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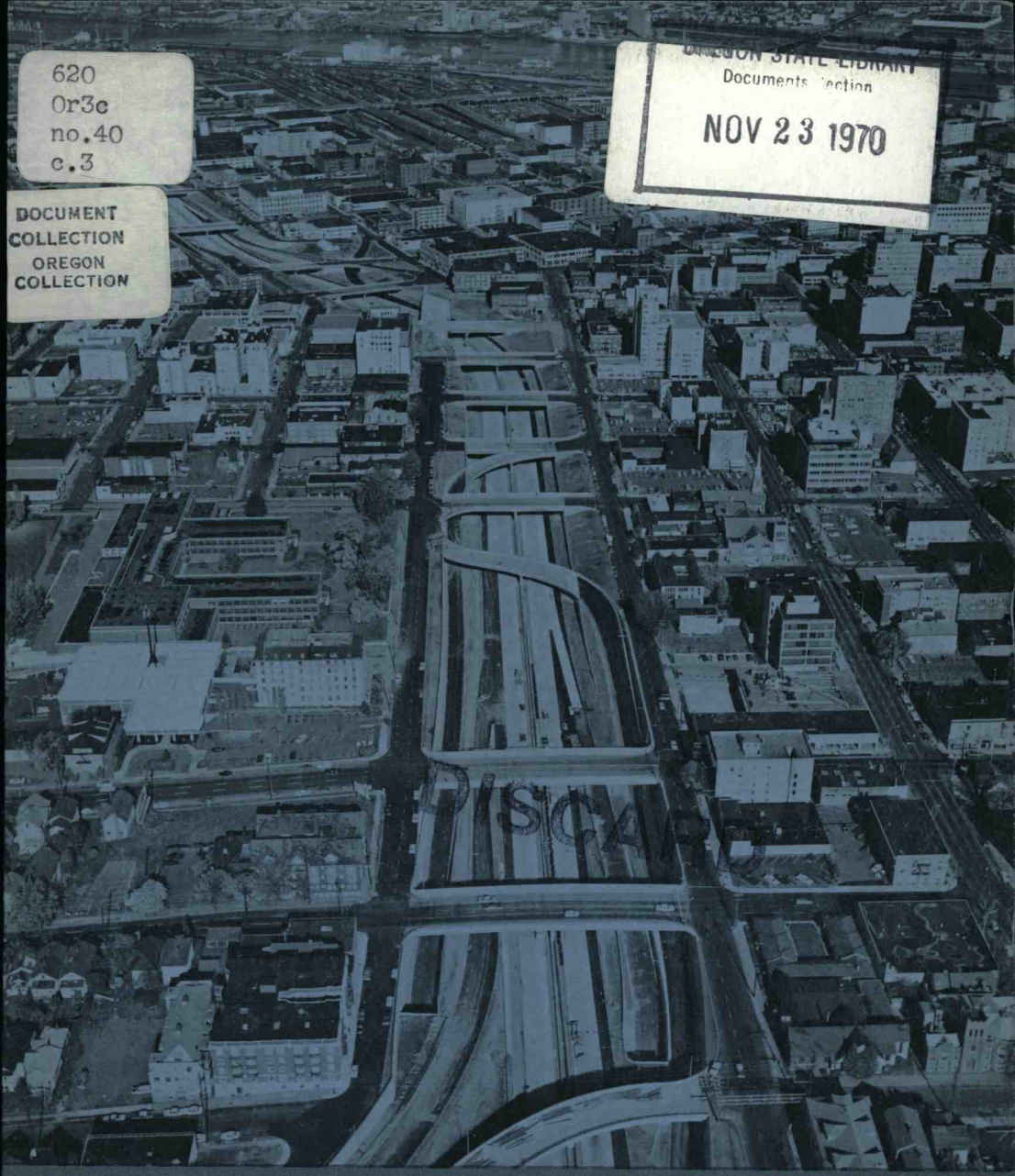

DISCARD

Proceedings of the 1970 NORTHWEST ROADS AND STREETS CONFERENCE

CIRCULAR NO. 40, AUGUST 1970

Engineering Experiment Station
Oregon State University
Corvallis, Oregon

THE Oregon State Engineering Experiment Station was established by act of the Board of Regents of Oregon State University on May 4, 1927. It is the purpose of the Station to serve the state in a manner broadly outlined by the following policy:

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(2) To serve the industries, utilities, professional engineers, public departments, and engineering teachers by making investigations of interest to them.

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Proceedings of the 1970 NORTHWEST ROADS AND STREETS CONFERENCE

Corvallis, Oregon
February 4-5-6, 1970

CIRCULAR NO. 40
AUGUST 1970

Engineering Experiment Station
Oregon State University
Corvallis, Oregon

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PROGRAM

Wednesday - February 4, 1970

WELCOME

Presiding:	Victor D. Wolfe
Welcome	George W. Gleeson

ACTION IN MOTOR VEHICLE SAFETY

Presiding:	G. W. Bellamy
Air-Bag and Shock-Absorption Frames:	A. J. Slechter
Energy Absorption Barriers:	John L. Beaton

LUNCHEON

Presiding:	Forrest Cooper
Speaker:	John M. Fulton

DESIGNING LOCAL ROADS AND STREETS

Presiding:	J. E. O'Hearne
AASHO Standards:	Melvin B. Larsen
Low-Volume County Roads:	Jay Painter
Base Designs:	C. E. Angermayer

FINANCING LOCAL ROADS AND STREETS

Presiding:	J. E. O'Hearne
Utah's Collector Road Program:	H. B. Leatham
Financing the Hartstene Bridge:	John C. Bridger

Wednesday - February 4

HYDRAULIC MODEL DEMONSTRATION

Presiding & Demonstration:	Gene R. Fiala

CONFERENCE BANQUET

Presiding:	George H. Andrews
Speaker:	William Merry

Thursday - February 5, 1970

COOPERATION

Presiding:	B. J. McClarty
Multiple-Use on ABC System:	Irvin C. Lloyd
BOR Programs:	S. B. Olson
Public Hearings:	R. L. Carrol

LUNCHEON

Presiding:	Fred J. Burgess
Speaker:	C. M. Halvorson

TOPICS ON THE MOVE

Presiding:	Elmer J. Leland
Planning:	Lloyd Anderson
Implementation:	Al Williams
Use of Consultants:	J. L. Thornton

Thursday - February 5

SAFETY AT LOW COST

Presiding:	Elmer J. Leland
Speaker:	Glen Yake

Friday - February 6, 1970

CONSTRUCTION FOR BEAUTY AND SAFETY

Presiding:	Gordon W. Beecroft
Structural Aesthetics:	Tom Edwards
Skid-Proof Pavements:	John L. Beaton

ARE YOU LEGALLY VULNERABLE?

Presiding:	Gordon W. Beecroft
Oregon's Tort Laws	Joe Henke
The Courts:	Willis A. West

ADJOURN

WELCOME

Presiding: Victor D. Wolfe

WELCOME ADDRESS

by

Dean George W. Gleeson

WELCOME ADDRESS

by

George W. Gleeson

Members of the Conference, gentlemen, good morning. I bring you greetings and welcome you to the campus as I have welcomed this group many times before. This morning I want you to join with me in paying a rather brief tribute to the memory of the late James Albert Head. Better known to most of you as J. Al Head. I note on his official record that in 1935, not liking the name James, he changed it to a simple J. And evidently not liking the name Albert, he changed it to Al. Subsequent to that time he was known to all of his friends, and particularly the people in this organization, as J. Al Head.

He was a native of Oregon, born in Eugene in 1913. He attended grade school in Eugene and then high school in Eugene and Portland and graduated from Jefferson High School in Portland. He attended what was then Oregon Agricultural College, starting in 1932 and attending until 1935 and then skipping for a period of time and returning to the campus in 1938 to recieve his degree in Civil Engineering in 1939. During the time he was in school, even from the beginning as far as my records show, Al was interested in highway work and worked in the summer and at odd times for the highway department starting as an office assistant while still in college. He was with the Highway Department for a long period of time, starting as office assistant in 1935; as assistant traffic survey engineer until 1938; as accident analysis engineer from 1942-1944; and as origin-destination studies engineer 1944-1946. He was on the Portland Metropolitan Traffic Study 1946-1949 and was assistant traffic engineer 1949-1963. He left the Oregon Highway Department in 1963 to go to Washington, D. C.

While Al was in school he was a very active person, being the president of his social fraternity, Pi Kappa Phi while he was on campus and subsequently president of the organization nationally from 1960-1962. He was a registered professional engineer of Oregon, a member of the Department of Traffic and Operations of the Highway Research Board. He also served on numerous committees of the Highway Research Board, was a member, a fellow actually, of the American Society of Civil Engineers and

was a member of the National Society of Professional Engineers. In 1955 Al received the Hughes Award of the Western Association of State Highway Officials for his outstanding contributions to highway engineering. In 1958 he was chairman of this group, the Northwest Roads and Streets Conference, and served in this capacity until 1962. All during the time Al was in Oregon he was an active participant in the affairs of this organization. He held national officerships in the Institute of Traffic Engineers, serving as president in 1963. He was a member of many of the activities of ITE and was on the Technical Council and president of the western section. He was a delegate to a number of international conferences and meetings.

He left Oregon in 1963 to be employed by the Bureau of Public Roads in Washington, in the office of Highway Safety, and he engaged in a wide range of activities during the period that he was in federal service, including traffic operation, motor vehicle operation criteria, development of performance standards, highway safety programs, and as the deputy director of the office of Driving Employment programs for the National Highway Safety Bureau. He was director of the office of Grants and Liaison of the National Highway Safety Bureau and the Department of Transportation 1963-1968. He was the director of the Safety Division of the Automotive Safety Foundation, 1968 until his death in 1969.

Al died suddenly on October the fifth, 1969, following a heart attack near his home in Church Falls, Virginia. His accomplishments are documented in a good many places and I am sure that Al's contributions will not be forgotten. It gives me pleasure to remember him in this connection.

Once again I welcome you. I hope you have a very profitable meeting and I will say good morning to you because it will be impossible for me to stay for your program. Thank you very much, gentlemen.

AIR-BAG AND SHOCK-ABSORPTION FRAMES

by

A. J. Slechter

Air-Bag and Shock Absorption Frames

by

A. J. Slechter

I am a member of the National Highway Safety Bureau and will speak this morning about some specific research programs that are underway sponsored by the Bureau. I will show some slides interspersed with film segments. What you will see in most of the film clips are tests of car crashes. You will have an opportunity to see the air bag in operation. For those who do not know what the air bag is, you will get a good opportunity to see the concept in action. You will also see some energy-managing structures concepts being tested as part of the Bureau's Crashworthiness Research Program.

This slide, I believe, states the highway safety problem very clearly: 55,200 fatalities, 2,000,000 injuries, 11.2 billion dollars financial loss on the highways in 1968. We expect this number of fatalities to increase up to 56,000 for the 1969 period. Divide the total number of hours of a year into this figure and you will find we kill about six an hour on the highways. You might also want to relate this to the war in Viet Nam in which latest counts for all the years of the Viet Nam war indicate a total of about 40,000 deaths. This is a slide of the elements and phases of the crash problem. A systems approach to the problem considers the vehicle, the human, and the road and environment in all three phases of the crash: the pre-crash phase, the actual crash phase, and the post-crash phase. I will consider particularly the vehicle and the crash phase as I discuss the crash survivability program of the Highway Safety Bureau.

Look at some concepts first that are basic to all kinds of crashes: the head-on, the rear-end, the side,and the roll-over crash. I will deal mainly with the head-on crash, with lesser emphasis on the side, rear-end, and roll-over crashes.

This slide shows why we are emphasizing the front-end crash. The numbers shown are the percentages of serious and fatal injuries in automobile crashes that occur in front-end crashes.

Side crashes account for about 10% and rear-end crashes 16%. The front-end crash is a substantial contributor to the more serious crash losses.

First some basic definitions and concepts. We call a crash an abrupt change in velocity. What we are really interested in is the fact that the car and its occupants are undergoing a deceleration. The problem is to find ways to control the forces that are involved in the deceleration. This slide shows a simple but interesting example of crash-energy management. Two eggs are dropped from the same height -- one breaks, one does not. We would normally say that one fell on a hard surface and broke, the other fell on a cushion and did not break. It is a little more involved than that. The forces acting on the egg that fell on the hard surface were imparted to a very narrow area of the egg surface. With the cushion the forces were spread over a reasonably large area of the egg surface. In addition, notice that the egg falling into the cushion used up some distance in its stopping maneuver. This relationship between the forces involved in crashes and distance traveled is very important. We will speak about acceleration and deceleration and probably use them interchangeably. They are obviously the same thing except for a change in algebraic sign. A car which impacts another vehicle or wall or pole undergoes a deceleration. A car which is impacted and takes on momentum undergoes an acceleration. We will use the g-value as the frame of reference in our discussion.

If you are driving your car towards an intersection, and make a normal braking stop, you will sense a g-value of about 0.1 g. If you make an emergency panic stop and lock all four wheels on dry pavement, you will sense something like 0.6 g. The astronauts during the lift-off phase sense about 4-g comfortably and in reentry they experience about 6-g, again with no problems. The relationship shown between g-value and stopping distance is all important relative to what we can do in the vehicle to control the forces involved in a crash.

Consider the normal braking stop from 60 mph with a 0.1 g deceleration. This maneuver takes about 1,200 feet. From 60 mph the panic stop at 0.6 g requires 200 feet. Note that the higher the g-value experienced the shorter is the stopping distance. If we could bring a car to stop in 12 feet from an initial speed of

60 mph, the car and its occupants would sense about 10 g. If it were stopped in eight feet, 15 g and in three feet, 40 g. We are particularly interested in the high g controlled crash in developing energy management techniques.

This is a picture of the Daisy Accelerator at Holloman Air Force Base where some early tests were run to determine what conditions develop in high-speed crashes and to get some early indication of what the human body might be able to sustain in the way of g-forces.

The film shows a chimpanzee on the sled at 90 mph, stopping in a distance of 2.3 feet by means of a high-energy water brake at the end of the track. This is a live test of the chimpanzee at 90 mph with a measured deceleration of 147 g. He was examined thoroughly after this crash and no apparent injury was sustained. I might add, however, it was rather difficult to get him on the sled for a second test. Keep in mind then that distance is required to control the crash forces and the higher the g, the shorter the stopping distance.

Now consider the head-on collision and see what can be done to control crash forces. There is really adequate distance available in the vehicle as this vehicle side view shows. The distance available inside the car is the distance from the driver or the occupant to the nearest front obstruction. In the case of the driver and the front-seat passenger, the obstruction is the windshield, the steering column,and the dash -- usually two to three feet. For the back-seat passengers, the obstruction is the back of the front seat. In front of the vehicle there is distance available from the front tip of the bumper back to the first heavy frame member or the engine-- usually two to three feet. We might pick up some extra distance if we could get the engine to deflect in a controlled manner -- say away from the passenger compartment. We effectively have six feet to work with to develop a crash-energy management system.

What can we do to make effective use of the two distances? Inside, of course, a restraint system may be used. You are familiar, of course, with the lap belt and shoulder harness available in most cars. The belt system is an active system, that is it requires an action by the occupant to be effective. It has the obvious drawback, therefore, that if the occupant does not take

the action, he is not restrained. A "passive" system requires no action by the occupant. Therefore, we are interested in developing a passive system which would lead ultimately to all occupants being restrained in frontal crashes.

The human subject, restrained by only a lap belt, will tolerate crash forces up to about 10 g. That is what we might call the "ouch" level of the driver or occupant with a lap belt restraint. What this means is if you put a live subject on a sled, he'll tolerate a test involving forces up to about 10 g on his body. Of course he can go a little higher than that and sustain some injury, but he will actually tolerate 10 g. If you add the shoulder harness in combination with the lap belt, then the live subject will tolerate about 15 g. The reason, of course, for the addition is that the forces are being spread over an additional area of the body provided by the shoulder harness. With the air bag we estimate a voluntary tolerance level of up to 40 g. The crash forces involved would be spread over an area including the complete upper torso and the head. This slide shows the air bag already inflated in a laboratory installation. It would look like this very shortly after the frontal crash occurred. The air bag is inflated by nitrogen or other inert gas stored at high pressure. It inflates fully in about 40 milliseconds. Immediately upon inflation it begins to deflate due to the body's movement forward into the bag. The deflation is controlled very carefully by gas expelling through a number of orifices and allows the occupant to "ride down" the crash. The next four slides show the air bag in action. This one shows the bag before the crash has started. Notice, for a frame of reference, that the head of the driver is just about even with what we call the B-pillar or center pillar of the car. The flash of light at the top indicates that the crash has begun. Notice the bag has started to inflate. The passenger is still in his original position, still centered at the B-pillar. Next the bag is just about fully inflated. Notice the dummy has moved forward. He is actually belted in by a lap belt for this test. Note that the lap belt stretches and the dummy moves forward into the bag. In the final sequence the bag has done its job, the gas is expelled and the dummy has ridden down the crash. That is the concept of the air bag. The air bag is initiated by a sensor mounted longitudinally along the car frame. It is in essence a mass and spring of proper size which when acted upon by sufficient force and time makes an electrical circuit that causes the high-pressure gas to be released.

This slide is an artist's conception of what the air bag installation might look like in the front compartment of the car. There is a bag installed in the horn ring and a larger one installed in the front dash.

The next film shows the air bag in action. Note the installation in the steering wheel and in the right front section. You can see the occupant sitting in the car with a friend and there is the air bag. You cannot blink your eyes as fast as the bag comes out. Next we see a front-end crash into a barrier in slow motion speed with three front-seat occupants. The light indicates that the crash has begun. Notice the occupants had no chance to move forward before the air bag was out.

The next sequence shows, in slow motion, an angle impact to indicate that the bag does have an effectiveness even in angle crashes.

Let me show you why we have an interest in experimenting with passive restraints. This slide shows the percentage of the people who now wear their restraint devices while driving or riding in a car. Today about 80% of the people are unrestrained in a crash. If we could develop a system that would be passive and acceptable to the public, we could increase this to 100 percent for frontal crashes. The air bag has the advantage that it is passive and that it spreads the crash forces over a large area of the body.

Consider now that part of the car outside the passenger compartment. In this film we see a front-end crash of an unmodified standard car. Notice how far the engine is pushed back and intrudes into the passenger compartment. There is buckling of the frame members, the transmission is torn away, and there is a very severe deformation of the passenger compartment. Inside the passenger compartment, the front seat has moved forward under the steering wheel. There is a rather severe penetration of the floor board into the passenger compartment and the steering column has been shoved aside. What can we do to improve this situation by structural modification outside the passenger compartment? This is a slide of some work underway at Cornell University. The yellow frame numbers to the left of the slide are a series of box beams welded together in such a way that the hinge points of each of the members--hinges which are known to the stress engineers as

plastic hinges--deform in a controlled manner when impacted by force.

The next film shows this design in operation and you will see how it absorbs some of the energy in a front-end crash. This test is at 40 miles per hour -- observe the engine. It does not penetrate the passenger compartment. The frame was pushed back to the engine, but did not cause a severe backward thrust of the engine into the passenger compartment. In the passenger compartment, after the completion of the test, the seats are relatively intact and there is still leg space available as there was before the crash. The passenger compartment is virtually intact. That was a 40 miles per hour crash into a pole.

The next film shows the air bag in combination with front-end modification for an angle crash. The light indicates the crash has begun. The dummy rides into the bag.

The Bureau considers the air bag to be truly a significant breakthrough in research. This does not mean that you are going to find it in next year's cars. The energy-managing structure, the box beam plastic hinge design is even less developed. In this application, it added substantial weight to the front of the car. Before it could be incorporated into production cars, it would have to be engineered into the total design. We consider, however, that these are promising devices for the future.

Now consider the rear-end collision. The same kinds of principles hold. The distance inside the compartment, of course, is just about zero. The occupants are sitting on the seat. The distance between the seat back and the occupant is zero. However, he is sitting in a relatively good restraint system for the rear-end collision given that he has adequate head restraint and given that the seat anchorage is of proper design so that the seat stays in position.

Outside the passenger compartment in the rear there are three or four feet in almost every car on the road, so again there is adequate distance to work with.

This slide shows a curve at 40 g acceleration giving the distance required to stop a car for given velocities. Notice that at

three feet distance the forces involved in a 60 mile per hour crash can be absorbed. Hence, there is adequate distance available in the rear of the car. We have not studied structural modification in reference to the rear-end collision because we are hoping to draw on what we learn in the front-end crash.

This is a slide of the side collision. Here is a car that has been impacted by the front end of another car. Forces have been rather well distributed across the area of the side of the car, but you can see the severe intrusion. The vast majority of side impacts are at 20 miles per hour or below. Here is another example of side impact where the car has spun into a pole. Again the penetration is severe. These are unmodified, production cars. The next film shows the dynamics of a 20 mile per hour crash in the side of an unmodified car.

For the side collision, the distance inside the compartment again is rather small. It is just the distance from the passenger's hip to the interior panelling of the door with whatever padding may be available. We do not consider it to be usually more than two or three inches. The distance outside the compartment is the thickness of the door itself. Most doors are five or six inches thick so we have a total of six to nine inches to work with in trying to control the crash forces of a side impact.

This curve again shows the constant 40 g curve indicating that for 20 mile per hour crashes, we may be able to do something with six to nine inches of distance at this speed. Therefore, we can effect improvements in the side impact crashes even though the potential is not as good as for front-end modifications. Remember again that two-thirds of the serious injuries and fatalities take place in front-end crashes.

We can do something, though, in the side impact at 20 to 30 miles per hour speed range. One of the things that can be done and is being done in some of the cars on the road right now is the installation of a series of hat sections or door guard rails to add structural strength in the door itself.

The next slide shows something more involved and is something that is not available today. This is a modification being tested at Cornell University. The idea is twofold; one is to

strengthen the doors and side by means of the door beams, and the other is to add a structural member laterally across the car in some manner, possibly through the roof line, possibly through the frame, that would transfer impact energy across the car to be absorbed by the other side of the car. Notice in the bottom picture that a pole impact on the right side deforms the left side. The theory of this kind of modification then, is that the opposite side of the car will actually be deflected and absorb a portion of the impact energy.

The next film shows this device in action. This is a 20 mile per hour crash into the pole, same kind of car as previously shown, but now with side structure modifications. Penetration is about one-half of that in the unmodified case.

The roll-over crash is not a part of our crashworthiness research program now, nor is it considered to be a really significant problem as far as managing the energy involved in the crash. It is, of course, a severe crash mode if the occupant is not restrained. Structural modification entails added strength in the A-, B-, and C-pillars (the front, center, and rear pillars) that support the roof and possibly a better roll cage. This is indicated by this sketch.

In summary, I would say that we are coming along fairly well with the front-end modification. The air bag is getting nearer and nearer to fruition. The front-end energy-managing structural devices are obviously several years away -- mainly because of the need for integration into the total car design. The theory has been demonstrated that the plastic hinge and several other concepts actually will work. We are very hopeful that these concepts will begin to be applied by the auto industry. The rear-end crash will be studied as the knowledge of front-end crash dynamics matures.

PANEL DISCUSSION

ACTION IN MOTOR VEHICLE SAFETY

Presiding: G. W. Bellamy

Remarks by G. W. Bellamy, Moderator

We have three elements in traffic crashes: the roadway, the automobile or the vehicle, and the driver. You just heard what the National Highway Safety Bureau is doing as far as the driver is concerned and our next speaker is from the California Highway Department, Mr. John Beaton, and he will discuss energy absorption devices.

In Oregon the leading cause of death up to the age of 44 is traffic crashes and you see I do not call them accidents. They really aren't. Your chances of dying in a traffic crash during your average lifetime in America (a little less than 70 years) are less than 1 in 60. Every year your chances are less than 1 in 3,700 that you will die in a traffic crash. Your chances are 1 in 50 every year that you will be injured in a traffic crash and your chances are 1 in 10 every year that you will be in a traffic crash. Now these are pretty high statistics when you are talking about your life. Basically, we have a few people that are involved in most of the crashes.

We estimate that about 4% of the drivers cause 50% of the fatalities every year. In other words, we could cut the fatality rate and perhaps the traffic crash rate in half by just controlling 4% of the drivers. I will describe a two-year traffic record for a 20-year old citizen of Oregon. Each two typewritten lines is a traffic conviction. These are some of the interesting points about this -- he has some very serious violations -- a wreckless driving charge -- suspension of his driver's license -- conviction for driving with a suspended license.

Two-thirds of the citations on this list were received when he did not have a driver's license. This particular one is not the longest one we have. We have a truck driver in Oregon with a valid driver's license who has had 104 citations. At the end of 1969, he purchased a 1969 Dodge Charger with a 440 magnum, V8, four on the floor, etc. In six weeks he had five tickets for driving with a suspended license and one for eluding police and speeding.

There are two laws in the state of Oregon that supposedly apply when you drive while suspended. One says that you serve a minimum of two days to one year in jail. The other one says that your

car will be impounded for 30 days to 120 days and you must pay the expenses whether you pick it up or not.

The Oregon Traffic Safety Commission is very concerned about the fact that the courts in the state of Oregon generally do not enforce either one of these laws, even though it is clearly the courts' duty to enforce laws and their only discretion is between the minimum and the maximum penalty. But we really don't do anything about it. I mentioned before that 4% of the drivers cause 50% of the fatalities.

Here are two clippings about the same 20-year-old individual relating to other instances of breaking the law. I've never checked his police record, but the point is these people are unstable, erratic, they can't interact with other people; they have no respect for the law or the rights of others.

We have another alternative to stiff law enforcement, and that alternative is preventative treatment. Recently, the Oregon Traffic Safety Commission, which gets the basic amount of its money from the National Highway Safety Bureau, voted to fund a project costing $365,000 for our consultant psychologists to develop a predictive scale, so that when a person shows positive on this predictive scale we figure that it is almost certain that he will be involved in an alcohol-related traffic crash within five years. As a preventive treatment, when a person does show positive on this scale, he receives psychological treatment. This of course, is the judges' reason for not enforcing the existing laws. They say alcoholism is a sickness and, therefore, we should not use punishment as a treatment. We hope to show that preventative treatment will work and, if so, we will expand it to the rest of Oregon. If this program does not work, if the people still drive under the influence of alcohol after taking preventative treatment, then we will have an answer to the judges and we will be able to show that there is no reasonable alternative to very though law enforcement.

ENERGY ABSORPTION BARRIERS

by

John L. Beaton

Energy Absorption Barriers

By

John L. Beaton

Resume:

The experimental development program of energy absorption barriers of the California Division of Highways was presented by a series of documentary and data films covering eleven full-scale crash tests of energy absorbing barriers. Eight of these covered development work performed on the water-filled plastic tube type and three configurations using 55-gallon drums. The water-filled tube barrier was developed by John Rich Enterprises and is being marketed by Energy Absorption systems, Inc. of Chicago. The developer of the drum concept was the Texas Transportation Institute of Texas A & M University. The crash tests indicated that both of these designs were practical.

The tests shown in the moving pictures used remotely-controlled test automobiles weighing approximately 4,700 pounds and traveling between 55 and 65 mph at impact. The tests were conducted head-on into the barriers and also at approximately 10-degree angles with the barrier center line. Points of impact for the angle tests were on the barrier nose, and also on the sides of the barriers. The sides of the barriers are protected by overlapping panels called "fish scales." The lateral and vertical movement of both types of barrier are restrained by cables inserted through the barrier system. With the exception of the cables, all barrier components are free to move backward with the colliding vehicle.

Instrumentation was used to take dynamic readings of water pressure buildup, strain and acceleration of the barrier components, load on the restraint cables, force in the seat belts, and deceleration of both the test vehicle and its dummy occupants. Average decelerations were measured in the vicinity of 10 g's, which was considered acceptable for 60 mph collisions.

The overall length of both attenuation devices was approximately 20 feet.

Experimental installations of these devices have been placed in several locations throughout the United States, and six will be placed, evenly divided between the two devices, on California freeways within the next year.

LUNCHEON

Presiding: Forrest Cooper

LUNCHEON ADDRESS

OREGON TRANSPORTATION - THE CHALLENGES AND APPROACH

John M. Fulton

Oregon Transportation - The Challenges and Approach

by

John M. Fulton

In just six years we will celebrate our bicentennial. It will mark the 200th anniversary of a pattern in government and the growth of a nation that has no parallel.

In this context I thought it might be interesting to look back very briefly at the role transportation has played.

By 1790, when Washington was inaugurated, our population was just under four million people. They lived along the Atlantic seaboard and only a few had begun to move inland. When they did move away from the seacoast it was usually by horseback, wagon, or pack train.

In those years the United States was in every sense a slumbering giant. Its coal mines were undiscovered. Its forests were virgin. Its potential was untapped.

As we compare the primitive transporation of those early days, and the progress we have made since, we find that two inventions played an impressively significant role -- so significant a role that they contributed immeasurably to the transformation of a fledgling nation.

The first, of course, was the steam engine developed to the point of practical use by James Watt in 1769. It was this steam engine that became, among other things, the catalyst of the revolution in early-day transportation.

Sailing vessels gave way to steamboats and stagecoaches yielded to railroad trains. Then in 1869, just 100 years ago, a venture by men of vision and courage culminated at Promontory Point in Utah with the driving of the Golden Spike. For the first time passengers and freight moved by rail from coast to coast.

Just as the steam engine gave us our steamboats and railroad trains, the ingenuity of a long-forgotten Frenchman, Etienne Lenoir, gave us in 1860 the internal combustion engine.

By the early 1890's men like Winton, Olds and Ford and Duryea began producing vehicles with gasoline-powered engines. The real breakthrough came in 1908 when Henry Ford introduced the Model T. This concept of an inexpensive, mass-produced automobile launched the automobile age -- and it is still with us.

It is interesting, parenthetically, that in 1908,when the Model T was introduced, Oregon had just 695 registered automobiles.

At about the same time the newly-invented gasoline engine was used by a couple of bicycle mechanics, Orville and Wilbur Wright, to power their first airplane. The engine weighed 139 pounds and the plane flew 120 feet. Two years later in 1905 the Wright Brothers had built a new plane which flew for eight miles. Aviation as we know it today was launched.

Today the Model T is an anachronism. Our automobiles combine power and comfort. Aviation has been similarly transformed. Progress has become commonplace. We have passed from the early work-horse planes such as the DC-3's to jets, and soon there will be supersonic jets.

Anyone making an objective assessment of transportation will recognize that the most significant single development has been the motor vehicle. It broke our early-day orientation to railroads and to rivers. It provided the vital impetus for a highway and road network -- a network that is now expected to serve as a transportation link for almost every conceivable use of land. Taken together the motor vehicle and the highway have given us economic vitality, unlimited mobility, and new horizons for living.

As we review the progress of transportation during the past 200 years, it is clearly evident that it effectively combined a period of fantastic technical accomplishment with a catalytic impact on growth and industrial development. Transportation has transformed both the character and the pattern of living. The prosperity we have today -- the comforts we enjoy -- are the result.

At the same time these changes have not been an unmixed blessing. While transportation has solved many problems, it has created and compounded others. We have been guilty of developing a transportation system without over-all goals or precise objectives. Much of what we've done has been enormously effective, but too often it has been on a piecemeal, solve-a-problem basis.

Thus today, as 1970 begins, the stakes are higher and we face even more crucial problems. A good many of these go beyond transportation in its technical sense and relate to social and economic problems to which transportation must bring its sophistication if these are to be resolved. Now it is essential to look for new solutions and fresh approaches. We must do this with specific objectives in mind.

Six elements identify the challenges with which I feel these specific objectives must cope. They are:

1. Our national population, and that of Oregon, proportionately, increases by a staggering 180,000 every month -- 180,000 citizens who will not be satisfied with less than the standard of living we now regard as an acceptable mean. This involves all of the pleasures and comforts of our mobile age.

2. Our metropolitan areas double in population every generation. Ironically, with all of the mobility that has been built into our day-to-day living, we still insist on congregating into relatively small geographic regions. We are crowding 90% of our people on 10% of our land.

3. Our housing deficit is acute. Few of our proposals to cure this recognize the value and wisdom of dispersion. Thus we face the anomaly of being a prosperous nation with our citizens' physical needs not fulfilled and with some trapped into substandard living.

4. Our air, land, and water are becoming increasingly polluted. The combination of past economic progress and the manner in which population is distributed has been at the expense of our environment as well as our social well-being.

5. Our transportation network is becoming more congested, particularly in metropolitan areas. This is a social blight costing us millions of dollars economically and numerous frustrations socially.

6. The demand for transportation services is outstripping population growth. The simple truth is that we must double the capability of our transportation network within the next 20 years. In doing this we must recognize that transportation must cease to react and must begin to anticipate. Our challenge is to provide a network with entities, private or public, best structured to meet the economic as well as the social needs of Oregon's citizens. If we fail, the structure of living in Oregon will deteriorate and our economic growth potential will be strangled.

One of the reasons that these challenges are frustrating is because they are filled with contradictions. They represent the end product of goals that all of us share. We push for industrial development as state and community leaders, pitching in to attract new payrolls. We want economic independence as individuals. We want our environment not only preserved but improved. We want a sense of full and unlimited mobility with no restrictions on new horizons for living.

I am optimistic that we will find solutions for we have a tradition as a nation of problem-solvers. To me this emphasizes that answers will be found to traffic congestion, to pollution, poverty, welfare and housing, protecting at the same time sound economic growth. Why we have not moved more aggressively is another question. It may be that we have not tried hard enough. It may be that we have not been willing to pay the bill -- or it may

be that we have been so busy putting out fires that we have not kept our ideas, our planning, and our implementation up to date.

This brings me to Oregon's new Department of Transportation. The legislation for this was enacted by the legislative assembly last year. The Department became operational on July 1, 1969.

Within the structure of the new Department of Transportation we have three able and experienced agencies which were formerly Departments but are now Divisions. I am referring to Highway, Aeronautics, and Motor Vehicles. In addition, the legislature charged us to establish two new Divisions, Ports and Mass Transit. Within the transportation area is one established unit of state government, the Port of Portland, and one new unit, the Portland Metropolitan Mass Transit Commission, commonly known as Tri-Met. The Department also has a continuing relationship with the Public Utility Commissioner. This relates to the service performance of carriers as opposed to the regulatory responsibilities which the Public Utility Commissioner discharges.

I think all of you are familiar with the functions and the responsibilities of the established Divisions, notably Highway, Aeronautics, and Motor Vehicles. Let me comment briefly on some of the others.

The Ports Division was designated by the legislature as the agency for state-wide coordination, planning, and research to insure the most orderly and efficient development of the state ports system. It is administered by a three-man Commission.

Through the Ports Commission we intend to develop balanced approaches to broad, economically-related geographic areas. As one example, the Ports Division is undertaking a comprehensive study of the Lower Columbia. This will involve not only the Ports of St. Helens and Astoria, but the Port of Portland and the Commission of Public Docks.

The Mass Transit Division, again administered by three commissioners, is charged with the coordination, planning, and research necessary for the orderly and efficient development of mass transit systems. Currently they are engaged in an analysis of public

transportation in urban areas throughout the state. They are, in addition, providing strong support to Tri-Met in Multnomah, Washington,and Clackamas counties.

The Mass Transit Commission recognizes that the movement of individuals, whether this is inter-city or within an urban area, is more than an economic problem. It now has compelling social overtones. Those who are mobile, whether they are the young or the elderly, together with those who are unemployed or under-employed, must be served.

The Port of Portland, as I think most of you know, is an able, long-established agency of state government. It is administered by nine Commissioners. They have broad responsibilities in Multnomah County for commercial and general aviation, industrial development,and maritime functions. The latter comprises a dry dock and a ship repair yard. Additionally, they have a general aviation facility in Washington County, the Hillsboro Airport.

The Port of Portland has a unique state-wide impact. This is due in part to the Portland International Airport which is Oregon's air traffic hub. Beyond that the economic impact of Rivergate will progressively have more and more of a ripple effect throughout the state. Similarly, channel surveillance in the Columbia, which the Port of Portland coordinates, has an impact on Oregon communities from Astoria to Umatilla.

Tri-Met came into being on October 14, 1969, under the aegis of House Bill 1808. The seven appointed directors have statutory responsibility for the development and operation of a mass transit system in Clackamas, Washington,and Multnomah counties. The birth of Tri-Met was stormy, but the prognosis for the infant is good.

It is interesting that of the Divisions within the field of transportation, six have independent and autonomous commissions. Of the six, four have extensive operational responsibilities; Highway, Aeronautics, The Port of Portland, and Tri-Met. Operational responsibility in each instance includes divisional planning and research.

The Ports and Mass Transit Commissions are similarly autonomous. While these Divisions have no operational responsibilities, both have significantly important planning and research assignments. Their ability to discharge this role is limited as the professional support to the two Commissions consists of a single administrator for each Division.

Those are the elements of transportation with which the Department of Transportation is involved. Now I would like to touch on our departmental responsibilities.

To meet the long-range challenges that we face in the field of transportation, the legislature charged the Director of Transportation to develop and report on legislative, budgetary, and administrative programs to accomplish comprehensive, long-range, coordinated planning and policy formulation.

To place this legislative charge in perspective let me comment on what might be termed absolutes if Oregon is to have coordinated, state-wide transportation planning. Then I will outline a tactical approach embodying the essential factors.

Coordinated, state-wide transportation planning is unique because of the scope and number of the decisions that have to be made and the number of policy-makers that are involved in the process. The coordination of transportation is more than a local or a state responsibility. Private enterprise is a vital element. It is not restricted to one mode. It is not isolated from land use.

The major point is that to effectively develop a balanced, workable, state-wide transportation plan, a myriad of interrelated policy decisions emanating from all levels of the state's political and economic structure must be coordinated. It is imperative that the coordination of the decision-making process not be restricted to transportation policy in a narrow sense. It must include residential, educational, economic, employment, recreational, esthetic, and other social values.

Currently Oregon's approach to transportation policy determinations, planning, and implementation is fragmented. Involved

in these processes are five Divisions of the Department of Transportation, and the two municipal corporations that I mentioned earlier, the Port of Portland and Tri-Met. In addition there are some 230 cities, 36 counties, 22 port districts, and 5 regional councils of government. Until now there has been no structure for state and local transportation planning to be integrated into a broad, comprehensive package.

An additional factor in this planning equation are the numerous ties that state and local agencies have with federal agencies dealing with transportation matters. These include the Civil Aeronautics Board, the Federal Aviation and Rail Administrations, the Corps of Engineers, the Bureau of Public Roads, the Urban Mass Transit Administration, the Maritime Administration, the Interstate Commerce Commission, the Federal Maritime Commission, the Department of Housing and Urban Development, the Bureau of Land Management, and the Forestry Department. All of these agencies affect our transportation planning and some have operational responsibilities within our State.

To effectively develop a workable program for comprehensive, state-wide transportation planning, all of those involved in the decision-making process must be included. The decision-makers must be seeking to achieve the same goals and objectives. They must share the same awareness of Oregon's needs. They must use the same assumptions for their decisions and they must have access to the same technical information in making their decisions.

This will require a phased program designed ultimately to incorporate basic, comprehensive, continuing planning. The only unique aspect of the approach I have in mind is scope and complexity. Yet, the planning parameter must be broad to be meaningful. At the risk of over-simplification, our program must include the following processes.

1. At the outset we must cooperatively develop carefully defined, precise transportation objectives -- objectives that will be acceptable throughout the State's social structure. This is the critically important point of beginning.

These objectives must be interdisciplinary. They must relate to users as well as providers, to approved land-use decisions, and to economic, environmental and social objectives. Appropriate governmental mechanisms such as Councils of Government will be a source of significant input. The answer we seek sounds deceptively simple -- what are Oregon's transportation needs? What is it that we want? As of now we don't know.

The development of harmonious objectives within this framework will require major policy decisions. These must be made deliberately and with meticulous care. Once made, they must be constantly reviewed, for the pattern of Oregon life is not static.

2. In contrast to the broad policy decision-making involved in pin-pointing objectives, the second process is more factual and analytical. We need a detailed analysis of what transportation facilities we have to serve our needs. This will entail evaluating current capabilities, public as well as private, and projecting need forecasts. Standardized methodologies will have to be developed. With this data in hand we will be able to relate existing facilities to agreed-upon objectives.

3. The third process will have many of the complexities of the first one. Given agreed-upon objectives and given a transportation capability analysis, the issue becomes one of what options do we have? What alternatives are available? Which options will most effectively meet our transportation objectives as well as implicit social, economic, and environmental goals? The challenge will be to create and continually perfect a mechanism that will insure agreement as these alternatives are evaluated.

4. The fourth process will require judgment factors as well as responsible and coordinated decision-making. Implementation will be more than initiating an approved program or project. Inherent will be the question of which programs must be coordinated and the timing of related programs. Priorities will have to be established. Once a program is inaugurated it must be monitored. We want to be sure that action meets demand.

It is far too early to even propose answers. To do this would destroy the concept of acceptable solutions reached by coordinated cooperation. This must be the approach. And planning for comprehensive transportation cannot be casual. It will be hard, serious, and long. There will be social and political constraints. But if we make the commitment and stay with it -- and make sure that all levels of authority are involved -- then we will achieve solutions that are acceptable and of optimum effectiveness.

I hope all of this, or a program akin to it, can be initiated within the existing Department structure we have today. I strongly support the concept of the able, volunteer Commissions that function so effectively. Their authority and responsibility should not be diluted. What must be provided is a reservoir of fresh information upon which their decisions can be based.

Currently -- and to establish this conceptual approach -- we are utilizing inter-divisional planning whenever possible. This is being constructively coupled with an inter-divisional awareness of problems that can be most effectively solved through coordination.

When I assess what we have been able to do in the past seven months and weigh this against the magnitude of the total problem, I have to confess that we have taken only a small, first step. But even that small step will help. It is a cornerstone on which to build.

As we look ahead -- perhaps as far as our next bicentennial -- I know that we must be prepared to cope with change and to contend with challenge, for transportation will be increasingly called upon to fulfill demanding economic and social expectations, yet be

structured to the legitimate public interest in conservation, in clean air and water,and in community values.

I am confident that all of you from Washington and Idaho as well as from Oregon share my conviction that transportation will make a positive contribution.

PANEL DISCUSSION

DESIGNING LOCAL ROADS AND STREETS

Presiding: J. E. O'Hearne

AASHO LOCAL ROADS AND STREETS STANDARDS

by

Melvin B. Larsen

AASHO Local Roads and Streets Standards

by

Melvin B. Larsen

Although my subject is the American Association of State Highway Officials' Local Roads and Streets Standards, I believe very sincerely that my purpose here today is communication. My hope is that I can talk with you face to face and bring you up-to-date concerning where we are in regard to standards for Local Roads and Streets.

I feel very strongly that the main problem in our secondary road program today is communication. The secondary road program is unique in the fact that there is a great amount of liaison, communications, and relations that must go on to make the program work. I am speaking of communication between the local agencies, the State Highway Departments, and the Bureau of Public Roads.

To lay the groundwork for the subject, I would like to preface my remarks with some recent information which you perhaps have seen and read. Mr. Howard Pyle, who is President of the National Safety Council, in a message in the January "Better Roads Magazine" on the subject "Our Urban-Rural System," stated "our urban and rural highways, due to heavier and heavier use, will require attention we have mandated for our interstate and defense highways." He goes on to say "as a consequence, a major portion of the nation's total highway system, rural roads, still has more than double the mileage death rate of other highways. By doing more to close the gap between our substandard roads and our superhighways, thousands of men, women, and children can be saved from accidental death and injury." You note that the secondary systems should have emphasis put on them, according to Mr. Pyle.

To add to this emphasis, I would like to quote from a statement that Agriculture Secretary Clifford M. Hardin made recently. He was talking about new national policies that would promote "unprecedented growth" in rural areas. He stated that we should make it a matter of urgent national policy to "create in and around the smaller cities and towns, sufficiently good employment

opportunities and living environment that larger and larger numbers of families will choose to rear their children there." This cannot be done without good roads, and most of the roads in and around our urban areas are local roads and streets which are the responsibility of many of you here today.

Now we all know if we are going to have to put that kind of emphasis on these roads, keeping in mind the great pressure for safety on our highways and the great pressure for more and better services on these highways, there either has to be more funds or the funds that we have need to be used in a more economical manner. In this regard, there is a report that is significant to the very subject which we are discussing.

The National Cooperative Highway Research Program has a project under study and research at Stanford University, by Professors Oglesby and Altenhofen. The title of their report is "Economics of Design Standards for Low Volume Rural Roads Their definition of low volume is 400 vehicles or less per day. The authors point out that nearly two million miles, or almost two-thirds of all the roads in the United States, fall into this 400 vpd and less category. The report examines current standards for roadbed width, for roads with comparable volumes, and shows the wide diversity among them. It goes on to explore the rationale underlying these standards and finds they have almost no scientific engineering or economic basis for these standards. Also, standards such as those of AASHO that are imposed from "the top down" by higher levels of government are usually among the most exacting. This report presents a set of derived costs and benefits to highway agencies and highway users through a range of roadbed widths and demonstrates that from an economic standpoint, there is little or no justification for wide roadbeds and none for shoulders. In the report it is found that (1) wider roadbeds do not improve the accident experience of low-volume rural roads and (2), that even if such improvements eliminated all accidents of given classes, the savings would be trivial in amount.

Now gentlemen, these are some very profound statements. I am not sure that I am ready to go along with all of them at this time, but I believe it points up the fact that we do need to start thinking about what we are using for standards on low-traveled

local roads. Perhaps I am overstating the case when I quote some of the findings of this report. I do this to gain your attention.

Now, how did the Subcommittee of AASHO Secondary Roads Committee come about. During 1968 the Division Engineers of the Bureau of Public Roads made requests of each state for standards that were used for Federal Aid Secondary (FAS) projects and local roads projects regardless of what funds were used to finance the work. These standards were then submitted to Mr. Loutzenheiser of the Bureau of Public Roads in Washington,who is Secretary to the Planning and Design Policy Committee of AASHO. He and his staff reviewed all of these standards from the 50 states and wrote an initial draft of a set of standards for local roads and streets. Naturally, after reviewing all of these standards that were being used by the states, one would assume that the initial draft of standards for local roads and streets would reflect what was being done. Such things as 70 mph design speeds, 6:1 side slopes,and other criteria were quite prevalent. They are just not used on local roads and streets.

In addition, this draft standard had been sent out to the AASHO Planning and Design Policy Committee. No counties had had an opportunity to review it, nor had secondary road committee members. Here was a set of standards that would directly affect the various state secondary offices, the counties and the cities; it would affect the use of their funds; it would affect the designs they were to draw up in the years to come. In fact, it would affect their whole highway and street program. At the meeting in Minneapolis, Mr. Coupal, Chairman of the AASHO Secondary Roads Committee,had scheduled Mr. Gene Johnson, then Chairman of the Planning and Design Policy Committee, and immediate past president of AASHO, to speak to the Secondary Roads Committee Session. After some discussion about this subject and the general subject of safety and standards (several members of the Planning and Design Policy Committee were in attendance),it was suggested that a subcommittee of the AASHO Secondary Road Committee be set up. Mr. Coupal wisely and quickly did just that. The subcommittee represents states from one end of the country to the other. William Bulley from Washington, Paul Gilgen from Utah, Gordon Fay from Minnesota, James Stober from Iowa, Floyd Avery from New Hampshire, B.A. LeFeve from New York, Gordon Blundon from Virginia, B.C. Goode from Alabama,with the Secretary of the Committee,

Frank Moore of Mississippi and I, as Chairman. Chairman Coupal outlined the functions of the committee as follows:

1. To receive from the Design Policy Committee a draft of the proposed Design Policies for Secondary Roads.

2. To disseminate these drafts to all secondary roads engineers.

3. To receive from all secondary roads engineers, their comments thereon.

4. Prepare a consolidated report to the Design Policy Committee incorporating these comments.

The Committee set about doing its task in reviewing the draft of the standards. At the first meeting, there were several questions or problems facing them:

1. Should the Committee start from scratch; should it scrap the whole draft; or should it use the original and merely try to amend it? With grateful help from Mr. Clifford Greene, the Bureau of Public Roads Secondary Engineer, we started with the draft but did not hesitate to make major changes in the original draft.

2. Should the standards apply to all roads? It was felt that since there was a great difference in jurisdiction in various states of the Federal Aid Secondary and local roads that we could not split it on jurisdiction nor on system. Since we had the opportunity, we felt that we would draft a set of standards that would be worthwhile for all roads and all local officials.

3. Where should functional classification fit in? As you will note, there is a statement in the opening paragraph. The Committee was very strong on the fact that the standards should be by functional classification. However, you will also note that we only have one set of standards and they are not by functional classification. It is hopeful that we can work on that in the future.

4. Should the manual be a standard or a guide? The Committee felt very strongly that it should be a standard but should be used as a guide. Finally, it was made a guide by the Planning and Design Committee.

5. Due to the great difference in topography, economics, environment, standards, and social aspects from one end of the country to the other, could we come up with one set of standards or should we consider the possibility of a level of service or possibly several levels of standards? To begin with we felt we needed something now, so we tried for one set of standards. Hopefully we can address ourselves to this problem in the future.

Our draft was submitted to the Planning and Design Policy Committee of AASHO in June. There were a few significant differences between the suggestions of our Committee and the National Association of County Engineers. It was, therefore, suggested that the two committees get together to resolve these problems. This was done in August of 1969.

We found immediately there was no difference in philosophy between the two committees. The major differences were by sections of the country.

A number of major changes were made in the draft by our Committee.

There is no definite width for right-of-way. We found a great variance throughout the country -- stone fences which are 49-1/2 feet apart in New York; 30-foot-wide highways in Virginia; very wide rights-of-way in the West and Middle West. It is only a narrative in the draft now.

Slopes gave us some real problems. Instead of a table of slopes we have a narrative pointing out that the local people know best what kind of slopes are needed due to soils, economics, local use, and social and environmental conditions.

The subject of clear roadway width was a new one. It is dealt with, we believe, in a practical manner. We must consider this aspect even on local roads, but it must not be "way out."

Finally, a draft was given to the Planning and Design Policy Committee. They reviewed it at the annual AASHO meeting in Philadelphia and approved it with these changes:

1. They made the manual a guide instead of a standard; this has a different meaning in AASHO definitions.

2. On new bridges a road using 50 mph design speed requires a wider width.

3. They changed the width of bridges to remain; it is now exactly the same as that which was balloted for the primary roads.

I am not sure why they used the same standards for primary roads as they do for local roads, since this is the whole purpose of our study.

The portion having to do with streets was delayed until we received information from the American Public Works Association. I urge city engineers as well as states to give us your comments and suggestions on what should be in the standards for local streets.

The guides have also been approved by the Executive Committee of AASHO and are now being printed. They will soon be out for distribution. Since they are guides they do not have to have a ballot of the states; a set of standards would have had to have approval of two-thirds of the states by ballot. Here then, is a set of the standards as approved by our Committee with the changes made by the Planning and Design Policy Committee of AASHO. The tables show a portion of the standards as approved.

Table 1

Minimum Design Speeds

Type of Terrain	Minimum Design Speeds in MPH for Design Volumes of					
	Current ADT* Under 50	Current ADT 50-250	Current ADT 250-400	Current ADT 400-750 DHV 100-200	DHV* 200-400	DHV 400 and Over
Level	40	40	50	50	50	50
Rolling	30	30	40	40	40	40
Mountainous	20	20	20	30	30	30

* Note: Current ADT is the annual average daily traffic expected after completion. DHV is the design hourly volume for the future design year, normally the 30th highest hourly volume about 20 years after completion.

Table 2

Maximum Grades

Type of Terrain	Design Speed MPH				
	20	30	40	50	60
Flat	7	7	7	6	5
Rolling	10	9	8	7	6
Mountainous	12	10	10	9	

Note: For highways with ADT's below 250, grades of relatively short lengths may be increased to 150 percent of the value shown.

Table 3

Minimum Width of Surfacing and Graded Shoulder

Design Speed, MPH	Width in Feet for Design Volume of:					
	Current ADT Less Than 50	Current ADT 50-250	Current ADT 250-400	Current ADT 400-750 DHV 100-200	DHV 200-400	DHV 400 and Over
		Width of Surfacing				
20	20	20	20	20	22	24
30	20	20	20	20	22	24
40	20	20	20	22	22	24
50	20	20	20	22	24	24
60	20	20	22	22	24	24
		Width Graded of Shoulder				
All	2	4	4	6	8	8

Note: Design volume in terms of mixed traffic. For design speeds of 50 MPH or less, surfacing widths that are two feet narrower may be used on minor roads with few trucks.

Table 4

Clear Roadway Widths for New (and Reconstructed) Bridges

Design Speed	ADT Volume	Minimum Clear Roadway Width of Bridge
50 MPH and over	750 or greater	Approach Roadway Width
50 MPH and over	Under 750	Pavement Width + 6 ft
Under 50 MPH	400 or greater	Pavement Width + 6 ft
Under 50 MPH	Under 400	Pavement Width + 4 ft

Notes: Where the approach roadway is surfaced for the full crown width that surfaced width should be carried across structures. On highways with a current ADT over 750, bridges with a total length over 100 feet may be constructed with a minimum clear roadway width of the surfacing plus six feet.

Table 5

Minimum Structural Capacities and Minimum Roadway Widths for Bridges to Remain in Place

Traffic		Design Loading Structural Capacity		Roadway Clear Width Feet[1]	
Current ADT	DHV	Desirable Minimum	Minimum	Desirable Minimum	Minimum[2]
0 50	-	H-15	H-10	24	20
50-250	-	H-15	H-15	26	20
250-400	-	H-15	H-15	28	22
400-750	100-200	H-15	H-15	28	22
	200-400	HS-15	H-15	32	24
	Over 400	H-20	H-15	36	30

Notes:

[1] Clear width between curbs or rails whichever is the lesser.

[2] For design speeds of 50 MPH or less, minimum clear widths that are two feet narrower may be used on minor roads with few trucks. In no case shall the minimum clear width be less than the approach surfacing width.

LOW-VOLUME COUNTY ROADS

by

Jay Painter

Low-Volume County Roads

by

Jay Painter

Mr. McClarty in his letter to me, confirming his telephone call, stated that in discussing the problems a county encounters in designing low-traffic rural roads,I should say something about the flexibility that I feel should be in any set of standards, and the situations that might be encountered in such design, both physical and political.

I am sure that I cannot advance any problem that many of you, if not all, have encountered from the physical point of view. I'm not going to attempt to suggest any.

The situations encountered politically, I am sure, many of you have experienced. It would appear, based on all that you hear on the radio, see and hear on TV, and read in the papers, that regardless of what is done, the environment is affected and this relates to people and dealing with people is politics.

I could dismiss the problems of rural road design with all its facets in a few simple words.

In order to help you more fully assess my point of view, it would be well to tell you something about my county, together with some of my experiences.

I became county engineer of Bonneville in 1946. The previous five and a fraction years, I had been an employee of the Idaho Department of Highways. I was stationed in Bonneville County, Idaho Falls being my home at that time. While with the State I had the opportunity to work with local officials in at least a dozen counties. Several years before working for the State my work with the Federal Government brought me in contact with public servants of one kind or another. During the times just mentioned I sensed the need of local units of government for engineering service. Every time the opportunity presented itself, I would suggest the hiring of an engineer. When I was offered the job, I was remiss about accepting. Finally, I succumbed and took the plunge. Within three days I was about the

sickest individual around. I would have quit in a minute if I had had the gall to ask for my old job back. Two members of the board persuaded me to stay on. With their support and the support of some good influential friends the task became bearable. There was a steady growth of support and accomplishment. It took nine years to bring about a system of management that was satisfactory to me, the Board Engineer system, a system that is recognized nationally.

I am no politician, certainly no diplomat. So I leave the politicking to the politicians, and I have convinced the politicians that I should be the engineer.

Since 1955 administrative problems have diminished. There has been continued improvement.

Bonneville County is located in the eastern portion of the State of Idaho. It is shaped somewhat like the state of Idaho, if Idaho was rotated 90 degrees to the left then turned over. Its east boundary borders Wyoming and is located about midway between Utah on the south and Montana on the north. It encompasses an area of 1,846 square miles. The topography is varied, the eastern portion is mountainous. The western portion comprises the Snake River plains and the desert. Sixty-one % of the county is owned by the Federal Government and the State of Idaho. Thirty-nine % is privately owned and constitutes the tax base.

Idaho Falls is the county seat and has a population of approximately 38,000. We have six other incorporated cities and several unincorporated communities. The total population of the county is about 50,000.

The road system under county jurisdiction consists of the following: 26.8 miles of primitive roads, 122.5 miles of unimproved, passable at certain seasons of the year, 123.6 miles of graded and drained, 411.8 miles with gravel surface, and 271.1 miles of bitminous surface, making a total of 962.6 miles. As stated, this mileage is under county jurisdiction. Incidentally, when I began working for the county there were less than four miles of bituminous or paved roads in the county system.

Some portions of the county are rather isolated from the county seat. In order to reach the Grays Lake area, a ranching and

dry farming section, one has to travel through a corner of Bingham County which forms part of the southern boundary. In the winter the Grays Lake residents have to travel through the county seats of Caribou County, Bannock County, and Bingham County in order to reach their own county seat. In the winter another portion of the southeast part of the county can only be reached by travelling through a portion of Lincoln County, Wyoming.

I mention these areas to point out that we have physical problems of design alignment, grade, and so forth.

Approximately 26% of our total road mileage is on the Federal Aid Secondary Road System. Seventy-five % of the FAS system has been improved to at least minimum standards with a bituminous surface.

During the time I spent with the Idaho Department of Highway and the early years with the county, I was aware of standards but did not think much about them.

There were standards that were used for structures. The AAHO standards for bridge design and construction was the bible I used constantly. With reference to the roadway, the geometrics of the layout was something that others, my superiors, recommended. As a county engineer I applied the practices I was used to.

Since Federal Aid funds are administered through the State, I naturally went to the State for recommendations.

There seemed to be no problems until additional right-of-way was required either to accommodate the section or the curvature. This is where politics enters in.

When asked why the additional width or why the curve, I gave the answer that the State requires it. To some these justifications were not sufficient, so State people were contacted. The State people would counter with, it is a Bureau requirement. The stock answers or reasons in most cases were effective because we met the standard or there was to be Federal sharing of the costs.

Two situations developed almost simultaneously that caused me to think a little and brought me face to face with standards.

During the process of acquiring right-of-way we ran into trouble. Perhaps I should go back just a little. The right-of-way width had been agreed upon between myself and State Highway people. A hearing was called. All interested people, particularly those who had property abutting the road to be improved, were invited. The design features were explained and the right-of-way that would be needed was pointed out to them. There were some minor objections, but we felt we could overcome those objections and that we had clear sailing.

One of those who questioned the need of additional right-of-way was a friend of the Chairman of the State Board of Highway Directors. The Board member was reported to have said that he could not see why the improvement could not be carried out on the existing right-of-way. The justification that the "State required it" would not hold.

The other situation referred to, in fact both, occurred about the time the standards were being upgraded. This I was not aware of. We had two projects scheduled for betterment. I use this term betterment because the county had adopted the policy of stage construction, a means we felt should be used to get more miles constructed to an all-weather standard.

This practice consisted of constructing the structures, grading, providing the base and a bituminous surface treatment. The pavement or mat was to be added at some future time. The mats, road mix, or plant mix were to be added when the surface treatment began to fail.

Incidentally the approval of the design of the two sections I am talking about were based on the old, I believe the 44 standard. It was my intention to construct the mats as heretofore explained. I was informed I could not do that. I argued the point that the project had been approved with a 22-foot travelway and that the former approval should stand. No, the travelway width had to be a minimum of 28 feet.

The subgrade had to be widened, more right-of-way was needed. Even the curves were outmoded. The plans were on file -- all I had to do was submit a revised typical section.

I was further dismayed because the State had just completed a

section of the interstate in the area where the two roads I hoped to improve were located. Two overpasses had been provided to carry local traffic over the interstate. These overpasses were 24 feet in width between curbs. The curves used to connect the county roads to the overpasses are something to behold.

I asked the question, why two sets of standards, one for the county and one for the State? This was not the case, we both were involved in a changing set of rules.

These two instances pointed up the fact that I was poorly prepared to answer questions which needed more than the stock answer. It is a requirement -- why the requirement?

Armed with proceedings of the meetings of the Northwest Highway Engineers Conferences, NACE Research manuals, information gathered at ARBA meetings which I attended, and other data, including my library, I set to work to justify standards which at that time seemed a little restrictive.

The results were a change. My attitude toward standards was a complete about face. No longer did I use the term, State or Bureau requirement. I discovered the justification for travelway width, flatter curves,and increased sight distance, as well as the needed right-of-way. I was successful in converting or selling the commissioners sound engineering principles. They, in turn, approached the problem from a different angle and when needed, initiated condemnation proceedings to acquire right-of-way and the projects began to get underway.

Every time there is a change in elected officials, I am faced with the same problem. However, it is becoming easier to justify what is being done and what should be done, because we have completed projects and have something to point to.

My problems are no different than they are in other counties. Many counties in Idaho feel the standards are too high; consequently, they do not use Federal-Aid funds, the excuse being they cannot afford to match federal funds because the cost of improvements are excessive. This is a fallacy in my mind. I feel sorry for the highway user in those counties. In Idaho the federal appropriations for secondary roads are split 50-50, the State gets 50% for its secondary

system; the remaining 50% is divided among the counties by formula. Of the remaining 50%, 10% is divided equally, 45% is divided on the basis of improved mileage within the county as related to the improved mileage in all counties and highway districts and 45% is divided on the basis of the motor vehicle registration in the county to the total vehicle registration in the State.

If a county or highway district does not use its allocations within a reasonable period of time, the funds are put back in the pot, so to speak, and made available to counties that are able and willing to match the funds. We in Bonneville County, I am sure, have had our share.

County engineers who proceed with projects, even though they are reluctant to do so, have words of commendation for those who are responsible for the development and completion of projects. They take great pride in the finished product and insist the next project shall be built to a similar standard.

All aspects of the standards -- minimum design speeds, minimum sight distances, maximum grades, maximum degree of curvature, normal pavement cross slopes, minimum length for super elevation runoff, minimum width of surfacing and shoulders, clear roadway widths for new and reconstructed bridges -- are reasonable and should be complied with.

As I read the standards, it is apparent to me there is plenty of flexibility. The first sentence of the third paragraph reads as follows: "These standards are to be used as guides." To continue, "It is anticipated that, when it is economically feasible, these standards will be upgraded. Likewise, in tight or unusual conditions it may not be practical to meet even these guide standards." Another sentence, "It may not be possible to get the obstacle-free roadsides that are desirable." This indicates flexibility. Another quote, "If not practical, it may be possible to provide combinations of elements."

Flexibility, yes, but my experience has taught me that it can be carried to the extreme. We sometimes look for ways to go around the problem because of the political implications. I am convinced every effort should be made to adhere to, if not upgrade, the standards.

I have been told many times that certain things could not be done, but when all the facts are presented and the alternatives considered, agreement can be reached and projects processed to completion.

With reference to right-of-way the standards have indicated no specific width. All that is said is, "The procurement of right-of-way to such widths as will accommodate the construction, adequate drainage, and proper maintenance of a highway is a most important part of the overall design."

The burden of proof is placed squarely on the shoulders of the local authorities. It can be readily pointed out that good roads increase property values. Therefore, a dollar spent for right-of-way at the time of the initial improvement will result in several being saved, say 10 years hence.

The standards have been discussed at length with Marcy Laragan, the Secondary Roads Engineer for the State of Idaho. He told me the real problem is not the standards, but the lack of continuity in administrations. In those counties where there is little change in comissioners, or those counties that employ full-time engineers, the problems are minimized.

The Board of County Advisors to the Bureau has had considerable influence and has contributed a great deal to a realistic set of standards that any county or local unit of government can live with.

NACE also has had a voice in the matter. I quote from a recent newsletter, "On August 22 and 23, the NACE Secondary Road Subcommittee on Geometric Design Standards, consisting of Richard Boccabella, Chairman; Bernie Leider; Bob Carrier; Bill McIntosh; and Ray D. Bass, met with the AASHO Subcommittee to discuss the standards as they now stand. The Committee reports that their meeting was very worthwhile and it is pleasing to know that NACE is having a voice in the Secondary Road Standards by AASHO."

Again, they are guides and with adequate justification, variances are permitted. My experience has proven that to me.

BASIC DESIGNS

by

C. E. Angermayer

(Paper not available for publication)

PANEL DISCUSSION

FINANCING LOCAL ROADS AND STREETS

Presiding: J. E. O'Hearne

UTAH'S COLLECTOR ROAD PROGRAM

by

Howard B. Leatham

Utah's Collector Road Program

by

Howard B. Leatham

On the 59th day of its 60-day session in 1969, Utah's House of Representatives recalled a bill which it had defeated on the 58th day and passed it by two votes. Passage of this bill and two companion measures brought to fruition part of a labor begun in June of 1962 by the Utah State Road Commission, the Utah Municipal League, the Utah Association of Counties, and many other individuals and groups. Nearly seven years had elapsed between the day that the three levels of government in Utah had agreed to begin a comprehensive statewide highway study and the day that the first laws implementing part of the recommendations of the study were passed by the Legislature.

The history of the activity leading to implementation is an interesting story of "From Studies to Legislation."

In June, 1962, a number of problems confronted State and local highway officials. Local officials felt that they were unable to meet their highway needs with revenue available for that purpose. The main sources of road revenue for counties were property taxes, a share of the State motor vehicle registration fees, and forest and mineral lease fees. The twenty-nine counties in the State shared a total of $6.2 million dollars from these sources in 1962. Salt Lake County received $2.0 million of this amount and Piute County received $15,000, representing the extremes. City sources of revenue were the property tax, State motor vehicle registration fees, and minor sources such as parking meter revenue, bonds, etc. A total of 212 municipalities shared $4.0 million dollars in 1962 from these sources.

Cities and counties for many years had been sharing the revenue from motor vehicle registration fees with the State Highway Department. Prior to 1961 cities and counties had received the first $2,000,000 in the registration fund and 50% of the amount above that figure. In 1961 the Legislature increased the local governments' share of the amount over $2,000,000 to 75%. The local share of revenue from this source in 1962 was $3.5 million and was divided among all cities and counties by a formula with land area, mileage,

and population as factors. Attempts by cities and counties to obtain more State-collected funds had been unsuccessful in the Legislature.

The $6.2 million available to the twenty-nine counties was used to administer a county system of 17,914 miles of road. The $4.0 million available to cities was used for a system 3,385 miles in length. Construction expenditures by counties in 1962 were listed as $1,816,000. Construction expenditures by cities for 1962 were listed as $502,000. The balance of the funds available was expended for maintenance, policing, equipment purchases, and other highway-related functions. It is obvious from the ratio of construction expenditures to road mileage that a local government highway construction program was minimal or non-existent in most jurisdictions.

As a result of the situation at the local level, the State Road Commission was confronted with an ever-growing State Highway System. For many years, any roads needing improvement had been added to the State System by active Legislators in the hope that pressure could be brought upon the Road Commission to make the needed improvements. Many miles of relatively unimportant roads were added to the system in this manner. In most instances the roads added to the State System carried such low priorities for improvement when compared with other State Highways that there was little hope that they could ever be improved.

The State Highway Department was faced with increasing maintenance costs resulting from roads being added to the System and the growing number of miles of new construction on the Federal-aid Interstate System.

Cities and Counties saw a need for greater financial assistance at their level and the State Road Commission saw a need for a better definition of local and State highway responsibilities.

Common need led to common action and the Utah Municipal League, the Utah Association of Counties, and the State Road Commission authorized a comprehensive statewide transporation study including the three phases of (1) functional classification, (2) needs, (3) financing. The Automotive Safety Foundation was retained to conduct the functional classification study and Wilbur Smith Associates accomplished the needs and fiscal studies.

The three studies were completed and the findings and recommendations published by March of 1965. The State Highway Department then began an effort to familiarize State and local officials and other interested parties with the studies' recommendations and the benefits and consequences of implementation of the recommendations. Considerable confusion and controversy existed. As the 1967 session of the State Legislature approached, it became apparent to the three groups involved that a consensus could not be obtained and legislation prepared in the time available. In December of 1966 an ad hoc committee was appointed to consider the recommendations of the studies and prepare legislation to be presented to the Legislature in 1969. The Committee was called the Utah Transportation and Economic Study (UTES) Action Committee and was composed of three representatives from the Municipal League, three from the Association of Counties, and three from the State Highway Department. Additional Highway Department personnel were assigned to act as staff for the Committee.

The next 18 months were spent by the Committee in carefully reviewing, adopting, or modifying the studies' recommendations and in preparing the legislation required.

The findings of the original studies may be summarized as follows:

1. No rational basis existed for the division of responsibility between State and local highway agencies.
2. The State Highway System was too large. Many State Highways served only local functions and some local roads should have been designated as State Roads.
3. Highway program management practices were generally lacking at the local levels of government.
4. Local governments would require additional funds to balance revenue with needs.

Recommendations were as follows:

1. The State System be redefined on the basis of functional classification such that a net transfer of approximately 1,100 miles of highway would be made from State to local jurisdiction.

2. A County Arterial System consisting of 1,800 miles of roads be adopted.

3. A City Arterial System consisting of 450 miles of roads be adopted.

4. The motor and special fuels tax be increased from six to seven cents with the increased revenue being allocated to cities and counties for improvement of the approved Arterial Systems.

5. The Road Commission be designated as the central agency for administration of State-aid cities and counties.

6. As a condition of State-aid, cities and counties limit the authority of their elected boards to formulation of road policies and broad administrative decisions pertaining to budgets, construction programs, and personnel, and that full-time registered engineers direct all County Road management functions.

7. The State Road Commission rather than the State Legislature be given the authority to designate the State System and City and County Arterial Systems.

The Committee organized itself with a city representative as chairman, a county representative as vice-chairman and a State representative as secretary. The Committee also invited to attend committee meetings as ex-officio members the following:

Chairman of the Senate Highway Committee
Chairman of the House Highway Committee
Member of the Legislative Council
Staff Member of the Governor's State Planning Office

A time table was established for review of all matters by the Committee. Dates for decisions and review and approval of decisions by the parent organizations of the Committee members were set. The approved schedule was adhered to strictly through all deliberations and actions by the Committee.

After careful deliberation and review the Committee determined that the legislation to be presented should do the following:

1. Define the State Highway System on the basis of functional classification using the A. S. F. recommendations as modi-

fied by the Action Committee after review with State and local officials.

2. Designate City and County Arterial Systems consisting of those roads classified by A. S. F. as Collector Roads as modified by the Action Committee after review with local officials.

3. Leave the designating authority for State Highways with the Legislature.

4. Place authority for designation of the City and County Collector Systems with the Legislature but grant interim authority for modifications to the State Road Commission.

5. Increase the tax on motor and special fuels from six to seven cents.

6. Allocate the revenue from the increase to cities over 2500 in population and to all counties for construction of the Collector Road System.

7. Not require as a condition of State-aid that engineering departments be required at the local levels, but require that all projects have plans and specifications prepared and be constructed in accordance with uniform standards.

8. Establish the State Road Commission as the Administrative authority for the Collector Road Program.

9. Provide for cooperative development of rules and regulations for administering the Collector Road Program.

The staff of the Committee and Highway Department engineers visited all counties and participating cities with maps depicting the recommended Collector Systems and the recommended modifications in the State System. Approval of the recommendations were obtained where there were no differences of opinion. Where there were differences, the modified recommendations were returned to the Committee for consideration. The Committee reviewed all modifications and came to a decision. Local and State authorities were notified of the decisions and were afforded the opportunity to appear before the Committee to present additional evidence for any recommendations not adopted by the Committee. A few officials did appear. Arguments were considered and ultimately the systems were finalized by the Committee. The final

systems called for a transfer of 928 miles of road from the State System to the local systems and a transfer of 206 miles from local systems to the State System. Approximately 108 miles of the roads to be transferred to local jurisdiction were presently the traveled way of the Interstate System and were to be transferred to local jurisdiction upon completion of the adjacent Interstate Highway. The City Collector System included 368 miles of highway and the County Collector System included 1,942 miles of highway. The County System included all mileage in cities with populations less than 2,500, accounting partially for the increase in county mileage and the decrease in city mileage from that recommended in the A. S. F. Systems.

The Committee did not feel that the Legislature would accept proposals to place designating authority with the Road Commission and therefore such a recommendation was not made. The Committee was successful in having the Legislature designate the State and Collector Systems as recommended by the Committee.

The Committee agreed that many cities and counties and their road programs were so small that it was not economical to require full-time engineering staffs and that a mandatory requirement for the consolidation of staffs of several cities and counties was too drastic a step to be taken initially. It was decided that proper management and engineering could be encouraged if projects were required to be designed and constructed in accordance with standards and specifications. Such a requirement would leave the local agencies free to establish staffs where practical or to contract with private engineers or the Highway Department for the engineering services needed. Further control and direction would be obtained by making the Road Commission the administering agency for the program and restricting the use of funds to construction, engineering, and right-of-way items only.

A number of methods were considered for distribution of funds among the cities and counties with a compromise formula being adopted using the ratio of the cost to complete the system as a 45% factor, population as a 45% factor, and land area as 10% factor. Cities with less than 2,500 population were considered as part of the counties since allocations and the Collector System in such cities would be very small and the work could be handled more efficiently by the counties.

Legislative Acts necessary to implement the Committee's proposals were prepared by the attornies of the Municipal League and the County Association under the direction of the Committee staff. It was the intent of those drafting the Acts that they be kept as simple as possible. The existing statutes regarding taxes on special fuel and motor fuel were amended to increase the tax rate from six cents per gallon to seven cents. The statutes listing roads on the State System were repealed and new sections listing the roads recommended by the study and a new section entitled the "Utah Collector Road Construction Act" were proposed. The Collector Road Program was written as an extension of the State Highway Program with cities and counties acting as agents of the State to avoid conflict with a constitutional provision which prohibits the use of State taxes for local purposes.

The proposals were officially approved by the Municipal League, the Association of Counties, the Road Commission, and the Utah Highway Users Conference. Official approval by the sponsoring agencies did not, however, consitute unanimous approval of the proposals by city and county officials. A minority group consisting of about one-third of the county commissioners opposed the proposals for a variety of reasons. Many opposed the engineering requirements and also sought to have an existing law requiring competitive bidding practices for projects over $25,000 repealed. This group wanted complete freedom in the use of the money and the use of county forces for construction. Others opposed the transfer of roads to the local system and wanted to be able to use a large portion of the revenue for maintenance purposes. This group actively lobbied for changes in the proposals or for the defeat of the proposals.

In the Legislature there was a very strong resistance to any manner of tax increase. Tax payers and housewives repeatedly marched on the Capitol and protested proposed increases in the sales tax, cigarette tax, and other taxes.

The proposals, after extended debate, ultimately passed the Senate by substantial margins, but not before a strong movement supporting the dissident county commissioners had amended them to allow 5% of the fund for maintenance.

In the House of Representatives on the 58th day the opposition of the minority county commissioners' group, coupled with the sentiment against any tax increase, caused the proposal to fail of passage

by three votes. However, in a most unusual move the measures were recalled on the 59th day, amended to allow 10% for maintenance, and passed by two votes. Strong action by the Governor, the Utah Highway Users Conference, the State Road Commission, City and County Associations, and the legislative sponsors of the measures saved the legislation in this last-minute action of the Legislature.

Passage of the measures is significant in that for the first time in Utah local and State highway responsibilities have been defined and revenue divided on a rational basis.

The revenue anticipated for distribution to cities and counties from the increased tax will be $4.5 million in 1970 and will increase to $7.5 million in 1990. The 20-year total will be $120 million.

The measures became a reality because care was taken from the beginning to involve local and State officials, legislative leaders, and the Highway Users of Utah in the decision-making process and the development of the legislation. Only the Highway Users as a tax-paying group came forward during the 1969 session of Utah's Legislature to support an increase in a tax they would have to pay. It was this support in a tax-conscious year that the author feels provided the narrow victory.

The Collector Road Construction Act stated that "The State Road Commission in cooperation and consultation with the counties and cities shall adopt rules and regulations . . ." for administering the Collector Road Program. The Act listed eight subjects which must be covered in the rules and regulations. These eight subjects are:

1. Establish procedures for programming apportioned funds to improvement projects.
2. Establish the design standards applicable to the Collector Road System.
3. Provide for the preparation of plans and specifications for projects and the review of said plans and specifications by the State Highway Department, except that cities and counties who maintain adequate engineering staffs may prepare the plans and specifications. In case where such staffs are not maintained this shall be done by the use of qualified consultants.

4. Provide that all contracts in excess of $25,000 shall be by competitive bidding procedures under the contract method by contractors prequalified by the State Highway Department.

5. Establish procedures for quality control of construction.

6. Establish procedures for the appraisal, appraisal review, and acquisition of rights-of-way for approved projects.

7. Provide for uniform accounting of funds to be expended upon Collector Roads and provide for necessary control over each fund.

8. Provide for the manner and times at which the apportioned funds shall be apportioned among counties and participating cities pursuant to this Act.

Some amendments in the original list prepared by the Action Committee were made on the floor of the State Legislature, but the intent was not significantly changed.

Following enactment of the Action Committee proposals, the State Road Commission asked the Municipal League, the Association of Counties, and the newly organized Governor's Council on Local Affairs to jointly appoint a committee to assist in the preparation of the rules and regulations and the adoption of minimum standards. A committee of eight men, some of whom had also served on the Action Committee, was appointed to serve as a Technical Advisory Committee on Collector Roads.

Through the voluntary efforts of this Committee, rules, regulations, and minimum standards have been drafted. These rules have been reviewed by the road committee of each association, by the Local Affairs Council, by the Conference of County Commissioners, and by the Executive Committees of each association. Each group has endorsed the proposals by resolution, and resolutions recommending the proposals have been adopted by the total membership of the Municipal League and the Association of Counties at their annual meetings.

The rules and regulations and minimum standards will be presented to the State Road Commission of Utah for adoption on February 13, 1970.

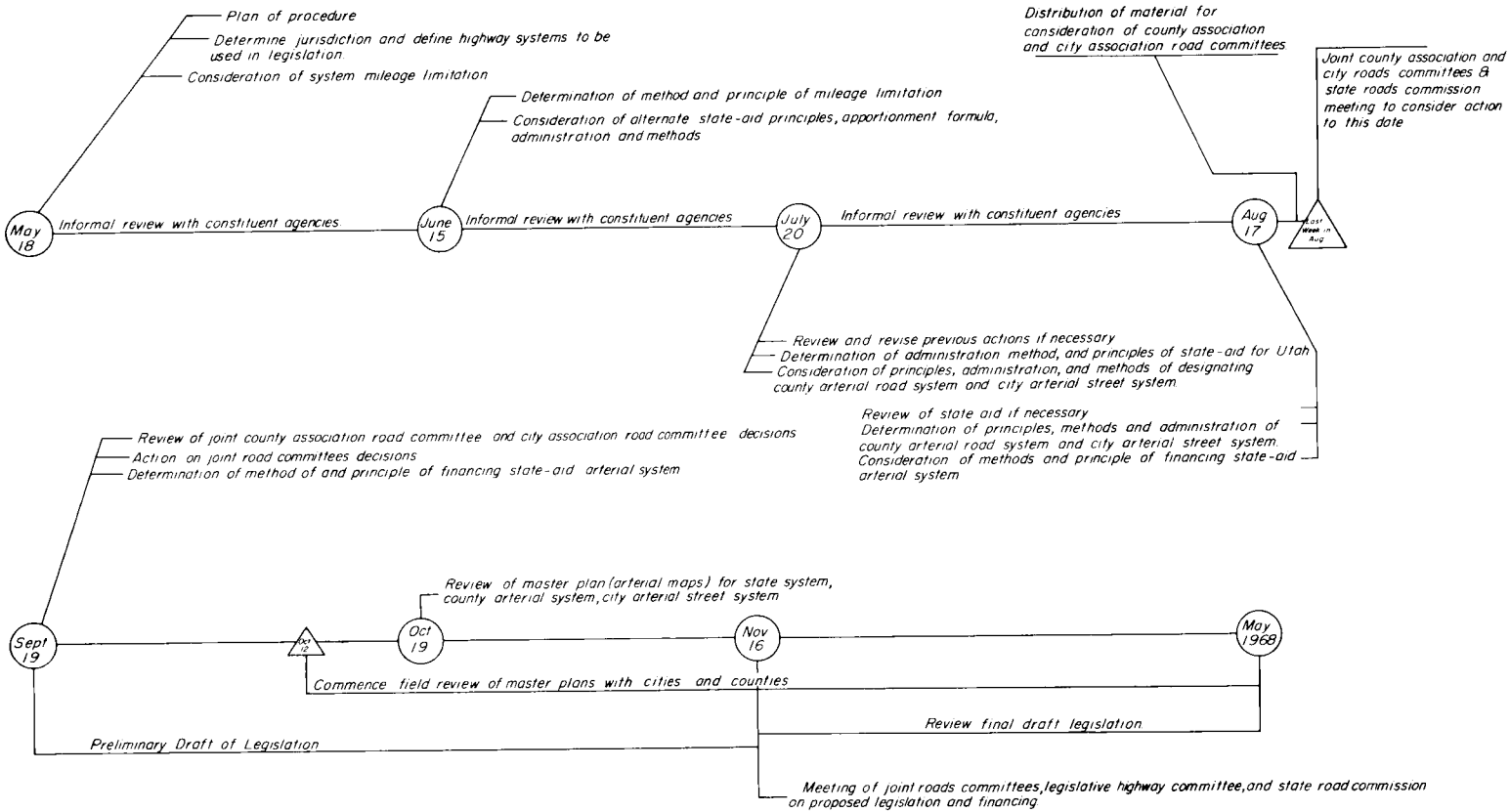
We in the Utah State Department of Highways feel that the Utah Collector Road Construction Act is a significant step forward. We feel that this program will complement the County Federal-aid

Secondary Program and the TOPICS Program. It should be invaluable in preparing highway organizations at the local government level for expanded responsibilities and opportunities which are sure to come with new Federal-aid highway programs proposed for the period after completion or termination of the Federal-aid Interstate Program.

UTES ACTION COMMITTEE FLOW CHART

LEGISLATIVE RECOMMENDATIONS

1967-68



UTAH COLLECTOR ROAD TECHNICAL COMMITTEE

FLOW CHART 1969 - 70

SUB-COMMITTEE TO GOVERNOR'S ADVISORY COUNCIL - LOCAL AFFAIRS

COUNTY MEMBERS

Comm. Paul A. Thorn, Chairman, Utah County
Comm. Calvin Black, San Juan County
Comm. Walter L. Ekins, Millard County
County Surveyor Glen Austin, Davis County

CITY MEMBERS

Mayor Richard A. Chambers, Vice Chairman, Logan
Mayor Alvin Kay, Vernal
City Manager Charles G. Kelley, Ogden
City Engineer Joseph T. Fenton, S.L.C.

COMMITTEE MEETINGS

Time - 9 a.m. to 2:00 noon
Place - Highway Dept. Conference Room
6th Floor State Office Building
Unless Otherwise Designated

June 12-26

1. Mission of Committee Defined
2. Review of Minimum Geometric Design Standards for Local Roads and Streets

July 17

18th - County Commissioner's Summer Workshop at Logan. Committee members invited to attend and participate

1. Complete Review of Geometric Design Standards for Local Roads and Streets
2. Adopt Outline for Rules and Regulations
3. Discussion - The Collector Road System
4. Discussion - The Collector Road Fund

Aug. 7-21

Joint Meeting - City & County Roads Committees to review and approve geometric design standards for local roads & streets.

1. Authority and Responsibilities (a) State Legislature, (b) State Road Commission, (c) Counties and participating cities
2. Definitions
4. Programming Construction & Maintenance Projects

Sept. 4-18

12th - Municipal League Convention. Approve geometric design standards, authorize Executive Board to approve rules and regulations

1. Final Review of Geometric Design Standards
2. Discussion - Preparation of Plans, Specifications, and Estimates
3. Bidding Practices and Requirements

Oct. 9-23

1. Construction Inspection (Quality Control)
2. Appraisal and Acquisition of Rights-of-Way
3. Introduction to Uniform Accounting
4. Reimbursement Procedures

Nov. 6-20

Prepare first draft of Rules and Regulations

1. Apportionment of Collector Road Funds
2. Use of Collector Road Funds with Federal and/or State Funds
3. Reversion of Unused Funds - Time Limitation

Dec. 19

Joint Meeting - County Road Committee
City Street Committee
Governor's Advisory Council
Review & Approve Recommendations of Technical Committee

Jan. 8

Prepare final draft of Rules and Regulations

23rd - Annual Convention - Utah Association of Counties. Approve rules and regulations

Adoption of rules and regulations State Road Commission

Joint Meeting - County Officials Executive Board
Municipal League Executive Board
Review and Approve Rules and Regulations

Feb. 19

Publish Rules and Regulations

1. Technical Committee Review of Final Draft of Rules and Regulations Prior to Publishing
2. Miscellaneous Business - Final Committee Meeting

THE UTAH COLLECTOR ROAD

CONSTRUCTION ACT

ENACTED MARCH 13, 1969

CHAPTER 68

S. B. No. 68 (Passed March 13, 1969. In effect May 13, 1969)

COLLECTOR ROAD SYSTEM

An Act Relating to the Road System of the State of Utah; Providing for the Designation of Collector Roads and Differentiating Between City and County Collector Roads; Providing for Additions and Deletions to the System; Creating a State Collector Road Fund and Providing for an Appropriation of Funds to it and for Their Use; and Allocating Funds for Construction of Such Roads by Cities and Counties as Agents of the State Under the Administration of the State Road Commission.

Be it enacted by the Legislature of the State of Utah:

Section 1. Short title.

This act shall be known and may be cited as "Utah Collector Road Construction Act."

Section 2. Legislative intent — Collector road system — Financed from motor fuel taxes — Additional funds.

The legislature recognizes that an adequate and integrated system of highways, roads and streets is essential to the general welfare of the state. It is the opinion of the legislature that the existing system of collector roads is not adequate to service the state highways and arterial roads. It is the intent of this act to provide a means whereby a portion of the proceeds of the motor fuels and special fuels tax of the state and any other revenues allocated for this purpose may be used for the construction and reconstruction of the collector roads designated in this act. The legislature deems it to the best interest of the state if this construction be performed under the direction of the counties and participating cities as agents of the state under the administrative control of the state road commission pursuant to rules and regulations of the state road commission developed in cooperation with the counties and cities. It is the further intention of the legislature that the funds provided pursuant to this act be deemed additional to funds normally used by the cities and counties for road construction and shall not be used in substitution for local road construction funds.

Section 3. Definitions.

As used in this act:

"Construction" means the function of constructing or reconstructing a collector road and shall be limited to land acquisition, engineering, inspection, construction and reconstruction as may be more fully defined by rules and regulations of the state road commission.

"Fiscal year" means a period of twelve calendar months commencing July 1 and ending June 30 of the following year.

"Participating city" means a city having a population of 2500 people or more as determined from the last official federal census.

Section 4. Collector roads designated — CR-1 to CR-427.

(1) The following named roads are designated as collector roads:

CR-1. Juab County line northerly via Ibapah to the Nevada State line.

(Collector Roads 2 to 422 are listed on Pages 292-305)

CR-423. Castleton northwesterly to a junction with SR-128.
CR-424. Undesignated.
CR-425. From SR-9 northeasterly to a junction with CR-427.
CR-426. Undesignated.
CR-427. From SR-9 northerly via Lisbon Valley Road to a junction with SR-46 west of LaSal.

Section 5. County collector roads — City collector roads — How determined.

All Collector roads within the unincorporated areas of a county and within the non-participating cities or towns situated within the county shall be designated county collector roads. All collector roads within a city of 2500 population or more, according to the last official federal census, shall be designated city collector roads.

Section 6. Additions and deletions to collector road system — Adjustments by legislature.

Between each regular session of the legislature, the state road commission may at the request of the cities or counties designate additions to or deletions from the collector road system, but a list of all such additions or deletions shall be submitted to the next regular session of the legislature by the state road commission for the approval or disapproval of the legislature and shall be adjusted in accordance with such legislative action.

Section 7. State collector road fund — Appropriation to commission from excise tax.

On and after July 1, 1969, there is appropriated from the state highway construction and maintenance fund to the uses of the state road commission an amount equal to one-seventh of the proceeds therein not appropriated to other uses derived thereafter from the excise tax imposed upon motor fuels and special fuels pursuant to the provisions of Chapter 11 to Title 41. All of said money shall be placed in a fund to be known as the state collector road fund to be used as provided in this act. The state auditor shall on or before the 20th day of July of each year make the necessary accounting entries to transfer said money to the state collector road fund.

Section 8. Appropriation for administration of act — Balance of fund to be used for construction of collector roads and maintenance — Distribution formulas.

3% of the money appropriated to the state collector road fund shall be apportioned to the state road commission for expenditure solely in connection with the administration of this act. The balance of said fund shall be used for the construction of collector roads except that 10% may be used for maintenance of collector roads. The fund allocated for construction and maintenance of collector roads shall be apportioned among the various counties and participating cities as follows:

(1) 45% in the ratio that the population of each county (including the population of the non-participating municipalities therein) and of each participating city bears to the total population of the state as of the last official federal census.

(2) 10% in the ratio that the land area of each county (including

the land area of each non-participating municipality therein) and of each participating city bears to the total land area within the state.

(3) 45% in the ratio which the estimated cost of completing construction of the state collector road system in each county (including the cost of the state collector road system in each non-participating municipality therein) and in each participating city, as determined in the manner provided in this act, bears to the sum of the estimated cost of completing the state collector system in all of said counties and cities. The estimated cost of construction of the state collector system in each county and participating city shall be determined by the state road commission in consultation with representatives of said counties and cities by July 1, 1970, and at the end of each five year period thereafter.

Section 9. Commission to adopt rules and regulations for collector road system — Items to be included.

The state road commission in cooperation and consultation with the counties and cities shall adopt rules and regulations which shall:

(1) Establish procedures for programming apportioned funds to improvement projects.

(2) Establish the design standards applicable to the collector road system.

(3) Provide for the preparation of plans and specifications for projects and the review of said plans and specifications by the state highway department, except that cities and counties who maintain adequate engineering staffs may prepare the plans and specifications. In cases where such staffs are not maintained this shall be done by the use of qualified consultants.

(4) Provide that all contracts in excess of $25,000 shall be by competitive bidding procedures under the contract method by contractors pre-qualified by the state highway department.

(5) Establish procedures for quality control of construction.

(6) Establish procedures for the appraisal, appraisal review and acquisition of rights of way for approved projects.

(7) Provide for uniform accounting of funds to be expended upon collector roads and provide for necessary control over each fund.

(8) Provide for the manner and times at which the apportioned funds shall be apportioned among counties and participating cities pursuant to this act.

The state road commission shall cooperate with the governing officials of counties and participating cities in order to put in effect the intent and purpose of this act.

Section 10. Reversion of funds to collector road fund — After five years.

The money apportioned to the state road commission for administrative purposes, and to each county or participating city for expenditure upon collector roads within the county or city shall continue available for such purpose for a period of five fiscal years after the close of the fiscal year for which such sums are authorized and any amounts so apportioned remaining unobligated at the end of such period shall revert to the state collector road fund. The state road commission shall reapportion said lapsed funds among the counties and participating cities during the succeeding fiscal year.

FINANCING THE HARTSTENE ISLAND BRIDGE PROJECT

by

John C. Bridger

Financing the Hartstene Island Bridge Project

by

John C. Bridger

At 2:34 P.M. on June 22, 1969, the Hartstene Island Bridge was opened to traffic and a cavalcade of vehicles headed by a horse-drawn surrey and several "vintage" autos crossed the bridge to Hartstene Island. This conclusion of formal dedication ceremonies was the culmination of eight years of positive efforts in Mason County by public-minded citizens, the Board of County Commissioners, the County Engineer's Office, and others to provide free highway access to Hartstene Island.

Mason County, with an area of approximately 1,000 square miles including 270 square miles of Olympic National Forest, is situated on the Olympic Peninsula on southwest Puget Sound. It is generally forested and ranges from sea level to 6,000 feet, with over 85 (named) lakes and 250 miles of salt water beach. The county's population is approximately 20,000 and its economy is based principally on forest products, including manufacture, and on recreation. The County Road Department currently operates on an annual budget of slightly over $1 million and maintains 600 miles of County Roads of which 40% are paved. Road districts are coincident with the three commissioner districts.

Hartstene, lying off the east coast of the Olympic Peninsula and forming a part of Mason County -- separated only by the quarter-mile wide Pickering Passage -- is the third largest island in Puget Sound proper (south of Whidbey Island). It comprises 12,000 acres and has 30 miles of salt water frontage. The island was settled sparsely as early as 1875 and some vineyards and other remnants of early establishments still remain. The present permanent population of the Island is approximately 400, plus several hundred summer homes and beach cabins.

Access to Hartstene was, of course, by boat. The crude private ferry to the Island was acquired by the county around 1921 and since that time Mason County has operated a ferry on generally regular runs. The latest vessel was a wood hull, beaching-type ferry built for the purpose in 1944 and operated at a continually increasing

loss - $40,000 in its last year on the run.

Efforts to Finance a Bridge

Interest in a bridge to the Island had been expressed for many years but perhaps not seriously. In 1961, certain interested citizens, the Board of County Commissioners, together with the County Engineer at that time, Mr. Frank R. Porter, engaged the services of a consultant, Mr. Harold V. Sargent of Olympia, and began active planning for a bridge crossing of Pickering Passage. After proper public notification, hearings were held and the Chief of Engineers, U. S. Army, in June, 1962, granted a permit for the proposed bridge crossing. Reconnaisance had resulted in the choice of a site about 1,000 feet south of Grant Point on the mainland, at the narrowest point at which bottom and bank features were favorable.

The structure was to approximately 1,475 feet long with short road approach embankments and was stipulated in the permit to provide a minimum clearance above mean high water of 31 feet. Early in 1962, tentative locations for roads were established to connect the route of the crossing to the nearby county roads on the mainland and on the Island and, after a regular public hearing, the route was established by the Board of County Commissioners as a part of the Mason County Road System. With funds provided by a loan from the Housing and Home Finance Agency (now Department of Housing and Urban Development), a series of borings in the channel and soil tests were made by the firm of Dames & Moore and a preliminary design and estimate were prepared by late 1962. At that time the estimated cost of the bridge and approach embankments (but excluding connecting roads and necessary rights-of-way) was $725,000. It was considered that approach roads and incidental costs could be provided out of road funds normally accruing to the road district involved, and that the cost of the bridge crossing only would require special financing. After careful consideration of the overall county-wide benefits which could be expected, a bond proposition for the issuance of $725,000 in county-wide general obligation bonds was submitted to the votors of the county at a special election on March 12, 1962. This proposition received a majority, but less than the required 60%.

In April, 1964, application was made to the Housing & Home Finance Agency for a 50% matching grant under the Accelerated Public Works Program; the estimate at this time for the total project

was $815,000. This grant was not made available because of the early depletion of Federal funds for this purpose.

Again in November 1964, a proposition for the issuance of $780,000 in general obligation bonds was put on the ballot; this proposition received less than 60% "Yes" votes.

There followed a period of near-frustration on the part of those actively promoting the project. During this time, however, various avenues were explored to determine if other means of financing might be available. Consideration was given to the collection of tolls to assist in financing the cost of the project. It soon became evident that supervised toll collection, essential to provide adequate security for revenue bonds, would be so costly that only an insignificant net annual sum could reasonably be expected from users' tolls. Furthermore, the requirement of the payment of tolls would mean a continuing restraint, to a degree, on free access to Hartstene Island and would not result in full development of the Island's potential so as to benefit the entire county.

The 1965 Washington State Legislature amended the statutes pertaining to county road improvement districts (RCW 36.88) so that it was made possible for all classes of Washington counties to form special road improvement districts and to levy special assessments against the property contained in said district to pay a part or all of the cost of all types of road improvements.

This opened a new avenue in the long-sought route to financing the Hartstene Island Bridge Project. A preliminary assessment roll was prepared in the County Engineer's office pursuant to a Commissioners' resolution declaring their intention to establish a Road Improvement District conprising Hartstene and McMicken Islands. This assessment roll involved over 620 separate property listings and was sent to 374 property owners; then a mail ballot by property owners was canvassed. This ballot was favorable to the formation of the Road Improvement District by a "yes" vote of over 78% of the proposed assessments voting, and on August 19, 1966, there was created by resolution of the Board of County Commissioners, Mason County Special Road Improvement District No. 1 to provide "Not to exceed $300,000 of the cost of the Hartstene Island Bridge Project." A proposition for the issuance of $450,000 in county-wide general obligation bonds was presented to county voters at the time of the General Election, November 8, 1966. The remaining

$250,000 of the cost, estimated at that time to total $1,000,000 was by Commissioners' resolution to be provided by the sale of limited general obligation bonds. County boards in Washington are empowered to issue bonds in an amount not to exceed 1 1/2% of total assessed valuation. These latter bonds would be retired by annual payments from normal road funds. The annual installments on this issue would be less than the operating loss in maintaining ferry service to the Island. This "package" seemed ideal -- degree of cost to be borne would be proportional to the degree of benefit.

Hartstene property would contribute to the greatest degree, Commissioner District No. 1 next, and the remainder of Mason County only on the general obligation bonds -- less than 1 mill annually for 20 years. However, perhaps because of the crowding of other "money" propositions on the general ballot, the county-wide general obligation bond proposition failed by a narrow margin to receive the required 60% "Yes" votes.

Early in the summer of 1967, a straight-forward and persistent public information campaign was initiated, stressing not only bridge benefit, but especially the cost of ferry operation. One Board meeting in late October, 1967, was duly publicized in advance as a "Question and Answer" meeting on the proposed bridge project. A large and representative turn-out at this meeting enabled the Commissioners, the Engineer, and the County Treasurer to impart factual information to the electorate. All the usual news media were used -- both on a "paid" and on a "news" basis. Excellent cooperation was afforded by the local Shelton-Mason County Journal, the Daily Olympian, the Tacoma News Tribune, the Bremerton Sun, radio stations KMAS, KGY, and KBRO. The Shelton Chamber of Commerce, granges, and various civic organizations actively supported the project.

On November 7, 1967, the voters of Mason County approved a county-wide general obligation bond issue in the amount of $450,000 by a "yes" vote of 60.7%. The project thus appeared to be assured.

Next followed adoption by the Board of County Commissioners of the Final Assessment Roll for the RID, the preparation of complete plans and specifications, advertisement for bids, and a planned schedule for sale of the three issues of bonds. Design of the approach road system and approach fills was accomplished in the County Engineer's office and design of the bridge was accomplished by Harold V. Sargent, Olympia, Washington.

Seven bids were received and opened on March 25, 1968, for construction of the entire project including approach roads. Award was made on April 22, 1968, to the low bidder, Western Pacific Constructors, Seattle, in the amount of $1,005,471. Consultants' fees, county engineering costs, right-of-way costs, and repayment of the advance planning loan to Housing & Home Finance Agency (now Department of Housing and Urban Development) was estimated to bring the total cost to slightly over $1,100,000. This project was at that time and is believed to be at this time the largest single road project ever undertaken independently by a Washington county without State or Federal assistance. Total tabulated cost of the project and the sources of funds are shown in Table 1. Persons and firms directly involved with the bridge project are shown in Table 2. The structure as finally designed, differs only slightly from the scheme proposed in the preliminary design of 1962. Two 12-foot roadway lanes and one 3-foot sidewalk are provided by a poured-in-place concrete deck carried by four lines of precast, prestressed concrete girders on eleven 133-foot spans for a total overall length of 1,465 feet, 9 inches. Girders are supported on poured-in-place reinforced concrete caps topping 12 twin-shaft column bents. The column shafts, except for the two end bents, consist of five-foot diameter hollow, precast, prestressed concrete piles set and pressure-grouted in cased excavations (borings) 35 feet below the bottom of the channel. Hollow piles are filled with concrete where and as required for strength. End bents are cast-in-place columns on reinforced concrete footings at or near normal low water, Elev. 0.00. The bottom of Pickering Passage drops on a uniform slope to Elev. -67.0 near mid-channel. The height of the structure from the bottom of the lowest foundation to the top of the bridge railing is approximately 159 feet. The bridge is designed to carry HS-15 loading as prescribed by the American Association of State Highway Officials; this is conservatively adequate for any forseeable character and density of traffic to the Island. In addition, the structure is designed to withstand the maximum normal tidal current of approximately five knots, and a wind pressure of 50 pounds per square foot on all vertical exposed surfaces together with seismic forces which might be anticipated. All exposed parts of the structure are concrete except the handrail of anodized aluminum and the one large, galvanized steel expansion joint near the middle of the bridge. Maintenance costs

should be very small and the "life" of the structure should be 50 years or more. Clearance and navigation lights are incorporated as stipulated by the U. S. Coast Guard, and roadway lighting by means of 11 mercury vapor lumenaries is provided for in the construction, and has been installed on a service agreement with Mason County Public Utility District No. 3. Power and telephone conduits were placed in the sidewalk by the utilities at no cost to Mason County.

Construction started May 7, 1968, and the bridge was opened to traffic after formal dedication ceremonies on June 22, 1969. The contract stipulated 250 working days - one year - but the severe winter weather in December and January necessitated a shut-down for nearly two months.

Table 1
Mason County Washington
Hartstene Bridge Project

Cost Summary

* Total Project Construction Cost	$1,065,892.00	5.8%	Overrun
Total Bridge Construction Cost	862,673.00	1.87%	Overrun
* Total Project Cost	1,203,400.00	9.4%	Overrun
* Overruns caused principally by excessive Right-of-Way costs and adverse soil conditions on approach roads.			
Road Improvement District - Bonds	207.943.45	5.95%	
Cash	92,056.55		
Unlimited General Obligation Bonds (Voted)	450,000.00	5.1654%	
Limited General Obligation Bonds (Comm. Resol.)			
1968	350,000.00	5.3684%	
1969	73,000.00	6.2484%	
Miscellaneous Receipts (Ferry, Interest, etc.)	30,400.00		
	$1,203,400.00		

Mason County Washington
Hartstene Bridge Project

Organization

Board of County Commissioners

*	District 1	Martin Auseth
	District 2	William O. "Bill" Hunter (January 1969 -)
		Harry Elmlund (January 1961 - January 1969)
	District 3	John Bariekman

* Bridge project in District 1

Country Treasurer

John C. Cole

Country Auditor

(Mrs.) Ruth E. Boysen

Design Consultant

Harold V. Sargent, P. E., Olympia, Washington

Contract Administration & Inspection

County Engineer, J. C. Bridger, P. E. & Staff

Contractor

Western Pacific Constructors, a joint venture of A. H. Powers, Inc., Seattle, and Willamette-Western, Portland

Bond Counsel

Roberts, Shefelman, Lawrence, Gay & Moch, Seattle

Fiscal Consultants

Foster & Marshall, Inc., Seattle

PANEL DISCUSSION

HYDRAULIC MODEL DEMONSTRATION

Presiding & Demonstration: Gene R. Fiala

HYDRAULIC MODEL DEMONSTRATION

by

Gene R. Fiala

Hydraulic Model Demonstration

by

Gene R. Fiala

Hydraulic Model

Five or six years ago the Bureau of Public Roads contracted with a consulting hydraulic engineer to design and construct a portable hydraulic flume, in which working models of hydraulic structures used in highway drainage practice could be shown. The Bureau did this after seeing this same consulting engineer demonstrate a very effective and compact hydraulic model which he carried around in a suitcase. We wanted something a little larger than a suitcase - and so specified. But we did want a highly portable, very water-tight flume, which we could set up even in an office with a rug and not need to worry about leakage. Those of you who have been associated with hydraulic models recognize these requirements as being quite a large order.

The model apparatus, as constructed, was portable or semi-portable, in that seven full-sized trunks were required to carry it around. It was a little larger than most of us had imagined in that it had overall dimensions of approximately 7 feet in length and 40 inches in height. The flume portion, where actual models constructed primarily of plastic were set to be shown, was approximately 5 feet long, 20 inches wide, and 10 inches deep. It was not completely water-tight and although leakage was not a bad problem, for our own peace of mind we always preferred to set it up on a concrete floor which had a drain in it.

Hydraulic Model Apparatus Demonstration

The Bureau of Public Roads hydraulic model apparatus provides a means of observing the complex hydraulic phenomena associated with typical highway drainage structures. The hydraulic performance of the various hydraulic models demonstrated must be viewed in a qualitative rather than a quantitative sense. That is, the hydraulic characteristics noted in the models are typical

of those occurring in actual-sized structures, but no attempt is made to scale up the model results to those of an actual-sized structure.

A description of the models used and a brief discussion of the hydraulic feature which each is intended to demonstrate is given below.

Culvert Hydraulics Demonstration

Models Used:

Two 3" diameter circular culverts - one smooth, one corrugated, a 3" x 3" conventional box culvert, a 2-1/2" x 2-1/2" drop-tapered box culvert with a 4-1/3" x 2-1/2" face, thin edge projecting inlet, headwall inlet, thick edge projecting inlet, grooved or bell end inlet, flared or tapered inlet.

This demonstration is designed to illustrate:

1. Inlet control and the effect of culvert roughness.
2. Outlet control.
3. The relative efficiency of the following inlets:
   a. Thin-edge projecting
   b. Thick-edge projecting
   c. Headwall
   d. Grooved or bell end
   e. Flared or tapered
4. The hydraulic performance of a box culvert with an improved inlet as compared to a conventional box.

Discussion:

1. In general, when a culvert is placed on a flat slope, the quantity of flow is controlled at the outlet; i.e., all the hydraulic factors, headwater elevation, inlet edge condition, pipe size and shape, roughness, length, slope, and tailwater all have an affect on the discharge through the culvert.

2. When a culvert is operating with inlet control, the length of pipe, slope, tailwater, and roughness do not affect the

discharge. The discharge depends only on the headwater elevation, the pipe size and shape, and entrance edge condition.

3. The inlet edge conditions demonstrated are listed below. The efficiency of the inlets is in descending order; i.e., the thin-edge projection requires the greatest headwater.

(a) thin-edge projecting
(b) thick-edge projecting inlet - headwall inlet
(c) grooved or bell end inlet
(d) flared or tapered inlet

4. The 2-1/2" x 2-1/2" drop-tapered box culvert requires slightly less headwater to discharge the same quantity of flow as the 3" x 3" conventional box culvert. The outlet velocities for the two structures are about equal.

In this demonstration the required size of culvert barrel was substantially reduced by using a drop-tapered inlet. However, this type of design can also be thought of as a means of increasing the capacity of existing culverts. For example, the capacity of a conventional 5' x 5' box culvert operating with HW = 1.5 D can be increased by over 100% with the addition of a drop-tapered entrance.

The drop-tapered design is practical only for those cases where inlet control governs. The barrel must be on a slope greater than critical (supercritical flow in the barrel). The drop-tapered design can result in considerable savings when the above conditions are met and when construction of the inlet is not too costly. Generally, the advantages of this type of inlet increase as the length and slope of the culvert increases.

Grate Inlets Demonstration

Purpose:

1. To illustrate proper grate bar orientation.
2. To show the effect of slope on grate efficiency.

Models Used:

Small plastic channel, two square grates, one rectangular grate.

Procedure:

Two square grates are placed in the small channel such that the bars are perpendicular to the oncoming flow direction. The flow is adjusted until the grates just accommodate the discharge. One grate is then removed and replaced by a solid piece of plastic and the remaining grate turned so the bars are parallel to the flow. This one grate properly oriented will accept all the flow that required two improperly oriented grates.

To demonstrate the affect of slope,the six-inch rectangular grate is positioned in the channel and the discharge adjusted until the grate accepts the entire flow. The flume slope is then increased with the result that part of the flow will bypass the grate.

Discussion:

Grate bars should be orientated parallel, not perpendicular, to the oncoming flow. Square grates should not be used due to the possibility of improper installation. Greater slope requires longer grates to accommodate the same discharge.

Bridge Backwater and Spur Dike Demonstration

Purpose:

1. To show the backwater created when the normal flow area is constricted by bridge approach fills.
2. To illustrate the affect of spur dikes in improving the flow pattern and alleviating scour at the abutment.

Models Used:

1. Simulated embankment - spillthrough abutment - 8" high, 1/2:1 side slopes.
2. Spur dike - 8" long with 2-1/2:1 elliptical shape.

Procedure:

The embankment model is constructed in three sections, one section and the abutment are initially inserted in the flume.

The backwater is recorded and dye used to illustrated the flow pattern; i.e., flow parallel to the embankment and the separation zone at the abutment face. The remaining embankment sections are then added, the backwater values recorded and resulting flow patterns demonstrated. The spur dike is then inserted, the improved flow pattern demonstrated with dye injections, and the backwater noted.

Discussion:

Increasing the degree of constriction increases the backwater and causes a deterioration in the flow pattern. The flow separation at the abutment face has two adverse effects:

(a) it decreases the effective flow area thereby reducing the efficiency of the bridge opening and

(b) it results in a flow pattern conducive to scour.

The spur dike improved the flow pattern through the bridge and reduced the undesirable flow parallel to the embankment. It results in less separation and scour at the abutment face and an increased effective waterway area.

Bridge Pier Demonstration

Purpose:

To illustrate the correct orientation of a bridge pier to reduce the local scour potential.

Models Used:

A rectangular rounded-nose bridge pier. This model is constructed to allow orientation at any angle with the oncoming flow.

Procedure:

The pier is initially orientated with its long axis parallel to the flow direction and dye used to demonstrate the flow pattern. The pier is then rotated so the flow attacks it at various angles. Dye injection illustrates the increased turbulence as the angle of attack increases. This turbulence is indicative of potential scouring around the pier footing.

Discussion:

For piers other than circular, scour potential is a direct function of the angle of attack of the oncoming flow. The greater the angle, the greater the scour potential. Piers should be constructed with their long axis parallel to the flow direction expected during flood periods.

Ogee Spillway Demonstration

Purpose:

1. To illustrate types of flow; i.e., subcritical and supercritical flow.
2. Demonstrate formation of hydraulic jump.

Equipment:

Model of ogee spillway, 5-1/4 inches high which completely obstructs flow to that depth.

The following hydraulic features are demonstrated.

1. Flow upstream of the structure is deep and the velocity is slow; i.e., subcritical flow prevails. Flow passes through critical depth near the spillway crest and supercritical flow exists from that point to a downstream point which is dependent upon depth of flow in the channel.

2. With sufficient depth of water downstream of the spillway, a hydraulic jump occurred. Depending upon the magnitude of the approach velocity preceding the jump as compared to critical velocity at that point, the form of the hydraulic jump varies from an undulating water surface with little energy loss to a well-established jump with appreciable loss of approach kinetic energy. The longitudinal location of the jump in the downstream channel can be shifted by varying the tailwater depths.

PANEL DISCUSSION

COOPERATION

Presiding: B. J. McClarty

MULTIPLE-USE ON ABC SYSTEM

by

Irvin C. Lloyd

Multiple-Use on ABC System

by

Irvin C. Lloyd

During the past two years highway journals and literature have been presenting articles on Multiple Use and Joint Development on the Interstate System right-of-way. Does this philosophy pertain to the administrator who is responsible for a State's primary or secondary system, county roads, or city streets? Yes. The same objective and goal may apply to all highway classifications.

Before we discuss methods, examples, and means of financing, let's define these terms. "Multiple Use" means development of the highway right-of-way for other compatible purposes along with the roadway. After the highway has been completed, the land space under the structure, air space over the highway, or extra width of right-of-way required for protection and construction of facilities may be utilized for other developments which will benefit the adjacent community.

"Joint Development" means the partnership between the highway agency and another governmental agency or a private operator. In most cases, the highway agency retains ownership of the land, supplies minimal construction costs such as limited rough grading, and provides design consideration such as spacing of bridge piers. The partner then finances the cost of the development which may include mini parks, recreation development, trails, public or commercial buildings over or under a facility, or acquisition of adjacent property to properly develop their installations.

Most communities are extremely anxious to work with the highway agency on Multiple Use, but the problem is one of communication on what are the needs of the community. This comes down to the point of Community Comprehensive Planning, which is a must for a locality to voice its needs and how it intends to develop those wants.

Borrow pits dressed up and left as fishing lakes; use of the highway embankment as a dike or water impoundment; trail systems;

fire stations; library; courthouse annex; parks; parking; fish or water access; and many other features have been created on the highway right-of-way across the country, based on a comprehensive plan which assured the highway department that this development would fit into the community and would be properly operated. Often a community has a need, but is limited by insufficient finances.

There are several government programs that can help the community: Housing Urban Development 701 planning, open space, and recreation programs; Bureau of Outdoor Recreation development and acquisition programs; Soil Conservation Service rural recreation and soil conservation programs. Often savings can be realized by the taxpayers of a community if the needs of the community are made known to the highway administrator prior to the highway design. Many times the most costly construction item for a community fire station is the purchase of the land. If the street or highway has excess right-of-way not required to operate the road, this may become available for construction of such facilities as fire station or some other community need. Many times excess right-of-way has been acquired originally because of acquisition problems, construction needs, or as a protection against the adverse use of the highway.

So far we have been discussing other related developments for Multiple Use, but a highway-oriented use is now being discussed by Congress, and has been for some time -- that is, a nationwide Scenic Road System. By Executive Order dated April, 1962, the Department of Commerce, Bureau of Public Roads, was asked to prepare a proposed plan for scenic roads and parkways nationwide.

Congress was starting to look ahead to what would be the greatest highway need after the Interstate System had been completed. They realized that many Primary and Secondary Systems will have to be improved, but due to the great pressure for recreation needs across the country, they felt that now was the time for a study to be undertaken on a Scenic Road System. This report was completed in 1965 under the title "Proposed Program for Scenic Roads and Parkways" for which each State had provided information on the routes they would consider for inclusion in such a system.

This has created considerable interest in several States that

have, on their own and until such time as a Federal program is devised, started their own scenic road program. The State of Washington has such a scenic road program, with routes which are designated by the State Legislature. This should not be confused with the Scenic Areas designated by the State of Oregon. Oregon's scenic areas only designate portions of a designated route, whereas other States have designated entire routes between cities as scenic roads. A good example is the route between Ellensburg and Yakima, Washington.

Periodically the Federal Highway Administration is asked to submit to Congress projected highway needs across the nation. This year Congress has asked that an item be included for a Scenic Road System. Following are several proposed items being considered for incorporation into that document:

1. Authorization for establishment of a Scenic Road System nationwide.
2. Criteria, standards, etc. to be incorporated with all agencies concerned.
3. States are to select certain routes which will qualify to the above criteria and establish the necessary legislation for such roads.
4. That the nationwide system be limited to 100,000 miles.
5. That the nationwide system be so marked by a uniform nationwide marker.

Up to the present time the Scenic Road System has been considered to be on the "back burner" until the Vietnam War has been settled.

Due to the increase in our population and their means of mobility, all levels of highway management will be challenged to assist in the utilization of our valuable land and the preservation of our environment. Multiple Use and Joint Development will be means we can use to fit the highway to the community needs and the surrounding environment.

BUREAU OF OUTDOOR RECREATION PROGRAMS

by

S. B. Olson

Bureau of Outdoor Recreation Program

by

Stanley B. Olson

The Bureau of Outdoor Recreation (BOR) was established January 1, 1965, when funding was first provided. The Organic Act set the agency up somewhat before that date. The money comes from several sources, sale of Federal real property, motor boat fuel tax, and up to this point, from entrance and user fees which are less than earlier predictions. The Act was amended July 15, 1968. It provided for more adequate funding up to 200 million dollars for five fiscal years; utilization of miscellaneous receipts from the outer continental shelf lands if appropriations fall short; use of advance appropriation authority; and repeal of the entrance and user fees effective March 31, 1970.

We have heard nothing specific about what Congress may do. There are bills in the hopper that will extend the Golden Eagle program, increase the fees to 10 dollars a year. In any event the agencies would still have the right to charge entrance fees or user fees for specific developments and probably utilize the money for maintenance.

The Land-Water Conservation fund was identified for specific purposes to stimulate, encourage, and assist local and state governments to create new and expanded high-quality recreation areas. This was to be done by providing for state-wide planning and financial assistance. This is referred to as our grants-in-aid program, and the monies are apportioned to the states on the basis of two-fifths equally, three-fifths on the basis of demonstrative needs. Federal funds are made on a fifty-fifty matching basis. Grants-in-aids have been an active part of this agency program. As an example in the State of Oregon, for the period from 1-1-65 through fiscal year 1970, there has been apportioned approximately 5-1/2 million dollars. Some 250 projects have been initiated, are in progress, or have been approved. There are several examples of projects nearby. In Corvallis, the Pioneer Boat Basin project. Here the City of Corvallis sponsored a 35-thousand dollar project which is a nice small project. On the

Columbia Gorge located along the Interstate Highway, is Ainsworth State Park, a new venture. This development consisted of land acquisition and development of a 40-unit camp ground, costing $325,000, one-half matched by Federal funds. South of here at Orchard Point on the Fern Ridge Reservoir, a Corps of Engineer Project, the city of Eugene put in a new imaginative day use area at a development cost of $75,000. There are many other excellent examples both in Oregon and neighboring states. The state of Oregon distributes money on a 60-40 basis, 60% to state projects plus administrative costs, 40% to local governmental bodies on a 50-50 matching. Most states have a similar formula with variations of their own. It is up to each state. The Bureau of Outdoor Recreation deals only with the state level through an interstate agency committee. A contingency fund, controlled by the Secretary of the Interior, can be used for special projects of significance. In the state of Oregon, a special grant was given for the Willamette River Park System to assist the State of Oregon. An approved state recreation plan is a basic requirement for receipt of grants-in-aid funds. These recreation plans are produced by the state with some land and water financial assistance and matching funds of their own. They are adjusted periodically to meet current situations in changing times. They cover supply and demand needs and they provide for a program of implementation.

The State of Oregon recently completed its third edition supplement. It identifies the needs through 1985. It has an action plan to implement this need. It represents coordinated effort by Federal, state, and local governments. It is within the framework of total state planning for all needs and objectives that should be met. The plan identifies a need for 333 million dollars for this period of time, approximately 21 million dollars per year until 1985. The State receives federal land-water fund money at an apportionment of less than one million dollars per year, so this is but a small part of total need.

While speaking of planning I might mention the Bureau of Budget directive effective 9-30-69, which stipulates that all federal projects must be approved by a state clearing house agency, and must be in accordance with state plans. This is operative now in most of the northwest states.

Also, the Congress has directed that the Bureau of Outdoor Recreation provide a nationwide recreation plan. This has been a long time coming, and the date has been extended ahead for compliance. Hopefully, it will be presented to Congress soon. It can be assumed from everything that you read or hear that emphasis will relate to urban recreation needs.

In addition to grants-in-aid to the states, provision is made for funding Federal land acquisition. I might point out specifically that many of the state grants-in-aid projects represent land acquisition which was identified as a basic need by the Outdoor Recreation Preview Commission, namely to save land now.

There are also substantial amounts of land-water conservation funds utilized to acquire private lands, in-holdings and selected recreation lands located within national parks, national forests, and national wild life refuges, and within newly authorized Federal recreation areas. Over one-third of a million acres have been acquired to date by this funding. This represents many subdivision lots and fractional descriptions of land. Substantial progress has been made, but escalation in land values continues, and much work remains to be done. For example, there are an estimated four million dollars worth of private in-holdings remaining in both Olympic National Park and Glacier National Park, two of the big natural parks near us. Both fee acquisition and scenic easement acquisition are involved along the national wild rivers which represent cost. A high cost and a big job remains in the newly authorized area at Point Rayes near San Francisco.

In the State of Oregon the United States Forest Service to date has acquired 25 tracts in seven national forests at a cost of approximately a million dollars. These include highly selective tracts on theRogue River, the Pacific Ocean Strip, some of which are sand dune management back-up lands; and in the Columbia Gorge where there is a coordinated effort to block in alienated lands. There are also some opportunity purchases in Eastern Oregon along streams and reservoirs. The Bureau of Outdoor Recreation is responsible to the Congress and the Appropriation Committee for the programming and verification of lands to be acquired by these Federal agencies.

Another division of this agency is involved with river basin

and water project planning. Currently there are three specific large comprehensive studies underway in the northwest involving - 1) the Columbia North Pacific framework study now at the printers which will soon be out for agency review; 2) the Willamette Basin comprehensive study involving two drainages in Oregon, a more extensive study; 3) The Puget Sound adjacent water study in the western part of the State of Washington. There are target dates for completion and public hearings will be held. They involve close inter-agency coordination in identifying a tremendous job ahead for these large areas.

We are also involved in individual water projects. We work closely with Bureau of Reclamation and the Corps of Engineers on cost benefit ratios and recreation aspects of specific projects under study. Examples are the controversial high-mountain sheep dam on which we spent a lot of time. We also get involved with channelization projects here and there. We work with the Soil Conservation Service closely relating to Public Law 566 (small Watershed Act). Sometimes there are grants-in-aid projects coupled with these facilities which are small impoundments and cannot carry large recreation costs.

Special Studies is another division in our agency. We are involved in scenic river studies, both designated and study rivers. We are also involved with national trails, both designated and study trail systems. We have done considerable work on the national island program and the lake program. If you have read the paper, you observed coverages on a study proposal for the Oregon Cascades which is apparently firing up. Undoubtedly, if Special Studies are made, we would have some role to play in a task force team.

The division of Federal coordination, technical assistance and environment is where I sit. It is a big field; there are new aspects every day. We have a role to play which relates to recreation and environmental factors. We coordinate our efforts with the General Service Administration. Under a intra-agency agreement we identify surplus lands for parks and conservation uses. We make special studies of some of these areas and inspect and report on compliance when they are converted to parks. Via agreement with the Bureau of Land Management, we identify specific tracts that are applied for under the Recreation Public Purposed Act for parks and conservation use. We are sometimes involved in providing

technical assistance. More private lands and private enterprises will assume a role in private recreation enterprises. There is a big future here, but it is still in its early stages. The Soil Conservation Service and the Agricultural Extension Service are responsible for assistance to private land owners, but we play a cooperative role in the workships, meetings, publications, etc.

I am just going to touch on the environmental matters. I think the speaker this noon really set the stage; also the movies shown enlarged further on environmental problems. I am simply going to say that we are involved in environmental matters and land use classifications as they relate to highways, bridges, airports, Corps of Engineers navigation permits, wilderness classification, nuclear sites, and transmission lines. I am a forester who with experience behind me in planting trees, harvesting timber, building roads,and fighting fires never thought I was going to be involved with high-rise apartments pre-empting water areas from boat usage, etc. These are the kind of things you get into today. We were involved to some extent in the Portland Airport and the Miami Airport controversy. We go to many highway hearings and we will probably have some position in some of these controversies. Also, in Legislative matters relating to scenic roads and rivers by the states, our main concern is recreation aspects and intrusive aspects. We have a regional coordinator for the Department who relates to all of the Department of Interior agencies involved dealing with water pollution in commercial and sports fisheries, etc. Hopefully the challenge ahead for the younger career people is to meet these changing times with the compression of time factor which allows little lead time. The dynamics of change, short lead time, the cross-fires of emotionalism, the necessity of political compromise will demand all the expertise we can muster. I am hopeful you can closely coordinate these things and achieve the end objectives. While the BOR is a small-growing organization, presumably our voice will be heard to some extent and we will be involved with you in achieving objectives. Let us hope that reasonable approaches prevail and that accomplishments will be made.

PUBLIC HEARINGS

by

R. L. Carrol

Public Hearings

by

R. L. Carroll

Landscape work, as you have heard takes many forms.

Some years ago we were working on a job called North Cross State Highway from the upper Okanogan Valley, upper Methow Valley in Washington, across the Cascades down Granite Creek into the Skagit Valley and ultimately on out into the Everett-Seattle area. We had started out on a program and I thought we were doing a fair job of the landscape work, trying to preserve as much of the native timber as possible and develop view points. After we had constructed a portion of the job, particularly over on the west side, there was a very substantial scar left on the side hill in a very light-colored granite rock. It really hadn't bothered me,but some of our landscape people looked at it and asked if anything could be done to cover it up. Well, obviously, we couldn't plant anything on it. Somebody in my shop came up with the idea that we could get some colored asphalt emulsion, mix it right, color it if we had to, and go in there and spray it -- kind of doing a large-scale antiquing job. After about six months, this thing was finally perfected and we went in and sprayed the rocks and they didn't look too bad. They looked like it was a new cut that had been painted, but some thought it looked pretty good. This was great. About two months later, I had a letter which I think had 37 names on it from a school in Seattle. It was from a class of geology students asking, "Why did you cover up that rock"? It was the only perfect display of this particular formation they had ever seen.

Joint use of right-of-way also tends to create a problem or two. It seems to me that joint use is kind of a one-way street where everybody wants to use highway right-of-way for one purpose or another.

I direct my comments along this line to probably a number of you in the group that this joint use and multiple use concept is a two-way street. It can't always be one way and I was pleased to hear Mr. Olsen's comment that the Bureau of Outdoor Recreation now is geared up to be funded. It is alot easier to cooperate with

another agency if they've got money.

For some number of years, the State of Washington has operated on a two-hearing process from the days of the establishment of the Highway Commission when the Access Hearing was first inaugurated back in the early 50's and later as we got into the Federal regulations covering Federal aid Route Hearing. We've operated on the two-hearing basis for quite a long time. Approximately a year ago, we were involved in an added hearing, I think known by definition as the Corridor Hearing, first when it was to replace the old Route Hearing and is now supplemented by Design Hearing.

In Washington, we have of course, the Access Hearing which is conducted by the Highway Commission. The first two hearings, the Route Hearing or Corridor Hearing, are conducted at the district level. Generally, the district engineer in the highway district serves as the hearing officer, and we conduct the Route Hearing. Later we get into the Design Hearing.

There are some basic disagreements, I've found, in what these hearings are attempting to do. There is some lack of unanimity of opinion, if you like, in the approach and the concept of what we are attempting to do. The policy procedure memorandum that was issued by the Federal Highway Administration, Bureau of Public Roads, states that the hearings are an opportunity to receive effective input from the citizen and get a citizen participation. This is pretty clean-cut -- you really don't have to wrestle with it too much.

My headquarters office elected to take that particular statement and expand, dictating how hearings should be held. I think that is the first mistake that we made in attempting to really make these hearings too formal. We are to the point now that due to challenges, opposition, legal questions being raised, the Attorney General's office is seriously considering retaining a hearing officer, a local attorney or a local judge, and have all hearings conducted under the rules of Superior Court, where it will all be sworn testimony. As we look at the problems in the Chicago trials, I'm not sure that is the solution either, but one point that I believe we have missed, as we begin to get a little more sophisticated in these hearing processes, is an attempt to conduct them too closely to court order and

court rules. Basically, the lay citizen who really may have something to contribute is to a degree frightened off by this process and you then only hear from either the well-financed or well-organized group. I don't mean to imply that group may be only the dissidence, for you may have support, but the first two hearings, I suggest, should be on an informal basis. They are formal to the extent that we use a court reporter or a recorder in an attempt to get all the comments in; but there is no sworn testimony, and the least amount of technical presentation, I believe, is an advantage. I have found on occasions where there were some traffic problems and I have had to call on my traffic engineer or others in that field to testify, the citizens sometimes just plain and simply don't understand what we are talking about. We had the occasion of trying to explain a portion of the Portland-Vancouver Metropolitan Transportation Study -- why the delays, whether or not the delays were caused primarily by the methodology that was used -- and about that time we had completely lost the citizens. I told my traffic engineer he lost me too, but that is not too difficult to do. It does get a bit frustrating as we get into the hearing processes.

Over the years we have had some very extensive, cooperative and coordinating committee meetings with various levels of government-city engineering staffs, city councils, counties and county commissioners, various planning commissions. We have done, I think, a very good job in this type of coordinated effort. In fact, I think we have coordinated and cooperated ourselves nearly out of existence. We have operated to a large degree like the mutual admiration society.

Dealing strictly with the technical aspects, I think that we are getting into an area where we must get away from pure and simple engineering staff type contact and review, that we have to get into the other disciplines.

Not too many months ago, we had a project in Seattle. It was known to be somewhat controversial in nature and in an attempt to do a better job in our preliminary study and route analysis, we engaged an urban design team. The urban design team was made up of sociologists, an expert in the area of economy and the economics of the area, a civil engineering professor from the University of Washington, a landscape architect, and an architect on structures.

As we got involved, we asked this particular group to review our planning and give us guidelines and point us down the right track of working with the citizens to get a better input on the feeling of local community, and I think they did a good job. The group was not charged with the responsibility of highway location or highway design, but merely to see that we applied the same criteria on all the routes. I think one of the most meaningful things that came out was the discussion with the sociologist. He raises the question, "Now, you've got a route going over this particular area. It is a rather high-density area. Have you considered the effect or the possibility of the disruption of family entities? You have a highway route going through a rather modest income area. You have 8,000 to 10,000 citizens. Certainly there are some family units that are pretty marginal. They are teetering on the brink. All it takes is a traumatic effect of a highway right-of-way or a highway plan coming through the area and this is the straw that will break the camel's back. Suddenly you have a divorce situation, a child being deprived of its mother or father. What weight do you put on that type of thing?" I had to admit that I really hadn't considered it too strongly, but it was a point and, I think it was a valid point, particularly for those that are oriented in the field of sociology. It is a valid point, so I looked to the same gentleman to give me an escape route and he did. He said, "I think you should put alot of weight on that and consider it on each of your routes, but don't forget that this same family unit that is sitting on the border of being shattered, just right on the brink, suddenly finds it is facing a common enemy and you've got a good solid family structure; hence, one outweighs the other, so don't worry about it." At times it's a little bit frustrating to attempt to draw from the community their true feelings and comments.

I think that we find that there is alot of comment within the local communities that we have been unable to draw out. We're making an effort in our daily processes to do two things:

1. Get a cross-section of opinion of a highway project or a plan and, at the same time,
2. Not be over-influenced by any particular group.

This is the thin line that was mentioned; that you could have the

best of two worlds. We too often find at hearings that we hear one side of the story.

I'm going to take just a couple more minutes to cite a few specific instances and details of what has occurred. I have been personally involved with some hearings, and there are some rather strange reactions. The policy and procedure memorandum and the Department of Highways procedures provide that the public shall be afforded the opportunity of a hearing. Can you think of a better way to duck an issue than to put a legal notice back in the classified ads? How many people do you know who make a practice of reading the classified ads to see that they know of all hearings? This is really a weasel way out. We have made a practice of not going the advertising route. We don't ask by a legal notice tucked away on the back page "Would you like to have a hearing?" We've been getting good press coverage. I don't necessarily mean favorable press coverage, but good press coverage on our hearings, and we are not advertising for desire, we are advertising for a hearing. The cases in which a hearing is not held are very few. By the time you go through the processes of advertising "Do you want a hearing?" you are bound to have a few people who say, "You bet." So then you start all over again and you advertise the date of that hearing. You have lost time. An example of that is in downtown Vancouver where, some number of years ago, the Department advertised for a Design Hearing. No takers; fine, everybody congratulated themselves and said no hearing. Down the road about fourteen months ago, a presentation was being made at the Chamber of Commerce and it was casually mentioned that an interchange at SR 14 and I-5 just north of the Columbia River was being designed which contemplated work with the Army's Vancouver barracks. We found that the property changed hands some 18 months before when the Army had transferred the property to the National Parks Service and the Army had no control over the land. The National Parks people were extremely disturbed, first because of the fact that we had contemplated taking National Park land, but most importantly we had not even talked to them. The lines of communication sometimes get cut.

It's difficult to find out in any given area how many public agencies are involved in any given operation. Had we gone through

the hearing process, I'm confident that particular job would have been advanced one year. Section 4 (f) requires that any encroachment on a National Park, historical site, recreation area, wildlife sanctuary, etc., must be reviewed, and we spent about a year making a special study of the Fort Vancouver National Park. We have developed a report that is on its way back to the President's Advisory Council on Historical Site Preservation, and we may be many months yet in getting a final determination. The real sad feature of this is that all the time this is going on, there are some 300 families hanging on the ropes. They've been there for about four years, wondering, "When are you going to buy right-of-way?" Our problems grow, particularly in the area of review. There are those who have no responsibility for the implementation of the project, but serve only to raise question such as Why it is there? Where are you going? Have you considered everything? Obviously, we have not considered everything because we continually get into trouble every time we try to move a project ahead. The average citizen does not care about our negotiatings with the National Parks or the Bureau of Outdoor Recreation or the review by my headquarters authority in Olympia, or the subsequent transmitting of material to the Bureau of Public Roads. He doesn't consider this. When are you going to get the job done? We've worked closely, particularly with people in the Parks agency. We think we have covered our bases on all State agencies, but there are continual developments as new agencies are created and we miss them. In fact, it was only this week that the division office in Olympia, Bureau of Public Roads, was issuing instructions in my office on how we are to handle our contact with the Bureau of Outdoor Recreation.

We have a job in Goldendale where two years ago a hearing was held for route selection. The testimony at that hearing was about 90% in favor of a route different from that which the Highway Department had recommended. We studied three routes, we made a recommendation to the Highway Commission, and the community opposed it in total. The Highway Commission saw fit to bypass our recommended route and adopted the route that the community wanted. A year later, we received letters and petitions from the Planning Commission, from the City Council, from the County Commissioners, from the Planning

Council and the Chamber of Commerce, asking that the Highway Commission reconsider and select the other route. In investigating and reviewing we rang alot of doorbells to find out what had happened. The comments were, "Well, we knew that whatever you recommended, the Commission would adopt, and we didn't have any say so anyway, so we didn't show up at the hearing." We took the unprecedented step of going back and holding another official, formal, legal hearing, at which time everything was reversed and we were back where we had started, but two years later.

The community, the citizen, is suspicious, he is not apathetic. We have a terrific job of salesmanship in front of us to try to at least get some degree of understanding with the citizen that we do not have our minds made up. We have gone to hearings with nothing more than a schematic, and I don't know of one case yet where there has not been some change made in the plan or the route as a result of some testimony that has occurred.

Last May we held a design hearing on the section of SR 105 at the mouth of the Willapa River, you may know it as Cape Shoalwater at North Cove. The beach is eroding at the rate of about 150 to 180 feet a year. A couple of coast guard stations, a couple of lighthouses, and lots of houses have gone to sea, and the erosion line is now within about 400 feet of the highway. Two years ago a plan was made as a joint venture with the Corps of Engineers, the State Highway Department, and the county to undertake a highway project that would also provide a dike to preserve some of the cranberry bogs. As this developed, the Corps found that due to some statutory limitations, they couldn't be a party to the project. The Board of County Commissioners took another good look and said, "Gee, if the Corps is getting out, I think we will." There were two of us left -- the Highway Department and the Water Resources Department. About 300 people showed up at the hearing we held in May. There was not one testimony in favor of the Highway proposal, which was to construct a new route back of the existing highway which would require new right-of-way. The only testimony at that hearing in favor of the highway route came

from one man I had recruited who said I would at least like to have someone on my team. In reviewing the testimony, the Highway Commission, my headquarters office, and the Department of Water Resources concluded that the community did not want this project. We indicated that the proposed project would be deferred, based on the testimony of the hearing.

Two weeks ago I had an invitation from people representing a group made up of the charter boat operators, the motel owners, and the restaurant association. It finally hit home. If that road washes out, how is anybody going to get to the area. We have been asked now to come down and hear the other side of the story. We did not shelve the job, because we continued on right-of-way acquisition. The plans are worked up and can go to contract in about 60 days. But my question to the group, and to the county and city officials, is "Where were you on the 26th of May when we held a hearing on this matter?"

I look to the representatives of the cities to be active participants in hearings. Through review and cooperative efforts over the years, when we worked through the city office, the county engineer's office -- maybe it was a wrong concept -- we assumed that when you work with the governmental agencies, this information filters down. We have had occasion to work for two years with the city engineer's staff on a plan; everything is gelled, we are ready to go within a week of the hearing date. Then the Fire Chief says "You can't do that; I cannot continue to provide fire protection to this area." And we are guilty, we didn't contact the Fire Chief. We have made up a mailing list that includes every group that we can think of, with particular emphasis on the citizen group, and that would include groups such as the PTA, the grange, and church groups. These are the ones who are not normally represented by a Chamber of Commerce or a Roads and Transportation Committee or some organized governmental group, and we have attempted to meet with these people. My office stands ready to meet with any group at any time, whether it is formal, informal, official, unofficial, organized, disorganized. If we can get out and get participation, we perhaps can overcome the problem of first working and then designing in somewhat of a closet of professionalism, where we only touch bases with those people who are directly involved in design.

We have a limited access facility east of Vancouver that has a grade intersection with a terrific accident rate, but fortunately no fatalities at this time. We want to close it, and I think right now we are going to get the closure accomplished with total support of the citizens. We have spent about two months on a doorbell and door-knocking campaign soliciting comments from the citizens. We have not asked for a public hearing, but one will probably be held since it is a limited-access facility. We've contacted the neighborhood, starting right at the intersection and fanning out, and have sampled about 25% of the population, and to date we have not had one objection voiced. There is some real advantage in this person-to-person contact. I'm afraid had we advertised first and held a public hearing, we would have gotten maybe one or two people who perhaps just like to be on the opposition side.

A hearing is scheduled on Interstate 5 next Wednesday night. It's going to be interesting to see what develops at that hearing. About 60,000 vehicles a day cross the Interstate Bridge. As you move north, we probably have 40,000 at the north limits of this job. I have a sneaking suspicion that there will not be a very large representation of those 40,000 drivers at that hearing. We have one intersection that in eight months has tabulated 134 rear-end type accidents. It is a little short slip ramp, and the first guy takes off and then chickens out and he gets rear-ended by the car behind him. I wonder how many of those people that use it are going to be at the hearing and support the plan to upgrade Interstate 5? What we are going to get are the property owners who live adjacent to the freeway. They don't like it basically because it infringes on their rights of ownership. I would like to put in a plug for a writer by the name of Robert Ardrey, who wrote African Genesis and Territorial Imperative. If you want to understand a little better some of the human reaction, I recommend these two books. They point out some of the reasons for opposition. There will not be much testimony from the citizenry speaking in favor of the plan. Someone who is reviewing the transcript of the hearing from some distance may not recognize all the problems, and we could conceivably assume that the community is against it, so let's drop it. I don't think that is going to happen, but it will be interesting to see the results of this particular hearing.

We have attempted and will continue to try to draw out the individual citizen. It is incumbent upon city and county governments and the staff members to at least make their position known. My headquarters office requires a certification from me, and I have no qualms about signing a blank check. They want me to make a statement that there will be no organized opposition to our plan at the hearing. That's fine. When we take the hearing processes to the extent that we try to wire them and don't have any objection, then I suspect that we are not doing our job; we are not getting the full feel of the local community. Hopefully, as we wrestle with this problem and can get more participation from the citizens, we will have seen the evolutionary processes of hearings. We are in the hearing processes because the people have, over the years, developed less reluctance to appear and speak their piece. We can try and work toward the best of two worlds and provide a highway system, a network of highways that will accomplish the needs of the traveling public and the needs of the community.

There is a myriad of problems that are attendant to this. We intend to continue our efforts to contact local citizens and local groups.

The utilization of public hearings provides a better understanding of highways and highway projects and the problems involved, and maybe we do a little bit better job by giving the public a chance to contribute to our highway project. Hearings as we know them today will no doubt change in the future, but we should use them to secure a better understanding of community needs and wants.

PANEL DISCUSSION

TOPICS ON THE MOVE

Presiding: Elmer J. Leland

PLANNING

by

Lloyd Anderson

Planning

by

Lloyd Anderson

As you may be aware, in the topics program for cities over fifty thousand, there is a requirement to receive aid on a completed planning process as set forth in the Transportation Act of 1962. For cities under fifty thousand, there needs to be developed a program of cooperation between the city and the state, due considerations being given to the traffic in the urban areas. The plan must be coordinated with the other forms of transportation.

In this whole program there is a need to look at the planning process itself and the elements, and I will briefly mention them. A plan for an area requires as a minimum a population forecast, a land use plan, a thoroughfare plan which is based on the population forecast, the possibilities of mass transit transportation in the area. It is my intent in the remarks this morning to develop this planning element a bit more, because I think that understanding it, and understanding its relationship to the topics program, and for that matter other programs, draws into focus some of the issues and the complexities.

A development plan then is intended to set broad community objectives and adopt policies to carry out these objectives. Of necessity, when dealing with traffic, with land use, with school interest, etc., there are conflicting objectives. I think one of the jobs in developing a planning program is to resolve these conflicts. For example, many times in a congested situation there is a change from a two-way street system to a one-way street system. Quite obviously when this begins to move through residential neighborhoods some serious conflicts arise in those neighborhoods with respect to the destruction of the livability of the areas. This needs to be reconciled with your objectives and traffic.

In my judgment a comprehensive development plan document is a political document that should be adopted by the council, not just by the staffs or by the Planning Commission. There should be a policy guideline for action by the Council. A planning development program includes policies which have in them a course of

action to take. Planning involves engineering and other disciplines.

Fifteen years ago I think the engineers felt they had the major responsibility to do the planning projects. I think that as the urban areas get more complex and the issues more complex, it is obvious that other disciplines are required as well. I think engineers should play an important role in the formulation of a comprehensive plan and program, but should not feel that they have the major responsibility for it. They play a role, but not all of it.

Once general objectives are set for a community development plan, and it is adopted in a preliminary way, then you begin to move into these general objectives which are stated in broad terms. I realize sometimes we get a little disgusted with dealing with broad terms; but at least sitting on the Council the limited time I have, it is clear to me we are not thinking about these broad objectives when issues come before the Council. So stating broad objectives and getting the program going within that context is important when you begin dealing with things like the population forecast and the economic prospects for an area.

Try making an economic prospect or an economic forecast for the Seattle area right now, and I am sure it would be anybody's guess as to what is going to happen. Generally, in a situation which isn't quite as critical as Boeing, you can realistically develop some forecasts and whether the timing is one year, five years, or ten years, you deal with land allocation for industry and other main activities. Land allocations for that purpose are going to come sooner or later, so you change your timing schedule of getting things accomplished in order to meet them if things speed up or slow down.

The land use plan generally contains the housing, commerce, industrial areas, semi-public facilities, and the transportation plan you are all familiar with. In addition, there is a need for public buildings and a facility plan which generally includes schools, parks, recreation, and other public buildings such as warehouses, shops, and the like.

As I indicated earlier, to have any plan that has any meaning, there is a need to have a program to carry it out. That program generally includes the adopting of zoning ordinances, sub-division regulations, a capital improvement program with a priority within

the capital improvement program. Those priorities can include priorities for streets, sewers, water, parks, schools, street lighting, and a whole range of public buildings. It involves citizen involvement and citizen participation in what goes on in the community. More and more you are beginning to see, in at least many areas that are beyond what could be called direct technical solutions, the need for citizen involvement and helping in the judgment of what takes place.

The judgment that is finally involved on how land develops and the intensity of land development has a direct effect on the volume of traffic that is generated out of any area. If you set a density of three or four families per acre and the area development forecast and the traffic system are based on that, and you later change the density to 25, 30 or 50 units per acre, quite obviously the amount of traffic you generate is greatly increased. Hence, your judgment on what should happen should be revised accordingly. No major change like that should be made unless the traffic engineer is involved in the analysis and the understanding of the impact of what takes place. It seems to me when you are looking as traffic engineers at this question of land use, you have a real stake in being careful what happens. You only need to look at all the intersections around the major interchanges and other areas to know that how the land is used has a great effect on whether vehicles move through easily. You only need to look at some of the areas to know that this is a major factor, and that zoning as a device to control that use has failed for the most part. The public policy that has been adopted in a land use plan is highly relevant to the way streets can safely move high-volume traffic.

Another regulatory measure, the sub-division regulations, should be carefully studied to judge what is going on and the procedures followed. By proper design of land sub-division, T streets, lots backing up onto the major thoroughfares, adequate right-of-way and getting it at the time the sub-divisions come in, changing streets from 60 to 80 or 120 feet of right-of-way are all ways that the sub-division regulations can be used to enhance a street program. In my judgment, a new developing area is a major place where you can have a significant and constructive influence.

You can raise funds by increasing rates on things like sewers; you can look at allocations such as King County is receiving in the way of gas tax and ask whether in terms of priorities all the money that is spent on road improvements in King County is being spent in accordance with the problem areas, and whether some or at least more ought to be placed in Seattle. You could ask the same in Pierce County as to whether more of those funds should be placed in Tacoma.

Where the money goes should be determined by some system of analysis and priority developed on an objective basis. It should be taken more and more out of the political arena and into the merits of the particular problem. It can be applied to dealing with streets in general and finally dealing with the allocation of resources for solving the problem of moving people in the metropolitan area, and even broader than that, developing an adequate place for people to live and move from one place to another.

IMPLEMENTATION

by

Al Williams

Implementation

by

Al Williams

I might start out by advising you that I come to you not as an expert this morning, but rather as one who is trying to share with you some of the agonies that the city of Eugene is going through right now in trying to get a Topics Program under way. I do not have all the answers, but I can tell you some of the factors that have to be considered and some of the problems we are running into and some of the ways we will handle them.

My focus this morning will be to, among other things, define for you as I see it the Type 2 system, show how the Type 2 system is selected, make some comments perhaps on why the Type 2 system is really necessary to begin with, and indicate what the Topic's project really is.

First of all, what is Type 2? Type 2 is not a mystery really. It is a new Federal-aid system that has been established through an act created by Congress, in which all primary routes, which are state routes and Federal-aid secondary routes, are now being classified as primary Type 1 routes. Then there is a new Type 2 system being developed, which will also be eligible for Federal participation on construction. This new Type 2 system will include, among other things, arterials and major streets. The Federal Government definition of an arterial is a principle route providing for direct service of through traffic to principle traffic generators and inter-connecting such generators.

The new Type 2 system will also include, and should most certainly include, streets in the central business district. Also it must necessarily include some limited street grids in other areas that may show particularly heavy concentration of traffic or may be expected to show some particularly heavy concentrations of traffic in the future. These Type 2 systems have a requirement that they must logically connect to another primary, another Type 2, or terminate at the urban boundary or the city limits. In addition, they may run from a primary or a major generator which

might be a large shopping center to a primary or another Type 2 system.

I will show some slides of the street system in the city of Eugene. Most of you know Eugene fairly well and probably recognize particular streets in the area.

The one shown here is Highway 99 business route (99 West) which comes through Eugene north of the central business district, then goes on out to the northwest. This is an example of primary Type 1 classification. The purple route is part of the interstate system, which in this case, is Interstate 105. The streets shown classified as a Type 2 system are basically through streets. For instance, one of them is Willamette Street, another Hilyard, and so on. Also, these streets shown as Type 2 would be carrying the heavier traffic flows. You would not classify this street as a Type 2 since it only collects traffic from this residential area and the total volume would be low. Basically, all that should be on the new Type 2 system is your existing arterial networks.

The slides have given you an idea approximately what a Type 2 system looks like. Traffic volumes on the new Type 2 should be high enough to justify being on the Type 2 system either now or in the future. In our case, since we are pretty well along in an area transportation study, we did have assignments to most of these routes for the year 1985.

Just because one street or location happens to be a political problem doesn't necessarily mean that it automatically gets on the Type 2 system as far as I am concerned. I think, again, you have to keep in mind that the Type 2 system is going to be checked by the State and by the Bureau of Public Roads and if they do not agree with your system, part of it is going to be thrown out.

I have shown you briefly what a Type 2 system is. Let us discuss Topics projects now. Actually the projects in the PPM are described in 11 different ways, but I think that primarily the most common project would be signalization (either brand new signals or signal modification), and occasionally this would

be associated with intersection widening and channelization. It can also, if you have justification (and it comes up high enough on your priority), include highway lighting and it most certainly can include corrrection of intersection which may have a volume or turning movement problem. These projects, according to the PPM, are supposed to be selected after an inventory and a Topics plan is made. I would point out that within 18 months the City of Eugene will complete the inventory and Topics plan. In the meantime we have recieved preliminary approval on our Type 2 system and are proceeding with actual construction of projects. Obviously the construction projects that we have underway during the 18-month period, are going to end up on the top of the final priority list. Keep in mind that there is the requirement that within the 18-month period, you must complete the inventorying and come up with your plan. Among the inventorying that is pointed out in the PPM are various things such as measuring traffic volumes, peak hour traffic volumes, both in the a.m. and p.m., peak hour a.m. and p.m. traveling speeds on the various parts of the network, present controls in the way of signals, parking restrictions, etc., on that particular route, right-of-way width, accident statistics, classification of vehicles, practical capacity, and transit information. How I am going to do all this on the system that I showed you? As far as I am concerned, I am not going to. Based upon discussions that I have had with the State and Bureau of Public Roads, we will do such things as measure traffic volumes, etc., to the point that I can identify where most of the problem areas lie. Quite frankly, if I don't already know where most of my problem areas lie, I might as well leave the City of Eugene right now.

Once you have established these problem areas, then you are going to have to do some detailed studies in these particular problem areas, and those studies are going to have to conform to the requirements of the PPM. Obviously, when you really think about it, you require this data anyhow to make a good eingineering decision on what you are going to do at that particular location, so what they are telling you is what you should be doing anyhow. After you have done all this inventorying, identified your problem areas and the corrections that are necessary at

these locations, then you, of course, will establish priorities. We have not decided how our priority system is going to be established. I do think that you are going to have to set the priorities based upon benefits, primarily probably to the public, and I am sure that there are some other categories that will have to fit in there.

Just what benefit is all this work going to be to the City of Eugene? It may look like quite a bit of work just to get a little money, but really is it a little bit of money? Where else at the present time in the Department of Transportation can you people get a set-up that quadruples your construction effort capabibility in traffic safety as it relates to intersection channelization, signalization, and so forth? Just for the City of Eugene, based upon the expenditures for the past couple of years, we will quadruple our efforts easily. If we get matching money budgeted by the City Council for the next fiscal year, and if a lot of you people do not get on the train, we expect to partake of some of the money that is going to be coming back up the pipeline. I know Don Bergstrom and Bill Stark are thinking the same thing.

Of course we do not expect that all you people are going to participate in Topics; therefore, even though we are allocated $225,000 a year, we have to assume that we are going to have to be able to lay claim to more than that for the two-year period. Maybe a lot of you people will prove me wrong, I don't know. I would say that as far as I am concerned, any system that benefits the traveling public as much as the Topics Program is going to, I have a responsibility to see that we get the maximum dollar amount available that is coming to Eugene.

Let me give you some examples of the projects that I am talking about and thinking about. Two of them are on a corridor which is a state highway. One involves a new signal at an intersection on the state highway with a Type 2 route in which there is an Oregon Electric crossing within a few feet of the intersection. We have had several fatalities on that crossing, plus several injury accidents. This one project which we have been dragging our feet on building was really made available through the use of the Topic funds and it will, of course, have material benefits

to the traveling public. The second one in the same corridor, at Roosevelt and Highway 99, will include a complete revamping of signalization which is now an old three-phase system. We have severe back-ups in the evening because the north-bound left turn pocket fills up and the south-bound left turn pocket stays red for the north-bound just as long as the south-bound pocket is moving until we reach a maximum time limit. The side street at that particular location has no curbs, free access anywhere you like, and there is a capacity problem. This is an example, I feel, of the benefit that will be derived again by the motorist through the use of Topics funds. In Eugene it will let us tackle projects which we would probably not tackle otherwise because of the initial dollar magnitude. In other words, if we would have done them on a fifty-fifty basis on a state highway with the State, it would have meant that we would have had to bankroll some matching funds for a couple of years in order to do that. Franklin Boulevard, out by the University of Oregon, is going to require a major job in order to get a system set up that is responsive to the different traffic flows. This job will be expensive and was expensive enough that the city would not have been able to come up with the matching money, but with Topics this type of project will be able to go forth and material benefit to the public will occur.

Necessarily my comments to you this morning on Topics had to be brief and gloss over a lot of the headaches and work involved. I have already told you about the fact, but again remember that you do have the 18-month provision in the law which allows you to proceed with Topics projects as long as you do have a plan and you have complied with the rest of the law, so don't necessarily let the inventory problem stop you. I am sure there are a few of my friends from the consulting field that are sitting right here in the audience that would be glad to do the inventorying for you, as long as you pay them, of course. I think, too, that I would like to comment upon the cooperation, very good cooperation in my opinion, that we have received to date from both the Bureau of Public Roads and the State of Oregon, realizing that they are trying to get a new program going themselves and do not have all of the answers. I would caution you also to consider the fact that Topics will probably continue after the initial two-year funding

period, provided you and I do a proper job of enumerating the benefits through the use of proper traffic engineering before and after studies. Let us not forget that the Department of Transportation has a Congress to sell also on the Federal level as far as funding goes. You people at the city level are going to have to do some work, obviously. This money is just not going to come down out of the heavens like manna. You have to do something to get it. You are going to have to put forth a few tears, blood, sweat, and so on.

I have indicated that we are generally happy so far. There are, however, in the State of Oregon some clouds appearing on the horizon as far as I am concerned. There are a couple of provisions that the State Highway Commission placed upon Topics in Oregon that I personally (speaking not for the City of Eugene and the administration at this point) do not agree with. But again, hopefully, some of these problems will be ironed out as time goes on; and I would like again to publicly thank the State and Dick Unrein for the cooperation and help they have given us and are going to give us in the future.

USE OF CONSULTANTS

by

J. L. Thornton

Use of Consultants

by

J. L. Thornton

Mr. Chairman, Members of the Panel, Gentlemen: It is a pleasure to be here and be a part of the discussion that will be held about the Topics Program. We have been attempting to get this program under way in the State of Washington for several years. As you know, about four years ago when the Topics Program first was initiated, there were no Federal funds directly allocated to the Program. In addition to the funding problem, however, Washington has a statewide classification and needs study which started about the same time that the Topics Program did. Also, at approximately the same, $200,000,000 Arterial Road and Street Program was started. These latter two projects took up all available engineering time of the local agencies, so that it was almost impossible to prime the Topics Program and get it under way. Since the Topics Program has been funded with a direct allocation of funds, we have made some headway. We have 16 different Urban Tentative Type II Arterial Networks approved. We have a total of approximately $1,750,000 worth of Topics projects ready to go. This dollar total includes both Federal-aid and local participating funds. In the City of Seattle we have two pedestrian overcrossings, a series of signal installations, gore area protection devices, and a median barrier approved for preliminary engineering and construction, so we do have a start.

Before getting into the consultant procedures, I would like to make a couple of comments relative to procedures that we have developed in our State. As you know, any area having over 50,000 population requires approval from the Regional Transportation Conference for any Federal-aid project. Mr. Roe Rodgers, who is the Division Engineer of the Bureau of Public Roads in Olympia, is on the Policy Committee for the Regional Transportation Conference. Mainly through his efforts the Regional Study Group approved a skeleton Type II System for the Puget Sound

Region. This is a Major Arterial Type System and is integrated with all levels of government. Any development beyond this at the local level is determined to have no regional interest. I think this is a big step, because we do not have to go to the Regional Transportation Conference for approval of each local system as it is developed. The Regional Conference did the same thing for construction projects, as they felt that intersection improvements to improve capacity and safety would not have regional significance and that they had no desire to review these types of projects. This again is a time-saving procedure.

The State Aid Division developed a manual for the Topics Program that was distributed throughout the State. Unfortunately, we are out of print of these manuals and I have only a sample or two available for the review of anyone interested. We are in the process of revising and bringing it up to date. This manual includes such information relative to the evaluation of the Comprehensive Urban Transportation Planning Process, criteria for selection of Type II System, Coordination of Tentative Type II System on a regional basis, approval of Tentative Type II System, preparation of study pospectus, funding for Topics Study, development of area-wide Topics Plan, approval of the Topics Plan, preparation of plans for Topics projects and Municipal Agreements, funding for Topics contracts, evaluation study, annual report and qualifications, selection and payment of consultants.

Consultant services may be financed with participating Federal funds for preliminary engineering as well as design and construction engineering. While the rules governing consultants on federally financed projects are stringent, they are not difficult to comply with. The Bureau of Public Roads' Policy and Procedure Memorandum 40-6, dated August 23, 1965, relative to "Employment of Consultants for Engineering Services" covers the ground rules for selection of and manner of payment to consulting firms. This Policy and Procedure Memorandum sets forth the requirements for qualification and selection of consultants. Federal approval may be obtained by certifying to the State that the local agency had, after a logical procedure, selected the consultant with consideration for the following items:

a. The consultant is qualified professionally to perform the engineering services required.

b. The consultant will have properly trained and experienced personnel available to perform the services within the time prescribed.

After approval by the State and the Bureau of Public Roads, the next step is the submission of the consultant's proposal containing the scope of work and terms of payment. PPM 40-6(4) - Determination of Payment - Federal regulations require that the basis of payment set forth in the contract should be one of the following:

a. A lump sum.

b. A cost per unit of work (or cost per mile).

c. Actual costs of the consultant plus a fixed amount.

d. Specific rates of pay for each class of employee, etc.

For the purpose of instigating a Topics Program, it has been determined that the most feasible and fair way to negotiate a contract for preliminary engineering required to establish a Type II System with its necessary inventories, analysis, etc., is to use actual costs of the consultant plus a fixed fee. This is based upon the fact that there are too many unknown factors to utilize either the lump sum or unit cost method of payment. With the preferred method, the consultant is paid for actual direct labor costs, indirect labor costs (overhead), plus a reasonable profit which is his fixed fee. On top of these items, he is reimbursed directly for out-of-pocket expenses; i.e., travel, per diem, communications, etc. In order to justify the reasonableness of his proposal, an estimate of man hours and hourly rates must be made either by the State or local agency. To this figure the consultant should add his payroll additives to arrive at his total direct labor cost. The additives will vary according to the consultant's operation, but generally they should be 25% or less of his direct labor cost. Items to be considered as additives will be leave, retirement, social security, medical, etc.

The indirect labor costs will be based upon the consultant's past records and will include such overhead items as principal fees not directly attributable to the specific job, clerical work, cost of office space, advertising, and generally any operating cost not chargeable to a specific operation. Care should be taken to see that State and Federal income taxes, interest on borrowed capital, uncollectable charges to clients, project development costs (other than costs of attendance to meetings for precontracual negotiations relative to specific contracts) are not included in items related to indirect costs. These items are not allowable as such and have to be included in the consultant's profit which is set apart as his fixed fee. As stated before, indirect costs are a function of the consultant's operation and are substantiated by his past records. A rule of thumb for indirect costs as a function of direct costs, plus additives, indicates that this figure may reasonably lie between 50% and 75%. Whenever this figure exceeds 75%, it may be necessary to more closely examine the consultant's records to substantiate this.

To the direct labor cost plus additives and indirect labor costs, a sum should be added for the consultant's profit. This sum is the fixed fee as called herein, and represents the agreed upon amount set aside in the contract for reimbursement to the consultant over and above his actual expenses. Thus it becomes readily apparent that, even though the direct and indirect labor costs may vary due to the undertain nature of the man hours estimate or other governing factors, the fixed fee remains constant. The only immediate factor which will affect this will be a change in the scope of work which will necessitate either another agreement, or a supplement to the original. Here again, the fixed fee may be expressed in terms of percentage, but only as a means of checking the reasonableness of the consultant's proposal. The percentage will vary with the type of operation and the size of the project. Generally speaking, a fixed fee, or profit, between 10% and 20% of the combined sum of the direct labor cost plus additives, and the indirect labor costs, seems reasonable.

Direct non-labor charges are out of pocket charges that are chargeable directly to the consultant's operation within the scope of his contract for which he will be reimbursed upon billing the

agency. No profit is allowed for these items and they include such charges as travel and per diem, reproduction expense, computer expense, communication, sampling and testing, outside consultants, etc. These charges, together with direct labor charges plus additives, indirect labor charges, and profit (or fixed fee), constitute the total fee which the consultant will make a part of his proposal to the agency.

It will be well to note at this time that no Federal reimbursement will be made for any work done prior to authorization by the Bureau of Public Roads and funding by the State.

When county or city highway departments utilize consultant services with participating Federal highway funds, the State is not relieved of its responsibility to the Federal Government and becomes a party to any agreement made with the consultant along with the local agency. Among items to be covered in the body of the agreement are the following:

1. General description of work.
2. Scope of work.
3. Time of beginning and completion.
4. Payment.
5. Employment.
6. Changes in work.
7. Termination of agreement.
8. Disputes.
9. Legal relations.
10. Maintenance of office.
11. Subletting or assigning of contract.
12. Endorsement of plans.
13. Certification of parties.

There are many people in the highway industry that do not believe the Topics Program is limited. Nobody knows for sure, of course, but many do, as I say, believe that this program could become a major one throughout the United States. It is one that could very easily be developed as a After Interstate Program. It is a program that is becoming quite popular as the local agencies - city and county - are actively engaged in developing it.

I would like to take this opportunity to thank those people with the Federal Highway Administration and the Bureau of Public Roads who have cooperated and given us all the assistance possible in aiding us in the interpretation of the rules and assisting us in establishing procedures for this Traffic Operation Planning to Increase Capacity and Safety Program.

PANEL DISCUSSION

SAFETY AT LOW COST

Presiding: Elmer J. Leland

SAFETY AT LOW COST

by

Glen Yake

(Paper not available for publication)

PANEL DISCUSSION

CONSTRUCTION FOR BEAUTY & SAFETY

Presiding: Gordon W. Beecroft

STRUCTURAL AESTHETICS

by

Tom Edwards

Structural Esthetics

by

Tom Edwards

Aesthetics is defined as the science of the beautiful, in taste and in art. Its application to structures is not new. In the first century B.C., the Roman Engineer and Author Vitruvius wrote the following:

> "... There are three classes of public building. The first for defensive, the second for religious, and the third for utilitarian purposes. All these must be built with due reference to durability, convenience and beauty. Durability, convenience and beauty. Durability will be achieved when foundations are carried down to the solid ground and materials wisely and liberally selected. Convenience, when the arrangement is faultless, and presents no hindrance to use, and when each class of building is assigned to a suitable and appropriate exposure, and beauty when the appearance of the work is pleasing and in good taste, and when its members are in due proportion according to correct principles of symmetry ..."

To these words of taste, beauty, and art, we would add that each structure should have its own grace and charm. For many years just past, I do not consider that structure design has been viewed in its proper light. The materials, per se (the concrete and the steel which went into the make-up) were and still are expensive when compared with yards of dirt or rock or tons of asphalt. Particularly in our nation the cost trends have dictated and, in fact, encouraged, the use of austere, angular, repetitive designs with almost complete elimination of any architectural embellishment. This trend is not one of recent development, nor of local origin. Dialogue with our counterparts in other States and other nations indicate that it is universal.

There have been two particular instances in which structure design had serious shortcomings. The first was in width -- too many bridges were built too narrow to meet the demands of our changing times. This, in my view, was an extremely flagrant

shortcoming. For too long, bridge engineers have estimated costs on a square-foot basis and have applied the square-foot cost of the entire structure to the problem of determining the cost of additional width. This is wrong. Very little extra cost is occasioned in foundation excavation and foundations, per se, and very little extra cost in beams. There is no extra cost in handrail. For these reasons, I think the method of analysis has been wrong. Fortunately, the trend has changed and we now build structures full shoulder width in all instances.

The second major shortcoming in design has been that of length. Too many times flood conditions have taken out bridge approaches and, in many instances, bridges themselves, simply because the opening was insufficient. The excuse has always been "This was a major flood which will not occur again." This is a fallacy which the thinking engineer cannot live with. There have been floods in the past -- there will be floods in the future. The designer's job is to meet the demands.

A third shortcoming has been that of aesthetics, as mentioned previously, and it is to this facet that I wish to address myself. The design of a bridge differs considerably from the design of a building or a house and it differs from the design of a landscape as normally pursued by a landscape architect. In a building, or a house, or a park, there is an unlimited area for thought in the selection of the theme in producing the final concept.

In the design of a bridge, this is not always true. In instances of long bridges or, more properly, long-span bridges, there is some latitude. Concepts can be controlled and a selection made which combines grace, charm, and beauty with functionalism. However, the bulk of the designer's work is contained in short-span applications.

The construction of a small bridge quite quickly divides into four components -- namely, the footings, the columns, the beams or trusses, the deck and handrail. In the application of aesthetics, the footing is a lost cause. Invariably, it is buried and not worthy of any further consideration. The deck has no possibility of beauty because a deck is a deck is a deck, the same as "a rose is a rose is a rose." The handrail has minor possibilities. Its prime function is one of safety in retaining the traffic on the bridge.

For many years the designs were not open and served only to hide the view from the bridge. This has been corrected in recent years.

This leaves, then, only two major segments of a bridge with which the designer can express himself -- namely, the columns and the beams or trusses. The number of columns should be held to a minimum. No single thing detracts from the appearance of a bridge as much as an excessive use of spindly columns. There has been a tendency at times to put a spindly, square support under each beam. This may be great for economics, but certainly not anything helpful in the way of aesthetics.

Each bridge is different, so a true comparison is hard to achieve. However, I have compared the Market Street Bridge in Salem on I-5 with the Burnside Bridge across I-405 in Portland, which have comparable width. Under the Market Street bridge there are 12 columns, containing 58 yards of concrete and 6,700 pounds of steel from footing to beam bottom. Under the Burnside Bridge there are three columns, containing 62 yards of concrete and 8,300 pounds of steel from footing to beam bottom.

While neither of these could be considered as an example of great architecture, the three-post design is, however, greatly superior to the twelve-post design. It should be noted that the principles of true symmetry are very difficult to attain in a normal overcrossing structure due to the limited height with which the engineer has to work. Higher piers or supports provide a greater latitude for expression. The beams or trusses or arches which support the deck provide the greatest area for expression.

There is no set rule with which to measure the probable reaction to the final result. Some designers still prefer the angular, straight-line type structure; some prefer the curved approach. I personally lean toward the latter school, inasmuch as I believe curves in their proper places are much more attractive than straight lines.

More important than the actual configuration of the beams, per se, is the application of the proper principles of symmetry. All too often, in designing structures, the designer will make use of all of the beam depth space which is available to him. This is commendable from an economic viewpoint, but most certainly not

from an aesthetic structural approach. Preferably, the slenderness ratio or depth ratio should be in the 27:1 ratio.

At this point, the designer is sometimes caught on the horns of a dilemma, particularly in our own design shop.

The deflection and the slenderness vary in inverse ratio to each other. We have examples where deflection was such that working on or underneath the bridge was extremely uncomfortable and where maintenance was high because of this reason. It is my firm belief that a structure with a high ratio of deflection under live load is a thing to be avoided. The easy way to avoid it without great increase in cost is through increased structural depth. This generally tends to destroy the values of symmetry which lead to pleasing completed bridge appearance.

In establishing the concept of appearance, there are some bridges which can be eliminated from study. For instance, short structures over small creeks or irrigation canals or, for that matter, over railroads in remote areas which will not be subject to public view, merit no specific architectural treatment. However, for each bridge which is subject to public view a study should be made of various types through the use of architect's sketches. These should not be taken lightly or quickly dashed off as a 10-minute exercise, because this is the place and the time at which the concept to be turned over to the designer is determined.

The architect's sketches must reflect correctly the true picture of the environment in which the bridge is to be placed. The architect should then attempt to develop a concept which is in keeping with the surroundings from which the bridge is to be viewed. Design and placement should be such that the structure should not be considered as intruding upon the area, but rather should be brought into being as an integrated unit of the surrounding environment, if possible in a manner to leave the impression that the whole scene had its orgin simultaneously, rather than to bring about the appearance of the bridge intruding upon the scene. In general, bric-a-brac should be avoided, particularly in rural areas, for reasons both economic and aesthetic. A bridge in proximity to the French Quarter in New Orleans could very well be adorned with an ornate grill-work type handrail. Such a thing

would definitely be out of place on a bridge over the Little Big Horn River in eastern Montana.

In these days of continuing programs, such as the Interstate, another point must be carefully considered in preliminary design. This is the matter of repetitiveness. Bunching a series of overpasses over a freeway into a bundle like bananas in the hopes of securing a low bid may be good economics, but it is rotten aesthetics. I have been guilty of this and may be so accused in the future, but not if reasonable practices can prevent it.

One final point I would stress in bridge aesthetics is that care should be taken to break up broad flat expanses of concrete. This usually can be accomplished at very low cost while securing a double benefit. First, the glaring, broad expanse is given a quieter sort of appearance and second, the construction joints are effectively camouflaged.

In summing up, then, it comes generally down to a simple principle that aesthetics can be secured with about the same amount of materials and about the same workmanship, but more careful selection of the way that it is stacked.

SKID-PROOF PAVEMENTS

by

John L. Beaton

Skid-Proof Pavements

by

John L. Beaton

Introduction

The term "slippery pavement" has been defined by Kummer and Meyer[1] in their report titled "Tentative Skid-Resistance Requirements for Main Rural Highways." They state that "Although it is generally true that a slippery pavement is conducive to skidding accidents, it is by no means correct to assume that a skidding accident automatically indicates pavement slipperiness. Skids that are due to excessive speed, smooth tires, unbalanced brakes, poor geometric design of the highway, or a "rough" or inattentive driver jerking the steering wheel or slamming on the brakes, cannot be blamed on the pavement surface. On the other hand, skids that take place at normal traffic speeds with well-treaded tires and vehicles in good mechanical condition, particularly if they re-occur at the same location, most definitely suggest pavement slipperiness. Thus, when the term slippery pavement is used it is with the understanding that all other factors involved are normal or nearly so and that they do not significantly contribute to any skidding which might occur."

It is probable that from a technological viewpoint, the slipperiness problem could be solved by improved geometric design of highways, improved specifications and construction procedures for road surface textures, improved design of tires and vehicles, rigid inspection procedures that would keep vehicles with smooth tires and faulty brake and suspension systems off the road, and the adoption and enforcement of different speed limits for dry and wet conditions as well as for day and night-time driving. How

1. Highway Research Board NCHRP Report 37.

many of these things can be implemented, of course, depends upon the economics involved, as well as the technical solutions. It is probable that the automobile and the driver are the most important factors involved in any skidding accident. However, insofar as this discussion is concerned, it is limited to pavement slipperiness rather than the overall field of skid accidents.

As such then it appears to me that the subjects of importance are: measurement of pavement friction, development of realistic skid resistance coefficients, reconditioning of worn pavements so as to improve their friction levels, construction techniques to insure specific friction levels of new pavements, pavement wear and the factors involved in specifying aggregate and construction quality requirements so as to lengthen the service life of our pavement surfaces, and interface characteristics between the tires and wet pavements.

Any discussion of skidding should consider the NASA[2] work in separating the two different types of loss of traction on wet surfaces, namely viscous and dynamic hydroplaning. Viscous hydroplaning occurs when a thin fluid film is on the pavement, and presently used methods of measurement for skid resistance deal with this form of loss of traction. Dynamic hydroplaning occurs when the pavement has a substantial thickness of water, approximately 0.2 inch, on the surface. Present methods of measurement do not provide an adequate indication of potential dynamic hydroplaning. One of the most important problems connected with loss of traction by viscous hyroplaning is the determination of a minimum coefficient of friction value for remedial action.

Measurement of Pavement Friction

While the California Division of Highways has recently purchased and is starting to use a lock wheel skid trailer conforming

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2. Horne, Walter B., and Leland, Trafford J. W., "Influence of Tire Tread Pattern and Runway Surface Condition on Braking Friction and Rolling Resistance of a Modern Aircraft Tire." NASA TN D-1376, 1962.

to ASTM-E274, all of our work up to the present has been done utilizing our California Skid Tester.[3]

The California Skid Tester used in determining the coefficient of friction of pavement surfaces is a portable device which was calibrated against a towed trailer constructed by Professor R. A. Moyer of the University of California.[4] Previous studies by Moyer and others, indicated that the lowest skid-resistance value for any given surface would be attained when the brakes are locked on a vehicle having smooth tread tires on a wet pavement with speeds around 50 miles per hour. It was felt that the California Skid Tester should be calibrated to simulate the worst conditions encountered by traffic. Therefore, in the correlation test program, the coefficient of friction values obtained from the Moyer unit using locked wheels, smooth tires, wet pavement, and a speed of 50 miles per hour were compared to our readings obtained with a smooth tire, wet pavement, and a tire speed of 50 miles per hour.

Development of Skid-Resistance Coefficients

In order to make effective use of test results derived from any form of skid-test apparatus, the engineer must be provided with recommendations on minimum requirements for deciding on the necessity for remedial action. It is interesting to note that there is a large volume of literature on skid-resistance measurements, but few recommendations for critical values that would be of aid to the engineer who must decide whether steps should be taken to improve the skid resistance of a given road surface. Remedial action must be taken before the road surface is excessively slick, so any value must be set high enough to allow for programming

3. Hveem, F.N., Zube, E., and Skog, J., "California Type Skid-Resistance Tester for Field and Laboratory Use." Proceedings First International Skid Prevention Conference, Part II, 1959.

4. Moyer, R. A., "Recent Developments in the Measurement of Road Roughness and Skid Resistance." Proceedings of the Association of Asphalt Paving Technologist Vol. 20, p. 42, 1951.

and accomplishment of the repair.

During the period of 1950 to 1958, Professor Moyer determined the skid resistance of a large number of different pavements in the road system of the California Division of Highways.[4 & 5] On the basis of this survey it was decided to tentatively use a value of 0.25f for a minimum value.

Since our available information on accident frequency correlation with skid resistance of the surface was very limited, it seemed desirable to obtain as much information as possible from the studies of other investigations. Two of the most complete studies are from the work of C. G. Giles in England and T. E. Shelburne in Virginia. Unfortunately the equipment used in these studies was different from that used by us. In order to make use of information attained by Giles and Shelburne, we obtained a British Portable Tester which was used in a comprehensive accident analysis in England by Giles,[6] and attained a correlation with the California tester. Also, D. C. Mahone[7] presents a correlation between the British Portable Tester and the Virginia test car. This correlation permits a comparison with the lowest coefficient proposed in Virginia as well as in England as shown in Figure 1.

The analysis leads to the conclusion that California pavements having California tester skid-resistance values above 0.30f should definitely be satisfactory. Based on the fact that England and Virginia receive more rains than California it seems logical to

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5. Moyer, R. A., "Effect of Pavement Type and Composition on Slipperiness, California Experience." Proceedings First International Skid Prevention Conference, Part II, 1959.

6. Giles, C. G., Sabey, B. E., and Cardew, K. H. F., "Development and Performance of the Portable Skid-Resistance Tester." British Road Research Laboratory Technical Paper No. 66, 1964.

7. Mahone, D. C., "A Correlation of the British Portable Tester and the Virginia Skid-Test Car." Virginia Council of Highway Investigation and Research, May 1961.

conclude that readings on the California tester above 0.28 should be satisfactory for probably all sites with the possible exception of curves. This correlates reasonably also with Marshall's[8] work in Florida and other work in Virginia.[9]

The above noted correlations were very encouraging, and it was decided to initiate further studies involving skid-resistance measurements at wet-weather accident sites on California highways. Unfortunately the California Highway Patrol accident report does not require the officer to determine if skidding was involved in the accident. However, the officer, in his observations, may note that skidding was a factor in the accident. Therefore, accidents occurring during wet weather involving only one vehicle with no recorded defects for either driver or the vehicle were selected from all reported wet-weather accidents. Test sites were selected for this survey on the basis of a concentration area which is defined as an area of three accidents within 0.1 miles. A number of these sites were chosen for skid testing. Other testing work has also been performed at sites selected by our district traffic departments on the basis of wet-weather accident information. The results of this investigation showed the average friction value to be 0.22f with none above 0.28f. It is interesting to note from Figure 1 that 0.28f is the same as the British minimum for all sites.

Improving Skid Resistance of Existing Pavements

Providing and maintaining a skid-resistant surface is a very important factor in the performance of any highway. All types of pavement surface will eventually show some reduction in coefficient of friction values during their service life. This reduction is caused by wear and polish of traffic, especially by heavy trucks.

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8. Marshall, A. F. Jr., "Skid Characteristics of Florida Pavements Determined by Topley Decelerometer and Actual Stopping Distances." Highway Research Board, January 1962.

9. Mills, J. P., and Shelton, W. B., "Virginia Accident Information Relating to Skidding." Proceedings First International Skid Prevention Conference, Part I, 1959.

Bituminous Pavements are normally "skid-proofed" by the placing of a chip seal or an "open-graded" seal. This practice has been very successful on California highways as illustrated in Figure 2. However, several years ago the California Division of Highways became aware that some sections of concrete freeways, especially on curves, were having an unusual number of accidents occurring during wet or rainy weather. After considering the use of acid treatment on the surface or the application of a coal tar-epoxy screening seal coat, it was decided to study the effect of grooving the pavement.

Grooves may be cut in the pavement in either a longitudinal (parallel to the center line), transverse direction, or diagonally. Practically all of our grooving to date has been performed in a longitudinal direction. We are of the opinion that this leads to increased lateral stability, and tends to guide the vehicle through a critical curve area. This has been confirmed by studies performed in Texas.[10] However, studies in England[11] indicate that grooving perpendicular to the centerline is better overall practice, and further effort will be required to resolve the problem.

Groove patterns vary. The most common type is rectangular in form and may be varied in width and depth and distance between centers of grooves. Other types have rectangular form, but the bottom is partially rounded, and the edges at the pavement surface are also rounded. Others have a large V cut separated by smaller V cuts.

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10. McCullough, F., "Slick When Wet and Field Evaluation of the Saw-Cut Method." Texas Highways - Vol. 10, No. 1, p. 9, 1963.

11. Blake, L. S., "Recent Research and Development on Concrete Roads, 1964-1967." The Concrete Society, Limited Terminal House, Grosvenor Gardens, London.

A number of patterns have been used in our serration work to date.[12&13] This was done in order to determine the increase in the friction factor, wear resistance, and possible vehicle handling problems. In all cases the grooves are all in a longitudinal direction. Figure 3 shows the effect of grooving on the average coefficient of friction value for the various PCC pavement projects.

A very important characteristic of any treatment for raising the existing friction value is its resistance to wear and polish of traffic. Results of friction measurements with time on various grooved projects are shown in Figure 4. Not enough time has elapsed on the majority of the projects to draw any firm conclusions. It appears, however, that the nature of the aggregate and mortar strength may influence the resistance to wear and polish of the grooved areas.

A Before and After accident study of our grooving projects to date indicates that the total accidents were reduced 62 %. Of this, wet-pavement accidents were almost completely eliminated (90 %) and dry-pavement accidents dropped 21%.

On seven jobs in our District 07 (L. A. area) the cost of grooving was in the range of seven to nine cents per square foot. In some other districts the cost is somewhat higher. The best average is approximately 10 cents per square foot.

Motorcycle and light-car tests clearly indicate that 1/4" x 1/4" grooves will create problems in vehicle control. It is suggested that cuts no greater than 1/8" x 1/8" be used if vertical grooves are cut in the pavement. 1/8" deep x 1/4" wide V grooves do not appear to create any problems. Further studies are required before any specific spacing can be recommended. However, since approximately equal accident reductions were noted for 1/2" and 3/4" spacing, it is suggested that 1/8" x 1/8" on 3/4" centers be

12. HRB Special Report 101.

13. Farnsworth, E. F., "Pavement Grooving on Highways." Langley Conference, NASA SP-5073.

used. Recent studies tend to indicate that a slightly narrower groove, 0.95" (3/32") on 3/4" centers, may be better for motorcycle traffic. This pattern is being used in the Los Angeles area on an experimental basis.

Dynamic Hydroplaning

Essentially, dynamic hydroplaning may be defined as the condition under which the tire footprint is actually lifted off the pavement by the action of fluid pressure and then rides on a fluid film of some finite thickness. Dynamic hydroplaning has been studied mainly by those concerned with wet-weather landings of high-speed aircraft.[14] However, some authorities believe that dynamic hydroplaning may be a factor in uncontrolled skids of automobiles during periods of heavy rainfall, at least those occurring at high speeds with bald tires.

The important parameters of significance to dynamic hydroplaning of aircraft, automobiles, or trucks are the speed of the vehicle, tire inflation pressure, tire condition, depth of water, and surface texture.

We have completed a preliminary analysis in an attempt to determine the importance of dynamic hydroplaning as a cause of accidents. In order to try to eliminate as many causes as possible only single-car accidents in 1964 and during periods of actual rain were analyzed. This was the latest year that records were available when the analysis was started in 1966. During the year 1964 there were 13,917 wet-pavement accidents, which was 9.7% of all accidents. There were 9,480 accidents during actual rain, or 6.6% of all accidents. Of the accidents occurring during rain there were 1,705 which involved only a single vehicle. These were selected for further analysis and the Highway Patrol reports were carefully studied. A study of the reports showed that 152 accidents out of

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14. Horne, W. B., Yager, T. J., and Taylor, G. R., "Recent Research on Ways to Improve Tire Traction on Water, Slush, or Ice." AIAA/RAeS/JSASS Aircraft Design and Technology Meeting, Los Angeles, November 15-18, 1965.

the 1,705 occurred during heavy rainstorms, where the possibility of a sizeable thickness of water cover might exist on the pavement. Information on these accidents is shown in the following table:

Speed						Road Section		Tire Condition		Vehicle	
20 30	30 40	40 50	50 60	60 70	70 80	Tan-gent	Curve	Not Stated	Smooth	Com-pact	Stan-dard
3	12	34	60	42	1	85	66	112	37	38	114

Total Accidents = 152

Of these 152 accidents, Highway Patrol reports in 17 cases mention water on the pavement in the form of puddles or hydroplaning as the accident cause. The fact that a sizeable number of the accidents in the potential hydroplaning group were traveling at speeds in the range of 50-70 mph indicates that excessive speed for the very poor weather conditions may have been a very responsible factor in either directly causing the accident or indirectly influencing the tendency of the vehicle to hydroplane.

Specifications and Construction

Pavement slipperiness depends primarily on two factors - coefficient of friction and texture of the surface. During construction it is important to build these features into a pavement with such durability that they will last. Measuring devices are now available for determining the coefficient of friction so a value can be specified as an end point requirement in the contract. Such a value must be set to satisfy local conditions, recognizing that the number must be high enough so that a reasonable service life can be attained. All pavement surfaces wear under traffic depending on amount of traffic, the materials, and construction procedures.

Texture of a pavement[15 & 3] is still an unresolved problem, although a great deal of work is underway in this area. A deep,

15. HRB Special Report 101.

durable texture constructed to last and provide a rainwater reservoir would be ideal to solve the skidding problem. Unfortunately this could cause other problems such as excessive tire wear and noise and diminished visibility due to splash and throw of the surface stored water.

At the State level here in California[15] we treat bituminous and portland cement concrete pavements differently. Our asphalt pavement construction is controlled by a combination end point quality and method specification using a mix design which we know by experience will give a nonskid surface. Our experience indicates that such pavements when new will have a coefficient of friction slightly below 0.33, but after a year or so (depending on traffic) it will raise above 0.33 and stay at a uniform level for several years (California's aggregates have excellent nonskid properties).

Portland cement concrete pavements are controlled by an end point coefficient of friction of 0.30 and the texture is controlled by requiring finishing with a burlap drag. This method specification does not always provide the texture desired, so we are attempting to develop a proper end point test that will measure a specified texture. Such a test, combined with our coefficient of friction, should result in a nonskid pavement at least while the pavement is new. Our past experience indicates that weak surface mortars can wear rather rapidly, so we are also developing a wear and polish machine so as to provide a means to measure a specification limit for durability.

Figure 1

CORRELATION STUDIES
MINIMUM FRICTION VALUE

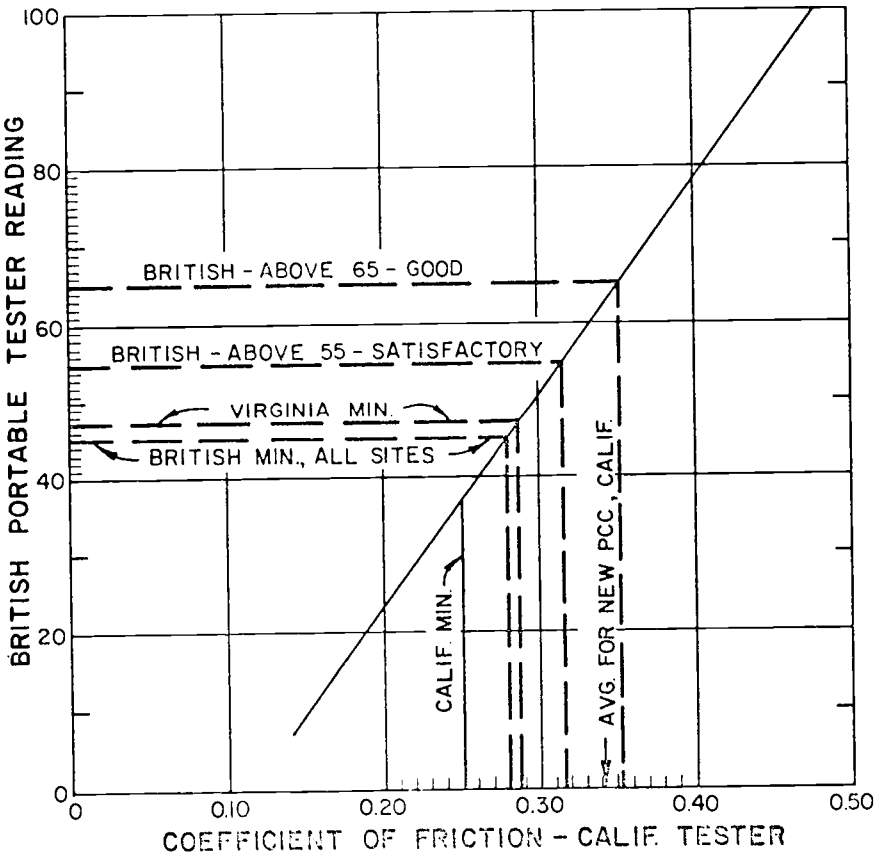


Figure 2

TRANSVERSE FRICTION VALUES

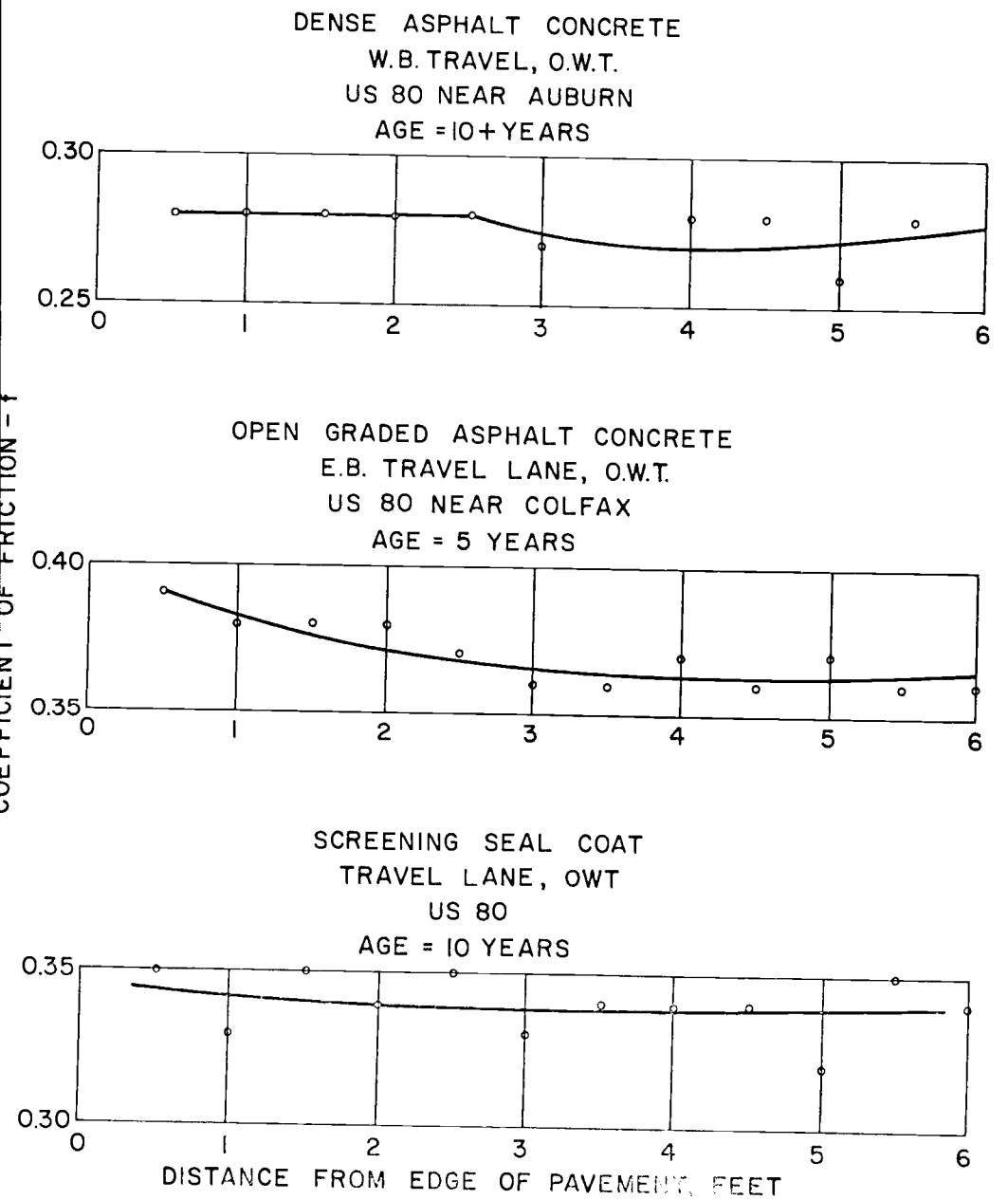


Figure 3

EFFECT OF GROOVING PATTERN ON AVERAGE COEFFICIENT OF FRICTION VALUE OF PCC PAVEMENTS

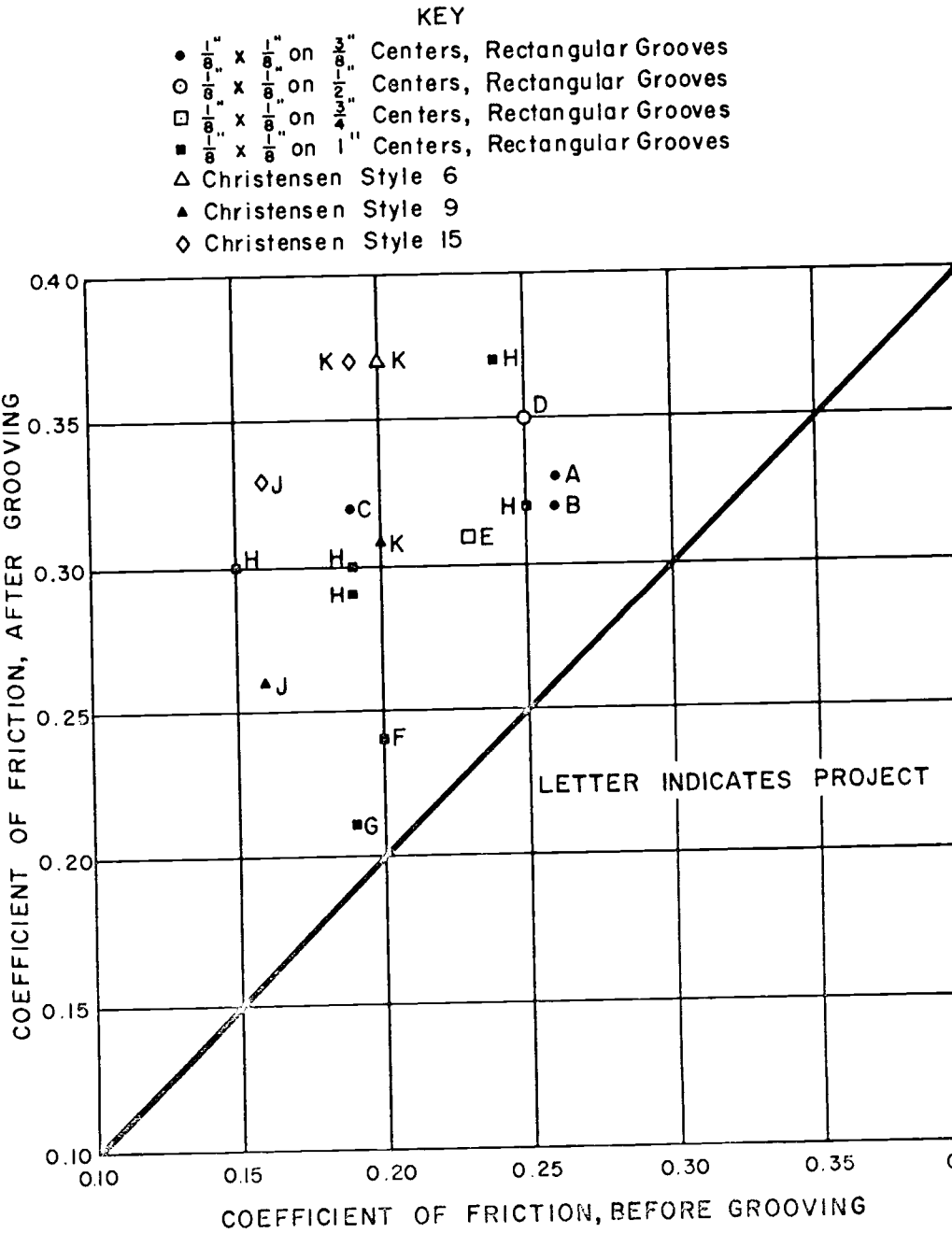
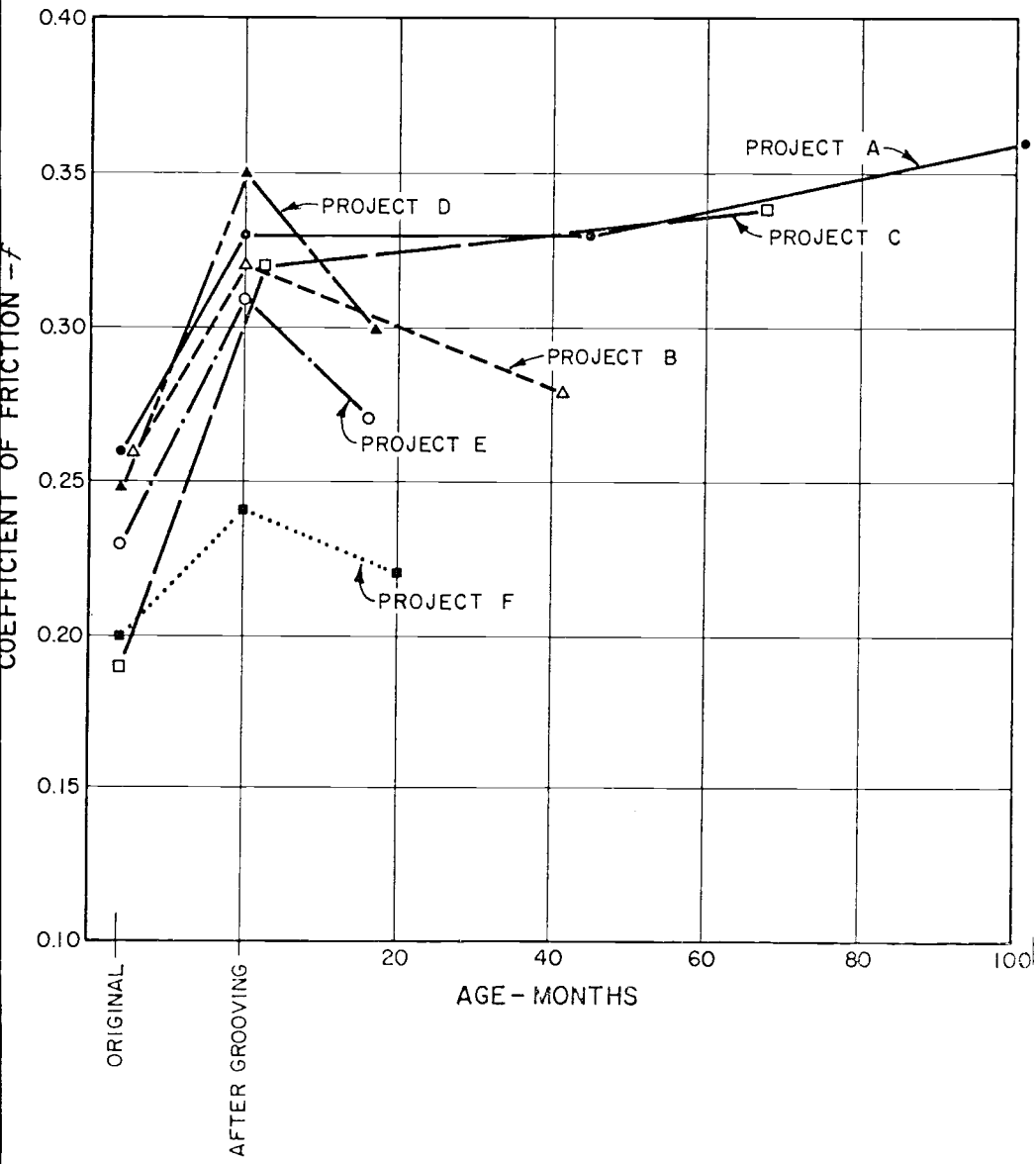


Figure 4

CHANGE IN FRICTION VALUES FOLLOWING GROOVING OF PCC PAVEMENTS



PANEL DISCUSSION

ARE YOU LEGALLY VULNERABLE?

Presiding: Gordon W. Beecroft

OREGON'S TORT LAWS

by

Joe Henke

Oregon's Tort Laws

by

Joseph Henke

First of all, I would like to offer a definition of "tort liability" and give you a few examples because the term "tort" is confusing to a lot of people, including lawyers. Then I'd like to give you a little of the history of the way the tort law has developed in this country and in Oregon. And then talk about the Oregon law and compare it with what Washington and California have done and give you some of the effects of the legislation passed in this State in 1967 and 1969. Finally, I will talk a little bit about the insurance aspect of tort liability, particularly of things that may be of interest to people who are involved in the construction and maintenance of streets and roads.

First of all, here is the definition of tort liability which is used in the manual published by the Bureau of Governmental Research. "A tort is negligent or wrongful conduct which causes bodily injury or property damage for which compensation can be recovered in a civil law suit." Most tort cases that we see in the courts are the result of negligence. The typical example of this is an automobile accident, but there are other torts such as libel, slander, and assault and battery, which are intentional but also come within the definition of a tort. There was a case in Arkansas a year or so ago in which the Arkansas Supreme Court upheld the traditional rule of governmental immunity from tort liability and in doing so listed 27 cases, the facts of which they thought indicated that the immunity rule should be retained. Among these cases were a large number that relate to streets and roads and I thought I'd just read the summaries to you to give you a better feeling of the type of risk that we are talking about. These are all facts from cases in which liability was found against governmental bodies in states where such suits are allowed:

1. Failure to install a fire hydrant where others within a similar area were protected.

2. Failure to maintain streets and highways in a safe condition.

3. Failure to maintain proper warning barriers for protection of persons using sidewalks and highways who unintentionally deviate therefrom.

4. Failure to adequately maintain drains or sewers to prevent clogging.

5. Negligence in placing, failing to remove, or permitting with constructive notice a rope or clothesline across the sidewalk.

6. Injury to a child by a flare placed in the street to warn of recent road work under the attractive nuisance doctrine. In these cases proof of adequate care is not a defense. If you place something that is attractive to children where they can have access to it, you will be liable for their injuries. This is a particular problem with equipment or other objects left in the roadway which might appeal to children as objects for play. Many early cases applied the doctrine to turntables for street railways.

7. Another example of the attractive nuisance doctrine: injuries to a child trying to light a warning lattern that had gone out.

8. Damages from temporary obstructions in the street.

9. Failure to erect a traffic warning against entering a street partially barred or obstructed by construction or improvement work.

10. Operation of street lighting facilities.

11. Injuries from overhanging tree limbs.

12. Injuries because of accumulation of water at a street intersection.

13. Injuries due to the effect of conditions of the sidewalk.

14. Injuries from a fall in a municipal parking lot.

15. Injuries from a fall by slipping on wet paint used to designate parking spaces on the street.

So that gives you a sampling of the type of exposures that we are talking about as they relate to streets.

What is the doctrine of sovereign immunity? The doctrine developed over several hundred years in this country and essentially provided that you could not sue the federal, state, or local governments for damages arising out of tort. There was one important exception to this doctrine which related to what were called "proprietory functions" of municipalities. A distinction was made between a city's "governmental functions" which enjoyed immunity and its "proprietory functions" which did not.

Generally speaking, states, counties, and school districts were immune from the type of suits that I have described to you here. Cities, on the other hand, were exposed to liability in many situations. There was some confusion as to whether maintenance of streets and roads constituted a "governmental function," on the one hand, or a "proprietory function" on the other. A distinction was often made between the discretionary aspects of planning or designing streets, and the actual work or defective work in constructing or maintaining the streets. In Oregon, the cases were confused before the new tort liability law went into effect in 1967. In one case, members of a city council were actually held individually liable for failing to repair a defective street.

One thing that cities used to do which had some effect on their liability, was to transfer liability by charter provision or by ordinance to abutting owners. In many old city charters you will find a provision that declares the city immune and the abutting owners liable for defects in his street or sidewalk. This is particularly true of the sidewalks. On the other hand, when a charter imposed the duty on the city alone to maintain the street it was much clearer that the city would be subject to liability if it failed to do so.

Now with regard to State and counties, there used to be a number of statutes dealing with specific circumstances which exposed them to liability. Perhaps the best known of these in Oregon was ORS 368.940 which provided:

> Whenever any individual while lawfully traveling upon any legal county road or bridge without contributory negligence and without knowledge of the defect or danger, sustains any loss, damage, or injury to the person or property in consequence of the defective or dangerous condition of the road or bridge of which the county court

> or board of commissioners or county road department for such county had noticed or of which in the exercise of ordinary care any of them should have had notice of and sufficient time to remedy such defective or a dangerous condition, he is entitled to recover of the county in which the loss, damage, or injury occured compensatory damages not exceeding ten thousand dollars in any case.

A similar statute applied to Multnomah County bridges over the Willamette River, another statute limited the liability of certain cities to $100 for defective streets and roads and other public places, and another limited the State Highway Department to $500 on claims against it. There were a couple of other minor sections.

This situation has been greatly changed by the enactment of legislation in Oregon, and the same is true in many other states. In recent years, particularly since about 1955, there has been a growing conviction, among legal scholars particularly, that the governmental immunity rule was unfair and undesirable, and as a result the states have begun to enact laws abrogating governmental immunity. New York was the first actually in 1929, but others have followed since. Washington took a simple approach which is similar to New York's. The Washington statute simply reads, "The State of Washington whether acting in its governmental or proprietory capacity shall be liable for damages arising out of its tortious conduct to the same extent as if it were a private person or corporation." The Supreme Court of Washington has ruled that this statute applies to local governments as well. Well, this would appear very simple on the surface, but in fact there are a number of very thorny problems involved in imposing liability on a governmental body. One is that although the law says that liability is going to be imposed in the same way as for a private person, in fact when it comes to decisions which are discretionary or legislative in character the courts have backed away from holding the government liable. The Washington courts are in the midst of trying to find these limits of liability now.

California took the opposite approach from Washington's. California was prompted by a court decision there which declared that the court was going to abrogate governmental immunity if the legislature didn't. The legislature then made a detailed study

and eventually enacted an elaborate statute which takes what is called the "closed-end approach." That is, the law starts off by saying that the governmental bodies will be immune from liability and then excepts specific circumstances under which they will be liable. This breaks down somewhat because you have to make some rather broad exceptions. For example, one exception is for liability related to conditions on public property, but then there are exceptions to the exceptions. One of which is that failure to provide control signals, signs, or distinctive markings cannot be the basis of liability. And then there is an exception to the exception to the exception which is "unless the failure to do so would constitute a trap for a careful driver." In other words, if you dig a six-foot trench across the main highway and then go home and just leave it there without any markings, you are not going to escape liability under this section, but the fact that the State Highway Department didn't put a double line where there should be no passing would not be the basis for liability.

Another important limitation which is particularly of interest to those who are involved in designing and building roads is that California excepts from liability damage caused by defective design or plans, where those plans have been approved by the legislative body, or approved by a person who is vested with discretion. Thus in California, you cannot hold the governmental body liable for a defect in the design of a street or highway if the plans were approved by the State Highway Commission or whatever office or body would have the proper discretionary authority for deciding what sort of design they should have. Finally, there is an exception which continues immunity from liability for unpaved access roads to recreational facilities.

Oregon takes the opposite approach to California. Oregon has what is referred to as an "open-end approach." The Oregon law starts off by saying "every public body is liable for its tort, and those of its officers, employees, and agents acting within the scope of their employment or duties whether arising out of a governmental or proprietory function," but then it goes on to list a number of broad exceptions, the most important of which is, "any claim based upon the performance of or the failure to exercise or perform a discretionary function or duty whether or not the discretion is abused." This wording is taken from the Federal law which has been in effect quite a bit longer and which has been a difficult one for the courts to interpret. Generally it allows the

government to argue that whatever activity was the basis for the claim was in fact the result of an exercise of discretion of a governmental official.

I'm not going to try to summarize the entire Oregon tort liability law which was enacted in 1967, but I picked out some of the effects of the Oregon law that might be of interest to you. First of all, I'll point out that most local governments, not the State government, but most counties and cities, had liability insurance in effect prior to the abrogation of governmental immunity, and State law generally required that any such insurance waive governmental immunity as a defense. So actually you find that there were many recoveries on the basis of tort liability under waivers of immunity on insurance prior to 1967. By generally abrogating governmental immunity, the law in 1967 placed governments in a position where they were obliged to purchase liability insurance or self-insure to cover all liability risks, and this has caused a lot of problems in trying to obtain insurance. However, the new law alleviates the insurance problem somewhat by providing monetary limitations which are as follows: "liability of a public body on claims within the scope of this law shall not exceed

(a) 25 thousand dollars to any claimant for any number of claims for damage to or destruction of property, including consequential damages arising out of a single accident or occurance,

(b) 50 thousand dollars to any claimant for all other claims arising out of a single accident or occurance and,

(c) 300 thousand dollars for any number of claims arising out of a single accident or occurance."

There were some problems with this language in 1967, and what I read to you is the amended language that was enacted in 1969 by the Legislature. The general effect of this provision is that in any accident or occurance the total amount the government could be liable for would be 25 thousand dollars for property damage and 50 thousand dollars for personal injuries. This actually is rather low in terms of the type of liability insurance that a private corporation might purchase, particularly the 50 thousand dollars for personal injuries, since it is becoming not uncommon to see larger judgments than that, but it is significant

from the point of view of local government in that it gives them a ceiling of liability which they can depend on in purchasing insurance. They know that if they purchase to these limits, they will not be faced with a claim over their coverages.

Another aspect of the new law that I don's intend to go into is that it has a specific procedure to make a claim that requires that a notice be given to the local government or State government. This was changed in 1969 and now provides that you can file your claim with the State department which was involved in the accident or with the State Attorney General, and for local government you may give the claim to anybody whom you could serve with legal papers as a representative of the local government. The 1969 law was particularly significant for counties in that the statutes which I read to you which provided for limited liability for counties on county roads and Multnomah County bridges were repealed. The Legislature also repealed the 100 dollar limitation on city liability, and the 500 dollar limitation applied to the State Highway Department. Although officials of the affected governmental units may be unhappy with these changes, greater uniformity of application of the tort law was accomplished and the same avenue for recovery was made available to injured persons against every local government. Only two relatively insignificant statutory limitations on liability remain. There is a State law which makes the county immune from liability for maintenance of unaccepted county roads where they have been dedicated but not officially accepted by the county.

I would say in reviewing the effects of the 1967 Oregon law and the awareness, both of plaintiffs, attorneys and insurance companies, as well as local government, of the possibility of tort claims against governmental bodies. I think that we'll see more claims against cities and counties and the State than we have in the past and probably more judgments. I think there were a lot of potential claims in the past that were never made simply because the attorney or the injured person was unaware that the local governments had insurance under which a claim might have been made. The local governments did not generally advertise the fact that they might be subject to liability.

I would like to say a few things about liability insurance that relate to roads and streets. For one thing, in trying to obtain

broad coverage for complete exposure to tort liability, cities, counties, and the State have experienced particular problems in obtaining special types of coverage: errors and omissions, false arrest, and personal injury. Errors and omissions insurance generally covers situations in which there are damages of a non-physical nature. For example, if you were to close off a street or highway with the result that a person suffered a loss in his business due to lack of access to it, he might sue you on a theory of tort. Typically this claim would not be covered by comprehensive liability policy. You would have to pick up errors and omissions coverage. False arrest has traditionally been a specialized type of insurance and most companies have been unwilling to write it. Personal injury insurance for intentional torts is typically written as a supplemental policy that covers things like assault and battery, interference with contractual relations, and a number of things which aren't due to carelessness but due to an intentional act of the person who is liable.

One thing I would emphasize is the exposure of public employes. Public employes were liable before the new law went into effect and they are still liable after the new law has gone into effect. The law provides that local governments may purchase insurance for employes; the law provides that local governments may assume the defense in case of suit and the law provides that local governments may pay a judgment against a public employe, but the law doesn't compel them to. I think that in terms of his own interests a person in public office should check coverage which his employer has to be sure it covers him also. Relatively speaking, it is not that expensive for a government purchasing liability insurance to name its officers and employes as additional insureds. When a suit occurs, assuming that the insurance covers both government and employe, the insurer is obliged to assume the defense of both the government and the individual, there is no conflict of interests between them, there is no problem with the individual employe having to obtain separate legal counsel to represent his interests in the suit, and there is no problem as to how the judgment is going to be enforced as between him and the city or county or State. These are things that you might consider. It has been common for police or firemen to purchase insurance of their own as a separate policy. It is also possible that some of you may have coverage under your home-owners policies. It's not uncommon for people who own homes to purchase a broad coverage that would include some protection against liability in cases involving torts.

In addition, if any of you have responsibility for reviewing insurance coverage of your employers, there are a number of exceptions that are very common in comprehensive liability policies that you should look out for because they may have particular application in the construction and maintenance of roads. One which is nearly universal provides that the insurance does not cover liability which you would assume under a contract. I'll read you a typical clause here:

> "This insurance does not apply to liability assumed by the insured under any contract or agreement except incidental contract, but this exclusion does not apply to warranty of fitness or quality of the named insured's products or a warranty that work performed by or on behalf of the named insured will be done in a workmanlike manner."

When a governmental body contracts with a private company to perform a particular job (construction, hauling, whatever it is), in many instances there is the possibility of a claim being made against the governmental body by the contractor. Therefore, often it is necessary to purchase a contractual supplement which covers a particular project or in the alternative to require a hold harmless agreement and a bond from the contractor to insure that he will provide the representation and pay the judgment in the event that a claim is made against him.

Another typical exception applies to certain special hazards: explosion, collapse, and underground property damage. In these instances I can see, particularly in relation to the construction of roads and changing grade and this type of thing, and blasting as well, that you would not find your coverage adequate. So these are things you might check if you are concerned about how well covered you are.

Another common exception is property in the care, custody, or control of the insured, or as to which the insured is for any purpose exercising physical control. Typically in your liability policy you are required to list any equipment or vehicles that are going to be covered by the insurance. Now, if for example, you rent a piece of equipment that is not on that list, and an accident occurs while it is being operated by a public employee, this exclusion would mean that you had no liability coverage.

Another common exception is particularly related to the design of roads. I told you that California's law excludes liability

for designs or plans that have been approved, but Oregon's does not. I'll read this policy exception to you:

> "This insurance does not apply to bodily injury or property damage resulting from the failure of the named insured's product or work completed by or for the named insured to perform the function or serve the purpose intended by the named insured if such failure is due to a mistake or deficiency in any design, formula, plan, specification, advertising material, printed instructions prepared or developed by the insured."

I would think that this exclusion might well exclude coverage in a situation where a road or bridge failed because of an error in design. It's something to watch out for.

You can acquire coverage for these exceptions, but it usually requires an endorsement to the policy and a supplemental premium. That's a matter of negotiation with the insurance company.

THE COURTS

by

Willis A. West

(Paper not available for publication)

REGISTRATION LIST

NAME	ORGANIZATION	ADDRESS
Adams, Don	Oregon Highway Dept.	Salem, Ore.
Albright, Wm. D.	Oregon Highway Dept.	Salem, Ore.
Allen, Dale D.	Oregon Highway Dept.	Eugene, Ore.
Allen, Don	City Hall	Eugene, Ore.
Ansell, C. K.	Oregon Highway Dept.	Ontario, Ore.
Apperson, James	City Hall	Portland, Ore.
Arenz, Richard	Bureau of Public Roads	Salem, Ore.
Auseth, Martin	Courthouse	Shelton, Wash.
Baldwin, Frank	Bureau of Public Roads	Salem, Ore.
Barney, Jim	City of Grants Pass	Grants Pass, Ore.
Beckett, Steve	Bureau of Public Roads	Salem, Ore.
Bedsaul, Chris	State Forestry Dept.	Philomath, Ore.
Beecroft, Gordon	Oregon State University	Corvallis, Ore.
Bentz, Donald	City Hall	Roseburg, Ore.
Bergstrom, Don	City of Portland	Portland, Ore.
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LIST OF PUBLICATIONS

Bulletins—

No. 1. Preliminary Report on the Control of Stream Pollution in Oregon, by C. V. Langton and H. S. Rogers. 1929. 15¢.

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No. 4. Interpretation of Exhaust Gas Analyses, by S. H. Graf, G. W. Gleeson, and W. H. Paul. 1934. 25¢.

No. 5. Boiler-Water Troubles and Treatments with Special Reference to Problems in Western Oregon, by R. E. Summers. 1935. None available.

No. 6. A Sanitary Survey of the Willamette River from Sellwood Bridge to the Columbia, by G. W. Gleeson. 1936. 25¢.

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