CIRCULAR NO. 38
FEBRUARY 1969

Proceedings of the 1968 NORTHWEST ROADS AND STREETS CONFERENCE

ENGINEERING EXPERIMENT STATION
OREGON STATE UNIVERSITY
CORVALLIS, OREGON

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OREGON STATE UNIVERSITY ENGINEERING EXPERIMENT STATION,

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CORVALLIS, OREGON 97331

Proceedings of the
1968 NORTHWEST ROADS AND STREETS
CONFERENCE

Corvallis, Oregon
February 14-16, 1968

CIRCULAR NO. 38
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Engineering Experiment Station
Oregon State University
Corvallis, Oregon

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PROGRAM

Wednesday - February 14, 1968

WELCOME

Presiding: VICTOR D. WOLFE

Welcome: MILOSH POPOVICH

ACCIDENT RECORDS SYSTEMS & THEIR USE

Presiding: MARTIN J. BOUMAN

Panel: PAUL HOOPER
JOHN PHILLIPS
TOM EDWARDS

LUNCHEON

Presiding: FLOYD SOMERS

Safety Vs Cost: GEORGE MOORE

LOCAL GOVERNMENTS ON THE MOVE

Presiding: DON WEST

The NACE County Public Works Demonstration Program:
W. D. McINTOSH

Washington State's County Road Administration Board:
ERNEST GEISSLER

Wednesday - February 14

Public Relations for New Highway Construction:

MEL GARDNER

Local Financing of Roads and Streets:

CLAYTON NYBERG

CONFERENCE BANQUET

Presiding: FORREST COOPER

Speaker: MARTIN J. BOUMAN

Thursday - February 15, 1968

52,500 TRAFFIC FATALITIES - - WHY?

Presiding: EDWARD BRANCHFIELD

Driver:

CAL LARSON

Vehicle:

ROY HAEUSLER

Highway:

JIM WILSON

WHAT SHOULD BE DONE

Driver:

CAL LARSON

Vehicle:

ROY HAEUSLER

Thursday - February 15

Highway:

D. W. LOUTZENHEISER

LUNCHEON

Presiding: B. J. McCLARTY

New Concepts in Federal Aid:

GRANT E. MEYER

WHAT'S BEING DONE

Presiding: WILLIAM L. HALL

State:

HOWARD EDDY

County:

GERRY ATTIG

City:

DON BERGSTROM

Enforcement:

WARNER MILLS

Motor Vehicle Department:

JACK NELSON

Highway Department:

E. S. HUNTER

Friday - February 16, 1968

CONSTRUCTION AND MAINTENANCE

Presiding: FRED BURGESS

Instant Bridges:

DICK IMPER

Spokane Co's Shortcut Contracts:

BOB LEACH

Litter Pickup by Contract:

VERN DORSEY

Electronic Control Paving Machine.

LEONARD HALLOCK

Imagination in Maintenance:

ROY JUMP

Open Graded Plant Mix Seal Coats:

ROBERT A. BOHMAN

ADJOURN

WELCOME

Presiding: Victor D. Wolfe

WELCOME ADDRESS

by

Dean Milosh Popovich

WELCOME ADDRESS

by

Dean Milosh Popovich

I really enjoy being reminded once in a while that I do have an engineering background. Those were some of my most pleasant days. Personally, I want to thank you very much for some of the very fine highways that we have now. It is really an extreme pleasure, comparatively speaking, to drive Highway 5 without any particular interference or competition all the way from the Oregon border to the Canadian border. The last missing link, the one through south Seattle, was put in last year, and it was truly the frosting on the cake. That section was probably the worst part of the whole route, and the new highway makes the whole length a very beautiful drive.

I also want to thank you personally for the great improvement in signs. I do not know whether you remember or not, but about ten years ago I told you some pretty hairy tales about getting lost every time I went north of the Oregon border into Washington I thought the Washington signs were pretty miserable, but I can find my way around pretty well now and really appreciate it.

Although there has been fantastic progress in highways and roads, traffic, and the associated problems within the last ten years, I know you still have a few problems left, and that is why you get together every year. We all have a funding problem; I know yours is rather acute now with reductions in federal funds. The federal government has a tiger by the tail some place in Asia, making it necessary to divert funds that ought to be coming here for our roads. I think we are very fortunate in the State of Oregon --I do not know what your situation is in some of the other northwestern states--in having dedicated funds to work with in maintaining some sort of stability in your programs. I know we in Higher Education envy you very much because we have to depend on general appropriations without any dedicated funds, and in effect, we are at the mercy of the few people on the Ways and Means Committee.

I know safety is always one of your foremost considerations. The freeways, I think, have developed a tremendous safety record,

but we do not have enough freeways. I am sure we never will have enough freeways. Handling traffic gets more complicated all the time, with more and more automobiles and less and less space. We had some first-hand experience with traffic handling here last fall when the first crowd of over 40,000 came to a football game in the state of Oregon. The scramble to get in and out of that game was really something to behold. I understand that a little later in the year there was a quite similar situation down around Eugene when Oregon and Oregon State played. I thought I would take this opportunity to warn you that there are three games next fall here in Corvallis with a potential of 40,000 crowds. We play the University of Washington on October 5. The game with UCLA still may be a battle for No. 2, I don't know; we never did make it last year in spite of whipping No. 1 and two No. 2's. And then the Oregon game should draw another 40,000 late in the season. So right there we have three very good Excedrin headaches.

Speaking for Oregon State University, we are most happy to have you on the Oregon State campus whenever you are scheduled to come here. I know from past experience that your conferences here are very informative and very worthwhile. I used to spend more time at them in the old days than I am able to do now. I also know that in between sessions you enjoy some very high standards of good fellowship, and I know this session promises to be very much the same. I thank you very much for the opportunity to be here before you today.

PANEL DISCUSSION

ACCIDENT-RECORDS SYSTEMS AND THEIR USE

Presiding: M. J. Bouman

ACCIDENT-RECORDS SYSTEMS AND THEIR USE

by

Paul C. Hooper

The Federal Highway Safety Act of 1966 placed special emphasis on the collection, analysis, and use of traffic accident data by the formulation of two different and separate program standards. Standard 4.4.9, "Identification and Surveillance of Accident Locations," demands that each state, in cooperation with county and other local governments, shall have a program for identifying accident locations and for maintaining surveillance of those locations that have high rates of accidents or high property damage losses. The purpose of this program is to produce an inventory of high accident locations, locations where there is a sharp increase in accidents, and to recognize design and operation features with which these high accident frequencies are associated. Further, the program shall provide appropriate measures for reducing accidents and for evaluating the effectiveness of the safety improvements on any specific section of the highway system. To implement this standard a procedure was developed in Washington on January 1, 1968, which required that the local government's code on each accident report the county number, county road number, and the milepoint of the particular road. The coded reports are then transmitted to the traffic division of the State Highway Department for preparation of a statewide summary of all traffic accidents. In King County, we have had only one month's experience with this program, so are not as yet able to comment on its effectiveness. However, it is an example of an accident-records system aimed at collection and analysis of a specific type of accident data.

The second national highway safety standard is Number 4.4.10, "Traffic Records." In this program, four classes of routinely collected information comprise the data base for the coordinated state traffic program. One of these data types is that of accidents linked to the involved drivers, vehicles, and highway locations. This program provides for the most intensive analysis of all accidents and their correlation with other data concerning drivers, vehicles, and highways. The basis shall be a statewide program with compatible subsystems at the local level. Output information on accidents include identification of location in time and space, identification of drivers and vehicles involved, types of accidents, descriptions of injury and property damage,

description of environmental conditions, and causes or contributing factors.

This program shall be capable of providing summaries, tabulations, and special analyses.

The inclusion of the accident-records program in the Safety Act of 1966 is a recognition that we at the local levels have in the past done only a partial job in establishing, and using to the fullest extent, good accident-records systems to create effective accident-reduction programs. Without the accident facts, the programs can only be based on opinion and guesswork.

My fellow panelists are presenting information on certain types of accident-records systems as they apply to a whole state or to smaller cities. I will discuss an accident-records system that has worked in rapidly urbanizing King County; it is similar to many of those in the larger metropolitan cities. With the advent of data-processing equipment, it became possible to analyze large masses of accident data rapidly and economically. When great volumes of data are handled manually, the output of useful, correlative data soars out of financial reach. Accident records become mere repositories of information. In King County we began our accident-records system by utilizing accident spot maps and intersection diagram cards. However, it soon became apparent that we were making one of those repositories of information rather than a useful and meaningful traffic engineering tool for the development of more efficient and safer highways. The man-hours needed to produce credible analyses of accident problems were so great that we were faced with adding additional personnel or adopting a better method. In 1963, the county began a new cost accounting program utilizing data-processing methods. Since there was not a full-time usage of the equipment, other programs were sought to utilize the system. During 1964, we developed an accident-records system utilizing the 80-column IBM punch card. This program has greatly reduced the man-hours required to develop pertinent and timely facts for a particular intersection or highway section. In addition, the flexibility afforded in allowing us to analyze the effects of different conditions such as weather and darkness has greatly expanded the depth of known facts. The real test of the system was passed when we were able to convert the results of analysis to the correction of traffic operational problems and the establishment of prevention programs.

The format for our coding system is outlined in a manual, "Coding Procedures for Accidents and Streets." The following information is recognized and recommended as necessary:

1. Age and sex of drivers, pedestrians, bicyclists, and other road users.
2. Types of motor and nonmotor vehicles involved.
3. Hour of day and day of week of accidents.
4. Geographic location of accidents.
5. Severity of accidents--fatal, personal injury or property damage, and degree of injuries sustained.
6. Types of accidents--motor vehicle, pedestrian, ran off roadway, and so forth.
7. Driver actions, pedestrian actions, contributing circumstances.
8. Highway conditions, weather, vehicle conditions.

At this time all information is coded onto a coding sheet, each line representing one accident, and forwarded for card punching.

The basic output from the card deck consists of a frequency tabulation by intersection or road section. Those tabulations are produced quarterly, with each quarterly report showing the accumulative accident total for each location. At the end of the year additional type tabulations, such as a collision pattern report, single vehicle accident report, or pedestrian accident report, are made. As you can imagine, many types of annual reports can be gleaned from the basic data. These reports have value to the user in developing trends, making reports, and other uses.

However, to make the greatest use of the data and to provide the real meat of the system, a great variety of special analyses must be made and their results used in day-to-day operations or for program planning purposes. Examples of such studies in depth are: (1) determining the highest accident locations, (2) studying nighttime versus daylight accidents to determine if roadway lighting is needed, (3) analyzing types of accidents at signalized intersections to see if signal timings need adjusting, and (4) studying skidding accidents to determine if skid-prevention measures need to be taken. There are many other types of studies in depth utilizing this data that can serve our needs.

Our experience over the past three years indicates that certain deficiencies exist. Since one accident per line is coded on the coding sheet and data-processing language offers no opportunity to review the

comments of the involved drivers nor those of the investigating officer, this information is lost. In many instances, these remarks give valuable clues as to deficiencies or qualifying circumstances. This problem can be minimized if the original accident records are filed at the using location. However, this is not always the case. We are now investigating the development of a coding format that utilizes a separate coding sheet for each accident. This sheet can carry written comments and then be used as the file copy at the using location.

Another difficulty of our system is the identification of location. We do not have a basic grid system to utilize road numbers or names. To fit the location description within reasonable card columns, an abbreviation system for all roads in the highway system needs to be developed. An alternate to this type of location identification can be the usage of assigned highway planning survey numbers.

Regardless of the type of accident-records system you decide to use, try to keep it as simple as possible, codifying only the information you require. Use this collected data to ascertain as many facts as you can, then apply the facts to meaningful and productive accident prevention and corrective programs.

URBAN ACCIDENT-RECORDS SYSTEMS

by

John Phillips

An accident-records system, if properly organized and maintained and containing sufficient information from the original accident report, can be a very useful tool to the engineer who is responsible for traffic improvements in a community. It is the intent of this paper to discuss various accident-records systems and then to explain how this collection of data can be analyzed and used in the design of traffic-oriented improvements. Much of what is stated is specifically concerned with accident data records techniques for cities under 30,000 population which do not now maintain a system or are looking for suggestions to change their current accident-records system. This paper is divided into three parts: 1. Results of a questionnaire concerning accident records that was sent to twenty cities in Oregon and Washington, 2. various accident-records systems, and 3. the engineering use of an accident-records system.

Results of Questionnaire

Before writing this paper I mailed a questionnaire to the responsible engineering personnel of twenty cities in Washington and Oregon in order to determine the current status of accident-records systems procedures for analyzing traffic improvements. The cities range in size from 23,349 to 5,651 population by the 1960 census. Out of seventeen responding, five were answered by the respective city's police departments, only one of which maintains a file system that could be used for engineering analysis. However, these same five cities do maintain an accident spot map. In the remaining twelve cities, seven engineering departments and two police departments maintain spot maps and three cities do not maintain spot maps (of this latter group, one city discontinued the use of the spot map due to the large number of accidents at some intersections). From the information and example accident cards received from these twelve cities, eight cities answered yes to the question, "Do you have an accident-records system?" In my opinion, only five of these were readily suitable for traffic engineering analyses. In summary, fourteen cities, six from Washington and eight from Oregon, maintain spot maps. Six cities, three from each state or approximately one-third of the cities, maintain an accident-

records system for traffic engineering purposes.

At the time of sending out the questionnaire I did not realize that the Oregon State Highway Department summarized each individual accident in the state by location on IBM print out sheets, which are available to every governmental jurisdiction upon request. Since only three of the six cities in Oregon who do not have an accident-records system indicated they made use of this service, I would assume that there are some cities in Oregon who do not know about this service or who do not utilize this available accident data for planning street and traffic improvements.

The last question was "Have you or are you considering data processing to facilitate your accident-records system?" The response to this question was almost unanimous--"No, our city is too small" and/or "It is not financially feasible." However, the City of Renton reported that it was presently in the process of converting to a data-processing system.

Accident-Records Systems--Spot Map

To quote from the Traffic Engineering Handbook, Institute of Traffic Engineers, 1965, "A spot map furnishes a quick visual index of the location of accident concentrations, thus supplementing the location file."

Of the many different types of spot maps, most jurisdictions show accidents by location with different colored pins representing property damage, injury, fatalities, pedestrian, and bicycle. The City of Wenatchee is an exception to this type of system and will be discussed later.

A spot map has five basic uses:

1. Locate hazardous locations. The spot map is a quick visual reference of the accident picture throughout the entire city. Concentrations of accidents not only on major streets but also on minor streets can be observed on a daily, weekly, or monthly basis with a minimum of time and effort. When the number of pins at some location increases faster than normal in relation to traffic volumes and type of district, the location file should be consulted to determine the type and pattern of accidents most frequently occurring. Then corrective measures can be sought to reduce that particular accident potential.

2. Calculate accident rate per million vehicles. If only a location file is used, the low volume intersections can be overlooked where few accidents have occurred in the past. A low volume intersection coupled with three or four accidents a year can produce an accident rate as high as those on a major arterial street. We should be just as concerned in seeking solutions to accident problems on low volume streets as to those on major arterial streets.

3. Public relations. The spot map becomes a handy reference tool when talking to citizens about "hazardous intersections" in their neighborhood. Digging through the location file is not necessary. Also, when you are talking before various civic organizations, a slide picture of the spot map can settle many arguments about how "hazardous" an individual intersection is.

4. Selective enforcement by police personnel. Specific police effort at high accident-frequency locations may correct hazardous driving habits.*

5. Education. Inform educational authorities of the need for corrective driver action under specific conditions or circumstances.* Also, the press can be informed of hazardous locations to warn drivers of problem areas if there is a substantial time lag between the cause and the improvement.

A spot map by itself does not supply enough information to make an engineering decision; hence a location file or accident card file is needed.

Accident-Records Systems - Location File

The location file forms the heart of any accident-records system. If the file is poorly organized or poorly maintained, the true accident trend can not be determined for problem locations without a tremendous amount of effort on the part of the engineer. There are basically two types of systems:

1. Filing of Original Accident Reports. The original driver or police accident report is filed by location of accident occurrence with a cross-reference file by name of driver. For more information on how to set up this filing system, refer to the Traffic Engineering Hand-

* Traffic Engineering Handbook, Institute of Traffic Engineers, Washington, D.C., 1965.

book or write to the City of Medford, which has an excellent seven-page report on its filing procedure.

An alternate to the above is to file the accident reports chronologically and provide a location cross-reference index file. The former is preferred for engineering use of the accident data.

2. Accident Card File. Certain information is taken off the original driver's accident report and placed on a 3x5 or 5x8 form card and filed by location. In this type of system the following minimum amount of information should be retained: chronological number for cross-referencing; date, day, time, weather and pavement condition; number of fatalities and injuries; dollar value of property damage; residence of drivers; and cause. Also, a collision diagram should be drawn.

The main disadvantage to this type of system is that it is very time consuming (from my experience it takes approximately 15 minutes per accident to decipher and record the necessary information and to draw the collision diagram). However, this time is somewhat offset because the accident card file becomes a quick and accurate reference for reviewing the accident trends at any given intersection.

Wenatchee System

In response to the questionnaire, the City of Wenatchee sent an example of its accident-records system which, to the best of my knowledge, is rather unique. Following is a quotation from the letter which explains the system:

"We record traffic accidents on a spot map. We receive from the Police Department a copy of the officer's accident report and make a superficial analysis of the accident, classifying it into one of four categories: right angle, rear end, head-on, other. We then assign each accident an indexing number in consecutive order. On the spot map near the location of the accident we draw a small circle in a color code correlating to the analyzed category. We enter in the circle the accident's index number, and at this time indicate whether the accident occurred during nighttime hours by an additional black circle around the code circle. From the circle we draw a line to the actual point of collision.

By observing the incident frequency at a specific intersection, we can observe a problem location. When we desire to investigate an intersection, we can pull the officer's reports by the indexing numbers and study in detail the individual accidents."

It is the opinion of this author that the system has some disadvantages in urban areas where the accident frequency is high on major streets. However, with some modifications this system could be very useful on the rural road system.

Collision Diagrams

A collision diagram illustrates graphically, by means of directional arrows and symbols, the paths and nature of collision of vehicles and pedestrians involved in accidents.

Many collision diagrams do not show the cause or probable cause; for example had the driver been drinking (HBD), was he exceeding a safe speed (ESS), was he exceeding the safe speed limit (ESL), did he run the stop sign or signal (RSS), was he following too closely (FTC), was he on the wrong side of road (WSR), or had he violated the right-of-way /VIO/RW).* By using a standard set of abbreviations similar to these for the cause and placing them on the arrow with the date, time, weather, and pavement condition, the complete set of accidents is reconstructed on paper and ready for analysis.

Use of an Accident-Records System

One of the primary objectives of the traffic engineer or the individual responsible for traffic improvements is to reduce the total number and severity of potential accidents as well as increase the capacity and efficiency of the street system. This function cannot be performed in a satisfactory manner without the use of a comprehensive accident-records system! The most important use of accident reports is the prevention of other accidents of a similar nature.

Perhaps the best method of showing how an accident-records system will help the engineer is by example. Following are situations that might exist in your community. It is not intended that the accident pattern alone will justify an improvement without conducting other traffic studies such as volume counts, turning movement counts, and speed surveys.

* These abbreviations are borrowed from Highway Research Record No. 188, Highway Research Board, Washington, D.C., 1967, p. 95.

1. Signing

   a. Situation: Two intersecting minor streets
      Control: Stop signs on two approaches
      Accidents: Two or three right angles within a couple of months at night--ran stop sign.
      Possible remedy: Replace stop sign--has lost its reflectorization or has been painted over with spray can paint.

   b. Situation: Two intersecting minor streets
      Control: Stop signs on two approaches
      Accidents: Two or three right angles within a couple of months during day--ran stop sign.
      Possible remedy: Replant stop sign installation--obstructed by tree in parking strip, pole, or other sign; remove parking for a specified distance--obstructed by continually parked car.

   c. Situation: Two intersecting major streets
      Control: Signal
      Accidents: Sideswipe accidents close to or in intersection.
      Possible remedy: Need advance destination signing or, if in place, too close to the intersection; need lane use control signs or those existing not readily visible; or street name sign not visible.

2. Signalization

   a. Situation: Two intersecting major streets
      Control: Two-phase signal
      Accidents: Several right angle collisions--some ran red light.
      Possible remedy: Provide better signal display; increase amber time; in the case of an actuated controller, not enough vehicle extension time thereby trapping car; or better progression of signal system to ensure that the entire platoon of cars makes it through the intersection on the green.

b. Situation: Two intersecting major streets
Control: Two-phase signal
Accidents: Several involving the left-turn car with oncoming car.
Possible remedy: Longer signal cycle so that drivers can choose longer gaps to make left turns toward end of green cycle; or provide a protected left-turn movement.

c. Situation: Two intersecting major streets
Control: Signal that operates stop-and-go during day and flashes at night.
Accidents: Several right angle accidents at night.
Possible remedy: Increase hours of stop-and-go operation; or change right-of-way when on flashing to opposite approaches if volume studies indicate that such action is consistent with the approach volumes.

3. Sight Distance Restriction

a. Situation: Two intersecting streets
Control: Stop signs on two approaches
Accidents: Two or three right angles within a couple of months any time of day, stopped then proceeded into intersection.
Possible remedy: Hedge grown too high on corner lot, cars parking too close to intersection; or private advertising sign placed on corner lot.

4. Street Lighting

a. Situation: Two intersecting streets
Control: Stop signs or signal
Accidents: Several of different varieties, some of which occur at night.
Possible remedy: Improve street lighting.

5. Channelization

a. Situation: Mid-block
Control: None
Accidents: Several rear enders and several involving the left-turn car with oncoming car.
Possible remedy: Provide continuous left-turn lane or place divider on center line to prohibit mid-block left turns.

b. Situation: Two intersecting streets
Control: Stop signs or signal
Accidents: Several rear enders involving a car attempting to turn left or involving the left-turn car with oncoming car.
Possible remedy: Provide a separate left-turn lane or prohibit left turns during certain periods of the day.

6. Delineation and miscellaneous

a. Situation: Mid-block on rural cross-section
Control: None
Accidents: Single car accidents any time of day.
Possible remedy: Paint edge lines on pavement; place 4-inch buttons on center line; place delineation on side of road for target value; provide street lighting; widen shoulder; or place guard rail.

7. Public Pressure Installations

a. Situation: Two intersecting streets
Control: Crosswalks with advance warning signs
Accidents: One involving a car and a pedestrian, otherwise none for the past three or four years.
Possible remedy: Not a signal installation as demanded by the PTA.

In Example 7 if the collision diagram or accident card is available, the "most hazardous intersection" in the neighborhood is reduced to

just another intersection where an unfortunate accident occurred. Unneeded and unwarranted traffic control devices can create more hazards and accidents than if the intersection were left "unimproved." Without a record of past accident experience, the "improvement" could be forced upon the city.

As stated before, the above situations are examples of various ways by which the accident-records system can help in the day-to-day job of making the streets safer for the traveling public.

Finally, an accident location file can be used for other purposes such as before-and-after studies to measure the effectiveness of improvements, priority programming, and securing additional funds either through your own jurisdictional budgeting procedure or through state and federal grants.

ACCIDENT-RECORDS SYSTEMS AND THEIR USE

by

Tom Edwards

In talking about traffic safety systems and their use, it is hard to put your finger on anything you can really talk about. These systems are sacred; they are more sacred than motherhood, at the moment. The demand for lowering the toll and carnage on our highways is foremost in people's minds. There is a paradox here which bears examination but yields no fruit. The fact is that the automobile today is such that you can drive it almost anywhere you want and get there in complete safety if everyone is so inclined. But there is a woeful disregard of the safety of others by the average American driver. The engineer, if he is of good conscience, must accept this. He must face the task of making the streets and highways as safe as possible even in the face of this handicap. You become your brother's keeper. And, really, there is nothing wrong with this. The builder and the operator are not of good conscience unless they approach traffic safety in this vein.

It is rather an unspectacular, drudgery sort of thing. Too often, if you call for an accident report you will get back something that says "There is nothing wrong with the roadway---I drove the curve both directions three times at 70 miles an hour." However, the record does not bear this out. The record will indicate that people are not passing this point in safety and something must be done about it.

The traffic safety system, to be effective, must be based on facts and studies. These facts must cover the entire range of transportation through planning, design, construction, and operation. In Oregon we have this modern status. We have under way continuous planning studies. I think the planning study which is directed to the orderly movement of people and goods is the most productive thing there is in the way of safety systems. It does no good to just go out and continually sweep up the carnage. You must plan to eliminate some of it in the beginning.

In Oregon we have planning surveys in each of the three mandatory standard metropolitan statistical areas. There is a land-use map in

Portland. We have in Salem a survey of the trip desires to the Central Business District. We have Eugene, where the committee making this study has reached a transportation planning system.

We also have a study under way in Albany. This has to do with a bridge location. We have a study in the Roseburg-Winston area. This is one of the smaller areas in the state. We have a study under way in Corvallis. We are convinced by the way, that the most effective planning is in the smaller cities which have not been desecrated by lack of planning or improper planning, or the plans have not been defeated by the leaseholders.

In the field of design and construction, we subscribe to the most modern techniques. We believe in and practice the construction of planned slopes, obstruction setbacks, full width bridges, overhead signs, and the best available alignment, both horizontal and vertical. I am sure these items will be covered later in the conference, so I will not go into the design and construction features. I would say that the trouble arises in funding. Of course, you all know this. The American public has developed an ability to own and operate sophisticated high-powered automobiles, and historically the type of vehicle has outrun the public's willingness to tax themselves to meet the transportation demands.

The engineering techniques are not new. I would like to call your attention to a publication called "Public Roads of the Past," published by the Bureau of Public Roads. In this you find reference to the oldest long-distance highway in the world. This was about 1,755 miles long and spanned the distance between the Persian Gulf and the Mediterranean Sea. One of the kings of the 700 B.C. era left a memorial to this road, inscribed: "The Royal Road, Let No Man Decrease It." One of his last instructions was that any person whose property encroached upon the 78-foot width of the main street along which the Royal Road passed should be put to death by impalation upon a pole erected in front of his house. This was rather a violent means of access control. However, note the width of 78 feet. This was some 2,600 years ago, and the 78-foot width still exceeds many of the present street dedications.

There is another reference in the publication to the famed Via Appia, or the Appian Way, as it is more commonly known, or the "Queen of All." It was completed in the year 244 B.C., almost 2,200 years ago. It has a central lane 15-1/2 feet wide flanked by parallel one-way roads 7-3/4 feet wide. The surface was from 2 to 5 feet deep, and I will bet there

are many people in this room that know of roads or streets in their area that are only 16 feet wide and have about 6 inches of surfacing on them. There is nothing new in the matter of standards, really. Not too long ago the highway fraternity in the United States made a backward step in bridge widths and approved a reduction in widths between curbs on the Interstate System from 30 to 28 feet. Fortunately, this backward step was quickly corrected and we now subscribe to the full width.

So much for the development of the plan. To operate an accident safety program you must have the facts. I think both of the gentlemen who preceded me have highlighted this. We are fortunate in Oregon that we have these facts. Our highway system was established by Act of the Legislature in 1916, setting up the highway system, basically, as we know it today. Each road was given a number. These are not the sign route numbers, but rather the reference number. The next link in the chain came in 1927 when the Department started the mile post system. It is a best guess that these were first installed for traveler information, but they have proven invaluable for record keeping. Our record is based on the highway number and the mile post system.

The next step in the chain was an Act of the Legislature in the early 1930's which required that all accidents involving property damage must be reported, whether single or multiple vehicle. (We now have arrived at a standard report form.) These data were recorded in the Department for many years. It was a part of this Legislative Act that the Department of Motor Vehicles was the keeper of the records, but we have an agreement with them wherein the work is done by the Highway Department. The data are all coded on accident cards.

Beginning in 1961, a study was made of the possibility of mechanizing these records, computerizing them, if you will, to get some information for our own use. We were continually embarrassed by the PTA or the Grange, or somebody writing in and telling us that seven people had been killed at the corner of so-and-so and why didn't we do something about it. We would get the record out and, sure enough, they were right; there had been seven people killed there.

The first step in our program was the cataloging of the accidents by location and into groups. The urban unit which we selected for a rate compilation was two-tenths of a mile. The rural unit was one mile. The next step was the cataloging of these by accident rates.

The "print out" contains certain classified information. The first column has the mile post; the second column, the length of the unit; the third column, the average daily traffic; then we have the number of accidents at intersections; the number of accidents not at intersections; the total accidents. The next column is purely a computer reference. The next two columns indicate the accident rate; then we convert these by rank in the order of their severity by rate. We have two columns, one the statewide rank and one the division rank. The last column is the type of accident--turning, rear end, sideswipe, or whatever it may have been. Our second listing is a listing by rank order, starting with the worst accident rate as ranking number one. We break the list down further then to a division ranking. We send these to each of our five geographical divisions. The next breakdown is a cumulative ranking. This has the length of the section, the year, the average daily traffic for the various years, the intersectional and nonintersectional accidents, the total accidents, the fatalities, the injuries, the rates, and the division priorities. This is our fifth year, and we will soon have a continuing record for five years.

We have one final record which I did not show here, which is a rank order of the cumulative total. We will maintain this cumulative record for five years; beginning with this year, as we add a year we will drop one.

Having thus accumulated this data, action is taken to select and cure trouble spots. This program is accomplished at the division level. We send the division rankings out twice yearly. The division then has the responsibility of selecting five high urban and five high rural accident locations and taking some corrective action. We do not insist they take the top five on each list, but those selected should be somewhere near the top. There are several reasons for this. For instance, the No. 1 rank on the rural listing always comes up Mile 1 on the Timberline Highway. This is the parking lot at Timberline Lodge and I do not know what in heaven's name you can do about it. Some of the others, of course, come up as major reconstruction projects, where you talk about correction by the advancement of $10 million or something like that.

We do not by any manner or means believe that this is the ultimate in traffic records systems. First, statistics are not available on a continuing basis for cross traffic. Our counting program does not cover the tabulating of traffic entering from side streets. You can well realize that in urban areas this would be a monumental task. Secondly,

this system is not quite honest, in that including accidents on the cross streets for a distance of some 50 feet beyond the right-of-way line overbalances the record somewhat. In other words, we are including in this system the accidents which occur within the highway right-of-way and for a distance of 50 feet on either side.

We believe it appropriate to expand the computer program to put certain values on accidents. I might refer to the intersection of Burnside and Union Streets, where about 40,000 cars pass per day, 20,000 in each direction. There is a high number of accidents there, many of them rear end accidents. Quite obviously, somebody changed his mind at the last minute or somebody was following too close. These accidents usually are not severe, but they are accidents; they count in the statistics and they must be reported. But in the analysis we do not give them the weight and consideration that we give multiple rear-end collisions on the freeway, such as we often have in Albany.

The effect of our past efforts in accident prevention indicates we have been driving the accident record down on the highway system in Oregon for the past four years. If we do what we are thinking about and that is take credit for accidents only in the right-of-way, we will probably drive it down some more.

When we have these records in the analysis stage, we determine where we should be working by plotting the accident rate per million miles of vehicle travel against the priority number of our high accident locations. This identifies the high accident cases. Nothing can be done about some of these. In some cases, you will find such things as the Timberline ski parking lot--these are not vicious accidents and injuries are rare. But you get down into the normal range somewhere after the first hundred spots. You would think, of course, that if the top hundred spots were corrected, the problem would soon go away. But there will always be accidents. You always have a before-and-after sort of happenstance, as Mr. Phillips explained.

Another one of our tools is a camera car. We have a photo record of practically the entire highway system. Our camera is mounted with equipment connected to the speedometer and takes a picture every one-hundredth of a mile. These pictures are stored in cabinets that have a film record for the entire highway system. They are used by various departments; for example, in coding an impact location. These pictures are invaluable in determining the impact location and providing other

essential information on the system .

An example of a "before and after" situation is an intersection on the Santiam Highway near Albany----Spi cer Drive. For a year prior to installation of the signals, we had 20 accidents and 12 injuries; for a year after the installation, we had five accidents and two injuries.

Another example is Park Avenue south of Milwaukie. This is on 99E. We installed a left-turn refuge here. The record on this for a year "before" was 37 accidents and 35 injuries; the "after" record was 19 accidents and 12 injuries. However, we did have a fatality in the "after" period.

Another example is an intersection in the city of Salem, facing the Capitol; it is rather an innocent-looking intersection, but the "before" record was 21 accidents and 32 injuries. The "after" record (this was a conversion from a single signal head to double heads with 12-inch reds) is 12 accidents and 4 injuries. Quite an improvement there. We also put the double installation with the 12-inch reds on the cross street.

On the Salem-Willamina Highway just west of the river in Salem there is rather an innocent-looking place, but in a year there were 18 accidents, 8 injuries, and 3 fatalities there. We striped it first; this was not adequate. We put in a simple sign bridge with the "Use Right Lane--35 Mile Speed" and a couple of blinkers up there. The "before" and "after" are 18 accidents before and after; however, the story is told in the injuries. There were 8 injuries in the year before, 2 in the year after; also, three fatalities in the year before, and zero afterward.

The last is an example of bridge widening. This is on the McKenzie Highway--the old Hendricks Bridge. You approached it going east on a rather sharp curve onto a narrow trestle. The "before" and "after" on this was nine accidents, two injuries before; one accident, one injury after.

PANEL DISCUSSION

LOCAL GOVERNMENTS ON THE MOVE

Presiding: Don West

THE NACE COUNTY PUBLIC WORKS DEMONSTRATION PROJECT

by

William D. McIntosh

Almost 2-1/2 years ago, the National Association of County Engineers (NACE) proposed a project to demonstrate the value of our NACE manuals and the advantages of operating a County Public Works Department according to the principles set forth in those manuals. Our association had been working for nearly ten years on a series of manuals with which I hope you gentlemen are at least a little familiar. They covered virtually every phase of county public works management, including such items as public relations, organization, cost records and budgets, personnel, purchasing, and design standards. Publication of our manuals was virtually completed, and we felt the next logical step was to implement them in an effective manner. County demonstration projects seemed the only logical answer.

The idea of county demonstration projects was to show the value of proper public works management by actually improving the management methods in a representative sample of counties throughout the United States. Inasmuch as a project of this kind would take money to implement, we sought a federal grant. After much investigation, it was decided the best bet would be to kill two birds with one stone and to work toward economic development as well as public works management. A project proposal was therefore filed with the Economic Development Agency in March of 1966. After discussions with that office, the proposal was redrawn and scaled down in January of 1967 to meet the wishes of the EDA. A contract was drawn up with the EDA and was approved by the NACE Board of Directors on May 17, 1967. The responsibility for administration of the contract was assigned to the NACE Research Committee.

The Research Committee contracted with John B. Benson and Associates to conduct the pilot demonstrations and investigations. Some of you present may remember John Benson as a former county engineer from Florida, and the first president of the National Association of County Engineers.

Thirteen states were surveyed initially to determine responsive attitude toward county demonstration projects. Fifty to sixty counties were considered within eight states, and finally six counties in three states formally requested participation in the program. Four of those counties were selected by the Research Committee.

The Economic Development Agency asked for further investigation after which the following four counties were named to participate in the program: Wayne County, New York; Orleans County, New York; Utah County, Utah; and LeFlore County, Mississippi. This selection was harder than you would think, as the counties first had to be eligible by EDA standards (be underdeveloped and/or economically depressed); in addition, the counties had to agree to participate in the program. The four counties selected have all demonstrated enthusiasm for the objectives of the program and have formally indicated their willingness to cooperate. Officials of the three states involved also have agreed to assist NACE by whatever means are at their disposal.

At the local level the program will work something like this:

1. NACE representatives, people experienced in local government, will study present practices, relationships and responsibilities of local officials in the demonstration counties (both elected and appointed) who are concerned with public works.

2. An analysis of operation will be made in relation to local objectives and potentials, with regard to long-range planning.

3. Recommendations will be made to the Boards of Supervisors (or County Commissioners) of areas of practices that may be improved, along with a description of actions necessary to accomplish these improvements.

4. Based upon those recommended items adopted by the Supervisors, assistance will be available to the county through NACE in implementing any changes or improvements.

5. Periodic evaluations will be made to determine the effectiveness of the recommendations and to work toward total success of the project in each county.

This could well be a very important first step in demonstrating to counties throughout America that there is a better way to operate their public works departments, and that county public works management properly should be taken out of politics and handled in a professional manner.

The National Association of County Engineers believes that the eyes of the nation will be focused on these four counties because local government must keep pace with present-day demands or it will be supplanted by higher level, more powerful but less responsive, types of government. Only by acquiring technical proficiency at the local level, can counties provide the multitudinous services now demanded by our present culture.

In closing, I would like to take this opportunity to extend you an invitation to attend the Eighth Annual Management Research Conference sponsored by the National Association of County Engineers. This year's conference will be held in Des Moines, Iowa, April 3-5 and promises to be a good one.

Headquarters will be at the Savery Hotel. We expect to have several nationally known speakers, attendance prizes, lots of hospitality, entertainment for the ladies, and interesting program subjects. The conference theme is "The County's Role In Public Works."

WASHINGTON STATE'S COUNTY ROAD ADMINISTRATION BOARD

by

Ernest Geissler

When your conference chairman contacted me several months ago and invited me to participate in this year's Northwest Roads and Streets Conference, I was quick to accept the invitation without really thinking too much about the subject matter of my assignment.

It would appear to be easy to address a gathering such as this on the subject of my own particular work. However, when I finally collected my thoughts I discovered that it was perhaps not quite so easy. I found that discussing the background and philosophy, the achievements, and the possible future plans of the County Road Administration Board was somewhat more difficult than discussing, for instance, the preparation and execution of some particular plan of construction or maintenance.

The main difference, of course, is that most engineers in their daily work deal with tangible things which can be seen and touched and measured. The County Road Administration Board deals essentially in problems of management and administration set in a framework of politics where the quantities are not as precise, the quality control not as highly developed, and the standards not as uniform as is normally the case in traditional construction or maintenance work.

In order to give you a little better perspective, it would probably be helpful to look at some of the factors of county road department operation in the State of Washington which preceded the formation of this Board. As far as I have been able to determine, the road departments in the State of Washington have for many years been considered by the experts as among the best.

I think it is significant to note that Washington was one of the first states to have a County Engineers' Association; it originated in 1906. Looking back in the old records, we find that in the early '20s the membership of the County Engineers' Association started lobbying for legislation which would require a licensed engineer in each county of

the state. It took years of hard work and debate, but finally in 1937 the Legislature passed a law requiring every Board of County Commissioners in the State of Washington to employ a licensed professional engineer to be responsible for the operation of the county road department.

As a direct result of a 1948 Needs Study commissioned by the then new Joint Committee on Highways, the County Commissioners Association sponsored and supported an act in the 1949 Legislature to improve the efficiency and effectiveness of county road departments.

In 1962 the Automotive Safety Foundation (ASF) conducted a study to show how the available funds could best be spent to meet the needs of the state, county, and city systems.

The major recommendation of this study was that all highway, road, and street construction in the State of Washington should be done on the basis of priority programming; i.e. on the basis of a system which would in theory, at least, insure that the most critical needs be met first. As a result of this particular study, the next Legislature required that the Department of Highways develop a priority programming system for the improvement of state highways.

As far as counties were concerned, this ASF report recommended that the Legislature create a board of "county and state officials to supervise actions essential to universally effective county road programming." In the ASF concept, this was to be essentially a technical and professional board with the Assistant Director of Highways for State Aid designated as secretary and with a majority of licensed professional county engineers plus a number of county commissioners as members.

It was further recommended that any staff services be supplied by the State Highway Commission through the State Aid Division. The main functions of this board were to establish general guidelines for county programming, and to review and approve individual county programs.

While there appeared to be general agreement on the part of county commissioners and engineers on the broad objective of concentrating the bulk of available construction funds on the most important arterials, there was, at the same time, widespread and strenuous opposition to the concept of this particular board because of a fear that it would be dominated by State Highway Department personnel, either directly or indirectly.

In a sense, this attitude is strange; on the other hand, it is not too difficult to understand. For years there has been a close and generally good relationship in the State of Washington between the individual counties and the State Highway Department. I think this relationship is probably as good or better than similar relationships in most other states. On the other hand, there is always the nagging fear that 'big brother' will become so helpful that he will eventually swallow us.

A bill to create this program board was drafted for the 1963 session of the Legislature, but as a result of strong county opposition, it never got out of committee.

Apparently convinced, however, that some improvements were necessary in county road department administration, the Joint Committee did not let the matter die. In 1964, it commissioned a study by Professor Riedesel which was intended essentially to review the basic recommendations of the ASF report and make alternate recommendations which might be more palatable to the Washington counties. Riedesel took a somewhat different approach than ASF and requested that the Washington State Association of County Commissioners appoint a committee of commissioners and engineers to act as an advisory body to him in the making of his report.

The result was rather interesting and perhaps unique. Riedesel changed the emphasis somewhat and apparently decided that good administration must precede good programming; therefore, he changed the name of this new body to County Road Administration Board. This, of course, was a big step in the right direction because at least now we had initials that spelled something. C-R-A-B is certainly much more meaningful than C-R-P-B. Riedesel recommended a County Road Administration Engineer to serve in the office of the Assistant Director of Highways for State Aid and a nine-man board composed of five county engineers and four county commissioners, with the county road administration engineer to serve as secretary.

However, as a result of continued opposition on the part of county people, voiced through his advisory committee of commissioners and engineers, Riedesel inserted an alternate recommendation into his report. He suggested that the Washington State Association of County Commissioners and Engineers voluntarily establish this County Road Administration Board within the framework of their own organization. Beyond that, the basic purpose was still the same. That was to promote improved county road administration to assure the best use of county

road funds, which would in turn reflect in better programming.

There were many lengthy and sometimes heated discussions in our own district meetings and at our annual convention about the merits of this new proposal. Finally, it became a challenge that had to be met. The county commissioners and engineers were faced with the alternative of having some kind of a board, roughly at least, within the framework of the State Highway Department, or with having a board which they might consider their own. Once it was put in that kind of perspective, of course, the choice was not too difficult.

With all due respect to my many friends in the Highway Department, and without in any way intending to be derogatory or facetious, I think it is a simple matter of fact that the general feeling on the part of county commissioners and engineers was, and still is, that we can solve our own problems and do not always need to be led by the hand.

As it turned out, the end result was something about half way between Riedesel's two recommendations. The County Commissioners Association did not voluntarily establish a county road administration board, but it did support legislation creating such a board. The only difference in the composition of the Board in practice, as compared with the original recommendation, is that the membership is now six commissioners and three engineers, where in its original concept the engineers outnumbered the commissioners by five to four.

It is interesting to note that while the Board is composed of county commissioners and county engineers and is appointed by the Executive Committee of the Commissioners Association, the Attorney General ruled that the Board is legally a state agency. Therefore, the County Road Administration Engineer is a state agency head. This caused some concern initially among county people, especially among our Board members, but I am convinced now in my own mind that this arrangement has actually worked in our favor.

As it turns out, the present County Road Administration Board has considerably more stature and importance than the proposed road program board originally suggested by ASF.

This is true for a number of reasons. The fact that it is composed of a majority of commissioners rather than engineers takes it out of the realm of being merely a technical advisory board. In fact, it puts six

of our county commissioners in the rather challenging position of having power to set road department policy applicable to all counties. The Board is charged with developing and adopting so-called Standards of Good Practice for the operation of county road departments. When you stop to think about it, this is really very broad authority and gives the Board the right (in fact, the obligation) to involve itself in the entire spectrum of county road department activities.

The Board also is charged with ascertaining the level of compliance by all counties with established Standards of Good Practice and with all other statutory requirements applicable to county road departments.

The Board has a potentially powerful weapon available, but to date unused. It may withhold the distribution of gas tax funds to any county not complying with established Standards of Good Practice or with existing statutory requirements. So in one rather short, simple statute the Legislature created a new agency--a new Board with rather broad power and authority. I recall that some of our county people were quite concerned about the implications of granting so much power to this new Board and about the possibility that this Board might ride roughshod.

On the other hand, we had the cynics who said, "If this is controlled by county people for the benefit of county people, it can't help but be anything but a whitewash, a waste of time. We need something tougher." In actual practice, I think we have found that neither of these predictions have been borne out by the Board in the first two and one-half years of its existence.

Under the gentle but firm leadership of a veteran county commissioner, Harry Sprinker of Pierce County, the Board has set a middle course. It has moved slowly and cautiously, but I think it has laid some extremely valuable groundwork for perhaps bigger things to come. In the very beginning, the Board decided it would be best to start by taking a rather careful look at existing statutory requirements. Analysis of our Washington statutes revealed they were generally adequate to assure a high level of performance in the operation of our county road departments.

Most of the basic ingredients needed for good administration have already been enacted into law. Then the Board looked through the eyes of its engineer at the performance of various counties in relation to statutory requirements. The basic conclusion was that we did not need

lots of new laws and regulations, but rather that we needed some clarification and/or amplification of existing laws. We also needed a means to call attention to lack of compliance with existing laws without officially pointing any finger of guilt.

The contact between the Board and the various counties has been mostly through me, the engineer. This has been very helpful to me and to the Board members, but the job has not been completed in the time originally anticipated.

The method of approach has been for me to travel to each of the counties for a personal look at the road department operation. The time required was from one and one-half to three days, depending on the size of the county and the complexity of its operations. The county visit includes at least a day, sometimes a day and a half, of actually driving as much of the county road system as practicable and taking a quick look at various county maintenance and shop facilities and at county equipment on the job.

The remainder of the time is spent in the office with the engineer discussing the entire operation of the department, taking a look at the financial condition of the road fund and equipment rental fund, the table of organization, and such things as programming, record keeping, and personnel policies, to name only a few. The quality of the information gathered in this type of "quickie" review depends largely upon the quality of communication between the county engineer and myself. Fortunately, having been a county engineer myself for five years, I have gotten to know every one of our 39 county engineers in Washington personally and feel that I can discuss even sticky matters with them in complete honesty.

In each county I also make an attempt to have a meeting with the Board of County Commissioners at some time during my visit. Although this has not been possible in every county in all cases it was certainly worthwhile. At the conclusion of each such visit, I have written a detailed report of six to ten pages of my observations and opinions. This has been addressed to the Board of County Commissioners in that county and each member of CRAB receives a copy for his own information. It is from these reports that my Board members have gained most of their knowledge of operations in counties other than their own. In some cases the reports have been highly complimentary. In other cases, just the opposite. I am pleased that in all cases they appear to have been well received. I think also that they have been instrumental in providing the

catalyst needed to convert some operations from questionable or limited compliance to full compliance with statutory requirements.

The Board's primary responsibility is to encourage and achieve the best possible administration of county road departments. Upon analyzing this problem, the Board agreed that certain basic foundations were required for good administration. The first and most obvious, of course, was the administrator himself. So we elaborated on the already existing statutory requirement that every county have a professional engineer as its county road engineer.

The Board developed a Standard of Good Practice which recognized there would be occasional vacancies in this position and provided for interim arrangements under which a county road department could continue to operate. In essence, this policy permits a Board of County Commissioners to appoint an acting county engineer for a six-month period during which they can interview and eventually employ a new county engineer. In a proven hardship case, the Board can extend this six-month period, but if it becomes obvious that a local Board of County Commissioners is not really trying to find an engineer replacement, CRAB has the authority to require a shutdown of all construction work and also a withholding of gas tax fund distribution to that particular county.

The next foundation block which was studied was in the area of programming and again really involved nothing more than the refinement of already existing statutory requirements. For almost 20 years, our laws have required that each county have an annual program. As a matter of fact, some counties had none and other counties adopted programs which literally were not worth the paper they were written on. Under the policy adopted by the Board, each county is required to submit its adopted program to CRAB along with its adopted budget.

Our programming policy requires that the annual program list each project by name, show its classification as either arterial or access, indicate whether it is to be done by contract or by day labor, and give a brief description of the work. It also requires that there be reasonably close correlation between the amount shown in the construction budget and the estimated total amount of the projects shown in the construction program. In the office, I compare the adopted program with the adopted budget and note whether or not it complies with the various elements of the policy. With a brief letter, I then acknowledge receipt of budget and program and make any comments or criticisms which I feel might be helpful.

Prior to the adoption of this policy there was a certain amount of apprehension and/or opposition on the part of some of our county engineers because of their fear of Olympia control over programming. Having now received and reviewed the budgets and programs of all of the counties for 1968, I am much encouraged by the results. I am convinced that by and large our county engineers are doing the best they can to comply with this new CRAB policy. This has been accomplished mainly through logic and persuasion rather than by resort to legalistic threats.

After the end of each program year the county will be required to submit another copy of its program, showing actually what work was done. By analyzing these "as built" programs, I hope to be able to develop some measure of program quality. In other words, all things being equal, a county which accomplished 85% of its programmed work would get a higher rating than one which accomplished only 50%. The details of this type of evaluation have not yet been worked out, and frankly it is still too early to tell how much improvement in programming we can accomplish in this manner. I have high hopes, however, that this persuasive approach can and will be most effective.

Having now dealt with the administrator of the department and with the basic program under which he must operate, it was necessary to develop yet another foundation stone. A uniform budget, accounting, and reporting system became the subject of CRAB's third Standard of Good Practice. Our county road departments have operated in accordance with a prescribed uniform accounting system for quite a few years. Unfortunately, as time went by there was a tendency to drift away from uniformity. In addition, county road departments found themselves engaged in a number of activities which did not really fit the accounting system because they did not exist at the time the system was first developed.

There also existed some confusion and debate about reports on county road activities prepared by the State Highway Department and by the Division of Municipal Corporations. These appeared to be in conflict at times, and one of the results was an increasing amount of static in the Legislature about the alleged poor quality of county road department operation generally. My conviction has been and still is that, in general, our county road department operations are effective, efficient, responsible, and respectable. The problem is to upgrade those operations which are not effective and to substantiate and at times defend the great majority which are. A uniform accounting system can be a big help in this direction.

My Board directed me to proceed with a revision of the existing manual which had been developed some fifteen or sixteen years ago. This was obviously a job I could not undertake alone. Working with a special committee of county engineers and top people in the Division of Municipal Corporations and Highway Department, I had a good cross section of experience and ability.

Our basic objective was to coordinate the annual budget, the system of accounts, and a new annual report, assuring that all county road departments and state agencies concerned with county road departments use one set of terminology and definitions. This took lots of meetings, lots of persuasion, occasional arm-twisting, and a certain amount of compromise, but the job was done. The Division of Municipal Corporations prescribed use of the new manual; CRAB backed up the manual by adopting it as a Standard of Good Practice.

The real significance here is not so much that we now have a better record-keeping system, but that it was developed by and with the county engineers themselves. Even more significant is the fact that through CRAB we were able to involve the Chief County Examiner in this work. As a result, we now have a much better understanding of each other's problems and have developed a much improved relationship between the county road departments and the Division of Municipal Corporations.

The activities described so far are rather strictly in compliance with the statutory requirements. A second type of activity has evolved since the 1967 Legislature. Since my Board is composed entirely of county people who are all members of either the County Commissioners or County Engineers Association, the County Road Administration Board is obviously very closely and inseparably related to the Commissioners and Engineers Associations. With county government becoming increasingly complex in recent years, the Executive Secretary of the Commissioners Association was finding it increasingly difficult to do justice to county road department problems in addition to all of the other activities of county government. It was no accident that the County Commissioners Association provided office space for CRAB in the same suite of offices in Olympia. As a result, the Association's Executive Secretary and I work very closely together; in a sense, I have become his associate in road department matters.

During the last session of the Legislature I made it my business to attend every hearing of the House Transportation Committee and Senate

Highways Committee when bills were being discussed that might have any effect on county road departments in any way, shape, or form. This was a most interesting experience and I gained considerable insight into the legislative process. At the same time I became acquainted with a considerable number of legislators, especially those interested and involved in developing highway, road, and street legislation. This type of activity during the session led most naturally to my continued involvement with the Joint Committee on Highways and its various subcommittees. This has proven to be rather time-consuming, but the time has been well spent since it has given the county road departments, through CRAB, a more direct line of communication to the Legislature than has ever existed in the past.

About a year ago, the By-Laws of the County Engineers' Association were changed to provide that the county road administration engineer be an ex-officio member of their Executive Committee. In this capacity I have attempted to work very closely with the president of the Engineers Association, especially in coordinating various special committee meetings and district meetings. It has long been my belief that a strong County Engineers' Association is absolutely essential before CRAB can be truly effective. Going one step further, I have also felt that a strong and effective association would be of real benefit to the parent County Commissioners' Association. Many of my activities, therefore, have been specifically aimed in the direction of improving the image and effectiveness of the County Engineers' Association.

If we add it all up, what do we have? What is the County Road Administration Board? It is an interesting and unprecedented experiment in local government. It is perhaps a small roadblock in the path of our drift toward centralization. It is, in a sense, a compromise between the old traditional conservative attitude that "what we do in our county is our business," and the more modern liberal attitude: "Since you are spending state-collected taxes on your roads, the state will tell you where and how you can spend those taxes." It is a specially appointed representative group of county commissioners and engineers taking a detailed look at our road departments, making an honest evaluation of what they see, and developing methods and procedures to upgrade and improve road department administration.

What is the County Road Administration Engineer? He must be a licensed professional engineer. He must have had experience as a Washinton County Engineer. He must establish a close relationship with

117 county commissioners, 39 engineers and who knows how many legislators, department heads, and key staff people in Olympia, so he obviously must be somewhat of a politician. He is frequently in the position of an intermediary, so he must be a good public relations man. He must be well versed in county law; he must have a working knowledge of budgeting and accounting procedures; he must be at times a troubleshooter, an interpreter, an organizer, a good listener. After a while he should become almost an expert on county road matters.

What do I think of my job? I think it's great. I have a good Board with excellent leadership; I have almost complete freedom of movement in implementing the Board's policies; I have a good working relationship with lots of wonderful people.

The County Road Administration Board has been good for me; our intent has been to make it good for all of our county road departments. We think that we have met with some measures of success; we hope that others think so, too.

PUBLIC RELATIONS FOR NEW HIGHWAY CONSTRUCTION

by

Mel Gardner

This subject is discussed today with full realization that much of the freeway construction in the Northwest states is completed. However, all communities have continual work before them in route changes and construction of primary and secondary highways, county roads, and city streets. In addition, some communities, like Vancouver at the present time, are upgrading the freeway system with additional lanes and new or revised interchanges. Therefore you are constantly faced with interagency relations on accomplishing these projects. But, primarily, you have the responsibility to your community and its citizens to keep them completely informed on the basic reasons of the project, the various alternatives possible, the recommendations of the local study, and the projected benefits of the project.

My remarks today, therefore, will be general in nature but will draw on experiences leading up to and including the public hearing for the Pendleton, Oregon, Bypass Section of Interstate 80N. A few items about the project will provide some background. The project included relocating seven miles of highway and constructing four new interchanges. The hearing lasted for only 1 hour and 20 minutes. There were no objections to the project, and well-documented statements in support of the project were received from the following: Pendleton City Council; Pendleton Planning Commission; Citizens Committee on Highway 30 Relocation; Umatilla County Court; Pendleton School District 16-R; Pendleton Junior Chamber of Commerce; Pendleton Rotary Club; Pendleton Kiwanis Club; Pendleton Lions Club; Pendleton Lions Auxiliary; Exchange Club of Pendleton; Pendleton Motor Court Association; Umatilla County Gasoline Dealers Association; and Main Street Cowboys of Pendleton. These are listed to indicate the cooperation of the community to achieve the goals it felt should be provided in the project. The community felt its position was reasonable.

With this brief history, the balance of the presentation will discuss city - highway department relations on highway planning to reach mutual decisions on community-affected highway projects. We hope to show the

value of local planning to assist the highway department in reaching a decision in the best interests of the community, and the manner in which city officials can cooperate with the highway department in working out matters related to the planning of highway location and facilities.

Keep in mind that the term "public relations" not only applies to the two-way communication between the community's leadership and the citizens but also to the communication of the interagency personnel involved in the long-term negotiations of the project.

The highway department is willing and even anxious to cooperate with local desires when the voice of local interest is clear and articulate. Therefore, the local government has responsibility to:

1. Have a clear understanding of the nature of the problem and limitation within which the state agency must operate.

2. Have a clear understanding of the local long-range interests of the community.

3. Have a clear understanding of the citizen's hopes and aspirations for the community, as well as their immediate concerns.

4. Accommodate the differences in the various local interests and develop a policy reflecting the most reasonable common views in terms of long-range implications for the community.

5. Translate the local policy into terms applicable to the state agency involved and into positive suggestions within the limitations of the agency.

6. Articulate the policy and its meaning and mobilize local groups, as well as individuals, to express this interest to the state agency.

Some examples of the application of these responsibilities and how they may be accomplished are as follows:

1. Understanding the state agency.
   City officials must meet with highway personnel and invite representatives of the department to discuss their problems with the local civic clubs and other interested groups at public

meetings. Close cooperation must be maintained between the local engineering and planning staffs.

2. Local long-range interests.
   The City Planning Commission and the Chamber of Commerce Citizens Committee must evaluate the various proposals in regard to their basic development policies and economic influence on the community.

3. Citizen understanding.
   A local citizen study group appointed by the mayor can work in conjunction with Chamber of Commerce Road Committee. In addition, the County Court can be represented in the negotiations between the local agencies and the state highway department. The Chamber of Commerce can sponsor a "Town Hall" meeting.

4. Unified local policy.
   The joint Citizens Committee, the Planning Commission, City Council, and the aforementioned local agencies and civic groups can meet with the highway department personnel, jointly and separately, to evaluate the various proposals and suggestions made by the diverse groups.

5. Local policy presented to state agency.
   Following the unified proposals adopted by the local groups, as just mentioned, these proposals should be submitted to the highway department. This responsibility is a continuing process, as negotiations for the final relocation are molded to fit the local demands and meet the state policies and limitations.

6. Community support of local policy.
   Through efforts of the Chamber of Commerce and City Council, a united front is presented at the Highway Department public hearing. Various groups in the community can provide assistance by developing and preparing statements to be made before the department.

Jointly, the city and the state agency then have the responsibility to come to an agreement that will most closely resemble the satisfaction of the accumulated local interest and the needs and limitations of the agency. Once such an agreement is reached, they share the responsibility of

standing united in presentation of the plan to the Bureau of Public Roads.

Of course, inherent in and basic to this approach is the development and maintenance of a working relationship founded on mutual concern, respect, and confidence. Vital to the development of such a working relationship is:

1. Constant and clear communication between the city and the highway department.

2. The position of the city must be based on facts and upon a reasonable interpretation of those facts.

3. The city must always be willing to persevere in genuine cooperation.

4. The city must be willing to be flexible in its approach to the total problem.

5. The city must respect the confidence of the department.

6. The city must be firm in its commitment, to the policy formulated at the local level, and must expect the highway department to be equally firm in its commitment to the overall interests of the state and to the purposes and intent of the legislation under which it operates.

Up to this point the discussion has been primarily with the planning and negotiating stages of the project. However, with some slight variation in the procedures, the same steps can be applicable during the construction phase. This is especially true in keeping the adjoining residents of a construction project alerted as to what is to happen next and how it will affect them.

In summary a few specifics should be emphasized.

1. The city, on a united front, should establish its practical goals and communicate them to the state. It must continue to provide a united recommendation and stand on each phase of the project. It must be prepared to make compromises, but should be united each time approval is sought.

2. The state should study the various options possible on the project, and communicate these to the city along with the clearly stated limitations within which the state must operate.

3. The city and state personnel must maintain the best of communications during the long-term negotiations.

4. City Hall and the Chamber of Commerce must have a wide open door to each other to obtain a united community front.

5. The city must establish and maintain confidence and the best of communications with the news media who in turn can assist in advising the public of the various phases of the project. This is especially true for the benefit of the property owners and tenants that will be displaced.

In closing, I would like to quote from two paragraphs of the official hearing on the Pendleton project. It would seem that these refer to goals that we, as the planners and implementers, should constantly be challenged to meet:

From Oregon State Highway Commissioner K. N. Fridley's remarks: "I would like to make it a part of the record that it is to the credit of this community, and also I will say this to the employees of the State of Oregon that a harmony of interest and cooperation has developed between the Highway Department and the local city governmental officials of this area, and I am proud to say that it is without parallel in any other section of the state I must take this opportunity to compliment the local governmental officials as well as the employees of the State Highway Department."

And from Mayor Paul Thalhofer's comments: "In one respect, we are sorry to see this hearing come to pass. During the process of develop ing our studies concerning this facility, we have also developed a fine work ing relationship with the Oregon State Highway Department. We trust that this splendid cooperation, and this honest appreciation of our local problem will not end with the conclusion of this hearing. The City Council has asked me to tell you that we are very grateful for the gracious cooperation and helpful attitude displayed by the personnel of the highway department."

FINANCING ROAD AND HIGHWAY CONSTRUCTION IN COUNTY GOVERNMENT

by

Clayton Nyberg

The transition from a rural road system to a combination of urban and rural roads imposes basic changes on the administration of a road program for a county. In order to keep pace with roads without finding new revenue sources one important device is to establish policies which will permit the use of existing road revenues in the broadest possible manner. For example, if the construction of subdivision roads is to be the responsibility of the adjacent property owner, then the existing resources derived from the road user generally can be used in the construction of other roads which serve the entire road-using public. If special revenues become available, such as a special tax levy, then the income from that special source can be assigned to the improvement of major arterials which are of general benefit and of higher importance on the scale of traffic measurement than other roads are.

The first responsibility of a county, traditionally, was the construction and maintenance of farm-to-market roads and the maintenance of dedicated roads which were received into the county system. As road needs increase, in order to facilitate the circulation and movement of people from and to work between commercial and industrial areas, it is essential to have firm advanced plans that can be fit into the road scheme as urban needs develop. The opposite should not take place; that is, the road system should not be designed to fit development that has already occurred.

One of the important virtues of good planning is the fact that land developers will work closely with the county to improve the road system if they know that road plans exist. In Washington County we have had industrial expansion finance both the cost of right-of-way and local matching requirements in order to get a road improved on a federal aid secondary route (FAS). The route and the industrial zone, of course, both conform with previously adopted master plans. We also have had other major FAS routes constructed after adjacent owners dedicated rights-of-way. They can do this knowing that Washington County is following the

course of planning development in the interest of all the road users.

Where county road dollars are invested in industrial tract development planned to fit overall community needs, the development of just one road will pay for itself a number of times from the increased tax base which occurs from the industrial expansion. This fact justifies not only the basic planning in the first instance but also the attention required on the part of elected officials to work with property owners to achieve compliance with that planning.

If available road dollars for the construction are to be expended prudently, one frequently used method is to classify roads for construction purposes. The roads designated as FAS routes or major arterials and farm-to-market routes present relatively little difficulty. In these cases all that is necessary is to maintain current data showing the average daily traffic count, road surface conditions, and the relative density of property served. It is with subdivision roads that counties face the difficult problem, not only in road classification but in obtaining sufficient funds to meet the needs of the property being served.

Densely populated urban areas require good roads. However, meeting accepted Class A construction standards--full width paving with curb and gutter--presents a real difficulty for the rural-estate type of subdivision. Lots with one, two, or more acres in size result in tracts with less dense construction and lighter traffic demands, thus not warranting the higher standard of construction required for the typical subdivision area. Yet, if a lesser standard of road construction is allowed and accepted into the county road system, a major problem presents itself when those roads must be improved to a higher standard. It is unfair to expect all road users throughout the county to finance the upgrading of secondary roads to the higher standard which is installed by adjacent property owners in the typical subdivision area. Clearly, the cost of constructing secondary roads must be borne by the abutting properties.

State legislation is needed to establish a means for counties to accept roads which are not improved to the highest urban standard and then still allow for the abutting property owners to finance the cost of constructing those roads to a higher standard later. Improvement to the higher standard should be postponed until the need exists. This also would allow the county to provide the cost of maintenance to these lesser standard roads and reduce, or at least defer, the deterioration which would occur when property owners seek to develop a road to less than

county standard and keep it in private ownership.

In California counties, a deferred cost to property owners for bringing a road to a higher standard is achieved by having the county enter into an agreement with the property owner at the time the development occurs. Under the terms of these agreements, the property owner pledges to pay the cost for future road improvement on a front foot cost where the need for establishing a higher standard of roadway is determined by the Board of County Commissioners. This typically occurs when a certain level of density per mile is achieved or when a fixed average daily traffic count is achieved. The road improvements are typically installed by an improvement district. The signed agreements recorded and on file with the county represent petitioners who wish to form such improvement districts and have waived their right of remonstrance. This agreement passes with the property. Oregon law does not permit this type of deferred liability to be entered into under a contractual agreement with the property owner. Legislation authorizing it or similar arrangements should be considered.

Whenever road cost is met by adjoining properties, the general road-user funds can be concentrated on the major arterials and trafficways for general overall benefit.

Another alternative for stretching existing road funds is for the county to encourage the formation of improvement districts to finance road systems. Under this arrangement, the practice followed by many cities of entering with the property owners on a cooperative basis can be followed. Under this arrangement the county pays for the center section of the traveled way, while the adjoining property owners pay for the cost of curb, sidewalk, gutter, and 10 feet of pavement.

The role of zoning to protect road money cannot be emphasized too strongly. Properly developed circulation plans as an instrument of the overall plan and development, when enforced with properly administered zoning regulations, can do much to protect and assure that roads will be built where the use exists and where the county can be justified to include that road as part of the overall road network of the county.

PANEL DISCUSSION

52,500 TRAFFIC FATALITIES - WHY?

Presiding: Edward Branchfield

52,500 TRAFFIC FATALITIES - WHY? (DRIVER)

by

Calvin F. Larson

Fifty-two thousand, five hundred traffic fatalities--why?

If I had a pat answer to that question, my place of employment, instead of being at 17th and Pennsylvania in Washington, D.C., would be one block down the street at 16th and Pennsylvania, where it is reported a former Texan has numerous equally perplexing questions for which he seeks answers.

When I first learned the assigned topic, I was somewhat overwhelmed. I would have a quarter of an hour or so to explain a national phenomenon which has been baffling some of the best minds in the country.

The time limitation did not bother me. Except possibly for a State of the Union message, 20 minutes is sufficiently long for any speaker to cover what he has to say.

The problem was filling the allotted time with pertinent comments. But even this would not have been too difficult except for an additional instruction given me by your conference chairman.

Address your remarks, he said, to the professionals. They are the ones who will be attending the conference. Every person in your audience, he explained, will be a traffic engineer, a highway planner, a design or construction engineer, a motor vehicle official, a traffic enforcement officer, a safety education specialist, or some other professionally trained individual who is thoroughly steeped in the subject of accident prevention.

What the conference chairman was really telling me was that my audience would have heard nearly everything known about the causes of accidents.

At first, the thought of speaking to an audience of experts disturbed me. But after some cogitation, I realized that, in a sense, this audience

would be no different from any other, including, say, the Corvallis Friday Afternoon Discussion Club. For, on the subject of traffic safety everyone considers himself an expert.

Even before receiving the invitation to this conference, I bemoaned the fact that I had selected a profession in which almost no one is recognized as an expert. I had thought that if I were to do it over again, I would go into some esoteric field such as astro-physics, where I would have to be considered an expert if for no other reason than that no one--other than a few other astro-physicists--would be able to understand what I was talking about.

So, with such thoughts running through my mind, I mulled over the assigned question for this panel discussion: Why--with highways so vastly improved--why are we killing fifty-two thousand persons a year?

Why--with the safest cars Detroit has ever produced--why does the traffic accident toll continue to creep upwards year after year?

Why--with almost half of our high school students receiving formal driver education--why is the driving record of motorists so disappointingly poor?

And why--with traffic control equipment and techniques not even known a decade or two ago--why has the motor vehicle accident problem grown to such proportions that it has become almost a national obsession?

I wondered--if I were a real expert (a scientist possibly, with three Ph.D. degrees), how would I answer these questions?

How, for example, might Newton-if he were alive today-have coped with this issue?

Or, to be more current, how would a genius like Einstein have gone about solving this problem?

Then, suddenly, the thought occurred to me: Perhaps Einstein did give us the solution. All we now have to do is apply it.

So, to make a long story short, that is why we are about to discuss "The Theory of Relativity."

Consider a chart with colored bars on it. First, an explanation of the symbols: The red color at the bottom of the picture denotes danger ...accidents. We shall refer to the top of the red color block as being the "hazard level." Determining this level are all the nondriver factors that contribute to accidents--highway design, roadside hazards, bad weather, vehicle defects, and a host of other things. If the red "hazard level" is low in the picture, there is a lesser likelihood of being involved in an accident. But if the red "hazard level" is high, the highway at that specific time and place is dangerous.

The green color at the top of the picture represents the caliber of driving. We shall refer to the bottom of the green color block as being the "driving level." Going into the determination of that level are driving experience, cautiousness, attentiveness, skill, knowledge of traffic rules, and all of the other factors by which we judge whether an individual is a "good" or a "bad" driver.

Now, when we put our two color blocks on the same chart we show a relationship between the red "hazard level" and the green "driving level." The "driving level" must always be higher than the "hazard level" or an accident results.

The space between the two levels shall be shown in yellow, for this is a caution zone. We are going to refer to that area as the "risk gap." The width of this gap, as we shall explain, is all important and has a far greater bearing on accidents than does either the "hazard level" or the "driving level."

Some drivers maintain, or at least try to maintain, a wide risk gap. This kind of driver sticks pretty closely to the posted speed limit. He keeps a greater following distance between his car and the one ahead. He keeps his eye on the road instead of turning frequently to look at the passenger with whom he is conversing. He even buckles his seat belt.

Another type of driver, on the other hand, is willing to take risks. He operates his car as close to the "hazard level" as he dares. Usually he is a pretty skillful driver. If he weren't, he wouldn't last very long on the highway.

As the motorist drives along, the "hazard level" is continuously moving up and down. However, for any given highway the "hazard level" remains relatively constant. Just as the "hazard level" fluctuates, so

also does the "driving level," as the motorist spots potential hazards and momentarily becomes more attentive.

We tend to view the "accident level" and the "driving level" as being measurable on some sort of absolute rule. We feel that if we can somehow lower the "hazard level" -- by building a safer highway, by buying a safer car, or perhaps by improving traffic control -- our "risk gap" would be increased correspondingly and our chances of being involved in an accident reduced. Therein lies the fallacy of our entire traffic safety program. We keep trying to measure "safety" in terms of some sort of absolute standard. We say "cars are safer than ever," meaning, of course, that they are mechanically superior to past models and are equipped with numerous safety devices. We say that the freeway is so much safer than the two-lane road. We say that traffic engineering has "greatly increased safety" with modern signalization, better street lighting, and improved signing. We say that drivers are "more safe" because of having taken driver education or because of having passed an examination for a driver's license.

Everything we have said is true -- in a sense -- and would be meaningful if we really could measure "safety" in terms of some sort of absolute standard. But that is not the situation. Everything is relative. Any "absolute" improvement -- in the highway, in the automobile, in traffic control -- must be related to the response on the part of THE DRIVER.

How THE DRIVER responds to a new highway facility determines what, if any, "safety" improvement has been achieved.

Take, for example, the replacement of a high-accident grade crossing with a full interchange. The "hazard level" drops, the "risk gap" widens, and theoretically, at least, the chances of having an accident at that location are reduced considerably. But, as engineers are repeatedly discovering, practice does not necessarily follow theory. The new facility has eliminated the bad right-angle accidents. However, those accidents now have been replaced by rear-enders and sideswipes. And the single accident location of yore -- mid-intersection -- has been replaced by eight accident locations -- at the foot of each of the ramps.

Recognizing the inherent safety advantages in a grade separation, THE DRIVER adjusts his driving accordingly, again leaving just the size "risk gap" he feels necessary. He no longer slows down going through that

area. He fails to move to an inside lane so that ramp traffic can merge. Consequently, although according to any set of absolute measurements that location is much safer than formerly, accident experience might show that THE DRIVER is as close to an accident now as he was before.

From an economic point of view, the new interchange is obviously a great improvement. Traffic flows much more smoothly than before. But from a safety point of view, no great improvement is seen. Although the "hazard level" has dropped, this is offset by a comparable drop in the "driving level." The relative levels remain unchanged.

On a narrow, winding shelf road in the mountains, the "hazard level" is extremely high. However, THE DRIVER recognizes the danger and acts accordingly. He creeps along in low gear, carefully watching the edge of the road and keeping both hands on the steering wheel. Consequently, despite the high hazard level, THE DRIVER is able to maintain a reasonably comfortable "risk gap."

At the other extreme of the highway system are the best of the new Interstate roads -- multi-lane with wide medians, barriers, buried guard rails, breakaway signs, excellent shoulders -- everything, in fact, that the combined skill of the design and construction engineers can come up with. The "hazard level" drops to an absolute minimum. However, the "driving level" drops, too. THE DRIVER now travels at freeway speeds. Because traveling on the new highway is so easy, only a fraction of THE DRIVER'S conscious mind is devoted to his driving. Operating on this kind of highway appears effortless, so THE DRIVER puts in an absolute minimum of effort. As a result, despite the very low "hazard level" on this excellent facility, the "risk gap" might remain disappointingly small.

As we gradually connect segments of the Interstate Highway System, it becomes possible for the cross-country traveler to make all or most of his trip via these new "safer" freeways. Theoretically, the vacationist should now have a much better chance of getting to his destination and home again without being involved in an accident.

Unfortunately, however, THE DRIVER discovers that he can make much better time now than he could on the old roads. And that, in turn, makes it possible for him to travel farther. Formerly, on a two-week trip starting, say, in Portland, Oregon, he might limit his destination to Chicago. But now he does not hesitate planning a journey all the way to New York City during his two weeks off. To reach such a distant

destination, his "driving level" goes down. He has to travel at higher speeds than he might otherwise choose. He cannot stop often, for fear of wasting needed driving time. On past vacation trips he covered possibly 400 miles in a day. Now, on the new Interstate System, he might go as far as 800 miles before he beds down for a very short night's rest. As a result, the "risk gap" narrows -- perhaps to the point it was before the driver had access to the new "safe" freeways.

At an obviously dangerous location, such as a narrow bridge, THE DRIVER tends to slow down and perk up just enough to get through the hazardous area safely. Momentarily, as he crosses the narrow bridge, that driver's "risk gap" is narrowed to an absolute minimum. After the completion of a spot improvement program in which the bridge is widened, the high hump on the hazard line is rounded off. However, unless the highway is completely rebuilt at that location, there remains a hazard hump, although less pronounced. Theoretically, that location should now be much less dangerous; and in an absolute sense that is true. However, THE DRIVER, to whom everything is relative, sizes up the bridge as now being "safe." Consequently, he no longer slows down or otherwise raises his "driving level" as he crosses the bridge. As a result, he might be as close to having an accident at that location as he was before the spot improvement project was undertaken.

Perhaps every traffic engineer in the country has found, to his chagrin, that, at a given intersection, yanking stop signs and installing signal lights instead, has resulted in an accident increase. By all rights, the improvement in traffic control should make travel safer. Certainly, the "hazard level" is lowered. However, THE DRIVER -- or, to be more accurate, a certain type of driver -- again demonstrates his capability of frustrating the traffic engineer. Recognizing that the "hazard level" has dropped, THE DRIVER drops his "driving level" correspondingly. Previously, at that location, the driver came to a stop at the stop sign, checked traffic, and then moved out when the path appeared clear. But now he puts full confidence in the signal lights and no longer bothers to check cross traffic. From a relative point of view, THE DRIVER might be no safer negotiating the improved intersection than he was when the stop signs were there.

The Theory of Relativity is applicable not only to highway and traffic control improvements, but also to advances made in the motor vehicle. Taking into consideration the obvious defects in his car, the driver of a venerable vehicle adjusts his driving to maintain what to him is a comfortable "risk gap." Then he buys a new car. Not only is his vehicle in

top condition, but also it is equipped with a variety of safety devices. The "hazard level" drops because the driver is now operating a "safe" car. Theoretically, the "risk gap" should widen accordingly, thereby reducing the likelihood of an accident. But does this happen?

THE DRIVER, feeling the power and control he has with the new car, adapts his driving to the new conditions. Subconsciously he maintains only his normal "risk gap," thereby lowering his "driving level" and offsetting any advantage gained from a lowering of the "hazard level." It is possible the driver might over-react to the safety features of his new car. Lulled by the soft ride, lack of road noise, and easy handling, THE DRIVER might underestimate the new hazard level -- especially during the period he is getting accustomed to the new vehicle -- and end up operating at the verge of an accident.

Speaking of being on the verge of an accident at all times, that is the stereotype we have of the youthful driver, especially the one who has never had a course in driver education. Driving records indicate that a good driver education course can so improve a student's "driving level" that he then maintains a respectable "risk gap," even though it is still smaller than that of his elders, most of whom are less inclined to take risks.

However, accident statistics seem to indicate that the trained youthful driver has difficulty retaining the wider "risk gap" he starts out with. Exposed to bad influences and responding to his innate risk-taking instincts, the youthful driver, despite his formal training, tends to revert to form. His "risk gap" gradually narrows so that within a couple of years it is difficult to see much difference between his driving and that of his classmates who had not taken driver education.

How driver education is further nullified is evidenced in driving after having consumed alcoholic beverages. THE DRIVER has been taught that the "hazard level" goes up if he has had more than just a few drinks. So, having every intention of maintaining his normal "risk gap" after drinking, he tries to raise the level of his driving. He might go more slowly, pay more attention to his driving, or otherwise try to compensate for any impairment caused by the alcohol in his system. As a result, he gets home safely. Having done this successfully once, he is encouraged to try again. And again he gets home without mishap. Eventually he develops a habit of driving after drinking.

Unfortunately, now that this practice has become commonplace, the drinking driver no longer bothers to compensate for possible alcohol-caused impairment. His level of driving drops back to where it was before. He has learned from experience that he can drive safely after drinking. He no longer is able to see that alcohol causes the "hazard level" to go up.

The drinking driver not only sees the "hazard level" lower than it really is, but he also has greater problems than does the average driver in maintaining the intended "risk gap." With any driver the "risk gap" widens and narrows as he goes along. Normally this is no great problem, for the ordinary prudent driver makes certain that his driving level is always well above the hazard level. But the drinking driver has extra difficulty keeping the driving level he intends to maintain. He drops below that level as he becomes drowsy, bleary-eyed, or otherwise affected by the alcohol. Faced with the double problem of, first, not being able to judge the "hazard level" and, second, not being able to adhere to an intended "driving level," the drinking driver operates with a narrow and fluctuating "risk gap." Should that gap disappear altogether, an accident results. How the accident could have happened, the drinking driver does not understand, for -- as he saw the "hazard level" -- he still had what appeared to him to be a safe "risk gap."

Not being able to see the actual "hazard level" is not unique to drinking drivers. To a lesser extent, this is a problem of all motorists, especially on specific highways. One such highway is the four-lane, divided road, which to the unsophisticated driver appears to be a freeway but which has occasional grade crossings. Another such road is the sub-standard freeway, which can look deceivingly safe to the ordinary driver.

The professional, of course, always sees the "hazard level" as it really is. His years of training have made him aware of highway design or construction defects that could cause accidents. Finding a given highway safe for his own driving, the professional might wonder why other drivers seem to have so much trouble. The answer, as we have tried to explain here, is simply this: To the ordinary, well-meaning but slightly confused driver, everything is relative.

52,500 TRAFFIC FATALITIES - WHY? (VEHICLE)

by

Roy Haeusler

I will address my remarks to the same question---why 50,000 fatalities? And the really implied question is: to what extent can they be charged to the car? It is really true that a car is unsafe at any speed? I very much appreciated Mr. Larson's dwelling upon the fact that such measures are not absolute, they are relative. I suppose you could go further and suggest that to talk about safe and unsafe cars is to mislead the public, intentionally or otherwise. This means it must be clearly understood that we do not have any absolute values, but we can say properly whether one car is safer than another; whether a car is safer because it has this or that construction, or this or that feature.

Sometimes, we are hard-pressed to provide any measure even of the relative difference, and this is true particularly with regard to those elements of the car that it is hoped will resist the likelihood of an accident. The factors most popularly considered for vehicle safety are: better lights, better brakes, better windshield wiping and washing, and so on. We do not have a measure as to the depth to which the nature of the car contributes to a professed accident. This is probably the result of our being unwilling as a society to engage in active investigation of the lowest level of the order that it takes to get such information. Such investigation is done with regard to commercial airliner disasters; some of the investigations cost hundreds of thousands of dollars per investigation. Traffic accidents happen by the millions, and we tend to give them rather short shrift. I think this is very unfortunate.

We should indeed be asking far more; specifically, what do we find in these accidents? What is the nature of the accident that suggests whether the vehicle was or was not contributing to the accident? Whatever the facts may be, we must have them.

We have gone ahead as automobile manufacturers and provided a number of hoped-for improvements. It would stand to reason that such measures must be taken that would reduce the likelihood of accidents or perhaps reduce the severity.

The first slide shows the picture of a windshield in which several areas have been delineated. This has been a matter covered by one of the new Motor Vehicle Safety Standards issued by the National Highway Safety Bureau. It calls for virtually all of the innermost area to be wiped as well as a large percentage of the outermost area. This is breaking it down to specifics. Each and every vehicle must comply with these specifics. It is not just a question of using adjectives, saying our windshield wipers are better than ever; it is a question of comparison with an absolute standard in this particular isolated area. Although we have not had absolutes in the past, industry and government are now cooperating in setting up arbitrary absolutes in the way of Motor Vehicle Safety Standards that will allow comparisons.

Windshield washers which are now standard, and again by Motor Vehicle Safety Standards, were introduced many years ago, were made available to all people, and were accepted to some random degree. They were made standard by one state (Michigan), but as always happens, of course, there was no accompanying action to persuade people not only to understand what the windshield washer was for but to maintain it -- to put not only water in it, but a mixture of half water and half antifreeze in a cold climate, so that it would operate properly. It should be checked occasionally to determine if the nozzle is open and the hoses in working shape. But at least the equipment was made mandatory, first in Michigan and now across the entire country by the Motor Vehicle Safety Standards. This is something that has been with us in the way of optional equipment for a long time. Now it is standard.

The next slide covers windshield defrosters and defoggers. Actually, the requirement is rather sketchily stated thus far, and basically it insists that there be defrosting and defogging equipment for the windshield. No longer is it possible to have a heater (of course, the defroster and defogger are probably affiliated with it) as optional equipment in mild climates where people think they might be able to save some money by not bothering with a heater. Those people, as you well know, are apt to take a vacation in an area where a defroster-defogger is really quite necessary. They should have had it all along.

Mirrors have been with us certainly for longer than I have been in this work. Inside mirrors have been standard equipment for a great many years. Outside mirrors have become standard equipment only very recently, but they were available all the time. You and I could indeed get them. Many a time, however, the car that has the whitewall

tires does not also have an outside mirror. Rather a ridiculous situation.

Yet another item thought of as contributing to the reduction and risk of accidents is the rear window defroster-defogger. We all have been familiar with the defroster-defogger for the front window or the windshield; the one for the rear window has been available, for example, since 1957 for cars provided by the Chrysler Corporation. That is a lot of years. Making something available, as we have seen many times, does not mean it will be widely appreciated or accepted; the two-tone paint item is chosen as an extra cost item, but the rear window defroster-defogger is omitted, possibly as a cost-saving reason. So far, this remains optional equipment. It has not been included in the National Safety Standards, nor as far as I know in standards in any state. But it is available and it does have real merit.

For visibility through the rear window, which we need if we are to use that inside mirror, we have provided a rear window wiper-washer system. The washer equipment and the wiper are down inside the tailgate. With the wiper blades standing still, the window is moved down and water is squirted on it from the side. Then the window is raised, wiped clean by the blades in the process -- all this for extra money. There is no requirement so far that back windows be kept clean by any such equipment.

Another item that we have had for many years and has been appreciated by commercial truckers, largely by the gentle but firm persuasion of the Interstate Commerce Commission, is the emergency flasher. This equipment, while flashing a turn signal at each of the four corners of the car, provides an indication that the car or truck may be stopped, stalled, or out of action. It is felt that an exposed position of the vehicle may constitute an unusual hazard. This feature is required equipment on all cars produced on or after the first of the year. It became standard on all cars provided by the American industry several years ago, but up to that time it had been optional. And it is generally not very much appreciated.

Side marker lights, or reflectors, have been added. Either one is permitted under the new National Safety Standards, again effective the first of this year. There shall be a light or marker at the forward corner and the rearward corner on each side of the vehicle. And the lights or reflectors are required to have various properties in the way of light intensities for adequacy of reflection.

As with many of these items that we are talking about, it seems to stand to reason that marking the side of the car with a flash will help to call the driver's attention to the presence of such a car even though the weather may be murky.

But we don't know, we didn't know before, whether any specific number of auto accidents was attributable to the lack of such markings. We do not know now whether we have done any specific good in terms of putting these markers on the cars, and we probably never will know. We needed, but we did not have, a proper basis for comparison; that is, information that should have been gained at an accident investigation. And we still do not have it; we do not know where to get it. There is no accident investigation program now, but there is the possibility that such a program will be generated in the future.

The same comment applies to the dual hydraulic braking system. It stood to reason this would be an improvement. Each one of us perhaps has experienced a sudden unexpected brake failure. You stepped down on the pedal and there were no brakes. Maybe you went through an intersection; sometimes this resulted in an accident and sometimes, injury. And yet, over all, we have no measure whatever as to whether brake failure has played any significant role. The driver often says at the accident investigation that his brakes failed. We find virtually no evidence, however, in the police report, the reports made available to the motor vehicle administrators, that anyone checked the brake pedal to see if it went all the way down to the floor, suggesting a gross hydraulic failure (a failure, by the way, that might be at least partly offset by the duomatic brake), or whether the driver would simply say his brakes failed when what he meant was that he had been asleep at the switch and applied his brakes too late to be able to stop in time. Or maybe, as a matter of fact, it was not really the brakes; it was the fact that the driver had four bald tires on the car or three of them were bald and he was sliding on wet pavement.

This dual hydraulic system has been in existence for some time. It has not been set up as a requirement for all vehicles, but the requirement goes beyond that which has been made available optionally.

The device shown on the next slide is a brake system warning light. It has been found in the past that on those vehicles with a dual master cylinder brake, many drivers continued to drive with the rear brake out of action; he did not realize he was driving only on the front brake. This

might apply particularly to people not mechanically inclined who did not take special note of the fact that the pedal was down lower than it had been before. And so a brake warning light was required, with a light when such failure occurred or at least every time the man put his foot on the pedal if the system were only partially in action. This light also serves, in some cases, as a parking brake warning light. If the driver puts on the parking brake and then tries to restart the car, the warning light will go on as soon as he turns the ignition on. He had better check to see whether the parking brake is left on and not try to drive away without releasing it. That is also standard.

Parking brakes have been required to meet a 30 percent grade test. That is to say, it would appear that the steepest grades on regularly traveled highways, as compared with back roads, have a slope of about 30 percent. This slide represents a slope in San Francisco, on some of the steepest hills, and it is required that the parking brake can be applied so the car will be held on a 30 percent grade, pointing uphill or downhill, without creeping.

All of the above items had to do with efforts to reduce accidents. We know very little about whether the car was contributing to any appreciable degree, but we do know of particular instances where it probably did.

In contrast, we know a good deal about the contribution of the car with regard to injuries.

The next slide indicates that accidents involving critical or fatal injuries frequently are associated with doors coming open; one or more doors of the car came open in the course of the accident. And so an interlocking type safety door latch was provided, not in 1965, but in 1955. And all cars made by American manufacturers were converted to this type of latch by 1956, that is, all new cars manufactured.

Interestingly, as to the shallowness of understanding of the items that made a real difference in automotive safety, there has never been any requirement by any legislature at any level calling for the application of such latches to cars as standard equipment. The Cornell Crash Institute research program investigated thousands of actual highway accidents, confirming an earlier finding that doors were coming open during accidents; this caused people to spill out, and those that spilled out had several times the rate of critical or fatal injury. In comparing

cars with the earlier type latches and cars with the later latches when involved in injury accidents, Cornell's research was able to show that the frequency of doors coming open had been drastically reduced by the new interlocking latches. There never has been any requirement that cars be equipped with these latches; many of the European cars were not so equipped, even as imports, until very recently.

A door lever was designed to reduce the likelihood of the occupant inadvertently opening the door in the crash. We call it a door release lever now, rather than a handle. The word "handle" suggests what really happened in some cases -- the occupant, especially a right front seat occupant, while slipping his hand through the handle and using it as a hold, worked the handle and opened the door. The new release lever does not lend itself to this type of accident.

The next slide indicates the manner in which the door is opened with the new release lever. It is rather an unusual method, but is gratifyingly well received by the public, I might add. Standard equipment on all of our cars.

About 11 years ago, we introduced recessed steering wheels for all of our cars as a way of allowing the rim to crush down somewhat to moderate the severity of a chest blow to the driver. Now this time we knew what we were doing, as contrasted with those efforts to reduce accidents. Here we were reducing injuries, the cause of which was shown by the Cornell program. A major cause of driver death was due to collision with the steering wheel. So we had every reason to believe that if the steering wheel yielded to greater degree under impact, whether the driver understood this or not, whether he cared or not, this would nonetheless reduce the likelihood of critical fatal injuries. And very recently this was supplemented by the collapsible steering column. Thus, more total movement was possible, and the force level which occurred when the driver hit the wheel was lower. It now appears that this combination is doing an extremely good job. I am hopeful that within the next year or year and a half, we will have sufficient information to allow us to say statistically with reasonable certainty that there has been a substantial reduction of the frequency of the driver deaths associated with the impact of the steering wheel column. Whether, as Mr. Larson suggested, this simply means he will now drive faster is a matter for debate, I am sure. I am not at all convinced that people who have the energy-absorbing steering column will feel they can drive ten miles an hour faster.

The next slide indicates steps taken to improve windshield glass to make it more penetration resistant. Injuries rise very steeply in seriousness when penetration occurs. Since the introduction of more penetration-resistant windshield glass several years ago, I have seen many a car involved in an accident in which the improved windshield had been struck but not penetrated. Judging from the details, however, penetration would have occurred with the earlier windshield.

Instrument panels have had their share of treatment, with cushioning on the top and with a panel designed to moderate the severity of the blow by head impact. Also, the instruments are recessed in a kind of valley across the panel to make them reasonably convenient to the driver, but at the same time make it less likely that the head might strike against the controls.

We have done the same thing with the front seat backing. Not only does the instrument panel have to be cushioned and have the metal designed so that it would yield properly under a blow and moderate the severity of the blow, the seat back also has to meet this requirement. Both items are covered in the new Motor Vehicle Safety Standards.

A lot of detail has been considered. The mirror mount also has contributed to injury according to the Cornell investigation. The results were specific, and there were examples in which injury was associated with the flexibility of the rear view mirror mount. Similar steps were taken in regard to a window crank handle. A soft knob is provided as a further effort to reduce the risk of injuries. I am not sure how much good this will do, but it is a step taken in an area known to be related to cause of injury. And we should do something about this rather than arguing about how much good it will do. It is a step in the right direction.

Lap belts have been widely introduced and rather moderately accepted. It is not only a matter, as Mr. Larson suggested, of buckling the seat belt; unfortunately, there is a good deal more. Not only must the belt be buckled, but the slack must be taken up. I recall one case just a little while ago of a rather small woman wearing her seat belt who went so far forward as to slam into the windshield, or possibly the door pillar that is by the windshield, with such force as to lose the sight of an eye. It is necessary to take all the slack out of the retractor, so that there will be no more slack to play out when a collision occurs.

Lap belts have become progressively standard, with fixed lap belts on our wagons being standard two years ago, at which time the issue began to arise as to why every occupant should not have a lap belt. This was the appropriate step to take and is now a requirement of the National Motor Vehicle Safety Standards. Every passenger for which the vehicle provides must be provided with a lap belt.

The shoulder belt has its place in this matter of protecting the occupant, too. The man wearing a shoulder belt does not hit the steering wheel; as you can well understand, he would have done so if he had not worn a shoulder belt. So we cannot just stop at buckling the lap belt; we cannot just stop with buckling and adjusting it properly. Where shoulder belts are available, and they are now standard for the driver and right front passenger for every vehicle manufactured after the first of the year, these, too, should be worn.

As part of the requirement for the shoulder belts, we had to accommodate the small person with regard to being able to reach the controls; this has meant that small people would have to wear shoulder belts with some degree of slack. Greater protection, however, is obtained if the slack is taken out. It should not be taken up to such a degree, however, as to discourage use of the shoulder belt.

The shoulder belt is now anchored in virtually every line of American car. Convertibles seem to be the exception. With all except the convertibles, the anchorages will be the roof rail or the door pillar near the roof level so that essentially the belt is coming from an overhead point. This provides for better stowage than previous shoulder belt arrangements. It may not be as well accepted in terms of convenience or comfort in use as the shoulder belt that lies down on the shoulder and passes over the shoulder to a point behind the second seat. Any shoulder belt that runs rearward horizontally from the shoulder of the front seat occupant interferes with access to the rear seat area. One must take the shoulder belt off and put it down to let someone in the rear seat get out.

Front seat back latches have been made standard for all of the cars with folding seats. Again, it is a matter of the National Safety Standards requirement. This is an inconvenience, admittedly, for the fellow who for 25 years has pushed that folding seat forward and down in order to step into the rear area. Now it resists him; he has to unlatch something. This is done specifically to insure that the seat back will remain upright

in a crash condition.

Finally, the head rest or head restraint is still another means for keeping a person from banging around in the interior of the car or from crashing about violently. In a collision from the rear, a person tends to have his shoulders driven out from under his head in a sudden forward lurch; the head snaps rearward, producing what is sometimes called a whiplash injury unless there is a back stop. The true head rest or head restraint is a back stop, not something to have the head rest against in normal driving. We hesitate to offer any such thing for fear the driver will fall asleep. But the back stop is desirable and the National Highway Safety Administration recently issued the standard that required that every car manufactured on or after the first of January 1969 provide a head rest for the driver and a head rest for the right front seat occupant.

Why 50,000 fatalities? One answer is that by no means have all vehicles been so well equipped in the past, although many of the above items, such as head rests, have been available for many years. While some of these items work automatically, whether the driver cares or not, the other items require his very active cooperation, his active power, his active assistance -- the head rests, for instance, as well as lap belts or shoulder belts.

So we have some reasons in regard to the car as to why there are 50,000 fatalities. We have known things to do; we have been slow to get them done. Let me leave it there. I am sure we will have more to discuss later.

52,500 TRAFFIC FATALITIES - WHY? (HIGHWAY)

by

James E. Wilson

My remarks here today were necessarily composed some time in advance without prior knowledge of what the other panelists might have to say in answer to the question: Why do we have 52,500 or, more accurately, 53,000 traffic fatalities in the United States in a single year?

My immediate reaction in reviewing the panel's assignment was to doubt that an adequate answer to the question could be presented in a single hour by any three panelists, each confining himself to a discussion of what the driver, the vehicle, or the highway contributes. This applies not only to traffic fatalities, but perhaps even more appallingly, to the four million people who are injured each year. For example, and I am not being entirely facetious, I cannot conceive of a single specific auto crash that could possibly have occurred had the victim or victims of the crash stayed home or elected to use some other form of transportation. Perhaps a cultural anthropologist serving on this panel could provide insights as to why Americans in traveling from point A to point B elect overwhelmingly to use privately owned vehicles, generally weighing from one to two tons and each transporting an average of only one and three-tenths persons. This is somewhat like one or two people riding on an elephant, except--and I wish I could be sure who first offered this observation--an elephant can operate on peanuts.

It may sound like heresy coming from a highway engineer but I, for one, have lamented the decline in passenger rail service in the United States and have viewed with dismay the decline of mass transit in our metropolitan centers. I even confess to a secret satisfaction that cable cars still operate in San Francisco; and to a certain nostalgia for the passenger ferries that used to ply San Francisco Bay.

Regardless of personal views, there can be no doubt that a substantial part of the explanation for the annual highway death toll lies in our failure as a nation to develop an integrated national transportation system, a system providing optimum utilization of existing modes of transportation plus rapid development of additional new modes--in brief,

the mission of the newly created United States Department of Transportation.

Lest it be overlooked in a discussion too narrowly confined to the driver, the vehicle, and the highway, may I also suggest that possibly tens of thousands of victims die needlessly each year because of deficiencies in emergency response systems. Dr. William Haddon, Jr., Director of the National Highway Safety Bureau, has pointed out that even under conditions of jungle warfare, members of our Armed Forces receive swifter and better emergency care, transportation, and definitive medical treatment than our victims of traffic accidents here at home. Surely, this fact is an important part of the why of deaths, not only to drivers and passengers but to pedestrians and other accident victims as well.

I might continue to discuss for some time additional factors in the highway death toll not directly attributable to the driver, vehicle, or highway, but because of the time limitation, let me now turn to the highway and its contribution to death and injury. Fortunately, my task will be neither time consuming nor particularly difficult. By this I mean it is relatively easy to point out what is wrong with our national network of streets and highways. A far more challenging task, and one I would welcome, is that of discussing what should be done through modification of the roadway not only to correct its accident-inducing features but also to reduce the severity of impact when crashes inevitably do occur. However, as I read the program, my associate in the Federal Highway Administration, Don Loutzenheiser of the Bureau of Public Roads, has been given the latter assignment in the discussion to follow this one. This being the case, I see my role here this morning as that of a devil's advocate determined to make his task just as tough as possible.

It has often been said that the United States has the finest highway system in the world. To this I would reply, "Yes, but no other nation relies on highway transportation to the extent we do". If anyone doubts the truth of my assertion that even the best parts of our best-of-all highway system are far from good enough, I would suggest they carefully read recent testimony before the Blatnik Committee.

It will be difficult for me to discuss specific features of the highway which induce crashes or increase their severity without suggesting their cures. So rather let me outline the basic reasons why the highway

contributes to the annual death toll. In doing so, I will take the position that much of the nation's street mileage, considering the use to which it is put, remains in a very primitive state.

By 1900, when automobiles were still a novelty, over two million miles of rural roads were already in use in the United States. Many of these roads followed animal trails and Indian paths.

By 1921, the rural road mileage had increased to nearly three million miles and motor vehicle registration had risen from eight thousand in 1900 to more than nine million in 1921. Today rural mileage is only slightly over three million; thus, two thirds of it predates the automobile and nearly all of the remaining one third was laid out prior to the introduction of the 1921 model cars.

Quite understandably, in the early years, when virtually all of our original mileage was laid out and constructed, road builders generally followed lines of least resistance. Part of the resistance, of course, was land topography, which they disturbed as little as possible, thus accounting in part for the numerous and often abrupt vertical and horizontal curves still characteristic of much rural mileage.

Perhaps even more important than topography, cost considerations, coupled with overconcern for private property rights as opposed to public welfare, influenced right-of-way acquisition and highway geometrics. We still see too narrow roadways and abrupt right-angle turns even in flat open country--curves dictated by the interests of influential landowners.

What I have said up to this point should not be considered a condemnation of early road builders. As I have said, two thirds of our rural mileage was in use before the automobile, and they served quite well in a horse-drawn society. Our predecessors could not have foreseen that their roads would eventually be used by vehicles propelled by hundreds of horse power but completely lacking in horse sense.

Thus far, I have considered only our three million miles of rural highways. When we turn to the nation's additional half million miles of urban streets, the outlook is even bleaker. Much of this mileage also predates the automobile, and here it is even more difficult and expensive to adapt the streets to the requirements of today's vehicles and drivers. Complicating the urban traffic problem has been the explosive and generally unplanned growth of the suburbs.

From an unforgettable essay by Wilford Owens, Director of the Transportation Research Program of the Brookings Institution, entitled "American Cities--A Fable", I would like to quote: "The commuting problem was compounded by an ancient tribal custom. People with light complexions worked close in and lived way out, while people with dark complexions were expected to work way out and live close in. As a result, the urbanites were always trying to get from where they shouldn't be to where they shouldn't have to go and they all tried to get there at the same time." Of on-street parking in the cities, which not only accounts for 15 percent of the city accidents but also reduces street capacity up to 50 percent, Owens also comments succinctly: "Never had so much space been used to help so few at the expense of so many."

As a highway engineer who has specialized in traffic engineering, I should be the first to assert that considerable progress has been made in adapting city streets and rural highways to present-day needs. However, considering the magnitude of the task, our progress has been agonizingly slow. Viewed from some distance, perhaps the most conspicuous change in the nation's road system since the invention of the automobile has been the surfacing of streets and roads originally laid out for horse-drawn vehicles. At the turn of the century, less than 7 percent of the rural roads were surfaced. Today, 75 percent are surfaced.

It may be argued that I have overlooked the magnificent Interstate Highway System, the biggest construction project yet undertaken by man, but when completed the Interstate will constitute little more than one percent of our total mileage and older roads will still be carrying 80 percent of the traffic.

If I have painted a rather dismal picture up to this point, I have done so deliberately to show that a major part of the answer to the "Why?" that concerns us has been the explosive growth of the number and use of motor vehicles and the attendant lag in the development of adequate facilities on which to operate them with safety. From eight thousand vehicles in 1900, we now have 97 million which are driven nearly one thousand billion miles per year by more than 102 million drivers.

Here I would like to offer a single observation on the driver. When one considers the astronomical number of possible conflicts in a movement of the magnitude I have described, it must be apparent that the majority of drivers most of the time are doing a magnificent job of

avoiding serious injury. And this is my point--their performance is all the more remarkable in view of the possibilities of vehicle failure, the lack of uniform regulations around the country, the bewildering array of nonstandard signs, signals, and highway markings; and the built-in booby traps remaining on much of the nation's road and street mileage.

Now to introduce an optimistic note; and to compound the problems of the next panel which must answer the question, "What should be done?", I shall make the flat assertion that virtually all fatal and serious injury accidents could be eliminated on a given section of highway by alterations to the roadway. Whether or not this is necessary or advisable, however, involves consideration such as the extent to which the given road is used and other cost-benefit factors including cost determinations of satisfactory alternate solutions that may exist. On the matter of cost, I would point out that the economic loss from auto crashes now amounts to more than one billion dollars each month in the United States. Particularly in view of demonstrated reductions in accidents at spot locations, often through modest expenditures for improvements in the roadway, perhaps an important part of the "Why?" of traffic deaths lies in our failure as a society to recognize that it may be far cheaper to prevent auto crashes than to go on having them.

Now I would like to comment on the so-called "Yellow Book", a report of the American Association of State Highway Officials (AASHO). I am sure most of you are familiar with this document, issued by the AASHO Traffic Safety Committee.

As a special observer assigned to the committee, I contributed to the report. Compromises are characteristic of committee reports, as you well know, and I have certain reservations. I am sure you have heard of the old saw that a camel is a horse designed by a committee. I do not wish to imply that the report is a camel; on the contrary, I believe it provides an excellent guide to the states. But here are my comments for what they are worth.

In general, I would have preferred to see the report couched in much stronger language. I would remind you that many of the recommendations contained in the report were previously published in the 1959 "Red Book," to which far too little attention was given. When taken to task by the Blatnik Committee, highway officials were embarrassed and even possibly surprised by the extent of their failure to act on their own previous recommendations. And today I am disturbed that many highway officials and

others are still wringing their hands and saying, "We can't do this or we can't do that", when in fact we must do these things and maybe much more.

This brings me to the observation that minimum design standards too often become a ceiling rather than a floor. While the report mentions the need for optimum design standards, I believe this point warrants much greater emphasis. It is far better and cheaper, too, to build in optimum safety in the original construction than to call in traffic engineers later to perform major surgery, surgery sometimes as drastic as the recent heart transplants in humans. Perhaps to overcome the "can't do" attitude, one major need is for in-service training of highway personnel, now fundable under the Highway Safety Act of 1966.

I do not believe the report sufficiently stresses the traffic operations field--the need for constant surveillance and the early introduction of remedial measures, not only to reduce accidents but to increase the efficiency of the facility as well.

As to specific recommendations in the report, I am sure that many are too conservative, the inevitable result of committee compromise. For example, regarding nighttime effectiveness as discussed on page 42 of the report, we have a hodgepodge of different types of delineation, often confusing to motorists. In my judgment, we need hard answers to the question of what is good and bad in edge lines, center delineations, sign posts, and other highway markings.

Finally, I disagree completely with the recommendation that green background should be universally adopted for freeway-expressway direction signs, and black and white combination should be retained as standard for direction signs on other highways. I believe they should all be one color or the other. We should not get them mixed up. We owe it to the motorist to treat this sort of thing in the same way everywhere.

Up to this point I have spoken as a highway engineer because that is what the program called for. In closing, may I put on my other hat and speak only briefly as Deputy Director of the Highway Safety Program Service. The Highway Safety Act of 1966 stipulates that 40 percent of federal funds apportioned to the states under the Act shall be expended by the political subdivisions of the state. Many of you here represent county and municipal government. May I urge you to initiate projects through your governor's office so that you as well as the states can attack the traffic safety problem through the thirteen national standards issued by the Secretary of Transportation.

PANEL DISCUSSION

WHAT SHOULD BE DONE

Presiding: Edward Branchfield

WHAT SHOULD BE DONE - (THE DRIVER)

by

Calvin F. Larson

The first part of this panel -- pointing out the problem -- was relatively easy. What we have been asked to do now -- provide solutions to that problem -- is much more difficult.

In case you are thinking that I am here to tell you how things are done in the big city, I want to assure you that that is the last thing I intend to do. If you want to know how we in Washington, D.C., can create such incomprehensible traffic jams, you have to come and see for yourself.

I might, however, mention our freeway system, which is unique in the United States. It is based on a circumferential highway, or beltway, that encircles the metropolitan area. Washington's freeway system is like a wheel except for one aspect; there aren't any spokes. You can circle the city forever, but you can't get in on a freeway.

It isn't quite true that we don't have any freeways; we have bits and pieces all over town. That is another interesting feature about Washington, D.C. We are the only city in the country that has freeways as wide as they are long.

You may have been reading about the problems we have been having in the District of Columbia in selecting routes for our freeways. The day I left Washington, the local highway department was under a federal court injunction not to do one single thing regarding the freeway program, including buying any further right-of-way.

In the southwestern part of the United States a popular song has immortalized one of our major highways, the "Fabled 66." In Washington, the Interstate route of the same number is known as the "Tabled 66."

Trying to do something about "The Driver," which I am supposed to be talking about, is much more difficult, I assure you, than trying to do something about the vehicle or the highway. You just heard Mr. Wilson tell you that if you people who design, build, and operate highways could get enough money, you could solve the highway problem totally.

You also heard Mr. Haeusler, in effect, tell you that his people in Detroit can build just about as safe an automobile as motorists are willing to pay for.

I have not heard anyone make a promise that if enough money were forthcoming we could really greatly improve the driver. About as far as anyone has gone today is to suggest that if enough additional funds were made available for research, driver education, driver licensing, enforcement, and so on, there would be some chance, at least, that we could make a little progress in this area.

I should like to suggest that there is only one way to improve the driver, and this is through driver education. I am not talking about driver education in the limited sense of a formal high school course, but as a continuing program. Where a driver is not coping with a driving situation as he should, the odds are he is in need of a driving lesson on some specific point. However, we cannot very well call in all adult drivers for brush-up courses, even though that might be a good idea. So, any lessons they receive have to be via some other educational process.

First, I should like to mention criticism of the high school driver education program. It is under fire on several fronts. Even Mr. Wilson's outfit (the National Highway Safety Bureau) has been eyeing the program dubiously, for there seems to be some question that young drivers are greatly improved after taking the driver education course.

Let me compare driver education with another program, one that was referred to yesterday by one of your speakers -- the Head Start Program. That program was very controversial when it started out, but, despite what our speaker yesterday had to say, the program has received a great deal of support, for it was found that real progress had been made with the younsters. The program was taking disadvantaged kids and putting them through a special course. The children were adapting socially; they were learning things; they were being fed properly -- possibly for the first time in their lives. As a result, even some of the most hardheaded opponents of Head Start were softening their opposition.

However, after the program had been in effect a few years it was found, much to the disappointment of Head Start workers, that many of the children, now in grade school, were reverting to their former level.

Using the rationale some people have adopted in condemning driver education, the conclusion reached by critics was that Head Start is no

good. As "proof," the youngster from the poor home was sitting in the back row; he was not talking to anybody, not learning. Head Start, it was contended, did not really prepare the child to enter regular school.

Supporters of the program, on the other hand, argued the problem was not with Head Start itself; it was with what was happening afterward. A follow-through program was needed, they said, to reinforce the early training.

This, I suggest, is what might also be needed in driver education. Generally speaking, high school courses are pretty good. These can be upgraded, in many cases, but it is what happens to high school students after they have completed driver education that sets back the program. No sooner does the high school driver education teacher complete his job than an undermining process begins.

Take, for example, the subject of tire care. The student is taught the importance of having air pressure checked regularly, but does a gasoline station attendant ever offer to check tires? Not on your life. Given the impression by some attendants that tire checking is beyond the level of duty, some motorists are hesitant to ask for that service. So, subconsciously, the new driver feels that if the people who operate service stations don't seem to think that tires need to be checked regularly, they must not. As a result, the driver tends to go for weeks, sometimes months, between the use of the tire pressure gauge. All the training in high school on tire care went for naught.

Now let's talk about the highway engineer as a "bad influence." The student is taught that on a long trip he should stop regularly at rest stops, get out and stretch, and possibly take a nap if he is sleepy. Then he is put on a highway with rest areas hundreds of miles apart or totally nonexistent. Further, he is confronted with roadside signs instructing him not to stop on the shoulders except in case of emergency. So, what is the new lesson the driver learns indirectly from the highway engineer? On a freeway you should keep moving.

How about the matter of traffic law enforcement? Certainly, this is an area of education. What the student is taught in school might be far different from what he learns from personal experience. He hears an arresting officer testify in minute detail about a trivial incident that occurred months previously and which the driver knows the officer can no longer remember. He sees the performance of a prosecuting attorney who is more concerned with his own conviction ratio than with any sort of justice; and he observes his own attorney taking advantage of every technicality in the law books to avoid, if possible, going to trial on the

merits. Although a bit disillusioned, the driver emerges more sophisticated.

We teach in school that drinking and driving don't mix. Then, we turn the student loose in a society where drinking and driving are commonplace, and, obviously, he follows suit. But being young and inexperienced, both as a drinker and a driver, he is not as likely to luck out as an equally inebriated but older driver.

In school we explain to the student driver the importance of accident investigation, how the information obtained from such investigation is used in an attempt to prevent other accidents. But when that driver is involved in an accident, how much information is he permitted to give the investigating officer? With possible civil and criminal action pending against him, the driver is advised by his attorney to make absolutely no admissions. The driver's insurance claims adjuster also instructs the driver not to talk. Consequently, an investigating officer gets from the sophisticated driver little more than "rank, name, and serial number."

We teach the student driver the state law or local ordinance requiring anyone involved in an automobile accident to notify the local police immediately; so our driver, after being involved in a minor fender bender, calls the police, who then proceed to issue him a traffic citation. Needless to say, that is the last accident that driver ever reports if there is any way possible he can avoid doing so.

We'll go on to another type of teacher, the traffic engineer. The student driver is told in driver education class to always get in the proper lane far in advance of the intended turnoff. Then the traffic engineer fails to give the driver advance warning necessary to heed this advice.

Or the student is carefully taught the techniques of getting on and off of freeways. He is told that while on the entrance ramp he should check the traffic in the near freeway lane, pick a gap to jump into, then accelerate rapidly in the acceleration lane in order to move into the through lane with speed close to that of the flow of traffic. But does it always work out? Sometimes he gets to the foot of the ramp, starts accelerating and then finds, to his horror, that there is no acceleration lane, or what lane there is you could not possibly build up to the flow-of-traffic speed.

The student also learns in high school that if his car breaks down on the freeway, he should stay with his disabled vehicle and wait for help

to arrive, usually in the form of a highway patrolman. But after once waiting for several hours on an unpatroled freeway, the new driver knows that his driver education teacher gave him a bum steer.

We do a lot of other things to "unteach" the high school student. We post a maximum speed limit; then we expect him to exceed it by 8 or 10 miles per hour, or more. We post a sign showing an arrow to the left for a given highway, then we put up another sign along side of it reading "No Left Turn." Several of you probably are guilty of that.

We prohibit "U" turns in one city, permit them in another. We enforce "No Double Parking" in one place, but not in another.

High school graduates would have little difficulty retaining the good driving habits and good attitudes learned in their driving education courses if subsequent learning reinforced what they had been taught in school; if each contact with a police officer made a new driver more respectful of traffic law enforcement; if traffic control devices were always understandable; if older motorists followed more closely good driving practices; if driver licensing examinations were more meaningful; if garage or service station operators were more concerned about the safety aspects of the vehicle they service, or if vehicle inspection programs were more thorough.

Just as a college education does little more than launch the student in his chosen career, so also high school driver education can only start the beginning driver down the right path. Whether that youthful driver continues to heed the excellent advice given him in his driver education course is a matter totally out of the hands of the driver education teacher.

We try to teach those people who are out of school via the mass media. This seems to be the only way we can think of to reach them. But nothing is more obvious in traffic safety than the impossibility of making significant changes in driving habits through exhortations via the radio, television, newspapers, and magazines. The techniques that can influence millions of persons to switch to a new brand of cigarettes get dismal results when the product being sold is safety.

The seat belt campaign is possibly the most notable failure of mass media in selling accident prevention. Every television viewer, radio listener, and publication reader in this country has been exposed to repeated "commercials" for seat belts. And what has been the response? Only about a third of the motorists queried in recent surveys admit to using seat belts regularly.

That percentage is probably unrealistically high, for many motorists who say they use seat belts regularly really mean that each time they take a long trip they regularly buckle their seat belts. But on the short drives around home, no.

Even though traffic safety promotion via mass media has brought disappointing results, obviously we have to continue -- at least until we think of something better. Anyway, there is no way of really knowing if some driving hint distributed by mass media might have gotten through to at least a few motorists. Accidents prevented cannot be easily tabulated.

Our organization is involved in this type of education. On my way back to Washington, I will stop in Kansas City where we have a new 15-minute traffic safety film coming off the production line. It is called "The Final Factor." Frankly, we do not have proof that such a film does any good, but we keep sponsoring films and showing them to high school driver education classes and civic clubs, hoping that some viewers will be influenced.

If it is impossible to communicate effectively with a hundred million drivers, as appears to be the situation, perhaps we can achieve our goal indirectly by communicating with those who, in turn, influence the motoring habits of the general public. Then, we would have to determine who influences the driver. Essentially, those influencers are the people I mentioned earlier. The variety of "teachers" includes the traffic engineer, the highway engineer, the service station or garage attendant, traffic officer, the automobile designer and manufacturer, the insurance representative, the automobile dealer, the tire merchant, and the driver's attorney.

Possibly, one of our problems is the reluctance of traffic and highway engineers to look upon themselves as "teachers." In the classroom sense, engineers are not, of course, in the teaching business. Seldom is there any direct contact between the pupil and the teacher. Perhaps the engineer compares more closely with the textbook author, who is certainly an educator if not a teacher. So, also, is the engineer an educator. His textbook is the highway system that motorists must learn to follow. And the textbook of the traffic engineer is the array of signals, signs, pavement markings, and other traffic control devices the driver is expected to understand and heed.

Part of our problem is the possibility that the engineer, although competent in his field, may be incompetent as a teacher. Perhaps every college of engineering should offer a special course in motorist psychol-

ogy so that the graduate engineer would better understand why the driver reacts the way he does to certain highway designs, certain signs or other controls. Obviously, if the engineer does not fully understand the driver, the facilities the engineer has dreamed up for use by that driver are not likely to function as planned.

One of our problems is poor communication between the engineer and the driver. We have an example in Washington, D. C., where we have two types of walk lights. One is a steady light; the other is blinking. The other day when I was crossing the street with another pedestrian I asked him if he knew why the walk light was blinking. His answer was that there must be an electrical malfuction. Obviously, our traffic engineer in Washington, D. C., had not got through to that pedestrian.

So I asked a couple of other people. These pedestrians had seen the walk light phenomenon over and over. At one crosswalk the light blinks; and at another crosswalk, it does not blink. It never occurred to those persons that the blinking was supposed to tell them something.

For those of you who haven't seen this system and haven't figured it out, the steady walk means that you as a pedestrian have an exclusive right to the crosswalk. If the light blinks, it means there is a possibility of a turning car entering the crosswalk. It is really a very clever idea, but it does not accomplish much if pedestrians do not understand what it is all about.

I should like to close by suggesting that this communication has to be a two-way system. You engineers, obviously, want to get through to the driver what he is expected to do with what you have presented him. On the other hand, you should be listening to him. He is not likely to call you up to tell you that he does not understand what you have done. But by the accidents in which he becomes involved he lets you know, dramatically, when you are not really getting through to him.

WHAT SHOULD BE DONE - (THE VEHICLE)

by

Roy Haeusler

Let me take up where Cal Larson left off. He was talking about the meaning of two different signals for pedestrians. The steady "WALK," as he indicated, meant that the pedestrian had exclusive right-of-way; the flashing "WALK," that he might be interfered with by a turning vehicle. This is ironic in that when a green light is used to control the vehicle, as the so-called flashing or advance green is used in Toronto, exactly the opposite indication is given. It is the steady green light at which you do not have exclusive use of the green light as a driver for all practical direction of travel.

For instance, if you turn left on that green light (I am talking about an intersection where there is no green arrow especially for left-turning), you turn left on the green light and you have to be careful of oncoming traffic in the opposing lane, when crossing through it. In contrast, if that green light flashes, you may use that green light for whatever purpose---going straight or turning right or turning left ---because the opposing traffic has a red light facing it. It is being held back so you can turn left in front of it as long as the light flashes.

So here are two closely similar situations, but exactly the opposite meaning is given the language for pedestrians as is given for vehicles.

With regard to the bad example set, I can hardly be more vehement that we greatly need example-setting with regard to the vehicles. I am going to stay with vehicles now. As I indicated, much has been done. Most of the safety features and items of safety equipment that have been provided over the years require the motorist's understanding and cooperation, one way or another--in use, in adjustment, in power, or in maintenance. Very few of these are of the ideal kind that provide the benefits, for instance, offered by an energy-absorbing steering system, whereby benefit is offered without regard of whether the motorist understands or cares. And the penetration-resistant windshield requires no cooperation from him. Very few safety features are the admirable kind that work so automatically that nothing is being asked of the motorist.

And yet this impression has been generated by demagogic prophets in these last several years--the motorist should have the right to sit there and say to the outside world, "forget me." Somehow this should be accomplished, according to the demagogues, through the vehicle. Somehow, the vehicle should be safe and the motorist can do no wrong, get into no accidents; nevertheless, if he gets into an accident, he receives no injury. The goal seems to have been to ram another motorist broadside at 60 miles per hour, or a concrete wall at 50 miles an hour, and yet be able to step out of the vehicle smiling. That has been a goal, but we are not very close; I think that if we direct public attention along such lines, we are doing a very distinct disservice. There are steps to be taken right here and now, and I do not think we should be talking about Cloud Nine stuff in a fashion that seems to excuse the motorist or the official or anyone along the way from taking advantage of what can be applied right now. I mean specifically with regard to belts, the most common example offered. Yet we have only 30 percent usage across the nation. This represents 30 percent of our 100 million drivers.

But we need more than just usage. We need to have the belt adjusted properly with all of the slack taken up, with the belt down around the hip bone so that it is likely to be there at the time of collision and restrain the person by his rather strong skeletal structure, not across the abdominal wall where even Charles Atlas could not take it. We need to have the lap belt augmented by the shoulder belt now that the shoulder belt is standard. But let me ask you, among those who have been most prominent, even noisy, in their declaration that they are for traffic safety---they are the representatives of the people and they are going to save the nation---how many of them have lately been noted being photographed for the purpose of the record and for the purpose of setting the public an example, using the equipment, using the shoulder belts that have been mandated for all standard motor vehicles. Has the legislator been found using shoulder belts as well as lap belts? Or is he hesitant to say belatedly that he now uses the lap belt? Has he helped any with the example-setting program? All of those who are assigned the job of leading the way in traffic safety---of policing, patroling, driver licensing, driver improvement, driver education---all of the people who are involved, especially those who are most prominently displayed because of their front and center positions, need to help set examples. I would say it would be most ridiculous if I urged the acceptance and use of shoulder belts and thereupon drove out of our company gates not using them. This is not a circumstance where we say, do not do as I do, do as I tell you; it is high time we cut that conversation and got on with the job.

I think it is also time we gave more emphasis to a quality we depended on with considerable degree in the years past. It is called initiative. I am not quite as sympathetic, perhaps, as I might be with the youth who is told the importance of checking tire pressure and who possibly had also been told (and he should have been told in his driver education class) that he will see a great many people in the outside world who don't understand or don't care, and don't do anything about it. But he nevertheless feels that if the job is not done for him, if the station attendant does not offer to check the tires, well, it can't be very important. I think we all need to learn at a very early age that we are our own best protectors. We need to rely on ourselves to a greater degree and not just say to the outside world, "I'm sitting here, protect me." This has been a rather popular approach to the subject these last two or three years, and I would like to squelch it to some degree.

I wonder whether we have done an adequate job, even for those who take driver education, in regard to studying the contents of the owner's manual. It does not just say that you put the ignition key in here, turn it to the right to start, and so on. It has a very extensive coverage of such matters as tire pressure. I wonder, for example, if the station attendant had indeed offered to check the tires, whether he would know for this particular car and this particular body style (and so on, model and year) what the proper tire pressures were. In view of the tires which he found on the vehicle, of which he probably did not know the identity, tire size, tire rating, and so on, would the gas station attendant be apt to decide that because the tires had 24 pounds, that was it; that for all cars, Corvairs, Volkswagens, Mercedes, Imperials, and Valiants, and everything in between, 24 pounds per square inch would be all right?

There should be no substitute for knowing such matters, as what tire pressure to use under which circumstances. There is not going to be any substitute except to read the owner's manual---that where the information is given. The company has gone to a great deal of trouble to get authoritative information and to present it in an interesting, readable fashion. Now, how will we get people to read the manual?

One way would be to make the contents part of the driver license examination and part of the re-examination when the driver came back for a license renewal; of course, this means driver license examiners would need to know something about the contents of these manuals and know they are not all alike. It would be desirable, of course, to have one set of instructions for all cars, all the way through from the Isetta right on up to the biggest Cadillac. It does not work that way. There are too many options; there are too many different conditions. There

are cars with trailer packages which are intended and designed especially for hauling travel trailers. We see many more of them on the road these days, and those cars have different requirements, including tires, tire pressures, and tire ply ratings, than other cars of the same make and model.

There is no magic easy short cut, rule-of-thumb kind of approach, so you have it made if you know three or four facts. We all wish there were, but since this is not the case, we had better be willing to take a little responsibility for knowing what the score is.

I hope driver education can be expanded in the years ahead to cover the proper appreciation and use of the safety features. The National Highway Safety Bureau has regarded these features important enough to make them mandatory. Every last car must have them. I think that driver education must cover these features and indicate what cooperation is needed. So I would think that the supplementary education program that Mr. Larson referred to would be very important, indeed. This includes, by the way, the approach by the motor vehicle administrator in his pamphlet called "What Every Driver Should Know." I would hope that approach also would include the coverage of shoulder belts and head restraints. I talked to one motor vehicle administrator several days ago, asking him about their "What Every Driver Should Know" booklet and wondering out loud whether it covered shoulder belts and their proper use and head restraints. Well, there seemed to be some question. I think I had the answer in the hesitation that went with it. I have seen a great many booklets on the "What Every Driver Should Know" order. You probably have some answers yourselves as to whether your local booklet covers such matters as the equipment that we are all now expected to buy and use for our own protection. Are we really stepping up to the job or are we just talking a good line?

I think what is needed right now, in short, is application; not a lot of additional conversation, but application. There are ever so many things we can do which involve making habits, adopting habits, adopting procedures. Some money has been spent with regard to the vehicle. The man who buys the 1968 vehicle, whether he likes it or not, has the equipment. It is there because it was felt that it was to his interest. He was being represented, I think appropriately, but the equipment was required to be there. He spent his extra money long enough for two-tone paint and whitewall tires and all the fancy ornamentation. Now he is required to get this safety equipment. But this certainly seems to be very appropriate for those who have the responsibility for driver control in all its broadest sense, including driver education and licensing. As

Mr. Larson indicated, we are thinking not just of high school education, but the big job of eduating all drivers. We have a responsibility for getting across the information and the motivation (to some degree , the persuasion) that will result in increasing use of safety equipment.

Yes, we wish there were some quick, short ways to get use of lap belts, shoulder belts, and head rests; getting them adjusted to where they should be and discouraging the motorist from yanking them off by the roots and throwing them to the top of the garage shelf. We wish there was a short way to do this. We do not know of any short way. And maybe we had better quit looking for short ways and get on the job. It is a formidable job, but if we are genuinely interested in saving not only 52,000 lives, but saving perhaps 150,000 to 200,000 people from very serious permanent injuries. If we are really interested, let's get on with the difficult job and stop dwelling solely on neat little gimmicks, thinking that we have really accomplished something. There is much more to do than that.

But there is another approach often proposed with regard to motor vehicles. Maybe now is the time, it is said, for laws that say you must use lap belts, it will be illegal to have the vehicle in motion unless you use shoulder belts; and the head rest must be in place and must be properly adjusted. I say head rests, because although they are not standard now they will be in 10 months. And presumably if there must be a law in regard to such matters, it is not too early to be thinking about it. It takes that long to generate one. No, I do not really think this is the approach, though. We are just kidding ourselves. We tried it only a few short years ago with regard to alcohol and called it prohibition. It was the Volstead Act. It was a miserable failure. We forgot, apparently, that laws against which there is considerable resistance involve considerable emotional reaction, and surely any proposal to enforce the use of lap and shoulder belts and head restraints would involve a lot of emotional reaction. We apparently forget that such an approach to law is bound to fail, at least until such time as we get very large-scale acceptance by whatever slow technique is required. We cannot get a great majority of unwilling people to accept these things by passing a law. I hope we have learned a lesson with the Volstead Act. It seems to me we have done a tremendous disservice to the police and to traffic safety by passing unenforceable, extremely unpopular laws. The fact still remains that for the most part we have to depend on public cooperation; it would not really be feasible to increase the police force in order to require drivers to use lap belts. Or, are we really going to build up to the point where the patrolman stops a particular car on the highway and the driver fastens his belt before bringing the car to a stop. I think there is a possibility of doing a great deal of harm by causing further contempt for police and

justice if we should pass laws requiring usage of belts. I would oppose such legislation.

Let us really be willing to do the job that is before us by the only real way of doing it--persuasion and education. It will take a lot more education and a lot more persuasion with regard to the acceptance of habits that involve emotional reaction such as use of belts, locking doors, and use of head rests if we are to get acceptance of these safety features. Let's be willing to get public acceptance of safety features in the one way we know to be successful. And let's not try short cuts that have more disadvantages than possible advantages.

WHAT SHOULD BE DONE - (THE HIGHWAY)

by

D. W. Loutzenheiser

What should be done to and with "the highway" to insure greater safety? Many items and features should be enumerated to respond to this question. To fit the panel schedule, only the main aspects can be briefly reviewed. These aspects are not new, but they warrant restatement for emphasis, particularly in their total.

It is easier to make this review by speaking of what the highway agencies should be doing rather than by referring to the physical highway itself. By highway agency I mean any and all -- county, city, state, and federal or their designated representatives. My notes suggest seven different subject groups. Their relative order of importance logically varies for different types of highways, for different regions and states, and for different highway agencies. So, no attempt is made to rate them -- that is left up to you. All of the items apply to high-type and main highways. But some of them also apply to any highway.

Accident Data

There is need to improve our information and knowledge on the details of highway accidents. Especially needed are more definitive report data related to a specific point on the highway and in turn to the three-dimensional conditions, such as curvature, cross section, or lateral clearance to a rail, related to each accident. Also needed is more information about the driver just before the unexpected happened and the total environmental conditions at that moment. Our design development work always has been handicapped by limited or indefinite data about accident cases related to specific design elements or combinations. In one sense, these data are a part of the "design load" for which the designer prepares an acceptable highway structure -- open road, street, intersection, or bridge as it may be.

Where the highway agency staff is directly engaged in providing some or all of the accident data, they must adjust as much as possible to insure better products. In cases where other local or state agencies are responsible for providing this data, the highway men must speak up loudly, clearly, and repeatedly to make their needs known. The Bureau of Public Roads has been pushing to do this on the federal-aid systems.

And now there is a broader and better effort under way by the still new National Highway Safety Bureau and the whole of the Federal Highway Administration. I think each of you can personally contribute in some way to this end.

Improve Existing Highways

Once high accident points or typical combined conditions that are hazardous are identified on a highway, for overall safety they promptly should be rectified. The correction may be a local fix-up by the maintenance crew, or an adjustment by the traffic engineer, or a small reconstruction project, or even a major project instituted as to widen a sizable bridge. The important point is that there be an active and continuing program to give early attention to identified hazardous spots.

In federal-aid work, the Spot Improvement Program was instituted some three years ago to make such corrections. It is healthy and growing -- many places are getting attention. Similar attention is needed on highways that are parts of the other systems. The TOPICS program to better utilize our existing street networks shows considerable promise to accomplish corrections that will reduce accidents while improving efficiency.

Also to be named are the reconstruction programs to rebuild the whole of highway sections. This continues at all jurisdiction levels as fast as manpower and funds permit. But greater attention can and should be given to the hazard factors in the system used to determine priority of highway sections to be reworked, even where they may conflict with traffic volume criteria or political promises.

Design and Safety Review Teams

Recent attention to design and safety review teams shows that they are a means of rapidly and effectively identifying sections, elements, or items on the highway that may be hazardous. In the sense of the usual highway organization, these teams are interdisciplinary in composition. They include the specialists in design, in traffic or operations, in construction, in maintenance, and in enforcement, with representatives from two or more agencies directly concerned. Desirably the team reviews the highway under operation, day and night, in good and in bad weather conditions and collectively notes those features that are not what they should be. The team should be headed by an engineer with authority, so that their findings are not just a new batch of reports but instead promptly move to an instruction for action on the needed adjustments.

Safety and design review teams are operating in two aspects. In one they are reviewing the entire highway system with new-view attention to what is there and how it works. In the other, they operate to review newly constructed highways either just before or shortly after opening to traffic to insure that the bugs are out and the highway is the best it could be. These on-the-ground and under-traffic checks are making significant contributions to highway safety.

Clear Recovery Area

In February 1967 the American Association of State Highway Officials (AASHO) issued a Report on Highway Design and Operational Practices Related to Highway Safety, identifying a new realm of highway safety features that warrant early and continued attention. These largely are treatments to ameliorate the severity of single-car, off-the-pavement accidents. While I have my own views, as a matter of records it is not clear why this type of accident suddenly zoomed to be one of major concern. Neither do we know all of what causes these out-of-control cases. But we do know what can be done along the highway to cut down the severity of this type of accident on high-type highways. A good start has been made. This effort should be expanded, the several indefinite elements studied rapidly until clarified, and the practicable realm of similar treatment worked out for low-type and urban area highways.

To minimize the severity of out-of-control vehicle accidents, the roadside area should be made as wide, as flat and rounded, and as clear of objects, both natural and manmade, as possible on that highway with reasonable expenditure of public funds. The broad objective is a clear recovery area that has a width and inherent safety fully consistent with the type of highway and the expected speeds of operations. To attain this objective, attention is needed on many geometric, structural, traffic control, and landscape elements, singly and in combination. Most of you know them. I will name only a selected few for emphasis. A longer discussion was given in my paper "Highway Safety" presented to the AASHO Committee on Design in October 1967. The Yellow Book covers much more.

Signs. In all ways possible, reduce or eliminate the solid sign post roadside obstacle. Take out or do not install signs not truly essential. Locate signs to take advantage of the specific point conditions: put the sign on a bridge, or behind guard rail otherwise needed, or move the sign laterally out beyond the area of concern, or install with clear-base breakaway posts.

Light Standards. Location to utilize protective guard rail or else conversion to a pole with breakaway characteristics are the best possibilities. The better lighting opportunities of 40- and 50-foot poles call for careful studies to determine guide safety criteria.

Drainage Units. Curbs should be set out to the edge of shoulder widths. Those near bridge or guard rails should be located very near the face of rail; the old one-foot, six-inch width of safety walk is uplliftingly hazardous. Urban conditions, both freeway and street type, need careful evaluation for definitive guides.

Stick-up drainage inlets near shoulders, in medians, gore areas, or outer slopes and ditches are unnecessary hazards to be corrected. Likewise, some types of culvert and minor structure headwalls need a new form of treatment to be parts of the clear recovery area. Open holes in medians between cross culverts can be closed and covered. The logitudinal drainage gutters or swales that become parts of the needed clear roadside area should be widened and flattened to be fitting parts and not abrupt dips.

Guard Rail. The first rule is to do everything you can to make guard rail unnecessary. Where this is not feasible, be sure to use updated location criteria and rail design details that will avoid the omissions and commissions of yesterday's design practices that we now see to be hazardous. The rail length should be enough to "effectively work" on impact. It should not be installed with gaps of a few hundred feet. The upstream end location should fit the speeds and cross section conditions. The approach end should be structurally anchored and turned out or down or both to avoid the square end impact and penetration possibilities. The rail type should be that fitting the site conditions. Since the four principal types each have different characteristics and space needs to work effectively, the type should be chosen carefully. Utilize local grading mounds or special graded transition sections to make better installations, since a guard rail down a slope may be ineffective. Also urged, is a field check after grading completion by a knowledgable engineer for final adjustment of each installation.

The Bureau of Public Roads recently issued an advisory memorandum to avoid further installations of strong-post cable guard rails based on country-wide reflections of accident experience. Weak-post cable designs are acceptable.

National Cooperative Highway Research Program 15-1 is being adjusted so that the investigating team will promptly pull together their summary of all available data on research, types, and design into an

interim guide publication. Principal State Highway Department and Highway Research Board engineers that have been leading in studies during the last few years will assist as advisors. This should result in a very needed publication that can be used immediately by all. It will be an interim guide, since the completion of the planned research study in 1970 is expected to furnish additional design assistance for all types of guard rail.

Remember, you should design so guard rail is not needed.

Cross Section and Slopes. Desirably the outer section should be flat, rounded, and clear of objects over to the right-of-way line. How flat? So that your wife driving a car at about 50 miles per hour could retain or regain control. Rapid design changes to work toward this objective have led to overuse of the "30-foot out" and "6:1 slope" criteria on open highways. These are good values but are not necessarily what should be used for the optimum but still feasible recovery area along each length unit of highway. Major attention is needed on the clear roadside area concept and not a certain width or slope. The concept tells us to do everything we can to make the whole roadside clear and free rolling. This is not attained by a predetermined fixed cross section, or any set of them. It calls for station by station study and practical utilization of all opportunities that good engineering can produce. It is a moulded, variable outer cross section very similar to that the landscape architects have been advocating for many years, albeit for other reasons. Where the space, land form, or construction costs do not permit a reasonably flat roadside, then engineering and safety logic tells us to transition the slopes to the conventional guard rail cross section as the next best treatment.

Median cross sections should be a part of the same concept design. As successively narrower sections are considered below the 60-foot commonly being used in open rural country, at some point it becomes narrow enough to warrant guard rail or other barrier to prevent head-on collisions. Also involved are center piers on overpasses and the twin bridge holes for which protective devices must be added. The 30-foot width presently is identified, but for national application any single such criterion should be amplified into a range of practical values for various traffic, highway, and site conditions.

Bridges

Bridge decks should be as wide as feasible, certainly wider than the pavement and desirably with shoulders as wide as on the approach roadway. Any curbs should not project inward from the rail more than a

"brush curb" width. Bridge rails should be structurally adequate as best we can today define that to be. The guard rail on the approach desirably should align with the bridge rail or be gradually transitioned in width to do so. Also, it should have a structurally adequate connection with the bridge rail and not a hole or weak junction.

Where bridges cross over the main highway, the piers or abutments on the right should be outside the normal position of guard rail if they are to be used on the approach highway section. Desirably, the clear roadside area should be carried through the structure, perhaps on a somewhat reduced width but with gradual contour. The views above stated about "concept" of recovery area apply fully here -- even more emphatically so, since the overcrossing is a very expensive 30- to 100-foot length of the underneath highway. Some careful balance of concept and structural economic considerations must be attained. Here, too, the last resort is utilization of typical guard rail section.

Recovery area concepts heavily encourage median cross section grading transitions to central humped areas that may reduce or perhaps eliminate the need for guard rail. Otherwise, center piers that are vulnerably close to the traffic lane edge should have guard rail installations. On bridge decks, the closing of the hole between left rails avoids the nasty problem of some protective installation in the median. Control dimensions need further clarification.

Other Highways and Streets

The above comments about clear recovery area features can be stated rather definitely for application on freeways and high-type highways. The largest single realm of unresolved new safety design today is that of a similar but yet attainable roadside safety treatment for the hundreds and thousands of miles of other than high-type rural highways. And also similar but yet different, are the many miles of urban highways and streets. Some scale-down in the roadside and other safety treatment features must be made to be realistic concerning the volumes and speeds of traffic, the right-of-way widths available or procurable, and the ability to finance upgrading work. These determinations are a large and difficult task, but they can be made.

Even though volumes may be low on many of our local, primary, and secondary roads, speeds are nearly as high as those on main highways. Narrow, abrupt roadsides here can be just as deadly as on a high-type road. Even at 35 mph., a vehicle colliding with a tree or telephone pole probably will cause a serious accident. The street and urban conditions appear to fall into several groups, some of which call

for a higher degree of roadside clearance than present practice but others which have little or no warrant for such attentions. All of us should work actively on the considerations that will clarify what and where additional safety features should be incorporated.

Other Design Items

Several other safety related design features should be mentioned that do not properly fit under the previous headings.

Pavement skid resistance warrants major and early attention by all highway teams. Our controls on this are at best partial and empirical. But several groups are moving to get definitive guides. So far National Cooperative Highway Research Program Report 37, 1967, is the best available; use it until better guides can be evolved. On a national basis there is need to (a) complete development of comparable measuring devices for skid resistance, (b) establish national guide values for pavement skid resistance, (c) develop regional and state specifications for construction methods and materials that will give optimum initial skid resistance, and (d) set up check and maintenance action stages, including proper material course, to promptly renew surfaces that lose their desirable surface qualities. Hydroplaning appears to be one part of this overall problem, in a special and rather sophisticated form.

Gore areas at interchanges are V's aimed at the oncoming driver. While this is a choice spot for major and overhead signs, any but a breakaway sign support in the gore is highly vulnerable. For the usual V-shape, guard rail protection for an overhead butterfly sign is not good. New impact attenuation devices soon may be practicable and feasible. The earth form area several hundred feet back of gore point should be a good example of smooth rounded grading. We have many butterfly signs to adjust or relocate.

Lane drops have been built into many interchanges, and most have proved to be accident causes. Special signs are needed. And some form of elongating an escape area downstream should be worked out. Above all, we should check our plans and not build any more.

In both geometric design and traffic control device application there are indications that design by rote is inadequate for many conditions. The standard or manual minimum layout or installation basis for some cases may be only part of what should be done for true safety on the highway. Broad thought, careful consideration of the driver's likely attention or inattention and reactions should be given each case, and provisions should be made for all likelihood of his actions. We tend to become com-

placent in doing only what the table or book says is "it" -- no more or less needed. Those that have helped develop any standard or criterion well know that at times compromises are made or assumptions used to arrive at the value stated. Nearly all values should have some flexibility in use. As brief examples, there is need for special speed reduction signs at many exits or U-turn openings, for both side pavement stripe delineation at ramp terminals, or for moving ramp terminals upstream so as to be fully in view. High production is needed in project plans -- but also good solid safety engineering throughout.

While much has been done recently, there remains a large realm of reevaluating our existing design standards, policies, criteria, and guides. And, directly attached are the standard cross sections, typical design details, standard plan sheets, and even some specification items. Any engineer is always bothered on having to leave the familiar, accepted practice way of doing his specialty parts -- to abandon the this-is-the-way-we-do-it approach. The whole of the federal-aid engineering process has received nationwide attention in inquiry as to why you in the states and counties continue to do it that way. Additional Congressional committee review is getting under way. As yet we have no good answer as to why it takes some three to five years after a good and understood concept is agreed in the national technical committee realm before it actually percolates down to the squad chief preparing the plans or to the project engineer executing them. In some states, major organized efforts have made a prompt breakthrough on new features. But many have not yet moved very far. Those working with and under you who supervise need to receive a complete fill-in on the objectives and concepts being effected, as well as the revised brief instruction or new detail sheet you normally fix. If we need more engineering manpower in order to attain a complete and rapid pass-down, let's make the needs known.

Research Needed

The highway safety subject has many facets where additional research is needed -- not several years from now but next month. Often the suggestor has to wait to get results. But none of us should hold back in making our needs known, loudly, clearly, and repeatedly until response is made. I will cite a few of the items I feel warrant early attention. They are cited as questions.

What are the main driver causes or highway conditions when the single-vehicle accident car leaves the traffic lane?

Does experience on a highway with a 30-foot clear recovery roadside area show that this dimensional realm is suitable?

To what extent can we vertically compress overhead signs without a significant drop in readability?

Where will a 40- or 50-foot breakaway light standard come to rest when struck by a car moving at 50 miles per hour?

For approach end design of a beam guard rail is the nose-down or the horizontal flare less likely to cause severe accidents when struck?

What is the effectiveness of a guard rail located out and down on a flat slope such that the top is a foot or more below the shoulder edge level?

What details of half-egg-shaped earth mounds at bridge median piers will serve to deflect vehicles?

On what heights of slopes in the range of 3:1 to 7:1 can passenger cars retain control at about 40 to 50 miles per hour?

What is optimum new pavement skid resistance?

By what means can we get through to high-speed drivers that there is a positive need to slow down ahead?

What is the accident experience on low volume and narrow highways with regard to fixed objects on the roadside?

What is the accident experience of cars crossing outer curbs on city streets?

Other Agencies

Highway agency responsibilities seldom include supervision of highway law enforcement agencies. Better highway safety cannot be attained fully, even if we accomplish all of the features that have been discussed herein, unless there is ample effective enforcement. And good enforcement calls for meaningful court actions upon violation. Vehicle inspection and driver license requirements likewise should be strengthened. Enforcement officials can profit by major, continuing assistance from the highway groups. Highway engineers are remiss not to work directly and positively with them. Tell them our problems, solicit their advice, and assist their efforts to expand activities.

I think many drivers have much more car than their needs call for. As a result they unthinkingly overuse or misuse the vehicle -- moments arise when it governs them. We need changes in vehicles also for safety - probably some cutback in power and speed. Manufacturers must be told this.

Do not forget PI -- Public Information. The total public that is driving needs to be informed, advised, directed, and even browbeat if necessary to attain a thinking, intelligent use of the highway. Many need a complete orientation on freeway driving. Nearly all should be cajoled to wait it out when weather is bad. Regard for posted speed limit, especially where it is reduced, should be instilled in all. Car conditions, map reading in advance, and brief stops every two hours are ways in which drivers should continually be informed of actions to be taken. Since there is no one else that sweepingly is doing these public information chores, obviously the highway agencies should understand this to be a part of their role in highway safety. The task requires a separate team of trained communicators, not engineers. But we have to advise and inform them on the areas needing attention.

Summary

Highways can be built anew or adjusted to incorporate greater safety. Not any one thing alone will insure desired safety. But attention should be given to each and every detail that has been identified as safety related. In combination these will result in improved highway safety. We should press for more definitive data -- about vehicles and drivers, about accidents, operations, design elements, construction, and all other features including organized research. Findings should be put to use promptly. This should include updating of criteria and standards, the adjusting of standard plan sheets and design charts, and modernizing of traffic control devices. We should take time for two-way cooperation with sister agencies that control the vehicles, the drivers, and the highway use.

We have the best highway system in the world -- thousands of miles of it in condition for comfortable, fast-moving travel to all parts of our country. We can make it better -- and safer. Should we? Certainly!!

What should be done to make it better and safer? We must utilize each and every item idea feature within our knowledge.

LUNCHEON

Presiding: B. J. McClarty

LUNCHEON ADDRESS

NEW CONCEPTS IN FEDERAL AID

Grant E. Meyer

LUNCHEON ADDRESS

NEW CONCEPTS IN FEDERAL AID

by

Grant E. Meyer

Looking back 50 years to the date of the first Federal Highway Act in 1916, we have come a long way. Highway improvements in this country during these 50 years have been outstanding. Rural roads in general have been upgraded so the traveler can cross the United States on paved highways from ocean to ocean or border to border with little or no inconvenience. The number of cars in the United States increases yearly, as we now have many families throughout the nation with two or more cars. We might say we are leaders in automobile transportation but have not yet learned to live with the automobile aesthetically, socially, or safely. We have increasing transportation bottlenecks in the cities and mounting pressure from the public to do something about it.

In Wichita in 1966 Rex Whitton, former highway administrator, said that the turn of the road in highway planning had arrived about 50 years after the first Federal Highway Act. During the first 50 years, we directed emphasis toward improvement of rural highways, but he predicted in the next 50 years we will face the task of solving our serious and complex urban transportation problems. In the last few years, a definite need has become increasingly evident for a new approach so that all methods of transportation, and not just highway transportation, are considered for improvement. Congressional action creating the new Department of Transportation clearly indicates national recognition of this need. The Transportation Department became effective April 1, 1967.

In 1966, the Honorable Alan S. Boyd, now Secretary of Transportation, commented, "As we plan for the future, the government and the private sector of the transportation industry will have to relate transportation to the total environment and to the society which it must serve. We also have to identify the way that our transportation can contribute to the achievements of goals of society while minimizing conflict inherent in such process." It appears this is an excellent appraisal of the

problem. If we are to provide freeways and roads in the city to move traffic better, it seems we must integrate this kind of transportation with other methods and work out plans in harmony with existing and proposed land use patterns within the urban area. Freeway location and design should be considered from two points of view--the view of the user and the view of the individual living along the freeway. Good highway aesthetics indicates the road should be pleasing to the eye. It should be useful and functional, but should provide driver interest.

The challenge, then, is threefold. We must try to provide better traffic movement to reduce traffic congestion in the urban areas in an economical manner, we must give complete and full consideration to the disruptions that are caused by freeway construction and the people who are displaced by this construction, and we must consider integration of our highways with other forms of transportation and other areas of urban interest. Since 1966, three new phases have received more and more discussion among highway engineering circles as new concepts in Federal aid. You may have heard of these phases: the TOPICS Program, the Joint Development concept, and the Baltimore Plan. I will discuss each of these plans briefly to emphasize some of the main points.

Highway planners seem to delight in working up a set of letters each of which will start a word and the beginning letter of each will also make a word. TOPICS means simply Traffic Operations Program to Increase Capacity and Safety. You leave out the conjunctions and prepositions and you get a word--TOPICS. We might also call this "Do With What You Have," but DWWYH does not make sense.

The first step in the development of a TOPICS program is an inventory of the street system and the traffic operational problems in the urban area. The federal-aid primary system within urban area boundaries would be subdivided into two types. First would be the regular primary and secondary systems selected by the states and approved by Public Roads for authorization of major construction or reconstruction programs. Supplementing this would be the development of a type-two system of streets and highways to be established at the option of the state highway departments for any urban areas with population of 5,000 or more. This system would include arterials and major streets and radial, crosstown, and circumferential roads not already on federal-aid primary or secondary systems. It would include most or all of the downtown street grid system and a limited street grid in other areas having a heavy concentration of traffic.

The TOPICS Program conceives improving and upgrading the facilities we now have to make them work more efficiently. The program involves selection of a second federal-aid primary system in urban areas which will be called the type-two primary system. The program does not provide any additional federal funds at this time but does suggest methods whereby larger cities of significant population can analyze their traffic problems and undertake improvements of traffic operation features to increase vehicle capacity on arterial streets. This increase may be as much as 25 percent in peak hours.

The possibilities available for such upgrading and reorienting of facilities are many. A few innovations to increase capacity are one-way street systems, intersection improvements and channelization, street widening for short distances to provide extra turning lanes, establishment of truck loading zones, bus loading zones, minor adjustments in locations of signals, traffic circulation to relieve overloaded sections of the street system in peak hours, improved pedestrian facilities, sign revisions and markings on routes for through traffic, erection of new signs and clearer sign messages, parking prohibitions on main streets and heavily traveled thoroughfares, and good accident-reporting programs so that accidents can be tabulated, reported, and studied to facilitate future street revision.

The TOPICS Program was proposed originally by the Bureau of Public Roads. Director Frank Turner was a great enthusiast for this program, as he has spent many years considering and studying the urban congestion problem.

No additional funds were suggested by the Bureau of Public Roads proposal. Perhaps this is a challenging problem. We can undertake a program to determine what our important arterials are within each urban area and place them on a type-two primary system. Such a system and the many problems inherent to such a system should indicate a need for construction and financial assistance from some other source if such is necessary. The fact that we undertake to study and analyze traffic problems on arterial streets in many of our urban areas will eventually produce significant and useful data. This information can be used for two purposes--as a basis to plan minor improvements and to increase traffic capacity. In the establishment of a type-two system in these urban areas, the data assembled also will definitely show whether or not reconstruction and upgrading of the existing street system is necessary. It seems evident, therefore, the TOPICS Program will provide basic

data for future consideration of construction improvements to help alleviate traffic congestion. These facts could eventually produce financial assistance from both federal and state governments to assist the cities to undertake future reconstruction programs. Groundwork can be developed now for possible consideration after 1975.

There has been grumbling among some circles that the Bureau of Public Roads or the federal government has suggested a program without any money. The 1916 Federal Highway Act did not provide a large amount of funds, but it did provide a beginning of our present-day accomplishments in the highway field. As studies were made and additional needs identified, additional funds have been forthcoming through the first 50 years. I believe we must always undertake such programs with preliminary review, study, and exploration to develop background and support for any large program that may develop in the future. I predict the TOPICS Program may be the introduction of a national urban highway program sometime in the near future.

I would now like to discuss briefly the joint development concept between urban housing and freeways--JDCBUHF. What does it spell? Nothing! But it means a lot. Perhaps if I had learned to speak Arabic fluently, I could pronounce it. This concept provides for the coordination of highway and urban housing relocation programs through analysis, planning, and development on a square-by-square basis. This will enable comprehensive programs on future urban freeway construction projects.

Such a plan contemplates a basic freeway and construction of housing over and along the freeway through the taking of additional right-of-way required for the housing development. The open spaces along the freeway can be interspersed with parks, plazas, swimming pools, and playgrounds. It probably will cost little more to take a whole block than to acquire a partial block in an urban area in order to construct a freeway. Determination of value for remnants is difficult. Often the total parcel can probably be obtained for about the same cost as a partial taking plus damage to the remainder.

The central cores of many cities contain low value, run-down housing. Most urban areas face a definite need to improve both quality and quantity of housing, transportation, educational, and recreational facilities. The Bureau of Public Roads believes we can locate freeways through these low-standard housing sections and plan housing and other urban improvements in a joint operation. We recommend the highway authority and

other interested agencies cooperate fully to solve the urban problems. This plan would put more valuable land back on the tax rolls, upgrade living conditions, and provide a better-looking city all in the same operation.

The relocation of families is always a difficult problem. The amount an owner receives for his run-down housing will never be sufficient to provide him suitable housing elsewhere. We ought to plan a housing program to handle dislocated persons on a temporary basis until new urban housing under the "joint concept" can be completed. Large cities indicate gradual decay and downgrading of the central core of urban housing and the need to improve schools, parks, and playgrounds and provide more open spaces. We must develop more efficient uses of our urban property in view of the urban space shortage.

I am sure we all agree it will be impossible to eliminate the impact of freeway construction on urban housing or urban living, but we can work together toward securing the best net improvement for the community. I predict the joint development concept should go a long way in overcoming the gradually mounting public resistance to urban highway construction. It makes more sense to provide an overall plan for parks, playgrounds, schools, freeways, and housing under a joint plan than to provide each separately.

After a comprehensive plan has been agreed upon by the various agencies--state government, interested federal agencies such as the Bureau of Public Roads and the Urban Housing Authority--we could proceed to acquire whole blocks of the urban area. Highway departments can buy a permanent three-dimensional easement from the agency for the space needed. In effect, this would be an air tunnel for the freeway, which might be elevated, depressed, or at ground level. The remaining space in each block, both beside and over or under the proposed freeway, will then be available for other development. Priority can be given for replacement housing for those citizens to be displaced.

Studies undertaken by the Bureau of Public Roads have shown that typical row-house or tenement buildings in blighted urban areas can be replaced with an equal number of much better housing units on about a third of the land area with the modern high-rise air-conditioned buildings. This would mean the equivalent of one block in every three would be for replacement housing, and the open space of the other two blocks could be used for parks, playgrounds, swimming pools, parking areas,

schools, public buildings, additional housing, or stores. Stores can be located under an elevated freeway. A random mixture in each block probably would be desirable and effective and could avoid ventilation difficulties for the highway.

This approach may have many undiscovered possibilities. Certainly, we have all undergone severe criticism in the construction of our urban freeways, even here in some of the sparsely settled western states. We believe plans can be developed where these complaints from local groups and local citizens will be greatly reduced if not generally eliminated. We must, of course, provide an attractive-looking facility with good low-income housing, good-looking parks, and good-looking highways.

Such a program is certainly worth undertaking in the large cities, and time is growing short. We should begin planning in this direction at once. We have a terrific challenge to overcome public opposition to the destruction of housing in urban areas, to try to provide something more artistic and aesthetic than common ribbons of asphalt and concrete. The challenge is here. I predict the highway engineer will accept this challenge and overcome it with his ingenuity as he has other problems over the last 50 years. In doing this, the highway engineer must work with other groups--architects, landscape people, school representatives, sociologists, community leaders, and representatives of the property owners--to improve instead of downgrading the total environment.

The Baltimore Plan is a procedure for integration of our highways with other forms of transportation, land use, and other items of urban interests. During construction of the Interstate highway system, the states have encountered stronger and stronger public opposition in the cities and some in the rural areas also. If we are to gain public support or even retain what we have in our future highway endeavor, we must intensify efforts to keep all other interested agencies and groups informed of our plans and work with these other interests to correlate planning to the serviceable advantage for all interests. If we can keep the public informed and organize supporting committees, we can overcome much public opposition. Admittedly, this is a time-consuming operation; but, in the end, it may be the shortest route to a conclusion. Certainly, if we spend six months or a year developing a freeway location and design to consider the needs, desires, and interests of other groups, we will be in a better position for the development of the final plan. When the final plan is completed, you should expect support from those with whom you have worked. If you go it on your own, you will have nothing but opposition.

We should, therefore, seek the location and design that will have the least impact on the surrounding environment within the economical concept of good highway design. We should take the position that a desirable highway design relates not only to what is within the right-of-way, but to the entire surrounding visual environment as well. Good design is concerned with the landscape as seen from the road, the road as seen from the landscape, and the road as seen from the road. The road, then, should be located to secure maximum advantage of the scenic potential and not reduce or destroy aesthetic benefits available to those viewing the landscape from another point than on the road. Bureau of Public Roads Director Frank Turner, in a recent discussion of the future highway program, said, "If I were to set one all encompassing goal for 1967-1968, it would be this: To plan, locate, design, construct and maintain highways with an enlightened view toward their total impact upon society." You have heard a lot of talk about human and social values in the past few years and it must be obvious to everyone by now that this is not just talk. If there ever was a time when roads were built only to move people and goods, the time is long gone. There are many observers looking over our shoulders to make sure that it does not come back.

The President's Citizens Advisory Committee on Recreation and Natural Beauty offered interesting comments in its report of June 1967. Despite the many other pressures on our nation at this time, we find the people of America are more deeply concerned about their environment than ever. They want more and better programs to enhance the natural beauty of this country and improve its recreational opportunities. Many citizens have felt that only "lip service" has been paid to the environmental values, that highway route selections are arbitrary and based on narrow grounds, and the public can express itself only after the decisions have been made; and once the decisions are made, there is no deflecting engineers from their inexorable course.

During the last 50 years, the chief concerns in deciding route locations were engineering considerations and costs. Preservation of open spaces in urban areas and scenery were hardly factors. Since that time, America has moved forward to a different set of needs. The pioneering area, when new routes were punched through fields and forests, is largely over. Experience has taught us we require more uses from the land than can be considered in the simple cost-benefit formula. Highways have effects that reach far beyond those who drive on them, yet our present devices for choosing locations are still based mostly on the requirements of the highway user rather than the community at large.

Federal Highway Administrator Bridwell at Lexington, Virginia, October 26, 1967, commented, "We must not take for granted, however, the notion that our highway system is limited to achieving only transportation goals which prompted its development, expansion and constant improvement. Within the context of the quest for much higher quality of environment for all Americans, the same men and agencies who have given us this impressive transportation resource are now challenged to develop concepts and techniques by which that resource can become a more positive force, a catalyst for obtaining new kinds of goals. A new opportunity for service has been opened to highways and those who plan, design and build them. It is an opportunity to make a unique and lasting contribution to the betterment of our total national environment, to join hands with all those in public and private lives who are committed to attaining that goal."

Mr. Bridwell concluded, "The opportunity is already being seized in many places and in many ways. In Baltimore, highway engineers have joined hands with their colleagues from a wide range of disciplines to form the Baltimore Location and Design Team which will chart the course for planning and construction of a segment of the Interstate system in Baltimore that can also provide a stimulus for urban renewal and improvement. These improvements will create new and better ways of living, more jobs, more opportunities, and enhance historic and aesthetic values and other elements of improved environment."

Secretary Boyd, in describing the Baltimore Plan, contemplates the location and design of 23 miles of Interstate highway in Baltimore by a team consisting of highway engineers, landscape architects, urban planners, architects, and others who specialize in the life of the city. "All environmental skills for the first time will be coordinated and organized in the design of the highway from the very beginning. It will help reach other desirable goals to help it become the kind of a city it wants to be," Mr. Boyd said. To augment the design concept team, other specialists in economics, sociology, psychology, political science, acoustical, electrical and mechanical engineering will be brought into the deliberations. It is expected this joint development study and final design will take about two years to complete.

It would seem, however, that the public will generally be advised of progress and will be less likely to oppose the final location and design than has been experienced on many urban Interstate projects. If we keep the people informed to show them we are trying to satisfy their needs and solve the problems, less opposition can be expected. Senate hearings

were recently held concerning the highway public hearings across the United States. Senator Randolph of West Virginia said, "We must know if we are really offering the people the opportunity to be heard and have their views considered or whether we are merely going through the motions of listening to their complaints, comments and criticisms." In his speech to the American Association of State Highway Officials in Salt Lake City, October 1967, Frank Turner, Director of the Bureau of Public Roads, said, "I believe strongly we must make a more aggressive approach to give the public what it wants and what it has shown a willingness to pay for. One of the most frequent criticisms of our work is that we are both unable and unwilling to develop any new ideas. We are accused of being hidebound in our narrow self interests, of building simply more roads in a straight line at the least cost, and thus produce more traffic by more cars creating more pollution and more congestion."

Mr. Turner pointed out that no one likes compulsory rules, controls, or penalty-type legislation. The shackles of such legislation can be avoided by keeping pace with the public demands and needs and by demonstrating that we are carrying out a program essential to the economic and social development of the nation and sensitive to the values of its citizens. We are in a period of change, of rapidly developing transition, and we have to justify everything we do, both to ourselves and to others to prove we are doing it right. We are constantly being accused of an alleged indifference to the wonderful world of nature, the open spaces, the parks, the trout streams, the wilderness, the historic sites, and the many other things which our forefathers left as our natural heritage, Mr. Turner concluded.

I have attempted short descriptions of the three phases that comprise the phrase "New concepts in federal aid." I hope these remarks have not been misleading and leave the impression that highway improvements in urban areas will become less necessary and other modes more important in our next 50 years. I believe remarks made by Secretary Boyd at Syracuse University in 1966 should dispel any anxiety in this direction. Secretary Boyd commented, "While traffic congestion may very well be the most crucial and frustrating problem facing our cities today, we must remember as we search for solutions that the same forces which have created the problems have also been responsible for the many good things which we come to take for granted and enjoy as a normal part of our lives. These same automobiles that crowd our city streets and highways at rush hour also give individual mobility never before known to man."

Mr. Boyd believes that in evaluating future transportation programs and considering solutions, it will be necessary to develop far better analytical techniques than we have at present. He has indicated that if this nation is to overcome transportation problems in the thickly populated cities, a very definite program of complete cooperation between all local, state, and national interests must be undertaken.

PANEL DISCUSSION

WHAT'S BEING DONE

Presiding: William L. Hall

WHAT'S BEING DONE - THE STATE

by

Howard Eddy

We are here to sum up a little bit on this traffic safety problem. Bill Hall presented a general resume about the National Highway Safety Act of 1966, which created this whole situation. For the last 20 years, at least since 1946, when the President's Committee on Highway Safety first met, some general guidelines for a comprehensive highway safety program existed in the state. The only problem was that nobody was following them. Finally, the number of people dying on our highways became a national disgrace and the federal government entered the picture.

Being somewhat new to dealing with the federal government, I am not in total sympathy with the red tape we encounter, but I am greatly impressed with the dedication of the men who have moved into the National Highway Safety Bureau, Department of Transportation. Many have come from a number of other walks of life not particularly associated with the broad concept of highway safety. They have done a great deal in a short time to meet some almost impossible deadlines imposed upon them by Congress. They had to come up with standards for a state highway safety program and have them approved by Congress. They had to recruit staff members.

Then, of course, the Act put some responsibilities on the state. First of all, we had to make a study to determine how much money was being spent in safety areas two years prior to September 1966. This was called our base year study. We also had to estimate our current expenditures in the total area of highway safety and then project them for the next ten years.

Here in Oregon our projection for the next ten years came to $1,394,000,000. We figured this to be somewhere between 10 and 20 percent low. We are not talking about peanuts in highway safety--for the first time highway safety has come of age. For the first time, we are being forced to look at highway safety as a package program. There is no denying the fact that the Oregon State Highway Department and the

highway departments of other states have had fine safety programs through the years. The Oregon state patrol and state police have been functioning in these areas just as have city and county police. Our motor vehicle departments, or whatever branch of government handles driver licensing, have generally had good programs. Our schools have had some good and fair driver and safety education programs. Our courts have functioned at a fairly nominal level of activity and efficiency. A number of Oregon agencies have had accident investigation teams, spot identification and surveillance programs, and have utilized accident records. But 99 times out of 100, these efforts were all fragments. They were individual agencies operating individual programs, employing individual information. This results in a tremendous amount of duplication, wasted effort, and lack of effect on the total problem.

We are concerned with three broad general areas. We are concerned with the vehicle, with the driver, and with the road. It seems to take all three elements to have a traffic accident. Very few accidents involve only two of these areas. We are looking at the problem from the standpoint of the standards that have been laid down for us by the National Highway Safety Bureau that says each highway safety program shall encompass a certain number of areas, certain specific areas. Safety is not limited to these areas, but it shall include such factors as traffic control devices, police traffic services, motor vehicle inspection, driver education, driver re-examination, a full driver licensing program, and programs for driver registration, identification, and surveillance services. In other words, many factors are involved in the highway safety program. For the first time, individual members of our team are being forced to look at themselves as members of a team. Those who represent city or county government should begin to look at themselves in the same way. The states around us enjoy some advantages we do not. The state of Washington, with 1,700,000 drivers, has a 4.3 death rate, whereas Oregon with 1,070,000 drivers has a 5.8 death rate. If I had to pick any two factors that have a bearing on this I would choose their adequately staffed state patrol system and an effective driver improvement-driver licensing program.

State traffic safety coordinators have another little duty to perform by December 31, 1968. This is to provide a comprehensive plan for traffic safety for our states. I do not think the plan will be required to be totally definitive in all areas, but it is going to have to be a good narrative. We in Oregon are going to have to tell the federal highway safety agency, the Department of Transportation, what our priorities

are, where we have to go, and how we intend to proceed. Oregon has already presented a report on what this program is going to cost. This report is before Congress now. The whole emphasis is on concentrating effort on areas of the greatest need. Coordinators in other states have exactly the same problem--trying to put together a comprehensive program.

In Oregon, when a project request comes for assistance, whether it be in the field of engineering, education or enforcement, it can be fitted into our master plan. We are going to have to revise our plan every year. We hope to accomplish a lot each year and consequently revise the master plan drastically.

We are somewhat hamstrung right now by a lack of funds, but this seems to be justified. Congress met last year and was asked to give somewhat of a blank check for the highway safety program in the United States. They were asked to fund the program without really knowing where it was going. The fact that they held out for a little more direction is admirable--unusual, but admirable. This year they are going to have the evidence before them--the needs of the states and estimates of how much it will cost to get compliance with the now-existing standards in ten years. Probably, we will have more standards, with more sophistication than our present ones. This is why our present estimates are low.

But our problem right now is to reach a team concept. One of the things we are telling the cities about planning for projects under the Highway Safety Act is that when we receive a project request from a political subdivision we would like to know what priority is placed on it. We want to know that the city engineer and the police chief and the city health officer and the traffic engineer and the accident record supervisor and superintendent of schools have all been considered in the project request and that this is the No. 1 priority for the area. We would like to have the same thing done at the county level. Otherwise, at the state level, in the governor's office and, in our case, the Traffic Safety Commission, we are forced to decide arbitrarily on the No. 1 priority. If it is not the No. 1 priority, a limited amount of money is being spent on a program that was not our No. 1 need. We are going to meet our traffic safety needs--there is nothing new in traffic safety. There are new ways of meeting the problem, but if we are going to meet our needs we are going to have to start in areas of the greatest need.

Perhaps, you say, we do not really need this kind of coordination. Are you sure? Have you, as traffic engineers, always consulted with your police chief when you built a new section of street or roadway to see what his problems are going to be in enforcing the laws on that stretch of roadway? If you had, maybe we would not have any problems now for our state police. I am sure your state patrolmen have the problem of trying to cross that median strip out there, but we cannot get an emergency vehicle across it until some kind of construction is changed. How about identification and surveillance of accident locations? How many of you in your jurisdictions meet with the responsible individual from your enforcement agency to survey accident locations, not just from an engineering standpoint but from an enforcement standpoint, to try to come up with a remedy? This is the cooperation we are talking about.

There are problems in driver education. As you know, Oregon is the only state in the United States that does not require certification of a driver education teacher to teach in our schools. Somewhere along the line we have encountered resistance here--it does not take any kind of education to teach driving.

How many of you have thought of the ramifications of an emergency medical service program? This is an area where Oregon is virtually lacking. What we are really talking about here is the number of ambulances in a community, the training of the individual man in the ambulance, and the number of people on that ambulance. How do we get to the location? Let's go a step further and look at a rural county. How do we even know where to send the ambulance? How does the tourist who just had an accident know how to tell you where he is when he finally finds a phone? How many miles of our rural county highways (and in many states, state highways) do not have a mile-posting system? This is a basic thing.

In how many states are they developing a uniform system of off and on ramp numbering so that, especially in the metropolitan areas, a dispatcher can get an officer or an ambulance to the scene of an accident on our new interstate freeway system?

All of these items tie into the whole safety program. It is going to be tough; we have a long way to go, and we are not going to accomplish highway safety overnight. However, we cannot slight the efforts of our agencies at the state or local level. Back in 1936, we were running 13.2

deaths per 100 million miles in Oregon. Now we are down to about 5.6 to 5.8 per year. This is not enough. It is very small consolation to the 660 people who died on our highways last year, even less so if we consider the cost in terms of dollars. It cost our state about $119 million to kill those 660 people last year.

We are trying to pull this program into a package, a package in which each of you play a very important role. First, determine what role you are going to play; but work with the other agencies concerned with highway safety in your area to put together an effective traffic safety package.

TRAFFIC SAFETY--WHAT LANE COUNTY IS DOING

by

Gerald K. Attig

Statistics show that the majority of public road mileage is under the jurisdiction of the various counties in most states. These roads provide access to the majority of the lands and are therefore of a local nature. Most of the users travel on these facilities each and every day in carrying out their activities. On these roads the produce is carried to market, logs to the mills, and people to recreation areas. Traffic volumes on these roads vary from extremely minor amounts to very heavy traffic loads. As the population increases in our counties, these traffic volumes are increasing daily. In Lane County we are experiencing volume increases of as much as 14 percent per year on some county facilities.

The overall condition of county roads in many jurisdictions leaves a great deal to be desired. There are many thousands of miles of roads that are of low standard, inadequately signed, and of poor surface condition. In many cases the maintenance of these roads consists of merely patching pot holes and wearing out grader blades. Many road approaches come into points of inadequate sight distance, and these same road approaches are generally constructed to an extremely low standard.

Today you can drive many miles of county roads and see a great many examples of inadequate signing, both warning and directional. You can see numerous signs that are hidden by brush or overhanging trees and many others that are improperly placed. One of the greatest problems in signing on county road systems is that of vandalism. We have had people remove stop signs and place them in different locations; in some instances, this has resulted in a serious accident. In the month of January 1968, on 30 miles of road in one area of Lane County, a total of 37 signs of all types were vandalized.

With the foregoing facts in mind, Lane County has initiated several programs in an attempt to reduce the accident rates in the county as much as possible. We receive from the State Highway Department a tabulation covering all the accidents in Lane County. This information is put into our computer system, and a listing by road number, location on the road, and the severity of accident is printed. Where more than two accidents

are recorded in the same area in any one year, an investigation is initiated by the Engineering Department and recommendations are made for alleviation of any dangerous situation. Many of these corrections may be of a very minor nature, and others can be extremely costly to correct. Our costs for the correction of these situations vary from twenty dollars to several hundred thousand dollars.

In 1963 the Lane County Board of Commissioners adopted Standards of Design for Construction of County Roads. The minimum road width constructed in Lane County today is 22 feet of asphaltic surfacing with 4-foot shoulders. The minimum bridge width is 28 feet between curbs.

A high standard of maintenance of county roads has been put into effect, with particular attention being paid to surface condition, sight distance impairment, and guard rail installation. Trees and brush are being removed from the road rights-of-way as rapidly as possible. Weeds and grasses that cause sight distance impairment also are controlled.

The signing of county roads is being brought into compliance with the State Sign Manual. Directional signing also is being upgraded. We have adopted a signing and flagging standard that must be used by anyone who is doing any work within a public right-of-way under the jurisdiction of the county.

Lane County was instrumental in setting up a Traffic Safety Committee to discuss safety hazards with interested public agencies. The public has been requested to inform this committee of any hazards they feel should be eliminated. The committee consists of judges, various representatives from cities and police agencies, and the District Maintenance Superintendent of the State Highway Department. We also work with other agencies, such as the Bureau of Land Management, Forest Service, and Army Engineers, in the pursuit of traffic safety in Lane County.

A large amount of money is spent in Lane County every year on traffic safety projects. In the 1966-67 fiscal year, $1,300,000 was expended on projects for the improvement and maintenance of the safety characteristics on the county road system. Our present-day needs are eight and one-half million dollars for improvement of bridges, intersection revision, resurfacing, and road realignment in areas of high accident potential.

We have found, upon investigation, a large percentage of the accidents in Lane County have been the result of some infraction of the law

by a vehicle operator. Traffic safety is a cooperative effort between many different jurisdictions. Public cooperation in this effort could alleviate a great many of the accidents that take place today.

A JOINT APPROACH TO A STREET IMPROVEMENT

by

Don Bergstrom

Burnside Street in Portland is one of the most important city streets. It extends from the western city limits throughout the city to the eastern city limits, a distance of approximately eight and one-quarter miles. Through a major portion of this distance it is multi-lane, and I think by most people's definition Burnside Street would be classified as a major arterial. As a major arterial, it has carried heavy flows of traffic throughout the city's history.

Late in the 20's and the early 30's portions of it close to the river were widened to accommodate six lanes of traffic, and a six-lane bridge was constructed over the Willamette River. On one portion of W. Burnside Street nothing was done, and prior to last summer there existed a 36-foot roadway on a 60-foot right-of-way in the section from Park Avenue to 23rd Avenue.

For years this section of W. Burnside had been a bottleneck because the flow of traffic was exceeding the capacity of the street.

In 1950, at the time Portland's Central Business District (CBD) streets were converted to a one-way grid, thought was given and planning was made to include Burnside Street and the street north of it, Couch Street, as a one-way couplet pair. Some difficulty was encountered with some business firms along W. Burnside Street, and rather than jeopardize the one-way grid plan for the CBD, that portion of the plan was deleted. This, of course, did not solve the problem on W. Burnside Street, and in 1953 an attempt was made to widen W. Burnside within its existing right-of-way by assessing approximately half the cost to the abutting property owners due to the fact that at that time Portland did not have sufficient Gas Tax or other tax money to do the job without adjacent properties picking up part of the tab. As with practically all assessment jobs of this type, particularly because there was a "No Parking" regulation that went along with this proposal, it was objected to very strongly by abutting property owners and the plan was defeated by the Council.

In 1953 we were successful in at least obtaining peak hour parking restrictions on both sides of the street. These were in effect from 7 to 9 in the morning and 4 to 6 in the evening. Remember now that the roadway was 36 feet wide, so that in effect all you had was four 9-foot traffic lanes. Another thing that complicated the traffic problem along W. Burnside was the fact that traffic signals were closely spaced, a matter of eight signalized intersections in a distance of only 0.9 miles.

Time marched on and traffic conditions kept getting increasingly worse along W. Burnside Street. Actually, for the major portion of the day the street approached that of a parking lot. Traffic was bumper to bumper, but nothing was done because of the problems with adjacent properties. The problem along W. Burnside became probably our worst one; because it did not lend itself to an easy solution, we kept putting it off. Many of you probably have streets, or locations, or intersections that for one reason or another defy solution.

Actually, conditions along W. Burnside Street got so bad that cross routes became affected. In our attempts to alleviate and relieve these conditions, we found that proposed new improvements and proposals were tied in to the W. Burnside problem and therefore we could not undertake these improvements until the W. Burnside problem was solved. So, then, in effect we had one street, whose problem lacked a solution, being the starting point and the cause of congestion that spread throughout our northwest district; projects two or three miles distance were delayed because for one reason or another they were tied in with the problem on W. Burnside Street.

In 1962 two things happened, actually separate events, which brought the W. Burnside problem to a head. One, the State Highway Department submitted preliminary plans for the Stadium Freeway, which underpassed W. Burnside Street in the middle of the section that had been having all the problems. Upon receiving this proposal and recognizing the fact that an interchange was proposed for W. Burnside, it was immediately apparent that an interchange at this location would, in effect, compound the problem and, if the interchange were to work, some type of improvement would have to be made to W. Burnside Street.

For a number of reasons it was felt at that time that a Burnside-Couch (this is one block to the north) couplet system would be the best solution to the problem. A couplet would provide the necessary capacity to accommodate existing traffic, with the capacity that was necessary for

the freeway interchange, and excess capacity that could be used for future volume generation. Actually W. Burnside Street is one of the few routes that crosses the West Hills into the Tualatin Valley, an area west of the city that is growing very rapidly.

Because it was recognized that there would be objection to the Burnside-Couch one-way couplet system, rather than having the traffic engineer, or the city engineer, or the highway coordinator write a report to the Council, it was decided to make this a staff report participated in not only by those mentioned before, but by the transit coordinator and the planning director as well. The report was finished and made to the City Council. Basically the plan involved a one-way couplet system extending from the river to 23rd Avenue with a 44-foot roadway available for each direction of travel. The cost of the project was $2,200,000, of which $1,600,000 was in right-of-way and the remainder for reconstruction of the streets.

The second event that affected the Burnside plan was a request by a large supermarket for a zone change in order to construct a store which would be in the path of the one-way couplet system and would block the improvement. A series of meetings were held with the developer in an attempt to either modify the couplet system, modify his proposed development plan, or both, to find some method whereby the plan for the supermarket and the couplet system would be compatible.

We were unsuccessful in trying to reach an agreement with the developer, and the Planning Commission, on the basis of the staff's report, denied the zone change and sent the request to the City Council, which reviews and has the final say in all such zoning matters.

At the City Council's public hearing on this question, the Chamber was jammed by people representing the developer and by members of the Catholic Church, which would be on the couplet system. This particular church is the headquarters for the Catholic Diocese, and their main concern was a grammar school which fronted on Couch Street. In addition, there were a number of property owners, particularly apartment house owners, who objected to this plan because of the street going through their neighborhood and because in some cases their properties were being acquired.

As a result of the hearing, the City Council decided to approve of the zone change, reversing their decision as far as the one-way couplet system was concerned. They instructed the staff to prepare a plan to

create a boulevard out of the existing W. Burnside Street by purchasing an additional 60-foot right-of-way which would provide a landscaped median, three lanes in each direction off peak, and four during peaks, plus left-turn refuge lanes.

The staff prepared such a plan, which was estimated to cost $4,400,000 as opposed to the $2,200,000 for the couplet system improvement, and the City Council held another public hearing on the boulevard-widening plan. At this hearing the property owners who would be affected by the widening, and whose property would be acquired, objected strongly to the Council, reminding the Council that their own staff had considered this and had recommended a couplet system. Because of the objections, because of the cost, and because the interchange under construction for the Stadium Freeway would not be compatible with a boulevard-type improvement, this plan was not recommended by anyone as a solution, except local aesthetic groups.

As a result of the boulevard-widening hearing, the Council decided to drop this plan and then ordered the staff to prepare a report on the cost and effect of widening the existing 36-foot roadway to a 44-foot roadway by cutting each sidewalk back by four feet. This was done by the staff and a plan submitted. It was pointed out to the Council that this limited widening project would solve the immediate problem but that it was not a long-range solution in that after the freeway was opened the volumes anticipated would exceed the capacity. The Council decided to go ahead, and since a portion of the project was State Highway US 30, an agreement was entered into between the city and state whereby the state would pay 75 percent of the costs, that is, curb-to-curb costs; the state did not participate in any sidewalk reconstruction. There was one provision, however, that the state insisted upon, and that was for the city to agree to prohibit parking on both sides of the streets during all hours of the day. As mentioned, this agreement was signed and the actual widening was completed last summer during the middle of August.

Prior to the widening, as mentioned before, traffic conditions were terrible on W. Burnside Street. As a matter of fact, it was the worst street in the city. We were attempting to carry an average of 15,600 vehicles per day on a street that had only a lane of traffic in each direction, except during peak hours. Speed and delay runs taken showed that the average speed, either during peak hours, or off-peak, averaged between 10 and 12 mph. Together with the extreme congestion, there was a very high accident rate. Totals for 1966 showed 609 accidents in this 0.9 mile section, a rate that was six times the city average.

West Burnside was widened during the summer of 1967. Studies made since the widening show that the volumes are up 18 to 20 percent and that for the initial three-month period after widening the number of traffic accidents has been reduced by one-third. Our checks also show that there has been a 25 percent increase in travel speed.

On the basis of present usage, the volumes are well within the capacity. We estimate on the basis of $1.50 per hour that there is a yearly savings of $270,000 to the motorists from a time and delay standpoint, and $91,200 from an accident standpoint, a total of $361,000. A very good benefit considering the $130,000 cost of the improvement.

We are not completely out of the woods, however. Abutting property owners have filed a petition pointing out to the Council that the "No Parking" ban is having a serious effect on their business. We have made one report to the Council on this, recommending that the "No Parking" ban be retained. Recently we submitted a second report requested by the Council concerning the effect short time parking, 10-15 minute parking, would have on W. Burnside. Again, we recommended to retain the present "No Parking" ban.

Actually we have one more immediate improvement scheduled for W. Burnside--at the western end there is a five-leg intersection on which three-phase signal control is necessary. In addition to the heavy volumes on W. Burnside Street, we also have heavy volumes on the cross street at this location. In the next fiscal year we have scheduled a $100,000 project for widening and providing additional capacity at this intersection.

SUMMARY

In summary I have two points I would like to make:

1. There is every advantage for all affected departments of the agency, be it city, county, or state, to work cooperatively and actually submit a joint report rather than individual reports on key controversial projects. It is my firm belief that today nothing would be done on W. Burnside Street if we had submitted individual reports without including other affected departments.

2. Your toughest traffic problem will never go away. Something like an old general, it will continue getting worse and worse, until even

you might be convinced that there is no solution.

My advice would be to prepare a plan as a team effort, making particularly sure that the report and plan are jointly recommended and approved by all other affected departments. While the policy body, the Council, the Board, or the Commission may not, after public hearings support your plan entirely, chances are good that a modification of the plan, or a portion of the complete project, would be approved. At the very worst you would get a complete turn-down and write it off as "nothing ventured, nothing gained." Most probably the next time it will be easier. I think most city and county governmental agencies have a tendency to take care of the easy problems first. The difficulty is that in the urban areas we are running out of the easy ones and coming head on with the difficult ones. With this in mind, I think the only solution is a joint team effort, approaching problems today because they will be even more difficult tomorrow.

WHAT'S BEING DONE - LAW ENFORCEMENT

by

Warner Mills

It was with considerable enthusiasm that I accepted the invitation to attend this conference where a solution to many of our pressing traffic and highway problems may be found. It is through gatherings like this that ideas and proposals can be exchanged and only those with "deaf" ears could go away uninformed. The long arm of enforcement often is weakened by its own structure. Thus we not only must follow present procedures in halting the wrongs being committed on our highways but also must project and devise means to halt the slaughter, to reduce the thousands of injuries caused by highway accidents, and to cut down on the millions of dollars in property losses which result from vehicle crashes. Enforcement of the traffic laws, rules of the road, call it what you will, is a day-to-day endeavor. It changes daily, as do our traffic patterns. With the amount of traffic we encounter each day, no particular set of procedures will bring ultimate results. The state trooper, the sheriff, his deputies, city police, and officers of smaller communities necessarily must change tactics as traffic patterns change, and they must be prepared to meet the challenge brought on by today's motoring public.

Of course, there are laws in your state and in mine which must be enforced, but that does not necessarily mean an officer must patrol the same street, the same highway at the same time at the same speed day after day. Nor does it mean radar and other speed-checking devices should be used in the same location for lengthy periods of time. Variety is said to be the spice of life; why then, should we not use variety in our enforcement procedures to help assure the motorist a longer life?

Harsh as it may seem, too many of our motorists need help in obeying the rules of the road. I do not think the majority of our highway users violate laws intentionally, but too many of them are mind-wanderers when their thoughts are not concentrated on the control of their vehicles, laws will be broken. Today's vehicles, especially those with powerful motors and quiet performance, lull the driver into a false sense of security. When one drove at 60 miles an hour a few years ago, it took full

attention of the driver to keep his car on the road. The accompanying rattles, noises, and vibrations reminded him of the speed he was traveling. This is not so today. I would ask each of you who drove to this conference to recall your trip. I'll wager that you'll discover your mind often was on matters not connected with your driving, and that now, if you try, you will not be able to remember passing through one town or another. And I'll bet there were times when you were driving in excess of the posted speed limit. Is is so easy to do. By driving as too many of us do, we become members of the lawless set. And that's where the job of enforcement becomes important.

Most of us agree laws and regulations are needed, but too often we complain that they are made for the other fellow, not us. A community, a society, or a highway without rules or regulations soon will become a shambles. Enforcement of our rules of the road is a job for everyone, not just the officer who wears the badge and has sworn to uphold all the laws of the state. I am sure none of you in this room would willingly steal, commit arson, or carry out murder; yet while we obey these laws to the very letter, we often ignore the traffic laws which were placed on our statute books to make our highways safe for all who choose to use them. In my state, Idaho, we constantly strive for enforcement of traffic rules on our highways. I am sure each of you do also, but we find that we are running behind; at least, that is what our accident record indicates.

Statistics prepared by our state police and traffic safety division of the highway department show driver error, inattentive driving, and a disregard of the laws are the largest contributing factors where accidents have occurred. More and different methods of enforcement will not stop all accidents, but I firmly believe that they will lead to a reduction in the number of accidents. Our department of law enforcement was surprised when we discovered the number of drivers involved in fatal and injury-producing accidents who had been arrested previously for traffic violations. Some of these drivers had as many as a dozen previous convictions. Still they had not learned, and many never will--they are dead now. Unfortunately, they wiped out the lives of others. From this we have learned a lesson; too late to help those who have lost their lives in traffic accidents, but in time, we hope, to aid others. The type of driver I refer to has no right or privilege behind the wheel of a vehicle. We hope that when such persistent violators appear before the judges and magistrates, their driving record will be reviewed and their privilege to be a licensed driver be revoked.

Enforcement by our officers is only as good as the cooperation rendered by our courts. The courts must recognize the highway traffic problem and help the enforcement officer impress upon the driver the necessity of obeying the laws. We often hear the plea, "We need more officers. We just can't arrest every violator because we can't be everywhere at once". We do need more officers, but until that time comes we should plan to make better use of what we have.

And how can we better enforce our traffic laws? Surely, everyone has some ideas along this line, and I would like to outline a few of my own.

In Idaho, we instituted a program wherein we pinpointed accidents; as we learned of the high accident ratio areas, we increased enforcement by moving additional troopers into those areas. This was not new to most of us. This system works, and we have figures to prove it. The number of arrests for moving violations went up; the number of accidents went down. But there is a drawback--when you pull officers from one regular patrol area to bolster enforcement in another, the unguarded area often becomes accident-prone. That is why I maintain that our motorists have to be helped to obey the laws.

Far too many of the accidents in Idaho have been traced to excessive speed for the road conditions. Because of this, we are considering asking our legislature to investigate the possibility of authorizing a top maximum speed. We have discovered our prima facie speed law is not foolproof. Much to our chagrin, our Supreme Court ruled it did not always apply. The case in question involved an attorney who was cited for traveling faster than the 70-mile limit on the Interstate. Actually, he was doing 95. He was found guilty in a lower court but appealed to a higher court and was able to convince the justices that at the time of his arrest his speed was not unreasonable due to the surrounding circumstances. The maximum top speed limit permits the state to set a maximum top speed, making it absolutely unlawful to any motorist to exceed this top speed regardless of the conditions. It is our belief, however, that for speed violations below the top maximum, the prima facie rule should be included.

Last year we took a step to increase enforcement by adding plain marked cars to our state patrol. This was not a novel or original approac I doubt there is a law enforcement agency represented in this audience which does not use plain or unmarked cars. In fact, I doubt if there is a

law enforcement agency in the 50 states that has not found use for such vehicles. However, I believe our approach was a little different. Alarmed by the great increase in traffic deaths during the latter part of last year, Governor Samuelson authorized the use of plain marked cars in an attempt to apprehend those drivers who have no regard for the rights of others. The decision to use the plain marked cars was given considerable publicity, and you can imagine the controversies which resulted. The law enforcement department and the Governor were attacked by the Idaho State Automobile Association and by some of the public. We were accused of being sneaky, resorting to unlawful means. This controversy was beneficial to us. It alerted the motoring public as to our intentions, and the psychological effect was tremendous. I must state that all the arguments were not against the movement. We had more backers than we did objectors.

I would like to point out that the first plain marked car was put on the road during the July 4 holiday, and the officer assigned took part in writing 88 citations as well as issuing numerous warning tickets. I cite this as one way of altering our enforcement pattern. I do not say it is a cure-all, but I do believe it has a sobering effect on many motorists.

There are other ways we can improve our law enforcement. One of these is having driver licensing and examinations which mean something. Driver licensing now is widely recognized as a primary factor in highway safety. The testing of drivers, both those who are licensed for the first time and those whose licenses are being renewed or reinstated, now requires a high quality of excellence and degree of uniformity. This is necessary to give some assurance that licensed drivers are qualified to cope with the complex task of driving in modern society. Modern driving must become to each individual driver a social responsibility and an exacting skill. The driver license examiner must recognize that he is in a position of highest public trust and that upon the wisdom of his decision the lives of many people depend. He must impartially administer all official duties without regard to race, creed, position, or influence.

Idaho, unfortunately, has a driver licensing law which needs improving. In my state, the holder of a valid driver's license, be he 14 or 85, is allowed to operate a motorcycle regardless of whether he has ever straddled a motorbike before. Registration of two-wheeled motor vehicles in Idaho has grown by leaps and bounds--some 22,000 are now licensed.

This brings me to the theory that licenses should be issued only to those who are qualified to operate the various types of vehicles. Adequate tests and examinations should be provided to determine this ability, and the state should be allowed to examine, periodically, its licensed drivers to ascertain their physical conditions and vision capabilities. As long as we allow the incompetent, the seriously disabled, and those with impaired vision to operate vehicles, we are asking for accidents, injuries, and traffic fatalities. Changes in driver licensing including penalties such as denial or revocation will not only reduce the number of dangerous drivers but will make enforcement more meaningful.

Idaho has a moving traffic violation point system, which can result in revocation of drivers' licenses, and the safety responsibility law, which offers a degree of protection to motorists involved in collisions. It is a means of removing drivers who fail to meet the terms of this law. This, too, is an effective means of enforcement, though sometimes prolonged. We must, of course, give everyone their day in court, and this sometimes runs not for days but months.

In Idaho we believe speed to be a major evil, the rule of the road most often violated. We are considering use of an airplane to patrol our highways and further enforce the speed laws. However, we have run into a legal entanglement which must be cleared first. If we could convince every motorist that the responsibility of obeying traffic laws is his alone, our job of enforcement would be much easier. Unfortunately, we cannot rely on this presumption. If we are to offer protection to those who use our highways, our duty and responsibility is to increase enforcement--increase it to the point where every driver will be aware that he may be subject to arrest for the violation he has committed. And such an arrest could lead to his loss of driving privileges. We, as law enforcement officers, do not want to be considered as operators of speed traps or as being unduly diligent in issuing citations. But I strongly believe that when a violation is witnessed or there is proof that a violation has occurred an arrest must follow; and it must follow that the courts must act accordingly. This is the only way that we can gain respect for our laws. A tap on the wrist or a light fine or suspension of a jail sentence does not leave much impression on many motorists. In such cases, only his pocketbook, not the individual, suffers.

Why is more law enforcement and loss of driving privileges needed? Let me tell you about 18 fatal accidents last month in Idaho which killed a total of 24 persons. The contributing factors to these accidents included

stop sign violations, three; loss of control of vehicle, generally due to excessive speed, seven; right of way, two; improper turn, one; and two cases where drivers ran into trains. But, more importantly, let me list the record of the previous convictions of seven of the drivers involved in those fatal accidents. Together they held 34 convictions for previous moving traffic violations. One driver had five previous convictions--two for speeding, and one each for negligent driving, failure to stop at a railroad crossing, and disregarding a stop sign. Another had six convictions; three were for speeding, the others for improper backing, passing over the white line, and failure to keep the vehicle under control. Another driver had three previous convictions, two for speeding and one for failure to yield the right of way. Another one with four--two for speeding, one for reckless driving, and one for driving while under the influence of alcohol. One driver had a single speeding conviction. Another driver had five convictions, four for speeding and one for improper control of his vehicle. Finally, the driver, and also the victim, had ten previous convictions since 1961, six for speeding and four for disregarding the stop sign; the last stop sign he ran cost him his life. One of the drivers that was killed in a one-car crash had been ordered on December 1, 1967, by myself to take the physical and visual examinations due to his age, which was 87. When he was killed early in January, no record of examinations had been received. These are the types of drivers we must control, and we need all the assistance we can get to keep them off our highways until they learn to play the game according to the rules. The road of enforcement is a rocky one; we on the side of the law must bear the brunt of the attack and hope the public understands that we are acting for its good.

Ideas exchanged at conferences such as this can lead to the measure of law enforcement that all officers and the general public alike desire.

WHAT'S BEING DONE - MOTOR VEHICLE DEPARTMENTS

by

Jack Nelson

Fifty-two thousand deaths on the national highways, three million crippling injuries, billions of dollars of property damage. These are statistics that overwhelm our public. But what do the people do? They rationalize this. They feel that it is a problem and nothing can be done to correct it. It is just the law of averages. There are so many people who are going to be killed, and there is nothing they can do about it.

We in the traffic safety field, if we believe that, might as well pick up our bags and go home. It is not true. I think we have a tendency to look at the negative side of this problem. Let's look at the positive side for one minute. Last year in the state of Washington, 872 people lost their lives on our state highways. That is not something to be proud of. It was the biggest slaughter the state of Washington ever had, but let's look at our mileage death rate--4.8, a reduction from 4.9 in 1966. Let's go back 30 years--1937. We had a mileage death rate of 12.9. If we had not have had good enforcement, good engineering, and control of the drivers over the past 30 years, we would have killed more than 2,300 people last year. So, gentlemen, we are improving, but there is much to be done.

Now we know that 90 of every hundred accidents were caused by a driver error. Now who has the responsibility of driver control? Normally, it falls within the province of the department of motor vehicles. We license the individual. Our initial drive test is important, because we weed out the people who are physically unable to drive and the people who do not have the skill to operate the motor vehicle. But, truly, what do we know about the driver? Who is the driver that causes all the problem in the field? We are fortunate in our state, for we have a staff of seven qualified research analysts. Our department is completely automated. We have a wealth of information on tape. So our research division staff started to look at the problem. Who are the drivers who are causing the majority of problems in our state?

The first interesting fact that came up was that of the almost two

million moving violations on our records, only 15 percent of the drivers received citations. Eighty-five percent of our 1,700,000 drivers had completely free driving records. So we did some studies. I would like to comment just a little on these studies.

The first one was motorcycle fatality studies. What caused motorcycle accidents and fatalities? Usually, the cyclist involved in a motorcycle fatality where he was not at fault, did not own the bike. It was usually a loaner or rented. It was the driver of the automobile who was the cause of the accident. But they found that the person who owned his own bike was the cause of the accident and his driver record was bad.

The next study conducted was an analysis of the fatal accidents of 1966. A wealth of interesting information can be found in that study. We have 56 percent male drivers in the state of Washington. It was learned that the male drivers were involved in 84 percent of the fatal accidents. I think that is interesting. But they found that the women who were involved in fatal accidents had driving records that were worse than the men's. So the women do not come out scot-free, either.

We find that the safest driver in the state of Washington is a 28-year-old female. The worst driver is a 21-year-old boy. And there is a direct correlation between the number of moving violations received and the possibility of being involved in an accident.

There has been a lot of controversy about driver education. Some people say the program is not effective. They say commercial driver training schools are better. Well, we don't believe it. We conducted a study of the 150,000 youngsters who took driver education in high school and compared their driving records with those 150,000 who did not complete the course. We found that those students that completed driver education had 34 percent fewer citations and accidents than those who did not have the chance to take a course.

We have other studies on relationship of accidents and number of citations. Our last study involved our medical restriction problem. All states will restrict certain drivers because of an illness or impairment. Prior to our study no one could tell us, based upon facts, that we should restrict a person from driving on a freeway because of bad vision or a heart condition. We compared all persons on our records that have medical restrictions and we found that persons suffering from epilepsy, diabetes, and fainting spells had substantially poorer records than the

average Washington driver. Those persons with restricted licenses, because of a deterioration of vision or because of heart conditions, had driving records that were not significantly different from the average Washington motorist.

Well, what are we doing to help control the driver? All states have what they call a driver improvement program. What they normally do is send a warning letter out to the individual when he receives one or two tickets. If the individual continues to receive tickets, they will call him in for a personal interview; and if he does not improve, they will suspend his license. But really, does the suspension of the driver's license correct the man's problem? In the majority of cases, I would say, no, it does not. So we instituted a new program in our state that I would like to mention briefly.

It is what we call group dynamics. We believe that when a person begins to receive citations, that is the time we should take our corrective action. Whenever a person gets four moving violations, we invite him to attend a Driver Improvement Clinic. He attends a class of two hours duration one night a week for three weeks--a total of six hours. We have a group leader to get the discussion moving. It is interesting to observe. We call in a group of thirty people, each having four moving violations on their record, and they are all rationalizing their citations. "It was the no-good police officer's fault. I was innocent." They all tell the same story; so the first hour they gripe. But at the end of the second hour, they turn around to look at each other and start to realize "We can't all have received bad tickets." So at the end of the course they usually find that they were wrong. They have a better outlook. They discuss many problems in this course which we won't go into, but I will never forget one of the first sarcastic letters I received from an individual that attended one of our classes. He wrote and told me that I was "no good" and that the Mickey Mouse program was useless, it was six hours of wasted time. He said, "Every time I get behind the wheel of my car, I think of you and I'll never get another citation."

I don't care what they call me as long as they don't become involved in accidents or receive citations.

We recently completed a pilot program with the driving simulator in the city of Tacoma. We feel there is a definite need for simulators in driver education and driver licensing. We called in 150 known bad drivers and 150 known good drivers. We tried to get airline pilots.

We thought that airline pilots with good driving records would be a good example. None of the pilots showed up, but eventually we did get good drivers to participate. After they took this test in the simulator, we found there was direct correlation of the simulator scores and their driving records. Persons with a poor driving record did poorly on the simulator and those with a good record did well on the simulator. So there is a place for the simulator in this overall program in the highway safety field.

I would like to mention, as a parting comment, a new program which we call CODE. It is Computer Oriented Driver Examining. We are going into this program in Pierce County, Washington, next summer. We are going to random access with our data-processing equipment. Ideally we should re-examine every time a driver renews his license. But everybody in state government knows that you cannot afford to re-examine every driver, each time he renews his license, with a behind-the-wheel driving test. We have a program where we send out a notice to renew a license six weeks prior to the expiration date. We send a little prepunched card. The applicant will bring the card to our examining station, and the examiner will slip it into a machine. Immediately, our computer in Olympia will indicate the man's overall driving record on a screen. If the man's record is good, the computer selects certain types of questions for the man to answer. The applicant will then go to a table top tutor and complete his written test. At this point, we will ask, maybe, five questions of the good driver. But if he is a bad driver, the screen will show his record and his current status. It is possible that in the interim period, after we have mailed his renewal notice to him, his license could have been suspended. At this point, we just take his license away from him and he walks home. If his record is bad, but we have not yet suspended him, the computer will select about thirty questions for him to answer. He then steps to the side and takes a simulator test. You want to take a good look at this man because he has problems. If he does poorly on the simulator, he has an option; he can stop driving or he can request a behind-the-wheel driving test in a car. If he does not pass that test, he doesn't drive again.

So we are doing things. We are trying to improve the driving records of our people on the highway, and we know that it is the driver--as some people say, the nut behind the wheel--that is causing the majority of the problems on the highway today.

WHAT'S BEING DONE--THE HIGHWAY DEPARTMENT

by

E. S. Hunter

During this conference, you have heard many speakers discussing the various aspects of highway safety, such as accident-records systems and their use, safety versus cost, why accidents and traffic fatalities occur, and what should be done regarding traffic safety. All this has led us to the subject of this panel--What's Being Done About Traffic Safety?

The President's Safety Program and the efforts of the automobile industry have all been brought to our attention through the news media. Those of us closely associated with federal aid have had the point driven home by threats of reduced federal aid as a penalty for not conforming.

As a result, changes have been made in the design standards now being used for construction of highways. Engineers engaged today in highway design are ever conscious that safety must be built into all new projects.

Although modern construction and reconstruction take into account the safety of the traveling public, the fact remains that many, many miles of our existing highway system cannot be reconstructed. Some of the older existing roads have a medium or low volume of traffic and simply cannot compete with high-volume roads for limited available construction funds.

This, then, is a fertile area for some other means of developing safety for the traveling public. The Oregon Highway Department finds it necessary to maintain a field strength of between 1,200 and 1,500 men in the maintenance division. These men care for the regular maintenance activities such as patching potholes, grading shoulders, mowing right-of-way, maintaining landscaped areas, removing snow and ice, and sanding

We have found that, through a rather large minor betterment program, our older highways can be improved to provide much greater safety to the traveling public. This work can be done with the regular maintenance crews during lulls in their other work and by utilizing the larger crews which are brought together in the fall for the winter snow removal and sanding.

Since these resources for improvements in roadway safety are available to the highway administrator, he must make use of them. The supervisors of the maintenance crews should be safety conscious in order that they do not drive by such things as trees on the edge of the traveled way and blind road approaches without taking notice and directing one of their crews to correct the situation.

I have compiled a series of slides which illustrate examples of safety hazards along our highway system. Some of these hazards were built into the particular highway by rather recent construction. However, generally, the slides show hazards inherent in our highways constructed 20, 30, and 40 years ago.

These are the same roads I mentioned earlier which, due to a lack of funds, will not be reconstructed for probably many years to come.

1. The first slide is an example of the type of bridge construction prevalent throughout the United States about 15 or 20 years ago. You can see that there are two bents from which traffic is almost totally unprotected. Additional guard rail should be installed for further protection of the motorist.

2. In comparison, look at this modern late-model bridge design. Traffic is adequately protected from the bent in the center of the road by the median guard rail. There are no piers or obstructions on the outboard sides.

3. This is another shot of a similarly designed structure offering the ultimate in protection to the traveling motorist. Designs such as this are showing up all over the nation since the advent of the Safety Act.

4. Older structures having piers too close to the traveled surface must provide guard rail protection. This is one such installation recently placed by maintenance crews. Notice the flared end of the guard rail is buried in the ground to eliminate the possibility of an automobile impaling itself.

5. This is another picture of the same installation, showing the alignment of the guard rail. It is both functional and pleasing to the eye.

6. Here is another guard rail installation, showing a flared end which was installed for the purpose of protecting the motorist from the sign post and from the bridge felloe guard. Note the flare to minimize chance of impalement.

7. In order to properly advise the public, many sign installations are, by necessity, placed in somewhat dangerous locations. These two signs are in a particularly vulnerable position and are a definite hazard to the errant motorist.

The Oregon State Highway Department is now making use of break-away sign supports similar to the design pioneered by the Texas Highway Department.

These poles are designed so that when struck by a car the sign flies up in the air, allowing the car to pass underneath rather than striking the car in the windshield as was the case with the older, solid-pole installations.

8. Ground-mounted signs are always a hazard. However, this hazard can be minimized by making use of a properly installed mast arm such as the one illustrated in this slide. The poles for such an installation are large, and the motorist should be protected by a flared guard rail.

9. The installation of large overhead signs on multi-lane highways is usually accomplished by using a sign bridge. The supports on sign bridges are large and, therefore, a safety hazard to the motorist.

Sign bridges can be installed by highway maintenance crews. When doing so, consideration should be given to using bridges long enough to allow placement of the sign support as far as possible from the traveled way. These large sign supports also should be protected by flared guard rail installations.

10. An obvious and cheaper solution to the hazard of ground-mounted signs is setting these signs back 30 feet from the edge of the traveled way. As in the case of this small sign advising the traveler of the Brooks exit 1/2 mile ahead, some consideration must be given to increasing the size of the sign due to its being farther from the roadway.

11. There are certain hazards connected with moving signs back from the roadway. Here is a sign which sets well away from the traveled surface and presents no hazard to the errant motorist. On the other hand, in the future it will be a continuous and almost impossible maintenance problem to keep the weeds from obscuring the legend.

If you look carefully, you can see the corner of another sign barely showing over the horizon. This sign, placed in a similar position on the

cutbank, while attempting to remove one hazard has created another--inadequate advance warning.

12. This is another example of a sign set back from the roadway. The likelihood of a motorist striking this sign is rather small. However, all such signs should have a breakaway support and certainly should have the concrete foundation constructed flush with the ground.

13. Probably the safest, easiest, and cheapest way of eliminating the ground-mounted sign is to place it on an existing overcrossing structure. Actually, making use of existing structures where possible provides a better service to the traveler, as signs over the traveled way are more easily observed and at the same time eliminate another roadside obstacle.

14. This is an example of another built-in hazard which is difficult to cope with. Presently, the Oregon State Highway Department is making use of breakaway bases on all luminaire installations. When existing poles with solid bases are replaced, maintenance crews use breakaway bases.

15. This is an example of opposing traffic lanes where the vehicles on the inside of the curve throw their headlights directly in the face of the motorist coming from the other direction. A rather simple and cheap solution is for maintenance crews to install a glare screen of expanded aluminum.

16. This is a shot of the same installation, showing the effectiveness of the glare screen.

The next series of slides deals with the problems of older primary and secondary highways which are similar to many of the county roads. Maintenance crews are continually working at their improvement, and I hope to illustrate ways in which we have been improving the older roads so the county and city people who are present may make use of some of our methods.

17. This is a particularly good example of a dangerously narrow bridge. As you can see in the background, the roadway has been improved and the shoulders widened to a reasonably high standard. Sometime in the future, our maintenance crews will pave them, and the shoulder stripe will be painted.

This is a desirable improvement, but only if the narrow bridge is also corrected.

In an attempt to warn the motorist of the narrow bridge hazard, zebra boards have been placed at both ends of the bridge rails. In this attempt to warn the motorist, we have helped obscure the clear view of the driver coming onto the highway from the side road which you see just beyond the bridge.

18. This picture shows how maintenance crews can widen concrete bridges by utilizing precast slabs. You will notice the extreme contrast between this and the last picture. We now have an improved roadway needing only shoulder paving or an overlay to place it among our modern safely designed rural highways.

19. In addition to widening the bridge and widening the shoulders, consideration should be given to channelization of turning movements at road intersections.

This treatment involves only minor widening of the roadway and minor paving, all of which can be accomplished by maintenance crews. This would be an excellent solution to the problem presented by the bridge with the zebra boards.

20. On all of the older highway systems, whether they be city, county, or state, there are numerous narrow bridges. By utilizing precast slabs, maintenance crews can do an excellent widening job on concrete structures.

However, a cheaper solution is the replacement of narrow bridges with culverts when the waterway can be reduced. Here is an example of an old wooden narrow structure being replaced by modern, easily installed metal culvert.

21. Following the culvert installation, the crew should immediately flatten the fill slopes and widen the shoulders. In this instance, the pavement also was widened to allow the installation of a shoulder stripe. What used to be a traffic hazard to the motorist is now a safe, high-speed modern highway.

22. This is an example of a reasonably wide and safe highway facility except for the road approach coming in from the right. Sight distance at this road approach is obscured by the low, steep cutbanks.

This is a common problem on older highways that can be easily corrected by flattening the cut slopes.

23. This picture also illustrates a something less than modern cutbank design. Minor excavation and flattening of this slope will greatly

improve the sight distance.

24. Here is yet another picture of a road approach that easily can be made safer by flattening the cut slope. You will note far off to the right the location of a telephone pole which marks the right-of-way line. There is adequate right-of-way for maintenance crews to flatten the cutbank at this location. The excess material can be used to widen embankments somewhere else along the roadway.

25. This is an example of an older highway with a narrow shoulder. The obvious safety hazard, however, is caused by the trees growing so near that narrow shoulder. This can, of course, be easily corrected by maintenance crews but has obviously been overlooked for a number of years.

26. This situation is similar to the one on the previous slide except that this is a man-made obstacle. It is, however, no less deadly to the occupants of cars which strike it.

27. This is a picture of a highway which has recently been widened and all obstacles set back out of the way of the errant motorist. This work was accomplished by maintenance crews and involved setting back ditches, flattening slopes, widening and paving shoulders, and removing roadside obstacles.

28. This is a picture along one of our most beautiful scenic highways. You will note that the fill slopes are steep enough to cause a vehicle leaving the roadway to overturn. There are large Ponderosa pines so close to the road that a car going off the embankment would likely strike one of them. Serious injury could result. Also note that on the left side of the road sight distance is severely impaired by the lack of proper clearing.

29. By utilizing our large winter maintenance crews we have been able to improve this section of scenic highway. As shown in the slide we have widened the shoulders and flattened the back slopes so that a car deviating from the normal traveled way could probably avoid overturning and return safely to the pavement. The obstacles, which in this part of the country are large rocks and ponderosa pines, have also been removed. A further safety benefit experienced by the motorist is that wider clearing allows the sunlight to reach the road and melt the snow and ice during winter months. This also reduces the cost of winter snow plowing and sanding.

30. Widening is also beneficial in the more arid and desert areas of the state. This is an example of the work being carried on in central and eastern Oregon by the regular section maintenance crews. Once again, the primary object is removal of roadside obstacles and the flattening of slopes. With the addition of shoulder rock and paving, this will be another fine highway adequate for the traffic volume.

31. In another slide I pointed out the sight distance impairment caused by a lack of roadside clearing on the inside of a horizontal curve. This is an example of a curve on which there has been adequate roadside clearing to provide stopping sight distance. In fact, the sight distance may have been improved enough to accommodate passing.

32. This slide clearly illustrates the added safety provided the motorist by increasing sight distance. The lack of adequate sight distance is particularly hazardous during inclement weather.

We all have conditions along our highways such as these I have illustrated. We drive by them every day. Our crews drive by them every day. We often do not recognize them as traffic hazards until a serious accident points them out.

The Oregon State Highway Department has placed heavy emphasis on the removal of safety hazards by maintenance crews. We like to think that we have become safety conscious and that we are correcting the smaller, easily corrected hazards with maintenance crews as fast as we can, thereby providing the motorists in Oregon a safer facility on which to travel.

PANEL DISCUSSION

CONSTRUCTION AND MAINTENANCE

Presiding: F. J. Burgess

INSTANT BRIDGES

by

Dick Imper

This is the age of instant coffee and instant credit. Today we are going to try for instant bridges. We all realize that bridges are not built overnight, but they can be so constructed as to minimize the construction period. Many of you here today are concerned with the secondary county roads, where the outage of a bridge can cause many inconveniences to the traveling public, and limited access or no access at all to the other side. But I am quite sure that many of you here today have many other reasons for these inconveniences.

From the economy standpoint, cutting construction time can also reflect favorably in the cost of the structure. It also can reduce the contractor's overhead and his equipment costs. Using plant-produced items and standard forms is another way to add to the economy. The demand for pre-stressed concrete has come from many agencies--federal, state, city, and county. These people have been willing to specify concrete and, in return, the concrete industry has worked with these agencies in developing and building sections to meet desired applications. This has led to various mass-produced precast items. I want to confine my remarks today to really short span bridges, up to 100 feet.

How can precast help shorten the construction time? As the contractor is working on the substructure, which can be cast-in-place retaining walls or piling foundations, the precaster is producing the deck elements. Once the substructure is complete, the contractor is ready to erect the unit. After erection, the units are tied together with steel rods cast into the units. Then the longitudinal shear key is grouted and allowed to cure for a minimum of three days. An asphalt-wearing surface is now placed over the precast elements to take up the irregularity. Curb and railing can be placed with or without the traffic on the bridge, depending on the schedule that is set up.

I would like to describe an actual job done last summer near Albany, Oregon. The owner is Linn County and the engineer is Oregon Bridge

Engineering. The new structure replaces a timber bridge over the Calapooya Slough about one-half mile southwest of Albany, Oregon. The structure had a fairly high average daily traffic which had to be detoured to another road. Due to the poor detour route, it would be necessary to minimize the close of bridge time in the contract documents. The proposed structure would have the same center line as the old bridge but would be wider, so the contractor was able to drive a test pile from the old bridge and order piling to length. The contractor waited until the piles were built before starting demolition of the old bridge. The old bridge had columns underneath, and the substructure needed replacing.

The following schedule was adhered to after the bridge was closed. On Day 1, the contractor removed the deck of the old structure; on Day 2 he removed the piling and also drove three prestressed concrete piles; on Day 3, he drove additional piling. On Day 4, he added more piling. In the meantime, he was working with other crews cutting off the piling to grade and also forming the caps. The fifth day, which was Friday, he completed driving the piling. The sixth day was a Saturday, the only Saturday he worked. He made preparations for pouring two of the caps on Monday.

On the eighth day, which was Monday (we are counting Sundays in this schedule, also), he poured two of the caps. He poured two more caps on the tenth day and one more on the eleventh day. On the twelfth day, the contractor completed the caps and started to erect one span of prestressed slabs. These were 4-foot-wide units, 18 inches deep and 40 feet long. Actually, five decks of 40 feet, for a 200-foot long structure.

On Monday morning he set two more bents of slabs and grouted the shear keys. On the 16th day, he set a few more slabs; and on the 17th day, the slabs were completed and the shear keys were grouted. Now there is a wait of three or four days for the grout to cure before traffic is allowed on the bridge. This takes up to the 19th day, which was a Friday again. On the 21st day after the bridge was closed, the structure was ready for traffic.

The bridge was not complete as far as the wearing surface and the curbs and rails, but it was open for traffic. The contractor actually worked 16 days on this structure.

The bridge just discussed was designed for precast caps, wherein pile is driven and the precast cap is placed over the top; then the joint is grouted through an 8-inch diameter hole in the top to form a monolithic joint. While driving the test pile, the contractor encountered problems with riprap below the surface causing deviation of the piling. The precast cap requires quite close tolerances to fit the sockets. There is not much driving tolerance, so the contractor elected to use poured-in-place caps for this structure. He probably could have saved another two or three days using precast caps.

Prestressed bridges compare favorably with other types of bridges This is evident by the number being used today.

A SIMPLIFIED METHOD FOR GRADING CONTRACTS

by

R. W. Leach

Many of you will recall that last year in Seattle I told you of an idea we had for simplifying the engineering required for simple grading contracts to reduce the cost in both time and money. At that time it was still just an idea which we felt sure would work but which we had not yet tried. Now we have tried it and I am able to give you a report on how it worked.

Our objective was to find a method of reducing both the personnel time and the cost required to work up a job for contract. In going through the steps required from initial location to completed job, it seemed that the most time was involved with calculating earthwork quantities, balancing the grade, and calculating the haul. If done by the old method, this means taking the cross sections, platting them, laying grades, determining end areas, calculating quantities, changing grade and recalculating until a balance is reached, constructing the mass diagram, and calculating the haul. Personnel time can be saved by machine calculations, but there is still considerable expense.

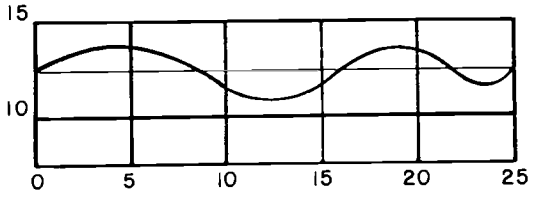
After this work has been done by either method, there is still the slope staking including the intermediate shots for quantity calculation either manually or by machine and blue topping for final grade.

We used a lump sum for grading approach on the theory that this would either greatly reduce or completely eliminate many of the time-consuming steps involved with a conventional grading job. We ran the center line and profile and laid a grade which we hoped would come close to balancing. This is probably the most critical step because a great deal of the difference between success and failure depends upon the ability to take a profile, go over the route, and lay a grade which is reasonably close to a balanced grade. We then set up the grading in terms of a lump sum item per twenty stations for grading to a tolerance of three-tenths of a foot above or below the design grade including haul.

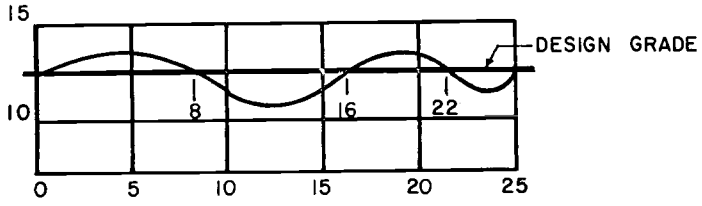
Since we were working with an unbalanced grade, we reserved the

right to raise or lower during construction to adjust the quantities. Since this could materially affect the quantity of earthwork moved, we provided we would pay for everything removed below the 0.3 foot tolerance. Our first thought was to include this as a bid item for each one tenth below the tolerance per station. Upon reflection, however, we decided that since we had no idea how many one tenth per station units there would be, we stood a good chance of being sandbagged. A bidder could gamble on us having to lower our grade a considerable amount and bid an unrealistically high amount per unit. Of course, it would backfire on him if we raised the grade an appreciable amount, since we subtracted for everything above the 0.3 foot tolerance. Frankly, we were afraid the contractors had a better eye for quantities than we did. We set the amount at $7.50 per station tenth, so it would be the same for all bidders, and therefore, not an item used to determine the lowest bid. The figure of $7.50 was arrived at by allowing .50¢ per yard for the thirteen yards included in a station tenth plus one dollar for haul.

In order to pull this whole thing together let me show you through a very simple example. We have run the center line and plotted the profile, which looks like this:

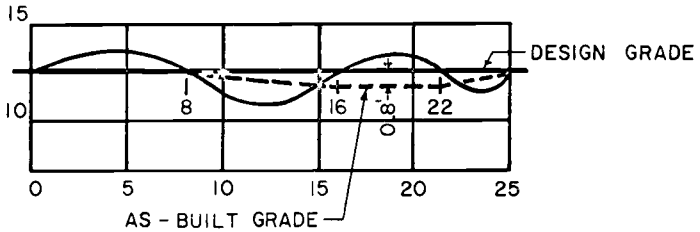


We now lay a grade which we feel is balanced so that the excavation will make the embankment:



We prepare the plans and call for bids. We call for a lump sum bid for grading per twenty stations. We also tell the contractor in the special provisions that this lump sum bid is for grading to within 0.3 foot plus or minus of the design grade. We also tell him that if it is necessary to lower the design grade more than the 0.3 foot tolerance, we will pay him (in addition to his lump sum bid) at the rate of $7.50 per one tenth of excavation per station. If we raise the grade more than the 0.3 foot tolerance, we will deduct from his lump sum bid at the rate of $7.50 per one tenth per station. This applies, of course, only to center line cut sections and not to any fill sections.

During construction we found that we did a poor job of laying a balanced grade, so we had to lower the grade and ended up with a grade which looked like this:



Because of this, in addition to his bid for the grading between Station 0 and 20, the contractor would receive an additional (20-16) x (8-3) x (7.50) = $150. The additional amount for grading between Station 20 and 22 would be calculated the same way and added to the lump sum grading bid from Station 20 to 40. Had the as-built grade been .8 above the design grade, these quantities would have been subtracted from the contractor's bid. All the other bid items such as water, drainage, culverts, and surfacing were set up in the regular way. Compaction was taken care of by providing for roller time, and finishing was made incidental and included with the grading.

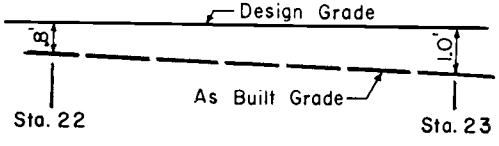
We decided to use Hatch Road as a guinea pig. It consisted of 3.3 miles of fairly light grading which included some solid rock. Generally the alignment followed the old road, but we flattened some curves and in a couple of places left the existing road. We received four bids, ranging from a low of $70, 253 to a high of $93, 117 with the contract being

awarded to the low bidder.

During construction we encountered no unusual problems. At our pre-construction conference we went over the job very thoroughly to be sure the contractor understood exactly what we were doing. When we staked the culverts, we made them on the long side so that we would have no problem in maintaining our finished width if we had to raise fill sections. As a further precaution, we suggested and the contractor agreed to start the fills a little wide, so that if we later found it necessary to raise the grade we would have our minimum subgrade width without having to widen the fills. If we did not raise the grade, we would end up with flatter slopes or wider subgrade, neither of which we considered to be detrimental.

We found it essential to keep an extremely close check on how the excavations were making the embankments. Just as soon as we saw we were running either short or long, the grade was changed to compensate. We were fortunate in having a contractor who worked very closely with us on this. Had we had one less cooperative who started hauling all the easy excavation to get a large first estimate as contractors sometimes do, this would have been extremely more difficult and could have caused some additional problems. Because we had a good contractor with a good blademan, there was no problem in finishing without blue tops.

It was a simple matter to determine the plus or minus quantities to be added to or subtracted from the lump sum for grading to compensate for grading above or below the tolerance. We simply ran a second profile when the grade was completed and at each station determined the difference between the final grade and design grade. From the difference we deducted the 0.3 foot tolerance, averaged them for each 100-foot station, and multiplied by $7.50. Here is a simple example:



The additions for this station were then:

$$\frac{(.8-.3) + (1.0-.3)}{2} \times 7.50 = \$45$$

These were accumulated for twenty station totals and added to or subtracted from the lump sum for grading bid.

It is necessary at this point for me to make a confession. In order to make a better evaluation of the success or failure, we cross-sectioned the job so we could calculate quantities after the job was completed and calculate cost per cubic yard to compare with other conventional jobs. After the work was done, we reduced the sections and calculated the quantities. By dividing the total yardage of excavation by the total paid for grading, we found that we paid $.70 per cubic yard for excavation. Considering that approximately 25 to 35 percent of the excavation was solid rock and this included all haul and finishing, this is comparable to our conventional bids.

In order to compare engineering costs with conventional methods, we picked five federal aid and five non-federal aid projects.

SPOKANE COUNTY
COMPARISON OF NON-FEDERAL AID PROJECTS
(Thousands of Dollars)

CRP	ROAD NAME	Length (Miles)	Contract Cost	Engineering Cost	Total Cost	Total Cost/Mile	Engineering Cost/Mile
778	Staley	2.32	70	17	87	38	7.3
495	Kentuck Trails	2.27	32	13	45	20	5.9
547	Drumheller	2.36	82	12	94	42	5.2
690	Andrus	2.16	95	11	106	49	5.2
921	Thierman	1.53	51	13	64	42	8.7
	TOTALS	10.64	330	66	396	37	6.3

SPOKANE COUNTY
COMPARISON OF FEDERAL AID PROJECTS
(Thousands of Dollars)

CRP	ROAD NAME	Length (Miles)	Contract Cost	Engineering Cost	Total Cost	Total Cost/Mile	Engineering Cost/Mile
547	Truax	3.88	216	32	248	64	8.3
655	Hayford	3.83	180	27	207	54	7.0
606	Coulee Hite	3.04	208	21	229	75	6.9
703	Old Palouse Hwy.	4.62	267	30	297	64	6.5
789	Day-Mt. Spokane	2.38	119	21	140	59	8.7
	TOTALS	17.75	990	131	1,121	63	7.3

For the non-federal aid projects the average for engineering per mile was $6,300; for the federal aid jobs, the average was $7,300 per mile. This was not particularly surprising because the amount and type of engineering involved for the two types of jobs is very much the same. The cost per mile for the construction was, of course, considerably higher for the federal aid projects. This again was not surprising since they are the more heavily traveled arterials and are built to considerably higher standards. Also, they include light bituminous treatment, the excavation quantities per mile are considerably greater, and they have thicker surfacing depths than the non-federal aid projects which are mostly on access roads.

By comparing the average of these two samplings with the Hatch Road:

SPOKANE COUNTY
COMPARISON OF FEDERAL AID AND NON-FEDERAL AID PROJECTS WITH HATCH ROAD

	Construction Cost/Mile	Engineering Cost/Mile
Federal aid projects	63,000	7,300
Non-federal aid projects	37,000	6,300
Hatch Road	26,000	3,900

we feel we have gained the objective we wanted. It should be pointed out that all the expense of obtaining the quantities of excavation for the Hatch Road after the job was completed was very carefully kept separate from the job itself, so none of it is included in the comparison.

We would like to develop a simple, inexpensive method of estimating earthwork quantities, somewhere between actual calculation and just guessing. So much of the success depends upon the ability to lay a grade which is somewhere near balancing. When we calculated the quantities for the Hatch Road, we found the design grade came to 47,500 cubic yards of excavation but the actual finished grade included only 40,250 cubic yards. We were able to live with this difference without any major problems, but it would have been better if we had some method of making an educated estimate. The next time we try this method we will include an item for finishing so that it will not be included with the lump sum grading item.

We feel that our experiment was enough of a success to use it on more of our projects. We found no problems which we feel to be great enough

to require any major change in our method. We found some minor features which we feel we can improve upon.

Last, and to me most important, we feel that since we have materially reduced our engineering costs, we have accomplished what we started out to do.

CONTRACT MAINTENANCE

by

V. L. Dorsey

The Washington Department of Highways has contracted various forms of maintenance work for many years now. Historically, we have always contracted our bridge painting, except for very minor structures, that is, those that can be practically painted from the ground. In recent years, with the increasing work load and the demand for greater services on the part of the public, plus steadily rising costs, we have been into a wider variety of maintenance contracting on what currently might be considered an experimental basis.

This last year we contracted for the maintenance of a rest area on the Interstate highway near the Canadian border, known as the Custer Rest Area. Part of the maintenance problem was due to the exceedinly high usage by Canadians, not so much southbound as on their return trip home. They apparently enter the state of Washington wearing the worst clothes they own, buy new clothes in Seattle or some nearby area, and stop to change in the rest area on the way home. They leave all of their old clothes with us so as to avoid the tax at the border.

Our first call for bids was not too well thought out--the wording of the specifications left something to be desired. Assuming heavy usage in the summer months, we asked the contractors to bid a monthly rate for that period and a separate rate for the winter months. This contract contained a two-way cancellation clause based on 15-day notice. While the total price bid was well under our estimate for annual maintenance, it was obvious that the contractor would have a very profitable summer, go south about September, thereafter advising us that he did not care to perform this work during the winter months at his stated price of $1.00. We rejected all bids and rewrote the specifications. On the next call for bids, we had solved our specification problems with the bidding and received what appeared to be an acceptable price.

Maintenance on the rest rooms was very good, but when we took over the landscaped area at the completion of the plant establishment period, even though the contractor was entitled to extra compensation in the contract, the service proved quite unsatisfactory and we canceled the contract in January.

We have contracted for garbage pick-up with local franchise garbage service companies at the price of 75 cents a barrel a week, which is, of course, a very favorable price for us. We managed to do this by making it part of a much larger project. Since the garbage collectors are not going after widely scattered, individual barrels, and are equipped with a garbage packer, they can provide this service at a cost considerably lower than ours.

Recently a contractor approached our Wenatchee District desiring to enter into a contract with us for re-lamping the entire district, both on schedule and on call as needed. We advertised for bids and the contractor that brought up the subject was, as might be expected, the low bidder. Here again, the work was being done as part of a much larger project. This particular firm services county and city lighting in various forms, outdoor advertising, and many other agencies. The service to date has been good and particularly pleasing to the Traffic Engineers. On schedule, they not only re-lamp those that are out but also they replace the entire installation, plus cleaning or any other service required. Our investigation has indicated that the level of illumination is much better maintained in this manner. So far, this contractor has done a good job.

Last year, we tried for the first time the contracting of picking up litter along our highways. I think the State of Oregon should be given the credit for getting us into this. This state has a quaint habit of selling beer on Sunday. (Note: The Washington State Liquor Board recently moved to permit Sunday sales in our state.) In south central Washington, the so-called tri-city area comprised of Richland, Kennewick, and Pasco, generally enjoys a long, hot summer. Apparently our natives cross over into Oregon on Sunday via the Umatilla Bridge, buy a six pack, or perhaps more, and start drinking them on the way home.

Mr. Gene Kasper of Clean and Beautiful contacted our department last winter on behalf of the National Association of Manufacturers of Glass Containers and wanted to sample a mile along one of our highways. They specifically requested that we take a problem mile so, with malice aforethought, we picked the section between Mile Post 1 and Mile Post 2, just north of the Umatilla Bridge. By pre-arrangement, our local Maintenance Superintendent acted as guide and witnessed the clean-up. They hired a truck and driver from a local garbage company, together with two laborers, to clean the specified mile, one man walking each side until the collection was completed, and then all of the litter was classified.

The findings were interesting. This particular section had been

cleaned about four months previously, at about the end of the tourist season. In the way of paper, there were 37 newspapers and magazines, 82 food packages, 148 milk and beverage cartons, and 1,156 miscellaneous pieces of paper for a total of 1,423. Of cans, there were 442 beer, 46 soft drink, 8 food, 7 miscellaneous, for a total of 503. It is obvious that beer runs way ahead of milk. Of bottles and jars, there were 70 returnable beer bottles, 308 nonreturnable, 34 returnable soft drinks, 4 nonreturnable, 7 liquor and wine, 8 others, for a total of 431. Auto parts consisted of 1 seat cover, several tire sections, a hub cap, some chrome trim, some windshield glass, and one spring leaf. Under the heading of miscellaneous, one fish head, some potatoes, one litter bag, which was full, 3 table knives, a number of plastic eating utensils, and some bailing wire. There was a total of 2,457 items for the one mile. I guess this made the district feel a little desperate about the situation. This area is lightly traveled in the winter months and does not present many maintenance problems. Our crew is small and we can accomplish little clean-up during the winter.

We have been urged to contract more and more of our maintenance. It is claimed that we can contract maintenance and save money by doing so. It might be said that we could provide this service for less money but certainly, to date, we have saved nothing because we have yet to fire anyone or sell any equipment. In one particular case, the low bidder on this 275-mile litter pickup contract was a former highway employee known as a hard worker, but his total price of around $10,000 just did not look right to us. We called him in for a pre-award conference. He had done a fairly intelligent job of planning. He said he had driven all of the roads, had noticed that litter occurred about one mile from a drive-in and ended about 3 miles out. Upon this line of reasoning, he assumed that he would not have to pick continuous miles of highway because many of them would probably remain quite clean. The contract required him to clean an area 50 feet each side of the center line, clean the medians, no matter how wide, and to the right-of-way fences where they were less than 50 feet from center. As we saw it, he would have to cover a stretch 50 feet each side of the highway, 20 miles long, every day and it didn't seem to us he was going to realize a profit. He further explained he did not plan to make frequent trips to the garbage dump but was going to have a burner on a towed trailer, burning the rubbish as he went, and he would not try to salvage the bottles but would break them in the bed of the truck because of the bulk problem. He really sounded convincing and since there was other competition, the contract was awarded. It was not very long before he found it necessary to hire a helper. Eventually he salvaged the bottles; also, he started hauling the trash to the dump because, in the hot, dry climate of the summer in that area, burning on the highway presented quite a problem. He and his helper drove the roads and took turns walking,

picking one side at a time, where the shoulder was wide enough. If the shoulder was narrow, one man drove ahead, left the pickup for the follower and then proceeded ahead, picking as he went.

The contract period was for six months, from May through November. Cleaning was excellent, and we were quite satisfied with this man's performance. As best we could tell, he made wages. It is indicated that he is very interested in bidding this work again; also, a number of other people have expressed an interest in bidding on this job. I expect that we will contract this particular area again this coming summer. Due to the variation from two lane to four lane, different right-of-way widths, and widely varying median widths, we cut the project up into like sections of road and requested a separate price for each section. He was paid each time he cleaned, which was specified as being every six weeks on heavily traveled sections and every eight weeks on the less traveled roads. It averaged out at $7.70 a mile, which we felt a very favorable price, although it is a little hard to see how he made money. Certainly, we cannot send two maintenance men out with a truck and accomplish an equal amount of work at that price.

One of the advantages, of course, to this form of contracting is the supplementing of our employees during the summer months, additional help during the busy season, without the need to carry the equipment and/or the men through the winter months. To date, our experience has been very good and I would expect others might try this.

ELECTRONIC CONTROL PAVING MACHINE

by

Leonard Hallock

A paver consists of a tractor--either crawler or rubber-tired--which has a hopper on the front to receive mix from the trucks, conveyors to carry the mix from the hopper to the rear of the machine, augers which spread the mix laterally, and the screed, which is a flat, heavy steel plate. The screed is attached to the tractor by pull arms and is free to float up and down while being towed. The screed is vibrated and its purpose is to smooth out the mix, impart a uniform density to the mat, and provide a means of controlling the depth of the material and the slope of the mat in the transverse plane.

We are concerned today only with the screed and the means of controlling depth of mix and slope.

The screed is free to float up and down. Its weight, its angler with the horizontal plane, and the compressive resistance of the mix dictate the thickness of the mat. The weight of the screed is static; if the paver is run correctly (we will discuss this a little bit later), the compressive resistance of the mix remains constant; this leaves the angle of attack or the angle of the screed bottom as the only variable.

Tilting the screed up allows more material to flow under it, increasing mat thickness; conversely, tilting the screed down decreases mat thickness.

Before automatic screed controls were available, the screed was controlled by the screed man. He had a gauge with a variable depth marker set to the desired mat thickness before compaction. He rode the screed, walking back and forth checking the mat thickness and changing the screed angle to maintain the depth indicated on the gauge. Imperfections in the base produced false readings and influenced the smoothness of the finished product. The screed man's position at the rear of the machine made it difficult for him to "eyeball" the grade and take corrective measures. The slope had to be checked with a level and straightedge--a time-consuming task.

Research proved that the screed could be tilted up or down as effectively by changing the elevation of the pull points as by the control wheel, and automatic screed controls were developed. Barber-Greene uses a hydraulic cylinder to control pull point height. The tow arm is hinged at this point. Blaw-Knox uses a variation of this method and is also controlled by a hydraulic cylinder. Cedar Rapids uses an overlapping knife-action tow arm controlled by an electric motor driven screw.

Basically the grade and slope control system provides the means to automatically control the two pull arms of the paver screed to lay an asphalt mat to a predetermined grade and slope. The grade sensor and grid which is attached to the side arm rides on a predetermined grade reference, which is a taut wire, and constantly and accurately maintains the pull point at a set distance from the wire. Either side of the machine may be used as the grade side.

The slope control sensor or inclinometer is mounted on a transverse beam which is connected at each end to the tow arms. The beam's function is to transmit the position of the slope pull point relative to the grade side pull point to the sensor. The inclinometer maintains the slope side pull point at a desired elevation to the grade side pull point. At the operator's command panel, this desired elevation is converted into terms of slope and is controlled with a fingertip dial. A positive or negative slope of up to 13° relative to the grade side pull point is easily realized by merely turning the dial in the right direction.

The grade sensor is fastened to either arm at the pull point on the Blaw-Knox machine. On the Cedar Rapids paver the sensor is mounted at the point where the control motor actuates the tow arm. The Barber-Greene paver has the sensor mounted almost at the screed. All use the same principle of operation.

The distance from the pull point to the reference grade line is determined by the angle of the screed that is required to produce the desired mat thickness. When this distance is determined, the sensor is cranked up or down until it reaches null point, that is, the system is in balance. In this position the grade pull point elevation will be maintained continuously as the paver travels over the rough base. It is important to note that both the grade sensor and the inclinometer operate at an electrical "null" in a bridge system. Basically each is striving to balance the voltage and maintain "null" in the bridge circuit at all times.

Visualize the machine traveling from right to left. At the instant the machine dips, the hydraulic cylinders are static because the system is in balance or at "null". Because the sensor is attached to the side arm,

it also begins to dip. As it dips, the grid rotates with respect to the sensor and causes an imbalance in voltage. This signal is sent through the system and the hydraulic cylinder on the grade side is actuated. As it begins to lift the pull point, the grid rotates back until it again retains its null position and the voltage is back in balance. As the machine rises, the grid rotates in the opposite direction and the cylinder must lower the pull point to bring the system back into balance. The sensitivity of the system can be adjusted so that a dime passed between the sensor grid and the reference level will actuate the system.

There are a few application "do's" and "don'ts" affecting the quality of the mat, which the automatic controls cannot correct.

1. Material level in augers must be fairly constant to permit the screed to function properly. Augers should run 30 to 90 percent of the time. This has a direct bearing on the compressive resistance of the mix.

2. Proper truck contact. Stop truck short of finisher. Do not let truck bump finisher when delivering mix. Make truck contact with finisher in motion.

3. Balance finisher speed to plant production. The screed on a waiting paver tends to settle, leaving a permanent defect in the mat.

Automatic controls on pavers do not aid these industry problems:

1. Waviness
   a. Mix inconsistency
   b. Improper conditions or operation of finisher

2. Cracking
   a. Excess 200 mesh material
   b. Over-rolling

3. Segregation
   a. Stock pile--cold feed
   b. Improper mixing
   c. Truck loading--finisher hopper

4. Tearing
   a. Too rich or too lean
   b. Aggregate size--mat thickness ratio

Automatic controls do not save material. They do not reduce manpower necessary to operate. But automatic controls do produce smoother riding pavement and more precise control of the finished product. The end result justifies the additional expense involved.

IMAGINATION IN MAINTENANCE

by

Roy Jump

It is indeed a pleasure for me to appear before this conference and discuss some aspects of maintenance confronting all those personnel engaged in it. I would like to define highway maintenance as it affects highway departments and I presume would affect county and city people as well.

Highway maintenance is defined as the preserving and keeping of a highway in its as-constructed condition, or as it has been later improved. This includes the operation of the facility and the services necessary to provide safe, convenient, and economical highway transportation.

I think West Virginia would be in quite a mess in trying to prove they had provided a safe bridge. As we all know, there was a bridge collapse in West Virginia in which some 47 people lost their lives. A convenience, probably, would be rest areas that states are now providing. Nowhere in this definition is there reference to how well we should do these things. In other words, what level do you preserve the integrity of the design from purely a maintenance standpoint without entering into betterment programs?

Management, at all levels of government has suddenly awakened to the fact that the price tag for maintenance of a transportation facility to the lowest degree of the definition is soaring to record heights. It has always been our dream in Idaho that as the construction projects accomplished in the 1920's and 1930's were replaced by modern construction, less maintenance. It does not seem to be happening that way. Any money that has been saved by better construction is being gobbled up by wider pavements from which we must remove snow, wider rights-of-way to be mowed, more safety features, beautification, higher standards, and expanded services for highway users.

Just recently the Highway Research Board released Report No. 42 which I recommend for your perusal. This concerns a project conducted by Betram Tallamy Associates and deals with maintenance requirements and unit maintenance expenditures for Interstate highways. I have studied this report in some detail and see no reason why the information could not apply to all systems of roads.

The states included in this study were New York, Florida, Ohio, Texas, and California. In the test states, 47.7 percent of maintenance expenditures were for traffic services; 24.1 percent for physical maintenance; and 28.2 percent on esthetic controls, including litter removal and vegetation control. Another way to split this pie would be to say, salaries and wages, 49 percent; equipment rental, 27 percent; material and supplies, 24 percent. During the past four years, Idaho has spent many hours at the management level (including all the division engineers and district engineers) in studying the manpower needs of carrying on the functions of our highway department. This included all personnel--engineering, maintenance, accounting, and so forth. At the conclusion of this study, we had in black and white, the manpower complement considered necessary to carry on the functions of the highway department. It did not come easily. When you start arguing with district engineers, you have a problem. But at least we had a tool, a competent tool, to justify our existence.

On the maintenance side, the complement provided enough people to perform a standard of maintenance that appeared reasonably satisfactory to road users and to the critical eye of our staff. A research project was initiated at the University of Idaho to determine what was going on to give us this particular level of maintenance. A preliminary report will be made this summer on the results of that survey. If there are any changes to be made--for instance, if we have to do more mowing or remove more snow, then we can expect an adjustment in the manpower complement. More funds, more people, better equipment, and the efficiency of the people-every one of these would have to be considered in order to perform the extra work.

With equipment being discussed at all levels and accounting for some 27 percent of the total outlay for maintenance, I would like to confine the remainder of my time to this subject.

About 23 states have their equipment sections directly under the maintenance engineer. Most states require the highway departments to purchase their equipment through a state purchasing agent under a competitive low bid procedure. In Idaho, the maintenance division has the responsibility of budgeting and specification writing in connection with purchasing all new equipment with the exception of office furniture and surveying equipment. Detailed specifications are drawn for the various types of equipment wide enough in scope to encourage competitive bids from three or more suppliers. We are not so concerned with brand names as we are with obtaining the maximum return for the dollar invested.

As a sequel to the manpower complement, last fall we hammered out

an equipment complement, which essentially provides for a basic number of units required to carry on all functions of the highway department. For example, we now need 95 sedans, 165 cruiser cars, 315 pickups, and so forth, clear down the list. By setting conservative but practical useful life spans on this equipment, it is relatively easy to compute the annual budget required to maintain the turnover. These funds never have been provided for us in sufficient quantity to make this turnover. To supplement our needs, we have turned to Government Surplus Allocations, we have extended the useful life span, we have attempted to decrease the inventory, and lately, we have resorted to purchasing equipment that can do more than one job.

Each of our six operating districts is equipped for major repair. Five years ago, each district had at least ten different year model trucks. We purchased 40 or 50 trucks a year and split them between the six operating districts. This provided a year model for the current year, and the next year the model was changed to a different make; at the end of eight years, we had eight different models in each district. In the last five years, the 45 to 50 trucks that we buy are put in one district. This year we are completing the fleeting of our last district.

Along with this fleet of trucks, we provide four extra engines complete and the power train necessary to go with them. We have materially increased the net working time available for each unit by this practice, coupled with a very energetic preventive maintenance program.

In closing, a few new horizons for maintenance might be listed as follows.

1. Use equipment that is expressly designed for maintenance. How about snow plowing at 70 miles an hour? I think someday we will probably do this. We are getting hit in the back end now at 50 miles an hour. High speed rotary snow plows are needed in certain areas. We can stand at least three right now in the range of 7,000 to 8,000 tons per hour.

2. Telemetry that will monitor all trouble spots on the highway system and feed information to a centralized headquarters for action as required.

3. High-speed dependable communications to all maintenance employees.

4. Strong and continuing programs to seek out and develop new materials and methods.

5. A strong and continuing program to train all involved personnel by modern and sophisticated techniques.

OPEN GRADED PLANT MIX SEAL COATS

by

Robert A. Bohman

In order that we have a common understanding of the meaning of open graded plant mix seal coats, I will first attempt to define the term and then, during the course of the discussion, describe the product as we know it in our Rocky Mountain area.

I understand that similar types of construction have been used in other areas, but my experience is limited to its use in Region 9 of the Bureau of Public Roads; this presentation, therefore, will be based on experiences in that region and specifically in the states of Colorado, New Mexico, Utah, and Wyoming.

By my definition, open graded plant mix seal coat means a seal coat consisting of an open graded aggregate of about 3/8-inch maximum size, mixed with a relatively high percentage of asphalt cement in an ordinary hot mix plant and placed on the surface to be sealed by conventional asphalt paving machines. Plant mix seals are usually placed to a compacted thickness of about 5/8-3/4 inch.

We first began using plant mix seals in our Direct Federal program in Region 9 because of the generally unsatisfactory results we were getting on many of our chip seal jobs. A good part of our work is in the mountain areas where construction seasons are short and bituminous paving seasons even shorter. Even during the hot summer months in these areas, afternoon rainstorms are frequently a daily occurrence. This weather factor alone presented quite a risk to the success of our chip seal coat projects. The risk is increased by the considerable summer traffic volumes on our two-lane roads. I do not think I have to elaborate on the result of unsuccessful chip seal coats since I am sure all of you have had some experience with this problem. In my opinion there is nothing that will detract more from the appearance and serviceability of a bituminous surface than an unsuccessful chip seal unless it might be an outright structural failure of the pavement system. In addition to detracting from the appearance and serviceability, poor chip seal jobs usually end up being dangerously slippery.

Those of us who believed there was a definite need for seal coats in many instances and who were looking for something better than chip seals,

something that promised less chance of failure and something less dependent on ideal weather and traffic conditions for satisfactory results, were intrigued by the idea of plant mix seals. We first heard about them in 1959 from Gordon McKenna, our Region 7 Materials Engineer who presented a paper on plant mix seals at one of our materials conferences in Denver.

Owing to the usual vagaries of programming and financing, it was 1961 before we completed our first plant mix seal project. This was in the Snake River Canyon south of Jackson, Wyoming. We were very gratified with the excellent results on this project, and the following year we completed two more projects with equally good results. These projects were in Grand Teton National Park in Wyoming and in Big Cottonwood Canyon, east of Salt Lake City, Utah.

The State Highway Departments in these two states have maintenance responsibilities in Snake River and Cottonwood Canyons and as a result have had first-hand knowledge of the serviceability and service performance of these particular projects. Encouraged by the appearance and early performance of these first projects, the Wyoming Highway Department let its first plant mix seal to contract the following year in 1963. They did this with some reservations, since the principles involved in this type of construction represent a radical departure from conventional chip seals, dense graded hot mixed sand seals, or dense graded asphaltic concrete. Because of their doubts and reservations, their first project was set up as experimental and follow-up evaluation reports on its performance have been prepared annually since its completion. This project continues to give excellent performance after nearly five years. Several other projects were completed within the next year or two, and Wyoming's experience has been so successful that plant mix seals are now a standard construction item on most of their flexible pavements.

Utah's experiences have been quite similar to Wyoming's, and they also incorporate plant mix seals in most of their flexible pavement designs.

After visiting highway officials in Wyoming and looking at some of their work, New Mexico decided to try a plant mix seal project. Their first job was completed in 1964, and it was an excellent piece of construction. They have since completed an additional 135 miles of equivalent two-lane plant mix seal construction with excellent results.

In 1966 the plant mix seal concept spread to Colorado, where three separate projects were completed using this type construction. Two of these are giving excellent results, while the third behaved less than satisfactorily due to flushing or bleeding during the second summer of use.

Despite the problems on their one project, Colorado has had generally good results and will continue to use plant mix seals.

This background or history of the continual growth in the use of plant mix seals in the Rocky Mountain Region reflects or demonstrates our almost universally good experience with this type of construction. This experience has brought to light numerous advantages this type construction has over regular chip seal coats in addition to the fact that outright failures appear to be almost nonexistent.

It is a combination of all these advantages that has stimulated the interest and caused the continuing expanded usage of this type of construction in our area of operation. It is possible that we have the ideal climatic and traffic conditions necessary for the successful use of plant mix seals, but we do not believe these conditions are unique or peculiar to this area alone; therefore, we would anticipate other states or geographical locations also might be well suited to this type of construction.

Advantages

We believe that in almost any location or under almost any circumstance plant mix seal coats would show the following advantages:

1. The problem of loss of chips and damage to vehicles is practically eliminated. Closely related is the fact there is no dust problem as with chip seal coats; also, traffic safely can be allowed on the new construction within a matter of minutes. These advantages make plant mix seal construction particularly well suited for city street and other urban work and for any location where minimum delay to traffic is important.

2. The surface has exceptional smoothness, and creates no road noise as contrasted to conventional chip seal coats. These characteristics are quite obvious to vehicle occupants and are even more convincingly demonstrated by roughness measurements using the California Profilograp or the BPR Roughometer. For example, we have found that roughness readings by the BPR Roughometer on plant mix seals are consistently 10 to 30 inches per mile less than our best dense graded asphaltic concrete surfaces. In terms of present serviceability index, by the AASHO Model Equation (8), NCHR Report No. 7, plant mix seal can be expected to raise the psi by .13 to .50 over any other type surface we normally see in our region. We believe this exceptional smoothness is a result of the high mechanical stability of the mix, which normally does not rut or shove laterally under rolling or subsequent traffic. The high stability derives from the large percentage of fractured faces and open grading of the aggregate, which results in a high degree of aggregate interlock.

3. The third advantage is that the surface has uniformly good skid resistance and is of a texture not subject to hydroplaning. With an ever-increasing emphasis on the need for highway safety, I consider this advantage alone to be sufficient justification for using open graded plant mix seals in many locations. During the summer of 1967, several hundred skid tests were made on a variety of surface types in Region 9 (Colorado, New Mexico, Wyoming, and Utah), using the Bureau's skid trailer, which conforms essentially to the requirements of ASTM E-274-65T.

As can be seen in the following tabulation, plant mix seals were found to have a higher average coefficient of friction than any other type surface measured. These tests were all made on wet pavement at 40 miles per hour speed.

Coefficient of Friction

Surface type	Colo.	Wyo.	Utah	New Mexico	Average and total number of tests
Plant mix seal	.45	.55	.51	.52	.52 (211)
Dense graded A.C.	.34	.50	.44	.50	.45 (326)
P.C.C.	.38	.44	.44	.47	.44 (114)
Chip seals		.49	.54	.45	.50 (87)
Road mix			.28		.28 (8)

Values below 0.33 indicate renewal of surface friction should be made. See page 5 of "Application of Skid Resistant Surfaces to New and Existing Pavement," Bureau of Public Roads, March 1967.

The AASHO Safety Manual (Yellow Book) indicates the same figure.

Approximate Adjective Ratings

Above 0.60--Excellent
0.50-0.60--Very good
0.40-0.50--Good
0.30-0.40--Fair
Less than 0.30--Poor, hazardous

NCHRP Report No. 37 recommends a minimum coefficient of friction requirement of .37 as measured by the standard skid trailer at 40 mph. Along with the general subject of skid resistance, hydroplaning seems to be receiving increased attention.

Hydroplaning of automobiles, as I understand it, is a phenomenon whereby under certain conditions of speed and tire condition and a more or less continuous film of water on the roadway surface, the tires on the automobile will rise onto the film of water and lose contact with the actual pavement surface. When this occurs, the frictional resistance between the tire and the roadway is essentially zero and loss of all steering control results.

All other conditions (speed, tire condition) being equal, the thickness of the water film between the tire and the pavement surface determines the susceptibility of a vehicle to hydroplane. Grooving or generally roughening of the surface will reduce the thickness of this film in most cases. We also believe that the texture of plant mix seal coats prevents any substantial film thickness from developing. This is readily apparent to anyone driving over one of these surfaces during or immediately after a rain or when the surface is wet from melting snow. The surface seems to dry out almost immediately, leaving no continuous film of water.

According to a formula developed by NASA and reported in the Bureau of Public Roads report, "Application of Skid Resistant Surfaces to New and Existing Pavements," March 1967, hydroplaning will not occur at speeds below about 46 mph even at low tire pressures (20 psi) and with smooth tires.

The type of skid testing done in our Region last summer, at 40 mph, therefore, was not measuring hydroplaning or even hydroplaning potential. Accordingly, we have no definite proof that any of the surface types we checked has any advantage over any of the others insofar as hydroplaning is concerned.

However, as indicated earlier, we believe the open graded plant mix seal is the most effective and economical way of eliminating the possibility of hydroplaning by providing a surface which is not susceptible to the retention of thick films of water.

4. The next obvious advantage of this type surface is its appearance, which is very pleasing and uniform. New plant mix seals, as with any bituminous surfaces, are quite black and without exception appear to be grossly over-asphalted. However, the surfaces usually lighten up quite readily due to weather and action of traffic. Night visibility seems to be better, particularly in wet weather, since there is no reflective glare as there might be from a continuous film of water. It also has been report that paint stripes last longer and provide a higher reflectance due to the rough surface texture.

5. The surface has good durability. The fear has often been expressed that due to the nature of the open graded mix, freezing and thawing might cause rapid and severe deterioration in cold wet areas. We have not seen this occur and, judging from some of our oldest projects which were put down in areas of severe climatic conditions, we do not expect this to become a problem. Our oldest jobs are now six to seven years old and have not given any trouble. The Wyoming Highway Department has indicated that they fully expect 10 years or more of good service from their plant mix seals.

6. Costs are reasonable. Actually the cost per square yard of plant mix seal is higher than for a chip seal coat, but is generally less per inch of thickness. The cost for either type seal coat is largely dependent on the cost of the aggregate, and with the high quality and clean nature of the material normally required these costs are quite high. Approximate average costs on recent projects in our region are as follows:

Plant Mix Seal Costs

State	Cost per ton of mix	Cost of asphalt (1) in mix	Total Per ton	Per sq. yd. (2)
New Mexico	$6.58	$2.16	$8.74	$0.30
Utah	4.82	1.95	6.77	0.24
Wyoming	6.50	1.73	8.23	0.29

(1) On basis of 6.5% asphalt cement by weight.
(2) At an estimated 70 pounds of plant mix seal per square yard.

Colorado costs are not included due to the relatively small quantity built so far. For comparison, an ordinary chip seal would probably cost not more than $0.11 per square yard, but would also be less than half as thick.

7. Structural value can be allowed. Because of their high mechanical stability and greater thickness than chip seal coats, plant mix seals can be considered a structurally integral part of the overall pavement system. In our area, where most of the states and our own Federal Projects office use the AASHO design procedures, as published in the AASHO Interim Design Guides, structural coefficients of from 0.25 to 0.40 are normally used for plant mix seals. This range is very nearly the same as for dense graded bituminous concrete. In this sense the plant mix seal provides for more than just a frosting on the cake; it is an integral part of the pavement system which helps carry the load.

8. Plant mix seals can and have been placed to good advantage on

rigid pavements and structure decks to retard or correct scaling and to increase skid resistance. Particularly good results have been obtained in an overlay project on old concrete street paving in Raton, New Mexico.

These are the advantages, as we see them, and we recognize there are also some disadvantages, as there are with any type of construction.

Disadvantages

Following are the disadvantages of which we have become aware:

1. We have found that under conditions of heavy traffic and continued high temperatures, additional consolidation can take place which may result in the voids being overfilled with asphalt, with the excess asphalt then flushing to the surface and eliminating the non-skid advantages. Our experience indicates that this disadvantage (bleeding) can be prevented by holding the asphalt cement content down to 7 percent maximum and by holdi the percentage of aggregate passing the No . 8 sieve to a maximum of 15 percent. We have many projects where these maximums have been exceed without any subsequent bleeding, but we have had absolutely no bleeding on projects which adhered to these maximum limits. We are convinced that on lower traffic volume roads and in areas where continually high temperatures (95°+) are not a problem that these maximums could be safely exceeded. However, we believe these limits are quite critical, on high traffic volume roads (60, 000 vpd) in areas of prolonged high temperatures.

2. Another disadvantage is that the mixing temperatures are quite critical. With the high percentage of asphalt and low percentage of fines, too high a mixing temperature will result in asphalt draining off the aggregate and running to the bottom of the truck before it can be spread on the road. This in turn results in fat or bleeding areas in the finished pavement. These can be eliminated, however, by good continuous construction operations and by close inspection. Hand raking of such fat spots can also minimize bleeding. Maximum mixing temperature of about 260°F is recommended to minimize the problem. Mixing at this temperature is easily accomplished since the open-graded aggregate dries easily and is much easier to mix at a low temperature than dense-graded aggregates.

Construction Procedures and Precautions

In order for plant mix seals to perform at their best, it is desirable that the lower one third of the seal contain a substantially higher percentag

of asphalt than the top two thirds. This extra rich layer on the base of the seal together with the tack coat, if used, is what actually seals off the surface water and prevents it from coming into contact with the lower pavement courses. In addition, owing to the open grading, water and air can flow more freely through the top two thirds of the seal, causing more rapid oxidation and hardening of the asphalt. To offset this, all aggregate must be coated with a relatively thick coating or film of asphalt. Normally this coating is three to four times thicker than on aggregates in dense graded mixes. The two things which have the greatest influence on the concentration of asphalt in the lower portion of the seal and the film thickness are the viscosity and the amount of asphalt in the mixture.

Normally we get the results we want when we use 6 to 7 percent (based on dry aggregate weight) of 60-70 or 85-100 penetration grade asphalt cement and control the mixing temperature to about 260°F. If more than 7 percent asphalt is used, bleeding might occur, and if mixing temperature exceeds 260°F, the risk of fat spots or streaks will increase. When less than 6 percent asphalt is used, the asphalt films will be quite thin and the mix will have a tendency to ravel more easily; in addition, there may not be sufficient asphalt to form an effective seal at the base of the seal coat.

Too low mixing temperatures can make construction quite difficult and also can prevent the formation of an effective seal. Mixtures that cool excessively or were not hot enough initially can have a tendency to stick in the dump truck beds and hang up in the paver.

The mixture should be spread carefully, and the operation should be as continuous as possible. Particular attention should be given to the joints, and as many irregularities as possible should be removed by hand raking, before any rolling is done. Rolling will not remove the normal irregularities, such as excess of material or gaps at joints. These irregularities must be corrected before rolling.

Rolling should be done immediately behind the paver; usually, one pass with a steel-wheel roller is all that is required. The thin layer cools so quickly that the second or third passes are usually ineffectual.

Traffic can use the new seal after one pass of the roller without any damage to the seal. However, until the mix cools sufficiently there may be some problem of tackiness which can be of concern to the motorist. If the problem is serious enough, the surface can be sprinkled lightly with water. This will quickly chill the asphalt and minimize any tire noise associated with the tacky condition.

As with any asphalt paving construction, warm, dry weather is desirable. While chances for failure in inclement or cold weather are less than with chip seal coats, we have had some unsatisfactory results in placing the mixture too late in the fall. A minimum surface temperature of 70°F is normally recommended.

We have placed plant mix seals to compacted thicknesses ranging from about 1/2 inch to more than 3/4 of an inch, using a 3/8-inch maximum size aggregate. With the thinner layers, some dragging under the paver screed has resulted, and it has been necessary to increase the thickness to prevent this. We believe a safe rule to follow is that the average depth of spread should be twice the maximum size of aggregate in the mix. It might be possible to use a lesser thickness by adding silicone to the mixing asphalt, but this has not been proven in our area.

It would seem there would be some advantage to using thinner lifts while using the same maximum size aggregate, inasmuch as this should minimize the possibility of additional consolidation by traffic and subsequent bleeding.

The use of a tack coat may or may not be required. If the plant mix seal is to be placed on a new surface or one that has a tendency to bleed or appear excessively rich, the tack should be omitted. On the other hand, if the present surface is old or rather lean, then a tack coat probably should be used. In our area a dilute SS-1 is normally used for tack coat.

Typical specifications and/or design requirements for plant mix seals as used in the Rocky Mountain area are as follows:

Aggregate gradation

Sieve	Percent passing
1/2"	100
3/8"	95 - 100
#4	30 - 50
#8	10 - 25
#16	0 - 13
#200	0 - 5
Los Angeles abrasion loss	40% maximum
Crushed particles (No. 4 sieve)	75%. This could be raised if more skid resistance is needed.
Stripping	75% retained coating by AASHO T182 (Static Immersion).
Grade asphalt	60 - 70 or 85 - 100 pen. A.C. (Although we have 1 6-year-old job with 200 - 300 pen. A.C. showing excellent durability).
Percent asphalt	6 to 7%
Mixing temperatures	260°F to 300°F
Placing temperatures	225°F to 265°F
Rolling	Roll immediately with steel-wheeled roller.
Tack coat	If used, use dilute emulsion SS-1 @ 0.05 - 0.10 gallons per square yard. If heavier tack is used, some reduction should be made in percent asphalt used in mix.

Summary

I recognize that in our business there is often a tendency to unintentionally oversell new products or ideas. In these instances the buyer or highway agency is sometimes left with the impression that the new product is a panacea for all highway ills. Open graded plant mix seals are not a panacea. They will not, by themselves, cure such problems as reflective cracking, lateral cracking in bituminous pavements, excessive plasticity in base or surface courses, poor construction of the underlying surface, and base courses or grossly underdesigned pavement structures.

However, it has been our experience that the advantages far outweigh the disadvantages and that these disadvantages or problems are not beyond solution. In our Region the results, on the whole, have been exceptionally good, and we expect to see an ever-increasing use of this type of construction in the months and years to come.

Acknowledgement

In the preparation of this report I have freely used information supplied by William L. Eager, Regional Materials Engineer (Retired), in his paper "Construction and Performance of Plant Mix Seal Coats," as presented at the 1967 convention of the American Association of State Highway Officials.

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