1. Application of existing freeway corridor model, CORQ1C;
2. Provision of demand responses that include spatial, modal, time, and total demand responses;
3. Provision of impact responses that include energy, air pollution, noise, safety, and operating costs;
4. Improvement of search procedures to obtain optimum control strategies that consider equity and additional practical aspects;
5. Extension of control strategies to include integrated freeway and arterial traffic-management strategies;
6. Application of existing freeway corridor to additional operating environments and sensitivity analysis of operating environmental parameters; and
7. Provision for alternative objective functions and constraints and sensitivity analysis of the effect of these alternatives on evaluating the impacts of management strategies.

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Abridgment

County Evaluation of Traffic Engineering Activities

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The National Highway Safety Act of 1966 was the result of national concern over traffic accidents and fatalities. Its enactment by the 89th Congress was based on the realization that uniform standards had to be established to effectively reduce safety deficiencies. In 1969, the National Highway Safety Bureau revised and published Highway Safety Program Standards, a manual prescribing standards for traffic engineering and operations. These standards attempt to accomplish the following:

1. Provide recommendations for the identification, surveillance, and correction of accident locations;
2. Establish uniformity in traffic-engineering operations, analysis control, and design of highway facilities; and
3. Ensure pedestrian safety.

To aid the various communities in Oakland County, Michigan, to achieve the standards of the highway safety act, the Traffic Improvement Association (TIA) of Oakland County, a private nonprofit organization, undertook a project to compare traffic-engineering operations in the county with appropriate safety standards and to develop corrective actions. This paper describes the data-collection procedure and summarizes the results

Table 1. Communities selected to participate in survey.

Class	Population Density (persons/km^2)	Communities in Class	Communities Selected in Sample: Number	Percent
1	>2317	7	6	86
2	772 to 2317	18	7	39
3	<772	35	17	49

Note: 1 km^2 = 0.4 mile^2.

and recommendations made to help achieve highway safety standards.

The size and diversity of the county and the complexity of variables involved in highway incidents made this task a significant one. Oakland County, in southeastern Michigan, is a part of the Detroit standard metropolitan statistical area (SMSA) and had a 1970 population of 907 871. Sixty communities spread over 2365.7 km^2(913.4 miles^2) maintain with the County Road Commission approximately 7401.4 km (4600 miles) of roadway.

Table 2. Summary recommendations for policy improvement.

Subject	Survey Results	Recommendations
Traffic-engineering functions in city charter and executive orders	Most communities do not include all traffic-engineering functions in city charter or executive orders	A formal standardized description of all traffic-engineering functions be prepared and recommended for adoption by local communities
Specific individual in community who has been formally assigned traffic-engineering responsibilities	27 percent of the communities do not formally assign traffic-engineering responsibilities to a specific individual	Specific communities be requested to formally assign traffic-engineering responsibilities to a specific individual
Official committee to review and handle traffic problems	72 percent of the communities do not have such a committee	All communities form such a committee or increase effectiveness of existing committee
Coordination between local agencies and county as a whole	70 percent of the communities indicated coordination greatly needs improving	Investigation be conducted of possibility of holding regular meetings of all traffic-engineering personnel in the county
Continuing education for policy makers	No community has such a policy; 93 percent indicated that a seminar on basic engineering approaches to traffic problems would have great value	Investigation be conducted to determine feasible means to disseminate basic traffic-engineering expertise to policy makers
Traffic-engineering manual for policy makers	90 percent of the communities indicated that summaries of basic traffic-engineering practices would have great value	Summaries of various traffic-engineering activities (i.e., warrants for traffic control) be prepared and distributed to all elected officials
Public support for excellence in traffic-engineering activities	50 percent of the communities indicated that some public support has been received for a few activities	Detailed procedure be developed for a public information dissemination plan and local agencies be advised to use this procedure
Traffic volume data	Communities indicated that a significant number of intersections and link locations do not have recent volume count data	Local agencies establish continuing programs for collecting traffic-volume data
Program to detect high-hazard locations	73 percent of the communities have no means of identifying high-hazard locations; 27 percent sometimes detect high-hazard locations by reconnaissance survey	A simple procedure be developed for detecting potential high-hazard locations and local agencies be trained to use it
Traffic-engineering priorities	93 percent of the communities have no traffic-engineering priorities	Traffic-engineering priorities be developed for entire county
Authorization of unwarranted traffic-control devices	Most communities authorize unwarranted installation of traffic-control devices	Communication between technical staff and governing body of local communities be increased to minimize or eliminate installation of unwarranted traffic-control devices
Written policies and procedures for performing traffic-engineering activities	87 percent of the communities have no written policies and procedures	Standard policies and procedures be developed and distributed to all communities for local adoption
Written job descriptions for traffic-engineering positions	87 percent of the communities have no written job descriptions	Standard job descriptions be prepared and distributed to local agencies
Written procedures for regulating traffic construction sites (in addition to the provisions of the manual)	87 percent of the communities have no written procedures for regulating traffic at construction sites	Written procedures be developed for traffic regulation at construction sites
Use of traffic-engineering professionals	18 percent of the communities in 1973 and 27 percent in 1974 used professionals more than 20 person-d/year	Increased use be made of traffic-engineering professionals
Assessment of traffic-engineering training needs	90 percent of the communities have no assessment of traffic-engineering training needs; 83 percent have never provided preservice training	A general procedure be developed that will allow individual communities to perform studies of training needs on a continuing basis

Table 3. Summary recommendations for system improvement.

Subject	Survey Results	Recommendations
Inventory procedures (traffic-control devices, roadway characteristics)	Most communities have no scientific method of record keeping; communities that keep records have manual systems, usually in the form of maps, drawings, or card files	Scientific method of inventorying and record keeping be pursued throughout the county
Capabilities of identifying non-skid-resistant pavement and procedures for correcting such deficiencies	No community has such a capability	Possibilities be investigated of procuring skid-testing equipment for the county and rectification procedures be developed
Capabilities of identifying substandard and deficient roadway lighting	70 percent of the communities have no means of identifying such deficiencies; those that have do not use scientific means	Standards and procedures be developed and adopted by local communities
Standards for locating utility poles along roadways	73 percent of the communities have no standards; those that have must have them checked with safety criteria	Standards be established
In-service training	54 percent of the communities provide no in-service training for professional development; 56 percent have sent employees to training programs offered by state universities	In-service training programs be increased in the county
Traffic-engineering staff	Only 3 communities have traffic engineers (by the standards of the highway safety act 10 communities should have traffic engineers)	Communities be requested to hire traffic engineers and traffic technicians as required by the highway safety act

PROCEDURE

A comprehensive questionnaire survey was made in the county to provide qualitative and quantitative measurements of current traffic-engineering information regarding organization, administration, personnel and operations, maintenance, budget, and community emphasis. This questionnaire consisted of 70 questions that dealt with the following general categories:

1. Traffic engineering problems—questions designed to elicit subjective opinions concerning perceived community traffic-engineering problems as well as county traffic-engineering problems;
2. Organization and administration—questions that pertained to formal policies and procedures for the initiation, performance, maintenance, and review of traffic-engineering functions;
3. Planning and implementation—questions concerned with the planning priorities and the implementation of highway-safety improvements;
4. Operations—questions that pertained to community traffic-engineering activities, methods of identifying hazardous conditions, management of accident-data inventory, highway features, and traffic-control devices;
5. Maintenance—questions related to methods and level of maintenance performed by the local community for traffic-control devices, highways, and lighting; and
6. Budget—questions directed toward determining how much of the community's total budget should be allocated to traffic-engineering activities.

COMMUNITY SURVEY

A stratified sampling procedure was used to select 30 candidate communities for the survey. In determining the stratifications, we recognized that the majority of traffic-engineering and safety problems occurred in that portion of the county where there is high travel demand and high population density. Thus, the number of samples in each category favored urbanized areas over nonurbanized areas. Table 1 gives the stratification used and the candidate communities selected for the survey.

The survey was administered in each community on a personal-interview basis by the community person who performs the traffic-engineering functions. Although answering the questions required approximately 2 h, most persons interviewed cooperated fully.

SURVEY RESULTS AND RECOMMENDATIONS

A summary of part of the survey results and recommendations is given in Tables 2 and 3. The subjects shown pertain to specific questions used in the survey, but the representation is not all inclusive.

The recommendations generated as part of this study were based on an evaluation of the current status of traffic-engineering activities within the county as determined from the questionnaire survey. The recommendations were aimed at specific problem areas in need of immediate attention to improve traffic-engineering activities. The recommendations were classified into two basic categories: policy and system. Policy improvements generally do not require much cost or personnel and may indirectly affect the accident experience in the entire county. System improvements produce direct results in terms of accident reduction if all other safety requirements are followed; these improvements often require a great deal of funds and personnel. Some of the recommendations, both policy and system, are also given in Tables 2 and 3.

CONCLUSIONS

The survey results and analysis clearly indicate the lack of traffic-engineering sophistication possessed by the majority of the sampled communities in Oakland County. The lack of conformance to highway safety standards may be typical not only of the sampled communities in Oakland County but also of the majority of small urban communities that, because of size or budgetary constraints, do not employ a qualified traffic engineer or technician to handle day-to-day activities. Efforts must be made at the county level or higher to aid agencies responsible for traffic operations.

The survey instrument developed as a part of this study is comprehensive and can be used by other communities. Typical policy improvements as presented here can easily be adopted by other communities to help achieve conformance to the highway safety standards.

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Abridgment

Evaluating Urban Highway Service

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Differences are apparent in the quality of road services between one urban area and another as well as between one place and another within urban areas. Traffic moves more freely and quickly in some cities. Statistics indi-