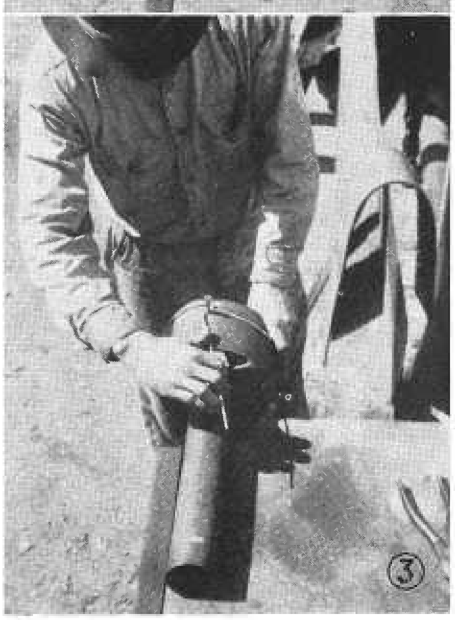
"The property thus acquired includes six miles of road 80 to 100 feet wide; more than 50 acres including producing oil field and grazing land; nearly 200,000 yards of road building material and more than 30 separate oil, gas and water pipe lines involved. No permits for occupation were required and no condemnation suits were necessary.''

North Sacramento Viaduct Officially Opened to Traffic

Two lanes of the Sacramento-North Sacramento viaduct, which provides an all-year highway between the two cities over the flood water area of the American and Sacramento rivers and two railroads, were opened to traffic on September 14 as this issue of the magazine goes to press. State, county, and city officials and representatives of Sacramento Chamber of Commerce and other civic bodies officiated at the opening. The total cost of the viaduct was $631,000, financed with State and Federal Aid funds.

Further details of the dedication ceremonies and engineering and construction features of the viaduct will be printed in our October issue.





Simplified Method of Making Traffic Flags For Use on Highways

FOR some time past, Superintendent T. W. Martin, Division of Highways, Whittier, California, has been working on improvements to speed up the construction of wire frame holders for red flags used for the protection, during drying, of newly painted center stripe or pavement markings. The latest development is an ingenious device which is unquestionably a time and labor saving method.

The wire can be shaped, both loops closed and a flag tied in about a minute and a half. This results in a flag of uniform size and appearance.

Flags of two different sizes are being observed for visibility to traffic, and ability to withstand air suction of passing vehicles.

Illustrations of the procedure are described as follows:

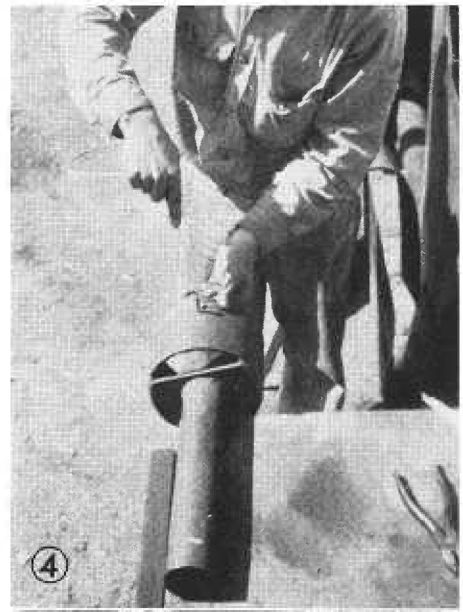
Fig. 1. Using a short section of pipe of about 8 inch in diameter which is welded to a longer section of 3 inch pipe, as a jig, the wire is pushed into a hole to a depth of about ¾ inch. Then the wire is bent at right angles to form the loop which will be closed to tie to the upright. After pushing the wire into the hole it is wrapped around the pipe making a circle of about 8 inches in diameter.

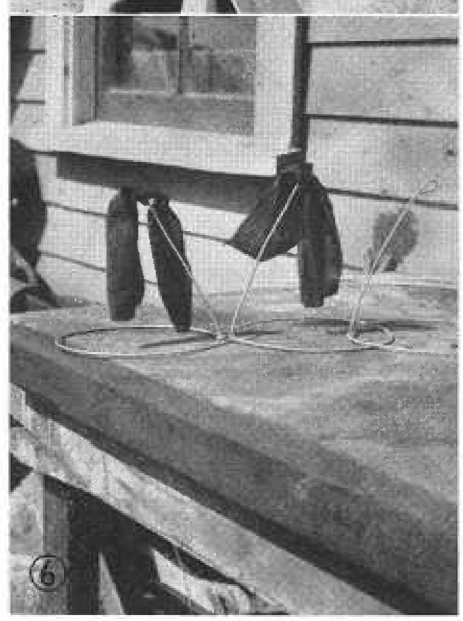
Fig. 2. This shows the completion of the circle and in Figure 3 the upright portion is bent around a screw fastened to the pipe. To make a sharp bend the wire is lowered between this screw and the head of a bolt, which can not be seen, directly behind the screw.

Fig. 4. The wire has been removed and the top loop, which will hold the flag, is being bent in the hole used for the lower loop.

Fig. 5. The upright is being bent into the center of the circle so that the flag will stand on the highway without turning over.

Fig. 6. The lower and upper loops have been closed in the standard on the right and a flag has been tied to the other two standards shown.





A. M. Nash Appointed District Engineer of Highway District I at Eureka

A. M. NASH, who has been serving in various engineering capacities in the Division of Highways for the past 22 years, has been appointed District Engineer of District I, with headquarters at Eureka, succeeding the late E. R. Green.

Mr. Nash entered the employ of the Division of Highways in January, 1920, as an engineering draftsman in central office at Sacramento. In January, 1924, when District X at Stockton was first organized he was transferred to that district as chief draftsman and remained there employed in both field and office work until 1934, when he was again transferred to the central office in Sacramento as assistant office engineer.

He remained in this position and later as assistant engineer of surveys and plans until February, 1942, when he was transferred to District IV in San Francisco as assistant district engineer.

Mr. Nash was born at Elk City, Kansas, and was educated in the schools of Kansas and Idaho and at the University of Washington. Previous to entering the employ of the State of California, he worked for the Idaho Highway Department, the Great Northern and Oregon Shortline railroads and the Interstate Commerce Commission.

He enlisted in the last World War in the Aviation Section, Signal Reserve Corps and was commissioned Second Lieutenant and Aviation Pilot, serving at March Field, California. At the termination of his Army service in February, 1919, he was employed by the California Department of Engineering and Irrigation as Chief of Party in Sacramento, which position he resigned to take employment with the Division of Highways.

Mr. Nash is married and has two daughters aged 16 and 14.

A. M. NASH

Four-Lane Divided Highway Reduces Traffic Hazard

(Continued from page 4)

pneumatic tired truck roller was used. After final rolling a curing seal of asphaltic emulsion was applied.

The cement treated base was placed to a compacted thickness of six inches. An asphalt concrete surface was then placed over the base to a three inch compacted thickness. The asphaltic mixture was hauled from the contractor's plant at Banning in dump trucks. After delivery to the street the material was handled in a manner very similar to that used for the cement treated base. It was spread through the self-propelled spreading machine operating on the base without the use of headerboards. The heavy three-axle roller was used for compaction and finish rolling was performed with a tandem roller operating longitudinal with the pavement. Cross rolling was not required.

A penetration treatment using liquid asphalt, SC-2, was applied to shoulder areas.

The war trend is discernible in the type of traffic stripe used which consists of a dashed line that is of narrower width than the pre-war standard. This Victory stripe is designed to conserve paint ingredients.

The work was performed under the supervision of R. A. Bergman, Resident Engineer.

New Rio Vista-Lodi Cut-off Saves 10 Miles

(Continued from page 2)

Although county authorities took the matter in hand and immediately started the work of repairing this bridge, had not this new section of highway been completed and open to traffic, a detour 10 miles longer than the old route or 20 miles longer than the new route would have been necessary.

There are four bridges on the former portion of State highway route now reverted to the counties: three movable type bridges located at Georgiana Slough, Miller's Ferry, and New Hope Landing, and one fixed type bridge at Beaver Slough. On the new route there are four bridges: two movable type bridges located at Mokelumne River and Potato Slough, and two fixed type bridges, one west of Potato Slough (trestle) and a small one at Woodbridge Irrigation Canal near Lodi.

The Rio Vista cut-off has been accomplished by several construction projects including a new bridge across Potato Slough at Terminous with approaches thereto constructed in 1937 by Bodenheimer Construction Company at a cost of $213,100.

At the westerly end of Potato Slough Bridge and extending thence west about one-half mile, a test road installation was placed using sand drains and fills, which work was done in 1940 by Mike Malfitano and Son at a cost of $25,100.

From the Potato Slough Bridge to a point west of the Mokelumne River connecting with the county road, a distance of 5.0 miles, grading with necessary vertical drains has recently been completed by Clyde Wood Construction Company at a cost of $293,800.

The new bridge across the Mokelumne River has been completed by the Tavares Construction Company at a cost of $368,000.

The existing county road being used temporarily as a State highway routing between the westerly end of the completed construction west of the Mokelumne River to Isleton, a distance of 3.6 miles, was touched up and conditioned by State forces at an expenditure of $2,500.

The above indicates construction expenditures to date of $900,000.

Procedure and Factors Governing Issuance of Truck Overload Permits

(Continued from page 1)

2. The gross load can be increased when it is practicable to make certain that the operation of a particular vehicle can be controlled, such as traveling along the centerline of the bridge and at slow speed.
3. Since general provisions must take into account the effect of repeated heavy loads (a structural member of a bridge or a load surface will fail under much lower stresses than a single load would cause if the loading is repeated frequently), it is only practicable to grant permits for very occasional loads that exceed the legal maximum weight. This, for obvious reasons, is only permissible in emergencies—that is, under circumstances that are only likely to occur at very long and infrequent intervals.

It is the duty of the Division of Highways of the Department of Public Works to determine when a road or bridge can stand an occassional load heavier than the law permits, and also when and how much the legal loading must be reduced because of structural weakness or bad condition. These decisions are strictly a matter of engineering calculations and judgment, and the engineers of the Highway Department have always advocated a policy of allowing the maximum loads consistent with the engineering principles governing the safe stress in road pavements or bridges.

SOME VARIANT FACTORS

The public should realize that reduced revenues, restrictions on construction materials and equipment, repairs or replacements, shortage of labor—all make it difficult to maintain the roads in their normal condition. In consequence, more frequent posting of highways and bridges and stricter limitations on overweight vehicles become necessary.

The procedure under which legal load limits can be reduced is covered by Sections 715 and 715.5 of the Vehicle Code and involves an engineering investigation, a public hearing to consider the recommended posting, and the placing of proper signs on the highway. The driver of a vehicle carrying a heavier load than that set forth in Sections 704 and 705 of the code, or heavier than load limits which have been reduced in accordance with Sections 715 and 715.5, must have a special permit or reckon with the Highway Patrol.

Section 710 of the code covers the issuing of an overweight permit by the Department of Public Works. For the convenience of haulers and for better control of the vehicle movement, application for an overweight permit is made at the nearest Highway District Office. All these offices have information showing the safe load capacity of structures on various sections of the highway and the proportionate increase in the legal weight restrictions that can be allowed when the operation of the vehicle is properly controlled.

Unusual or borderline conditions may have to be taken up with the Sacramento office but this can be done by telephone or by wire if the time is short and delay is serious. If an overweight permit can be justified it will be issued by the District Engineer.

Haulers can prevent unnecessary delay to themselves by having an accurate description of their vehicle or vehicles. This means, primarily, the axle spacings and their actual weights. The gross load and the relative axle weights under similar loading conditions are usually sufficient to cover the latter data and many concerns have furnished the Highway Department with a description of their equipment, in which case it is only necessary to refer to the particular vehicle and give its gross load.

The applicant for a permit must also get the government officials to certify by letter or wire that the movement of this particular load is required in connection with the war effort. Finally, it is requested of applicants as a favor to the engineer who is trying to give the best service he can, sometimes under trying circumstances, that they try to give at least a few hours notice before a permit is needed and not expect that the laws of nature can be entirely ignored, even if it is a National emergency.

Broken Traffic Line Striping Machine Developed at Shops

(Continued from page 13)

When applying the interrupted stripe, the painted interval of the line will be applied first, which will be 15 feet in length, and will be followed by a 25-foot space, giving a cycle length of 40 feet.

To accomplish this, a synchronizing pointer is set at the point of beginning the line, the mechanism is engaged by a hand lever, and the interrupted stripe is then automatically laid down while the machine progresses over the highway. When it is desired to stop the painting process, this is accomplished by turning a hand valve, or by disengaging the air valve driving mechanism shifting lever, depending upon the station in the cycle at which the line is to terminate.

Variations in the tire air pressure and the desirability of matching a new stripe with an old one when restriping and the beginning of the stripe at a particular point necessitated a degree of flexibility in the mechanism. A period adjustment is provided that changes the length of the cycle while in motion if the operator so desires.

There will be times when it will be necessary to make a break in the cycle length of 15 feet of painted line and 25 feet of interrupted space, such as when striping up to a cross-over or other interruption in the established marking. When this situation is encountered, the machine may be changed from automatic to hand control simply by turning a hand valve, converting the machine to its original type.

The operation of the striping machine with the automatic interrupting mechanism can be carried out at the accustomed speeds and in the usual manner. Single lines with or without beads may be painted, as well as multiple line stripes with or without beads.

There are twelve painting machines in operation throughout the State, each requiring a skilled operator, and the mechanism was devised by the writer to function under the varying field conditions and with a minimum number of controls, having in mind the efficient operation of the paint striping machines.

Highway Bids and Awards for the Month of August, 1942

CONTRA COSTA COUNTY—Between 1½ miles west and ¼ mile east of Glenn Frazer Station, about 1.9 miles to be graded, surfaced with imported borrow and armor coat constructed thereon. District IV, Route 106, Section A. Contract awarded to N. M. Ball Sons, Berkeley, $323,145.

KERN COUNTY—Between Fort Tejon and 14 miles north of Grapevine Station, about 6.0 miles to be widened with portland cement concrete pavement and plant-mixed surfacing to be placed. District VI, Route 4, Section A. Contract awarded to Griffith Co., Los Angeles, $384,951.

LOS ANGELES COUNTY—Across Los Cerritos Channel about 6 miles east of Long Beach, a timber bridge to be constructed. District VII, Route 179, Section A. Carlo Bongiovanni, Los Angeles, $19,333; Byerts & Dunn, Los Angeles, $19,931; R. M. Price, Huntington Park, $24,648. Contract awarded to E. G. Perham, Los Angeles, $17,092.

LOS ANGELES COUNTY—Through Hermosa Beach on Sepulveda Blvd. about 1.3 miles to be widened and paved with asphalt concrete and portland cement concrete. District VII, Route 60, Section HmB, Rdo B. Oswald Bros., Los Angeles, $99,385. Contract awarded to Griffith Co., Los Angeles, $76,861.

MODOC COUNTY—Removing four timber bridges and constructing three timber bridges and installing one corrugated metal pipe culvert between 9½ miles and 13 miles north of Alturas. District II, Route 73, Section A. J. P. Brennan, Redding, $5,781; C. C. Gildersleeve, Colusa, $6,535; California Paving Co., San Mateo, $7,650; L. C. Smith, San Mateo, $7,807. Contract awarded to Jack Gilmore, Redding, $4,978.

SAN DIEGO COUNTY—Across Boat Channel in San Diego City, a timber, concrete and structural steel bridge to be constructed. District XI. R. E. Hazard & Sons, San Diego, $346,275; Byerts & Dunn, Los Angeles, $382,417. Contract awarded to Ralph A. Bell, Eureka, $341,479.

SAN DIEGO COUNTY—In the city of San Diego on Harbor Drive between Civic Center & Rosecrans Street, about 3.7 miles to be graded and paved with portland cement concrete. District XI. R. E. Hazard & Sons, San Diego, $492,870; V. R. Dennis Construction Co., San Diego, $523,575. Contract awarded to Ralph A. Bell, Eureka, $459,899.

SAN DIEGO COUNTY—On Rosecrans Street and Mission Valley Road, between Lytton St. and Sixth St. extension, about 3.5 miles to be graded and paved with portland cement concrete and asphalt concrete. District XI. Ralph A. Bell, Eureka, $746,073. Contract awarded to R. E. Hazard & Sons, San Diego, $712,918.

SAN DIEGO COUNTY—On Eighth St. and Harbor Drive, between Roosevelt St. in National City and G St. in San Diego, about 4.7 miles to be graded and paved with asphalt concrete and portland cement concrete. District XI, South Harbor Drive. R. E. Hazard & Sons, San Diego, $797,093; Griffith Co., Los Angeles, $822,585. Contract awarded to V. R. Dennis Construction Co., San Diego, $694,167.

SAN LUIS OBISPO COUNTY—Between Santa Margarita and northerly boundary, about 28.8 miles to be resurfaced with plant-mixed surfacing. District V, Route 2, Sections C.B.A. W. E. Hall Co., Alhambra, $324,265. Contract awarded to A. J. Raisch, San Jose, $264,738.

SANTA BARBARA AND SAN LUIS OBISPO COUNTIES—At various locations, seal coat to be applied for a distance of 6.8 miles. District V, Route 2, Sections G.F.E. Contract awarded to Brown, Doko and Baun, Pismo Beach, $14,690.

SISKIYOU COUNTY—Between Edgewood Road and 4.0 miles north, about 3.8 miles to be graded and surfaced with plant-mixed surfacing. District II, Route 72, Section A. Contract awarded to Poulos & McEwen, Sacramento, $83,317.

SOLANO COUNTY—A bridge across Napa River at west city limits of Vallejo to be repaired and a new concrete deck constructed. District X, Route 208, Section A. E. E. Smith, El Cerrito, $292,950; A. Teichert & Son, Inc., Sacramento, $345,088. Contract awarded to Trewhitt-Shields and Fisher, Fresno, $247,865.

In Memoriam

Everett R. Green

May 9, 1887-July 25, 1942

To his numerous friends among the officials and fellow employees of the California State Division of Highways, the sudden passing of Everett R. Green, District Engineer of District I with headquarters in Eureka, came as a shock. His death occurred at a hospital on July 25th following a heart attack on the previous day.

Mr. Green was born May 9, 1887, at Oregon City, Oregon. He received his schooling at Oregon City High School and at Oregon Agricultural College.

His first work was railroad engineering in the northwestern States and in Alaska. His first employment on highway work was with the Oregon State Highway Department in 1914. He was with the Oregon Highway Department from 1914 to 1917. From November 1917, to June 1919, he served with the 23d Engineers, U. S. Army in France. After the war he returned to the Oregon Highway Department where he stayed until June 1922, at which time he accepted employment with the U. S. Bureau of Public Roads, District I, at Portland, Oregon. He was with the Bureau until September 1928. His experience with the Oregon Highway Department and with the U. S. Bureau included all phases of highway location and construction.

In 1928 he became affiliated with the Division of Highways of the Department of Public Works. He served first as maintenance engineer, then as construction engineer, at San Luis Obispo until 1938, when he was appointed district engineer at Eureka.

He is survived by his mother, Mrs. Mary Green of Detroit, Michigan; his wife, Frances; and children, Eris, Bonnie Lee and Patsy Ann; and five brothers and sisters, Grylam Green, Mrs. Alvin Sheppart and Mrs. Anna Talbot of Oregon City; Herbert Green of Clinton, Washington; and Mrs. Gladys Scott of Detroit.

Bids and Awards for July, 1942

SAN MATEO COUNTY—Near Half Moon Bay, area to be graded and a portion thereof to be surfaced with plant-mixed surfacing. District IV. Chas. L. Harney, San Francisco, $458,431; Marshall S. Hanrahan, Redwood City, $561,005. Contract awarded to Macco Construction Co., Oakland, $394,878.

SANTA BARBARA COUNTY—At various locations, about 6 miles in length, portions of existing roadbed to be repaired with plant-mixed surfacing and seal coat. District V, Routes 2, 56, 149, Sections KEDC, AB,A. Contract awarded to L. A. Brisco, Arroyo Grande, $49,788.

VENTURA COUNTY—At Beetox, over Beardsley Channel, about 0.5 mile in length, a reinforced concrete box culvert to be constructed, approaches thereto to be graded and paved with Portland cement concrete. District VII, Route 2, Section C. Carlo Bongiovanni, Los Angeles, $66,362. Contract awarded to Vido Kovacevich, South Gate, $61,459.

YOLO COUNTY—Near Winters, surface area and related approach roads to be graded and surfaced with plant-mixed surfacing on gravel base. District III. Fredrickson & Watson Construction Co., Fredrickson Bros., Oakland, $573,367. Contract awarded to Fredericksen & Westbrook, Sacramento, $54,848.

YUBA COUNTY—Between Linda Corners and Camp Beale, about 7.9 miles to be graded and surfaced with crushed gravel base and plant-mixed surface. District III, Route 3, Section B. A. Teichert & Son, Inc., Sacramento, $519,507; Fredericksen & Westbrook, Sacramento, $615,454. Contract awarded to Hemstreet & Bell, Marysville, $476,224.

Pedestrians Deaths In United States Number a Third of Traffic Fatalities

Motor vehicle accidents throughout the United States killed 13,600 pedestrians and injured 265,000 during 1941—one-third of all traffic deaths, and almost one-fifth of all injuries, according to official reports.

The 1941 pedestrian death toll was 7 per cent greater than the 1940 figures. Nonpedestrian deaths, however, rose 21 per cent. In the last 10 years, the report disclosed, pedestrian deaths have increased 2 per cent, while nonpedestrian deaths were rising 30 per cent.

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