



UNITED NATIONS



THAILAND

REPORT
OF
THE THIRD ECAFE STUDY WEEK
ON
TRAFFIC ENGINEERING AND HIGHWAY SAFETY

BANGKOK

June 4 to 10, 1963

SPONSORED AND ORGANIZED
BY
THE GOVERNMENT OF THAILAND
UNDER
THE AUSPICES OF THE UNITED NATIONS
ECONOMIC COMMISSION FOR ASIA AND THE FAR EAST

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**A group photograph of the delegates and experts
in
The Conference Hall.**

**REPORT OF THE THIRD STUDY WEEK ON TRAFFIC ENGINEERING
AND HIGHWAY SAFETY**

Contents

	Page
I. Introduction	1
II. Design and capacity of road and road—rail intersections	5
III. How to meet parking problems in the cities of the ECAFE region	8
IV. Driving licences	16
a. Qualifications for the issue of driving licences	16
b. Driving tests	17
c. Policies on the restriction and revocation of driving licences	18
V. Policies and administrative measures needed in licensing taxis to ensure their economic utilization and safety in big cities of the region	20



**Local traffic problems in Bangkok and vicinity
to be observed and discussed by the experts attending
the Study Week**

	Page
1. Vehicle headlights—visibility and glare	25
2. Regulation and control of speed and its effect on traffic flow and accidents	25
3. Traffic flow and congestion in Bangkok	26

Appendices

1. List of participants	28
2. Agenda	30
3. A list of technical papers submitted to the Study Week	31

I. INTRODUCTION

The Third Study Week on Traffic Engineering and Highway Safety, convened by the Government of Thailand under the auspices of ECAFE was held at Bangkok, Thailand, 4-10 June 1963 in pursuance of the recommendations of the Highways and Highway Transport Sub-Committee at its fifth session in November 1960.

Attendance

Representatives of the following member and associate member countries of ECAFE participated in the Study Week: Australia, China, France, India, Japan, Laos, Pakistan, the Philippines, Singapore, Thailand, the United States of America and the Republic of Viet-Nam.

A list of the participants is given in appendix 1 to this report.

Opening Addresses

His Excellency, Field Marshal Srisdi Dhanarajata, Prime Minister of Thailand, inaugurated the session and welcomed the participants to the session. He observed that, since the end of the last world war, there had been a phenomenal increase in the number of motor vehicles throughout the world as well as great changes in the speeds and length of trips performed by motor vehicles both in Thailand and elsewhere. The social and economic benefits flowing from the improved means of highway transport had been considerable, but this had not proved an unmixed blessing. Traffic congestion which frustrated free use of the highways had brought in its wake a crop of accidents in urban areas; the rapid development of motorized highway transport had thus brought about much avoidable suffering, tragedy and loss, both of life and property. He mentioned that in the year 1962, 540 fatalities had occurred in the Bangkok and Thonburi areas and that, in the kingdom as a whole, deaths from accident had amounted to about 10 fatalities for 100,000 of the population. Injuries from accidents were 15 times more numerous than the fatalities, and property damage was estimated at 14.5 million bath per annum. In view of this serious situation, he hoped that the Study Week would undertake a thorough study of the various problems of highway safety and make recommendations to minimize the accident hazards which beset the highways of the countries of the region.

U Nyun, Executive Secretary, referred to the rapid growth of highway transportation and to the vital contribution it is making to economic and social development. He noted that in the ECAFE region, motor transportation had increased considerably in recent years despite certain economic handicaps such as import restrictions and shortages of foreign exchange resulting in lack of funds for road construction. Despite these handicaps, the number of motor vehicles registration in the world as a whole had doubled in the last five years and expenditure on the improvement of the highways had increased more than 2.5 times during the same period. In the ECAFE region, as in other parts of the world, the rapid growth of highway transport had brought with it a number of vexing problems which required careful and urgent study. Among them, the most urgent and important was the awesome toll of human life, injuries and damage to property caused by highway accidents. These economic and social losses had posed many social and economic problems demanding urgent attention and it had become imperative that government should develop adequate highway safety programmes to decrease the proportion of traffic accidents without delay. He observed that although much attention had been devoted to improving the performance of motor vehicles with regard to acceleration and higher speeds, etc., so far much less attention had been given to safety features involving the vehicles themselves. It was however reassuring that this problem was now receiving increased attention throughout the world. Another aspect, to which he referred was that road and traffic accidents had been dealt with hitherto by investigating the cause of death, police inquiries on liability and damage to property, but there was not as yet any single administrative authority charged solely with the functions of prevention. He also referred to the important and increasing role played by local voluntary safety councils, at the national and other levels which had helped in reducing traffic accidents. Although every highway user was concerned about the prevention of accidents, he felt that attention should be specially focussed on the drivers of motor vehicles because they can endanger the lives of other users and their own. He observed that, while there was no panacea that would prevent all traffic accidents, organized team work by people in many disciplines such as engineering, edu-

cation, psychology together with stricter enforcement of regulations and increased voluntary action, could render invaluable service in making accident prevention more effective.

In conclusion, he stated that since the motor vehicle had come to stay and was destined to play an increasingly important role in national economic and social life, it was incumbent on all concerned with the problems of highway transport to ensure that the highways, vehicles and the users are properly adjusted to one another so that the integration of the motor vehicles becomes smoother and least irksome.

Vote of thanks

A vote of thanks to His Excellency the Prime Minister for inaugurating the session, to the Government of Thailand for its generous hospitality and to the ECAFE secretariat was unanimously adopted.

Convener: Mr. WANG, YU-CHING
Members: Mr. THAO SERC VOLAVONGSA
 Mr. JOSIAS K. QUINTO
 Mr. MANUS CORVANICH
 Mr. CHARAT PHAIPRADISHT
 Mr. PRACHOOM ANNAVADHANA
 Mr. PRASERT NAVARATANA
 Mr. A.A. KAHLON
 Mr. L.O. FREY
 Mr. H.L. BROWN
 Mr. W.H. VIL
 Mr. PHILLIP M. DAVENPORT
 Mr. E. BLACK

Election of Chairman and Vice-Chairman

Mr. Sirilak Chandrangsu (Thailand) and Mr. Josias K. Quinto (Philippines) were unanimously elected as Chairman and Vice-Chairman respectively.

Adoption of agenda

The agenda as adopted is given in appendix 2.

Establishment of Technical Sub-Committees

Four technical Sub-Committees were established with the following memberships to study in detailed the subject assigned to them:

Sub-Committee A. Agenda item 4 - The design and capacity of road intersection.
 Agenda item 5 - The design and capacity of road-rail intersection.

- Republic of China
 - Laos
 - Philippines
 - Thailand
 - "
 - "
 - "
 - Pakistan
 - USA
 - "
 - "
 - "
 - ECAFE

Sub-Committee B. Agenda item 6 - How to meet parking problems in the cities of the ECAFE region.

Convener: Mr. SYDNEY SCHUBERT
Members: Mr. L.N. RAY
 Mr. JOSE T. TUMBOKON
 Mr. KOMATE WONGTONGLUA
 Mr. POJANA KANTAMALA
 Mr. SONG PRATCHAYANAN
 Mr. I.P. VASSILIEV

- Australia
 - India
 - Philippines
 - Thailand
 - "
 - "
 - ECAFE

Sub-Committee C. Agenda item 7 - Driving licences:

- a. qualifications for the issue of driving licences.
- b. driving tests.
- c. policies on the restrictions and revocations of driving licences.

Agenda item 8 - Policies and administrative measures needed in licensing taxis for their economic utilization and safety in big cities of the region.

Convener :	Mr. HIROSHI MATSUMOTO	- Japan
Members :	Mr. ZIEN, YIH	- Republic of China
	Mr. YOSHIE HARA	- Japan
	Mr. TAKAYOSHI KITAMURA	- "
	Mr. TIAO JAISVAD VISOUTHIPHONG	- Laos
	Major BOUALY PANNHASITH	- "
	Mr. ADOLFO V. CELERA	- Philippines
	Mr WONG KENG SAM	- Singapore
	Pol. Col. SRISAK DHAMARAK	- Thailand
	Pol. Col. VARINTR NETRABOOTH	- "
	Mr. BUI-VAN-QUOI	- Republic of Viet-Nam
	Mr. C.N.R. RAU	- ECAFE

Sub-Committee D. Local traffic problems to be observed and discussed by the experts attending the Study Week :

1. Vehicle headlights - visibility and glare.	2. Regulation and control of speed and its effect on traffic flow and accidents.
	3. Traffic flow and congestion in Bangkok.

Convener :	Mr. JOHN HUGH JONES	- Thailand
Members :	Mr. R. HUSSENET	- France
	Mr. ARUN KANTI DAS	- India
	Mr. SUNGWARN WONGWAN	- Thailand
	Mr. SUPACHAI WANGLEE	- "
	Mr. UDOM SRI SAO VAJATI	- "
	Mr. GUN NAGAMATI	- "
	Pol. Lt. - Col. SARIT SUNGKAWATR	- "

Documentation

A list of technical papers dealing with the various aspects of traffic engineering and highway safety contributed by governments and organizations are given in appendix 3.

Adoption of the Report

At its concluding plenary session on 10 June 1963, the Study Week Group considered the reports of the Technical Sub-Committees and adopted the report.

Some participants drew attention to the fact that the Study Week on Traffic Engineering and Highway Safety, which had so far been convened by member governments of the region under the auspices of ECAFE on three occasions, had been playing an increasingly important role in keeping alive the interest of governments in the problems of traffic engineering and highway safety had also provided a very useful forum for experts from within and outside the region to exchange knowledge and experience on important highway safety problems. They therefore felt that it would be desirable if such

study weeks could be regularly convened by member governments under the auspices of ECAFE, so that those problems which had so far not been dealt with by the study weeks could be taken up. In this connexion, it was suggested that a future study week might be convened in one of the developing countries of the region, such as Singapore, where participants would have opportunities to study traffic problems in a busy metropolitan area and the study week could specifically deal with the following items:

- (1) The design and capacity of road, and road-rail intersections.
- (2) Training of enforcement staff.
- (3) Local traffic problems.

The participant from Singapore stated that he would convey the suggestions of the participants that the next session of the study week should be held in Singapore to his Government and would in due course communicate its decision to the Executive Secretary.

The Study Week noted with interest that the Government of Thailand (Royal Thai Transport Department) had held a national highway safety week

during the same period as the Third Study Week on Traffic Engineering and Highway Safety and in this connexion had arranged a highway safety exhibition. The Government of Thailand had kindly extended all facilities to the participants to visit the highway safety exhibition, which was found to be technically interesting by all the participants who visited it. The Study Week placed on record its sincere appreciation to the Government of Thailand for having provided an opportunity for the participants to visit this interesting exhibition. As a means of encouraging better and safer driving, the Organizing Committee of the Highway Safety Exhibition and the Police Department (Public Safety Division) presented, in a ceremony held during the closing session of the Third Study Week on Traffic Engineering and Highway Safety, certificates and prizes to 25 public vehicle drivers who were considered to be the best for the year 1963.

The attention of the Study Group was specially drawn to the need for providing technical assistance to the countries of the region in order to assist them in developing a sound highway safety programme on a national basis. In this connexion, it was noted that useful results had been achieved by establishing a panel of experts in different fields, with the co-operation of the United Nations Bureau of Technical Assistance Operations (BTAO), which upon request from governments, visited the countries concerned and made on the spot studies and recommendations for further action on the part of governments. It was felt that this procedure should also be adopted for providing technical advisory services in the field of

traffic engineering and highway safety and the Study Group recommended that the Executive Secretary should, in consultation with BTAO, arrange to form a team of 2 experts—one in highway safety and the other in traffic engineering and that interested countries might request this team to visit them and make on the spot studies leading to recommendations for establishing highway safety programmes and for introducing modern techniques of highway traffic engineering.

The Study Group was also of the view that, as a follow-up action, it might be useful if ECAFE member and associate member countries could, by mutual agreement, arrange for experts from individual countries to tour the other countries in order to undertake first-hand observation and study of traffic engineering and highway safety problems and to facilitate exchanges of views and experience between the participating experts from the different countries of the region. To implement this suggestion, it was felt that it would be useful if interested countries would extend through ECAFE appropriate invitations to other countries of the region. A beginning might be made by studying problems such as training, education and public information on traffic engineering and highway safety, parking problems, taxi licensing, and administration and driver licensing, regulation and control. These exchanges of experts enable them to enrich their experience and knowledge. The Study Group felt that such a programme could be implemented either by bilateral agreements or through such aid programmes as the Colombo Plan technical assistance programmes.

II. DESIGN AND CAPACITY OF ROAD AND ROAD-RAIL INTERSECTIONS

(The Report of the Sub-Committee A)

1. Introductions

With the phenomenal increase of road transport in recent times the congestion and the undue delays at road intersections have become more or less a universal problem. This situation is perhaps aggravated in most of the cities in the ECAFE region by the variety of modes of transport and the mixture of fast and slow moving vehicles. Due to implementation of fairly large scale development programmes, the number of vehicles on roads is steadily increasing. Thus finding ways and means to solve this problem has become very urgent, particularly pertaining to intersections. It has been generally accepted that the capacity of a road depends largely on the capacity of road intersections. In this context, the solution of congestions and delays at intersections is of a very high priority.

2. Purpose of study

The purpose of this Sub-Committee has been to compile a study on the subject and to make recommendations for countries to follow when improving existing intersections and factors to be borne in mind when undertaking new construction. The Sub-Committee is of the view that, as the scope of such a study is very wide and the time available so short, it can only make some very broad observations and general recommendations and that fresh problems arising in connexion with road traffic may be taken up at a future study week. It was decided that the present study would be on the basis of maximum flow of traffic through road intersections with minimum delay and with due regard to safety.

3. Essential characteristics of an effective improvement programme

Improvement of road intersections can be mainly achieved by the education of road users, proper enforcement of traffic laws, and better planned layouts of road intersections. These can be classified under three headings, namely, Education, Enforcement and Engineering. It was, therefore, proposed to carry out studies of these three equally important aspects in turn.

Education

Since road can only be efficiently used by well-informed road users, their education is of prime importance. It is recommended that all available media be used, i.e., radio, television, press, cinemas, posters and safety weeks in schools. These campaigns should always be backed by police activities as these will contribute to their success. Motorists and pedestrians alike should at all times have a good knowledge of existing traffic regulations.

Enforcement

Although most countries do have traffic rules and regulations, highway codes, etc., unless these are effectively enforced, the smooth flow of traffic and prevention of accidents cannot be achieved: hence the police should actively enforce them and, on the basis of their experience, recommend such changes as seem to them desirable.

Engineering

Road intersections may be broadly classified under two categories, namely, urban intersections and rural intersections. As the latter are generally composed of one priority road and a non-priority road, and as these intersections are designed and constructed to accepted highway standards, the problems to which they give rise are of less concern than those relating to urban intersections. Accordingly, the Sub-Committee is of the view that the problems at urban intersections are of primary concern. It was therefore decided to confine the study to problems at urban intersection, for which the first requirement is the carrying out of a comprehensive traffic survey. This traffic survey should be on the pattern of time, speed and volume, and should cover:

- (i) Physical characteristics of an intersection,
- (ii) Vehicle characteristics,
- (iii) Road-user characteristics,
- (iv) Road signs, markings and traffic signals.

Physical characteristics of an intersection: The intersection should have sufficient width. The condition of the roadway should be smooth and level to

ensure that maximum safe speed can be maintained when negotiating the crossing of the intersection. The geometric design of the intersection should be such as to provide a smooth flow of traffic in all directions. In order not to interfere with the flow of traffic, parking, loading and unloading should not be permitted within its immediate vicinity. These should be restricted to areas beyond the intersections at distances to be determined by local conditions.

Vehicle characteristics : If the local pattern so demands, heavy or slow moving transport should not be permitted to cross the congested intersections during peak hours.

Road users characteristics : It should be emphasized that roads are built for motorists as well as pedestrians. Both should observe existing rules and regulations and show courtesy towards each other to avoid delays and ensure safety.

Road signs, markings and traffic signals: Signs must be easy to understand, easily visible and legible at night as well as in the day time, adequate in numbers and placed at such distances as to give adequate time for the driver to make a decision. They should include prewarning signs that an intersection is being approached and directional signs to give the drivers sufficient time to choose the right lane. The lane should be clearly painted on the road surface at adequate distance from the intersection starting with broken lines followed by a solid line up to the pedestrian crossing. All curbs at the intersections should be painted in white or yellow stripes for easy visibility. The traffic signals should be easily visible and regulated so as to assist the movement of the major trends of traffic in order not to impede the traffic flow.

4. Design and capacity of road-rail intersection

Road-rail intersections may be classified under two headings: (i) unguarded crossings, (ii) guarded crossings. At a road-rail crossing, the problem is somewhat different from that of a road intersection. At the former, the rail traffic always has the priority and this feature should be taken into consideration when providing protection at level crossings. At railway crossings the primary concern is to protect the road traffic against accidents and also to some degree, to minimize the duration of the closure at the crossing and thus avoid undue delays to road traffic, and to rail traffic in some special cases,

(i) General requirements at unguarded crossings:

Incidence of accidents is always highest at unguarded level crossings and this class of crossing therefore requires very efficient and effective warnings and protection. It is essential that a road user should have sufficient advance information when he is approaching a road-rail crossing. With the steady increase in the speed of motor vehicles, the warning should be sufficiently advanced to enable a motorist to reduce speed before he reaches a level crossing. To meet this situation it is essential that more than one pre-warning sign is to be provided. The road surface through the railway crossing should always be as smooth and level as possible in order to provide safe movement of traffic over it. Another important requirement at an unguarded level crossing is good visibility for the road user. A motorist when approaching a level crossing should be able to see an approaching train from an adequate distance to enable him to stop his vehicle in good time. In providing good visibility at a level crossing the speeds of both the train and the road vehicle should be taken into consideration. In a case where good physical visibility cannot be economically provided, it may be desirable to install a "stop" sign which would demand that the motorist stop ahead of the crossing before proceeding. At all crossings warning and pre-warning signs should be provided according to internationally accepted standards and be installed at adequate distances. The Sub-Committee would recommend that these should conform to the following established distances: The first pre-warning sign should be installed at not less than 150 metres from the crossing, the second at 100 metres and the third at 50 metres. These warning and pre-warning signs should be clearly visible and legible both night and day. In addition to the pre-warning signs it may be necessary to install light and/or bell signals. When road traffic is considerably increased, in order to give maximum safety for the road users, the crossing should be guarded.

(ii) General requirements at guarded crossings :

A pre-warning sign should indicate what type of crossing a motorist is approaching. The duration of closure of the crossing to the road traffic should be kept to the minimum so that this traffic is not unduly held up. Its length depends largely on the type of the barrier used and the method of the operation. The barriers or gates should at all times be marked in order to give the motorist timely warning. The co-operation

of the road user will greatly help in reducing the duration of closure of the crossing to the minimum.

Protection at guarded road-rail crossings is generally provided by either gates or barriers. Gates are generally of the swinging or sliding type and barriers are generally either half or full barriers of the lifting type. The gates or barriers are usually operated by three different methods, i.e. manual, automatic or remote control; of these the first two are generally used. In the case of gates or barriers operated manually, the duration of closure depends on the system adopted for the gate-man to be advised of an approaching train. In this connexion, the Sub-Committee would recommend that the system of advising the gate-man of an approaching train should be such that he need not close the gates too early and cause undue delay to road traffic. For this purpose a very efficient communication system between the nearest station or signal box and the gate-man should be established. It would be most advantageous if the indication to the gate-man could be given by the train itself. This could be provided by the installation of suitable automatic devices. To further reduce the duration of closure, the automatic operation of barriers or gates should be considered. It is also recommended that for maximum safety to road users the gates or barriers and the gate or barrier signals should be interlocked.

While this system of automatic operation of the barriers or gates reduces the duration of closure to the minimum, certain other problems arise in the working of such crossing. Although sufficient warning

signals and indications are given to the road users of the proposed lowering of a barrier or closing of a gate, these warnings are invariably ignored and can result in serious accidents. It is therefore very important that the warning signals should be of a type easily understood by the road users and given well in time so that they will halt their vehicles before a barrier or a gate starts moving. If, when the limit of reducing the duration of closure of the road by these various methods has been reached, hardships and delays to road users continue, the authorities concerned should consider the question of grade separation.

The Sub-Committee is of the view that both at guarded and unguarded crossings all buses should stop ahead of the crossing, before proceeding.

General remarks

The above remarks should be taken as guidance, as it is impossible for the Sub-Committee to make suggestions with exact patterns to suit every case. However, implementation of even some of the suggestions made above will improve the flow of the traffic and increase the safety of the road users. The Sub-Committee would recommend that a standing committee be set up in larger cities in countries within the ECAFE region to deal with the ever-increasing problem of the road and road-rail intersections. The Standing Committee, which should include appropriate officials of the Highway, Highway Traffic Engineering, Traffic Police and Railway Departments and representatives of road-users should recommend techniques for improvement and new designs.

III. HOW TO MEET PARKING PROBLEMS IN CITIES OF THE ECAFE REGION

(The Report of Sub-Committee B.)

1. Introduction

The approach to parking in most countries has developed along with the development of motor vehicles as the demand on existing curb spaces has come to exceed the supply. The first approach was the sharing of the available space by the installation of parking meters or other means of operation followed by the trend to increase the various types of off-street parking facilities. In order to preserve existing businesses today in the highly motorized cities, the degree to which adequate off-street parking facilities can be provided is being studied critically. From this examination, major features which have emerged are that the demand for parking is intimately associated with such matters as public transportation, zoning, building codes, and city planning. Hence it must be fully realized that attempts to solve parking problems by the provision of curbside control or off-street parking in specific areas will serve only as short term measures and possibly be doomed to failure unless relegated to their rightful places in the study of the overall urban problems.

2. Parking as an aspect of the urban problem

Initial examination of the parking problem must be considered along with other possibilities:

(i) *Public transportation.* To make adequate provision for the overall transportation in the community, parking policies should fully recognize the role which public and private transport should and can play. It must be recognized that both forms of transport are necessary in any future city.

(ii) *Land use and zoning.* In planning parking facilities in any particular area of a metropolitan community, recognition must be taken of land use in every other part of that metropolitan area. This is particularly true with respect to new users. A recently constructed large traffic generator can have a terrific impact on not only parking but traffic congestion in a particular area. Along with this is the provision of zoning ordinances which requires that parking facilities be provided in connexion with new buildings.

(iii) *Integration with development of high-class roads.* It is axiomatic that the character and amount of parking space that may be needed in any particular area of a city is intimately related to highway improvement. The terminal point of a new expressway for example leading into the heart of a city may well constitute a logical location for establishing a parking facility. Likewise a new system of one-way streets may alter parking habits drastically.

It must be admitted that parking is only one of the aspects of the transportation problem with which any city is confronted. Transportation today is so broad and so complex and its elements are so inter-related and inter-dependent that it is not logical to attempt resolving one problem without fitting it into the whole pattern.

The approach to parking problems must follow a logical control of land use, and the future road system must be based on traffic volumes not only for the present but in the future.

Provision has now been made for this type of study in the concept of a transportation survey where recognition has been given to the need for an integrated approach to transport planning. The data required for such a survey are:

- (a) the pattern of travel desire and traffic distribution
- (b) an inventory of land use
- (c) traffic generation characteristics of land use
- (d) characteristics of transport services
- (e) parking characteristics of various land uses including roads themselves.

3. Method of approach

With a full awareness of the relationship of the parking to the overall solution of the city problem and mindful that it must be examined in conjunction with the data outlined above the following procedure is recommended:

- (i) *Analysis of the cause and effects of parking difficulties*
 - (a) The first and most obvious reason for shortages of parking place is the

almost phenomenal increase in motor vehicles now occurring and likely to occur. It is necessary to make predictions regarding vehicle increase for all types of vehicles involved.

- (b) Along with this growth will come changes in the structure of the city. People will tend to disperse and the area of the city to increase as a result of the increased mobility which the automobile offers.
- (c) As vehicle use increases, more people will desire to park in the business district and the conflicting claims to space of moving traffic and vehicle parking will be magnified.
- (d) The time and economic losses resulting from searching for a parking place offset the fast and convenient transportation which the automobile offers.
- (e) The inconvenience caused to the motorist by not being able to find parking place can result in his carrying out his business elsewhere in the outlying area.
- (f) As a corollary, businesses tend to be relocated away from the central area and the future of the central area is unstable.

(ii) *Factual studies and expert interpretation*

- (a) A sound parking improvement plan cannot be formulated without a knowledge of the facts applying to that particular city. It may be possible to generalize the result of one city when compared with another but this is not sufficient for tackling that city's parking problems.
- (b) The most effective and satisfactory method of obtaining complete and comprehensive facts is through a well organized parking survey.
- (c) The elements of a parking survey require information on population trends, vehicle trends, cordon counts, curb and off-street use, available parking time, purpose of trips of parkers and motorists, parking needs and desires.

- (d) On these factual data expert analyses and interpretations must be based.
- (e) These interpretations lead to recommendations regarding the conclusions, policies, both legal and financial, to be adopted.

(iii) *Improving curb parking conditions*

- (a) It is not wise to think of the parking problems principally in terms of parking at the curb. Curb space perhaps may be available in terms of present demands but it is certain that it will not be adequate for future demands.
- (b) Therefore the planning for its use must be further distributed as to benefit the greatest number of persons or those persons whose use of the curb is most justified.
- (c) Hence various sorts of restrictions on time and space are inevitable.
- (d) Parking is restricted by *time* to give more people the opportunity to use the space.
- (e) Parking is restricted by *space* to benefit moving traffic or to facilitate loading, or for other purposes warranting prior claim to the use of the curb space such as safety.
- (f) Generally where curb parking space is most desired it is most restricted both by time and location.
- (g) Failure to define parking stalls by pavement marking will result in insufficient and haphazard use of the space.
- (h) It is an accepted principle that the needs of moving traffic should have precedence over curb parking and that parking should be limited to off peak hours.
- (i) In small communities, parking congestion can often be relieved by the construction of by-passe roads for through traffic.
- (j) Regulations governing curb parking must be reasonable, warranted by conditions and clearly and simply set forth on signs.

- (k) The signs should be worded as briefly as possible, properly maintained, and readily understandable.
- (l) The decision regarding angle or parallel should be based on the width of the roadway and the demand upon the roadway for vehicular movement.

(iv) Off-street parking

- (a) The parking problem of a city will never be solved by the provision of curb parking alone. Off-street facilities must be provided.
- (b) It must be recognized that the problems of handling all-day parking and short time parking demands are separate and that off-street parking is necessary for the all-day parkers.
- (c) Off-street loading facilities should also be provided if possible.
- (d) Consideration should be given to the co-ordination of off-street parking facilities with major traffic arteries.
- (e) The provision of off-street parking facilities so as to fit in with certain desired effects as a result of planned land use is a new concept which has been mentioned earlier in this paper.
- (f) Due to the high cost of central city land, "fringe" parking areas have been developed with some success for all-day parkers, but to short time parkers this is not acceptable.
- (g) The economics, financing, construction, layout and methods of operation of off-street parking areas require intensive investigation.

(v) Information and education of the public

- (a) Even before a parking problem arises, the public be informed as to parking problems and their effects.
- (b) The installation of a new system of parking should be widely publicized and the publicity continued for a considerable period.

(vi) Legality

- (a) The legal aspects associated with parking, and relevant matters should be examined closely.

(vii) Enforcement

- (a) The success of any curb parking layout depends to a large degree on the degree of enforcement applied.

4. Special considerations

(1) The merits of banning parking in the central area, and the operation of a feeder bus service

The increase in numbers and in utilization of automobiles have created a community problem, leading especially to strangling congestion of downtown city streets.

About two-thirds of all automobiles are owned by people in urban areas. Most of these cars come downtown everyday, thus creating traffic congestion and consequent economic waste. This gives rise to a great demand for on-and-off street parking facilities. It has also led to current and proposed expenditures for street and highway improvement.

Traffic engineers are becoming increasingly aware of the dangers of continued downtown congestion. It is slowly, but surely, becoming apparent that an unfettered expansion of automobile utilization with a "blindly following" programme of street and highway improvements is not the way for the central city to fulfill its role in urban metropolitan growth and development. A better balance between the use of private automobiles and public vehicles must be restored. In the vital job of moving people, future plans must include properly balanced programmes for street improvement, off-street parking, and improvements to the transit system and its facilities.

The efficiency of transit vehicles gives the traffic engineer an opportunity to prescribe solutions for the problem of downtown congestion which are practical and feasible in terms of space and money.

Take the average private automobile of today's vintage—some 17 feet long and 6½ feet wide. It requires a space of 110 square feet over which to "exist" at any moment, and seats an average of 1.5 passengers during peak periods. A large transit bus, some 40 feet in length and 8½ feet wide, handles 60 passengers with ease (a few more if necessary), and occupies 340 square feet at any moment.—

Thus, the bus described is the equivalent of forty automobiles at average automobile loadings. Its use to move these passengers would relieve the streets of forty automobiles and would constitute an important contribution to the relief of downtown traffic congestion. Remember, the basic problem is one of movement of PEOPLE, not vehicles; for it is People, not automobiles, who work downtown, shop downtown, etc.

The bus takes up more room in the public streets but requires much less street space per passenger, as the following comparison shows: (a) motor bus 340 sq. ft. divided by 60 passengers, or about 6 sq. ft. pass. (b) private automobile—110 sq. ft. divided by 1.5 pass., or about 75 sq. ft./pass. Thus, in its "static" use of street space, the transit vehicle is $75 \div 6$ or $12\frac{1}{2}$ times as efficient as the automobile in carrying passengers.

Let us assume that the transit vehicle operates only $\frac{1}{4}$ as fast as the automobile:

$12.5 \times \frac{1}{4}$ equals to 9.4; thus, allowing for its longer occupancy of any one square foot of space due to its relatively slower speed, the transit vehicle is STILL 9 times as efficient as the automobile in its use of street space to move persons.

Transit vehicles and automobiles differ in one highly significant respect which has no direct relationship to their use of street space for MOVEMENT but which does directly affect their relative TOTAL SPACE REQUIREMENTS.

— When the transit vehicle rider arrives downtown he alights from the vehicle "ready for business".

— When the motorist arrives, he must first find a space in which to LEAVE his car - in an unmetered or metered parking space on-street, or in a lot or a single or multi-storied garage off-street. This space comprises the space taken up by his car and a margin for manoeuvrability - an added $4' \times 6.5'$ or 26 square feet. On a "per passenger" basis, this amounts to an additional $26 \div 1.5$ or 17 sq. ft. per auto passenger; adding the 75 sq. ft. per passenger for the vehicle itself, we have 92 sq. ft. per automobile passenger for a parked car in the downtown terminal area.

A definite and inescapable requirement for the automobile is 92 sq. ft. per passenger in which to park and 75 sq. ft. per passenger occupied any moment while in motion. Contrasted with this, the transit vehicle rider requires NO PARKING SPACE, and only 6 sq. ft. per passenger while in motion.

(2) *Comparison of parking meters and manually supervised parking*

Pay parking at the curbside has certain obvious advantages over free, time-restricted parking.

(i) Pay parking helps to eliminate the casual motorist who has no particular reason to park and thus permits more parking for people with a real need.

(ii) It affords a much tighter control of violations.

(iii) It facilitates more orderly parking and more effective use of available space.

(iv) It provides income to defray the cost of the equipment and supervisory service and also, in most cases, additional revenue which can be considered as income from the short-term rental of public property.

The decision whether to install parking meters or to use manual supervision under a pay parking system is largely a matter of economics. Thus a manual system will be preferred in areas where labour is cheap and parking fees are low. Whereas in places where parking attendants can demand high pay there will be a preference for metered systems. In such areas also, parking meters may be cheaper than in non-industrialized areas with low wages. It should be recognized, nevertheless, that a metered system requires the frequent personal checking of violations and the regular collection of meter receipts. On the other hand a sound system of manually supervised parking on a time-limit basis requires accurate time-recording equipment. The manual system also requires detection of violations and a system of inspection to assure honesty on the part of the attendants. (See section 5 for details of Bangkok's experience with attendant supervising and meter parking.)

The advantages of the manual system increase where administrative operations can be concentrated in a small area and there is a rapid turn-over of parked cars. Thus in the United States, parking lots are for a large part attended. Furthermore the authority given to attendants to move vehicles permits more effective use of available parking areas. Manual supervision is less effective for curbside parking where an attendant must supervise a fairly large zone. Delays or errors in issuing parking receipts can cause considerable annoyance to the public. It is difficult for attendants to function efficiently in areas where there are only a few scattered pay-parking places interspersed with extensive

no-parking zones or in pay parking zones with a low occupancy rate. On the other hand, manual supervision prevent the more flexible use of available parking places and eliminates waste of space for smaller cars and cramping of larger vehicles into too-small metered spaces. Attended parking also eliminates burglary and vandalism of meters, which has been a serious problem in some areas. A manual system also permits greater financial flexibility. Revision of parking rules and fees can be made without extensive alteration of mechanical equipment. Attendants can more easily enforce systems based on the size of a vehicle and charge fees varying according to the time of day or length of parking period. Occasionally parking meters cannot be installed because of physical limitations such as lack of curbs or narrow sidewalks. Operation of parking meters can also prove cumbersome and impractical in countries where appropriate coins are not used or are in short supply. Finally an attendant-operated system can provide security for parked vehicles, thereby reducing the need for regular police surveillance of theft and pilferage.

(3) *Off-street parking versus on-street parking*

a. Off-street parking

Two basic types off-street parking facilities are :

- (i) surface lots
- (ii) multi-floor structures
 - a. ramp garages
 - b. mechanical parking devices.

Off-street parking facilities, considered in terms of ownership and operations, develop other classifications:

- (i) privately owned and operated
- (ii) publicly owned, privately operated
- (iii) publicly owned and operated.

All types of off-street facilities have been operated successfully. No one type can be labelled the best. The success of each depends on local conditions, siting, operations, and other circumstances. Each city must decide which type will best serve its needs. Efforts can then be directed toward a specific goal rather than divided among conflicting approaches.

The lack of sufficient curb space to satisfy current parking demands exists in all cities of the ECAFE region. Curb parking regulation juggle the use of available space and temporarily help the parking situation. But permanent relief can come only from off-street developments.

A city, in undertaking an off-street parking programme, must set important policy decisions including :

- (i) Administration of off-street parking programme
 - (a) To place activity under a separate department, such as the traffic engineering department;
 - (b) To establish a separate city department for off-street parking;
 - (c) To appoint a parking committee, commission or board;
 - (d) To create a parking authority.
- (ii) Acquisition of land for off-street parking facilities
 - (a) donation or gift
 - (b) purchase
 - (c) lease
- (iii) Type of facilities
 - (a) garages
 - (b) surface lots
- (iv) Operation
 - (a) city
 - (b) commercial operators.

b. On-street parking

On-street, or curb, parking can be divided into three classes developed as the parking problem became more critical:

- (i) unrestricted curb parking
- (ii) restricted curb parking
 - (a) police controlled (through enforcing restrictions posted on signs)
 - (b) meter controlled.

On-street parking is convenient only for the parker fortunate enough to find a space reasonably near his destination. It is inconvenient, and to a certain degree unsafe, for the majority of motorists in moving vehicles.

In areas of concentrated land use, such as city central business districts, the disadvantages far outweigh any advantage claimed for on-street parking.

The encouragement of off-street parking in cities of the ECAFE region will necessarily involve important decisions on:

- (i) *Elimination of curb parking* The decision to eliminate curb parking, however, must be based on the result of careful study of local conditions and needs. From extensive parking information collected and carefully analyzed, a policy can be established and definite relief measures initiated.

Determination of policy must be tempered by local considerations. Since many may consider prohibition of curbside parking as a drastic step, every effort must be made to balance conflicting interests and needs.

(ii) *Time-limit control of curbside parking.*

Time-limit controls force sharing of curbside parking spaces and afford the only fair way to use curbside spaces when demand begins to exceed supply.

Time-limit controls should be installed only after careful study to insure that the regulations ultimately adopted are realistic, enforceable and productive of results.

(iii) *Enforcement.* Parking restrictions are only as effective as the effort to enforce them. Regulations that can not be enforced might better be rescinded. Regulations carefully related to parking needs and impartially enforced help to achieve the best use of existing facilities.

5. Some experiences with parking in cities of the ECAFE region Bangkok, Thailand

a) Background—pay parking was first introduced on five streets in Bangkok in September 1960. The system employed was one of manual supervision whereby some 87 attendants supervised some 400 parking spaces. Parking fees were fixed at two baht an hour and cars were identified by small hand-written slips stuck behind the windshield wiper.

In August, 1961 parking meters were installed on four of the five streets which had been under manual supervision. Meters on these streets include 333 of the total of 750 meters now installed in Bangkok. Manually supervised parking is still in effect on Songwad street because of lack of adequate curbside space to place parking meters. The installed cost of each meter is 2,500 baht (US\$125) and it is estimated they have a ten year life. Only 17 persons are required to attend the 333 meters as compared with 72 attendants under the previous manual system and parking fees remain the same as under the manual system, i.e. 2 baht (10C.) an hour. At first the collection of coins from parking meters was performed by hand by the collector but the loss in receipts was so great that it was found necessary to purchase automatic coin extracting devices which give the collector no personal access to the receipts.

b) Financial results—comparison of returns obtained by the Bangkok municipality under the two systems reveals an average profit of ticals 151.34 per

space per month for metered parking as compared with 102.56 baht per space for the same areas under the manually attended system. Gross revenues in the study have declined from 238.67 baht per space per month under the manual system to 205.31 baht for metered parking. (There are reasons to believe that construction work in some of the streets since installation of meters has curtailed parking.) Operating costs, however, have declined to an even greater degree than receipts; i.e. from 135.73 baht under the manual system to 53.97 baht with meters.

An outline of the calculation is as follows:

MANUAL SUPERVISION:	Per space Baht per month
Revenues:	
Monthly average receipts for period Sept. 1950–Aug. 1961	238.67
Expenses	
Wages of 72 attendants at 600 baht each per month	129.73)
	<u>6.00)</u>
	<u>135.73</u>
Monthly profit per space	102.94
METERED PARKING:	
Revenues:	
Average per meter for 333 metered spaces for period Sept.–Oct. 1961 and Oct. 1962–May 1963	205.31
Expenses	
Capital charges (amortized over 10 years):	
Meters (at cost of 2,500 baht each)	20.83
Coin collection devices (pro- rata cost of 5 at 3,500 baht each)	<u>0.53</u>
Total capital cost	21.36
Operating expenses (per meter basis):	
Wages of 12 meter watchers at 600 baht each per month	21.60
Wages of 5 receipts collectors at 600 baht each per month	9.01
Average cost of mechanical maintenance per meter	<u>2.00</u>

Total operating expenses	<u>32.61</u>
Total expenses	<u>53.97</u>
Monthly profit per space	151.34

c) General observations on Bangkok's experience—Bangkok has found parking meters to be both convenient and acceptable. They are economically worthwhile and have obtained general public acceptance. At first both motorists and shopkeepers did not like them, but more recently shopowners have sometimes requested installation of parking meters in front of their establishments. One of the major problems in Bangkok has been the shortage of 50 satang coins required by the meters. However, as experience has developed shopowners and some filling stations have been providing change in 50 satang pieces as a public service. Bangkok has experienced little difficulty with vandalism or pilferage of parking meters, and damage to and theft from unattended cars are not serious problems.

New Delhi, India

An assessment of the parking demand was made and the following approach recommended:

- a) The maximum use should be made of the available space by demarcation of parking stalls;
- b) Entrances to and exits from the parking areas to the main roads should be kept to a minimum;
- c) Separate parking lots should be provided for short time parkers with lesser walking distances than all-day parkers;
- d) Parking meters which will operate between 9 a.m. to 7 p.m. should be installed.
- e) Zoning ordinances should be enforced to provide for the minimum parking requirements when new buildings are constructed;
- f) Curb parking should be minimized in important roads by enhancing the parking meter rates in central business areas;
- g) Off-street parking should be encouraged;
- h) Slow moving vehicles should be banned on important road;
- i) Heavy duty vehicles should be banned during peak hours.

Madras, India

A survey of Madras revealed that 72 per cent of the vehicles parked for more than 20 minutes, and only five per cent of the cars were parked for more than 60 minutes. It also revealed that the parking facilities provided by public and private buildings were inadequate and that the location of taxi stands, bus stops and cycle parking needed a change. The recommendations of the survey were:

- a) to include 30 minutes curb parking;
- b) to carry out marking of stalls and signing of regulations;
- c) to relocate taxi stands and bus stops;
- d) to enact a zoning ordinance prescribing parking space provision for buildings.

Tokyo, Japan

Emergency parking spaces have been provided every 1000 metres along the 71 km. divided arterial Tokyo expressway. The Tokyo Engineering Corporation anticipates the building of parking facilities for about 2,000 cars in downtown Tokyo. The Tokyo metropolitan government proposes to construct off-street parking garages for about 13,000 cars before 1966. The Expressway Corporation plans parking garages directly under expressway or close to the off-ramp so that the outward flow of traffic from the expressway will have a minimum effect on the congestion in downtown streets. The Corporation's first parking garage with a capacity of 420 cars was completed 1962. It is a two-floor underground parking garage directly beneath the elevated expressway, constructed as an integral part of the expressway's foundation. Garages of a similar type are also under construction.

Saigon, Republic of Viet-Nam

The following are some of the measures taken to improve parking by regulations:

- a) Parking is allowed only along on the right side of oneway streets;
- b) Parking is allowed alternate sides depending on whether the date is odd or even in narrow two-way streets;
- c) Parking is prohibited during peak hours in streets where traffic is heavy at office opening or closing time.

In many thoroughfares which carry heavy traffic, and must be kept clear, parking is always prohibited.

However, with the rapid increase in the number of vehicles, these measures are becoming less and less effective and new solutions are proving necessary.

Manila, Philippines

Statistics show that today about 50 per cent (about 100,000 vehicles) of the 200,000 vehicles registered in the Philippines operate on the Manila streets. During the last decade the scarcity of parking spaces in the central business sections has become apparent. Some ten years ago, a limited parking survey was made in downtown Manila by the Bureau of Public Highway in co-operation with the United States Bureau of Public Roads. Since then, no additional survey has been made. In the sample study made in the early 1950s, the area considered consisted of 88 blocks in what were the central districts in that time. After deducting corner clearances, fire plugs and driveway frontages and other prohibited curb locations, there remained a curb parking supply for 1422 passenger cars.

Any future parking study must be aimed at determining among other things:

- (a) the supply and demand of parking spaces both on-street and off-street
- (b) usage of both on-street and off-street spaces
- (c) origin and destination and trip purposes of parkers
- (d) the number of blocks parkers are willing to walk to and from their point of destination.

On-street parking spaces can no longer be provided in Manila especially in the major streets. It is considered that on-street parking will have to be prohibited to ensure an orderly flow of traffic. The remaining on-street parking spaces will continue to dwindle. It is fully realized that business and industry must discontinue relying on curb space for parking. The present and future demand of moving traffic in Manila will not permit storage on even a square

feet of surface. Three alternatives are proposed for solution:

- (a) construction of more off-street parking facilities.
- (b) decentralization
- (c) zoning provision for parking.

A significant proposal has recently been made by the city government to utilize as parking spaces riverside and esteros instead of backyard lots. The latter is not feasible as almost all areas are already developed and covered by improvements. This proposal has many advantages:

- (a) These areas are within walking distances of the central business districts;
- (b) They are owned by the Government and do not involve long negotiation and purchase expense as with private properties. Also currently under study is a plan to construct an underground parking garage beneath a downtown plaza in the city. A progressive step has been carried out by an addition to the building code which requires newly constructed buildings to provide parking for the traffic it will generate. It is realized that the solution of Manila's traffic problems will be highly expensive due to its constricted layout and its existing improvements.

6. Conclusion

In conclusion it must be recognized that the parking problem will neither solve itself nor be eased in the near future and that as traffic increases the problem will be magnified. It is true to say that no city has really solved its parking problem. The growth of automobile traffic is making such an impact on cities of the ECAFE region as to affect their whole structure. It is therefore apparent that organized planning on a metropolitan or regional basis to include all phases is indispensable. While it is admitted that this planning will not guarantee perfection, it will at least ensure progress.

IV. DRIVING LICENCES

(The Report of the Sub-Committee C)

The Sub-Committee in reviewing the practices and procedures governing the issuance of driving licences in the countries of the ECAFE region specially stressed that while all road users were either directly or indirectly concerned with the prevention of accidents, it was essential to focus attention particularly on the drivers of vehicles because they have a double potentiality and responsibility, as they can endanger their own and other lives by their inexpert or negligent handling of vehicles. With the increasing realization that driving a vehicle on a public highway is more a privilege than an inherent right of the individual, it was most important to ensure that this privilege is not abused, thus endangering the lives of others or causing properties damage. In view of this, it has become important that every care is taken to screen as carefully as possible all prospective drivers before they are granted privilege of independently handling vehicles on the public highways and that adequate provisions exist to withdraw this privilege should it become necessary by reason of its abuse or in the interest of highway safety. The Sub-Committee, therefore, was of the view that the rules and regulations for the issuance of driver licences must not only insist on proper qualifications on the part of the applicant and clearly establish his driving ability, but must also constantly keep in view the needs of highway safety.

The Sub-Committee noted that the majority of the accidents in most countries of the region are caused by the negligence or inconsiderate conduct of the drivers rather than any lack of skill in their handling of their vehicles.

The Sub-Committee, therefore, considered that it was very important to ensure that only the right type of people are granted licences and that a very rigorous and carefully devised test is imposed on the learner driver before he can obtain a licence. It was of great importance that the drivers who are prone to accident and those who have actually been responsible for accidents should have their licences suspended either for a specified period or permanently, depending on the circumstances. Hence adequate provisions for the effective enforcement of the regulations governing the granting of licences were essential.

a. Qualifications for the issue of driving licences

Age limit

The Sub-Committee felt that it was desirable to set a minimum age limit for drivers of both light and heavy motor vehicles in the interest of highway safety and that this limit could be determined by governments in the light of local conditions.

As to the maximum age limit, the Sub-Committee felt that this also might be fixed by governments at their own discretion. However, it was necessary that care be exercised in fixing this limit, taking into consideration the physical fitness of the applicant in the interests of highway safety.

Physical fitness

The Sub-Committee stressed the importance of the physical fitness of drivers as a precondition for licensing. When applying for a driving licence, the applicant should prove that he is physically fit either by producing a medical certificate issued by an approved medical authority or by a declaration to that effect, in the manner provided for by the government. Generally the declaration of physical fitness includes a statement that the applicant does not suffer from heart diseases, sudden attacks of disabling, giddiness or fainting, or any other mental or physical disabilities likely to make him unfit to drive. In some countries psycho-physical tests, such as glare, night vision, reaction time, depth perception, speed estimation, traffic light colour, etc., are carried out as part of the routine for testing applicants.

Educational and technical qualifications

The Sub-Committee noted with interest that, in some countries of the region, certain minimum educational requirements for the applicants of driving licences are fixed, such as ability to read and to understand traffic road signs, in order to drive safely. However, in other countries, no such requirements are insisted upon, although the applicants are required to have a good knowledge of the highway code and traffic regulations obtaining in the country. To lay down minimum educational standards such as elementary education in the interest of highway safety, was felt to be advantageous.

As regards the technical requirements, the Sub-Committee thought that it might be helpful if, in the case of public service vehicles, applicants are required to possess rudimentary knowledge of their mechanism.

Validity of licences

The Sub-Committee noted that the periods of validity of licences in the countries of the region varied to some extent. Generally it was one year. It was also noted that in some countries driving licences are valid for life with provision for periodical checking of the licences. The Sub-Committee felt that it would be more convenient for non-professional motorists if the licences could be valid for longer periods subject to existing local conditions.

b. Driving tests

Testing of drivers and methods of testing

The main purpose of licencing drivers is to grant the privilege of driving only to those who are :

- (a) physically capable of safe driving;
- (b) possess a good knowledge of the rules of the road and;
- (c) have the skill to drive and a proper driving attitude.

Physical fitness is recognized as an essential pre-requisite and the purpose of the actual test by all the countries of the region will give an idea of the applicant's ability to drive. Physical fitness is one of the essential qualifications required of an applicant before he can apply for a driving licence. Proof of the applicants knowledge of the rules of the road and skill and attitude in driving can only be established after a test.

It is generally recognized that a driving test must always include a test of the applicant's knowledge of the highway code in force in the country. The test on the highway code or other traffic rules and regulations may be a separate test either written or oral, or it may be part of the test on the road.

As the methods of testing in the countries of the region were found to vary, it was felt that the basic items set out below might be followed when road tests are applied:

1. Starting the engine of the vehicle.
2. Moving away straight ahead or at an angle.
3. Turning right or left hand correctly.
4. Stopping the vehicle in an emergency and bringing it to rest at an appropriate part of the road.

5. Driving the vehicle backwards and while so doing entering a limited opening either to the right or the left.
6. Causing the vehicle to face in the opposite direction by the use of forward and reverse gears.
7. Giving by hand and by mechanical means (if fitted to the vehicle) or in the case of a disabled driver, for whom it is impracticable or undesirable to give signals by hand, by mechanical means in a clear and unmistakable manner, appropriate signals at appropriate times to indicate the driver's intended actions.
8. Acting correctly and promptly on all signals given by traffic signs and traffic controllers and taking appropriate action on signs given by other road user.
9. Stopping the vehicles on a slope and re-starting.

Testing on road or in special grounds

The Sub-Committee was of the view that, wherever possible, testing should be undertaken on public roads, as this will enable the tester to gauge the driver's ability to meet conditions normally encountered on the road. However, in cases where testing on the road is impracticable because of traffic congestion or because of the large numbers of drivers to be tested at one time, such tests may take place in a special testing ground.

Driving school

The Sub-Committee considered that in some countries of the region, certificates issued by driving schools are acceptable in lieu of actual road tests for the issue of driving licences. It was felt that while there was no objection to this arrangement, it must be emphasized that a high standard should be set for the operation of these driving schools and that they must be carefully regulated and controlled by the licensing authorities.

Standards for drivers of different types of vehicles

The Sub-Committee considered that the tests mentioned earlier are the minimum for all applicants to qualify for licences to drive private motorcars. Additional tests should be taken by applicants for licences to drive public service vehicles and heavy vehicles. Tests for a licence to drive public service vehicles should include the following:

- (a) The applicants' knowledge of the topography of the city and the area where he intends to operate;
- (b) Some knowledge of the mechanism of the vehicles.

Some countries of the region may find it desirable to make it a condition for granting a licence to drive a public service vehicle that the applicant must have possessed a driving licence for private motor-cars for a certain length of time.

Periodical testing

The Sub-Committee considered that in most countries of the region periodical testing of the driver's skill in driving is most required, although some form of simple medical test should be carried out before renewal of licences. The Sub-Committee considered it desirable that periodical testing should be carried out of those drivers who have been involved in serious traffic accidents or who have been found guilty of serious driving offences and whose licences have been suspended for a long period.

If at the time when the driver qualified for a driving licence, he employed glasses, hearing aids or other devices, the validity of the driving licence must be made conditional on the use of such aids by the holder of the licence while driving.

Provisional driving licence

The Sub-Committee considered it desirable that before an applicant appears for a driving test he should have a period of probation, wherein he has an opportunity to learn driving under the guidance of a licenced driver under actual traffic conditions. The learner driver must not drive unless accompanied by a licenced driver and the vehicle must bear a plate indicating clearly that it is being driven by a learner driver. The period of probation may be fixed by the governments in accordance with local conditions. However, it is strongly recommended that, in the interest of highway safety, no passengers other than the instructor should be carried in a vehicle driven by a learner driver.

The Sub-Committee noted with interest that in one or two countries of the region bicycles fitted with auxiliary motors had become very popular on the streets. Such bicycles, in some countries, were capable of attaining a speed of 50 kilometres per hour or more. It was felt that, as they constituted an essential element of the mechanical transportation in

certain urban areas, drivers of such bicycles should also be licenced as in the case of drivers of motor-bicycles and scooters.

c. Policies on the restriction and revocation of driving licences

The Sub-Committee felt that, as most traffic accidents are caused by negligence on the part of motor drivers rather than their lack of skill in driving, a strict enforcement of traffic rules and regulations is imperative. In this connexion the Sub-Committee felt that the following points must receive special consideration.

(1) A comprehensive set of rules and regulations governing the suspension, revocation and cancellation of driving licenses should be put into force either through legislation or by other administrative regulations. These rules and regulations should make very clear to all motorists the circumstances under which their licenses would be suspended, revoked or cancelled, so that they will take care to avoid reckless driving or bad behaviour. The Sub-Committee felt that, in view of the different practices prevailing in the countries of the region, it might be desirable to inscribe in the driving licences any serious violations of traffic regulations or court convictions, as this would assist the enforcement authorities.

(2) A complete record of both major and minor traffic violations should be kept by the enforcement authorities for each motor driver committing such offenses. The Sub-Committee noted that, in some countries of the region, these matters are recorded in the driving licences while, in some others, they are recorded on separate folders to be carried along with the driving licences. In no cases, would the offenders be able to conceal records of past violations, as these should serve as a basis for checking their behaviour, especially when the authorities are considering the suspension, revocation or cancellation of licences.

(3) The Sub-Committee noted with interest the adoption of a point system by the Republic of China, where a detailed description of cases of violation is prescribed and points are given in addition to the fines and penalties imposed in accordance with the existing regulations. The points when accumulated to a certain number result automatically in the suspension or revocation of the driving licences of the violators. After its enforcement in 1962, a reduc-

tion of 4 percent in the total number of accidents as compared with 1961 was reported. The Sub-Committee felt that such a system would help considerably in keeping the motor drivers constantly on the alert when at the wheel and it therefore recommended that consideration be given to the adoption of such a system by the countries of the region. However, it considered that warning should be given to offenders when their points have accumulated to certain number before suspension or revocation of the licence is considered. The Sub-Committee also felt that parking offenses and similar other minor offenses should not be awarded points.

(4) The Sub-Committee, while considering the question of the suspension or revocation of driving licenses, attached great importance to the training of enforcement staff, with special reference to the traffic police. Not only should they have sufficient knowledge of traffic rules and regulations but also they should be well-behaved when handling cases of traffic violations. This cannot be achieved without an extensive training programme for the traffic police and others who are closely related to enforcement. The Sub-Committee felt that it might be useful to conduct further studies on the training of traffic police forces, and develop model procedures in respect to enforcement practices. Motorists will normally drive with caution when they see a traffic policeman on the road.

(5) In some countries of the region, traffic courts have been established to deal with cases of traffic violation, while in some others police decisions are considered as verdicts. The Sub-Committee felt that in the latter case offenders are deprived of their right of proper enquiry and may not have an

opportunity to know the reasons for their being charged. It was therefore recommended that traffic courts be established in these countries, so that the enforcement forces will act only as prosecutors, with the final verdict being left to the juries of the court. However, there is a limit to the number of traffic policeman which countries can recruit; consideration may therefore be given to using civic minded members of the public as monitors whose duties are to report traffic offenders to the enforcement authorities. There should be provision in the legislation for the compounding by the traffic police of minor traffic offenses. The motorist will have an opportunity of paying a fine and thereby relieving the burden on traffic court, but if he disputes the charge, he must have recourse to the traffic court.

(6) The Sub-Committee felt that the above recommendations would only help to penalize traffic offenses already committed. The basic measure in promoting road safety should be the institution of refresher and training courses for motorists, with particular emphasis on those for drivers of public service motor vehicles. These courses may include (i) one day or three orientation of those drivers who have no records of accidents, (ii) three or more days for those who have no records of no accident but who have committed traffic violations and (iii) a longer period of in-service training for those who have caused accidents due to negligence or bad driving behaviour. Such courses should include instruction on traffic rule and regulations, the proper techniques of driving and the encouragement of good driving habits. The Sub-Committee felt that such courses would contribute, to a considerable extent, to the promotion of highway safety.

V. POLICIES AND ADMINISTRATIVE MEASURES NEEDED IN LICENSING TAXIS TO ENSURE THEIR ECONOMIC UTILIZATION AND SAFETY IN BIG CITIES OF THE REGION

The role of taxis in the public transport service in a city

A well organized public transport service is a vital need in a modern city. The chief modes at present are tram cars, trolley buses, omnibuses, taxis and trains. Unlike the other public service vehicles and trains which convey passengers in consideration of separate payments made by them and which may pick up and let down passengers along the routes, the taxis generally convey a passenger or a group of passengers from point to point as desired by the passenger or passengers in consideration of a single payment only. Thus they perform a distinct function and are supplementary to the other modes of public transport.

Desirable features in the taxi industry

For the public welfare and safety and in the national interest, the following features are desirable if an efficient and adequate service is to be provided:—

- (a) Taxi owners and taxi drivers must be of good character and conduct;
- (b) Vehicles should be clean and comfortable and maintained to a high standard of mechanical fitness;
- (c) Living standards and working conditions of those engaged in the industry should be at an adequate level;
- (d) Hours of driving should be restricted in the interest of road safety;
- (e) The operators should have sufficient finance to carry on the services satisfactorily;
- (f) The services to the public should be efficient and effective and provided at a reasonable charge;
- (g) The best use should be made of available capital;
- (h) Undue or unfair competition must not be allowed to jeopardise other public transport services.

The need for control

In order to ensure that these desirable features are present in the taxi industry, some form of restrictive licensing and control both with regard to the taxis and the taxi drivers, appears necessary.

Licensing of taxis

(1) *Number of taxis to be licenced in a specific area.* The number of taxis to be licensed in a specific area would appear to depend on the one hand on the need for sufficient taxis to provide adequate and efficient service to the public and on the other hand on restricting competition sufficiently to maintain reasonable living standards and working conditions in the industry and to prevent excessive driving hours.

To assess the number of taxis that will provide an adequate and efficient service in a specific area, it may be necessary to carry out periodic surveys of passenger traffic in the area. Generally, complaints of non-availability of taxis and demand for fares above the prescribed rates would be an indication of the short supply of taxis. The demand and supply should be properly balanced. Boosting of the number of licences in excess of demand would make the trade an unprofitable venture. Short supply would give rise to "private taxis".

(2) *Zoning of taxis.* It was noted that only one country in the ECAFE region has adopted the policy of zoning taxis. This practice has its advantages and disadvantages. Further studies on the desirability of zoning in the light of local urban conditions should be made before its adoption.

(3) *Licensing procedure and qualifications for obtaining a taxi licence.* Because taxis provide a personal service to individual users, it is essential that adequate administrative measures be taken to ensure that suitable operators are selected and proper vehicles are licenced. Such measures may be summarized as follows :

- (a) Screening of applicants to ensure that they are of good character and have no criminal records ;

- (b) Enquiries or investigations as to an applicant's financial ability to carry on the service satisfactorily;
- (c) Wherever possible, production of proof of availability of suitable off-street parking accommodation for the taxi;
- (d) So far as vehicles are concerned, inspection of taxis to ensure vehicle fitness, once every six months. This inspection should include an examination of brakes, steering, tyres and windscreen wipers. Standards should also be set for the size of cabs, seating and general body requirements;
- (e) Making of rules for the installation of meters and for the correct operation and use of such meters.

(5) *Single ownership versus collective ownership (fleet system)*. Both systems are in existence in the countries of the region. Collective ownership on either a co-operative basis or a fleet system whereby taxis are owned by well organized business concerns would appear to be the more desirable system. Such organizations not only ensure better maintenance and easier identification of vehicles and driver control but are also in a position to provide telephone and radio facilities for their members. In the single vehicle ownership system, on the other hand, there is a tendency to keep maximum profit or income on a small outlay and the efficiency of operation thereby suffers. There is moreover the difficult administrative task of exercising control over a large number of individual owners.

Fare structure. For the protection of passengers, it is essential that fares and charges should be fixed. For fixing fares and charges, the following factors should be taken into account: the capital cost, running expenses, margin of profit and fares and charges fixed for other forms of public transport. Fares for the ordinary type of taxis should be reasonable. If a more luxurious type of taxi service is to be provided, taxis may be divided into two or more classes to cater for various categories of passengers. Taxes, licence fees and other fees which may be levied on taxis should be such as to make it possible for taxi fares to be fixed at a level acceptable to passengers and at the same time ensure a reasonable income to the operator.

(6) *Licensing of drivers*. The efficiency of the taxi services depends on the taxi drivers; accordingly an effective system for their control by licensing is

necessary. In the interest of efficiency and safety, it is considered desirable that clear regulations should be made to prescribe for the eligibility of any person applying for a licence to drive a taxi and to regulate the activities and behaviour of taxi drivers after they have been licensed. Such regulations if desirable, may include the following:

- (i) The applicant should make taxi driving his sole occupation;
- (ii) Persons who have been convicted of criminal offenses against persons and property or such offenses as smuggling, trafficking in women or similar offenses, should be debarred;
- (iii) The hours of work of taxi drivers should be restricted;
- (iv) Taxi drivers should be required to keep a daily record of their hours of work.

Before a taxi driver is licenced, he should comply with the requirements laid down in *Driving tests* of this report.

There should be more driving licenses than available taxis. This situation will give the operator a wider choice of good, efficient and honest drivers of taxis.

(7) *Owner and driver relationship*. To ensure fair dealing to taxi drivers, there should be proper labour legislation. The hours of work and the wage structure should be on agreed terms. There should be proper protection against unhealthy exploitation of labour.

(8) *Pay of taxi drivers*. To ensure safe, efficient and honest taxi services, taxi drivers must be adequately paid. The goal must be to enable them to concentrate fully on the efficient transport of passengers. The practice of giving commission pay to drivers from their earnings should be discouraged. It has been observed to be the cause of recklessness dictated by the desire to earn more.

(9) *Responsibilities of taxi operators and drivers*. The holding of a licence under a restrictive licensing system, while conferring privileges on the holder also places certain responsibilities on him. Such responsibilities should be clearly specified in legislation.

(10) *Identification of taxis*. Taxis are made distinguishable from ordinary motorcars by distinctive licence numbers assigned to them or by identification plates or other suitable indications. In some cases they are painted in two colours for easy identification.

(11) Use of three-wheel motor vehicles as taxis.

It is noted that in some countries of the region, three-wheel vehicles are licensed as taxis. These vehicles are slower moving than the four-wheel vehicles and tend to impede the flow of traffic in congested parts of the city. They are also unsafe. The Sub-Committee accordingly felt that their use as taxis in big cities should be discouraged.

(12) Cruising.

In some countries of the region, cruising of taxis along the streets of the city looking for passengers is an offence. Cruising taxis tend to move slowly and thus impede the smooth flow of traffic. They increase the number of vehicles in circulation on the roads thus adding to traffic congestion. There is also unnecessary wastage of fuel oil.

(13) Taxi stands.

In some countries of the region, taxi stands are established by local authorities for the convenience of both the taxi operators and taxi travelling public. Such stands should be situated in or near places where demand for taxi transport is greatest.

(14) Pirate taxis.

Either due to short supply of taxis or to laxity in enforcement, the operation of unlicensed taxis (pirate taxis) has become a problem in some cities of the region. This should be eliminated. It permits low fares to be charged which would not be possible if the "pirate taxis" paid their proper licence fees. It can undermine the finances of the public services, and in the end result in poorer services for those who rely upon them. It takes business away from the taxis proper, which are regularly inspected and properly licensed. It involves the carriage of passengers without insurance coverage, for the insurance policy is invalid in the case of accidents which occur when the vehicles are improperly used. It adds to congestion on the streets, and in any case it is illegal.

(15) Technical documentation presented to the

Sub-Committee. The Sub-Committee in the course of its work took note of the interesting and informative technical papers contributed by the various governments and technical organizations.

LOCAL TRAFFIC PROBLEMS IN BANGKOK AND VICINITY

(Report of Sub-Committee D)

Members of the Sub-Committee conducted two inspections of traffic problems in Bangkok and spent considerable time in discussing their observation and related facets of these problems. It was the considered conclusion of the working party that the problems which were observed, and others which were brought to its attention, are not fundamentally different to those facing civic authorities in numerous other cities both in and outside the ECAFE region. The difference are only variations of degree, not of causes or of hopes for solution. The Sub-Committee agreed that Bangkok's urban congestion is so severe as to require action on two fronts. One of these is immediate improvement of street traffic and the other is a concurrent attack on a long-range solution, such improvements and attack being in the nature of engineering solutions. In the industrially developed nations, the traffic engineer does not work alone but depends upon the support of enforcement and public information services. This three-pronged attack on the traffic problem has led to the catch phrase, "the three E's of traffic safety", the three E's being engineering, enforcement and education. Engineering and enforcement are separate but complementary functions. In the opinion of the Sub-Committee reiterating the conclusion reached at the Second ECAFE Study Week on Traffic Engineering and Highway Safety, it is essential that engineering be the responsibility of professional persons competent in the speciality of road traffic and that police authorities devote their attention to the enforcement function, rather than being burdened with the responsibility of important policy decisions of an engineering nature.

Traffic education

The function of education is manyfold. It has to begin at a very early age. In many schools in the auto-dominant countries, education for traffic safety takes place in the classroom along with the teaching of academic subjects. Children in the kindergartens and primary grades are taught good pedestrian practices, slightly older boys and girls learn safe cycling methods, and a number of states in the United States now teach teen-agers the elements of driving, including behind-the-wheel instruction.

In addition, practical assistance is provided by many schools in the overall effort to reduce the numbers of traffic injuries and fatalities. In Berkeley, California, each school has its Junior Traffic Patrol, students who guard designated intersections and escort younger children across busy streets. The programme is administered by the schools with one police officer responsible for the city-wide programme for this city of 120,000 population. The pattern developed at Berkeley has been copied and adapted by many cities both in Europe and North America.

This education facet cannot be limited to schools, however. Traffic safety education must be a continuing campaign, varied to suit the requirements of season, special events, or holiday weekends. Both in the United Kingdom and the United States, the national road safety organizations wage a relentless war on all aspects of the road safety problem. In their traffic safety work, all advertising media are utilized: billboards, posters, radio and television. Even some unorthodox methods of disseminating information are used as, for example, the use of stencilled painting on sidewalks to remind pedestrians to "cross at cross-walks" or to "wait for the green". In fighting a problem so critical as the traffic menace to safety all the standard methods must be used and a whole range of new methods has to be devised.

Traffic engineering

Upon being assigned a problem, the professional engineer applies a pattern of solution. This pattern, sometimes called the technological method, is sufficiently fundamental that as a policy or approach it may be applied with equal success to the design of a bridge, the provision of a water supply system, or the solution of the problem of urban congestion.

In its technological aspects, the method first requires determination of the character and magnitude of the problem. This stage is known to engineers as the data gathering or survey stage. The second step is to study the results of the analysis of data to assess the possibilities and to evaluate the requirements of all possible solutions. It is this stage which especially requires competent, experienced professional talent. This is a critical stage because the handling of the

problem now and its future course is wholly dependent upon the ability of the engineer who is to make the decision as to which is the best of several alternative solutions. It is the experience and professional judgement of the engineer which is the key to detailed study of alternatives and, ultimately, to the selection of the solution which will best fit all the existing needs and anticipated future demands. The third stage, design, requires great technical skill and painstaking attention to details. Here again, experience and training are of paramount importance but equally significant is the need for a wide exchange of information with professional contemporaries engaged in studying similar problems. It has been a well-learned lesson in the highly-motorised countries that the application of the technological method by professional engineers, in consonance with enforcement and public information officials -- each group carrying out the function of its primary competence -- has led to acceptable solutions to urban congestion. Available to the professional traffic engineer are many means of improving the management of usage of existing city streets. Chief among these are lane markings which tend to keep vehicles moving in orderly streams thus occupying a minimum space per vehicle. Traffic signal systems can be remodeled to favour predominant movements, inbound during the morning peak and outbound during the evening peak. The selection of arterial streets and the provision of adequate signing to protect through traffic using the arterials from cross traffic is an important aspect of this whole area of improved management of street traffic. Restriction of parking on selected arterials serves to make available additional street capacity. In many large cities in Europe and the United States, tow-away ordinances have been enacted which enable arterial streets to be cleared of parked cars. Signs which state the times of operation of the tow-away regulation also inform the errant driver of the nearby location at which he can claim his automobile. There will be, of course, an over-time parking violation to be settled as well as the bill for towing the vehicle.

One-way street systems have been successfully used in many cities. To be truly effective, a one-way street system requires much study, careful planning, and co-operation from enforcement and public information services. Without adequate engineering, one-way street operation may lead to longer trips for some vehicles, with attendant inconvenience and an over-all increase in traffic volumes; to the transfer

and compounding of capacity problems at some intersections; to the necessity of installing an excessive number of traffic control signs and signals; to difficulties in public transit vehicle operation; and, perhaps of chief importance, to confusion on the part of motorists.

Prior to instituting one-way street operation, the following engineering data should be obtained and analysed to ascertain whether the contemplated action is wise and to be able to forecast the effects of such one-way operation: traffic volumes by direction of flow and time of day; turning movements at all effected intersection; parking studies to determine the feasibility of parking prohibitions; speed and delay studies to determine the causes and locations of delay; signal-timing studies to ascertain whether progressive movement can be achieved under the contemplated scheme; a physical condition survey to determine layout, end-connexion capabilities, bus stop modifications, and revision of control devices; capacity analyses to determine the comparative capacities of the different methods of traffic movement; studies of added travel distance which may result from one-way operation; investigation of probable effects on business fronting the effected streets; probable effect on movements of emergency equipment, fire apparatus, police cars, and ambulances; and the study of their probable effects on pedestrian movements and upon traffic crossing and joining the one-way streets.

Progressive signal timing is possible under certain conditions. Where these conditions exist it is to the advantage of the city to utilize inter-connexion of a series of signals so groups of vehicles, "platoons" as they are known in technical jargon, proceed along the arterial in an orderly manner. As the head of the platoon approaches an intersection the signal changes to green and remains so for a sufficient duration for the platoon to pass through the intersection. Timing sequences for the proper operation of inter-connected signals cannot be obtained by trial-and-error methods; careful analysis by means of time space diagrams and related engineering techniques are required to achieve satisfactory results.

In order for a city to be able to instigate and satisfactorily develop even the simpler of the street-traffic management devices listed above, it is necessary that there be a professional traffic engineer who has been delegated both authority and responsibility. This, then, is the first consideration: the delegation of these responsibilities to a competent individual.

Immediate action with interim measures would be the first direct result of this administrative development. Carefully documented recommendations for the incorporation of the post of municipal traffic engineer were set forth in the report of the second ECAFE Study Week on Traffic Engineering and Highway Safety to which reference is made.

During its inspections of traffic problems in Bangkok, the Sub-Committee particularly noted the following items for consideration as interim improvements in the management.

- (a) Improved pedestrian control both at intersections and midblock locations;
- (b) The use of engineered timing of traffic signals, measurements and computations can lead to selection of optimum signal cycles with improvement in intersection capacity;
- (c) Better control of parking, including the prohibition of parking where warranted and study of the possibilities of off-street parking installations;
- (d) Greater control of construction operations to minimize infringement on the traveled ways and the elimination of hazardous practices attendant upon construction and reconstruction of Bangkok's street and utilities systems;
- (e) The adoption of the engineering method for study of modifications to intersections;
- (f) Stricter enforcement of traffic rules and regulations.

Long-range developments

The traffic engineer's approach to long-range developments is inherently not basically different to that used in the determination of the best interim improvements. The first step is data gathering. Analysis of the data and selection for further study of the mode of improvement from a host of potential solutions can satisfactorily be made only by a competent professional engineer of broad experience; there is no place for amateurs in this exacting task. Finally, the implementation of the recommendation and its guidance to consummation including the refinements which inevitably occur as the pace of a growing technology advances along with the growth of problems, can only be made by an individual who is in close touch with the development of the technology of traffic. It is therefore the considered recom-

mendation of the Sub-Committee that a careful and detailed study of the traffic and transportation needs of the Bangkok metropolitan area be conducted by a firm of professional engineers having an established reputation and widespread recognition of competence in this specialty.

Additional matters

The Sub-Committee was assigned the problem of vehicle headlights, with particular attention to be paid to visibility and glare aspects. Reference for detailed technical information, which was considered to be beyond the scope of the working group, is available in ample quantity and detail in the US Highway Research Board Bulletin series titled *Night Visibility*. Observations by members of the Sub-Committee led to questions being raised with regard to the practice of operators of commercial vehicles in Thailand of painting the upper portion of headlamp lenses with an opaque shield. In view of the demonstrated effect of such painting in reducing the intensity of illumination upon the roadway ahead of the vehicle, serious doubts as to the wisdom of this practice were expressed by members of the Sub-Committee. It was the considered judgment of the Sub-Committee that effective legislation and enforcement of regulations pertaining to all vehicular lamps would produce greater benefits than alterations by obscuring a portion of the lens of the headlamp. Vehicle manufacturers have developed well-engineered lighting systems for vehicles. It is the recommendation of the Sub-Committee that advantage be taken of the fullest technological improvements as basic requirement for safety and that the proper maintenance and use of this equipment be enforced. Wherever difficulties of this nature occur, an essential first step is sound legislation which establishes high standards. Subsequent enforcements is necessary to assure continuing conformity to the desirable standards.

Vehicles speed and its effect on traffic flow and accidents

At the Second ECAFE Study Week on Traffic Engineering and Safety an excellent paper was presented by the United Kingdom which dealt with vehicle speeds. This paper sets forth the fundamental effects of speed limits on observed speeds and traffic accidents, and presents the results of research in several European countries. The working group concurs with the conclusions set forth in part as follow:

"... although there is a very considerable disregard by drivers of the actual signed value of a speed limit, speed limits do, in general, bring about some reduction in speed particularly of the fastest drivers. Although the effect on vehicle speeds is not as marked as one would perhaps expect it appears to be accompanied by worthwhile reductions in accidents, especially those involving fatal or serious injury. These effects are likely to be greater if the limits are near to the 85 per centile speed than if they are unreasonably high"

Traffic congestion in Bangkok

In preparation for its observation of traffic flow and congestion in Bangkok, the Sub-Committee had available a document prepared by the City Planning Division, Bureau of Public Works, of the Bangkok Municipality. This report sets forth the circumstances which led to the problem as it now exists and clearly delineates many of the causes of the difficulties which were observed. The following paragraphs are drawn from that report.

"The road system of the Bangkok Area, which has been developed within the framework of an originally water-oriented transportation system, now consists of a system of a few major streets providing limited cross-city travel, and extremely narrow residential lanes which branch off the major streets, many of which dead-end or simply end at the limit of development.

In recent years a major street improvement programme has been undertaken, a portion of which is being accomplished with the assistance of the United States; however, much remains to be done in terms of widening and re-surfacing streets.

In the Bangkok Area practically every type of vehicle is utilized. Based on registration, it is estimated that there are now 3.6 motorized vehicles per 100 persons in the municipality of Bangkok and Thonburi. This high proportion of such vehicles concentrated in this area, coupled with an inadequate street system, accounts for the extreme traffic congestion in many sections.

Although in the past non-motorized vehicles played a significant role in urban transportation, and created serious problems because of

their slow speed, lack of manoeuvrability and vulnerability, registrations of such vehicles excluding bicycles, decreased at an average rate of 1.2 per cent per year between 1946 and 1957. The ban on the operation of three-wheel pedicabs in the Bangkok Metropolitan Area on December 31, 1958 means that now and in the future such non-motorized forms of transport will be increasingly less important. The tendency, however, to replace the pedicabs with motorized three-wheeled passenger vehicles which are slower than automobiles indicates that a problem still remains.

Motorized vehicles, on the other hand, show a significantly different trend. Registrations of these vehicles increased approximately 172 per cent between 1953 and 1961, from 30,173 to 81,998, at an average annual rate of increase of 19 per cent per year. This high rate of increase has prevailed for most of the classes of vehicles: passenger cars 132 per cent; taxis 169 per cent; buses 135.5 per cent; trucks 86 per cent; and motorized bicycles 370 per cent. On the other hand motorized passenger tricycles, according to the registration data for 1960, showed a decline of approximately 2.5 per cent over the previous 2-year period. Trams once were operated in the city but now they are almost completely abandoned due to their great interference with free-moving traffic.

Because distances are too long between intersections, many of the approaches to intersections are carrying traffic volumes far greater than the practical capacity of the approach roadways. This means that congestion and delay at these intersections is above that considered to be desirable maximums.

The average speed of traffic in Petchaburi Road between Rajatewi and Pratunam during peak hours is about 10 kph, which results in unsatisfactory travel times and delays. As most of the serious delays occur at intersections, rather than at the midblocks, it is evident that traffic signal system cannot handle the imposed traffic volume with desirable timing.

There are quite a few improperly located loading zones for public transit. Very often bus loading zones are sited at the approach to the intersection. This location will block the straight-through traffic and cause congestion.

Relocation and lengthening of certain of the bus loading zones is therefore necessary in order to improve the general traffic flow. Signs and curb marking of the zones, as well as parking-stall lines, stop lines, cross-walks, and center lines require improvement by relocation or maintenance. In connexion with parking problem, the city is introducing use of street parking meters. There are now twelve streets in the commercial area having 867 parking meters for motorized vehicles and 342 for motorized bicycles installed along the curb. The parking problem in the residential areas has

not yet been recognized. In the commercial areas which require a great amount of parking space, an attempt should be made to provide adequate off-street parking facilities to reduce traffic congestion in the streets."

Recommendations of the Sub-Committee

- (1) That there be an intensified and expanded driver and pedestrian educational programme.
- (2) That existing and amended traffic regulations be vigorously enforced.
- (3) That an overall transportation engineering study be conducted by a professional qualified consultant.

Appendix 1

LIST OF PARTICIPANTS

Country	Names	Designation
AUSTRALIA	Mr Sydney Schubert	Assistant Research & Planning Engineer, Queensland Department of Main Roads.
CHINA	Mr Zien, Yih	Deputy Director, Taiwan, Highway Bureau, Taipei.
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	Mr Arun Kanti Das	Second Secretary, Indian Embassy, Bangkok, Thailand.
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	Mr Hiroshi Matsumoto	Vice-Councillor, Second Planning Section, Planning Department, Tokyo Express Highway Corporation.
	Mr Yoshio Hatano	Third Secretary, Embassy of Japan, Bangkok, Thailand.
	Mr Yoshie Hara	Chief, Traffic First Section, Traffic Division, Tokyo Metropolitan Police Department.
LAOS	Mr Thao Serc Volavongsa	Public Works Engineer of the Ministry of Public Works and Transport, Vientiane.
	Dr Tiao Jaisvasd Visouthiphong	Chief, Medical Officer, Mahosot Hospital, Ministry of Health, Vientiane.
	Commandant Boualy Pannhasith	Directorate of Co-ordination, Ministry of National Defence (Urban & Highways), Vientiane.
PHILIPPINES	Mr Josias K. Quinto	Commissioner, Public Service Commission, Manila, Philippines.
	Mr Adolfo V. Celera	Administrator, Motor Vehicles Office, Quezon City, Philippines.
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SINGAPORE	Mr Wong Keng Sam	Acting Registrar of Vehicles, Singapore.
THAILAND	Dr Sirilak Chandrangsu	Deputy Director-General, Department of Highways.
	Mr Manus Corvanich	Chief of Bridge Division, Department of Highways.
	Mr Sungwarn Wongwan	Head of Highway Design Section, Department of Highways.
	Mr Komate Wongtonglua	Head of Design Section, Department of Highways.
	Mr Pojana Kantamala	Chief, Survey and Testing Section, Department of Public and Municipal Works.
	Mr Supachai Wanglee	Second Grade Engineer, Department of Public and Municipal Works.

Country	Names	Designation	
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	Mr Prasert Navaratana	Chief, City Planning Division, Public Works Bureau, Bangkok Municipality.	
	Mr Snong Pratchayanan	Director of the Land Transportation Division, Department of Transport.	
	Dr Gun Nagamati	Chief, Road Transport Engineer, Department of Transport.	
	Pol. Col. Srisak Dhamaraks	Deputy Commander, Traffic Police Division.	
	Pol. Col. Varintr Netrabootr	Superintendent of Mechanical Sub-Division, Traffic Police Division.	
	Pol. Lt. — Col. Sarit Sungkawatra	Superintendent of Central Sub-Division, Traffic Police Division.	
	Mr Charat Phaipradisht	Deputy Chief Civil Engineer, State Railways of Thailand.	
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	Mr M.S. Ahmad	Chief, Transport and Communications Division, ECAFE, Bangkok.	
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	Mr U. Tha Dok	Chief, Highway Section, Transport and Communications Division, ECAFE, Bangkok.	
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	Experts and Observers	Mr John Hugh Jones	Associate Professor of Highway Engineering, SEATO Graduate School of Engineering, Bangkok, Thailand.
		Mr Harold L. Brown	Regional Marketing Manager, Minnesota (3M) Far East, Ltd., Hong Kong.
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Mr Anwar Ahmad Kahlon		Chairman, East Pakistan Employers Association, Representing Pakistan Federation of Commerce & Industry.	

Appendix 2

AGENDA

1. Opening address.
 2. Election of the chairman and vice-chairman.
 3. Adoption of the agenda,
 4. The design and capacity of road intersections.
 5. The design and capacity of road-rail intersections.
 6. How to meet parking problems in the cities of the ECAFE region.
 7. Driving licences:
 - a. qualifications for the issue of driving licences.
 - b. driving tests.
 - c. policies on the restriction and revocation of driving licences.
 8. Policies and administrative measures needed in licencing taxis for their economic utilization and safety in big cities of the region.
- Local traffic problems to be observed and discussed by the experts attending the Study Week.**
1. Vehicles headlights—visibility and glare.
 2. Regulation and control of speed and its effect on traffic flow and accidents.
 3. Traffic flow and congestion in Bangkok.

Appendix 3

LIST OF TECHNICAL PAPERS

1. The Influence of Speed and Speed Regulation on Traffic flow and Accident.
by Mr. R.J. Smeed.
2. How to Meet Parking Problem in the Cities of the ECAFE Region.
by Central Road Research Institute, New Delhi.
3. Driver Testing.
by Central Road Research Institute, New Delhi.
4. Driving Licences.
by Mr. Bui-Van-Quoi.
5. Solving the Parking Problem in Big Cities in the ECAFE Region.
by Mr. Bui-Van-Quoi.
6. Point System Against Traffic Violators.
by Mr. Yihien.
7. Driving Licences and Classes of Licences.
by the Government of New Zealand.
8. Capacity of Urban Intersections.
by Mr. F.V. Webster.
9. Policies and Administrative Measures Needed in Licencing Taxis For Their Economic Utilisation and Safety in Big Cities of the Region.
by the Government of New Zealand.
10. Driving Licences.
by the Government of Federation of Malaya.
11. The Design and Capacity of Road Intersection.
by Shri G.M. Andavan.
12. Regulation and Control of Mixed Traffic in Major City Roads.
by Shri R. Thillainayagam.
13. Driving Licences.
by Shri K. Radhakrishnan.
14. Policies and Administrative Measures Needed in Licencing Taxis for their economic utilisation and safety in big cities of the region.
by Shri K. Radhakrishnan.
15. Parking Studies and Regulation in Urban Central Areas.
by Shri P.S. Srihari.
16. Driving Licences.
by Shri C. Pereira.
17. The Design and Capacity of Road Intersection.
by Shri N.S. Vasudevan.
18. How to meet parking problem in the cities of the ECAFE Region.
by Shri D. Linge Gowda.
19. How to meet parking problem in the cities of the ECAFE Region.
by Shri Syed Abid Ali.
20. How to meet parking problem in the cities of the ECAFE Region.
by Shri Ramanatha Pillai.
21. Outdoor odvertising and traffic.
by Sarvashri M.S. Kasbekar and A.E. Thorley.
22. The Redesign and Capacity of Urban Intersections.
by the Government of Australia.
23. The Traffic Police of Japan.
by the Government of Japan.
24. On the Economical Importance of Road Traffic Signalisation.
by Claudio Podesta, Ing., Automobile-Club of Italy, Rome-Doctor Franco Giannini, University of Rome.

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