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A Survey of the Fifty States to Determine Design Standards for the Multiple Car Method

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A SURVEY OF THE FIFTY STATES TO DETERMINE DESIGN STANDARDS FOR THE MULTIPLE-CAR METHOD

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A survey of the supervisors of traffic safety education programs of the fifty states was conducted to determine what, if any, design standards or guidelines were imposed upon school districts when designing multiple-car facilities for use in traffic safety education programs.

From the information gathered it is apparent that many states are improving the pupil-teacher ratio through the inclusion of the multiple-car methods of instruction and thereby reducing the cost of the traffic safety education programs.

However, only two states, Texas and Minnesota, had well-defined minimum standards for the design and approval of such facilities in approved programs. Georgia and Tennessee had suggested sizes and inclusion of certain exercises but had no requirements as all of the other states had indicated.

CHAPTER I

THE PROBLEM

Since, 1962, growth in driver and Traffic Safety Education programs in the state of Washington has been greatly increased. During 1966-67, enrollment in approved school courses exceeded 30,000 of a potential of 55,000 who reached the minimum legal driving age during that year (23:21-23). Currently, 98 percent of Washington youth eligible for Traffic Safety Education are receiving instruction (43:1-A).

The enrollment trend has been rising sharply as a result of financial support and recognition of the value of Traffic Safety Education. In the state of Washington, such impetus was provided by the 1967 Legislature. RCW 46.20.100, Chapter 167, Laws of 1967, State of Washington, requires all students under the age of eighteen years to successfully complete an approved course in Traffic Safety Education as a prerequisite to licensing. On a national basis, the Highway Safety Act of 1966 (P. O. 86-564) is effecting a similar positive influence on program expansion and improvement. In order for a state to be eligible for Federal funding under this Act, it must have a comprehensive highway safety program approved by the Secretary of Transportation. Such approval may not be legally granted unless the state's comprehensive program includes continuing, improved and/or expanded Traffic Safety Education programs administered by appropriate school officials for all school age youth.

However, Traffic Safety Education, as indeed all disciplines taught in schools at one time or another, has been subjected to criticism. Even though critical of this subject field, Moynihan states:

> Now, at the hopeful beginnings of a new era, it becomes necessary to give a new cast to driver education. Although there is no conclusive proof as to the comparative effectiveness of various driver education techniques or, for that matter, the whole of present driver education practice, there is even less proof of the efficacy and value of any alternatives to present practices for communicating to the young person the rudiments of how to handle a car in modern traffic, and the associated social responsibilities. But operational driver education programs must continue. The problem is no different in principle than that for education in general. We have to continue with present systems even while recognized needed improvements are being studied. One would hardly advocate a moratorium on all schooling while looking for proof of better methods (39:118-119).

The Washington State Superintendent of Public Instruction, desiring to provide for a best possible program of instruction, and recognizing both the criterion and its responsibility under new legislation to find effective and efficient means for program expansion and improvement, has designed a five year plan for curriculum development and implementation, including determining standards for utilization of multiple-car methods of instruction.

STATEMENT OF THE PROBLEM

The problem is to develop performance standards for multiple-car facilities which are compatible with the proposed statewide curriculum guide being developed by the Superintendent of Public Instruction. Currently, the state of Washington is reimbursing Traffic Safety Education programs in the state of Washington for use of a multiple-car facility. At this point in time, there are no standards established for determining how efficient or effective this multiple-car facility might be. Actual criteria has not been established in that respect. A parking lot could be used on a part-time basis and receive the same treatment as far as reimbursement and substituting behind-the-wheel hours as a comprehensively planned facility that is designed to accomplish specific tasks. It is obvious that standards are lacking for determining the effectiveness of these facilities. At this point, other states are doing the same thing as far as reimbursing and substituting hours on a multiple-car facility for behind-the-wheel work. There is a need to cut down the cost of a program for use of a facility such as this. Guidelines or criteria should be established for determining what constitutes acceptable multiple-car facilities.

The substitution of instructional time should be determined on the basis of the facility capability. Some facilities will be able to accomplish a wide range of driver tasks, where others will be seriously limited. This determination should be made by the Superintendent of Public Instruction on the basis of a concept of the multiple-car facility, rather than on the basis of a judgment made by state supervisors.

PLAN OF PROCEDURE

The information for this investigation will be of two distinct kinds, and drawn from two different sources. The first task will be to gather and classify information from the fifty states regarding multiple-car methods and support material that would indicate the nature and kind of standards for multiple-car facilities. This information will be procured by writing a letter-questionnaire to the fifty state Traffic Safety Education supervisors requesting the needed data. Follow-up letters will be sent where appropriate in order to obtain an adequate sample of this type of investigation.

The second source of information will be that of expert judgment. The author and two Washington state supervisors, from the Superintendent of Public Instruction, will study the multiple-car methods material gathered from the various states and determine which states have guidelines and/or standards appropriate for determining performance standards, based on the Washington state Traffic Safety curriculum guide.

DEFINITION OF TERMS

1. Task description. Task descriptions are the statements of those events which constitute the interaction of man and machine. These statements specify exactly what it is that man-machine units are doing. In a sense, task descriptions allocate certain functions to man and others to machines at a certain point in the development of the system.

2. Task analysis. Task analysis determines the man and machine capabilities necessary to perform the task identified in the task descriptions. From a human perspective, it is a systematic study of the behavioral requirements of the tasks to be performed.

3. Basic control tasks. This represents the lowest level of operator task complexity. In a sense, these tasks

are prerequisite skills and maneuvers for functioning in highway settings. The basic control tasks include enabling operator activities such as shifting, speed control, acceleration, deceleration, directional change, steering and signaling.

4. Traffic flow tasks. Traffic flow tasks provide for a higher level of operator performance. As such, basic control task proficiency is a prerequisite operator requirement. Primarily traffic flow tasks are generated as a result of complex interaction among vehicles, roadway and operators.

5. Critical systems tasks. Critical systems tasks are based on errors, inadequate conditions and failures generated by operator-vehicle-environment interaction. As a critical task, on-highway behavior is identified for road users prior to and subsequent to official system assistance. These tasks are classified into precrash, crash and postcrash factors. They focus on highway operator and nonoperator roles to prevent failure or compensate for failure within the highway transportation system.

6. Washington state curriculum guide. This is a systematic, performance-based program guide for teachers of beginning drivers. The guide includes a scope and sequence

for Traffic Safety Education based on a task analysis approach. The guide will include, in final draft (1973), standards for the design of multiple-car facilities.

7. On-street driving instruction (behind-the-wheel, dual control instruction). This is a selected student learning experience while actually operating a dual control car on public streets and highways under the direction of a qualified and certified teacher of Driver and Traffic Safety Education seated to the right of the student driver. (To satisfy the objectives of this report, each student also received two hours of in-car observation for each hour on-street driving instruction.)

8. Multiple-car facility (multiple-car method, range, off-street area). This is an area in which students learn and practice certain driver tasks in a simulated traffic-roadway environment under the supervision of an instructor. Driver-driver and driver-teacher interaction is controlled by a one- or two-way communication system. The experience on this facility increases the student-teacher ratio, student responsibility for vehicle control and can provide supplemental and enriching activities for on-street instruction.

9. <u>State supervisor</u>. A state supervisor is a Traffic Safety administrator identified by the National Safety Council as being responsible for Traffic Safety Education in a given state, State Department of Education.

CHAPTER ORGANIZATION

Chapter II contains a review of literature. The literature was drawn from both task analysis information and from a treatment of the multiple-car facility. Presented in Chapter III is the nature of the survey and the role of the expert judges. Chapter IV contains the findings in terms of states with standards and guidelines for multiple-car facilities and states with performance criteria appropriate for Washington Traffic Safety Education curriculum. Presented in Chapter V are the discussions, conclusions and recommendations in terms of performance standards for the different types of multiple-car facilities.

CHAPTER II

REVIEW OF LITERATURE

The review of literature for this project must come from two areas, the literature available on the multiple-car facility or range, and a review of literature related to the task analysis of driving.

While reviewing the literature related to the multiple-car method, it became obvious that there is a need for clarification of terms. Range, as used in this review, means the same as multiple-car facility.

The driving range settings and design characteristics were originally developed and used for training purposes. It has evolved from a situation used only for teaching and practicing basic skill maneuvers and vehicle operating procedures to a multiple-car setting used also for simulating traffic interaction situations and decision maneuvers and practicing emergency evasion (1; 22; 13; 42:1-3; 50).

A more specific statement is made by Quane, in the introduction to his manual.

> In the past since the inception of the use of driving ranges in Driver Education, the philosophy of the range instructor has largely been determined by his consideration of the physical skills used in

> driving. Recently the mental processes used in driving have become more important for curriculum purposes than the mere manipulation of the motor vehicle (42).

The multiple-car method has not been a subject of extensive research.

There have been a few evaluative studies conducted using different methods of evaluating driver performance after completing Driver Education programs comprised of various combinations of instructional treatments.

In one such study the driving performances of over 2,000 male students were investigated several years after they had completed driver education courses in Dearborn, Michigan. In this study Brazell (4) used state driving records as criteria (indicating moving violations and accidents). Brazell found that off-street methods, including the multiple-car method, were as effective as the on-street method.

Bishop conducted a study comparing the effectiveness of on-street instruction with multiple-car. According to his study, six hours of on-street instruction is not significantly better than the following combinations of instructional treatment: six hours under multiple-car methods; six hours of multiple-car, plus one hour of on-street; or six hours of multiple-car, plus two hours of on-street (3).

In a study conducted by Nolan, little difference was found between the driving of high school students receiving ten hours of multiple-car, plus two hours on-street instruction, and a comparable group receiving ten hours of simulator and three hours of on-street instruction (40).

The results of students taught under a combination method (driver simulator and multiple-car) was compared with those taught solely under the multiple-car method in a study by Gustafson (21). To determine the effect of on-street instruction, on-street instruction was later added to both methods.

In both instances students taught under the combination method did not score as well as those taught exclusively on the multiple-car facility when tested to measure ability to maneuver vehicles. The test was conducted using the exercise areas on the multiple-car facility.

In San Diego, California, Tom Seals and Charles McDaniel conducted a more recent research project and found that instruction utilizing the driving simulator and the multiple-car method compares favorably to on-street driving instruction only (47:46-49).

Other research has been done to establish validity to testing done in off-street driving test scores of a group of 1,000 drivers involved in fatal accidents with the test scores of 1,000 randomly sampled drivers. Campbell was able to differentiate between the two groups on individual test items as well as the total test scores, which seems to give validity to testing in off-street driving areas on basic skill maneuvers (5).

The literature available on the task analysis of driving is much more extensive than the material available on the multiple-car method. The task analysis approach has been researched by individuals and by teams of people representing large organizations. Some of the documents are quite extensive and lengthy, being comprised of as many as four volumes. Some of the analyses of the driving task have been handled in a descriptive manner and in other instances have been organized and constructed into schematic models.

Gibson and Crooks developed the historical model of the driving task. Their description of the task was based on a systematic set of concepts which was felt to have both psychological and practical validity for automobile operation. They felt that driving an automobile was predominantly a perceptual task, with overt behavior (manipulation of the vehicle) being relatively simple and easily learned. According to Gibson and Crooks, an operator of a motor vehicle was limited to speed and direction changes. Therefore, he manipulated his vehicle controls in an effort to achieve a field of travel and maintain a minimum stopping zone (20).

Another model was developed by Schlesinger and Sofren (45) and was further refined by Schlesinger (44). They also view motor vehicle operation as a form of locomotion which was guided by perception, so that paths were identified within the perceptual field which led to a collision-free destination. Visual perception was considered more important than motor responses which were easily mastered. The objective visual field of the driver was constantly changing and required continuous organization. On the basis of this organization the operator is seen making physical adjustments to the vehicle in the form and speed and direction changes.

Schlesinger (44) organized two broad classifications of driving behavior--guidance and control. The driving behavior classes were further divided into required human functions.

The guidance behavior was sub-divided into three subtasks (functions): search, identification and prediction. These functions are all perceptually derived.

The control behavior was divided into two sub-tasks (functions): decision making and execution. Decision making is concerned with what to do, and execution with the driver's responses to or with the vehicle. Schlesinger and Sofren then viewed the operator's role as a task of attending to a continuously changing perceptual field which could be successfully transferred to a destination by employing two broad classes of behavior--guidance and control.

Forbes identified, in several articles, the human function required in performing the driving task, and developed a schematic model to illustrate his concept of the driving process. Forbes analyzed the driving task in terms of perceptions, judgments and responses. Attitudes, motivations and knowledge also influenced driver reactions. Forbes' diagram in Figure 1 provided for the study of a number of functions. However, Forbes stated that the analysis was an oversimplification of the driving task (14; 15; 16).

Lybrand (30:59-60), as part of a contract for the U. S. Department of Transportation, developed a task model to evaluate driver education as an accident countermeasure. This report defined the driving task objectives as follows.

To control the movement of his vehicle in its environment:

1. From one location to another within specified time limits;

2. On defined roadways;

3. In paths and velocities coordinated with paths and velocities of other independently controlled vehicles and pedestrians on the roadways;

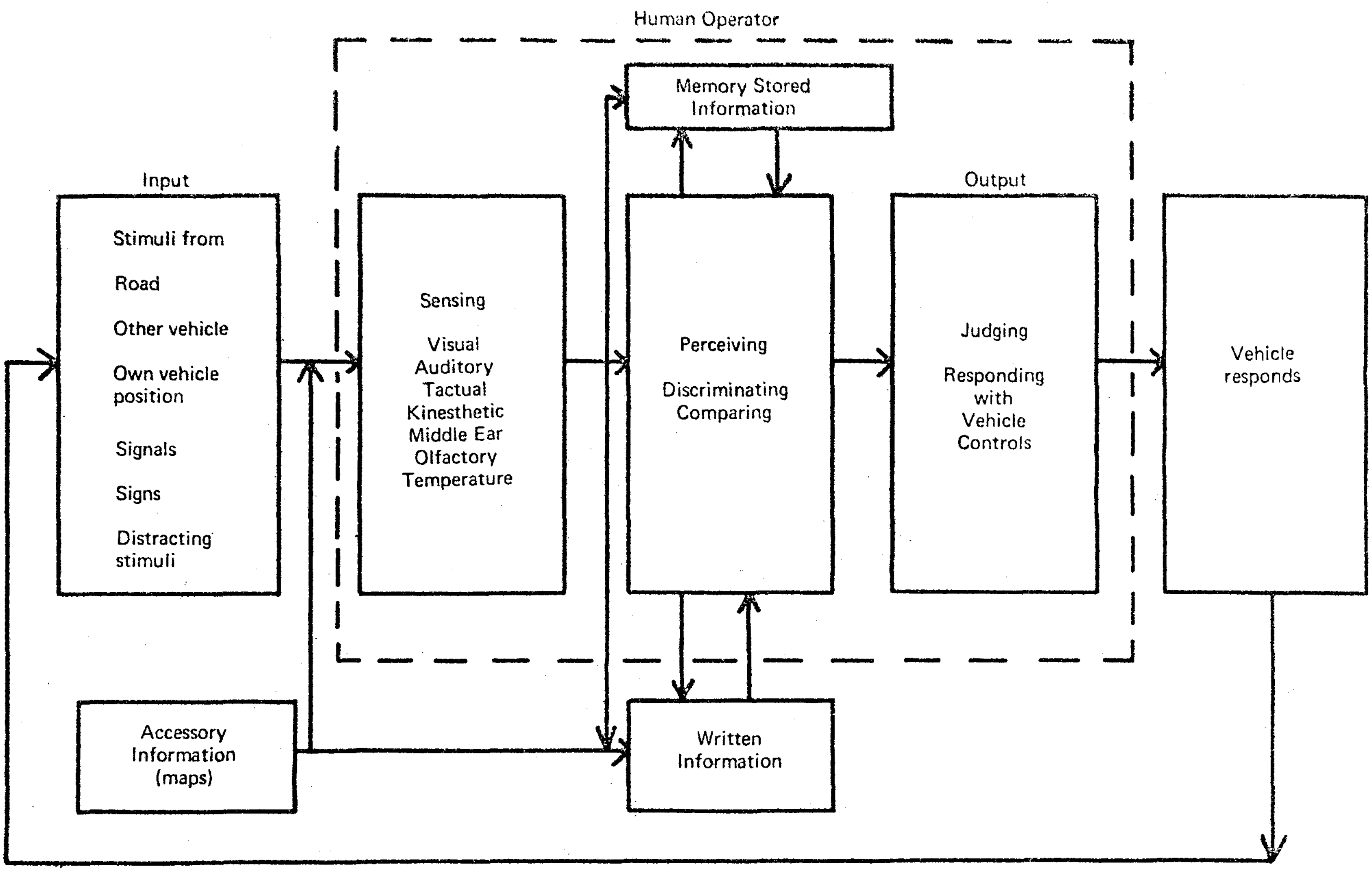


Figure 1. Forbes' Concept of the Driving Task

4. Without collision with other vehicles or pedestrians on or near the roadways;

5. Within the bounds of applicable operational rules of the motor vehicle transportation sub-system (laws and prudential norms).

Proceeding from the objectives of the task, Lybrand, et al, then divides driving into modes or tasks which included open road driving tasks, entering and leaving traffic tasks and traffic flow tasks. These modes or tasks served as broad descriptive categories which, when applied to Lybrand's driving task matrix, resulted in a total of forty sub-tasks. Following the statement of objectives and development of modes or tasks a functional analysis was developed.

The functional analysis (Figure 2) (30:110-111) was based on the concept that motor vehicle operation was primarily a guidance task employing the operator of the vehicle to acquire information, analyze the information in relation to the situation, forecast probable situational occurrences, make decisions based on input, communicate with other roadway users, and make necessary control adjustments in the vehicle's path or velocity.

LaFond (29) prepared an evaluation report on the effect of dynamic visual training on manipulative driving skills. In discussing the importance of perception as a

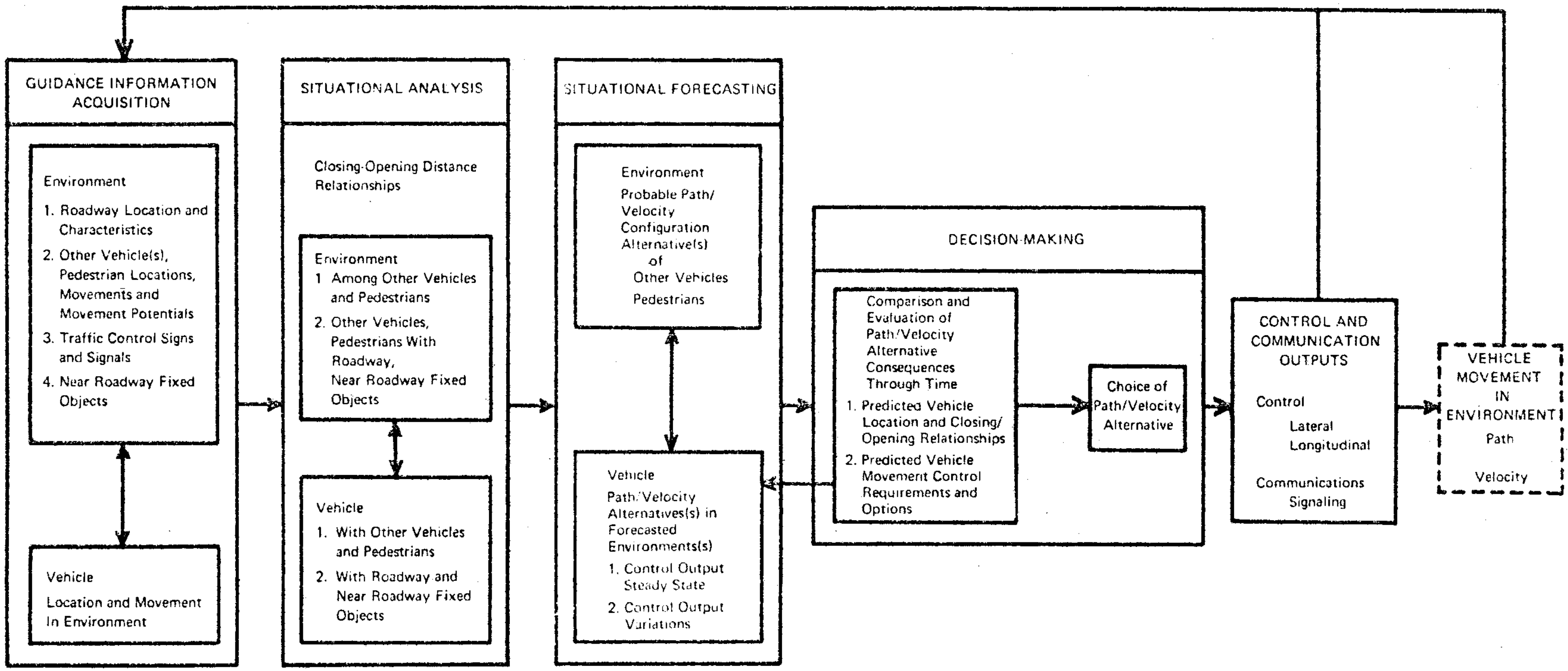


Figure 2. Lybrand's Driving Task Matrix

part of the driving task, LaFond presents an analysis of the driving task prepared by the teaching staff at Illinois State University (Figure 3). Their analysis places more importance upon the human being as an interacting force to accomplish the control factors of moving the vehicle. The human functions of motivation, perceptions, judgments and decisions revolving around the background of stored knowledge is ongoing and influenced by many factors such as physical condition, personality, fatigue, alcohol and drugs. This analysis places more importance on the operator and what is required of him to accomplish control of the vehicle in a safe and legal manner in the environment.

McKnight and Hundt developed a Driver Education Task Analysis for the U. S. Department of Transportation (32). In the fourth volume of a four-volume report, McKnight and Hundt report on a different type of driving task analysis to accomplish their goal. Their approach is called system analysis. They analyzed the highway transportation--the driver, the vehicle, roadway, traffic, and natural environment--to identify those characteristics of the system capable of creating situations, to which drivers must respond. They identified over 1,000 behaviorally relevant characteristics. By analyzing these characteristics they developed a list of over 1,000 specific driving behaviors. These behaviors were then organized into tasks, or behaviors

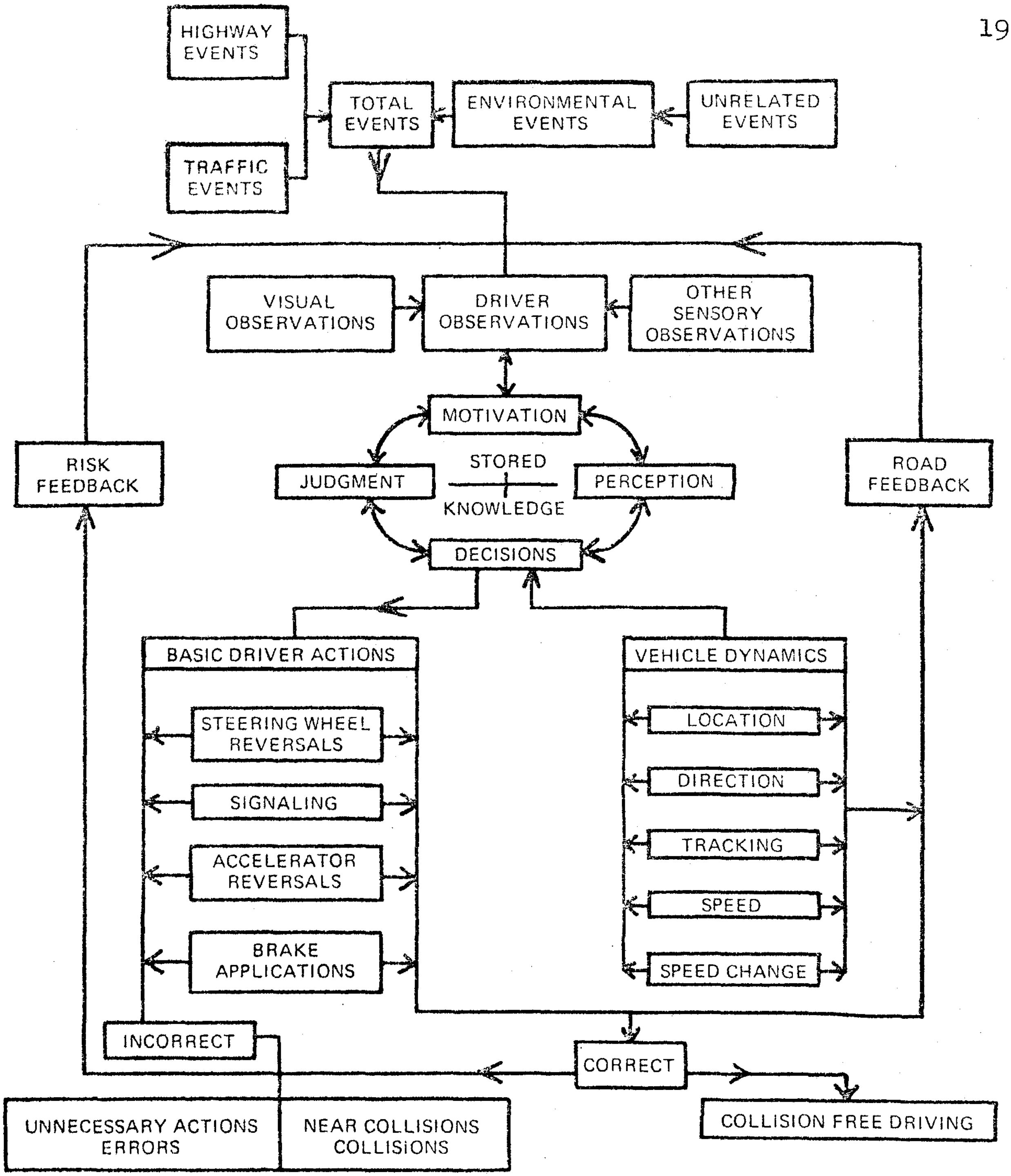


Figure 3. LaFond's Evaluation of Effect of Dynamic Visual Training on Manipulative Driving Skills

that were related to one another by having a common end-goal (e.g., passing or driving through an intersection). This resulted in grouping a list of more than 1,700 specific behaviors into forty-five tasks. To determine the criticality of these behaviors to the safety and effectiveness of the highway transportation system, one hundred authorities in the field of traffic safety--including law enforcement officers, fleet safety and training personnel specialists, driver educators and driver licensing officials--were asked to judge a segment of these behaviors.

Using the judgments of these experts, the driving behaviors and their associated criticalities were assembled into a set of task descriptions. The results of using this approach of analyzing provides a list of sub-tasks necessary to safely and efficiently accomplish the driving task.

The Washington State Traffic Safety Education Curriculum Guide, now in its second draft (43), is a curriculum guide that is designed for teachers to use in teaching the driving task. The guide lists sub-tasks and breaks them down for clarification so that they (the sub-tasks) are sequential from simple to complex as they should be in an instructional program. The driving task is subdivided into three broad categories: basic control tasks (Figure 4), traffic flow tasks (Figure 5), and critical systems tasks (Figure 6). Each of these categories is further broken down

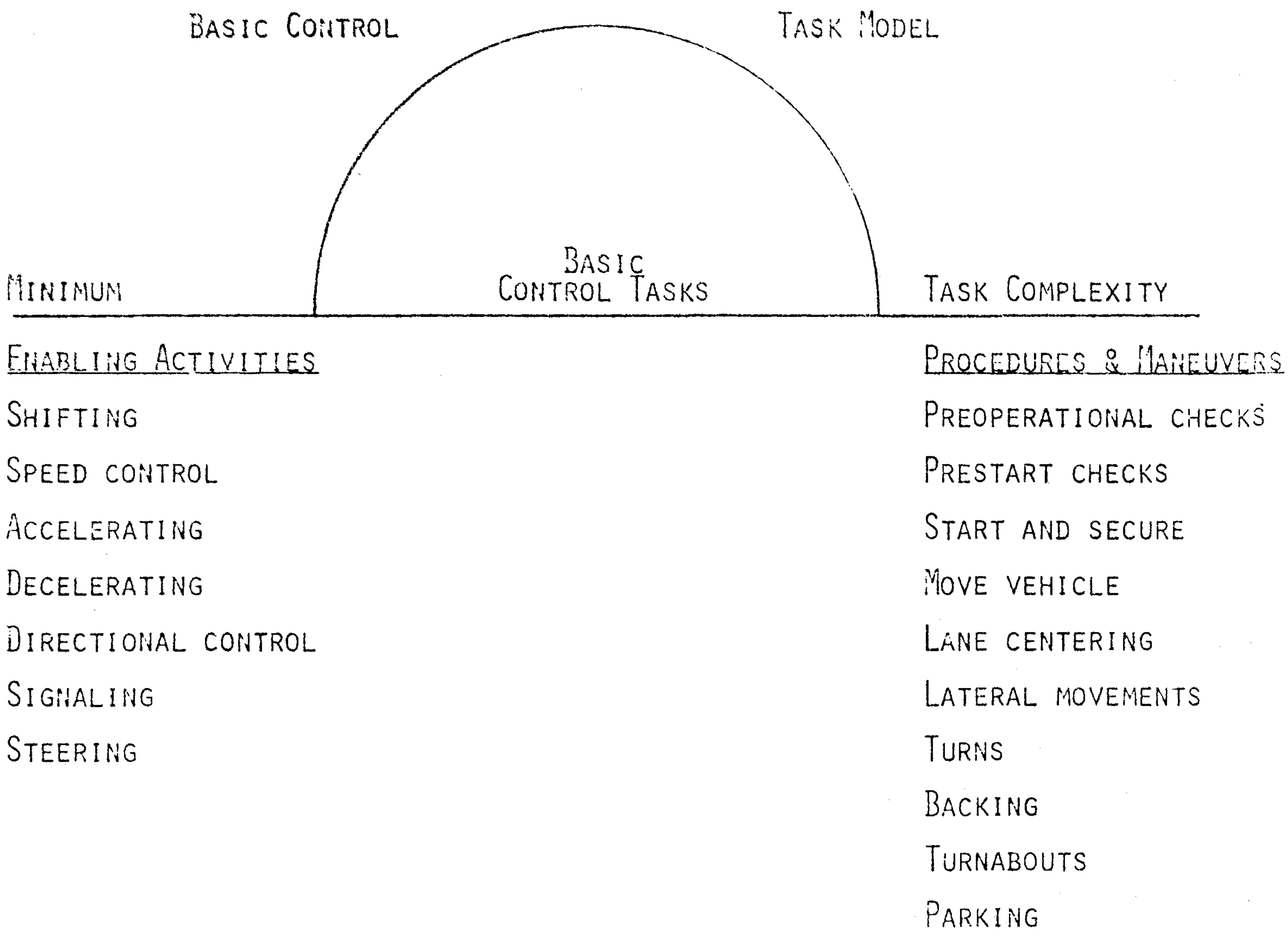
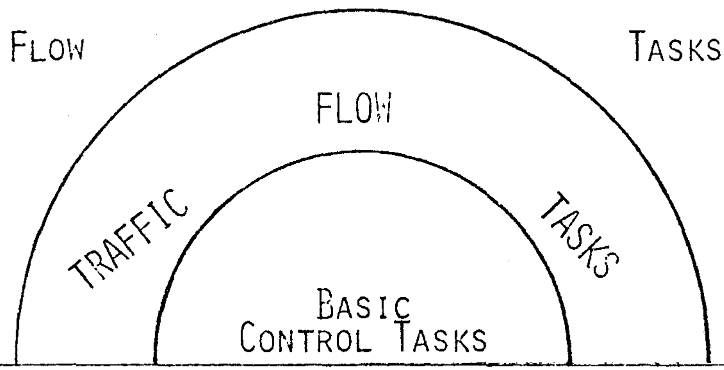


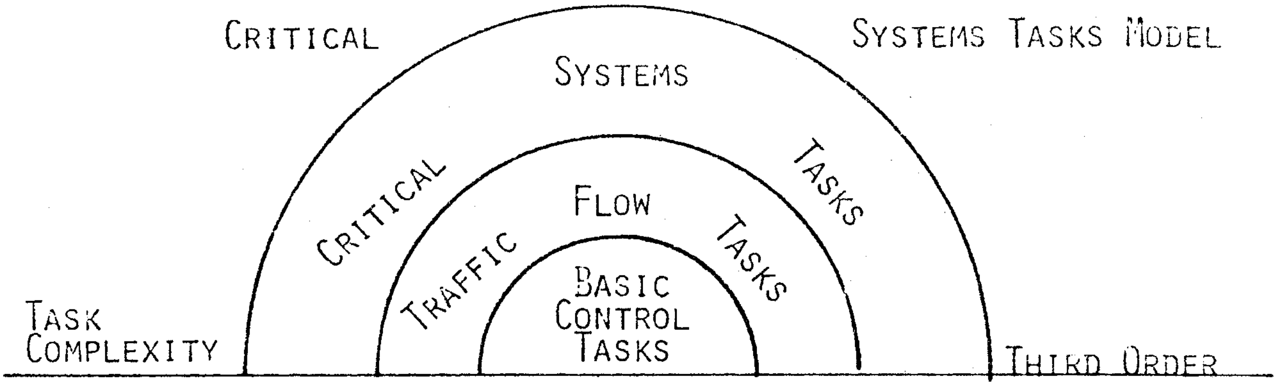
Figure 4. <u>Washington State Traffic Safety Education Curriculum Guide:</u> Basic Control Tasks

TRAFFIC FLOW TASKS MODEL



TASK COMPLEXITY	BASIC CONTROL TASKS	SECOND ORDER
<u>INTERSECTION</u>	<u>ROADWAY-INDUCED</u>	<u>FORE - AFT</u>
APPROACH	NARROWING	FOLLOWING
LANE SELECTION	SURFACE	PASSING
TURNING	HILLS	MEETING TRAFFIC
MERGING	CURVES	LANE CHANGING
DIVERGING	LANES	BEING FOLLOWED
	MARKINGS	REACTING TO TRAFFIC

Figure 5. Washington State Traffic Safety Education *Curriculum Guide:* Traffic Flow Tasks



PRECRASH FACTORS	CRASH FACTORS	POSTCRASH FACTORS
DRIVER FAILURE	OCCUPANT PACKAGING	OBTAINING POLICE ASSISTANCE
VEHICLE FAILURE	MINIMIZING IMPACT	FIRST AID
ROADWAY OBSTACLE AVOIDANCE		DEBRIS REMOVAL
OFF-ROAD, ROAD RE-ENTRY		TRAFFIC DIRECTION
SKID AVOIDANCE AND RECOVERY		REPORTING
ROADWAY HAZARDS		
ENVIRONMENTAL CONDITIONS		

Figure 6. Washington State Traffic Safety Education Curriculum Guide: Critical Systems Tasks

into lists of sub-tasks which fall under one of the previously mentioned broad categories. One must remember that there are not clear-cut lines of separation in these categories and that some of the previously learned sub-tasks then become an enabling activity for more advanced tasks (e.g., steering, even though it is listed as a basic control task, is still a necessary skill in recovering from a skid which is a critical systems task).

This guide is the first task analysis reviewed that acknowledges that there is a difference in the method performance of the driving task at different levels of competence. When a person is just beginning to learn to drive he is operating the vehicle at what is referred to as the procedural level (43:41). The driver is following procedures to accomplish the task of moving the vehicle and controlling its path and velocity rather than processing all of the necessary information and then making decisions based upon his input and judgments. It is at this level that the presence of an instructor is necessary in that the instructor can provide cues and guidance where the student may not be able to perform alone. After the learner masters the basic control sub-tasks, he is ready for traffic flow tasks and is then able to begin to process information from the environment, make judgments and decisions appropriate to the conditions that he will encounter, and at this point the teacher should let him do so (43:41-41A). Critical systems tasks are tasks that are of the highest level of complexity and urgency resulting from a failure in the highway transportation system. The failure could be driver error, vehicle failure, roadway induced, or from some environmental problem such as weather. The task is for the driver to successfully cope with the encountered situation.

In summary of this review of literature, the first and most obvious statement is that there has been very little research done related to the multiple-car facility. In those studies reviewed it appears that when a student spends some driving time on a multiple-car facility instead of driving all of the time on public roadways that he learns to drive at least as well.

The review of the task analysis approach was quite a different situation. There have been many analyses done on the driving task, and there have been varied reasons for the analyses. Some of the reasons are as follows: determine the effectiveness of driver education as an accident countermeasure; to determine the most important thing to teach about driving; to develop instructional objectives for driver education; and to provide organization and reasons for what is being or going to be taught in Traffic Safety Education classes. Some of the analyses were perceptually oriented, others guidance (control of the vehicle) oriented and others viewed the driver and the functions he must perform as the most important. They all have meaning and are of value to the reader. Much can be learned from such systematic analyses. For some it may justify what has been done in the past; in other instances it most probably is a basis for change.

CHAPTER III

METHODS AND PROCEDURES

A survey of forty-nine states was made asking for information from each state about the use of multiple-car facilities. Forty-nine states were surveyed excluding the state of Washington because the office of the Superintendent of Public Instruction for this state assisted in conducting the survey. Information about the use of multiple-car facilities in this state will be included because the information is available and was not a necessary part of the survey.

The survey request was sent to the director of the Driver Education program in each state's education agency. Based on specific information from those persons in charge of state programs, certain identified experts were also queried. Tallies in the summary of the survey were based only upon information from the director of the program in the state agency. The information from those identified experts was used only as supplemental information. The source of the mailing addresses was the National Safety Council Directory of State Driver Education Personnel.

The objective was to receive information from as many of the states surveyed as possible. The use of follow-up letters was planned to be used until the response from the states was at the 80 percent level.

PURPOSE OF THE SURVEY

The purpose of the survey was to gather as much information as possible that would assist in establishing performance standards for multiple-car facilities in the state of Washington. The survey also indicated whether or not other states have existing design standards and if they are used by persons responsible for policymaking in Driver Education programs.

The survey also served the following secondary purposes:

1. If states have no standards, do they have guidelines and recommendations?

2. If states have no standards, do they have any information in general that could be used by teachers or persons responsible for multiple-car facility design?

The objective was to gather as much information as possible and to make sure that the responses were high. The nature of the information request was kept as simple and as easy to answer as possible.

Because of the nature of the information request the following limitations exist in the survey:

1. It is not possible to accurately determine the states that do or do not use the multiple-car facility in their instructional programs.

2. Some states may have information and not use the multiple-car facility without indicating this situation.

3. Some states may use multiple-car facilities and have no standards and, therefore, did not respond to the use of the facility with no standards.

In many instances the above limitations have been spoken to in the returned letter but not to the extent that it could be accurately reported in percentages.

THE INFORMATION REQUEST

The request for information was handled by the office of the Superintendent of Public Instruction in Olympia, Washington. The letter was sent as a request of that office to similar offices in the other states. The request was on official letterhead of the Washington State Superintendent of Public Instruction with the signature of a state supervisor of the Traffic Safety Education--see appendix.

The information request conducted in this manner is a process frequently used to exchange information between offices of this type. Because the mechanism for exchange has already been established, a high percentage and an expedient return was expected. Another factor that indicated success of return of request was the knowledge that states are required to exchange information that results from United States Department of Transportation funding.

The following techniques were used in the initial request for information to gain a high percentage of return of information.

The appeal for assistance.

1. An appeal for assistance.

2. Explanation of need for the information, i.e., the revision of the state guide in Traffic Safety Education with the inclusion of design standards for multiple-car facilities.

3. A commitment to send them a copy of the Washington State curriculum guide upon its completion and publication.

4. An offer of assistance to them at any time that they may have need.

5. Provision for ample time to gather and return material.

The following schedule was set up to attain as high a return as possible of the information requested. The initial mailing was sent October 10, 1971. Early in December a list was compiled of those states that had not yet responded with the information requested nor a negative answer about not having any information. Those states were sent a follow-up request on December 14, 1971.

THE FOLLOW-UP INFORMATION REQUEST

The follow-up information request was only sent to those state program supervisors that did not respond by December 7, 1971. The follow-up request was designed to make it as easy as possible for the supervisors to respond. This hopefully would increase the percentage of responses from those supervisors that had not yet answered the initial information request. The following techniques were incorporated into the follow-up letter to accomplish a higher percentage of return.

1. The letter contained a self-addressed and stamped return envelope.

2. They did not have to write a letter of transmittal in that the letter sent to them could be returned with just a check mark to indicate their situation.

3. There was provision for them to check an item indicating that they would like to have a copy of the completed Washington State curriculum guide.

4. They could respond negatively to the request for information without embarrassment because of the nature of the wording of the item that they could check, i.e., "I have no information available at this time."

Incorporating these techniques into the follow-up request was accomplished as they were typed and mailed on December 14, 1971--see appendix. These follow-up letters were also on the official letterhead of the Superintendent of Public Instruction and signed by a Traffic Safety Education program supervisor.

CHAPTER IV

FINDINGS

The returned information, in response to the original information request, came from the following twenty-seven states:

Arizona	New Jersey
California	New Mexico
Delaware	New York
Florida	North Dakota
Hawaii	Ohio
Iowa	Oklahoma
Kansas	Oregon
Louisiana	Pennsylvania
Maine	South Dakota
Maryland	Texas
Michigan	Virginia
Montana	West Virginia
Nebraska	Wisconsin
Nevada	

This return represents a 55.1 percent return on the original mailing. From those twenty-seven states that did respond, seventeen of them had some information and sent this information to be reviewed. Ten of the respondents indicated that they had no information available at the present time. The follow-up letter was then sent to those states that had not yet responded. As a result of the follow-up letter, the following twenty states replied:

Alabama	Massachusetts
Alaska	Minnesota
Arkansas	Mississippi
Colorado	Missouri
Connecticut	New Hampshire
Georgia	South Carolina
Idaho	Tennessee
Illinois	Utah
Indiana	Vermont
Kentucky	Wyoming

Of the twenty states that answered following the second letter, thirteen of them provided no information on the subject of multiple-car facilities. Seven of the respondents had some information about Traffic Safety Education in their respective states, some of which included information on multiple-car facilities.

Including these twenty states, the total number of respondents was forty-seven of a possible forty-nine. This represents a 95.9 percent return of the information request which, as anticipated, was a very high return. The only two states of the forty-nine that did not respond were North Carolina and Rhode Island.

Twenty-three of the forty-seven states that answered the information request indicated that they had no information on the subject. Twenty-four of the states had some information and sent this material. The following section will be a summary or review of the information returned. Some of the information returned was a part of that state's curriculum guide. Some of the states returned curriculum guides which had no information about multiple-car facilities included.

Arkansas. The material received from Arkansas indicated that they did not have a multiple-car facility in their state. Each school was responsible for setting up an off-street driving area for its use (11).

California. The response received from California revealed that multiple-car facilities are very limited in that state (51). San Diego County schools completed a project utilizing a multiple-car facility as a part of the instructional program. San Juan Unified School District in Carmichael recently initiated a multiple-car facility program. No apparent standards or guidelines are in existence in California at present.

Florida. The response indicated that there are over one hundred multiple-car facilities in operation in Florida with very few of them alike (56). Florida does not require specific sizes or shapes of multiple-car facilities. Experience has shown that school districts would probably not construct a multiple-car facility if they did not have that exact piece of property. However, certain features are recommended which would simulate the driving environment. It was felt that if these features are incorporated, the overall dimensions and shape are not necessarily important.

Georgia. The curriculum guide received from Georgia stated their multi-car ranges include engineered surfaced streets and intersections. The area may be any shape with a recommendation of 400 x 300. Georgia recommended a standard list of features as a minimum. This list of features was taken from the Automotive Safety Foundation publication "The Multiple Car Method" (9:33-35).

Kansas. The state of Kansas has published a guide which includes a section on multiple-car facility instruction and utilization. The guide does not indicate any recommendations, guidelines or standards for multiple-car facility design. It does contain information to aid an instructor in planning lessons on the multiple-car facility (46).

Louisiana. The guide sent by Louisiana in response to the letter contained no information relative to the multiple-car facility. It appears that multiple-car facilities are not used in Louisiana (38).

Maryland. There are no standards or guidelines for design of a multiple-car facility in Maryland, but recent installation does follow Larry Quane's publication from Illinois State. They do have recommended exercises and design characteristics but no requirements for construction or design (7).

Massachusetts. The response from Massachusetts included a copy of their curriculum guide. Multiple-car facility instruction and/or design was not mentioned in the guide (52).

Michigan. The curriculum guide received from Michigan contained an organization of basic control tasks only. There was no indication in the guide of use of design standards. Michigan utilizes the multiple-car facility approach primarily through modification and use of existing student parking lots (6). Financial difficulties prevent them from developing a multiple-car facility program from its inception with program objectives and student needs as first criteria. In their treatment of multiple-car facility programming, major emphasis is placed on development of manipulative skills in the student (36).

Minnesota. The Minnesota curriculum guide has a section on use of the multiple-car facility in Traffic Safety Education. A part of that section is about size, design and teaching stations for multiple-car facilities. Minnesota accepts three basic laboratory instructional programs that employ the multiple-car method. They further explain that the overall design of the facility depends on the planned use of the facility, and that the individual school system must determine which program best meets the objectives of its own community. Those three acceptable programs are identified as follows:

1. Six hour on-street laboratory program employing an off-street area for specific skill development.
   a. For any such program, plans must be submitted to the commissioner of education for approval
2. Integrated program of multiple-car and on-street instruction.
   a. Eight clock hours of actual driving experience per student on the range (six or more vehicles) and two clock hours of actual

driving experience per student minimum on-street.

b. Four to six clock hours of actual driving experience per student on the range (four or more vehicles) and three to four clock hours of actual driving experience per study on-street (size, speed, and experience).

c. Alternative plans require the special approval of the Commissioner of Education.

3. Integrated program of simulator, multiple-car and on-street instruction.

   a. With six or more vehicles, the minimum standard possibilities are:

      (1) Eight clock hours on range, two students per vehicle.

      (2) Four clock hours on range with one student per vehicle.

      (3) Eight clock hours in simulators and two clock hours of actual driving experience on-street.

   b. With four or more vehicles, the minimum standard possibilities are:

      (1) Four to six clock hours on range, two students per vehicle.

(2) Four clock hours on range with one student per vehicle.

(3) Six to eight clock hours in simulator, three to four clock hours of actual driving experience on-street.

Note: Alternative plans require special approval from the Commissioner of Education.

For multiple-car facility design standards, there are none; they indicated some safety factor and teaching stations which schools might incorporate into the design depending on the school's purposes and objectives. The items are similar to the list of points found in other guides and appear to come from the Automotive Safety Foundation publication on the multiple-car method (2).

Missouri. There is a section in the guide submitted by Missouri related to multiple-car instruction. Missouri also has made reference to learning being stressed on multiple-car facilities rather than teaching. In this guide brief reference was made to instruction beginning from basic skills and progressing to complex emergency maneuvers. Missouri also indicated that a wide variety of vehicle types could be operated by students during instruction. Missouri has no minimum standards for multiple-car facility design or construction (31). Even though they have identified a wide range of driving tasks to be taught on the facility there are no requirements for design. They do say that the physical characteristics should include:

1. Space for development of fundamental and advanced driving skills;

2. Street surfaces wide enough for two-way and multiple-lane traffic;

3. Intersections, curves, and grades;

4. Lane marking, signs, and signals.

Montana. The curriculum guide submitted by Montana contained no mention of multiple-car facility design. There was indication of scheduling such a facility into the program but no specific design standards (37).

Nebraska. The state of Nebraska submitted their curriculum guide which listed fifteen design features and exercise areas they felt should be considered. To date, no exact method has been found to measure the influence of a facility's size and design on the quality of instruction, as mentioned in their guide (54:19).

New Jersey. The response received from New Jersey indicated there were three multiple-car facilities in the state (49). In the absence of established national construction specifications for multiple-car facilities, general guidelines for layout were considered. These included: space for development of fundamental skills; smooth, paved surface of either concrete or asphalt for driving areas; road surfaces wide enough to permit two-way and multiple-lane traffic; a variety of lane markings, signs, and signals; realistic intersections, grades, and curves; potential hazards eliminated through design of physical features; and a communication system (48:66-67).

New York. There are approximately six operational multiple-car facilities in the state of New York (18). The design of each has been determined by local site conditions and information obtained from the "Multiple Car Method" publication released by the Automotive Safety Foundation (17). New York encourages the school districts to explore this method.

North Dakota. The guide received from North Dakota contained a list of lessons and suggestions for exercises on a multiple-car facility. These included a "T" exercise, garage exercise, "X" exercise and a figure eight exercise (28).

Ohio. The state of Ohio submitted its curriculum guide. This included multiple-car facility objectives, of which one was not typical: to emphasize learning rather than teaching and to strengthen the bonds between knowledge and performance because of feedback from the vehicle and the road environment. A multiple-car facility make-up list was given with dimensions; however, no requirements or task relationships were indicated (12:66, 70-71).

Oklahoma. The curriculum guide which Oklahoma submitted in response to the letter indicated they utilize a multiple-car facility but have no guidelines or standards for design (53).

Pennsylvania. The state of Pennsylvania had no particular multiple-car facility design. Schools that had a large enough area were building their multiple-car facility after the Michigan State University multiple-car facility design. The schools that did not have the space were designing their own multiple-car facilities. No guidelines or standards were indicated. One example had no streets to intersect and merely a figure eight and an "X" exercise, a "Y" turn, and angle parking.

Tennessee. There were six pages about multiple-car facilities in the curriculum guide submitted by Tennessee. They recommended dimensions of 360' x 460' and then used the recommendations as initially developed by the Automotive Safety Foundation. Also provided was a short section on teaching methods and techniques as well as a sequence for multiple-car facility instruction. Tennessee seems to emphasize a multiple-car facility's contribution in the development of basic skills and its ability to make the program available to more students by increasing the pupil-teacher ratio (55).

Texas. Of the states which responded, Texas was the only state that had a separate curriculum guide for multiple-car facilities. The guide was very thorough and probably the most complete document on multiple-car facilities implementation reviewed. See appendix. Their guide contained minimum standards such as multiple-car facility specifications of surface and dimensions, number of automobiles, markings, curbing, location, communication, required maneuvers, signs, plans, and procedures. Although not directly associated with specified tasks analysis, Texas does require that a multiple-car facility be designed that meets program objectives and maintains that those objectives should be identified before a multiple-car facility design is started (10).

Utah. The state of Utah has used multiple-car instruction for four years and, according to a letter received from the Utah State Board of Education, the multiple-car facility method is proving quite successful (25). They have tried 6-, 8-, 9- and 12-car multiple-car facilities and feel that the most success has been with the 6-car installations. Utah has no two multiple-car facilities alike. In most cases the facility is designed by the local district's building and grounds division to fit that particular piece of property which is available. No standards or guidelines are included in Utah's guide (26:40). There is a section under experimental programs which says that such programs utilizing multiple-car facility instruction will need approval from the State Board of Education. The guide does mention that multiple-car methods may substitute for hours of instruction in traffic at a 2:1 ratio, up to three of the six hour requirement of behind the wheel instruction.

Virginia. Instruction follows a systematic pattern beginning with the basic skill development and proceeding to the more complex perceptual and judgment tasks. A list of items should be included. The ideal multiple-car facility should be designed to provide perceptual abilities (24:25-27).

Wisconsin. Use of the multiple-car facility was acknowledged by Wisconsin. Any off-street area could be used for multiple-car facility purposes. Essential items included communication system, traffic cones and flags, traffic signs, inclement weather personal protective gear, temporary curbing, rooftop vehicle identification, storage facilities, snow removal equipment, fire protection equipment, battery chargers, and area illumination (27).

CHAPTER V

SUMMARY

PROBLEM

This survey was an attempt to determine if the states using the multiple-car method were using a task analysis of driving as a basis for the design characteristics of the facilities used in instruction. It was determined that many states were introducing instruction on a multiple-car facility to reduce the cost of their traffic safety programs by improving the pupil-teacher ratio. Established minimums of six hours of in-car instruction in traffic at a 1:1 ratio between instructor and pupil may be reduced to two or three hours of in-car instruction with the remaining hours made up of multiple-car facility instruction with up to twelve or fifteen students and one instructor. Two hours of multiple-car facility instruction may be substituted for one hour of instruction in the car in traffic.

If this substitution of in-car in-traffic instruction for time in multiple-car facility instruction is to be meaningful and consistent, the design of the facility should guarantee certain learning experiences for the students who receive training on the multiple-car facility.

To help maintain some consistency in multiple-car facility instruction, requirements should be established for the design of multiple-car facilities based on an analysis of the driving task.

METHOD

A survey was conducted to determine how many states in the United States have standards for the design of multiple-car facilities. The survey was to determine how many states had standards for multiple-car facilities and if states had standards, how many were based on an analysis of the driving task with a rationale for what was included in the multiple-car facility design. To help attain a high return of the information requested from the forty-nine states, the survey was conducted from the office of Superintendent of Public Instruction, Olympia, Washington. This was effective enough to receive a 95.9 percent return from the forty-nine states surveyed (Washington was not included in the survey, but information was made available).

FINDINGS

It was discovered from the information gathered, that there was an absence of requirements or standards for the design of multiple-car facilities in the United States, also there was a lack of designs related to an analysis of the driving task. Only two of the states had any minimum requirements for multiple-car facilities. Texas very carefully spelled out minimum requirements for multiple-car facilities for approved programs in that state. However, those requirements were not specifically related to the accomplishment of specified driver tasks. There were required exercises and situations for the design to include, and accomplishment of driver tasks may occur, but the tasks were not identified as driver accomplishments. One thing was certain, if one were going to implement multiple-car facility instruction in Texas, there would be specific well-defined minimum standards to develop in order to have an approved program qualifying for state reimbursement. Minnesota was the only other state that had minimum standards identified for multiple-car facility instruction in a Traffic Safety Education program. However, these minimum standards were on program organization only. They included requirements as to the number of vehicles, number of hours on the multiple-car facility and other instructional areas such as simulators and/or in-car in-traffic instruction. They included a list of possible recommended exercises but there was no requirement or standard to be met in the design of the facility. Georgia and Tennessee recommended minimum sizes of 300' x 400' and 360' x 460' respectively. They recommended a list of minimum exercises to be included in the design, but recommended minimums were not requirements or standards and would not usually be interpreted as such by persons designing facilities. No mention of any relationship between driver tasks and range design was included by these two states.

Some states provided sample lesson plans and instructional sequences to follow in multiple-car facility teaching. Most of these emphasized the basic manipulative skills that could be taught on a multiple-car facility. Others, such as Missouri, sequenced lessons on multiple-car facility instruction from very basic control maneuvers through complex critical situations and evasive maneuvers such as controlling skids and blowout simulation.

Ohio and Missouri both mentioned in their guides that instruction on a multiple-car facility stressed learning rather than teaching.

Many of the states indicated a list of possible exercises to include in the design of a range. Most of these were patterned after the Automotive Safety Foundation publication, "The Multiple-Car Method."

The information received indicated that multiple-car facility instruction was encouraged by most of the state supervisors of Traffic Safety Education programs in the United States.

CONCLUSIONS

Many states used the Automotive Safety Foundation publication, "The Multiple-Car Method," as a source of guidelines. However, this source had not been tested and did not give a rationale based on a task analysis. The information in that publication is based on expert opinion which at the present time is the best information available.

Based on the rapid exchange of materials gathered for this paper, any sound, proven design standards could be exchanged and implemented by all states that have multiple-car facility instruction.

Many states recognized and accepted instruction on multiple-car facilities without having minimum requirements or design standards based on any rationale.

Based on information received there was an absence of design standards for multiple-car facilities. Only loose guidelines or recommendations were apparent in all states except Texas as to the design characteristic of an acceptable multiple-car facility.

A multiple-car facility that would contribute to a complete Traffic Safety Education program should make a contribution in all three broad categories of driver tasks identified in the Washington State curriculum guide, i.e., basic control tasks, traffic flow tasks and critical systems tasks. This does not mean that if a multiple-car facility does not contribute to all three broad categories of the driving task that the facility should be eliminated. Certainly some contribution is made at the basic control level even on the simplest of multiple-car facility designs.

Multiple-car facility design was treated separately from the total curriculum development and design as indicated by the lack of minimum design standards with the development and implementation of new curriculum guides in nearly all of the states, except Texas and Missouri.

RECOMMENDATIONS

1. The Superintendent of Public Instruction in the state of Washington should incorporate minimum design characteristics of multiple-car facilities based on driver task analysis in the Washington State curriculum guide.

2. The Superintendent of Public Instruction, through some project, or any researcher, could determine through experimental research the contribution of each design characteristic to the development of operator performance to the driver task.

3. When experimental research has been completed, the Superintendent of Public Instruction should use these findings to determine standards for approval of school districts' multiple-car facilities.

4. The Professional Traffic Safety Education Association (American Driver and Traffic Safety Education Association) should assume the leadership role in establishing national standards for multiple-car facilities.

5. Research should be done to determine if specific design characteristics of multiple-car facilities are learner constant. This should reveal whether or not the driver violator, the non-driving adult and the handicapped can gain the same competencies from learning experiences on the facility designed for high school Traffic Safety Education students.

6. The development of multiple-car facilities should include provisions for learning activities for other highway users than just the standard-size automobile. Motorcycles, bicycles, pedestrians and a variety of vehicle sizes should be considered in a total program of instruction in Traffic Safety Education.

7. The approval of multiple-car facilities by the Superintendent of Public Instruction should be commensurate with the three broad categories of driver task accomplishment identified in the Washington State curriculum guide:

basic control tasks, traffic flow tasks and critical systems tasks. A multiple-car facility that contributes to a comprehensive Traffic Safety Education program will have capabilities and design characteristics enabling task accomplishment in all three broad categories. The contribution of a multiple-car facility at the basic control level of driver task accomplishment should be accepted. A limit on the number of hours of driving in traffic that could be substituted for driving on a multiple-car facility with only basic control of task accomplishment capabilities should be established (possibly a one hour limit). The next consideration would be a multiple-car facility with design characteristics enabling driver task accomplishment of traffic flow tasks with an appropriate increase in allowable substitution of time required for driving in traffic (possibly more lessons on multiple-car facility and substitute for two hours in traffic). A complete multiple-car facility, with design characteristic enabling driver task accomplishment in all three categories, basic control tasks, traffic flow tasks, and critical systems tasks, would be able to substitute at the maximum level of reduction of in-car in-traffic driving.

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APPENDIX A

CORRESPONDENCE

STATE OF WASHINGTON

Superintendent of Public Instruction

LOUIS BRUNO
TE SUPERINTENDENT

P. O. BOX 527
OLYMPIA 98501

October 1971

State Director
Driver and Traffic Safety
Education

Dear Sir:

The Superintendent of Public Instruction, State of Washington, is currently revising the state driver and traffic safety education curriculum guide.

Included in this revision will be a multiple-car range, and I am soliciting from the various states range designs and support material that help define the concept of ranges. It would be very much appreciated if you could furnish our office with material from your state that would assist us in this project. This information would be most beneficial to us if we could receive it in early December 1971.

In turn, we will be sending you a copy of our revised curriculum guide upon its publication.

Your cooperation in this matter is greatly appreciated; and I trust that if we can be of assistance to you, you will feel free to contact us.

Sincerely,

DIVISION OF CURRICULUM
AND INSTRUCTION

Dr. Kenard McPherson
Associate Supervisor
Safety Education Programs

KM:mc

STATE OF WASHINGTON

Superintendent of Public Instruction

LOUIS BRUNO
ATE SUPERINTENDENT

P. O. BOX 527
OLYMPIA 98501

December 14, 1971

Dear Sir:

This is a follow-up to a previous request for information about your state's driver and traffic safety education program.

We are currently revising the State of Washington curriculum guide for driver and traffic safety education which will include a multiple-car range. If your state does have a range design or any other material which you feel would be of help to us, we would appreciate receiving the information.

However, if you cannot provide us with information of this nature, please indicate below and return this letter to me. For your convenience, I have enclosed an addressed envelope for your use.

May we hear from you soon?

Sincerely,

DIVISION OF CURRICULUM
AND INSTRUCTION

Dr. Kenard McPherson
Associate Supervisor
Safety Education Programs

KM:mc

/_/ We cannot provide you with the information you request at this time.

/_/ Please send us a copy of your revised curriculum guide.

APPENDIX B

STATE OF TEXAS MULTI-CAR DRIVING RANGE SPECIFICATIONS

STATE OF TEXAS MULTI-CAR DRIVING RANGE SPECIFICATIONS

A multi-car driving range is an innovation being used advantageously in driver education programs in several states across the nation. The multi-car range is primarily intended to increase the pupil-teacher ratio in driving instruction without sacrificing quality. To teach driver education with quality, using the multi-car procedure, a range must be constructed and used properly.

Range Specifications

Surface. . . . . .All Weather

Dimensions . . . . . .Minimums

Four cars.	60,000 square feet
Five cars.	70,000 square feet
Six cars	80,000 square feet
Seven cars	90,000 square feet
Eight cars	100,000 square feet
Nine cars.	110,000 square feet
Ten cars	120,000 square feet
Eleven cars.	140,000 square feet
Twelve cars.	160,000 square feet

The average minimum width or length of the range must be no less than 150 feet.

Number of Automobiles

Minimum. 4

Maximum. 12

Markings

Clearly marked by lines with colors equivalent to lines used by the Texas Highway Department.

1

Texas Education Agency
March 18, 1968

Capitol Station
201 East 11th St.
Austin, Texas 78711

Curbing

Required in angle and parallel parking areas. Recommended in other appropriate areas (turns, traffic islands, etc.). Either cones or other devices must be placed on right corners to allow the student to know if he cleared the "curb."

Location

Time going to and from the range cannot be counted as instruction time; therefore, the range should be readily accessible.

The range must be located where its operation is not affected by pedestrian or vehicular activities.

Communication

Schools must have reliable, clearly receptive electronic communication systems with a receiver in each car.

Tower

A tower with a base floor, a minimum of six feet from the ground. The tower should offer protection from the sun, wind, and rain.

Required Maneuvers . . . . to be accommodated into range markings

1. One-way traffic
2. Two-way traffic
3. Uncontrolled intersection
4. Four-way stop
5. "T" or "X" exercise (one required)
6. Turn about area for a "Y" turn
7. Left and right parallel parking
8. Left and right lane changing
9. Left and right turn on and off a one- and two-way street
10. Angle parking (right side)

Signs

Signs must be adequate to reflect the maneuvers listed above in the same manner they would be shown on a public street or highway.

Sign colors and designs must be the same as described in the "Texas Manual on Uniform Traffic Control Devices for Streets and Highways."

Stanchions

Stanchions (at least 4'6" high) must be used to limit forward and rear dimension of a parallel parking area. Barrels or automobiles may also be used.

Range Plans and Procedures

Each school must have a written plan for their range program. This plan must define and standardize all range terminology and commands. This plan must outline each lesson to be covered by each student in the program.

References

More information concerning range construction and operation can be obtained from the following sources:

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   March, 1967
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   Education Division
   Automobile Safety Foundation
   200 Ring Building
   Washington, D. C. 20036