

CAN ROAD DESIGN MAKE HIGHWAYS COMPLETELY SAFE?

An inquiry conducted by Chester Rowell, editor of the San Francisco Chronicle, with the help of Thomas H. MacDonald, Chief, Federal Bureau of Public Roads; Gibb Gilchrist, Texas State Highway Engineer; Charles H. Purcell, California State Highway Engineer; C. B. Treadway, chairman, State Road Department, Florida; and J. D. Adams, chairman, State Highway Commission, Indiana, and broadcast Tuesday, December 8, from the San Francisco Studios, National Broadcasting Company.

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SAN FRANCISCO ANNOUNCER:

Meeting in San Francisco today are a group of men who have as much to do with the daily life of America as any group of the same size that could be gathered together. Their work touches your daily life and mine and all our neighbors' daily lives. They are the members of the American Association of State Highway Officials. Several of the veteran members of this Association have gathered in our studios this evening for a discussion among themselves and with Mr. Chester C. Rowell, distinguished editor of the San Francisco Chronicle, and well known commentator on public affairs. They are to talk about safety and the highways. I need say no more to rouse your interest, and shall no longer delay the start of our discussion. Ladies and gentlemen, Mr. Rowell.

ROWELL:

Good evening ladies and gentlemen. We are gathered here that you may learn from expert authorities what can be done to make our highways safer.

We have more than 26 million motor vehicles operated at different times by 44 million drivers on more than 3 million miles of streets and highways. Last year in traveling 192 billion miles, there resulted 827 thousand accidents involving personal injury and 37 thousand people were killed. Usage of highways continues to increase both for business and pleasure. Motor vehicle operators pay over a billion dollars yearly in taxes, presumably for highways. As one of the 44 million drivers I am going to ask these gentlemen a few questions about the policies that govern the expenditure of our billion dollar contribution. But, first let me present each member of the group.

Here is the President of the American Association of State Highway Officials - the State Highway Engineer of the State of Texas - who has under his immediate direction 20,000 miles of road - more than any other man in the world. Ladies and gentlemen, Mr. Gibb Gilchrist.

GILCHRIST:

Thank you, Mr. Rowell, and good evening to this radio audience.

ROWELL:

Another member of our group is the Chairman of the State Road Department of Florida. The roads over which this department has jurisdiction are crowded with tourists from more than half the States of the Union, and the Department tries to make them as safe as engineering science can make them. The man in charge is . . . Mr. C. B. Treadway.

FREADWAY:

Mr. Rowell, the State of Florida here and now issues an invitation to you and to all this audience to come down and see for yourselves how safe our highway system is . . .

ROWELL:

That's true Southern hospitality - such a cordial invitation from a Floridian to a Californian. But of course it went to all others also. And a good many who travel southward to Florida will use the roads of Indiana for a part of the way; so will many travelers headed in other directions. Great traffic arteries converge on Indiana from all directions, and create many difficult problems in road administration for another of our guests this evening - the Chairman of the State Highway Commission of Indiana. Ladies and Gentlemen, Mr. James D. Adams.

ADAMS:

Good evening.

ROWELL:

I'm sure Mr. Adams won't be so laconic when we get into our discussion because he's widely known for his plans to revise the highway system of his State to meet present conditions.

Now I ask you to meet a man of whom Californians are proud. Our State highway engineer heads a department responsible for highways known throughout the world for their excellence. Also he has been engineer in charge of the construction of the San Francisco Bay bridge, one of the engineering achievements of the century. Ladies and Gentlemen, Mr. Charles H. Purcell.

PURCELL:

Spare my blushes, Chester. And please proceed with your introductions.

ROWELL:

Very well, Charley. But you know the editor of the home town paper has to publish the fact when a local boy makes good.

Now, radio listeners, I present the Chief of the United States Bureau of Public Roads. Under his direction, the Federal-aid system of highways has grown from only a plan on paper to a great system of through routes reaching to every part of the nation. Mr. Thomas H. MacDonald.

MACDONALD:

Thank you, Mr. Rowell. Good evening, radio listeners.

ROWELL:

Now, Mr. MacDonald, you and these other gentlemen with whom you work are here, as I understand it, to consult with each other on plans for designing and building the highways of tomorrow. And as I've sat in some of your sessions, I've heard men say repeatedly that the highways of tomorrow must embody every feature that the skill of the road builders can devise to make them safe.

So say all of you, I take it, gentlemen.

MACDONALD:

Assuming the role of spokesman for the road officials, I'll answer a very firm, "Yes," Mr. Rowell.

The safety of highway traffic is the concern of all highway builders.

Every highway builder is shocked and grieved to see the accident toll mounting year after year. We want it reduced. We are continually studying principles of design and construction to find how roads may be built safer, and we are continually building safer roads insofar as hazards in the road structure itself are concerned. As highway engineers we are concerned about safety on all streets and highways, city and rural, but I should point out that the responsibility of the group we represent has been restricted largely to rural highways in the past. Of the 37 thousand deaths resulting from motor vehicle accidents in 1935, 11,800 occurred in cities of over 10,000 population and 25,200 occurred in small cities and on rural highways. We do not know the number occurring on rural highways, but 25 thousand is an outside limit. This is 1,200 more deaths than occurred from falls in 1934. Rural highway deaths are probably fewer than those resulting from falls and somewhat more than those from burns and drowning combined. We intend that highway deaths shall decrease, but we can now point out that highway travel is the safest form of transportation.

ROWELL:

I presume you mean per mile traveled per person, Mr. MacDonald.

MACDONALD:

I do. The National Safety Council reports that in highway transportation in 1934 there were 9.4 deaths of all kinds, including those of Pedestrians, to each 100 million miles of travel. That record is more than twice as good as the record of any other form of transportation.

PURCELL:

We highway engineers also draw some comfort from the fact that highway travel seems to be somewhat safer, per passenger-mile, than it was 15 years ago. In the year 1920 there were 26.1 fatalities on streets and highways per 10 million gallons of gasoline produced (that's a rough measure of the extent of highway traffic) and in the year 1934 there were 20.6 fatalities per 10 million gallons of gasoline produced. What are your views Mr. Adams?

ADAMS:

So many more passenger-miles of use are occurring nowadays that the death and injury toll is bound to be larger, absolutely, even if not relatively. However, I admit that some things about the design and construction of our highways are responsible for its being so large. I say that even though I know that no amount of improvement in the design and the building of roads can make all drivers of automobiles careful and sober and completely competent physically.

MACDONALD:

You are right, Mr. Adams. The Bureau of Public Roads feels that the one important job for the future is to make existing highways safer and build still safer new highways. There is potential danger in some highway conditions of today. More than one-third of those killed on rural highways are pedestrians. The need for footpaths, separate from the roadway, is widespread. Some road surfaces are too slippery and narrow; some blind intersections are invitations to accident; railroad grade crossings continue to take their toll; many of the older roads are not built to make passing safe at modern road speeds; too many bridges and culverts are narrower than the roads. *Macdonald*

TREADWAY:

No one, least of all the responsible highway officers, denies that such hazards exist on the highways. But they're being bettered. Take grade crossings for example. Over six thousand grade crossings on State systems have been eliminated in the past decade, largely with Federal assistance; over two thousand crossings are being eliminated in the current emergency program, and the work is to be continued as a regular Federal-aid policy.

ROWELL:

That's encouraging. But a blunt, not quite completely courteous question has thrust itself into my mind. Gentlemen, you all recognize these conditions as dangerous; and you acknowledge that they exist. Now why did you and your predecessors responsible for our highways, allow them to be built into the roads to begin with? Suppose I direct that question to you, Mr. Gilchrist.

GILCHRIST:

That's fair enough. And the question's fair enough. Now here's what I answer, on behalf of the highway designers and builders:

For obvious reasons, road builders have not been able to keep pace with vehicle builders. The roads last longer than the vehicles. Twenty-five years ago, there were only 640 thousand motor vehicles in the United States and now there are 26 million, and what different vehicles they are. With increasing motor vehicles, the demand for improved roads developed into a clamor that has not abated, but on the other hand has increased, and what a difference in what would be termed a satisfactorily improved road in 1911 as against 1936.

The first job of the early road builder was to get the traveler out of the mud. He had to stretch the funds as far as possible to give some measure of improvement and to cover as much mileage as possible.

I don't mean to say that the older roads were dangerous when they were built. They were not. But, with the improvement of motor vehicles and increasing speed, these old highways became inadequate to a greater degree and by reason of short sight distances at curves and over hills, they did not develop the utility that was available in the motor vehicles of a later age.

It is clearly the duty of road officials to see that highways are properly located and provided with adequate rights-of-way. It is the duty of the designing engineer to see that every opportunity is given the sane, sober, and alert driver to proceed along a public roadway with safety, barring defects in his own equipment. Reckless drivers, a relatively small percentage of the total, can, in my opinion, be educated, controlled, or punished at a cost equivalent to four gallons of gasoline per motor vehicle per year. There is no such thing as a fool-proof highway with these drivers behind the wheel. Motor vehicle speed is with us to stay and we must face and recognize it because we are going to have it anyway.

ROWELL:

A very impressive answer, Mr. Gilchrist. But you end with a statement which moves me to ask if the road builders regard high-speed motor vehicles as the cause of the high accident rate.

PURCELL:

No, Chester, as Mr. MacDonald has often said, it isn't speed, but speed at the wrong place that's to be condemned.

MACDONALD:

Quite so, Mr. Purcell, quite so. I can't too strongly state that road builders do not regard modern motor cars as dangerous. Not only that: We regard the reserve power which permits them to travel at high speeds as a potential factor of safety, in that the same power which makes speed possible also makes the car respond more quickly to the needs of the driver when he meets an emergency. History shows that increase in speed has been a principal factor in the advance of all transportation. But always other factors must be adjusted to permit increased speed, and operators must learn where speed is safe. Many adjustments to meet modern conditions are being made. What about the erection of signs in Indiana, Mr. Adams?

ADAMS:

In the past two years our State has spent more than 83,000 dollars to reflectorize signs to mark curves, highway intersections, and the inside limits of bridge handrails. But it's money well spent. So is the 60,000 dollars or more a year that we spend on centerline markings.

TREADWAY:

In Florida we have many deficiencies on important, heavily traveled highways. These roads are still adequate structurally. But many of them are bad in alignment, so that passing is not safe at all places. To improve the alignment, we must take out curves, and improve grades. This

means spending money for new right of way. The cost of right of way is high, and we have to go slower than we wish on some of these improvements in alignment. That is true generally isn't it, Mr. MacDonald?

MACDONALD:

Yes. After all, the public will have to decide how fast the States can go in spending to correct these faulty road conditions. But much is being done at the present level of expenditure. It would be instructive, Mr. Rowell, to have each of these men tell us briefly what his State is doing to improve the safety of its highways.

ROWELL:

Splendid. Suppose we ask Mr. Treadway to continue his remarks and illustrate them by telling of Florida's improvement program.

TREADWAY:

Very well. Our State population is more than doubled in the winter season. We must provide highways for our own 500 thousand motor vehicles and for tens of thousands from other States. Deficiencies in our system are greatly magnified by the presence of motorists who have formed driving habits in other States. It is of first importance that we follow standards that are national in scope in placing signs and in construction practices.

The Florida State Road Department now insists on a 200-foot right of way for every new State highway. New pavement is laid at one side of the center line to allow widening when required. The wide right of way permits broad shoulders, gentle slopes in cuts and fills, and shallow ditches.

Many of our main roads that meander around to serve many farms are being relocated on broad rights of way.

A force of 45 specially selected and carefully trained motorcycle officers in distinctive uniforms patrol our highways and are a most effective agency. Their primary purpose is to promote safety by acquainting visitors with our regulations. Arrests are made only in extreme cases.

We are making our highways safer but it will be many years before highway improvement catches up with rapidly growing traffic, as we can proceed no faster than funds are provided. The motorist is paying enough today to meet the cost of the kind of roads he should have, but many uses have been discovered to which the motorists' fees and taxes are arbitrarily diverted.

MACDONALD:

Thanks for the Florida story. Mr. Adams, what are the main points in Indiana's program of highway improvement for safety's sake? You've already told us about your program of marking. What else?

ADAMS:

In Indiana we feel that the greatest contribution to motoring safety during the past three years has been widening rights of way on 1,800 miles of State Highways to 100 feet on primary roads and to 80 feet on secondary roads. (This makes it possible to extend shoulders, widen culverts and build shallow side ditches.) We find that the number of accidents--as compared to years prior to the widening--has been reduced by half. On other sections of these same highways where the shoulders have not been widened a shocking increase is found both in the number of accidents and the number killed.

Indiana has expended millions in the elimination of curves which were too sharp for modern speeds and in the improvement of sight distance to meet changing needs.

Indiana's most perplexing problem is the modernization of bridges and culverts. More than 1,900 of them on our State Highway System are too narrow. These structures claim many lives annually. The public insists that they be widened, but Indiana faces a prohibitive replacement cost of between 25 and 30 million dollars for such a program alone.

During the past four years Indiana has widened more than 3 thousand small bridges and narrow culverts but the more costly work remains to be done.

In the past four years we have constructed or now have under contract 61 railroad grade crossing eliminations--more than were built in the all-time history of the State Highway Department prior to four years ago.

Indiana has embarked upon an extensive program of divided lane highways on the more heavily traveled routes. Twenty-five miles of such construction is now under contract and the 1937 program provides for paving the first lane of a divided lane highway on an additional twenty-five miles and grading and structures on 62 miles.

MACDONALD:

An impressive list of safety improvements in Indiana. And by the way, Mr. Rowell, we'll want to discuss this divided lane road matter more when we come to sum up what the engineers are pointing toward in the highways of the future. But now, let's ask Mr. Purcell to give us the California improvement program.

PURCELL:

California is using the most modern standards in new construction and has expended millions to modernize its old roads. The great volumes of traffic pouring into and out of our cities are a conspicuous part of the safety problem and California has many notable projects where we have entirely relocated sections of old highways and built broad highways over which traffic can flow with facility and safety so far as the highway itself is concerned.

In the mountains we have expended enormous sums and moved millions of yards of dirt to make broad highways with easy grades and curves and long sight distances, but I cannot say that we have eliminated accidents on these roads.

In building the San Francisco-Oakland Bay Bridge our objective has been to build the ideal highway of the future, a highway as safe as the engineer can make it.

The bridge extends for $4\frac{1}{2}$ miles over navigable water with approaches in San Francisco and Oakland. The bridge has two decks. Fast moving vehicles are routed over the upper deck which has six lanes. Heavy trucks and busses must use the three lanes of the lower deck. We have introduced a new idea in marking lanes on the bridge. Granite tiles are embedded in the concrete with a double row of tiles separating east bound and west bound traffic. These lines will never be worn off the pavement. The concrete paving on the bridge is non-skid.

Another feature of importance, both in speeding traffic and reducing accidents, is the distribution structure of the east Bay approaches. This structure distributes traffic in three directions without right angle crossings or left hand turns.

A sodium vapor lighting system is used on the bridge and approaches. About one thousand luminaries are used in lighting 15 miles of bridge and approaches. The highway is so well lighted that it is possible to drive without headlights and all glare is eliminated. The roadway signs and markers stand out distinctly.

MACDONALD:

Experience tells us that accidents will occur even on such a bridge but they will clearly be the fault of drivers. Now, Mr. Gilchrist, what are you doing with the Texas system?

GILCHRIST:

I will not say we've done everything we might have done, but we've made much progress. One of the principal items has been the use of the flat section and the elimination of deep ditches. We've built the bridges two feet wider on each side than the pavement. Sight distance has been lengthened, and heavy topography and old construction have been suitably marked to give the driver due caution. In many places along the roads and over bridges we've built sidewalks for pedestrians, especially for (school) children going to and from school. Hundreds of railroad grade crossings have been eliminated. Luminous signs have been provided to increase the safety of night travel.

Non-skid road surfaces are being provided and intersecting roads are being graveled to the right of way line to decrease the amount of slippery mud and dirt brought on the pavement.

ROWELL:

Well, gentlemen, it does appear that a great deal is being done to improve the design and the construction of highways. But I take it you hold that with the greatest possible progress, you'll never be able to create a highway that's immune to accidents. Suppose we ask Mr. Purcell to give the answer.

PURCELL:

Decidedly not. The Bay Bridge is as nearly so as we can make it, but in preparing our plans we studied the record on a number of older highways in this country that embody practically every element of design and construction that engineers regard as perfect for accident prevention - yet accidents occur on them. With nearly 200 billion miles of motor vehicle travel each year some accidents are inevitable.

ROWELL:

From what you gentlemen have said here plus my common sense, I can guess it would be very expensive -- to relieve all roads, or even the most heavily traveled roads of head-on collision and intersectional hazards. How about that, Mr. MacDonald?

MACDONALD:

Very expensive indeed, Mr. Rowell. Our engineers have made a very rough estimate of the cost of thus improving the 5 percent of all roads that have the heaviest traffic volume. We find it would cost 4 billion dollars to carry that through.

Four billion dollars is just about the amount that has been spent in the last 20 years in the program of Federal-aid to the States including State funds used, plus the recent emergency highway authorizations.

ROWELL:

So we may conclude that achieving complete protection by making roads foolproof will cost more than we'll be able to pay in the immediate future.

Going back to the question of highway design and construction: it seems to me you engineers are pretty busy just trying to correct the defects of past accomplishment -- to bring the work of the past up to today's needs. Now I wonder this: In what you engineers are doing now, do you have your eyes on tomorrow and its needs -- or will today's roads be found inadequate in some near tomorrow? What do you say, Mr. Gilchrist?

GILCHRIST:

We hope not, Mr. Rowell. At least we're considering tomorrow's needs. I wish we had time to ask Mr. MacDonald to tell you about the cooperative surveys of highway needs going on in 40 States now, to provide a basis for framing the highway building and maintenance program of the future. When these surveys are completed, we'll be able to tell the people of our States what it will cost to have State highway systems improved in varying degrees -- not only what it will cost to build them, but what it will cost to keep them up, year after year. Knowing the costs of different degrees of adequacy in their highway systems, our people can choose what degree of adequacy they think they can afford.

MACDONALD:

If I may add just one thought there, let me say this: Nothing is so likely to result in an unsatisfactory condition of the highway system in the future as public unwillingness to face the continuing costs of the highway system. We expect, through the highway planning surveys, State by State, to be able to map a program, and to present recommendations with supporting facts, so the public may decide intelligently on what it wants and will pay for. The annual highway expenditure can never be less than it is at present. It will inevitably be increased by the further improvements that have to be made.

ROWELL:

Straight talk, Mr. MacDonald. But reasonable and business like - and statesmanlike. Now, to return to engineering features of future highway construction that we are likely to see, will you sum up some of the changes in store for us drivers, Mr. MacDonald?

MACDONALD:

There will be provided for motor vehicle operators of the future, roadways that can be used with safety by the reasonably careful driver. The roadways will be designed for a speed of 60 miles per hour.

The roads of the future will have traffic lanes wide enough for ample clearance. That means that at the speeds we now foresee we'll want a 22-foot road for two-lane traffic. It will have shoulders wide enough for stopping; no deep side ditches. Its surface will be consistently smooth, and nonskid. It will be so designed as to alignment, profile, and cross section, that at no place will the traveler suddenly encounter the unexpected or traffic so slow that if impatient he will be tempted to take a chance.

Where the traffic is so heavy that two lanes won't carry it, there will be four-lane roads. But they will consist of two lanes on each side of a center parkway - there'll be no chance to meet opposing traffic as there is in the present road with four contiguous lanes. We all endorse the principle of separated-lane roads at all points where more than two lanes must be provided to carry the traffic.

ROWELL:

I hope you'll give us your comments on lighting the highway of the future, Mr. MacDonald.

MACDONALD:

Very well. More lighting will undoubtedly be used, but the amount will depend on the funds made available for highways and where we can spend the money most effectively to prevent accidents. Greater dividends in lives saved per thousand dollars of expenditure could be produced by construction of footpaths along heavily traveled routes and separation of grades at intersections of main traffic arteries than by a general lighting program.

However, lighting will have a place in the future program. Old methods of lighting are inefficient and of doubtful value, but marked improvements are being made. We must experiment to produce a thoroughly efficient system of lighting. We must also light experimental sections of highway and accumulate accident records as a guide in determining where the expense of lighting is justified. I think it is clear that lighting for all roads isn't possible now. Installation is not expensive, but operation would cost more than all the other items of highway maintenance put together. And most highway departments don't have enough maintenance money as it is, to keep the highways in as good shape as they would like.

Continuing with other possible improvements - we will have pedestrian walkways at a safe distance from the highway surface; also, on heavily traveled roads we will have surfaced areas where buses may pull out of the stream of traffic to receive and discharge passengers; and turn-outs for the R.F.D. carriers to use in serving the boxes of their patrons. The danger spots which can't be eliminated by reason of the great expense will be plainly indicated by signs that will advise the motorist what speed is safe.

The highway engineer's part in promoting highway safety is to design highways that are safe for reasonably careful drivers. That is - as safe highways as can be built with the funds available. They will be highways on which you can pass an overtaken vehicle with safety, highways that will not confront a driver with hazardous conditions without ample notice or warning. When this has been accomplished, the highway will occupy its proper place in supporting the safety triangle of the road, the vehicle, and the driver. But finally, safety will always rest with the driver.

ROWELL:

Thank you, gentlemen. If you'll allow me to summarize your discussion you've said that the present highway system was developed in the face of heavy obstacles; that the prospects for highways of tomorrow are brighter, because experience has shown some things that need to be done, and careful surveys and planning will reveal others; that the roads of tomorrow will be safer, in so far as it is economically practical to make them safer ----- and that you hope the drivers also will be safer.

SAN FRANCISCO ANNOUNCER:

You have heard a discussion of highway safety on tomorrow's roads. Participating were Thomas H. MacDonald, Chief, Federal Bureau of Public Roads; Gibb Gilchrist, Texas State Highway Engineer; Charles H. Purcell, California State Highway Engineer; C. B. Treadway, Chairman, State Road Department, Florida; and J. D. Adams, Chairman, State Highway Commission, Indiana.

This has been a Blue network presentation - from San Francisco - of the National Broadcasting Company.