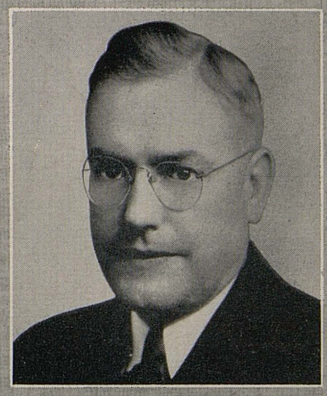
# CALIFORNIA
## HIGHWAYS AND PUBLIC WORKS

PRESIDENT
C. W. PHILLIPS

AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS 1914



1st VICE PRESIDENT
R. H. BALDOCK

DELEGATES TO 32nd ANNUAL MEETING OF AASHO

EXECUTIVE SECRETARY
HAL H. HALE

TREASURER
G. H. HENDERSON

AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS

ANNUAL MEETING ISSUE
JANUARY 1947

# CALIFORNIA HIGHWAYS AND PUBLIC WORKS

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

C. H. PURCELL, Director | GEORGE T. McCOY, State Highway Engineer | K. C. ADAMS, Editor

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# American Association of State Highway Officials Maps Attack on Postwar Highway Problems

AT WHAT was considered its most important meeting since it was founded, the American Association of State Highway Officials at its thirty-second annual session in Los Angeles, December 17th-20th, laid out a program of action to overcome the multitude of highway construction problems with which it is confronted.

Some 900 delegates, representing the United States, Puerto Rico, Hawaii, and the United States Public Roads Administration of the District of Columbia were in attendance.

At the conclusion of four days of intensive work, the association elected C. W. Phillips, Commissioner of Highways and Public Works of Tennessee, its new President to succeed M. J. Hoffmann, Commissioner of Highways of Minnesota.

Other officers elected were: First Vice President, R. H. Baldock, Chief Engineer, Oregon State Highway Department; Regional Vice Presidents, Spencer Miller, Jr., Highway Commissioner, New Jersey; F. Elgin Bayless, Chairman, Highway Commission, Florida; W. W. Polk, Illinois, and Clarence B. Shain, Director of Highways, Washington. Mr. Miller and Mr. Polk were reelected.

Three new members of the executive committee of 10 were elected as follows:

R. H. Leavitt, Chairman, Highway Commission, Utah; C. H. Sells, Superintendent of Public Works, New York, and F. R. White, of Iowa.

Hal H. Hale of Washington, D. C., and G. H. Henderson, Principal Highway Engineer of Rhode Island, succeeded themselves in their respective positions of executive secretary and treasurer.

### NEW YORK NEXT MEETING PLACE

The Executive Committee voted to hold the 1947 meeting in New York State. The State Highway Department of New York will designate the city where the session will be held.

Committee meetings, the President's luncheon for the Executive Committee, a session of the Western Association of State Highway Officials, and the Executive Committee dinner for new commissioners and new chief engineers of member departments attending an association meeting in this capacity for the first time preceded on Friday, Saturday, Sunday, and Monday, December 13th-16th, the opening of the general session in the Biltmore Hotel on Tuesday, December 17th.

Highlights of the morning and afternoon meetings on this date were the annual address of President Hoffmann, presentation by F. R. White, Chief Engineer, Iowa State Highway Department, of a testimonial to Past President H. A. MacDonald, addresses by Thomas H. MacDonald, Commissioner, Public Roads Administration; Representative J. W. Robinson, Utah, Chairman of the House Committee on Roads, and Congressman Paul Cunningham of Iowa, and the reading by D. C. Greer, State Highway Engineer of Texas, of a paper prepared by Major General Philip B. Fleming, Administrator, Federal Works Agency, who was unable to attend the meeting. The addresses of Mr. Hoffmann, Mr. MacDonald, and General Fleming may be found elsewhere in this issue of California Highways and Public Works.

### RESOLUTION

**COMMENDATION OF DIVISION OF HIGHWAYS OF CALIFORNIA DEPARTMENT OF PUBLIC WORKS IN ITS HIGHWAY IMPROVEMENT PROGRAM**

**WHEREAS,** During the past year the State of California, through its Legislature and in cooperation with the Division of Highways of the Department of Public Works, has completed comprehensive and thorough factual studies of future highway needs, utilizing the products of highway research and survey; and

**WHEREAS,** The members of this association, as guests of California at their annual meeting in Los Angeles, December 17-20, have had opportunity personally to see the results of these studies and to observe the manner in which the basic data underlying the highway improvement program have been made widely available to all public officials, legislators and the general public in the State, as a means of assuring sound determination of the future program; now, therefore, be it

**RESOLVED,** That the delegates of the American Association of State Highway Officials, desire to express their commendation to the State of California, and particularly to the Legislature and the Division of Highways of the Department of Public Works, on these studies, and to express also its gratitude to the California Division of Highways for making it possible on this occasion to view at first hand some of the excellent activities the State is carrying forward in this important field.

### GENERAL SESSION

The general session Tuesday morning was opened by President Hoffmann, and following an invocation by Dr. Louis T. Talbot, Pastor, Church of the Open Door, the delegates heard welcoming addresses from Mayor Fletcher Bowron of Los Angeles and C. H. Purcell, Director of the State Department of Public Works and Chairman of the California Highway Commission, representing Governor Earl Warren, who was unable to attend because of prior official commitments.

In his talk Commissioner MacDonald said that the "limited access highway," a term interchangeable with express way, parkway, and freeway, is the only possible means of coping with urban congestion and that adequate parking facilities must be made an integral part of any over-all plan.

In approving Mr. MacDonald's advocacy of freeways, Congressman Robinson expressed the opinion that bond issues for freeways by cities to be amortized out of federal aid and matched by state funds were feasible and said he believed that existing law will support such financing. He urged a definite long range program by federal, state, and local governments to provide for highways through congested metropolitan areas.

## RESOLUTION No. 1

### WAR SURPLUS ROAD EQUIPMENT

WHEREAS, There exists a serious shortage of equipment needed for the maintenance of public roads and streets, particularly such equipment as motor graders, tractors, scrapers, passenger cars, light and heavy duty trucks; and

WHEREAS, Lack of equipment is making it necessary to defer much needed repair and rehabilitation work accumulated during war years and aggravated by increased traffic since the close of active war; and

WHEREAS, The safety and well-being of the increased volume of traffic now using public highways requires that increased efforts be made to restore, repair and maintain public highways; and

WHEREAS, The agencies of the states and their subdivisions charged with the responsibility for maintaining public highways are unable to obtain the necessary equipment from private sources; and

WHEREAS, The present method of distribution of surplus war commodities has resulted in very little benefit to the agencies of the State and their subdivisions; therefore be it

RESOLVED, That the American Association of State Highway Officials request and urge the allocation of equipment be made to states and their subdivisions on the basis of a fixed percentage of the total amounts available; be it further

RESOLVED, That copies of this resolution be forwarded to Members of Congress, with a request that consideration be given to remedying the situation as suggested, or in some other manner that will result in the states and their subdivisions securing a fair share of surplus war commodities.

Mayor Fletcher Bowron of Los Angeles welcomes delegates to the meeting of the American Association of State Highway Officials. Seated, left to right: C. H. Purcell, Director of California Department of Public Works; Thomas H. MacDonald, Commissioner, Public Roads Administration; and Congressman J. W. Robinson, Utah

COMMITTEE MEETINGS

On Wednesday throughout the day important sessions were held by the Committees on Bridges and Structures, Administration, Maintenance and Equipment, Planning and Traffic Engineering, Road Design, Highway Transport, International Highway Relations, and Public Relations and Publicity.

During the noon recess, the delegates were guests at a luncheon in the Biltmore Bowl of the Right of Way Association.

Addressing the Committee on Bridges and Structures, Professor John S. Worley of the University of Michigan, voiced the belief that bridges on the interstate highway system should be capable of supporting the same maximum load as other portions of the system.

Professor Worley pointed out that once constructed, the interregional highway system would be relatively permanent and that highway engineers should project their thinking into the future 75 years to 100 years, rather than think in terms of two or three decades. To construct bridges with the same rated capacity as the paved portions of the interregional system would require the expenditure of only about 2.7 percent additional funds.

"Sound engineering calls for a structure with no weak parts," he commented. "The development of highway transport 50 years hence is unknown, but great advances are certain. The interstate highway system once built fixes the pattern of highway transport for the next 75 years.

"Future military needs are unknown. It seems certain that there will be much greater demand for highway transport than in the war just closed. Highways for carrying heavier military vehicles are probable. The government has just released information regarding a new tank which weighs 200,000 pounds.

"Future economic growth of the country should not be stymied by a restricted highway system. The national and state policies should be to give opportunity for natural growth, rather than a throttled existence. The policies should be to meet potential future needs rather than current pecuniary savings.

"The Interstate Highway System probably never would have been recommended had its construction been dependent upon economic justification. Evidence indicates that construction of the Interstate System cannot rest solely upon economic justification and must rely in part on public welfare—faith in America's future.

"The small additional cost—less than 3 percent—calls for bridges with carrying capacity approaching the other parts of the highway. This is sound engineering, sound administration and sound public welfare."

TRAFFIC SURVEY TECHNIQUES

E. H. Holmes, Chief, Division of Highway Transport Research, Public Roads Administration, Washington, D. C., addressed the Committee on Planning and Traffic Engineering on the subject "What Can Factual Surveys Contribute to Solution of Urban Area Traffic Problems." He said in part:

"New traffic survey techniques have been developed during the last three years which make it possible to forecast with complete accuracy the future daily travel habits of any metropolitan area.

"The new type of survey was developed by the Public Roads Admin-

## RESOLUTION No. 2

EXTENSION OF TIME FOR AVAILABILITY OF FUNDS UNDER FEDERAL AID ACT OF 1944

WHEREAS, The Federal Aid Highway Act of 1944 authorized the apportionment of certain funds for each of the first three sucessive postwar fiscal years for federal aid highways, for federal aid secondary roads, and for projects on the Federal-Aid Highway System in urban areas; and

WHEREAS, Section 4(d) of said act provides that any sums so apportioned to any state shall be available for expenditure in such state for only one year after the close of the fiscal year for which it is apportioned and that any sum so apportioned that remains unexpended at the end of such period shall lapse and revert to the Treasury of the United States; and

WHEREAS, The aforesaid provisions of Section 4(d) of said act will operate to cause each state to lose any portion of such funds apportioned to it for the first postwar fiscal year that may not be expended by June 30, 1947; and for the second postwar fiscal year not be expended by June 30, 1948; and for the third postwar fiscal year not expended by June 30, 1949; and

WHEREAS, The Highway Departments of many of the states are certain that the elements of inflation and the acute shortages of labor and engineering personnel materials and equipment that are known to exist will make it impossible to have these funds expended within the time now prescribed by said Act, notwithstanding said highway departments and the public generally realize that the need for the expenditure of such funds on highway work is, and will be, more intensified by reason of obsolescence, deterioration, increased unit costs, and ever mounting traffic volumes; therefore, be it

RESOLVED, By the American Association of State Highway Officials, in annual convention assembled, that the Congress of the United States is hereby petitioned to enact suitable legislation to extend the periods of availability of such funds for twelve (12) months after June 30th of each of the years 1947, 1948 and 1949, and that the executive secretary of this association is hereby instructed to transmit a copy of this resolution to the President of the Senate and to the Speaker of the House of Representatives of the Congress of the United States, and to the Federal Works Administrator and the Commissioner of Public Roads of the United States, respectively.

istration, assisted by the U. S. Bureau of the Census, and has been conducted in 54 cities in 26 states. It uses a scientific sampling basis.

Retiring AASHO President, M. J. Hoffmann chats with Commissioner Thomas H. MacDonald, U. S. Public Roads Administrator

"By interviews with people in their homes, on the streets and at destination points, the survey discovers how many trips are made each day, where they start, where they end, their purposes, and type of transportation. Other data are gathered on where people work, their recreation habits, and parking requirements.

"The surveys have disclosed that in most cities, up to half of the traffic found in the downtown area is there only because the layout of the street system has forced it to be there, adding to the general congestion and delaying its own travel.

"Other typical findings are:

"In the average city, three-quarters of all automobile trips are made by drivers having both origin and destination within the city, but traffic coming into the city from outside accounts for 40 percent of the city's total vehicle mileage;

"Short-time parking spaces can't be used to more than 80 percent of their theoretical time capacity, because of time lost in parking and unparking;

"Downtown department stores under present traffic conditions find one parking space used by their patrons for every 1,000 square feet of floor area, compared to one for every 300 square feet for suburban shopping areas.

"The trouble is that too many surveys are made and then not fully used in planning city traffic facilities.

"Of the 54 cities where the new surveys have been made, reluctantly it must be admitted that the uses made of the data have been disappointing.

"The most commendable job, and one that stands conspicuous in its field is the survey in Fort Wayne, Indiana, recently reported by the Indiana Highway Commission.

"A 10-year program for expressways, parking facilities and other improvements to meet Fort Wayne's future highway transportation needs has been completed."

Freeways are essential to safety, David M. Baldwin of the National Safety Council, told the Committee on Planning and Traffic Engineering.

Baldwin made known the conclusions derived from a joint research project of the Council and the U. S. Public Roads Administration. The report covered 9,000 traffic accidents in 10 states and records of 4,000 miles of major highways.

"Two-lane pavement can safely carry relatively light volumes of traffic," Baldwin said. "But the accident rate increases as the volume of traffic increases up to the point of congestion. On roads carrying more than 9,000 vehicles a day, the accidents actually decrease because of the congestion.

"The rate goes sky-high on three-lane highways; about three times higher than the accident rate on four-lane highways. Generally speaking, curves in a road are not more hazardous than straight roads But the worst record is found on sharp curves. The width of the pavement is a major factor in accidents. The accident rate on pavements less than 18 feet wide was

## RESOLUTION No. 3

FOR CANCELLATION OF RESTRICTIONS ON DISTRIBUTION OF CONSTRUCTION EQUIPMENT

WHEREAS, The rehabilitation and expansion of the highway systems of the Nation are vital to the continuing health, safety and welfare of the people of the nation; and

WHEREAS, The various states and subdivisions of government are prepared with plans and finances to commence the reconstruction and construction of these transportation arteries but are prevented, in part, from so doing by the insufficiency of adequate construction equipment which, while being manufactured, is not freely distributed to the construction agencies capable of performing these operations of highway restoration; and

WHEREAS, One of the impediments to the free flow of this needed construction equipment from the manufacturer to the constructor is the restriction imposed by regulations of the Civilian Production Administration concerning priorities and methods of distribution for such equipment; and

WHEREAS, It is the opinion of the American Association of State Highway Officials, in meeting assembled, that free and untrammeled operation of equipment manufacturing and sales processes will make possible the acquisition by the construction industry of the equipment required for this necessary work; now, therefore, be it

RESOLVED, That the American Association of State Highway Officials recommend to the Civilian Production Administration and other governmental agencies the immediate cancellation of all rules, regulations, orders, directives and any other restriction on the free manufacture, sale and distribution of construction equipment and machinery and its component parts; and be it further

RESOLVED, That copies of this resolution be sent to the Civilian Production Administration and to other appropriate federal agencies having jurisdiction of the distribution of such equipment.

50 percent higher than on those 20 feet wide or wider."

Thursday was devoted to meetings of the Committees on Materials, Uniform Accounting, Road Construction, Planning and Traffic Engineering, Road Design, Use of Radio in Highway Departments, Right of Way, Highway Research Activities, and Legal Affairs, together with a panel discussion on State-wide Planning Surveys in the afternoon.

Director of Public Works C. H. Purcell, who is also Chairman of the California Highway Commission, extends to the AASHO the greetings of Governor Earl Warren, who was prevented from attending the meeting by official business

At the meeting of the Committee on Legal Affairs a paper on the subject "Controlled Highway Access Court Decisions and Their Effect on Actual Right of Way Acquisition" was read by C. C. Carleton, Chief Attorney of the Department of Public Works of California.

An unusually large number of attorneys and right of way representatives from the several states and territories was in attendance.

Among the out-of-state counsel who participated in the discussions were J. M. Devers, Chief Counsel, Oregon State Highway Commission, Chairman of the group; Judge L. E. Boykin, Solicitor of the Public Roads Administration, Washington, D. C.; C. Nils Tavares, Attorney General of the Territory of Hawaii; Tom W. Holman, Chairman, Washington State Highway Commission; and H. A. Cohen, Contract Attorney of the Highway Department of the State of New York.

The practical effect of recent court decisions on the field work of acquiring lands and right of way for modern highway development was analyzed by the various speakers.

Numerous other legal topics of interest to the gathering, and relating to highway matters, were presented for open forum discussion.

Also, it was the consensus of the meeting that plans should be formulated whereby the Committee on Legal Affairs could be of more all-year service to the American Association of State Highway Officials and its members.

The thirty-second annual meeting was officially adjourned at noon, Friday, December 20th, following the reading of annual reports by the Executive Secretary, Treasurer, and Auditing Committee, and the election and installation of new officers.

During the afternoon the delegates and their ladies were taken on a sightseeing trip, which included a ride over freeway construction projects in Los Angeles, through the industrial area, oil fields, orange groves, and to the beach cities and Los Angeles proper. The inspection concluded with a trip over the Terminal Island Freeway now under construction and a buffet supper at the Riviera Club.

# Designs for Interchange of Traffic Streams

By A. M. NASH, Engineer, Surveys and Plans

**Designs for the interchange of highway traffic streams were discussed in the following paper read by A. M. Nash, Engineer, Surveys and Plans, California Division of Highways, before the Committee on Road Designing of the American Association of State Highway Officials in session in Los Angeles.**

IN PREPARING this paper, I have tried to keep constantly in mind the fact that I would be addressing an audience with a rather comprehensive knowledge of the subject we are considering.

A. M. Nash

Nevertheless, the fact that a discussion on types of interchanges has been scheduled for this meeting, suggests of itself, that all of us feel there is still room for exploration and discovery in the field.

While there are many designs for the interchange of traffic streams (the minds of design engineers being very fertile in this regard), basically, there are only two distinct types—the direct and the indirect. Interchange designs are either pure examples of these types, or what is more often the case, hybrid designs using elements of both.

### TWO TYPES OF INTERCHANGES

By "direct interchanges" we, of course, refer to the types which are designed to provide the most direct and natural movement for all segments of traffic without conflict with any of the major movements. Invariably this type requires the provision of multiple structures.

By "indirect interchanges" we refer to the types in which circuity in the paths of the interchange roadways are considered to satisfy requirements. The typical indirect interchange can be accomplished with a single structure, the classic example being the clover-leaf.

An appreciable number of various forms of interchanges have been built in California; but a much larger number exist only on our drawing boards or as a part of completed plans which have not yet been placed under construction, or are now in the process of construction but are not yet in service.

### HARVEST OF WAR

This condition is a result of the almost complete shut down of highway building during the war years.

As interchanges are most frequently required and used in freeway or parkway design, and as this phase of highway development was just coming into widespread use in this State at the beginning of the war, the prohibition against highway construction permitted us to conceive and plan but not to build.

The harvest from these four years of arrested highway development is now being reaped in an appalling record of traffic accidents and deaths on our highways.

I have every reason to believe that practically all the highway design departments of the various states find themselves in a similar position to ours, hence, our discussions here will deal, to some extent at least, with types of interchanges which exist as plans rather than as actualities proved in traffic service.

### COMMITTEE HELPFUL

I believe we are fortunate indeed to have had the benefit of the analytical thinking and constructive deliberations of the members of the Special Committee on Administrative Design Policies of this association. Their efforts have resulted in the publication of a series of design policy pamphlets which have been of inestimable help and guidance in improving our approach to the design problems with which we have been confronted in preparing our designs for postwar construction.

As a result, I am firmly convinced the designs and plans which we have prepared during the war years and which are now in process of construction into actual traffic service facilities, are immeasurably better conceived than would otherwise have been the case.

I want to confess that, in my opinion, few of the traffic interchanges which were designed and built in this State prior to the war, are completely satisfactory.

I suspect that most of you would report a similar opinion with respect to your experience in your State in the same period.

### FORMATIVE STAGE OF DESIGN

This was a natural result, for we were in the formative stage in this phase of design and were learning by trial and error the basic truths on traffic behavior in connection with this problem as well as educating the driver into new action patterns for proper use of the facilities.

I am not so naive as to believe we have found all the answers, or that further driver education is unnecessary. We shall, I hope, continue to experiment, to analyze, and to learn from close observation the mistakes which should not be repeated.

With this preamble, I would like to discuss with you two forms or types of interchanges which were evolved to fit peculiar and rather difficult conditions of freeway interchange design here in the Los Angeles metropolitan area.

### FOUR-LEVEL STRUCTURE

I have chosen my examples in this locale for the specific purpose of permitting you to supplement our discussions here with a visual examination of topographical conditions at the sites, for they are close to the scene of this meeting.

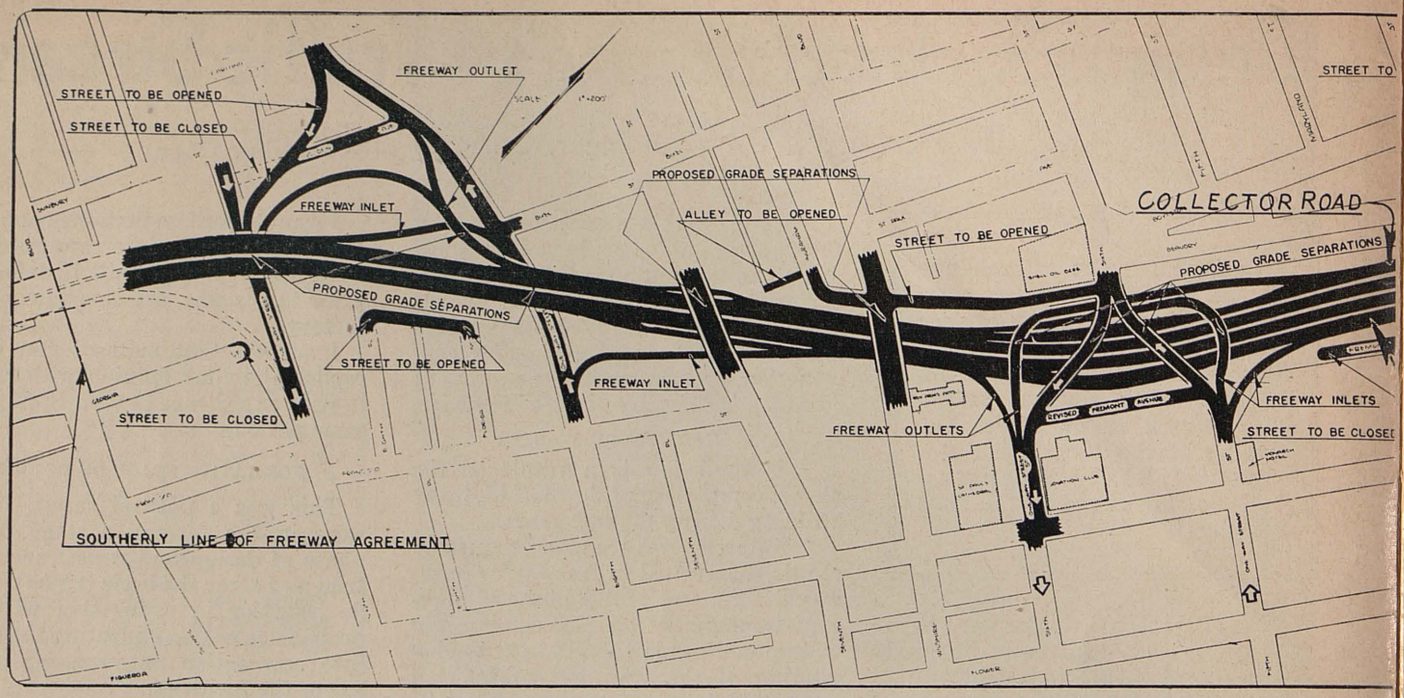
The first of these is the so-called four-level structure, a scale model of which is on display at this convention.

Here we have the meeting place of two major freeways, the Hollywood and Harbor Parkways.

The site location has severe limitations, and the traffic volumes desiring to interchange will be very high.

Many designs were studied and discarded as analysis disclosed their deficiencies, before the present adopted plan was evolved.

As you may note by inspection of the model, the major element in this solution was the decision to expand the interchange in the vertical plane to accommodate the interchange move-




**This sketch delineates the section of the Harbor Parkway west of the four-level structure between First a be discharged and collected the largest possible volume of motor vehicles at concentrated peak periods. The sketch practicable, for outer highway use and for local interchange approach to ramp and crossover facilities. Many tim**

ments. By separating the movements in this fashion, the following desirable attributes are attained.

NO GRADE CROSSING CONFLICT

The design provides complete interchange of all movements without grade crossing conflict. Through traffic on the two freeways has preferential roadways with no deviation from straight courses. Right turns are natural movements in their respective quadrants, while left turns are required to make only the minimum deflection from straight paths. A studied feature of the design is the symmetry and uniformity of all roadways from points of departure to points of convergence. Every movement, considered by itself or viewed in relation to the whole layout, is simple and uncomplicated. A driver must make but one choice to select his desired path and thereafter his course cannot possibly be distracted from its destination. Moreover, the driver departs via right-hand lanes and enters into right-hand lanes, a very desirable requirement.

Local conditions dictated this eventual solution as to form of interchange, the type being direct throughout because of the large volumes of expected traffic.

The intersection of these two major parkways was inflexibly fixed by approach conditions through lines of least resistance in one of the most highly developed sections of the city. In addition, the intersection area was limited to the minimum because acquisition of rights of way entailed destruction of large buildings and was unusualy expensive. Adjacent streets of importance had to be preserved and fitted into the ultimate plan, and ground topography was irregular. Traffic would be capacity loads in all quadrants and would demand complete interchange provisions.

These factors dictated the solution, for everything was against lateral expansion with its large space requirements, and we feel the adopted design was a happy one and admirably fits the site.

The Harbor Parkway also furnishes another example of an unusual solution of an extremely complex problem in interchange design.

HARBOR PARKWAY

To illustrate better the factors involved, I have had this sketch prepared which I hope all of you can see. It delineates the section of the Harbor Parkway west of the four-level structure between First and Ninth Streets.

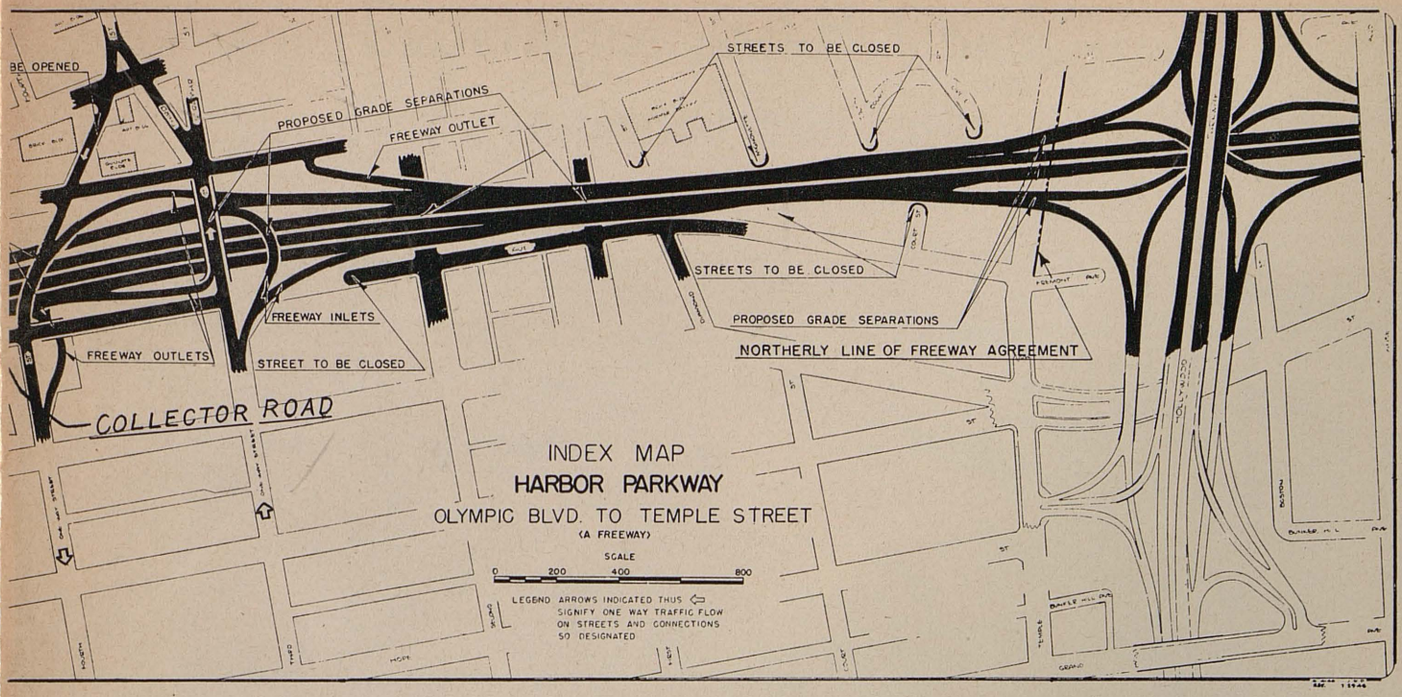
This area comprises the heart of the business section of Los Angeles, where will be discharged and collected the largest possible volume of motor vehicles at concentrated peak periods.

Because of the close spacing of the intersection streets, it would obviously be impossible to provide interchanges at each street with traffic flow in both directions thereon. The number of ramp connections required would have been a maze, with indirection and circuity of travel the rule, let alone the lateral space requirements in an area of extremely high property values. Moreover, it would have been impossible to maintain the desirable maximum of four lanes in each direction on the freeway proper.

COOPERATION OF CITY

The first step in the solution was to obtain the cooperation of the city in restricting the main cross streets in the area to one-way traffic, alternately east or west on successive streets.

The next problem was to provide for the entrance or exit from the freeway, of the huge peak loads expected without too severely penalizing the traffic on the freeway. Our solution has been what we have termed a "collector" road, lying parallel to the freeway proper, into which the traffic will first




**nd Ninth Streets in Los Angeles. This area comprises the heart of the business section of Los Angeles, where will illustrates one of the adopted principles of the California Division of Highways of utilizing existing streets, where s this practice affords direct movement in lieu of artifices that must be of an indirect character.**

enter, or exit, and adjust its speed either faster or slower as the case may be, before proceeding into the fast-moving freeway traffic stream or into the slower-moving traffic on the desired one-way street leading to its destination. These "collector roads" thus will serve as magnified speed-change lanes, as well as adjusting and smoothing the flow of the traffic streams entering and leaving the freeway, with a resulting minimum of conflict with the traffic already in the freeway traffic stream.

The ramp connections are to and from these "collector roads," which have all the elements of the freeway proper.

Another desirable element which this design provides is the longer spacing between successive entrances and exits to and from the freeway than would have otherwise been necessary by use of the usual conventional designs.

Here again, we find design limitations forcing the designer to look beyond the conventional for a solution to his problem, and in the process, evolving what, we believe, is a far better answer than could have been produced by too rigid adherence to the usual approach.

This sketch, incidentally, illustrates one of our adopted principles of utilizing existing streets, where practicable, for outer highway use and for local interchange approach to ramp and crossover facilities. Many times this practice affords direct movements in lieu of artifices that must be of an indirect character.

I would also like to call attention to the fact that the system of overpasses, as determined by ground elevations, places the crossing streets in favorable position for readily signing and directing movements from and to them. The spacing of ingress and egress points for road connections and dispersals, with one exception, allows plenty of time for the motorist to pick up the directions, one at a time.

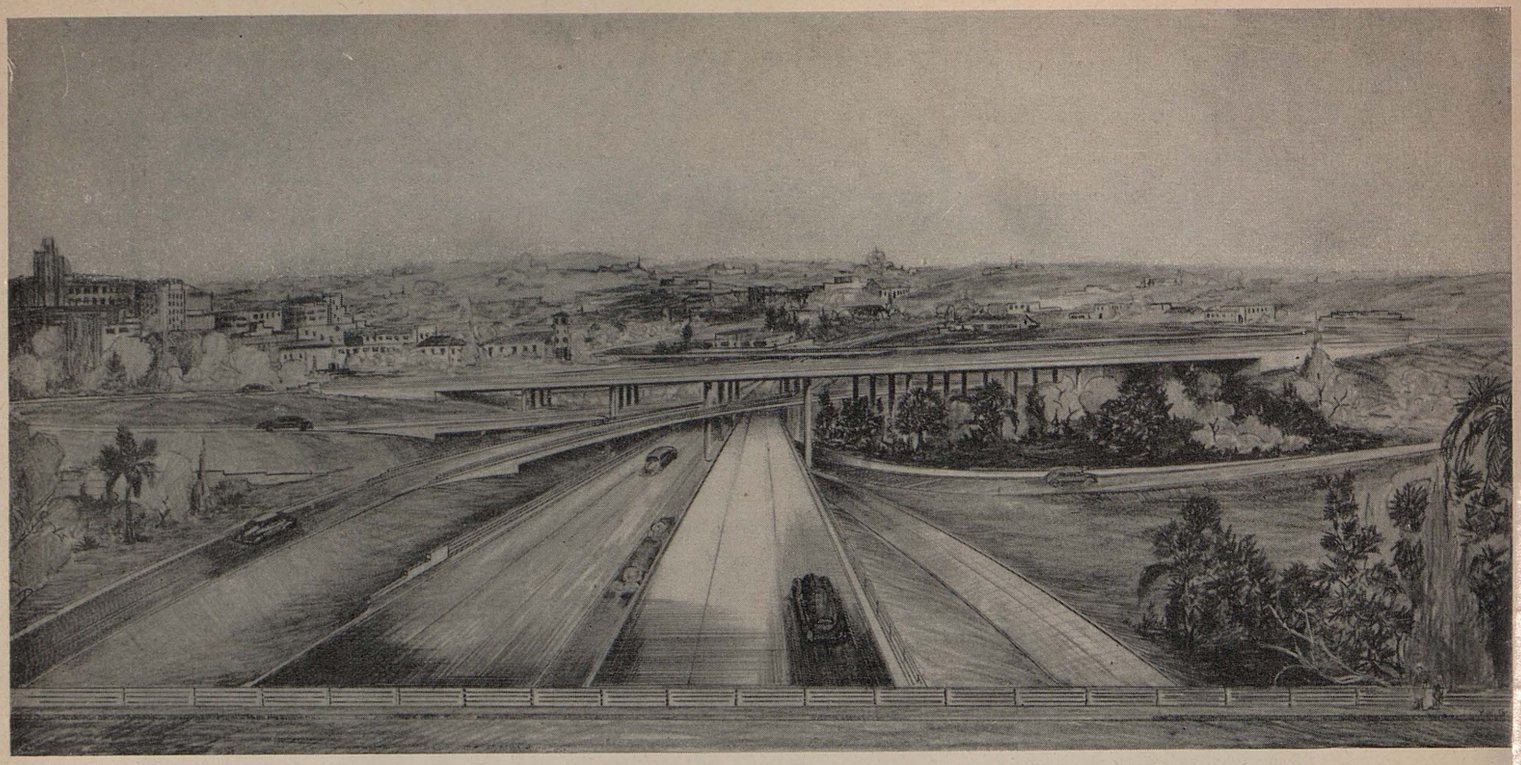
The one exception is for a relatively light traffic movement, where the users will be mostly "repeaters" and, hence, this departure from desirable practice is not considered sufficiently serious to justify the large expense required for its elimination.

While I am on this subject of signing, it is our opinion that the perfection of an interchange design can often be judged by determining how readily and completely it can be signed. In my judgment, it is a sure indication of weakness in design if there is difficulty in properly placing direction markers. It is a basic rule of good signing practice not to give a driver more than one instruction at a time and the space between signs should allow him time to assimilate and respond to one instruction before giving him another.

A frequent design error, which we try to carefully guard against, is to allow the sense of proportion to be lost in drafting to a large scale and neglecting to check on distances between points of traffic divergence. Distances between turning points or junctions of ramps and roadways must always be checked against design speed so that the driver may read, comprehend, and act as he goes forward.

Careful regard for aiding the public in interpreting the proper use of highway facilities should also include a studious adherence to uniformity of design, especially uniformity in interchange features. Uniformity of treatment must be studied for consistency of approach and application over the entire route rather than with regard to one site irrespective of any other site.

It is recognized that complete uniformity is often impossible at reasonable outlay because conditions at sites differ; but if the fundamental verity of simplicity be our guiding star, it is my belief that uniformity from the driver's point of view will usually result.



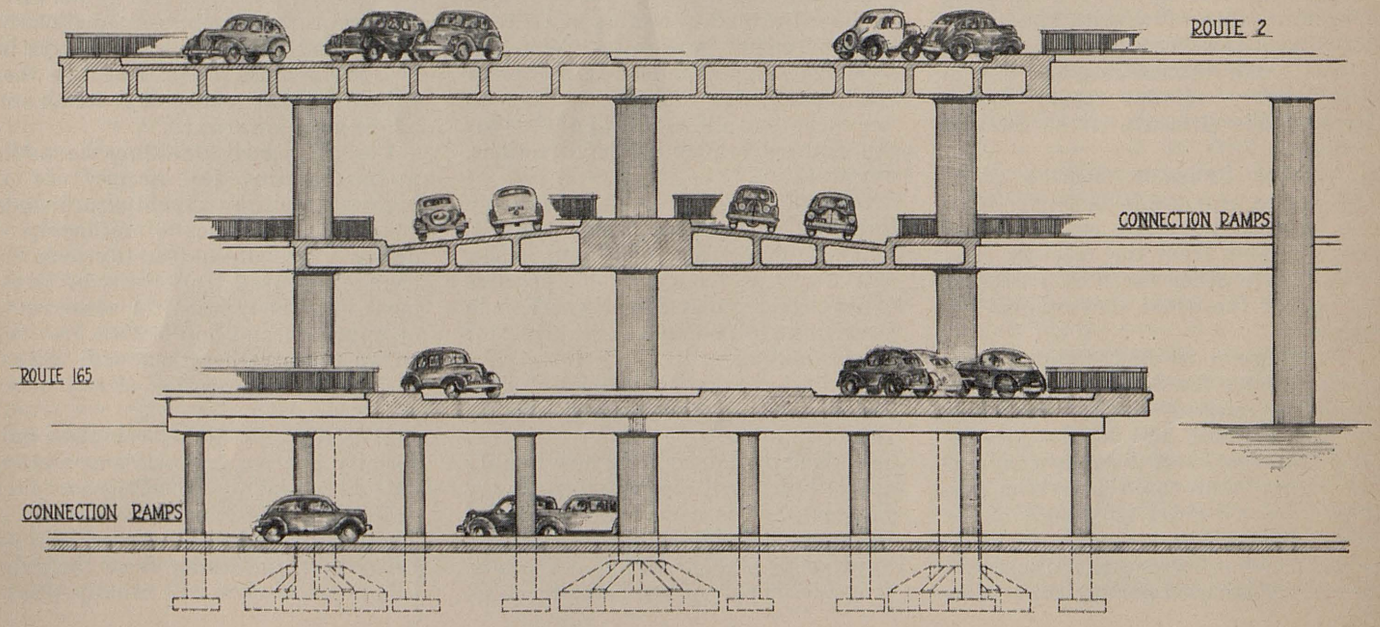
Artist's sketch of proposed 4-level grade separation in Los Angeles of State Highway 165, Arroyo Seco-Harbor Parkway, shown as the broad six-lane divided highway in center of picture and Route 2, Hollywood Parkway, crossing the picture at top level. The other roadways are traffic interchange connections with the two major arterials.

Simplicity of design should be the goal of every interchange design solution and will shine as the sun from every exhibit we see illustrating a commendable project.

In this regard, many otherwise simple and sound designs are too often cluttered up and unnecessarily complicated by the designer's attempt to take care of a minor and unimportant traffic movement that could just as well be required to occur at some other place with only small inconvenience resulting to a limited number of drivers.

Complications often arise from an attempt to extend the "Freeway Principle" to connections to and from city streets or local roads. In many instances the elimination of left turns or cross movements on local streets or roads at the terminal end of ramp connections results in costs out of proportion to the benefits afforded.

Cross section sketch of 4-level structure showing traffic on two major highway routes and interchange ramp connections crossing at one point



# California Experience and Practice In Highway Pavement Foundations

By R. M. GILLIS, Construction Engineer

**The following paper was read before the Committee on Road Construction at the American Association of State Highway Officials meeting in Los Angeles by R. M. Gillis, Construction Engineer of the California Division of Highways.**

THIRTY years ago this State was laying four-inch pavement on native soils or existing roads, about the only base preparation being to scarify and roll the base. After 10 years or so these pavements were broken enough to cause comment and a complete survey was made by the Bureau of Public Roads and a comprehensive report made by Dr. Hewes. An interesting point brought out by this survey was not the number of pavement failures but rather the number of miles that were still in useable condition. However, it was definitely recognized that both pavements and foundations would have to be more substantial.

R. M. Gillis

In studying this problem, the Laboratory, under the direction of Mr. T. E. Stanton, developed the California Bearing Ratio test. Most of you are familiar at least with the general principle of this test, and we have not the time to go into it. By accumulating a record of the C.B.R. values for bases of failed pavements and bases of sound pavements there was built up a graph to show that thicknesses of base and surface might be expected to carry traffic.

### TEST TRACK EXPERIMENTS

In 1940 this study was amplified by a test road and the Laboratory is just now completing studies on a second test track, working to determine the number of load repetitions that would be required to produce failure for a given thickness of base and surface. Also, studies are being made on other possible tests to measure the supporting power of soils and consideration is being given to other soil properties that possibly should be measured.

Because of its experience with increasingly heavy planes, the U. S. Army has made and is making extensive tests along the same lines but with far heavier loads than are permitted on highways. One of these tests is now nearing completion at Stockton, California. They should give us valuable information on our problem.

### TRUCK TRAFFIC INCREASES

Studies by the Public Roads Administration confirm the belief that trucks of the larger sizes are more numerous in California than in other states. In 1944, for-hire trucks received two-thirds of every freight dollar in California. From 1930 to 1940, commercial vehicles (trucks and buses) increased from 99,387 to 248,388, or 150 per cent. The average maximum axle loading increased from 6,622 pounds in 1936 to 11,995 pounds in 1944. During the war years, the total traffic on California highways dropped to 70 per cent of the 1941 figure, while at the same time the number of trucks was greater (this does not include military convoys). It should also be noted that since many of these trucks have more than two axles, the increase in loaded axles is still greater. With the roads taking this kind of punishment, you will understand why we are worried about pavement foundations.

As the traffic and the wheel load repetitions have increased, an effort has been made to keep pace with the design. Among the points along this line that might be mentioned are:

1. **Requirements have been raised for coverage of ground with a given supporting capacity.**
   - (a) **C.B.R. test has been stiffened.**
   - (b) **The thickness of base and surface required for ground of less than 5 C.B.R. is now 24 inches. The base may be secured from selected cuts on the job, from a pit outside the limits of the contract, from a commercial source, or from a combination of these sources.**
   - (c) **A few years ago, we accepted 20 CBR as adequate immediately under PCC pavement; we now try for at least a 50 CBR. Where 50 CBR was formerly accepted under A.C., an effort is now made to get 80 CBR (the equivalent of crushed rock).**
2. **The Plasticity Index has been added as a requirement for base material—generally less than 6 being specified.**
3. **Compaction requirements both for the base as well as material below it have been increased.**
   - (a) **Standard specifications now require 90 percent relative compaction for all fills; in addition the top 2½ feet below grade is placed in 4-inch layers which with most materials will give a relative compaction of over 95.**
   - (b) **In cuts where material has less than 90 relative compaction, the cuts are rolled or if necessary are taken out and replaced in 4-inch layers to insure compaction at least 2½ feet below profile grade.**

### FREEWAY CONSTRUCTION

It is hoped that you will be able to take the trip scheduled to go over the Santa Ana Freeway and the Terminal Island Access Road contracts now under construction. On the Santa Ana Freeway, still in the grading stage, the contract calls for 8-inch PCC pavement (with no expansion joints); under the pavement will be 6 inches of untreated rock, 2-inch maximum size, 50 CBR, less than 1 percent expansion and less than 6 P.I.; under the rock

(Continued on page 28)

# Evolution of Culvert Design

By R. ROBINSON ROWE, Senior Bridge Engineer

**The following paper was read at the AASHO meeting by Mr. Rowe, California Division of Highways.**

THE CULVERTS I remember as a boy in Michigan were rather small stone arches built by township road commissions from plans they carried in their heads and passed on from generation to generation. The ingredients were lots of stone and horse sense assembled in a stout manner. If there were blueprints and engineering behind the designs, the matter was a township secret.

Since then I have wondered about the origin of culverts, just as I wonder now about the future of them. The best information I have is that bridges and culverts, by those names, developed in England and that they borrowed the name "bridge" from the Scandinavian and "culvert" from the Norman French. The Normans called it a *couluerre-vertie,* the *couluerre* being a side gutter and the *vertie* showing that it had been turned transversely. The culvert, then, is simply a cross-gutter. That is, it was; we all know how it has been growing lately.

### TRANSFORMATION OF CULVERTS

The culverts I remembered were 12 to 15 feet long under one-way roads that dipped deep into gullies and barely cleared the keystones. Most of the traffic was horse-drawn and there was no fuel tax on hay to pay for high roads over the gullies.

Culverts have grown as highways have grown. At first the growth was moderate and highway departments adapted railroad designs, both box and arch culverts, to highway needs. Then, as earthwork became cheaper and cheaper and traffic demanded smoother alignment and grades and backed the demand with more and more money, the culvert was buried deeper and deeper in the gully embankment. For every foot the highway was widened, one foot was added to the length of the culvert, but for every foot the grade was raised, the culvert grew by three.

**Lengthening the culvert was no great problem at first. We had standard plans, so that it cost no more to design one 50 feet long than 15 feet long. Supporting the weight of high embankments was a more difficult problem, for which the usual solution was a stout and safe but costly overdesign. The importance of cost increased with length. To reduce cost it became essential to determine more precisely the hydraulic and structural duty of the culvert.**

The evolution of the culvert is now in that phase and engineers in many of the states are devoting much time and thought to economy of design. This paper is limited necessarily to a very small part of the practice. First of all, it is limited to the practice governed by Bridge Specifications of AASHO, that is, to monolithic and sectional-plate structures. Second, particular attention will be given to the larger waterways under very heavy and compact embankments. Finally, more consideration will be given to hydraulics than to hydrology, and to earth loads than to stresses.

### HYDRAULIC DESIGN

Hydraulic design of culverts has been handicapped by a number of difficult hurdles. One of the highest is due to the inclusion of the study of hydraulics in the field of mechanical engineering, whereas the study of highways and bridges is in the field of civil engineering. Then the principles of hydraulics must be applied to a most complicated combination — debris-laden flow through a part-full conduit at varying depth and velocity.

The association's specifications require or strongly imply that such flow through a culvert shall be "without head." This archaic principle is still acceptable for short culverts, but for long culverts it is uneconomic and largely the cause of difficult hydraulic computations. Several years ago, California inquired of the other states and found that design "without head" was nearly universal, but that flow under head was very common and not particularly undesirable.

As this confirmed our observations, we have chosen to interpret this specification rather freely. The interpretation has been published, but a brief summary will introduce some further thoughts on the subject. We consider that frequent flow under head involves undesirable risk of blocking by debris or erosion at the extremities of the culvert and therefore require that flow will be without head for a 10-year flood. This requirement usually fixes the minimum waterway at the entrance.

### THE 100-YEAR DESIGN FLOOD

We then conceive of a 100-year flood as the real design flood. For this flood the culvert will usually flow full, so that hydraulic computations are simple, using the well known formulae of the University of Iowa. These computations determine stages and velocities at the extremities so that all appurtenances can be designed for the one extreme flow condition. Although the expression is overworked, we call this system "balanced design."

**Use of these two criteria will be illustrated by an example. Suppose the hydrologic study has concluded that the 10-year flood is 100 second-feet and the 100-year flood is 180 second-feet. Our chart shows that a 4 x 4 box culvert will admit 100 second-feet without head on the entrance.**

Suppose first that the natural gradient is very flat, so that the design flood of 180 second-feet will pond 8 feet deep at the entrance and that this is objectionable. For this flat gradient we ignore the first criterion and design the culvert with a constant section larger than 4 x 4 so that pondage is just tolerable.

### A GOOD DESIGN

Suppose next that the natural gradient is steeper, but less than the neutral slope of 0.009. The culvert will be filled throughout by the 180 second-feet and a constant 4 x 4 section will be a good design.

Finally, suppose that the natural gradient is much steeper than the neutral slope. The 180 second-feet will be ponded by the 4 x 4 entrance, but drop

just inside the entrance, and the rest of the barrel will not be filled. In that case, a 3 x 3 barrel with a 4 x 4 tapered entrance might be adequate and much cheaper.

This procedure is most economical for long culverts, usually under high fills, for which barrel efficiency is more important than entrance efficiency. The proportioning must be done carefully; if the barrel is too large, the cost of the unused waterway will be large; if too small, the cost of enlarging it will be very great. There will also be contingent problems at entrance and outfall, which will be discussed later.

### ALTERNATIVE INVERTS

We are studying another difficult problem in barrel design—the best shape for transport of mineral detritus. In our new standard box culverts, we have provided three alternative invert sections for particular situations.

The regular invert is a flat slab without corner fillets. This is the cheapest construction and is satisfactory for clear water—even for turbid water if there is a fair gradient and good get-away.

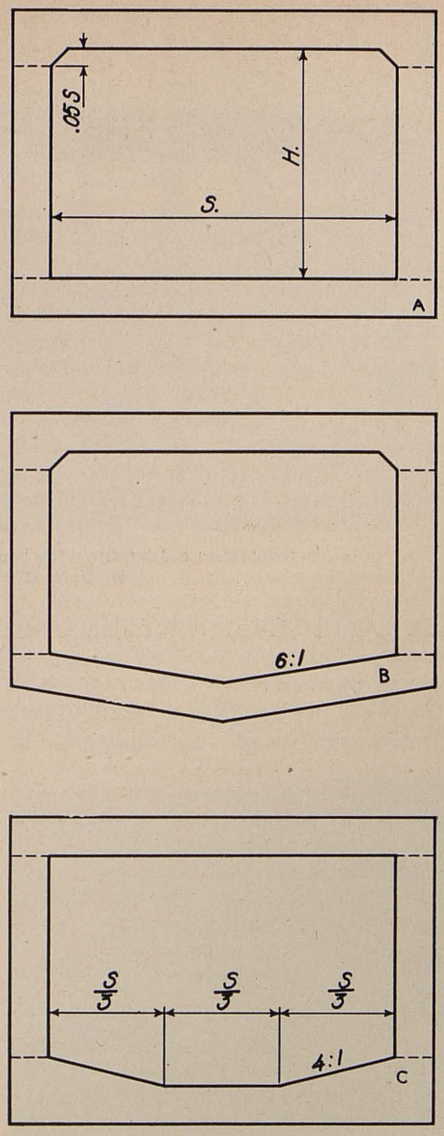
However, if turbid flow decelerates in the barrel because of flat gradient or poor get-away, culverts are clogged by sedimentation, especially on falling stages. Maintenance of such culverts is expensive and there is hazard of great damage if another flood occurs before the culvert has been purged.

The V-invert has been widely used for many years as a partial solution of the silt problem. On the falling stage, flow is deeper in the vee, maintaining a velocity that will transport more of the detritus through to the outfall. We provide the V-invert as a second alternative.

### TRAPEZOIDAL INVERT

The third is a trapezoidal invert for boulder-laden streams. When we used flat inverts for such streams, the boulders would be stranded during the falling stage. As the stage continued to fall, finer and finer detritus is deposited around the boulders, building a compact bar that may resist later floods. In some cases V-inverts were used for such streams and the heavier boulders were transported by sliding or saltation along the bottom of the vee, wearing a deep groove in the invert slab.

The trapezoidal section is level for the central third of the invert and inclined with 4:1 slopes on the outer




**Alternative standard inverts—(a) Flat invert for nonsilting streams; (b) "V"-invert for silting streams; (c) Trapezoidal invert for heavy bed loads**

thirds. This slope can be struck with a screed. We consider this experimental, but expect it to maintain fair velocity on the falling stage and disperse erosion over the central third.

Curved alignment of a culvert raises the question of superelevation required to distribute boulders laterally and prevent erosion of grooves at the lower corners of the culvert. Ordinary formulae will not solve the problem because of the greater density of the boulders. Model studies will be required. Observations made by the Hydraulic Section of District VII in a model built for another purpose have given us some clues to the answer. We have also tried to dodge the issue by using a curved invert section, so that the concentration of boulders would move laterally as stage rose and fell, which provides some measure of dispersion of wear.

### FILLETS DESIGNED HYDRAULICALLY

It has been mentioned that fillets are not provided at the lower corners of the barrel, these corners not being considered rigid. At the upper corners we provide the usual fillets and the question of proper size was raised during the design. Since we do not specify a structural value to such fillets, it occurred to us to use hydraulic values by proportioning the fillet to obtain maximum hydraulic capacity. Up to a certain limit, reducing the waterway actually does increase its capacity because of the consequent reduction of hydraulic radius. In terms of span S and depth H of the rectangular box section, the fillet dimension should be:

$$F = \frac{kSH}{S+H}$$

where k is 0.113 for triangular fillets and 0.182 for circular fillets. For standard culverts with triangular fillets, we use the approximation F=0.05S to the nearest inch.

### ARTIFICIAL ROUGHENING

Sometimes instead of increasing the hydraulic capacity we wish to diminish it to reduce the energy in the stream at the outfall. Our experiments in this field have been published* and we have nothing to add at this time, but the paper would be incomplete without a brief summary.

If culvert gradient is steep, hydraulic efficiency would call for a very small waterway and very high velocity. There is a reasonable limit for velocity, but if we try to reduce velocity by increasing waterway, the barrel flows part full with velocity still high. The ideal flow regimen would be a filled waterway for most of the culvert, with water surface dropping until there is critical flow and a minimum of energy at the outfall.

Several expedients are workable—roughening the interior surfaces of the culvert, laying the invert grade as a series of long steps, or constructing weirs or baffles on the invert. We have tried the first two, being warned that weirs or baffles would trap debris.

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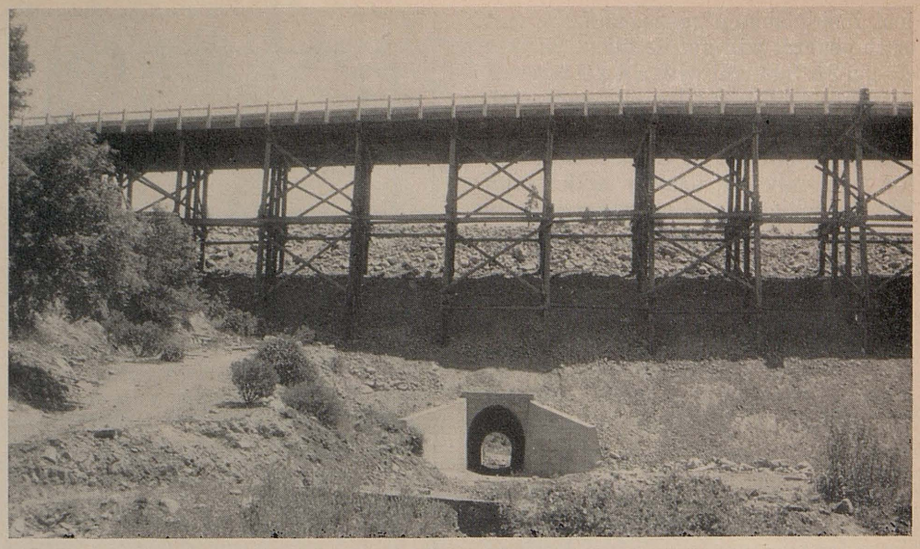
* Proceedings, Highway Research Board, 1943, or California Highways and Public Works, November, 1942.

CONFLICT OF HYDRAULIC AND STRUCTURAL PRINCIPLES

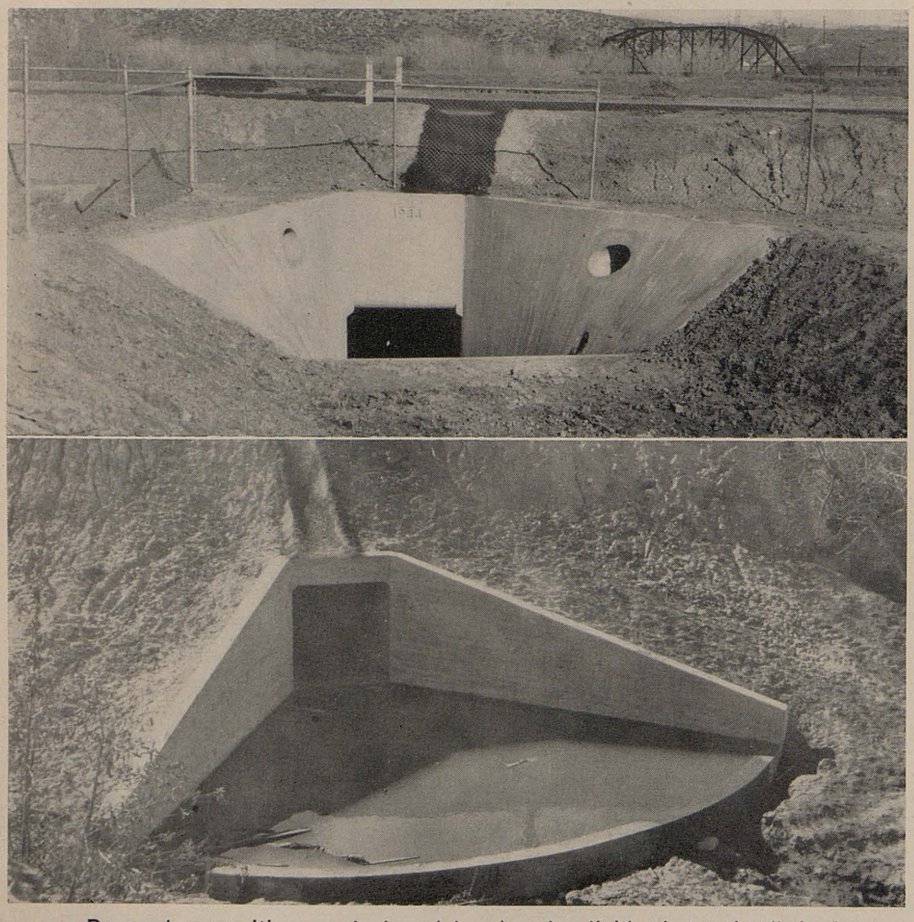
As culvert barrels are designed larger and larger, we find a conflict between hydraulic and structural principles. The shape of the cheapest barrel, say a square box or a high arch, makes an unnatural and dangerous waterway. An example will make that clearer.

Suppose we are designing a box culvert for 1,000 second-feet on a gradient that will support a velocity of 10 feet per second and the natural flow has a depth of five feet. The hydraulic engineer suggests a 20 x 5 box culvert, but the structural engineer points out that a 10 x 10 box would provide the same waterway at much less cost. However, to use the full area, the stream backs up at the entrance and the extra five feet of energy head carried through the culvert may be very destructive at the outlet. If the structural engineer had suggested a high arch culvert, the extra energy would have been still greater.

On special designs, the hydraulic and structural engineers can work out the conflict of principles together. For standard designs we have set up an arbitrary control of waterway shape. In effect, we say that a large culvert barrel consists of two segments, the lower segment being the usable waterway and the upper segment being a structural void. Thus, in the example, the 10 x 10 box has a "rated waterway" of only 75 square feet and would not satisfy the design conditions. The same rule would show two acceptable alternatives, a 12 x 9 box or a 13-foot arch. We express the rule in an empirical formula and show the rating for large standard culverts on the layout drawing.



Replacing old bridge with high-arch culvert at Seaman's Gulch on U. S. 299 in Shasta County



Drop entrance with warped wings (above) and radial bucket outlet (below) on State Route 79 in Los Angeles County

ENTRANCES AND OUTFALLS

We are planning to design standard appurtenances for entrances and outfalls to fit the requirements of long culverts flowing at high velocity. Our ideas of these requirements have also been published and have been incorporated in some special designs. I will give a brief resumé only.

Foremost is the sobering thought that the economy of slenderizing long culverts under high fills is offset, in part at least, by the cost of the appurtenant structures. Alternative designs should compare costs of the entire structure, not those of barrels alone.

At the entrance, the extra cost may be large to prevent detention of detritus. Large drift must be screened from flow entering the convergent throat of a tapered culvert, or it will jam in the throat. Ponding at the entrance may cause deposit of bed load unless the wingwalls and apron form a sluiceway.

At the outlet, the problem is to dissipate the kinetic energy without damage to structure, embankment or downstream improvements. Flared outlets, hydraulic buckets, drops or bank pro-

tection can be used in many combinations.

For either end, we have found frequent use for a transition from the natural trapezoidal waterway to the rectangular waterway of the culvert, using what we call a "warped wingwall." Special designs have developed a wide variety of proportions, but good progress has been made in reducing the variety to a few standard patterns.

### STRUCTURAL PROBLEMS

The proportioning of structural sections of culverts differs little in principle from regular problems of bridge design except for the determination of design loads due to weight of overfill and pressure transmitted through the fill from live loads.

At first we were much concerned over inconsistencies in the partly empirical specifications of the association for live-load pressures and we took an active part, with others who were also concerned, in suggesting radical revisions. The failure of a culvert during construction led us to a new policy that eliminates much of the conflict.

This failure called our attention to the expediency during construction of allowing heavy earth-moving equipment to pass over fairly new culverts. For small culverts, we found that a legal live load on a bare slab was more severe than many feet of overfill and decided that all culverts, no matter what the overfill, should be designed for the bare-slab condition. This minimum design governs our new standards throughout most of the range of overfills in which live-load pressures were disputed. This matter, as you know, is being studied by a sub-committee, and we are still looking forward for its report. It cannot affect our smaller culverts, but may permit some revision of the larger ones.

### EARTH LOADS

**It has long been recognized that a culvert may have to support more or less earth than the weight vertically above it, but engineers have been slow to adopt theories of soil mechanics to rationalize their designs. It may be of interest to review some ideas on the subject as an introduction to our proposals.**

Our practice of 18 years ago allowed neglect of overfill above 50 feet. There was no published premise for this policy, but it was usually justified by a vague reference to arch action. The rule was the same for 2-foot spans and 10-foot spans. There was fair agreement that culverts as a rule were overdesigned and many designers felt safe in taking small liberties with load and stress specifications. Modern overfills were compacted to weigh 120 pounds per cubic foot, but the classical 100 is still widely used.

Dr. Marston of Iowa State College analyzed the problem and his theory is widely known and accepted. However, application of the theory has not been rapid. Briefly, he made it plain that the load on a culvert could be either more or less than the weight of the overfill prism, according to the relative settlement of this prism and the adjoining fill.

### VISUALIZING THEORY

One way of visualizing the theory is by considering vertical shear along vertical planes on each side of the culvert. If the overfill prism has settled more than the side fill, this shear is holding up part of the weight of the overfill prism, and vice versa. Marston related this shear to the location of a horizontal plane where this shear is zero; this is his plane of equal settlement. Its location is related to rigidity of culvert, elasticity of subgrade and compaction of sidefill and overfill.

Another way of visualizing it is to conceive of lines of zero vertical shear in the longitudinal section of the embankment. If the culvert settles with the embankment, these lines will be vertical. If the culvert settles more than the embankment, these lines will converge upward and join, perhaps in the shape of a bothic arch. In that case the load on the culvert is no more than the weight of earth under the vault, no matter how deep the overfill. On the contrary, if the culvert settles less than the embankment, the lines of zero vertical shear diverge upward, and the culvert may have to support an enormous load.

### STANDARD BOX CULVERTS

For standardization of box culverts, we have proportioned designs for the classical conception of the culvert supporting the overfill prism—that is, with vertical lines of zero shear. Then we have rated each design for the other two conceptions—converging and diverging lines of zero shear.

This is an application to box culverts of a principle used for concrete pipes for many years. For pipes of standard strength, the allowable overfill depends upon whether the bedding is *ordinary* or *first-class* or *cradled*. For box culverts it is just as logical to limit the overfill according to whether the subgrade is yielding or unyielding, and according to whether there is firm natural soil or backfill alongside the box to share the load.

For low fills, it is evident that the convergence or divergence of lines of zero shear will not have much effect on the culvert load. Therefore, it will not be economy to require expensive improvement of culvert subgrade. As fills get higher and higher, it will be more important to improve bedding and backfill at some expense.

### HIGH OVERFILLS

The objective, for high overfills, will be to assure greater settlement of culvert than of sidefill. Modern compaction technique assures good sidefill support, but the thought of yielding

(Continued on page 28)

### RESOLUTION No. 4

**ADJUSTMENT WITH VARIOUS FEDERAL AGENCIES ENGAGED IN FLOOD CONTROL, NAVIGATION AND OTHER ACTIVITIES**

WHEREAS, Many federal agencies have been authorized by Congress to engage in activities to develop natural resources of this Nation and in the orderly development of these natural resources it becomes necessary to construct works for navigation, flood control, power, irrigation and other projects; and

WHEREAS, Such construction often involves the relocation, adjustment, utilization or reconstruction of state highways; and

WHEREAS, There appear to be existing laws, regulations or policies pertaining to the responsibility for these highway adjustments that in the opinion of the members of this Association are not equitable and fair to the states; therefore, be it

RESOLVED, By the American Association of State Highway Officials in convention assembled this twentieth day of December, 1946, that this association appoint a committee to confer with representatives of these federal agencies to work out an equitable solution of these problems and to determine what amendatory legislation or policies are required to correct this situation; be it further

RESOLVED, That copies of this resolution be delivered to the Department of Interior, the Department of Agriculture, the War Department and such other federal agencies as are or may be involved.

Newly elected officers of AASHO, left to right—R. H. Leavitt, Utah, Executive Committee; Clarence B. Shain, Washington, Regional Vice President; C. H. Sells, New York, Executive Committee; R. H. Baldock, Oregon, First Vice President; C. W. Phillips, Tennessee, President; G. H. Henderson, Rhode Island, Treasurer; Spencer Miller, New Jersey, Regional Vice President; and W. W. Polk, Illinois, Regional Vice President; F. Elgin Bayless, Florida, Regional Vice President, and F. R. White, Iowa, Executive Committee, are not in this group.

# Relation of The Petroleum Industry To All State Highway Gas Tax Programs

**Speaking in his capacity as President of the American Association of State Highway Officials, M. J. Hoffmann, Minnesota State Highway Commissioner, delivered the following address at the annual convention of the American Petroleum Institute in Chicago on November 12, 1946. A good part of it dealt with the very pertinent and potent subject of gasoline tax, its relation to the highway program, and the respective interests of the two groups thereon. Mr. Hoffmann's address was a rather straight-forward discussion of this important matter and one which California Highways and Public Works believes is worthy of widespread publication.**

AT THE outset I want to congratulate the members of your group, and the industry you represent, upon the excellent job of reconversion which you have done. When gasoline rationing was ended immediately following V-J Day, you were prepared to meet the increased demand for your products and you have continued to do so without interruption by strikes or shortages and with only a relatively moderate increase in retail prices.

The steady flow of motor fuel has been of particular interest to the members of the organization I represent, since the taxes you collect from the road user group supply a large part of the nation's highway funds. If the industries which furnish our road and bridge materials and equipment had been as fortunate in reconversion as you have been, the postwar highway improvement program would indeed be much farther advanced than it actually is.

It is hardly necessary to point out the mutual interest in highways between the petroleum industry and the highway administrators group. While it may be said that the gasoline tax is not a tax on the petroleum industry as such, but a tax on the road user which your industry collects for the state and federal governments, admittedly there is a direct relation between this tax and your business. If the tax is unreasonably high, it will affect your business adversly.

### MORE TRAFFIC; MORE GAS SALES

**On the other hand, if the tax is reasonable, and if it is properly expended for improving highway facilities, this will mean more traffic, more demand for gasoline, and in turn more revenue for more good roads to serve the public. In view of this interdependence, it is unfortunate that from time to time in various states, opinionated differences over highway tax problems have developed to such an extent as to jeopardize the friendly relations that should exist between your industry and the officials administering our highway system.**

Such controversial differences regrettably breed ill feeling. They contribute nothing toward a sound solution of the issues confronting us, in that they obscure the large and important areas in which highway officials and the petroleum industry share common interests and objectives.

I speak plainly on the point because I believe the best way to overcome difficulties of this kind is to get together and make a sincere effort to reconcile our differences. Frank and friendly discussion of any problem usually has a way of dissipating mistrust and misunderstanding, and of promoting greater mutual respect and cooperation.

### BETTER UNDERSTANDING

The Chairman of your Highway Policy Committee, Mr. L. S. Wescoat, I am sure shares the same viewpoint. His forthright and sincere remarks at the last annual meeting of our Association in Oklahoma City did much to open the way to an interchange of views and I hope a better understand-

(Continued on page 29)

# Ladies of AASHO Are Kept Busy

FROM the time they arrived in Los Angeles until the closing hours of the thirty-second annual meeting of the American Association of State Highway Officials, the ladies who accompanied delegates were kept busy attending entertainment functions arranged for them by the Women's Committee, headed by Clare P. Balfour, and Harold P. Norton, Chairman of the Entertainment Committee, under the direction of Convention Manager Frank C. Balfour.

Clare Balfour

Upon their arrival the visiting ladies were met by Mrs. Charles H. Purcell, Chairman, and Mrs. George T. McCoy, Vice Chairman, of the Women's Reception Committee, and the ladies of the Department of Public Works, Division of Highways, who composed the reception committee.

On Tuesday, December 17th, the ladies were tendered a luncheon at the Los Angeles Athletic Club. On Wednesday, they were taken on a sightseeing tour of Hollywood, including a ride through the Paramount Studios, Beverly Hills, Brentwood, Holmby Hills, Bell-Air, and to Santa Monica, returning by way of Wilshire Boulevard to the Beverly Wilshire Hotel for luncheon and a style show presented through the courtesy of the Downtown Business Men's Association of Los Angeles. Following the style show the group visited famous department stores on Wilshire Boulevard. Many of them attended radio broadcasts in Radio City Wednesday night.

Those who wanted to enjoy in full the program arranged for Thursday had to rise early in order to attend Tom Breneman's "Breakfast in Hollywood" as the guests of Raymond P. Day, Western Field Editor, *Contractors and Engineers Monthly,* and the California Ladies. Following the breakfast, the ladies were driven through Pasadena to the Huntington Library and Art Gallery and returned to the Biltmore Hotel headquarters by way of the San Gabriel Mission.

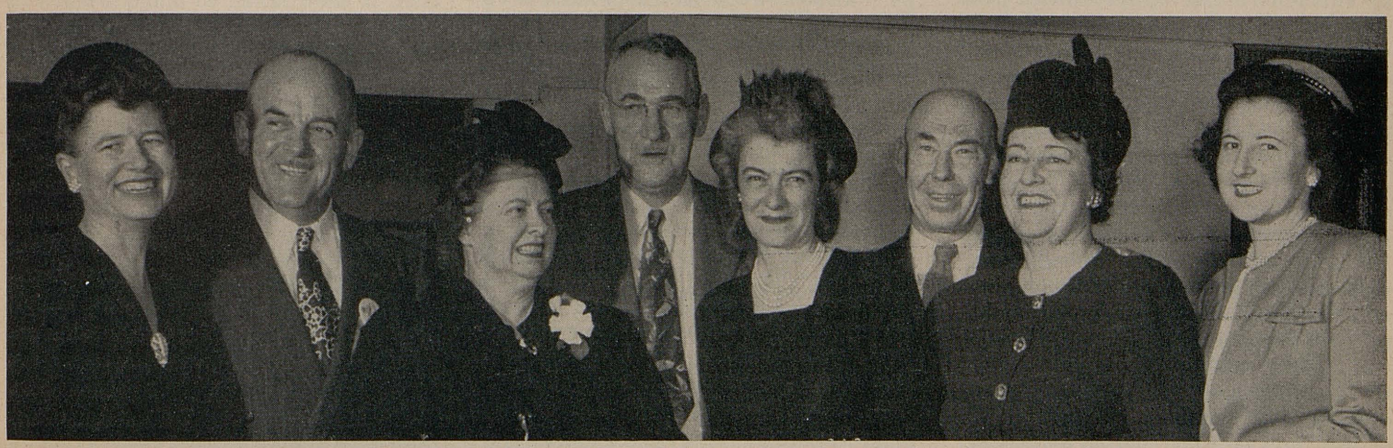
In addition to the special entertainment provided for them, the ladies of the AASHO were also guests at the dinner at the Earl Carroll Theatre Restaurant in Hollywood, the Banquet in the Biltmore Bowl on Thursday night and the sight-seeing trip which concluded convention activities on Friday.

## Honored by AASHO

THE TWENTY-FIVE Year Award of Merit was bestowed upon the following 12 officials of the California Division of Highways by the American Association of State Highway Officials. The award is for 25 years or more outstanding service in highway work.

Retiring President Hoffmann presents gavel to his successor, President Phillips, left

| | Years |
|---|---|
| C. H. Purcell, Director of Public Works | 33 |
| G. T. McCoy, State Highway Engineer | 29 |
| R. M. Gillis, Construction Engineer | 31 |
| Richard H. Wilson, Office Engineer | 31 |
| Charles H. Whitmore, District Highway Engineer, Marysville | 29 |
| George F. Hellesoe, District Highway Engineer, Eureka | 28 |
| S. W. Lowden, Acting District Highway Engineer, Bishop | 34 |
| F. W. Panhorst, Bridge Engineer | 25 |
| H. B. LaForge, Engineer, Federal Secondary Roads | 27 |
| Fred J. Grumm, Assistant State Highway Engineer | 25 |
| L. V. Campbell, Engineer of City and Cooperative Projects | 28 |
| R. E. Pierce, Headquarters Office, Sacramento | 31 |



This is the group largely responsible for the success of the 32d annual meeting of the American Association of State Highway Officials. Left to right—Asthore Clark; Frank C. Balfour, Convention Manager; Lucile Carleton; State Highway Engineer George T. McCoy, General Chairman; Marion Farrant; Harold P. Norton, Chairman, Entertainment Committee; Clare P. Balfour, General Chairman, Women's Committee; and Dorothy Williams. Larry P. Friel, Chairman of the Housing Committee, is missing from this picture.

# Retiring President of AASHO Reviews Problems and Hopes of Highway Builders

**President's Address, American Association of State Highway Officials, Los Angeles, California, December 17, 1946. By M. J. Hoffmann, Commissioner of Highways of Minnesota.**

THIS thirty-second convention of the AASHO marks a return to prewar custom. It has long been our practice in annual assembly to visit states in all sections of the country—north, south, east, and west. Through this means our members have had invaluable opportunity to observe firsthand, methods used and progress made in various localities in highway administration, construction and maintenance.

M. J. Hoffmann

Today we are indeed fortunate that present-day travel conditions have permitted us to assemble once again in the great State of California. Outstanding accomplishments by our host state during the year in legislative fact-finding studies, in highway planning, and in expediting a vast construction program, have indeed aroused our keen interest. They will, I am sure, afford us extracurricular opportunities over and beyond those to be derived from the convention proper.

At our last annual meeting we looked forward expectantly. Economic conversion was already in the making. We hopefully envisioned the early possibility of meeting urgent highway needs with an expanded postwar program. A mounting resurge in highway traffic found the states prepared to meet the challenge with adequate funds and road plans. Certainly public demands for highway improvements were not lacking—what with all the information that had been broadcast concerning the readiness of the states to embark on vast construction programs.

However, major disruptions in basic industries suddenly demoralized reconversion efforts. We recall now all too well the crucial situation which developed immediately following the close of our convention. Labor-management differences on a nation-wide basis at once blacked-out all possibility of early highway construction on an unprecedented scale. Yet in spite of the obstacles, the states generally proceeded to launch their postwar construction programs. From January 1 to November 30, 1946, contracts have been awarded for a total of approximately $479,000,000 for projects involving federal funds, or federal and state funds on a 50-50 basis. This amount of work constitutes a good start, but from the standpoint of highway needs, it admittedly is only a start towards rehabilitation of our Highway System.

Not many states since the end of the war have been so fortunate in awarding construction contracts as has been the State of California. Throughout the country local circumstances together with conditions affecting manpower, equipment, materials and right-of-way have varied greatly. As a result construction figures disclose a wide variation in the amount of highway work placed under contract in the individual states.

### A DIFFICULT PROBLEM

Highway officials, faced with increasing construction costs did not find it possible to use the same standards nationally in determining at what level of increase they were justified in awarding contracts or rejecting bids. They truly have been confronted with a difficult problem. Officials, faced with demands for urgent improvements, felt that they would be subject to criticism if they failed to make a start in meeting those needs. On the other hand, they felt that if they proceeded to award contracts at prices that might be construed as excessive, they would likewise be subject to criticism. Some felt too in certain localities that if highway construction contracts absorbed large quantities of manpower, materials and equipment such a development would lend strength to the belief held in some quarters that highway construction was interfering with the urgent housing program.

Highway officials in general appear to have followed a middle course. In conformity to restrictive conditions they have made a sincere effort to carry on justifiable road improvements. As circumstances necessitated they have altered their programs from time to

### RESOLUTION No. 5

"ACTION PROGRAM" OF PRESIDENT'S SAFETY CONFERENCE

WHEREAS, This association and its members are unreservedly pledged to support all sound measures for greater street and highway safety; and

WHEREAS, A balanced "Action Program" to this end was formulated and adopted in May, 1946, by the President's Highway Safety Conference, in which the association and its members participated; and

WHEREAS, The "Action Program" recommends cooperative effort, on a nation-wide basis, to secure maximum coordination of highway safety activities, and provides for the establishment of voluntary national committees for this purpose. One of these is a National Committee of State Associations; and

WHEREAS, The program recognizes that major responsibility for meeting the problem rests with the states and communities, and calls for organized state and local effort, with public cooperation and support mobilized through state and municipal conferences and other appropriate activities; and

WHEREAS, Encouraging progress has been achieved in many of the states since the President's conference was held in getting adoption, where needed, of the various measures for highway safety recommended in the "Action Program." Preliminary steps also have been completed for establishing the National Committee of State Associations; now, therefore, be it

RESOLVED, That the members of the American Association of State Highway Officials, assembled in annual convention in Los Angeles, California, December 17-20, 1946, do hereby endorse and support the objectives for highway safety as approved in the "Action Program"; and be it further

RESOLVED, That the association and its members further pledge their support and cooperation in making effective the work of the voluntary nation-wide committees established to promote this program.

Business session of AASHO with many of delegations in seats

time—eliminating or deferring such work as could not be completed due to shortages or other circumstances, and advancing those types of projects on which no serious handicaps existed. As a result the 1946 program reckoned in dollars is approximately at the prewar level.

In the light of urgent needs, highway administrators cannot agree with those who even yet would curtail all public works during periods of "prosperity" and hold such programs in abeyance until there is clamor for governmental efforts to relieve unemployment.

NO CONFLICT WITH HOUSING

**There are also other well-intentioned people who would curtail all types of construction except home building, until the present housing shortage is relieved. Obviously housing needs still rate as priority job number one in the construction industry. It is rather difficult, however, to see how highway construction can interfere seriously with home building. The two activities are in different fields entirely. Actually very little road construction equipment can be used advantageously in building homes. Certainly personnel experienced in highway construction cannot be converted readily into carpenters, bricklayers, plumbers and painters. Very significantly, the Federal Works Agency after a most careful investigation found that road construction requires only a negligible amount of critical building materials. The agency further declared that such limited use would not interfere with the housing program.**

A basic advantage in continuing highway construction in spite of handicaps is the need for maintaining and increasing such skilled construction organizations as are now available. Contractors, organizations, crews and equipment should so far as possible be kept increasingly busy, but no attempt should be made to unduly push construction work of any type or in any locality so fast that costs will jump to unjustifiable levels.

It is especially important that highway officials keep the public informed of the task confronting them in their endeavors to satisfy the demands of the local communities and the road user groups. It is well to enlighten them on the effects which changing economic conditions have on highway programs. After all, a great deal has been said in recent years about the vast volume of work contemplated under the postwar highway program. With the reduced purchasing value of the dollar obviously fewer improvements are going to be made with the use of available funds than the public might be expecting.

The federal funds already apportioned for the first two fiscal years after the war total approximately one billion dollars. It now appears that by the end of 1946 with but six months of the second fiscal year remaining, only about one-third of available federal aid funds will be committed to approved projects. Obviously many states will not be able to absorb all of the authorized federal aid allotments within the limits of time prescribed by law. The loss of any such aid would work an injustice on those states which, for good reason, have been unable to expedite construction work as rapidly as some of the other states. It is most desirable in preserving present equities that

Congress be asked to extend the time limits during which allotments under the Federal Aid Highway Act of 1944 may be expended.

**The matter of future federal aid funds must receive most careful consideration. Slowness in the expenditure of funds provided under the 1944 Highway Act might reasonably justify delay on the part of the new Congress in authorizing additional federal aid funds. Regardless of this possibility we might well, in anticipation of congressional hearings in the relatively near future, heed the warnings now being sounded by various groups.**

Significant legislative proposals already are being suggested, such, for instance, as a drastic reduction in all federal expenditures— the early repeal of the federal gas tax and other automotive excise levies—limiting use of federal aid funds exclusively to the National System of Interstate Highways and a limited mileage of other main highways — curtailment of federal aid for use on secondary roads. All these proposals derive support from strongly organized groups. We must not minimize the impact of any such proposals on future highway legislation.

Congressional reorganization of committees if followed presumably will lead to changed procedures. Highway legislation will be routed through new channels, with public hearings being conducted by subcommittees instead of by major committees as heretofore. The responsibility for consideration of authorizations for all kinds of public works by one major committee will likely lead to a substantial change in the methods of evaluating highway needs.

UNCLE SAM NOT SANTA CLAUS

**Personally, I am not one of those who expects Uncle Sam to double as Santa Claus every time the states feel the need for additional highway funds. In final analysis, the road users must furnish the greater portion of our highway revenues, whether they are channeled through federal, state or local treasuries. I am of the belief, however, that substantial and continuing federal aid allotments will be needed and in fact are essential to the integration of our various state road improvements into one national highway system.**

I am aware that this association on past occasion has by resolution duly made, requested the Federal Government to withdraw from the field of gasoline taxation, leaving this source of revenue exclusively to the states. Far be it from me to question the propriety of the resolution under the conditions existing at that time. But we must admit that circumstances have changed. Certainly under conditions existing today we might well and carefully consider the possible effects of such a policy on future federal aid financing. Revenues must be derived from some source whenever federal aid is authorized by Congress. It seems to me, both proper and justifiable that the Federal Government might well continue to levy road user taxes to an extent sufficient to offset the amounts appropriated for highway aid purposes. The elimination of all federal levies on road users, in my opinion, would be a serious mistake. It could have but one effect—the jeopardizing of future federal highway aid.

**RESOLUTION No. 6**

**PUBLIC LAND HIGHWAY FUNDS**

WHEREAS, The Congress of the United States, in recognition of the great burden resting on states having large areas of federal public lands from which they receive no revenue in financing the improvement of highways across such lands, has authorized and appropriated special public lands highway funds to assist the Public Lands States; and

WHEREAS, These appropriations have made possible the expediting of the improvement of links in the Federal Aid Highway System and other main roads across such lands; and

WHEREAS, There are still numerous gaps requiring further improvement which cannot be reached for many years with available State and local funds; and

WHEREAS, There is an unappropriated balance in the existing authorization for Public Lands Highways of $3,000,000 which could be used to great advantage in furthering this needed work; therefore, be it

RESOLVED, That the American Association of State Highway Officials respectfully urges the Eightieth Congress of the United States to provide for the prompt appropriation of this balance which has been authorized for public lands highways.

OUTSTANDING LEGISLATION

You perhaps recall that the 1944 Federal Aid Highway Bill was enacted only after long drawn-out and exhaustive hearings by the Congressional Highway Committee. Various and diverse ideas were presented by representatives of the various states and others, due largely to the different conditions prevailing in their respective localities. Some of the proposals developed much controversy. The committee carefully gave full consideration to all suggestions.

**The act as finally passed is recognized as an outstanding measure in highway legislation. It embraces basic provisions for the Nation's highway needs. Properly, it affords the states considerable latitude to meet the varying conditions. I, for one, believe that the 1944 highway act might well continue for some time as the basic law in general conformity to which future federal aid allotments might be authorized.**

In the light of difficulties incidental to the enactment of any highway legislation we might well give serious consideration to this proposal. A reopening on the part of the states, of the controversial questions which developed in the enactment of the 1944 highway act would unquestionably add confusion to a situation which at best is fraught with many difficulties.

Association activities during the past year have involved events and actions worthy of mention on this occasion as a part of my report of stewardship. Permit me briefly to review and comment on some of these matters.

IMPORTANT PROBLEMS

There are many important problems in which we as highway administrators share a common interest with other organizations concerned with various phases of highway improvement, travel and transport. Generally there has been good cooperation and friendly relations with these groups, but occasionally misunderstanding and controversies do develop. This is understandable, since each group must necessarily approach the general problem from a different viewpoint. During the past year your officers and members of the various committees have from time to time met with representatives of other groups or agencies to discuss our mutual problems. While it is not always possible to reach full agreement on all points, it has once again been found that the way to achieve mutual respect and confidence is to subject controversial issues to frank and friendly discussion. I believe that the various joint meetings during the year have opened the way to better understanding and cooperation. I trust that such efforts will be continued.

(Continued on page 27)

# Highway Safety Finally Comes Down to Matter of Individual Responsibility

## By MAJOR GENERAL PHILIP B. FLEMING

**Major General Philip B. Fleming, Administrator, Federal Works Agency, who was scheduled to be one of the principal speakers at the meeting of the American Association of State Highway Officials, was detained in Washington, D. C., and his prepared address was read by D. C. Greer, State Highway Engineer of Texas, a member of the executive committee, AASHO. Following are some excerpts from General Fleming's address:**

HIGHWAY safety finally comes down to a matter of individual responsibility. This does not mean, however, that there is not also a collective responsibility to see that the motorist is held strictly accountable for the consequences of his actions. It is a collective responsibility—the responsibility of government, if you please—to see that as much safety is built into our streets and highways as possible; to draw up simple, uniform and understandable rules of the road; to provide clear and unambiguous warning and directional signs, and to proceed with the work of education for the purpose of indoctrinating every motorist and every pedestrian with the safety concept to a point where he will accept his personal responsibility.

The Action Program adopted by the President's Safety Conference covers these three principal points of our collective responsibility which, briefly, are Education, Engineering and Enforcement. There is no magic formula in the program, no simple trick by which traffic accidents can be prevented. The techniques for achieving traffic safety are not new, by any means. They have been tried and found effective; the job is to intensify their use in every city and town and on every highway in America. Too often in the past they have been used only sporadically, and it is now perfectly obvious that brief 'spasm' campaigns produce no lasting benefits.

That rule is best which enforces itself, or which, because it is so logical and so much in accordance with common sense, brings about conformity instinctively.

### APPALLING TRAFFIC TOLL

The President summoned his Highway Safety Conference because of the appalling increase in traffic fatalities that followed the abolition of gasoline rationing. At first some thought was given to calling the conference immediately, but it seemed wiser to postpone it until about the beginning of the 1946 touring season, when it was thought the attendant publicity might be more effective in saving lives. Also, it seemed desirable to allow sufficient time to complete a preliminary organization, to afford time for the various committees on different aspects of the traffic problem to complete their studies, and also to enlist the widest possible support. Accordingly, the conference was held early in May.

A year ago it seemed likely that the death toll in street and highway accidents within 12 months would exceed that of 1941, which was the peak year in traffic fatalities. Fortunately we shall fall far short this year of piling up another ghastly record. I hope it is not merely a coincidence that in May, the month in which the conference was held, fatalities turned sharply downward, and the improvement generally has continued since then. More people will be killed this year than in 1945, when, for more than half of the year, gasoline was rationed, but considerably fewer than in 1941.

### SOBERING STATISTICS

In the first 10 months of 1946, 27,520 persons were killed in traffic accidents. If such deaths have continued at the same rate during the last two months —for which final reports are not yet available—we shall end the year with a traffic death list of about 34,000. That prospect is sobering enough, but it still represents 4,000 fewer deaths than in 1941.

There was an absolute increase over last year, but a relative decrease. And even in comparison with 1941 our experience this year is much better than the figures alone indicate. The population has increased since 1941 so that the deaths per hundred thousand of population are now much less. Another logical comparison between 1946 and any former year is one based on the number of fatalities per mile driven. During the first eight months of this year fatalities per million motor vehicle miles were 10.2. In August the number of deaths per million vehicle miles was just slightly over seven, the low for recent years. After we have taken such consolation as is possible from such comparisons, we still have to face the fact that traffic fatalities still represent our greatest national disgrace, and must be dealt with. And I think we are almost unanimously agreed that it can best be dealt with along the lines laid down in the President's Conference Action Program.

### MUST BE COOPERATIVE EFFORT

That program, as already noted, must be applied locally. The problem cannot be solved from Washington; it cannot be solved by fine words written on paper. The program must be taken to heart and applied by the governors of the states, by our state highway officials, motor vehicle administrators, by the mayors and police chiefs of our cities. It was for that reason that the conference recommended that the governors call state conferences paralleling the President's Conference. The governors have responded very generously, and I believe that about half the states and a number of cities have now held such conferences and others are projected. I have attended some of these city and state conferences and, frankly, I have been surprised at the large attendances and at the enthusiasm displayed. Literally, thousands of citizens in all walks of life are indicating a willingness—even an eagerness—to sacrifice their time and means in the work of promot-

ing highway safety without thought of compensation.

This work must be continued and I feel confident it will be continued, provided only that leadership is forthcoming. And I believe it will be, for we have even arranged for that, too. Among the recommendations which the conference instructed me, as general chairman, to convey to the President, was that steps be taken to coordinate all efforts in the safety field through the organization of three outstanding committees. The first of these was to be a National Committee of Non-Official Organizations interested in the safety field. That committee already has been organized, is at work, and ready to cooperate. It was suggested that the President appoint a Federal Committee on Highway Safety on which would serve representatives of the various government agencies interested in motor vehicle transportation —including the Interstate Commerce Commission, the War and Navy Departments, the Post Office Department, the Department of Agriculture, the Bureau of Standards, the Department of Interior and others. That committee was organized under my chairmanship on October 29th and is at work. We are now compiling a manuel on automobile operation and maintenance, and it also will be our purpose to promote wholehearted cooperation for safety with the appropriate state and local officials wherever throughout the country motor vehicles are used in government business.

NATIONAL COMMITTEE

The third committee suggested was to be a National Committee of State Officials. What is visualized here is an organization embracing the American Association of State Highway Officials, the American Association of Motor Vehicle Administrators, the International Association of Chiefs of Police, the National Association of Railroad and Utility Commissions, the National Council of Chief State School Officials, the Association of State and Territorial Health Officers and the Council of State Governments.

A preliminary meeting of representatives of some of these organizations was held at Washington in my office on October 30th. They were sympathetic toward the objectives sought, but generally they felt they could not commit their organizations to membership without specific instructions from their governing officials. It will take some time, of course, to inform the members of the various organizations of what is intended and obtain their consent to participation. But I have no doubt that consent will be forthcoming and that it may be possible to complete the organization of the State Committee early in the new year.

STATE FUNCTIONS

In some respects I think the state committee can be more useful than either of the others. Traffic regulation and control, the licensing of drivers, the inspection of motor vehicles are state functions, and I think we all want them to remain state functions. I don't think any of us want to see Uncle Sam stalking over the Country in the role of a traffic cop. There has been a good deal of complaint that the Federal Government already has usurped too many state functions and prerogatives. However, I think that much of that has come about because of unwillingness of the states themselves to act. Overlapping of authority among state departments, each concerned with some aspect of the traffic problem, must be avoided. Also, lack of uniformity in licensing regulations is notorious. Such regulations range all the way from the unnecessarily rigid to the unbelievably lax. In one state the penalty for driving without a license may be as light as a reprimand or a five-dollar fine, while in the next state it may be a thousand dollar fine and a year in jail. It seems at times as though traffic regulations were as diverse among the states as devilish human ingenuity could make them.

Addressing his Highway Conference, the President pointed out that in his own state of Missouri anyone could buy a driver's license at the corner drug store for 25 cents. He denounced the laxity of regulations in many of the states which, to use his own expression, turn any "nut" or "moron" loose on the highways to maim and kill. When a member of the Senate, the President three times introduced legislation which would have established certain minimum standards for the licensing of drivers crossing state lines. Twice the Senate approved such legislation but each time it died in the House. I think stringent federal legislation in the safety field is almost certain to come unless the states themselves soon take appropriate action.

The legislatures of most of the states will be in session again this winter. Certainly it is not too early for those state officials who have any responsibility whatever in matters of highway traffic and highway safety to begin laying the groundwork for appropriate legislative action. The situation is fatally serious, and we dare procrastinate no longer.

## Shanghai May Be Far Ahead of Us

SHANGHAI, China, may be a jump ahead of the Action Program adopted by the President's Highway Safety Conference in attacking the problem of traffic fatalities. Major General Philip B. Fleming, Administrator, Federal Works Agency, injected this humorous possibility in his address which was read before the meeting of the American Association of State Highway Officials.

In discussing the action program, General Fleming said he had recently received a newspaper clipping setting forth what he assumed might be the action program of an organization known as the Shanghai Health Precautionary Association. The clipping follows:

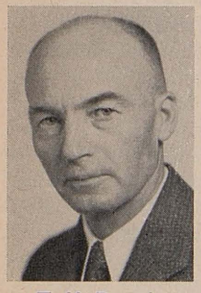
**"All motor cars have rubber tired wheels and run without noise. It is too late to blow a horn when a car has already collided with a pedestrian. A car should have a very small bell attached to one of the front wheels and this bell should be kept ringing all the time so that when pedestrians hear it they can get out of the way.**

**"There should be one licensed chauffeur and an assistant to take care of each motor car. The assistant should sit behind and keep a lookout when the car turns around, goes backward, enters or leaves the garage. The owner of the car will not mind spending a little money in employing an assistant chauffeur.**

**"After a person is killed by a motor car a wax image of the decedent should be made and placed in a room. Any chauffeur who causes injuries to others should be locked up in the room so he will see the image and feel sorry. This may cause him to repent. This has been introduced in America and has produced successful results."**

# Radio Communication System Demonstrated by California Division of Highways

AS A special feature of an exhibit prepared by the California Division of Highways for the annual meeting of the American Association of State Highway Officials there was a demonstration of two-way radio communication as used by the Division.



T. H. Dennis

For this purpose two radio stations were installed in the Biltmore Hotel, one system demonstrating the use of FM radio (frequency modulation or very high frequency) the other the use of medium wave or the type commonly used by commercial radio stations.

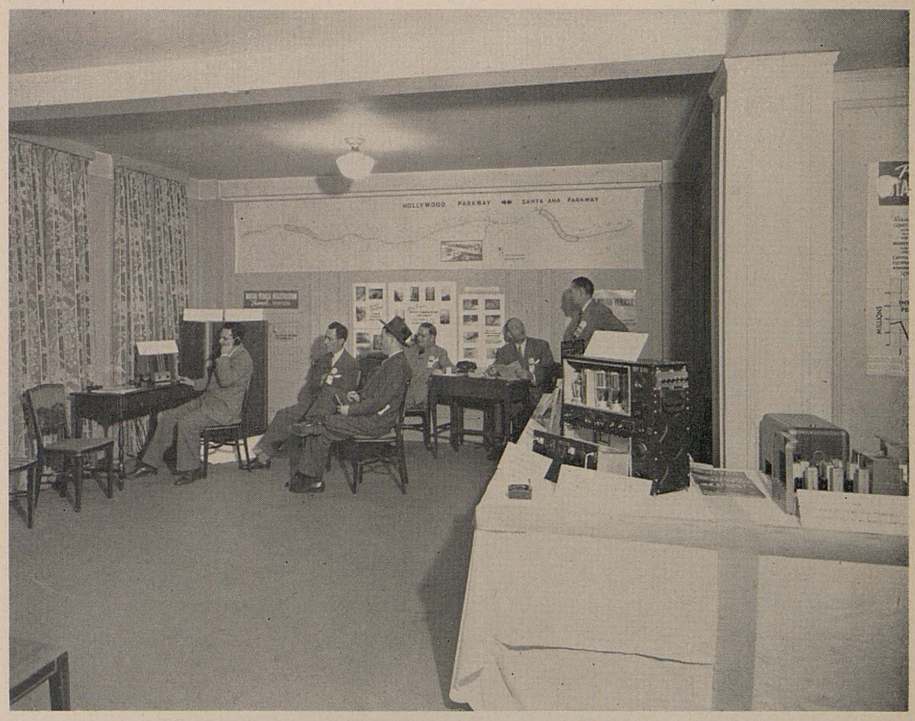
From the exhibit room in Los Angeles radio contact was maintained with permanently located land stations owned and operated by the Division of Highways stations in the San Bernardino-Lake Arrowhead area.

The State of California is one of the few states operating a radio communication system owned and operated by the Highway Department.

There are presently 75 land and mobile stations throughout California and there are now plans for immediately expanding the system.

This radio system is used for a variety of purposes but its principal use is in emergencies arising during the winter season as regards snow removal on state highways. Snow plows in the San Bernardino Mountains in Southern California and the Sierra Nevada Mountains in Northern California are equipped with two-way radios enabling them to maintain contact with land stations located at their base station.

In addition two-way radio has been installed in superintendents' and foremen's cars responsible for maintenance of their respective sections of state highways. This enables them to expedite men and equipment in emergencies arising from storms, slides, slip-outs and any emergency arising which requires immediate attention. Such a system is also to be installed within a short period on the San Francisco-Oakland Bay Bridge to expedite the removal of stalled cars and wrecks and for fires.



Scene in radio communications exhibit room of California Division of Highways

The Committee on Use of Radio in Highway Departments, which is headed by T. H. Dennis, Maintenance Engineer of the California Division of Highways, conducted an all-day session on Thursday, December 19. Many of the states were represented and there was much interest manifested in the demonstration of the use of radio equipment. Henry A. Radzikowski, Chief of the Division of Maintenance of the Public Roads Administration, Washington, D. C., acted as secretary.

It was pointed out by Frank B. Durkee, Attorney for the California Department of Public Works, that if the states wish to protect their rights under the Federal Statutes administered by the Federal Communications Commission, it is urgent that they work together to show that public convenience and necessity require definite allocation of classifications of wave lengths by the Federal Commission. This proposal was supported by the convention.

More than 450 delegates visited the radio exhibition room and witnessed demonstrations of California's use of radio in highway work.

**RESOLUTION No. 8**

**USE OF RADIO BY HIGHWAY DEPARTMENTS**

**WHEREAS,** The railroads and users of highways, such as power, gas, transit utilities, bus, truck and other road services, have been removed by the Federal Communications Commission from the special emergency classification for the use of two-way radio telephone and given a broader defined permissible use of radio for their operations; now, therefore, be it

**RESOLVED,** That the highway departments, agencies of state and local governments, with the duties to build, maintain and operate highways for the safe use of traffic and the public welfare be given similar treatment by the Federal Communications Commission.

# Highway Improvement Program in Relation To the Conventional Public Works Concept

**(Paper presented by Thos. H. MacDonald, Commissioner, United States Public Roads Administration, at the Thirty-second Annual Meeting of the American Association of State Highway Officials.)**

TRADITIONALLY, the popular concept of public works embraces highway improvements. This, in itself, might result in no adverse consequences were it followed by a breakdown of all public works into the deferable and the nondeferable groups, predicated upon the degree of essentiality of the service which each one provides or the purpose which each one serves. There has been, as yet, no accepted distinction. It is common to include all works directed and paid for by the government in a single category, subject to the same policies.

In a period covering little more than a decade, the Nation has lived through two experiences reflecting the extremes in public works undertakings. The first of these was the result of the desperate efforts to supply employment during the depression years. Public works of many types were undertaken on a maximum scale virtually unlimited by the finances required. The second period was coincident with the war years when public works were severely limited to those serving the war effort. These two extremes in our recent national experience had this in common. The realized and product was determined by the human and material resources that could be, and were, made available. These resources reduce principally to the elements of labor, management, equipment, and materials.

### ELEMENTS THAT CONTROL

Now we are in a third period, as yet more limited in time, but the postwar months have evidenced control of production by the same influence of available resources. While we worry about costs and the finances to meet them, it is evident that basically our ability to carry on a highway program rests on other factors. Since we started the postwar program, the criterion of contract awards has been the price index, but this is only a composite reflection of the meager availability of resources relative to the overall demands. While the contributing causes may be different, the current status of the program follows rather closely the pattern set in the months immediately following World War I. The federal aid projects put under way since the bars were taken down approximate 40 percent of our estimate of the program that would have matured with the funds available under normal postwar conditions. As it is, the progress compares favorably with the level reached in other fields. The evidence indicates that any further extension would not have been justified since 28 percent of the projects are lagging, due to deficiencies in one or more of the necessary elements. In general, additional awards would only have increased this percentage of lag.

With the close of the war, housing was rightfully accorded priority, and the highway officials have been faced with no criticism resulting from interference with the housing program. On the contrary, much assistance has been rendered this program by the extension of access roads to facilitate the production of building material, such as lumber. An even more important aspect of the interrelationship of housing and highways will be suggested later.

### RESPONSIBILITY OF HIGHWAY OFFICIALS

We are, as yet, a long way from being out of the woods, and in the many years of cooperative effort between the state highway departments and public roads there has never been a time when mutual helpfulness and tolerance were needed as they are now. This responsibility extends beyond the highway officials to include the major elements of highway users and industries which are the chief beneficiaries of a sound program of highway improvement. As public officials responsible for highway administration, it is our duty to inform the public at large, and more particularly the legislative branches of the State and Federal governments, of the problems currently confronting the integrity of our highway plant. Fortunately, to serve this purpose we have the factual data from the Highway Planning surveys. This attitude of responsibility to the public is a characteristic inherent in qualified public officials under any circumstances, but under the stress of present uncertainties it becomes an essential.

**The executive departments of the states and of the Nation are facing difficult policy determinations. This is true also of state legislatures. The Congress has adopted a reorganization plan that places highway work under the jurisdiction of a Public Works Committee, which will, in the future, consider and determine the policies for all works supported by**

**RESOLUTION No. 7**

**REVIEW OF POLICIES OF U. S. ARMY ENGINEERS CORPS ON CLEARANCE OF HIGHWAY BRIDGES OVER INLAND WATERWAYS**

**WHEREAS, Large expenditures of public highway funds are being made by the various states largely in cooperation with federal funds in the construction of highway bridges over inland waterways; and**

**WHEREAS, The cost of such structures is influenced by rules and regulations prescribed by the Corps of Engineers, United States Army, in fixing clearances both vertical and horizontal, to be met in the design of such structures; and**

**WHEREAS, Such rules and regulations are not in all cases consistent with the relative importance of waterway and highway traffic to be accommodated, resulting in vehicular traffic being unduly penalized and an unwarranted expenditure of public funds made; now, therefore, be it**

**RESOLVED, That the Corps of Engineers, reinforced by the report of the Bridge Committee, be requested to review their present policy and at their public hearings on applications for waterway crossings by public highways, that arguments be requested showing relative benefits, both present and future, to be derived by water borne and vehicular traffic and that clearances be determined upon a basis of the relative importance of the class of traffic to be served—consistent with the expenditure required and with the public interest.**

**federal funds. We can have full faith in the decisions that will be reached, whether these are executive or legislative determinations, if we first agree among ourselves upon a sound program and, second, marshal the convincing and accurate factual data upon which our recommendations rest.**

FALLACY IN THEORETICAL CONCEPT

There is no purpose here to draw comparisons or to argue the relative importance of the various types of public works. This analysis concerns itself solely with highways and is designed to prove why the traditional concept of highway improvements as public works that may be undertaken or may be deferred is fallacious in the extreme. Government has undertaken to supply certain services which cannot be provided as private undertakings with private capital. All such efforts in the past have ended in failure or, at best, inadequate services.

Among such government-supplied services are sewerage, water, roads and streets, public schools, and police and fire protection. These are all an inseparable part of our individual and community lives. They are to a large extent interdependent or complementary. They require certain continuing works of construction and maintenance that cannot be turned off or turned on to accord with some theoretical concept of using such works to fill the gaps if private employment lags. There can be, of course, a reasonable degree of acceleration or deceleration, but a going program must be maintained.

The theoretical concept of such works as intermittent activities presupposes quite falsely that all private works and all private employment transcends in importance the health, the protection, the daily pattern of life of every community, large and small. He who realistically thinks through the daily, even the hourly, dependence of every individual and of every community upon all these services will reject any such conclusion.

The utter dependence upon the roads and streets in the routine of our daily life has been doubly fixed by the advent of the motor vehicle, both passenger and goods carriers. Thus, highway improvements cannot be evaluated as public works. Their services must be measured in terms of saving lives, of preserving property values, of maintaining essential services, and of sustaining major industries. The too prevalent economic concept of holding back highway improvements to bolster employment, if or when unemployment appears, is a completely fallacious theory. It disregards the essential principle that the highway plant, like all physical properties, is constantly deteriorating. This fictitious concept, which has too long been unchallenged, fits well the definition of economic theory that draws "a mathematical precise line from an unwarranted assumption to a foregone conclusion." The only sound approach is to accept the principle that to avoid irreplaceable losses the highway plant must be continuously renewed and replaced.

On behalf of delegates, California State Highway Engineer Geo. T. McCoy presents retiring President Hoffmann with gold watch

Adjusted to current values, our highway plant reasonably represents a $30,000,000,000 asset. There are (1945) 1,430,000 miles of surfaced rural highways and 220,000 miles of surfaced urban streets. This mileage provides a virtually continuous network for the movement of traffic, but it is composed of many thousand individual segments from less than one to more than 30 years in age. Basically, our problem is to keep this vast physical structure operating efficiently. It cannot be done without a large scale annual program of replacements and modernization, in addition to routine maintenance. Most fortunately, it is not necessary to beg the question. Down-to-earth research has been a handmaiden to the highway administrator from the early inception of modern highway development. We now do not need to depend on broad generalization. The facts are available.

**Just what do our highways mean today? First, consider their relation to the public in general. Total highway use skyrocketed from an estimated 55,000,000,000 vehicle miles in 1921 to 333,000,000,000 in 1941. This later figure represents a travel for each person of our total population of**

**around 2,400 miles annually. What possible use of the highways and streets could add to this amazing total when considered in terms of this comprehensible figure of the average person's travel? To understand this, it is necessary to review what has happened to the pattern of daily life and the reorganization of our internal economy in every quarter of the United States.**

SERVICE TO THE RURAL AREAS

Total traffic is about evenly divided between urban and rural areas. Consider the rural areas first. No attempt is made to recite the whole story. The examples given are only indicative of the magnitude and range of the services the highways must perform for agriculture. There are approximately six million farms producing foods and materials for processing into clothing, building materials, and other products of commerce. In 1945, the production of 28 important farm items aggregated more than 177,000,000 tons, a 37 percent increase over the average for 1936-1940. For the current year, the record is expected to go higher.

SERVICE TO AGRICULTURE

The first movement to market of substantially every ton of agricultural production is over the highways. Important percentages of these food products continue direct to the market and to the individual consumers. For example, 62 percent of the butter for the Chicago market is received over the highways; so is 85 percent of the fresh fruits and vegetables for the City of Los Angeles, and 96 percent of the live poultry for San Francisco. In 1944, when meat was so vitally necessary, more than 52,000,000 head of livestock, which was 59 percent of the total receipts, came by the highways to 17 of our larger stockyards.

One needs to experience the scant supply and inferior grade of milk in other countries to appreciate what a luxury our dairy farms supply in copious quantity and at relatively low prices for us. In England, at present, or in India continuously, milk of good quality is simply not available for general use. How often do we pause to consider how many of the essential foods are made possible only through highway transport? When we have eggs for breakfast here in Los Angeles, as road builders we can claim a reasonable share in their availability since 93 percent of the supply comes over the roads.

Rural education has rapidly embraced the school bus without much fanfare and without much recognition that it is the magic wand that has transformed the one-room district school to the graded consolidated school, which also frequently serves as the community center. When such a predominantly agricultural state as Iowa has a motor vehicle for each 3.5 persons, this figure of 2,400 miles of road travel per year per person begins to appear reasonable.

But this is only the first half of the story. Until about 1917, the typical urban area was compact. There was

# Delegates from Puerto Rico and Hawaii Travel Long Distances To Meeting

Delegates from Puerto Rico and Hawaii get together at 32d annual meeting of the American Association of State Highway Officials. Left to right, Top Row—J. C. Myatt, B. F. Rush, Frank R. Carlson, and T. Y. Awana, Hawaii. Lower—Ernesto Pinero and Jorge V. Toledo, Puerto Rico; C. Nils Tavares, Attorney General, Honolulu

THE GOVERNMENTS of Puerto Rico and Hawaii considered the thirty-second annual meeting of the American Association of State Highway Officials important enough to send delegates thousands of miles to attend.

These delegates attended many committee meetings to learn at first hand how the highway departments of the United States proposed to cope with the many postwar problems involved in highway construction.

From Puerto Rico came Ernesto Pinero, Director of Division of Maintenance, and Jorge V. Toledo, Chief Counsel.

Hawaii sent Frank R. Carlson, District Engineer, Public Roads Administration, Honolulu; B. F. Rush, Superintendent of Public Works, Honolulu; C. Nils Tavares, Attorney General, Honolulu; J. C. Myatt, Highway Engineer, Honolulu; and T. Y. Awana, Chief Cadastral Engineer, Honolulu.

only a moderate finger development into the surrounding areas along the extension of city streetcar lines. An example of what has happened since the general urban use of the motor vehicle is more concretely expressed by the example of the District of Columbia, which has a land area of 61.4 square miles. In 1915, there were only 8,000 motor vehicles; busses had not come into use, and 65 miles of streetcar track served the residents. A few lines of street railway extended through the District into adjacent Maryland. There were about 380,000 people, and excluding the 15 square mile compact area, 50 percent of the remaining, that is, 23.2 square miles, was within one-quarter mile of the streetcar lines. Only 8.4 square miles of the area within this distance had been developed and that rather sparsely. Of the 23.2 square miles of more than one-quarter mile from street cars, 2.8 square miles had been developed.

In 1940, with a population of 663,091, practically the entire useable area has been developed with no appreciable increase in street car mileage. There has been a large extension of public service by bus lines. The suburban area of Washington is considered about 130 square miles, of which about 31 square miles are in Alexandria and Arlington County, Virginia. In 1915, there were 43 square miles within one-quarter mile of suburban street car lines, of which about 7.5 square miles were within one-quarter mile of these lines in Alexandria and Arlington. Some three-quarters of this latter area was developed to some extent, and about two square miles in the Virginia portion of the metropolitan area.

### TYPICAL EXAMPLES

Since 1915, the street cars have entirely disappeared from Arlington and Alexandria. The area between the radial routes first built up along the car lines now is largely developed into residential areas served entirely by motor vehicle transportation. At present, there remains only about five square miles undeveloped, some of which is in rough topography along the banks of the Potomac River. Thus, motor-vehicle transportation has increased the developed suburban area of Washington in Virginia from 9.5 square miles in 1915 to approximately 22 square miles at the present time. This development has been the result of filling in between the radial routes without an appreciable extension of the developed area until very recently.

## RESOLUTION No. 9

### COMPLETION OF PAN-AMERICAN HIGHWAY TO PANAMA

WHEREAS, The Government of the United States was officially responsible for initiating the creation of a Pan-American Highway System and for inaugurating the original reconnaissance surveys of that section thereof between Panama and the United States; and

WHEREAS, The government has from time to time encouraged other countries to undertake both cooperative and independent construction within their respective jurisdictions, furnishing assistance of both a technical and financial character; and

WHEREAS, These activities and official expressions by our government have produced a public and official opinion in most of the interested countries, that the United States Government is committed to assisting so far as may be necessary each of the countries of Central America and Panama in carrying the Inter-American Highway Project to practical completion without serious interruption; therefore, be it

RESOLVED, By the American Association of State Highway Officials in annual convention assembled, that the Eightieth Congress of the United States be urged to recognize as a policy of this government the furthering, as a peacetime project, of the completion of a highway between the United States and the Panama Canal, and to provide from time to time such funds as may be needed, under terms and conditions that the Congress considers practicable, for the uninterrupted prosecution of the Inter-American Highway to Panama.

This is typical of what has been going on in all metropolitan areas. The population of the central cities of 140 metropolitan areas increased by only two and a half million in the decade from 1930 to 1940, while in the same period the urbanized area outside the central cities gained almost 3,000,000. As a percentage, the surburban areas gained at a rate approximately three times as fast as the central area. But in many cities, there was an actual decrease of the population. The central city area of Boston lost 10,000 people, and the suburbs gained 53,000. Cleveland decreased 22,000 in the city proper, and increased 42,000 in its outlying areas. While the population of the city of Detroit was increased 55,000, the metropolitan district increased 136,000.

Some have attributed this changing pattern of our cities to the motor vehicle. This is not true. The motor vehicle made it possible for the people to escape from decadent areas at the hearts of cities, but they did not create the conditions which forced the people to abandon these areas. The motor vehicle offered escape from intolerable conditions which had developed. This abandonment of the central city has created serious problems, of which more will be said later. The very existence of these problems, however, indicates the degree to which urban life has become dependent upon the motor vehicle, which means necessarily the maintenance of the highway plant.

### DEPENDENCE OF MAJOR INDUSTRIES UPON HIGHWAYS

These are some of the facts of highway utilization. Just what do they mean to the industries dependent not only upon the maintenance of the existing mileage of all-weather roads and streets but upon its extension? Facing the future, there is one precept upon which there is general agreement. It is repeated over and over by high authority, not only in our own country but in other nations of the world. The one formula urged to defeat economic catastrophe is full production.

In the United States, the highway plant is the principal support of a number of our major industries directly, and of a very considerable number more indirectly. Of these, the petroleum, automotive, and rubber industries are examples. Full production in these industries means nothing and cannot be sustained unless there is an equal consuming market. We are proud of these great industrial empires. Yet, they could not exist without the highway plant. Conversely, neither would we have brought into service the extensive mileage of highways without the pressures created by the public demand to use the products of these same industries. So the two are mutually dependent and common problems need to be considered in this spirit.

### THE PETROLEUM INDUSTRY

The dependence of the petroleum industry upon the maintenance and constant expansion of the highway plant to furnish the major market for its products is dramatically shown by the growth in consumption of gasoline from 3.9 billion gallons in 1921 to more than six times as much, estimated at 24 billion gallons in 1941. This astonishing record of expansion of the market of motor fuels runs parallel and, in fact, outpaces the mileage of roads capable of carrying the ever-increasing numbers of cars that the public was eager to use as rapidly as even reasonably suitable facilities upon which to operate them were provided.

The total mileage of all-weather rural roads increased from 387,000 miles in 1921 to 1,385,000 in 1941. The mileage of high-type surfaces increased from 36,000 to 194,000 in the same period. The consumption of motor fuel increased six times, while the all-weather surfaces were increased between three and four times. This is explained by the increase in the use of the individual motor vehicle from about 4,500 miles per year in 1921 to over 9,000 in 1941. That the use of each motor vehicle was doubled reflects primarily the growth of improved highways and streets that imposed less and less restriction on the freedom of movement of the individual owner.

GASOLINE TAXES

Gasoline taxes, federal and state, have increased steadily since the original Oregon law of 1918. A searching examination of the relation between the rate of taxes imposed and the individual state consumption of gas does not disclose the faintest evidence of restriction of the market from this cause. On the contrary, since the income from these taxes has been so large a factor in extending the mileage of improved roads, the conclusion is inescapable that the constantly growing market for motor fuel is a direct result of these taxes.

One of the most remarkable facts reflecting the importance of highway transport and its capacity to sustain the gasoline market is that the growth of the over-all consumption continued through the depression, with the exception of two years, although the sales of new motor vehicles decreased to about 30 percent of the peak year, 1929, of 5,358,420 units. The motor industry at present does not have to worry about markets for its output. As a long-term matter, however, there are two areas which offer the best chance for increased sales, but the potentials of both of these for increase in car ownership are dependent upon the extension of road improvements.

**Unincorporated areas, as of 1940, supported only 168 cars per 1,000 population. At the other extreme, cities in the 500,000 and over class had only 183 cars per 1,000 population. For the same year, the average for all areas of the United States was 208 motor vehicles per 1,000 population. In California, there is the startling ownership of 355 vehicles per 1,000 population.**

INCREASING MARKET

Assurance of the constantly increasing market for the output of the rubber industry is inherent in the constant upward trend in the mileage each vehicle is operated annually. In addition, one of the very important outlets is the growth in the requirements for heavy duty tires in mammoth sizes, which have become standard in roadbuilding equipment. The fact may be noted that the efficiency of roadbuilding equipment, and even the type of design, have been controlled in a major way by the ability of the rubber industry to produce tires of the capacity and durability which make possible the larger units.

**There can be no serious question as to the degree of dependence of the petroleum, the automotive, and the rubber industry for their major markets directly upon the maintenance and extension of the highway plant. Many other industries are directly or indirectly supported by this same plant. If there is any legitimate criticism of the state and federal taxes upon the products of these major highway industries, it must rest upon the diversion, the dissipation, of the failure to collect equitably these taxes and to use the proceeds for highway improvement purposes.**

## RESOLUTION No. 10

### INTER-AMERICAN COOPERATION IN INTER-AMERICAN HIGHWAY PROJECT

**WHEREAS, Mexico, the several countries of Central America and Panama, over many years, both by independent action and through cooperation with the United States, have substantially advanced the construction of the Inter-American Highway across their respective territories to such extent that over fifty (50) percent is now paved and over seventy (70) percent is passable in all seasons; now, therefore, be it**

**RESOLVED, By the American Association of State Highway Officials, in their annual convention assembled, that the association reaffirm its interest in the Inter-American Highway project: extend to the several countries concerned its appreciation of the excellent professional and technical accomplishments of each of them; and assure them of the continuing encouragement and support of the association in the united efforts of their governments and that of the United States in carrying the project to an early and successful completion.**

In 1946, the total of all state and federal imposts upon the road user amounted to no more than three-fourths of 1 cent per mile of travel. If the cost of car ownership and operation is no higher than 4 cents per mile, a figure far too low for a fair average, the highway cost would be only 18.75 percent of the operation cost. This is less than the differential between operating cars over worn and rough roadways, as compared with the cost of operation over smooth roadways.

PRESENT TRENDS IN HIGHWAY TRAFFIC

October of this year produced the highest volume of traffic for that month ever recorded for the United States as a whole. In the eleven Western States, the total traffic was more than 31 percent above the October, 1941, counts, and on the main roads in California the increase was 45 per cent over the 1941 volume, which was the previous highest October record. As compared with 1945 volumes, traffic in the Western States is up 23 percent; in the central regions, 25 percent; in the Eastern States, 26 percent, and on California main roads, 30 percent. Traffic in seven representative cities in October of this year showed volumes well in excess of the 1945 volume, varying from an increase of 15 percent in Washington, D. C., to 34 percent in Santa Fe, N. M. This acceleration of highway use induces much foreboding on the part of the highway official confronted as he is with current limitations upon replacements and maintenance of the highway plant.

The highway construction program must continue at as high a level as is consistent with the availability of the component resources. It is certain that most of the required elements are as yet in scarce supply. The line will still have to be held on the basis of prices, which quite accurately reflect the ability of the contracting industry to deliver the finished product. It is apparent that high prices as such will not complete work. It is our responsibility to keep contract prices on a basis fairly comparable with costs.

One of the elements that is seriously lacking in many States is sufficient competent engineers for the highway departments' own organizations. This is a serious drag on production, and the situation will not be remedied until there is a decided upgrading in salaries. There are certain phases of the current situation that should be given special attention.

Housing can be greatly aided by proper planning of highways, particularly in urban areas. It is probable that much emphasis will be placed upon large projects of the multiple-unit type because of the high cost of single dwellings. Such projects may be undertaken as part of the redevelopment of slum areas and the recapture of property values in decadent areas. Seven such projects are now under design or under construction in the City of New York. One of these Stuyvesant Town, financed by the Metropolitan Life Insurance Company, is to have 8,773 apartments. Although the project is located within walking distance of centers of employment, thus reducing transportation requirements, a provision for motor vehicle transport is an essential part of the plan. One corner of the area fronts on an existing expressway, which is to be extended. Garage space for 2,400 cars is to be provided and off-street surface parking is to be available for 300 cars. Frontage roads encircling the development at the edges of the area are to be widened. This would have been impracticable because of cost were it not undertaken as a part of the over-all plan. The interior streets will be closed.

**Here in Los Angeles, is an excellent example of the problem of the metropolitan areas. The city has an actual corporate area of 452 square miles, but the urban area spreads over 600 square miles. Within this area, there are 1½ million people and 30 cities of 5,000 or more population. This situation is on an exaggerated scale perhaps, but it is more or less characteristic of the situation confronting all metropolitan areas.**

Parking congestion on the streets and lack of off-street parking are gradually throttling the business district and the loss of property values can only be checked by major redevelopment of these necessary traffic fatalities. It is hopeless to attack this problem of city traffic congestion by palliative measures, such as street widening. One well-designed four-lane expressway will accommodate the same number of vehicles at nearly twice the average speed as will five 40-foot ordinary streets on which parking is prohibited and under favorable conditions of traffic control for the intersecting streets. Under unfavorable conditions, it will require eight typical city streets 54 feet wide on which parking is permitted to serve the volume of traffic that may be handled more efficiently on one four-lane expressway. The limited-access highway is the only possible means of coping with urban congestion, so far as moving traffic is concerned. Parking facilities must be made an integral part of the over-all plan. This city problem in the States where it exists is so serious as to demand the full cooperation of State, urban, and federal highway officials.

The serious lag in replacement of federal-aid highways is indicated by the latest in-

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# Problems and Hopes of Highway Builders

(Continued from page 18)

Immediately following our last meeting, the states by letter ballot officially adopted the "Recommendations on Highway Loading" as prepared and submitted by the Transport Committee. This action by the association has brought forth numerous expressions of approval by various groups interested in highway transport problems. Even so, certain segments of the truck and bus industries have already requested revisions in the newly adopted recommendations.

TRANSPORT COMMITTEE STUDIES

In view of the thorough and careful study of this subject made by the Transport Committee, and the general approval of that report as given by the association membership, no action looking toward further revision of that policy should be taken without most deliberate consideration. Nevertheless, it cannot be considered a closed subject. It is certain that requests for revisions will be made from time to time, and it is necessary that such requests be carefully scrutinized. It should also be borne in mind that present day design of highway structures has direct bearing on possible future revisions of the policy relative to highway loading. This is particularly significant in the case of bridges on the National System of Interstate Highways and other main heavy traffic routes. This situation may well merit our further consideration.

The revised constitution adopted at our last annual meeting provides for a number of changes in association committees. Reorganization in conformity therewith was authorized by the executive committee at its midyear meeting. To avoid undue interference such committee changes as are necessary will be made immediately following this convention. Whereas in general committee assignments are made on the nomination of the officials of the various states, it is important that such officials extend their full cooperation in making such nominations, in order that the committee changes can be effected with the least possible delay.

**An event of significant importance, in which members of the association participated actively, was the President's Highway Safety Conference. Out of that conference came an "action program" for the states and for communities which, if aggressively applied, will aid materially in reducing the unnecessary toll of life and limb resulting from highway traffic accidents. Highway officials in many states are presently giving leadership and support to follow-up conferences and to other activities designed to make our streets and roads safer. The safety problem demands full and active participation by all state highway departments.**

ACTION PROGRAM

The "action program" recommended that the activities of the several state agencies having jurisdiction in highway transportation matters be coordinated nationally through a committee representing their respective national organizations. Such a committee has been set up for this purpose, and our association must of necessity extend its cooperation in this work.

The shortage of technical personnel is one of the serious handicaps still confronting the states in their efforts to expedite the postwar program. Graduates from engineering schools who formerly sought state employment in lower grades in the hope of later improving their status, are continuing to enter federal service or private industry at starting salaries much in excess of what highway departments in most states are permitted to pay. The Commissioner of Public Roads at our last convention very emphatically sounded a word of warning regarding the inadequacy of engineers' salaries. A special association committee since appointed to make a comprehensive study of the problem will submit its report at this meeting. I trust the states will find this report to be one that they can use advantageously in their efforts to obtain requisite legislation in their respective states.

WAR SURPLUS PROBLEM

In the matter of disposal of war surplus equipment and supplies, repeated efforts to obtain reasonable amounts of such materials for the states have proved unavailing. The shifting of disposal authority together with changing personnel made contacts with responsible authorities practically impossible. Even worse, congressional action during the year granting ex-servicemen priorities ahead of state agencies removed all chance for the attainment of our objective. Reversal of governmental policy by the new Congress alone can correct the situation. Our united efforts should be directed to that end.

This year a number of the states have made encouraging progress in developing workable relationships with city and county agencies of government to carry out the provisions of the Federal Aid Highway Act of 1944. Due to the delays occasioned in actual construction work we have not as yet demonstrated our ability to meet the test which these new and important provisions of the law impose upon us. It is of the utmost importance to the future of the highway program that the states meet the situation successfully, through close cooperative relationships with their city and county agencies. We must justify the confidence which the Congress has expressed in the ability of the state governments to administer the federal aid program for all elements of a state-wide highway transportation system, urban and rural alike.

HIGHWAY TRANSPORTATION

**Following the end of the war, we have witnessed a strong revival of interest in highway transportation in nations all over the globe. The free movement of goods and persons by motor vehicles has become a basic element in the economy and in the social structure of many nations. It is only natural that men everywhere responsible for development of highway transportation should look to the United States for counsel and assistance. The U. S. Public Roads Administration and the state highway departments will be called upon with increasing frequency to render advice and assistance to the road authorities of other lands. Our association can be of material assistance in the arrangements which this interchange of information will require from time to time. Such cooperation can do much to promote good will between our people and those of other nations.**

Members of the association have noted this year with considerable interest the splendid program which our host state has carried on in the field of highway planning. Under the sponsorship of a special bi-partisan legislative committee, and with the Division of Highways and other state departments cooperating, California has made an intensive fact-finding study of future street and highway needs, to serve as the basis for legislative action next year.

CALIFORNIA OUTSTANDING

**Substantial progress has been achieved in other states as well, but I mention California as an outstanding example because we are meeting here, and also because the engineering studies which were completed this year are more comprehensive in their scope and in much more usable form than similar projects in the past.**

The only proper basis for sound and long-range highway programming is engineering study. The needs are too great, and the amounts of money involved too large, to permit any other kind of approach. But the making of highway planning surveys is by itself not enough. The facts thus obtained must be made available to the public and to the legislatures, so that the problems are understood, and the necessary programs can receive intelligent and informed public support.

**In this respect, the California projects this year should be of special interest to all of us, and an inspiration to our own further efforts. They serve to remind us at a timely moment of the tremendous importance of good highway planning to the future progress of our state programs.**

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He—"Why does a woman say she has been shopping when she hasn't bought anything?"

She—"Probably for the same reason that a man says he has been fishing when he hasn't caught anything."

# Evolution of Culvert Design

(Continued from page 13)

subgrade under the box culvert is not acceptable for all sites. It may mean expensive excavation several feet below subgrade in order to lay a blanket of cushioning material. A simple expedient is the answer—put the cushion on top of the box.

We have for that purpose a specification for *Method B* Backfill. For high fills over a box culvert on unyielding subgrade, the embankment is built to a level above the box equal to the height of the box. Then the compacted fill above the box is replaced by an uncompacted fill, or, more simply, the compacted fill is loosened in place by suitable disturbance. Thereafter the rest of the embankment is built compactly over the loose cushion course.

SECTIONAL-PLATE CULVERTS

Recently we had occasion to apply the Marston Theory and the sequel Spangler Theory to the revision of overfill allowances for sectional-plate culverts. One manufacturer in this field proposed a new shaping of corrugations, an increase in depth of corrugations and a larger bolt for assembly of plates.

We found that the shape and depth of corrugations was important only for shallow fills, to resist eccentricity of live superloads and temporary inequalities of backfill pressures. Once backfill has been built 10 feet or so above the top of the pipe, the corrugations are no longer critical. The weakest element is then the bolted longitudinal seam.

Before determining a new policy of overfill limits, we are reviewing the performance of installations made under our former policy. We are considering use of a table of gage requirements for structural resistance and requiring additional thickness of metal for corrosion and abrasion resistance. That is, for a certain fill and diameter, the table might show 5-gage plate to be structurally adequate. To assure the existence of that thickness throughout the design life, we might specify 1-gage plate for the invert and 3-gage plate for the other sections. The extra gage would be determined from experience and some knowledge of bed load of stream and corrosiveness of soil, water, and atmosphere at the site.

**RESOLUTION**

Michael J. Hoffmann, Commissioner of the Minnesota State Highway Department, who has served as President of the American Association of State Highway Officials for the past year has brought to the responsibilities of that high office not only a long and distinguished service in the highway department of his own state, but a broad comprehension of the needs of an integrated highway system throughout the Nation. During his year as President he has given a wise and able leadership. Upon his retirement from his office we desire to tender to him this official expression of appreciation for his able leadership of our association; his stewardship has been faithfully performed.

CONCLUSION

In conclusion, a few words are in order on the importance of culvert design. A busy bridge engineer, concerned with many projects costing $100,000 to $10,000,000, can't devote much time to any one culvert. However, from the standpoint of mass production, these culverts represent a very large investment in highway plant.

Several years ago we tallied a few road projects and found that 12 percent of the construction cost was for culverts. Last February at a Highway Research Board meeting, the statement was made that drainage structures aggregated 17 percent of highway costs. The proportion varies widely with topography and climate, of course, but we are probably spending well over $1,000,000 each year for culverts on state highways in California, and that may be increased ten fold if recommendations of the Collier Committee are adopted.

To meet this problem of mass production and fit the wide variety of site conditions, standard designs must also provide variety. With skillful selection from such a variety of standards it is expected that future applications of standard culverts will be tantamount to individual designs, obtaining unusual economy and assurance of performance at a very nominal design cost.

# California Experience and Practice in Highway Pavement Foundation

(Continued from page 9)

will be imported or selected material of varying thickness with 30 CBR.

The Terminal Island Access roads are still in the grading stage, all of the roadway being an imported borrow embankment which is specified to have greater than 20 CBR and less than 6 P.I. The pavement for these contracts will be 7 inches of asphaltic concrete placed on 6 inches of imported subgrade material having a CBR value of 80 and a P.I. less than 10, with the added provision that the product of the P.I. times the percent passing 200 mesh shall not be greater than 75. This makes the 6 inches of imported subgrade material equal to crushed rock, and gives a total of 13 inches base and surface.

On all contracts, the resident engineers are being trained and instructed to select and save the best cuts for the top layers of the grade.

PROBLEM STILL UNSOLVED

The foregoing will give a little idea of what is being done in this State. We would remind you that the full application of these designs is necessarily limited to the main line heavily travelled roads where the traffic will justify the expenditure. There are many miles in outlying areas where the money that can be expended will build only a stage construction—a part of the ultimate base perhaps—with the hope that it will hold at least for a few years. This condition is particularly aggravated in the timber areas where log and lumber hauling has come up so rapidly. However, the same principle of design should apply, even though the full design cannot be built.

In spite of all the work and study that has been expended, we are still a long way from a final and satisfactory answer to our problem. We hope to be able to improve the tests that we have, or to develop other better and more satisfactory ones. No test is infallible, and there is still plenty of room for judgment based on experience.

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It is only an error of judgment to make a mistake, but it argues an infirmity of character to adhere to it when discovered. The Chinese say, "The glory is not in never falling down, but in rising every time you fall."—*Christian Bovee.*

# Petroleum Industry and Gas Tax Programs

(Continued from page 14)

ing between our respective organizations.

The serious problems facing highway transportation in this Country today demand all the understanding and intelligent cooperation we can muster. They are the heritage of our past experience and definitely a challenge to our immediate future.

During the quarter of a century between the two World Wars, travel on America's streets and highways skyrocketed to fantastic proportions. Between 1920 and 1940, the increase was nearly 100 percent in average annual mileage per vehicle, and more than 200 percent in the number of motor vehicles registered. The number of miles traveled has thus increased about 500 percent in this period of years.

### MARKETS EXPANDED

For the petroleum industry, it meant a tremendous expansion of markets, for after all, gasoline consumption is a direct index of highway use.

For the Country as a whole, this increased travel brought about a profound change in our way of living. Family mobility opened up new horizons for the farmer and the city dweller. When shortages of fuel, rubber and vehicles during the war compelled drastic curtailment of driving, we were jolted into a realization of just how thoroughly our gasoline-powered vehicles had become integrated with day-to-day living, and with our business and industry, education, recreation, and other phases of American life.

### PROBLEM OF ENGINEERS

For the highway engineer, the last quarter century has been, above all, a period of strenuous and unrelenting effort to keep up with the mounting demands for highway facilities. An understanding of what happened in these years is essential to a proper judgment of our course for the future.

At first, it was a case of getting traffic out of the mud. The towns in general had surfaced streets, and the major objective was to connect the towns with all-weather roads. The job was undertaken on a vast scale, with the encouragement given by the first Federal Aid Highway Act.

It was fortunate for the Nation that there emerged on the scene in those early days a man of great practical vision and leadership—Thomas H. MacDonald, Commissioner of the Public Roads Administration. Through his administration of the federal aid laws, during his continuous service of more than a quarter of a century, he has brought about classification of roads into designated systems, thus making orderly improvement possible. He encouraged the raising of administrative standards in state highway departments. He worked out a coordinated federal-state relationship in the highway field which has become a landmark in the history of our democracy.

### TRIBUTE TO MACDONALD

Then, as now, Chief MacDonald fostered study and research, to develop better techniques of design, construction, maintenance and financing. As the Nation's outstanding authority on highway engineering, his leadership in the immediate years ahead will contribute vitally to the further development of a sound highway program. Such improvements as we envision them must include ways and means of eliminating needless slaughter of citizens on our highways.

With the early improvement of rural highways came the first breath-taking jumps in traffic volume. But increasing traffic was not the only problem. The characteristics of road use themselves changed rapidly.

Thanks to the technological advances made by the automotive industries, including your own, vehicles got bigger, heavier and faster as well as more comfortable. The old crown road managed to get horseless carriages out of the mud, but its usefulness was limited. Highways constructed on a vast scale during the early twenties were in all too many instances obsolete 10 years later, because of the volume and tempo of traffic. They were inadequate as to types of surfacing. They were too narrow, the curves were too sharp, the grades too steep.

### TRAFFIC DEMANDS INCREASE

In the three decades since the creation of the federal aid system many roads in that system have been rebuilt two or three times, in a continuing effort to meet the changing traffic demands. Such was the pace of automotive progress.

Yet in spite of these roadbuilding achievements, engineers never succeeded in catching up with traffic demands. Congestion increased on main arteries, at times clogging some of them beyond capacity. Traffic accidents increased. Inside metropolitan areas, and on main roads approaching them, the rate of travel during rush hours slowed down to that of horse and buggy days.

As a result, all sorts of schemes were offered for solution of highway traffic congestion. Elaborate systems of toll roads should be established. Cities should be by-passed. Transcontinental superhighways should criss-cross from coast to coast, and from border to border. This last proposal gained considerable headway.

### PLANNING SURVEYS

Meanwhile, there was started in 1935 the highway planning surveys, which were destined to influence the whole course of the road program. These surveys were conducted by the states, in cooperation with the Public Roads Administration. They included a complete inventory of existing highways and a detailed, factual examination of how motor vehicles were being used.

The planning surveys made possible the publication in 1939 of that noteworthy report, entitled, "Toll Roads and Free Roads," which emphasized the significant importance of urban traffic in the highway system. Attempts to by-pass all the traffic around a city just don't make sense when the facts show that most of the traffic on the adjacent rural roads is actually heading for that city.

Some five years later, these facts were utilized by the National Committee on Interregional Highways in developing a plan for a national system of interstate highways. This plan, based on sound engineering study, left no room for the extravagant or grandiose features of the superhighway schemes previously suggested.

### A FOUNDATION

But the highway planning surveys have done more than merely block out

impractical panaceas. They have given us the foundation of factual information on which sound highway planning must be developed. They have disclosed, for example, the necessity for linking the origin and destination of traffic with the selection and location of routes. They provide the data which make it possible to develop improvement programs orderly and responsive to requirements of traffic. In short, their effect has been to put the highway program on an engineering basis, thus eliminating guesswork and furnishing definite means to combat local pressures. Thus through proper advance planning the motorist has reason to expect the greatest possible return for his highway dollar.

One of the outstanding lessons learned from the fact-finding techniques in highway planning is the acute need to improve highway facilities in and around our larger urban centers, particularly in the more densely populated states. The traditional checkerboard pattern of city streets with present parking provisions, is grossly inadequate to handle large volumes of traffic safely and efficiently. Major traffic movements must be concentrated on arteries capable of moving it.

Along with this is the need to improve a limited mileage of interstate roads to high standards, including the controlled access design where volumes justify it. These highways will serve intercity as well as rural travel, and will penetrate the hearts of cities, the destination point for a large share of the traffic.

### WAR INTERRUPTION

The planning surveys also disclosed the necessity for modernizing a large part of our existing rural trunk line mileage. More than half of these highways today are inadequate as to width or type or road surface. Likewise the surveys pointed to the need for extensive improvements in a far greater mileage of secondary roads. This need is particularly urgent in many of the states with large agricultural areas and relatively small urban population.

By 1940, many of the states had reached the point where they were ready to apply the lessons of the highway planning surveys to large-scale improvement programs. And then came the war.

Between 1942 and 1946, highway construction was suspended, except for a limited mileage of access routes to factories and natural resources. Normal replacement of worn-out facilities was deferred. Maintenance was handicapped by shortages of materials and manpower and in some instances of funds. Meanwhile, traffic was heavy on many routes, and so the pre-war deficiencies were further increased.

Fred F. Grumm, Assistant State Highway Engineer of California, contacts field stations from radio communications headquarters in Biltmore Hotel, Los Angeles

### CONGRESS PLANS AHEAD

While construction was at a standstill during the war, ways and means for meeting the augmented highway deficiencies after the war were considered. The facts obtained through the planning surveys were applied in advance engineering studies. Bills were introduced in Congress for an enlarged postwar federal aid program. Congress patiently heard much testimony and gave careful consideration to the urgent needs of the various states throughout the country, particularly to the deficiencies revealed by the planning surveys.

When Congress passed the Federal Aid Highway Act of 1944 granting $500,000,000 annually for the first three postwar years, funds were specifically earmarked for primary highways, secondary farm-to-market roads, and the major arteries in urban areas. Formulas were revised. Whereas funds for years were allotted on the basis of area, road mileage and total population, the new act made urban population the basis for allotting funds for urban highways, while rural population became one of the factors in allotting funds for farm-to-market roads.

Up to the present time allotments have been made for the first two years of the three-year program. The second fiscal year will end next June 30th. I wish I could report to you, on behalf of the members of our Association, that all of the states are going forward on schedule. Unfortunately, such is not the case.

Numerous factors have combined to delay and in fact restrict the program. Many bids have been and are continuing to be rejected on major projects because of current high prices. Right-of-way purchases are in many instances being delayed by reason of interference with the housing situation. The shortage of steel has practically stymied the ability of states to make progress on bridge and other structural work. Contractors cannot get much needed equipment. To meet this situation highway officials have from time to time reoriented their programs so as to permit construction of those types of urgent work with which there was the least interference. As a result highway construction work is running nationally, in dollars, close to the level in the years just before the war. The amount of work accomplished, however, will be considerably less, due to higher unit prices. If our situation in Minnesota is typical, the work accomplished will provide a very small part of the highway improvements which the public is demanding since the end of the war.

### FEDERAL FUNDS

Federal funds remain available for one year after the end of the fiscal year for which they are allotted. Consequently federal apportionments for the first fiscal year will expire next June 30th, and many of the states will not have taken up their funds at that time. I anticipate that Congress will be urged to extend the availability of those funds, in order to preserve the equities which are provided in the federal aid act.

The cost of rehabilitating our highway plant in the years ahead will be great. One major reason is the high price of land in the urban areas, where many of the urgently needed facilities will have to be constructed. Another reason is the high type of design which is needed on the key segments of our major networks. And in addition there is the backlog of accumulated wartime deficiencies which must be met.

### HIGHWAY FINANCE

This naturally leads us to the question of highway finance, which appears to have been the source of many past differences in opinion.

I am convinced that so far as broad, general principles of finances are concerned, the highway officials and the petroleum industry are in substantial accord.

We believe, as you do, that the costs of highways excluding those properly financed in whole or in part by local taxation should be apportioned equitably among beneficiaries of highway transportation, according to the benefits received. We believe that the user imposts for this purpose should be consistent with highway needs that the revenues so raised should be utilized exclusively for highway purposes, and that taxes should be limited to the highway users' ability to pay. We realize the fact that these determinations cannot be readily made with precision.

### UP TO PUBLIC

We cannot speak for the users in determining what taxes they should pay. Nor can any industry or other group. That decision is squarely up to the people themselves who foot the bill. In every state the issue finally rests with the highway users and the public.

As to measurement of needs, we believe that the only sound answer lies in factual study. The job is too big, the amounts of money too large, to permit any other kind of approach. On that point, too, I am sure that you concur.

As to the method of raising the highway users' share of the costs, I believe that a combination of license fees and gas taxes is the most equitable. Highways must be planned to take care of the peak loads in rush hours, Sundays and holidays, and the license fee acts as a minimum fee or service charge to help pay for the facilities needed to serve those who drive only occasionally. The gas tax is levied in proportion to the use each taxpayer makes of the highways and on such basis is equitable. I recall that in the twenties when the gas tax was beginning to produce the large revenues which later made possible so much of our highway development, that representatives of your industry shared in the popular viewpoint that this was one tax the people paid without protest

### GAS TAX PROTECTION

They will continue to pay these increased road user taxes readily only so long as the funds are used exclusively for the highway purposes for which they are levied. Here I want to digress to point with justifiable pride to the fact that my own state—Minnesota—was the first to dedicate motor vehicle taxes to highway purposes, by constitutional amendment. Subsequently, when our state followed the plan pioneered by Oregon and decided to levy a gas tax, we similarly dedicated those revenues to highway use. Up to date, and not counting states which voted on the question last week,* 17 other states have similarly dedicated their road user funds by constitutional provisions.

When the federal gas tax was first levied in 1932, and throughout the depression and the war years, this tax was also paid without protest because it was an emergency tax. Whether the people will continue to pay it together with other automotive excise taxes in normal times will depend to a large extent upon the use made of this revenue. I am not one of those who would look to Uncle Sam to act as Santa Claus every tme we need more highway funds. I do believe, however, that a substantial amount of federal highway aid is necessary to integrate the state highway systems into one national system, and it seems proper that the Federal Government should levy automotive taxes sufficiently large to offset the amounts appropriated for such highway aid.

### MUCH TO BE DONE

Another requisite for ready payment of gas taxes is that the people get from their taxes the modern facilities demanded by modern traffic. That calls for careful planning, for administration of a high caliber, free from harassments of special pressures and devoted to the task of getting the most possible value out of every dollar expended.

Like you, we are much concerned with the problem of tax exemptions and refunds. A great deal needs to be done in several of the states to improve administrative machinery to the end that legitimate claims for tax exemption can be honored, without the serious abuses which tend to creep into the picture.

On these fundamental issues of finance, I am sure you men, as petroleum industry leaders, will agree. I am confident that our approach to other questions likewise may be the same. For example, we share a mutual interest in seeing to it that on controlled-access facilities, the motorists can obtain fuel and other essential services with maximum convenience and economy. We are thoroughly in support of the principle of free enterprise, and as state officials we have no desire to enter into the gasoline, garage or tire business.

Well, if we can admit accord on all these important questions of policy, where, then is there likely occasion for misunderstanding?

### LACK OF MUTUAL CONFIDENCE

As I see it, the possibility lies mainly in a lack of mutual confidence. There seems to be a rather definite gap between our agreement in these principles, on the one hand, and the specific positions taken in the several states where the issues arise.

Certainly the petroleum industry in America does not wish to be identified exclusively with efforts to reduce or oppose gasoline taxes, regardless of conditions or needs. By the same token, highway officials are not seeking arbitrarily to increase such taxes. Both concepts are extreme and false. Yet they have been fostered in parts of the Country from time to time with the result that confidence has been weakened, and opportunity lost for helpful cooperation on common problems.

The state highway officials are responsible administrators, facing difficult problems. It is not their purpose to levy or spend revenues which are not required to meet the demands of highway transportation.

### COSTLY EXPERIENCE

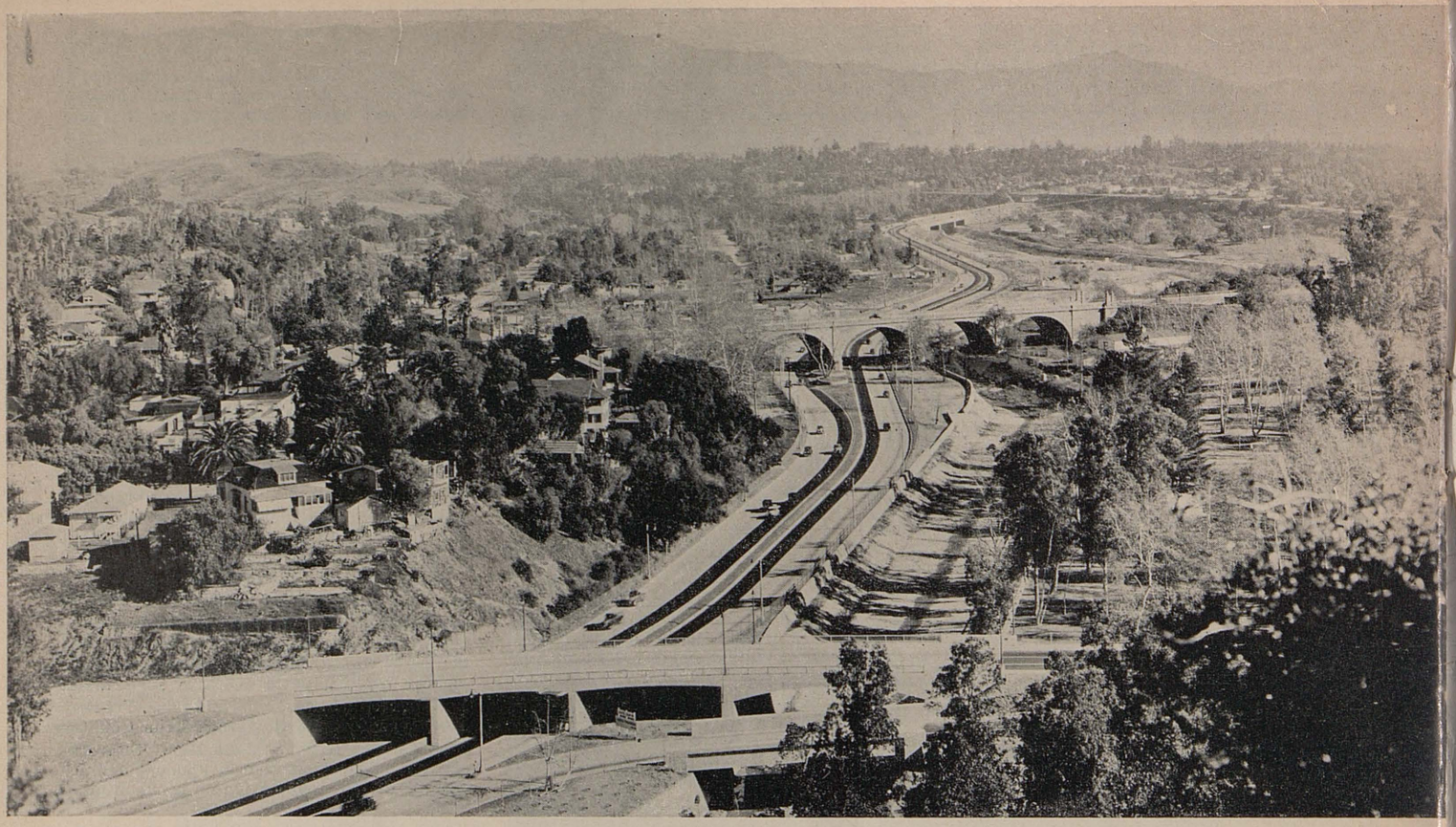
From the costly experience of the last quarter century, we have learned that early obsolescence of expensive highways must be avoided; that true economy is achieved by designing and building facilities in the first place which will last out their full service life. We recognize, too, the importance of acquiring land for right of way in advance, to keep costs down, and in sufficient width to avoid the enormous penalty of having to purchase additional widths later.

The highway officials have as their objective the providing of roads, streets and bridges which will make expanded highway transportation possible. We believe that this is your objective, too, and one which lies squarely in the public interest.

We ask for understanding, support and cooperation in the task of reaching that goal. We also ask for tolerance; no group of men can claim infallibility. As highway officials, we know we have made mistakes in the past, and will make more in the future. But with your help, and with the help of others who foresee the great benefits which safe and efficient highway transport can confer on the Nation, we are going to move forward with the program as soundly, as efficiently, and as rapidly as we can.

In concluding permit me to express my appreciation for the kind invitation extended to contribute to your program on this occasion.

*Maryland and Texas.



Section of Arroyo Seco Parkway, six-lane freeway connecting Los Angeles and Pasadena, which was viewed by AASHO delegates

# Highways and Public Works Concept

(Continued from page 26)

spections. These show that of 187,557 miles, 27,218 miles or 14.5 percent, are in a condition requiring reconstruction. This mileage has deteriorated with age and traffic, or the design is obsolete, resulting in unsafe highways. If this ratio holds on other highways maintained by State highway departments, of the 547,285 miles there would be 65,000 miles in need of reconstruction. How serious is this situation is indicated by the growth of maintenance costs to approximately $750,000,000 this year. This illustrates very well the fact that if replacement is neglected, maintenance costs increase and we substitute the less efficient maintenance dollar for the construction dollar.

On the showing that the desirable safe capacity of a two-lane road is 3,000 vehicles per day, on an annual average, there are in the neighborhood now of 14,000 miles which need to be stepped up to the four-lane design, and these inadequate highways are on the main-traveled routes of the States.

### HIGHWAY SAFETY

All of our efforts must be aimed at greater highway and street safety. Since the President's Highway Traffic Safety Conference in May, the downward trend of accidents has been most encouraging. The three committees contemplated by the program adopted by the conference have been formed or are in process of formation. The response of the governors of the states and the highway departments has been splendid. These state safety conferences are the most effective organization of public and official support we have yet had and centers the movement where it can be most effective. The conference committees and the state meetings have received encouragement and material assistance from the Automotive Safety Foundation and other organizations dedicated to the cause of greater traffic safety. Motor vehicle administrators, the state highway police, and the highway departments are in their associations, and as individuals, devoting increasing efforts and are cooperating fully to advance the safety cause.

### WORLD INTEREST IN HIGHWAYS

This is an appropriate time for a word of appreciation to the highway officials of the states who have devoted time and attention to the engineers and officials who have visited this country to advance their knowledge of highway construction. During the past months, more than 32 countries have been represented by more than 150 representatives. There has just been formed a World Health Conference to cooperate with the United Nations. Dr. Thomas Perran, Surgeon General of the Public Health Service, who served as president of the conference, said in his address: "The fundamental freedoms can be realized only when the people are healthy and well nourished. Hunger and malnutrition stunt the bodies and warp the minds of a large number of the world's population. To attain freedom from want of food is another goal which we may hope to reach by pooling our nutritional knowledge with the food and agricultural efforts of the United Nations."

The experiences stemming from the construction of the Inter-American Highway in Central America are convincing that food is the key to ability of the individual to produce and the major element in a better standard of living. This conclusion is confirmed by observations in many other parts of the world, but along with this is the equally ruling principle that transportation in the end determines whether people are or can be properly fed. Today. the ability of the United States to feed her own people abundantly and to share great quantities of food with other nations is as much the result of a great transportation plant as it is of the production of the foods themselves. This transportation plant must be carefully and constantly improved. Every element, railways, airways, waterways, as well as highways, must be kept in efficient operation and economic health. We will get the best and most economical service if there is full cooperation between the different forms of transport. It might be desirable to broaden the contacts of this association with the railroads now confined to the gradecrossing improvement program to include other matters of mutual interest. Serious questions immediately arise. We will certainly be wise if we leave transportation as it is in this country and perfect the services through cooperation.

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