The development of the professional field of "Traffic Engineering" is comparatively such a recent addition to the older professional fields dealing with transportation that growing pains and some confusion are to be expected. It would indeed be overlooking natural human characteristics if one should fail to anticipate that persons with thirty years' experience, such as civil engineers, planners, highway engineers, police administrators, and others would at least view with suspicion any new group that proposed to take over functions that they had come to feel, through custom and tradition, belonged to them. In all fairness it should be admitted that if the roles were reversed, even the same personalities would have reacted in almost exactly the same way.

Signs, signals, and markings in cities had always been handled by the police; so why should traffic engineers take over this function?

Planners had always designed roadways; so why should traffic engineers have a legitimate interest in this field?

Highway signs and markings had always been handled by the maintenance divisions; so why should a traffic engineering division take over these functions?

These few examples should be ample to explain why there has been confusion, misunderstanding, and adverse pressure which has made the development of the field of traffic engineering anything but easy.

Under these circumstances, it is incumbent upon the "newcomers," the traffic engineers, to demonstrate to the "old timers" a breadth of understanding of the total transportation field and a full appreciation of the broad fields of these older professions. Only in this way can mutual understanding be developed, and the new field of traffic engineering functions attain its maximum development through the sympathetic support of the older professions.
For these reasons, the following analysis of the broad field of transportation is set forth:

**Examples of the Elements of the Transportation Field**

The following have been selected at random to illustrate the enormity and complexity of the total transportation field.

1. The subject deals with what has variously been called "Transport," "Transportation," "Transportation Systems."
2. The public transportation system (owners of private passenger cars, trucks, etc.) has some of the same elements as described by the railroad terminology of "rolling-stock," "road bed," and "terminal facilities."
3. The broad planning field ranges all the way from zoning, housing, and transportation planning to economic planning.
4. The highway construction field ranges all the way from the construction of new facilities to the reconstruction of old facilities, and the "over maintenance" of facilities for whose reconstruction the funds are not yet available.
5. The broad design field is concerned with many items such as materials, strength, cost, appearance, functions, and cost of maintenance.
6. The broad field of transportation weaves its way into almost every avenue of the broad field of economics and financing.
7. Roadside control includes design, land acquisition, channelization, and zoning.
8. Terminal operations range from loading bays, transfer depots, curb parking, and bus depots to off-street parking facilities.
9. The value of future property will be controlled to a considerable extent by zoning and traffic arrangements.
10. Traffic regulations back up traffic equipment, substitute for the limitations of design, and control the authority.
11. Traffic surveys run the gamut from volume, origin and destination, customer wishes, speed and delay, traffic patterns, lateral placement, and capacity to parking and economics.
12. Maintenance controls the continual use of facilities and some aspects of design, and can change traffic patterns critically. For example, a "washboard" rough pavement on the inside of a curve will cause accidents because drivers move over to avoid the bumps.
13. Traffic devices range from signs, signals, markings, islands, delineators, parking meters, and illumination to survey devices and instruments.
14. Transportation is deeply involved in public relations ranging from building support for financing improvements to acquainting the public with new designs, devices, or regulations.

15. Education (elementary, high school, college, and adult) is needed for pedestrians, drivers, public officials, legislators, and experts in the field.

16. Traffic design, traffic devices, and inherent weaknesses in both, which cannot at the moment be corrected because of lack of funds, are largely dependent upon good enforcement.

17. Driver training explains to the drivers how properly to use the design and devices, especially in the presence of heavy and/or high-speed traffic under difficult weather and visibility conditions.

18. Motor vehicle administration attempts to screen out those who have not yet learned safe driving, and requires them to learn or stay off the streets and highways.

19. School bus operations involve signs, signals, regulations, loading places, special maintenance, etc.

20. Buildings are still being placed in trouble-causing locations, such as schools across a highway from the students or truck-driver eating places in the middle of hills and curves.

21. Numbered traffic routes and alternates are still not all based on origin and destination studies, and many cities are without especially marked truck routes and intra-city routes for local use to by-pass the central business district.

22. The operation of fire apparatus in many locations has not had the benefit of traffic engineering.

23. The engineering use of accident records and its overlap with the police use is still not on the best administrative basis in many localities.

24. The traffic engineers have still not made their best approach to elected and appointed officials by showing that preventing accidents and reducing congestion are good politics.

To put these hundreds of pieces together takes a bit of doing!

Different Approaches to the Problem

Stated in simplest terms, the theoretical solution to transportation problems is strictly a matter of increasing efficiency and reducing inefficiencies. These operations are more commonly broken down into:

(a) Accident reduction

(b) Congestion reduction

(c) Inconvenience reduction
(d) Reduction of economic loss
(e) Providing additional facilities

Woven into these are all the emotional elements as reflected through votes, public opinion, and administration judgment.

One thing is certain. Traffic engineers have not assembled existing proof of their gains, or have failed to present them as vigorously as have other professions.

Every single remedial measure simply must have "before" and "after" studies resulting in advertising-type reports and public-relations-support programs for future remedial measures. Much has been said about "pay as you go" systems and not enough about "sell as you go" systems. The traffic engineering package must be more attractively wrapped and more intensively sold.

Each of these five different approaches has a particular appeal to some group that can provide strong support if it is presented to them effectively.

Many Different Groups Interested in Transportation

A fair indication of the broad scope of the problem is indicated by the large number of different groups that are legitimately interested in transportation problems. Prominent among these are the following:

1. The public is of course interested in reductions of accidents, congestion, economic laws, and irritation.

2. Governmental officials are interested because many of them have direct responsibility and others receive the blame for transportation difficulties.

3. Elected officials are highly sensitive to complaints from transportation people. It is desirable to change their attitude from a negative answering of complaints to a positive will to make improvements and get credit for them.

4. Insurance groups have a direct financial interest and an indirect public-relations and advertising interest. A group of 29 companies selling automobile insurance in Michigan spend $14,000 a year in safety programs.

5. Transportation companies have both a direct interest and a public-relations advertising interest. The bus company of Lansing, Michigan, spent $7800 for a safety film for the city.

6. Transportation manufacturers have a broad public-relations interest and a long-range market interest since the ultimate volume of their sales will depend upon the number and efficiency of their facilities.
in use. The customer must be preserved and kept in a good frame of mind.

7. Safety organizations have a direct responsibility.

8. The oil interests are in the same position as the automotive manufacturing interests.

9. Retail trade has a special interest in the preservation of downtown shopping areas which would both reduce congestion and provide adequate parking facilities.

10. The operators of roadside businesses have an interest in how the traffic is controlled, and how it enters and leaves their places of business.

11. Parents have a special interest in the training of their children in safe driving and safe walking.

12. Chambers of Commerce, represent business, and have an interest in making specific improvements, among which traffic improvements have a high rating.

13. Tourist agencies have an interest based chiefly on the convenience of tourist travel.

14. Hotels have a customer interest because if congestion is too difficult and parking is too difficult, tourists will prefer tourist camps.

15. The Interstate Commerce Commission of course issues specific regulations and has a definite responsibility.

16. Official associations such as the American Association of Motor Vehicle Administrators, American Association of State Highway Officials, International Association of Chiefs of Police, and Institute of Traffic Engineers all have specific safety programs.

17. Schools and colleges are fast becoming involved in traffic and transportation courses.

18. Equipment manufacturers have a definite sales interest in the accident-reduction values of their products.

19. Police administrators have a strong interest because poor engineering can hinder their activities in reducing accidents.

20. Motor vehicle administrators are tied into the picture because their publications, “What Every Driver Must Know,” cover all traffic control devices.

21. Automotive engineers are interested because the design characteristics of the vehicle must in the long run fit the design characteristics of the roadway.

22. Advertising agencies have an interest because many of their clients have responsibilities and a public-relations interest.
23. Some 100 national safety organizations are all playing a part in safety programs.

24. All planning agencies are deeply interested, because so many of their plans are contingent upon good transportation.

25. The Highway Users Conferences in each state are concerned with safety programs and promotional programs to promote greater transportation facilities.

It can readily be seen that those concerned with traffic engineering functions have a great many interested groups whose resources they can mobilize to do an effective job.

**Traffic Engineering Functions**

In order to clarify the major parts of the numerous functions dealing with the application of engineering to traffic, the following are set forth as examples:

1. Traffic planning deals chiefly with the location and character of new facilities and the collateral impact of adjacent buildings and operations.

2. Traffic surveys include surveys in all fields which undertake to measure something related to traffic.

3. Traffic economics is involved in the cost of transportation, the losses in transportation, and what transportation improvements can be financed on the basis of savings which they produce.

4. Roadside control involves access to all roadside developments, with special emphasis on channelization and parking control.

5. All new buildings should of course be situated in strategic places, and should make provision for their own loading and unloading and storage for their customers.

6. Channelization is that part of design which undertakes to control the direction of movement of vehicles by the shape of the roadway structure.

7. Control over new streets is essential unless the inefficiencies inherent in all older streets are to be increased.

8. The economics of new facilities are deeply involved in the losses which can be produced by accidents and congestion.

9. One-way streets and one-way roadways represent an administrative process of applying rules to increase the efficiency of a given width of pavement.

10. The terminal facilities involve the provision and control of facilities for loading, business parking, and storage of commuters' vehicles.
11. Traffic regulations have a considerable influence on congestion as well as accidents.

12. Illumination probably has a greater effect on accident reduction today than it does on crime prevention, and hence the traffic engineer should control its location and quality.

13. The functional design of roadways is the controlling feature of design, which is of far greater importance than slight differences of material, cost of construction, or cost of maintenance.

14. Signalization will in the future find wider applications of flexible equipment and adaptations for pedestrian control.

15. Traffic signs are moving into the field of increased night visibility, larger size, and, in some cases, locations lined up with traffic lanes.

16. Traffic markings are bound to increase as the pressure increases to squeeze more efficiency out of each foot of pavement width.

To become an expert in all these fields takes a lot of training and experience.

STATE TRAFFIC ENGINEERING DIVISION

The sheer magnitude of the problem of trying to build, maintain, and control a state-wide public transportation system makes it imperative that the responsibility for this be centered in a division of the highway department. If the traffic engineering functions are scattered throughout the highway department, it is highly unlikely that the problem will receive the attention which it deserves.

The following elements are of major importance:

1. The division should have equal rank with the maintenance division or it will not “draw enough water” to get its share of the personnel and funds available, nor will it receive cooperation from other divisions commensurate with its standing.

2. There is some logic in combining the highway planning survey operation with the traffic engineering operation in a single division in order to obtain a greater lump budget and a larger number of personnel, both of which would give it greater visibility in the highway department and throughout the state in general.

3. The division should have control of the following: (a) functional design, (b) control of access, (c) control of routes, (d) control of illumination, and (e) control of signs, signals, and markings.

4. The division should provide state leadership in traffic engineering, and should have on its staff an experienced municipal traffic engineer having the title of municipal traffic engineer. There are very few state traffic engineering matters.
5. The division should make every effort to encourage local communities to establish municipal traffic engineering divisions.

6. The Division should conduct a broad public relations program, utilizing the public appeal of traffic engineering improvements to support all highway operations.

7. Members of the division should appear at almost all meetings throughout the state to build support for traffic engineering.

8. Division representatives should speak before high-school students just as police representatives do now.

9. The division should conduct specific public support programs to build up from the “grass roots” a sympathetic understanding of new traffic engineering proposals.

10. The division should do an excellent accident analysis and proof job not only for its own operations, but also for those of the State Police or Highway Patrol.

11. The division should work with roadside business people to secure their approval of standards.

12. The division should upon request conduct local traffic surveys with the assistance of the Public Roads Administration, but such surveys should be jointly sponsored and conducted by the municipal officials, state officials, and federal officials.

13. Exploration is needed by divisions to establish the quickest and safest routes both at different times of the day and in different seasons for the use of tourists and trucks.

14. The division should establish complete traffic engineering standards for the use of cities and counties.

15. In larger counties the division should assist in the development of county engineering traffic divisions.

16. The division should develop a working relationship with all business and truck companies.

17. The division should use its influence to help get established in the state a state safety commission or state safety council.

18. The state should increase its day-by-day working relationships with planning agencies.

19. The division should develop special cooperative programs with counties, particularly along the line of speed-control zones.

20. The state highway department and the traffic engineering division should through the coming years get to be known as agencies that deal with transportation, rather than agencies which merely construct and maintain state highways out in the country. An interesting example of a step in this direction occurred in the state of Washington where,
in a new building into which the head of the Highway Department moved his offices, the door carries the single word "Transportation."

It is perfectly obvious that the future work of traffic engineering divisions will become progressively more important in proportion to all the activities of the highway department. After all of the new facilities now planned are actually constructed, it appears likely that from 50% to 70% of the vehicle miles traveled on all streets and highways within the state will be on old roadways, and that these old roadways must have their efficiency greatly increased by traffic engineering techniques to handle a double load by 1960. It is further obvious that construction and design problems of highway departments will be 10 times more difficult in built-up areas than they will be in the country, and thus the good public relations which a municipal traffic engineer could build with communities would make the state's over-all job considerably easier.

**City Traffic Engineering Divisions**

Quite obviously traffic and transportation cannot receive the maximum value of the application of engineering unless there is created a city traffic engineering division having equal status with the police department and other municipal agencies. Such a division would have the same general functions as would a state traffic engineering division, with emphasis upon the following:

1. The provision of parking facilities off-street,
2. The development of expressways and access to expressways,
3. Zoning control with special reference to new buildings,
4. The expansion of one-way street systems,
5. The development of limited ways at grade through the application of regulations such as "no left turn," "right turn only," and "no right turn,
6. The physical channelization of many intersections,
7. The control of truck loading,
8. Assisting the city in establishing a full-fledged safety council,
9. Control of signs, signals, and markings.

In smaller communities it would seem logical to combine the personages of a "city traffic engineer" and a "city planner," thus in effect creating a combination "Planning and Traffic Engineering Department."

In larger cities, because of the necessity of financing off-street parking facilities, there must ultimately be developed a "parking authority," which would have authority to raise money, purchase land, build buildings, operate or lease facilities, and do all of the collateral work. Since this should not be divorced from the traffic engineering operations, it may be that this will force the establishment of a "traffic au-
authoritiy," which would have all authorities dealing with traffic movement and facilities, and it would not need the approval of the Mayor, and/or City Manager, City Council, and any other city agency for its activities.

**Where is Traffic Engineering Weakest Today?**

Traffic engineering functions and traffic engineering divisions are of course in the developmental stage. More progress has been made along some lines than others. Following is a list of some items which need increased attention to bring them up to the “par” of other activities:

1. Some of the simplest traffic engineering improvements have not been measured, such as the reduction of congestion and accidents due to lane lines.
2. Traffic engineers and traffic engineering divisions have not yet received sufficient status.
3. There has been too much emphasis in the traffic engineering field on mechanical equipment such as signs, signals, and markings.
4. There has not been enough emphasis on traffic planning.
5. Not enough proof has been submitted on accident reduction.
6. There have not been enough speed and delay surveys to prove the reduction in delay resulting from traffic engineering improvements.
7. There has not been enough effort to get the traffic engineering function properly positioned in government.
8. There has not been enough sales effort to have traffic engineering functions in smaller cities conducted by engineers rather than by police administrators.
9. There has not been enough state leadership in traffic engineering.
10. The technique of establishing scientific speeds for highway curves has not been applied generally.
11. The possibility of establishing scientific speeds over the tops of hills has not been investigated thoroughly.
12. The main intersections still need more intensive signalization and channelization.
13. Filling stations, taverns, and roadside stands are still being established in dangerous locations.
14. There has been a tendency for departments to take a negative position in traffic engineering for fear of too many requests for service; whereas a positive approach with standards and proper screening would have a better long-range effect.
15. There has been the lack of a control of access for subdivisions.
16. The technique of delineation at night has not been thoroughly exploited.
17. Traffic engineers have not utilized all the values of public appearances before groups.
18. The building of cheap models of proposed designs has not been exploited from the sales point of view.
19. There has been no active solution for accident and congestion problems in "transition areas," where high-speed highways penetrate built-up areas just outside of municipalities, where vehicular and pedestrian traffic is heavy but where there are neither sidewalks, illumination, signalization, nor channelization.
20. The increased use of paint lines can be justified for the purposes of regulating traffic flow, and incidentally advertising the traffic engineering field.
21. There is a great need for closer working cooperation day by day between traffic engineers and police officers, as witness the common occurrence of traffic engineers erecting traffic signs without previously arranging for a fixed commitment by the police department for enough enforcement to make the signs effective.

Summary

More travel will produce more accidents and more congestion. Most of this will be on existing roadways, and not on new facilities being planned. Thus existing roadways must have a greatly increased application of traffic engineering techniques if accidents and congestion are to be held down to an acceptable minimum. If fifteen billion dollars will flow from the federal government for new facilities in the next 20 years, and this affects less than half the problem, then where is a like amount of money coming from to improve the efficiency of existing roadways through traffic engineering techniques?

It seems obvious that by 1950 the increased travel will have created a complete accident and congestion mess in many places. It will not be possible to deal with this unless two things take place; (1) the creation of strong, vigorous traffic engineering divisions in states, counties, and cities; and (2) the acceptance of traffic engineering principles and their use by all other groups having activities relating to transportation.

The seriousness of the effect of double traffic by 1960 compared to 1940 is clear cut. Congestion is today at a high level in most cities. Imagine what it will be like when twice as much traffic is dumped upon it. The construction of "express-ways" adjacent to central business districts cannot be relied upon to solve this problem down town. For
every vehicle the express-way removes from the central business district because it does not wish to be there, the expressway will put back at least one vehicle which will then go down town because it is more convenient to get down town.

Horse sense dictates that central business districts and main routes simply cannot carry twice as much traffic unless certain major steps are taken which, at the moment, would appear violent to many persons.

(1) Complete prohibition of parking will be necessary on all down-town streets and arteries. This naturally will require a like amount of off-street parking spaces.

(2) All streets will probably have to be made one-way streets.

To achieve both of these will take two or three years in many cities, which would bring us up to 1950. To delay getting started will necessitate having the mess first and suffering under it for a few years before the improvements can be made.

(3) Truck loading will have to be prohibited during rush hours.

(4) Naturally the best mechanical-electrical aides, such as signals, street lights, reflecting signs, markings, and channelization, must be used.