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ABSTRACT

Phase I of this project was conducted to pilot test an associate degree program for the preparation of traffic safety technicians. Previously developed curriculum materials were revised by an advisory committee in accordance with the level of expertise and sophistication of the 27 students enrolled in the 2-year program and to meet the needs of the employers of highway safety manpower. Some conclusions drawn from the field test were: (1) Training and education programs, such as the traffic engineering technician curriculum, are likely to be relevant to the needs of local employers if centered in an educational institution that has a commitment to serve the community, (2) A pool of expertise in the form of the community college staff and community-based professional groups may be quickly mobilized to prepare highway safety manpower at technical levels, (3) Highway safety agencies find it valuable to cooperate with a community college in providing training opportunities within commuting distance of the place of employment and the employee's place of residence, and (4) Economies are gained when employers and educators share their resources and utilize the community as a laboratory to prepare traffic safety technicians. (SB)

IMPROVING HIGHWAY SAFETY MANPOWER: TRAFFIC ENGINEERING TECHNICIAN PROJECT AT LANSING COMMUNITY COLLEGE

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FINAL REPORT, PHASE I

AUGUST 1972

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16. Abstract

Under contract with the National Highway Traffic Safety Administration, U. S. Department of Transportation, the American Association of Community and Junior Colleges tested an associate degree curriculum to develop traffic engineering technicians. Lansing Community College (Michigan) served as the site for the test. During the test, the curriculum was revised to reflect the needs both of the students enrolled in the program and the employers of highway safety manpower, as perceived by college faculty and staff, and by the project advisory committee. A primary conclusion in the report is that the revised curriculum is appropriate for use by community and junior colleges to develop traffic engineering technicians. The report recommends that the revised traffic engineering technician curriculum be implemented by other community and junior colleges in conjunction with both local and state highway safety agencies and employers of traffic engineering technicians.

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PREFACE

Under contract with the National Highway Traffic Safety Administration of the U.S. Department of Transportation, the American Association of Community and Junior Colleges tested an associate degree curriculum designed to develop traffic engineering technicians. Lansing Community College (Michigan) served as the test site for Phase I of a two part contract. This report covers the details of Phase I of the project. Phase II of the contract involving Community College of Denver (Colorado) and Longview Community College (Missouri) will continue for another year.

The American Association of Community and Junior Colleges wishes to express its appreciation to Lansing Community College, for serving as a Subcontractor. The College was able to mobilize its resources on short notice and to expedite the project.

Particular recognition is due Edwin C. Bergmann, who served as the Project Coordinator at Lansing Community College. Frank De Rose, and Marvin Church who served as the principal instructors for the project deserve recognition for their resourcefulness. The Association is indebted to the faculty, guest lecturers, students, advisory committee members, and state and local officials who participated in the project.

We wish to thank the following persons who served as monitors and consultants for the project: William Grecco, Joseph Young, Ronald Daugherty, Vernon Burgner, Donald Lindahl, Jo Elen Zgut, Ronald Greathouse, Muriel Ratner, and Robert Knoebel.

Valuable direction was received throughout the project from Aaron Adams, Contract Technical Manager, National Highway Traffic Safety Administration. Helpful assistance was obtained from Richard E. Wilson, Kenneth G. Skaggs, Ann Maust, and other personnel of the Association. Mary Yenchick and Carolyn Jackson performed valuable secretarial services in preparing this report.

Andrew S. Korim
Principal Investigator
August, 1972

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I. INTRODUCTION

Highway safety has risen progressively higher and higher up the list of national priorities over the years as the economic and social costs of personal injuries, deaths, loss of property and wasted time erode the benefits of engineering advances in transportation. Highway safety has demanded greater and greater investments of public resources by local, state, and federal instrumentalities. Congressional action has mandated a national effort to improve the highway safety record.

Uniform Safety Standards and Manpower Needs

Recognizing the need to improve continually the flow of vehicular traffic and to increase substantially safety on the nation's roads, Congress enacted the Highway Safety Act of 1966. This law provided for the establishment of a national highway traffic safety program. Sixteen uniform standards were promulgated by the U.S. Department of Transportation. (Table 1.)

Table 1. National Highway Traffic Safety Administration Highway Safety Program Standards

1.	Periodic Motor Vehicle Inspection
2.	Motor Vehicle Registration
3.	Motorcycle Safety
4.	Driver Education
5.	Driver Licensing
6.	Codes and Laws
7.	Traffic Courts
8.	Alcohol in Relation to Safety
9.	Identification and Surveillance of Accident Location
10.	Traffic Records
11.	Emergency Medical Services
12.	Highway Design, Construction and Maintenance
13.	Traffic Control Devices
14.	Pedestrian Safety
15.	Police Traffic Services
16.	Debris Hazard Control and Cleanup

The implementation of viable highway safety programs by state and local governments needed first to be translated into manpower terms. For example, who and how many shall be required to carry out program activities, what training and/or education is essential for practitioners to enable them to meet the goals and objectives of highway safety programs, and what kinds of agencies are best prepared to offer the necessary preparation for prospective manpower?

These and other critical questions relating to manpower and staffing needs for a successful national highway safety program were studied comprehensively. Problems and questions relating to nationwide manpower training capacities, preparedness, and curriculum content were studied similarly and concurrently.

The National Highway Safety Bureau (now the National Traffic Safety Administration), U.S. Department of Transportation, began to collect manpower data shortly after the passage of the Highway Safety Act of 1966. This effort resulted in a report Safety Specialist Manpower that provides data on the manpower required to implement highway safety standards in the fifty states. 1/

Safety specialist needs in the ten-year period between 1968 and 1977 were projected in terms of minimum estimations and maximum estimations. Based on minimum projections, findings indicate that 87,000 additional safety specialists would be needed by 1977. If maximum estimates are used, then 250,000 more traffic safety specialists would be required. The bulk of the jobs would be at the technical and semi-professional levels.

In 1967, with funds from the W.K. Kellogg Foundation and the Insurance Institute for Highway Safety, the American Association of Junior Colleges (now the American Association of Community and Junior Colleges) assembled recognized leaders in the field of transportation to determine how the community colleges could provide the personnel needed to implement the Highway Safety Act. The committee looked at the entire field of transportation services to determine:

1. the types of manpower required to deliver the essential highway safety services;
2. the skills, knowledge and competencies required of the manpower;
3. the types and length of preparation and training such manpower would require to function optimally; and
4. the particular kinds of specialists for which the community colleges could best provide training and education.

The committee found that at least five categories of specialists were essential to the implementation of the Highway Safety Standards. 2/ These five categories were directly related to the following functional areas:

1. Motor Vehicle Administration
2. Traffic Engineering
3. Police Traffic Services
4. Driver and Traffic Safety Education
5. Commercial Highway Transportation

In analyzing these functional areas, the committee further concluded that:

1. the skills, knowledge and competencies were at the technical level rather than at the professional level;
2. the appropriate training and education was at the certificate and associate degree levels rather than the baccalaureate level; and
3. the appropriate education environment to deliver the training and education was the community-oriented two-year college rather than the secondary school or university.

These initial studies showed that a substantial number of highway safety personnel will be required in jobs demanding technical training and education beyond the secondary level, but less than the baccalaureate level. In short, the studies of manpower requirements indicated a mounting need for technicians and semi-professional specialists who could carry out the tasks necessary for improving highway safety in the nation. Although no sustaining flow of technical manpower was being generated specifically for highway safety occupations, among educational resources dedicated and geared to preparing technicians for a broad spectrum of career fields were the community and junior colleges, and technical institutes. Furthermore, the community colleges, both philosophically and functionally, seemed to have the potential to serve as centers to meet this need. Characteristically, the community colleges are ever-prepared and willing to accomodate community needs by developing programs for new or specific kinds of technical manpower. Their interest in gearing educational and training activities to the manpower requirements of the labor market on the one hand, and to the needs of individuals on the other, makes them valuable manpower development agencies. Their accessibility and economical operations make them appropriate for highway safety manpower development. The prior experience of community colleges in developing and implementing occupationally-oriented educational programs in a broad range of career areas provides a base for delivery of manpower for highway safety.

The Traffic Engineering Technician

In the above-mentioned areas of highway safety, there was a scarcity of curriculum materials. Therefore, a second phase of American Association of Community and Junior Colleges activities was launched to focus on the development of materials in one of the areas--the Traffic Engineering Technician. This decision resulted from the fact that several of the Highway Safety Standards were related to the field of traffic engineering. For example, identification and surveillance of accident locations; highway design, construction, and maintenance; traffic control devices; pedestrian safety; and debris hazard control and cleanup.

With funds from the Automotive Safety Foundation and cooperation from the Institute of Traffic Engineers, the American Association of Community and Junior Colleges convened a committee of consultants to examine the educational needs of the Traffic Engineering Technician. The committee identified the following specific tasks as the job of the Traffic Engineering Technician:

1. Surveillance of existing traffic patterns;
2. Study of problem location;
3. Geometric design of streets and intersections;
4. Channelization studies;
5. Planning of traffic signal installation, operations and maintenance;
6. Timing of traffic signals to coordinate flow;
7. Planning of sign and street-marking program;
8. Study of school and pedestrian crossings;
9. Planning of safe school bus routes;
10. Surveys of parking and traffic requirements of retail shopping centers; and
11. Collecting traffic data involving volume, speed, origin and destination, parking supply and demand, traffic accidents, and lighting levels.

With these tasks as the frame of reference, the committee identified basic concepts and skills that should be developed in a training and education program implemented to produce a Traffic Engineering Technician. The following were found to be the most critical concepts and skills:

1. Communication skills (oral and written), since the technician will be dealing with people;

2. A knowledge of the driver, roadway, and vehicle characteristics, and an understanding of physical laws as they relate to them;
3. The ability to extract design information from manuals and apply it to specific problems;
4. A knowledge of data collection methods, tabulation, and analysis;
5. A knowledge of the operation and maintenance of traffic control devices and equipment;
6. The ability to prepare sketches, engineering drawings, and to use graphics for illustrative purposes;
7. A knowledge of highway capacity analysis;
8. The basic principles of traffic and highway engineering; and
9. An appreciation of the general concepts and principles of related fields -- particularly urban planning and police traffic supervision.

The committee's deliberations led to the development of curriculum guidelines for an associate degree program to prepare Traffic Engineering Technicians.3/

This effort by the American Association of Community and Junior Colleges provided the National Highway Traffic Safety Administration with the basis for consideration of testing the credence of the curriculum outlined by the committee. In May 1970, a contract was negotiated between the American Association of Community and Junior Colleges and the National Highway Traffic Safety Administration to undertake such a testing effort under Section 403 of the Highway Safety Act of 1966.4/ Subsequently, Lansing Community College (Michigan) agreed to serve as the Subcontractor to conduct the test.5/

II. STATEMENT OF PROBLEM

As specified in the contract, the basic problem assigned to the Contractor was to pilot test an associate degree program for the preparation of traffic safety technicians. Guideline materials for highway safety manpower programs had been previously developed by the Contractor but were untested. Such a field test of the curriculum guide for traffic technicians would disclose strengths and weaknesses of the materials, thus permitting revision before many students completed the course. Under the project, additional curriculum materials in support of highway safety manpower development were to be formulated and tested.

Furthermore, the project, as conducted by the Contractor, was to provide information regarding student recruitment, student interest in traffic safety occupations, the interest of employers and professionals in highway safety technical manpower, and the character of the labor market for traffic engineering technicians. State and local highway safety administrators were to be involved in the project.

The Contractor had the responsibility of selecting a community college environment as the test site. The test site had to reflect capability, desire, and a suitable demography. The curriculum outline published in Traffic Engineering Technician Programs in the Community College was designated as the basis for the program of instruction.

In preparing the final report, recommendations were to be offered for the role of the nation's community colleges in the National Highway Traffic Safety Administration manpower development program.

III. METHODOLOGY

Preparation by the Contractor

Early in the project the Contractor will conduct a search of the literature to provide background information on highway safety manpower development with particular emphasis on those factors that would be pertinent to traffic engineering technician programs in community and junior colleges. This background information will be utilized in carrying out the contract. The literature will be up-dated periodically during the course of the study.

Next, early in the project the contractor must develop a set of criteria for identifying the colleges with the highest qualifications, and for selecting colleges interested in and capable of serving as the test site for the project.

Furthermore, the Contractor must develop a written agreement which will specify the obligations of the Contractor and a community college, that will serve as a Subcontractor. This agreement will be completed when the college accepts the invitation to participate.

Selection of the Participating College(s)

With the cooperation and assistance of the National Highway Traffic Safety Administration, the Contractor will use a set of criteria (Table 2.) to serve as a basis for selecting a community college in which a pilot demonstration traffic engineering technician program could be centered.

Using these criteria, the Contractor will identify the ten most highly-qualified community colleges. Of the institutions which qualify, the final selection will be based on the ultimate criterion: the willingness and ability of the institution to launch the pilot program with considerably less than the normal lead-time required for developmental activities; the exigency of time requires this ability. Specifically, the college to be selected must provide evidence of its delivery capability. The decision to offer a new technological career program is generally based on favorable findings that derive from a comprehensive feasibility and capability study. The decisional

Table 2. Criteria for Selecting Participating Community College

1. Institution grants Associate Degree
2. Offers Civil Engineering Technology Program
3. Offers Associate Degree in Transportation
4. Prior communication with the National Highway Safety Bureau concerning highway safety manpower
5. Prior proposal regarding highway traffic safety on file at the National Highway Safety Bureau
6. Sponsor of the American Association of Community and Junior Colleges regional traffic workshops
7. The institution is comprehensive in that it offers both transfer and occupational educational programs in an atmosphere of higher education
8. The institution is accredited by a regional accreditation association
9. Institution is located in close proximity to state office for coordination of highway programs-
10. Institution is located in close proximity to state office for coordination of highway programs
11. Demographic considerations are favorable to institution
12. No conflict with maintenance of effort provisions specified in the contract
13. Institution has been in operation for at least two years

elements comprising such a study briefly are as follows:

1. Need for the program;
2. Community support;
3. Job placement opportunities;
4. Student interest in program;
5. On-campus and off-campus instructional facilities and resources;
6. Availability of adequately and appropriately prepared faculty; and
7. Availability of financial resources for capitalization and operating costs.

The institution that accepts the burden of testing the curriculum must be able to ascertain the feasibility of offering the program locally.

Start-up of Project at College

Assuming the findings lead to a decision to offer the program, the next step is staffing the project. Secondly, an advisory committee must be organized early in the project. This advisory committee should include representation from local employers of traffic engineering technicians and professional groups such as the local chapter of the Institute of Traffic Engineers. A program coordinator and/or instructor must be employed to assume the major responsibility of organizing the program and instructional resources. His qualifications should include experience in traffic engineering or a related field.

Concurrently, the college must begin active information, recruitment, and guidance activities. These activities normally require as few as six months and as many as twelve or more months. But due to the short lead-time under the contract, the college must be able to compress these activities into a short time-frame.

Course Development and Instructional Materials

One earlier study was undertaken by a group of traffic safety consultants under the sponsorship of the American Association of Community and Junior Colleges. As noted earlier, the task of these consultants was to develop curriculum guidelines for an associate degree program to prepare traffic engineering technicians. Their findings are published in Traffic Engineering Technician Programs in

the Community College. It should be noted that the publication offers only a curriculum outline and sketchy course descriptions. Upon selection of the instructional staff, and with the assistance of the advisory committee, the college will review the curriculum outline and course descriptions to determine their adequacy. Appropriate curriculum changes will be made. Comprehensive course outlines, lesson plans, lectures, and demonstration activities must be prepared. Much of this activity will be conducted as the project progresses.

Monitoring and Evaluation

Periodic on-site evaluations shall be made by monitors selected by the Contractor. The monitors shall have experience in the field of highway safety and/or community college education.

The monitor shall review the instructional aspects of the program, focusing in particular on the adequacy of course content, instructional materials, teaching aids, equipment, and facilities. The monitor should obtain outlines and syllabi of the courses as well as copies of examinations and project assignments to aid him in making his assessment.

In addition, the monitor shall ascertain the effectiveness of the other supporting courses in the curriculum, and meet with the instructional staff to determine the adequacy of their qualifications and their capacity to relate to the students. Furthermore, the monitor shall determine the attitudes of the students toward the program.

During his evaluation visit, the monitor should be alert to problems encountered in meeting the objectives of the program. To accomplish this task, the monitor shall interview the students, instructional staff, college administrators, members of the advisory committee, and other persons associated with the program. In addition, he shall inspect records and other documents maintained by the instructors and the college.

The coordinator of the program at the college shall be briefed by the monitor disclosing the findings of the visit. A comprehensive written report shall be submitted by the monitor upon completion of a monitoring visit.

The subcontractor shall submit monthly reports to the contractor on the accomplishments, problems, and delays associated with the program. These reports shall be prepared by the college coordinator of the program. At the end of each term, a report giving an overview of the progress of the project shall be submitted to the contractor. Periodic meetings shall be held between reprepresentatives of the contractor and subcontractor to review the status of the project.

IV. REVIEW OF LITERATURE

In order to establish a foundation for the traffic engineering technician project, a number of studies and surveys pertaining to highway safety manpower development, to related education and training programs, and to two-year colleges were reviewed. The findings of this review are summarized in the following section.

Survey of Two-Year Colleges

In an attempt to identify colleges that offer programs relevant to traffic safety, the U.S. Office of Education publication Directory of Public Schools Offering Technical Education Programs, Fiscal Year 1969 was reviewed. This directory lists the names of public educational institutions, their locations, and their technical programs. The directory lists schools and programs reported by the states through various channels or shown in various publications for fiscal year 1969. No specific reference is made to traffic safety. The civil engineering technology program is the primary program listed that offers education and training pertinent to the skills needed by traffic engineering technicians. The directory identified 152 institutions that offer civil engineering technology programs at the post-secondary level. One-hundred of these institutions were two-year colleges and were located in thirty-one states. No indication as to whether these programs were or were not supported by federal funds under the Vocational Education Act of 1963, as amended in 1968, was discernible. It was impossible on the basis of the available information to ascertain whether the programs were at the associate degree level or at the certificate level. The American Trucking Associations conducted a survey to collect information on transportation programs in junior colleges. This information was published in the Directory of Transportation Education in U.S. Colleges and Universities. This publication lists 25 junior colleges offering associate degree programs in transportation. Four other junior colleges were identified as offering associate degree programs in transportation. The 29 programs were distributed among 13 states.

The American Association of Junior Colleges, announced in its Occupational Education Bulletin, (February, 1970) that information on manpower needs in highway safety was available from the National Highway Traffic Safety Administration. Thirty-eight letters were received requesting information as a result of this announcement.

Of these requests, twenty-four were from two-year institutions. In response to these requests a summary entitled "Safety Specialist Manpower" was made available by the National Highway Traffic Safety Administration. This statement summarizes the findings of the Safety Specialist Manpower study made by Booz, Allen, and Hamilton, Inc. under contract with the National Highway Safety Bureau.

Curriculum Information

In searching for materials pertaining to curricula in traffic safety in community and junior colleges, only two publications were identified. The Role of the Community College in Developing Traffic Specialists and Technicians, published by the American Association of Junior Colleges in 1968, summarizes the proceedings of a series of regional workshops conducted by the Association, and supported by funds from the Insurance Institute for Highway Safety and the W.K. Kellogg Foundation. This publication contains reviews of the following topics: highway safety management; the National Highway Safety Act; manpower and training needed; types of highway safety personnel; types of training; major classifications of traffic specialists including motor vehicle administration, traffic engineering, police traffic services, driver and traffic safety education, and commercial highway transportation. In addition, the publication discusses the importance of the survey technique in determining the need for educational programs.

Traffic Engineering Technician Programs in the Community Colleges, published in 1969 by the American Association of Junior Colleges, provides additional information related to curriculum development in highway safety. This publication offers detailed information on the job description for the traffic engineering technician, information on job opportunities for traffic engineering technicians, and a review of the responsibilities of the community college in this regard. In addition, the publication outlines a two-year traffic engineering technology curriculum, consisting of fifty-four class hours and forty hours of laboratory instruction. The curriculum leads to an associate degree providing sixty-eight credit hours.

General Information on Two-Year Colleges

A valuable source of information on higher education is the Educational Directory 1968-1969, published by the National Center for Educational Statistics, U.S. Office of Education. This directory

lists institutions of higher education in the United States legally authorized to offer, and those that do offer at least a two-year in-residence program of college level studies or occupational studies beyond grade 12, or both. The directory contains information on and lists criteria for accreditation. It serves as a useful guide in determining the delivery capability of an institution.

An important source of general information on junior colleges is the 1972 Junior College Directory, published by the American Association of Community and Junior Colleges. The directory provides basic information about non-profit two-year colleges including information on tuition costs per academic year. It reports a total of 1,111 such institutions with a total enrollment of almost 3,000,000 students. It projects that there will be 1,225 two-year colleges by 1975. Factors contributing to the projected growth of community and junior colleges include: increasing numbers of high school graduates; growth in percentage of college-age persons who are seeking opportunities; rapid expansion of curriculum and career-education opportunities within the two-year college; increasing popularity of adult, continuing education, and community service programs; and stepped-up recruitment of disadvantaged and minority students.

No source of information was found which gives specific data on sources of funds available to community junior colleges for financing the costs of education in general, and training programs to prepare highway safety personnel in specific. Generally, the costs of occupational education in community and junior colleges may be financed by tuition, local taxation, and funds from state sources. Funds for these programs may also be available under the Vocational Education Act, as amended 1968, and the Education Amendments of 1972.

Manpower Requirements

The major source of information on technical manpower requirements related to highway safety legislation and the program of the National Highway Traffic Safety Administration is the study conducted by Booz, Allen,and Hamilton, Inc. (National Highway Safety Bureau Contract No. FH-11-6496). Under this contract four reports were prepared. These reports are summarized in "Safety Specialist Manpower", an executive summary prepared by the National Highway Safety Bureau. Major findings of the Booz, Allen,and Hamilton study are:

1. About 65,000 state safety specialists are currently employed in highway safety programs;

2. State officials expect about 95,000 state safety specialists to be required in 1977;
3. An estimated maximum of about 250,000 state safety specialists will be required in 1977;
4. An estimated minimum of about 87,000 state safety specialists will be required in 1977.

A limitation of the Booz, Allen, and Hamilton study is its failure to consider the anticipated demand for personnel specifically at the associate degree level of training and education. However, the study does identify a projected shortage of personnel with educational preparation in the category of less than baccalaureate level. By 1977, a shortage of 47,892 persons in this category is estimated.

Table 3. Shortages of Highway Safety Personnel Who Need Less Than Baccalaureate Degree Educational Preparation

Occupational Titles by Degree of Shortage	Shortage by Actual Numbers
Acute shortage (over 1,000)	
Accident Site Investigator Aide	1,013
Motorcycle Motor Vehicle Inspector	1,140
Driver License Examiner	1,754
State Wrecker Operator	4,183
Motor Vehicle Inspector	12,686
Police Traffic Service Patrolman	20,198
Moderate shortage (under 1,000 but more than 100)	
School Bus Motor Vehicle Inspector/ Station Inspector	169
Driver License Hearing Officer	357
Traffic Control Device Technician	429
Engineering Aide - Traffic	438
Motorcycle Driver License Examiner	506
Highway Safety Site Officer	536
Engineering Aide Safety	723
Police Traffic Services Officer	758
Motor Vehicle Station Inspector	871
Minor shortage (under 100)	
Police Traffic Services Program Specialist	81

Although all of the occupational titles listed in Table 3 do not necessarily require an associate degree level of education, there is no source of sustained supply of trained personnel for these positions. Many of the competencies, concepts, and skills needed to perform the tasks related to these positions are at a level consistent with community and junior college education and training programs. An analysis of the tasks performed and the skills required would be needed to identify the specific levels of training and education required in these occupations. A study of manpower needs in local government, conducted by the National Association of Counties, gives valuable direction but needs interpretation in order to be significant for a particular college.

According to information from the Institute of Traffic Engineers, there is a national shortage of 1,400 traffic engineers. It may be anticipated that a minimum of two to five technicians would be required to support each professional traffic engineer. A majority of the traffic engineering personnel are employed by state governments. Local agencies that have potential uses for traffic engineering personnel consist basically of planning offices in county and city governments. Other information describing careers related to traffic engineering may be found in A Career in Traffic Engineering published by the Institute of Traffic Engineers.

Manpower Requirements for National Objectives in the 1970s, a report of a research project conducted for the Manpower Administration, U.S. Department of Labor, is a significant source of information on the demand for manpower. The publication provides considerable statistical data on manpower requirements for meeting the transportation goal in the 1970s, but does not provide specific information pertaining to manpower needs for highway traffic safety.

In an article in the May 1967 issue of Occupational Outlook Quarterly entitled "State and Local Government Burgeoning Need for Manpower", personnel requirements for occupations related to highways and streets were indicated. It was noted that in the period from 1965 to 1975, employment in these occupations would grow from 560,000 to 675,000 -- an increase of twenty-one percent. Although these figures do not specifically refer to traffic engineering technicians, it may be expected that the growth in total manpower needed in this area may increase proportionally to the highway and street manpower needs. This article was based on a report, Manpower in State and Local Governments 1965 and 1975, prepared by the U.S. Department of Labor's Bureau of Labor Statistics in December 1966.

Another study of highway safety manpower, conducted by Stanford Research Institute, entitled The Feasibility of Establishing Highway Safety Manpower Development and Research Centers at University Level Institutions, recommends the division of the United States into ten geographic regions and the establishment of a regional highway safety center in each region. These highway safety centers would be designed to train personnel for highway safety positions to conduct research in traffic safety. A major study limitation is the failure to consider the possibility of two-year colleges serving as feeder institutions. Although the Stanford report does not consider the possibility, it could be feasible to identify community and junior colleges in each state that would function as satellites of the regional center, serving as centers for associate degree and certificate levels of traffic safety preparation. The Stanford study relies heavily upon the manpower requirements identified in the Booz, Allen, and Hamilton study.

Additional sources of information relevant to this study are listed in the Bibliography.

V. FINDINGS

Start-up

In exploring with a number of community college administrators, the possibility of their college serving as the pilot institution for the project, several problems were cited. Among the most frequently mentioned were:

1. The failure of the contract to provide start-up or developmental funds to cover the cost of staff time and related expenses, to prepare syllabi and instructional materials, to conduct counseling and guidance activities, and to administer the program;
2. Tuition stipends provided under the project would not be adequate incentive to the prospective student to attract a sufficient number of full-time enrollees to justify the costs of the program;
3. The job market for the graduate of a traffic engineering technician program is not clearly defined;
4. The contract was out-of-phase with local and state planning, thus not allowing adequate time to permit hiring of staff, development of materials, recruitment of students, approval of program by state vocational education agency and/or state community college agency, and inclusion of the program costs in the budget of the college;
5. The over all costs to the college would be greater than would be justified with only limited financial support from federal or state sources;
6. A twelve to eighteen-month procedures formula is fairly routine for tried, tested, and established technological curricula. The procedure for offering a totally new program is generally a much lengthier one. However, considerably less time was allotted for implementation of this program.

Of the community and junior colleges who seemed qualified to participate, the field was narrowed down to one college -- Lansing Community College, Lansing, Michigan -- that agreed to become the pilot institution for testing a new traffic engineering technician curriculum. Although the contract specified that two community colleges be selected for simultaneous participation in the project, only Lansing Community College proved able to gear up and to initiate the project early enough to permit completion of the project within the two-year time-table established for the effort.

Curriculum

Instructional Materials -- The guidelines for an associate degree curriculum, used by the College's faculty and students, were contained in Traffic Engineering Technician Programs in the Community College (hereafter called Traffic Engineering Technician Programs). These guidelines were consistent with the Department of Transportation's mandate to conduct manpower development activities as a component of the national highway safety program. The publication offered course descriptions for the traffic engineering technician program, but left the task of developing comprehensive course outlines to the college. Both the advisory committee members and the college faculty agreed that the basic publication was adequate in terms of suggesting learning goals for the two-year curriculum, but it was not specific enough in terms of breadth and depth of subject matter to be covered. Another limitation of the publication was the absence of suggestions on selected reference and text book materials. However, the college staff developed these materials as the program progressed.

Since most of the students had some background in various aspects of traffic safety or highway management through their employment experiences, the course outlines and instructional scheme were developed in accordance with their level of expertise and sophistication. The original and the revised versions of the curriculum are outlined in Tables 4 and 5. Course descriptions and outlines developed during the project are found in Appendix A.

Lansing Community College operates on a quarter system. Therefore, in making revisions, the curriculum outlines in the Traffic Engineering Technician Programs had to be translated from 68 semester credit hours into 90 quarter credit hours. When completed, it was found that the College already offered in its basic civil technology curriculum 63 of the credit hours that were required. The College needed only to translate the special traffic engineering technical content into the remaining 27 credit hours (eight courses) to meet associate degree requirements. These adjustments were easily integrated into a revised curriculum. In addition, two of the recommended courses -- Field Traffic Survey and Traffic Studies -- were combined with the laboratory field experiences scheduled for the summer between the first and second years. This was done, in part to accommodate the part-time students, and in part, because the content in both areas was sufficiently related to provide for a cohesive single unit.

Table 4. . Original Curriculum

FIRST YEAR	
Semester One	Credit hours
Introduction to Traffic Engineering	2
Engineering Drawing	3
Technical Mathematics I	4
Technical Physics	4
Communication Skills	3
Physical Education	1
	17
Semester Two	
Principles of Traffic Administration and Safety	2
Graphics	3
Technical Mathematics II	4
Technical Physics II	4
Communication Skills	3
Physical Education	1
	17
SECOND YEAR	
Semester Three	
Field Traffic Surveys	4
Control Devices	3
Geometric Design	4
Statistics	3
Social Science	3
	17
Semester Four	
Traffic Studies	4
Traffic Laws and Regulations	3
Urban Transportation Planning	4
Data Processing	3
Social Science	3
	17
Total Credit Hours	68

Table 5. Revised Curriculum

FIRST YEAR	
QUARTER ONE	Credit hours
Introduction to Traffic Engineering	3
Industrial Drafting	4
Technical Mathematics I	5
English	4
Physical Education (optional)	1
	16-17
QUARTER TWO	
Principles of Traffic Administration	3
Engineering Drawing (Civil)	3
Technical Mathematics	5
English	4
Physical Education (optional)	1
	15-16
QUARTER THREE	
Field Traffic Survey	4
Descriptive Geometry	4
English	4
Elective	4-5
Physical Education (optional)	1
	17-18
SECOND YEAR	
QUARTER FOUR	
Control Devices	3
Descriptive Statistics	5
Physics	4
Physical Education (optional)	1
Elective	3-5
	16-18
QUARTER FIVE	
Traffic Studies	4
Geometric Design	4
Introduction to Data Processing	5
Physics	4
Physical Education (optional)	1
	17-18
QUARTER SIX	
Urban Transportation Planning	4
Traffic Laws and Regulations	3
Physics	4
American Government	4
Physical Education (optional)	1
	15-16
Total Credit Hours	96-103

Impact -- A most significant observation of the evening session instructor/coordinator, an experienced traffic engineer, was the conceptualization of the field of transportation and all its component parts -- traffic flow, design, management, highways, railways, seaways, vehicles, travelers, manpower, etc. -- as a system in the traffic engineering technician curriculum. A further observation was that traffic safety as a process had, until recently, been accorded a secondary role in the structural and functional development of transportation education programs; facility of movement for greater quantities of goods and services had received primary consideration. The traffic engineering technician curriculum was able to incorporate highway safety as a major concept in the design, construction, and management of a transportation network. Program participants from the Michigan Department of State Highways and many students agreed that the traffic engineering technician curriculum emphasized safety as a key factor in resolving contemporary problems of transportation.

The College's Resources

Although the College lacked the critical resource of time necessary to assess adequately its total capability to develop a viable program, it proved rich in vital resources, especially in regard to its administrative structure and staff.

Administrative Structure -- Administratively, the College is divided into three smaller colleges -- Arts and Sciences, Business, and Technology. Each of these is further subdivided into various departments. The contract was negotiated through the College of Technology. The Department of Engineering Technology a unit of the College had for many years offered a "highway option" as part of its curriculum.

Faculty and Staff -- It was impossible in the time allotted to engage a full-time instructor-coordinator for the program. The chairman of the Engineering Technology Deparment was given full responsibility for directing all aspects of the program. His duties included organizing and arranging advisory committee meetings, directing curriculum review and revision, writing periodic program reports, securing faculty, recruiting students, and maintaining liason with community agencies and personnel. The civil technology professor, in addition to his assigned teaching loads, assumed instructional responsibilities for all pilot program students who could attend day-session classes. A part-time instructor who is a professional traffic engineer organized and coordinated the evening instructional program and individual class sessions.

Community Resources

The significance of the community resources available to the College cannot be overlooked. Thirty-seven specialists in a variety of highway safety activities provided adjunct instructional services throughout the course of the two-year pilot program. Advisory committee services, instructional facilities, and guest lecturers constituted valuable community resources.

The Advisory Committee -- The advisory committee, consisting of statewide representation from city and state agencies, the Michigan Chapter of the Institute of Traffic Engineers, the County Road Association of Michigan, Michigan State University, the Automobile Club of Michigan, and the students, faculty and staff of the College, was a valuable resource. The Committee gave generously of its time to assist in the development of course objectives and outlines; to identify potential instructors and lecturers; and to participate in selected instructional activities. One of the monitors for the project described the advisory committee as impressive both in terms of qualifications and its accomplishments under the project. Appendix B lists the members of the advisory committee.

Instructional Facilities -- Both the Michigan Department of State Highway and the City of Lansing Traffic Department became valuable off-campus instructional facilities where students participated in field and traffic surveys, studied the use of traffic signal control equipment, and carried out class projects in geometric highway design, among other related activities. The Governor's Highway Safety Coordinator gave the support of his office to the project.

Guest Lecturers -- The community was a rich source of lecturers to supplement the instructional staff. The lecturers provided specialized instruction that usually is unavailable. The lecturers represented the Lansing Traffic Department, Michigan Department of State Highways, the Michigan Department of State Police, the County Road Association of Michigan, and the Highway Safety Center of Michigan State University. A number of the guest lecturers were active in the Institute of Traffic Engineers. A roster of the guest lecturers is included in Appendix C.

Students

Recruitment -- An underlying, although unspecified, assumption in establishing the associate degree curriculum for traffic engineering technicians was that it would be attractive to entering college students. Studies had supported the fact that job employment opportunities in city, county, and state agencies, and with private firms

would increase appreciably as uniform traffic safety standards were effected. Unfortunately, the time available in the start-up period was inadequate to mount a major informational and recruitment program.

However, experience at the College had shown that new programs or new college courses initially attracted individuals who were already employed in the field toward which the program and courses were directed. Announcements and flyers describing the new curriculum were placed in a variety of local publications and posted in state and local traffic agencies. This effort attracted twenty-six students for the first quarter. The majority of these students were already employed in some area of traffic safety, but were interested in upgrading their knowledge and skills. A number of students in the initial group of enrollees had graduated from the College's civil engineering technology program and were interested in earning related academic recognition in the new technical specialty.

The basic publication (Traffic Engineering Technician Programs) contained useful promotional materials. As such, it could be used effectively in recruitment, particularly if such information were available to, and used by, high school counseling departments.

Austerity in public spending for highway safety had affected the extent to which vacancies for traffic engineering technicians could be cited in attracting recent high school graduates in the program. In addition, the College had no tradition specifically pertinent to traffic safety programs or prior experience except in the area of civil technology upon which to draw in recruiting students.

Composition -- Fifty-seven students were enrolled in one or more technical courses during the two academic years of the project. Of these students, 26 were employed by the Michigan Department of State Highways; 1 was employed by a county road department; 4 had other employment; 26 indicated no employment, but a number of these had prior experience in highway safety occupations.

Of the eight technical courses offered in the curriculum during the two academic years (September 1970 - June 1972), only one student

completed all eight courses. However, 8 students completed seven technical courses; 5 students completed six courses; 4 students completed five courses; 3 students completed four courses; 4 students completed three courses; 11 students completed two courses, and 20 students completed one course. Table 6 indicates the number of students enrolled in each of the technical courses.

Table 6. Number of Students in Technical Courses (both full-time and part-time enrollees)

Course No.	Course Title	Number of Students
CT 260	Introduction to Traffic Engineering	28
CT 261	Traffic Administration and Safety	31
CT 262	Field Traffic Surveys	19
CT 263	Traffic Operations and Control Devices	33
CT 264	Traffic Geometrics	26
CT 265	Traffic Studies	15
CT 266	Traffic Laws and Regulations	18
CT 267	Urban Transportation Planning	14

Table 7 shows the number of full-time students (those taking 12 credit hours or more per term) enrolled in the total curriculum, by term.

Table 7. Full-Time Enrollment by Term

	Total Number of Students (Full-Time)	Students Added	Former Students Lost	Former Students Added
1st Term	5	*NA	NA	NA
2nd Term	9	4	0	NA
3rd Term	12	3	0	NA
4th Term	11	7	8	NA
5th Term	7	0	5	2
6th Term	5	0	2	0

*NA - Not applicable

The college reported that by the end of the 1972 Summer Term, six students completed all requirements for the associate degree. Some students met the requirements by taking a number of the courses on a part-time basis. This was accomplished by taking some courses during Summer, 1972 and some courses at other times during the project. Other students have reported that they plan to continue their work toward the associate degree.

Reaction -- As a result of the pilot program, a number of students and instructors indicated that the field of traffic engineering technology has considerably more meaning as a career field. The interrelationship and interdependency of the separate components were clearly demonstrated during the instruction. Some students (who are employed in specialty divisions of the Department of State Highways) said that they developed a better understanding of the work of other divisions. In short, the program surveyed the entire field of traffic engineering for practitioners who previously had concentrated only on one small segment. For example, one of the students commented as follows:

> "I feel that the Geometric Design Course has been a help to my understanding of the problems of traffic engineering. Being a construction instrument man, my previous concerns were merely the proper layout of the job that was before me. Now, though, I feel I can better understand the reason the roadway was designed as it was."

A number of students noted that their employment experiences combined with their participation in the College's traffic engineering technician program encouraged them to consider seeking employment as traffic engineering technicians so that they could utilize their skills in a variety of capacities rather than in one specialized area. One student, who has more than twenty years of specialized experience, has become motivated to enter baccalaureate studies to prepare for a professional traffic engineering career.

Funding

When a community college proposes to offer a totally new curriculum, it generally follows a complex application procedure to the state education department to obtain approval to offer the program and to acquire funds for capitalization (if necessary) and operating costs. Time did not permit the College to develop a "new curriculum" proposal, but because the program only required the introduction of eight new courses, it was possible to gain state approval by treating the courses as an option under its existing civil engineering technology associate degree curriculum. Thus, the College was able to secure some state funding on a per-credit-hour basis for full-time students.

No capitalization funds were available for the program, but the College either had equipment or was able to secure community resources for the laboratory portions of the courses. Students were able to conduct field tests, surveys, and individual study projects, with equipment and materials provided by the state and city highway departments.

Table 8 gives an estimate of the sources of support for the project. It should be noted that a significant in-kind contribution was made by the community.

In the start-up phase of the project, it became apparent that the Federal contracting process compounded with delays in Congressional appropriations and the lock-step fiscal year funding, is out of phase with the planning process in educational institutions. This problem hampered the College's ability to acquire State financial support. For instance, applications for financial support of new programs under the Vocational Education Amendments of 1968, usually must be submitted to the state vocational education agency four to five months prior to the beginning of the fiscal year. As a result, planning for new programs at the local level must begin far in advance of the start-up date.

Job Market -- Notwithstanding the demonstrated "need", based on the Booz, Allen, and Hamilton study, for increased manpower in traffic safety fields, the "demand" in terms of job openings or budgeted vacancies, has been considerably less than studies indicate. The Michigan Department of State Highways, on the strength of its studies, confirmed that the addition of trained personnel could significantly increase traffic safety on its state-wide road system.

Table 8. Estimate of sources of financial support and cost

Item	Income	Direct Cost	Estimated Value of Services
Tuition	4,830.00		
Local Revenues	11,413.00		
State Vocational Education Aid (15%)	493.00		
Salaries - Faculty, Full-Time (pro-rated)		3,432.00	3,432.00*
Part-Time Faculty		5,124.00	5,124.00*
Honorariums		382.00	
Guest Lecturers			4,800.00
Contributions-Rental of Equipment			800.00
College Equipment			500.00
Indirect Costs, College-Operations		10,690.00**	
Program Supervision-Administration		2,870.00**	2,000.00
	16,736.00	22,489.00	16,656.00

*Course development time based on hour preparation per hour in class

**Pro-rated on 1971-72, 1972-73 budget

Despite the studies that call for the addition of trained manpower to effect traffic safety improvements, the increase in technical personnel in county and municipal road systems is severely hampered by inadequate budgetary appropriations. The additional technical manpower needed by the State of Michigan for its highway safety program is not reflected in additional budgeted positions in the organizational chart. However, this absence of budgeted openings did not cause the College to abandon the project, but did limit the number of full-time students enrolled in the program.

Professional traffic engineers employed in the Department of State Highways who served as guest lecturers for the program observed that the program, as presently constituted, expanded their view of the transportation field. However, they were resigned to the fact that despite the field's potentially dynamic new emphases and trends, their own professional utility will continue in the old established mold -- a high degree of specialization -- rather than be multiplied through increased use of technicians. Two factors were alleged to be responsible for this somewhat pessimistic prophecy: 1) the administrative structure governing the present "system" is simply too large and cumbersome to be changed as rapidly as it should be or as radically as it could be; and 2) the very size of the governmental organization precludes restructuring the specialized divisions along other lines for professional engineers. In short, they believe that professional engineers (baccalaureate and beyond) will probably always need specialization since, on a state-wide basis, there will always be a need for them.

These same traffic engineers noted that technicians graduating from the kind of program conducted at the College could significantly facilitate staffing in the various specialty divisions of the Department of State Highways. The in-depth, yet broadly-based preparation of traffic engineering technicians will enable their utilization in any of the divisions at any time. Moreover, they observed, as work volumes within and among the divisions increase or decrease, work assignments for technicians may be kept flexible. An optimum cadre of well-prepared technicians could substantially increase the productivity of the entire Department by responding to fluctuations in the work-load as needed at the divisional level.

In addition to the lack of budgeted vacancies for the additional manpower needed for its highway systems, civil service ranking, rating, and grade requirements in Michigan (whether for state, county, or municipal employment) do not reflect the broad areas of competence or expertise in <u>one</u> job category for which the new traffic engineering technician could qualify at the entry level. Such competence and

expertise are apportioned among three ratings (See Appendix D for a listing of civil service ratings for traffic safety technicians under the Michigan Department of Civil Service). Advancement through this system is based on employment experience in each of the grades, beginning with the lowest level. Under this ranking system, graduates of the College's present associate degree civil engineering technology program are eligible. Any graduate could eventually attain the highest level within as few as 4½ to 5 years from entering the civil engineering technology program, but only after they had spent time in each of the first two levels.

The broader scope and depth of preparation in the new traffic engineering technician program presumably would qualify graduates for immediate entry into the highest grade. It is interesting to note that "safety" as a major functional responsibility of technicians' work does not appear in the civil service requirements until they have achieved the highest rank, and then seemingly, only as an incidental function of traffic control devices and as part of traffic engineering principles and practices.

Although the civil service requirements could be modified (usually by legislative action), as they now stand, they constitute a barrier--beyond the College's control -- to the optimal utilization of graduates from the traffic engineering technician curriculum. Based on other studies by the American Association of Community and Junior Colleges, this condition was found to exist in other technical and middle level occupations that are predominantly government in character. f/

Continuation of the Program -- A number of considerations must enter into the decision regarding the continuation of the program beyond the two year test period. Such factors as the limited employment opportunities for traffic engineering technicians, the unstructured character of the labor market for traffic engineering technicians in the Lansing community, and the high level of general unemployment are important considerations in such a decision.

However, the College has expressed confidence that it can continue to generate interest in the program among technicians who are presently employed by governmental agencies, highway construction companies, and traffic consulting firms. In addition, potential students exist in police traffic services and other highway safety functions. Therefore, the College plans to continue to offer the program on a regularized basis.

Activities in Other Highway Safety Manpower Areas -- A number of other community and junior colleges showed an interest in the project as it developed and have since initiated two-year programs, short courses, and seminars related to the preparation of technical personnel for existing as well as for new and emerging highway safety occupations.

Highway safety functions related to the National Highway Traffic Safety Administration's uniform safety program standards such as breath analysis, emergency medical services, motor vehicle inspection, fleet safety supervision, and traffic safety education are being given increasing attention in manpower development activities of community and junior colleges.7/ This is traceable in part to effects of the National Highway Traffic Safety Administration's manpower development efforts, the activities of the American Association of Community and Junior Colleges, and the interest in aspects of highway safety by local and state agencies and by commercial groups as well as by other groups and organizations interested in highway safety.

VI. SUMMARY AND CONCLUSIONS

The fact that a number of community and junior colleges were found to have the capability to offer a curriculum under test conditions to prepare persons for technical positions in highway safety was particularly significant. In particular, Lansing Community College was able to mobilize administrative staff, instructors, support services, and financial resources on short notice and to proceed with the testing of the prescribed curriculum as specified in the contract. An adequate number of persons enrolled in the program to permit the pilot test of the curriculum to be conducted. These students were predominantly part-time students.

Changes in the curriculum were necessary first, to adapt the sequences of courses from a semester system to a quarter system; second, to strengthen the course offerings; and third, to provide a level of instruction consistent with the students' needs. These changes were made on the basis of advisory committee recommendations. As other community colleges offer the curriculum, additional changes may be necessary in order to be responsive to the community's needs.

The bulk of program funding came from local regularized sources of educational funds. Only a small fraction of the program cost was covered by funds from the Vocational Education Amendments of 1968.

Important elements of the community gave strong support to the project. The state highway safety agencies, the Lansing city traffic agencies, professional traffic engineers, and private highway safety consultants contributed valuable services by providing guest lecturers and members for the advisory committee, and by assisting in providing field experiences for the students.

A number of factors external to the College such as the general level of unemployment and the lack of a structured labor market for highway safety manpower -- and for traffic engineering technicians in particular -- were considered by the College in deciding to continue or not to continue the program beyond the test period. With all factors considered, the college plans to continue the program on a regularized basis.

A number of community colleges have developed programs to prepare highway safety manpower in areas additional to traffic engineering technology. This is due, at least in part, to interest generated by

the project under this contract. It may be expected that interest among community colleges in offering programs for the preparation of highway safety manpower will continue. In the long run, such considerations as the continued recognition of the need for and value of technicians; civil service practices pertaining to hiring and promotion in highway safety occupations; and the earmarking of federal and state funds in highway safety budgets for the employment of technical manpower will determine the extent to which the two-year colleges continue to offer associate degree curricula and related short courses in highway safety.

In summary, the overriding conclusion of this project is that community and junior colleges do have a role in the total national highway safety effort. In particular, it may be concluded that:

1. Training and education programs, such as the traffic engineering technician curriculum, are likely to be relevant to the needs of local employers if centered in an educational institution that has a commitment to serve the community.

2. Highway safety agencies find it valuable to cooperate with a community college in providing training opportunities within commuting distance of the place of employment and the employee's place of residence.

3. A pool of expertise in the form of the community college staff and community-based professional groups may be quickly mobilized to prepare highway safety manpower at the technical levels.

4. Economies are gained when employers and educators share their resources and utilize the community as a laboratory to prepare traffic safety technicians.

5. Special legislative efforts may be needed to mandate full utilization of technical manpower as an integral part of the highway safety professional team.

VII. RECOMMENDATIONS

The major study recommendation is that the associate degree curriculum for the preparation of traffic engineering technicians, as outlined in Traffic Engineering Technician Program and the Role of the Community College, and as modified by the project at Lansing Community College, be utilized by other community and junior colleges (including technical institutes).

Furthermore, it is recommended that the National Highway Traffic Administration communicate to the U.S. Office of Education the priority character of highway safety manpower development, and periodically supply data to the U.S. Office of Education and state education agencies on cricical technical occupations needed to implement more fully the Highway Safety Act of 1966. This is recommended in order that financial support from state education agencies under Federal vocational and adult education programs and other related programs may be more readily available to community and junior colleges. This would enable the colleges to undertake the development and implementation of highway safety manpower education and training programs.

Other recommendations include: 1) that community and junior colleges be identified in the annual work program of state highway safety agencies as potential resources for the up-grading of in-service personnel and for the preparation of a flow of new personnel for traffic engineering technology functions, and for other highway safety occupations, and that a plan for the utilization of these institution be incorporated in the annual work program of the states; 2) that as highway safety program standards of the National Highway Traffic Safety Administration are periodically revised, priority be given to the utilization of technical manpower, such as traffic engineering technicians, in the plans for the implementation of the standards; 3) that the National Highway Traffic Safety Administration undertake programs to encourage, enhance, and facilitate the employment of persons with associate degrees in traffic engineering technology, and other personnel at the technical and semi-professional levels in other aspects of highway safety; and 4) that the National Highway Traffic Safety Administration, and state and local highway safety agencies request Congress and state legislatures to appropriate increased funds to support the development and to facilitate the

utilization of technical manpower, such as traffic engineering technicians, in increasing the safety of vehicular traffic on the nation's streets and highways.

Finally, it is recommended that the National Highway Traffic Safety Administration continue to conduct task analyses of highway safety occupations and to develop and test curricula, training programs, and related materials to be used in preparing and upgrading technical manpower and semi-professional personnel to perform highway safety functions, and that community and junior colleges continue to be utilized as contractors, testing sites, development centers and laboratories for these activities.

APPENDIX A. COURSE DESCRIPTIONS AND OUTLINES DEVELOPED BY LANSING COMMUNITY COLLEGE

During the term of the project, Lansing Community College developed technical course offerings geared to the specific needs of a traffic engineering technician. These courses were based on materials in Traffic Engineering Technician Programs in the Community College and on the recommendations of the project advisory committee. This appendix consists of a list of the technical courses offered, the course descriptions, and an outline of the major divisions of each course.

I. INTRODUCTION TO TRAFFIC ENGINEERING (Course Code Number: CT 260)

This course offers a general overview of the field of traffic engineering technology and provides an insight into related career opportunities. This course also serves as an introduction for traffic engineering technology students as a survey course of the remaining seven traffic technology areas to be covered in this program.

A. AN OVERVIEW OF TRAFFIC ENGINEERING

1. A definition of a Traffic Engineering Technician

2. General and specific objectives of this program

   a. Communication skills (oral and written) since he will be dealing with people
   b. A knowledge of the driver, roadway, and vehicle characteristics and an understanding of physical laws as they relate to them
   c. The ability to extract design information from manuals and apply it to specific problems
   d. A knowledge of data collection methods, tabulation, and analysis
   e. A knowledge of the operation and maintenance of traffic control devices and equipment
   f. Th ability to prepare sketches, engineering drawings and to use graphics for illustrative purposes

g. A knowledge of highway capacity analysis
h. The basic principles of traffic and highway engineering
i. An appreciation of the general concepts and principles of related fields--particularly urban planning and police traffic supervision.

3. Brief discussion of class sessions for remainder of term include:

a. Principles of traffic administration and safety
b. Field traffic surveys
c. Control devices
d. Geometric design
e. Traffic studies
f. Traffic laws and regulations
g. Urban transportation planning

B. TRAFFIC ENGINEERING ADMINISTRATION

1. Traffic Engineering Administration at the national level

a. Organizational structure
b. Operational structure
c. Budget
d. Public relations
e. Interagency structure

2. Traffic Engineering Administration at the state level

a. Organizational structure
b. Operational structure
c. Budget
d. Public relations
e. Interagency structure

3. Traffic Engineering Administration at the county level

a. Organizational structure
b. Operational structure
c. Budget
d. Public relations
e. Interagency structure

4. Traffic Engineering Administration at the city level

   a. Organizational structure
   b. Operational structure
   c. Budget
   d. Public relations
   e. Interagency structure

C. TRAFFIC STUDIES & SURVEYS

1. Types of traffic data needed in surveys and studies

   a. Administrative studies
   b. Operational studies
   c. Planning studies

2. Motor vehicle volume studies

3. Motor vehicle speed studies

4. Traffic flow studies

5. Parking studies

6. Mass transit studies

7. Analysis and presentation of data

   a. Methods - graphic analysis
   b. Equipment

D. TRAFFIC SIGNALS AND OTHER CONTROL DEVICES

1. Signal applications based on traditional and historic warrants

   a. Qualities of traffic signs
   b. Requirements of signs - size - symbols
   c. Sign location, erection and supports
   d. Maintenances

2. Traffic Signalization

   a. Signal heads and optical units
   b. Signal warrants
   c. Progressive signal systems
   d. Network coordination

e. Actuate equipment timing
f. Interconnection
g. Maintenance of equipment

E. TRAFFIC GEOMETRICS

1. Highway classifications

2. Highway types

3. Design controls and criteria

4. Intersection design

5. Planning and procedures for geometric design

6. Engineering studies and reports

F. ACCIDENT ANALYSIS

1. Types of accident analysis

2. Collection of data

3. Traffic engineering analysis and uses of accident records

4. Accident trends

5. Causes

6. Relationship of accidents to highway design

G. TRAFFIC LAWS AND REGULATIONS

1. Federal, state and local traffic laws and regulations

a. Laws and regulations as legal framework for:

(1) Geometric design
(2) Signs and signals
(3) Wheel loads
(4) Markings
(5) Warrants

H.. FIELD TRIPS

1. Local traffic engineering office

2. Traffic and Safety Division; Michigan Department State Highways

I. PROBLEM SESSION

a. Students are required to select a project or problem involving a traffic engineering application.
b. An oral and written presentation of the project or problem is to be presented at the next session.

J. ORAL REPORTS BY STUDENTS

II. TRAFFIC ADMINISTRATION AND SAFETY (Course Code Number:CT 261)

By studying traffic administration and safety, the student learns how budget, public relations, interagency problems and other system operations affect traffic engineering. Stressing traffic safety as a basic consideration for all technical aspects of the field, the student is shown that field traffic surveys, control devices, geometric design, traffic laws and urban transportation planning constitute the major subject areas of traffic engineering technology.

A. COURSE ORIENTATION

1. Purpose of the course

2. Objectives of the course

3. Outline of class sessions

4. Principles of traffic and safety administration

5. Review of basic management principles

B. PRINCIPLES OF MANAGEMENT AND ADMINISTRATION

1. Basic elements of an organization

2. Types of organizations

   a. Horizontal
   b. Vertical

3. Types by function

   a. Line organization
   b. Staff organization
   c. Line and staff organization

4. Personnel in organizations

5. Organization communications

C. HIGHWAY SAFETY ADMINISTRATION AND MANAGEMENT PROGRAM

1. Personal Development

   a. Introspection - self appraisal
   b. Development of whole man as supervisor
   c. Managerial skills
   d. Attitude

2. Creative supervision

   a. Criteria for creativity
   b. Obstacles to creativity

3. Essential elements to problem solving

   a. Problem solving techniques in decision-making process

D. TRAFFIC ENGINEERING ORGANIZATION AND STRUCTURES

1. Basic traffic engineering organizations

   a. Structures
   b. Facilities

2. Types of Traffic Engineering Organizations

   a. National Highway Traffic Safety Administration, U.S. Department of Transportation
   b. National Safety Council
   c. State organizations

d. County organizations
e. City or municipal organizations

3. Other related organizations

a. Institute of Traffic Engineers (National and State)
b. Other national and state organizations

E. TRAFFIC ENGINEERING ORGANIZATIONS AND STRUCTURE CONTINUED

1. Traffic Engineering Functions and Administration

a. System surveillance
b. Traffic system planning
c. Traffic design
d. System operations control
e. Traffic research

2. National Highway Safety Program

a. Review of standards

F. STATE TRAFFIC ORGANIZATION AND ADMINISTRATION

1. Organizational structure

2. Functions of the Department of State Highways

3. Administrative structure

4. Constraints

5. Budgeting and fiscal policies

6. Personnel and training programs

a. Role of traffic engineers
b. Role of traffic technicians in state organizations

7. Legislative and legal constraints in state organizations

G. COUNTY TRAFFIC ORGANIZATION

1. Organizational structure

2. Functions of County Road Commission

3. Budget and fiscal policies

4. Personnel and training

   a. Role of traffic engineers in county organizations
   b. Role of traffic technicians in county organizations

5. County-City relationships

6. County-State relationships

H. CITY TRAFFIC ENGINEERING ORGANIZATION

1. Organizational structure

2. Function of City Traffic Engineering Department

3. Budget and fiscal policies

4. Personnel and training

   a. Role of traffic engineers
   b. Role of traffic technicians

5. City-County relationships

6. City-State relationships

I. PUBLIC RELATIONS

Public information programs at all levels of traffic engineering organizations

J. REVIEW AND SUMMARY

III. TRAFFIC SURVEYS (Course Code Number: CT 262)

The traffic survey course will enable students to learn how to plan and execute various types of traffic engineering studies. Students will learn the various ways of processing data and techniques for analyzing the results. This course gives the theoretical basis for the field work performed in Traffic Studies (Course Code Number CT 265).

A. TRAFFIC AND TRANSPORTATION CHARACTERISTICS

1. Traffic

2. Roadway

3. Human

4. Vehicle

B. TRAFFIC VOLUME STUDIES AND CHARACTERISTICS

1. Techniques, methods

2. Types of studies

3. Uses of data

4. Equipment

C. TRAVEL TIME AND DELAY STUDIES - SPEED STUDIES AND CHARACTERISTICS

1. Spot speed studies

2. Speed zoning studies

D. PARKING STUDIES AND CHARACTERISTICS;
PEDESTRIAN STUDIES AND CHARACTERISTICS

E. ACCIDENT STUDIES AND ANALYSIS

1. Accident record system and data

F. ACCIDENT STUDIES AND ANALYSIS

1. Accident location studies

2. Engineering procedures, collision, diagram uses

3. General accident data uses - for traffic engineering improvements analysis

4. Evaluation of engineering improvements and increased safety

G. ORIGIN AND DESTINATION STUDIES

1. Method and technique of conducting studies

2. Field coordination

H. ORIGIN AND DESTINATION STUDIES

1. Urban transportation planning process

2. Data Utilization in future planning and system design

I. TRANSIT STUDIES

1. Types

2. Methodology data requirements

G. STATISTICAL TREATMENT OF TRAFFIC DATA

IV. TRAFFIC OPERATIONS AND CONTROL DEVICES (Course Code Number: CT 263)

This course will cover the use, operation, maintenance and placement of traffic signs, markers and traffic control devices.

A. TRAFFIC CONTROL DEVICES AND OPERATIONAL CHARACTERISTICS

1. Define traffic operations tying in traffic control devices

2. Course overview

3. Relationship between traffic control devices and operational characteristics

B. SIGNS AND MARKINGS - PRINCIPLES

1. Qualities

2. Requirements

3. Warrants

4. Manuals

5. Purposes

6. Delineation

C. SIGNS AND MARKINGS - EQUIPMENT, MATERIALS, MANUFACTURE AND INSTALLATION

1. Optics

2. Support structures

3. Sign shops

4. Materials

5. Specifications

D. TRAFFIC SIGNALS

1. Purpose

2. Type (pre-timed and actuated)

3. Warrants

4. Signal timing

5. Time-space diagrams

6. Signal systems

7. Pedestrian control (school and other)

E. TRAFFIC SIGNALS

1. Equipment

2. Operation

3. Installation

4. Signal shops

F. REGULATIONS

1. Basis for Michigan Vehicle Code

2. Turn controls

3. Parking regulations

4. Speed regulations

5. One-way streets

6. Special regulations

G. SPECIAL CONTROL DEVICES

1. Construction area (traffic control)

2. Railroad crossings

3. Beacons

4. Channelization devices

5. Experimental devices

H. FREEWAY OPERATIONS

1. Definition

2. Special characteristics

3. Unique features of freeway operations

I. PROBLEMS

1. The instructor will present two problems, using one hour for each. He will use slides, diagrams, and data to stimulate discussion leading to recommendations for alleviating existing problems.

2. Course review

V. TRAFFIC GEOMETRICS (Course Code Number: CT 264)

Geometric highway design is planning the visible elements of the highway or street. It deals with such roadway elements as cross section, curvature, sight distances and clearances and thus depends directly on traffic flow

characteristics. Traffic composition, volume and speed are significant in the geometry of the highway facility. These must be related to traffic performance and traffic demand to achieve safe, efficient and economical traffic operations.

A. TRAFFIC CHARACTERISTICS

1. Criteria for design

2. Traffic features

3. Expertise and the public aspect

4. Average annual daily traffic

   a. Definition
   b. Usage

5. Fluctuations

   a. Significance
   b. Peaks

6. Directional distribution

7. Composition of traffic

   a. Passenger cars
   b. Trucks
   c. Operational characteristics
   d. Peak hour breakdown

8. Projections

   a. Current traffic
   b. Increased traffic

B. SIGHT DISTANCES AND OTHER SAFETY FACTORS

1. Stopping distances

   a. Coefficient or friction
   b. Response time

2. Passing sight distance

3. Sight distance and no passing zone

4. Sight distance

   a. Driveways
   b. Ramp terminals
   c. Approach roads

5. Sight distance to ramp terminals

   a. Overpasses
   b. Underpasses

6. Clear vision areas

   a. Approach roads
   b. Railroad crossings

7. Turn-in roadway

8. Other considerations

   a. Gradual slopes
   b. Lateral clearances
   c. Wide medians
   d. Guard rail usage

C. HIGHWAY CAPACITY - LEVELS OF SERVICE

1. Introduction

2. Highway capacity

   a. Definition
   b. Prevailing conditions
   c. Capacity and highway design
   d. Uninterrupted flow
   e. Interrupted flow

3. Levels of service

   a. Service volumes
   b. Volume to capacity ratio (V/C)
   c. Determining factors
   d. Designated levels

4. Influence factors

   a. Roadway factors
   b. Traffic factors
   c. Ambient factors

D. HORIZONTAL ALIGNMENT

1. Circular curves

   a. Elements
   b. Definitions
   c. Even radius
   d. Metric

2. Super elevation

   a. Basic equation
   b. Design values

3. Super elevation transition

4. Spirals

   a. Basic law
   b. Equations

E. INTERSECTION CAPACITY

1. Introduction

2. Analysis procedures

3. Highway capacity manual method

   a. Physical and operational conditions

      (1) Width of approach
      (2) Parking conditions
      (3) One-way versus two-way operation

F. INTERSECTION DESIGN

1. Design of intersection

   a. Comprehensive traffic data needed
   b. Compatibility of topography and development of area

2. Vehicular characteristics

3. Intersection conflicts

4. General principles of design

5. Physical properties of intersection design

6. Specialized design

G. DRIVEWAY DESIGN AND PARKING LOT LAYOUT

1. Types of driveways

2. Important aspects of driveway design

3. Commercial driveways

4. Parking lot layout

H. HIGHWAY TYPES AND CROSS SECTIONS

1. System classifications

2. Basic highway type classification

3. Cross section elements

4. Special purpose roadways

I. FLOW CHARACTERISTICS AND AUXILIARY LANES

1. Auxiliary lanes

   a. Definition
   b. Purpose
   c. Types

2. Flow characteristics

3. Freeway and expressways

4. Freeway weaving sections

5. Operating characteristics of weaving sections

J. SUMMARY

VI. TRAFFIC STUDIES (Course Code Number: CT 265)

This course presents the student with actual field problems related to planning and executing traffic engineering studies. Studies concerned with illumination, origin and destination, speed and volume emphasize the basic concepts of counting procedures, counting equipment, cordons, flow maps, short counts, peak hour, platoon flow, composition, and other traffic concepts. In addition, the course emphasizes the use of data processing and statistics to reduce bulk data and analyze results.

A. ADMINISTRATIVE STUDIES

B. OPERATIONAL STUDIES

C. PLANNING STUDIES

D. INVENTORIES

E. MOTOR VEHICLE VOLUME STUDIES

1. Areawide counts
2. Cordon counts
3. Screen line counts
4. Spot counts
5. Volume study equipment
6. Manual volume counts

F. PEDESTRIAN VOLUME STUDEIS

G. MOTOR VEHICLE SPEED STUDIES

1. Spot speed studies
2. Travel time and delay studies
3. Intersection delay

H. TRAFFIC FLOW STUDIES

I. LAW OBSERVANCE STUDIES

J. ORIGIN-DESTINATION STUDIES

K. PARKING STUDIES

1. Parking Supply Inventory
2. Parking Space Occupancy
3. Parking Duration
4. Parking Interview Survey
5. Parking Post Card Survey
6. Cordon Counts
7. Land Use Intensity
8. Legal, Financial, and Administrative Studies
9. General

L. MASS TRANSIT STUDIES

1. Mass Transit Inventory
2. Mass Transit Riding Studies
3. Other Mass Transit Studies

VII. TRAFFIC LAWS AND REGULATIONS (Course Code Number: CT 266)

This course offers a thorough study of federal, state, and local traffic laws and regulations. As such, it provides the legal framework to be used in geometric design, vehicle characteristics, wheel loads, bus stops, parking, signals, markings, pedestrian and driver characteristics, warrants, and general traffic law enforcement.

A. HISTORY OF TRAFFIC LAWS AND REGUALTIONS

B. MICHIGAN VEHICLE CODE, ORIGIN AND USE

C. SPEED REGULATIONS--BASIC--PRIMA FACIA--ABSOLUTE

D. TRAFFIC LAWS AND REGULATIONS--TRAFFIC ENGINEERING VIEWPOINT

E. TRAFFIC LAWS AND REGULATIONS--JUDICIAL PROCESS

F. RIGHT OF WAY AND IMPROPER PASSING REGULATIONS

G. PARKING REGULATIONS

H. IMPLIED CONSENT--DRIVING UNDER THE INFLUENCE OF LIQUOR--IMPAIRED

I. RECKLESS AND CARELESS DRIVING

J. SUMMARY AND REVIEW

K. EXAMINATION

VIII. URBAN TRANSPORTATION PLANNING COURSE (Course Code Number: CT 267)

The urban transportation planning course should provide the student a process for looking ahead in order to facilitate an orderly progressive integrated transportation system. This would include highway and public mass transit system and their terminal facilities.

A. INTRODUCTION

1. General overview

2. Total transportation planning process

3. Introduction to total planning data

B. ESTABLISHMENT OF THE PLANNING DATA BASE

1. Data collection and inventory or proposed data use

C. TRANSPORTATION CLASSIFICATION SYSTEM AND NEEDS

D. PLAN DEVELOPMENT

1. Analysis techniques development

2. Use of planning models

E. FORECASTING FOR ANALYSIS OF PLAN AND ALTERNATIVE TRANSPORTATION SYSTEMS

1. Traffic estimating techniques and uses

F. ENVIRONMENTAL IMPACT

1. Public involvement

2. Relocation assistance

G. ALTERNATIVE PUBLIC TRANSPORTATION MODES

1. State level planning

2. Bureau of transportation

H. TRANSPORTATION PLANNING

1. Urban area view

2. SEMTA-SEMCOG

I. HIGHWAY ROUTE LOCATION

1. Process and considerations

J. COURSE SUMMARY AND REVIEW

1. Panel discussion

2. Panel made up a small number of guest speakers representing the various areas of interest.

APPENDIX B. ADVISORY COMMITTEE
TRAFFIC ENGINEERING TECHNICIAN PROGRAM

Mr. Noel Bufe
Executive Director of
Highway Safety Planning
Department of State Police
541 East Grand River Avenue
East Lansing, Michigan

Mr. Harold Cooper
Engineer of Traffic and Safety
Michigan Department of
State Highways
State Highway Building
Lansing, Michigan

Mr. Frank De Rose, Traffic Engr.
Interagency Transportation
Michigan Department of
State Highways
State Highway Building
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Mr. Arthur Gibson, Manager
Safety and Traffic Engineering
Automobile Club of Michigan
150 Bagley
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Mr. Allen T. Hayes
Traffic Engineer
City of Lansing
Room 623 City Hall
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Mr. Robert Pohl
Traffic Technician
City of Lansing
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Lansing, Michigan

Mr. Adrian H. Koert
Traffic Consultant
Highway Safety Center
Kellogg Center
Michigan State University
East Lansing, Michigan

Mr. Earl Rogers
Engineer Director
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Michigan
P.O. Box 487 (617 W. Allegan St)
Lansing, Michigan

Mr. Donald Orne
President, Michigan Chapter of
the Institute of Traffic Engineers.
Michigan Department of State
Highways, State Highway Building
Lansing, Michigan

Mr. Gordon Sheehe, Director
Highway Safety Center
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Mr. Marvin Church
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Mr. Edwin C. Bergmann
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Mr. Donald Sehnke
Student
Lansing Community College
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Mr. Mort Fenner
Student
Lansing Community College
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APPENDIX C. ROSTER OF INSTRUCTORS AND GUEST LECTURERS

INSTRUCTORS:

Marvin Church, Professor
Civil Technology
Lansing Community College

Frank DeRose, Traffic Engineer
Interagency Transportation
Michigan Department of
State Highways

Max Hoffman
Traffic Safety and
Surveillance Engineer
Michigan Department of
State Highways

*GUEST LECTURERS:

Robert Addy, Assistant Field
Services Engineer
Michigan Department of
State Highways

George Allen, Traffic Engineer
City of Flint, Michigan

Captain John Amthor, Commander
Traffic and Safety Division
Department of State Police

Ivan Bartha, Director of Research
Bureau of Transportation
Michigan Department of
State Highways

Richard Blost, Supervising
Engineer, Electrical Devices
Michigan Department of
State Highways

Weldon Borton, Traffic Engineer
Markers and Signs Division
Michigan Department of
State Highways

Keith Bushnell, Analysis Engineer
Michigan Department of
State Highways

Sergeant Donald Calcatera
Safety and Traffic Division
Department of State Police

Herb Crane, Supervising Engineer
Freeway Projects
Michigan Department of
State Highways

Richard Charles, Supervisor of
Engineering Research
Traffic Division
Michigan Department of
State Highways

Richard Folkers, Director of
Traffic Control
Oakland County Road Commission
Oakland County, Michigan

Allen Hayes, Traffic Engineer
Lansing, Michigan

John Kennedy, Bureau of
Transportation
Department of Commerce
State of Michigan

Al Lampella, Surveillance Engineer
Safety Division
Michigan Department of
State Highways

William Lepczyk, Transportation
Survey and Analysis Engineer
Michigan Department of
State Highways

Tom Malecki, Geometrics Engineer
Michigan Department of
State Highways

Al McBride, Traffic Engineer
Ingham County Road Commission
Ingham County, Michigan

Donald Oates, Retired State
Police Captain
Department of State Police

Max Pickney, Traffic Technician
Control Devices
Michigan Department of
State Highway

Robert Pohl, Traffic Technician
City of Lansing, Michigan

Robert Riggotti, Traffic
Operations Engineer
Michigan Department of
State Highways

James Roach, Planning Division
Transportation Planning
Michigan Department of
State Highways

William Savage, Reflective
Devices Engineer
Michigan Department of
State Highways

Larry Suboski, Assistant to
Director, Traffic and Safety
Michigan Department
State Highways

Ken Underwood
Survey and Analysis Engineer
Michigan Department of
State Highways

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* In addition to the persons listed, other individuals assisted the college with specific components of the instructional programs.

APPENDIX D. MICHIGAN DEPARTMENT OF CIVIL SERVICE RATINGS FOR HIGHWAY TRAFFIC TECHNICIAN

I. CLASSES

7441107 Highway Traffic Technician 07
7441108 Highway Traffic Technician 08
7441109 Highway Traffic Technician 09

II. GENERAL DESCRIPTION

Employees in these classes engage in sub-professional engineering work under the supervision of a traffic engineer; and perform related work.

III. EXAMPLES OF WORK

A. Highway Traffic Technician 07

1. Prepares detailed designs, drawings or strip maps for roadway improvements and control devices.
2. Conducts field investigations on problem locations; takes measurements, prepares sketches and recommends remedial action.
3. Under supervision, prepares quantity sheets, authorizations, and cost estimates for roadway improvements and sign or signal projects.
4. Assists engineers in establishing and revising standards and specifications for geometric design guides, signs and signals.
5. Compiles and analyzes traffic accident data; prepares accident analysis studies.
6. Assists the engineer in making public contacts.
7. May supervise lower level personnel on various work assignments.
8. May prepare correspondence and memos, and maintains records relative to the work.

B. Highway Traffic Technician 08

1. Assists in the more complex traffic surveys and public contacts in a district.
2. Calculates span loadings, heights, timing cycles and electrical energy usage on electrical signal projects.

3. Assists traffic engineering personnel in determining design treatments and placement of control devices.
4. Makes investigations to determine the adequacy of signing and pavement marking.
5. Makes investigations and recommendations concerning complaints.
6. Performs the work described at the lower level.

C. Highway Traffic Technician 09

1. Performs complex assignments requiring independent analysis of a traffic engineering problem that result in a completed project or a complete recommendation.
2. Prepares layouts of traffic control devices where some judgment is required in addition to clear-cut standards.
3. Under general supervision, redesign intersections and interchanges and other hazardous locations.
4. Prepares and reviews geometric layouts for highway planning and design studies.
5. Makes cost estimates, authorizations and subsequent field checks of projects.
6. Reviews work orders not in accordance with current practices.
7. Conducts traffic accident investigations, collects and analyzes data, and prepares a recommendation.
8. Makes field studies that involve independently meeting with power company, local, municipal, and/or district personnel.
9. Supervises technicians and aides as required.

IV. EXPERIENCE AND EDUCATION REQUIREMENTS

A. Highway Traffic Technician 07

1. *Possession of an Associate of Science degree in civil technology, and six months of sub-professional engineering experience at the 05 level in the traffic division.
2. or, *Status as a junior in a college of engineering and one year of sub-professional engineering experience at the 05 level in the traffic division.

B. Highway Traffic Technician 08

*One year of experience as a Highway Traffic Technician 07.

C. Highway Traffic Technician 09

*Two years of experience as a Highway Traffic Technician 07.

V. OTHER REQUIREMENTS

A. All Classes (07,08, and 09)

1. Physical condition adequate for performance of the work of the class.
2. Willingness to travel about the state as required.
3. Willingness to participate in inservice training.
4. Knowledge of nomenclature and conventional drafting symbols.
5. Knowledge of standard drafting instruments and their use.
6. Knowledge of algebra, trigonometry and mathematical tables used.
7. Knowledge of traffic and safety control measures.
8. Knowledge of principles involved in obtaining topographical layouts.
9. Ability to evaluate relative merits of traffic devices and to prepare cost estimates.
10. Ability to make public contacts and prepare correspondence and reports.

B. Additional Requirements for Highway Traffic Technician 08

1. Greater skill in the application of knowledges and abilities required at the lower level.

C. Additional Requirements for Highway Traffic Technician 09

1. Greater skill in the application of knowledges and abilities required at the lower level.
2. Elementary knowledge of traffic engineering principles and practices as applied to operations, geometrics, research and safety.
3. Knowledge of methods of investigating and analyzing highway traffic conditions.
4. Knowledge of sign and signal design, installation, and maintenance.
5. Knowledge of highway geometric design, including its application and operation.
6. Ability to learn and apply current design standards, policies and procedures, to work projects.

7. Ability to conduct routine and special traffic studies.
8. Ability to make capacity analysis, to prepare functional intersection, interchange and roadside control layouts, and evaluate traffic control devices.
9. Ability to organize work details and supervise lower level positions.
10. Ability to analyze accident patterns at specific locations preparatory to recommendations for correction.

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* Minimum Requirements -- Education and experience

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2. Bishop, Richard and Sheehe, Gordon, The Role of the Community College in Developing Traffic Safety Specialists and Technicians (Washington, D. C.: American Association of Junior Colleges, 1968)

3. Koert, Adrian, Traffic Engineering Technician Programs in Community Colleges (Washington, D. C.: American Association of Junior Colleges, 1969)

4. Public Law 89-564, Highway Safety Act of 1966, Section 403, p. 3.

5. It should be noted that in May 1971, the contract was amended to introduce instruction pertaining to accident investigation into the traffic engineering technician curriculum and to pilot test the revised curriculum. The Red Rocks Campus of the Community College of Denver (Colorado) and Longview Community College of Metropolitan Junior College District (Missouri) are serving as the subcontractors on this aspect of the contract.

6. Korim, Andrew S., Government Careers and the Community College (Washington, D. C.: American Association of Junior Colleges, 1971)

7. Daugherty, Ronald D., et. al., Expansion of Vocational-Technical School Programs to Accommodate Highway Safety Manpower Requirements (Columbus, Ohio: The Center for Vocational and Technical Education, The Ohio State University, 1971)

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