

# HIGHWAY RESEARCH CIRCULAR

Number 25

Subject Area: Traffic Measurements

June 1966

COMMITTEE ACTIVITY  
Committee on Quality of Traffic Service  
Department of Traffic and Operations  
Highway Research Board

## REPORT ON RESEARCH NEEDS

### Research Problem Statements

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## INTRODUCTION

The need for the more efficient operation of intersections, city streets, expressways and, indeed, of the entire highway transportation system makes a better understanding of the concept "Quality of Traffic Service" increasingly urgent. At the same time, the development of acceptable standards and procedures for measurement of traffic service and for its application are becoming more and more critical.

Past efforts in defining the quality of traffic service and in developing practical means of measuring the selected parameters have resulted in a number of approaches none of which have been universally accepted thus far. While these efforts have been commendable and have provided a useful base for further study, the present state of the art suggests that the proper perspective to the problem has not yet been successfully established. It also suggests that considerable research effort remains to be applied toward gaining a more profound understanding of the interrelationships that exist between the parameters used as measures of traffic service. Likewise, sizable efforts remain in developing acceptable standards and in devising practical means for applying measures of traffic service to the planning, design and operational functions in highway transportation.

State of the Art

It is generally agreed that the most meaningful measures of traffic service are safety, time, economy, comfort and convenience. Divergence of views, however, begins from this point on. Of primary concern is the problem of how much weight each of these measures should be given in order that they jointly result in the highest (or some stipulated intermediate) quality of traffic service. The additional problem of developing a common dimension for these five measures tends only to add more difference in opinion.

A brief review of past efforts in this area reveals three broad approaches toward defining the quality of traffic service and developing measures for its use.

- a. The Systems Approach. This approach considers the the entire highway transportation system of the study area. It is principally used by transportation planners. Past applications of traffic service as a measure in planning, have recognized that proper functional classification of the roadway system is basic to its meaningful application. A typical example in which levels of traffic service are used, frequently without being regarded as such, is found in the area of traffic assignment. Many measures of traffic service, involving time, distance and cost, have been used in the past. Of these, travel time has perhaps been the most commonly used in recent years, principally because of ease in measurement.
- b. The Traffic Dynamics Approach. This approach considers smoothness and continuity of the traffic stream as useful measures of traffic service. It is commonly used by transportation operations engineers. Quality of traffic service is expressed in terms such as traffic density, speed-volume relationships, lane occupancy and the like. At this time it appears that the appropriate measure to be used in a specific situation will depend upon the circumstances which, in turn, may vary with definition.
- c. The Driving Task Approach. This approach is based on the premise that driver demands should be met as best possible. (After all, it is argued, the motorist who pays the taxes is entitled to the highest quality of traffic service that available resources will provide.) In this approach galvanic skin response tests together with driver performance measurements are translated into the quality of traffic service provided by the roadway. Thus, a low level of driver tension together with a low level of effort indicate a high quality of traffic service. In the past, this approach has essentially been confined to research and experimental use.

The research and experimental achievements to date provide a good base for future work in this area. It is unlikely, however, that a universally acceptable measure will ever be developed unless the limits within which it is to be valid are clearly defined and set. It is equally unlikely that substantial progress can be made without a better understanding of the demands placed by traffic upon the transportation system. The primary challenge for the future, therefore, lie in two broad areas. The first includes the establishment of a general framework which will permit placing the many diverse approaches and techniques of measuring traffic service into their perspective, according to criteria such as the purpose for which they are intended and the use to which the results are to be placed. The second area includes the developments of new methods for measuring the parameters, and new ways of interrelating these not only for researchers but also for those who have to make decisions on the strength of such measurements.

#### Areas of Research

Five specific problem areas have been selected by the Committee for further research and study. These five areas by no means exhaust the research needed in this area. Instead, they are aimed at providing some of the answers most urgently needed for further strengthening and broadening the base established by past studies.

The first two proposed studies are aimed at the over-all problem. The latter focus on specific areas.

1. Quality of Traffic Service: Concepts and Techniques

The time has come for a critical overview of past research and experimental efforts which have produced a variety of unrelated approaches and measures in this area. This study proposes to provide a better understanding of the concepts underlying quality of traffic service. It also proposes the development of a framework within which future research can be coordinated more effectively.

2. Quality of Traffic Service: An Analytical Study

A logical step following the former proposed study would be an attempt at the formulation of a single model or a set of models that would express quality of traffic service, taking into consideration the function of the system, the purpose for which this measure is to be used and means by which this measure can be established.

3. Quality of Traffic Service: The User's Measure

Unlike the two previous ones, this study would concentrate on a specific area. It proposes to find answers on the quality of traffic service by addressing itself to the user reaction and attitudes to a variety of types of facilities under conditions of varying load and stress.

4. Esthetics as a Traffic Quality Service

Esthetic considerations have thus far received all too little study in the past. They have, furthermore, seldom been associated with the measures commonly used in gauging quality of traffic service. This study proposes to determine whether the driver considers esthetics in his evaluation of the quality of service provided by the highway and, if so, whether a value can be attached to it.

5. The Effects of Intersection Geometry on Quality of Traffic Service

This proposed study confines itself to the traffic service provided by one single element of the highway transportation system. Specifically, it proposes to investigate the effect of geometry and traffic control upon the traffic service provided by an intersection where free right turns are permitted.

A more detailed description of these research areas is given in the five project statements that follow.

RESEARCH PROBLEM STATEMENT

Title: Quality of Traffic Service: Concept and Techniques

PROBLEM: The concept of quality of traffic service is still little understood. Past years have seen several attempts at its definition and at the development of acceptable techniques for its measurement. These attempts have resulted in a number of diverse approaches. While considerable controversy remains concerning the validity and usefulness of these approaches they provide a good starting point for further study.

Much of the confusion and controversy centers around the lack of definition. A thorough appraisal of past efforts, with particular reference to their scope, purpose and to the techniques developed for the measurement of the parameters is needed to assist in the better understanding of the concept of quality of traffic service.

PROBLEM AREA: Planning, Design and Operations.

OBJECTIVES: The ultimate objective would be to develop a framework within which further study could proceed toward defining the quality of traffic service and toward developing useful techniques for its measurement.

The specific objective would be to collect, review, summarize and appraise past and current studies, to seek common denominators by which the various approaches can be related to each other and to define the limits within which each approach is valid.

RESEARCH PROBLEM STATEMENT

Title: Quality of Traffic Service: An Analytical Study

PROBLEM: No generally acceptable techniques are available for comparing the traffic service provided by alternative streets or street systems. Yet, this operation constitutes an important step in the planning, design and operational procedures of both rural and urban highway networks. Past efforts have primarily been confined to a localized scale, narrow in scope and specific in purpose. These studies have made use of the commonly accepted parameters, namely, time, distance, safety, convenience and cost. It is now necessary to expand the scale and scope of the previous efforts, in order to provide a common base from which comparisons in the level of service can be made according to purpose (design, planning, operation) and according to the function of the system or the element in the system under study. A model that would accomplish this should be formulated so as to permit ready measurement of its variables, thus, to make it a useful working tool.

PROBLEM AREA: Planning, Design, Operations.

OBJECTIVES: The ultimate objective of this study would be to develop a technique or method for use as a tool in planning, design and operation of the street and highway network.

The specific objective would be to identify the parameters that express traffic service (there might be some that have thus far not been used) and to relate these to each other in a way that would permit quantification of specified levels of traffic service. The model should be adaptable to various purposes for which traffic service is required and to any part of the highway transportation network (including to the entire network).

RESEARCH PROBLEM STATEMENT

Title: Quality of Traffic Service: The User's Measure

PROBLEM: In designing streets and highways the engineer must determine capacity and control requirements of individual sections in order that these accommodate the predicted number of vehicles. One of the major concerns in this operation remains the volume to capacity ratio, particularly as it relates to the level of service in terms of speed, cost, convenience and safety. Several approaches have been taken in the past in attempting to define level of service and to attach a measure to it, however, no universally acceptable approach has evolved thus far. While efforts toward this end continue, one area that is not receiving the deserved attention concerns user attitudes and opinions. Since the user ultimately pays for the facility through road user taxes, he should be given the opportunity to make known his preferences, with due regard to the limits of available resources.

PROBLEM AREA: Planning and Design.

OBJECTIVES: The ultimate objective of this study would be to determine whether and how better use can be made of road user's attitudes, opinions and preferences in establishing a measure for the quality of traffic service.

More specifically, the objective would be to develop a method of rating existing or proposed facilities for the "level of service or quality" which is provided. This should result in an objective, rational method of predicting the level of acceptance of the "user" - based on objective measures of the project.

RESEARCH PROBLEM STATEMENT

Title: Esthetics as a Traffic Service Quality

PROBLEM: This problem is part of the broader area of measuring the total quality of traffic service afforded by a highway facility. For instance, it is generally conceded that such factors as travel time, traffic interruption, freedom of maneuver, safety, driving comfort, convenience, economy, and psychological well-being are all functions which establish the quality of traffic service. The point is raised however, whether or not pleasantness and beauty should not also be considered. Grouped under the general term of esthetics, it is felt that this factor is important because it may well influence a driver to reach a decision as to which facility he will travel. After all, traffic assignment hinges on predicting a choice of facility that a driver will make under a given set of circumstances. The purpose here is to determine the extent to which esthetics is one of the elements influencing such a choice.

Specifically, the problem is to (1) Determine whether esthetics are important as a traffic service quality; and (2) Determine a technique for measuring this importance.

OBJECTIVES: The specific objectives of the proposed research are to assign a weight or value to the element of esthetics when compared to the factors used in the past (time, distance, cost, safety, convenience). Previously developed formulas establishing a quality of traffic service based on travel time have included some of these factors but, if ever, esthetics has rarely been included.

RESEARCH PROBLEM STATEMENT

Title: Effects of Intersection Geometry on Quality of Traffic Service

PROBLEM: What is the difference in traffic service provided by two different geometric layouts for accommodating right turns at the intersection of two major streets? Specifically, it must be determined whether a design with long corner curb radii providing a free right turn through a channelized slot provides a higher quality of service than the standard short corner curb radii (25' to 35') design.

The problem falls within the general area of efficient geometric design for the intersection of two major streets. While it might seem advisable, whenever possible, to provide long, smooth, right turn flow, experience seems to indicate that such a design may have distinct disadvantages. There is a definite effect on pedestrians, buses, turning volumes, extra signal appurtenances, extra signs and markings, accident potential, driver confusion, and extra right of way needed. Sometimes, the simpler the design, the better understood it is by the driving public and consequently, the more efficiently it operates.

PROBLEM AREA: Geometric Design and Traffic Control

OBJECTIVES: The specific objectives of the proposed research would be to study actual installations of the two types of intersections. Data concerning traffic volumes, accidents, pedestrian flow, efficiency, ease of traffic movement, and capacity when inter-related in a meaningful way should reveal whether or not one of these designs provides a higher level of service than the other.

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