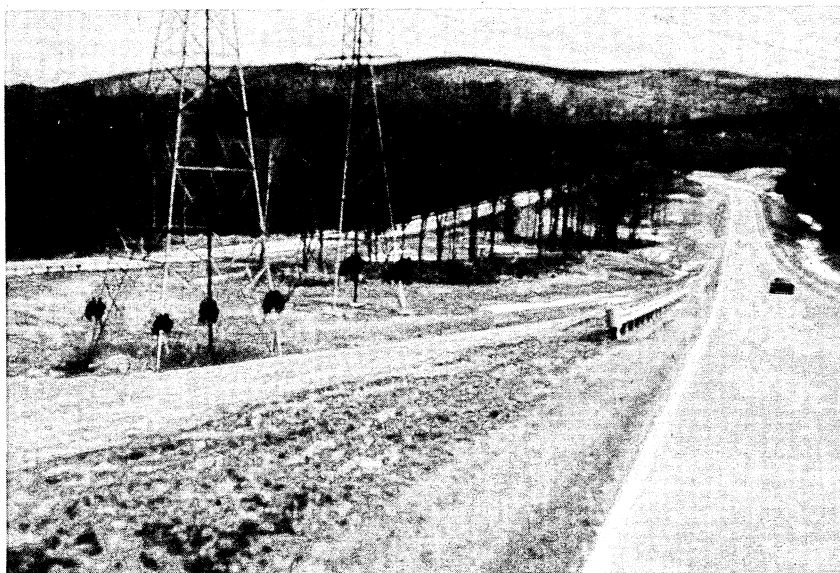


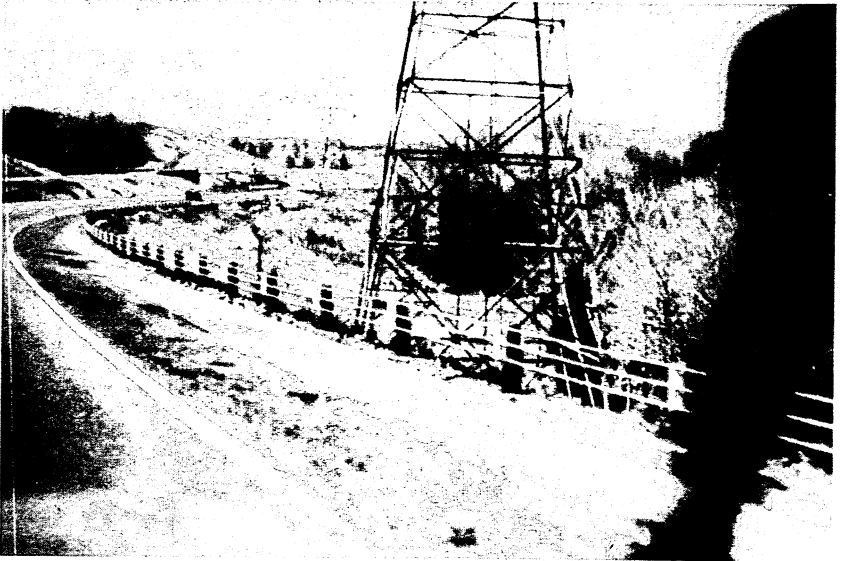
Here you see a guardrail supposed to keep cars from going into that river. It will not do the job. Somebody could go right through there and drown. Those trees won't do the job either; they're too small.



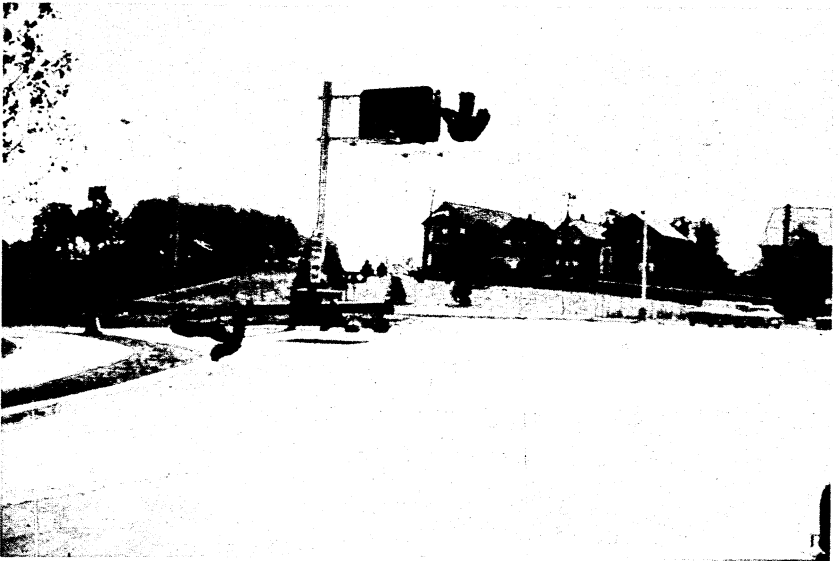
Here you see high-voltage wire towers. Anyone riding over this curb will have gravity to help them go down and they will just cave in that particular installation there and the high-voltage wire will fall on top



of the car. I feel you need a guardrail there. A large truck can roll over the cable.



Here you see a sign that says—the arrow is pointing in—it says “Goethal’s Bridge.” That is actually one way, but that sign is telling you to go in there. I recommended to the State engineers to get that arrow to point down as I have it shown, so at least somebody knows you have to go past it. The last time I looked at it, it was still that way.



They do have a sign on the left, a little sign, saying "do not enter." Maybe it will be foggy and that overhead sign would be lit up there. You would be looking at the lit-up sign and go right in that area. I feel we are asking for trouble.

Mr. BLATNIK. Thank you, Mr. Linko, and thank you, Mr. Prisk. May we have the lights, please.

Mr. Linko, we are more than indebted to you for the continuation of very effective and impressive testimony, illustrated by excellent pictures. If I were to try to summarize all of your valuable testimony, it would obviously set the stage for hearings yet to come. It is obviously a very serious situation, and in some matters a grim situation. How these points could have escaped the attention of experienced and trained traffic people, safety people, engineers, is beyond me. On second thought it is perhaps not so mysterious when you realize that the average driver just takes for granted, perhaps, 80 to 90 percent of what flashes by him. I know, from my own experience, I have been unaware of this potential for impact with fixed objects.

I do believe it is the responsibility of those who design and build these roads to do so correctly. If we did not make mistakes we would not need erasers on the end of pencils but when mistakes are made, you have to learn from them.

You showed us light poles put in with concrete bases where old poles had existed, wrongly positioned.

Mr. LINKO. Correct.

Mr. BLATNIK. You have impressed me with the almost unending combination of variables and situations—a guardrail will protect one side of the pole, and the other side left exposed; it will protect correctly one side and not the other. You have a good installation at the wrong place and the wrong thing done at a needed place, and then something done where nothing should be done.

The hazardous situations can result from different combinations of installations. You have the lights, transformers, fire call boxes, telephone boxes, directional signs, conventional signs, telephone poles, and other such structures.

We thank you very much, Mr. Linko. I know I speak for the whole committee. We are deeply indebted for your contribution and will have more to say about that later on.

The testimony we have heard in these hearings to date has identified these various roadside hazards in the Greater New York, Connecticut, and New Jersey area, and in the State of Michigan.

The Chair has repeatedly emphasized that the conditions shown are by no means confined to these areas alone, but, on the contrary, are nationwide. Our staff has learned, during the course of a painstaking, in depth investigation, that the roads in every region of our country contain design deficiencies of the hazardous and lethal sort which we have seen and heard described by our witnesses over a period of several days.

There will be testimony later on concerning conditions in other areas of the country. However, we need not travel far to locate and identify built-in hazards on our highways for they exist all around us. I know from personal observation, just while driving in and around the Nation's Capital, that the sort of things Mr. Linko and other witnesses have described can be found within a very short distance from right where we sit.

One of the sections of our great Interstate System inspected by investigators from our staff was I-495, better known as the Capital Beltway. On Thursday of this week, when we next meet, we will hear an analysis of the beltway from a staff member. His testimony will be supplemented by the comments of Mr. Prisk, whose continued presence at these hearings has been so helpful to us.

The Capital Beltway was one of the first of the free Interstate circumferential highways completely encircling a major American city—and very properly it encircled the Nation's Capital, together with the very rapidly spreading and growing metropolitan area.

It is a wonderful convenience to the interstate traveler and to the hundreds of thousands of Washington metropolitan area residents who enjoy the use of it, who commute back and forth to work around and through the area.

As with the testimony we have previously heard, the Chair wishes to point out that, again, there is nothing peculiar to this highway alone. It is far from perfect, so far as roadside hazards are concerned; but the lessons we may learn from its imperfections can be of great value to the people who design and build our highways, both here and elsewhere.

Another point I think, as Mr. Linko has made very clear, some of the lessons can be put into effect almost at once. Is that not true?

Mr. LINKO. That is right.

I would like to point out again that 90 percent of the material that I am showing you has nothing to do with money. In other words, the job could have been done at the same cost, or even less, as the slides have shown.

Mr. BLATNIK. Yes. If they just did not put obstacles there in the first place, it would give a better chance to the motorist, and chances of impact would be greatly reduced.

We will recess our hearing at this time and meet again later on.

Before adjourning, I would like to recognize our colleague and very close friend, Mr. Clausen, of California—and Mr. McEwen.

Mr. CLAUSEN. Thank you, Mr. Chairman. My comments will be brief.

I think it is very necessary that on behalf of the minority, we recognize, Mr. Linko, you as an individual, and the great public service that you have provided.

Certainly those of us that have had an opportunity to see your presentation have been most impressed. As a matter of fact, I quite honestly feel, Mr. Linko, with what you have done, its impact on our society certainly is comparable to the fellow who is going to find a solution in Vietnam. I mean this sincerely.

As you know, our former colleague, Mr. Baldwin, was the initiator of safety amendments. What you have done as a layman, coming in before this committee, in my judgment is one of the great services to this country, not only now but in the future.

I also hope that whatever takes place following this particular hearing, there will be some action as a result of your efforts.

I think, in short, it proves, Mr. Chairman, that many of our people—we tend to live in ivory towers and do not get down to the facts at hand. Here, as I understand it, is a television repairman—is that correct?

Mr. LINKO. That is right.

Mr. CLAUSEN. I think there ought to be reprints of this presentation sent out to prick the conscience of every engineer in this country. I think they have been sadly lacking. I am a great respecter of engineers, but I think it should be on their conscience, because they, in effect, have been killing a great many Americans. I think it should be presented to people very forthrightly, so this thing does not occur.

When a layman like this can come before the committee and make this sort of impression, I am just hopeful now that this committee will take the information and see that it is implemented immediately. Because, as I said, it is not a question of money.

Mr. LINKO. Yes. And I would like to point out, millions can actually be saved every month. I have visited at random new highways and they still have these defects now. It can save millions right now, if only by not building more hazards. That is the point.

Mr. CLAUSEN. I would think, frankly, the engineering organizations of this country would be well advised to take some copies of these photos and voluntarily see that these go out to their members. If they do not do this, I would think the committee would be well advised to see that they are sent to the service clubs throughout the country to prick their conscience.

Some of the people injured or who lost their lives might have been members of your family. It disturbs me greatly.

I think what you have done is one of the greatest services to mankind.

Mr. LINKO. I am glad this committee will listen, because I have given this information out in the last 4 years to everybody, and nobody else has listened.

Mr. McEWEN. Mr. Chairman.

Mr. BLATNIK. Mr. McEwen.

Mr. McEWEN. I would like to add also my appreciation to Mr. Linko for what he has presented. I think you have made us all very mindful of many of these situations that are repeated time and again on our highways.

I would say, Mr. Chairman, I would say to Mr. Linko, just this past week when I had to drive quite a few hundred miles over our Interstate System, I had occasion to observe there are improvements being made. For example, on I-81 in New York State, between Binghamton and Syracuse, I noted there in the newer sections that have been opened where the guardrails are being buried, the ends of them. They are being flared back and buried into the ground.

After looking at your slides prior to my trip of last week, I found, Mr. Chairman, as I think all of us on this subcommittee have, as we have been driving now we have been looking for a lot of these things that you have pointed out.

I will say, Mr. Linko, I saw many of the things that you called to our attention that are still being repeated, particularly on location of signs where they could be placed back of guardrails and they are not placed back of them, or where a slight change in the location would take care of the situation. But I did note some improvements. One, on the flaring of the guardrails and burying them into the ground, and also I saw some better protection on some of our bridge abutments.

Again, Mr. Chairman, I would like to say to Mr. Linko, he has made a great contribution; and I think your testimony, more than the specifics that you brought to our attention is a reminder to all of us that we can get valuable information from people who are outside of our own particular profession or discipline.

I am impressed that you, as a concerned citizen—not as a highway engineer—have looked at this and brought to us I think some of the most valuable information on highway safety that we have had presented to this committee.

Mr. CLAUSEN. Mr. Chairman.

Mr. BLATNIK. Mr. Clausen.

Mr. CLAUSEN. I think that this sort of citizen effort must be recognized, and I do not know if there is anything in the way of recommendation that could come from this particular committee to the appropriate people, but this gentleman, in my judgment, is worthy of one of the high awards of this country for what he has done.

If it would be in order, Mr. Chairman, and I think everyone on this committee would agree, I would like to see a resolution of commendation to Mr. Linko. May we ask the staff to draft a resolution and to make a recommendation in Mr. Linko's behalf to the appropriate people?

If you think it is in order, I make the request.

Mr. BLATNIK. I think it is definitely in order, and as I indicated in my statements earlier, certainly we had that in mind.

I think both gentlemen, as usual, are both thoughtful and considerate with the suggestion. It may be a little premature to say at this time, but I believe, from what I have seen and what I have heard, and having some idea of the testimony yet to come, I believe that the hearings, which have been started, were initiated, sort of launched by Mr. Linko's most revealing presentation.

In every instance we have seen beneficial positive results from our hearings. I am confident the same thing will happen after these hearings. To that we owe you, certainly, more than just expressions we have made so far, and we will consider a suitable and more pertinent and more justifiable expression later on.

Mr. CLAUSEN. Mr. Chairman, I think that if this recognition is given—we are saying this, obviously, in front of the gentleman himself—it is conceivable that other Americans would be motivated to make a similar effort. The fact he has taken the initiative on his own, in my judgment, has to be recognized, hopefully to improve the lot for everyone throughout the country.

Mr. BLATNIK. Thank you, gentlemen. Again, may we thank the witnesses. The hearings for today are adjourned and the hearings will be resumed at 10 o'clock Thursday morning.

(Whereupon, at 12:18 p.m., the subcommittee was recessed, to reconvene at 10 a.m., Thursday, June 8, 1967.)

HIGHWAY SAFETY, DESIGN AND OPERATIONS

Roadside Hazards

THURSDAY, JUNE 8, 1967

HOUSE OF REPRESENTATIVES,
SPECIAL SUBCOMMITTEE ON THE FEDERAL-AID
HIGHWAY PROGRAM OF THE COMMITTEE ON PUBLIC WORKS,
Washington, D.C.

The subcommittee met, pursuant to recess, at 10:15 a.m., in room 2167, Rayburn Building, Hon. John A. Blatnik (chairman) presiding.

Present: Messrs. Fallon (chairman), Blatnik (subcommittee chairman), Howard, McCarthy, Cramer, Harsha, McEwen, Schadeberg, Denney, and Zion.

Staff present: Same as previous days, and John P. O'Hara, associate counsel, and Mrs. June Teague, staff assistant.

Mr. BLATNIK. The Special Subcommittee on the Federal-Aid Highway Program will please come to order.

We will resume hearings pertaining to the safety aspects of the Federal-Aid Highway System.

As I announced at the close of our last session, today we will take up an analysis of the Capital Beltway, known as Interstate 495, which has been made by our staff.

There are many favorable things that can be said on the positive or plus side of this modern section of multilane, divided highway that completely encircles the Nation's Capital.

If I may suggest, let us keep in mind those features, including the great convenience to thousands of motorists every day, as we explore what might be some of the minus side or deficiencies in the area of this highway's design and operational efficiency.

Our witness from the staff this morning will be John P. O'Hara, associate counsel; and in addition to our staff witness we continue to have present Mr. Charles W. Prisk, of the Bureau of Public Roads, who has contributed so much to our hearings.

Mr. O'Hara, will you please stand and take the oath. Raise your right hand. Do you solemnly swear that the testimony you will give before this subcommittee will be the truth, the whole truth, and nothing but the truth, so help you God?

Mr. O'HARA. I do.

Mr. BLATNIK. Please be seated. Mr. Prisk, you are still under oath and will continue to be for the duration of these hearings. Mr. May.

Mr. W. MAY. Mr. Chairman, today we are going to receive an analysis of the Capital Beltway primarily from a statistical and roadside hazard viewpoint. At a later date in the hearings, we shall receive additional testimony on other aspects of the beltway.

Mr. O'Hara is one of our Nation's top investigators. He has served as associate counsel on the staff now for a number of years. He is not an engineer. He is not a design expert, but he has made this study of the beltway.

Mr. O'Hara will you proceed with your presentation.

**TESTIMONY OF JOHN P. O'HARA, ASSOCIATE COUNSEL, COMMITTEE
ON PUBLIC WORKS**

Mr. O'HARA. Thank you, Mr. May. Mr. Chairman, in December of last year I was assigned to look into the design features of the Capital Beltway around Washington.

Mr. BLATNIK. Please proceed, Mr. O'Hara.

Mr. O'HARA. In December of last year I was assigned to look into the design aspects and roadside objects on the Capital Beltway.

I started out by acquainting myself with the beltway from one end to the other. At this time I would like to go to the map which we have mounted here.

This is a map of the Capital Beltway [indicating] surrounding Washington, D.C. This is the Capital area in here where we are.

The beltway circumscribing this area here [indicating] is a 66-mile highway.

Mr. BLATNIK. How many miles?

Mr. O'HARA. Sixty-six. The last segment of this highway was opened in August of 1964, completing the circle.

There are approximately 42.8 miles in Maryland, 22.1 in Virginia, and down here on the Potomac River on the Wilson Bridge, 650 feet which lie within the jurisdiction of the District of Columbia.

The costs which we have ascertained to date have been \$172.5 million. The Wilson Bridge was constructed entirely with Federal-aid money.

Mr. W. MAY. One hundred percent Federal money?

Mr. O'HARA. That is correct, 100 percent Federal money.

In the last 2 years, from 1965 through 1966, there were 2,676 accidents on this stretch of road. There were 50 fatalities. There have been 1,620 people injured. In connection with fatalities, I would like to mention this. We did not have complete statistics available for the year 1964. We did have fatal accidents. There were 10 in 1964. And in 1967, to June 6, Tuesday of this week, there have been 17 additional fatalities.

Breaking this down we find that, of the accidents in Maryland, there were 1,694 in this 2-year period.

Mr. W. MAY. Excuse me. According to your figures, there have been 77 persons killed on the Capital Beltway since it opened in August of 1964?

Mr. O'HARA. Approximately 3 years, 77 fatalities.

Mr. W. MAY. Where did you obtain your statistics?

Mr. O'HARA. The statistics I obtained came from the Maryland State Police for Maryland, from the Virginia State Police for Virginia, and from the District of Columbia Highway Department and the Metropolitan Police Department.

Mr. W. MAY. Thank you.

Mr. BLATNIK. Just a moment. Mr. O'Hara, just repeat that. The last section was completed in 1964 so the system was completed as of August 1964. Is that correct?

Mr. O'HARA. That is correct.

Mr. BLATNIK. From that time on, August of 1964 until this month right now, June 1967, over a period of time of 2 years and 10 months, how many persons have been killed on the beltway?

Mr. O'HARA. There have been 77 people killed. Now in connection with those fatalities, one of the fatalities may have occurred prior to August of 1964. We are not sure of the date on that. The statistics are not available, just the number of fatalities.

Mr. BLATNIK. Will we have a breakdown later on as to the nature of these accidents? First the nature, where they run off the road, single car to fixed objects or collisions between two moving vehicles? Will we have that type of information?

Mr. O'HARA. I will go into detail on some studies I made in some specific areas where we will use both statistics and slides.

Mr. BLATNIK. You also have the geographical location of all accidents to show what sections of the beltway may be more accident prone?

Mr. O'HARA. We will look into certain areas of the beltway, Mr. Chairman, where the accidents were much higher than in other sections.

Mr. BLATNIK. Last question. It is the first time I have heard the figure, of course, until the staff told me about it very recently. Why weren't these figures available sometime before? I have never seen them in any newspaper.

Mr. O'HARA. I cannot answer that, Mr. Chairman. I can only say that in my travels around the beltway I discussed this with the various police agencies and learned that this information was available at the Maryland State Police and at the Virginia State Police.

Mr. BLATNIK. Any central authority or central agency—did the Bureau of Public Roads know about the total fatalities?

Mr. O'HARA. I have no information on that.

Mr. BLATNIK. Will you check on that?

Mr. O'HARA. Yes; I will.

Mr. BLATNIK. No one knows the total number because by dividing the responsibility the jurisdiction is spread between two States and the District. Unless there is central coordinating information on what accidents are happening, where and why, obviously there will be no way of correcting or removing or reducing the causes for those accidents. We will get into that later.

Mr. O'HARA. Yes. In the course of my presentation I hope to show some of the areas that have high accident numbers.

Continuing in discussion of statistical information on the beltway as regards accidents, this is a 20-percent increase in the number of accidents in 2 years. This is a 17-percent increase in the number of injuries and a 50 percent in the number of fatalities for this 2-year period which was my period of study.

Mr. W. MAY. That is 1966 versus 1965?

Mr. O'HARA. That is correct.

Mr. BLATNIK. Just one moment on that. I would like to have an analysis made or evaluation or interpretation, whatever you may call it, why accidents increase by only 20 percent, but fatalities by 50 percent. Are people going faster or is the volume of traffic greater? Are there more people getting onto the beltway as they learn it is more convenient and faster to get to wherever they want to go? It is a very significant figure. It seems to be a close relationship. But the deaths are $2\frac{1}{2}$ times greater—increased by $2\frac{1}{2}$ times—over the rate of accidents. Please proceed.

Mr. O'HARA. Mr. Chairman, I made a few detailed studies, and I would like to show you where they are on the beltway before I turn this map around.

The first one is this area, which is the interchange of 495 and 270.

At this point 495 is northbound and southbound roadway, and 270 is a $1\frac{1}{4}$ -mile section connecting 495 with Interstate 70S, which comes down from Rockville and Frederick.

The areas I would like to discuss are in this particular area of the 495 and 270 interchange. Just for the record I would like to say my study in this area covered a radius of 1,000 feet from the interchange gore, that is where 495 veers to the right and 270 to the left.

In this area in 1966 there were 78 accidents. And of those 78 accidents, 60 ran off the road, which is 77 percent. And of those 60 which ran off the road, 41 or 68 percent subsequently struck a fixed object.

From the standpoint of injuries and deaths, there was one fatality and 49 injuries at this interchange in 1966.

Mr. W. MAY. One year within 1,000 feet?

Mr. O'HARA. Yes. The second area I would like to discuss is the section known as the Rock Creek Park section of the Capital Beltway. This extends from the interchange at Pooks Hill, which has received some notoriety as the spaghetti bowl interchange, in an easterly direction 3.8 miles past the interchange at Connecticut Avenue and ending at the interchange at Georgia Avenue. In this section, according to the records, in 1966 there were 219 accidents; 88 of the 219 were run off the road accidents, and of these, 55 subsequently struck a fixed object.

In that same area there were four fatalities and 128 people injured in 1966.

Mr. W. MAY. That is in a 3.8-mile section?

Mr. O'HARA. Yes. 3.8 miles of a 66-mile highway.

Mr. W. MAY. You personally reviewed the accident reports over 1966?

Mr. O'HARA. I reviewed every accident report that was available at the State police headquarters in Pikesville for that section.

Mr. W. MAY. Thank you.

Mr. O'HARA. The third section is the Woodrow Wilson Bridge, which is a 5,900-foot bridge connecting Virginia and Maryland, a very important segment of the Capital Beltway.

Last year, 1966, there were 102 accidents with 2 fatalities and 107 injuries. In the 3-year period for which statistics were available to

me for this bridge, 10 people have been killed here. That is 10 out of the 77 figure I mentioned earlier.

Mr. W. MAY. Let us go back. In 1966, you say that there were 102 accidents which accounted for 107 injuries and two deaths. Mr. Prisk, you were somewhat surprised at those figures?

Mr. PRISK. Yes, I was. It seems to be a very weak spot, I would say, in the total beltway experience. Quite a concentration of accidents.

Mr. W. MAY. You were surprised at the number of injuries relating to the number of accidents also?

Mr. PRISK. Yes, it is most unusual, this particular feature of it, to find as many or more injuries than you have accidents.

Mr. W. MAY. Yes. All right, Mr. O'Hara.

Mr. BLATNIK. One point. Would that indicate, Mr. Prisk, having more injuries than accidents, would that indicate that the accidents were rather of a moderate to severe degree?

Mr. PRISK. Definitely so. Normally injuries on a facility of this sort will run about half the number of accidents, so that you would expect perhaps 50 injuries on a freeway facility that had 100 accidents. This is not abnormal.

Mr. BLATNIK. Is that over a high speed freeway?

Mr. PRISK. Yes.

Mr. BLATNIK. So it would be a normal situation?

Mr. PRISK. Somewhere about 50 or 60 injuries per hundred accidents in not abnormal.

Mr. BLATNIK. You have twice as many or about a hundred percent more injuries than would normally occur on a modern freeway system?

Mr. PRISK. Yes.

Mr. BLATNIK. On this modern bridge which is part of the beltway?

Mr. PRISK. Yes, sir. This indicates very definitely a high severity location.

Mr. BLATNIK. Thank you.

Mr. O'HARA. Mr. Chairman, before I sit down, I would like to point out these two aerial photographs.

In this aerial photograph here [indicating] this is the segment of the Capital Beltway to the interchange at 270 crossing Old Georgetown Road, Rockville Pike, over to Connecticut Avenue and finally to Georgia Avenue. We will discuss this in some detail, and we will also discuss this area which is the interchange of 270 and 495 [indicating].

This second aerial photograph is a blowup of this outlined area in this first aerial photograph [indicating].

Mr. W. MAY. You took photographs of some of the design features of the Beltway?

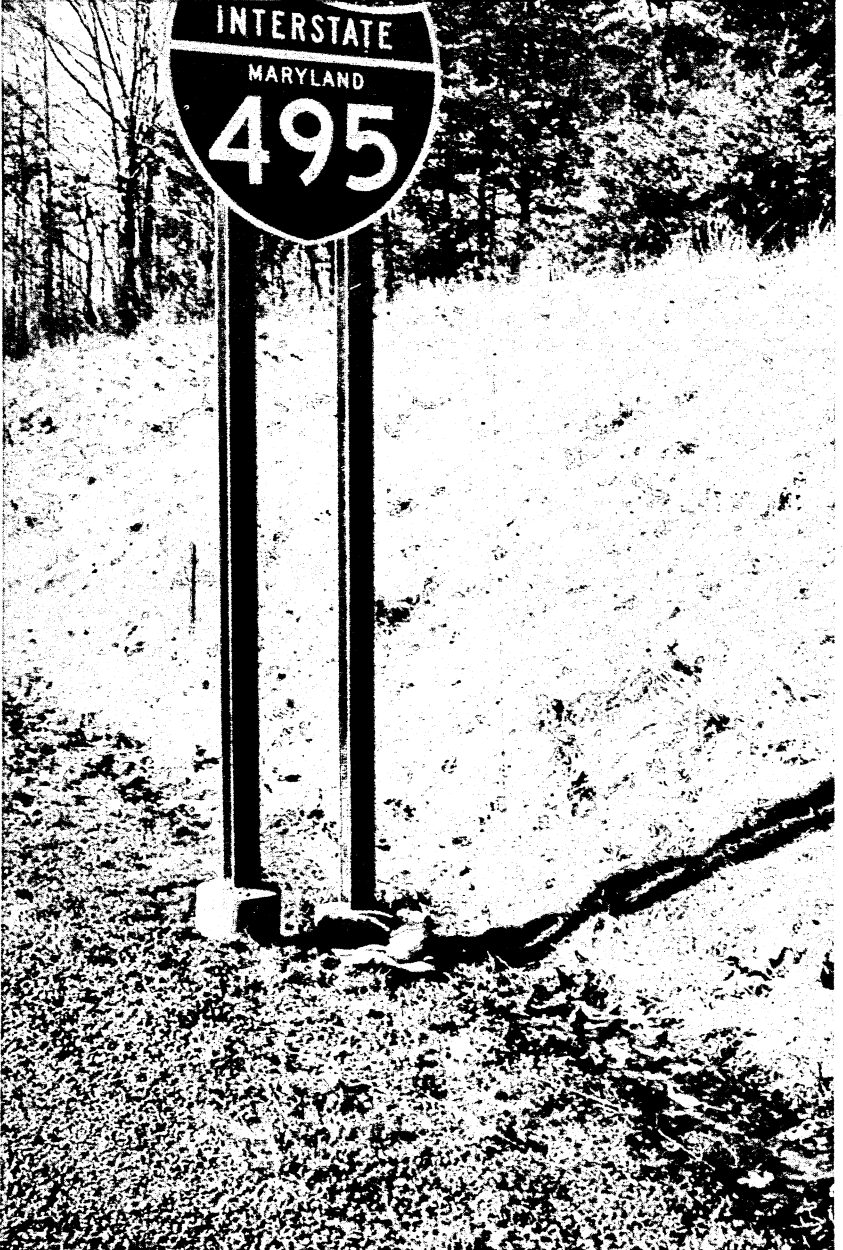
Mr. O'HARA. Yes, I did. In connection with my survey in learning the beltway as best I could, I took photographs of areas which I felt would be the scene of accidents. And at this point I would like to show you some of the objects and accident locations I found in reviewing the State police records.

Mr. W. MAY. Proceed.

Mr. O'HARA. Mr. Chairman, this is a picture of an Interstate route marker which you will find on the Maryland portion of the Capital

Beltway. Unfortunately the photograph is a little large for the screen.

However, the shield is on top of those two steel I-beams. That shield is 36 by 42 inches. It is mounted on two steel, 4-inch I-beams, which are mounted in 3 feet, 6 inches of concrete. That is a concrete base at the bottom of those I-beams.



This is a speed sign, which you will find on the Maryland side of the beltway. Again the sign is mounted on two 4-inch I-beams embedded in 3 feet, 6 inches of concrete.



Mr. W. MAY. Mr. O'Hara, you previously showed the shield being held up by similar supports. Are they located about the same place generally as the speed sign, a couple feet off the shoulder?

Mr. O'HARA. Yes, they are generally right at the edge of the shoulder or a couple feet beyond depending on the shoulder area available.

Mr. W. MAY. All right.

Mr. O'HARA. This is what happened. Here is a pickup truck which ran off the highway at 3 o'clock in the afternoon, and struck the I-495 route marker. As you can see, the sign is still there.



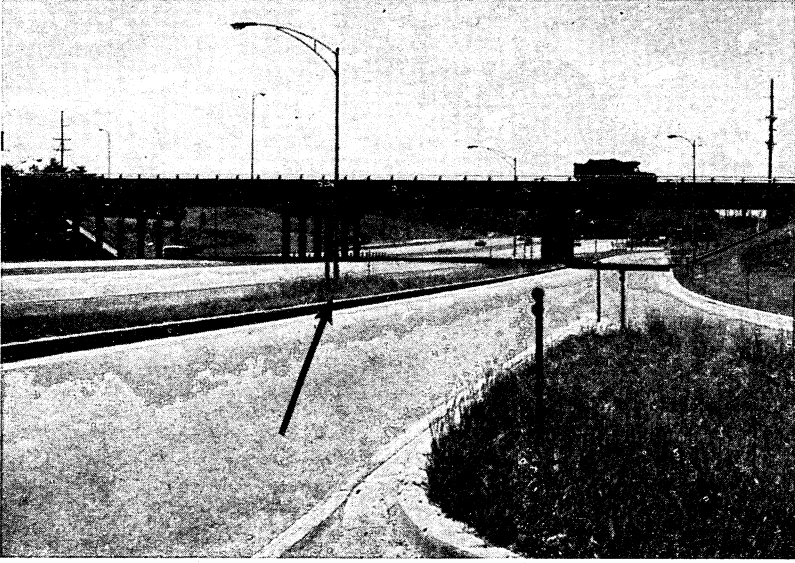
As you can see from this slide, the pickup truck is pretty heavily damaged.

Mr. BLATNIK. Is this the same truck?

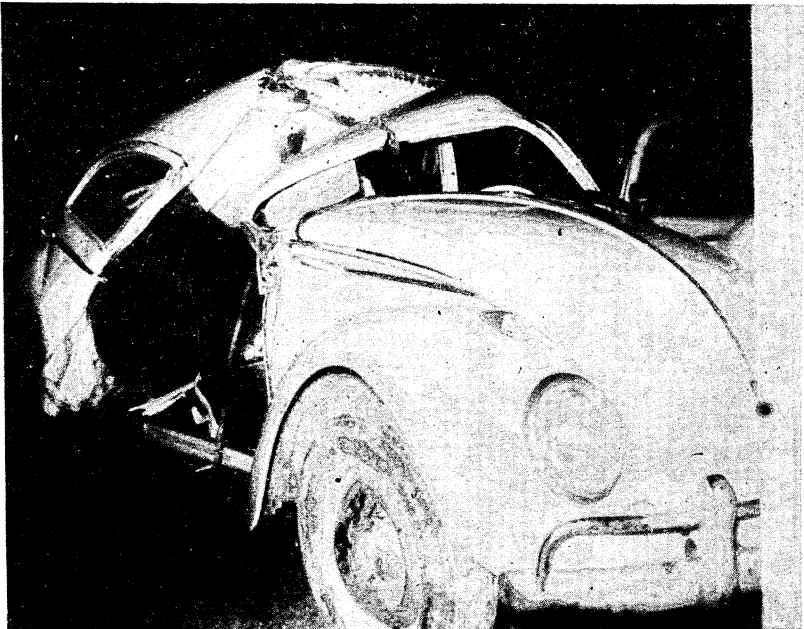


Mr. O'HARA. Yes. This is a closeup of the same truck. The driver received severe injuries in this accident.

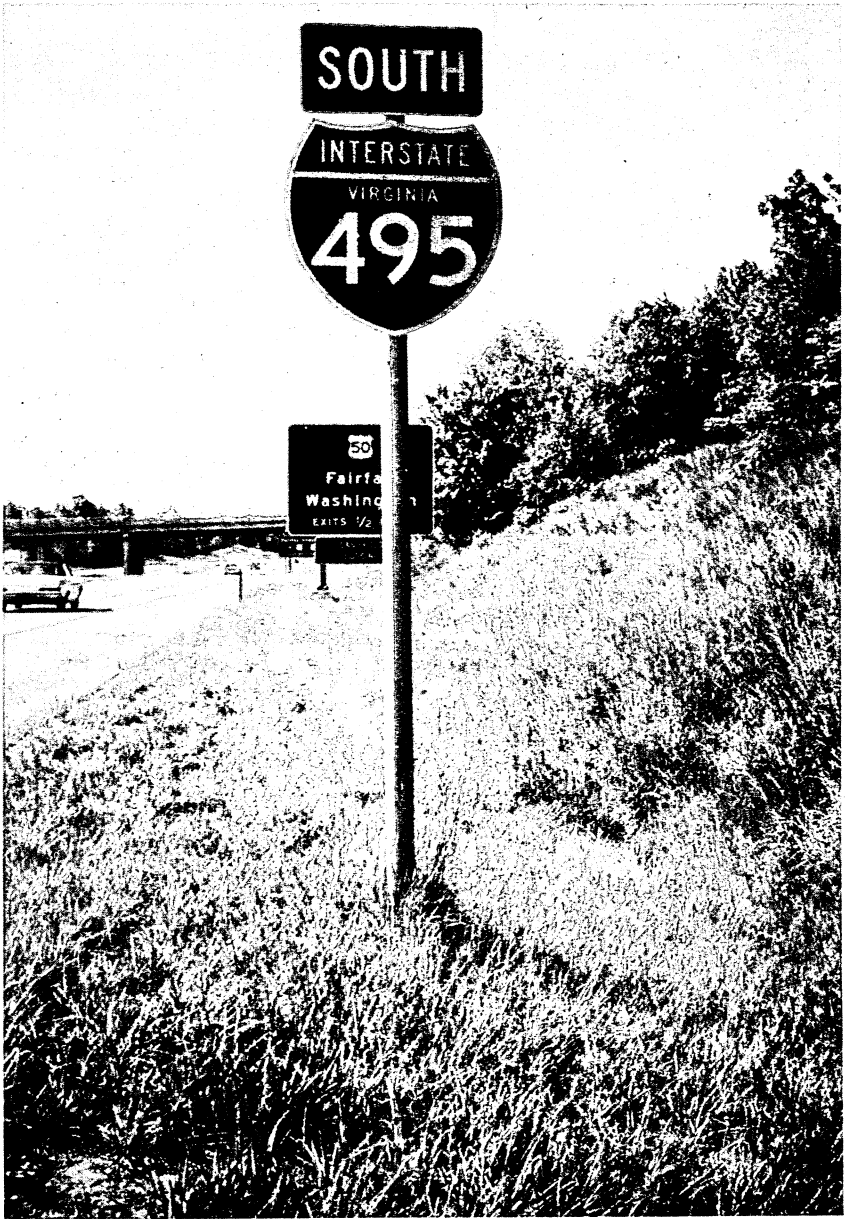
After the accident, the sign was put back up. This is a photograph I took subsequently of the exact location of the accident scene which we just looked at. Now the sign is mounted on one 4-inch I-beam.



And this is what can happen to a vehicle which hits one 4-inch I-beam. This was a 1966 accident. The driver in this car was severely injured.



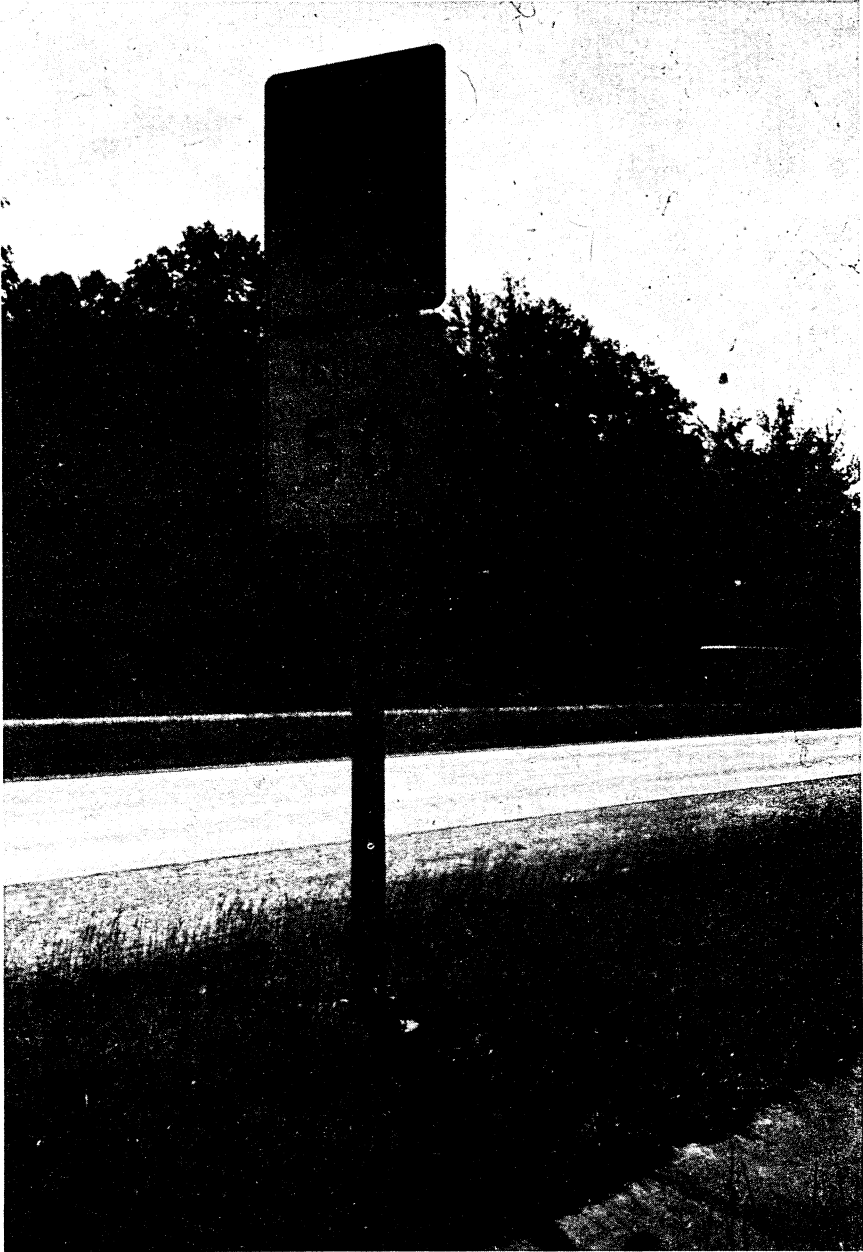
Now we go over to the Virginia side of the beltway. This is a route marker used all along the Virginia portion of the Capital Beltway. Again, a couple feet off the shoulder area mounted on a 4- to 6-inch steel pipe embedded in concrete.



And this is a Virginia speed sign mounted on a 4- to 6-inch steel pipe and embedded in concrete. This photograph was taken from inside looking out across the traffic lanes of the beltway. It is about 2 feet from the shoulder.

Mr. BLATNIK. Two feet from the shoulder?

Mr. O'HARA. That is correct.



Mr. BLATNIK. If a car should happen to go off at a speed of 60 miles an hour, which is not excessive for that beltway or any throughway like it, and hits a 6-inch steel pipe——

Mr. O'HARA. That is correct.

Mr. BLATNIK. A car traveling at 60 miles an hour, Mr. Prisk, hitting a steel pipe embedded in concrete, would it be possible to give some estimate of what might happen?

Mr. O'HARA. Mr. Chairman, if I might interrupt here, I would like to show you what happened as recently as 10 days ago, in just such a situation.

Mr. BLATNIK. Please proceed.

Mr. O'HARA. This vehicle hit a sign similar to the one we were just looking at. This accident occurred on Interstate Route 95, and I am showing this only for the purpose of letting you see what happens to a vehicle which hits one of these steel posts.

Mr. BLATNIK. Single-car-off-the-road type of accident, hitting the same type of steel post we just saw embedded in concrete?

Mr. O'HARA. That is correct.

Mr. BLATNIK. Hit no other——

Mr. O'HARA. No other objects.

Mr. BLATNIK. Or vehicle?

Mr. O'HARA. That is correct. And in the lower portion of that photograph you can see the 50 number from the sign laying on the ground.

Mr. BLATNIK. Fifty right at the very center?

Mr. O'HARA. Right where the light is shining (indicating) you can see the 50.

Now, in this accident four people were killed and five were injured.

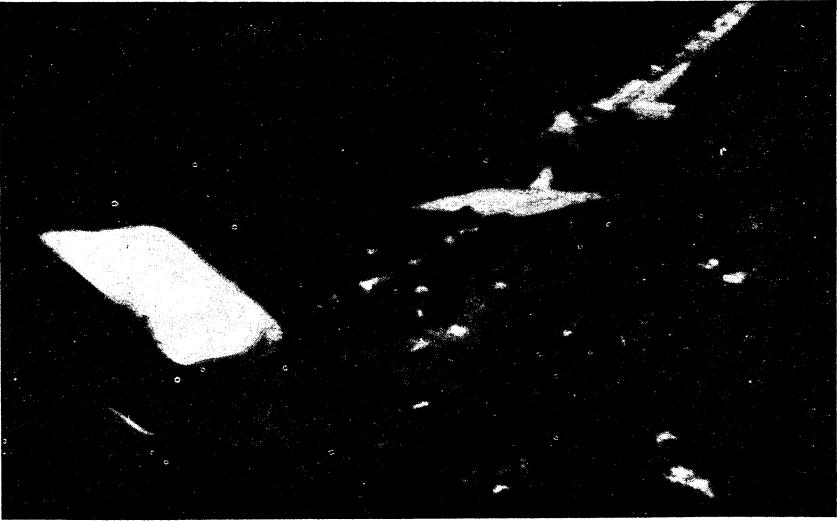
Mr. BLATNIK. Where did this happen and when?



Mr. O'HARA. This happened on Interstate Route 95 just south of the Springfield exit on May 29, 1967. In order to orient you on that location that would be about a mile and a half south of the Capital Beltway, but this is the same sign that is used on the Capital Beltway.

Incidentally, this is what happened to the sign. This is the sign that that vehicle hit.

Mr. BLATNIK. Out of the ground?



Mr. O'HARA. That is right. You can see the concrete base where it was torn out of the ground. That is the bottom part of the sign.

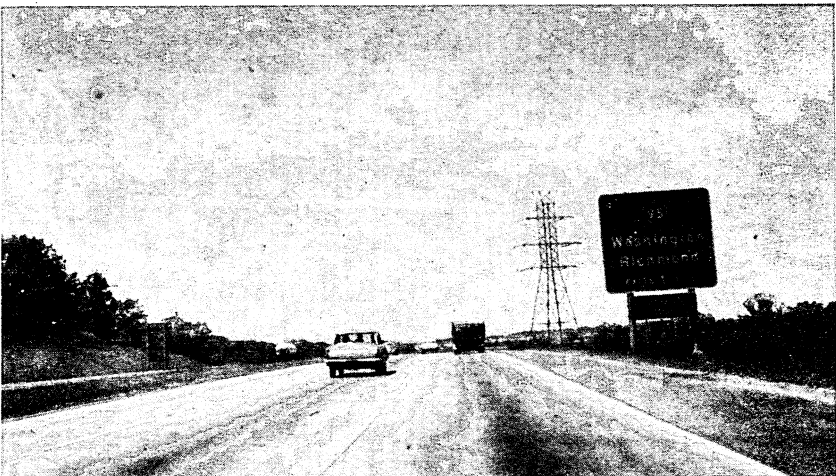
Mr. BLATNIK. It did not break the steel post, did it?

Mr. O'HARA. It bent it slightly.

Mr. BLATNIK. Bent it, but did not break it?

Mr. O'HARA. No, sir.

Mr. Chairman, this is a typical sign known as a destination sign, which you will see on the Capital Beltway. Again it is extremely large, mounted on steel poles.



Mr. W. MAY. Is that located in Virginia?

Mr. O'HARA. That is a Virginia sign on the Capital Beltway just west of the interchange with Interstate Route 95.

Notice there is no guardrail to shield the motorist from that sign. The steel poles are embedded in concrete. You have quite a bit of information for the motorist to read there, and again you will notice it is just slightly off the shoulder area.

On the far side, the westbound lane, you see a similar sign, of the same mounting, and in the same general location.

Mr. CRAMER. How far off the right-of-way is that high-tension power equipment right there? How far off the right-of-way is that?

Mr. O'HARA. I have no information on that, Mr. Cramer. That may or may not be within the right-of-way.

Mr. CRAMER. It looks even more dangerous than the sign, does it not, from the cars speeding off the road?

Mr. O'HARA. Yes, sir, I would say it would be just as dangerous.

Mr. BLATNIK. Can we have that checked; it is a very important point. Mr. Prisk, a tower of that type would usually be off the right-of-way entirely, would it not?

Mr. PRISK. Normally it would be off the right-of-way. The alignment here bears to the left, a slight curve as you see, and I expect the tower is off the right-of-way just about at the fence line.

Mr. BLATNIK. We will have that checked. But there could be circumstances where the tower could be on the right-of-way; is that right?

Mr. PRISK. Yes. Certainly, I would agree that there could be circumstances where it could be in a more vulnerable location than this sign.

Mr. BLATNIK. Mr. O'Hara.

Mr. O'HARA. This is another type sign which you will find on the Virginia section of the beltway. Again you have an extremely large sign. Again, the steel post is mounted in concrete and again a few feet from the shoulder area.

And here we have a concrete drain (indicating). Now the staff has seen photographs and the results of what has happened to a vehicle



which has gone down this drain. It could lead you right into this sign support.

Here is another sign on the Virginia side of the Capital Beltway. Again, the sign is mounted on the steel post embedded in concrete; but this time it is up against the bridge. And neither the bridge piers nor the steel posts have a guardrail to shield a motorist who might run off the road and run into it.



And here is another sign on the Virginia section of the Capital Beltway. I have shown this one to show you the amount of concrete which is above ground, especially on this right support.



Mr. W. MAY. Mr. O'Hara, you just did not select individual signs?

Mr. O'HARA. No, this is not a single sign. There are many of these on the Capital Beltway. But these are best illustrative of the points I want to make.

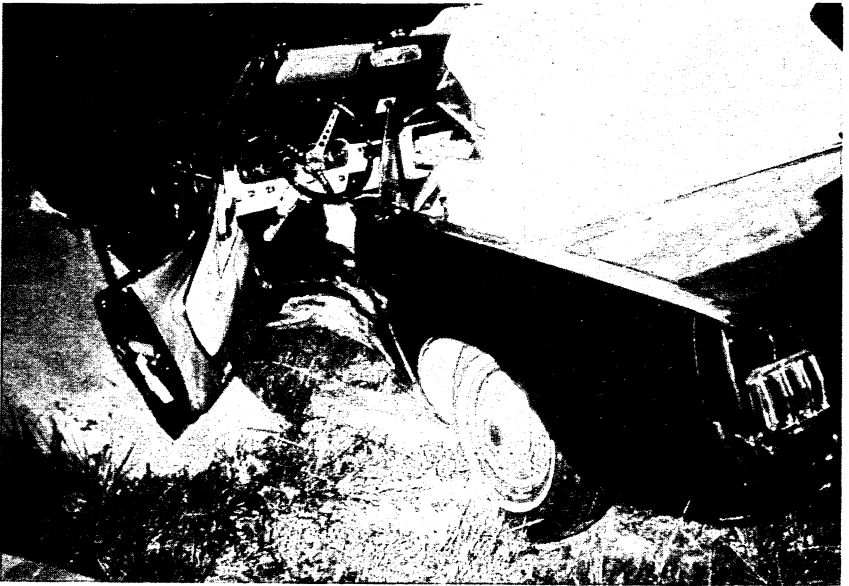
Again you will notice down here (circle) this is an emergency stopping sign only. It is mounted on a 4- to 6-inch steel pole similar to the poles the speed sign and route markers were mounted on.

Mr. W. MAY. That is a real shame. The bridge piers in this particular span are considerably off the shoulder and the motorist would normally have considerably more recovery area than he generally does with the bridge piers that we have seen. But now they have placed this pipe close by the shoulder, and created an obstacle. Is that right, Mr. Prisk?

Mr. PRISK. Very definitely so. That is an elevated structure. There is plenty of lateral clearance to the right.

Mr. W. MAY. That looks relatively innocent. Yet, we have just seen it can cause an accident. Mr. O'Hara.

Mr. O'HARA. This vehicle ran into a sign similar to the one we just looked at which had the concrete exposed above the ground. And in this accident there were a number of injuries. The police officer who gave me this photograph was not sure whether it was two or three but it was serious, and this accident occurred in 1966 on the Capital Beltway.



Now, jumping over to the Maryland side of the Capital Beltway, this is a sign installation which you will find along its 42 miles. The sign here is mounted, not on a steel pole, but on an 8- to 12-inch steel I-beam. The size of the I-beam will depend on the size of the sign. This particular one happens to be 8 inches, and again it is embedded in concrete. Concrete can be as much as 5 feet into the ground.

Notice that the road in this area is fairly straight. There is a drainage ditch here and fairly steep backslope [indicating].

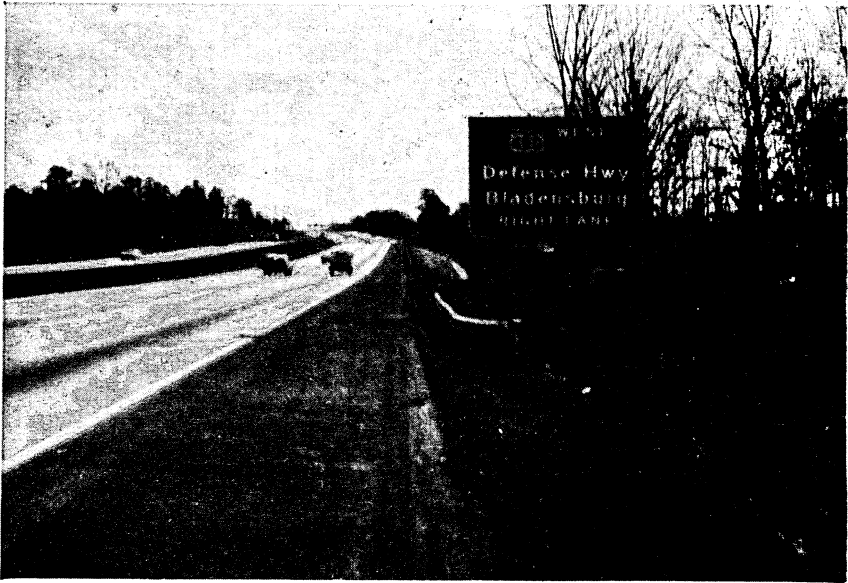
Mr. BLATNIK. If you hit that drainage ditch, it would be pretty hard to pull the wheel when it is soft. It would be pretty hard to pull a wheel out of it.

Mr. PRISK. Yes. Certain designs on the roadside call for a rather rounded section of the ditch, flat-bottom-type ditch. This appears to be a V-ditch.

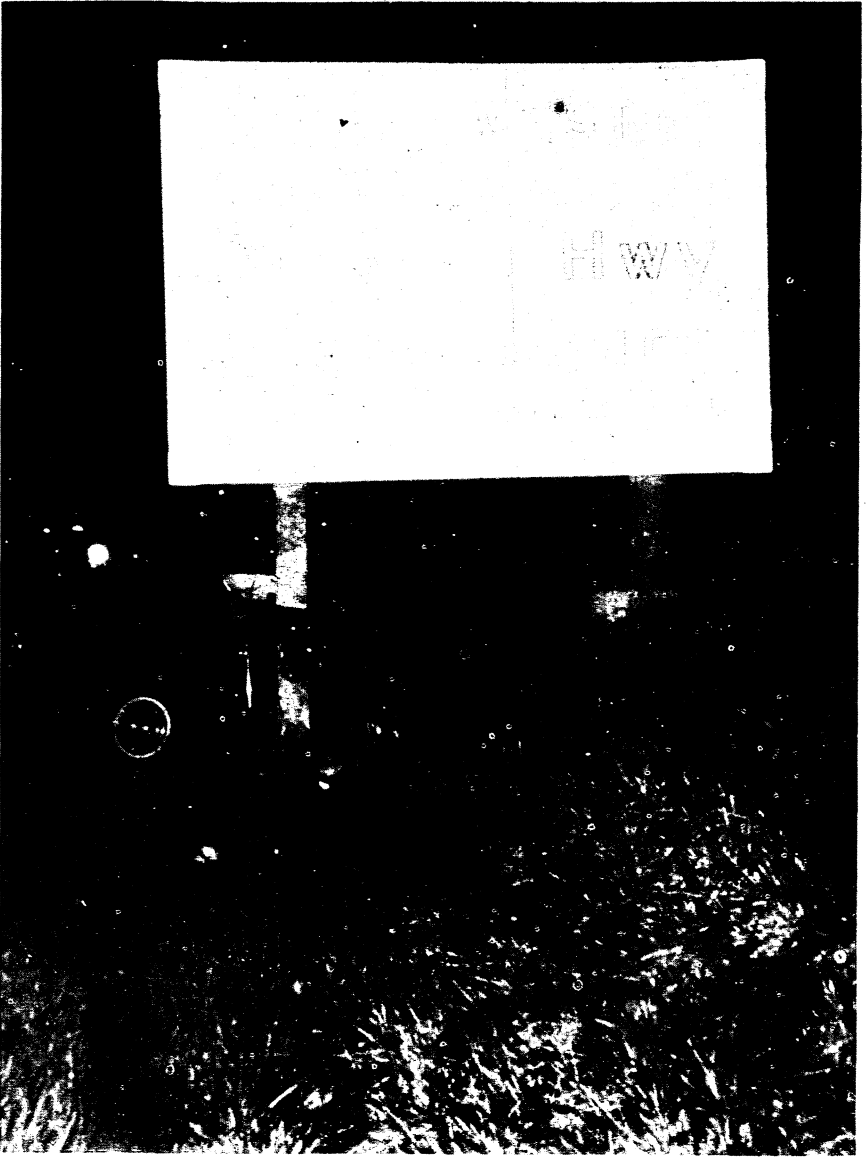
Mr. BLATNIK. Would it lead a car right on into the sharp end of the guardrail first before hitting the sign; is that very likely to happen?

Mr. PRISK. This very well could happen. That is true.

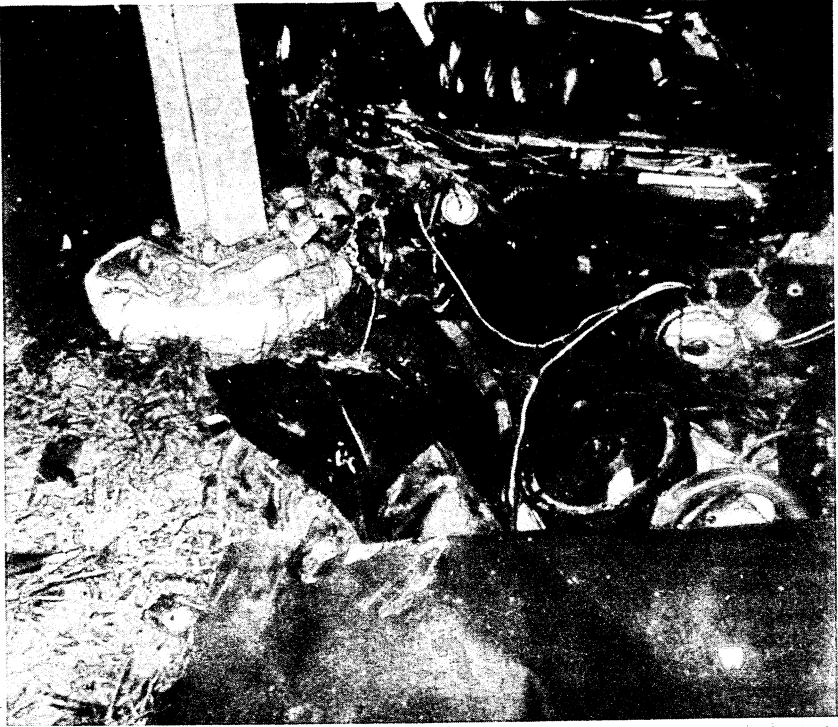
Mr. O'HARA. As regards this particular sign, following is a photograph I took in December 1966.



And when I was reviewing the police accident records, I found that there had been an accident at this very location. The driver of this car, a young sailor, was killed. His vehicle got up on the embankment and hit just one of the sign supports, this 8-inch I-beam.



This is the base of that sign support. And you can see that the support has not been damaged.



The photograph speaks for itself as to the vehicle.

Mr. BLATNIK. The vehicle is totally demolished and just a few scratch marks on the concrete and on the I-beam, is that right?

Mr. O'HARA. Yes.

Mr. W. MAY. That accident occurred prior to the time you took your photographs?

Mr. O'HARA. Yes, it did. This accident occurred in October of 1966 and I took this photograph (fig. 3-17) in late December, or early January of 1967.

Mr. W. MAY. So your photograph depicts the way the situation stands today?

Mr. O'HARA. That is correct. That is the way it is now.

Since we are speaking of guardrails, this is the same accident, and you can see that the guardrail did not stop him from getting behind and up to that sign support. Because here is the guardrail you saw in the first photograph. The car is in behind it.

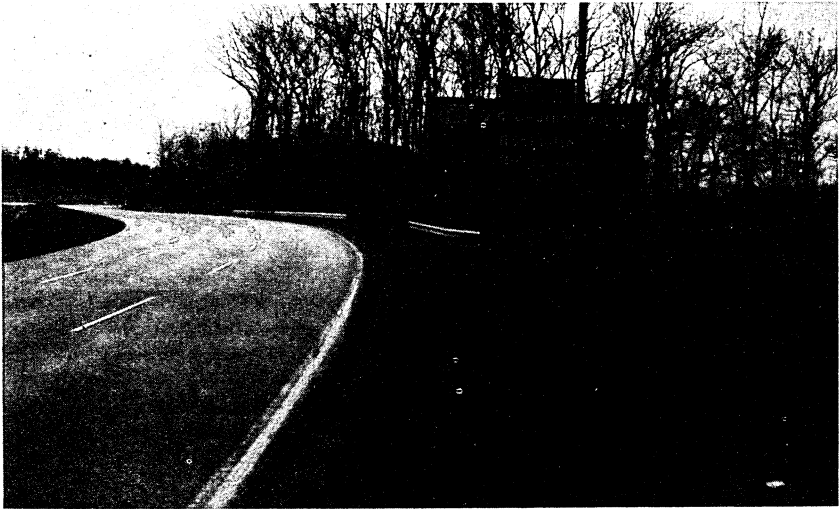


Now this installation of guardrails is typical of what you will find in Maryland. This particular scene is just west of interchange 19 on the Capital Beltway in Maryland. And look at this area, if you will.

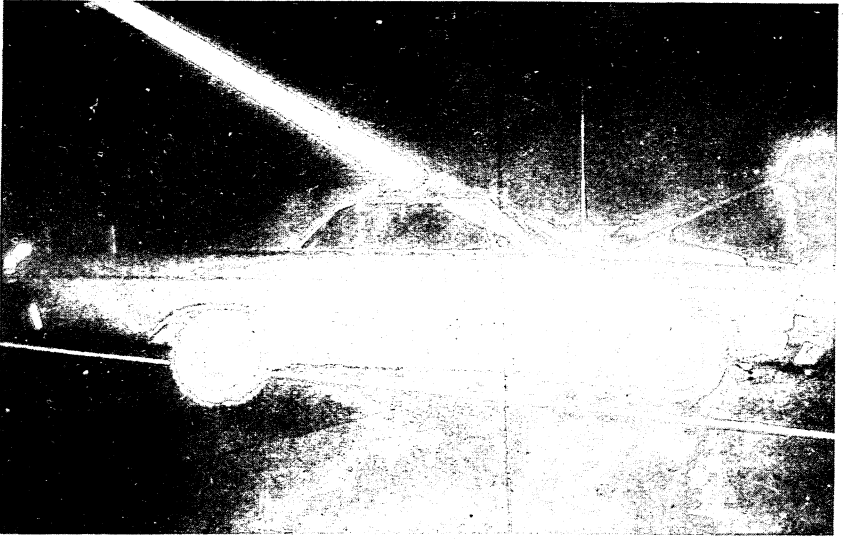
You have a road which is curving at this point slightly to the left. Here is a fixed object, a steel light pole embedded in concrete. Here is the end of a guardrail meant to shield this sign. Yet there is an open space in here. The guardrail could have been longer. It could have come down here [indicating in front of light pole]. Here they have discontinued the guardrail for a distance of 40 or 50 feet [indicating beyond sign].

There is a drainage area in there. They could have carried it in here [indicating between two guardrails]. Back beyond the end of the guardrail here is a speed sign, mounted on two 4-inch I-beams, which could have been moved up behind the guardrail.

This is what happens when a vehicle hits a guardrail.

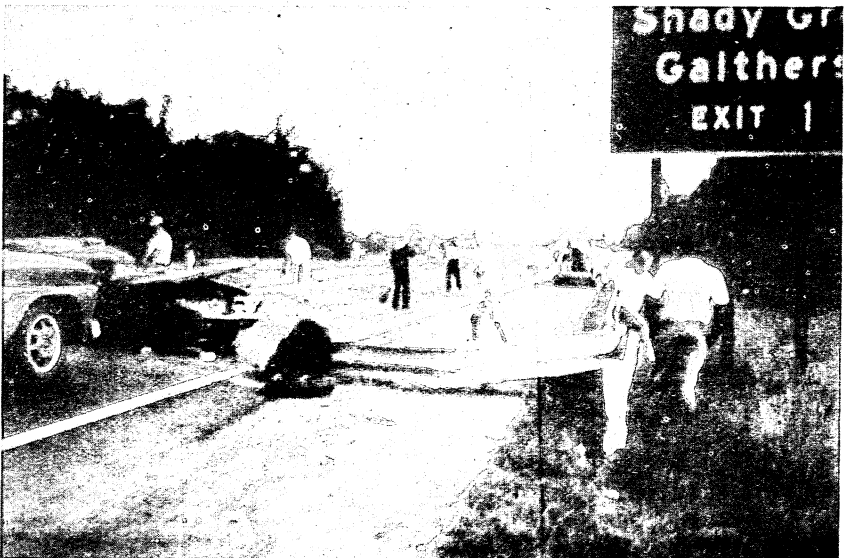


And in April of last year a woman driving on the beltway hit the end of this guardrail. The guardrail went through the front of her car, smashing her windshield, narrowly missing her and came out through the roof of her vehicle extending some 20 feet into the air.



A couple of months later a similar accident occurred on Interstate 70-S, and I show this photograph only to show that this guardrail installation is typical of what happens on the beltway and other roads.

This guardrail which was facing us, as we are looking at this scene, is the end of the guardrail. This is the vehicle which ran into it. And in this case you notice that the sign is mounted on wooden posts. The runoff area is fairly smooth. It is not even, but it is not a deep drop either.



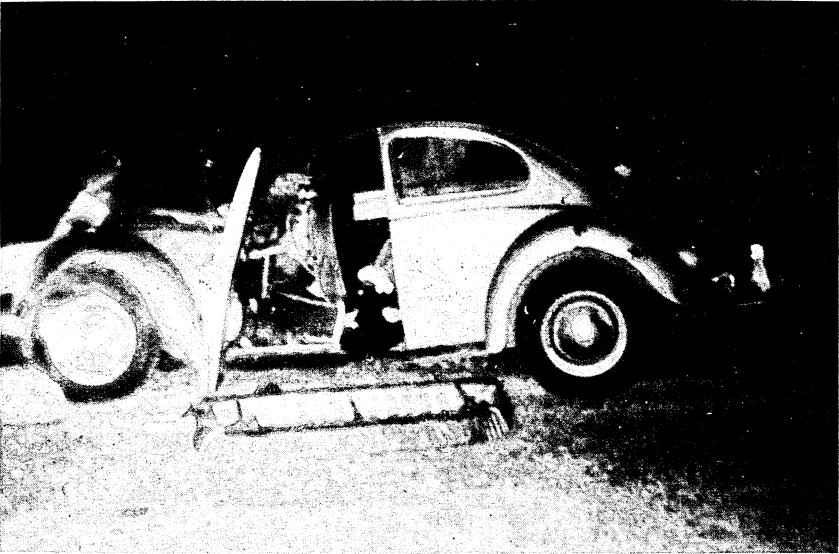
And here is a closeup of that same car. The driver of this vehicle was severely injured. He was alone. Maybe we should say fortunately.



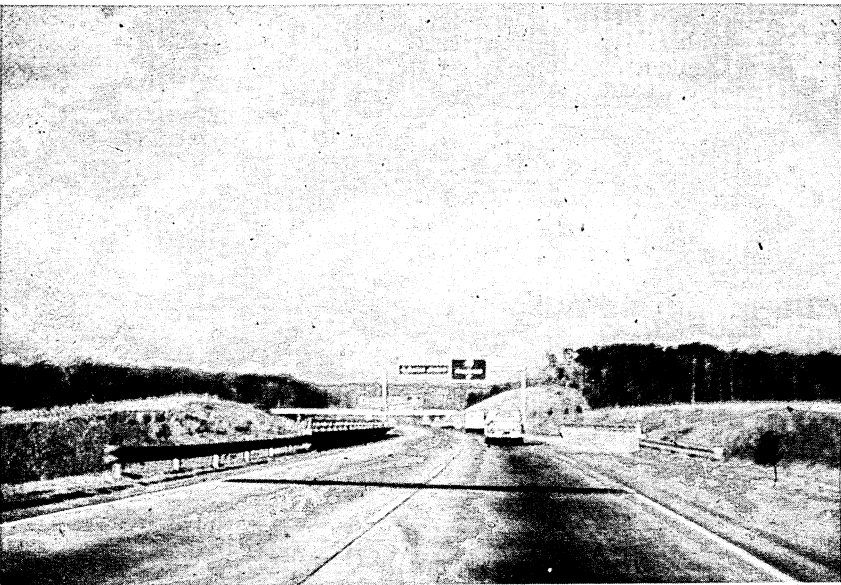
In August, a month later, on the Capital Beltway two young students ran into the end of a guardrail. In this case the guardrail again went through the car, through the windshield, through the passenger compartment, and out the rear window, extending many feet.



It extended beyond the car. One person was killed and one person severely injured. The same type guardrail installation.



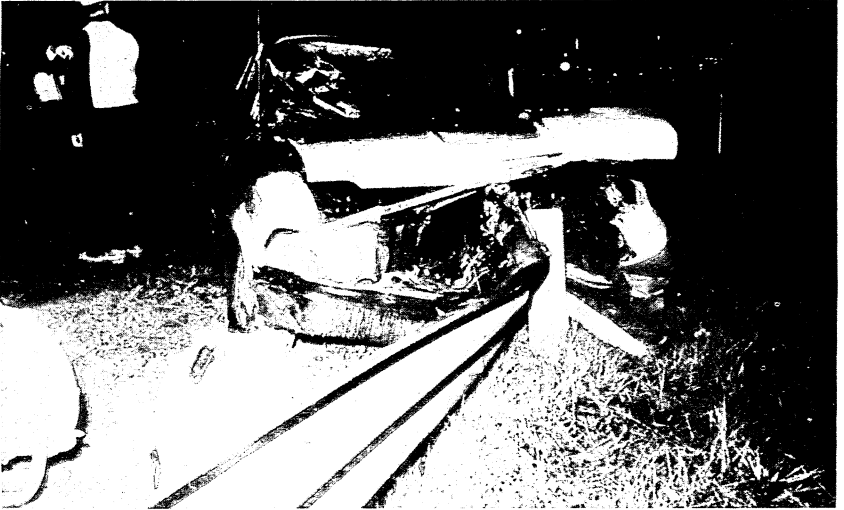
We can go to Virginia and we can find similar situations. Here you have a guardrail approaching a bridge. Here is a guardrail not flared back on the left. The guardrail runs up to the bridge parapet. It is not anchored. On this side the guardrail extends back somewhat like an arrow. It ends at the bridge parapet. In this case they have taken the shoulder through the bridge.



And here again is an accident in Virginia in 1966 where a driver hit the end of a guardrail, and the guardrail end went through the window, through the car, and killed the driver in this case.

Mr. W. MAY. Is there any question that guardrails should be more properly installed than what we have just seen in these photographs?

Mr. PRISK. I do not think so. The tests that have been made, and certainly the lessons that are displayed all too gruesomely with experience as recorded on these slides, I think teaches that the ends of guardrails need to be taken back away from the road, flared, anchored, otherwise smoothed into the approach alignment so that you have a smooth surface where you have to introduce guardrails.

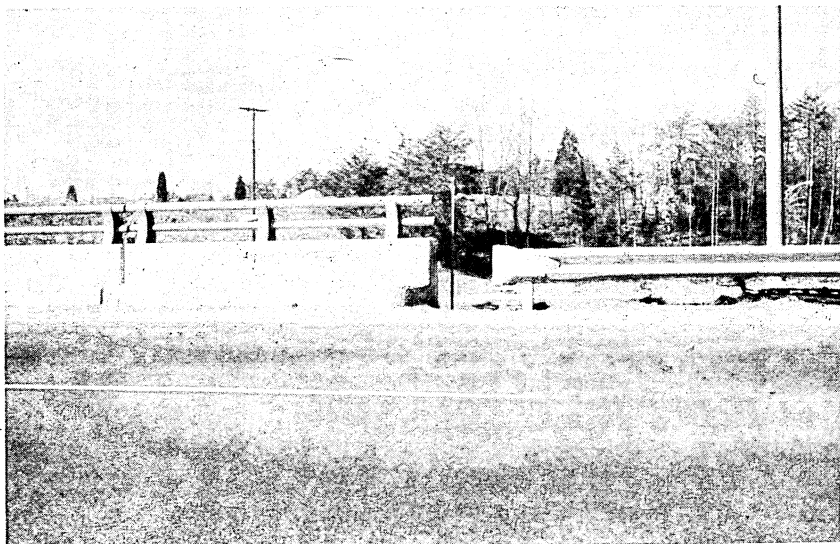


Mr. O'HARA. Mr. Chairman, I would like to say that this photograph was taken on Interstate Route 95 but it is used to illustrate

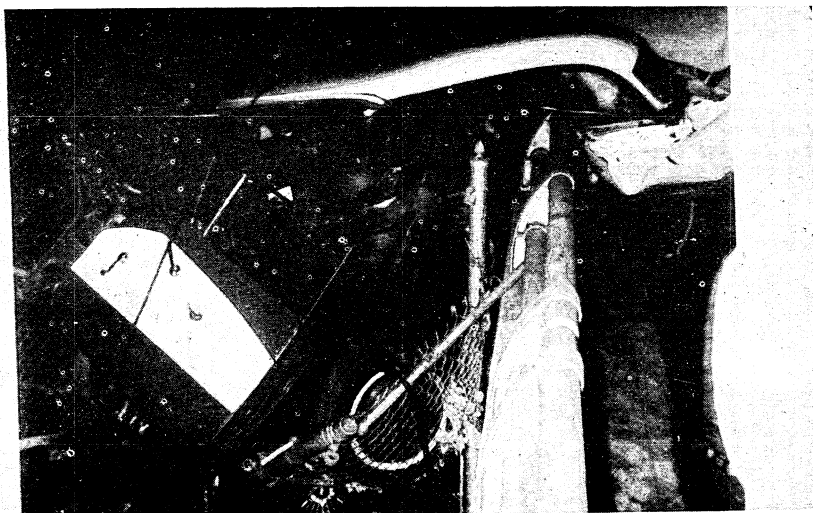


what happens to a vehicle when it hits a guardrail. There were similar photographs from Route 495 in Virginia, but this one best illustrated the point.

This is a typical installation of a guardrail where it meets a bridge parapet on the Maryland side of the Capital Beltway. This particular photograph was taken in December 1966.



In checking the accident records I found there have been accidents at locations similar to that. This one occurred in December 1965, on the beltway where it crosses University Boulevard. This is in the area just west of the Baltimore-Washington Parkway. This accident resulted in one death and one injury.



This is a location where I took a photograph in January 1967. The road at this point, which is just south of River Road as you are proceeding toward Virginia on the beltway, crosses over the Cabin John Parkway. The road begins to curve to the right. And on the left your guardrail runs up to the bridge parapet. And on the right the guardrail is again like an arrow, and the shoulder is dropped as you go through the bridge. The guardrail goes up to the bridge parapet and is not anchored.



And again checking the police records I found that that location was the scene of a fatality in 1966 where the vehicle smashed into the guardrail and was led into the bridge parapet. I cannot show you a photograph of the vehicle. It was totally demolished and would not serve any purpose at this point.



Mr. W. MAY. What is the recommended way of installing this guardrail?

Mr. PRISK. At the structure, the rail should be brought onto the structure and made integral with the design of the structure itself, anchored firmly to the bridge structure.

Mr. W. MAY. Anchored to the parapet itself?

Mr. PRISK. Yes, and in line with the configuration on the traffic side of the structure. This would be a rather difficult thing to do in this case perhaps with that curb there, but nevertheless could be done and is a necessary part of protection to the approach to these bridges.

Mr. W. MAY. Should the curb be there as we see it?

Mr. PRISK. No, that is not a desirable feature. That is a separate problem.

Mr. W. MAY. If the curb was not there, then you could easily bring up that guardrail and anchor it to the parapet——

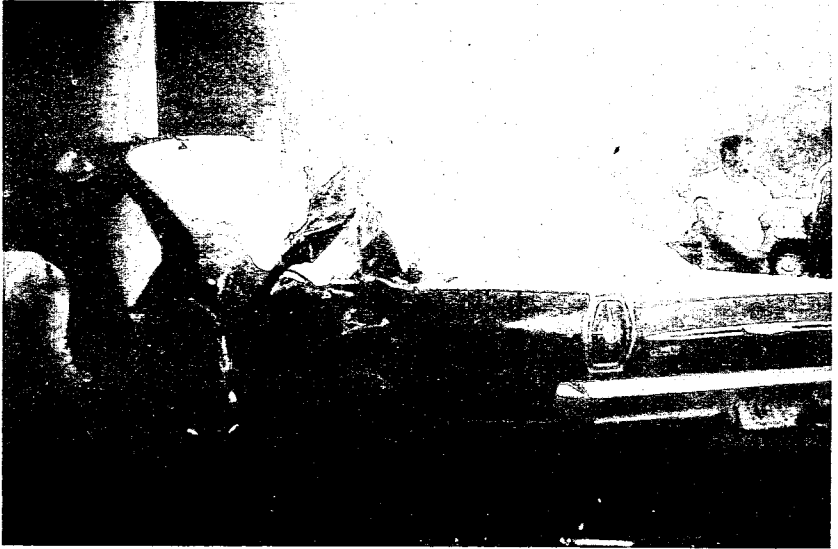
Mr. PRISK. Yes, this is not difficult. It is necessary to make a pretty firm anchor because of the expansion-contraction of the guardrail itself, which tends to pull it loose or possibly break the concrete at the end of the structure if you do not put it in there with proper design. But carrying the rail onto the face of that parapet wall that you see in the picture, about 3 or 4 feet, with proper anchorage through the parapet wall would hold the rail.

Mr. O'HARA. Now this again is a Maryland sign. Again the 8-inch I-beams are anchored in concrete. There is a guardrail near the edge of the shoulder to shield a motorist from running up and striking the sign supports. The purpose of this picture, however, is to show the median.

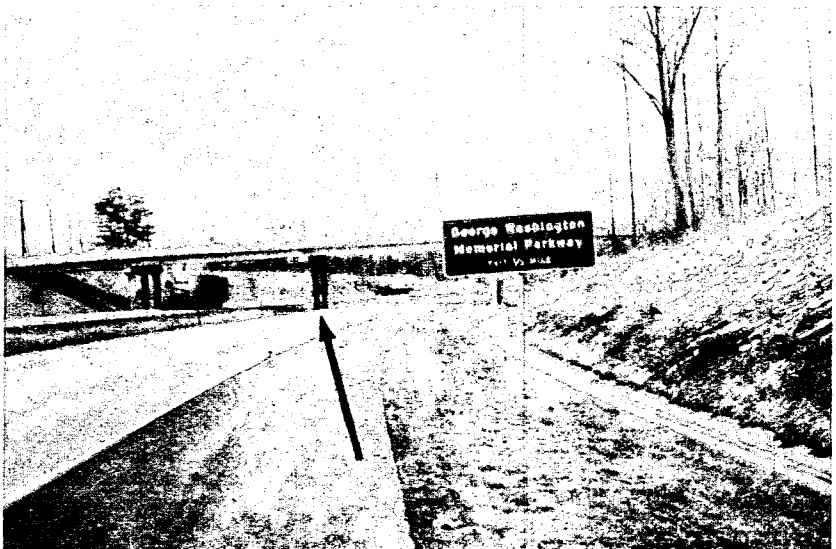
Here are the bridge piers in the median which are unprotected where there is no guardrail to shield the motorist from running into them. The same thing is true on the shoulder side. The guardrail ends before we get to this bridge. This particular overpass is at Lincoln Road. And when I was checking the accident records of the State police



in March and April of this year I found that in September 1965 there had been a fatal accident at the very location which I have just shown you. This occurred at 4:30 in the afternoon. Now this is just illustrative of the type of damage and injury that can be sustained when you hit a bridge pier such as this.



This is a photograph of the approach to the George Washington Parkway on the Virginia side of the beltway. In this area the road is curving slightly to the right and again you will see there is no guardrail to shield a motorist who might happen to wander down in this area [indicating]. Nor is there a guardrail on the southbound



shoulder [indicating] and there is no guardrail over on this side, the northbound shoulder.

And in checking the accident records, I found that in April of last year this vehicle hit this bridge pier, killed three people and injured another.



A few minutes ago I showed you a sign. And in the background was this particular bridge. There are a lot of things to look at here. We are approaching this from the south, heading toward Maryland. And for orientation purposes, this is just north of Dulles Airport. There is a creek which passes under both spans of this bridge.



You will notice the bridge is boxed in. This is a solid piece of concrete extending from the northbound lane to the southbound lane across the median. As you approach, you will notice a number of places where there is no guardrail. There is no guardrail here [indicating] in the median. There is no guardrail to protect a vehicle from the bridge parapet or from the end wall or from running off the road down into the creek. There is no guardrail on the far end of the bridge on the median side, northbound. There is no guardrail in the approaching southbound lane in the median.

There is no guardrail at the end of the bridge in the southbound lane. And here we have the ever-present sign mounted on a 4- to 6-inch steel pole embedded in concrete. There is some guardrail here on the southbound shoulder. You see guardrail in the southbound lane at the end of the bridge, and this approach to the bridge parapet from the north. You see guardrail starting at the northbound end of the bridge.

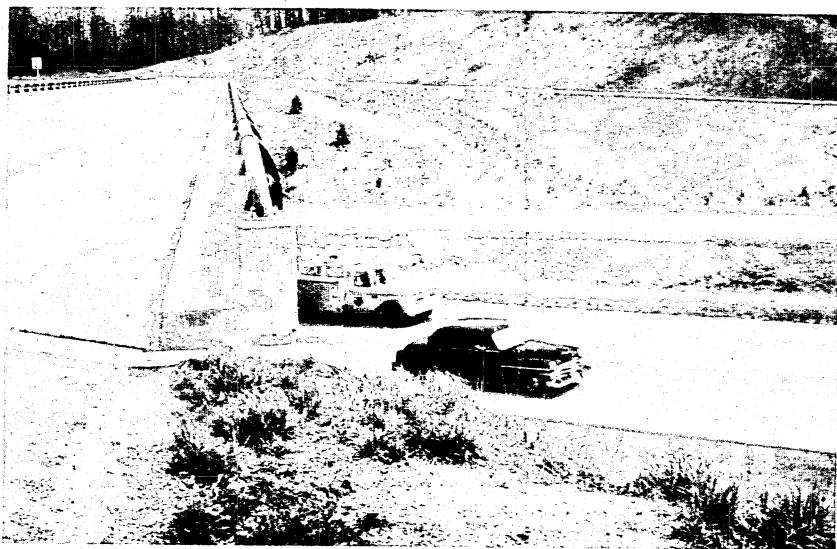
This guardrail is not anchored to the bridge parapet at any location in this structure. You will notice they did carry the shoulder through this bridge structure on the Virginia section of the beltway.

This is a bridge over the Capital Beltway. You are on the approach to the George Washington Parkway. The George Washington Parkway is up here [indicating]. These are the southbound lanes of the beltway from Maryland, crossing into Virginia, passing under this bridge.

To orient you again, the Cabin John Bridge would be to your left. This photo looks toward Washington on the George Washington Parkway, and this is the approach. You will notice the bridge parapet. There is no guardrail here at this end and nothing to prevent a vehicle from getting down into this lane of traffic below.

The same situation exists on the far end of the bridge, and, in addition, we have a speed sign which says "Speed Limit 40 Miles Per Hour," mounted on a 4- to 6-inch steel post. And there is the same situation as regards the guardrail, there is none.

Mr. W. Max. Mr. Prisk, there is no question that there should be a guardrail at this location.



Mr. PRISK. This would appear to be a very hazardous omission of guardrail.

Mr. W. MAY. Thank you.

Mr. O'HARA. Before I go to the next slide, I might add that below here is your sign on the beltway. Again a 4- to 6-inch steel pole, "Emergency Stopping Only."

Mr. CRAMER. Is this the George Washington Parkway?

Mr. PRISK. Yes, the upper structure is on the George Washington Memorial Parkway, Virginia.

Mr. CRAMER. That parkway is a totally Federal project, is it not?

Mr. PRISK. That is true.

Mr. CRAMER. So nobody can suggest that the State had any responsibility relating to this structure. This is engineered, paid for by the Federal Government, and engineered and supervised by the Bureau of Public Roads; is that correct?

Mr. PRISK. This is correct. There is of course an agreement between the Bureau of Public Roads and the National Park Service concerning their facilities. This structure, at the same time, is just one of many that spans Interstate 495 and was built at the same time that Interstate 495 was built.

Mr. CRAMER. The point I am making is, there was nothing in that agreement with the Park Service that suggested that highways should be built by the Bureau of Public Roads and at 100-percent Federal cost in this particular fashion, was there? Nothing prevented them from putting the guardrail up there?

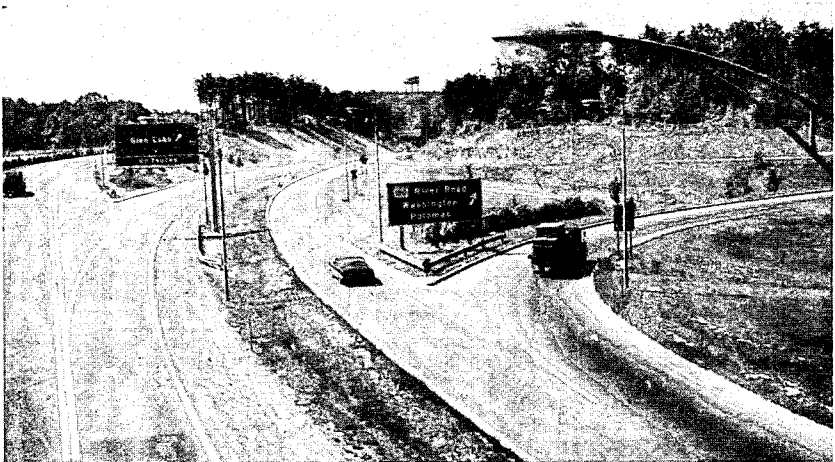
Mr. PRISK. Oh, no, not at all.

Mr. CRAMER. Well, this seems to be a clear example of where there was entirely Federal responsibility and the traffic hazards were built into it.

Mr. PRISK. I think that must be admitted.

Mr. CRAMER. Yes, thank you.

Mr. O'HARA. This is a typical Maryland gore area, which you will find on the Capital Beltway. This happens to be an interchange at River Road in Maryland. We are now looking southbound. This lane



here [indicating] leads to Glen Echo on the Cabin John Parkway. There are a number of things to notice on this particular picture.

It may be difficult for some of you to see some of the things I am going to point at. You will notice, first of all, this sign, which is for this lane, [indicating] is not in the gore area, where you usually find a number of signs. They put it over on the right, off the shoulder, and they put a piece of guardrail in front of the sign and flared it back. And yet in that gore area there is a sign which says, "No Hitchhiking," which is mounted on channel irons.

Mr. W. MAY. Mr. O'Hara, for the benefit of some of the visitors here, would you explain what a gore area is?

Mr. O'HARA. Yes. Gore area is an area found on the highway, generally at an interchange area, where the motorist has to make a decision, as for instance here [indicating]. Here is a motorist on a collector-distributor road. He has to make a decision here, whether he wants to go this way to the right or whether he wants to go south on the Capital Beltway with the Cabin John Parkway. This area is known as a gore area [indicating].

Mr. W. MAY. That pie-shaped area.

Mr. O'HARA. That is correct.

Mr. BLATNIK. What is the other phrase that Mr. Linko uses as you approach that type of gore area, with those types of fixed hazards? Is it the area of indecision? Would that be correct, momentarily, for fleeting precious seconds, traveling at 60 miles an hour; momentarily while you are reading, your eyes bounce around, you are looking to the right and the left and at the sign, and you register these impressions; and you are trying to decide, what am I to do, turn off here or next exit?

Mr. O'HARA. That is correct, Mr. Chairman.

Mr. BLATNIK. It is an area, such as the gore area, where four times as many accidents take place, is that not true?

Mr. O'HARA. Yes, sir.

Mr. BLATNIK. Mr. Prisk, is that correct, gore areas such as this—how do you say it—you have four times the accidents here as any other place on the freeway?

Mr. PRISK. The drivers are four times more frequently running off the roadway at gore areas than other points on the road.

Mr. BLATNIK. Right.

Mr. PRISK. Four times more frequently.

Mr. BLATNIK. Therefore, we have to give at least four times more attention for these areas, for sign construction; would that not be true?

Mr. PRISK. Correct.

Mr. CRAMER. As you indicate, that Glen Echo sign on the left was taken out of the gore area. But it looks like just a little bit beyond the gore area in the line of the curve, they have planted some trees, have they not?

Mr. O'HARA. Are you referring to this area?

Mr. CRAMER. The area to the left.

Mr. O'HARA. There are a number of evergreens and small shrubs in here. There are some small trees at this time.

Mr. CRAMER. Of course they will grow, I presume.

Mr. O'HARA. Yes, they generally do.

Mr. CRAMER. And so these beautiful trees will become just as much a hazard from a standpoint of safety as any other obstructions put that close to the highway, is that not correct?

Mr. O'HARA. Yes, sir, they do become hazards.

Mr. CRAMER. And of course these are planted right in the direct line of where a car out of control would go if it got off the road and turned that corner?

Mr. O'HARA. Yes, sir.

Mr. CRAMER. They did not plant the trees on the right, where you might miss them, but they planted them on the left where, if you over-accelerate, you would run right into them. This appears to be being done all over the highway system.

Mr. O'HARA. Yes, sir. I will show you some trees shortly.

Mr. CRAMER. What price beauty?

Mr. O'HARA. Again in the same area you will notice this gore area on the right. Here is the sign mounted on 8-inch I-beams imbedded in concrete. The guard rail, to shield the motorist from running into it, is placed in front. The sign could have been placed over in here off the right shoulder and cantilevered as the Glen Echo sign is.

Again you will notice they have taken part of the shoulder here. You see the shoulder starts back here, beyond the sign.

They took part of the shoulder, apparently, to put this sign in here. Here is a light pole mounted right behind or at least adjacent to that piece of guardrail. Notice one thing, if you will. This light pole is located very close to the roadway. You will notice the bracket arm is a lot shorter than the one on this light pole over here, which is close to the bridge where I was standing.

The same situation is true of the other light poles on this curve. They have a shorter bracket arm. We see that there are longer bracket arms available where the poles could have been put back further from the roadway. The shoulder again is lost up in this area beyond the gore. They take it back again, and that is for this lane which is coming in over here. There is merging traffic from here and from here and from here.

This lane on the left is a fast lane off 495. This is your collector-distributor road on the right, your exit ramp to River Road turning right at the gore area, and your entrance ramp from River Road to get onto the Capital Beltway or the Cabin John Parkway, beyond the grass plot above the sign.

This is typical of gore areas in Maryland.

In reviewing records I found this accident, which occurred last year, on the Capital Beltway, in Prince George's County. In this accident the motorist was in this right lane, which is the deceleration lane to leave the beltway. This second lane is your slow lane. The motorist hit this curb on the right, which is about nine inches in height. He bounced off the curb, slid over into the slow lane, and sideswiped the other vehicle.

The two of them ended up sliding into the guard rail, which is pointed like an arrow. There is a piece that comes out this way from the right, and another piece that comes straight at you from this direction, behind the vehicles.

This gore area is not one with a deep drop. If the vehicles had run in there, they probably could have escaped with no injuries or maybe minor injuries. This sign could have been placed over here off to the right and cantilevered.

The sign is your point of last decision. If you have not made your decision now, you are in trouble, especially if you are out here in the slow lane and you want to be in here in the deceleration lane [indicating].



This is a gore area on the Virginia side of the beltway. They do the same thing on that side. Here is your deceleration lane leaving the Capital Beltway to get on Route 50. This is a collector-distributor



road. I will not go into detail on collector-distributor roads, because this will be covered in another hearing.

Here is your gore area. This is very even, and yet the sign is in there, mounted on steel poles, while over on the shoulder—this sign could have been mounted and cantilevered over the roadway somewhat in advance of this gore area.

Just beyond this you see the merging traffic sign, again mounted on the 4- to 6-inch steel pole.



Now we are back in Maryland. This is known as a bridge sign. It is for the eastbound lane in this area. I say eastbound because actually the beltway has no direction; it goes north, south, east, and west, in completing its circumference of Washington. In this area we happen to be eastbound. There are a number of things to notice.

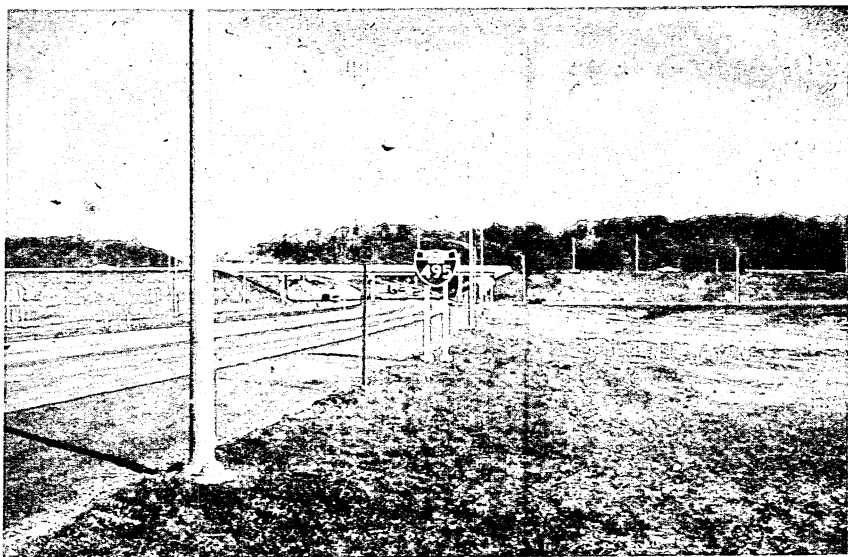
First of all, you have a sign, food and gas, mounted on two channel irons, a few feet off the shoulder.

Just beyond that you have a light pole with a bracket arm carrying the light over the traveled portion of the roadway. Just in back of that light pole is a piece of guard rail, which runs somewhat beyond this concrete support for this sign bridge. The guard rail could have come around in front of this light pole instead of where it is.

The bridge sign is mounted in concrete. Some of these concrete supports for bridge signs can be as much as 6 to 8 feet long, 3 feet wide and 10 feet into the ground. Notice the piers on the bridge. There are no guard rails to shield a motorist from running into them.

As you enter the Maryland beltway from Virginia, after crossing the Wilson Bridge, this is the interchange with Interstate 295. We are now looking eastbound. There are a number of things to be noted here.

First, the steel light pole. Secondly, a no parking sign mounted on a channel iron. Thirdly, a route marker, the I-beams and concrete.



Another light pole, a merging traffic sign, another light, and so on down the roadway.

Mr. BLATNIK. Mr. O'Hara, will you pause for one moment.

We have been pleased to have a very fine delegation of students from the fifth and sixth grades of the Jackson School with us today. They are now leaving to meet with the Speaker, in the Speaker's office in the Capitol. Would you raise your hands?

(Raising of hands.)

Mr. BLATNIK. Mrs. Nancy Elisburg is the teacher of Jackson School's fifth and sixth grades. One of the students is Patricia Carroll. Her dad is Mr. Sterlyn Carroll, who is on the staff of the Committee on Public Works and has been for quite some years. We welcome the students, and I hope this gives you some idea of how a committee of Congress works.

This particular committee is the Committee on Public Works. This committee is responsible for the Federal-aid highway system, especially the Interstate Highway System. Mr. George Fallon, from Baltimore, who is here this morning, is the chairman of the committee and the leader and original author of this highway program.

Today we are studying how to make the highways more safe for you young people. We have made them very safe, but there are still more improvements to be made. This is true of anything. No matter how good it is, it can be made a little better.

We want to make these highways so good that, when accidents do happen, it will be no one else's fault but the person who has been driving. We are doing everything possible to help you.

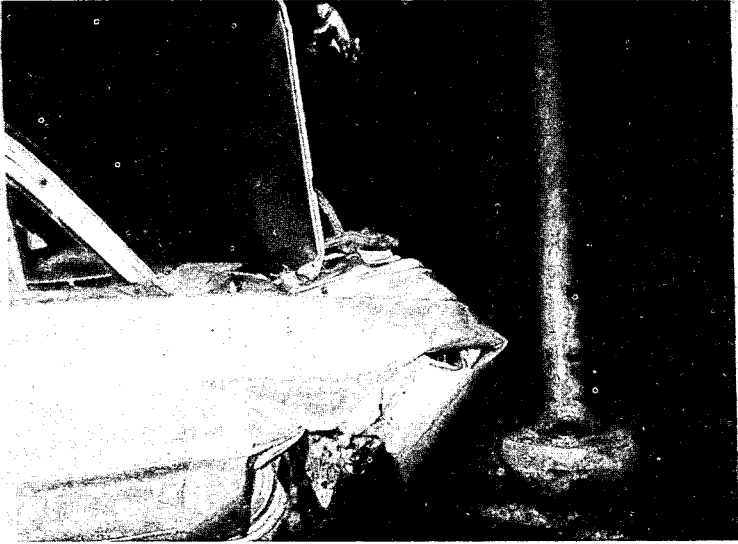
Thank you for visiting us, and I hope you have an enjoyable day. Mr. O'Hara.

Mr. O'HARA. Thank you, Mr. Chairman.

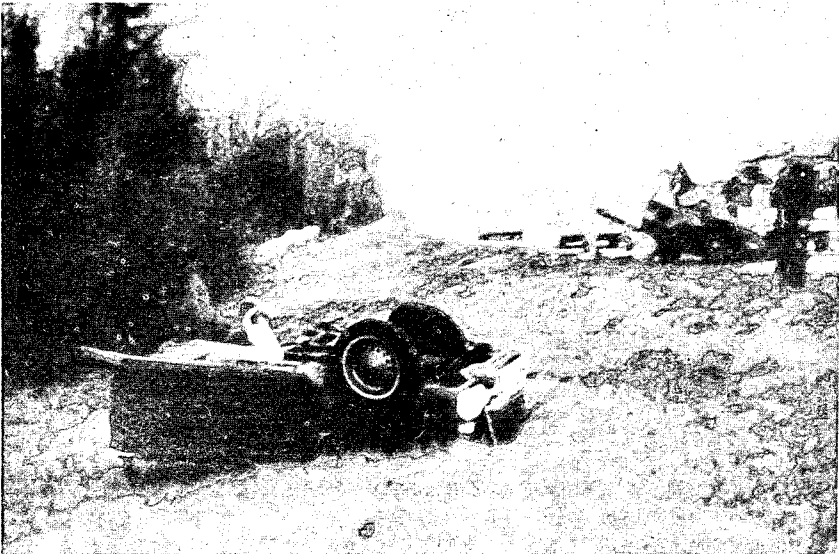
The light pole which you see here on the left of the picture is a steel pole approximately 28 feet in height, together with the mounting

bracket which gives it an overall height of 30 feet. The steel pole is mounted on a minimum of 5 feet of concrete. Now, the base plate to which the pole is attached is anchored to the concrete by four 1- by 40-inch bolts. And this is class A concrete with reinforcing rods.

I would like to show you what happens when these light poles are hit.



In November of 1965 the doctor driving this car, according to the witnesses and the police reports, was driving at about 50 miles an hour. He hit this light pole. He was killed, and there is his car, broken into two pieces.

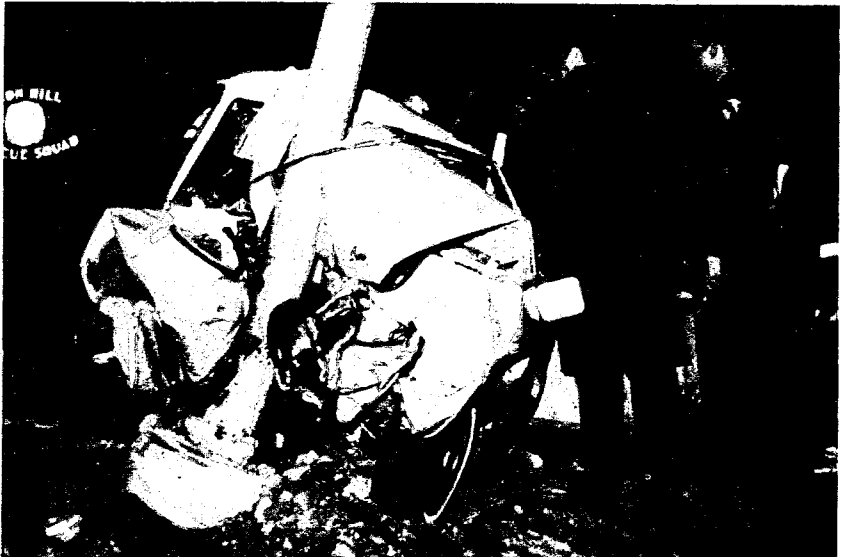


A month later, in December of 1965, again on the beltway, this vehicle hit this light pole. The driver was killed. Damage to the vehicle is evident. Here is the light pole.

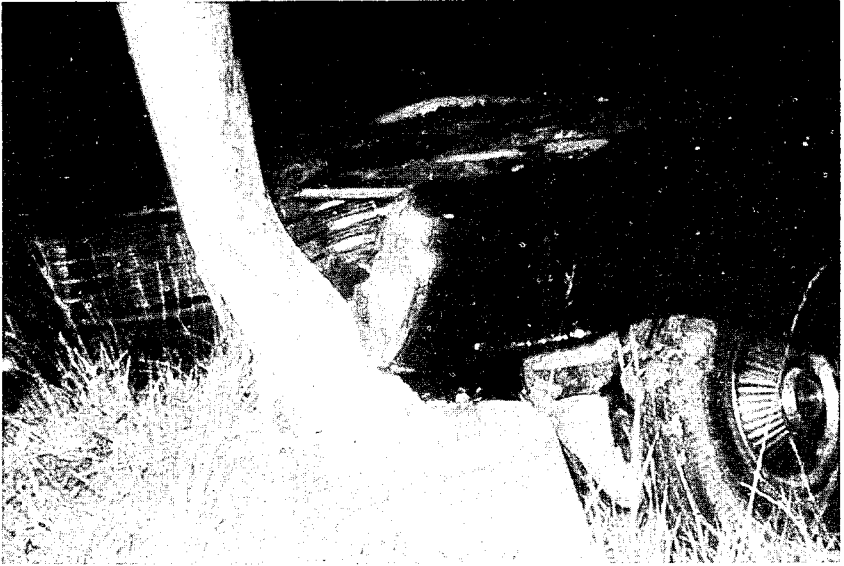
In February of last year, in this accident, three people were injured hitting this light pole, which was knocked down.



The following month, in March, this vehicle hit this light pole. There is the concrete base, partially out of the ground. One person was killed and two injured.



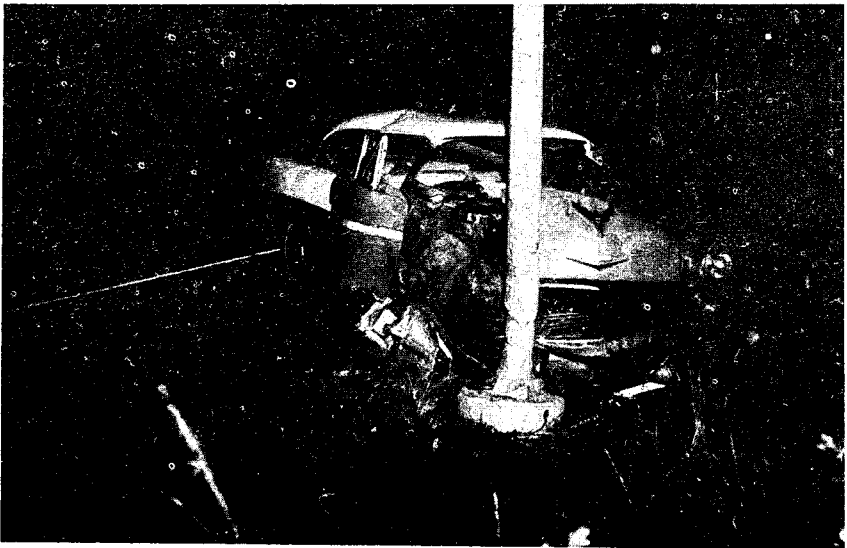
In June of last year this accident resulted in serious injury to one person when the vehicle struck this light pole.



And in November of last year, two men were returning from a fishing trip. There is your travel lane of the beltway on the left. Next to it is your shoulder. They hit this light pole. It killed one man and injured the other.

Mr. W. MAY. Mr. O'Hara, it is well for us to remember that there are such things as breakaway type light posts?

Mr. O'HARA. Yes, sir; there are.



Mr. W. MAY. We have learned that in those localities that have installed the breakaway light poles the experience has been wonderful in that people do not get killed.

Mr. O'HARA. Yes, sir. I am glad you mentioned that. I did not want to get ahead of myself. I think this will be covered in another hearing.

Mr. BLATNIK. But Mr. May has had pictures, slides by Mr. Linko, showing that with aluminum type pipes or poles for lights, where the concrete was flush with the ground, the aluminum would shatter with minor damage and minimum damage to the occupants.

Mr. O'HARA. Yes, sir.

Mr. BLATNIK. What is the guideline or guiding factor in the determination by a State, whether to use a rigid-fixed steel pipe or aluminum pipe or some breakable material for light stands, Mr. Prisk? Is it left up to the States to choose, or are there any directives or guidelines sent out by the Federal bureau?

Mr. PRISK. On Federal-aid projects in general, of course, we have asked that due attention be given to getting as much competition as possible between suitable types of materials that are alternately employed in the usual design practice. It comes down to steel and aluminum. We have talked exactly the same way, that competition should be maintained at the best possible level in the interest of an economic program. But we have attempted to point out also the features that relate to this shearing off that occurs with the lighter type of pole.

You may make a pole that will shear off out of steel or aluminum, either one. The aluminum basically is more brittle material. But, depending upon the alloys, steel or aluminum can both perform satisfactorily, reasonably well.

The State makes the initial determination, of course, and we give our approval to the pole. In this case, evidently the State of Maryland decided to use the steel pole, and very obviously we must have approved it.

Mr. BLATNIK. Mr. O'Hara.

This occurred in January of this year on the beltway, resulting in a fatality. This is the light pole that was struck.



And again in January, another fatality, and a serious injury in this accident.

The subject of light poles became of interest to me when I saw all the accidents that were recorded in the accident files of the State police in Maryland. Maryland has lighted the Capital Beltway only in the interchange areas. There is no lighting on the Virginia side, although their conduits are set up so that the light poles can be installed in the future.

When I checked the records concerning light poles, I found that 124 light poles were struck on Interstate 495 from 1965 through February of this year, which was the latest figures that were available.

In this same period nine people were killed in light pole accidents on the beltway, out of the total of 77 killed in the last 3 years.

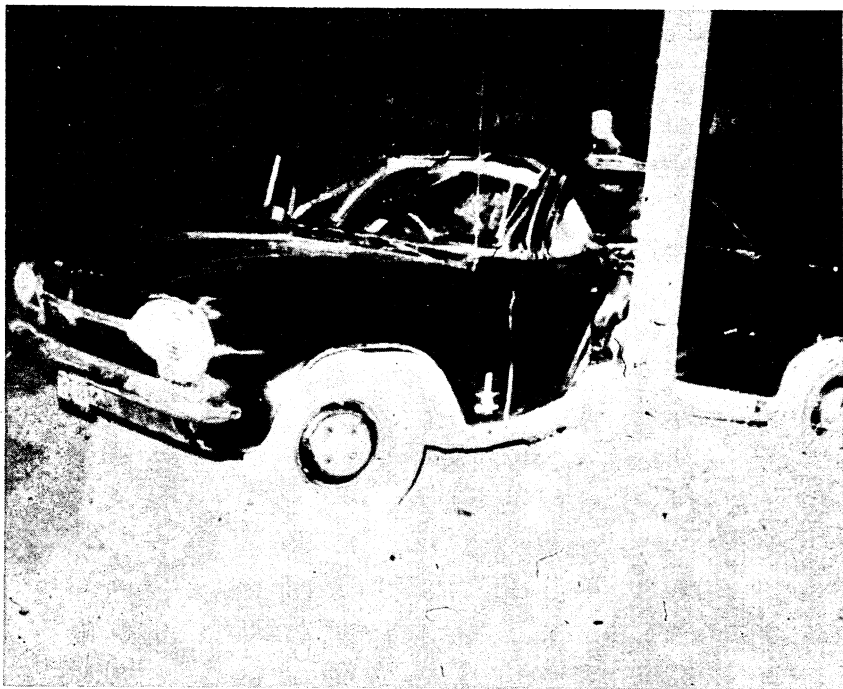
In checking the beltway and trying to determine where the light poles were being hit, I found that eight light poles had been reported hit a total of 19 times. Three of these poles had each been hit three times, and five poles each had been hit twice.

And again, in reviewing accident records, there were 50 injuries sustained in 1966 in the reported light pole accidents.

The 61 struck light poles reported in 1966 accounted for 26 percent of the fixed-object accidents.

And, incidentally, the cost to repair the light poles was approximately \$22,500. This does not include damage to vehicles.

The light pole repair can vary in cost, in amounts up to \$700 depending on the extent of damage. And of the cost sheets available to me on certain light poles which had been struck, most of them ranged from \$400 to \$600 per pole.



Of the light poles that I was able to identify, where I was able to say that light pole number so-and-so was hit at such a location, I was able to identify 15 as being struck at Interchange No. 17 from November of 1965 to February of this year.

I would like to add one other thing. In reviewing the accident records, and in discussing light poles in particular, I found that, of the 2,186 light poles on the beltway, many of these are on the roads which cross over or pass under the beltway; and, as such, accidents involving these light poles would be reported on that road and not on the beltway itself.

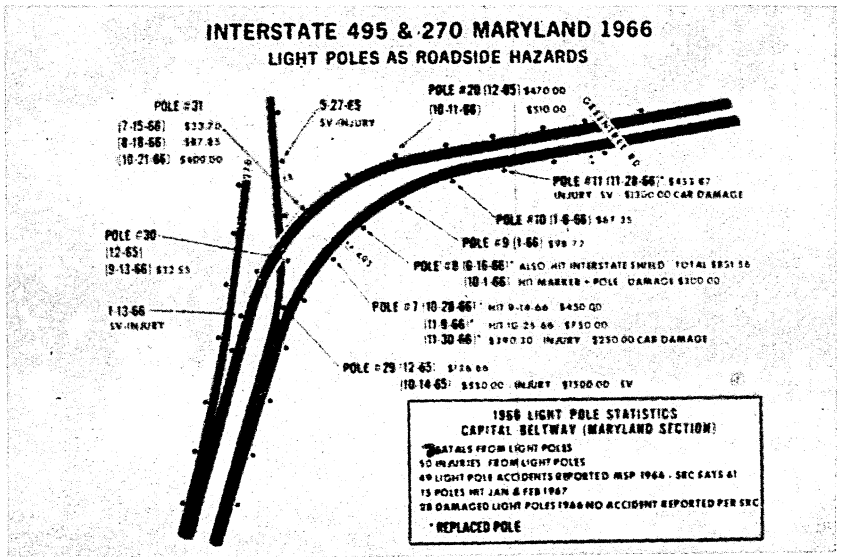
This is an artist's drawing of Interchange No. 17 on the beltway. This is the area where I found many of the light poles which had been struck. This is 495 going north, and turning east toward Bethesda and down in this lower left area is Bradley Boulevard. This road extending to the top is Interstate 270 as you head toward Rockville or Frederick, Md., this bottom lane being the eastbound lane to 495 and the top lane is the westbound lane.

This is Greentree Road crossing over the beltway. This area I will cover in some detail in the next several slides, but in this slide here these dots which are alongside the black line are light poles which are mounted approximately 2 feet from the edge of the shoulder.

The dark line would indicate the lanes of travel. You notice this light pole in here in what we described before as the gore area was hit in December of 1965, and again on October 14, 1966.

It was hit twice in that gore area. Going slightly around the curve, here is another light pole, No. 7, which was hit three times last year, and incidentally, between October 25 and November 9, the pole was hit in this particular location, and while it was being repaired, it was struck again before the repairs were completed.

So you have two accidents in that location within a relatively short period of time.



Another light pole which received more than its share of strikes, but is not reported as being on 495, is this light pole here [indicating] No. 31. This light pole was hit three times last year from July through October.

This light pole here, No. 30, and this light pole, No. 31, would not be recorded, as I said, on 495, even though they are in the interchange area.

I would like to point out one thing before I move on. You will notice that we have a succession of light poles being struck on 495 around the curve. This light pole, and this one and this one and this one, all being struck last year. And I wondered what about this light pole here [indicating] No. 6.

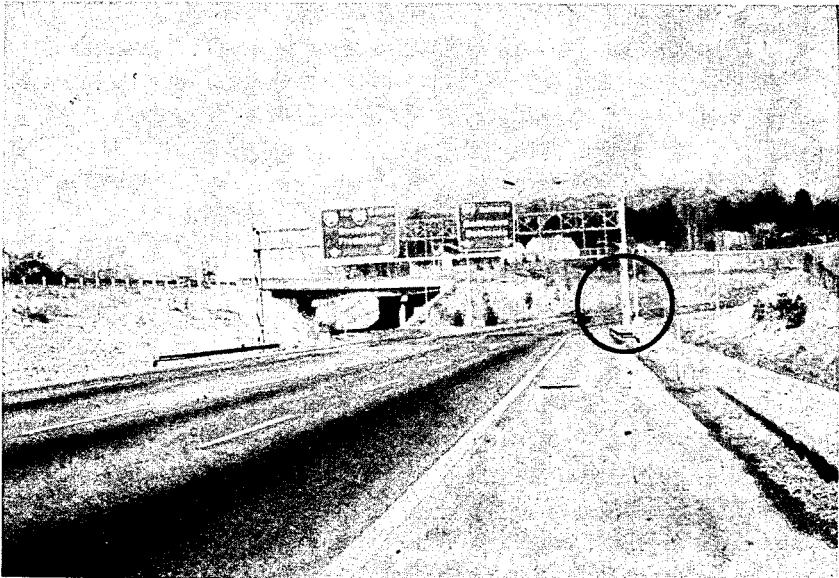
Here is a light pole that is one out of several that has not been struck.

So, in going back to the interchange area, I marked off the poles and I found out why it was not struck.

You will notice that we are now at the gore area or approaching the gore area. This is 495, and we are looking north. If you will look at this map over here [indicating on map], this aerial photograph, this is the approach to the interchange area, 495 running this way to the right and 270 running north. I was standing right about here when I took this photograph. [Indicating.]

This is the light pole in question, where the arrow is pointing. And you will notice the reason why it has not been hit. There is a huge piece of concrete just in front of that light pole. The reason why that concrete is there is another story.

At this point I am going back to Bradley Boulevard, which is the overpass 1,000 feet from this gore area, the interchange of 495 and 270.

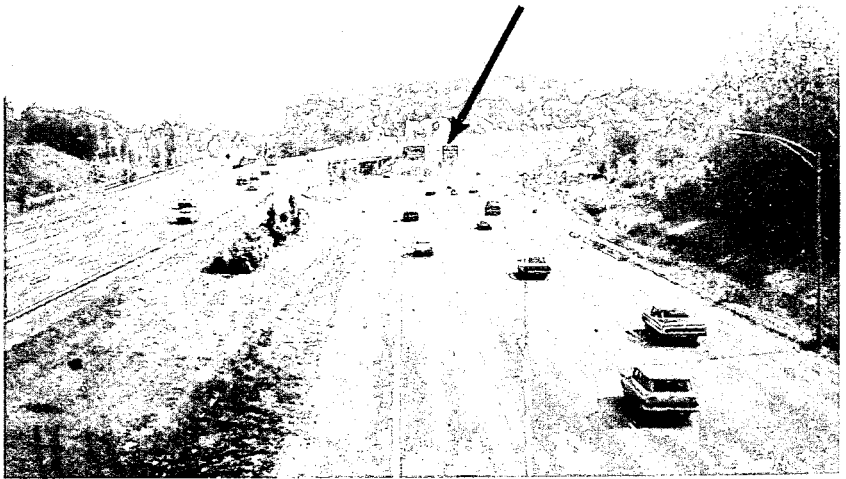


We are now approaching that gore area. I am standing on Bradley Boulevard. There are a number of things I would like to point out here. First of all it is a four-lane highway, northbound. This is 1,050 feet, roughly, from where we are to where the two roads divide at the gore.

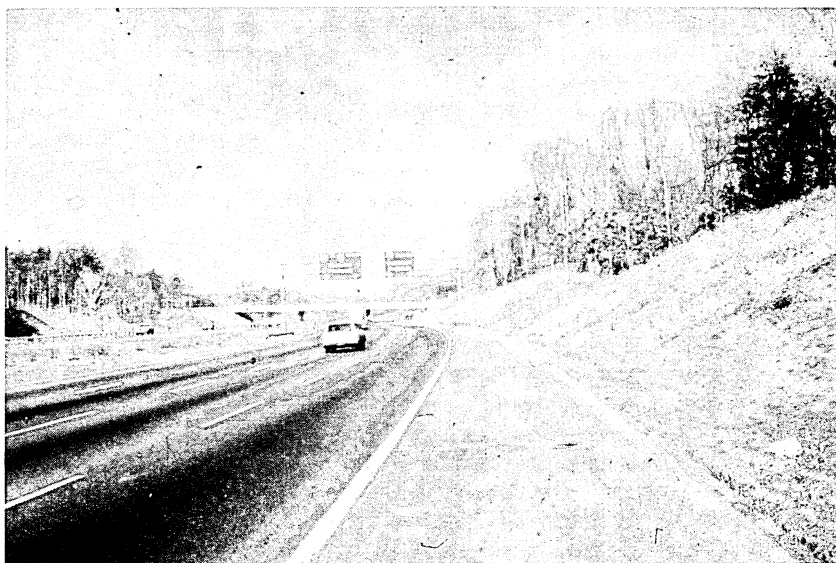
I noticed, in talking to the police and standing out here making observations, that there were a number of vehicles which ran across this area in here which we call a gore area. This photograph was taken last Friday morning. I have a number of these, but this gentleman up in the gore just below the arrow was traveling in the fast lane of 495. He suddenly realized he wanted to be over here on the right. He had to make his move against this vehicle to his right and against these vehicles over in the other lanes. He narrowly missed the light pole, which is in that gore area which I showed in the last photograph.

He got by the light pole. In this area, in this northbound lane, there were 16 accidents and 13 people injured in 1966. Six were single-vehicle accidents, where the vehicle ran off the road and struck a fixed object.

Now, that is within 1,050 feet. In order to familiarize you more with this area, I am going to backtrack another 1,000 or 800 feet from Bradley Boulevard toward River Road.

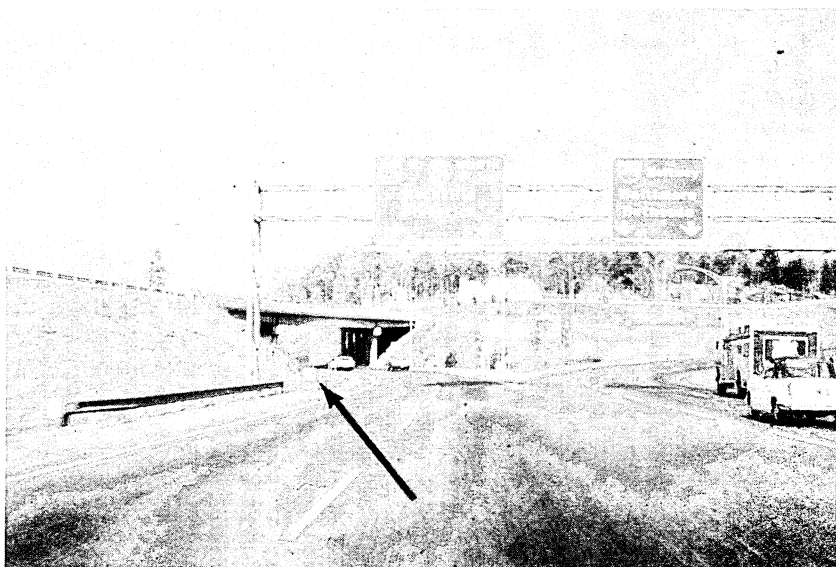


This photograph shows a bridge sign which is over 495. At this point 495 is a four-lane roadway with a 12-foot shoulder and a 60-mile-per-hour speed limit. Just before this area there is a sign off the shoulder which advises that Interchange No. 17 is 1 mile ahead. It says "Junction 270 to 70S North 1 Mile"—this then is the next sign you see, approximately 1,700 to 1,800 feet from the interchange gore. This sign says, "Rockville-Frederick"; it has two arrows. This sign says, "Baltimore-Bethesda," and has two arrows. Again the speed limit in this area is 60 miles an hour.



Now we are going to go forward where we were before, back up beyond Bradley Boulevard and just short of the gore area. This is the next sign you see. This is about 100 feet in advance of the gore area, telling the motorist this is 270 if you turn left; if you bear to the right you are on 495.

You will notice the concrete on the left side of the road (arrow). Before, I talked about a light pole which is to the right of this truck and there was a piece of concrete in front of the light pole. And I wondered why that was there. And I looked at them and I could not figure it out. I went to the State police and county police and I talked to them.

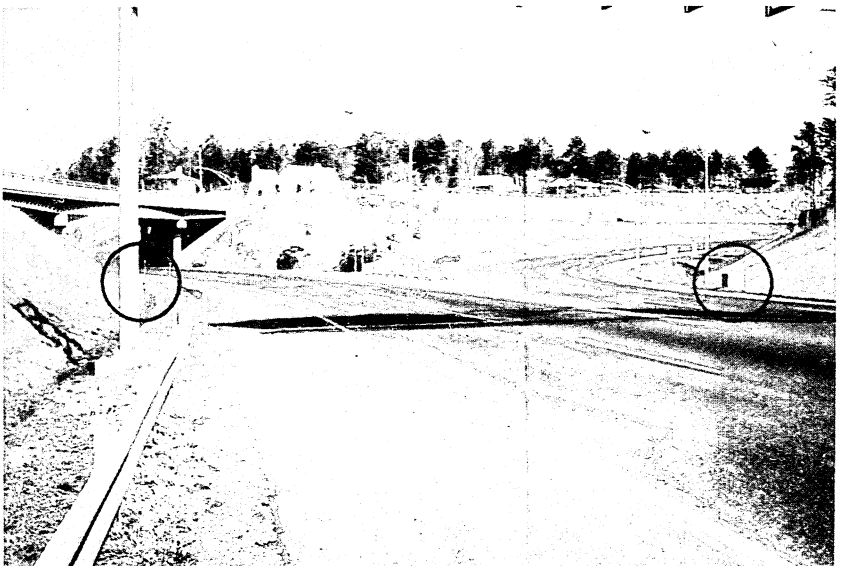


And I found out that in 1964 this steel sign pole and this concrete base had been there. On each side of the roadway that huge piece of concrete we were looking at before was the base for a sign support.

In March of 1964 this vehicle was traveling northbound on 495. He came to this area. He was traveling on the right side of the beltway. He realized he wanted to be over here on the left. He lived in Frederick, Md. So he decided to cross over. Unfortunately he did not make it. He hit that steel pole, resulting in serious injury to himself. And this is what's left of his car.



Subsequently that sign was removed and brought to where it is at the present time. This is the same area.



This is the piece of concrete upon which that sign support had been; on the left is the piece of concrete we referred to before, and you will notice they have lighted the interchanges on the beltway and here we have a steel light pole just in back of where the steel pole had been for the gore area sign.

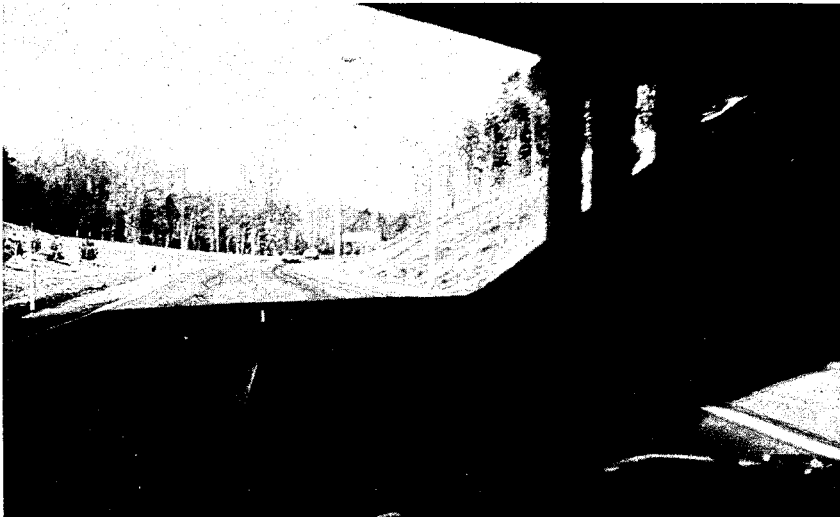
So we have taken one steel pole away and we have replaced it with another. In addition, you see here a number of 4-inch I-beams. The exact purpose of these, I do not know. It might be to prevent vehicles from crossing this area after they have passed and failed to negotiate the turn they wanted, and maybe this is the reason they put them in there. You have a "no hitchhiking" sign mounted on channel irons and there is a reflector, which at night is visible for a few hundred feet.

Now I am going to take you on 270, which is this road leading to the left, and following that we will go this way on 495 to the right. But first let's go on 270. And the next photograph you will see was taken just as we get under this overpass which is the westbound lane of 495.

This is what you see as you go under that overpass. The road is curving gradually to the left. Here you have bridge piers. Then the light pole, a route marker mounted on 4-inch I-beam, another light pole, and steep backslope. And over here off the shoulder, in the median, is a drainage ditch.

I studied this area and I selected 1,000 feet as a stopping point. I found in 1966 there were 25 accidents in this northbound lane in 1,000 feet in which 18 people were injured, and 22 of the 25 accidents were single vehicles which ran off the road. Fourteen struck the fixed objects we are looking at, bridge piers, light pole, route marker, and so forth.

Four ran off the road and overturned; they probably hit a ditch; the accident reports are not too clear on that; 22 of these 25 accidents I am discussing occurred within 300 to 400 feet of this gore area interchange. So you can see that taking 1,000 feet, there were only three that occurred beyond 400 feet.

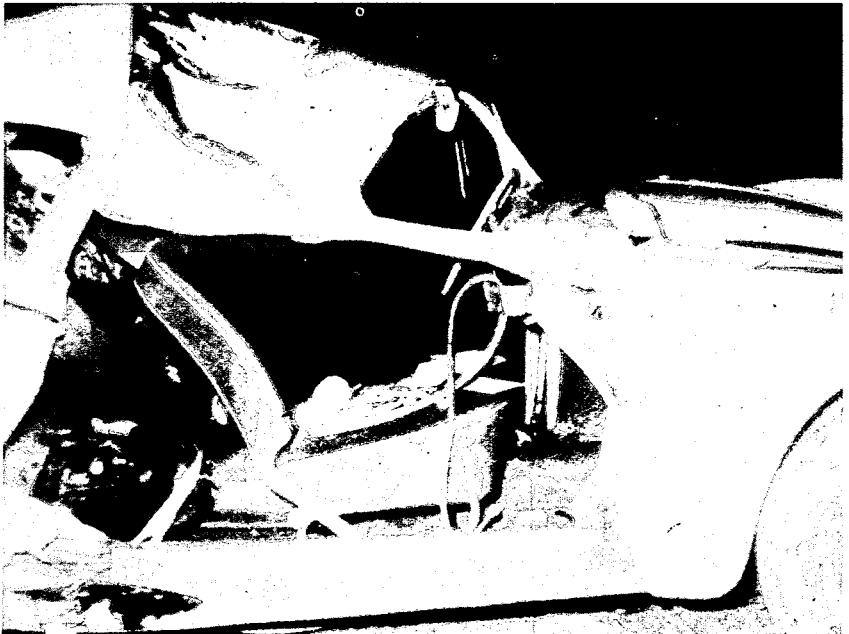


The majority of them occurred from this point to just beyond the 270 route marker. This route marker is mounted on a 4-inch I-beam, and in checking the accident records I found that in April of last year:

This vehicle ran off the road and hit that 4-inch I-beam. It took that 270 marker off the I-beam.



The driver was injured, and again this is what those 4-inch I-beams can do to a vehicle.

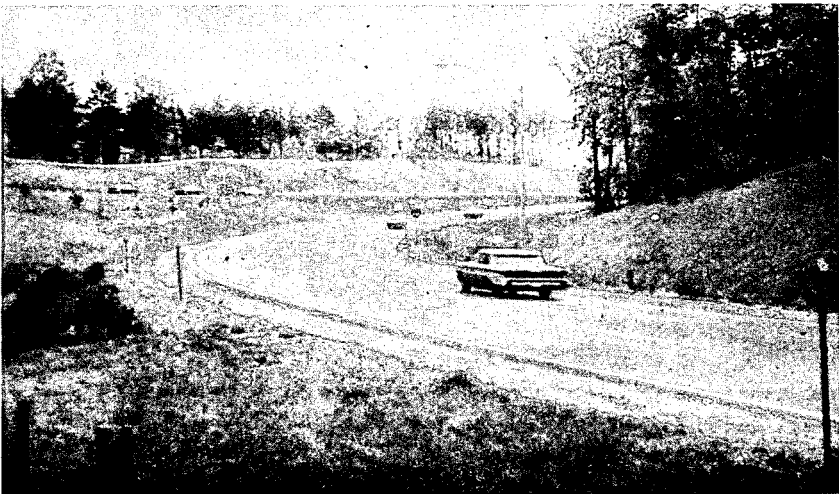


And 2 weeks ago it was hit again. Still in the same place, still on the same 4-inch I-beam.



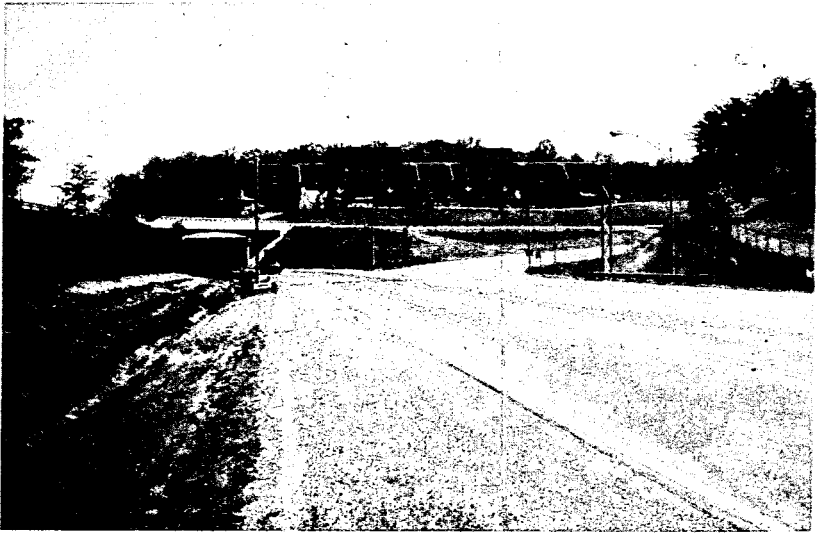
Now we go back to that gore area we were discussing before, where I told you we would look eastbound on 495. In this section of road which curves slightly to the right and then straightens out, again I selected a distance of about 1,000 feet. And this generally was the area within which the accidents occurred, although the distance to Green-tree Road is about 1,300 feet; but I used 1,000 feet, give or take a couple hundred feet.

In this area last year there were nine accidents and five people injured. Eight of the nine accidents involved single vehicles. Six hit the light poles we discussed earlier in this area.

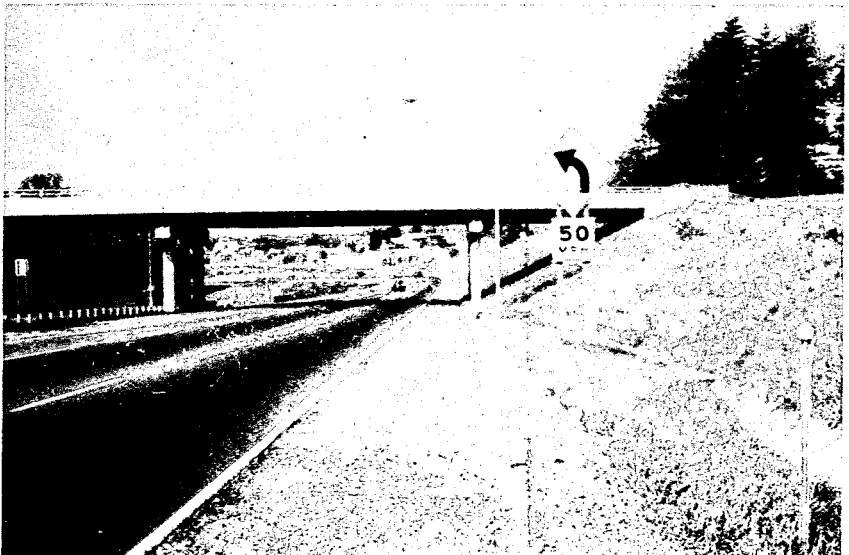


Now, I am just going to back up for this one slide, to show you where we will be next. This top lane is the westbound lane of 495. We are looking north. This right lane is 495 to the east, and we have already been on 270 to the north.

We are now going to discuss this section of the road up here. On the aerial photograph we are going to start about this area here [indicating on aerial photograph], which is Greentree Road, and come around this curve to where I-495 meets I-270 coming down from Rockville and Frederick, Md.



This first photograph, taken just east of Greentree Road, shows Greentree Road overpassing the beltway. This is westbound. This is an area of three traffic lanes, with 12-foot shoulder. The design speed



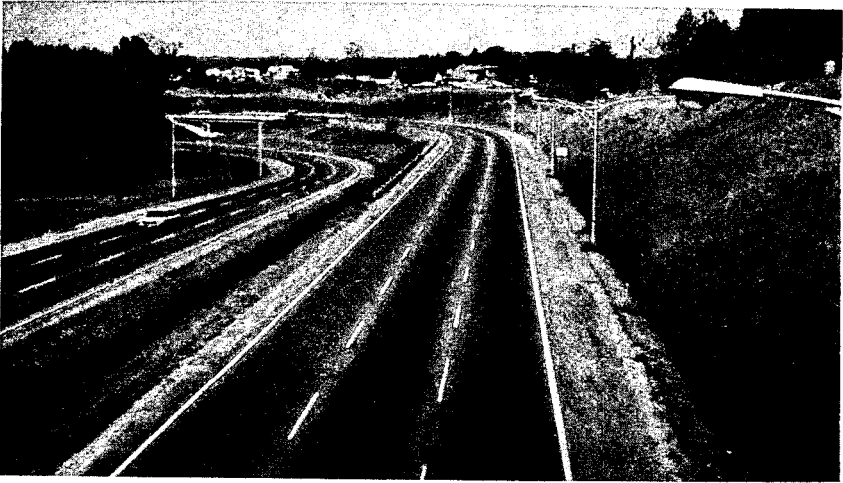
here is 70 miles an hour. The speed limit is 60 miles an hour. And here we have a sign with a recommended or advisory speed of 50 miles an hour, warning you of a curve ahead.

Notice the light pole just off the shoulder. The concrete piers in the median and on the shoulder are unprotected.

The next photograph is taken from the bridge at Greentree Road.

I want to give you a view of what is facing a motorist traveling in this direction. You will notice the light poles continuing on around the curve on 495. Over here in the median, small shrubs planted along here; guardrail not flared back, running toward and ending short of the curve.

The next photograph was taken about where this light pole is [indicating] in the curve.

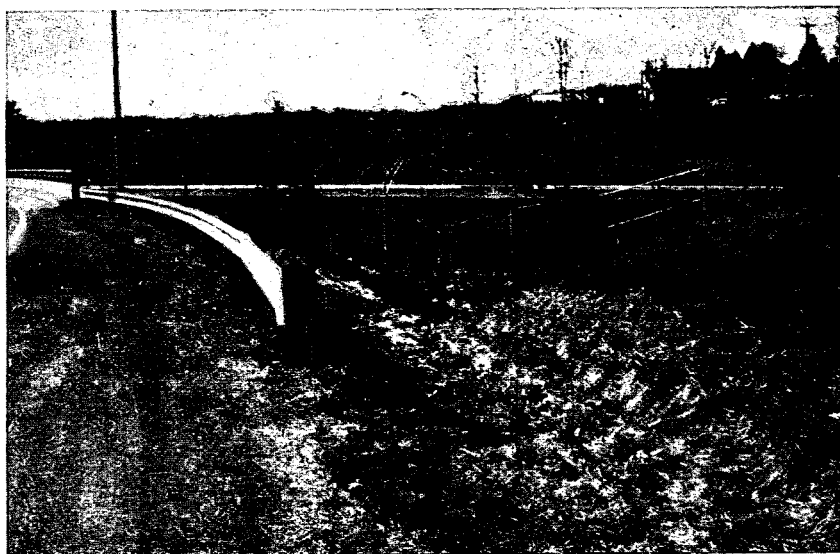


Last year, in this stretch around the curve, there were 24 accidents and four more occurred just beyond this curve in that short stretch to Bradley Boulevard.



So we have a total of 28 accidents with one person killed and 13 injured, and 20 of the 28 accidents involved single vehicles which ran off the road and hit fixed objects.

Now, we will go closer to the area of the curve.



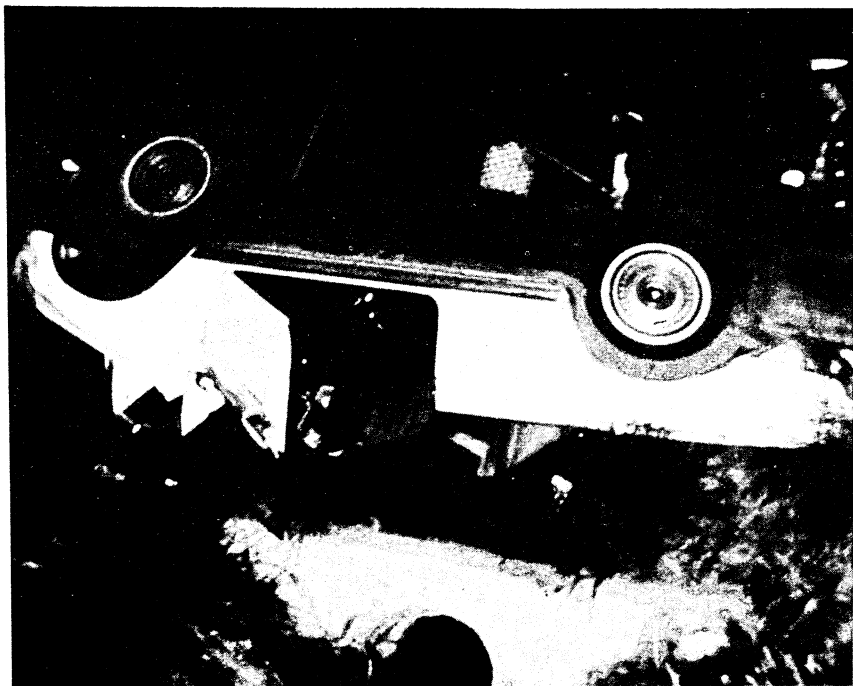
Here we are approaching it. To orient you, this is the bridge which passes over the northbound lane of I-270. This guardrail is short. It could have come back further. We are in a curve, curving gradually to the left, and it seemed to me a car could run off in here, in between the guardrail end and the light pole.

The guardrail is pointed at you and you are continuing around the curve, and I will discuss this bridge parapet in just a few seconds. First, I will discuss this guardrail.

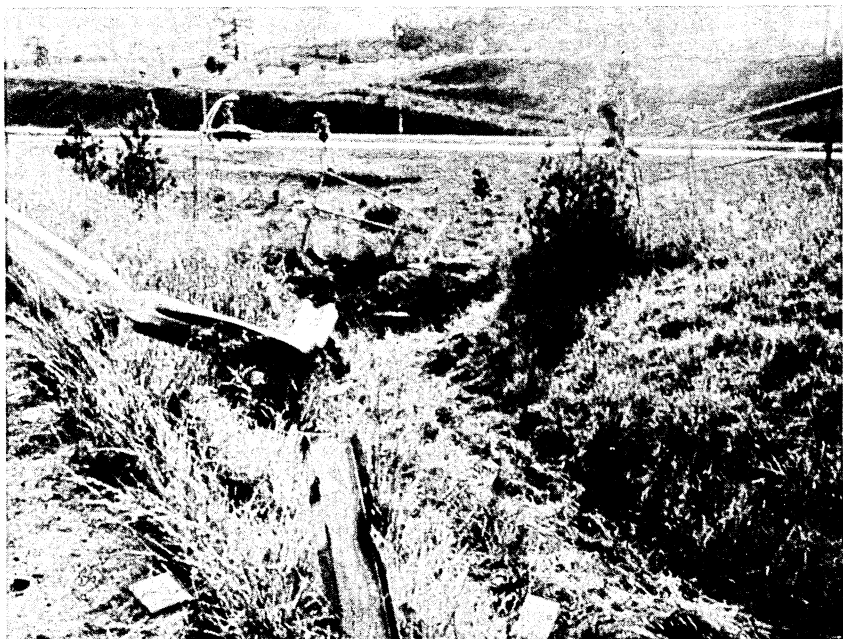
Here off the shoulder you have a drainage ditch, with a steep back-slope. There is a concrete headwall but you cannot see it, nor can many other people. This is the problem with grasscutting equipment. They cannot get close enough to these things, to clear grass and weeds which hide the headwall.

In checking the accident records, I found that in May of 1966 a man got behind this guardrail, hit the concrete headwall, turned his car over, and it killed him.

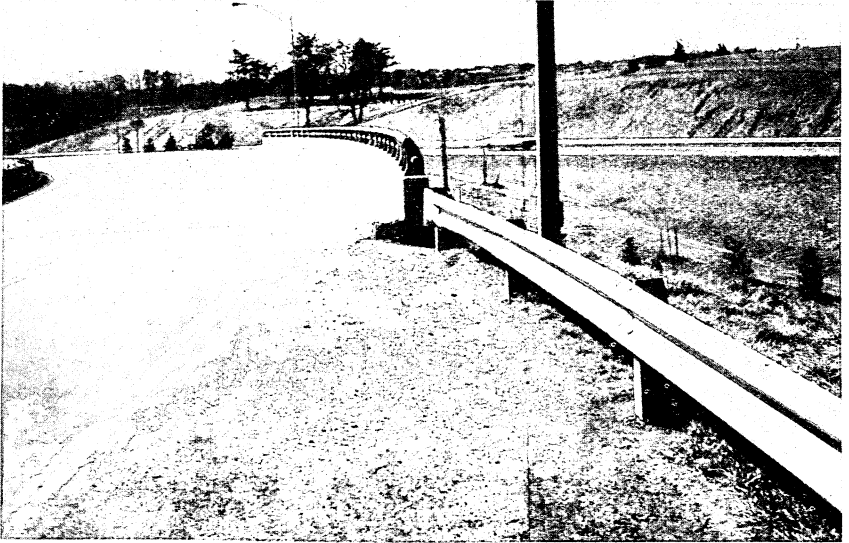
Six months later, again 1966, same location, a man got to that guardrail, and caught the end of it. He got past the concrete headwall, and managed to get over that chain-link fence, and down into the north-



bound lanes of Interstate 270, which is not visible here. He was severely injured.



This is the same bridge parapet I was talking about a few seconds ago. There are a number of things to note here. The full shoulder ends before the bridge. The guardrail comes back in toward the bridge parapet. There is a slight shoulder on the bridge. This is a raised curb, and a bridge parapet with guardrail not anchored.



This is that same bridge parapet which in November of 1966 was struck by a vehicle. The vehicle first hit the guardrail, and you can see the guardrail gave way. The vehicle was carried into the bridge parapet. In this particular accident, the vehicle then went across the road—through three lanes of traffic, and slammed into the bridge parapet on the other side, as seen in this picture.

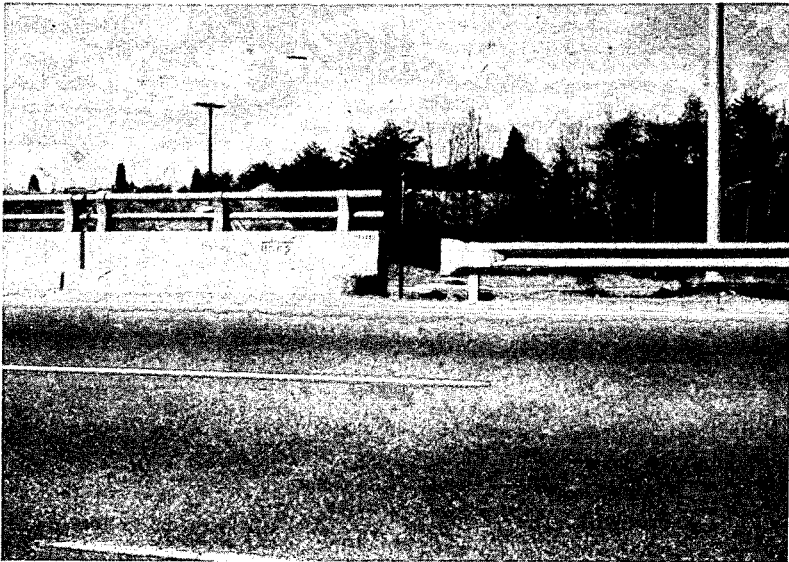


This bridge is skewed somewhat. He was able to hit the parapet end of the other side of the bridge.



That accident was in November 1966. This photograph was taken in December 1966, 1 month later. This is the way the guardrail was installed after the accident.

In checking the records I found in January, 1 month after I took the last photograph, 2 months after the first accident, a man traveling in the same location went off the road, hit the guardrail which guided him into the parapet and he was killed.



Mr. W. MAY. Mr. Prisk, if we made a mistake in the first instance and we had a serious accident and had to go back and fix up the guardrail, we had another opportunity to do it correctly, did we not?

Mr. PRISK. Yes; obviously.

Mr. W. MAY. This picture (figure 3-75) was taken after the first accident?

Mr. O'HARA. In December 1966, 1 month after the first accident.

Mr. W. MAY. It shows you the way it was reinstalled.

Mr. O'HARA. Yes. One month later we had this accident (figure 3-76) resulting in a fatality.



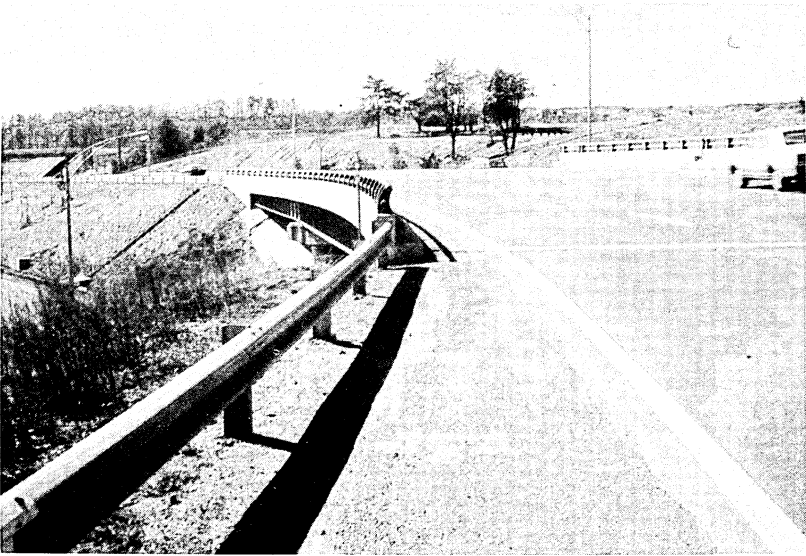
We saw a few minutes ago the other side of the bridge, where the vehicle hit the guardrail and parapet on the right and then came across and hit this parapet here. This photograph was taken in late December or early January of this year. In checking the accident records, I found that in September of 1966 this vehicle ran into the guardrail and hit that same bridge parapet we are talking about, again resulting in a serious injury.

You will notice at the left in the picture there is quite a backlog of traffic on I-270.

Mr. BLATNIK. That is I-270?

Mr. O'HARA. This is I-270 (indicating) and we are on I-495. We are looking down here where the line of vehicles is stopped.

Mr. BLATNIK. What is the reason for that line of traffic?



Mr. O'HARA. In checking the accident records, I found that 15 minutes before this accident occurred there were two other accidents in the northbound lanes of I-270. In the first one, the vehicle ran off and slammed into a light pole. And in the second accident the driver wanted to avoid debris from the first accident, and he ran off the road and overturned. You had two accidents blocking both lanes of traffic on I-270 and this accident in the westbound lane of I-495, all within 15 minutes.



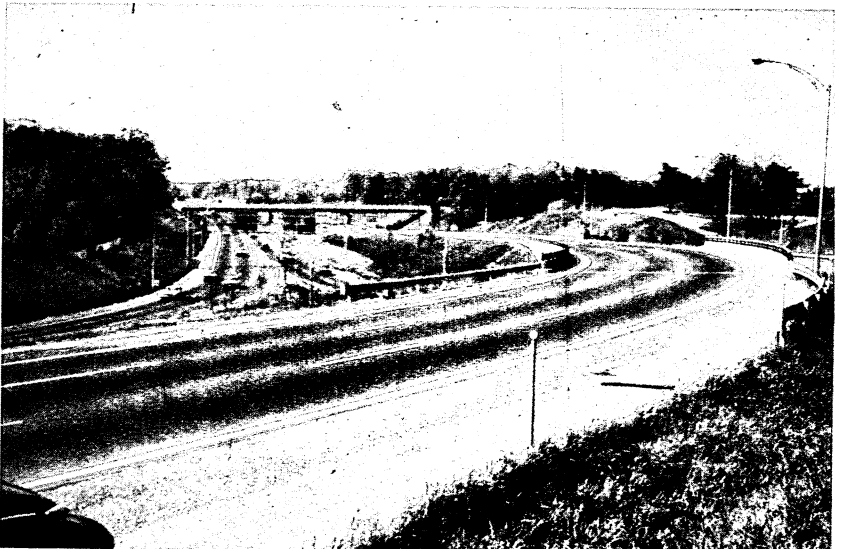
This shows you what happens to the front of a vehicle when it hits one of these bridge parapets. This is the same accident we were just talking about.



This photograph was taken last month.

Mr. W. MAY. That is the way it is today?

Mr. O'HARA. This is the way this interchange is today, after the accidents I have just shown you.



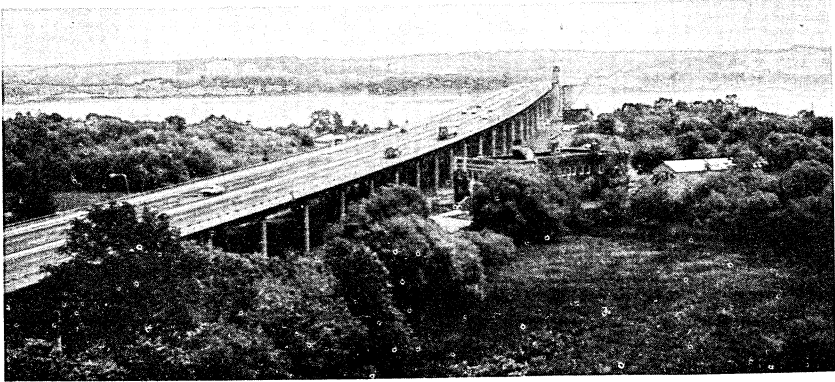
Mr. W. MAY. Same as before?

Mr. O'HARA. Same as before. No changes have been made.

(Mr. Howard assumed the chair.)

Mr. W. MAY. All right, Mr. O'Hara.

Mr. O'HARA. At this point, Mr. Chairman, I would like to discuss another area of the Capital Beltway, where I made some studies.



This is a view of the Woodrow Wilson Bridge, looking from Virginia across the Potomac River to Maryland. This 5,900-foot segment of the Capital Beltway cost over \$14 million and was opened to traffic on December 28, 1961. It has two 38-foot roadways, with three 12-foot traffic lanes, divided by a 4-foot concrete median with a 9-inch beveled curb.

Of the 77 fatalities we have been talking about on I-495 for the last 3 years, 10 were killed here; 13 percent.

Last year there were 102 accidents, with two killed and 107 injured.

I would like now to take you down on the bridge. This is the view from the Virginia side. It shows the tower which is on the drawspan portion of the bridge.



The bridge passes through three jurisdictions. We are in Virginia right now. In front of us you can see just about all that is in the District of Columbia, 650 feet. Now, this 650 feet begins at about the point where that diamond-shaped sign is that tells you there is a drawbridge, and ends beyond the drawspan or bascule leafs. You will notice the speed limit is 60 miles an hour, and you have three traffic lanes each way. There is a traffic light which hangs over one lane of traffic.

We will discuss this a little more, very shortly. This is the tower from which the man who operates the drawspan has a commanding view of both approaches.

This is looking from the tower toward Maryland. You will notice above the car between the two trucks in the westbound lane, which is facing us, a traffic light which hangs over the inside lane. And directly below us, where the vehicle is heading eastbound, that is the bascule leaf which raises.



This is looking from the tower toward Alexandria, Va. Here I want to show you, first of all, the traffic light which is just above this truck. And here in the middle of the photograph is a barrier gate [arrow]. This is a gate which swings from the side of the bridge to stop traffic when the operator is going to operate the drawspan.

Before he can swing this gate, he has to have the traffic stopped. And this is somewhat of a problem to the operators I have talked to.

First of all, they have to sound a horn or a siren, to warn the motorists that the drawspan is going to open. The traffic light turns from green to yellow and finally to red. And finally, when the traffic is stopped, the barrier starts to swing from the side of the roadway, and it has three red lights on it. They are hard to distinguish now, but there are three red lights which flash.

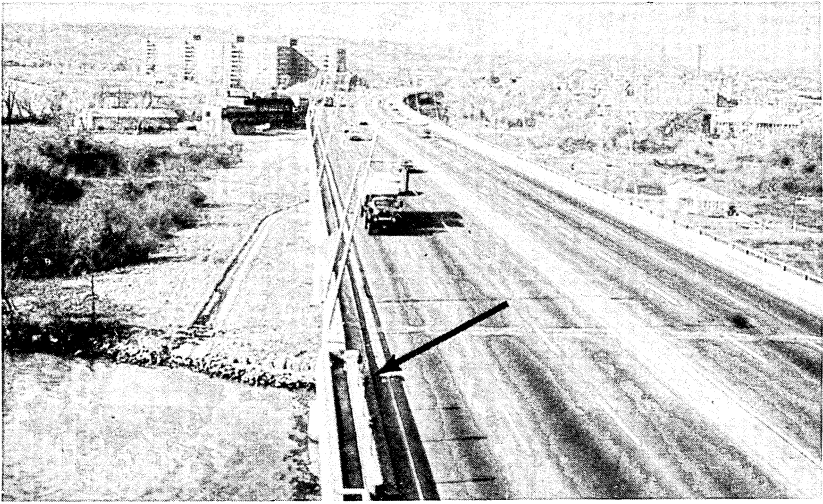
The barrier crosses the three lanes of traffic. The same situation exists on the approach from Maryland.

The effectiveness of these barriers and these lights is questioned. When you talk to the operators they tell you they have had some problems with some drivers getting beyond this barrier. In one instance, one of the operators told me that he had 17 vehicles stopped on the bascule leaf which was about to be raised. He had to go out on a cat-walk with a megaphone and chase them off the bascule leaf so he could open the drawspan for the approaching ship.

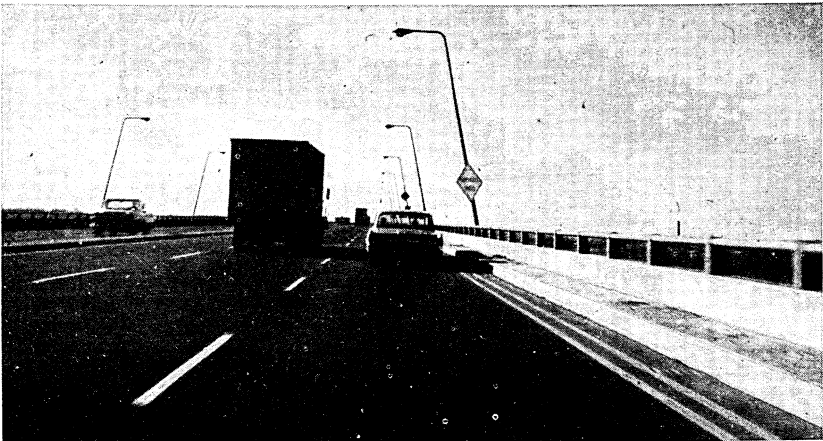
This is not just an isolated incident. It has happened a number of times, but this one occasion of 17 vehicles on the bascule leaf impressed me.

Mr. W. MAY. He leads an exciting life.

Mr. O'HARA. I would say so. He has many experiences to talk about.



This is the approach to the draw portion of the bridge from the Maryland side. This is the first sign that you see. This sign says, "Draw-bridge Ahead." It is 700 to 800 feet from the actual drawspan.



Mr. W. MAY. This is a very poor sign. A motorist can travel many miles on our Interstate System, over toll roads and expressways, and if this is the first drawbridge he comes to after traveling at a high speed, this is his first notice.

Mr. O'HARA. That is correct.

Mr. W. MAY. I would like to point out a personal experience. I travel this daily, and that sign is normally pointed toward the airplanes coming up the river from the south.



Mr. O'HARA. As in this slide.

Mr. W. MAY. It is continually, in some fashion, moving down the road and away from the motorist, so no longer is he able to see this sign.

Mr. O'HARA. That is correct.

Mr. W. MAY. Do you have another sign as you move along?

Mr. O'HARA. We have already discussed the motorist who has traveled a great distance on the Interstate System, and here is a small sign that says, "Drawbridge Ahead."

Mr. W. MAY. Excuse me. If you were over in the left lane, traveling at a high speed, with the right kind of angle you would not see it anyway?

Mr. O'HARA. That is the point I was about to make. If that truck (fig. 3-85) was over in the right lane, and I was over on the left, I probably would not see that sign.

This is the next sign that he sees. This sign is somewhat dirty, and I deliberately show this photograph to point that out, that after a snowstorm we do get things like this. The sign is covered with dirt from the trucks passing by.

Here are two lights that flash, when they are operating, and the drawbridge sign which says it is 500 feet to the draw span. If you miss that first sign, this is your next chance.

Speed limit on the bridge is 60 miles an hour. You are traveling 88 feet a second at that speed. You have to read the sign, if you see it and you have to comprehend it. You have to understand what it means and know that there is a possibility that the drawspan may go up.

Mr. W. MAY. You have a few hundred feet.

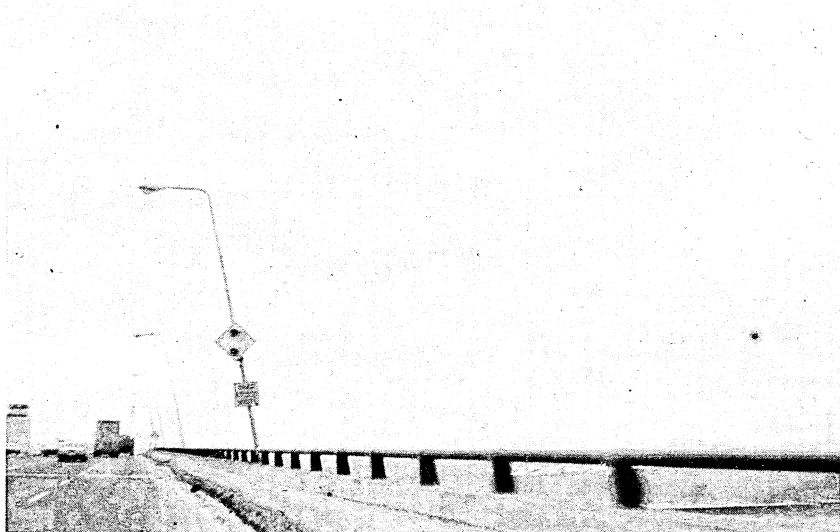
Mr. O'HARA. 500 feet.

Mr. W. MAY. However, if the span is up and the traffic has stopped, the traffic can back up toward this sign, so he may have a lot less than a few hundred feet to stop.

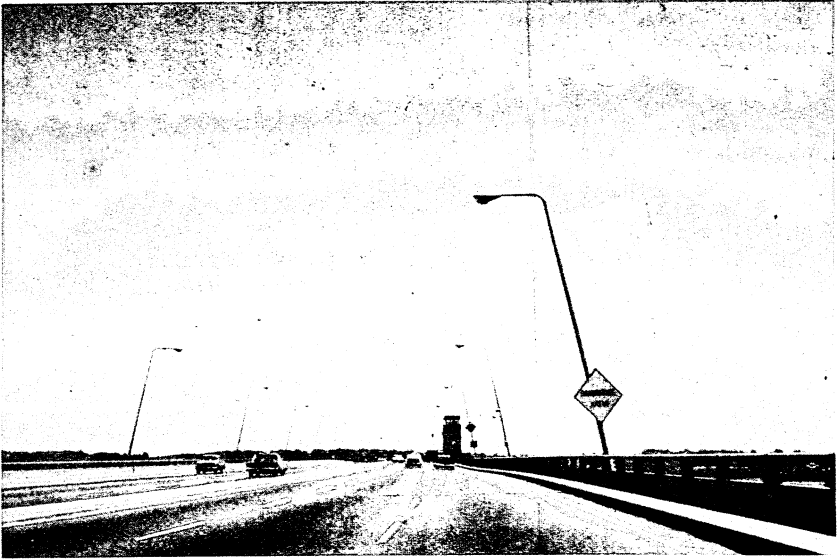
Mr. O'HARA. That is correct. This can be a problem at night, as I will show you in several slides from this one. I will show you what can happen.

Here is the sign we were just talking about; beyond that at the drawbridge is the next sign. This says, "Drawbridge", and hanging over the roadway is the traffic light. If that truck had been over in the same lane as I and had been a little closer to me, I may have had difficulty seeing it.

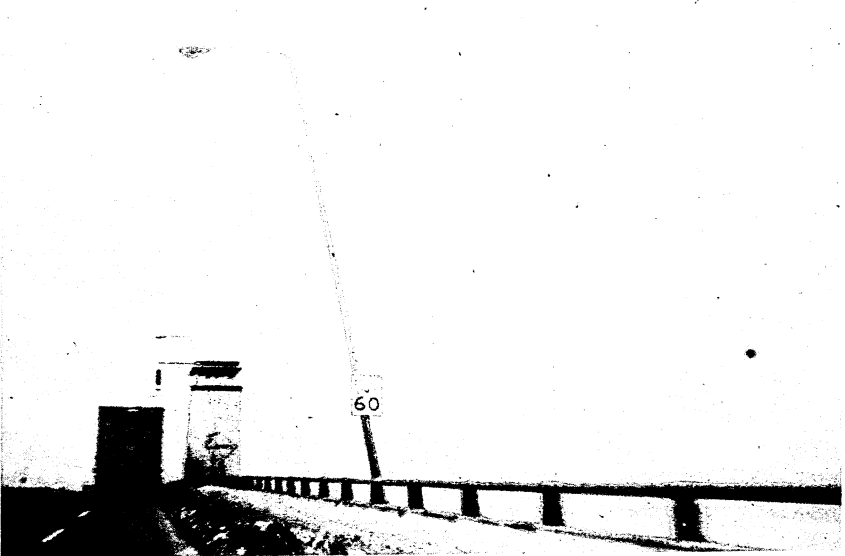
There is no other light, other than this one, and the three other lights which are mounted on the barrier. If those three lights are flashing at the barrier and there is somebody in front of me, chances are I am not going to see them, because I am on an upgrade, and they are at the top.



This is the approach from the Virginia side. This is the same situation, same warning sign. Beyond that you can see the diamond-shaped sign and the lights above it, which warn that the drawbridge is 500 feet.



And here you get up closer to the tower, approaching it from Virginia. There is your speed limit sign, again your drawbridge sign, and the traffic light. That is an 8-inch lens hanging over the right lane. And I can tell you that you can have difficulty seeing that light when it is snowing and raining, because we have traveled the bridge a number of times in all kinds of weather to see what the effect has been.



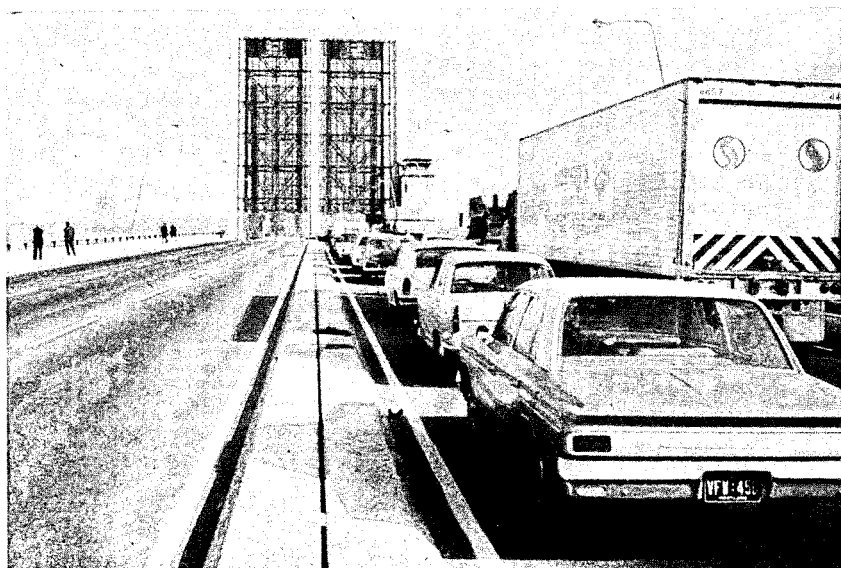
Mr. W. MAY. Would you refer back to figure 3-88?

There are no shoulders, braking lanes, on this bridge.

Mr. O'HARA. That is correct. I was going to point that out shortly.

Mr. W. MAY. Go ahead.

Mr. O'HARA. This picture was taken after a snowfall. You can see we have lost some of that right lane because the snow has taken part of it, and that truck which is in front of us is riding in the inside, in the middle lane, so we have lost some of that lane also.



If you are driving on the bridge and the drawspan opens, this is what you see. And here I would like to make several comments.

First of all, up toward the tower, that little dark patch which you see at the left of the tower is the traffic light. You cannot see the barrier gate, but it is in front of those cars. There are no lights on the bascule leafs, except at the top where we have lights as required by the CAB.

Now, I took this photograph standing on this 4-foot concrete median, which is 9 inches in height, and you can see that it is beveled; so if a car hits it, it has an excellent chance of crossing into the opposing lane of traffic, as borne out by the accident records.

Another thing to notice is that when the bascule leaf is up, look at all the drivers over on the side of the bridge. They know they are going to be there for a time. They have gone over to watch the river traffic. This is the daytime, so their lights are not on. And of all the cars that were on here, nobody had emergency flashing lights on.

Picture yourself coming up this bridge at night. There are no lights on the bascule leaf except at the very top for aircraft. You do not know that it is up. Chances are you may not see that traffic light, and for sure you will not see that barrier with the three flashing lights. Here are cars stopped, and if the drivers have gotten out to look at the ship, all you are going to see are their taillights. There is no indication

that they are stopped, and again the accident records show that this has been a factor.

There were seven accidents in 1966 where this was the result of the bridge being up, and the traffic stopped. A vehicle came up and slammed into the rear of a stopped car.

Mr. W. MAY. Do you know about how many times a year that bridge is raised?

Mr. O'HARA. This particular bridge was raised 396 times last year, an average of better than once a day.

Mr. W. MAY. Opens only certain times?

Mr. O'HARA. No, the bridge will open any time of the morning, day or night, rush hour in the morning or rush hour in the afternoon.

As a matter of fact, in 1966 there were 10 days on which this bridge was raised 47 times, so that there are some days that it is raised more than twice and some days not raised at all.

Mr. W. MAY. How long does it take for them to raise the bridge and then to have the traffic moving?

Mr. O'HARA. An average time is 10 minutes. You have to make sure the spans are even. I understand there are some problems of getting the bascule leafs straight, and then to move the barrier gates back, and have the traffic start up and start accelerating over. You can have traffic tied up when the bridge is only open for 8 to 10 minutes. Traffic may not get moving for 15 minutes. When the bridge is opened, especially during rush hour, the operators have told me that the traffic has backed up all the way over into Maryland back onto Interstate 295, into the District of Columbia. He tells me that he can see the lights all the way over in the vicinity of the naval facility over there.

We have talked about the median. Mr. Prisk is knowledgeable about what is being done about this concrete median here, and I would like for him to say a few words at this time.

Mr. PRISK. Mr. Chairman, Mr. May, I think all I might add to the discussion at this point is that there is a plan which has been approved by the three jurisdictions concerned, Virginia, Maryland, and the District of Columbia, to install a positive physical barrier protection along the top of this median. This will consist of a steel barrier that will be parabolic on each side and will raise up to a height of about 28 to 30 inches above this median as it presently stands. This will be effective, almost certainly, in the prevention of any cross-median type accidents.

This median barrier, as we see it, has not been too effective because it has been crossed on a number of occasions. Mr. O'Hara will have some pictures of some accidents involving the crossing of this particular barrier. The new barrier is not of the type that is likely to be crossed and, therefore, should at least reduce the chance of fatality from head-on collisions.

Mr. W. MAY. There is little we can do about the lack of shoulder or breakdown lanes on that bridge, is there?

Mr. PRISK. There is absolutely nothing that can be done about that without complete reconstruction. The roadway that you see is three 12-foot lanes. They are marked; a total distance of 38 feet, curb to

curb. There is a sidewalk on the side, and I think sometimes it is a little bit ironic to reserve lateral space on a structure for sidewalk when this seems to be the principal use for it: You stop for ship traffic and you get out there on the sidewalk and watch the goings-on on the river.

Mr. W. MAY. Pedestrians are not allowed to walk on those sidewalks?

Mr. PRISK. I am not certain whether there is complete regulation or prohibition of pedestrians on the sidewalks; but I know it is not used by pedestrians, except in this way, for the most part.

Mr. W. MAY. Thank you.

Mr. O'HARA. I might add, in connection with the sidewalk, Mr. May, that the people who operate the drawspan and work in the tower reach the tower by means of a catwalk under the bridge. They do not use the sidewalk.

Mr. W. MAY. All right.

Mr. PRISK. I might add, Mr. May, that we know from experience there will be frequent breakdowns on a bridge crossing of this sort. Somewhere around once every 20,000 miles of travel, you can depend on the car breaking down. For every 20,000 cars that this bridge carries across, you can be fairly sure that one of those 20,000 is going to break down. This bridge is about a mile long, I would say.

About once every 20,000 vehicle miles you can expect a breakdown. So that presents a very important hazard. It is truly a fixed object and a most unexpected one, if I may say so, when it occurs in a normal moving lane.

Mr. W. MAY. Do you have something to add to that, Mr. O'Hara?

Mr. O'HARA. In talking to the State police a couple of the troopers remarked to me that, in addition to vehicles breaking down, they have had a number of vehicles running out of gas on the Wilson Bridge. And this is also a problem. There are no service stations close to that bridge. We computed the distance, and it is about 250 miles from the New York City area to the middle of the Woodrow Wilson Bridge, and in some cars that is about the average distance they can get on a tank of gas.

Mr. W. MAY. If they do not stop and get gas on the toll portions of I-95, they probably cannot get gas prior to arriving in the middle of the Woodrow Wilson Bridge.

Mr. O'HARA. A trooper may have it with him.

Mr. W. MAY. What is the traffic volume on the bridge?

Mr. O'HARA. The traffic volume has increased 30 percent in the last 2 years. The average daily traffic count, which was made sometime prior to September of last year, was 62,400 vehicles a day, and in 1964 it had been 47,000. The design capacity is 100,000 vehicles a day.

Mr. W. MAY. Using your figures, Mr. Prisk, would we expect three cars to break down on that bridge each day?

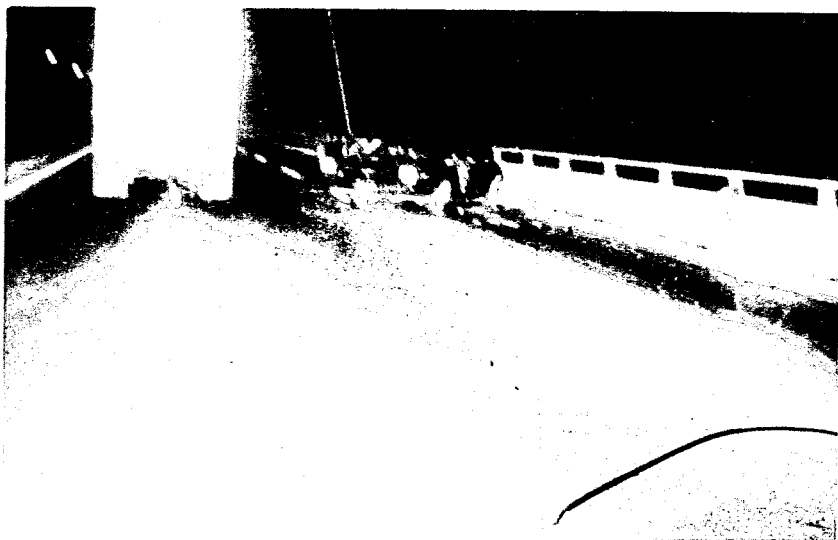
Mr. PRISK. That is right; that is about what it would be. The figure I referred to includes running out of gas as well as flats and so on.

Mr. W. MAY. Yes. When you get up to 100,000, you would get five a day?

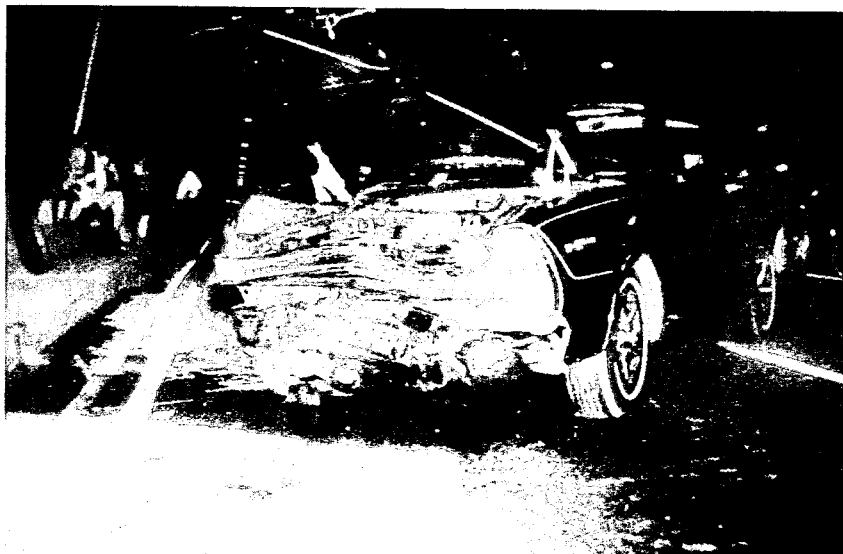
Mr. PRISK. That is right.

Mr. O'HARA. This accident occurred last year on the Woodrow Wilson Bridge, and the reason I had not mentioned the shoulder before is because I was going to mention it here. The vehicle in front of this vehicle had a flat tire.

As you pointed out, there is no shoulder on the bridge and the motorist decided to change the tire on the bridge. Another vehicle approached from Maryland, and only saw the taillights of the stopped car and apparently assumed that the vehicle was traveling in the same direction. A rear end collision followed, resulting in injury to three people.



And this is the front of the car which ran into the stopped vehicle. You can see the spare tire sitting on the sidewalk, which the man was going to change.

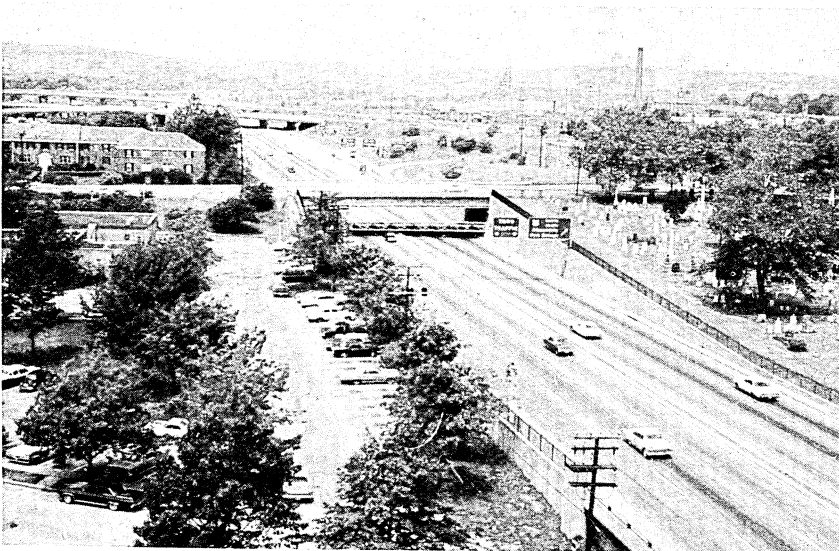
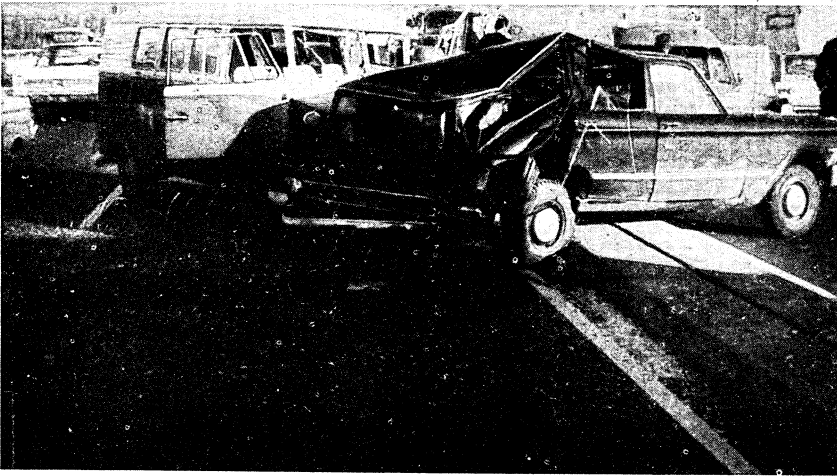


This picture illustrates what happens when a vehicle hits that median. The bridge span had been up. It was lowered. The driver of the vehicle, the station wagon straddling the concrete median, was unable to get the vehicle in gear. The other traffic started to move, and along came the Volkswagen bus and the driver did not realize the first vehicle was stopped. The bus struck the rear of that vehicle, threw it across the concrete median, where it blocked the westbound lane. This accident resulted in injury to four people.

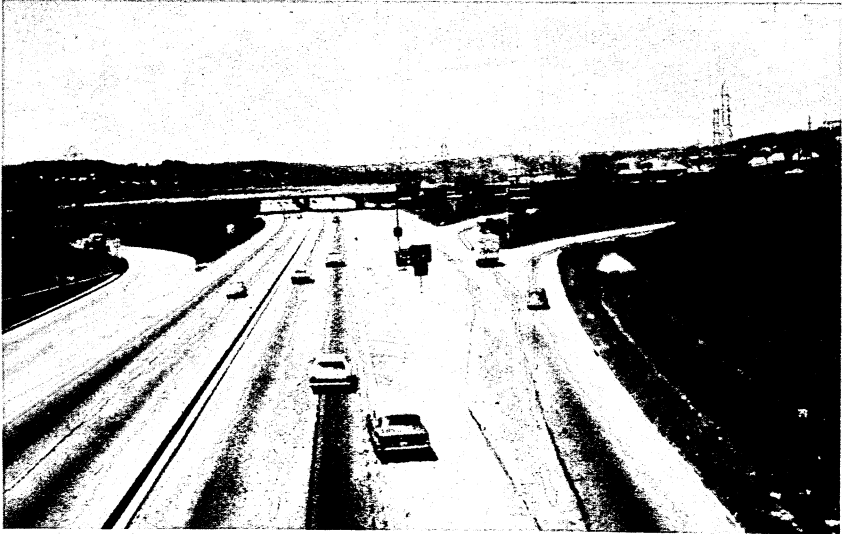
This is one of the points I wanted to make. When you have an accident on the Woodrow Wilson Bridge, you can have as many as four to six to 10 cars involved in a collision, depending on the time of day, and you can also have a number of people injured, which accounts for the 107 people injured in 102 accidents.

Mr. W. MAY. Last year, 1966?

Mr. O'HARA. 1966.



This next view is looking at the interchange with U.S. 1. If you are traveling away from where we are these right lanes are the westbound lanes as they come across the Woodrow Wilson Bridge, and at this point in the bridge there is a raised concrete barrier about 24 inches in height. This traffic on the left is heading toward Maryland. This left sign over the westbound lanes says "Through Traffic," with an arrow for this lane, and an arrow for that lane.



This sign on the right tells you that this is your exit to Route 1, and it gives the destinations for traffic which wants to turn off. Now, this right lane which the vehicle is in goes down under Washington Street, which is the overpass here; then it leaves the beltway. This is three lanes at this point. Just beyond that bridge, the beltway becomes two lanes.

This right lane then becomes a collector-distributor type road. It collects the traffic off I-495. The first exit will take you up to get on Washington Street. The second turnoff will take you into Alexandria, and beyond the overpass would be the turnoff to go south on U.S. 1.

The motorist who knows this area knows that he can stay on this road and travel through the interchange area and come back on 495 beyond this far overpass where the beltway again becomes a six-lane facility, with three lanes in each direction.

In 1966 this interchange area had 35 accidents, the majority of which occurred in this area over here on the right, according to the people I talked to in the Virginia State Police headquarters. There is a question of whether or not there would be more accidents here, because a lot of the accidents which should have been in this area took place on other crossing roads. This is a problem they are trying to resolve.

Now I would like to take you down to just about where this vehicle is crossing on the bridge.

The next photograph is taken from there. Remember, this is a collector-distributor road on the right. The two left lanes go through. The right lane or slower lane becomes the collector-distributor road. Here is a motorist from out of State [indicating]. This picture was taken last Friday morning. He did not know that this right lane ran off in here. He did not know that he could continue on in that lane and come back out on the beltway further down the road.

Fortunately for him, traffic was not heavy, and he was able to go from this right lane, crossing this lane of traffic and crossing the white-striped lanes, as you see, and continue into the slow lane of traffic, to continue on I-495.

If he had known, he could have continued on through and come out on the other side. There are a number of things to note here.

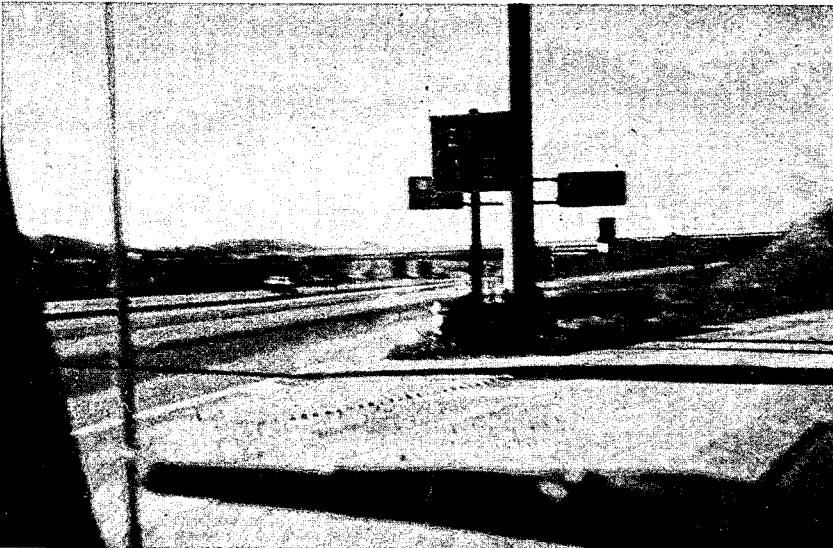
First of all, there are a lot of skidmarks, some of which are well worn and did not come up in the photograph; but this one did and this one did, and here are some more off in here, and beyond that you can see others.

They may be part of this one; but these skid marks indicated to me that there probably are a high number of happenings such as this.

In other words, people who are not sure where they are going, but suddenly realize they want to be in the left lane; this is actually what I would call an "accident," because the motorist did not do what he wanted to do. He wanted to be over on the left. It was not reported as an accident, because nobody was struck, and he did not hit another car.

So, to be technical about it, you can say it was not an accident. But he did not do what he should have done, or what is done in the ordinary course of driving.

The curb just beyond the white lines is a ramp-type curb, that white patch is what they call a rumble-strip. I will show you a closeup of the rumble strip up where the truck is.



That is the rumble strip and there is a sign; and if you go up in the gore area on the right there is another rumble strip there. There is a steel signpost. There is a road going out to the right to Washington Street from the deceleration lane. There is a speed sign on a 6-inch steel pole. There is no shoulder.

The next exit lane does the same thing, and beyond that, in the second gore area there is another steel pole and another sign right in the gore area.

Now we are at that first gore area and this is the rumble strip that I was referring to, which is directly in front of this sign support. This is a steel pole supporting a sign. There is a guardrail in front of it.

Mr. W. MAY. Mr. Prisk, does that rumble strip make any sense?

Mr. PRISK. At that location, I fail to see that it has any value. It is too close, too short, too close to the hazard.

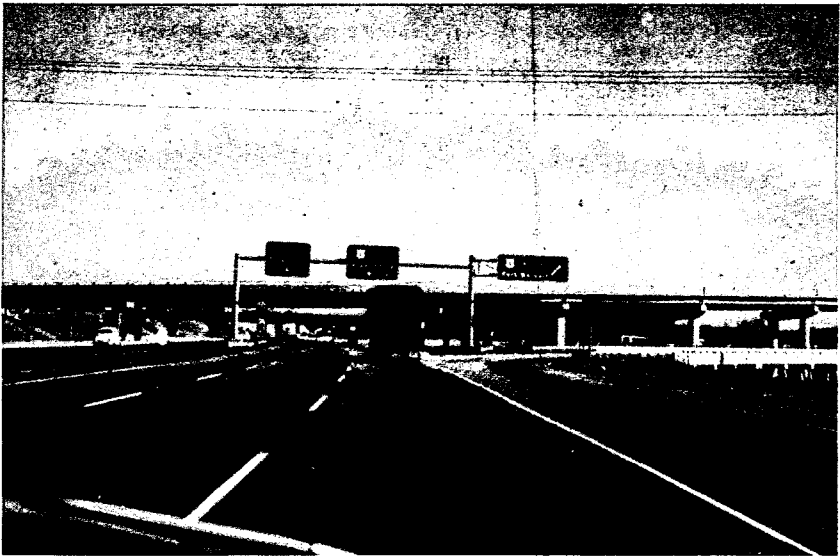
Mr. W. MAY. By the time you get the noise of the rumble strip you would have gotten—

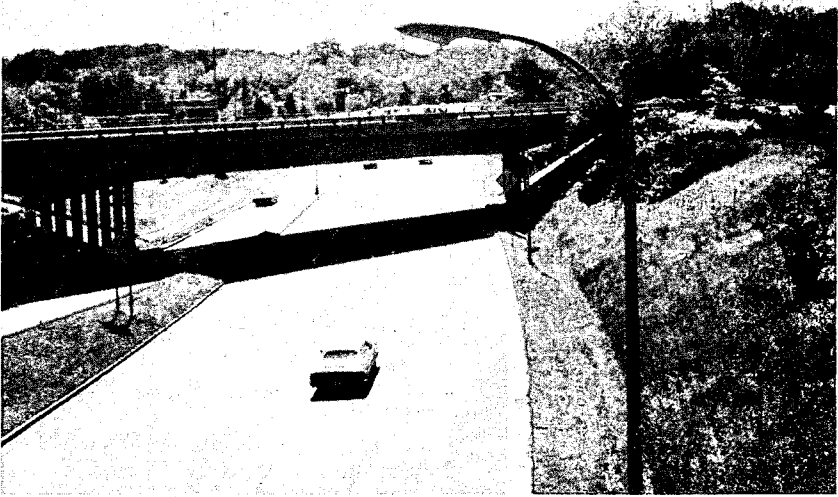
Mr. PRISK. You would be rumbling when you hit the pole, that is right.

Mr. O'HARA. Now we are approaching the same interchange from the west. We are now facing east. We are in a slow lane of 495. Again a number of things here.

There is a steel pole supporting the sign, and a guardrail in front of it, the guardrail ending beyond it, and then the guardrail beginning again just shortly beyond that, shielding a vehicle from these bridge piers in the median.

There is another gore area just beyond where this truck is. Here is another gore area. This is a deceleration lane. This is the guardrail in front of that steel pole, just a short section of guardrail. It ends and then it picks up again.





There is an opening and there is an end of the guardrail. Notice the skidmarks going into this area.

Mr. CRAMER. May I ask Mr. Prisk a question? Is there any regulation or standard with regard to six lanes going into four lanes and back to six lanes in an intersection area such as this?

Mr. PRISK. I know of no regulations. It is undesirable to have a lane drop.

Mr. CRAMER. I thought turnoffs were supposed to be outside the traveled roadway. Seemingly, this area ought to be outside the six lanes.

Mr. PRISK. That is true. There are occasions, for one circumstance or another—

Mr. CRAMER. What would be the circumstance in this area that would justify closing in the four lanes?

Mr. PRISK. One typical thing that happens is that failure to have sufficient right-of-way to permit opening up the pavement to the wideness—one possibility, of course, is difference in capacity, analysis, you do not figure that the traffic involved is going to be as heavy as it turns out to be.

Mr. CRAMER. Nobody can suggest that traffic in that area was not going to be heavy.

Mr. PRISK. I think that is correct.

Mr. CRAMER. Secondly, I have traveled that area quite a bit, at least to the south, and as I recall it is a swamp area.

Mr. PRISK. That is right.

Mr. CRAMER. There were not any buildings there, none to be condemned at any great value. How in the world can reducing the six lanes to four lanes be justified? I think it is obviously a traffic hazard the way it is built.

Now, does the Bureau have to approve that design?

Mr. PRISK. Yes. The Bureau has to approve that.

Mr. CRAMER. Did you ever see that design?

Mr. PRISK. No, sir.

Mr. CRAMER. Who would see it?

Mr. PRISK. The Bureau's division engineer for the State of Virginia, in Richmond.

Mr. CRAMER. I just cannot understand why a design like that can get by the division engineer in the first place, even if it is recommended by a State, in an area where there appears to be no justification for not making an additional turnoff area available, or turnoff lane. I just do not understand it.

Mr. PRISK. I am afraid I cannot help you.

Mr. CRAMER. I hope somebody can help the situation in the future.

Mr. PRISK. These are the kind of things certainly that we need to do a great deal more about than have been done. I think the lack of review of some of the details has been one of the principal weaknesses, particularly in large interchanges that are complex, where there are several existing ramps, as is the case here.

You have a certain amount of directional interchange between the routes that are involved, and we have the important U.S. 1 route, and we are also attempting to serve the city of Alexandria.

There are a good many considerations here. And I think oftentimes this may come, and perhaps this is not fair to the people that plan the structures, but I think structure design crusades are over with in some cases.

Mr. CRAMER. I notice over on Shirley Highway, Route 7, which is where I turn off to go home, they are sure doing a lot of interchanging around there. I hope somebody has looked at that before it got under construction, from a safety standpoint. I cannot quite figure out what they are doing yet. But I do know they were demolishing the bridge that was there, that looked like it was in pretty good shape. And putting another bridge exactly where it was. I do not understand that, unless it is for esthetics.

And I admit the old bridge was not as pretty as the new one but it looked to me like it was in pretty good shape. They took a crane and big steel ball on the end of a chain and knocked it down and built another one right where it was. That is along Route 7.

I would like to know something about that, Mr. Prisk.

Mr. PRISK. I dare say we could develop some material for the committee, to inform you about that situation. I do not have it here now, I am sorry.

Mr. CRAMER. That is all I have.

Mr. O'HARA. One other thing I would like to point out in this scene is that the lane in which I am traveling, behind this truck, ends just beyond this overpass, and this becomes a two-lane highway at that point. And the only advance warning you have is a small sign behind that truck, which is a few hundred feet from the turnoff, and the road then becomes a two-lane highway; and as you get to the foot of the

Wilson Bridge, the acceleration lane of U.S. 1 becomes the right lane of the beltway.

Mr. CRAMER. May I make another observation relating to this decreasing number of lanes at interchanges? It was just a year or so ago that action was taken because Interstate 4 going through Tampa and St. Petersburg, in Florida, was decreased in lanes to one lane going west, right to the middle of Tampa, and it decreased to one lane. Rather reluctantly, and after a few accidents and a considerable period of time, it was agreed to do something about it and make it two lanes.

There is another instance.

I just cannot imagine how a division engineer would ever approve such a construction as that. Do you understand how that could happen?

Here is an Interstate, limited-access highway, going through Tampa, and it was reduced to one lane going west. You may be familiar with it; but I just cannot understand that.

Mr. PRISK. I have seen a situation such as you describe also in South Carolina, so I do not think it is unique to Florida. But unfortunately these things are seen after they get hardened in the concrete, reinforcing rods, and it is pretty difficult without using a wrecking ball, as you mentioned, to make any remedy.

I think we have cautioned, in the yellow book which you are familiar with, which has been endorsed now as policy by the Bureau of Public Roads, and it calls attention to the necessity in the future of carefully considering all lane drops. That is what this is. This is a dropping of the lanes going into an interchange.

Mr. CRAMER. Up to this point there has been no regulation, no requirement regarding lane drops, going into an interchange?

Mr. PRISK. No regulation that I am aware of. It has been recognized as an undesirable design practice.

Mr. CRAMER. Who recognizes it as undesirable?

Mr. PRISK. It is generally regarded as undesirable design practice.

Mr. CRAMER. Do the engineers who design these highways not know it? They get paid pretty well. Design engineers get paid pretty well.

Mr. PRISK. They get paid pretty well.

Mr. CRAMER. Consulting engineers sometimes get a percentage of project costs?

Mr. PRISK. If you are talking about consulting engineers, yes.

Mr. CRAMER. That is part of the cost of the project, if the State decided to use consulting engineers?

Mr. PRISK. Right.

Mr. CRAMER. That is all.

Mr. HOWARD. Continue.

Mr. O'HARA. In connection with the accidents in Virginia, I did make a study. They reported 501 accidents in 1966; 166 of the 501, or 33 percent, were single vehicle accidents; 111 of those 166 ran off the road and struck a fixed object, or 67 percent.

Also, 23 more of the 166 ran off and overturned. I could not determine from the accident report whether they hit a bank or ditch or other object; it was impossible to do so.

At this point, Mr. Chairman, I would like to take you into another area where I did a study of accidents. This is the section known as Rock Creek Park, Capital Beltway, beginning here at Pooks Hill interchange and traveling in an easterly direction 3.8 miles to Georgia Avenue. This section, No. 4, is a section legend used by the State police. The State police reported 219 accidents in this 3.8 miles, with four fatalities and 128 people injured.

Mr. W. MAY. When was that, 1966?

Mr. O'HARA. Yes, sir.

Mr. W. MAY. Thank you.

Mr. O'HARA. This curving alinement came about as a result of an agreement between the State Roads Commission of Maryland, the Maryland National Park and Planning Commission, and the National Capital Planning Commission, and this will be the subject of future consideration.

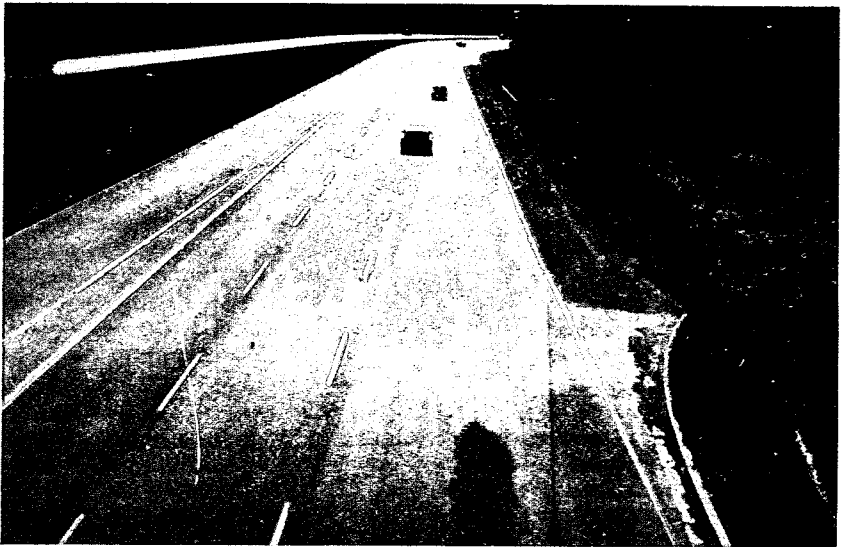
Now, to orient you with where this slide is, this is the area around Pooks Hill. I am standing in the southbound lane of Wisconsin Avenue. This lane, this lane and this lane [indicating], are the three traffic lanes of 495. This fourth lane on the left is for traffic coming in from Interstate 70-S, in the vicinity of Rockville and Frederick.

This fifth lane up on the left is the merging traffic lane from Rockville Pike, Maryland Route 355, and the overpass is the northbound lane of Wisconsin Avenue.

There are a number of things to notice here. We have a merging traffic sign, a steel light pole of the kind that we discussed. On this side another steel light pole, a drainage ditch, and a fairly steep backslope.

Over on the right is a concrete drain. And I will have something to say about this in a few minutes.

Another steel light pole, a reflector, and here a triangular-shaped sign, with two dark lines, and then the dotted lines in the middle. The



reason for this sign is that this right lane is about to end. We are traveling at 60 miles an hour. This is the first and only warning that you have that this lane is going to end.

And the next slide I show will be taken from this overpass, and it will be just above this black patch in the roadway. The significance of this area is borne out by the fact that in this section of the beltway last year there were 37 sideswipe accidents, a number of which occurred here, and just beyond here, where another lane is dropped.

In addition, in this section of the beltway there were 32 vehicles which ran off the road and overturned; 88 of the 219 accidents involved vehicles which ran off the road and, of those 88, 55 subsequently struck a fixed object.



This next slide is taken from the northbound lane of Wisconsin Avenue. The lane on the far left being the merging traffic lane from Wisconsin Avenue, Rockville Pike.

Notice that Interstate 70-S has become the third lane of the beltway, and up in the top of the photograph, where the car is going around the curve, just beyond that curve there is another sign similar to the one I just showed you. It has the same marks. And the purpose of it is to point out that again the right lane is going to be dropped. Also in this scene here you will notice a number of objects.

You have off to the right, off the shoulder, several trees. You have light poles. Beyond that you have a guardrail. And I would like to get up and point something out.

There is a guardrail here pointing at you like an arrow. I think it is meant to protect that headwall in there. There it is. The light pole beyond it.

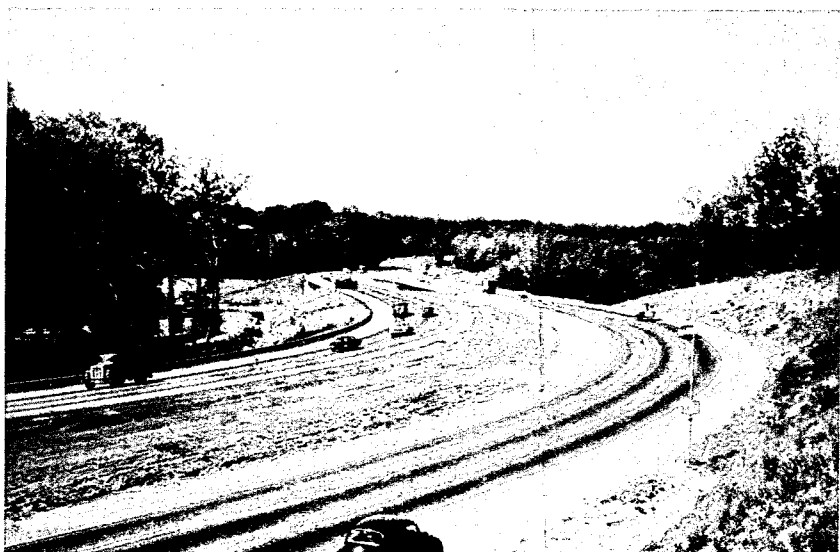
These are all the objects that you have as you come into the park, and you have traffic moving at 60 miles an hour.

This area of the park has a pretty heavy traffic rate, somewhere in the neighborhood of 55,000 vehicles a day, as of September of last year.

This is a little bit east of where I was before.

The traffic has come around the curve, swung sharply left, and it is now swinging back to the right, heading toward Connecticut Avenue.

There is a sign up here and there is a short piece of guardrail in behind this vehicle. There are a number of trees off the westbound lane. In the median is a concrete drain.



Now, I have taken you to the east end of the section. I am just west of Georgia Avenue.



This photograph was taken just beyond Stoneybrook Road, looking west; and for orientation purposes, this is Kensington Parkway running underneath the beltway [indicating].

There are three traffic lanes and the speed limit is 60 miles an hour. Incidentally, this section of the park is the only section on the beltway which is designed for 60 miles an hour, whereas the rest was designed for 70 miles an hour. The traffic weaves to the left, back to the right, back to the left, and back to the right again, constantly in motion.

There are a number of things in here. The guardrail is here, and trees down in here. The guard rail is not anchored to the bridge parapet, nor is it in the median, nor is it on the other side.

Now the last photograph I took was up in here, looking in this direction [indicating]. We are now heading east again, just east of Connecticut Avenue. Here the road is curving gradually to the left. This is where the road makes a sharp curve. The guardrail ends. A number of trees are back in there, the tree line being somewhat away from the traffic lanes. You can see a heavy front slope, drainage ditch down in there, and a tree line, with the tree line coming back toward the road and the road curving.

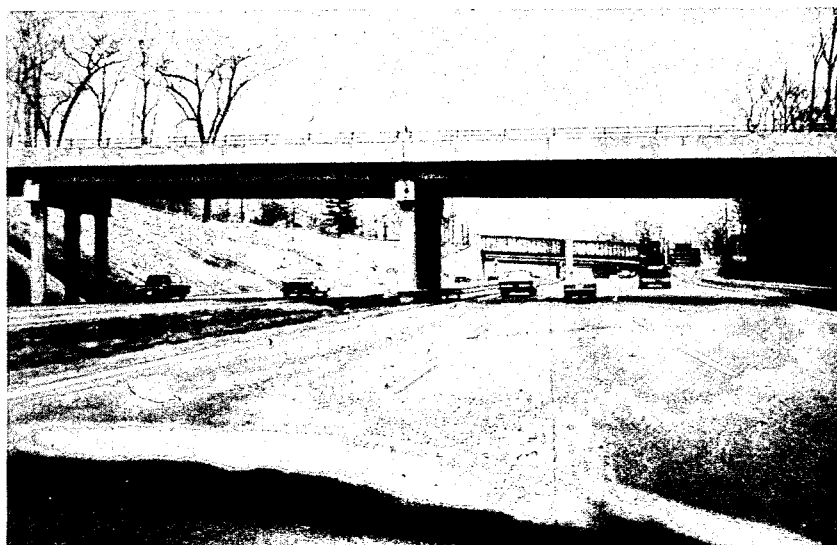
Up here is a piece of guardrail and beyond that open space.



The guardrail I pointed at was this piece. Here is a distance of about 40 to 50 feet, with a guardrail ending and then it picks up again. I think that picture is self-explanatory.



This is the concrete drain that I have been talking about, and I pointed it out to you in a number of places. This piece of steel sits on top of the concrete; it is not anchored. And the reason for that is so they can remove it and get down there to clean the drain if it is clogged up.



The grass is not cut around that concrete drain. And, as you saw, it was not visible in the slides I showed before.

In September of last year a man ran off the road in this section of the beltway and hit this type object. His car overturned and he was killed. These concrete drains are located all over the beltway.

We now are approaching Georgia Avenue. This is Stoneybrook Road on the left. Jones Mill Road is on the right. There are a number of inconsistent things here.

The guardrail extends beyond the bridge here in the median and the guardrail on the right is considerably beyond the bridge. In the westbound lanes, there is no guardrail on the shoulder side and no guardrail on the pier in the median.

The next slide will be taken up in the area of the sign on the right shoulder.



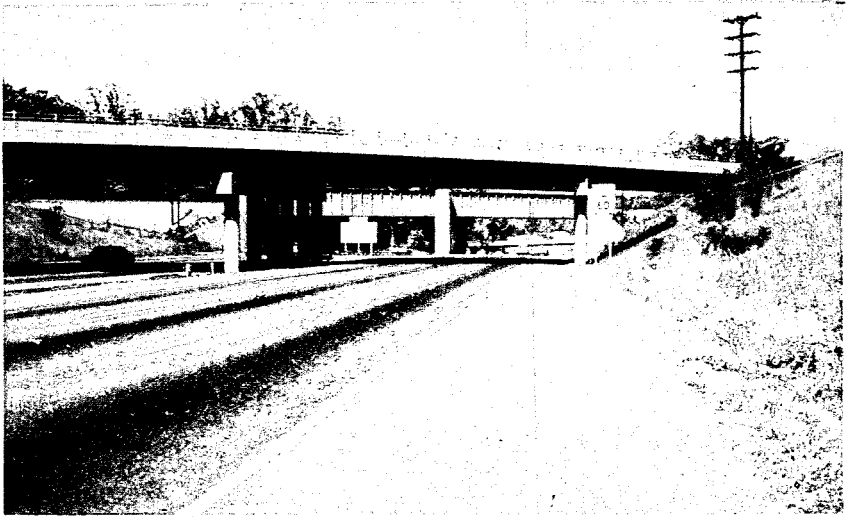
We are now approaching the B. & O. Railroad overpass. Here is the usual guardrail installation with sign supports off the shoulder. There is not too much of a runoff. The guardrail ends before the



bridge abutment. Over in the median, a short section of guardrail and the concrete support for the B. & O. Railroad overpass.

On the other side which we cannot see, there is no guardrail on the shoulder; but the next overpass is Seminary Road, and there is no guardrail on that side to shield piers from vehicles which might get off the road.

This is the next overpass just beyond the B. & O. Railroad overpass. There is a guardrail protecting the concrete piers in the median. On the shoulder there is no guardrail. However, there is a small piece of guardrail beyond the piers, but it ends just short of the light pole.



On the left or westbound side, there is a sign but with no guardrail, and in the median there is no guardrail. This area I thought was important. I wanted to show you these three structures to point out the inconsistencies in guardrail treatment.

We are now heading westbound. This is Seminary Road passing over I-495. Notice the speed sign does not have guardrail. The bridge piers do not have it. And there is no guardrail in the median. On April 7 a man traveling westbound hit this bridge pier in the median and was killed.

And about 2 $\frac{3}{4}$ hours or 3 hours later another vehicle came along. The debris from this accident had not been cleared up. He stepped on his brakes, skidded across this median, and hit another car head on, we had two fatalities within 3 hours in this section.

That concludes my presentation on the beltway.

Mr. W. MAY. Mr. O'Hara, I want to thank you for a most beneficial presentation.

Mr. HOWARD. Thank you very much, Mr. O'Hara. The chairman is about to return very shortly to the subcommittee, so the subcommittee will be in brief recess, pending the return of the chairman.

(Short recess.)

(Mr. Blatnik resumed the chair.)

Mr. BLATNIK. The subcommittee is reconvened from its brief recess.

We have heard testimony today on the Capital Beltway, officially known as Interstate 495.

Previous to today our investigating subcommittee, the Special Subcommittee on the Federal-Aid Highway Program, has heard testimony pertaining to highway design safety in the Greater New York-New Jersey-Connecticut area, and in the State of Michigan.

Some of the things we heard were appalling, in that they showed conditions where roadside hazards were designed right into the newly completed roads.

But what we found even more appalling was testimony that these conditions are not local in extent, but exist nationwide. Even many of the most recently completed sections of our great Interstate System were found by our staff to contain the same built-in hazards that were found elsewhere.

The unnecessary dangers described thus far in our hearings have been mainly of the roadside hazard type, as demonstrated so clearly and in so many, many categories by our very effective first witness, Mr. Linko. These include such things as improperly installed guardrails, which often are a head-on, spearlike structure that will impale the vehicle and quite often the driver or other occupants of the vehicle.

We have the overdesign. By that I mean the overly strong structures and design of sign supports, consisting of steel pipe mounted on high concrete bases, which will withstand tremendous and violent impact, in many cases demolishing the vehicle and causing fatal injuries to the driver and the occupants.

We have concrete bridge piers and concrete abutments exposed with no guardrail. In many instances the abutment should not be there to begin with. In other instances, where guardrails were installed, they, instead of protecting the motorist, become the first impact point.

There are a whole series of sign structures and light poles and other types of structures along the roadside, adjacent to approaches to bridges or curves, which number as many as five to seven possible impact points, and if you are traveling at 60 to 65 miles an hour along the highway, it would be a matter of merely a fraction of a second in between these impact points, giving the motorist of course abso-

lutely no opportunity to use his reflexes or to react in his own defense, to avoid these impact points.

Simple things like drainage ditches are often too steep, and the backslope too steep.

Heavy-duty light poles we mentioned should be breakaway, snap-away. These are only a few of the deficiencies. We will have these listed by categories, and different types within categories, and have a better familiarity with the nature of the obstacles that are causing these accidents which are in so many cases, lethal ones.

Today the testimony shifted to the Washington, D.C., area. A member of our staff, John P. O'Hara, testified to an analysis made of the Capital Beltway, which as I-495, encircles Washington and much of the suburban Maryland and Virginia areas.

The Chair wants to commend Mr. O'Hara for a first-rate presentation. Here is a man well skilled in his presentation as an investigator; he is a very experienced and recognized and outstanding investigator on the staff. This man is not an engineer.

I think I am correct in saying that he would be classified in terms of a good, above-average, safety-conscious driver. But he was unaware of many, if not most of these obstacles on the highway until he, completely alone, without any technical assistance, as in the case of Joe Linko in New York, went out and just picked out instances in which he thought it looked, in his own estimation and in his personal judgment, to be a hazardous situation.

He checked back with the police records and found out that invariably these areas which just looked dangerous to him were in fact dangerous and that lethal accidents had taken place, and other accidents were continuing to take place; that in the restoring of these broken road fixtures, guardrails or whatever they may be, signposts, et cetera, they were reconstructed to be identical to the condition previously, and subsequently the same type of accidents again, quite often, took place, showing someone was not learning anything.

In connection with I-495, the Capital Beltway, it was dismaying to learn this morning that during the 2 years and 10 months since the completed beltway was opened to traffic in August of 1964, there have been more than 2,676 accidents.

In these accidents, 77 persons were killed.

The strange distribution which the Chair feels has great significance, and which has been examined and evaluated in much more thorough depth, is that of the 77 persons killed on the 66 miles of modern freeway, the Capital Beltway, 10 took place on a 1-mile span called the Woodrow Wilson Bridge.

In short, 13 percent of the fatalities took place on 1/66 of the stretch. The same hazards existing elsewhere continue to exist today. The Capital Beltway is no exception, safetywise, to what appears to be the general rule.

This concludes the statement for today. The hearings will be recessed until further call of the Chair.

Any further announcement, Mr. Counsel, before we adjourn the hearings for today?

Mr. W. MAY. No, sir.

Mr. BLATNIK. With that, the hearings for today are adjourned. We thank you, Mr. O'Hara, and we again thank you, Mr. Prisk. (The statement of Representative Gilbert Gude follows:)

STATEMENT OF REPRESENTATIVE GILBERT GUDE

Mr. Chairman, early last month after a review of accident reports for the Capital Beltway (Maryland Portion), I-495, based on the Maryland State Police accident data, I pointed out the high rate of accidents on a limited section of the Beltway between Georgia Avenue and Wisconsin Avenue in Montgomery County.

While this hearing is concerned with safety, design, and operational efficiency of the highways, I think it is important that the Committee have the report and recommendations of the Maryland State Roads Commission after their own evaluation of the above-mentioned section. The attached resolution lists the immediate order for interim action by establishment of a reduced speed limit on the affected section. Further corrective action by the Commission, in the immediate future will undoubtedly involve lighting, marking and "signing".

Excerpt from minutes of meeting of the State roads commission, Wednesday, June 7, 1967:

"On recommendation of assistant Chief Engineer Traffic—Lewis, and as the first step resulting from studies being conducted to improve safety on the Capital Beltway, the Commission adopted the following regulation in Montgomery County:

"Resolved, and it is hereby ordered, that the speed limit on (I-495) be lowered from 60 miles per hour to 50 miles per hour, from a point 1500 feet west of the end of the concrete surfacing at Georgia Ave. (Md. 97) to a point 3700 feet west of the end of the center line of old Georgetown Road (Md. 187), a distance of 4.14 miles."

The work of this committee is extremely valuable in assessing the progress of the Interstate and Federal-aid highway systems, and the extent to which this system provides the safest possible means of travel for all the citizens. The members and staff are to be commended for their valuable research.

We must be assured without any doubt that we have complete compliance with the design standards required in the Federal Highway Act, meaning the building to the design characteristics required according to the best known traffic projections developed by the responsible authorities. To do otherwise, is to short-change the public in the most costly fashion, in the tragic loss of life and limb.

(Whereupon, at 12:50 p.m., the subcommittee was adjourned, subject to the call of the Chair.)

HIGHWAY SAFETY, DESIGN AND OPERATIONS

Roadside Hazards

TUESDAY, JUNE 20, 1967

HOUSE OF REPRESENTATIVES,
SPECIAL SUBCOMMITTEE ON THE
FEDERAL-AID HIGHWAY PROGRAM
OF THE COMMITTEE ON PUBLIC WORKS
Washington, D.C.

The subcommittee met, pursuant to notice, at 10:08 a.m., in room 2167, Rayburn Building, Hon. John A. Blatnik (chairman) presiding.

Present: Messrs. Blatnik, Kluczynski, Edmondson, Johnson, McCarthy, Howard, Cramer, Harsha, Cleveland, McEwen, Duncan, Schadeberg, Zion, and McDonald.

Staff present: Same as previous days.

Mr. BLATNIK. The Special Subcommittee on the Federal-Aid Highway Program will please come to order.

This morning the subcommittee is resuming public hearings relating to the design and operational efficiency of the Nation's highways, particularly as it pertains to the safety features.

Testimony heard thus far in our hearings has disclosed conditions in the design of our highways, roads, and streets that are disappointing and, indeed, alarming.

One witness after another has described a seemingly endless number of roadside hazards that have been designed and built into our roads. We have been shown scores of photographs to document the testimony, and the implications as to the extent of the conditions thus revealed are ominous.

Most disappointing of all has been repeated evidence that the conditions shown to exist generally are not limited to our older roads, but include our primary and secondary Federal-aid roads and extend to even the Interstate System itself.

Since the Interstate System typifies the design and construction of our most modern highways in the very best way we know how to plan and build, it becomes important that we now turn our attention to determine how the concept of safe highway design is faring on that network.

The state of the art on a nationwide basis, therefore, will be the main subject of the testimony we are about to hear today.

We are pleased, and indeed fortunate, to have with us today a panel of nationally recognized experts in the field of safe highway design and traffic engineering, who will review design and operational features relating principally to roadside hazards. These witnesses will help us examine and discuss some of the most recently opened segments of the great Interstate System.

Mr. Constandy, assistant chief counsel of our staff, will you please take over?

Mr. CONSTANDY. Mr. Chairman, during February 1967 we asked Mr. Frank Turner, Director of the Bureau of Public Roads, to submit a list of the latest sections of Interstate highway opened in each State.

We wanted to be able to choose one section in each of the nine regions of the Bureau of Public Roads, and to develop a sample which would be a fairly representative cross section of the Interstate System, as of this point in time, in order to review the design and construction from the standpoint of roadside hazards.

From the list Mr. Turner supplied in February of this year we selected the nine projects listed on the sheet before you, which I would like to offer now as exhibit 3.

Mr. BLATNIK. Without objection, so ordered.

(Exhibit No. 3 was marked and is retained in subcommittee files.)

Mr. CONSTANDY. These sections were chosen without any prior knowledge of what they looked like. We tried to select a group which had a variety of traffic volumes, a range in topography from flat to mountainous, and both urban and rural sections.

After selecting the group to be reviewed, we requested the assignment of Mr. Charles Prisk to assist in the analysis.

Both Mr. Prisk and I went to each section and took a series of photographs.

We are now prepared to present to the committee what was observed and photographed.

In order to assist the committee in this review, we have asked five distinguished gentlemen to appear before the committee and act as a panel. Each is nationally known, and highly qualified and respected, both personally and professionally. Each has had a career in which he has distinguished himself in the subject before us today.

Collectively they offer a needed opportunity to measure the state of the art in highway design as it relates to roadside features.

I would now like to ask, Mr. Chairman, if the panel members and myself might be sworn.

Mr. BLATNIK. Will the five panel members please stand. Please raise your right hand.

(At this point the panel members and Mr. Constandy were sworn by the chairman.)

Mr. BLATNIK. Please be seated.

Mr. Prisk, you are still under oath. We appreciate your standing by.

At the outset, the Chair speaks for the entire committee for the splendid cooperation of the members of this distinguished and outstanding panel. It is not necessary to qualify that description any further. I think the testimony to be presented in the course of this morning's hearings will be evidence in itself of the caliber of witnesses before us. We appreciate the special effort—first of all in the cooperation you have given the staff, and the special effort you have made to be with us this morning.

Mr. CONSTANDY. I will identify myself and then ask each of the panel members, beginning with Mr. Wilson, to do likewise.

I am, as you said, assistant chief counsel of this committee.

Mr. Wilson, will you give your name, address, and present occupation, please?

TESTIMONY OF CHARLES W. PRISK, DEPUTY DIRECTOR, OFFICE OF TRAFFIC OPERATIONS, BUREAU OF PUBLIC ROADS; JAMES E. WILSON, TRAFFIC ENGINEER, CALIFORNIA DIVISION OF HIGHWAYS; EDMUND R. RICKER, DIRECTOR, BUREAU OF TRAFFIC, PENNSYLVANIA DEPARTMENT OF HIGHWAYS; PAUL SKEELS, CHAIRMAN OF COMMITTEE ON GUARDRAIL, HIGHWAY RESEARCH BOARD; T. S. HUFF, CHIEF ENGINEER OF HIGHWAY DESIGN, TEXAS HIGHWAY DEPARTMENT; W. JACK WILKES, CHIEF OF BRIDGE DIVISION, OFFICE OF ENGINEERING AND OPERATIONS, BUREAU OF PUBLIC ROADS

Mr. WILSON. My name is James E. Wilson. I live at 1420 Mendota Way, Carmichael, Calif. I am traffic engineer for the California Department of Highways.

Mr. SKEELS. My name is Paul C. Skeels. I am the safety engineer of General Motors Corp. I live at 824 Colliston Street, Ann Arbor, Mich.

Mr. HUFF. I am Talbot Huff. My address is 3215 Windsor Road, Austin, Tex. I am chief engineer of highway design for the Texas Highway Department.

Mr. WILKES. I am W. Jack Wilkes. I live at 7801 Greely Boulevard, Springfield, Va. I am presently Chief of the Bridge Division, Office of Engineering and Operations, Bureau of Public Roads.

Mr. RICKER. I am Edmund R. Ricker. I live at 1709 Mitchell Road, Harrisburg, Pa. I am director of the Bureau of Traffic Engineering for the Pennsylvania Department of Highways.

Mr. BLATNIK. Mr. Ricker, you are also president of the Institute of Traffic Engineers, are you not?

Mr. RICKER. Yes, I am.

Mr. BLATNIK. We also have with us a very distinguished guest in the audience, Mr. Ronald L. Moore, head of the Motor Layout Section of the Road Research Laboratory of the Ministry of Transportation, from London, England.

Mr. Moore, we met you earlier. Would you please stand so the other committee members can see you.

We welcome you. We look forward to visiting and chatting more with you on the problems which I believe we will find of common interest and mutual concern. All right, Mr. Constandy.

Mr. CONSTANDY. Mr. Chairman, I would like to give a brief biographical sketch of the panel members.

Mr. Wilson is chairman of the National Joint Committee on Uniform Traffic Control Devices and the AASHO representative on the same committee.

He is member of the AASHO traffic committee; member of the Interpretations Committee for the Interstate Sign Manual Committee of AASHO. He is a member and the AASHO representative of the committee on uniform traffic laws and ordinances; a member of the Institute of Traffic Engineers, and the American Society of Civil Engineers. He has been with the California division of highways for 18 years during which time he has had 8 years of design and 2 years in construction.

Mr. Skeels is engineer in charge of vehicle safety test and development of the General Motors proving ground. A great deal of the information we will be discussing has been researched by the General Motors Corp. at their proving ground. We believe it will be a valuable addition to the panel.

He is chairman of the Highway Research Board Committee on Guardrails, Guideposts, Signs, Signals, and Lighting Supports. It is an ominous title.

He is also vice chairman of the ASTM committee, E-17, which deals with road slipperiness, and he is a member and chairman of several SAE committees.

Mr. Talbot Huff has been the chief engineer of the highway design section since 1954 and he was assistant to that post, from 1945 to 1954.

Within AASHO, he is a member of the operating committee on design; chairman of the subcommittee on interim design standards for flexible and rigid pavements; a member of the subcommittee to study feasibility of variations in design standards; and he is a member of the freeway study and analysis committee, 1959, which produced the red book. It was probably one of the earliest evaluations of our freeway system.

Within the Highway Research Board, Mr. Huff is a representative for the Texas State Highway Department; a member of the regional advisory committee of the AASHO road test and a member of the analysis panel. He is also a member of the committee on shoulder design within the Highway Research Board.

In the American Society of Civil Engineers, he is chairman of the highway division executive committee and member of the committee on geometric design, the structural design of roadways committee, the technical procedures committee.

He is chairman of the policy committee of breakaway sign research project in the Bureau of Public Roads and Texas A. & M., jointly. That project involves 14 States.

We will hear more about breakaway signs, the fruits of that research.

Mr. Huff is also chairman of departmental research and development of the State Highway Department of Texas.

Mr. W. Jack Wilkes, as he mentioned, is chief of the bridge division of the office of engineering and operations, U.S. Bureau of Public Roads. He has been with public roads for 21 years, and for 4 years was division engineer for North Carolina. Within the Highway Research Board he is a member of the committee on design; and within AASHO, he is secretary of the bridges and structures committee.

Mr. Ricker is the director of the Bureau of Traffic Engineering of the Pennsylvania Department of Highways; president of the Institute of Traffic Engineers; secretary of the AASHO operating committee on traffic; chairman of the joint vehicular signal system committee; and a member of the department of traffic and operations of the Highway Research Board.

We have a highly qualified panel. In the course of selecting them, none of them was a second choice. Having made the initial choices, we checked with people both within AASHO and the Bureau of Public Roads and found that they were eminently qualified to act in the capacity we have asked them to today.

I would like to ask Mr. Prisk if he would begin by giving us his remarks relating to this subject.

Mr. BLATNIK. Mr. Prisk.

Mr. PRISK. Thank you, Mr. Chairman, and Mr. Constandy.

Members of the committee, I think it goes without saying that the Interstate System provides high quality service for the motoring public of the United States.

The projects that we will be looking at today and conducting a review of, are representative projects in nine States. These are the most recently completed projects open to traffic in the nine States that are available for review. They are representative of urban and rural conditions, and I think they cover the gamut from high-volume traffic, high-speed traffic conditions, on the Interstate, to the lightly traveled sections of the Interstate.

The visits that Mr. Constandy and I were privileged to make were conducted largely during the month of April and early May. So this information that we bring to you today, which will be largely pictorial, is of very recent conditions.

I think that we should start in our consideration of conditions on the Interstate System with this handout sheet that was circulated to you a few minutes ago. The top sheet shows the interstate accident experience, compiled by the Bureau of Public Roads. It shows 65 percent of the accidents and 61 percent of the deaths are associated with one vehicle, 88 percent of the single-vehicle accidents, and 89 percent of the deaths involve the vehicle that leaves the road. This may be a single car or a multicar collision course. This then is the condition to which we are principally directing our attention today, and in our review of the nine interstate projects, which have been presented to you, identified by the sheet that has been circulated to you earlier; 10 categories of information which were thought to be significant from an engineering standpoint.

Analysis has, therefore, been organized in these 10 general categories and I would simply like to mention them here so you have an idea of the way the ground may be covered.

First is the subject of guardrail and median barriers. We often compare our Interstate System to the railroads, I think, remembering, of course, that the railroads have track and fixed path to follow. And I think in a sense that the guardrail, median barrier problem, is perhaps associated with this matter of keeping drivers on course.

Bridges are another category. Shoulders, curbs, drainage facilities, signs and sign supports, lighting, lighting standards, design posts or gores, and slopes at the sides of the embankment at the roadside.

These then are the 10 categories in which the review information has been organized.

The guardrail item has been chosen for initial discussion today because we find that as cars leave the road, this is the most frequently struck item. In fact, in the accidents involving fatalities where vehicles leave the road, the guardrail is struck in one-third of these cases. It is the most frequently struck. So we then have selected guardrail for this median barrier for this first presentation.

Now I show you by this chart something that we see of the design demands as far as guardrail and median barrier are concerned.

First of all, these barriers must prevent penetration by the vehicle. They serve no purpose, if they do not prevent penetration, at least in some degree. They redirect the vehicle along the rail. In other words, they do not deflect the vehicle off the rail back into the course of traffic out of control, but redirect the vehicle along the course of the rail.

No. 3, they decelerate the vehicle within human tolerance limits.

Mr. CONSTANDY. It is the sudden stop that kills people, is it not?

Mr. PRISK. It is that. And we certainly strive for each of these objectives in construction and design of guardrail.

The applications where guardrail is appropriate to use—I might say with respect to these, all of these are carried out with appropriate consideration for economy and for esthetics.

As to applications, there are applications obvious at grade separations and bridges, where guardrail is used. Also on steep, high embankments guardrail has obvious application, and at other roadside hazards where fixed objects are at place.

Mr. CONSTANDY. I think it is advisable for the committee to keep the initial three items of the design demands in mind as we review this series of slides.

Most important, the three Mr. Prisk has mentioned here.

Mr. PRISK. Now as we proceed, I think that I would like to move to our consideration of the history, briefly, of guardrail development.

I can recall in early highway department experience when 2 by 4's were used or 2 by 6's were used for guardrails, causing rather sad experience with splintering wooden rail coming through the car or through a windshield. So types of rails are quite important and we shall be looking for various types of rails as we review these nine projects.

Also the rail must be sufficiently strong to absorb energy without undue deflection and be suitably anchored. And we should be looking at different types, different characteristics, of the rail in this respect.

One very significant thing that has been found in recent research is that it is important to have washers to hold the rail to the post, so that the rail will not, in effect, peel off, lose its tensile quality as a system.

Mr. CONSTANDY. Do you have one of those you might show the committee?

Mr. PRISK. Yes. This washer is a rather obscure item, in many people's judgment, but that is the washer. This is the standard bolt that is used to hold the washer on the face of the rail. This is the traffic side.

Mr. CONSTANDY. The purpose of that is to keep the head of the bolt from going through the guardrail; is that right?

Mr. PRISK. Exactly so. This is the rail, the section of a common-type rail that is used.

Mr. CONSTANDY. Is that called a W-beam?

Mr. PRISK. W-beam rail. And the washer goes in in this position as it is bolted to the post.

Mr. CONSTANDY. Do you have any idea what the washer costs?

Mr. PRISK. Well, these washers, of course, are bid like other items, but 15 to 25 cents would cover the range. Perhaps that is a little bit high. The full strength of the rail cannot be realized in a crash without a washer; that is correct.

The rail is actually a system. It is not a disconnected series of pieces of rail. And it must be built as a system, a rail and post system, in order to achieve its maximum effectiveness.

Mr. CONSTANDY. So if a 12-cent washer is not acquired, the investment in the rail may not be realized.

Mr. PRISK. I have heard of them costing 12 cents and that statement is correct; yes, sir.

Mr. CONSTANDY. What does guardrail cost, approximately, per foot?

Mr. PRISK. A linear foot of guardrail will run \$2.50 to \$3.50, installed.

Mr. CONSTANDY. Post, guardrail, and washer?

Mr. PRISK. Entire cost; yes, sir.

Mr. CONSTANDY. We are speaking now of W-beam guardrail cost?

Mr. PRISK. Yes. Some other types are cheaper. Some types are a little more expensive.

So we shall consider various types of guardrail. I think in addition to this, with respect to its placement, that it is important to look at how guardrail is used and what situations it is used in, and how it is related to the design of the highway.

One very important consideration is how high this rail is. If a rail is too low, it may be vaulted over or topped. As the vehicle hits it, the vehicle will roll over.

Mr. CONSTANDY. I might say in that connection that during the course of this trip, we viewed a section of guardrail at a point where there had been an accident and there wasn't a scratch in the guardrail. The car completely leaped over the guardrail and the people within it suffered severe injury, or death, I do not know. But that does happen; a car can leap completely over the guardrail.

Mr. PRISK. That is entirely possible. And accident records have substantiated the fact that cars do go over guardrails that are mounted too low. So consideration of rail height is rather important. And we found important variations in rail height among the States.

Another very important fact is the concern of blocking the rail out to the point where the rail will not be in a position that would permit the car wheels to engage with the post.

Mr. CONSTANDY. Could you explain what blocking out means?

Mr. PRISK. Yes. Blocking out refers to placing of a block, a steel or wood block behind the rail and in advance of the post. The post goes into the ground, the rail is actually offset from the post a sufficient amount so that, when a car comes in, the wheel does not get under the rail and attach itself to the post.

Mr. CONSTANDY. So the purpose of the block in the instances is to separate the guardrail from the post to allow sufficient clearance of an automobile wheel sliding along the guardrail to miss the post. Is that correct?

Mr. PRISK. This is the case as far as the normal installation of guardrail is concerned.

There are certain types of guardrail systems where the post is a retarder itself of the vehicle and helps to decelerate the vehicle. In those cases, the post is built light, of light material, in strength, and is intended to collapse. In these cases, contact with the post is not important. In fact contact with the post is a desirable part of its

operation. Where you use a sturdy post, you must block the rail away from it.

Mr. CONSTANDY. Of what material are the posts made, Mr. Prisk?

Mr. PRISK. Posts are usually wood or steel. Usually I-beam sections in the case of steel. There has been some use of aluminum, although this is not widespread.

Mr. CONSTANDY. How about the block, what is that made out of?

Mr. PRISK. The block is normally made of the same material as the post. If the post is a wood post, you will find a wood block behind the rail frequently. A steel post will have a piece of steel. Actually, these sections that block the rail out are just exactly like the post itself.

Mr. CONSTANDY. Sometimes the block is made of wood and the post is made of steel; is that correct?

Mr. PRISK. This is on some occasions; yes, sir.

There is a feeling that the wood block tends to absorb energy and this by itself is a desirable consideration.

Mr. CONSTANDY. There is apt to be an advantage in using wood for a block?

Mr. PRISK. There is some advantage to be gained; yes.

Mr. CONSTANDY. Do you want to say something about the length of the guard rail sections, Mr. Prisk?

Mr. PRISK. Yes; this is a very important thing about its application. If it is to be effective at grade separations and bridges and on embankments and hazards on the roadside, it necessarily must be in a position, not directly opposite the hazard, but in line with the normal path of a vehicle that would leave the roadway. And as the vehicle leaves the roadway, it frequently will go off on a very flat angle and the rail must then be long enough to cover that approach path.

In addition to that, of course, you do have the very practical matter of avoiding a series of short sections of rail, each one of which presents a hazard by itself, with the exposed end of the rail.

So commonly, I think, we find rather too often sections of guardrail that are altogether too short.

At the same time there are other places where a guardrail is in, where it is not warranted. I would not for a moment suggest that we put guardrail everywhere.

Another point of great importance is that the end of the rail, this rail faced by blocked-up posts here, as you run into the end of this, it has quite a lethal effect on a vehicle and its occupants, and it has been found through research that it is appropriate and highly desirable to flare the end of this rail into the approach alinement so that you have a smooth transition.

Mr. Linko testified here several weeks ago about some of the rough transitions on highways that he had looked at and which were in his own pictures. I think it is a principle that must be recognized, that as you approach a section where a rail is used, that that rail, as you introduce it in the cross section, must be flared into the approach so as to present a smooth surface.

Mr. CONSTANDY. Do you have some slides that illustrate these points? Perhaps it would be appropriate to look at those now.

Mr. PRISK. We are set to go on the slides. If we may have the lights out, please—

I think, incidentally, the analysis we have here in review, pictures, will stimulate some comment from this distinguished panel that I am happy to have at the table today.

Mr. CONSTANDY. They may even disagree either with you or among themselves. We hope they will feel free to voice their opinion whether it agrees with anyone else's or not.

Mr. PRISK. I would welcome that.

Mr. CONSTANDY. Incidentally, we are not attempting here to establish any design standards; it would probably be inappropriate for a congressional committee to do so. We simply want to review and analyze this without it being thought that we are setting any design standards to be followed. I think there are appropriate points here that could be commented on, which should prove interesting to people who have the responsibility of setting design standards.

Mr. HUFF. I would like to ask Mr. Prisk if he has any accident data or knowledge of installations that are in operation that prove the superiority of the blocked-out rail versus the non-blocked-out rail?

And I also have one other comment I would make now, Mr. Prisk, if I may. I would suggest that you stress the importance of not putting a curb directly in front of a rail, if you do that as you go along.

Mr. CONSTANDY. I think Mr. Prisk will agree with you on the curb. He has convinced me that is undesirable. We will get to a section of this discussion later when we are dealing almost entirely with curbs. Mr. Skeels?

Mr. SKEELS. While we are talking about the advantages of the blocked-out rail, I would like to point out another one. When a rail is mounted directly on a post and not blocked out, as the rail is struck by a car, the post will tip backward in the ground and the height of the rail then immediately starts to decrease; as the post is pushed backward the rail lowers. With a blocked-out rail, as the post is pushed backward, initially at least, the rail rises, actually gets higher, and so it is very effective in preventing cars from mounting the rail.

Mr. CONSTANDY. Have you conducted research on this point, Mr. Skeels?

Mr. SKEELS. I have not conducted research personally on this point, but Mr. Beaton of California has, and has proved this beyond a doubt.

Mr. CONSTANDY. You have reviewed the—

Mr. SKEELS. I have reviewed his work. At General Motors we do use a form of blocked-out rail. It is blocked out by a spring section instead of by a solid block, but it does the same function and it is very effective. And we have done a considerable amount of evaluation on the benefits to be obtained by mounting the rail forward of the post face.

Mr. CONSTANDY. Thank you.

Mr. Wilson.

Mr. WILSON. I am somewhat familiar with Mr. Beaton's experiment done by the California Department of Highways, and I can confirm that what Mr. Skeels says is correct.

I would like to comment on the problem of the guardrail not being blocked out. Mr. Beaton also conducted some experimentation which led to the use of the block. What happened, the car would hook into a post and have a tendency to circle and throw occupants out of a car.

Mr. CONSTANDY. In that case, is it not true that the front of the car begins to decelerate and the back end of the car then is caused to swing around, either overturning or going end over end?

Mr. PRISK. That is right, and quite often the occupants of the car receive severe treatment, and sometimes are thrown from the car if not restrained by seat belts.

Mr. SKEELS. I would like to reinforce that with one more statement. If the wheel of the car is allowed to contact the post, which happens when the rail is not blocked out, it is very likely that the wheel of the car is torn off and you make a major accident out of a situation which otherwise might be quite a minor one.

Mr. CONSTANDY. Mr. Huff, I think you would like to say something more.

Mr. HUFF. I would like to state that with our guardrail, where the ends are anchored, securely anchored on the ends, the non-blocked-out rails have been performing very satisfactorily.

Mr. CONSTANDY. You use such installation in Texas, do you not?

Mr. HUFF. Yes. I can understand if the end is not secure you might have trouble. Where you anchor the end you probably will not have trouble.

Mr. CONSTANDY. Mr. Ricker, do you care to comment?

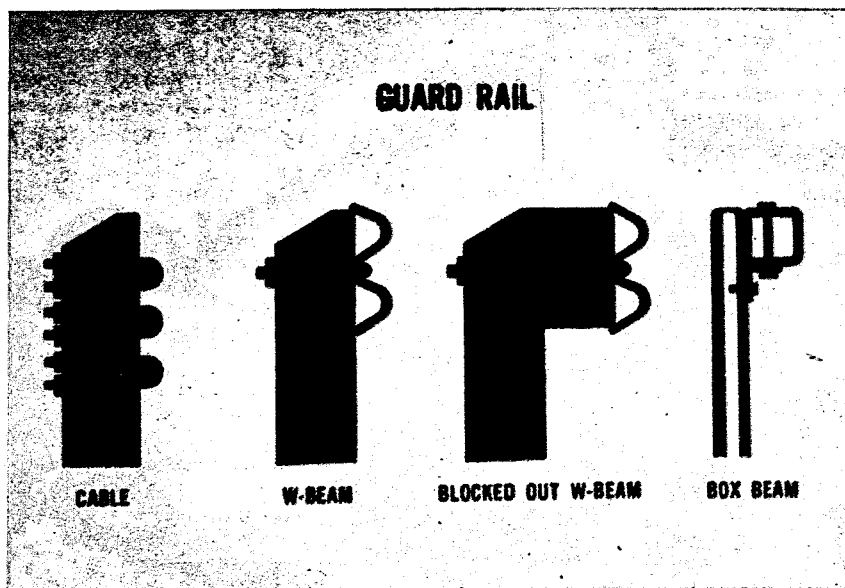
Mr. RICKER. I was going to raise a different question.

I wonder if Mr. Prisk is going to speak of the spacing of the post and the siting of the post spacing.

Mr. CONSTANDY. I think so, yes. That will come up in the course of the slides in any event.

Mr. PRISK. Yes. Just as a matter of getting this before us pictorially, let's take a look at what we mean by a blocked-out rail.

The third from the left is the common example of a blocked-out W-beam rail. This same section that I have here at the table. And this shows the difference between that and the one next to the left, the standard rail which is mounted on the post.



Now, there are other types of guardrail even beyond the ones that are here, of course, but the farthest to the left is the cable rail where you have a wire cable, steel cable, mounted on wood post, or on steel posts for that matter, which will perform, and again depending upon the post, of course, with various kinds of effects.

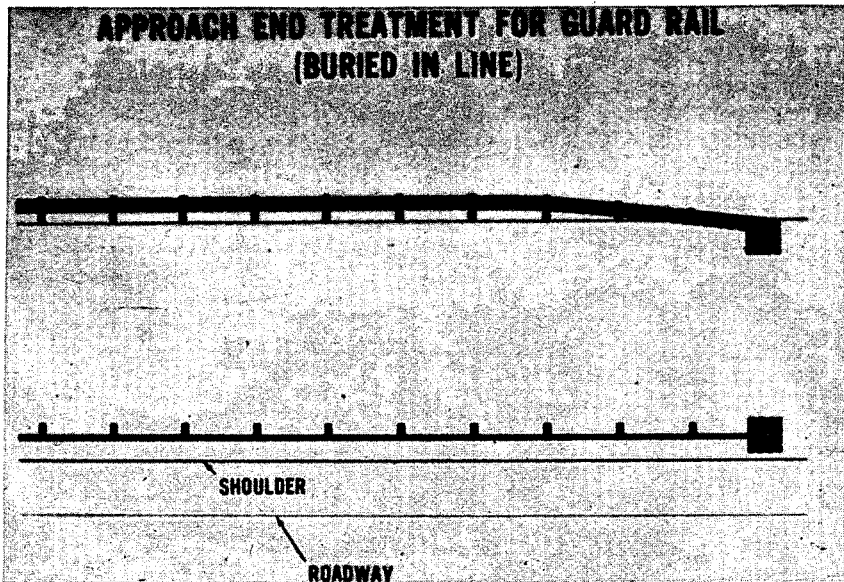
The farthest to the right is the box beam type of rail which is a rather new development in the field, starting in New York. This depends for its effectiveness not on the blocking out but on the fact that that post collapses upon contact as the vehicle goes into the rail, the box beam rail, it will knock down the vertical supports and bend this little square section that you see up here at the right end [indicating]. So there are various types of rail systems. These are four.

Mr. CONSTANDY. Incidentally, in connection with the box beam rail, we will have testimony further in these hearings from people who developed it. But it is important to recognize, in use of that type guardrail, that the post be weak and it is intended that the car will knock it down as it slides along.

Mr. PRISK. May I show you the various types of approach end treatment that are commonly used?

This is a case where the end of the guardrail, which is at the right of the slide, is buried in line. In other words, it is dropped to the ground level and anchored there with a concrete block. So that as the vehicle approaches that, he is not going to be impaled on the end of the rail.

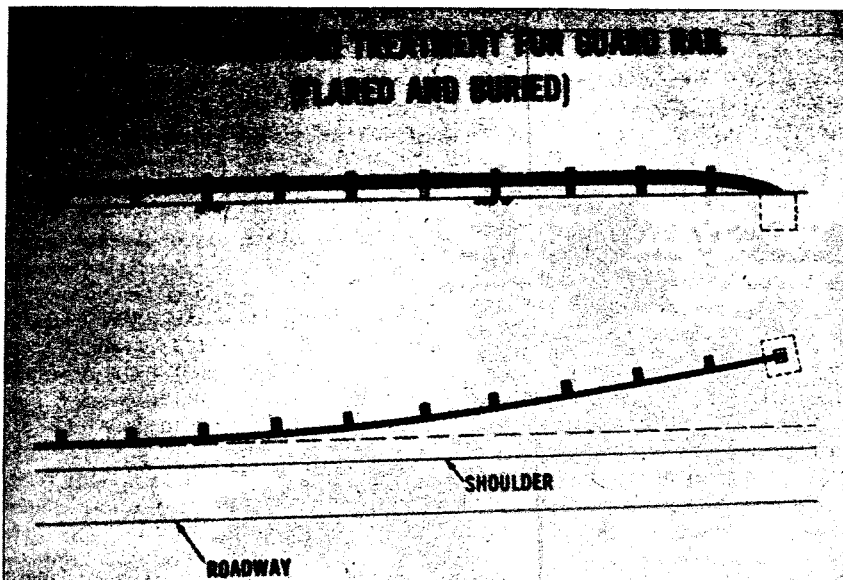
Mr. CONSTANDY. I think it would be appropriate here to make reference to the Highway Research Board Special Report 81. Correct me if I am in error, but in it they depict both this and the next one you show which has a flare on the end of it and they recommend this one over the other one; do they not?



Mr. PRISK. Yes, this is the flared and buried installation, where the approach end of the rail is actually carried laterally away from the roadway, so that your contact is in that curved section before it gets back to the edge of the shoulder.

Mr. CONSTANDY. Mr. Skeels is chairman of the committee of the Highway Research Board which had a subcommittee develop Highway Research Board Special Report No. 81; is that not correct, Mr. Skeels?

Mr. SKEELS. That is correct, yes.



Mr. CONSTANDY. Was that not a distillation of the known research which has been performed by various people on the use and application of W-beam guardrail?

Mr. PRISK. That is.

Mr. SKEELS. That is right. Although the known test data was assembled and investigated by the subcommittee and Special Report 81 is the result of the findings of all available work.

Mr. CONSTANDY. I see. Thank you.

Mr. ZION. Mr. Prisk—

Mr. CONSTANDY. When was Special Report 81 published?

Mr. SKEELS. I don't have the exact date in mind. I would say about 4 years ago.

Mr. CONSTANDY. I would like to make that exhibit No. 4, Mr. Chairman, Highway Research Board Special Report 81.

Mr. BLATNIK. Without objection, so ordered.

(Exhibit No. 4 is retained in subcommittee files.)

Mr. ZION. Mr. Prisk—

Mr. BLATNIK. Mr. Zion.

Mr. ZION. Where you have—I have seen new installations where you have the end of W-beam buried. It appeared to me that if it is not flared, as some I have seen, an automobile would have a tendency to ride up over it and then overturn as a result. Is this a possibility?

Mr. PRISK. This is a distinct possibility. It is a function, in part, of the factor that I mentioned in my earlier remarks as to how long a rail section is anyway.

But you are quite correct that any rail that is taken into the ground can be used as a ramp by a vehicle.

Mr. CONSTANDY. Mr. Huff, I think you have a comment.

Mr. HUFF. I would like to comment on the flared rail.

Our experience has led us to believe the flared rail introduced too severe an impact, which is what you try to avoid in guardrail. You like as flat an angle of impact as you can. If you flare it, you do necessarily increase the impact.

Now, on our anchored rail, or buried rail, as shown on the top section, we have been putting that in line with the rail.

Mr. CONSTANDY. As the previous slide shows.

Mr. HUFF. Yes.

Mr. CONSTANDY. Same alinement as the roadway.

Mr. HUFF. Same alinement as the road and not over a 2-foot flare.

Our experience in several hundred accidents has indicated to us that if a car gets on top, the post will act as a decelerating force to the automobile that is involved.

Mr. CONSTANDY. In other words, the post that sticks up above the rail will decelerate the automobile as it hits the bottom of the automobile riding along the top of the rail.

Mr. HUFF. That is correct. The post spacings must be as close together as 6 feet 3 inches, which fits the rail.

Mr. CONSTANDY. I think we raise another issue here on the desirability of the flared and nonflared guardrail approaches.

Mr. HUFF. In our experience and studies, we find that we need a longer rail, a longer approach rail, than Special Report 81 indicates that we need. I believe 125 feet, as I remember, is your length, Mr. Skeels.

We think it ought to be upward to about 200 feet in order to accomplish—

Mr. CONSTANDY. We will see slides of some installations which are only 25 feet. Mr. Skeels, you have something further to say?

Mr. SKEELS. A couple more comments. I agree with Mr. Huff on the use of the inline approach rather than the flared approach. We do use the inline approach at General Motors.

Mr. CONSTANDY. In spite of the fact, we must recognize, Special Report 81 does prefer a flared approach?

Mr. SKEELS. That is right. I also recognize the fact that if a car does strike this, it is carried into the air; it can induce a rollover. However, a rollover is a much more preferable type of accident than being speared with the end of a guardrail. It is a matter of—

Mr. ZION. Mr. Skeels, would not this in many instances throw a car into the approaching traffic in the other lane?

Mr. SKEELS. I don't think I can say yes or no. It is a possibility. Personally, I think it is a remote one.

Usually a car that goes up on the rail, catching the rail on one wheel, does not roll. It depends on many factors, such as the angle of the slope at the end. In other words how many sections do you taper into the ground on high-speed roads? You have to use a flatter taper than would be acceptable on low-speed roads. Our conclusion

is that this is a preferable situation than to have an exposed end, as is the normal practice, even though it is flared.

Mr. CONSTANDY. Don't we have to keep this in mind, when we install a guardrail or median rail, we are attempting to choose the lesser of the two evils; and that frequently we find that the thing that has been chosen as a protective device is really a compromise anyhow. You can't find the ultimate, in any event.

Mr. SKEELS. I would like to add two other thoughts. One, a guardrail should be used only as a last resort. An impact with the guardrail is an accident. And if you can eliminate the guardrail or eliminate the need for the guardrail, this is a much preferable solution.

Mr. CONSTANDY. I might add, we have developed, or structured these hearings on the same premise, that it would be desirable, although somewhat uneconomic and unfeasible, if an automobile could leave the traveled portion of the roadway at any point and allow sufficient room for a driver to regain control. That would be desirable. It is not going to happen in our time.

But that initial objective, while it is unattainable, does have some features which should be utilized, in some circumstances, to provide flat, wide, runoff areas.

There are some devices, such as signs, which are installed for the protection of the motorist, by giving information to prevent him from being confused, and if they are mounted where he can use them, they can present a hazard. The next step is to try to lessen the severity of the accident, involving things that need to be near the roadway, hazards of light standard or signposts.

We will have additional testimony of developments that lessen hazards of light standards or signposts.

Another category consists of things that cannot be removed from the shoulder of the highway, such as bridge abutments, bridge piers, rivers, canyons, ravines, other natural phenomena, from which the driver must be protected. There we find ourselves in a situation where we should install a guardrail; while it is not ideal, it is better than the alternative. Mr. Skeels?

Mr. SKEELS. One other quick comment. I agree with Mr. Huff on the length of guardrail he talks about. At General Motors we are using as much as a 500-foot lead-in guardrail at the bridge pier.

Mr. CONSTANDY. 500 feet?

Mr. SKEELS. As much as 500 feet.

Mr. CONSTANDY. You have made reference several times to General Motors. I wonder if you might mention to the committee what it is you have, in Michigan, that has given you this experience?

We will, incidentally, later on, get into this in greater detail with other witnesses.

Mr. SKEELS. The General Motors Proving Ground at Milford, Mich., has 75 miles of road of all types designed to operate at all feasible speeds. And the practice of the corporation, of course, is to make the plant in which the employees work as safe as possible for these employees.

At the proving ground, the plant in which our employees work is a road system. Hence we got into the problem of making our road system as safe as engineering knowledge would allow.

Mr. CONSTANDY. I see.

Mr. SKEELS. This is how we got into this business.

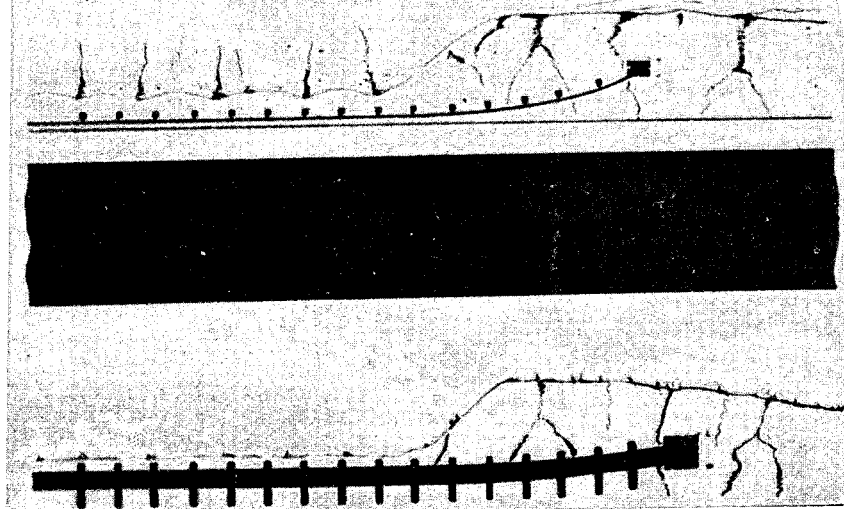
Mr. CONSTANDY. Thank you.

Mr. PRISK, could we get on to these slides?

Mr. PRISK. Yes. I think this discussion has been very helpful. Here again is the flared treatment that we have been talking about.

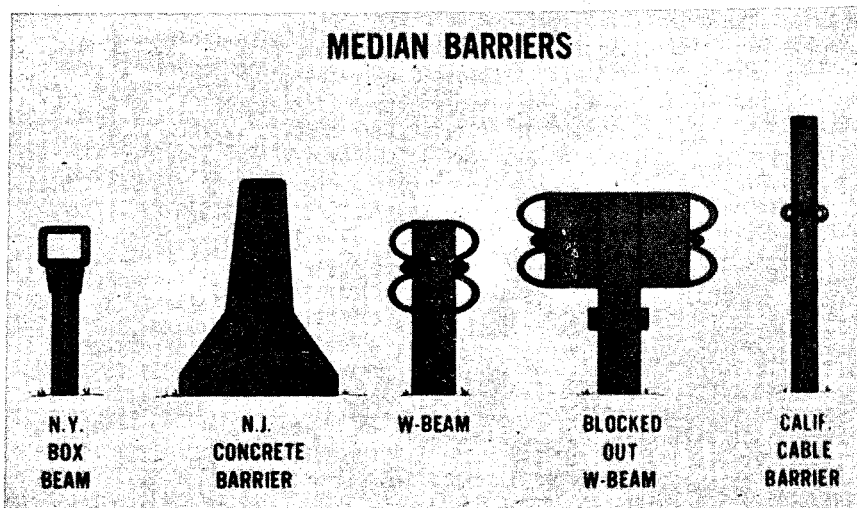
This is another flare approach where you move from a cut section into an embankment area, simply an elaboration of the previous slide.

GUARD RAIL END ANCHORED IN SLOPE



Now these are the types, or common "garden variety" of median barriers. The New York box beam, which has the relatively weak post and strong beam, there at the top, that box section, is one of the newer types. This takes a lot of the bending and these posts will drop as the car runs into that type of rail.

MEDIAN BARRIERS



This is a New Jersey type of concrete barrier. This sometimes is made of steel and, for the benefit of those here, I think that it is fair to say that this is the kind of barrier, Mr. Chairman, that will be used on the Woodrow Wilson Bridge very shortly, the structure we were talking about the other day here.

This is the W-beam type rail, again, just doubling up what we had before, and the blocked out section.

This is the California cable barrier, sometimes used with a cable down here low as well as these two at the top.

These again are various types of median barriers.

Mr. CONSTANDY. We will get into that cable barrier shortly, see some pictures of it. Mr. Wilson?

Mr. WILSON. I want to point out one thing that is different on this set of drawings. The blocked-out W-beam, you will notice, has got a little piece of rail which we call a rubbing rail, mounted on the post itself. This is to further insure that the wheel of a vehicle will not penetrate into the post area and cause a spinout.

Mr. PRISK. Thank you, Mr. Wilson.

Mr. CONSTANDY. You are serious about the car not touching the post?

Mr. WILSON. That is right.

Mr. SCHADEBERG. Mr. Chairman, may I ask a question about the last slide? This New Jersey barrier, why is that slanted on the bottom? Just a matter of strengthening the barrier?

Mr. PRISK. No. This design, which is very similar to a design that was developed at General Motors Proving Ground, is intended to prevent the car from riding up on the barrier beyond a reasonable point.

The top of the section of the barrier then engages the side metal of the car, so that you have a deflection of the vehicle in its path as it strikes that barrier and then rides away from it.

Mr. SKEELS. Could I say a word on that?

Mr. PRISK. Mr. Skeels would like to elaborate on that.

Mr. SKEELS. I would like to say just a word on this, not to contradict you, Charlie, but—

Mr. PRISK. Go ahead.

Mr. SKEELS (continuing). As the car approaches this type of a cross section, the wheel does ride up the lower section; it is intended to. This brakes the automobile in the direction you want it to turn.

The wheel contacts—or perhaps I should say the tire contacts the upper portion, at about the break in the two slopes, forcibly turning the car, or turning the wheel in the direction to bring it to a parallel path. This is intentional and will be elaborated later on in the testimony, I am sure.

Mr. CONSTANDY. Yes.

Mr. PRISK. Thank you.

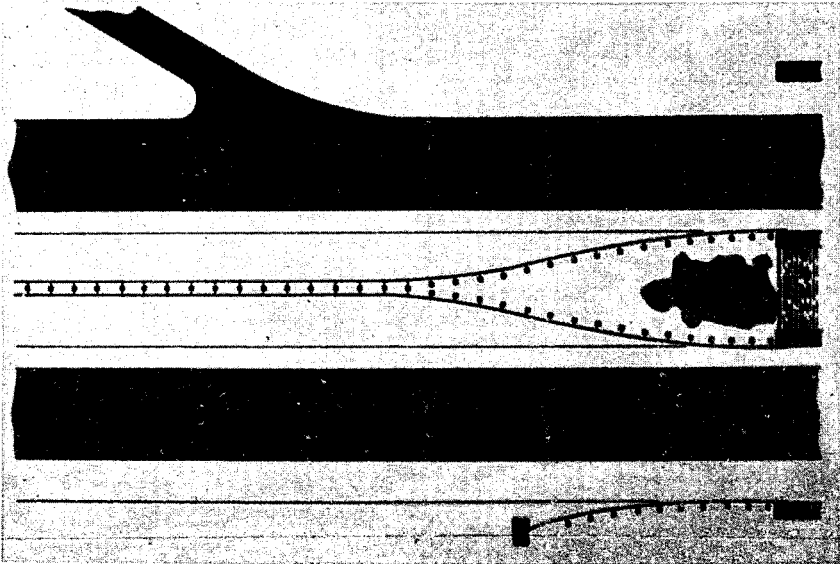
Taking a look at our next slide, this is simply an application of two types of rail, the guardrail at the edge and the guardrail or median barrier in the center, flaring out at the approach to the structure.

Incidentally, what we commonly shall be referring to as a gore is this area right in here [indicating], where traffic coming up leaves the expressway or the freeway.

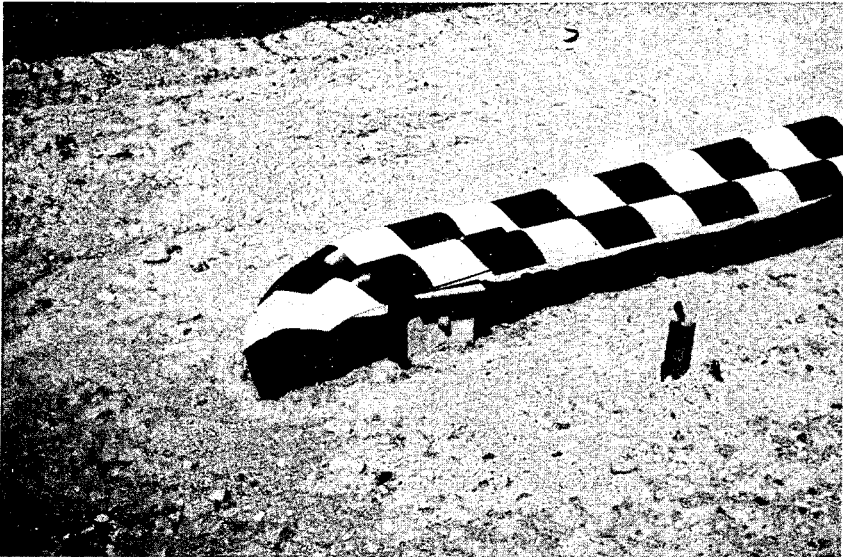
This drawing is intended to represent here the case of dual bridges where you have one bridge built here, an open space here, and another bridge built in this area here [indicating].

This is one type of rail treatment which is very common. You will see many slides of this.

I would like to move into some of the actual projects that we saw, Mr. Chairman. The first State that we are looking at is Utah; and this is on Interstate 80, in Salt Lake City.



Here is the end treatment that is being used on projects in Salt Lake City now. This is a case where you have a rail section which comes on down, essentially, to the ground level. This is anchored and bolted to this steel post, and held to the ground level.



This is about the way this looks in the field. You can see there a slight flare away from the edge of the shoulder, 3 or 4 feet. The rail is, as you approach it, smooth, essentially with the ground level, then rises and twists through a length of about 25 feet. And then it carries on along about 1 foot off the edge of the shoulder.

I think the thing to point out here is something that has been mentioned a couple of times already; this appears to be too short, and in field review you can very easily imagine the car going down into this deep ravine. This is fairly rough country. And it would be possible for a car to pass the end of this rail and drop down into this area on his approach.

I was glad to hear the comments a moment ago about the longer rail. Certainly it would apply here.

Here is another section, which is rather typical of what you find on this project on Interstate 80; this again I would remind you is the most recently completed and opened section in Utah.



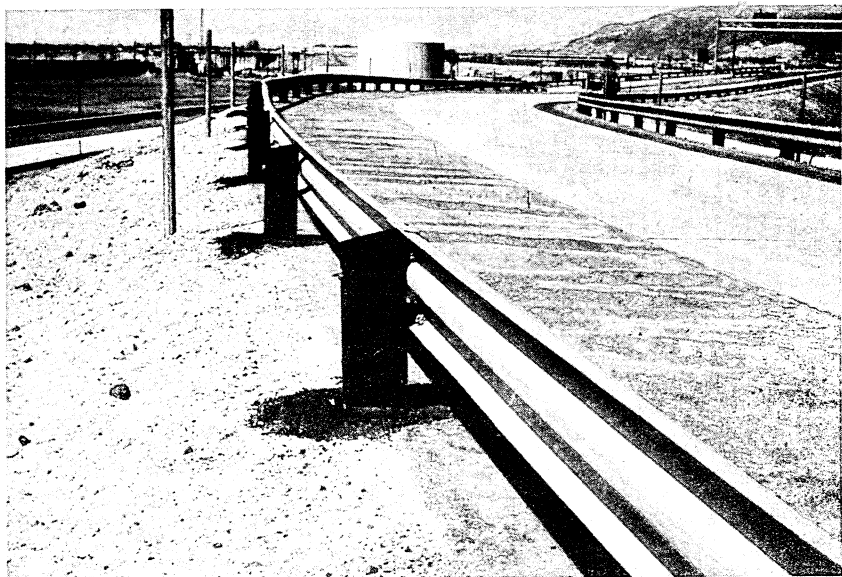
The rail here is not blocked out but rather mounted directly on 8 by 8 wood posts. This is just a view of the general design, the way rail is used at that point.

Mr. CONSTANDY. What was the post spacing?

Mr. PRISK. Post spacing here is 12 feet, 6 inches. There are some variations in this at some places but 12 feet 6 is the nominal standard.

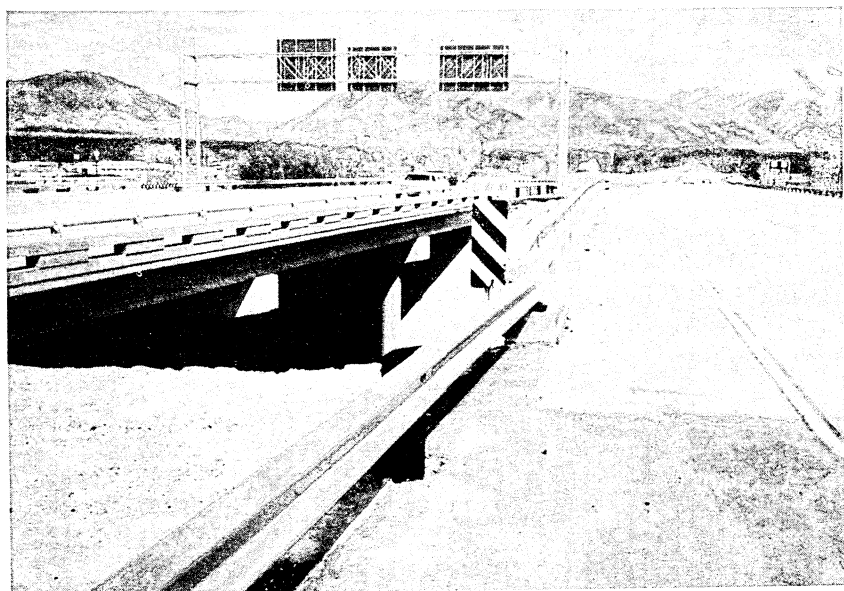
Here, now, is another application of rail as it approaches a bridge structure. In this case we have the twin bridge problem, with the open space, so there is a protective rail, again a 12-foot-6 spacing, somewhat more than seems desirable in a place like this where you can cut down the possibility of penetration and riding down in between these bridges.

The rail is blocked to the edge of the bridge structure in the traffic face of the parapet wall.



Mr. ZION. Mr. Prisk, in this last slide, the rail is not blocked out. It looks as though it is low enough that a wheel wouldn't go below the W-beam. Is that correct?

Mr. PRISK. That is right. This rail was about 25 inches, if I recall correctly, on this particular project; 25 inches was their mounting height. So you would—



Mr. ZION. Now, does this imply, then, if the W-beam is low enough, it would not be necessary to go to the expense of blocking it out? Or would this make the guardrail too low to be effective?

Mr. PRISK. You have two considerations, Mr. Congressman. If you get the beam low enough, you can prevent the blockout—I mean you can prevent this wheel engagement with the post—but then you run the risk of the vehicle topping the rail. This rail was mounted low enough so that you might presume that a wheel could not get in there, although I think Mr. Skeels would differ with me about that.

Mr. CONSTANDY. Mr. Skeels?

Mr. SKEELS. I would like to just add, under accident conditions, when that rail is hit, that post will deflect backward in the dirt. It will push back at a considerable angle. When it does, the bottom of the post is ahead of the rail and will catch the wheel.

Mr. ZION. I see.

Mr. CONSTANDY. Do we have any thoughts on the desirable height of the rail, Mr. Prisk?

Mr. PRISK. Yes. I think the research that has been performed indicates that the rail on the median barrier side, as a median barrier, should be about 30 inches, 30 or 31 inches.

Mr. ZION. Is that the bottom of the W?

Mr. PRISK. That would be the top of the W-beam. And on the edge barrier, about 27 inches. This rail was low on this particular project.

Mr. CONSTANDY. Would you care to make a comment, Mr. Wilson?

Mr. WILSON. I was going to make almost the same comment, that in our continuing test program, we ran a test, a full-scale test, on the 24-inch height normal guardrail.

Mr. CONSTANDY. Twenty-four inches?

Mr. WILSON. Twenty-four inches high. This is the height we were using several years ago. And in order to verify that we either should continue or make modifications, it told us we ought to go to 27 inches in height. And this is the way it is being done now.

Mr. CONSTANDY. That is on the shoulder?

Mr. WILSON. That is on the normal guardrail installation as you see here. On a barrier, it would be higher, median barrier.

Mr. CONSTANDY. When you speak of the research conducted in California, these were live tests, were they not? Actual automobiles being smashed into guardrails?

Mr. WILSON. Oh, yes. We have had several hundreds of these tests run into guardrails, curb, median barriers of all kinds.

Mr. CONSTANDY. Those several hundred tests give a considerable amount of data to justify the standard you then used?

Mr. WILSON. Right.

Mr. ZION. In the center, it appears that if someone were guided along this guardrail, it would guide them right into a concrete curb of some kind. Is that true?

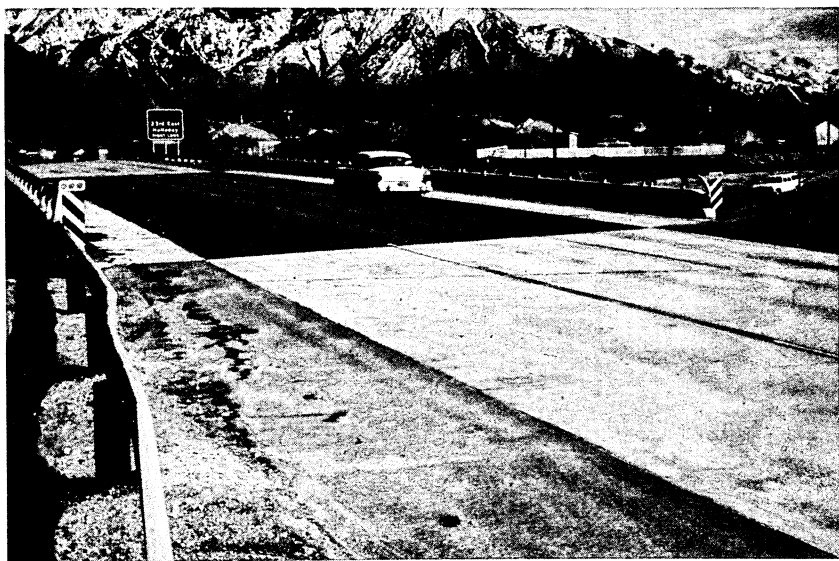
Mr. PRISK. Yes, the curb that is at the base of the rail as you get onto the bridge is a hazard point, and a car sliding on the rail would, if he slid all the way to the bridge, certainly have to put up with that curb on the bridge.

Mr. CONSTANDY. That is a significant point, Mr. Congressman. We propose to get into that in some detail in the next section of this presentation when we deal with the bridges.

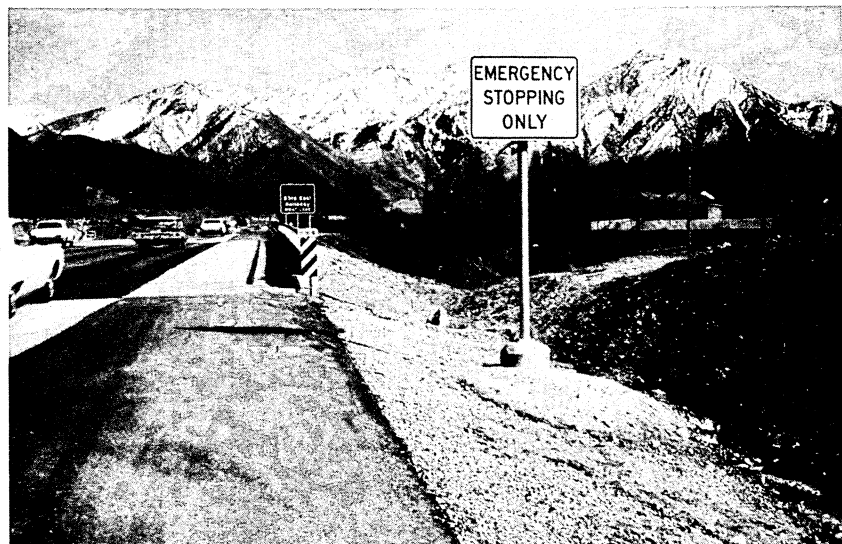
Mr. PRISK. This is a very good observation. We shall consider that a bit later.

I have a slide showing that people actually do hit the rail. There is a similar situation on Interstate 80 where a car has hit that panel of rail and bounced off.

You will notice the treatment on the right-hand side of this roadway; there is no rail at all. The median is protected because of the hole between the bridges. The right-hand side has no rail. And here is a closeup of that same right-hand side [indicating].



I think there is something a little bit ironic about that sign "Emergency Stopping Only," because if you reached the line of that bridge end, you certainly would make an emergency stop.



Mr. BLATNIK. If you would go over the embankment or hit the concrete abutment, either one, it would really be an emergency stop, would it not?

Mr. PRISK. It would be an emergency. True. So this is the condition that we found.

Moving on now, we find then, in the same project, a guardrail which is placed in line, and not buried.

The end, as you see here, is distinguished by the fact it is striped, black and white, for that last 12-foot, 6-inch section. But this portion of it is at the full height, and anyone who went off the roadway on that curve might have difficulty if he struck that. I am almost certain he would.

This is an installation, quite obviously, for the sign bridge. But if you look in the background of the picture, you will see a couple of sign footings here which are pretty big hazards by themselves; the rail stops short of those.

Mr. BLATNIK. Mr. Prisk, again is this the brandnew road, recently completed Interstate System?

Mr. PRISK. Yes.

Mr. BLATNIK. Where is it located in Utah?

Mr. PRISK. This is Salt Lake City.

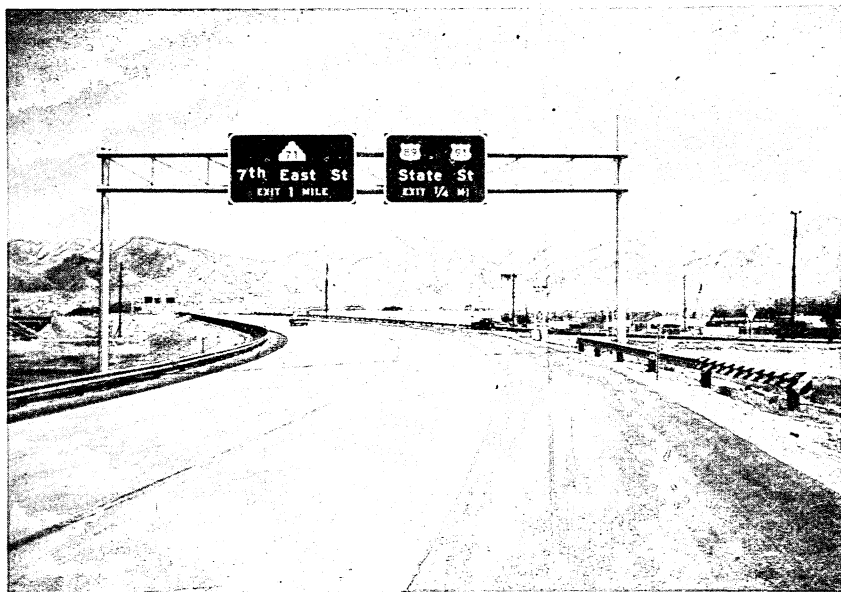
Mr. BLATNIK. Which was completed last December 1966. So you visited this last April?

Mr. PRISK. Yes.

Mr. BLATNIK. It was about as modern and up to date and as fresh or recent as you could find?

Mr. PRISK. Yes. It is a new section, recently opened. Most recently opened. And this is just on the outskirts of Salt Lake City.

Mr. CONSTANDY. Would you move on, Mr. Prisk?



Mr. PRISK. Here is another similar hazard where the rail is there on the approach to the structure, but you have got a pretty good gap there to get through. I don't think you would have to have a small vehicle to get through that gap.



Here is another gap in the rough terrain that I spoke of, between two rails. Originally the contractor used a roadway across here for construction hauling and that section appears to have been left open—is still left open for turnarounds.

Mr. WILSON. On that last slide, I would like to point out a good thing about this installation is the fact that the curb, or dike, normally



used to control drainages, is behind the guardrail. At a lot of installations I have seen in the past years, this dike appears on the front, which would have a tendency to vault people over the rail. In this one I would say this is the place to put it.

Mr. PRISK. This was characteristic of this job all the way through and we were delighted to see that.

Here is another section where the rail runs for a way on the right-hand side, discontinues, and leaves you an opportunity up in this area to get, again, into pretty rough going.

Mr. CONSTANDY. That is quite a drop, incidentally. It doesn't appear so in that photograph, but it is very similar to others we have seen; you can go between the two sections of guardrail; if you went very far you would sail out into space. It is quite a drop.

Mr. PRISK. That is a very deep ravine.

Mr. BLATNIK. Mr. Prisk, what would be the reason for this spacing or discontinuing the guardrail, picking it up not too far beyond?

Mr. PRISK. This is the slide with the deep ravine. There is a road right in here which apparently was used as a haul road by the contractor during the construction period, and now the highway patrol uses this in crossing from this roadway over to this one over here [indicating]. Otherwise, it is a long road to turnaround.

Mr. CONSTANDY. In this instance the gap serves a purpose?

Mr. PRISK. It does serve a purpose.

Mr. CONSTANDY. It is nonetheless hazardous.

Mr. PRISK. It still is. You have an opportunity to impale on this post here. This gap we have seen.

Mr. RICKER. On that previous slide, there was an example of a median barrier with the rub rail.

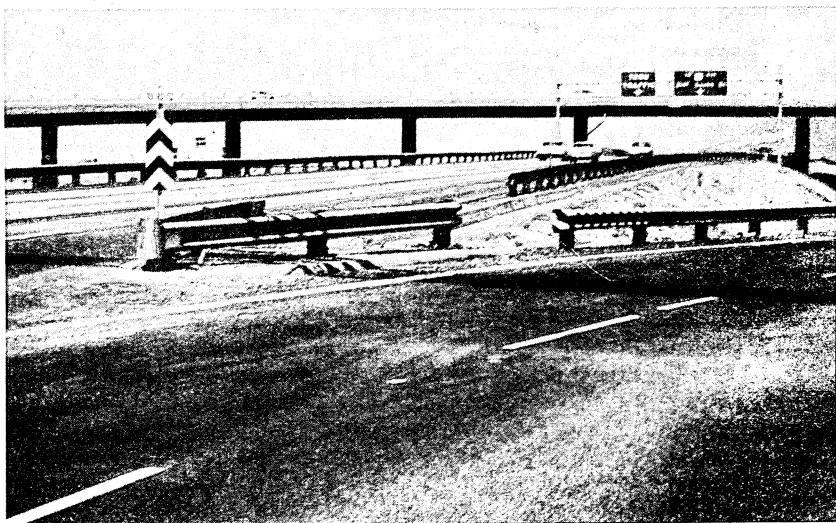
Mr. CONSTANDY. We will get into that. I think there are some later slides.

Mr. PRISK. We will reach that in just a minute.



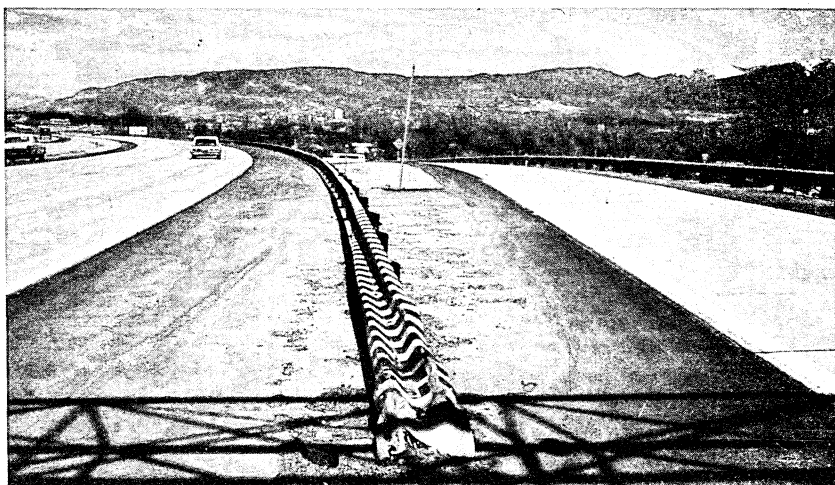
Mr. CONSTANDY. Incidentally, members of the panel have not seen these slides. We thought it would be best to show them initially now.

Mr. PRISK. This is quite a trick to play on those fellows, but they are responding nobly.



Here you have some discontinuous rail in the vicinity of a decision point, or a gore, as we call it. In this case it is a small section, very short section of guardrail installed here, behind the curb, a short break and on the other side the same thing, again giving multiple chances to failures of the rail.

This I would say is a section where the guardrail probably was not needed. An exit takes off into a portion of Salt Lake City down this roadway and this portion of rail [indicating] buried in here carries on around that curve rather nicely, but there is some question as to how much of this rail is necessary until you get up in this area [indicating].



Mr. BLATNIK: One quick comment. It is incredible that we saw, a few slides back, a deep ravine with gaps between two rails, with no reason for a gap. Now referring to where the road was and where the ravine was, we needed a guardrail badly to keep from going over into a deep ravine, and they had no guardrail, and you have it here. Now, this is a rather simple observation, and does not require any complicated, computerized, sophisticated engineering, how to differentiate whether you need a guardrail or do not need it.

How come they do not have it where they need it, and have it where they do not need it, and have it in this very well placed——

Mr. PRISK. I like to think of engineering as being commonsense, Mr. Chairman. That is what you are talking about now, and I think that there are certainly cases where the amount of engineering that is put into developing the design and the application of guardrail is proportional to its costing as it relates to the total cost of the project. The Interstate System is costing more than \$1 million a mile to build but the guardrail at \$3 per foot is only \$15,000 a mile, and I think it is getting, disproportionately, about that much engineering attention, and I think this probably accounts for some of the difficulties that we find in guardrail applications.

This again is what would appear to be an unnecessary installation of rail. This is an entrance ramp coming from the right, main line here on the left of the picture, all of this rail not really in front of anything, except this sign which has a concrete footing on it. I would hate to strike that, but if you discount that particular thing, the terrain does not seem to call for rail at that point.

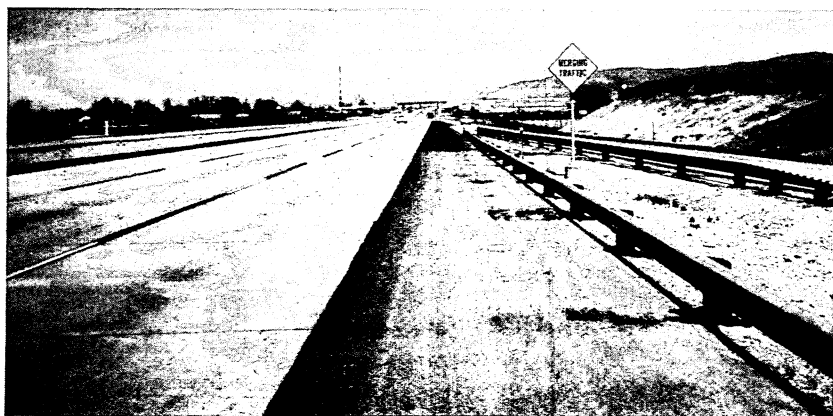
Mr. BLATNIK. The only real hazard there is a concrete plaque which has been engineered and put in by engineers, is that correct?

Mr. PRISK. True.

Mr. CONSTANDY. We would not want to suggest that the guardrail there is to protect the sign. There are a number of signs that have the same legend, "merging traffic," mounted on pedestals that do project above grade, and they are unprotected. It is just a chance that this sign is in a place where it was otherwise necessary to install guardrail. We will see others later that have a sign, the same type, with none.

Mr. PRISK. Right.

Mr. BLATNIK. Mr. Cramer.



Mr. CRAMER. I want to make sure that I understood what you said about the amount of money spent on the engineering for guardrail, which you say is about \$15,000 a mile as compared to a million dollar per mile total construction cost, therefore that the amount of engineering going into guardrails is possibly less than what it should be.

Do I understand, then, that your comment relates to section 121(d) that limits payments for construction engineering to 10 percent of the cost of construction? Is that what you are referring to?

Mr. PRISK. I can talk to you about the design efforts in general that are put into the development of guardrail plans and their place.

Mr. CRAMER. It is true that there is a limit, is that correct?

Mr. PRISK. There is a limit, yes.

Mr. CRAMER. So in this guardrail section costing, say, \$15,000 per mile, assuming it were all guardrail, which apparently it is not, it would be sections of guardrails, then the amount of maximum engineering that could be put into it costwise would be \$1,500, is that right?

Mr. PRISK. If you take that literally, I guess you are correct. Actually, \$15,000 a mile is a single run of rail a mile long. It would come out about that. If you put rail on all sides of all roadways, then you get up to \$60,000 a mile.

Mr. CRAMER. I understand that.

Mr. PRISK. \$6,000 for engineering. I am not sure this \$15,000 worth of attention that has been given, even accepting your low figure—

Mr. CRAMER. But you do not require a breakdown of the 10 percent relating to each phase of the construction, do you?

Mr. PRISK. No, sir.

Mr. CRAMER. So they could put more than 10 percent into the planning and safety features if the State wanted to, were inclined to, is that not correct?

Mr. PRISK. This is correct.

Mr. CRAMER. So the obvious conclusion is that the States just have not been inclined to spend money for safety engineering planning as compared to construction? They want to get maximum construction, is that not the general attitude?

Mr. PRISK. I believe that the accent has been on mileage production.

Mr. CRAMER. That is right, and that has been the attitude of the Bureau, has it not?

Mr. PRISK. This is not the attitude of the Bureau currently. It has been.

Mr. CRAMER. In other words, currently since these hearings started, since we passed the Safety Act last year, we are looking into things that happened prior to that time, and it appears, according to these slides, that even currently there is not much interest in safety, based upon the evidence we have.

Mr. PRISK. Well, I do not know whether I can say any more than the fact that the Bureau's first contact with the State highway departments in a formal sense was devoted totally to considerations of safety. The Director of Public Roads a few weeks ago wrote to the head of each State highway department asking that such items as we are looking at this morning occupy a major place in the program.

Mr. CONSTANDY. Mr. Ricker, do you want to comment?

Mr. RICKER. It might be worth while noting the standards for guardrail placement are related to the cross section of the road and it is rather difficult to anticipate in advance just how much guardrail

you are going to need. So it is pretty much tailored during construction, rather than as part of the design, and we call it the windshield view you are seeing here, which in the slide here looks quite different than it looks on a set of plans, so a great deal of this depends on the skill of the people who are actually saying put more guardrail on or take it off, and many times we go back and observe the road after it is open for traffic, and we see the need for guardrails and add them. That is a common practice.

Mr. CONSTANDY. But the common practice bears on the design?

Mr. RICKER. Oh, it certainly does, but the basic design of the guardrail is on cross section, not on the windshield view.

Mr. CRAMER. Mr. Ricker, as I see it, the basic problem has been there are no standards, criteria, or guidelines relating to the type of guardrail construction, relating to placement of guardrail as it relates to safety in particular, which we have seen displayed throughout in these slides. That has been, perhaps, one problem in the past, has it not? You say to put up a guardrail; you do not say where to place it, how to construct it for safety purposes, how to ground the end of it so it does not itself become a hazard?

Mr. RICKER. I guess we have to fall back on Special Report No. 81 of the Highway Research Board in which we put our best thoughts together at that time.

Mr. CONSTANDY. Was that ever adopted, Mr. Ricker, to your knowledge, as actual policy?

Mr. RICKER. I do not know that it was actually. It was sent out by the Bureau of Public Roads with a letter of endorsement.

Mr. CRAMER. Well, this was put out as a report by the Highway Research Board of the Division of Engineering and Industrial Research, National Academy of Science, National Research Council. To what extent were the States required to conform to this?

Mr. CONSTANDY. Mr. Huff.

Mr. HUFF. Mr. Congressman, several years ago—I am sorry, I do not know how long ago, I would guess some 5 or 6 years ago, the American Association of State Highway Officials took up the subject of guardrail, being closely associated with the Highway Research Board. It was decided to let the Highway Research Board complete its studies which they had done, and I do not know whether AASHO has taken formal action on it or not, but those of us involved in AASHO have accepted it.

Mr. CONSTANDY. I do not think it has ever been adopted by AASHO as policy.

Mr. HUFF. If it has, I do not know about it.

Mr. CONSTANDY. I think what happened upon completion of Special Report No. 81, it was sent to the AASHO committee and was reviewed and the comments of those members were reviewed by the members of the committee who produced Special Report No. 81 but I do not think it was formally adopted by AASHO.

Do you know, Mr. Prisk, whether it is a requirement of the Public Roads as something to be followed?

Mr. PRISK. The Bureau of Public Roads in August 1966 issued an instructional memorandum identified as 21-5-66—excuse me, July 1,

1966, is the date of that instruction—saying that the criteria in the Research Board report should be followed.

Mr. CONSTANDY. Should be?

Mr. CONSTANDY. They make a distinction between “should” and “shall,” do they not? In other words, it is not mandatory unless it says it shall be followed?

Mr. PRISK. This is normally used as a recommendation.

Mr. CONSTANDY. Yes. The date it came out was in 1960, was it not—81?

Mr. PRISK. HRB 81—1964.

Mr. CONSTANDY. 1964. I believe we should have that in the record.

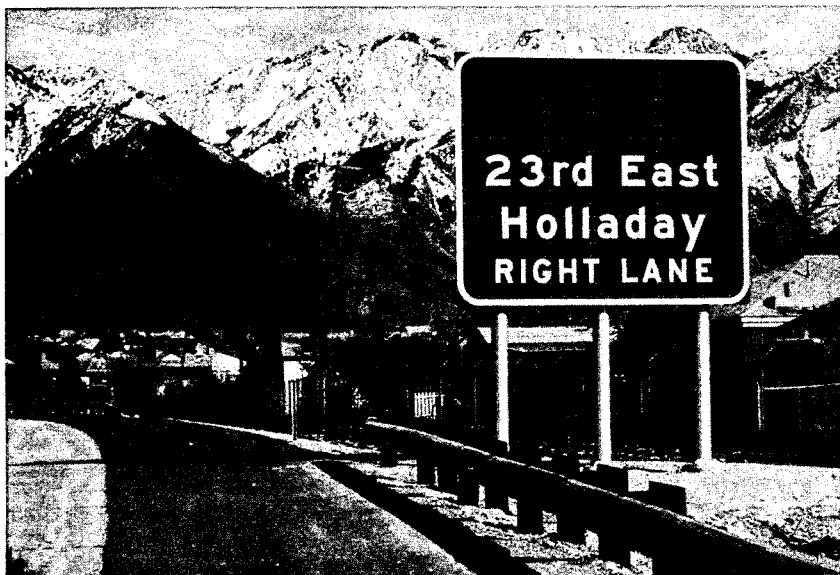
Mr. CRAMER. So I get back to my point that there is no requirement that these safety features be followed and, secondly, that the Bureau's endorsement of the report was only in July of last year. Is that correct, Mr. Prisk?

Mr. PRISK. That was July 1966. I think the instructions that have more recently been issued are stiffer than that, and certainly would bring into full use the recommendations of the HRB 81 findings.

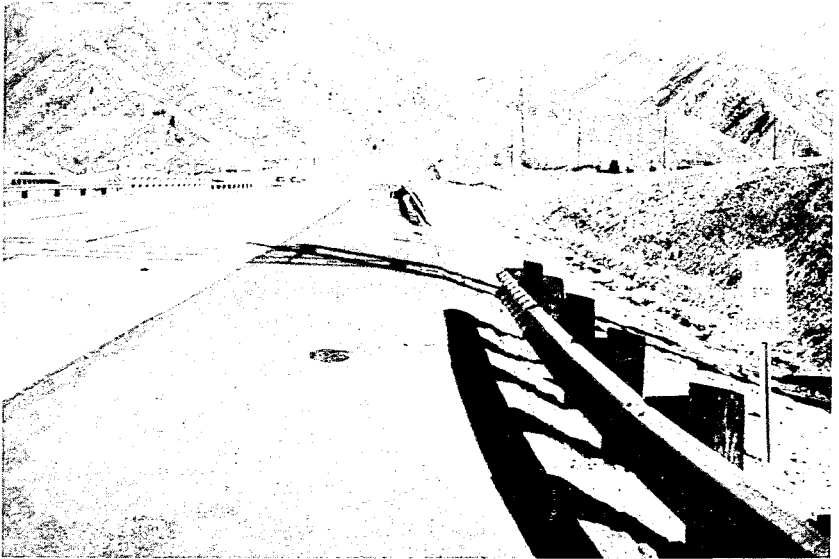
Mr. CONSTANDY. If we could move along, Mr. Prisk, we have quite a few slides to show.

Mr. PRISK. Yes.

Here is a case also in Salt Lake City where there is another gap, as you see, running from here down to here [indicating]. This rail was put in and in this case is blocked out for shielding this highway sign at the roadside.



Here is a case of another gap where there is a rail discontinued here and picked up over here [indicating]. Again the same sort of situation.



Here is a flared section rather than short, again protecting, shielding a sign. I do not like to say "protecting" a sign; hopefully we are protecting the motorist but it would be possible, again, to get around the edge of this rail. I think that longer runs of rail in these situations would be desirable.



Here you see again about the same kind of situation, rather short run of rail around the sign; no consideration of the hazard presented by these side piers in this case.

Mr. CONSTANDY. Which would seem to be a more severe hazard.

Mr. PRISK. Well, these certainly have more decelerating ability than these poles. [Laughter.]

Mr. CONSTANDY. It appears a greater hazard. They are unprotected, but the sign which has four steel posts supporting it does have a guard-rail in front of it.

Mr. PRISK. I think we can all see that the four concrete piers are bigger than the four steel poles.

Mr. CONSTANDY. That is right, Mr. Prisk. Note there, too, when the rail was installed for the roadway, the State followed one design standard, and by the time they came to letting the contract for installation of signs, they upgraded the design standard for the guardrail, hence we have roadway guardrail on this project not blocked out, and the guardrail protecting the motorist from the sign is of a higher design. One thing, it is blocked out.

M. PRISK. Yes. There is definite improvement that is installed here on this project.

Mr. CONSTANDY. So we see some improvement within the same project, even though the protection of the motorist is handled entirely separately when it involves a sign as it does here.

Mr. PRISK. True.



This again in the picture is a closeup showing about where the rail stands as far as these piers are concerned, and the sign post.



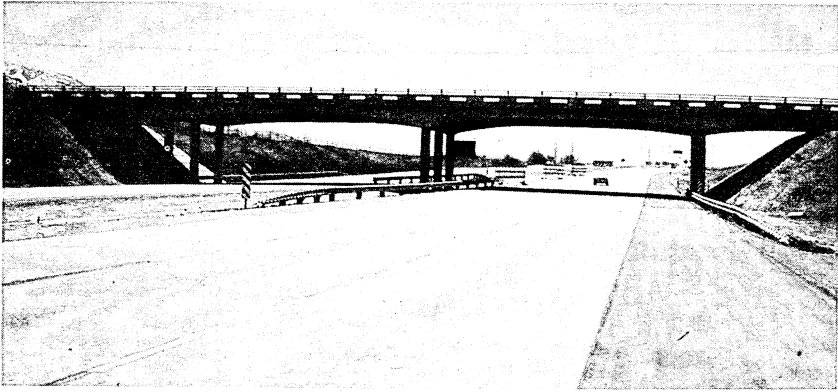
Here is a rail going partially through a structure on the median side and over on the far side for the opposite direction, the same kind of treatment and same kind of sign treatment as you see in the distance.

Mr. CONSTANDY. Of the four piers there, one of them is protected by the guardrail and the other three are exposed.

Mr. PRISK. That is true.



Now here again is a somewhat newer section we had the opportunity to see while we were in the State Lake City area. This is on I-15, and in this case there is a much longer guardrail, buried as you see desirably and carried right on through, past the median piers in this case; and also the same thing on the margin of the roadway. So there is evidence on this particular project of picking up what appears to be a more desirable practice.



Mr. CONSTANDY. So a third step in the evolution for improvement of guardrails is what you see?

Mr. PRISK. That is right.

Mr. CONSTANDY. I would like to say that this project was opened about the same day as the other Interstate project, although this one has higher design standard as far as guardrails go. Mr. Huff?

Mr. HUFF. I would like to remark there is a fourth evolution that should be on there. It should be anchoring the downstream end of the rail as well as the upstream rail.

Mr. CONSTANDY. For what purpose, Mr. Huff? To strengthen the guardrail?

Mr. HUFF. Yes, that is correct. Our latest designs are incorporating that.

Mr. PRISK. This is another case where the rail is flared and carried through the structure.



Here is a closeup running through the bridge on the median side.

Now, here for some unexplainable reason you find that this guard-rail is buried in line at the very edge of the pavement and runs through the structure, but there is essentially no real protection for that angle of departure from the roadway insofar as that center pier is concerned.



Mr. CONSTANDY. This is the same bridge we looked at in the preceding—

Mr. PRISK. That is right.

Mr. CONSTANDY. Just looking at it from another angle, they improved the length of the guardrail but we see it is still possible to go behind it and strike the median piers.

Mr. WILSON. I do not know how the other members of the panel might feel but in this particular installation, I would rather see the rail nearer the center piers, not to the point where if they happen to bend over slightly, they would hit those piers, but I think giving extra maneuvering room to traffic is extremely important here, and I would move that over about 10 feet.

Mr. CONSTANDY. That is from the left shoulder closer to the median piers.

Mr. HUFF. I agree with that.

Mr. CONSTANDY. You agree, Mr. Huff?

Mr. HUFF. I do; yes.

Mr. CONSTANDY. Mr. Skeels?

Mr. SKEELS. I would agree.

Mr. CONSTANDY. How about you, Mr. Ricker?

Mr. RICKER. I would agree.

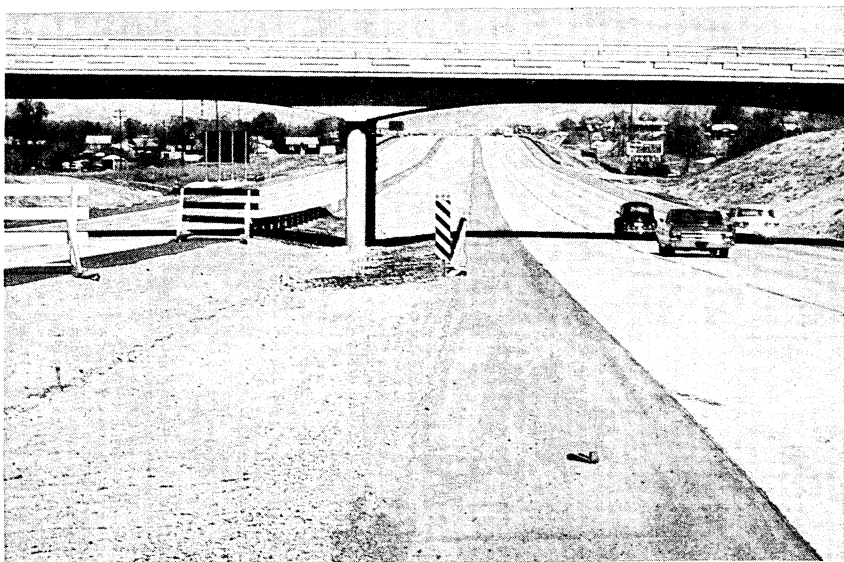
Mr. CONSTANDY. Mr. Wilkes?

Mr. WILKES. Yes, I would agree.

Mr. CONSTANDY. We have unanimity.

Mr. PRISK. That is remarkable.

Mr. CONSTANDY. Yes.

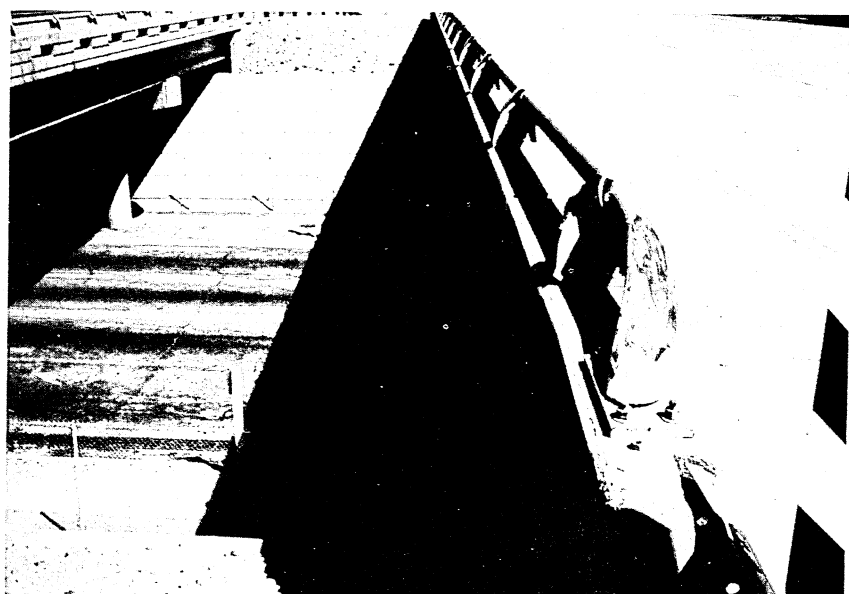


Mr. PRISK. Next we have an approach to a twin bridge showing the treatment there. We just looked at a pier treatment. Here again the rail is flared, runs on down the slope of the median, so that the approach end is rather low and then comes on into the structure itself.

Mr. JOHNSON. Mr. Chairman, may we have some identification?

Mr. CONSTANDY. These photos we have seen are in Salt Lake City. The last few slides have been of Interstate 15 south of Salt Lake City. Both were constructed at about the same time. We are back here on Interstate 80.





Mr. PRISK. Here are some pictures of a bridge which again is a twin-bridge situation. You can see the edge of the traffic rail on the bridge itself has been damaged by collision, very substantial violence, of course, involved to cause that much damage. In the case of this accident a man rode the approach rail which you see here; he came off this curve pretty much straight ahead, came on up to the ramp section of the rail or at least got on top of the rail and rode on into the bridge and caused this damage. He then went through the air and landed on



all four wheels down here by this parking sign [indicating]. According to the measurements, he traveled 85 feet through the air and made a 26-foot drop and walked away from his car. Local police wanted to know which way he was moving on this roadway, and he said he was not, he was up here. [Laughter.]

Mr. CONSTANDY. I think another worthwhile thing to mention is that, according to police officers, he was going within the legal speed limit at the time he had the accident.

Mr. PRISK. True.

Mr. CONSTANDY. Fifty, and the speed limit there is 60.

Mr. WILSON. Are we going to talk later about the decking of structures?

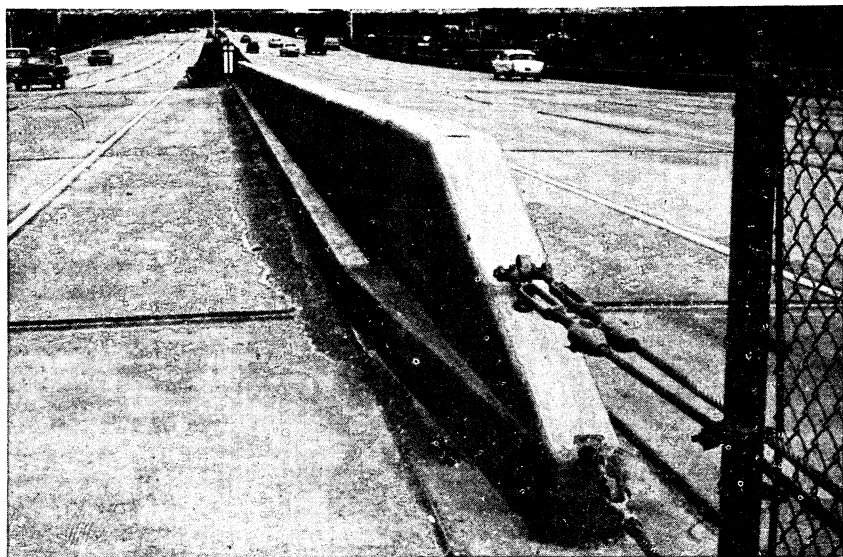
Mr. CONSTANDY. Yes. We hope to get into that when we are dealing with structures themselves.

Mr. PRISK. Just could not avoid throwing one of these in. We have more structural pictures later. Here is a very interesting collection of guardrail, I guess I would have to call it.

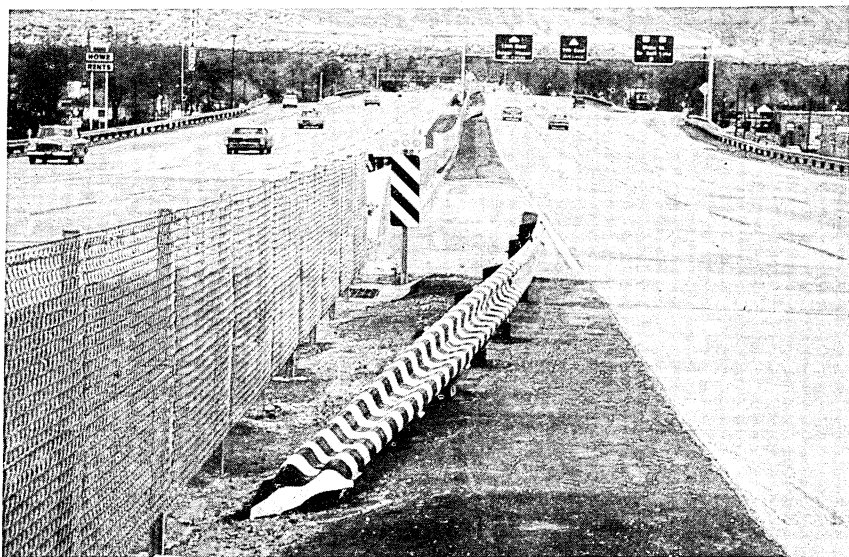
You see the California barrier type with the anchor fence. Here is the twisted W-beam rail which comes on out, unfortunately, almost to the edge of the pavement itself, and down here there is a bridge, so on the bridge they have elected to build a wall section and there is a concrete wall here. They have decked this bridge over. This is a twin-bridge situation again, but instead of leaving that hole like the one we just saw, and this is very close to the same location, they have decked this one over and actually built a concrete wall in that area, so we have three different types of median barriers. Here is one here of concrete. Another one is of cable, and another with a W-beam.



Here is the way the concrete wall looks when you are up close, and of course, I-bolts here to hold the cables for the California-type barrier system. That anchorage, of course, is a necessary part of this system's working, but it is rather unusual that you have three types of barrier here, and as you stop and look at that, you find that there really is not very much reason that you can see for continuing this.



This is done not just at this location but up here [indicating] and at still another place, so that you have this rail which obstructs the clear shoulder for one thing. You have this cable rail which does its



job back here on the approach [indicating], and a wall up here [indicating]. Conceivably I think you might theorize at least that you could select one barrier, any one of these three barriers, and carry it straight through on a median line and possibly get a superior job. I have a little difficulty seeing why three types are used at that point.

Mr. CONSTANDY. Paving that space between the twin bridges avoided the other hazard we have just seen.

Mr. PRISK. They get credit for that; yes, sir.

Mr. CONSTANDY. Had they used only the chain link fence cable barrier, it would have been good.

Mr. PRISK. Yes.

Mr. CONSTANDY. It would not have been necessary to protect the motorist from the transition between the chain link fence and the bridge structure, is that not true?

Mr. PRISK. That is the place you have to watch, of course, that anchor point and the exposed end of the wall.

Mr. CONSTANDY. Might this have come about because two different groups of people designed their own relative speciality? You have roadway engineers designing and specifying chainlink fence and the bridge engineer, at the same time, doing a complete design of the bridge?

Mr. PRISK. I have seen that happen but whether that is the case here is difficult to say; impossible for me to say.

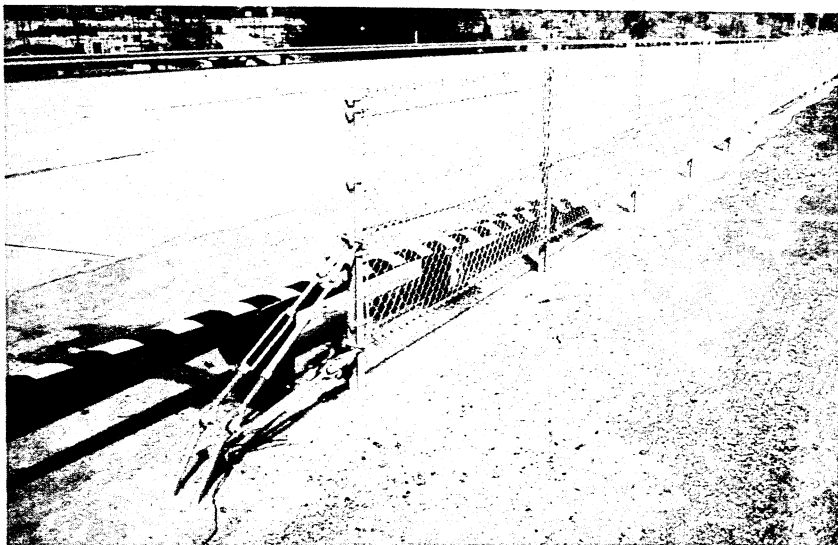
Mr. CONSTANDY. Do you want to say something, Mr. Wilson?

Mr. WILSON. I was going to say, Mr. Chairman, this can be overcome. We have devised a continuation of this kind of a chainlink cable across the deck of a bridge by the design of a proper post well for it, and that could be overcome.

Mr. CONSTANDY. You would have omitted the concrete parapet?

Mr. WILSON. Yes; we would have omitted that and, I think in this case, I might even have taken the risk of leaving out this piece of rail entirely. It may be slightly more hazardous than letting a fellow ride along that fence and hit that rail because it is so close to traffic. You notice it is about 2 feet away from the travelway.

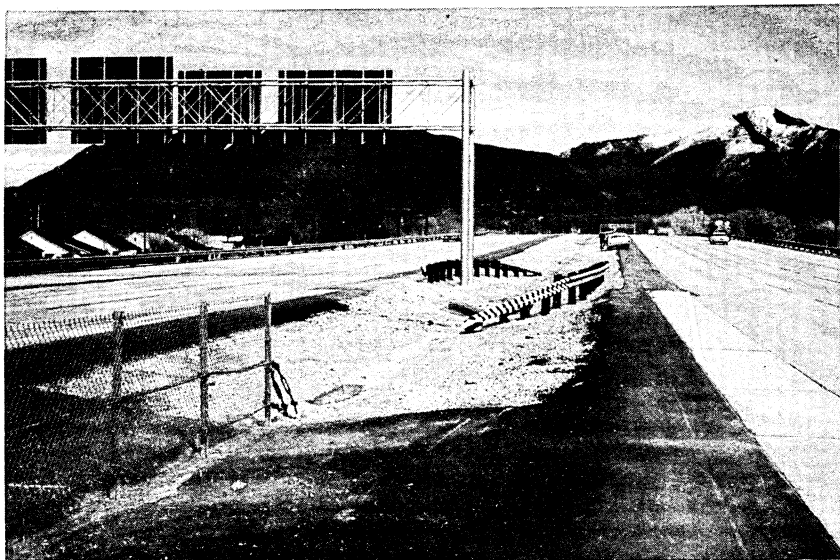
Mr. PRISK. Hardly that.



Mr. PRISK. As we move along, we see the other end of this transition where the rail and cable fence come together, begin another hazard point, at least from one side.

Mr. PRISK. And here is the transition between a paved median and again you have this end fairly well exposed [indicating]. There is quite a bit of care taken to protect the overhead sign structure supports, as you will see here.

Mr. PRISK. There is a decrease in the number of lanes and width of the roadway at this point.



Mr. PRISK. This is the median barrier that Mr. Ricker spoke of. This is a relatively high one we found. This is toward the east end of this Interstate 80 project in Salt Lake. The top of this is 36 inches



and the rub rail down here at the bottom is to prevent, again, wheels from getting into these posts.

Mr. McEWEN. Will you go back—what is that object that seems to be sticking out from the top of the sort of W-beam?

Mr. PRISK. This?

Mr. McEWEN. Yes.

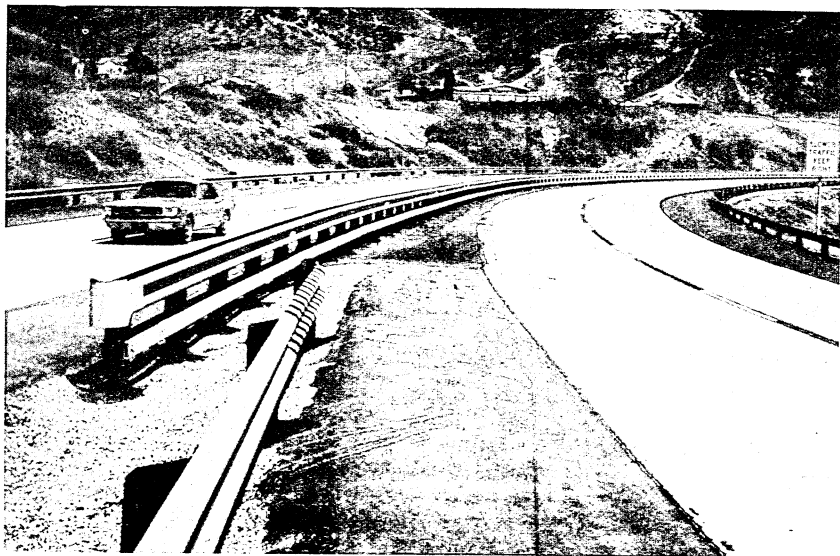
Mr. PRISK. That is a reflector unit. There is one up here [indicating] and they delineate the rail at night for drivers. You see reflection from this surface and from this one [indicating] helps to guide your course.

Mr. McEWEN. They would break away?

Mr. PRISK. Yes, that is a very thin piece of metal just fastened under the bolt.

Mr. McEWEN. Thank you.

Mr. PRISK. This is an overlap, again a transition between two different types of treatment. The left edge rail is going nicely into the median barrier, apparently with no great difficulty going in that direction. Coming the other way you have a possibility of hitting the back end of this rail if you go straight-to left of the roadway.



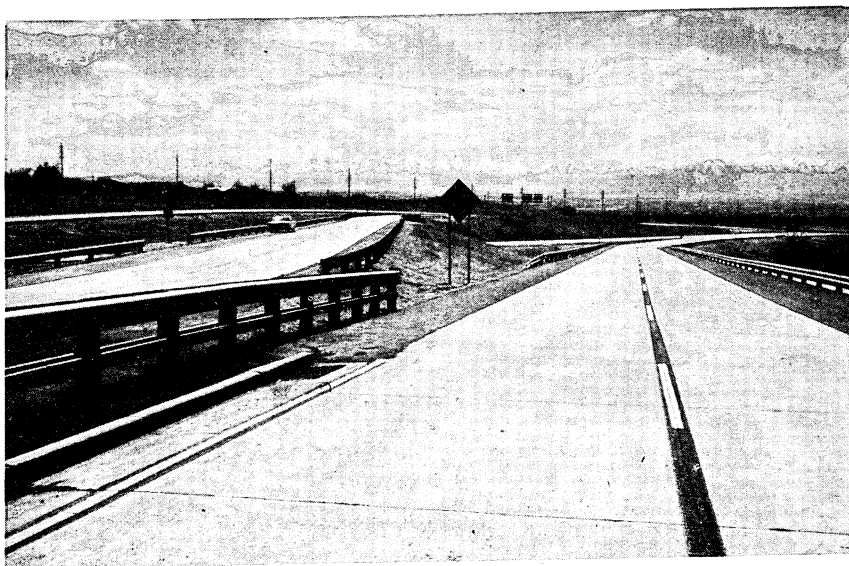
Mr. PRISK. Here is another shot about in the same—just a little farther to the east, where this high rail stops and the sign is in here, and then again you introduce the standard twist and buried section which again is another rather unaccountable kind of gap.

Mr. CONSTANDY. How could that have been done, Mr. Prisk?

Mr. PRISK. This could have been carried straight through as a single rail after you get past this transition area.

Mr. CONSTANDY. The sign at the end of the next piece of guardrail?

Mr. PRISK. Yes. While we are looking at gaps, there is another one over on that side almost unaccountable in some of these. Now we move into another State, after treading pretty hard, perhaps, on Utah.



Mr. CONSTANDY. Before you begin this, do any members of the panel have something they would like to say about the impressions they have from the slides taken in Utah? Mr. Skeels?

Mr. SKEELS. I have just one comment on the last median barrier which I noticed was not blocked out. It did have the lower rub rail, but the upper one was not blocked out. This seems inconsistent with recommendations that I have heard. I agree with all your comments about the gaps. These are unexplainable. In this picture also you will note there is a curb back in front of the barrier at the left. I kind of assume perhaps this is a bridge, but this might be a good point to bring out the fact that, in general, all that curbs in front of guardrails do is help cars to get over them.

Mr. CONSTANDY. Do any other members of the panel have comments?

Mr. RICKER. I think there is a hazard here. We sometimes look at guardrail installations, and we say we must have a longer approach rail on this particular section, and we connect the two sections to avoid the opening between. We may overdo it and finally line the whole road with guardrail. I do not think this is what we are really intending when we buy right-of-way and flatten slopes, and so on. We should remember a guardrail is a crutch we use, and we should avoid a continuous line of guardrails for the whole job.

Mr. CONSTANDY. Yes, that is a good point. Of the pictures we have seen, do you agree some of the gaps should have been avoided, however?

Mr. RICKER. I think gaps should be avoided, yes.

Mr. CONSTANDY. Mr. Wilson.

Mr. WILSON. During my tenure in design and construction, placement of guardrail was in fact—this was a number of years ago—was based on pretty subjective analysis. You take a look at it and make some judgments. However, recently there has been some work done in

connection with where do you use guardrail and where, if you use it, do you create more of a problem than you correct; and we have put out some information on the use of guardrail, particularly on slopes. If you notice the slope behind the sign from the roadway coming from the other direction, it appears as if it were somewhere in the neighborhood of three to one. We would normally not put a guardrail on a slope of that nature because in our investigation of several hundred accidents where cars have gone over slopes, and there has been a guardrail at the top, we find there would be less hazard to just let the car go over and go down the embankment.

Now, this may seem like not the thing to do, but this has been our experience, and I think on that slope down there we would not use a guardrail.

Mr. CONSTANDY. Thank you. Mr. Huff.

Mr. HUFF. I would like to make one observation in relation to the chairman's question why do you use guard fence when you do not need it and why do you not use it at the point where you do need it. I think there is confusion in the minds of a great many designers; this confusion as to whether you are putting up guardrail for protection of human life or protection of something they might run into or whether or not it is for delineation. Now there is a great deal of guard fence that is put up for a simple safe delineation that would serve the same purpose as guardrails.

Mr. CONSTANDY. Thank you.

Mr. CRAMER. I would like to ask a question.

Mr. PRISK. Surely.

(At this point, Mr. Johnson assumed the chair.)

Mr. JOHNSON. Yes, Mr. Cramer.

Mr. CRAMER. We have been sitting through better than 2 weeks now of hearings indicating that there are a number of death traps being built into these so-called modern lifesaving highways. The Interstate System, being built with 90-percent Federal money, was expected to save something like 8,000 lives a year. They have planted trees along the right-of-way, which themselves can be death traps.

You see studies giving more consideration to bridge design than to safety. We are finding all kinds of engineering mistakes or oversights relating to safety. We are seeing safety downgraded. We are seeing the construction of mileage being put first and safety features second. You have now adopted highway design and operational practices relating to highway safety, which I gather in future construction is going to have a substantial effect and make certain that safety is designed into the highway. Now, my question is, since over 50 percent of the Interstate System has been completed and we have seen ample evidence of deathtraps in the gore areas and what have you, what approach can be taken that will encourage the States in spending additional funds or spending funds in the future to upgrade safety on already constructed highways. The States obviously are going to want to finish the Interstate System; that is going to be their primary objective. What can be done to assure spending some of these funds for going back and taking these deathtraps out of the highway? There is no special fund available under the Highway Safety Act of 1966 for construction. As a matter of fact, we specifically prohibited spending funds for the construction of safety items. Research, yes, but actual construction, no. This is going to cost a lot of money.

Mr. PRISK. Well, the Bureau of Public Roads has been receptive to proposals and has urged proposals to correct existing faults and existing sections of the Interstate System as well as incorporate desirable improvements in new sections yet to be built, and the essence of our most recent instructions to the field include both approaches; namely, to improve sections yet to be built and to go back on sections that are still deficient, and to make corrections there with Federal aid participation.

Mr. CRAMER. How can you encourage the States to do this, though? They get a certain allocation of money; they spend that money for construction or for modification of existing highways.

They are going to want to build more miles, basically, are they not?

Mr. PRISK. Well, the law leaves the initiative with the States.

Mr. CRAMER. I understand that. How can we encourage them to get interested in safety, particularly relating to already built highways.

Mr. PRISK. Well, I think through the medium of this hearing there would be some interest. We have seen some turnaround, Mr. Congressman, as a result of our activities and these visits; corrections have been made.

Mr. CRAMER. Well, I urge further, and I bring this out because the committee, I think, is going to have to give some consideration to it, the legislative Subcommittee on Roads, anyway. The General Accounting Office has issued a ruling that once an Interstate highway is built to standard, has been approved, finalized, when you go back to do any modifications or improvements, Federal 90-10 Interstate funds cannot be used, and the cost sharing is reduced to the 50-50 ratio. Now that is not going to be any encouragement to the States to go back on a 50-50 matching basis and improve already existing Interstate highways from a safety standpoint, is it?

Mr. PRISK. I believe that there have been cases, Mr. Cramer, where 90-10 money has been used to correct existing deficiencies on the Interstate System.

Mr. CRAMER. Well, just a minute. I want to finish that point. That would only be in the case where the Bureau made a determination that the construction had not actually been completed; in those lengths where the Bureau determined it was completed, then it would be 50-50 matching, would it not?

Mr. PRISK. This is possible.

Mr. CRAMER. That is true, is it not?

Mr. PRISK. Yes, that is true.

Mr. CRAMER. Well, that presents a serious problem, does it not?

Mr. PRISK. Yes, I am sure it does.

Mr. CRAMER. The State is not going to take 50-50 money for improving a presently completed Interstate highway for safety purposes when they can get 90-10 money for new construction. That is a considerable deterrent, is it not?

Mr. PRISK. I am sure it would make a difference.

Mr. CRAMER. Well, I think it is quite obvious then that one approach the legislative committee ought to consider is that the Congress might feel that on safety projects the State should continue to be able to get 90-10 matching for the specific purpose of safety features on existing Interstate highways.

Secondly, consideration should be given to providing some kind of an inducement for the States to go back and do the safety job that was not done. I mean, after all, we are letting the States spend 75 percent money for beauty, and it would seem to me it would make some sense to give safety equal consideration with beauty.

Mr. PRISK. Mr. Cramer, the last instruction to which I referred has this phrase in it: "Federal participation will be the usual pro rata amount applicable for the system involved."

This is the Interstate System. I see no reason why this would not mean 90-10 funds would be available.

Mr. CRAMER. I understand that, but the General Accounting Office does not agree.

Mr. PRISK. Well, I can only reflect the attitude the Bureau of Public Roads has taken.

Mr. WILKES. Mr. Prisk, if I may say, I believe we can furnish a number of Interstate projects that have been authorized when they are so identified as safety projects with the appropriate 90-10 financing on completed sections of the Interstate; so they have been authorized where they are identified as safety projects.

Mr. CRAMER. Even though the projects have been completed?

Mr. PRISK. Yes, sir.

Mr. CRAMER. I would like to have for the record a list of those projects.

Mr. PRISK. I think that can be furnished. I am sure there are projects that have been handled that way.

Mr. CRAMER. GAO determination could pose a problem relating to some of these if it were raised, is that correct?

Mr. PRISK. Yes.

Mr. WILKES. That is correct.

Mr. CRAMER. I understand that the AASHO, testifying before this committee in executive session—the record now is made public—recommended upgrading the Interstate System with Federal matching money after the system is completed, but I speak for myself as being one not willing to wait until 1973, 1974, or 1975, until it is completed in order to do something about these deathtraps built into existing highways.

That is all, Mr. Chairman.

(Mr. McCarthy assumed the chair.)

Mr. McEWEN. Mr. Chairman I would like to ask just one brief question of Mr. Prisk. Does the Bureau of Public Roads have a standard as to where the guardrail should be placed in relation to the slope, if it is more than 1 in 6, or whatever grade you take?

Mr. PRISK. No, sir.

Mr. McEWEN. That is left to the States to determine?

Mr. PRISK. We have endorsed, the closest thing we have come to this endorsement of the recommendations of H.R.B. 81, in which there are projected standards. I think that as you move from State to State the establishment of a nationwide standard becomes one that would be extremely difficult to arrive at a single set of values, and so we have considered this more on a project by project basis and on the basis of the principles that are enunciated in the H.R.B. 81 report more than any other way.

Mr. McEWEN. Well, one of the things I notice, Mr. Prisk, traveling quite a few miles on interstate highway, is where off the highway you

have a rather steep slope, guardrails were placed but then you come to a cut through the rock, where there was not any slope of any kind, just a sheer rock wall, and in none of these sections did I find any guardrail at all, and I wondered if you or the members of this panel would care to comment on that.

Mr. CONSTANDY. Mr. McEwen, we will have examples of that as we go through these slides. In a couple of projects at least there were some situations of that kind.

Mr. McEWEN. I will be happy to hold the question if we are going to come to slides on this.

Mr. CONSTANDY. Mr. Wilkes?

Mr. WILKES. That was a point I was going to make, that most of the guardrail that has been installed on a project is on the basis of standards developed by each individual State and that the designer can only roughly indicate where in his opinion the guardrail would be required and it is most desirable to feel the engineer constructing the project be allowed sufficient latitude to add or delete a guardrail as a project is developed, but the guardrails, like so many other items of highway hardware, are generally installed from standards that are developed by each State.

Mr. CRAMER. Well, Mr. Chairman, I wanted to ask if the panel or any of its members could give the committee a recommendation as to what can be done as an incentive to bring the existing highways up to proper safety standards. Now, we gave a 0.5 percent bonus by legislation in 1958 to the States for billboard control. We didn't hesitate to do that for beauty. What can we do to encourage the States to do a job on safety on the present highways? Does any member of the panel have any thoughts? We want to face that question.

Mr. WILSON. I think every State has some type of program where they are going back and looking at their present highway system. The Bureau of Public Roads asked us a couple of years ago to start a program of spot improvements where accidents were happening. There were places where accidents were apt to happen, and we have gone into a considerable program and I am sure other States have, too, although they have not given us any more funds to spend on this program. The money that has been spent comes out of our regular Federal-aid appropriations, but almost any highway department, in taking a look at their accident-prone locations and analyzing what can be done toward accident reduction, I think, would certainly want to get into this in some depth.

Mr. CRAMER. How much is California spending on safety?

Mr. WILSON. Our safety program, which involves merely spot improvements, or projects where safety is a primary consideration, is up to about \$15 million annually. We do about 600 projects per year from a mere placing of a sign—a few dollars' cost—to up to a million dollars per project. This was as a result, or we had a program going prior to it, where we made a very detailed inventory of our State highway system and turned up about 4,000 locations that met the criteria we had established, which was about five accidents per year on a one-tenth mile section of roadway. We took a look at these 4,000 locations and decided on about 700 of them we could do something with ordinary traffic-type improvements, channelize, curve signals, this sort of thing and now we are in a 3-year program to, you might say, wipe out these 700 places and we are on a level now of doing

about 600 per year and we think this program is paying off. When these 700 locations are met, we expect to have 4,800 less accidents per year as a result of it.

Mr. CRAMER. Well, I think that is an admirable program, but by your testimony I assume if you had adequate funds you could do it even better and more expeditiously.

Mr. WILSON. I think all the traffic engineers would like to have more money because they feel they can do a great deal here.

Mr. CRAMER. Would any other members of the panel like to comment on what their States are doing or what they think should be done?

Mr. HUFF. On our 6,000- or 7,000-mile system in Texas, we attempt to improve and upgrade at least 2,000 miles each year. Now, of course, safety is a very general term. Probably you can't do a complete job on it, but you can take the highest priority items and concentrate on them, in our opinion, the widening of bridges and paving of shoulders and some of the things we have been talking about here, but also other things in the spectrum of safety. We concentrate on this 2,000 miles a year.

This program which is mostly orientated to safety, we call it our safety betterment program, will run between \$30 and \$40 million in an average year.

Mr. CRAMER. So Texas is spending \$30 to \$40 million a year?

Mr. HUFF. Yes, sir.

Mr. CRAMER. On upgrading existing highways.

Mr. HUFF. Yes, sir. Those are State funds.

Mr. CRAMER. All State funds.

Mr. HUFF. Yes, sir.

Mr. CRAMER. California uses State funds or matching funds?

Mr. WILSON. Primarily State funds. We are getting some 90-to-10 participation on some pieces of interstate where we are doing some minor work.

For the record, I would correct on the Interstate, the safety work we are doing on there is State. We do expect to get Interstate money on that, for such as modification, rigid sign bases, and so forth.

Mr. CRAMER. Getting 90-10?

Mr. WILSON. We hope so, sir.

Mr. CRAMER. Yes.

Mr. RICKER. On the subject we are discussing this morning, guard-rail, we have not had any trouble getting 90-10 funds to go back and add it as a median barrier or guardrail for bridge piers and so on. As you get into some of the other subjects of safety where there would be more money involved, bridge widening, rebuilding interchanges and so on, particularly those that were incorporated into the Interstate System but were not designed according to the standard, there we will need money.

Mr. McCARTHY. Mr. Prisk, just on the point raised by Mr. Cramer, we have these figures here, 65 percent of the accidents and 61 percent of the deaths involved one vehicle, and 88 percent of the single-vehicle accidents and 89 percent of deaths, the vehicle leaves the road. I am wondering, do you have any figures indicating how the various States are doing? I assume there are some States that have a better record than others, each one I gather pretty much going its own way. Would there be a way of making available to the other States, say, the top

10 States in terms of safety, what they have done, what kinds of guardrails they have, what their procedure is on location of signs and so forth, sort of an information gage on safety. Is there anything of this sort being made available by the Bureau?

Mr. PRISK. The Bureau of Public Roads mails reports from States as they become available on subjects of this sort, reports that are of particular interest. I recall as a specific example, the research performed in California on wrong-way driving, the use of ramps at interchanges in the wrong direction, causing headon collisions through this maneuver. A research report on this work was circulated to all State highway departments with the request that this be considered as they treated this problem.

This is one example, and as things appear that are of merit, these also are sent to the State highway departments.

Mr. McCARTHY. Which is the safest State in the Interstate?

Mr. PRISK. This is impossible—we have no yardstick to measure that.

Mr. McCARTHY. Well, you have statistics on accidents from each State, right?

Mr. PRISK. Yes.

Mr. McCARTHY. Then you must know which is the safest State?

Mr. PRISK. It is very difficult to measure this because it involves putting lives in terms of dollars and how much is a life worth in terms of dollars? You can count property damages in terms of dollars, but you can't count broken bones in terms of dollars, injuries, nor can you count the loss of a life, specifically or accurately.

Mr. McCARTHY. Well, is there any place where figures are published on death rate by State on the Interstate System?

Mr. PRISK. We are compiling right now State by State figures for experience on the Interstate System, yes. I would be glad to get this available for the next session of the committee, just where we are at the present time, so that it could be part of your consideration.

Mr. CONSTANDY. We will have testimony later in the hearing relating to that, Mr. McCarthy.

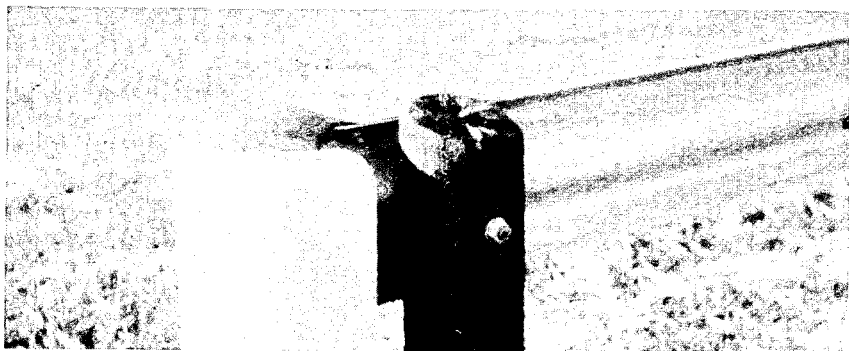
Mr. McCARTHY. Is this the first time you are compiling this information?

Mr. PRISK. This is the first time the Bureau of Public Roads or any Federal agency has undertaken to compile accident data on a nationwide basis, yes.

Mr. McCARTHY. OK. Thank you.

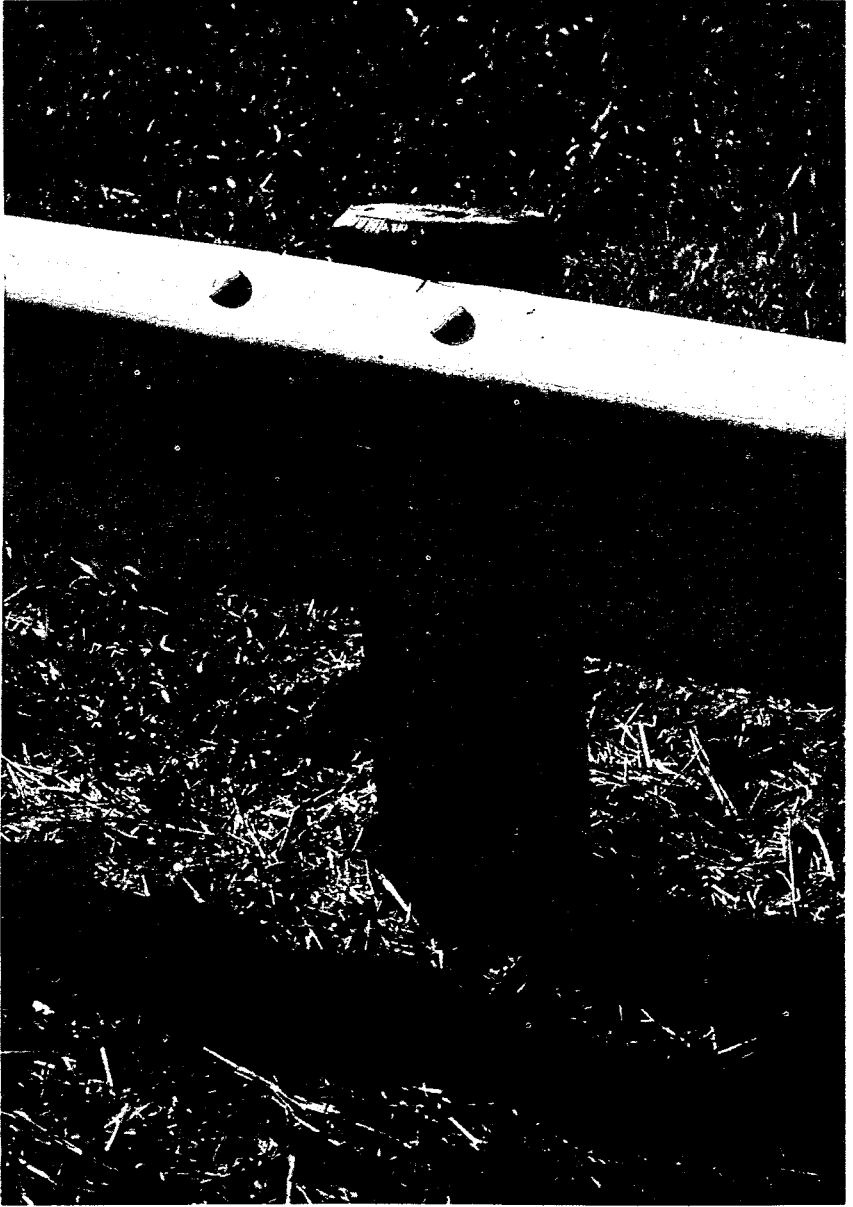
Mr. CONSTANDY. Will you continue, Mr. Prisk, with Ohio?

Mr. PRISK. Yes.



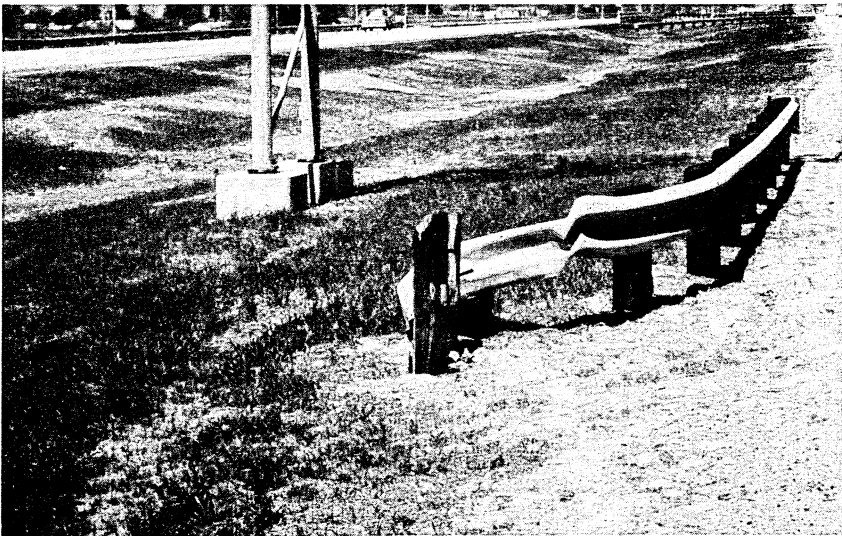
This is Ohio, again standard practice not to block out. Here you see a round post and this bulbous section on the end.

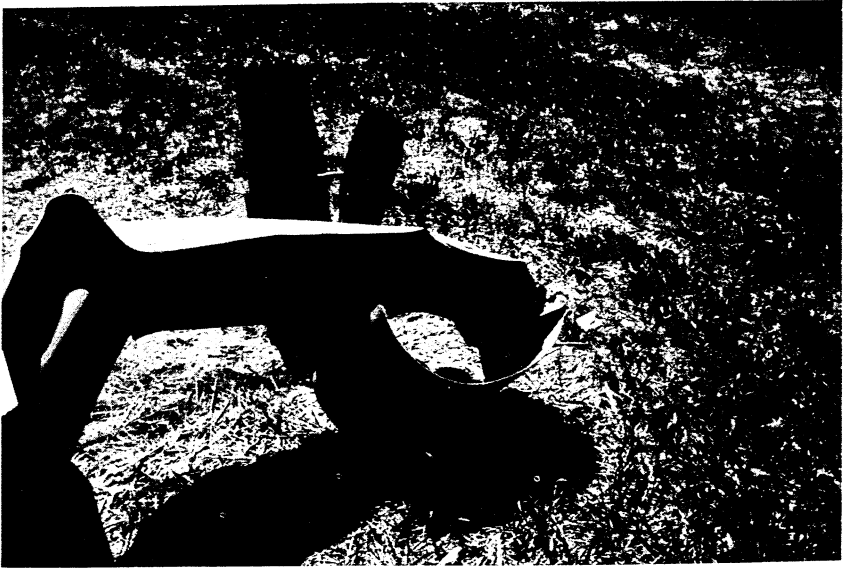
A post here also mounted rather low and in the case here, no washers are used on the head of the bolt. It does not show too well on the picture, but that is true.





Here is an installation we passed en route to the subject job. This is on I-71, near Cleveland, where there is a guardrail installation at an overhead sign bridge and it is rather short and moving up close to it you see what happened on the median side. This guardrail without the washers, as I said, was torn off the post.





Here is a closeup shot. You can see the bolt still on the post and the rail actually pulled off the post coming right through without the washer. With the washer in there you would have had at least benefit of a little more guardrail than was working at the time of this collision.

Moving back to the subject project——

Mr. CONSTANDY. Interstate 80?

Mr. PRISK. That is right, in Ohio.

Mr. CONSTANDY. January 1967?

Mr. PRISK. That is right. True.



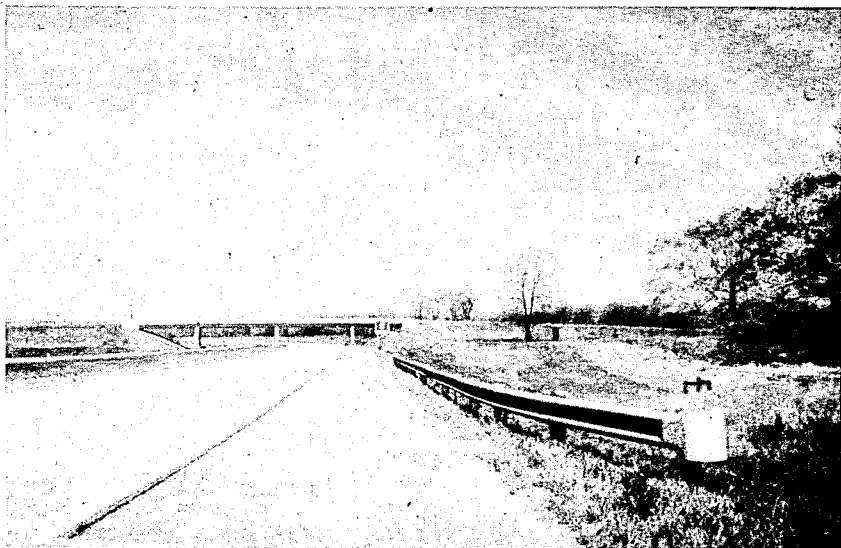
Mr. CONSTANDY. Rural section of 5.5 miles.

Mr. PRISK. Yes.

And this is a typical installation you find here. The guard rail is flared slightly and it is not buried. In this case the installation was made for drainage structure just part way up the rail. It gives you a general view; in the distance is an overcrossing structure.

Mr. CONSTANDY. What is the post spacing in here?

Mr. PRISK. Twelve feet, six inches in Ohio.



Here is a closeup of another installation, a slight flare at the beginning and a rather short run of rail across the top of the culvert.

Mr. BLATNIK. Mr. Prisk, in addition to the short run of rail, it



appears that the back is pretty steep, is it not? The slope is a little bit too steep to negotiate safely.

Mr. PRISK. That is correct. Probably it is 2 to 1 anyway.

Mr. BLATNIK. Your drainage ditch is sharp and it serves similarly to the return groove on a bowling alley, which turns the bowling ball back.

Mr. PRISK. Yes.

Mr. BLATNIK. It is short. In that groove one could pretty well be frozen, fixed or locked in and run right into the culvert headwall; would he not?

Mr. PRISK. Yes. I think there is a pretty good chance. It would depend on the angle of entry. In any event, when you traverse a V type of ditch, you are far more apt to go out of control than you are with a flat, rounded bottom ditch.

Mr. BLATNIK. Mr. Ricker, you had your hand up.

Mr. RICKER. This illustrates a question of whether the guard rail does not present more hazards than the culvert did originally. We think it would be worth review. You can't judge this just from this picture. Omit the guard rail entirely and the hazard may be so small it could be ignored or else perhaps extend the culvert slightly and you don't need any rail.

Mr. CONSTANDY. In other words, a change of design in the culvert might permit elimination of guardrail?

Mr. PRISK. Right.

Mr. CONSTANDY. Plus elimination of a possible hazard.

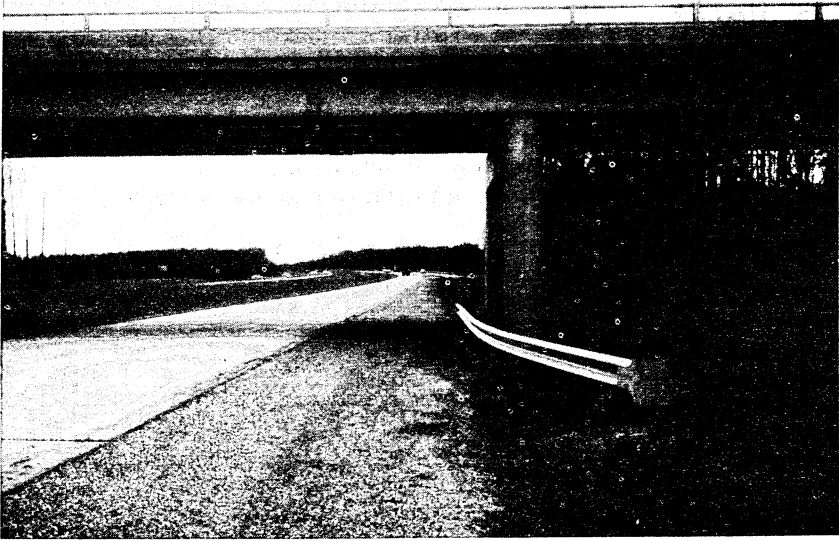
Mr. PRISK. This is a very good comment and this is also along the line of the investigation that was done in California under Mr. Wilson's direction, where the criteria for installation of guardrail was considered against the possible hazards involved by having the rail there. Its protective value against its hazard value, I think, must be compared.

Here is an instance of a very short section in front of a sign, again a very slight flare over a very short distance on this rail.



Mr. CONSTANDY. On this project of 5.5 miles, about half of which is used up by a bridge, there is no interchange complete within the project and we cite this example on the interchange immediately preceding.

Mr. PRISK. That is correct. This is at one end of the project and shows a flared rail running through the piers of the structure.



Here is rail lined up with the structure with the exception of the curb that sticks out in front. You see the characteristics we have noted before. The rail is not blocked out. The rail here is set back two or



two and a half feet from the edge of the paved shoulder. In some cases travel on that grass surface or on the off-the-paved surface, I should say, presents a problem in itself.

Mr. CONSTANDY. I wonder if we might have some comments by the panel relative to that. We have seen it in several of these, or we will see it, where the guardrail is installed beyond the paved shoulder, leaving a distance of sometimes 2 to 4 feet of unpaved shoulder area in front of the guardrail, which generally as we found it, visiting in the spring, was muddy and quite soft. Is it desirable that the shoulder be paved up to the face of the guardrail?

Mr. Huff?

Mr. HUFF. As far as safety is concerned, in my opinion it is all right. It creates quite a mowing problem.

Mr. CONSTANDY. So if it were paved, part of the cost of paving might be offset by the lower maintenance cost by doing away with mowing.

Mr. SKEELS. I would agree with that. One matter I would like to call attention to is use of these round wooden posts. We have not talked much about posts and I don't want to get into it right now. Perhaps you will later, Mr. Prisk, but the strength of the posts is a very critical item and should be examined.

Mr. CONSTANDY. Mr. Ricker?

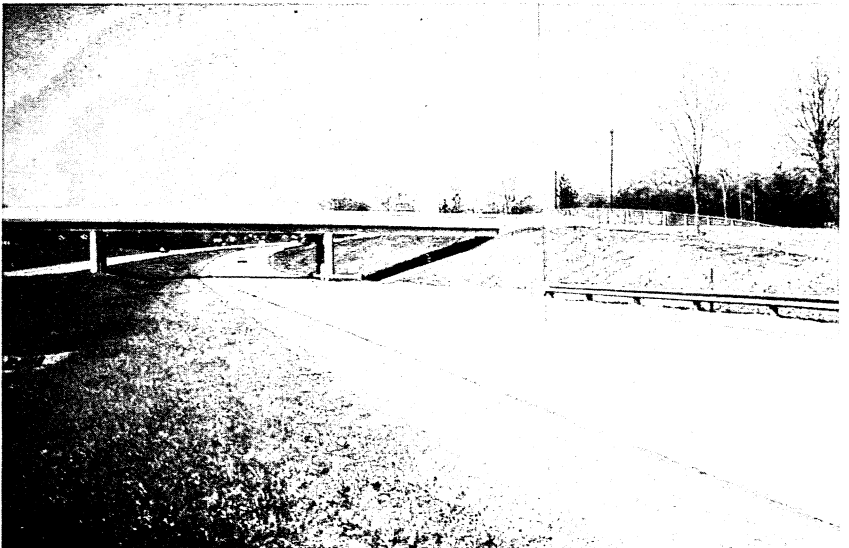
Mr. RICKER. Relative to the placement of this rail, I point out it is desirable to have it back there so you can open the car door on the outside and not have to step into traffic. It is good to have the rail back that extra 2 feet.

Mr. CONSTANDY. Might it be desirable to pave the additional width?

Mr. RICKER. Yes.

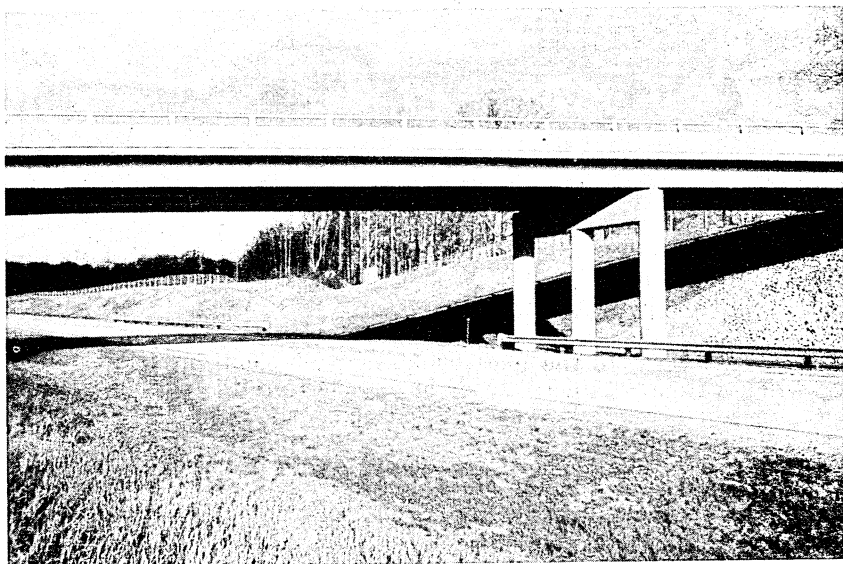
Mr. CONSTANDY. We will see some slides in other areas where that space is quite pronounced and we wonder what would happen if a vehicle left a paved shoulder and entered that muddy area before it struck the guardrail.

Continue, Mr. Prisk.



Mr. PRISK. Continuing, you find again there are sharp, uncomfortable gaps of rail. In this case, right-hand piers are shielded by a short section of rail, which begins shortly after another one stops. Very nice slope protections, you will notice, on the structure itself. The center piers are fairly well guarded from traffic simply by the slight slope that is there. We will talk about that on another series of slides.

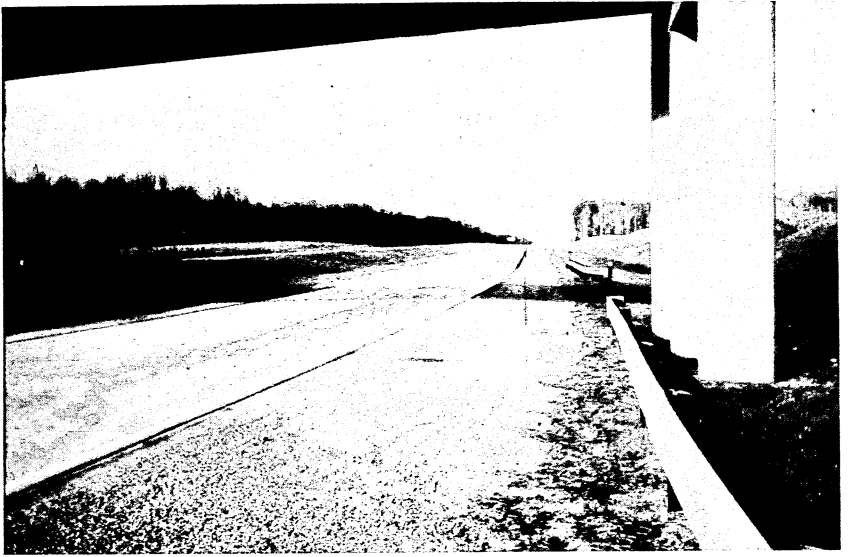
Here is a closeup of that same shot. You find the structure not only has that rail which starts a short distance before it, but after you get through the piers it stops and then there is another one that starts for another reason. So here are some more gaps.



Here is one where, if you go far enough, you could be in the lake because the guardrail here does not too well protect that total slope.



This is another consideration of a gap.



When you come to the dual bridges in Ohio on Interstate 80-S you will see from this picture they have done a pretty good job swinging the median rail back to protect and guard against that open space between the structures.

In a fairly wide median, of course, something of this sort probably is superior to attempting to pave the entire median over.

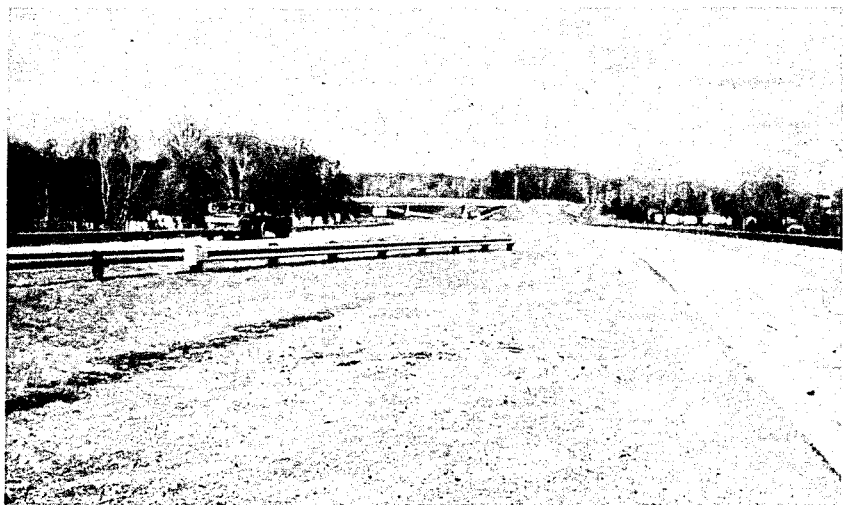
Mr. RICKER. There is another good feature of that. You will notice they have regraded the ditch between the two roadways and this is



necessary if that guardrail is to work properly ; otherwise it dips down into the center depression and makes a different kind of hazard. This is a good design where the median has been flattened.

Mr. PRISK. At the same time, I call your attention to the headon posture of the rail on the right-hand side of the road.

Here is a treatment on the end of that median flare that is doubled back so that actually for about seven or eight panels you have protection on which ever side you hit it, going in the direction of the camera shot or in the opposite direction.



Here is another one showing approximately the same thing.

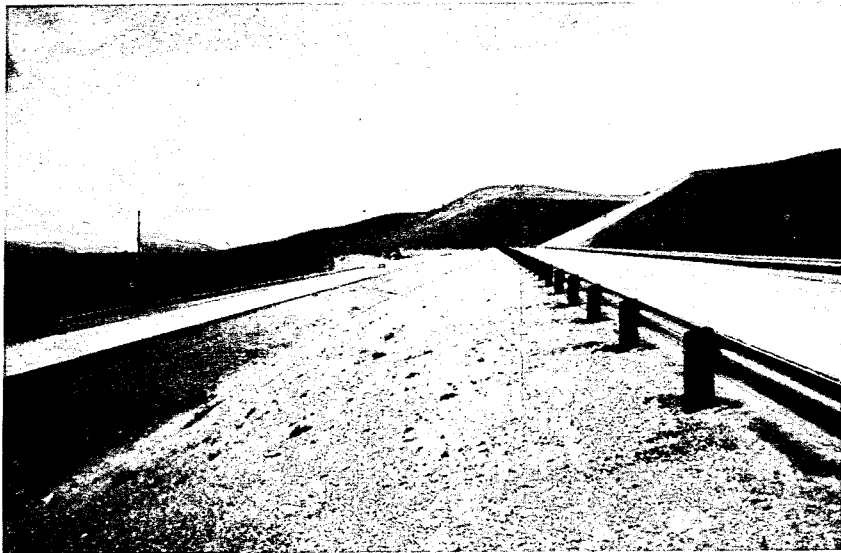
Now we move to Montana and find about the same situation.

Mr. CONSTANDY. Mr. Prisk, that would be I-90 and this section was made up of three projects, two of them being opened in 1966 and one in July 1966, 11.2 miles total. This is just on the edge of Missoula.



Mr. PRISK. Thank you.

That position shows we are out in the country here. Here are the two roadways on separate grade, obviously, with very substantially different elevation. Standard guardrail installation is what you see, with no blocked-out posts.

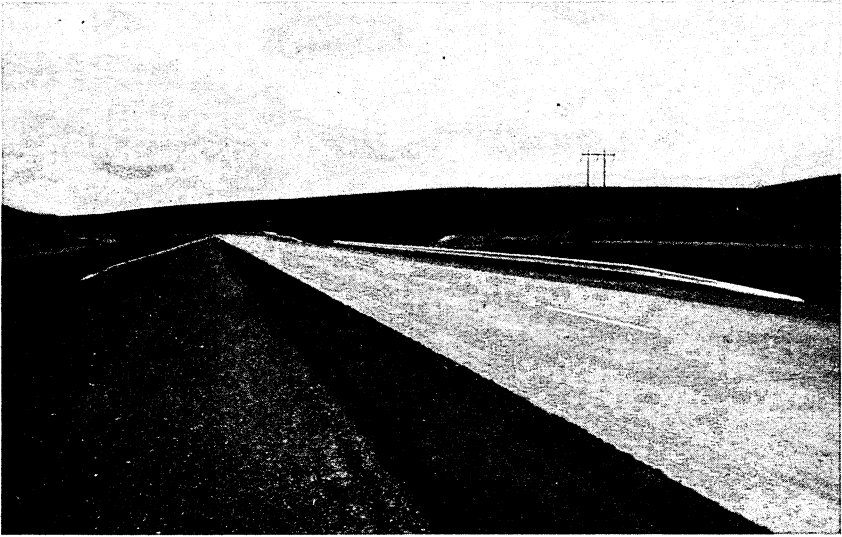


In this instance you will find that they are patching the ends—I should not say patching, but they are extending the ends of the guardrail on the right-hand side, so as to get the benefit of a flare section.

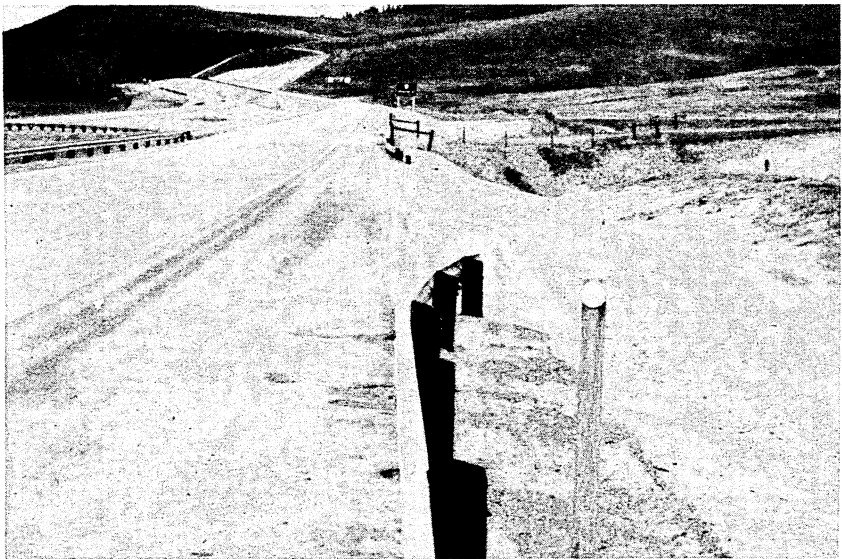


This was field changed during the construction, and work, I expect, now is completed. It was under way as we visited the project.

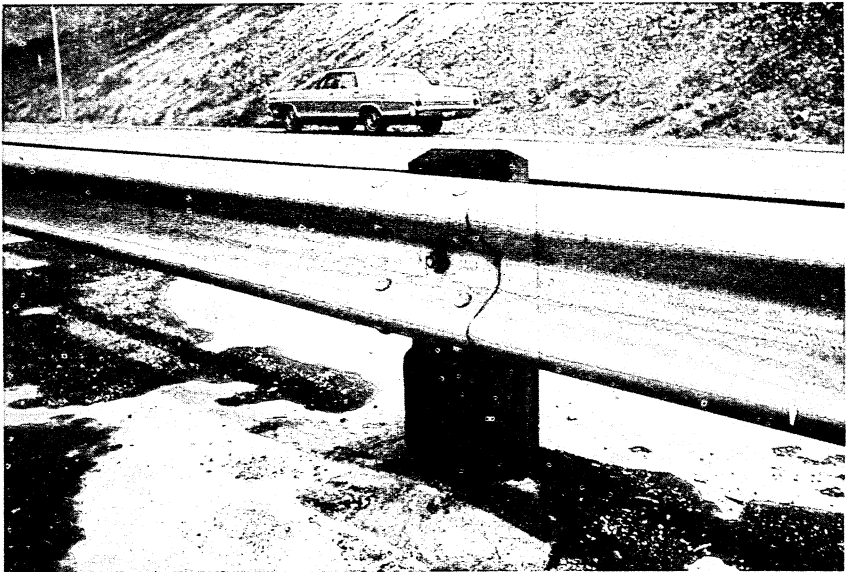
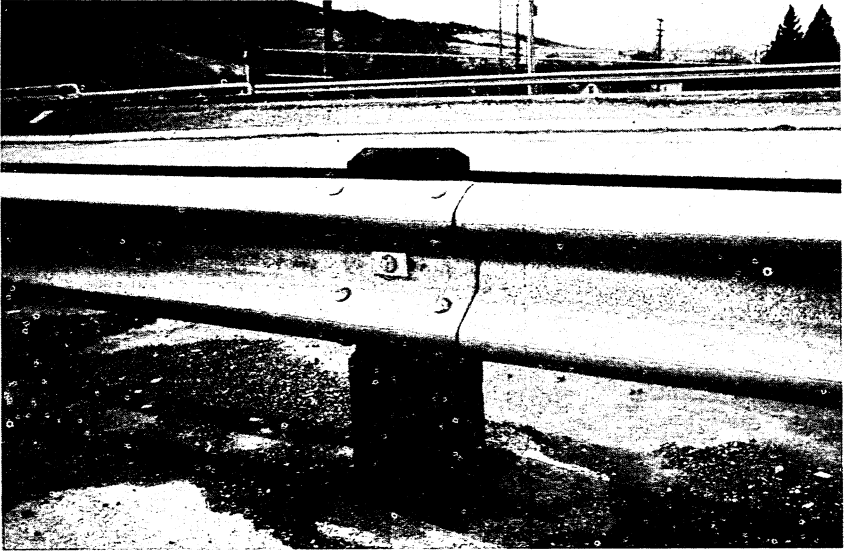
We move along on this section. This is about the way it looks as those portions are completed. The rail is taken down a slope, both in the median and on the right-hand side.



Here is a case where you have a gap and somebody put the flare in on the wrong end, because you are driving in the same direction as the camera is looking and there is a nice waterhole straight ahead, if you follow that flare, that you could drop into, up in this general area here [indicating].



The sections in Montana have something to recommend them because here is the appearance of a washer clearly on a median barrier and this is back in the urban portion, near Missoula, and in this case the rail is not only not blocked out, but the rail is notched into a wooden post. There is an 8-by-8-inch wood post there and the post actually has been notched so it is down to about 5 inches thick at the top.



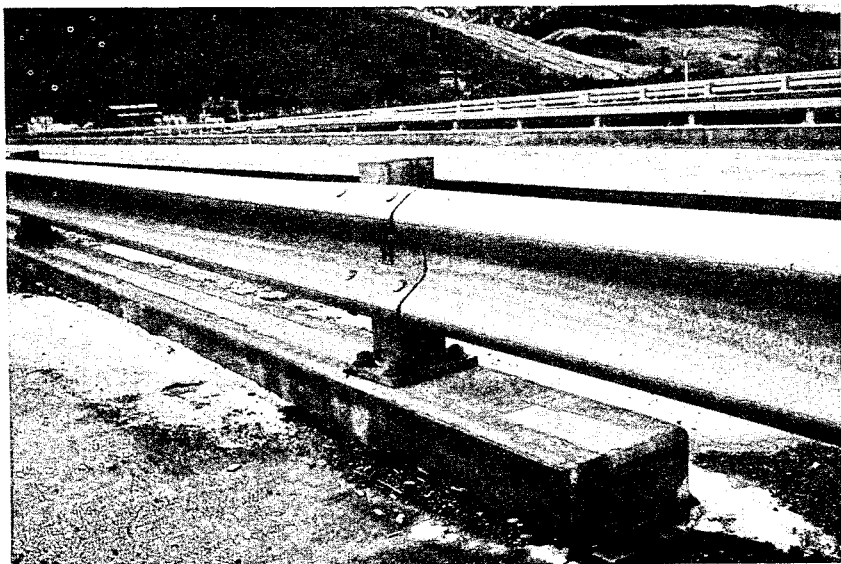
Mr. CONSTANDY. What do you think of that, Mr. Skeels?

Mr. SKEELS. I wouldn't dare say.

Mr. PRISK. Inquiring into this notching made me not say anything either. I found that this was done to obtain the 3.5-foot clearance to the edge of the pavement. That is the hard way.



Here is a section on a structure where concrete curb is introduced as you cross the structure and steel posts are substituted for the notched-out wood post and I dare say this is a little better to hit than that other section, from a number of viewpoints.



Mr. CONSTANDY. Do any of the members of the panel have anything they would like to say about the notched-out post?

Mr. SKEELS. Well, it certainly weakens the post and it is going to break right at the bottom of that notch as soon as a car hits it, and leave stub post sticking up there. It is not going to perform properly.

Mr. CONSTANDY. Thank you.

Mr. PRISK. I am informed that the median width has now been moved to 10 feet instead of the 8 that is here, so that part has been recovered.

Here is an approach to a dual structure in Montana where there is a flare carried well down into the median area.

Mr. CONSTANDY. Before you get to this slide, Mr. Prisk—Mr. Ricker, you made a comment on the project in Ohio relative to the same thing. Could you look at this slide and perhaps tell us something about it, as to the swale?

Mr. RICKER. I think it would be desirable to take some of that swale out at the locality where this guardrail begins, to avoid this not-too-good effective section of rail, where you are going down the slope and hitting the rail at the same time. You wedge in there.

Mr. CONSTANDY. Apparently there is good reason to flare the guardrail on the left, as it is, to prevent the motorist from meeting the hazard between the bridges, but there is a like hazard on the right side. This seems to be followed in many places, the median side is considerably flared and the guardrail on the right-hand side is not. I wonder if someone would care to comment on that. It perplexes me.

Mr. RICKER. I would like to comment on this median side a little more.

Mr. CONSTANDY. Go ahead.

Mr. RICKER. I notice in the picture there is an embankment down near the actual opening which provides a second line of defense for somebody who does happen to get in there. That is as good a place to



find bushes and so, on behind the rail, where they normally would not be hit and they do improve the appearance as well as to slow down vehicles that do get that far.

Mr. CONSTANDY. Mr. Huff?

Mr. HUFF. In my opinion, the obtuse angle of approach on the median rail makes it an unsafe area and as a matter of fact I think it is more unsafe than the one on the right.

Mr. CONSTANDY. What would your solution be—extend the length of it and lessen the angle? Then you would not have to worry about a car getting behind it.

Mr. HUFF. Well, I think you get virtually the same advantage if you move the one on the left back up near the shoulder, the same distance from the shoulder as it is down the road.

Mr. CONSTANDY. Anyone else care to comment?

Mr. PRISK. Here is another treatment where a different solution approaching what Mr. Huff just suggested has been followed: Just a very slight flare and this seems to be the end of it. I think that the one thing that bothered me, as an engineer, looking at these jobs, if I may be permitted a very general comment, is the variability even on specific jobs of the treatment of essentially the same kind of situation. Perhaps we learn from doing things differently and with incomplete knowledge; also, of course, perhaps we can gain as one is built this way and this one is built another way. Maybe later on we will know something about this.

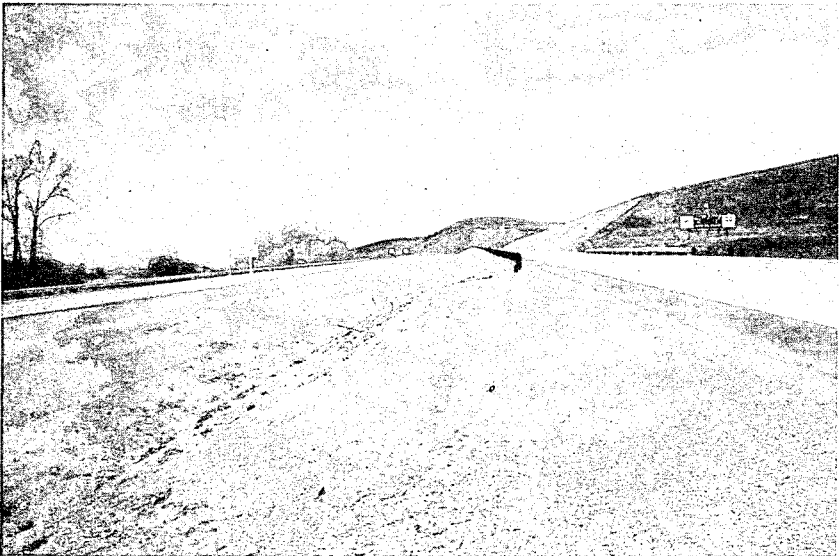
Mr. CONSTANDY. Both of them are intended to protect the motorist from some hazard in the median?

Mr. PRISK. That is right.

Mr. CONSTANDY. In the former case it is the twin bridge, in the latter it is the slope?

Mr. PRISK. The embankment, yes. True.

Mr. SKEELS. On this one we have here, I don't know the whole situation, of course, but it appears that perhaps that slope could have been modified and not need the guardrail.



Mr. CONSTANDY. It might be a bad picture. I would hate to ride down here at this point where there is no guardrail. It is kind of steep and rather high. Mr. Wilson?

Mr. WILSON. I think this is a good place to point out another thing involving the guardrail indirectly. Highway engineers over the years have been subjected to pressure to construct separated roadways, thinking these may be somewhat more beautiful, and I suppose at times some are more economical but in this case here, and I am speaking of separated roadways, separated vertically one above the other, you will notice we had to put a guardrail in here to protect either the upper roadway or protect the cars from going off into the lower roadway. I think in this case it would have been better to have kept the roadways at the same elevation and eliminated need for the guardrail as you have right here in the section in the foreground of the picture. The added hazard of going to separate roadways in my opinion is considerable.

Mr. CONSTANDY. Mr. Ricker, do you care to comment?

Mr. RICKER. I was going to make almost the same comment. Some of us wonder, if you have to have the guardrail on the upper roadway, whether there is any use in making such a wide median. If you have decided already to put the guardrail in on the upper level, the width of median is relatively unimportant.

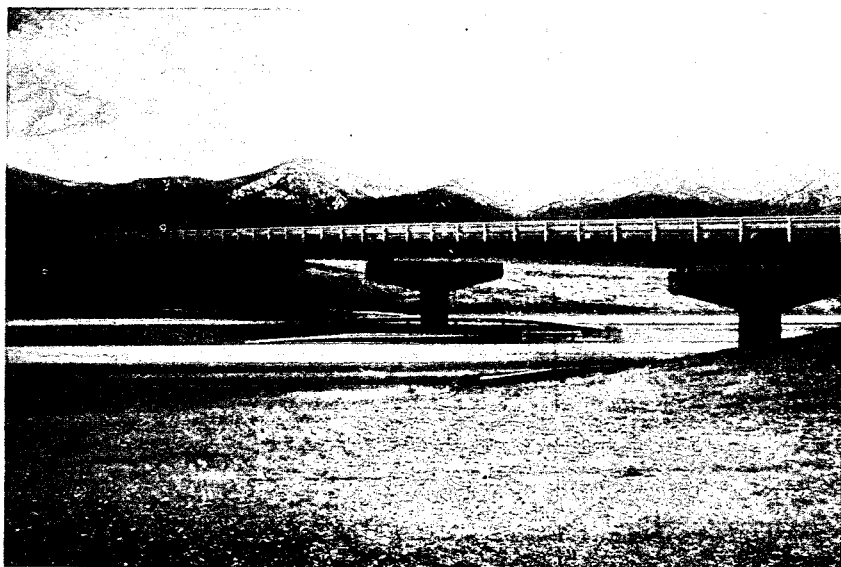
Mr. CONSTANDY. Maybe the guardrail came at a later time than the decision to have the roadways on separate grades.

Mr. RICKER. Could be.

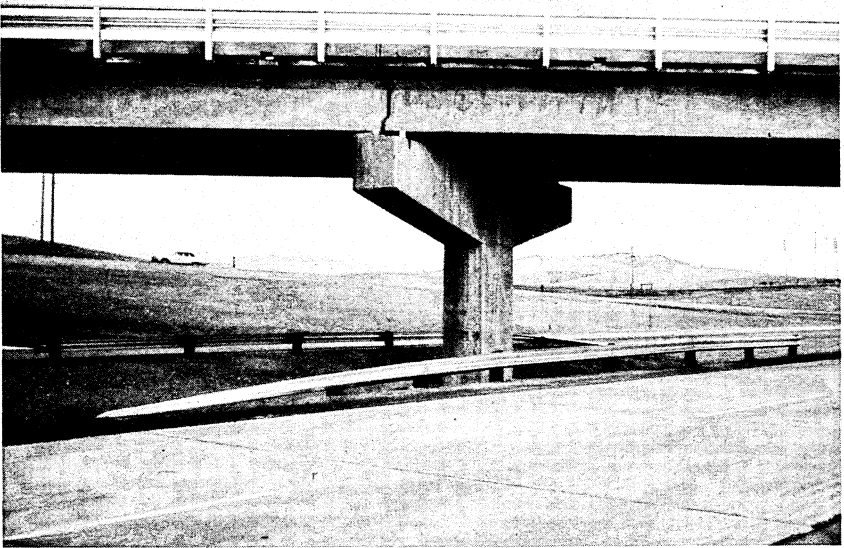
Mr. CONSTANDY. Mr. Prisk?

Mr. PRISK. It is quite possible, I should think.

Now I move to a structure to take a look at practices in Montana, and find the guardrail, as you will see, on both sides of the roadway in both directions, center piers and side piers, and this gives you a general view of the installation.



As we move in on it, this is a closeup of the median protection and you will see that the panels are in there with the end posts tightened up to 6-foot-3-inch spacing along in through this area here [indicating], then lengthening out to 12-foot-6-inch spacing down through here. This is perhaps a minimum length, you might say, of guardrail, looking at it from this angle.



Let me give you another angle on this same structure. Here is the side protection, which is done about the same way.



But here we swing around and take a look at the median pier problem, in terms of where that rail is placed. This shot, of course, was taken perhaps a couple of hundred feet away and it is not too difficult to visualize someone getting into the bottom of this bowling alley gutter here that the chairman referred to a little while ago, and ending up in difficulty with that pier.



As you look to the right-hand side, you have about the same situation as a couple of hundred feet away. There is not an awful lot of protection here. You have a steep slope here which can turn you back



into the embankment of the rail or possibly wedge you between the rail and the pier. All of this can be a little uncomfortable.

Mr. WILKES. I would like to point out, though, greater justification for this offset at this pier than it would be at the median because the pier cap is not skewed parallel to the roadway and it overhangs, so that a truck could theoretically get in and strike the cap.

Mr. PRISK. That is a good point.

Mr. CONSTANDY. Is that the only kind of cap that could be designed? Or would it be another hazard?

Mr. WILKES. Of course you could make the cap parallel to the roadway at an increase in cost of construction. It would be more expensive. This is not typical. Usually they are designed to be parallel to the roadway.

Mr. CONSTANDY. Of course, this bridge is not skewed.

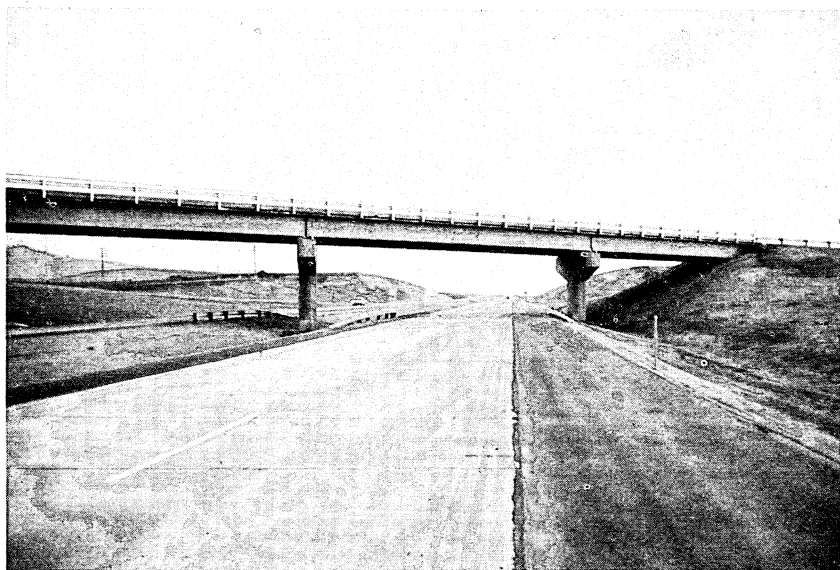
Mr. WILKES. This bridge is not skewed and I am sure they used this design because they had a standard prepared for this.

Mr. CONSTANDY. Mr. Huff, your earlier comment about the bolt and guardrail might suggest this situation where the other end could be anchored or at least the post space be doubled up for greater strength.

Mr. HUFF. Of course, the principal reason for anchoring is to eliminate this weak spot, weak ends.

Mr. CONSTANDY. That could be done either by anchoring or decreasing spacing of posts; is that true?

Mr. HUFF. In my opinion, it should be anchored on both ends and it should be longer.



Mr. PRISK. Moving along, this again is a far view taken 400 or 500 feet in advance of the structure. I think you can still see these same points stand out rather prominently and suggest that perhaps there has been a bit too little guardrail used at this point.

Mr. CONSTANDY. That concludes the slides on Montana, Mr. Chairman. If we can this afternoon begin with Oklahoma, Missouri, Nevada, we will.

Mr. MCCARTHY. The committee will stand in recess until 2 p.m.

(Whereupon, at 12:30 p.m., the committee was recessed, to reconvene at 2 p.m. the same day.)

AFTERNOON SESSION

Present: Messrs. Blatnik (subcommittee chairman), Howard (acting chairman), Cramer, and Clausen.

Also present: Staff as heretofore noted.

Mr. HOWARD. The subcommittee will please come to order. The Chair recognizes Mr. Constandy.

Mr. CONSTANDY. Mr. Chairman, there is one thing I would like to clarify. It was referred to this morning. We have selected nine States; one in each region of Public Roads. We have, roughly, 10 different elements which relate to roadside hazards in the design and construction of the highway. We propose to go through each of the nine States looking at each of these elements, one at a time. We hope to conclude guardrails this afternoon. Tomorrow we will deal with bridges, and so on, through the 10. But each day we will be discussing a different element, or maybe more than one each day; in each case as it relates to each of the nine States.

I think the next slides we have depict conditions we found in Oklahoma. The project here is I-40, located in Oklahoma City. It was opened to traffic in January 1967 and is a 2-mile urban section.

While we were concerned with that particular project the next project contiguous to it was under construction and we took several slides of the work on the new project.

Members of the panel, we still solicit your comments on each of these elements. Even though it is apt to begin to appear repetitive, it is not as it relates to that particular State.

I would assume that silence concerning Mr. Prisk's comments would suggest agreement by each of you with what he says. If you differ with anything he says, raise your hand and we will clarify that. Unless you do differ, I will assume you agree with his comment. Mr. Prisk.

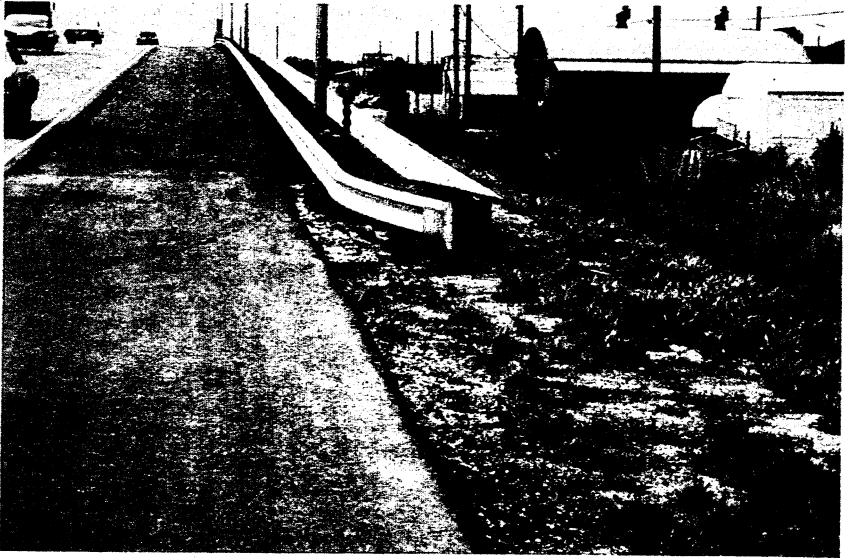
Mr. PRISK. This concerns Interstate 40 in Oklahoma City, an urban area project. This is a closeup shot of their guardrail section and guardrail design. Here again you see round posts, bolts with no washers.



Moving along to the actual application, you see this rather abruptly curved transition into a guardrail section. This is in advance of a slope condition.

Mr. CONSTANDY. Is that type of flare sufficient, Mr. Prisk?

Mr. PRISK. This appears to be an extremely short flare, and the treatment here certainly is a rather abrupt flare and is not buried, as you can see.



Mr. CONSTANDY. I notice that there is one post on the end, and by the next post the guardrail is back on a tangent, so the length of that flare is generally 12 feet.

Mr. PRISK. That is about right.

Mr. CLAUSEN. May I ask a question?

Mr. HOWARD. Mr. Clausen.

Mr. CLAUSEN. Did I understand you correctly, Mr. Prisk, that you feel this particular design could be altered so as to improve safety?

Mr. PRISK. I think that it should be. This is a very abrupt flare, for one thing, and the end of the post, the end of the rail was exposed to traffic at a rather close point as far as the shoulder is concerned, only 3 or 4 feet away.

Mr. CONSTANDY. I think, Congressman, the slides taken on the new contiguous project would suggest they think so, too; because on the new work, they have increased the degree of the offset from the end post to the shoulder, and so, in effect, have increased the flare.

Mr. CLAUSEN. My immediate reaction, again as a layman, is that it offers no protection. If a person were to skid off and hit that rail there, certainly there would be no deflecting tendencies on the part of what you have there.

Mr. CONSTANDY. In addition, as Mr. Prisk pointed out, these particular installations do not have a blocked-out section. Neither do they have in all cases—am I correct, Mr. Prisk, they do not always have washers?

Mr. PRISK. That is right.

Mr. CONSTANDY. Mr. Ricker.

Mr. RICKER. Mr. Prisk has not commented on the terminal section, although he should.

Mr. CONSTANDY. Would you care to comment?

Mr. RICKER. I am satisfied.

Mr. PRISK. Well, in the case of the terminal sections, the new work, as we will see in a moment, has reduced the post spacing in situations like this. In addition to making a smoother flare, and longer flare, they have tightened up the post spacings to 6 foot 3 inches in place of 12-6.

Mr. CONSTANDY. Did you want to say something further?

Mr. RICKER. I am talking about that piece of steel that is curved around the end.

Mr. PRISK. Oh, that. You mean the terminal section.

Mr. CONSTANDY. It looks like a collar on the end of the guardrail?

Mr. PRISK. What Mr. Ricker is talking about is this [indicating], and I would be glad to speak about it.

I would say it is not worth anything that I can think of. I really think that it serves no particular purpose unless it be esthetics.

Mr. CONSTANDY. You know, you see them all over the United States, that collar, is it not true?

Mr. RICKER. I think some of your other pictures have shown that they have almost no value at all in the case of a collision. They look good in, but not afterwards.

Mr. CLAUSEN. Mr. Wilson, do we have anything like this in California?

Mr. WILSON. We use the end section. We use a 10-by-10 post for the first post and 6 foot 3 spacing.

I question the round post, whether it is strong enough to withstand what it is supposed to withstand.

However, Congressman, we do use that type of cap around the end of the post.

Mr. CONSTANDY. What do you think of its value, Mr. Wilson?

Mr. WILSON. Well, the intent of it is to keep the rail itself from spearing the car, and I imagine it has some deterrent effect in that regard.

Mr. CONSTANDY. Possibly increasing G forces on the occupant, though?

Mr. WILSON. It is possible.

Mr. CONSTANDY. Mr. Skeels, do you have an opinion about that?

Mr. SKEELS. Well, it is a step in the right direction. It is an improvement over an unprotected end. However, it is completely inadequate and I am certain that technology knows how to do better.

Mr. CLAUSEN. Now, Mr. Chairman, I would like to direct this comment to counsel regarding what we are looking at in some of the photographs. Is there going to be something included in the record in the way of recommended design change by some of the panel members here to correct this problem? Would that be a permanent part of the record?

Mr. CONSTANDY. I think it would be such a massive chore. We would find it extremely difficult to ask the panel members, even as experts, to undertake it. Actually this whole process is currently involving the Bureau of Public Roads and the design sections of the 50 States. I am sure the panel members have spoken individually, as they have presented papers before the Highway Research Board and

AASHO in making specific recommendations as to particular elements of the design. I think it would be kind of difficult for them through this committee, to produce something in the way of design standards, other than as their comments would indicate what is more desirable.

Mr. BLATNIK. Will the gentleman yield on the same question?

Mr. CLAUSEN. Yes. Just one second, Mr. Blatnik.

The point I am trying to make here is I am hopeful what we have started here as a committee would provide a permanent record, so that we can actually compare the problem areas with what we will have in the way of correcting recommendation.

It seems to me our hearings should at least have the comparison, examine the before and after approach. I would be pleased to yield to the chairman.

Mr. BLATNIK. Later on, Congressman, we have very fine witnesses, top officials of AASHO and certain Bureau of Public Roads people, who will try to answer the question: How come as many findings were presented, things we have been viewing, things we have been hearing, in these past several weeks of hearings?

It is a massive attack. AASHO is working full speed and earnestly, revising the whole safety criteria, as we call it, regulations, directives, etc.

Wherever it is possible, we can get recommendations and be helpful. I think the gentlemen will agree, as Mr. Constandy points out, the overall job which must be gotten underway, we hope the big end result of these hearings, will be specific action as to modifications. Whether we can do it in the hearing itself is highly doubtful.

Mr. CLAUSEN. Actually what I am after, I guess, is a way to prepare what I think could be a historical document. Because that which has been brought to the attention of we lay members of the committee here certainly could well be recorded and be properly utilized, for instance, among many of the engineering schools and students now coming on, to point out how, in effect, good engineering has brought about a certain amount of oversight. I think the principal intent of these hearings is to do just this; it is simply to get at the heart of the problem and, hopefully, record this as an historic document, so engineers in the future will not be making these inadvertent mistakes. I am sure they are inadvertent.

Mr. CONSTANDY. In addition, in the course of this work, as we will see in the next few slides, where possible we have shown a before and after, in a sense, by showing, as here, the design standard that was in effect just as recently as 1966, when this project was completed, and the evolution in the design standards showing the better design within the same State probably within a fraction of a mile of this particular installation.

We will, in that sense, get to see an example of something that is desirable and something that is less desirable, even though the improvement, we may find from the experts, is not perfect.

Mr. CLAUSEN. Yes. I gathered that very point during the discussion just prior to the opening of this hearing with Mr. Wilson, from my State of California, that this is underway. But I still hold the point of view we continually provide an extra service by supplying a document which prohibits this sort of thing as best we can in the future.

And I would like to ask the staff to give very careful consideration

to incorporating this in whatever kind of document leaves this subcommittee.

Mr. CONSTANDY. Mr. Prisk.

Mr. PRISK. We proceed here to look at another installation of guardrail. This is as you leave a structure with the sidewalk on it in this urban section. You find that the guardrail is directly in your line of path, presumably put in there partly for protection of the light standard, which is a steel light standard behind the guardrail. Anyone going off through this area certainly would not find himself in very good shape, hitting the end of that rail.

Up in the decisionpoint, the gore area, you find the same treatment we just looked at a moment ago.

Mr. CONSTANDY. Would this strike you members of the panel as being an undesirable feature?

Mr. SKEELS. On that guardrail on the gore up there, it appears to me, from looking at the slide, that it is unnecessary to start at the point where it starts.

The gore area is very critical. It is frequently invaded. There has been placed there an obstacle that certainly is not necessary.

Mr. CONSTANDY. How about this piece right here [indicating]? Assuming an automobile was sliding along the bridge rail and has managed to get up here.

Mr. SKEELS. This is, I think, obvious even to a layman. A car coming along the bridge is going to hit not only the guardrail, but is going to hit the light pole.

Mr. CONSTANDY. We are agreed on that. Mr. Wilson?

Mr. WILSON. I would like to comment on the gore area. We recently have taken steps to clean that area out. As Mr. Skeels says, that is often invaded, due to the fact you are often making a decision in that area.

It is not exactly the subject of the hearing now, but the curb there is also a matter that would throw a car out of control.

Mr. CONSTANDY. We will later have an element in these discussions that deals both with gore areas and curbing.

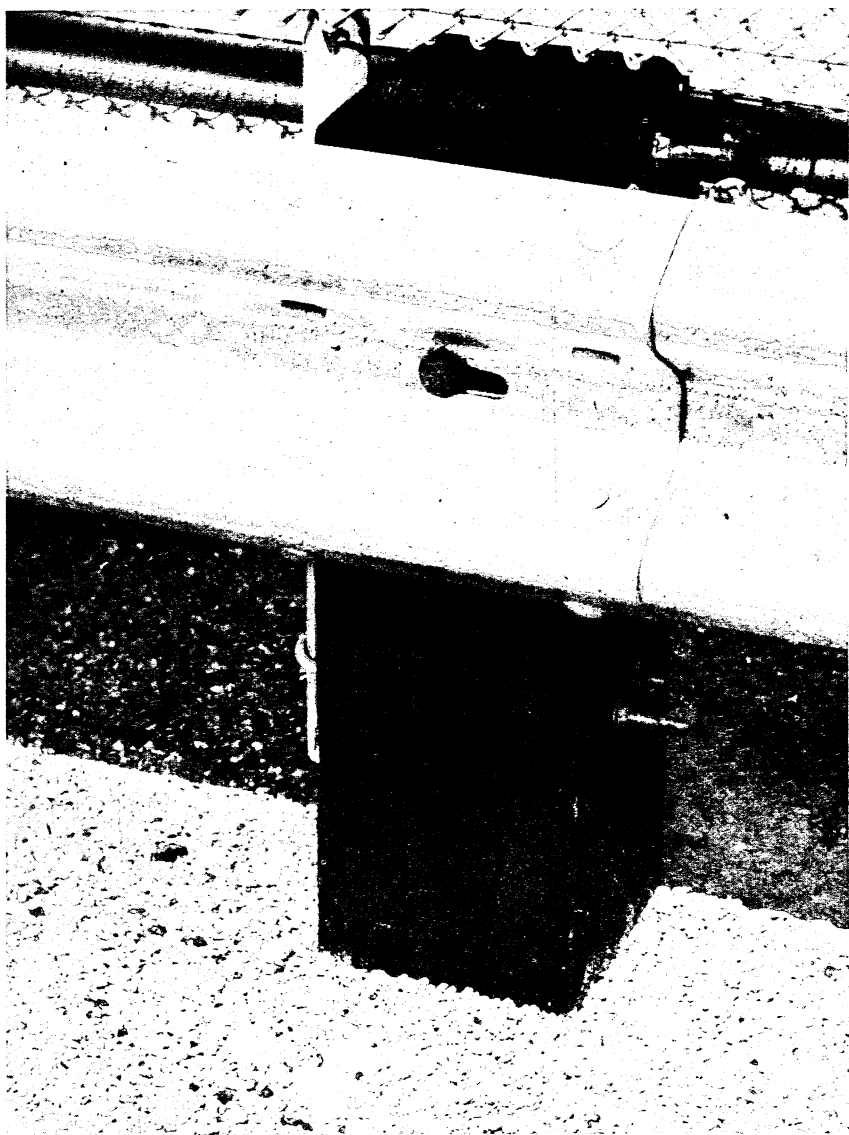


Mr. WILSON. I see. With regard to the light standards, studies we have done recently indicate, to us, if you are using a light standard without a breakaway base under it, you are better off having a light standard exposed than 20, 30, 40, or 50 feet of guardrail to protect it. The consequence of the accident is less if you hit the light standard.

Mr. CONSTANDY. Ideally you have a breakaway light?

Mr. WILSON. Right. California last year took steps to take a look at old light standards, with the idea of putting some kind of frangible base beneath them.

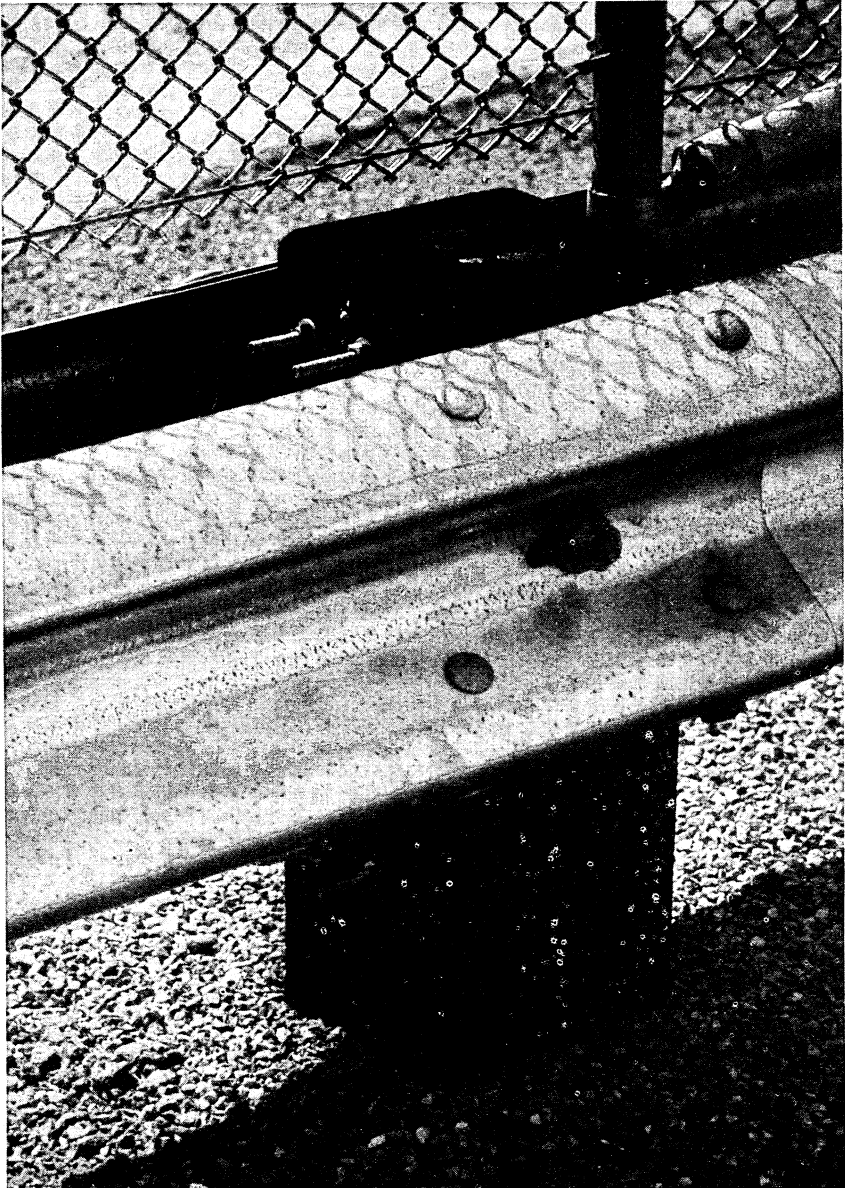
Mr. CONSTANDY. Yes. We have seen slides of some poles in the vicinity of Washington involving accidents. The light poles were not of the breakaway type.



Mr. PRISK. I think with credit to Oklahoma, we will see evidence that fragile light bases have been used in Oklahoma as well. This is an exception.

Mr. HUFF. Incidentally, it might be noted that this particular type of light base could be converted to a frangible base for some \$40 or \$50 for installation.

Mr. PRISK. There are a good many things in these pictures. We could talk about one picture for half an hour. But we will try to concentrate here in this section on the guardrail aspects.



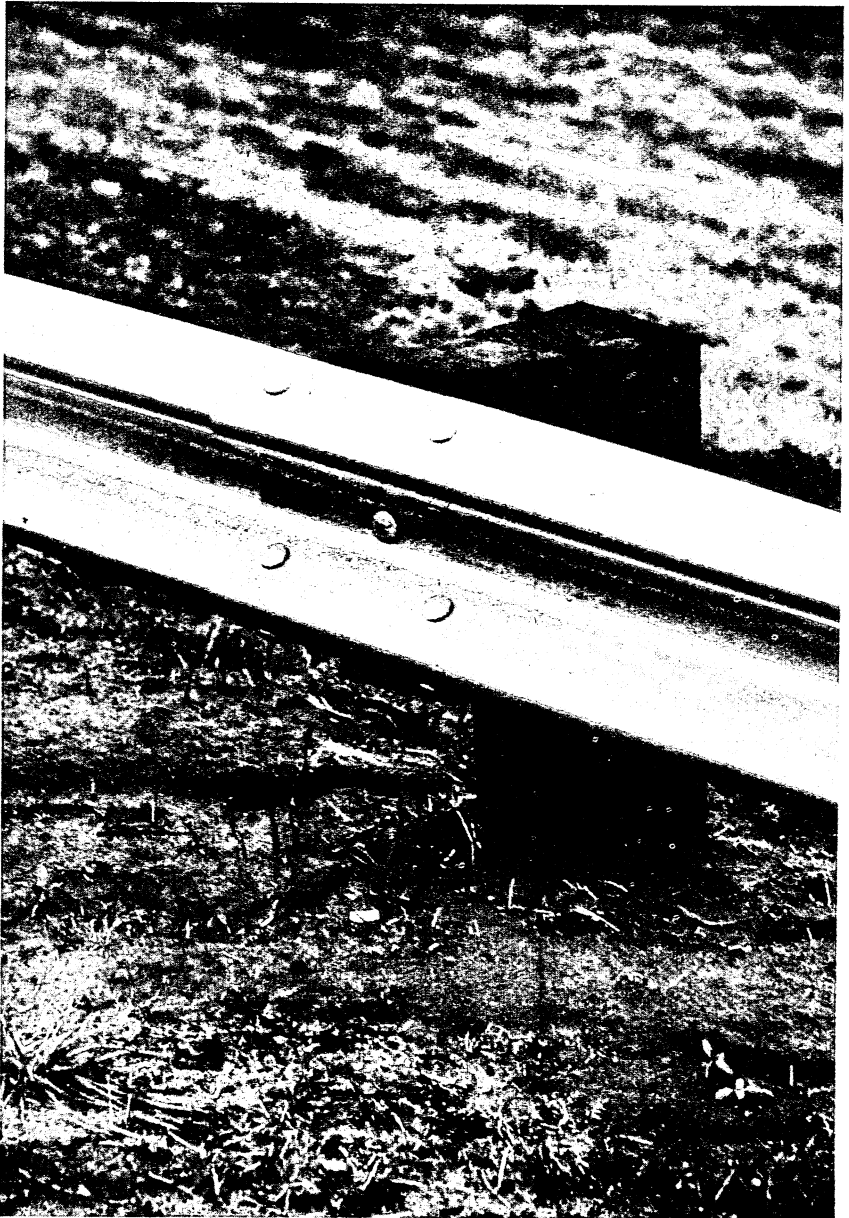
Here is the median barrier where there is an 8 by 8 post, rail bolted directly on, again without washers.

The rail here was set rather low. This is about 26 to 27 inches.

The side rail is 24 inches. This is the other side—small washer, nut, as you see, bolted all the way through.

Here, now, we are on the new job, which adjoins slightly to the west, of the work we were just looking at. Here they have blocked out the rail with wood block and at least gained improvement.

Mr. CONSTANDY. I think they have square posts there, do they not?



Mr. PRISK. Square posts and wood blocks.

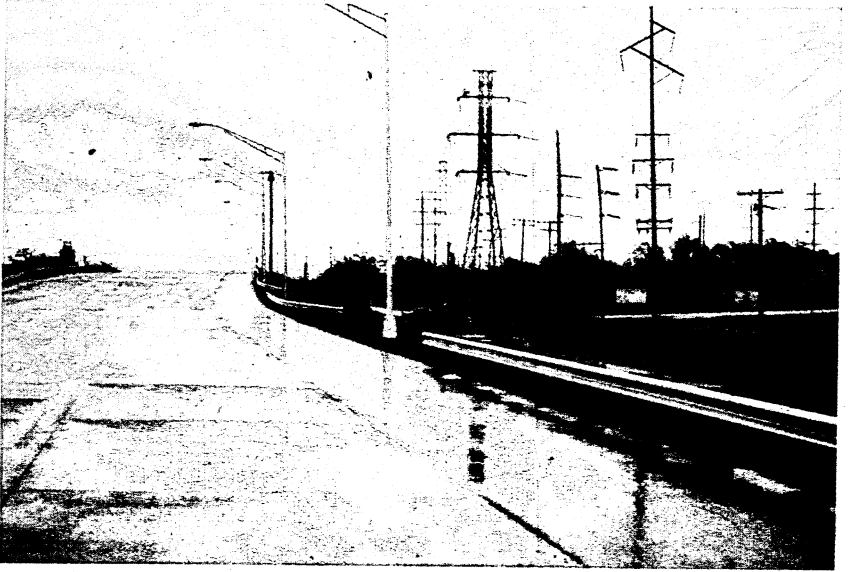
Here you do see that muddy area between the edge of the shoulder and the rail, makes you wonder a little bit whether that rail would perform as well as if it had a paved surface coming up to the face of it. When it is soft, certainly the wheel would be down somewhat lower that it would otherwise.



This rail—look at it a little bit farther—here is an installation where there are some light poles involved. The one that you see first, beyond the end of this rail, has a frangible base, transformer base in there. This one is a steel pole and so are the others behind the guardrail.

During the course of the work, the contract was changed to introduce these frangible bases in those places where the light poles were exposed.

One thing that you will notice is that there is a separate guardrail around each post installation and some of the other places, and that, again, begins to bring some concern about the continuity of the rail and desirability of closing up gaps that we see there.



Here is another view of the same thing looked at along the line of the guardrail. You can see the position of the light pole.

Mr. CONSTANDY. Is it true, Mr. Prisk, both the entering and leaving end of the guardrail installation has a 6-foot-3-inch post facing to give greater lineal rigidity?

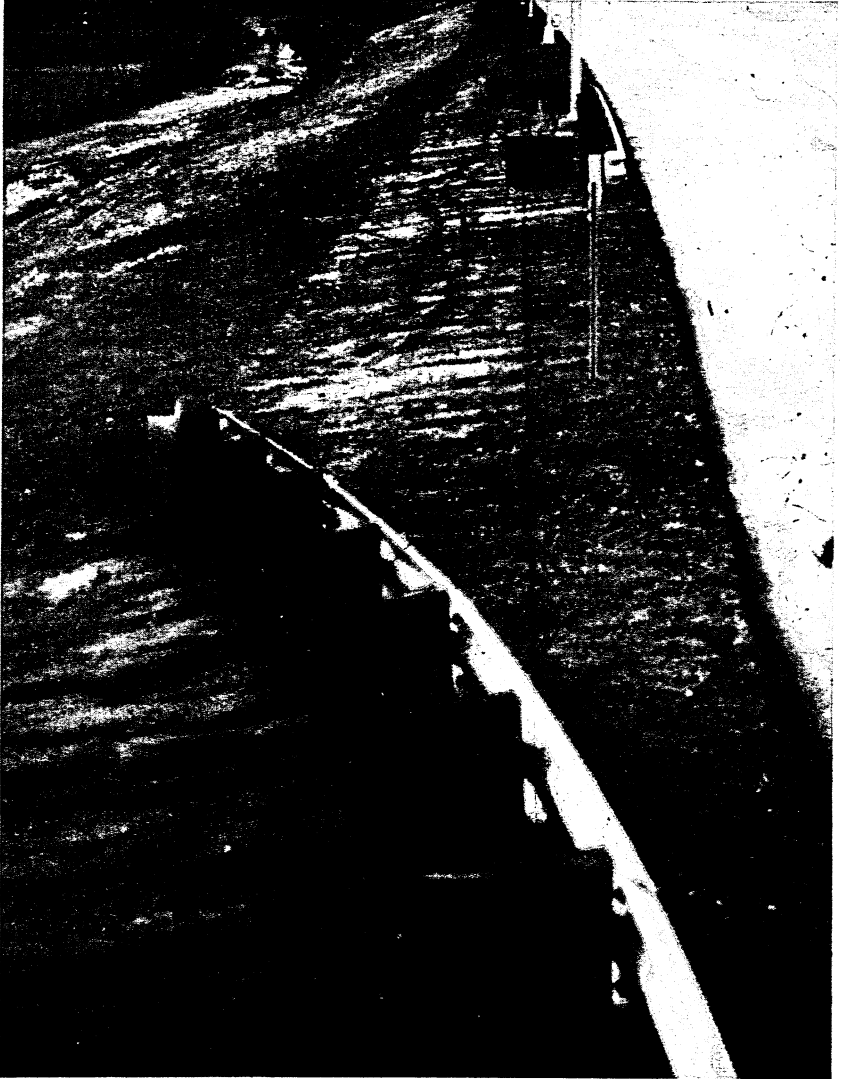
Mr. PRISK. Yes. There are several panels of 6 foot 3 on this particular project; four panels, I think it is, at each end of the guardrail section, that are tightened up in spacing.



Here you will see, looking at the flare end in some detail, how they have tightened up on the spacing. Rather an abrupt flare.

This is the same line of poles that we are looking at, except we are up near the structure now, looking back on the approach to the structure.

Another element in here, of course, is a block of concrete. These appear on projects once in a while. This is intended as a future sign support.



Again, we will talk about signs and sign supports later.

Mr. CONSTANDY. This piece of guardrail is there because that is the entry ramp?

Mr. PRISK. That is correct.

Mr. CONSTANDY. The next section of guardrail is to protect the foundation of the sign?

Mr. PRISK. That is correct.

Mr. CONSTANDY. The one in front of us is the beginning of the guardrail leading up to the bridge?

Mr. PRISK. That is right.

Mr. CONSTANDY. Have we not found where there is a position for a light pole, and there was guardrail already installed for some other purpose, they then put a steel light pole behind the guardrail, and where the light pole fell outside the guardrail, they put the frangible base?

In the far section behind the guardrail they are steel. The next one, as you pointed out in the first picture, is a breakaway, frangible pole. Did it not work out by pure chance that the light pole happened to come behind a piece of guardrail that actually was there for some other purpose?

Mr. PRISK. I do not know. This frangible light transformer base that is on this standard is the result of field change during the project. Originally this was laid out with steel light poles everywhere. So I do not know as it is quite correct to say this is completely a matter of chance. It was a matter of deliberate design that they put a frangible base light pole in the exposed position.

Mr. CONSTANDY. Mr. Ricker, you think this is the kind of situation where you would have the rigid guardrail?

Mr. RICKER. I am not clear as to the first section—that is the third one in this picture—what it was for.

Mr. CONSTANDY. The right-hand entry ramp. It appears the slope on that is a little bit steeper, a little bit higher than it is here in the forefront.

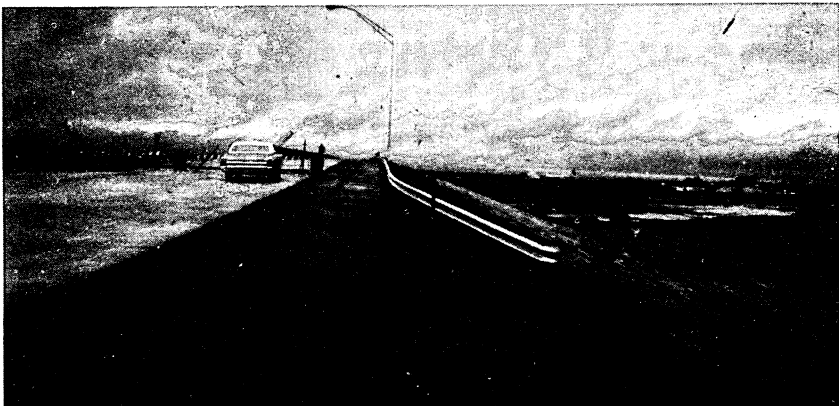
Mr. RICKER. If it is necessary, I think the whole thing should be continuous. I am not sure the first section would be necessary.

Mr. CONSTANDY. Mr. Wilson?

Mr. WILSON. I agree. Here is a place where, obviously, they bought enough right-of-way, and if in fact those slopes are so steep that a guardrail would be required, a very modest amount of fill in the area where the pointer is (indicating), would take care of any danger as far as running off the road is concerned.

Mr. CONSTANDY. Perhaps at no more cost than the expense of the guardrail and its maintenance?

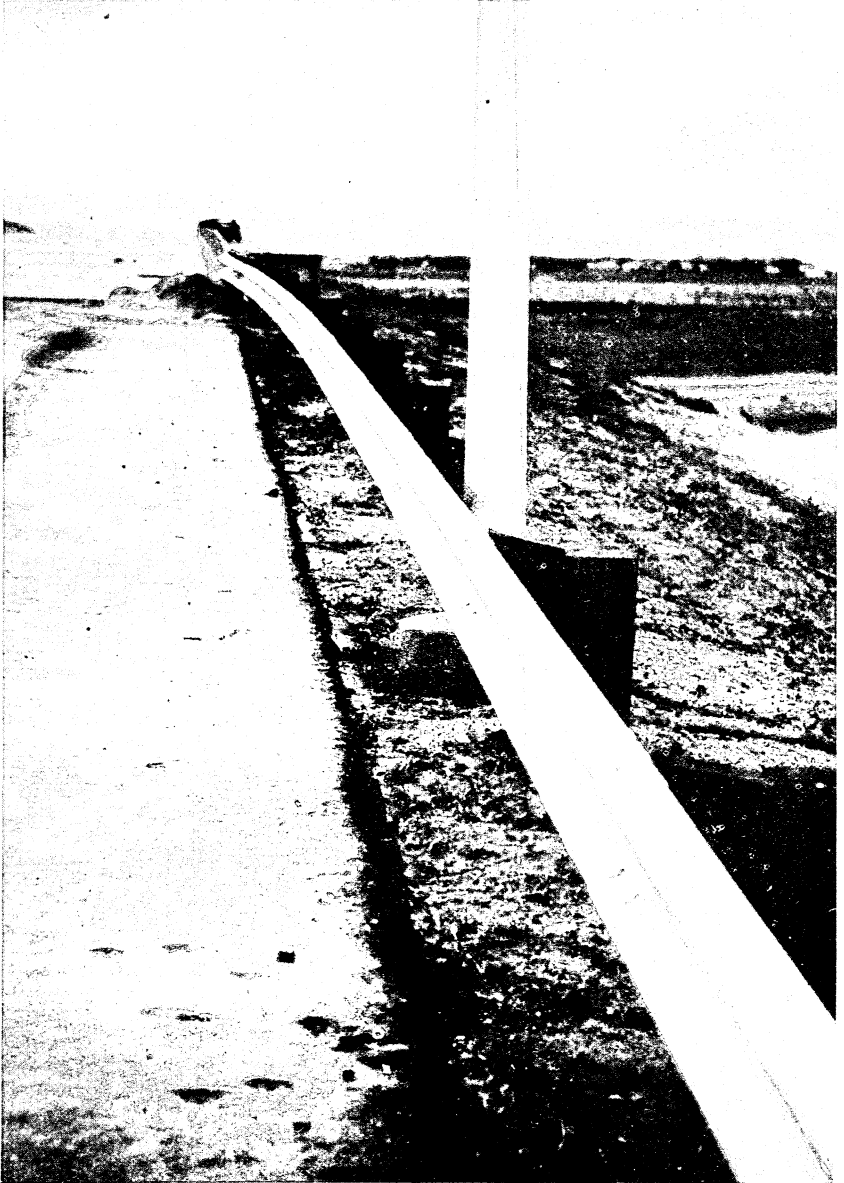
Mr. WILSON. It may even have been a lot less.



Mr. PRISK. Here now is another view of the guardrail installation on new work, showing the flareback. There is no indication of any rail being buried here at all, carrying on up to this bridge structure.

That light pole, of course, would be a steel light pole behind the rail.

And here is the way it looks close up. You will find when you get there that you have the light pole mounted on a concrete footing, and some of these footings get very close to projecting in front of the rail. Some of them actually did.



The rail is set, nominally, 2 feet behind the edge of the paved shoulder. It is 2 feet off this line. And, as you move up here to the structure, the rail is then, of course, tied into the traffic side of the parapet rail.

Mr. RICKER. Would you back up to the previous one?

Mr. PRISK. OK.

Mr. RICKER. You mentioned that is not buried, but that is a well-designed guardrail and post. Many, many of these have been installed and work very successfully. It is not the exposed end that spears the car. The only way a car can spear on that is if he goes down the bank and comes back up again, which is possible but not done very frequently.

Mr. PRISK. I think I would agree with you on that.

Mr. CONSTANDY. Is that consistent with the recommendation of Special Report 81, or do you differ from that? Do they not recommend that the end be anchored whether it is flared or not?

Mr. RICKER. I think Bulletin 81 recommends flaring and anchoring. But there are some other problems here, too; because if it is buried or brought down to the ground level, then a vehicle can get on top of it, where it cannot get on top of this one. This is not a bad design.

Mr. CONSTANDY. Does anyone differ with that? Mr. Huff?

Mr. HUFF. I would like to differ with it. That supported end there is less than 30 feet. Of course, the Bureau and the States have agreed on 30 feet as being the limit to which an obstruction should be permitted. I would disagree that it would be a good design.

Mr. CONSTANDY. All right, we will leave it at that. Mr. Prisk?

Mr. PRISK. In any event, this is a closeup of the same shot, and I think the condition is obvious.

Here we are on the median side now, with the rail flared back pretty much into the center of the unpaved median.



Again, in that terminal section showing there, square posts are used, and the guardrail height here measured at the foot of the post, on the line of the post, is 27 inches, not any too high in that kind of condition.

Mr. CONSTANDY. Is that chain fence, Mr. Prisk?

Mr. PRISK. Yes.

Mr. CONSTANDY. Is that a glare shield or is that intended to add to the barrier effectiveness?

Mr. PRISK. It serves moderately as a glare shield, but is intended to be a barrier against any crossing of the roadway at this point.

The thing that concerns me about this fence was the fact that there is a rail up here along the top edge of that fence, and anybody who penetrated that rail or upsets that system would possibly endanger himself because of the rail at the top.

Mr. CONSTANDY. There is a point which does not seem to be tremendously apparent. Mr. Wilson, you have had some experience in California relative to the pipe support on the chain fence, have you not?

Mr. WILSON. Well, 15 or 20 years ago, we used to put a lot of chain-link fence up with the pipe in it. It was not very long until we found out these could be lethal weapons, and we took them all down. They have been down for a long time.

Mr. CONSTANDY. What happens to the pipe on top?

Mr. WILSON. If the car runs into the end, it is liable to spear the occupants, or it will spear the car. And even if you break into a fence with that type of member as the top member of the fence, it could break anywhere and come into the vehicle.

I want to point out one thing here, though; they did use special anchoring on the end of this guardrail. I think the post spacing is closer than it is farther down. I do not know what the post is, the first one, whether that is a steel post or not.

Mr. CONSTANDY. The post on each end is steel.

Mr. WILSON. I presume that it is set in heavy concrete.

Mr. SKEELS. Pretty obviously that should be ramped.

Mr. CONSTANDY. Sir?

Mr. SKEELS. And pretty obviously the end of that rail should be ramped into the ground.

Mr. CONSTANDY. Buried?

Mr. SKEELS. Yes.

Mr. CONSTANDY. I think that is the last slide, is it not, Mr. Prisk, on Oklahoma?

Mr. PRISK. This takes care of Oklahoma.

Mr. CONSTANDY. Before we get on to Georgia, do any of the panel members have any comment to make on the slides we have seen, beyond what you have said?

Mr. SKEELS. I have just one comment. I noticed that even on the blocked-out sections, they did not use the washers.

Mr. PRISK. That is true.

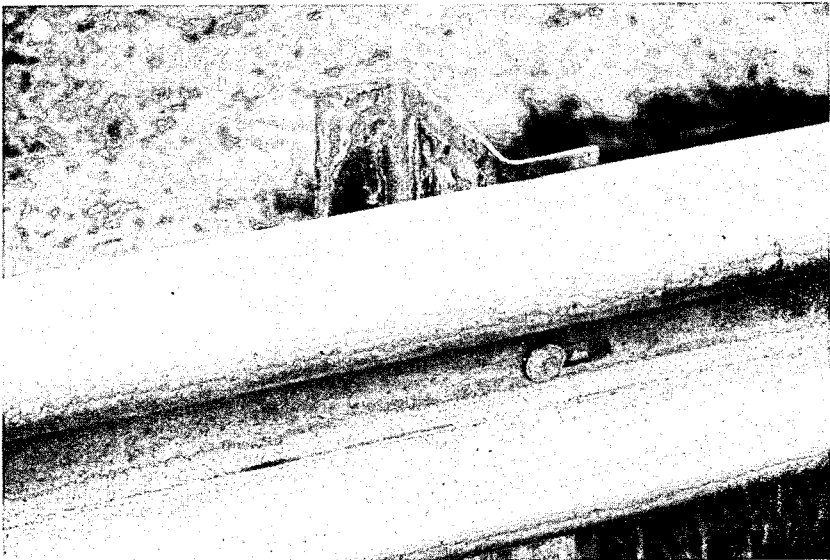
Now, we take up a section of I-75 in Georgia, north of Atlanta. It was opened, parts of it, in late 1966, other parts in early 1967.

It is a rural section, which has a variety of conditions on it that are quite unique. First of all, I guess, is this post used to support the rail, the Z-type post, which has been used in Georgia for a number of years.

You see also no indication of washers at this location.

Mr. CONSTANDY. Do any members of the panel have any comment to make on the type post used there?

Mr. SKEELS. I might make one. We would not consider using this type of post. It certainly—well, I have not run tests on this particular design, but obviously it is a very weak post. The proper performance



of guardrail, or the proper performance of this type of guardrail, is very dependent upon the strength of the post on which it is mounted. As you pointed out, there are other types of guardrail that depend on weak posts, but this type is not; it requires a strong post.

Mr. CONSTANDY. In this we have a good picture of the slot where, incidentally, there is no washer. When the forces are applied to the guardrail, that slot can open and you can see how easily the bolt head can go through the slot.

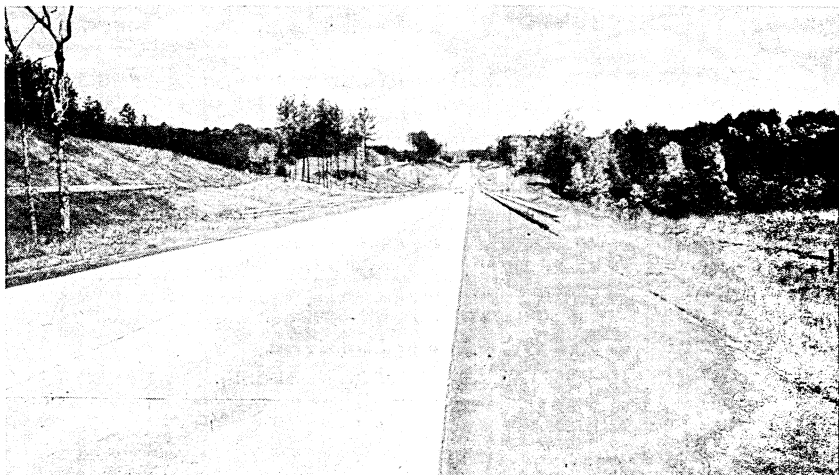
Mr. SKEELS. That is why you need the washer.

Mr. CONSTANDY. Yes. It has to be on, is that correct?

Mr. PRISK. This rail runs about 25 inches high at most locations where it was measured. Here is a section head-on, on the job, just beyond the light pole. As you can see, the light pole was set barely a foot and a half off the edge of the shoulder and the rail about 1 foot off, with no special treatment at all in this particular instance.



Now, they space their posts, these steel posts that we are looking at close up, at 12 feet 6 inches, until you come to a sign location and then a bit later you will see a different treatment there.



Here is a view seen rather commonly along the job, showing about the way it looks. Again your head-on rail on this side and also on this side [indicating]. This is about 10 feet or 10 feet 6 inches off the edge of the pavement and this is about 9 feet on this side.

Mr. CLAUSEN. Is this on a primary road system or is this part of the Interstate System?

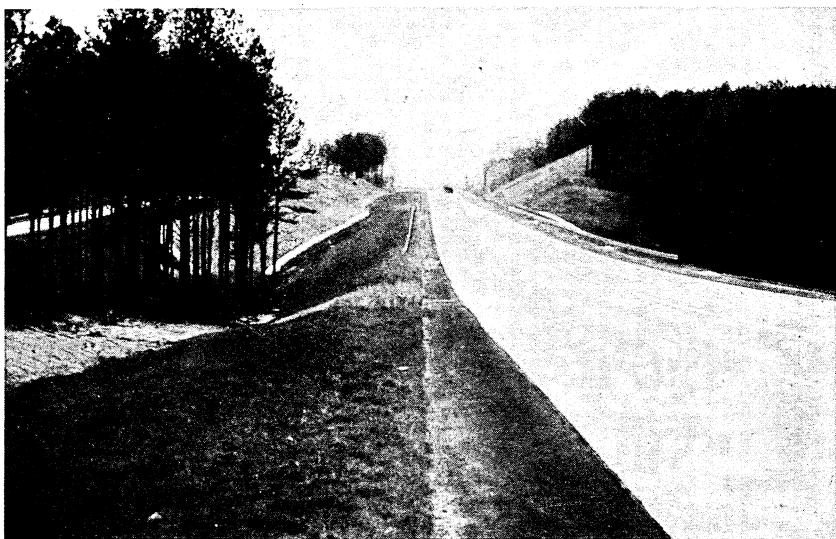
Mr. PRISK. This is the Interstate System, I-75.

Mr. CONSTANDY. This was opened in 1967?

Mr. PRISK. Opened in February 1967.

Mr. CLAUSEN. In what State?

Mr. PRISK. Georgia. I-75, just about 15 miles north of Atlanta.



This, again, is a general view showing the median section, separate line and grade, installation of rail here, evidently at a fill height which corresponds to the Georgia standards. This fill here, of course, is not as high, but it apparently meets the height here [indicating]. So meeting the standards here, that section is in. The same thing over on that side.

Mr. CONSTANDY. Mr. Prisk, is that long enough to protect the motorist from the dropoff, that slope?

Mr. PRISK. Well, there is, of course, the danger of approaching through this area.

Mr. CONSTANDY. I mean on the right side.

Mr. PRISK. On the right side? No, I think, as I recall that location, that it is quite a dangerous drop at that point.

Mr. CONSTANDY. Would it have been more desirable here to eliminate the guardrail from the median and use that material?

Mr. PRISK. I should think this could be considered certainly as an opportunity to regrade the median at that point.

Mr. HUFF. Is that a drainage structure this side of the barrier?

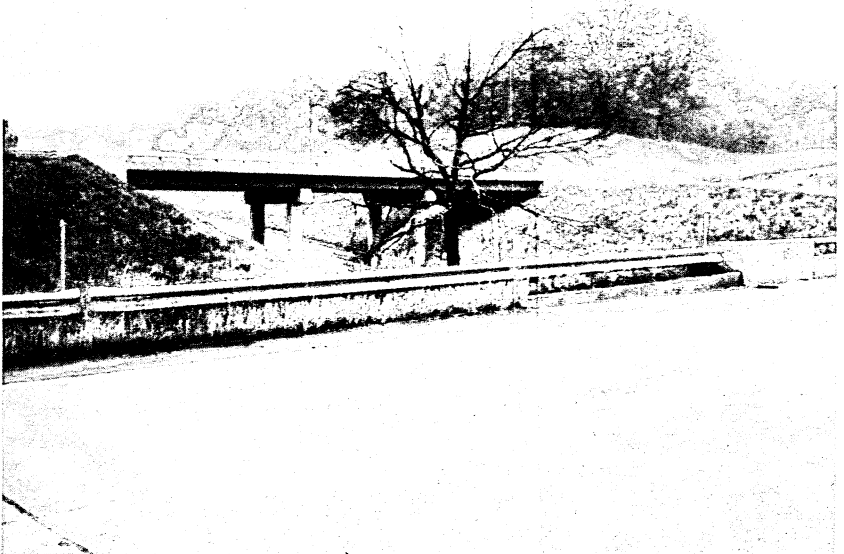
Mr. PRISK. Yes, it is. There is a minor drainage structure right there at the trees, right in this area [indicating].

Mr. CONSTANDY. I think with the trees there, the drainage structure might not present a great problem.

Mr. SKEELS. I was going to add, the trees give you far more hazard than the slope up where the guardrail is. The guardrail really ought to be down there protecting motorists against the trees, rather than against the slope up above. That slope, in the slide anyway, does not look lethal.

Mr. CONSTANDY. We could cut the trees down, too.

Mr. PRISK. OK, we move along to a very unusual situation here, which is a sign of progress. Maybe this is encouraging, because on the



median side you find that the structure is protected by this much advance guardrail—four panels, I guess it is, it would be 50 feet—and starting at this place, they have now added some more. So you have an additional protection beyond what was originally afforded on this project.

This was not joined together in any way. This is clean air between the guardrail ends.

Mr. CONSTANDY. How about that, Mr. Huff? Did you want to say anything about it?

Mr. HUFF. Did they give a reason for that? Have you thought of a reason?

Mr. PRISK. I cannot think of any reason. This is an improvement.

Mr. CONSTANDY. The area engineer, I believe, or some member of the Bureau said they realized that the section of guardrail for the bridge was too short and decided to make it longer, so they put in another section of the same length, but they did not connect it. They are sitting side by side or end to end. Is that undesirable, panel? We are all agreed on that?

Mr. SKEELS. That bridge rail appears to be extremely low.

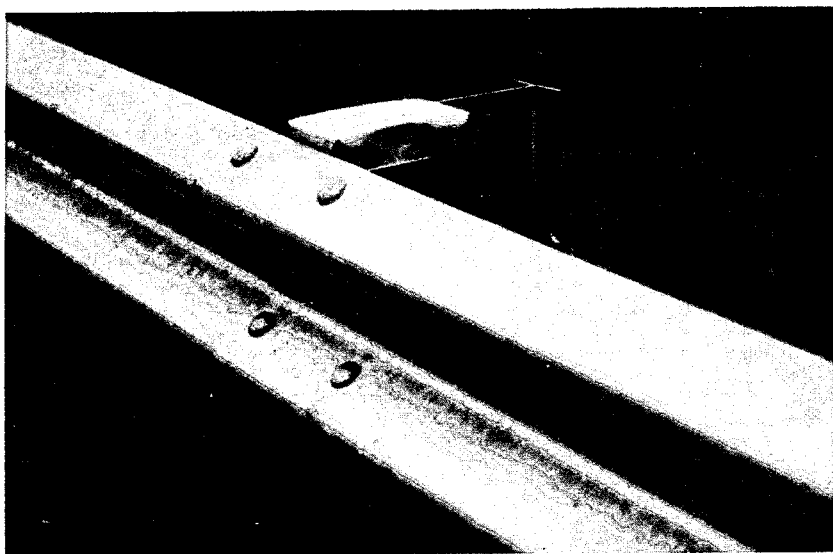
Mr. PRISK. We are going to take that up later, too.

Here now is what you get as you get to a sign location.

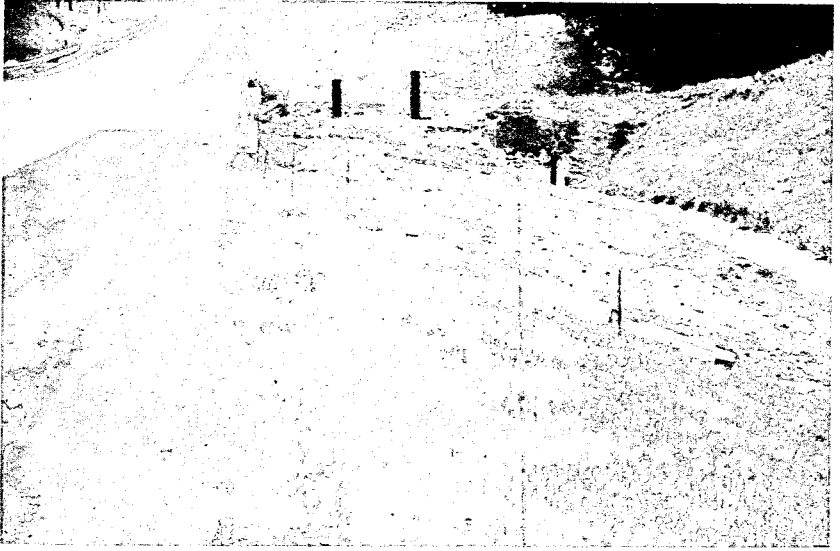
You find that this block is produced. This is a 6- by 8-inch block fastened to a steel post, so that your rail actually is blocked out when you come to a sign location. This is only at sign locations.

Mr. CONSTANDY. That did not have a washer in it, Mr. Prisk?

Mr. PRISK. No. It did not.



This is an interesting situation where there is a sign to be put in here, and this first installation of rail was head on at the edge of the shoulder, and then there was some additional flare and additional length of rail that was laid out here. You can see the headwall down at that point, the earthfill across here, which more or less is a sign island.



Here, in this picture, you see the completed installation, the sign island. Here you see the flared blocked-out rail. Here you have no more blocks running up to the structure. That is the treatment at that point.



Now we look ahead. Here is what you have. As you go down the sign, you see the blocks in here on the posts, and then the rail is mounted directly on the posts as soon as you get beyond the sign.

Mr. CONSTANDY. Yes, I think we should make this very clear: originally the standard to which the guardrail was installed did not



require blocking it out. Subsequently, when they got a contract for the sign, and that included the guardrail, the standards had been improved and, consequently, when they joined the two sections together, they were protecting the motorist from the sign, which has the added feature of the blocked-out beam. As you get away from it, you find this, the older standard without the blocked-out section.

Mr. RICKER. Just out of curiosity, do you know what the shiny cap is on the standout block?

Mr. PRISK. That is a piece of very thin sheet metal that is tacked on the top of the block. I would say it is a piece of aluminum sheeting.

Mr. RICKER. To protect it from weather?

Mr. PRISK. Yes.

Mr. RICKER. Thank you.

Mr. CONSTANDY. There is one other point here, in connection to the two different design standards. The new installation has a steel I-beam post and the other, not being blocked out, has the same—is that a Z-post?

Mr. PRISK. Z-post.

Mr. CONSTANDY. I just cannot imagine what might happen to an automobile, as it came down sliding along the guardrail at the new portion of the installation and then slid into the older portion—does anyone care to speculate?

They are quite a bit different, are they not? And they probably would perform differently.

Mr. PRISK. Here is another installation that was carried out the same way; blocks on the rail up to the point of the sign and then you fade back into the rail mounted directly on the post going into the structure.

Mr. WILSON. I know we are not talking about signs right now, but if that sign were moved about 100 feet ahead, just beyond the end of the bridge rail or just at the end of the bridge rail, then all this protection on this end would be unnecessary and the sign itself would not be able to be hit.

Mr. CONSTANDY. Of course, without a guardrail installation, it would be possible for an automobile to go behind.



Mr. SKEELS. The guardrail is doing double duty, protecting not only the sign but the dropoff there. The guardrail is probably necessary anyway.

Mr. CONSTANDY. You have left what they had placed there for the protection of the bridge and the ravine. This installation was only put there because of the sign.

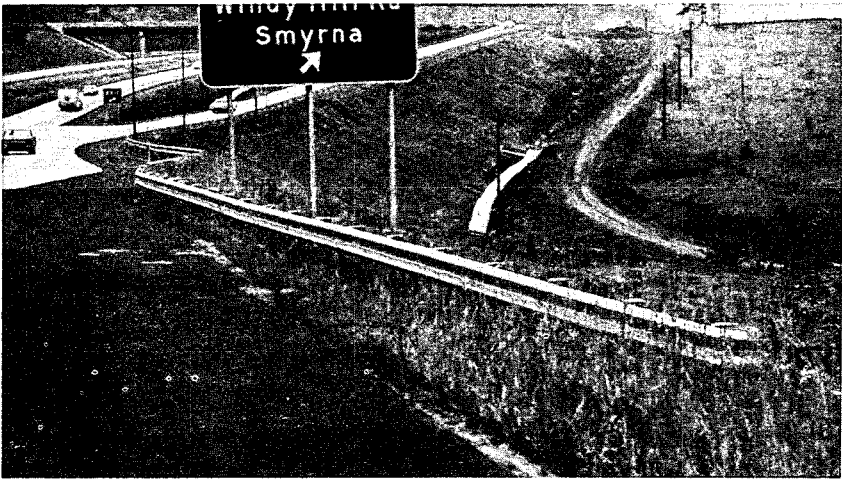
Mr. SKEELS. I realize that; but as it stands, it is doing double duty protection.

Mr. CONSTANDY. Oh, yes.

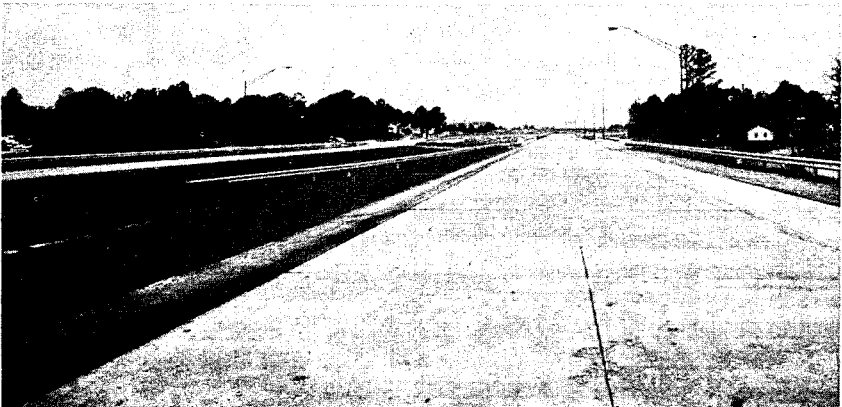
Mr. SKEELS. If you moved the sign over to the other side or by the bridge, you would still need the same amount of guardrail you have there now.

Mr. CONSTANDY. Only because of the sign, the original was inadequate.

Mr. SKEELS. The original was inadequate.

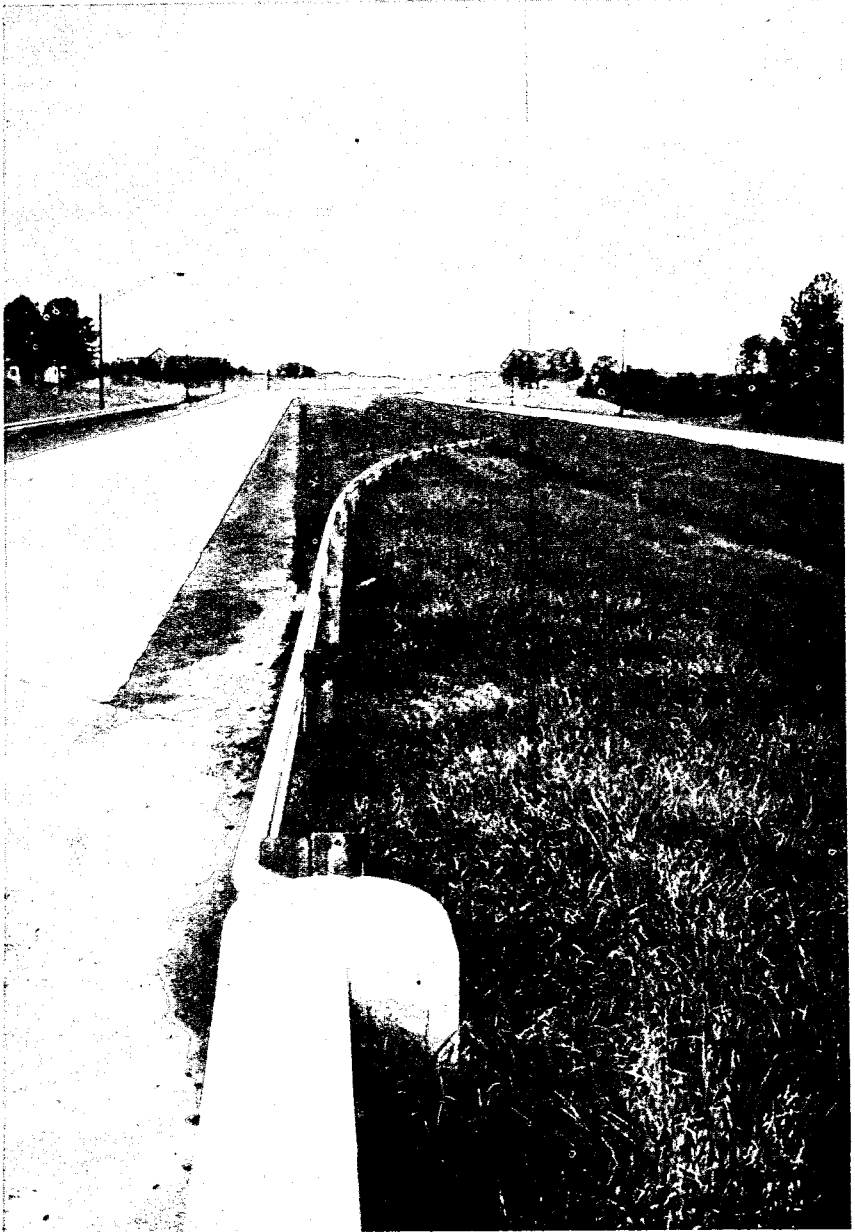


Mr. PRISK. Moving along, here you see as a result of some of this, when you combine it with a deceleration lane, parallel deceleration lane, you get quite a whip in here. You go past the sign, drop the blocks, and follow the line of the decel lane, and you get a pretty good pocket there before you reach the end of that particular installation.

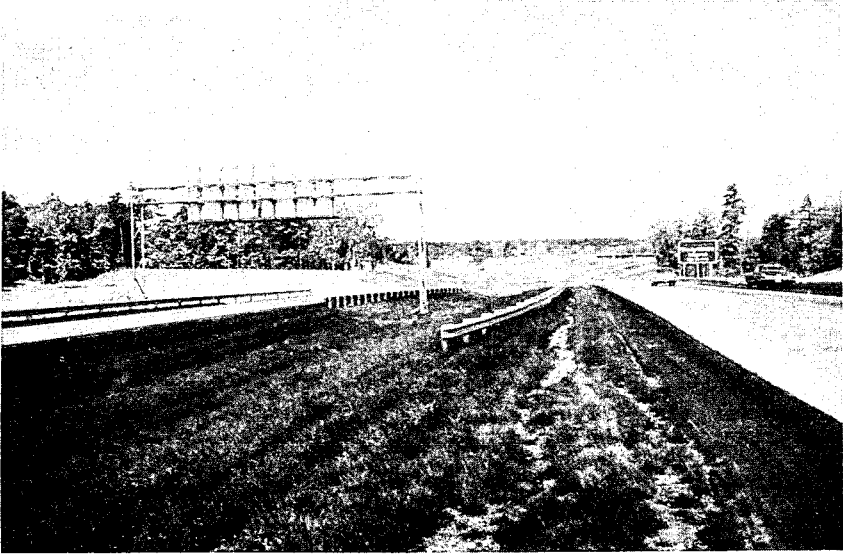


This, now, is on the median side where the rail is taken across the center of the median and buried in the upslope on the other side. It is quite a long treatment.

There seems to be a good bit of respect around the country, on all of the projects we visited, I would state, for the hazards of this dual bridge, as far as possibility of treating it by rail is concerned. This is one place where the length of rail would seem to be entirely adequate.



This is looking back from the structure to that rail installation. As you will see, it goes back across the median on a rather easy flare.



Here is an installation put in around a signpost, sign structure support. And here the treatment is not quite as elaborate, because this comes, oh, possibly 12 feet from the edge of the paved shoulder and does not go on out to the place where you guard that sign support in the same fashion that the bridge itself was treated, the open bridge.

Mr. CONSTANDY. That concludes the section on Georgia, does it not, Mr. Prisk?

Mr. PRISK. That is true. We go now to Rhode Island.

Mr. CONSTANDY. Yes.

Do any of the panel members care to say anything relative to the slides we have seen in Georgia? Mr. Skeels?

Mr. SKEELS. In referring to these last few slides, it looks as though they are trying to do an adequate job, but the principal criticism I would have would be the posts, the Z posts that they are using.

Mr. CONSTANDY. Do you care to throw in the washer?

Mr. PRISK. Oh, yes. The washer is always in there, or the lack of the washer.

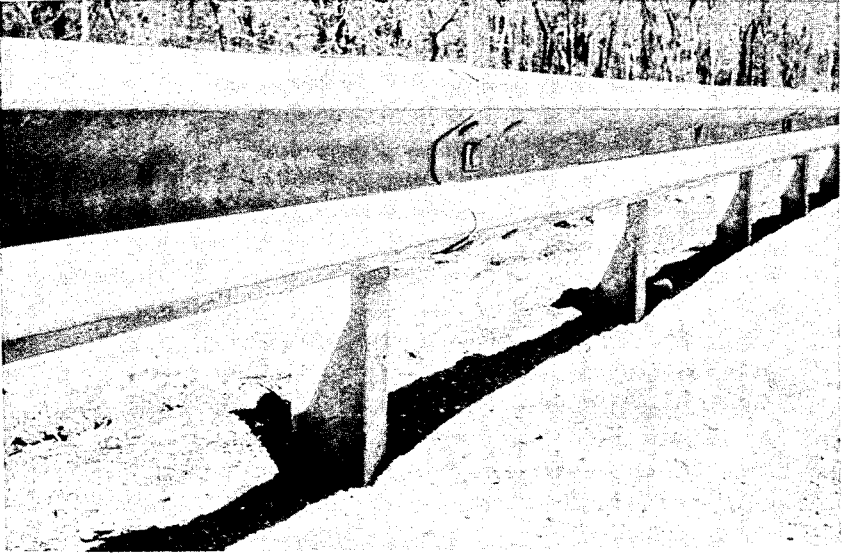
Mr. CONSTANDY. Fine. Mr. Prisk, would you please proceed.

Mr. PRISK. All right, we will consider Rhode Island now as our next State. Here we are on a section of Interstate 95, which is partly in rural area and partly in the urban, in the Providence district. This particular section lies south of Providence.

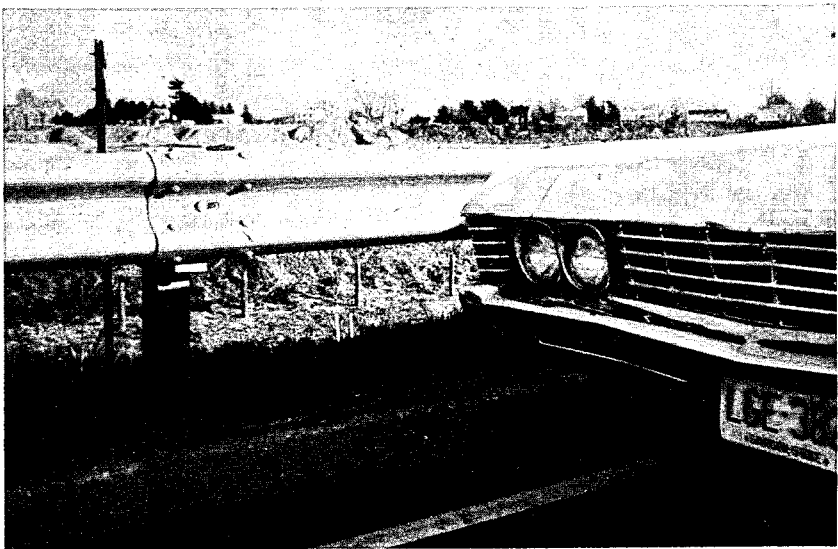
This is the general view of their blocked-out rail, using steel blocks and washers, and everything looks fine. Measuring the top of the rail shows that that is up 31 inches high. This is an edge rail.



Here is a general view of the same installation, washers all the way through, and this looks pretty good. They have used 6-foot-3-inch spacing on posts.



Here, however, is one thing that we did find, that that 31 inches is up on top of a 6-inch curb for a good bit of the project, and compared to a standard American automobile, you will see that the top of the rail is fairly well up on the car, and I daresay that the possibility of getting into those posts might be a little greater. Just what would happen with respect to the curb in front of the rail on the rail's performance is a little hard to conjecture, but I do not think it would help it.



Mr. SKEELS. I would like to comment on rail height a little bit. I do not want it to be inferred that the higher the rail is, the better it is. It can get too high. The 31 inches, in my experience, is too high, the danger being when struck with the force involved in collisions, the rail will tend to come off the posts, particularly if washers are not used. If it comes off the post, the car will go under it with the rail going over the top of the car.

The height, then, is always a compromise between being high enough to prevent the car from getting on top of the rail and low enough to prevent the car from wedging underneath the rail.

Mr. CONSTANDY. Could it be that wider rails would be more satisfactory? I realize this is what they make. Has anyone done any research?

Mr. SKEELS. I do not know of any research with wider rail. I know of research with double rails; two rails, one on top of the other. And of course the design with the lower rub rail. When the lower rub rail is used, you can mount the main rail higher; but if you mount it, I believe 31 inches is, in my opinion, a little too high.

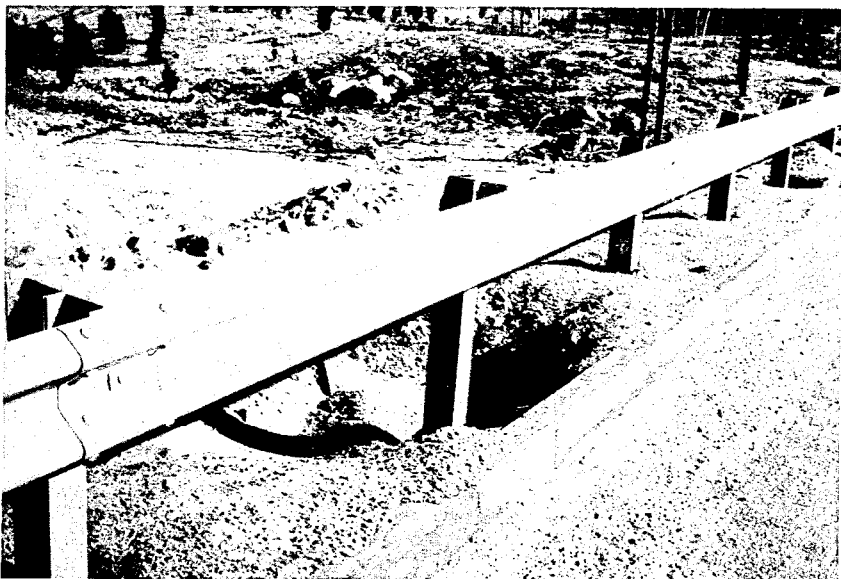
Mr. CONSTANDY. I would like to point out in this picture there is no washer. In the two preceding pictures there were washers. I think that is common. We found some places there were washers and other places there were no washers.

Mr. PRISK. That is right. In most places washers were installed. This particular shot shows a place where they did not use the washer.

Here you see the washers in place. Posts again are behind an asphalt curb at this time, some work still remaining on this project in spite of it being open to traffic.

This is another thing that I suppose we could comment on, the disposition to get these projects open before everything is cleaned up. But the work here—I mean, what you see here, this condition is rather typical of that project. This is not picked out to be particularly bad, but rather representative.

Mr. CONSTANDY. You reminded me of something that I meant to say earlier and I think it might be a good thing to say here. Some



people may get the impression that on a section of road 10 or 12 miles long, we sought out those places that did not look too good. Nothing could be further from the truth.

Mr. PRISK. No.

Mr. CONSTANDY. What we have shown are typical, representative things on that project in the way they were found. We took 2,300 pictures, all told, and from them we will use some 600.

We have not gone out of our way, either way, to look for things that were good or look for things that were bad. We simply took pictures of these various 10 elements for what they were.

Mr. Skeels, do you want to say something?

Mr. SKEELS. I want to call your attention to one other item in this photograph. These posts are spaced at 6-foot-3-inch intervals, which means that one of the posts occurs at a splice portion; the next one occurs at a position where the rail is not spliced.

The spliced portion on the rail is two rail thicknesses thick. At the intermediate post, then, there is only one rail thickness involved.

In our test at GM, we have had several occasions when a car impacting a rail at a point where it is not spliced will tend to cut the rail in two in a shearing action at the mounting point, and it is our practice to put in a doubling section. In other words, a short section of rail about a foot long to act as a doubler at the point where we attach to a post, where it does not fall on a splice.

Mr. CONSTANDY. If my recollection serves me that is also recommended in Special Report 81?

Mr. SKEELS. I forget. We will have to check that.

Mr. CONSTANDY. I think it does.

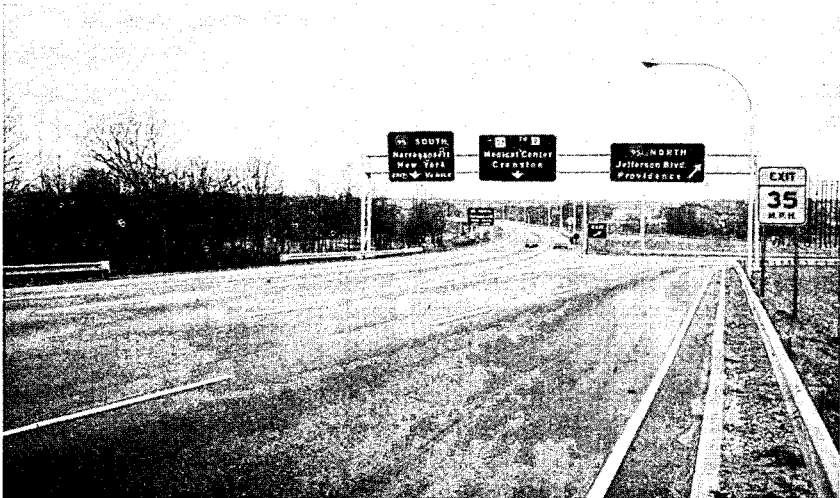
Mr. RICKER. It is.

Mr. CONSTANDY. It is?

Mr. SKEELS. It is a very cheap little thing. It does not cost much except a little foot of rail at each one of these, and it does prevent shearing action.

Mr. CONSTANDY. Thank you. That is a good point.

Mr. PRISK. OK, now we move along and look at some of the installations.



We have one on the right set 2 or 2½ feet behind the curb and the edge set in about 2 feet from the curb the other way, in this particular case approaching a major gore division between the route taking you to New York and one of the connections into Providence.

This, again, can be looked upon as a standard type treatment. You will find railing that starts down in here [indicating], on this curve, in the gore. In many of these gores, the area was relatively flat. There is some question as to whether the rail was necessary there at all.

I would also point out on this side you have a short section of rail installed around the bridge structure support, and a brief section here with no rail at all, though there is an embankment here, and then another start. So there are quite a few things in this picture to look at.

Mr. CONSTANDY. That you would consider undesirable?

Mr. PRISK. I think it could be improved, Mr. Constandy.

Mr. CONSTANDY. Thank you.

Mr. PRISK. Here is another one. Behind the curb you have a blunt end of rail. In this case these are aluminum poles which, elsewhere along on this project, are left exposed very frequently, but in this case railing is put in there. It is a little difficult, again, to see the reason for that installation.



On the left-hand side, you find the sign that might warrant some shielding, because of the fact there are concrete bases somewhat above ground and very husky upright supports, and there is no railing at that point.

Mr. CONSTANDY. Mr. Skeels?

Mr. SKEELS. I would just like to emphasize the undesirableness of mounting rail on top of curbing. Or to put it another way, to place curbing in front of the rail. This does nothing but encourage the car to get on top of the rail and make the rail ineffective.

Mr. CONSTANDY. Thank you. Mr. Wilson?

Mr. WILSON. It appears as if, in this picture here, it is a policy to erect a rail on the outside of the curvature. I want to point out we found that quite often rails on the inside of the curves are necessary and it looks to me like one ought to be combined with this to protect the traffic from the sign post, and also the slopes that exist over there. And I question whether the one on the right here is needed at all, because it appears as if there are flat slopes here.

Mr. SKEELS. I might add to that, at the proving ground, we found that we get five cars off on the inside of the curves where there will be one on the outside, in spite of the fact people's normal intuition is that a car would go off on the outside.

Mr. CONSTANDY. Five times?

Mr. PRISK. If you lose control and go into a spin, it very commonly goes off on the inside of a curve.

Mr. CONSTANDY. Five times as often?

Mr. SKEELS. It is pretty hard to predict, right.

Mr. CONSTANDY. Of course, we may recognize that your employees using the proving ground are professional drivers, who perhaps are less inclined to go out of control on the outside.

Mr. SKEELS. I do not want to elaborate on the point, but they are not professional drivers; they are farm boys we hire for six months at a time. Normal people. They are also good drivers, but not professionals.

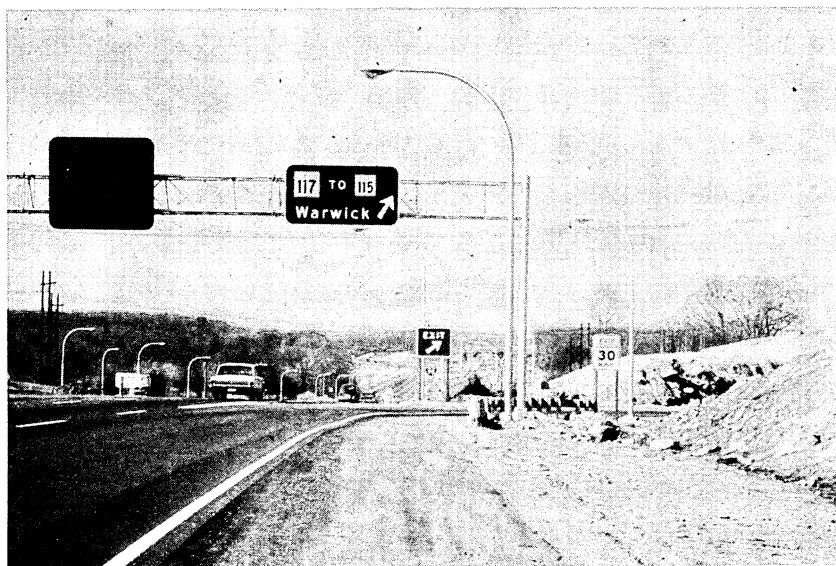
Mr. CONSTANDY. Thank you. Mr. Huff?

Mr. HUFF. Our traffic experts report the same thing. I do not know about the 5-to-1 ratio, but for some unknown reason, more than normal go off on the inside of a curve.

Mr. CONSTANDY. That is surprising.

Mr. PRISK. Moving on here to still another type of gore on the urban section, this is in the connection from 117 to 115, taking Route 117 off Interstate 95.

Here is a head-on section, which is extremely short, for one thing, and which has no protection at all. If there is any tendency to run off the inside, I would say this has the prospect of being hit.



You also see several other things in here besides the boulders. There is the light pole, and of course the sign-support structure itself with its footing.

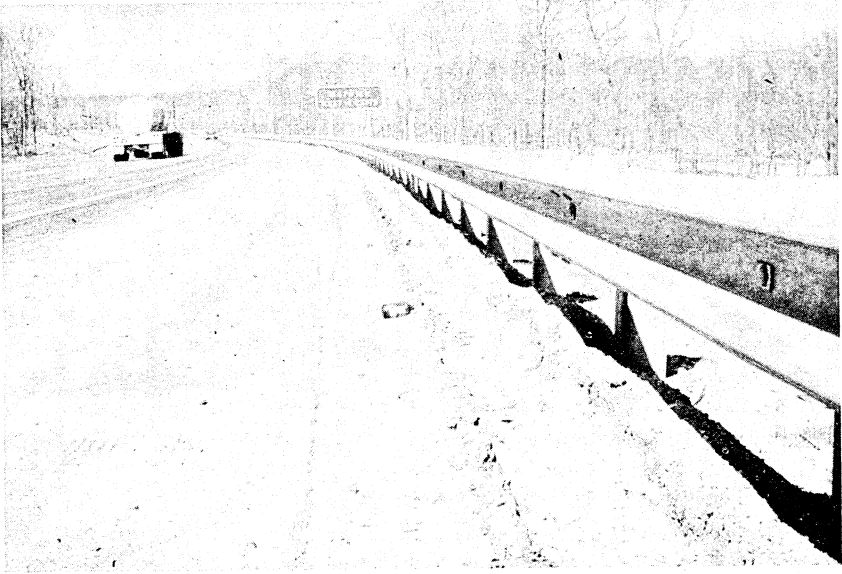
This job, as I said earlier, is not finished. You will see a couple of signs here that say the same thing, "Kent Hospital." Obviously the larger one is the final sign, which has just been installed; the other one just has not been taken down. Nor has the end of the guardrail been yet finished off. A good bit of the rail that we saw is exactly in this condition, exposed end.



Here is more on the median side.



This is a section of the side rail also showing how people get into this area, like it or not. This is shoulder here and this is just dirt, churned up and muddy. Well, muddy certainly in wet weather, as these ruts tend to indicate. And I suspect that the performance of rail with that kind of surface in between cannot be too good.



There are washers on this median divider, which runs right down the middle of a fairly wide median, in the process, as you can see, of landscaping, completing work, finishing work on the median area.



Now, when you come to a structure, this is one of the treatments that we see on this I-95 job. Starting at this point here, you break away from the post [indicating] and install separately blocked-out sections that flare out and go around the pier, and then return to this head on, down in the middle, double section, double backed-out section.

When you look as this, I think you get an impression that cars can easily be thrown off this area here across the roadway itself. The transition is perhaps a little bit more abrupt than desirable.

Mr. SKEELS. My comment would be that it would seem to me that this flare is much too much. It is not necessary to clear that pier that much. You might flare the two rails enough to give maybe a 2- or 3-foot clearance to the bridge piers, but not to get clear out to the edge of the road.

Mr. PRISK. Right.

Mr. SKEELS. It looks to me like they made a real attempt to do it properly, but I question their approach.

Mr. CLAUSEN. Mr. Skeels, I am going to have to try to figure out what is the line of communication between yourself and myself; because you anticipated the very question I was going to ask.

