# The Engineering Approach to Traffic Safety

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As traffic volume continues to grow, it is essential that there be increasing emphasis on the engineering approach in the study and solution of our highway transportation problems. Undoubtedly this will be discussed in relation to congestion tonight by the banquet speaker, John W. Wheeler. I shall therefore confine my remarks primarily to the *safety* aspects of the engineering approach to traffic operations.

It is particularly timely to mention safety this afternoon, since the National Safety Council's estimates for the 1947 traffic death toll have now been prepared, and are just now being released for tomorrow morning's newspapers. The 1947 traffic death toll for the United States is estimated by the Council at 32,000 persons killed—this is 4 percent less than the 1946 total in spite of a 9 percent increase in the vehicle mileage for 1947 over 1946. The estimated 1947 traffic death rate of 8.6 persons per 100,000,000 vehicle miles is 12 percent lower than the rate for 1946, and 28 percent below the corresponding rate for 1941.

The improvement in terms of numbers of persons killed was confined primarily to deaths in urban areas. The 1947 figures show that about 2,200 fewer persons were killed in urban areas in this country than in 1946. Deaths in rural areas increased somewhat over 1946, although not nearly so much as the percentage increase in vehicle miles of operation.

Even a nation-wide traffic death rate of 8.6 persons per 100,000,000 vehicle miles is too high. Paul G. Hoffman, President of Studebaker Corporation and Chairman of the Public Support Committee of the President's Highway Safety Conference, stated two years ago that "if we all work together, in three years time we can bring the traffic fatality rate down from 12 to 6, and that would mean an annual saving of 19,000 lives, 650,000 injuries and well over a billion dollars in annual loss from property damage." We still have quite a way to go to get the rate down to 6, and hardly more than a year to do it, if we are to meet Mr. Hoffman's time table of three years. All of us should strive toward fulfilling his goal.

The engineering approach to traffic safety really should be a fourfold approach for maximum effectiveness. These four phases are:

1. *Analysis.* Use of engineering procedures in studying, analyzing, and interpreting facts about our highway transportation system. Analyses of accident statistics, traffic volume, speeds, and highway needs. Use of the engineering approach in planning related activity in other fields of accident prevention—in enforcement, driver licensing, vehicle inspection and education, as well as engineering. Engineers can help a lot in guiding the analysis techniques used in all of these other phases of traffic safety.
2. Building safety into highways. Modern highway design standards provide for many features which can almost eliminate several types of accidents. (Note: Highway design was scheduled for the preceeding talk; so was not covered in this paper.)
3. Traffic operations—fixing up and making the most efficient use of the existing street and highway system. This involves the study and treatment of high-accident locations, the intelligent use of standard signs, signals and pavement markings, speed zoning, and other techniques of traffic operations. I'll discuss these important engineering applications in more detail later.
4. Active participation by engineers in coordinated planning of the complete accident prevention programs. (Sometimes overlooked). It is becoming more and more apparent everyday that coordination of enforcement, engineering, accident records and educational activities is essential for maximum effectiveness of traffic accident-prevention programs.

Engineers can and should contribute a lot to this coordinated approach because of their background and training in the factual approach to all problems. Here in Indiana, the engineers of the state highway commission participate actively in such a coordinated planning through the Governor's Traffic Safety Coordinating Committee.

The President's Highway Safety Conference, incidentally, has recommended that the officials in each community having responsibility for traffic safety meet periodically together as a coordinating committee to coordinate their activity in the field of traffic safety. Engineers can perform a real service by participating actively in such meetings and in offering to help with the factual studies that are needed for the determination of a sound over-all program of traffic accident prevention.

## Traffic Control on Existing Highways

Now to return to the subject of traffic operations or traffic engineering, as it relates to dealing with the existing street and highway systems.

While new highway construction will aid materially in the future, we still will have many, many miles of streets and highways which never will be improved much beyond their present condition. The intelligent application of sound traffic engineering principles to such highways, and proper maintenance of them, will yield a sizable return in safety and increased mobility.

Speed control, while ordinarily thought of as a matter for the enforcement officer, is a matter of primary concern to the engineer too. There are many miles of city streets and county and state highways on which general state-wide speed limits do not fit road and traffic conditions, and on which there should be established safe and reasonable speed limits, based upon engineering studies. Several states, such as Michigan, Utah, Connecticut, and Colorado, to mention a few, have made state-wide surveys and are revising and re-establishing speed zones, with special attention to high-accident locations and to sections of highway at the approaches to communities.

On Monday of this week, for example, Captain C. J. Scavarda of the Michigan State Police was telling me that Michigan now has completed the job of revising the speed zones in the transition areas that approach the communities, and that the state now is working on expansion of their program of establishing speed-control zones on dangerous sections of rural highways. Mr. Milner, your state traffic engineer, tells me that Indiana also has completed the job of revising the speed zones at the approaches to communities on state highways in Indiana.

The numerical speed limits for speed zones, of course, must be based upon thorough engineering study, involving checks of prevailing motor-vehicle speeds, studies of the accident experience, studies of the physical characteristics of the highway, and trial runs over the highways.

Many states are providing indications of safe speeds for curves on the major state highways. The numerical values for these safe speeds are determined on the basis of a careful field study, involving trial runs in cars equipped with ball-bank indicators. The state speed signs are posted just below the curve symbol signs. These help considerably in adjusting motoring speeds to normal traffic conditions, increasing the comfort in driving, and reducing the number and severity of accidents on such curves. Indiana was one of the pioneers in making studies of the effectiveness of such speed indications at curves.

Standard signs, signals, and pavement markings can be great aids to motorists and pedestrians if they are used properly. Official standards for traffic-control devices and techniques for their use have been established, and a revised edition of a national manual containing these standards has been completed and should be off the press soon. The new manual, incidentally, stresses warrants for using signs, signals, and markings only where needed, as well as giving information on the standards for sizes and shapes for these control devices.

Over half of the states, including Indiana, already have a state manual patterned after the national manual. Undoubtedly many of the states now will be revising their manuals, in line with the revised national manual, and will be making copies available for use by city, county, and state officials in applying these standards uniformly throughout the state.

No-passing zones now are marked in a majority of the states at least for the major state highways. According to a recent tabulation, no-passing zones are marked on over half the state highway mileage in eleven states. The standard pavement marking for no-passing zones is a solid barrier line placed alongside the center line for the portion of highway on which there shall be no passing. The solid barrier line, preferably yellow in color, is to be placed on the driver's side of the center line when passing is prohibited. Indiana is one of the first states to reflectorize its no-passing lines.

Many states now are doing more in the control of parking along rural highways, especially at locations near roadside businesses where cars often park very close to the pavement. The latest revision of Act V of the Uniform Vehicle Code delegates to state officials the authority to designate sections of highway where parking along the roadway is prohibited.

Accident records can aid a lot in identifying intersections or sections of streets or highways which have had a bad accident experience. On sections of highways at the edges of communities, for example, you may find that there is a concentration of accidents involving pedestrians. In such areas, installation of pedestrian sidewalks and street and highway lighting often will aid in reducing such accidents. Incidentally, a study in Michigan some years ago showed that more than 38 percent of all pedestrian accidents which happened on rural highways occurred within one mile of the municipal limits.

The use of islands, divisional curbings, and other means for channelization of traffic has proved helpful in providing safe and orderly movement of traffic. In each instance, of course, the channelization treatment must be carefully designed to fit the circumstances at the intersection or other section of highways.

With regard to counties, the county engineers have a real challenge facing them in providing maximum safety with the limited funds at their disposal. Our 2,400,000 miles of county and other local roads carry about a quarter of all the travel on rural highways. Over 40 percent of the county and local roads in this country have some all-weather surface, and much of this mileage has a smooth surface which compares favorably with that on state highways. Consequently, the smooth surface on the straight sections may disarm the motorist into thinking that he can operate at speeds corresponding to those on state highways. Unexpected transitions in alignment, sharp curves, grades, blind intersections, narrow bridges, and other points of hazard may catch him off guard, however, and contribute to accidents.

Correction of hazardous highway conditions on these county roads should, of course, be undertaken as rapidly as possible within the limits of funds available for the purpose. Since funds are not available to bring all of the mileage up to the desirable design standards in the near future, priority should be given to especially hazardous locations.

Some of the corrective steps which can be taken without great expense include the following:

1. Eliminating or reducing excessive curvature by rebuilding, widening, and providing proper superelevation. Special attention should be given to curves or turns at locations where speeds are likely to be higher, and sudden changes in alignment are unexpected.
2. Providing greater visibility across corners at intersections, at sharp curves, and at railroad grade crossings by cutting back backslopes, cleaning out shrubbery, etc.

3. Increasing visibility at hillcrests, and providing frequent sections where motorists have enough clear-sight distance to pass with safety.
4. Eliminating steep side slopes and deep ditches, or using guard rails.
5. Widening roadways, shoulders, and bridges where inadequate widths are contributing to accidents.
6. Correcting and resurfacing road surfaces which have high crowns or are slippery when wet.
7. Removing or setting back physical obstructions which are close to the roadway. Set back mail boxes, especially those just over the crest of a hill, and provide surfaced turnouts.
8. Providing surfaced turnouts, or so locating school bus stops that such buses will not be stopping on the roadway at points having restricted sight distance.
9. Providing sufficient widths for parking at locations where there is need for it.
10. Providing safe driveway facilities for vehicles entering or leaving the roadway.
11. In new construction, using approved design standards which provide sight distance and curvature for uniform speeds for safety.

Since funds for reconstruction and new construction are limited, most county engineers must rely upon intelligent use of traffic control devices for warning motorists of hazards, for controlling travel speeds, and for otherwise informing motorists of regulations. It is important that standard signs and signals be used, that they be placed only where needed, and that they be kept in proper condition.

## Traffic Problems in Cities

Now as to the smaller cities, there is a tendency in many places to leave all traffic engineering problems to the police, who usually do not have the training or time to deal with the engineering phases properly.

In the other fields of engineering, city officials and the public recognize the need for specialists. In sanitary engineering, for example, specialists design the sewerage system only after careful study. Likewise, in traffic engineering, it is essential that the proper techniques be used for determining which types of remedies are appropriate for the conditions. Responsibility for traffic engineering needs to be definitely assigned to an engineer in the city government, the necessary budget and staff provided, and proper training given.

In this connection, the report of the Committee on Engineering of the President's Highway Safety Conference has recommended that in cities from 50,000 to 100,000 population, there be at least one full-time traffic engineer with sufficient authority delegated to him for traffic engineering functions. In cities below 50,000 population, the report recommends that the responsibility for traffic engineering functions should be delegated to an engineering official, such as the city engineer, head of the department of public works, or other employee in the engineering department, and that opportunity be given this man to obtain the necessary training and experience.

Reports of cities in the National Traffic Safety Contest for 1946 show that practically every city of more than 250,000 population now has a traffic engineer. Thirty-seven percent of the cities in the population group from 100,000 to 250,000 population have appointed traffic engineers, while in the population group from 50,000 to 100,000, 11 percent report traffic engineers. In cities not having traffic engineers, the responsibility for traffic engineering has been assigned to someone in the engineering department in well over half the cases.

I would now like to list some steps which can be taken in improving traffic-control and accident-prevention systems in smaller cities. The following five items deal primarily with engineering matters, rather than with traffic law-enforcement or public education, which are also essential in an accident-prevention program:

1. First, assign the responsibility for traffic engineering functions to an engineer and provide sufficient staff assistance and budget. If the man has not had training or experience in traffic engineering, arrange for such training.
2. Second, bring your traffic regulations and restrictions up to date and in step with present traffic conditions by modernizing your traffic ordinance. This may involve adopting an entirely new ordinance, based upon the recently revised Model Traffic Ordinance. A survey usually is needed to bring up-to-date the schedules or lists of through streets, one-way streets, parking prohibitions, and restrictions and speed zones which are usually incorporated in such an ordinance. In Indiana, many communities have obtained such assistance by calling upon the

State Highway Commission and the Public Safety Institute of Purdue University. Obtaining this assistance not only aids in selecting proper control measures, but also aids in training a local person assigned to traffic engineering responsibility. Here in Indiana, requests are now in from 20 cities for such assistance.

3. Inventory your traffic signs, signals, and pavement markings to make sure they are fully in conformance with the uniform standards. Keep records of where signs and signals are, prepare schedules for the maintenance, and have a regular schedule for placing pavement markings.
4. Set up the administrative procedures for centralizing traffic engineering functions under the traffic engineer or other engineer made responsible. This would include procedures for referring complaints and suggestions to him, having him check plans for street improvements from the standpoint of capacity and safety and review applications for curb cuts, building construction, etc., from the standpoint of traffic operations.
5. Arrange for the engineer to periodically study developing high-accident locations, parking conditions, pedestrian problems, and evidences of congestion, and make periodic checks of signal timing. The engineer also should cooperate with state officials on major plans for express highways and for off-street parking.

## Contest Analysis Service

I would like to mention the assistance which is available from the National Safety Council through the National Traffic Safety Contest. All 35 cities in Indiana of more than 10,000 population are enrolled in this contest. Each city submits a report to the Council through the Indiana Traffic Safety Commission. This report summarizes the city's accident record and its traffic safety activities for the previous year. Any city then can request that an analysis be made of the information submitted on its report.

These analyses are then prepared for each city requesting them, with comparisons made of the city's performance with that of the performance which would be needed for the city to rank among the leading 30 percent of the cities in that population group. The analyses then are presented either by the Council engineers or by representatives of the Indiana Traffic Safety Commission.

In many instances, requests are made for more detailed studies of traffic engineering features, such as location of through streets and studies of high-accident locations. In these instances, the requests are turned over to the Indiana Highway Commission and to Purdue University.

In conclusion, may I point out that the safe, free-flowing, and convenient movement of vehicles and pedestrians is the most important measure of success in all vehicle and highway development efforts. It is up to the engineers to do their best to provide highways that will not only "keep traffic out of the mud" but will also keep traffic moving with a maximum of convenience and safety.