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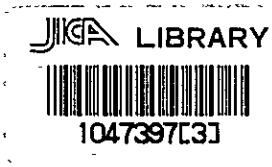
FROM ASIAN HIGHWAY SEMINAR
HELD IN TOKYO, NOV. 1968

HIGHWAY CONDITIONS IN ASIAN HIGHWAY COUNTRIES

NOVEMBER 1968

OVERSEAS TECHNICAL COOPERATION AGENCY

JAPAN



From Asian Highway Seminar
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HIGHWAY CONDITIONS

IN ASIAN HIGHWAY COUNTRIES

November 1968

Overseas Technical Cooperation Agency,

Japan

Contents (No Special Order is Observed)

1. ASIAN HIGHWAY

Mr. Tha Dok
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I have great pleasure in welcoming you all to the Seminar on highway engineering for senior engineers. As you were aware, the expert working groups of the Asian Highway for each zone had, up to 1961, been meeting separately at different places in the three zones. In February 1962, the expert working groups on International Highways held a combined meeting at Bangkok, as it was considered advisable to provide from time to time a common forum for the experts from all three zones to come together to discuss problem of mutual interest and to pool knowledge and experience so that the implementation of the International Highway project could be accelerated.

The first joint session of the Expert Working Groups in February 1962 was followed by the second joint session at Bangkok in November 1962. The former session considered the report of the Reconnaissance Survey Team of the priority route A-1 from Calcutta to Bangkok. It included the Indonesian Highways within the International Highway network and dealt with other matters. The latter session took up among other items the report of the reconnaissance survey team of priority routes A-1 and A-2 in Afghanistan, Iran and part of West Pakistan.

An application on a regional basis was submitted to the United Nations Special Fund in June 1963 for financial assistance to carry out pre-investment surveys in Afghanistan, Iran and Pakistan. Of the 14 countries directly concerned with the International Asian Highways, 13 signed and the only remaining country was developing its roads either through its own efforts or through bilateral assistance. In Afghanistan, a change in the requirements was considered necessary and instead of a pre-investment survey from Kabul to Jallalabad, a pre-investment survey from Kabul to Herat on the direct route was considered more pressing.

In October 1963, a zonal meeting was held at Kabul for zone III which discussed the third reconnaissance survey in Indonesia of the Asian Highway route A-25 and part of A-2. The third joint session was held at Bangkok in August 1964 which considered, among other matters, the report of the economic and engineering feasibility surveys of the East-West highway in Nepal (A-2).

The first Co-ordinating Committee meeting in April 1965 directed the preparation of a check list of work requirements including manpower, materials and equipment for the Asian Highway project as well as to work out a Five-Year Plan for completing the priority routes in such a manner that at least one route should be completed by 1970 connecting all the Asian Highway countries.

The second Co-ordinating Committee meeting in September 1966 approved the tentative Five-Year Plan and the representatives attending the session signed the application to UNDP (Special Fund) for an Institutional Support to the Asian Highway Co-ordinating Committee as well as for establishing and expanding highway research and testing laboratories and training in the Asian Highway countries.

The third session of the Co-ordinating Committee in August 1967 was historic in that representatives from 10 countries signed the Plan of Operation for the Institutional Support and agreed to the formation of an Advisory Board. Subsequently, two more countries signed the Plan of Operation.

The fourth session of the Asian Highway Co-ordinating Committee at Bangkok in October 1968 reviewed the current status of the Asian Highway and its five-year plan, approved the action taken by its Transport Technical Bureau in implementing the programme of work for the first project-year 1968, and approved the programme of work proposed for the second project-year 1969 together with the budget for 1969.

Among other matters, the Committee considered various proposals and recommendations for holding an Asian Highway Motor Rally from Vientiane to Singapore by way of Bangkok and Kuala Lumpur in April 1969. The first meeting of the Asian Highway Motor Rally Committee was held on 17 September 1968 and the second meeting from 14 to 15 October 1968.

The advisory Board to the Asian Highway Co-ordinating Committee held its first meeting at Bangkok from 20 to 24 September 1968. The Asian Highway Co-ordinating Committee examined the report and approved the priorities of the work programme. It also reviewed the work done in the development of international highway traffic in connection with

the easing of frontier and other formalities, the preparation of basic data for travellers, highway classification and design standards establishment of a documentation center, and a survey of ancillary services and facilities.

The experts on the Asian Highway zone I had a meeting at Bangkok in December 1965 for laying down the basic principles and criteria for the establishment of research centre and training facilities at different levels.

A reconnaissance survey of the Asian Highway priority routes in Laos was carried out in December 1964 while another reconnaissance survey was undertaken in Cambodia in November 1965.

You may recall that about eight years have now elapsed since the ECAFE project on the Asian Highway was initiated and it is gratifying to note how much progress has been made towards its implementation. The latest achievement is the fact that the application to the United Nations Development Programme for institutional support for the Asian Highway was sanctioned and the Plan of Operation signed.

Everyone will agree that, for the smooth and easy flow of international traffic, many frontier formalities and administrative arrangements will have to be eased and a general agreement arrived at on the uniformity of road signs and signals, pavement markings and signs for road works.

Ribbon development problems in the countries concerned in respect of the Asian Highway will also have to be considered, together with a proposal for providing new or improving ancillary services and facilities along the Asian Highways. The Code on a Uniform System of Road Works as alreay drafted has been printed. The outcome of deliberations of the UN Conference on Road Traffic held in Vienna will soon be known and further action on the Code on a uniform signs and signals will largely depend on the decisions after the deliberations.

2. SOME ASPECTS OF ROAD CONSTRUCTION IN DEVELOPING COUNTRIES

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Delivered at the Meeting on Productive Employment in Construction in Asia
Sponsored by I.L.O. Oct.-Nov.1968, Bangkok

The modern techniques for all types of construction are becoming more and more machine oriented. The use of construction equipment not only quickens the pace but also ensures high quality of output which is essential for the successful execution of works in accordance with modern specifications. In developing countries, however, it is not always possible to acquire all the necessary construction equipment, firstly, because the machines have usually to be imported, involving foreign exchange costs, and, in some cases, considerable delays in delivery, and secondly, for want of trained personnel their efficient use and proper maintenance cannot be ensured. But above all the utilisation of manual labour cannot be given up, in all cases, without causing serious unemployment problems with obvious repercussions, both social and political. In a number of developing countries, the population is already large and is increasing at some 2 1/2 per cent per annum with even greater increases in the labour force, and therefore there is a strong case to use manual labour on construction works to the maximum extent possible, compatible with economy and quality control. The use of equipment might therefore be limited to situations where works cannot be executed efficiently without machines.

The construction of roads is one of the first pre-requisites for a development programme in the developing countries. Since the activity has to be spread over the entire country, it lends itself admirably to the employment of labour on a large scale. The use of sophisticated machines should thus be confined to those items of construction where execution is not practicable by manual labour alone.

With the exception of very high-class roads, such as an expressway, it will generally be possible to carry out most of the works by manual labour with the help of road rollers only. The first item of work in this connection is land clearance which may be done entirely by manual labour. The next main group of items include earthworks involving the following operations:-

(a) excavating earth in borrow pits or cuttings;
(b) carrying earth from borrow pit to road alignment;
(c) spreading earth in road embankment in layers;
(d) compaction.

The first three operations can easily be carried out by manual labour where the lead is not great. The fourth operation, however, will require the use of a smooth-wheeled road roller or some other type roller.

Where the soil, as naturally available, has poor bearing properties it will be necessary to strengthen and stabilise it by either mechanical means, such as through the admixture of coarse angular material, or by chemical means - using lime, cement or bitumen. Thorough mixing by hand is difficult to achieve and manual labour in this operation is less efficient than machinery; however since the stabilised layer is only to the order of 6" to 12" the total volume of work involved may not be large.

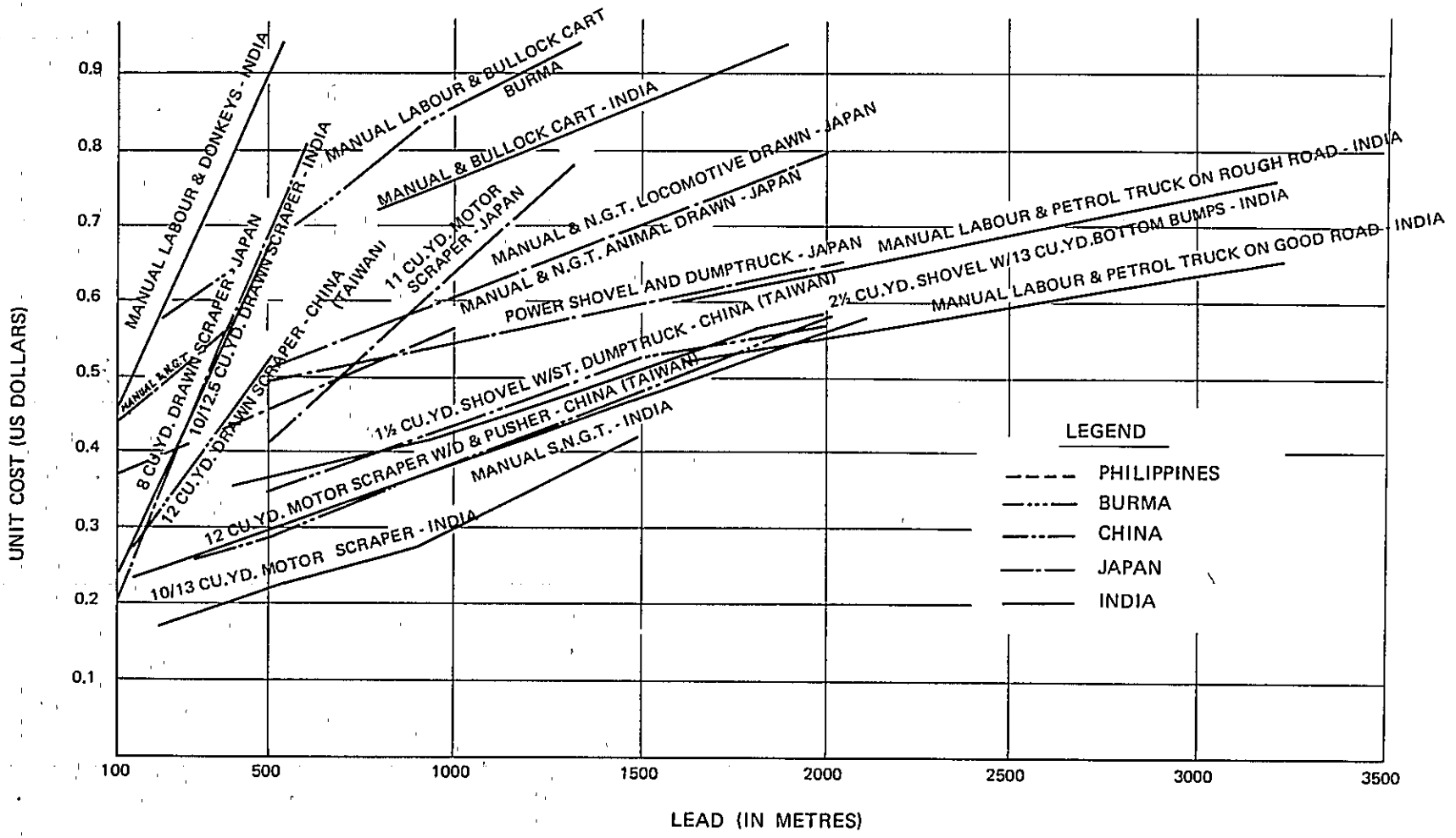
If the road bank consists of a very high embankment such as at the approaches to a bridge or fly-over, the quantity of earth is very large and the borrow area has to be located far away. In such circumstances, it would be economical to move the earth with the helps of motorized scrapers, dumpers or trucks. In such cases manual labour may not only be not so efficient but also uneconomical. This is clear from Figures 1 and 2 which compare the unit cost of earth work by manual labour and machines.

In regard to the construction of road pavement the work can be divided into two parts:-

(a) the base course;
(b) the wearing course.

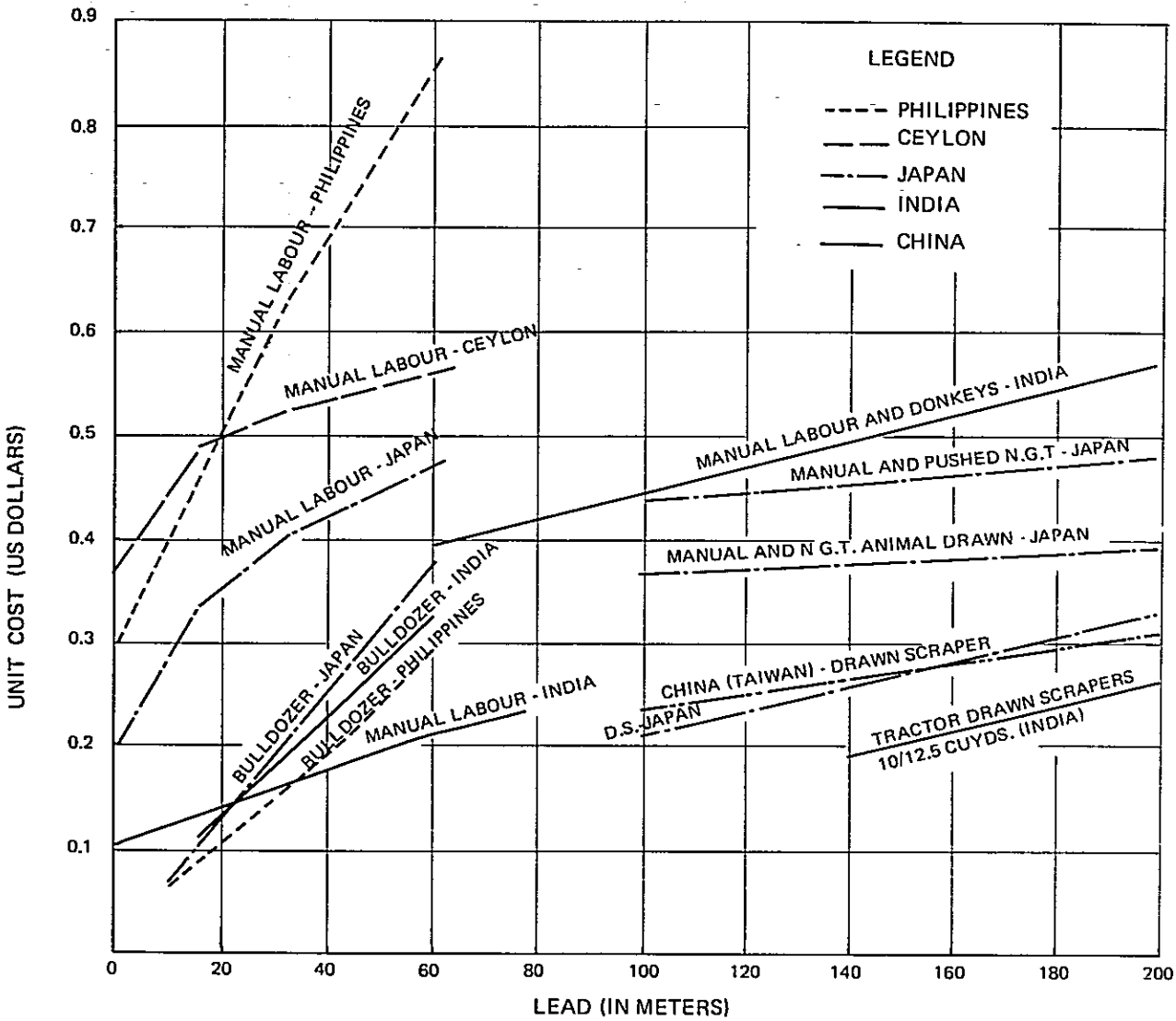
In developing countries the base course generally consists of a layer of soling followed by a layer of water-bound-macadam. This type of construction can be efficiently carried out by manual labour. The soling consists of a layer of 6" to 9" stone boulders (if stone is available) or one or two layers of bricks. Water-bound-macadam consists of single size stone ballast with suitable soil binder. In many situations quarrying of stone and breaking it to single size ballast can be done by manual labour but if the requirement for stone is large, stone crushers will have to be installed.

For roads having very heavy traffic the use of soling and water-bound-macadam is not advisable because the pavement is likely to deform under the heavy traffic. Modern specifications for such roads demand the use of graded gravel available either from natural deposits or made artificially by crushing rock.



UNIT COST OF EARTHWORK OF COMMON SOIL-COMBINED MANUAL LABOUR WITH MACHINES VERSUS MACHINES

Source: UN/ECAFE Earthmoving by Manual Labour and Machines - (Report and discussion papers of the Working Party on Earthmoving Operations) - Bangkok, 1961.



UNIT COST OF EARTHWORK OF COMMON SOIL - MANUAL LABOUR VERSUS MACHINES

Source: UN/ECAFE Earthmoving by Manual Labour and Machines - (Report and discussion papers of the wo Working Party on Earthmoving Operations) - Bangkok 1961.

Where such specifications are adopted the use of manual labour will be much reduced. The compaction of gravel base materials is done in the same way as the compaction of soil. Since roads with very heavy traffic will be relatively fewer in developing countries, major portion of construction work may be carried out with soling and water-bound-macadam so that manual labour can be used quite extensively.

A common wearing course for roads in developing countries consists of one or two coats of surface dressing i.e. painting with bitumen and blinding the surface with small sized stone grit. This work can be done efficiently by manual labour using handpump sprayers for spreading the bitumen. The stone grit is also spread over the painted surface by manual labour. No doubt the use of mechanical sprayers and gritters is found to be more efficient and it should be adopted increasingly as situation permits. The equipment is not costly and should be within the reach of every developing country.

For roads with heavy traffic, surface dressing has to be replaced by a more durable surface such as a bituminous carpet either open graded, for comparatively lighter traffic, or asphaltic concrete for heavier traffic. With both methods bitumen is mixed with stone chips. The mixing can be done efficiently only with the help of proper bitumen mixers. However, the roads that will require heavy treatment of this kind will not be many, to start with, in the developing countries and therefore the use of bitumen mixers would be limited.

In the foregoing paragraphs some of the problems of road construction pertaining to labour and machinery have been discussed in a general manner. There can, however, be no hard and fast rules for deciding the choice in the use of labour or equipment. Situations are bound to differ from place to place in each developing country. Some of the main considerations that would influence the decision are detailed in subsequent paragraphs,

Untill construction equipment is manufactured to a large extent within the country itself, it would be necessary to restrict the use of equipment to unavoidable situations only.
Such situations would be:

(a) For very high-class road construction such as an expressway where modern specifications must be rigidly applied, the use of sophisticated construction equipment is inescapable because quality control must be fully enforced. Equipment must be used even if it has to be imported.

(b) For the construction of large works especially when they have to be completed in a limited period of time, the use of mechanical equipment is essential so that the labour force employed on the site does not become too unwieldy besides creating administrative problems. The employment of a very large number of workmen also creates the problem of their housing and welfare which is not easy to solve in remote areas through which the roads generally pass.

(c) Certain works such as excavation in rock and stabilisation of soil with the admixture of lime, cement or bitumen; mixing bitumen and stone aggregate for bituminous carpets; mixing cement concrete for pavement, would require the use of mechanical equipment for efficient working since the output from manual labour in these cases is not satisfactory.

(d) The use of smooth-wheeled powered road rollers of 8-10 tons weight is indispensable on all road works. Manual labour is unable to replace them. Many developing countries have developed plants for the complete and partial manufacture within the country. The roller is used for:

(1) compacting subgrade and earth works to formulation;
(2) compacting stone soling and water-bound-macadam;
(3) compacting graded gravel bases;
(4) compacting bituminous surface courses.

Depending on the nature of the soil, it is sometimes more efficient to compact earthworks with rubber tyred or sheeps-foot rollers, but the ordinary smooth-wheeled road roller can do the job fairly well if special type rollers are not available.

(e) A motor grader is a very useful piece of equipment for dressing earthworks or for shaping and maintaining the side slopes of banks, or for maintenance of earth or gravel surfaces.

The quality of work achieved by this machine is much superior to that obtainable by manual labour. The work involved in the operation of motor-grader is quite simple. But it is not an indispensable piece of equipment if labour is plentiful and a little lowering of quality can do no harm to the road work as a whole.

(f) A pavement-laying machine either for bituminous or concrete pavement, is also a very useful implement and the quality of its output cannot be matched by the work carried out by manual labour. Here again, as in the case of motor grader, it is possible to do away with the machine if one is hard pressed for funds for investment in equipment. The work can be executed by manual labour though the quality of surfacing would suffer to some extent.

(g) For producing high quality cement concrete, it is essential to control the size and grading of the coarse and fine aggregates and also to proportion them by weight. Simple weigh-batching plant is therefore necessary for concrete roads. This part of work cannot be done efficiently by manual labour and no compromise with quality can be permitted in this case, because an indifferent mix of cement concrete will seriously affect the strength of the finished pavement.

(h) In difficult terrain such as waterlogged areas, it is sometimes economical to employ earth-moving equipment for embankment construction, because the output of manual labour for excavation in moist soil, especially with a long lead, is low. A detailed analysis of such a case was carried out by Messrs. Amman and Whitney International Ltd., for the Dacca - Chittagong highway in September 1965. It was found that as the working season is short due to the area being flooded during the rainy season, 30,000 labourers were required to complete 13,780,000 cubic yards of earthworks in three construction seasons. The cost worked out to $0.95 per cubic yard. With mechnical equipment using 20 cubic yard scrapers the cost worked out to $0.53 per

cubic yard. The calculations are given in Appendix I. This shows that the cost with manual labour would be 1.72 times the cost with mechanical equipment. Even in such circumstances favourable so much more for work with machines, the government may sometimes prefer to use manual labour from social and other economic considerations.

The success or otherwise of the use of construction equipment ultimately depends on the economy that can be brought about by its use. This in turn will depend on the efficiency with which the equipment can be used on the works. The upkeep of the equipment therefore, is a very important factor. The developing countries face considerable difficulty in this respect except where the equipment is produced locally. Equipment, being expensive, must be used intensively in order to keep unit costs down. Uninterrupted working depends on the manner in which the plants is serviced and repaired. For this purpose good workshop facilities must be available centrally for heavy repairs and at each site for minor repairs. An adequata supply of spare parts should be held, which is difficult when the parts have to be imported. Often the multiplicity of machine-makes, renders the problem still more complicated, it is therefore advisable to restrict procurement to as few makes as possible.

Another important aspect of mechanised working is the skill with which they are run and used. The operator thus plays a very vital role and it is therefore essential to improve the quality of operators by giving them proper training at well equipped institutions, manned by suitable instructoms. Similar training is also required for maintenance mechanics and foremen responsible for the upkeep, repair and overhaul of the machines.

The ultimate success of working with mechanical equipment will largely depend on the efficiency with which the whole organisation is administered. When large investments are involved it is necessary to ensure that:

(a) the right type of equipment is obtained:
(b) the equipment is utilised to the maximum extent possible - if

necessary work should be carried out in more than one shift and incentives in the form of performance bonuses permitted;

(c) the operators and mechanics are well trained;

(d) servicing and repair facilities are available in properly equipped workshops;

(e) an efficient system of working and control is established so that the equipment receives due care in regard to daily and periodic servicing, is overhauled and repaired at the proper time, gives the rated output of work and is not kept idle for want of spare parts.

These are matters which a good administration can enforce.

Construction equipment is being improved all the time. The larger the output from a piece of plant the greater is its working economy. The tendency therefore is to increase the size and to provide very sophisticated systems of control, many of which are electronic. The developing countries have, however, to be careful to choose only such equipment as they can maintain with the limited means at their disposal for operation and repairs. Very sophisticated machines should be avoided. Giant size machines also may not be suitable because the quantity of work at one spot may not be sufficient to keep the machine fully occupied. Since the total number of available machines will be limited, it will be necessary to move them from job to job, sometimes over long distances. The load restriction for movement along roads due to weak bridges should be kept in view before fixing the size of equipment. Portability of equipment after partial dismantlement would be of added advantage in movement.

The nature of work in developing countries involves mainly simple type of construction. No doubt there will be some cases of high quality road construction especially near large towns where traffic may be very heavy and such projects would need the advanced equipment. But by and large, the works are usually much simpler and may be tackled with simpler equipment. Advantage should be taken of this situation and plant of comparatively simple type should be procured since it will not only be less expensive in initial cost but will also be easier to maintain. It is sometimes argued that

the more sophisticated equipment would be more economical as a whole. This may not be disputed in theory, but the chances of such complicated equipment being well operated and maintained for continuous working are generally remote in the developing countries and therefore the economy anticipated from such equipment may never be achieved.

It is clear that for a considerable time the developing countries will continue to utilise manual labour for a large proportion of their works. Mechanisation of construction will be adopted in special circumstances only and even then substantial manual labour would be simultaneously employed. The use of manual labour with as high an efficiency as possible is therefore to be aimed at. The labour must be assisted to give their best by ensuring that:

(a) the working conditions are congenial;

(b) the personnel maintain good health;

(c) the working tools are appropriate, well maintained and can be conveniently handled;

(d) specialised training both initial and periodical is given for jobs which are skilled or semi-skilled.

The location of roadworks is generally far away from inhabited areas. It is thus incumbent on the employer to provide temporary housing facilities for the workmen. Along with dwelling places, it is also necessary to arrange water supply, sanitation and transport if the distance from the site of work is long. Investment in these amenities should pay off in the form of better output from the labourer.

Arrangements for medical care and recreation are also very important. They will constitute an insurance against work loss due to sickness. The personnel will also be more active and willing to works will be in areas where malaria and water-borne diseases have to be countered, in which circumstances medical facilities will be indispensable.

It is customary in some countries for the labourers to bring their own small tools. This is not always conductive to maximum output since the labourers are inclined to use the old-fashioned tools which may not be in good condition. Even when the advantages

of improved tools are known to them, they may not be able to afford them. The use of wheel barrows, improved types of shovel, light weight pans of aluminium in place of heavier iron pans or baskets for carrying earth by head load, etc. would help a great deal in improving output. The employer should be willing to invest money on these articles because of the advantages they bring to him in the form of higher output.

There may be many ways of doing an item of work, but there will be only one way in which it can be carried out most efficiently. It would be necessary to train the workmen to adopt the most appropriate manner of working otherwise each will work according to his own inclination and unknowingly become accustomed to less efficient manners of working. A training programme for all types of labour should therefore be arranged and the workers encouraged by incentives to undergo this training. Even the familiar skills of the mason, carpenter, blacksmiths, etc. require training to improve the efficiency and output.

The points discussed in the foregoing paragraphs may be well illustrated by taking the example of execution of earthworks for a road formation.

Before the work is undertaken a detailed survey of soils all along the alignment has to be undertaken to ascertain the properties of available soils. The bank should be made of a suitable soil which should be sandy in nature. If, however, heavy clay soil alone is available as is sometimes the case, it may be necessary to import better soil over some distance or to modify and stabilise the soil by mixing lime. The work involved will thus be:

(a) When soil properties are adequate, it is excavated from the borrow pits located on both sides of the road alignment and at a short distance away. The excavation as well as carrying onto the road formation can both be done entirely by mannual labour. Spreading of earth in 9" layers for embankment can also be done by manual labour. Each layer has to be compacted to proper density by means of ordinary smooth-wheeled road rollers or alternatively by double drum sheeps-foot rollers towed by 120 to 150 h.p. tractors. The moisture in the soil has to be

maintained optimum moisture content by sprinkling water from water tankers where the soil is too dry. Watering and compaction has thus to be carried out with the help of equipment with labour conformed to the operation of the machines.
During the course of compaction it is necessary to dress the soil layers to ensure uniform thickness. This may be done by manual labour where motor graders are not available. The soil layer is tested for correct density from time to time by laboratory staff. After the first layer has attained the specified density, the second layer is laid and compacted. In this way the embankment is built to the required height.

(b) When the bearing properties of the soil are inadequate but nevertheless not too poor, the embankment up to 18" to 24" below the full height is made from the local soil as before, The remaining 18" to 24" is made up by using stabilised soil of the required strength which is derived from the process of stabilisation. The work of mixing the soil with other ingredients for stabilisation has to be carried out by mechanical equipment such as rotovators since manual labour is not very effective for this part of the work. Compaction, after adding water where necessary, has to be done again by equipment. Thus the use of manual labour in the construction of stabilised earth pavements would be very limited.

(c) In the last case where the soil is heavy clay of negligible bearing strength it may be economical to remove this soil to certain depth and replace it with imported soil and then form the bank also with imported soil provided such a soil is available within reasonable distance. The haulage of soil will have to be carried out with the help of mechanical equipment such as scrapers, dumpers or trucks. The earthworks on the road formation may however be done in the same way as for (a). A combination of men and machines is thus possible in this case. If suitable soil is not available within reasonable distance, the heavy clay soil itself will have to be modified by use of

chemicals such as lime. Mixing and compaction will require use of equipment in the same way as for the top soil for the bank as outlined in (b). Very little manual labour can, therefore, be used in this situation.

A general appraisal of the suitability of manual and mechanical methods for various highway construction operations for adoption in developing countries, compiled in a tabular form by Professor S. R. Mehra, Director, Central Road Research Institute, New Delhi, India, is attached in Appendix II.

All countries of E.C.A.F.E. region do not have similar problems. While countries like Ceylon, India, Indonesia and Pakistan have a great pressure of population, due to which they have to prefer using manual labour sometimes even in circumstances where its use is apparently more expensive than that of machines other countries like Cambodia, Malaysia and Thailand have scarcity of labour. The use of machines in the latter case is essential and will be limited only by the consideration of availability of foreign exchange till such time as the machines are produced locally.

Conclusion

While a great deal of work connected with road construction can be carried out economically by manual labour, which is plentiful in most of the developing countries, there are certain items of work, such as rock cutting, stabilisation of soil, preparing bituminous mix for pavement, mixing cement concrete, etc. for which mechanical equipment is unavoidable. The degree of mechanisation will, however, vary from country to country according to labour and economic situation prevailing at the time. In many cases a combination of labour and machine will be most suitable.

Where the pressure of population is a live problem, manual labour will have to be given some preference. Its efficiency can be increased by:

(1) Improving the quality of output by giving the labourer adequate training.

(2) Providing suitable tools.

(3) Establishing suitable labour - machine combinations for working with the object of using machines to the minimum extent possible.

In the selection of equipment, care has to be exercised to procure simple types, not too large in size and capable of being moved from place to place along ordinary roads. Multiplicity of make should be avoided.

Training of operators and mechanics should be arranged extensively and workshop facilities should be provided within easy reach of work sites.

A system of procurement and storage of spare parts for quick supply to maintenance organisations should be established to prevent losses due to idle equipment.

An efficient administrative system should be developed to co-ordinate and control the working so as to eliminate unproductive machine time and to ensure maximum output during operation.

APPENDIX 1

Calculation for Cost of Earth-Work by Manual Labour and by Machine DACCA - CHITTAGONG Road

I. EQUIPMENT-HOURLY RATE ANALYSIS

POL: 80% F.E. - 20% R.s.
Field Maintenance: 50% F.E. - 50% Rs.

		Costs		
		Total	Foreign Exchange	Local
FARM TRACTOR - $8,250 CIF				
Depreciation	20%	$1,650.00	$1,650.00	Rs.
Parts	8%	660.00	660.00	
Shop	7%	577.50	202.12	1,876.90
Interest-Insurance	7%	577.50	577.50	
Storage	4%	330.00		1,650.00
	46%	$3,795.00	$3,089.62	Rs. 3,526.90
FIXED HR. CHARGE		$ 2.70	$ 2.19	Rs. 2.55
POL	30%	.81	.81	
Field Maintenance	3%	.08		.40
Operator		.25		1.25
DIRECT HOUR COST		$ 3.84	$ 3.00	Rs. 4.20
Percent		100%	78%	22%
OFF-SET DISK HARROW - $6,100 CIF				
Depreciation	25%	$1,525.00	$1,525.00	Rs.
Parts	15%	915.00	915.00	
Shop	5%	305.00	106.75	991.25
Interest-Insurance	7%	427.00	427.00	
Storage	4%	244.00		1,220.00
	56%	$3,416.00	$2,973.75	Rs. 2,211.25
DIRECT HOUR COST		$ 2.77	$ 2.41	Rs. 1.80
Percent		100%	87%	13%

		Costs		
		Total	Foreign Exchange	Local
D-7 CAT - $35,000 CIF normal use				
Charge (AGC) Formula				
Depreciation	20%	$ 7,000.00	$ 7,000.00	Rs.
Parts	7 1/2%	2,625.00	2,625.00	
Shop Expenses	7 1/2%	2,625.00	920.00	8,525.00
Interest-Insurance	7%	2,450.00	2,450.00	
Storage	4%	1,400.00		7,000.00
	46%	$16,100.00	$12,995.00	Rs.15,525.00
FIXED HOUR COST		$ 11.43	$ 9.23	Rs. 11.00
Fuels	22%	2.52	2.39	.65
Field Maintenance	3%	.34		1.70
		$ 14.29	11.62	Rs. 13.35
Local Operator		.25		
DIRECT HOUR COST		14.54	11.62	Rs. 14.60
Percent		100%	80%	20%
PNEUMATIC ROLLER - 50 TONS - $9,500 CIF				
Depreciation	33%	$ 3,135.00	$ 3,135.00	Rs.
Parts	20%	1,900.00	1,900.00	
Shop	10%	950.00	332.50	3,087.50
Interest-Insurance	7%	665.00	665.00	
Storage	4%	380.00		1,900.00
	74%	$ 7,030.00	$ 6,032.50	Rs. 4,987.50
FIXED HOUR CHARGE		$ 4.99	$ 4.28	Rs. 3.55
Field Maintenance	3%	.15		.75
Lubes, etc.	5%	.25	0.20	.25
DIRECT HOUR COST		$ 5.39	$ 4.48	Rs. 4.55
Percent		100%	83%	17%

		Costs		
		Total	Foreign Exchange	Local
D-8 CAT - $46,533 CIF				
Depreciation	20%	$ 9,306.60	$ 9,306.60	Rs.
Parts	7 1/2%	3,489.97	3,489.98	
Shop	7 1/2%	3,489.97	1,221.50	11,342.35
Interest-Insurance	7%	3,257.31	3,257.31	
Storage	4%	1,861.32		9,306.60
	46%	$21,405.18	$17,275.39	Rs.20,648.95
HOURLY FIXED CHARGE		$ 15.20	$ 12.27	Rs. 14.65
Percent		100%	81%	19%
Forwarded --		$ 15.20	$ 12.27	Rs. 14.65
POL	22%	3.34	3.17	.85
Field Maintenance		.45		2.25
Operator		.25		1.25
DIRECT COST		$ 19.24	$ 15.44	Rs. 19.00
Percent		100%	80%	20%
A.C. PULL SCRAPER MOD - 315 15 STRUCK YDS - $15,000 C and F				
Depreciation	20%	$ 3,000.00	$ 3,000.00	Rs.
Parts	12.5%	1,875.00	1,875.00	
Shop	7.5%	1,125.00	393.75	3,656.25
Interest-Insurance	7%	1,050.00	1,050.00	
Storage	4%	600.00		3,000.00
	51%	$ 7,650.00	$ 6,318.75	Rs. 6,656.25
FIXED HOUR COST		$ 5.43	$ 4.49	Rs. 4.70
Field Maintenance	3%	.16		.80
Lubes, etc.	5%	.27	.22	.25
DIRECT HOUR COST		$ 5.86	$ 4.71	Rs. 5.75
Percent		100%	80%	20%

		Costs		
		Total	Foreign Exchange	Local
MOTORISED GRADER, MEDIUM - No. 12 CAT - $21,860 CIF				
Depreciation	20%	$ 4,372.00	$ 4,372.00	Rs.
Parts	7 1/2%	1,639.50	1,639.50	
Shop	7 1/2%	1,639.50	574.00	5,327.50
Interest-Insurance	7%	1,530.20	1,530.20	
Storage	4%	874.40		4,372.00
	46%	$10,055.60	$ 8,115.70	Rs. 9,699.50
FIXED HOUR CHARGE		$ 7.14	5.76	Rs. 6.90
POL - Fuels	22%	1.57	1.49	0.40
Field Maintenance	3%	.21		1.05
Operator		.25		1.25
DIRECT HOUR COST		$ 9.17	$ 7.25	Rs. 9.60
Percent		100%	79%	21%
3 WHEEL ROLLER (RT TOWED) - $2,570 CIF				
Depreciation	33%	$ 848.10	$ 848.10	Rs.
Parts	20%	514.00	514.00	
Shop	10%	257.00	89.95	835.25
Interest-Insurance	7%	179.90	179.90	
Storage	4%	102.80		514.00
	74%	$ 1,901.80	$ 1,631.95	Rs. 1,349.25
DIRECT HOUR COST		$ 1.35	$ 1.16	Rs. 0.95
Percent		100%	86%	14%
SHEEPFOOT ROLLER - $6,000 CIF				
Depreciation	33%	$ 1,980.00	$ 1,980.00	Rs.
Parts	15%	900.00	900.00	
Shop	5%	300.00	105.00	975.00
Interest, etc.	7%	420.00	420.00	
Storage	4%	240.00		1,200.00
	64%	$ 3,840.00	$ 3,405.00	Rs. 2,175.00
FIXED HOUR COST		$ 2.73	$ 2.42	Rs. 1.55
Field Maintenance	3%	.08		.40
Lubes, etc.	5%	.14	.11	.15
DIRECT HOUR COST		$ 2.95	2.53	Rs. 2.10
Percent		100%	86%	14%

II. LABOUR RATES

CLASS	RS.-DAY-8HR MIN.	MAX.	25 DAY MONTH MIN.	MAX.	HOUR MIN.	MAX.	BASED ON 200 HRS/MO
Coolies			$ 15.75	$ 21.00	$0.0787	$0.105	without food
	3	4	75.00	100.00	0.375	0.5	without food
Common			$ 21.00	$ 26.25	$0.105	$0.131	" "
	4	4	100.00	125.00	0.50	0.625	
Semi-skilled			$ 26.25	$ 36.75	$0.131	$0.183	
	5	7	$125.00	75.00	0.625	0.875	" "
Skilled			$ 36.75	$52.50	$0.183	$0.26	
	7	10	175.00	120.00	0.875	1.25	" "
FOREMEN							
Gang-50 Men			$ 73.50	$115.50	$0.3675	$0.5775	
			350.00	550.00	1.75	2.75	With food
Grade Foreman			73.50	115.50	0.3675	0.5775	
			350.00	550.00	1.75	2.75	" "
Shop-Mech.			63.00	123.90	0.315	0.6695	
			300.00	590.00	1.50	2.95	" "
Mechanic semi-skilled			21.00	31.50	0.105	0.1575	
			100.00	150.00	0.50	0.75	" "
Mechanic skilled			32.55	52.50	0.1625	0.26 1/4	" "
			155.00	250.00	0.775	1.25	
OPERATORS							
All Tractors			$ 34.65	$ 50.40	$0.173	$0.252	
			165.00	240.00	0.825	1.20	" "
Shovel			34.65	50.50	0.173	0.252	
			165.00	240.00	0.825	1.20	" "
Dragline			34.65	50.50	0.173	0.252	" "
			165.00	240.00	0.825	1.20	
Mobile Crane			34.65	50.50	0.173	0.252	
			165.00	240.00	0.825	1.20	" "
3WH Roller			34.65	50.50	0.173	0.252	
			165.00	240.00	0.825	1.20	" "
2 AX Tandem			28.35	44.10	0.14	0.22	
			135.00	210.00	0.625	1.05	" "
3 AX Tandem			28.35	44.10	0.14	0.22	
			135.00	210.00	0.625	1.05	" "
14 S Concrete Mixer			23.00	44.10	0.116	0.22	
			110.00	210.00	0.55	1.05	" "
50 Ton/Hr Crusher			34.65	50.40	0.173	0.252	
			165.00	240.00	0.825	1.20	" "

III. EARTHMOVING COST ANALYSIS: MANUAL LABOUR

1. FOUNDATION TREATMENT

(a) 6 ft. height embankment

(b) Area toe to ton = 37,546 sq. yds.= ± 9,300 cu. yds.

(c)

ITEM	PRODUCTION	HRS.	DIRECT COST/HOUR in $	TOTAL COST $	F.E.$	LOCAL Rs.
Plow	8,800 sy/hr.	4.50	2.50	11.25	9.79	7.30
Farm Tractor	8,800 sy/hr.	4.50	3.84	17.28	13.53	18.75
Disk	4,400 sy/hr.	9.00	2.77	24.93	21.69	16.20
Farm Tractor	4,400 sy/hr.	9.00	3.84	34.56	27.06	37.50
Motor Grader	450 sy/hr.	20.00	9.18	183.60	145.79	189.05
RT Roller	3,000 sy/hr.	13.00	1.35	17.55	15.09	12.30
Farm Tractor	3,000 sy/hr.	13.00	3.84	49.92	39.09	54.15
Sheepfoot	220 cy/hr.	42.50	2.95	125.37	107.57	88.00
D-7 Tractor	200 cy/hr.	42.50	14.55	618.37	494.08	621.45
50 Ton RT Roller	3,000 cy/hr.	3.00	5.39	16.17	13.42	13.75
D-7 Tractor	3,000 cy/hr.	3.00	14.55	43.65	34.88	43.85
		TOTAL		1,142.65	921.99	1,103.30
		%			80.7	19.3

Unit cost $0.03 per sq. yd.

2. EMBANKMENT

(a) 6 ft. height

(b) 12 layers - 366,804 sq. yds. Average layer = 30,567 sq. yds.

(c) 79,200 cu. yds. loose

(d) ITEM

BORROW

Plow	8,800 sy/hr.	42.00	2.50	105.00	91.35	68.25
Disk	4,400 sy/hr.	83.00	2.77	230.00	200.10	149.50
Tractor, 90 hp.		125.00	3.84	480.00	375.84	520.80
D-8 Bulldozer	400 cy/hr.	200.00	19.25	3,850.00	3,087.70	3,811.50
		TOTAL		4,665.00	3,754.99	4,550.05
		%			81.0	19.0

Unit cost $0.06 cu. yd.

	PRODUCTION	HRS.	DIRECT COST/HOUR In $	TOTAL COST $	F.E.$	Local Rs.
3. EXCAVATION AND SPREAD (17,600 cu.yd/day)						
Coolies		316,800.00	0.105	33,264.00		166,320.00
Gang Foreman		6,340.00	0.577	3,656.00		18,280.00
Grade Foreman		72.00	0.577	42.00		210.00
Foreign Supervisor		36.00	13.06	470.00	329.00	705.00
		TOTAL		37,432.00	329.00	185,515.00
		%			0.88	99.12
		Unit cost $0.47 cu. yd.				
4. COMPACTION						
3-wheel Roller	3,300 sy/hr.	123.00	1.35	166.05	142.80	116.25
Farm Tractor	3,000 sy/hr.	123.00	3.84	472.23	369.76	513.35
Sheepsfoot Roller	220 cy/hr.	360.00	2.95	1,062.00	911.20	754.00
D-7 Cat	220 cy/hr.	360.00	14.55	5,238.00	4,185.62	5,261.90
Motor Grader	1,500 sy/hr.	245.00	9.18	2,249.10	1,785.78	2,316.60
		TOTAL		9,187.38	7,395.16	8,961.10
		%			80.5	19.5
		Unit cost $0.12 per cu. yd.				

5. SUMMARY

(a)	Foundation Treatment	$0.03/sq. yd.
(b)	Borrow	$0.06/cu. yd.
	Excavation and spread	$0.47/cu. yd.
	Compaction	$0.12/cu. yd.
	Sub-total	$0.68/cu. yd.
	Plus 2%	$0.01/cu. yd.
	Plus 25%	$0.17/cu. yd.
SUB-TOTAL		$0.86/cu. yd.
	Profit - 10%	$0.08/cu. yd.
TOTAL		$0.95/cu. yd. in place

38% in $	62% in Rs.
$0.37	$0.58

IV. EARTHMOVING COST ANALYSIS: MACHINE LABOUR

(a) Scraper Production: 20 cu. yd. heaped pull scrapers with D-8s for power and 1 pusher for 3 units. 50% E - 130 cu.yd/hr.

(b)

ITEM	PRODUCTION	HRS.	DIRECT COST/HOUR in $	TOTAL COST $	$	Rs.
Borrow: Ploughing and Aerating (79,200 cu. yds.)						
Plow		42	2.50	105.00	91.35	68.25
Disk		83	2.77	230.00	200.10	149.50
Tractor		125	3.84	480.00	375.84	520.80
		TOTAL		815.00	667.29	738.55
Scraper		610	5.87	3,581.00	2,872.00	3,545.00
D-8 Pull		610	19.25	11,742.00	4,758.00	34,920.00
D-8 Push		200	19.25	3,850.00	3,107.00	3,715.00
		TOTAL		19,173.00	10,737.00	42,180.00
	Unit Cost $0.25 per cu.yd.					
Compaction	Unit Cost $0.12 per cu.yd. (as before)					
Personnel:						
Foreign Superintendent		36	13.06	470.00	329.00	705.00
Grade Foreman		144	0.577	84.00		420.00
		TOTAL		554.00	329.00	1,125.00
	Unit Cost $0.01 per cu.yd.					

SUMMARY

Borrow	$0.25/cu.yd.
Compaction	$0.12/cu.yd.
Personnel	$0.01/cu.yd.
Sub-total	$0.38/cu.yd.
Plus. 2%	$0.01/cu.yd.
Plus 25%	$0.01/cu.yd.
Sub-total	$0.48/cu.yd.
Profit 10%	$0.05/cu.yd.
TOTAL	$0.53/cu.yd. in place

COST	64% in $	36% in Rs.
	$0.34	$0.19

APPENDIX 2

Suitability of Manual/Mechanical Methods for Various Highway Construction Operations in Developing Countries

S. No.	TYPE OF CONSTRUCTION	OPERATIONS	METHOD OF CONSTRUCTION IN DEVELOPING COUNTRIES
1	Clearing operations	Preparation of ground	By manual labour
2	Earthwork	Excavation	By manual labour
		Transportation	By manual labour with the help of wheelbarrows for small leads, and with trucks for longer leads
		Compaction	With power rollers
3	Soil stabilisation	Borrowing of soil	By manual labour
		Pulverising of soil	Possible in most cases by manual labour even though light and heavy machinery can do the job more efficiently and economically
		Adding stabiliser to the soil	By manual labour
		Dry mixing	Possible by manual labour, even though machinery would be better and cheaper
		Adding required moisture	By manual labour
		Wet mixing	By manual labour
		Compaction	With power rollers
4	Granular bases and surface courses	Laying of aggregate	By manual labour

S. No.	TYPE OF CONSTRUCTION	OPERATIONS	METHOD OF CONSTRUCTION IN DEVELOPING COUNTRIES
		Adding filler material	By manual labour
		Watering	By manual labour
		Rolling	By power rollers
5	Cement concrete	Batching of aggregates	By small capacity with batchers using manual methods for loading
		Mixing	Mechanical - using driven concrete mixers
		Spreading of the mix	By manual labour
		Compaction	Mechanical with small hand-operated vibration screeds
		Finishing and jointing	Manual - by manual skilled labour
6	Bituminous pavements		
	(a) Surface dressing	Spraying of bitumen	Light binder district
		Spreading of stone chips	Light gritters
		Rolling	With power rollers
Maintenance			
	Earth roads	For maintaining concentrated lengths	Light graders
		For maintaining scattered lengths	By manual labour
	Surfaced roads		By manual labour, preferably with some of transport i.e. bicycles, or motor-cycles or light trucks

S. No.	TYPE OF CONSTRUCTION	OPERATIONS	METHOD OF CONSTRUCTION IN DEVELOPING COUNTRIES
	(b) Opengraded premix surfacings	Mixing	Mechanical - by using mechanical mixers
		Laying	By manual labour
		Rolling	With power rollers
	(c) Grouted macadam	Laying of aggregate	By manual labour
		Spraying of bitumen	By manual labour
		Rolling	With power rollers
	(d) Asphaltic concrete	Mixing	With hot mix plants and pug-mill mixers
		Laying	With mechanical pavers
		Rolling	By using power rollers
7	Quarrying and crushing		
	(a) Large quarrying	Quarrying crushing	Full mechanisation
	(b) Small quarrying	Quarrying crushing	By manual labour
	(c) Small-scale crushing of graded stone		Portable mechanical crushers
	(d) Breaking into single size stone		

3. ROAD CONDITIONS IN THAILAND

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Before 1965 there were about 9,200 kilometers of road (Primary and secondary systems) in Thailand, about 4,500 kilometers were paved, the rest of them were crushed stone, laterite or dirt roads. The ones that already paved were rapidly and severely damaged by the heavy trucks which increased very rapidly in numbers due to the gowing economy. The government of Thailand had therefore set up a road construction and rehabilitation programme early in 1965. This plan set out to improve the primary and secondary route either by new construction or rehabilitation as the economy of the transportation called for. By rehabilitation, we improved mainly the structure of the existing roads to have good and sufficient base course with asphalt surface. We tried not to relocate the new alignment and changed the geometric standards of the existing roads in order that we could speed up our works and our roads could be paved more kilometers as much as possible so that it could keep pace with the transportation needs of the growing conomy of the country.

This highway development plan started in 1965 and will be ended 1971. It would cover some 8,200 kilometers of road, primary and secondary system, in all parts of the country. Parts of this 8,200 kilometers would be carried through government budget and the others through World Bank loan. The World Bank projects were concentirated mainly on primary system which are the main trunk line of roads in the country. The government projects covered the rest either by major improvement or rehabilitation. This project originally were estimated to amount to about 537 million U.S.$, but after 3 years of operation it was found out that the total money needed should be a little more. This is due to some adjustments in the design standards.

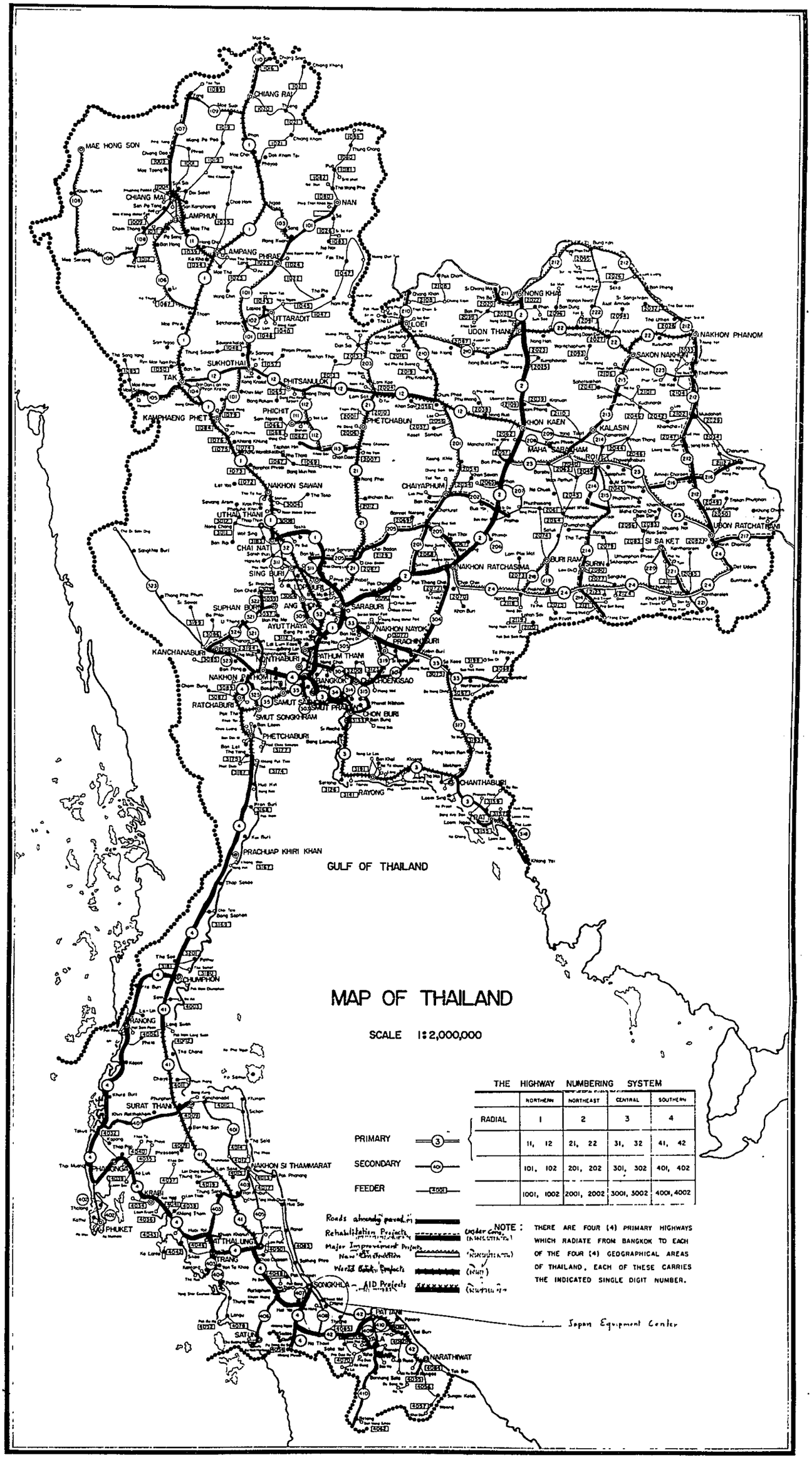
Highways Development Plan (Primary & Secondary)
1965 - 1971

Project	Distance km.	Estimated Cost mil. U.S.$.
A. Major Improvement Projects or New Construction Projects		
a) Government Budget	2,915	200
b) World Bank	2,381	234
c) AID	193	27
Sub-Total	5,484	461
B. Rehabilitation Projects	2,711	76
Grand-Total	8,200	537

Project	Completed km.	Under Construction km.
Construction Projects (Gov'nt)	614	495
Construction Project (World Bank)	577	740
Rehabilitation Projects (Gov'nt)	888	1,449

The figures above are of 1968, upto September.

Thailand also has some 8,000 kilometers of feeder road systems, only 1,000-kilometers of which are paved or paved to substandard, the rest of them are laterite or dirt roads. Most of these dirt roads which comprise the most percentage of them can only be passable during dry season. Last year the Department of Highways made an extensive economic study of all the feeder road systems and set up a feeder road improvement program which will start next year. Part of the financing fund would be from the World Bank loan, the rest would be through government budget.



MAP OF THAILAND

SCALE 1:2,000,000

PRIMARY (3)

SECONDARY (40)

FEEDER (4001)

Roads already paved

Rehabilitation Projects (under Cons.)

Major Improvement Projects

New Construction (Kanchanaburi)

World Bank Projects (Nhu)

AID Projects (Khon Kaen)

THE HIGHWAY NUMBERING SYSTEM

	NORTHERN	NORTHEAST	CENTRAL	SOUTHERN
RADIAL	1	2	3	4
	11, 12	21, 22	31, 32	41, 42
	101, 102	201, 202	301, 302	401, 402
	1001, 1002	2001, 2002	3001, 3002	4001, 4002

NOTE : THERE ARE FOUR (4) PRIMARY HIGHWAYS WHICH RADIATE FROM BANGKOK TO EACH OF THE FOUR (4) GEOGRAPHICAL AREAS OF THAILAND, EACH OF THESE CARRIES THE INDICATED SINGLE DIGIT NUMBER.

4. PRESENT CONDITIONS OF ROADS IN MALAYSIA

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INTRODUCTION

Malaysia coverw an area of about 130,000 square miles. It consists of two separate regions, East Malaysia and West Malaysia. East Malaysia (78,000 square miles) is the northwestern coastal area of Borneo and is made up of two states namely Sabah and Sarawak. Whilst West Malaysia is made up of eleven states of the Malay Peninsula which projects from the southern tip of Thailand into the South China Sea. At Appendix A is a map of Malaysia.

ROAD ADMINISTRATION

2. The aministration of roads in Malaysia is under four main organizations. The roads in Sabah and Sarawak are administered by the Sabah and the Sarawak Public Works Departments respectively whilst most of the roads in West Malaysia - about 95% - are administered by the Public Works Department of the Malay States. The four municipalities of Kuala Lumpur, Penang, Ipoh and Melaka are responsible for the rest of the roads in West Malaysia; roads which are within their respective areas. The four organizations function and operate independently.

3. The writer being an officer of the Public Works Department of the Malay States only, will in this report discuss merely the present conditions of roads in West Malaysia which are under the jurisdiction of his department. However some information on the roads in East Malaysia is given at Appendix B. The breakdown of roads in West Malaysia administratively is as follows:

(i) Public Works Department .... 9,591.78 miles
(ii) Municipalities ..... 547.92 miles

4. Further it should be noted that the roads under the Public Works

Department in West Malaysia are again sub-divided into two groups, namely:

(i) Federal roads ..... 3,018.28 miles

(ii) State roads ..... 6,573.50 miles

The Federal roads are generally the main trunk roads and those leading to the ports and the airports. Those roads are constructed from the Federal government funds. The State roads on the other hand are constructed either from the respective State funds or from grants given by the Federal government.

ROADS BY SURFACE TYPES

5. At present there are 10,139.70 miles of road in West Malaysia. About 83% (8,376 miles) have concrete or bituminous metal (asphalt concrete) surface; 13% (1,355 miles) have gravel or laterite surface whilst the remaining 4% (408 miles) are earth roads. In addition to these roads there are stretches of earth roads in the numerous rubber, coconut and oil palm estates constructed by the estate owners to serve their needs; some of those roads are used by the public.

ROADS SPECIFICATIONS

6. General For the design and construction of roads, the Public Works Department in West Malaysia currently has three standard specifications, namely:

(i) Specifications for the Construction of New Roads and Improvements to Existing Roads - 1955.

(ii) Specification for Mountain Roads - 1959.

(iii) Specification for Rural Roads - 1963.

The first specification is for the construction of the normal main roads other than roads in the mountainous area for which the second specification should be used. The third specification however needs some clarification.

7. Rural Roads The term "Rural Roads" does not have the same significance as that adopted by the American Association of State Highway Officials (AASHO). In Malaysia the term is applied to roads which penetrate the rural areas thereby giving vehicular access to the relatively small centres of population scattered throughout the

country. The term also covers roads which provide access to newly opened land areas for agricultural projects. The rural roads are intended as a mean to uplift the living standard of the once neglected and poor population of the rural areas. By the rural roads the government can bring the essential facilities e.g. medical, education, water supplies etc., to the rural population. Likewise the rural people then can readily take their agricultural products to the towns. The provision for rural roads in 1968 is about M$11,000,000.

8. Design Characteristics The main design characteristics of the three road specifications are as given below:

Design Elements	Normal Roads	Mountainous Roads	Rural Roads
1. Design Speed	60 m.p.h.	30 m.p.h.	40 m.p.h.
2. Minimum Radius of Curvature			
Desirable	1,500 feet	100 feet	1,000 feet
Minimum	965 feet	50 feet	480 feet
3. Gradient			
Desirable	1 in 30	1 in 15	1 in 20
Maximum	1 in 15	1 in 10	1 in 15
4. Pavement Width	22 feet	18 feet	14 feet

The three specifications have several limitations and are now being reviewed in order to revise and improve them so as to conform to the present day requirements of traffic and highway engineering.

PAVEMENT DESIGN

9. The road pavement is designed generally as a flexible type using the California Bearing Ratio (CBR) method. The subgrade is required to have a minimum CBR value of 11% at modified ASSHO density at optimum moisture content. The sub-base is generally of sand - minimum thickness 2 inches. The base is of crushed stone and the wearing course is generally premixed bituminous macadam (asphalt concrete) or to a limited extent semi-grouted.

CONSTRUCTION OF ROADS

10. Generally road construction in West Malaysia is fully mechanised. Only in surfacing work, where the working site is more than 60 miles from a central quarry that the labour-intensive method of semi-grouting is adopted. In the First Malaysia Plan (1966 - 1970) M$244,400,000 has been recommended for road improvements.

BRIDGES

11. Most of the bridges on main roads are of reinforced concrete except for a few timber bridges. The bridges are designed with Type HA loading of British Standard 153: Part 3A: 1954 (and amendments) of the British Standards Institution. The design stresses of steel and concrete are all in accordance with the relevant British Standards Code of Practice. On the rural roads however the bridges are still generally of timber.

ROAD MAINTENANCE

12. The major item in road maintenance is resurfacing. The roads are generally resurfaced with asphalt concrete produced at seven central quarries located at selected points throughout the country. Appendix C shows the locations of the central quarries. Maintenance funds for both Federal and State roads are provided by the Federal government at the following average rate:

(i) Federal Roads - M$5,400/ = per mile per year.

(ii) State Roads - M$4,500/ = per mile per year.

Each State government is at liberty to increase the maintenance fund of its roads from its own resources. For 1968 the Federal Government provided about M$15,000,000 and M$30,000,000 for the maintenance of Federal and State roads respectively.

ASIAN HIGHWAY

13. Until 1967, the only stretch of Asian Highway in Malaysia is Route A-2. It starts from south of Haadyai in Thailand on the western Thai border and goes down to Alor Star and through Kuala Lumpur,

the capital to Johor Baharu. All this stretch, about 580 miles has a width of 22 feet generally and is surfaced with asphalt concrete or semi-grout work. Then in 1967 at the meeting of the Asian Highway Coordinating Committee in Kabul, Afghanistan, Malaysia requested that the Asian Highway should be extended to East Malaysia. Further Malaysia also requested the inclusion of two other roads as part of the Asian Highway network:

(i) The road from the eastern Thai border at Golok down through Kota Baharu and Kuantan to Segamat.

(ii) The proposed East-West Highway connecting Butterworth to Kota Baharu.

All the requests was accepted by the Asian Highway Coordinating Committee. The locations of all the above mentioned roads are shwon on Appendix A.

TRANSPORTATION SURVEY

14. Towards the end of last year a general transportation survey covering the whole of Malaysia was conducted by the consultants Messrs. Frederic R. Harris, Inc., and Messrs. Robert R. Nathan Associates, Inc., of the United States of America. The survey was carried out for the Malaysian Government, the United Nation Development Programme and the International Bank for Reconstruction and Development. One of the objectives of the survey is to ascertain ways and means to provide a safe, efficient and economic road system for Malaysia. The survey has just been completed and the Malaysian government is now studying the report of the consultants. Whatever may be the decision of the Malaysian government on the report, one fact is obvious - the survey will certainly bring vast improvements to the present conditions of roads in Malaysia.

APPENDIX B

BRIEF INFORMATION ON ROADS IN EAST MALAYSIA

Generally the roads in East Malaysia are of lower standard than those in West Malaysia. However the roads in Sarawak are in better condition than those in Sabah. The location and extent of the roads can be seen on Appendix A.

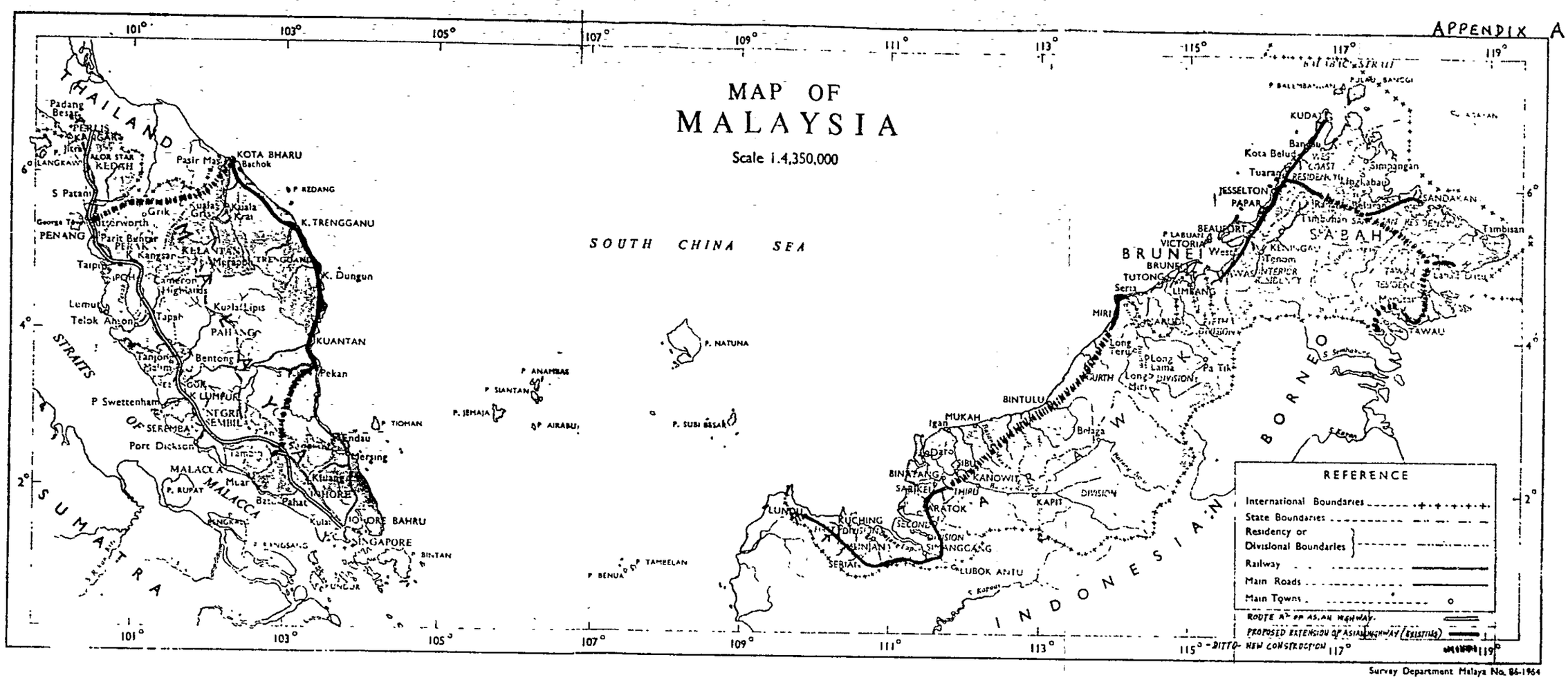
The road mileages in Sabah and Sarawak are as shown below:

Type of Surface	Sabah	Sarawak
Paved	276	131
Gravel	759	536
Earth	462	44
Total	1,497	711

Note: The above mileages are of 1966.

MAP OF MALAYSIA

Scale 1.4,350,000



Survey Department Malaya No. 86-1964

APPENDIX C


MALAY PENINSULA
SCALE OF MILES
THAILAND
KEDAH
Alor Star
Kangar
PERLIS
LANGKAWI ISLANDS
PENANG
PROV: WELLESLEY
PERAK
Port Weld
Kuala Kangsar
P. PANGKOR
Bagan Datoh
KELANTAN
Kota Bharu
Kuala Krai
Kuala Gris
Kuala Trengganu
TRENGGANU
K. Dungun
K. Kerich
Chuka
Kuala Lipis
PAHANG
Kuantan
Pekan
Temerloh
SELANGOR
K. Selangor
K. Lumpur
Port Swettenham
NEGRI SEMBILAN
Seremban
Port Dickson
Pontian
MALACCA
Malacca
JOHORE
Kluang
Batu Pahat
Kota Tinggi
Johore Bahru
Pontian Kechil
Kukup
SINGAPORE
P. TIOMAN
Mersing
STRAITS OF MALACCA
SUMATRA
CHINA SEA
REFERENCE
Railways
State Boundaries
International Boundaries
Main Roads
Central Quarry

5. ROADS IN SINGAPORE

Mr. Joseph Thorairatnam Nallaiah
Senior Executive Engineer
Department of Public Works, Singapore

(1) Prior to 1958 the roads in Singapore were administered by the City Council and the Public Works Department. The roads within the city limits were under the City Council and those outside the city limits under the Public Works Department. In 1958 the City Council was integrated with the Central Government organisation and since then the Public Works Department administers the road system in Singapore.

There are approximately 600 miles of metalled roads with asphalt wearing surfaces and approximately 400 miles of laterite roads in Singapore. The latter serve mainly the Kampong Areas where only temporary buildings exist. As these temporary buildings are replaced by permanent buildings these roads will be metalled. Some of the laterite roads which carry more traffic than others are provided with an asphalt wearing surface laid on the laterite base. Provided satisfactory drainage system is constructed, the asphalt wearing surface on the laterite base will stand up to a fair amount of traffic.

Singapore like other cities has problems due to congestion. There are approximately 250,000 vehicles and the rate of increase per year is around 6-8 %. To cope with the existing growth of traffic the expenditure on roads for the period 1966 - 1970 will be approximately S$80,000,000 (Singapore dollars). This amount is for construction only. The average maintenance expenditure is S$3,000,000 per year.

Singapore has a system of road network which basically is orientated towards the city centre. As early as 1955 on outer ring road system was mooted and construction work was commenced. This outer ring road to some extent caters for east-west movements bypassing the city centre. However, with the development of Jurong Industrial

Complex in the west and Toa Payoh New Town in the centre and other major developments in the eastern part of the Island it was found necessary to modify the old road network. Consequently a system of primary road network catering for commuter traffic to the city centre and an expressway in the form of an east-west direct link with a spear towards the city centre was proposed. Singapore is now engaged in upgrading the primary road network into 6 lane roads divided by a centre median strip. Construction of the expressway has already commenced and a three mile section will be completed by 1969. A further five mile section has been surveyed and work is expected to commence in 1969. Another 5 miles of a 3 lane road which will form one of the two dual carriageways has already been completed. It is expected to complete 13 miles of the proposed expressway by 1971.

In the southeastern part of the Island a major reclamation scheme is now in progress. A coastal expressway has been planned on the reclaimed land. The expressway will be from Bedok to the city centre and will be approximately 7 miles in length. This expressway will have to cross the mouth of the Geylang River Basin along the back of which shipbuilding industries are existing. Consequently a high level bridge will be required.

For long term considerations a land use and transportation survey is now in hand as a UNDP Programme. This survey is expected to be completed in 1970.

(2) ASIAN HIGHWAY ROADS IN SINGAPORE

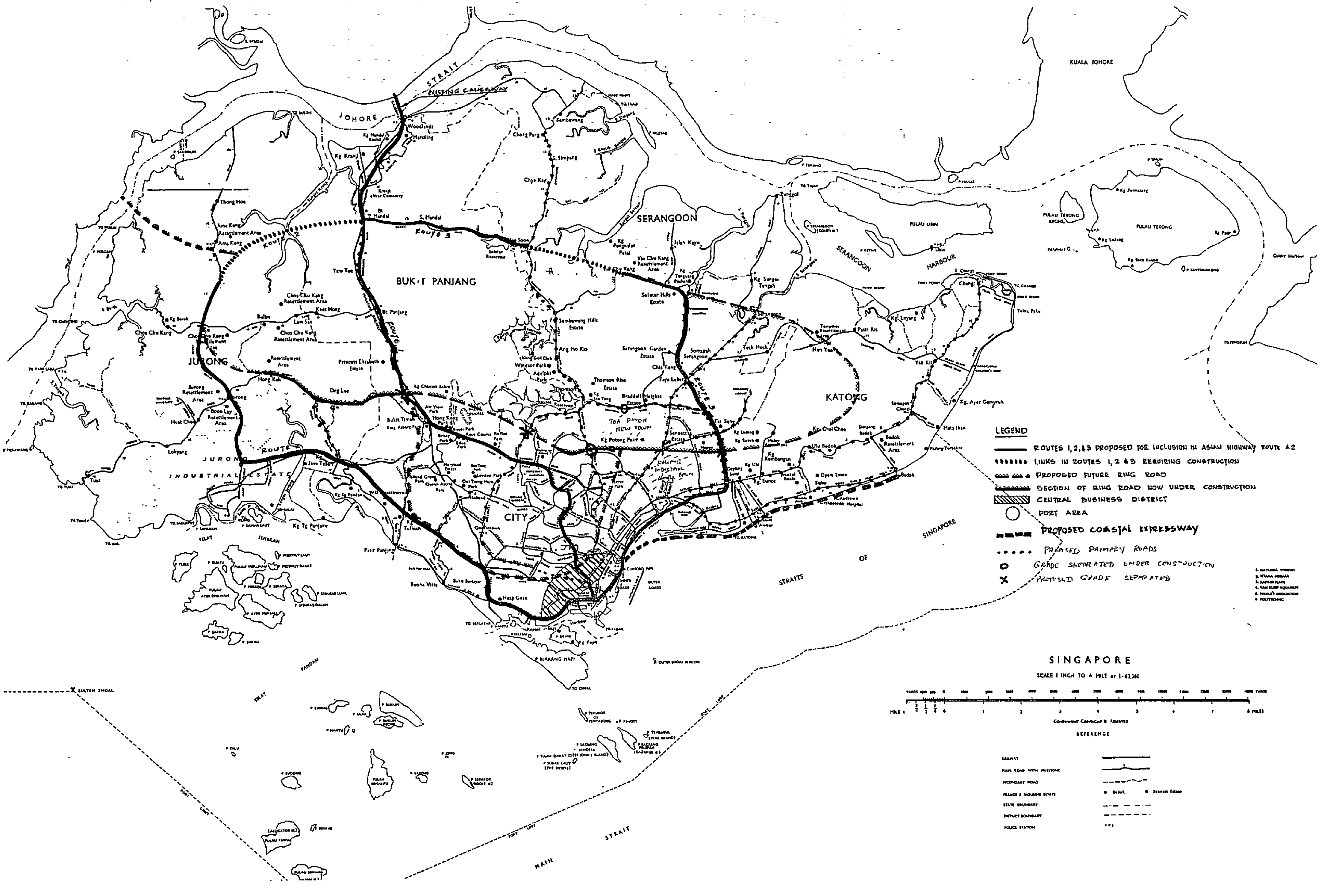
Singapore is the smallest of the Asian Highway countries. It has an area of 224 sq.miles but has the problems similar to any other large city. There are approximately 600 miles of metalled roads all of which are above minimum standards laid out by E.C.A.F.E. Of this approximately 60 miles are dual carriageways having dual three lanes. In addition there are approximately 400 miles of laterite roads. Some of these laterite roads have been provided with a bitumen wearing course. These roads are generally constructed to serve Kampongs and Rural areas.

Although the construction of the metalled roads in Singapore are above the minimum standards laid out by E.C.A.F.E., Singapore has problems due to congestion in the existing roads. There are approximately 250,000 resistered vehicles and there is an increase of 10,000 vehicles per year. The problem which faces Singapore like in any other large cities, in the problem of the growing number of cars entering the Central Business District. In order to cope with the increasing traffic congestion the yearly expenditure in Roads is gradually increasing. In the past the yearly expenditure on road construction excluding maintenance average 12 million Singapore Dollars per year. During 1968 approximately 18 million Singapore Dollars will be spent and from 1969 this figure is likely to increase to 29 million each year. The maintenance expenditure i.e. purely on our roads and bridges is approximately 3 million per year.

The main road from Malaysia into Singapore is the Bukit Timah Road. This forms part of the Route A2 of the Asian Highway. Certain sections of this road carries approximately 40,000 vehicles per day and congestion is the biggest problem. Bukit Timah Road entering the Central Business District area travels through heavily built up sections and any widening of this road would involve very expensive land acquisition and clearance. Consequently alternative diversion routes have been proposed, and included as part of the Asian Highway System. These routes will divert the traffic entering Singapore from Malaysia towards the Western and Eastern parts of the island without having to go through the more built up areas of the State. Because of other National commitments and other high priority Roads within the more congested parts of the State very little progress has been made on the Engineering Investigation of these two Diversion routes. The westerly proposed Diversion will lead directly into Jurong Industrial Complex from which a very good system of roads network have been constructed leading into the central business district areas. The Easterly Diversion route will lead towards the Eastern Part of the Island where the S'pore Airport exists and also where the Multi-Million Dollar Reclamation Scheme is now in progress.

Singapore's first Expressway is now under construction. The proposed Expressway is in the form of a loop and will link the Jorong Industrial Complex in the Western part of the Island with the New Town now under construction in Toa Payoh; the Kallang Industrial Basin Area and the proposed Developments in the Eastern part of the Island. Three miles of the Expressway are already well under construction and nearing completion. A further five miles from Thomson Road to Jurong Road has already been surveyed and plans and Tender Documents are being prepared. Five miles of Existing Jurong Road which will form part of the proposed Expressway has been realigned and upgraded and one of the dual three lane carriage way has been completed. The proposed Expressway will have six lanes each lane 12 ft. width with 10 ft. hard shoulders and a centre median of 8 ft width. The proposed Expressway will be grade separated at its junctions with existing roads.

A Reclamation Scheme is now in progress in the South Eastern Coast. A Coastal Expressway is being planned on the Reclamation Area. The Expressway will be from Bedok Road into the City and will be approximately seven miles long. A high level Bridge will be required near Tanjong Rhu. TaTarong Rhu is a ship building and repairing area and consequently ships will have to be permitted below the high level bridge.


LEGEND
ROUTES 1, 2, & 3 PROPOSED FOR INCLUSION IN ASIAN HIGHWAY ROUTE A2
LINKS IN ROUTES 1, 2 & 3 REQUIRING CONSTRUCTION
PROPOSED FUTURE RING ROAD
SECTION OF RING ROAD NOW UNDER CONSTRUCTION
CENTRAL BUSINESS DISTRICT
PORT AREA
PROPOSED COASTAL EXPRESSWAY
PROPOSED PRIMARY ROADS
GRADE SEPARATED UNDER CONSTRUCTION
PROPOSED GRADE SEPARATED
SINGAPORE
SCALE 1 INCH TO A MILE or 1:63,360
JOHORE STRAIT
EXISTING CAUSEWAY
KUALA JOHORE
SERANGOON
BUKIT PANJANG
JURONG
JURONG INDUSTRIAL ESTATE
CITY
KATONG
TOA PAYOH NEW TOWN
SERANGOON HARBOUR
PULAU UBIN
PULAU TEKONG
STRAITS OF SINGAPORE
MAIN STRAIT
ROUTE 1
ROUTE 2
ROUTE 3
Woodlands
Bt Panjang
Serangoon Garden Estate
Thomson Rise Estate
Braddell Heights Estate
Changi
Bedok
Pasir Panjang
Buona Vista
Queenstown
Hong Kong Park
Bukit Timah
Tai Seng
Paya Lebar
Hun Yan
Kg. Ayer Gemyruh
REFERENCE

6. CONDITIONS OF ROADS IN INDONESIA

Mr. Sudarsono
Chief. Road Division
Directorate General of Highways
Department of Public Works
Indonesia

1. Background information

Indonesia consist of 5 major islands (Sumatra, Java, Kalimantan, Sulawesi, West Irian) and about 15,000 smaller islands. The population distribution is very uneven, 74 million or 2/3 of the total population (115 million) is concentrated on the islands of Java which has 1/13 of the total area. The population in Sumatra is 19 million and the area 4 times bigger than Java.

Transportation conditions in Indonesia are unusual because of the country being an archipelago of islands spread out over thousands of miles of sea, Indonesia requires transportation facilities at sea, on land, in the air. There will be more intensive use of vehicles, stimulated by better airfields ports and highways. Nearly every where major production and consumption areas are relatively close to ports. Thus inter insular shipping largely plays the role of the country's trunk transportation system. Java has a 4,000 km railway system and there are four separate areas on Sumatra which are served by a total of 2,200 km of railway. The road network totals 83,000 km. With the exception of Java, land transportation is predominantly to and from the ports. Because of relative short distances, and the main types of produce carried roads are of special importance, this importance is certain to increase.

The shortage of funds consequent of Indonesia's unprecedented inflation has led to serious neglect of all transportation facilities over many years. This has been particularly true for roads and they are generally in poor condition. To keep matters in perspective it is necessary to appreciate that quite apart from the poor condition of existing roads, due to neglected maintenance, an even greater problem is that the structural and geometric standards of the

existing network must be upgraded to meet modern traffic needs. In addition it will be necessary to extend the system to meet high priority infrastructure demands.

A recent I.B.R.D. report "The Economic Development of Indonesia endorses the Government's view that very high priority must be given to an appropriate comprehensive road programme".

2. Road network

The road network totals 83,852 km, and only 20 percent are in reasonable condition. The road classification is as follows:

a. State roads	10.139 km
b. Provincial roads	22.682 km
c. Country roads	51.031 km

a. State roads :		
asphalt concrete	:	144 km
surface treatment	:	4.513 km
gravel/macadam	:	5.482 km
		10.139 km
b. Provincial roads :		
surface treatment	:	7.833 km
gravel/macadam	:	12.549 km
unpaved	:	2.300 km
		22.682 km
c. Country roads :		
asphalt concrete	:	-
surface treatment	:	5.030 km
gravel/macadam	:	16.151 km
unpaved	:	29.850 km
		51.031 km

3. Responsibilities for road programs

Responsibility at national level is with the Department of Public Works (e.g. Directorate General of Highways). The annual program for maintenance goes directly to the department of Finance which will allocate the funds through the routine budget.

The annual program for rehabilitation and new projects must be submitted to the Central Planning Board for National Development (Bappenas) which will coordinate the plans of all Departments and will be made available by the Department of Finance through the budget for Development.

Responsibility at provincial and country level is with the Provincial or Country Public Works Department. The maintenance and development program must be submitted to the Office of the Governor or of the Country Chief (Bupati). Funds for maintenance will be made available through the Provincial or Country Routine budget by the Office of the Governor or Country Chief.

Funds for rehabilitation and new projects will be made available by the Office of the Governor or Country chief (Bureau of Finance) through the Provincial or Country Budget for Development.

4. Financing of road works

(a) The budget for National Roads is on the National or Central Budget (Routine or Development Budget). The budget for Provincial Roads is on the Provincial Budget (routine or Development gudget). The budget for country raods is on the country budget (routine or Development Budget).

(b) The Central Department of Public Works with the approval of the Planning Board can also allocate funds for regional road programs in the form of subsidies directly to the Provincial or Country Public Works Departments in case such regional road programs have national or interregional significance but cannot be borne by the Regional Budget. The same procedure applies also within the Province with regard to the Governor (e.g.Provincial Puylic Works Department) and the Country road programs.

(c) All fund for road maintenance, rehabilitation and projects are contributed by the ordinary budget. There are no special road funds for toll administrations (Exception: The Trans Sumatra Highway Authority, which is still in status nascendi).

In several province special road taxes or road-rehabilitation contributions are levied on vehicles on an annual basis; these contributions are not administered by a special road fund but by the Governor's Office and are regarded as incomes for the Provincial Budget.

5. Execution of the road works

(a) Maintenance :

The maintenance of National and Provincial Roads is with the Regional Offices of the Provincial Public Works Department, for the National Roads under supervision of the Directorate of Maintenance and Rehabilitation of the Directorate General of Highways (Directorate level).
The maintenance of Country Roads is with the Country P. W. Department.

(b) Road project executed under foreign aid must use the services of foreign consultants for engineering and supervision, Road projects without foreign aid are usually without employment of consultants, all engineering and supervision works can be done by the respective agencies and branches within the Central or Local Government.
Only in a few cases are consultants for engineering engaged, these are Government owned Engineering and Contracting Companies.

6. Design standards

The present design standards were based on the road classification according to maximum axle loadings. A revision in process of new road classification and design standards is influenced by different economic needs, growing traffic numbers, and modern and international adopted criteria. The new classification will be based on both the maximum axle loading :

Class A - 8 tons
Class B - 5 tons
Class C - 2 tons

and traffic density according to the newly adopted highway standard of the ECAFE.

7. The five year plan (1969 - 1973)

It is widely known that Indonesia's first five year plan (1969 - 1973) will be concentrated on agricultural development. Agriculture contributes 65% to our national income. Approximately 70% of our total labour force are employed in agriculture. Agriculture outputs produce 70% of our export earnings.

While programming of inputs for rice production can be mapped out, and perhaps also the same thing on the channeling of its output, it is clear that planning of rice-production cannot be separated from the programming of its supporting facilities, such as road rehabilitation between the production centres and the cities, the harbours and the rice area, etc. Good transportation may by its own merit already contribute to a higher rate of production. Better communication between source of information and the farmers are also important. Weather reports, reports of prices of fertilizer, rice etc. may helps the former in selling their products.

As calculated in the I.B.R.D. report, the order of cost is US$1,2 billion for roads development. And it has been suggested, again by the I.B.R.D. that a tentative planning period for completion should be 10 - 15 years. To realize this, a rate of expenditure approaching US$100 million per annum must be achieved within the next five years or so. This is about eight times the present rate. We believe this enormous task can be accomplished.

In order to work positively towards the Highway Development objective, a simple physical target has been established for achievement during the next years. This is to rehabilitate more than 50% of existing highways and to undertake such limited urgent development works as may be essential and feasible.
The main prerequisites for success include technical assistance and financial credits on a large scale. Comprehensive surveys and investigation are obviously essential.

A draft five year Road Development Plan has been prepared. This is based on the target 1973 "rehabilitation of more than 50% of existing roads plus urgently new roads construction". Limited funds

and available equipments (rollers, graders, dump trucks, etc.) dictates that to get the optimum results, most of the efforts should be concentrated on several regions only. As such Sumatra has been selected as the principal area for rehabilitation programs for 1968 and the next few years.

The estimated cost is about US$ 294 million (equivalent) with a minimum exchange component of 21%. This plan provides for a program under five main headings as follows :

a.	Rehabilitation and upgrading	US$ 144,7
b.	Construction/development	20,1
c.	Planning survey and design	5,1
d.	Research and investigation	4,1
e.	Supply and equipment	119,7
		US$ 293,7 million (equivalent)

This is of course realistically modest when compared with the I.B.R.D. assesment of US$ 1,2 billion over the next 10-15 years; it does however involve a rate of expenditure almost five times that of the inadequate programme now in hand. It is expected that it will be possible to finance the programme partly by credits from the I.B.R.D. and its associate organizations, partly from bilateral financial aid we anticipate will be made available, and as our economy improves increasing allocations from our own financial resources.

Contract for consultants services between IBRD and KAMPSAX (Denmark) in association with Louis Berger Inc. (U.S.A.) is signed on September 20, 1968.

The purpose of this assignment is to :

(a) Assist the Government of Indonesia in the preparation of an inventory of existing highways, equipment and materials available for the maintenance and construction of highways, and all existing organizations and personnel engaged in highway administration, maintenance and construction.

(b) Prepare a program for immediate rehabilitation of the existing highways and assist in the procurement of maintenance equipment and material required therefore.

(c) Provide support, during 1969 and 1970, in the operation and management of the organizations responsible for highways in Indonesia and assist in the implementation of the rehabilitation program resulting from (b) above and the development program resulting from (d) below.

(d) Prepare a program for the development of the highway system of Indonesia in the years 1970 through 1973.

(e) Prepare selected high priority highway projects for foreign financing.

8. The Asian Highway

The A-25 in Sumatra having a total length of 2686 km and the A-2 route is interupted at Singapore, begins again at Merak, crosses Java from west to east, and ends at Denpasar. The traffic is relative light, or light with the exception of the Djakarta - Bandung section where it reaches 10,000 veh./d. Now and the next few years Sumatra has been selected as the principal area for rehabilitation programs. At the end of the five year plan (1969 - 1973) we expected the A-25 route is entirely asphalted. The condition of the road in Java (A-2 route), which is almost entirely asphalted, is acceptable. The Government has recently been making a considerable effort to maintain and improve it.

Hotel facilities are inadequate in both quantity and quality, with the exception of four international hotels at Djakarta, Jogjakarta, Bali and Medan.

Fuel distribution, which is handled by a state company, is presently adequate.

Day and night pump stations exist in major cities. Gasoline is incomparison to other countries very cheap. The premium grade cost Rp.20 per liter and the regular grade cost Rp.16 per liter or comparable to 3.2 US Cents per liter (10,5 yen per liter).

9. Foreign aid

Financial credit has been arranged with the US Government under its Balance Export program. With this money urgently required bridging steel, work-shops, construction equipment and trucks are being purchased and materials laboratories are being established. This program also includes for US-AID to provide support technical assistance, including master mechanics and a construction specialist.

Further credits have been arranged with the Netherlands government for bulk asphalt storage and transport facilities. The Japanese Government has considered to provide the balance of our bitumen requirements.

The assistance will be forthcoming in the first quarter of 1969 and will set our five year roads plan of with a good start.

Indonesia today is back on the path of rationalism. We have no doubt that the energy of our people will soon find its rightful outlet and contribute to the world more and better products, more and better friendship.

A new and reborn Indonesia is entering the family of nations. May God give us our rightful place under His Sun.

7. VIETNAM HIGHWAY NETWORK

Mr. Trans-Van-Quinh
Chief of South District of P.W., Cantho, Viet-Nam

In the Republic of VietNam, the Highway network is under management of the Directorate General of Highway belonging to the Ministry of Public Works, Communications and Transport.

I. — ORGANIZATION (see chart I)

According to the scheme of organization the Directorate General of Highway is composed of 3 separate Divisions and two Directorates with five Divisions at the central office, and five Regional Districts with fifty subdivisions in the provinces.

The principal aim of the Directorate General of Highway consists of :

— Maintaining and improving the existing highway system in order to serve the increasing needs of transport.

— Building new roads to satisfy economic and military needs.

In order to accomplish this work, the Directorate General of Highway has to spend almost one billion piasters (8 millions $US) a year, and mobilizes more than 6,000 full time persons.

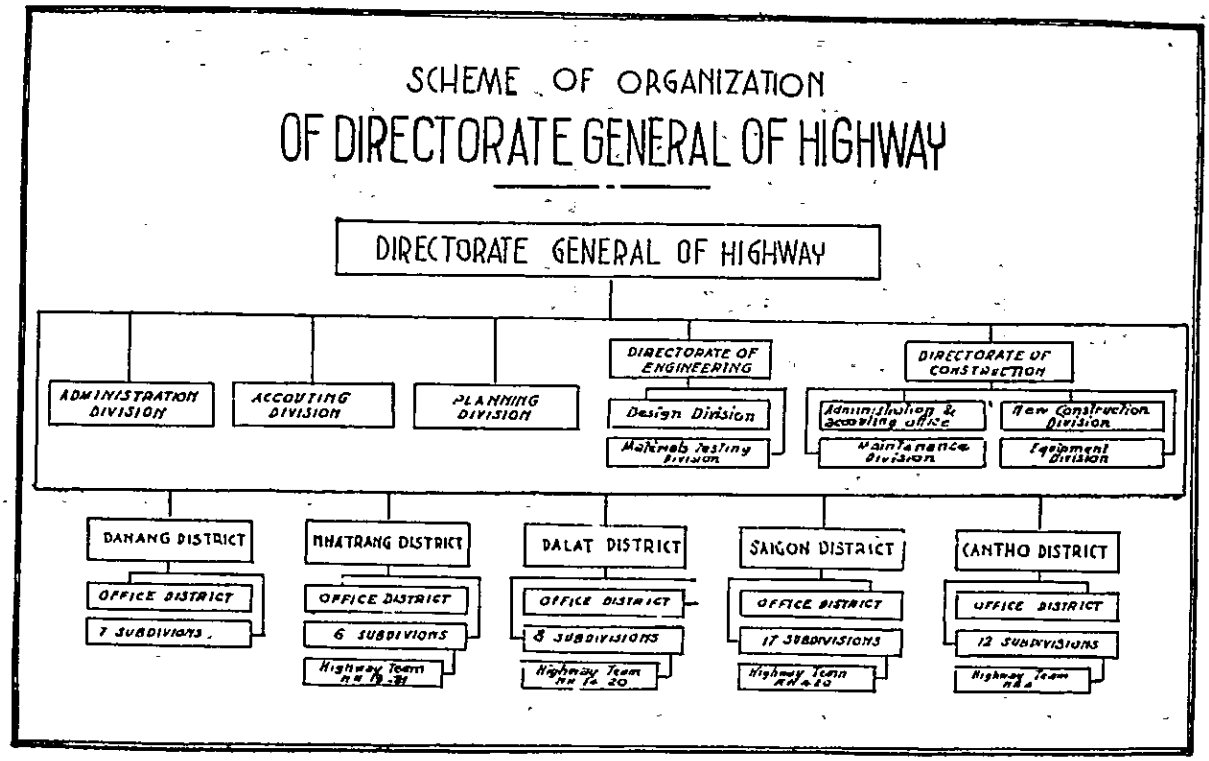
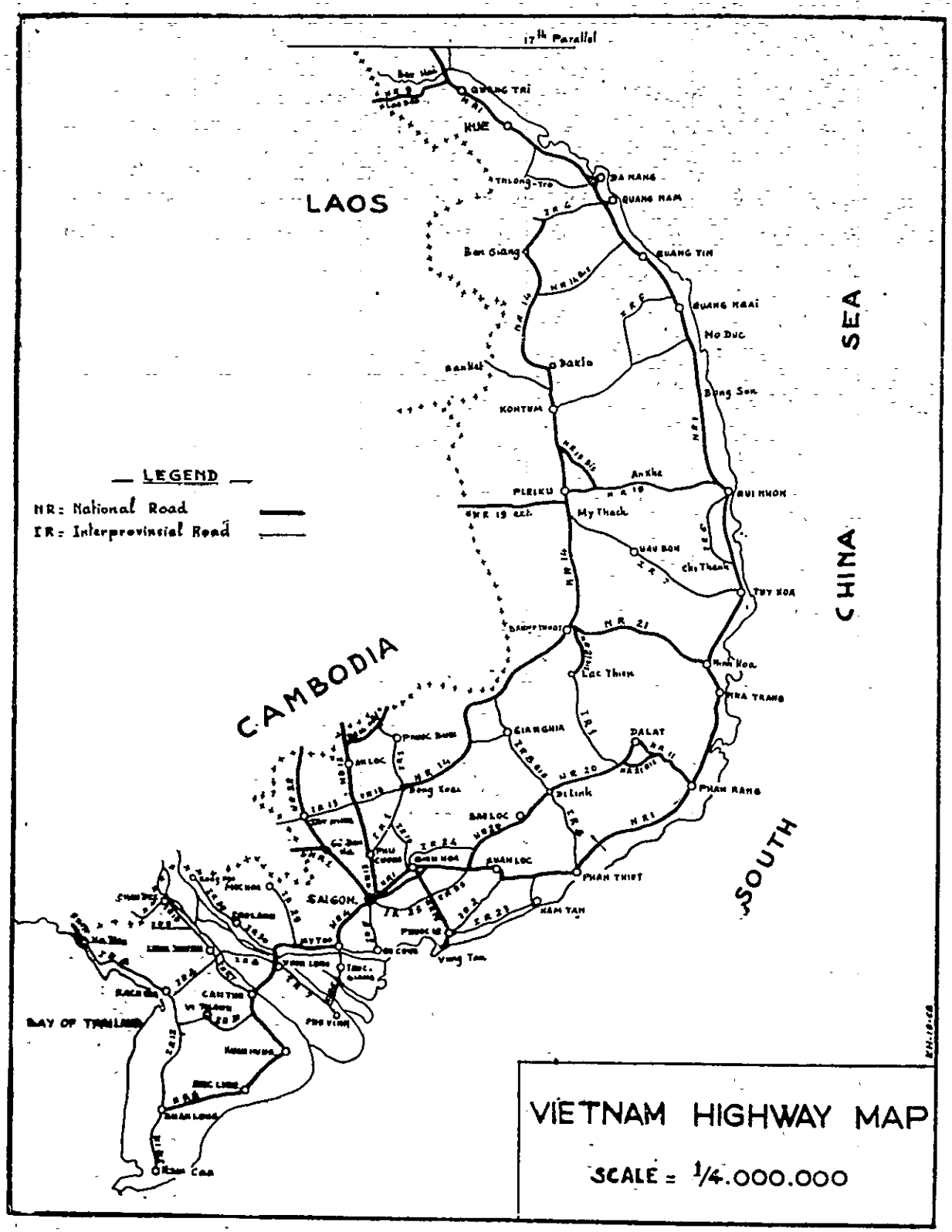


CHART I


17th Parallel
LAOS
CAMBODIA
CHINA SEA
SOUTH
LEGEND
NR: National Road
IR: Interprovincial Road
VIETNAM HIGHWAY MAP
SCALE = 1/4.000.000

MAP I

II. — THE EXISTING HIGHWAY NETWORK (see map I)

Presently the Republic of Viet-Nam has an important highway system consisting of 20,255km this is an equivalent of 11,500 km for every 100 sq. km.

The existing highway system has a surface pavement width from 4 to 6 meters and 4,448 bridges with a total length of 97,201 m (see chart II and chart III) including 1,627 temporary timber bridges, having a mean load carrying capacity of 12 tons. Besides that, there are 16,064 pipes and culverts with a total length of 44,457m.

The highway system is denser in the delta region than in the Highlands and the center of Viet-Nam.

The principal highways are :

— The National Highway (N-H) N° 1, long of 1,242 km, going from Dông-Hà to Saigon by the seaside.

— The N-H N° 14 Saigon-Banmêthuôt-Pleiku long of 746 km, connecting the capital with different provinces in the Highlands.

— N-H N° 19 Pleiku-Qui-Nhon long of 153 km, and

N-H N° 21 Banmêthuôt-Ninh-Hoà long of 149 km. joining the important cities in the Highlands to the harbours on the coastal region.

In the delta, two important highways are the N-H N° 4 Saigon-Camau long of 345 km, and the Interprovincial highway, N° 8 (Vinhlong-Longxuyên-Rachgia-Hàtiên) long of 210 km.

The Section of an existing road was composed of :

— subbase : 30cm of laterite

— base : 10cm of crushed stone

— pavement : 4cm of light bituminous treatment.

In certain region where there is a lack of laterite sometimes young bricks or cooked mud are used as subbase (for example in the Mekong Delta area).

The design vehicle for old existing bridges are 12 - 18 Tons.

From 1965 one part of the existing highway system has been improving to modern standards according to the ten-year plan of highway improvement (1965-1975) (see map II).

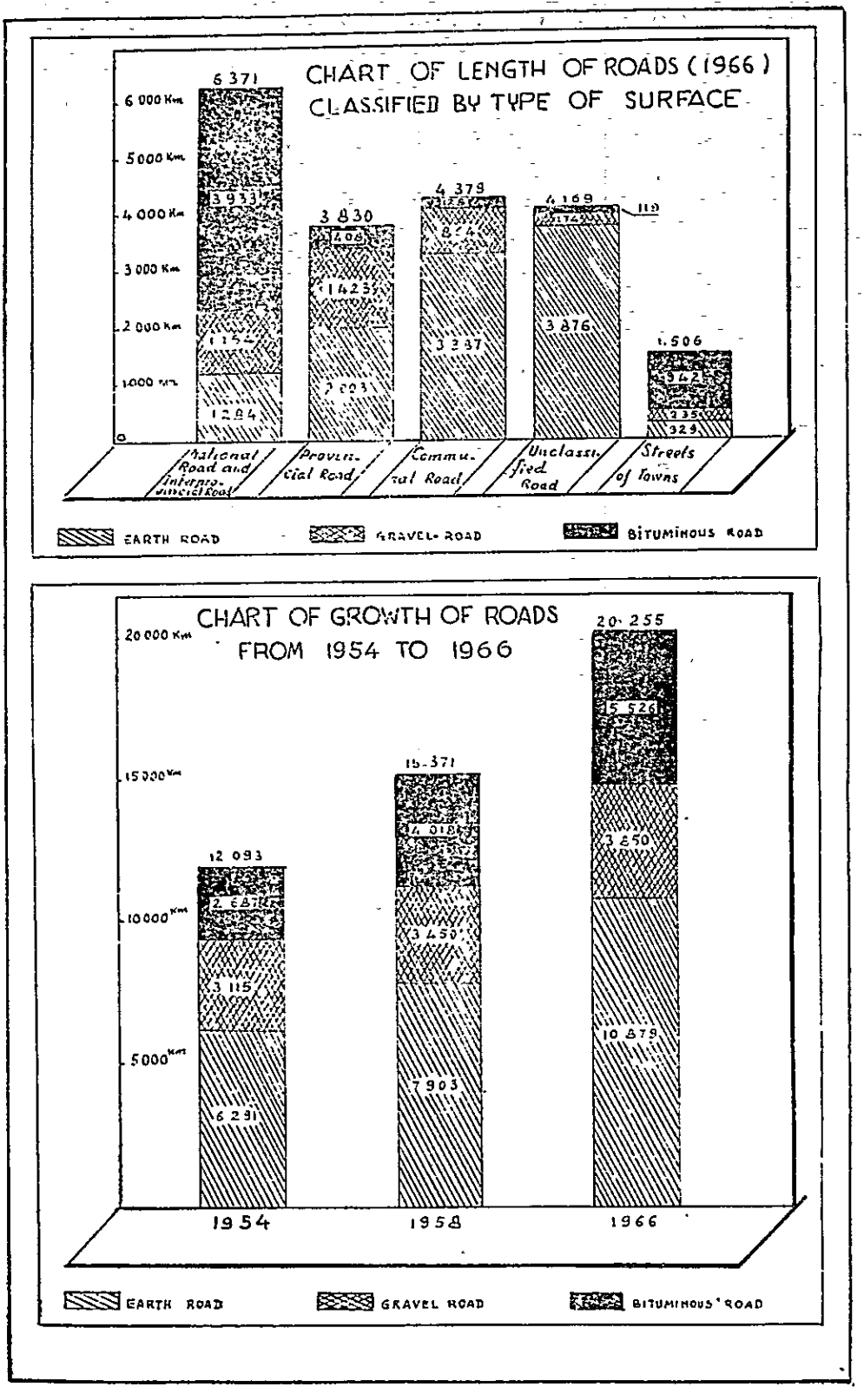


CHART OF LENGTH OF ROADS (1966)
CLASSIFIED BY TYPE OF SURFACE
6 000 Km
5 000 Km
4 000 Km
3 000 Km
2 000 Km
1 000 Km
0
6 371
3 933
1 154
1 284
3 830
406
1 423
2 003
4 378
854
3 237
4 169
176
3 876
119
1 506
342
335
329
National Road and Inter-provincial Road
Provincial Road
Communal Road
Unclassified Road
Streets of Towns
EARTH ROAD
GRAVEL ROAD
BITUMINOUS ROAD
CHART OF GROWTH OF ROADS
FROM 1954 TO 1966
20 000 Km
15 000 Km
10 000 Km
5 000 Km
12 093
2 647
3 115
6 291
15 371
4 018
3 450
7 903
20 255
5 526
3 850
10 879
1954
1958
1966
EARTH ROAD
GRAVEL ROAD
BITUMINOUS ROAD

CHART II

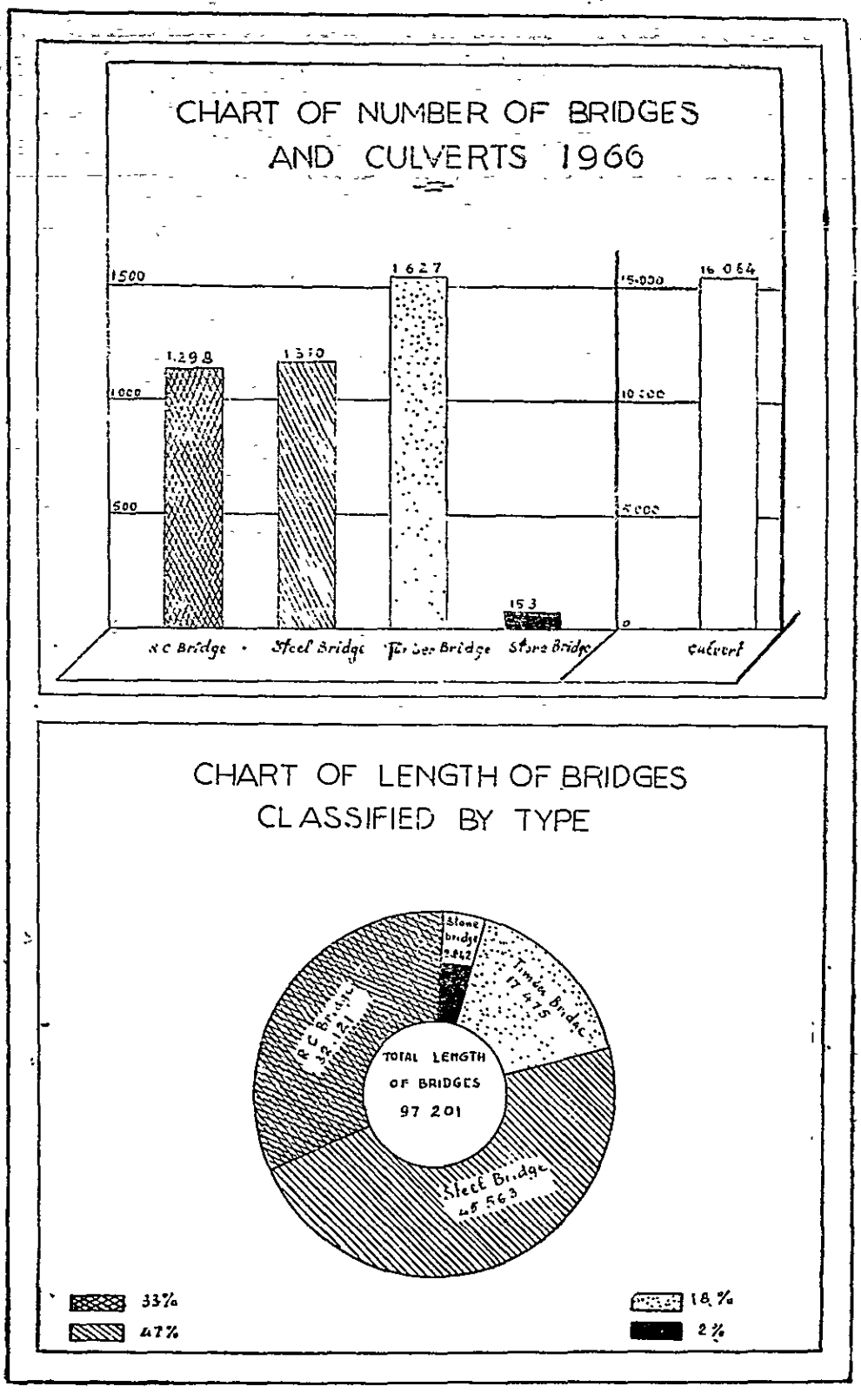


CHART OF NUMBER OF BRIDGES
AND CULVERTS 1966
1500
1000
500
1298
1350
1627
153
15000
10000
5000
0
16064
R C Bridge
Steel Bridge
Timber Bridge
Stone Bridge
Culvert
CHART OF LENGTH OF BRIDGES
CLASSIFIED BY TYPE
Stone bridge 2842
Timber Bridge 17 475
R C Bridge 32 121
TOTAL LENGTH OF BRIDGES 97 201
Steel Bridge 45 563
33%
47%
18 %
2 %

CHART III

TABLE OF LENGTH OF HIGHWAYS AND BRIDGES

HIGHWAY	TOTAL in Kilometer	ROAD			BRIDGE	
		Bitumi-nuous	Gravel	Earth	Number of bridge	Length of bridge in meter
— 1 NATIONAL HIGHWAY.	3.788	3.177	206	395	1.098	33 512
— 2 INTERPROVINCIAL HIGHWAY	2.593	756	948	889	746	18.495
— 3 PROVINCIAL ROAD	3.830	404	1.423	2.003	1.080	17.993
— 4 COMMUNAL ROAD	4.379	128	864	3 387	891	15.463
— 5 NON CLASSIFIED ROAD	4.169	119	174	3.876	516	7.374
— 6 CITY STREET	1.506	942	235	329	117	4.364
TOTAL	20.255	5.526	3.850	10.879	4.448	97.201

III — ASIAN HIGHWAY (see map II)

The Republic of VietNam has a total of 2.802 km of highways belonging to the Asian Highway system.

The international highway priority A - 1, long of 67 km connects the border of Cambodia and the Capital Saigon by borrowing N - H No 1.

The international highway priority A - 3, long of 1,648 km, going from Hatiên (border of Cambodia) to Lao-Bao (border of Laos) is composed of different parts of highway :

— Hàtiên - Cântho (I.H No 8 and I.H No 27)

— Cântho - Saigon (N.H No 4)

— Saigon - Pleiku (N.H No 13 and N.H No 14)

— Pleiku-QuiNhon (N.H No 19)

— QuiNhon-LaoBao (N.H No 1 and N.H No 9)

— The international highway priority A - 14 long of 135 km connects Pleiku and BanHet (border of Laos).

The international highway A-10 long of 663 km connects Saigon and Qui-Nhon by following N-H N° 1.

The international highway non priority A-17 long of 284 km connects Tân-Canh and Vinh-Diên.

IV.— THE PRESENT HIGHWAY TRANSPORT

At the present time, the traffic in the different highways increases very quickly. The increase is estimated with the average of 12% a year, in comparison with the increase of 3% a year of the population and the increase of the national income of 4% a year. (see figure I)

The total of civilian motor vehicles is about 180.000, where there are about 12% of trucks (25% of four-wheel vehicles), so the land transport occupies the most important part in the branch of transport. (see chart IV)

The land transport uses in majority 5,000 km of principal highway where almost 65% are centralised around the Saigon area and the delta area; however the Highlands and the Center of Viet-Nam have only 15% of the total traffic in each area.

The increase of civilian motor vehicles and also of military vehicles causes a problem of congestion in the large cities specially in Saigon and a problem of overloading due to the heavy axles acting on the highway foundation built long ago for light vehicles.

V.— NEW GEOMETRIC DESIGN STANDARDS (4-1968)

I— TRANSVERSE PROFILE STANDARDS, FOR TWO-LANE ROAD

Class A :

Used for :

— All National Highway (N.H.)

— Interprovincial Highway with ADT $>$ 1000

— If ADT $>$ 3000, 4 lane road or more is used.

Class B :

Used for Interprovincial Highway (I.H.) with ADT $<$ 1000.

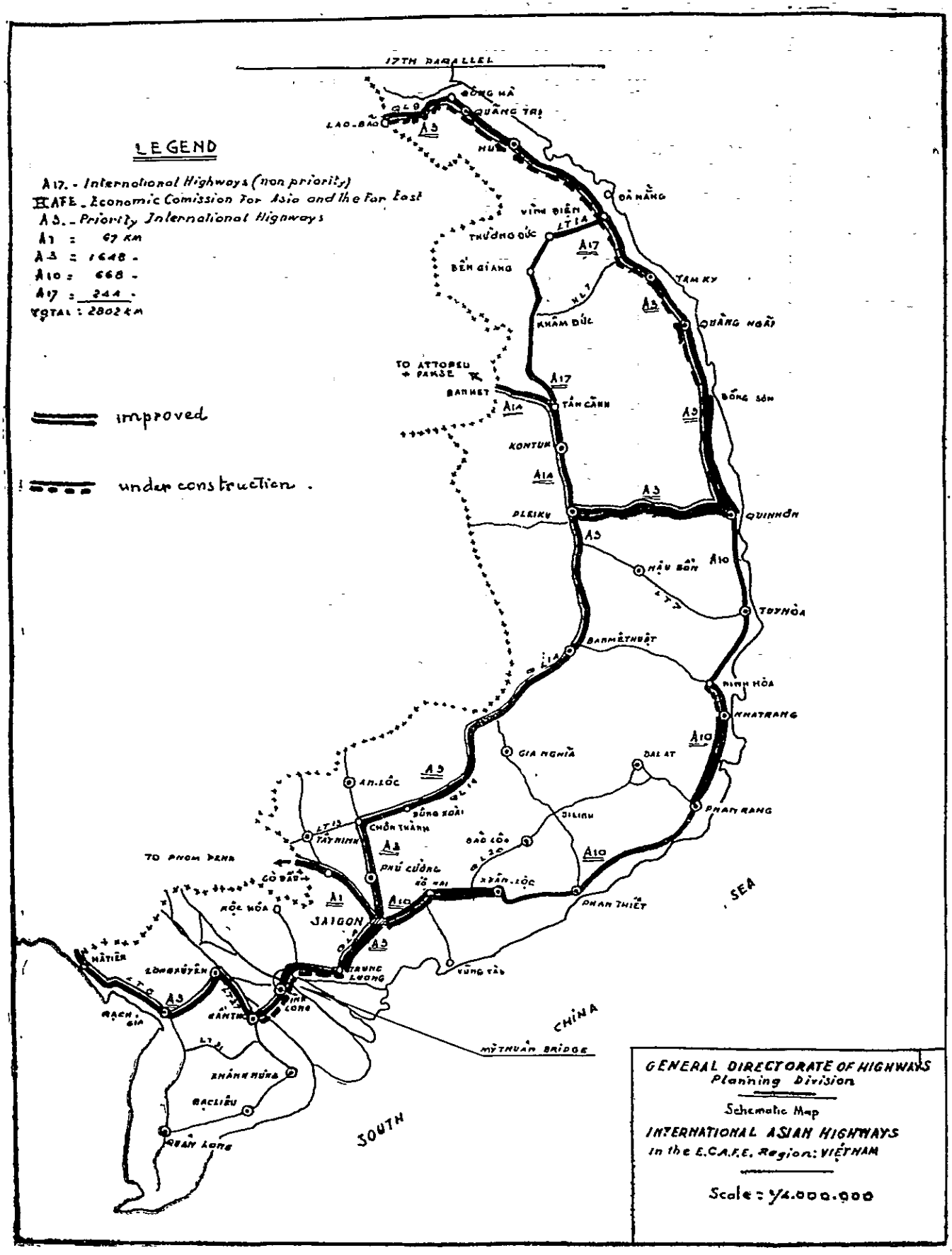
Class C :

Used for Provincial Road (P.R)

Class D :

Used for Communal Road (C.R),

For more details see figure II.


17TH PARALLEL
LEGEND
A17. - International Highways (non priority)
ESCAFE - Economic Comission For Asia and the Far East
A3. - Priority International Highways
A1 : 67 KM
A3 : 1648 -
A10 : 668 -
A17 : 244 -
TOTAL : 2802 KM
improved
under construction
ĐÔNG HÀ
QUẢNG TRỊ
LAO-BẢO
HUẾ
ĐÀ NẴNG
VĨNH ĐIỆN
THƯỜNG ĐỨC
BẾN GIẰNG
TAM KỲ
KHÂM ĐỨC
QUẢNG NGÃI
TO ATTOPEU + PAKSE
BANMET
TÂN CẢNH
BỒNG SƠN
KONTUM
PLEIKU
QUINHƠN
HẬU BỔN
TUYHÒA
BANMÊTHUỘT
NINH HÒA
NHATRANG
GIA NGHĨA
ĐALẠT
AN.LỘC
BÙNG XOÀI
PHAN RANG
TÂY NINH
CHƠN THÀNH
DILINH
BẢO LỘC
TO PHOM PENH
CỬA BẮC
PHÚ CƯỜNG
XUÂN-LỘC
PHAN THIẾT
SEA
MỘC HÓA
SAIGON
MỸTHO
LONG XUYÊN
VŨNG TÀU
CHINA
MỸTHUẬN BRIDGE
RẠCH GIÁ
BẾN TRE
VĨNH LONG
SOUTH
KHÁNH HƯNG
BẠC LIÊU
CÀ MAU
GENERAL DIRECTORATE OF HIGHWAYS
Planning Division
Schematic Map
INTERNATIONAL ASIAN HIGHWAYS
in the E.C.A.F.E. Region: VIỆTNAM
Scale : 1/4.000.000

MAP II 62

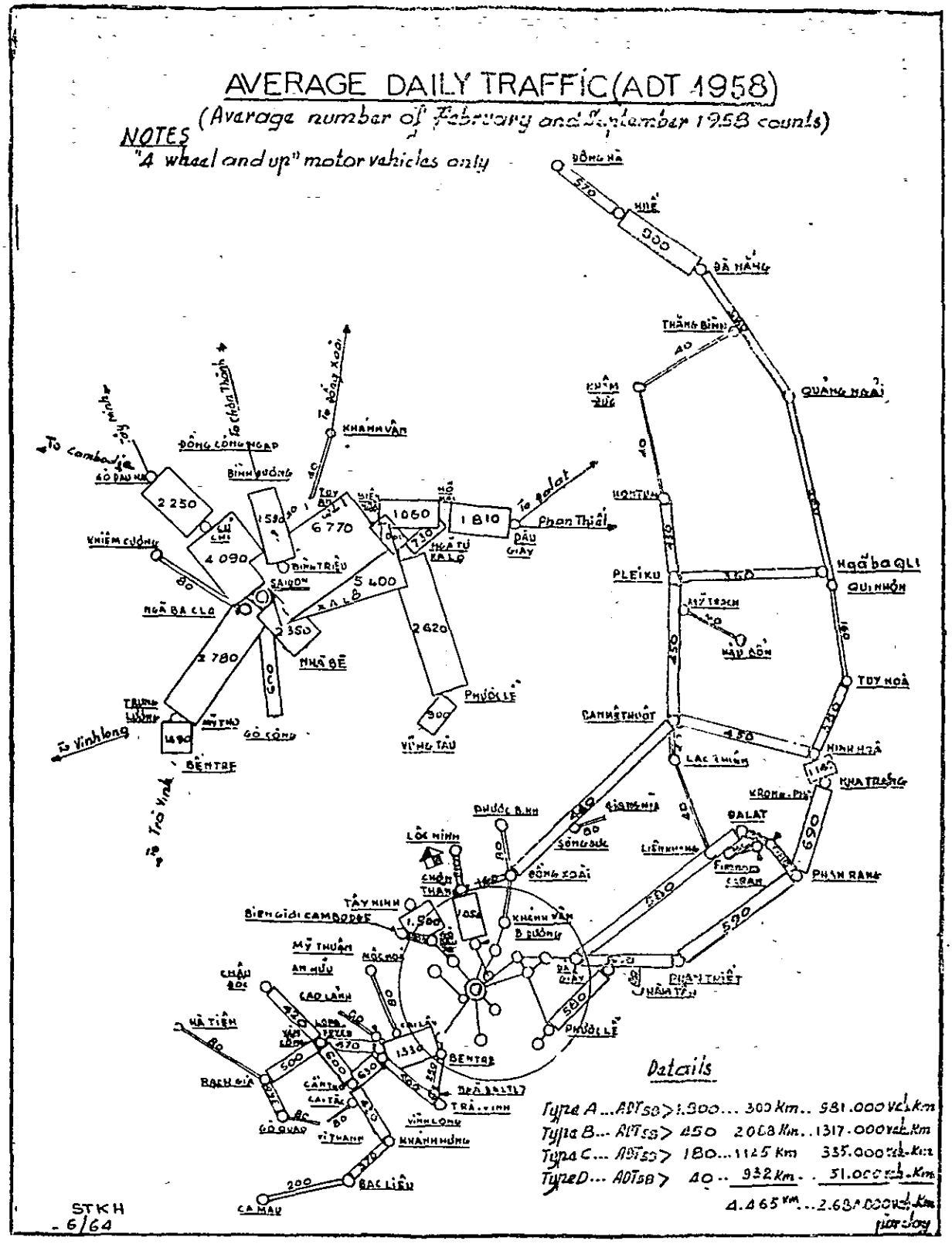

AVERAGE DAILY TRAFFIC (ADT 1958)
(Average number of February and September 1958 counts)
NOTES
"4 wheel and up" motor vehicles only
ĐỒNG HÀ
HUẾ
ĐÀ NẴNG
THĂNG BÌNH
QUẢNG NGÃI
KHÁNH VÂN
ĐỒNG CÔNG NGẠP
BÌNH DƯƠNG
GÒ DẦU HẠ
KHIÊM CƯỜNG
BÌNH TRIỆU
SAIGON
NGÃ BA CLO
NHÀ BÈ
MỸ THO
GÒ CÔNG
BẾN TRE
PHƯỚC LỄ
VŨNG TÀU
HOÀNH SƠN
PLEIKU
QUI NHƠN
TUY HOÀ
CAM RẠT THUỘT
NHA TRANG
LẠC THIỆN
KRONG-PHA
DALAT
PHAN RANG
PHƯỚC BÌNH
LỘC NINH
ĐỒNG XOÀI
TÂY NINH
BIÊN GIỚI CAMBODGE
MỸ THUẬN
AN HỮU
CHÂU ĐỐC
CAO LÃNH
HÀ TIÊN
RẠCH GIÁ
GÒ QUAO
VĨNH LONG
TRÀ VINH
SÓC TRĂNG
BẠC LIÊU
CÀ MAU
PHAN THIẾT
HÀM TÂN
To Cambodge
To Vinhlong
To Trà Vinh
To Saigon
To Dalat
Details
Type A ... ADT 50 > 1.300 ... 300 Km .. 981.000 Veh.Km
Type B ... ADT 50 > 450 ... 208 Km .. 1317.000 Veh.Km
Type C ... ADT 50 > 180 ... 1125 Km ... 335.000 Veh.Km
Type D ... ADT 50 > 40 .. 932 Km .. 51.000 Veh.Km
4.465 Km .. 2.684.000 Veh.Km
STKH
- 6/64

FIGURE I

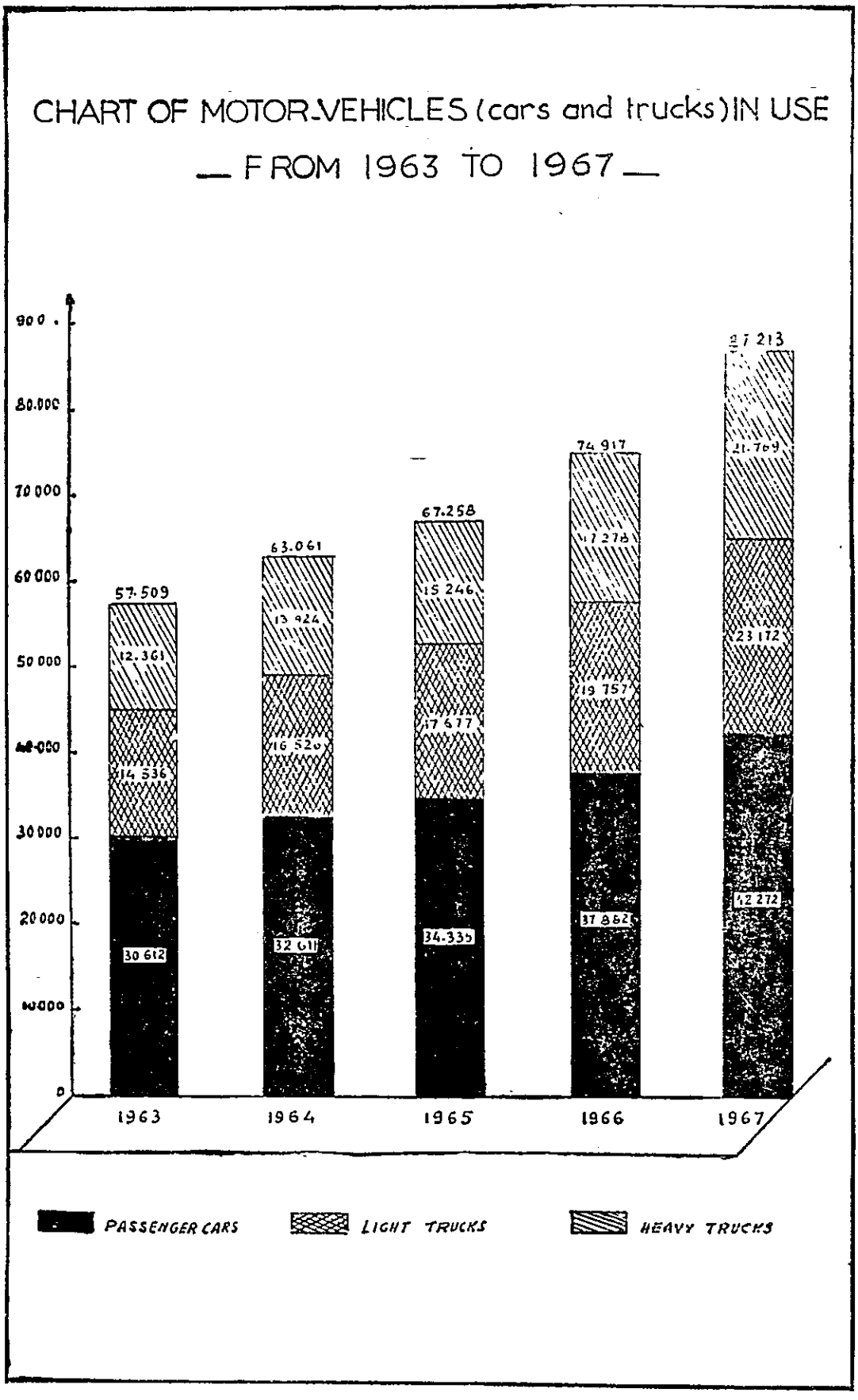


CHART OF MOTOR-VEHICLES (cars and trucks) IN USE
— FROM 1963 TO 1967 —
90 000
80.000
70 000
60 000
50 000
40-000
30 000
20 000
10000
0
57.509
12.361
14 536
30 612
63.061
13 924
16 526
32 611
67.258
15 246
17 677
34.335
74 917
17 278
19 757
37 882
87 213
21.769
23 172
42 272
1963
1964
1965
1966
1967
PASSENGER CARS
LIGHT TRUCKS
HEAVY TRUCKS

CHART IV 64

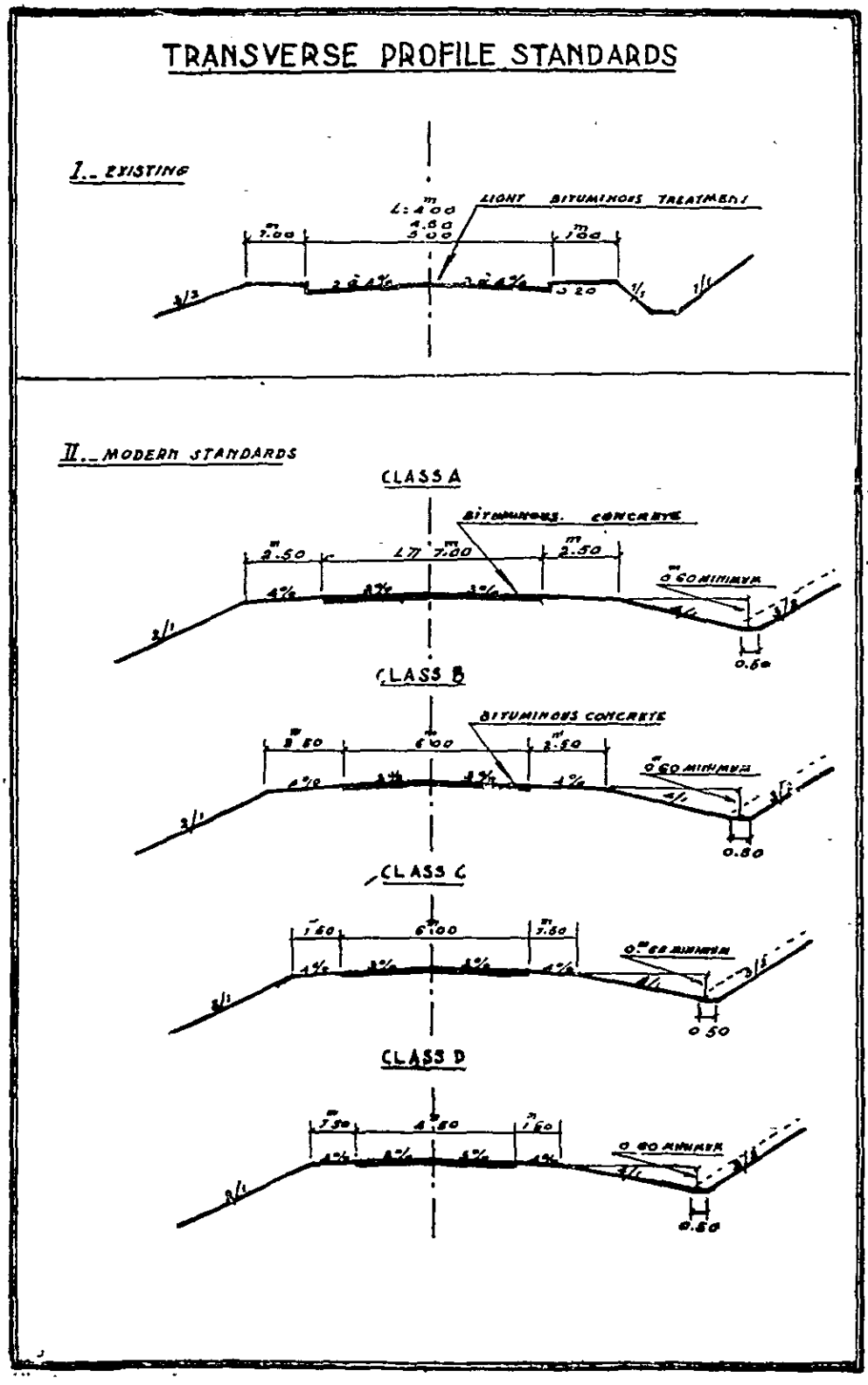

TRANSVERSE PROFILE STANDARDS
I.- EXISTING
LIGHT BITUMINOUS TREATMENT
II.- MODERN STANDARDS
CLASS A
BITUMINOUS CONCRETE
CLASS B
BITUMINOUS CONCRETE
CLASS C
CLASS D

FIGURE II

2— STANDARDS FOR RIGHT OF WAY.

ROAD	RIGHT OF WAY	NON ENCROACHMENT ZONE		TOTAL
		Each side	Two sides	
N. H.	30 m	15 m	30 m	60 m
I. H.	30 m	5 m	10 m	40 m
P. R.	20 m	10 m	20 m	40 m
C. R.	20 m	5 m	10 m	30 m

3 — SPEED

ROAD CLASS	A AND B	C	D
1 — Flat zone	60 mph 96 km/h	50 mph 80 km/h	(45) — 40 mph (72) — 64 km/h
2 — Rolling zone	(60) — 50 mph (96) — 80 km/h	40 mph 64 km h	(35) — 30 mph (56) — 48 km/h
3 — Mountainous zone	(50) — 40 mph (80) — 64 km/h	30 mph 48 km/h	(25) 20 mph (40) — 32 km/h
4 — City	(50) — 40 mph (80) — 64 km/h		

NOTE : The number in parenthesis ( ) indicate the desirable speed.

4 — CURVE

SPEED	MAX. CURVE	MIN. RADIUS
20 mph	D : 56o	102 ' = 31 m
30 mph	20o	286 ' = 87 m
40 mph	11o	520 ' = 158 m
50 mph	7o	818 ' = 250 m
60 mph	5o	1,145 ' = 350 m

5 — GRADE

SPEED	MAX. GRADE
30 mph	P : 6 % — 8 %
40 mph	5 % — 7 %
50 mph	4 % — 6 %
60 mph	3 % — 6 %

NOTE : For class A and class B roads, the max grade is adopted as 6% for all cases.

6 — LOAD

— Expressway : 24,000 lbs for one axle load

— N.H and I.H : 18,000 lbs for one axle load

— P.R and C.R : 12,000 lbs for one axle load

FOR BRIDGES :

— **Class A and B :** HS 20 of AASHO Specifications, for one lane.

— **Class C and D :** HS 15 of AASHO Specifications, for one lane.

7 — PAVEMENT :

The type and the thickness of the pavement depend on the class of road and are determined by the design Engineer according to the CBR chart of the "Asphalt Institute" or by the AASHO Road Test method described in the Highway Research Record N° 90, published by Highway Research Board in 1965. But in general, the highway class A must have a pavement of 5 cm thick minimum of asphaltic concrete.

VI.— MAIN HIGHWAY PROJECTS

In the last decade, the Directorate General of Highway has realized several projects, such as the new construction of Saigon-Biênhoà Highway long of 30 km, built with modern standards, and the improvement of the two existing National Highway N° 19 QuiNhon-Pleiku long of 153 km, and National Highway N° 21 Ninhhoa-Banmêthuôt long of 149 km, both rebuilt to modern standards.

In the same time, the Directorate General of Highway has built many important bridges such as:

— Saigon River Bridge (986m.45 long)
— Dong-Nai River Bridge (402m.6 long)

} on the Saigon-Biênhoà Highway (Asian Highway N° 10).

— Cân-Lâu Bridge on N.H. 1 (840m. long) Asian Highway priority A-3.

— Tra-Khuc Bridge on N.H. 1 (635m. long, on A-3).

— Cai-Khê Bridge on N.H. 4 (74m, on A-3, Cânthơ).

— Longxuyên Bridge on city street (105m.40 long).

— Châu-O Bridge on N.H. 1 (A-3) (168m. long).

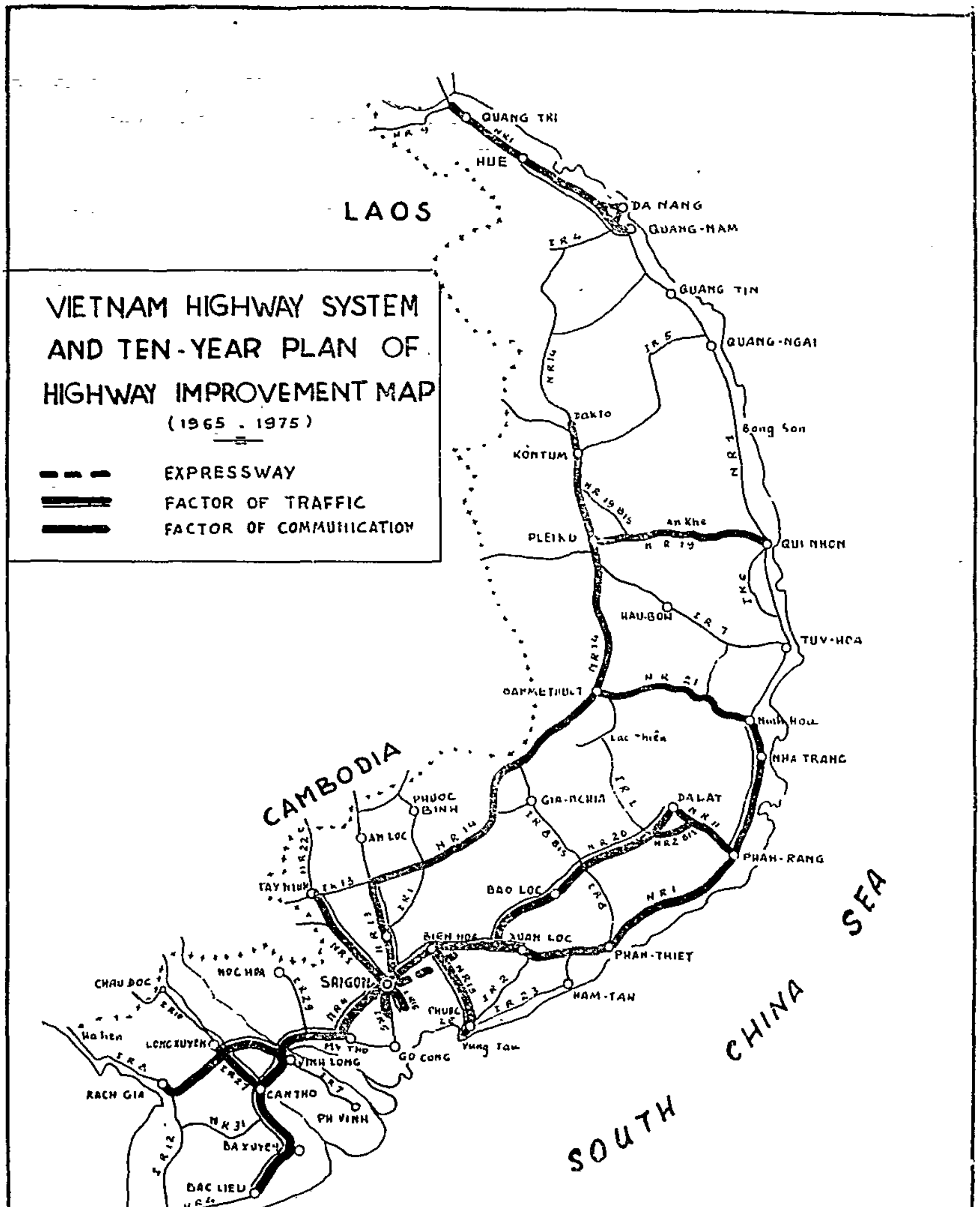
TEN-YEAR PLAN OF HIGHWAY IMPROVEMENT (1965-1975)

The Directorate General of Highway has elaborated a Ten-Year Plan of Highway Improvement (1965-1975), and this plan was revised in August 1968 in order to fit more to the present conditions of the country. This plan consisted of improving 2,675 km of highway and 26,820m. of bridges, as indicated on the map and is divided as below. (see map III)

	LENGTH OF ROADS	LENGTH OF BRIDGES
A — Expressway	31.3 km	1,786 m
B — Factor of Traffic.	1,270.2 km	17,050 m
C — Factor of Communication. .	1,373.1 km	7,984 m

This long range program necessitated a total cost 17,626.9 millions of VN. piasters (400 millions US$), and is divided as following (rate of exchange 120$ VN. to 1 US$).

	COST in million of VN$	YEARLY BENEFIT in million of VN$	RATE of return
A — Expressway	6,425.6	1,923.0	0.299
B — Factor of Traffic . . .	25,702.5	5,509.0	0.214
C — Factor of Communication	15,498 8	1,610.3	0.103


VIETNAM HIGHWAY SYSTEM AND TEN-YEAR PLAN OF HIGHWAY IMPROVEMENT MAP
(1965 - 1975)
EXPRESSWAY
FACTOR OF TRAFFIC
FACTOR OF COMMUNICATION
LAOS
CAMBODIA
SOUTH CHINA SEA
QUANG TRI
HUE
DA NANG
QUANG-NAM
QUANG TIN
QUANG-NGAI
Bong Son
KONTUM
PLEIKU
An Khe
QUI NHON
TUY-HOA
BAN METHUOT
NHA TRANG
DALAT
PHAN-RANG
GIA-NGHIA
PHUOC BINH
AN LOC
TAY NINH
BAO LOC
BIEN HOA
XUAN LOC
PHAN-THIET
HAM-TAN
SAIGON
Vung Tau
GO CONG
MY THO
VINH LONG
CAN THO
LONG XUYEN
CHAU DOC
RACH GIA
BA XUYEN
BAC LIEU
QUAN LONG

MAP III

The improvement and reconstruction of roads and bridges in this Ten-year plan will be designed according to new standards, to be able to carry heavy traffic. This plan consists to satisfy all needs caused by the increase of traffic estimated at 12 to 10% a year until 1985.

We noticed also that a great majority of highway in this ten-year plan belonged to Asian Highway particularly A-1 (Saigon-Godauha), A-3 (Rachgia-Cantho-Saigon) and other priorities.

The ten-year plan of highway improvement will participate a large part in the development of the economy of the country. But because of a very large cost, our country doesn't have sufficient funds and means to realize the whole program. Foreign assistance both financial and technical is welcomed.

MY-THUAN BRIDGE PROJECT.

Now, the Directorate General of Highway is working actively to achieving the My-Thuan Bridge project across the Mekong River, and on the N.H. N° 4. Now the circulation across the Mekong River at My-Thuan is desserved by ferry-boats (3×160T ; 1×50T ; 1 Fort-Slocum 250T). With a traffic of 1,000 vehicles a day the ferry-boats cannot solve the problem of congestion at this station. So now, the Government of the Republic of VietNam decided to build a low level bridge instead of a high level bridge if the International Mekong Committee cannot finance the difference in cost between the 2 bridges at the time of bidding.

The design of the low level bridge is done by the Korea Engineering Consultants the high level bridge by Nippon Koei, and the construction is estimated to be started at the end of the year 1968.

The bridge will have these principal dimensions :

	LOW LEVEL	HIGH LEVEL
Length	1,410 m	2,242 m
Effective roadway width.	13.40 m	12 m 30
Sidewalk width.	1.50 m	1 m 50
Center span clearance	25 × 90 m	45 × 110 m
Cost. . . . . (very rough preliminary estimate)	13,100,000 US	21,300,000 US

SAIGON-BELTWAY PROJECT.

With the aim to develop the region of Thu-Duc, and to improve the circulation from the east zone to the delta, and also to provide security beltway for the capital, the Directorate General of Highway has realized the project of Saigon-Beltway long of 40 km, and connecting the Saigon-Biênhoa Highway to the National Highway N° 4. The highway is projected to be 13m.50 wide, with a pavement of 7m.00 wide of asphaltic concrete, and about 600m. of bridges. The total cost is estimated to be about 500 millions VN. piasters.

The Saigon-Beltway is started to be constructed with the help of Korea Army Engineering and the U.S. Army Engineering.

VII. — DAMAGES TO THE HIGHWAY SYSTEM

Because of the war situation in VietNam, and as the highway is the best mean of transport, so the communists direct all their efforts to damage the highway system. Until August 1968, there are 3,207 bridges and culverts damaged, with a total length of 80,644m. (See chart V). These bridges and culverts were blown up many times. Not only the bridges and roads were damaged by the communists, but the personnel and the equipment of the Directorate General of Highway were also the aims of their aggression. Until August 1968, there are 187 persons killed, 154 persons injured by the communists during their work, and 155 cars, trucks and heavy equipment damaged.

The Highway system suffered heavy damages during the Tet 1968 Aggression, there are also many offices damaged particularly the Huê District office, and the Nguyên-Hoàng Bridge on the Huong-Giang at Huê.

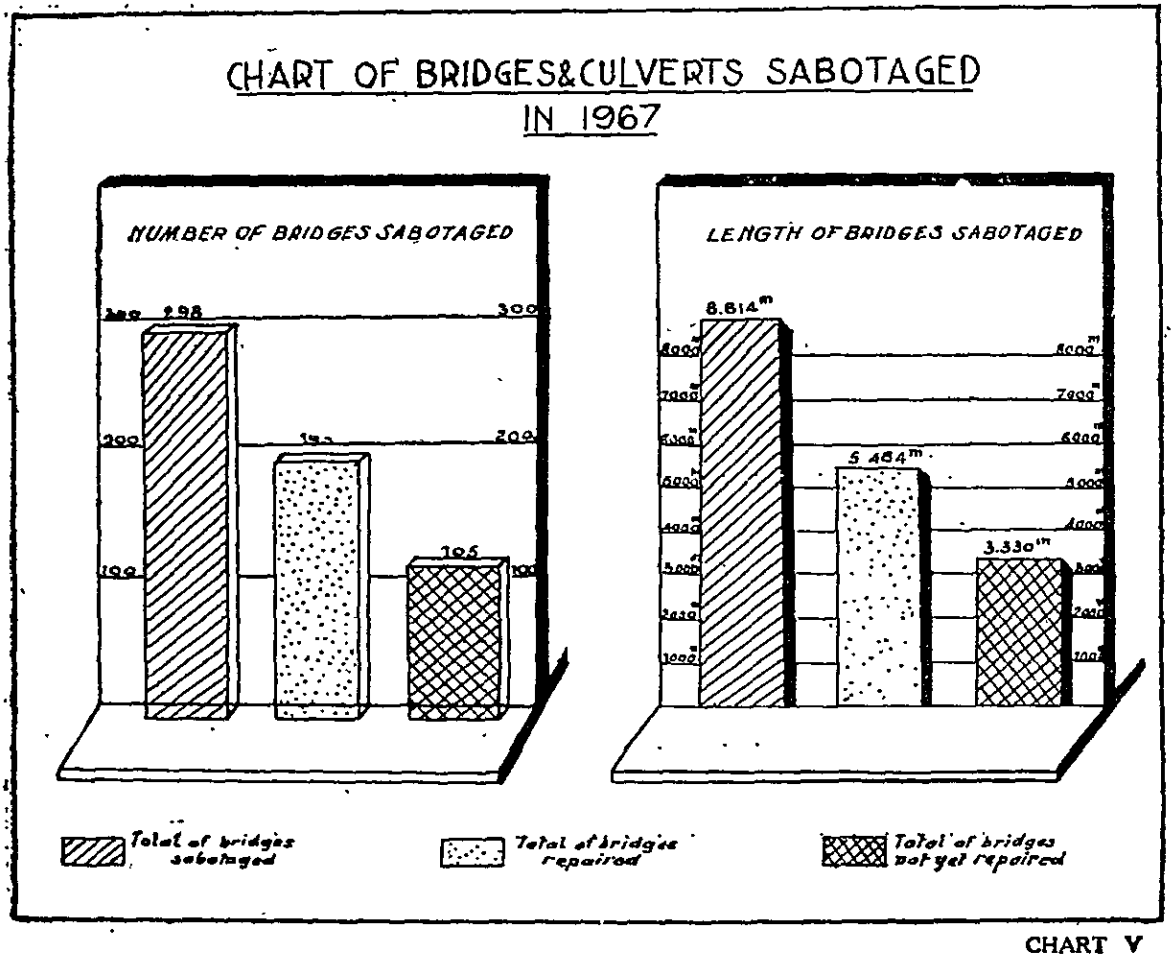


CHART V

VIII. – CONCLUSION

Because of the war which lasts more than 20 years, the highway network damaged by the communists is partly and temporarily repaired to meet local communication need but not the economical development of the country.

We hope that once peace comes, with the ever increasing effort of the Directorate General of Highway doubled with foreign assistance, the Ten-Year Plan and the Asian Highway Plan will be achieved in time. That is our contribution to the development of the South East Asia.

TEN-YEAR PLAN OF HIGHWAY IMPROVEMENT

(1965-1975 modified)

GENERAL PLAN (FOR 1985 ADT)

Viet-Nam
Appendix I

Road and Section of road	Length of road (km)	Length of bridge (m)	Cost of improvement in $ VN				Grand total in $ VN 1.000.000	A.D.T.	Annual benefit		Rate of return (12) = (11)/(8)	Order of priorities	Vehicle/Km (14)=(2)x(9)
			Roads		Bridges				per vehicle	Total in & VN 1.000.000			
			1 km	Total	1m	Total							
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
A- Expressway	31,3	1.786		2.294,5		4.131,1	6.425,6			1.923,9	0,299		3.630.000
Saigon - Thu-Duc	10,0	1.309	91	910,0	2,5	3.272,5	4.182,5	150.000	530$	795,0	0,190	18	1.500.000
Thu-Duc - Ho-Nai	21,3	477	65	1.384,5	1,8	858,6	2.243,1	100.000	530$	1.128,9	0,503	1	2.130.000
B- Factor of traffic													
N.H.1	414,5	5.036		5.139,7		2.324,0	7.463,7			2.100,3	0,281		3.963.480
Hue - Quang-Nam	140,3	2.546	9	1.262,7	0,36	916,5	2.179,2	4.500	530$	334,6	0,153	24	631.350
Ninh-Hoa - Nhatrang	34,3	628	9	308,7	0,36	226,1	534,8	6.000	530$	109.0	0,203	15	205.800
Nhatrang - Phan-Rang	103,4	846	9	930,6	0,36	304,5	1.235,1	5.200	530$	2.284,9	0,230	13	537,680
Xuan-Loc-Boen-Hoa	49,5	30	18	891,0	0,72	21,6	912,6	10.000	530$	262,3	0,287	9	495.000
Bien-Hoa - Thu-Duc	17,0	389	22,5	382,5	0,72	280,1	662,6	33.000	530$	297,3	0,448	3	561.000
Thu-Duc - Saigon	13,0	467	35,5	461,5	1,08	504,3	965,8	55.000	530$	378,9	0,392	4	715.000
Saigon - Cu-Chi	28,9	67	22	635,8	0,72	48,2	684,0	21.000	530$	321,6	0,470	2	606.900
Cu-Chi - GodauHa	28,1	63	9,5	266,9	0,36	22,7	289,6	7.500	530$	111,7	0,385	5	210.750
H.H.4	270,9	6.243		5.502,5		3.179,8	8.682,3			1.487.1	0,171		2.806.140
Saiton-Trung-Lutong	57,8	1.267	26	1.502,8	0,72	912,2	2.415,0	24.000	530$	735,2	0,304	7	1.387.200
Trung-Luong-My-Thuan	68,3	1.323(1)	31	2.117,3	0,72	952,5	3.069,8	11.000	530$	398,1	0,129	27	751.300
My-Thuan - Cantho	33,9	2.448(2)	13	440,7	0,36	881,3	1.322,0	5.700	530$	102,4	0,077	37	193.230
Cantho - Soctrang	61,6	882	13	800,8	0,36	317,5	1.118,3	4.100	530$	133,8	0,119	30	252.560
Soctrang - Baclieu	49,3	323	13	640,9	0,36	116,3	757,2	4.500	530$	117,6	0,155	23	221.850
N.H. 13	75,8	479		1.081,4		271,4	1.352,8			362,4	0,267		683.900
Binh-Trieu-Phu-Chong	21,9	275	26	569,4	0,72	198,0	767,4	14.000	530$	162,5	0,211	14	360.600
Phu-Cuong-Choh-Thanh	53,9	204	09,5	512,0	0,36	73,4	585,4	7.000	530$	199,9	0,341	6	377.300

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
H.H.15	97,0	1.395		1.516,5		667,8	2.184,3			550,1	0,251		1.038.000
Bien-Hoa-Long-Thanh	26,0	184	18	468,0	0,72	132,5	600,5	13.000	530$	179,1	0,298	8	338.000
Long-Thanh - Phuoc-Le	44,0	276	18	792,0	0,72	198,7	990,7	11.000	530$	256,5	0,258	11	484.000
Phuoc-Le-Vung-Tau	27,0	935	9,5	256,5	0,36	336,6	593,1	8.000	530$	114,5	0,193	17	216.000
N.H.20	32,2	997		2.089,8		358,9	2.448.7			472,0	0,192		890.560
Dau-Giay - Dinh-Quan	45,8	140	9	412,2	0,36	50,4	462,6	5.200	530$	126,2	0,272	10	238.160
Dinh-Quan - Bao-Loc	74,0	273	9	666,0	0,36	98,3	764,3	3.500	530$	137,3	0,179	19	259.000
Bao-Loc - Dalat	112,4	584	9	1.011,6	0,36	210,2	1.221,8	3.500	530$	208,5	0,170	21	393.400
N.H.22	36,0	145		324,0		52,2	376,2			95,4	0,253		180.000
Go-Dau-Ha - Tay-Ninh	36,0	145	9	324,0	0,36	52,2	376,2	5.000	530$	95.4	0,253	12	180,000
Total N.H....	1.126,4	14.295		15.653,9		6.854,1	22.508,0			5.067,3	0,225		9.562.080
I.H. 5	15,0	315		210,0		113,4	323,4			64,4	0,199		121.500
Saigon - Can-Giuoc	15,0	315	14	210,0	0,36	113,4	323,4	8.100	530$	64,4	0,199	16	121.500
I.H. 6	4,4	132		114,4		95,0	209,4			24,5	0,117		46.200
My-Tho-Trung-Luong	4,4	132	26	114,4	0,72	95,0	209,4	11,000	530$	24,5	0,117	31	46,200
I.H. 8	52,8	929		686,4		334,4	1.020,8			125,9	0,123		237.600
Vinh-long-Vam-Cong	52,8	929	13	686,4	0,36	334,4	1.020,8	4,500	530$	125,9	0,123	29	237.600
I.H. 15	11,7	171		304,2		123,1	427,3			68,2	0,159		128.700
Saigon - Nha-Be	11,7	171	26	304,2	0,72	123,1	427,3	11.000	530$	68,2	0,159	22	128.700
I.H. 27	59,9	1.208		778,7		434,9	1.213,6			158,7	0,130		299.500
Cantho - Longxuyen	59,9	1.208	13	778,7	0.36	434,9	1.213,6	5.000	530$	158,7	0,130	26	299.500
Total I.H....	143.8	2.755		2.093,7		1.100,8	3.194,5			441,7	0,138		833.500
TOTAL B....	1.270,2	17.050		17.747,6		7.954,9	25.702,5			5.509,0	0,214		10.395.580
C- Factor of communication													
N.H. 1	315,5	2.427		2.839,5		873,7	3.713,2			559,7	0,150		1.056.100
Dong-Ha - Hue	52,0	721	9	468,0	0,36	259,6	3.727,6	3.300	530$	92,7	0,127	28	174.900
PhanRang - Phan-Thiet	147,0	1.322	9	1.323,0	0,36	475,9	1.798,9	3.300	530$	257,1	0,142	25	485.100
Phan-Thiet-Kuan-Loc	116,5	384	9	1.048,5	0.36	138,2	1.186,7	3.400	530$	209,9	0,176	20	396.100

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
N.H. 11	110.0	1.236		990.0		444,9	1.434,9			93,1	0,064		175.800
Phan-Rang-Song-Pha	47	1.036	9	423,0	0,36	372,9	759,9	2.400	530$	59,7	0,075	39	112.800
Song-Pha - Pa-Lat	63	200	9	567,0	0,36	72,0	639,0	1.000	530$	33,4	0,052	40	63.000
N.H. 14	552,9	1.451		4.976,1		522,3	5.498,4			492,9	0,089		930.220
Chon-Thanh-Banmethuot	269,9	674	9	2.429,1	0,36	242,6	2.671,7	1.800	530$	257,5	0,096	35	485,820
Banmethuot - Pleiku	188,0	158	9	1.692,0	0,36	56,9	1.748,9	1.800	530$	179,3	0,102	34	338.400
Pleiku - Kontum	49,0	275	9	441,0	0,36	99,0	540,0	1.600	530$	41,5	0,076	38	78.400
Kontum - Dacto	46,0	344	9	414,0	0,36	123,8	537,8	600	530$	14,6	0,027	42	27.600
N.H. 19	153	1.245		1.377,0		448,2	1.825,2			154,0	0,084		290.700
Qui-Nhon - Pleiku	153	1.245	9	1.377,0	0,36	448,2	1.825,2	1.900	530$	154,0	0,084	36	290.700
N.H. 21	149,0	896		1.341,0		322,5	1.663,5			181,6	0,109		342.700
Ninh-Hoa-Banmethuot	149,0	896	9	1.341,0	0,36	322,5	1.663,5	2.300	530$	181,6	0,109	33	342.700
Prolonged N.H. 21	26	206		234,0		74,2	308,2			12,4	0,040		23.400
Phon - Don-Duong	26	206	9	234,0	0,36	74,2	308,2	900	530$	12,4	0,040	41	23.400
Total N.H...	1.307,4	7.461		11.757;6		2.685,8	14.443,4			1.493,7	0,103		2.818.920
I.H. 8	66,7	523		867,1		188,3	1.055,4			116,6	0,110		220.100
Vam-Cong - Rachgia	66,7	523	13	867,1	0,36	188,3	1.055,4	3.300	530$	116,6	0,110	32	220,110
Total I.H.	66,7	523		867,1		188,3	1.055,4			116,6	0,110		220,110
TOTAL C	1.373,1	7.984		12.624,7		2.874,1	15.498,8			1.610,3	0,103		3.039.030
Grand Total A, B, C.	2.674,6	26.820		32.666,8		14.960,1	47.626,9			9.043,2	0,189		17.064.610

OBSERVATION : (1) N.H.4 excluded the width of Tien-Giang river at My-Thuan (577m)

(2) N.H.4 included the length of bridge (2.000m) to be designed across Hau-Giang River at Cantho.

8. ASIAN HIGHWAY IN LAOS

Mr. Lytou Lytoung
Chief, Subdwision of Public Works
LAOS

I. A-3 The A-3 starts from Burma and goes through Laos and to Sinsh in Viet-Nam with the length of 1428 km. From Xiengkok, Lao-Burmese border to Luangprabang is 365 Km long. This section is nothing done except from Luangprabang to Paksuong 20 Km. From Luangprabang to Xieng Ngeum is 26 Km long with two-lane road and good maintenance but only with gravel surface. The length from Xieng Ngeum to Hin Heup is 276 Km that started the improvement in September 1966 and will be finished at the end of July 1969 with the cost of US$7 millions. Up to now 163 Km were improved. 95 Km to Vientiane from there are in good condition with 15 Km asphalted two-lane road from Vientiane.

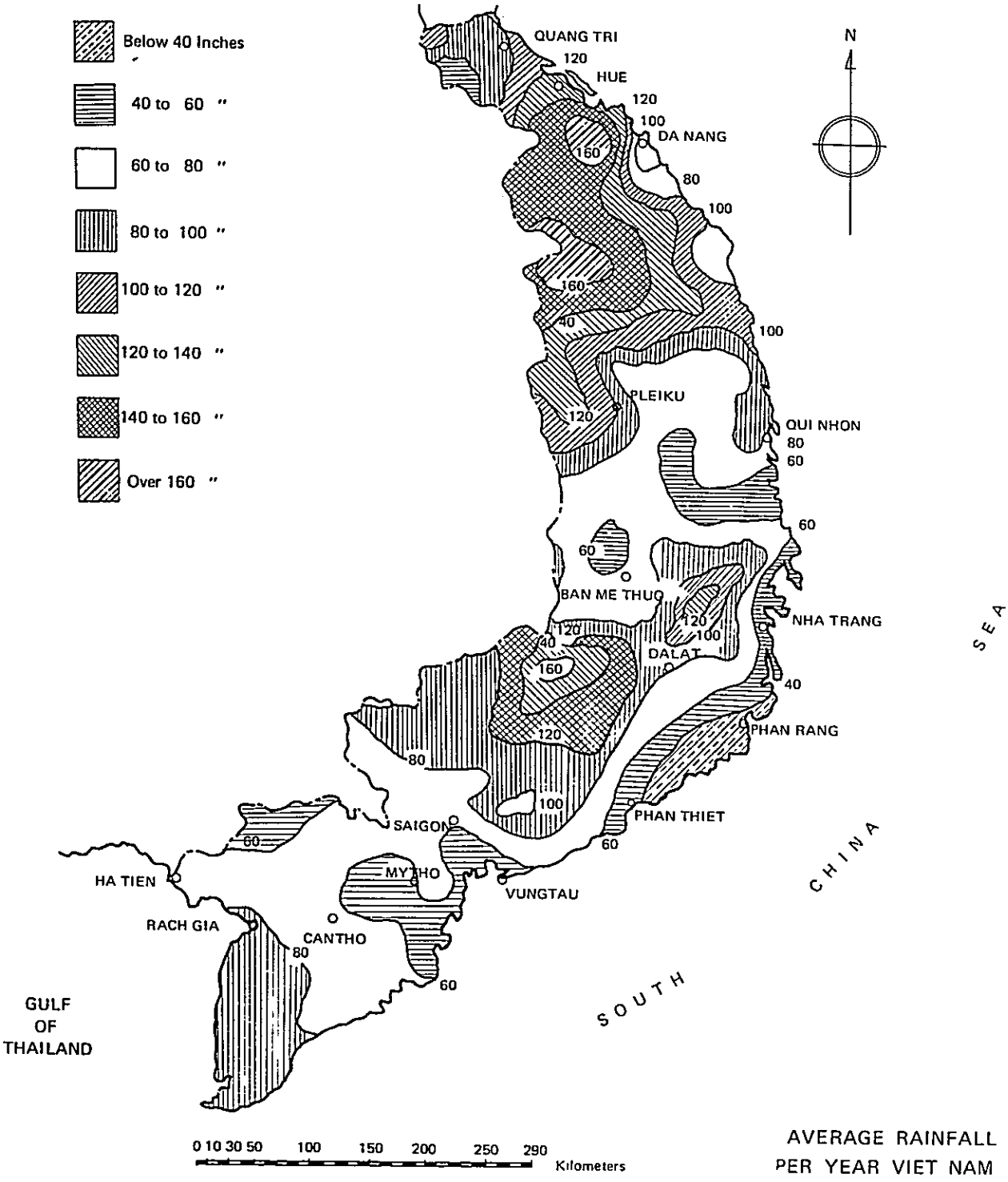
The section between Vientiane to Seno, 449 Km in length, is in good condition with 90 Km asphalted two-lane road from Ventiane but there are two ferries to be crossed at Nam Ngum River at the point 63 Km from Vientiane and at Nam Cading at the point 189 Km from Vientiane. These bridges were already designed by Nippon Koei in 1961 and reexamined by the experts of ECAFE.Asian Highway Transport Technical Bureau in April 1968.

The rest of A-3 to Viet-Nam border, 214 Km long, is not taken care of maintenance because of unsecurity.

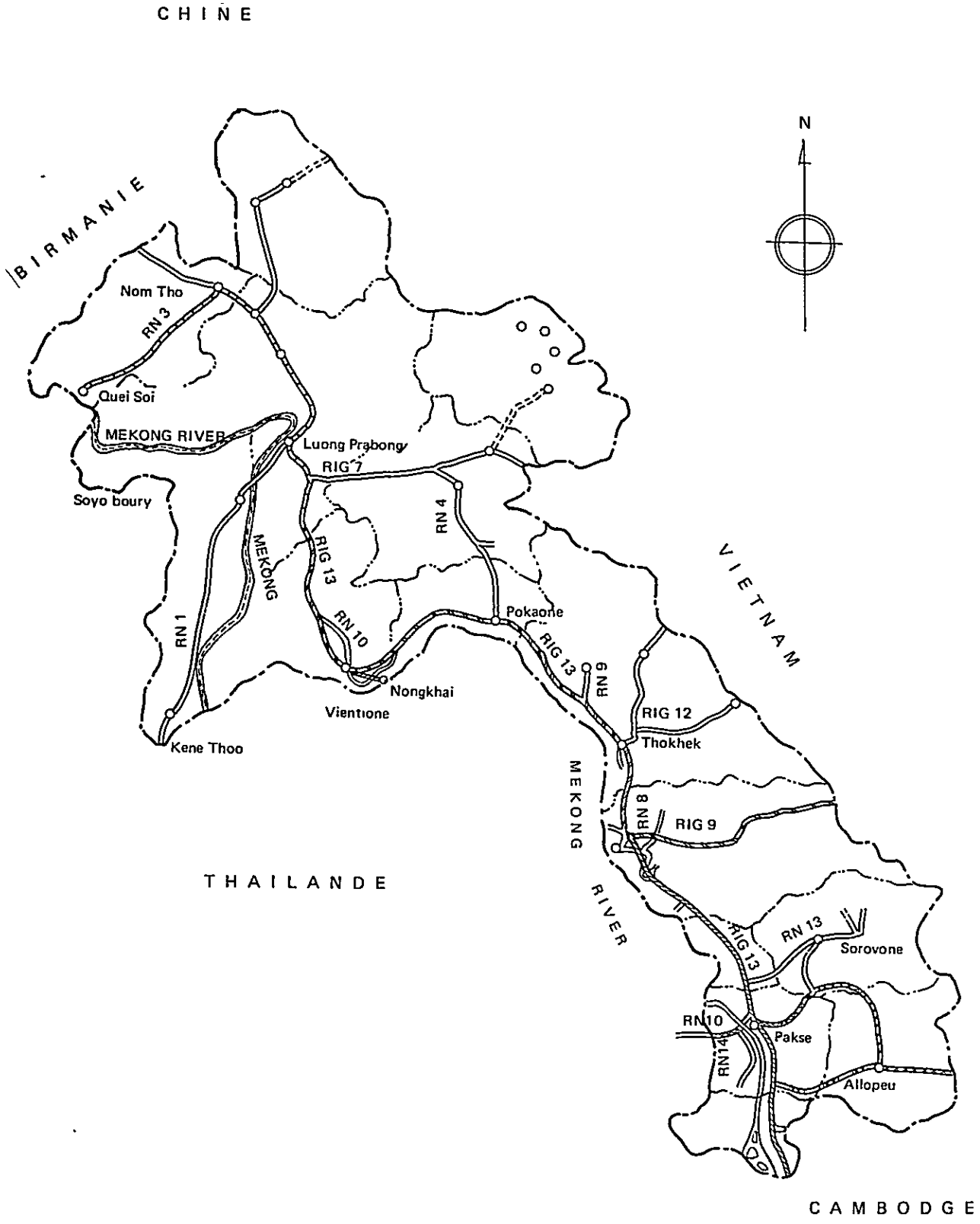
II. Others. A-11 in Laos that starts from Savannakhet and goes to Cambodian border is 422 Km long with two-lane asphalt pavement except more than 10 Km.

A-12 is 19 Km long from Vientiane to Thanaleng and the bridge between Thanaleng and Nongkhai over Mekong River is under the final design by the Mekong Committee and the Japanese Government.

A-14 is about 303 Km in length and a half of this road is asphalted. One ferry has to be crossed at Pakse-Muong. USAID is helping in the ramp building for this ferry.



AVERAGE RAINFALL PER YEAR VIET NAM



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9. CONDITIONS OFTROADS IN EAST PAKISTAN

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Road & Highways Directorate
Goverment of East Paleistan.

INTRODUCTION.

Pakistan has two provinces, namely, East Pakistan and West Pakistan. Pakistan is unique in that its two provinces are separated by about a thousand miles of another territory, India. The population of Pakistan was about 101 million according to 1961 census of which about 55 million resided in East Pakistan. The area of land in East Pakistan is 55, 126 square miles and of West Pakistan about 310,403 square miles, making a total of 365,529 square miles.

The capital of Pakistan is Islamabad in West Pakistan. A second national capital is under construction at Dacca. Dacca is the capital of East Pakistan and Lahore is the capital of West Pakistan. Construction of roads is the responsibility of the Provincial Governments in their own jurisdictions. The Provincial Government formulates and implements the various road schemes through their respective Highways Directorate.

The writer of this report is an official of the Roads and Highways Directorate of the Government of East Pakistan and is familiar with the condition of roads owned by the Government of East Pakistan.

This report will deal with condition of roads in East Pakistan whose construction, extension, maintenance and improvement happen to be the responsibility of the Government of East Pakistan.

EAST PAKISTAN.

East Pakistan, the portion of the state with which this report is concerned, is bordered on the West by Indian provinces of West Bengal and Bihar, along the north by the Indian provinces of Coach Bihar and Assam, along eastern boundary by Assam and Tripura, at the extreme

southern end of the eastern portion by the Union of Burma, and on the south by the Bay of Bengal. The total length of boundaries of the province is 2,928 miles including a length of boundary of 445 miles by sea. The major administrative units are 17 districts, making up four divisions.

The average population in East Pakistan is 1,150 persons per square miles according to 1961 census, although is some areas of the province the density of population exceeds 2,000 per square mile, one of the highest in the world.

East Pakistan is an extremely flat delta built by three major rivers, the Ganges, the Brahmaputra and the Megna. Only the portions comprising northern borders of Mymensingh and Sylhet Districts, a part of Chittagong and most of Chittagong Hill Tracts Districts are hilly.

The highest areas of East Pakistan lie along the borders of Chittagong Hill Tracts, where the elevation range upto about 2,000 feet. Most portion of the province is less than 100 feet above the mean sea level and about half of the total area of the province is innundated by flood water every year. The land remains submerged for a period of about 4 months, from mid July to mid November.

CLIMATE AND HYDROLOGY.

The normal average rainfall ranges from about 43 inches at Rajshahi near western border of the province to 200 inches in the hilly regions along the north eastern border of Sylhet District. About 80% of the total rainfall for the year occurs during monsoon season, from June to September.

Almost all of the water which flows in the major rivers of East Pakistan comes from outside the province, to be passed through the Bay of Bengal. In an average about 1,070 million acre feet of water enters the province annually from India and about 100 million acre feet of run off is generated by rainfall in the province. If all this water is allowed to stay on land, it will innundate the province to a depth of 34 feet.

The warm season, March to May, has the highest yearly temperature. The mean maximum temperature ranges from 90° F to 96° F. and the humidity ranges from about 72% to 85%.

The cool season, November to February, has the minimum temperature.

The mean minimum winter temperature ranges from 50° F to 55° F.

SOIL

The soil in the province is mainly alluvium. The soils vary considerably from place to place, but medium sand, fine sand, silty sand, sandy silts and clay silts are found throughout the delta.

ROAD COMMUNICATION.

At the time of Independence in 1947, the province inheritted only 286 miles of paved roads and 350 miles of shingle roads. These roads existed in detached sections in several districts and were serving the local needs only. After Independence, plans were drawn to build five Trunk Routes and some other Secondary and Feeder roads.

The trunk roads were to connect the capital with the headquarters of 15 districts which included two pprt towns at Khulna and Chittagong. The remaining two district headquarters at Mymensingh and Rangamati were to be connected by a secondary road from Dacca and Chittagong respectively. The existing roads including those of local bodies influenced the selection of alignments of trunk roads. As a result the trunk routes leaves scope for further improvement of their alighments in future. However, the existing trunk routes connect most of the important places of the province. The policy of integrating the existing roads on the trunk routes helped in building the road net within a shorter period of time spending a smaller amount.

Following are the trunk routes:- (Routes shown in Map-A).

1) Teknaf-Cox's bazar-Chittagong-Mainamati-Dacca-Arich.	...	365 miles.
2) Tamabil-Sylhet-Mainamati.	...	197 "
3) Nagarbari-Bogra-Rangpur-Dinajpur-Tetulia.	...	263 "
4) Khulna-Jessore-Kushtia-Rajshahi-Nawabganj.	...	210 "
5) Barisal-Faridpur-Goalondo-Magura-Chuadanga-Meherpur.	...	185 "
Total:		1,220 miles.

The secondary and feeder roads were to connect the important places of the districts like Sub-divisional headquarters industrial and commercial centres with the trunk system.

Incidentally it may be mentioned that the Asian Highway routes A-1 & A-2

mostly follow the trunk routes:

Route A-1 enters East Pakistan-Assam border (Tamahil) and follows entire length of trunk route No. 2 upto Mainamati and then passes through Dacca, Aricha, Goalondo, Faridpur, Jessore and Benapole, thus traversing parts of trunk routes No. 1, 4 and 5.

Route A-2 enters East Pakistan border near Gundum and passes through Chittagong-Dacca-Aricha-Nagarbari-Bogra-Rangpur-Dinajpur-Tetulia. A-2 route covers the entire trunk route-3 and most of trunk route-1.

In East Pakistan, Sylhet-Sutarkandi (27 miles), a shingle road, forms a part of Asiam Highway route A-40. The total length of route A-1 and A-2 passing through East Pakistan are 418 miles and 581 miles respectively. In addition there is a major ferry crossing at Aricha which is 12 miles long.

PRESENT CONDITIONS OF ROADS:-

a) Trunk routes:-

1) TRUNK ROUTE NO. I - Out of 365 mile route only a portion between Marisha and Teknaf (about 15 miles) remains to be constructed. The remaining portion has been surfaced either with bitumen or concrete. The entire route was constructed on single lane standard, utilising mostly the existing roads of the Goverment and the local bodies, except for a length of 25 miles between Dacca-Daudkandi which was constructed as double lane road.

At present there are five unbridged rivers on this route: three (Sitalakhya, Megna and Gumuti) on Dacca-Daudkandi section and two (Bangsi and Kaliganga) on Dacca-Aricha section. Power ferries of 10 ton capacity have been provided on these river gaps. At Chittagong, a railway bridge exists on Karnaphuli river. The road traffic on Chittagong -Cox's bazar road is presently using this railway bridge.

Near Dacca at Mirpur on Dacca-Aricha road, an old Iron bridge exists. Only light vehicles are allowed to use this bridge. For heavier vehicles power ferry of 10 tons capacity has been provided.

At Suvapur on Feni-Chittagong section of this route one bridge was constructed on Feni river during Ist plan period (1955-60). Due to severe flood in Feni river during last monsoon, the river washed out Feni side

approach of the bridge. The bridge, however, remained undamaged. A floating bridge has been established, temporarily, in order to restore the road communication between Dacca and Chittagong. In the meantime efforts are being made to bring the river back to its original channel. Protecting works will be done in order to prevent future shifting of the channel.

Widening of Daudkandi-Chittagong road has been taken up in a small way in some places in order to cater the present need of traffic. By now out of 130 miles, between Daudkandi and Chittagong, about 50 miles have been made double lane. Single lane roads with inadequate specifications were constructed in the past in order to open up as much area as possible within the resources that were available. These single lane roads cannot cater for trucks heavier than 5 tons. With rapid industrialisation of the country during the current decade, larger and heavier vehicles started using these roads under compelling circumstances and the pavement started showing signs of failure. The roads are being maintained at high cost.

Bridges on the road sections between Daudkandi and Chittagong and Chittagong and Cox's bazar (Maricha) are single lane with only a few exceptions. Most of these single lane bridges are old and weak.

Bridges on Daudkandi-Dacca and Dacca-Aricha sections are all new double lane bridges and designed for ASHHO H-20 loading.

TRUNK ROUTE NO. 2

Out of the total length of 197 miles 66 miles lie in Comilla district and 133 miles in Sylhet district. The entire road is single lane, able to carry trucks upto 5 tons. The length of the road in Comilla district has been mostly constructed after Independence. The portion of the road that lies in Sylhet district existed before Independence. The bridges are single lane and very weak, The bridges are single lane and very weak. The alignment of the road located in Sylhet district is poor. Two ferry crossings having power ferries of 10 ton capacity exist on Sylhet portion of this route.

TRUNK ROUTE NO. 3.

Except for a part of Pachagarh-Tetulia section (about 20 miles), the

entire 263 mile route has been surfaced either with asphalt or concrete. The road is single lane and can carry trucks upto 5 tons. This route has both single lane and double lane bridges. Condition of pavement on this trunk routes is better than other truck routes where traffic volume is higher.

The Boral river on Nagarbari-Ullapara section of this route remains to be bridged. Power ferries of 10 tons capacity have been provided.

TRUNK ROUTE NO. 4

Construction of a single lane pavement on this 210 mile route has been completed. Condition of the pavement is detoriorating very fast on Khulna-Jessore section of the road. Condition of the pavement in other places is also not good particularly near urban centres like Jessore, Jhenaidah, Kushtia, Ishurdi, Natore and Rajshahi. Both single lane and double lane bridges exist on this route- the bridges constructed upto 1958 are single lane and those constructed after 1958 are double lane.

Some old culverts and bridges exist on the road. One power ferry over the river Ganges exists on Kushtia-Ishurdi section of this route. Vehicle upto 10 ton weight can cross this river with this ferry.

TRUNK ROUTE NO. 5

A single lane pavement on trunk route no. 5 which is 185 miles long has been constructed. The pavement can carry trucks upto five tons. Pavement is showing signs detoriations as volume and axle load of vehicles are increasing.

Both single lane and double lane bridges exist because of reasons already explained. Some of the bridges are pretty old. The Gorai river on Faridpur-Magura section of this route remains unbridged. A power ferry exists which can carry vehicles upto 10 ton capacity.

East Pakistan Water and Power Development Authority is constructing a dam on Navaganga river near Magura. The diversion cannel has cut across the Faridpur-Magura road near Magura. A temporary wooden bridge has been constructed on the diversion channel. Four ferry crossings having ferries of 10 ton capacity exist on Faridpur-Barisal section of this route.

(b) OTHER PAVED ROADS.

The total mileage of paved roads in the province is 2,247 miles. The mileage so far surfaced on the five trunk roads is 1,185 miles.

The remaining 35 miles are being surfaced now. 1,062 miles paved surface are on secondary and feeder roads which have been shown in Map 'A'. The roads have been paved at different time of the nation's history. Map 'B' shows the locations of paved roads and period during which these were paved.

STATUS OF ASIAN HIGHWAYS ROUTES A-1 & A-2:-

The present status of these routes have been shown at the end of this report in the standard proforma supplied by ECAFE. The Asian Highway routes in East Pakistan has been surfaced except for a small length of Pachagarh-Tetulia road (20 miles) which is presently being surfaced.

NAME OF RIVER	Route A-1/A-2	Approximate width of crossing
1. Kushiara on Sylhet-Teliapara Road.	A-1	1,000 feet
2. Sadipur " " " "	A-1	700 "
3. Megna-Gumoti on Dacca-Daudkandi	A-1 & A-2	6,000 "
4. Megna " " " "	A-1 & A-2	2,700 "
5. Sitalakhya " " "	A-1 & A-2	1,300 "
6. Bangsi on Dacca-Aricha Road	A-1 & A-2	640 "
7. Kaliganga " " "	A-1 & A-2	2,100 "
8. Jamuna on Aricha-Goalonda	A-1	12 miles.
9. Jamuna on Aricha-Nagarbari	A-2	12 "
10. Gorai on Faridpur-Magura.	A-1	2,300 feet
11. Boral on Nagarbari-Bogra.	A-2	2,000 "

FUTURE DEVELOPMENT

The following principles guided the development of roads in the past.

i) Opening up as much areas as possible.

ii) Establishing a road net as fast as possible.

iii) Constructing roads within the scarce resources that were available.

In order to meet these principles, large mileages of roads were taken up, adopting the alignment of many local Council roads. Specifications were lowered to meet immediate needs and to open up as much areas as possible.

Many of these roads have been constructed and some are under construction as shown in map 'A'. It has now become possible to reach all the District Headquarters and most of the Sub-divisional Headquarters from the Capital at Dacca and the port towns at Chittagong and Khulna by means of roads alone.

The objectives that were laid down have been realised. The task now remains to construct the myriad secondary and feeder roads necessary to complete the system, to fill the numerious river gaps and to continue to Upgrade the network to meet the pressing demands of the rapidly increasing traffic.

PLANS FOR IMPROVEMENT OF EXISTING NETWORK

Already a scheme has been approved which will provide a direct link between Dacca and Sylhet. The present distance between Dacca and Sylhet via Mainamati is 215 miles. This distance will be reduced by about 60 miles when the direct road is constructed. This will be a double lane road. Provision exists in this scheme to convert the present Sorail-Mainamati section of the trunk route No. 2 to a double lane road. A power ferry over Megna near the existing Railway bridge at Bhairab will be provided as per provisions made in the scheme. All other gaps will be bridged. It is likely that the direct route when constructed will be the future A-1 route in East Pakistan instead of its present route via Mainamati.

A similar scheme (Jessore-Madhukhali) has been drawn up which will reduce the present distance of 116 miles between Khulna and Faridpur by 40 miles and Jessore and Faridpur 20 miles..

The two roads when constructed will bring down the present length of A-1 route from 418 miles to 338 miles. Government has plans to build another short cut road between Dacca and Mymensingh. This road when constructed will reduce the present distance of 120 miles by about 50 miles.

Under IDA credit the present Dacca-Chittagong road will be improved and as a result the distance between Dacca and Chittagong (160 miles) will be reduced by about 10%. The project consists of construction and reconstruction of about 74 miles of roads to double standards between Dacca and Chittagong in the following sections:-

a) Construction of Dacca-Demra-Narayanganj	....	11 miles.
b) Construction of Daudkandi-Mainamati	....	26 "
c) Construction of Feni by-pass	....	23 "
d) Chittagong port penetrator and Strand road	....	9 "
e) Approaches to six bridges to be reconstructed on Feni-Chittagong section.	....	5 "
		74 miles.

These schemes when implemented will improve the existing network to a very great extent. The other existing roads will be widened and strengthened gradually. Already the following schemes which envisage Up-grading have been approved and works on them have either been taken up or will begin shortly

a) Mirpur-Savar on Dacca-Aricha (Trunk route No. 1) ..... 14 miles.
b) Jessore-Khulna (Trunk route No. 4) ..... 16 "
c) Chittagong-Kalurghat (Trunk route No. 1) ..... 4 "
d) Feni-Raipur (Secondary road) ..... 51 "
e) Thakurgaon Station road (Feeder Road) ..... 4 "
f) Khulna-Chuknagar (Secondary road) ..... 21 "

At present traffic census is being taken on all the existing roads. Works on widening and strengthening of existing roads are likely to be taken up in a big way in the 4th plan period (1970-75) on the basis of priority.

Similarly, schemes are being prepared for replacement and Up-grading of old and weak bridges on the existing roads. It is hoped that many of the old and weak bridges will be replaced by the end of the 4th plan period.

One scheme has already been approved for constructing a double lane road and replacing the old bridges on Sylhet-Zakiganj road which form a part of A-40 route in East Pakistan. This scheme do not include construction of bridges on the two unbridged river-gaps which lie on A - 40 route in East Pakistan.

PLANS FOR BRIDGING MAJOR RIVERS

It will be seen from map 'A' that as many as 25 ferry crossings on major rivers exist on the present road network. 14 such unbridged rivers exist on the five trunk roads. As many as eleven ferry crossings are involved on Asian Highway route A-1 and A-2.

Bridging the river gaps on the trunk system has become relatively more urgent. The Provincial Government is making all efforts to initiate Engineering Studies for undertaking construction bridges on these river gaps.

In some cases outside assistance has already been obtained and in other cases outside assistance is being sought. Their present status are as follows:-

1. Sitalakhya bridge on Dacca-Chittagong and proposed Dacca-Sylhet direct roads:-

The bridge is to be constructed under IDA credit. Design have veen prepared and tenders construction is now being called.

2. Bangshi and Kaliganga bridges on Dacca-Aricha Road:-

These two bridges will be constructed out of an USAID loan. Design have been prepared and tenders have been called. Under this project the existing old iron bridge at Mirpur on Dacca-Aricha road will also be replaced.

3. Gorai bridge:-

Overseas Technical Co-operation Agency, Japan, at the request of Government of Japan, has conducted the Engineering studies of this project and has submitted their report already. Investigation on alignment leading to the proposed bridge which is about 6 miles down-stream of the existing crossing will be undertaken by the Overseas Technical Co-operation Agency, Japan during this year.

Construction of the Gorai bridge will be taken up as soon as funds can be arrange to finance the project.

BRIDGE OVER JAMUNA-BRAHMAPUTRA RIVER:

Government has decided to undertake a study on the economic and technical feasibility of constructing a bridge or a tunnel over the river Jamuna-Brahmaputra. The name of the river on the upstream is Brahmaputra while its name on the down stream is Jamuna. Negotiations are going on at present with a foreign firm, for the purpose of undertaking necessary feasibility and Engineering Studies.

BRIDGE OVER KARNAPHULI RIVER AT CHITTAGONG.

Chittagong-Development Authority is constructing a pontoon bridge on Karnaphuli river, which will ultimately connect the Chittagong-Cox's bazar road with Chittagong. When this bridge will be opened, traffic will utilise this pontoon bridge instead of the railway bridge which is presently being utilised.

For other river crossings on Asian Highway route and the Trunk Roads, efforts are being made to obtain outside assistance for Engineering Studies and construction of bridges. It is hoped that the loan giving agencies will come forward to finance these extremely useful schemes.

GROWTH OF TRAFFIC IN EAST PAKISTAN

The number of motor vehicles in the province increased from 14,219 in 1960 to 55,060 in 1967. The average yearly growth rate of the province is 21.3%. Since the comparison has been made with respect to a low base, it cannot be taken as an indication of rate of growth for next 15 or 20 years.

However, with the present rate of economic growth which is about 8%, it is expected that the growth rate of traffic will be around 15% for the next 10 or 15 years. In view of the high growth rate of traffic and low capacity of a single lane road, construction of single lane pavement and bridges is now being abandoned in favour of double lane pavement and bridges.

GEOMETRIC STANDARDS OF FUTURE ROADS IN EAST PAKISTAN:-

A Foreign Consulting Firm has been appointed by the Government of East Pakistan as its General Consultants. The General Consultants are reviewing the various geometric standards and it is hoped that the geometric standards for future roads in East Pakistan will be finalised soon. It may be of interest to know that the following geometric standards and design criteria were followed in case of Dacca-Chittagong Highway whose construction will be financed out of an IDA credit.

1. Design speed.	....	60 miles/hour
2. Minimum radius. ...	....	1,140 feet.
3. Minimum stopping distance	....	475 "
4. Minimum stopping distance	....	3%
5. Maximum inter-devation	....	8%
6. Minimum pavement width	....	22'-0"
7. Minimum shoulder	....	9'-0"
8. Maximum axle load	....	18,000 lbs. + 20% impact
9. Bridges minimum double lane.		
10. Loading H-20 - S-16 loading.		

From the foregoing it is evident that large mileages of roads had to be constructed to open up new areas and this had to be done as fast as possible. Road building in East Pakistan is an extremely difficult job: high embankments are to be built and large number of bridges are to be constructed almost on every road; soil has poor bearing value and rivers meander. On the top of it there is dearth of good construction materials, equipment and

trained personnels. Inspite of all these odds it was possible to build about 2,000 miles of paved roads and 27 miles of bridges in a period of last 20 years.

The task now is to Up-grade the existing network, to fill up numerious river gaps and to construct sufficient secondary and feeder roads in order to provide an adequate dependable road network. To accomplish this task, large funds, equipments, suitable construction materials and trained personnel are needed.

Government is conscious of this and doing everything possible in this direction.

National effort needs to be supplemented by outside assistance in order that pace of development and improvement of roads in the province can be accelerated.

ROUTE NO. - A-1.

Country & Section : East Pakistan.

Route No. ..... Section from ..... to	Distance k.m.	Existing Conditions.					
		Above minimum ECAFE Standards			Below minimum ECAFE Standards.		
		2-lane Asphatt or concrete k.m.	1-lane Asphatt or concrete k.m.	Gravel or stone aurfaced k.m.	Fair weather motorable k.m	Fair weather jeepable k.m.	No. Access k.m.
1	2	3	4	5	6	7	8
A. Bonapole to Dacca Section.							
Bonapole-Jessore.	38.62		38.62				
Jessore-Jhenaidah.	46.10		46.10				
Jhenaidah-Magura	28.20		28.20				
Magura-Kamarkhali.	13.69		13.69				
Kamarkhali-Goalondo	56.40		56.40				
Goalondo-Aricha.	Ferry						
Aricha-Dacca	90.00		90.00				
	273.01						
Goalondo-Aricha (Ferry)	19.30						
	292.31						
B. Dacca to Sarail Section.							
Dacca-Demra	11.25	11.25		N		I	L
Demra-Daudkandi	28.95	28.95					
Daudkandi-Mainamati	45.00		45.00				
Mainamati-Companyganj	24.10		24.10				
Companyganj-B. Baria	46.60		46.60				
B. Baria-Sarail	11.29		11.29				
	167.19						
C. Sarail to Sylhet Border (Tammbil) Section.							
Sarail-Taliapara	33.70		33.70				
Taliapara-Moulvibazar	144.00		144.00				
Moulvibazar-Sylhet.							
Sylhet upto Border on (Shilong Road (Tammbil)	56.40		56.40				
	234.10						
Total	674.30	40.20	634.10				
Ferry at Aricha	19.30						
Grand total	693.60						

ROUTE NO. - A-2

Country & Section : East Pakistan.

Route No. Section From ..... to	Distance k.m.	Existing Conditions. Above minimum ECAFE Standards: 2-lane Asphatt or concrete k.m.	1-lane Asphatt or concrete k.m.	Gravel or Stone surfaced k.m.	Below minimum ECAFE Standards: Fair weather motorable k.m.	Fair weather jeepable k.m.	No. Access k.m.
1	2	3	4	5	6	7	8
A. Burma Border to Mainamati Section							
Burma Border to Chittagong	185.50		185.50				
Chittagong-Comilla	162.50		162.50				
Comilla-Mainamoti	6.44		6.44				
	354.44						
B. Moinamati-Dacca Section.							
Moinamati-Daudkandi	45.00		45.00				
Daudkandi-Dacca	40.20		40.20				
	85.20						
C. Dacca-Aricha Section							
Dacca-Aricha	90.00		90.00				
D. Aricha-Nagarbari Section.					N	I	L
Aricha-Nagarbari (Ferry)	(19.30)						
E. Nagarbari-Tetalia Section.							
Nagarbari-Kashinathpur	4.44		4.44				
Kashinathpur-Shahjadpur	28.15		28.15				
Shahjadpur-Ullapara	18.15		18.15				
Ullapara-Sherpur	47.40		47.40				
Sherpur-Bogra	19.30		19.30				
Borga-Rahabal	25.70		25.70				
Rahabal-Rangpur	80.40		80.40				
Rangpur. Beldanga	64.40		64.40				
Beldanga-Panchagarah	77.20		77.20				
Panchagarh-Tetulia	41.80		41.80	30.00			
	408.94						
Total	938.58		908.50	30.00			
Ferry at Aricha	19.30						
Grand total	957.88						

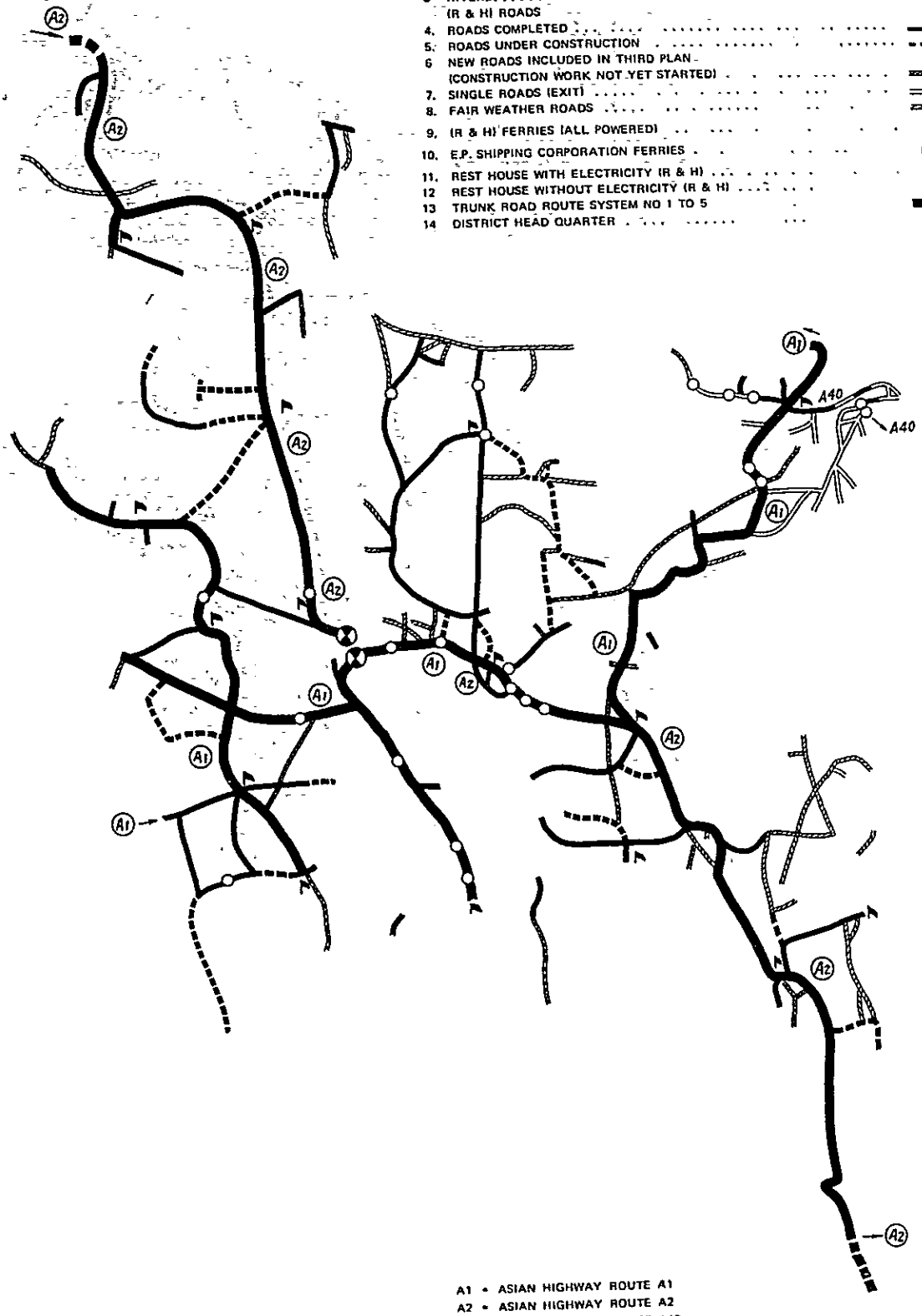
ROUTE NO. - A-40

Country & Section : East Pakistan.

Route No. ..... Section From ..... to	Distance k.m.	Existing Conditions.					
		Above minimum ECAFE Standard			Below minimum ECAFE Standards		
		2-lane Asphatt or concrete k.m.	1-lane Asphatt or concrete k.m.	Gravel or Stone surfaced k.m.	Fair weather motorable k.m.	Fair weather jeepable k.m.	No. Access k.m.
1	2	3	4	5	6	7	8
Sylhet-Sutarkandi Section							
Sylhet-Sutarkandi	43.85		27.36		16.49		
	43.85		27.36		16.49		

LEGEND

1. INTERNATIONAL BOUNDARY
2. DISTRICT BOUNDARY
3. RIVERS
   (R & H) ROADS
4. ROADS COMPLETED
5. ROADS UNDER CONSTRUCTION
6. NEW ROADS INCLUDED IN THIRD PLAN
   (CONSTRUCTION WORK NOT YET STARTED)
7. SINGLE ROADS (EXIT)
8. FAIR WEATHER ROADS
9. (R & H) FERRIES (ALL POWERED)
10. E.P. SHIPPING CORPORATION FERRIES
11. REST HOUSE WITH ELECTRICITY (R & H)
12. REST HOUSE WITHOUT ELECTRICITY (R & H)
13. TRUNK ROAD ROUTE SYSTEM NO 1 TO 5
14. DISTRICT HEAD QUARTER



A1 - ASIAN HIGHWAY ROUTE A1
A2 - ASIAN HIGHWAY ROUTE A2
A40 - ASIAN HIGHWAY ROUTE A40

Country & Section: Pakistan

Route No. .....

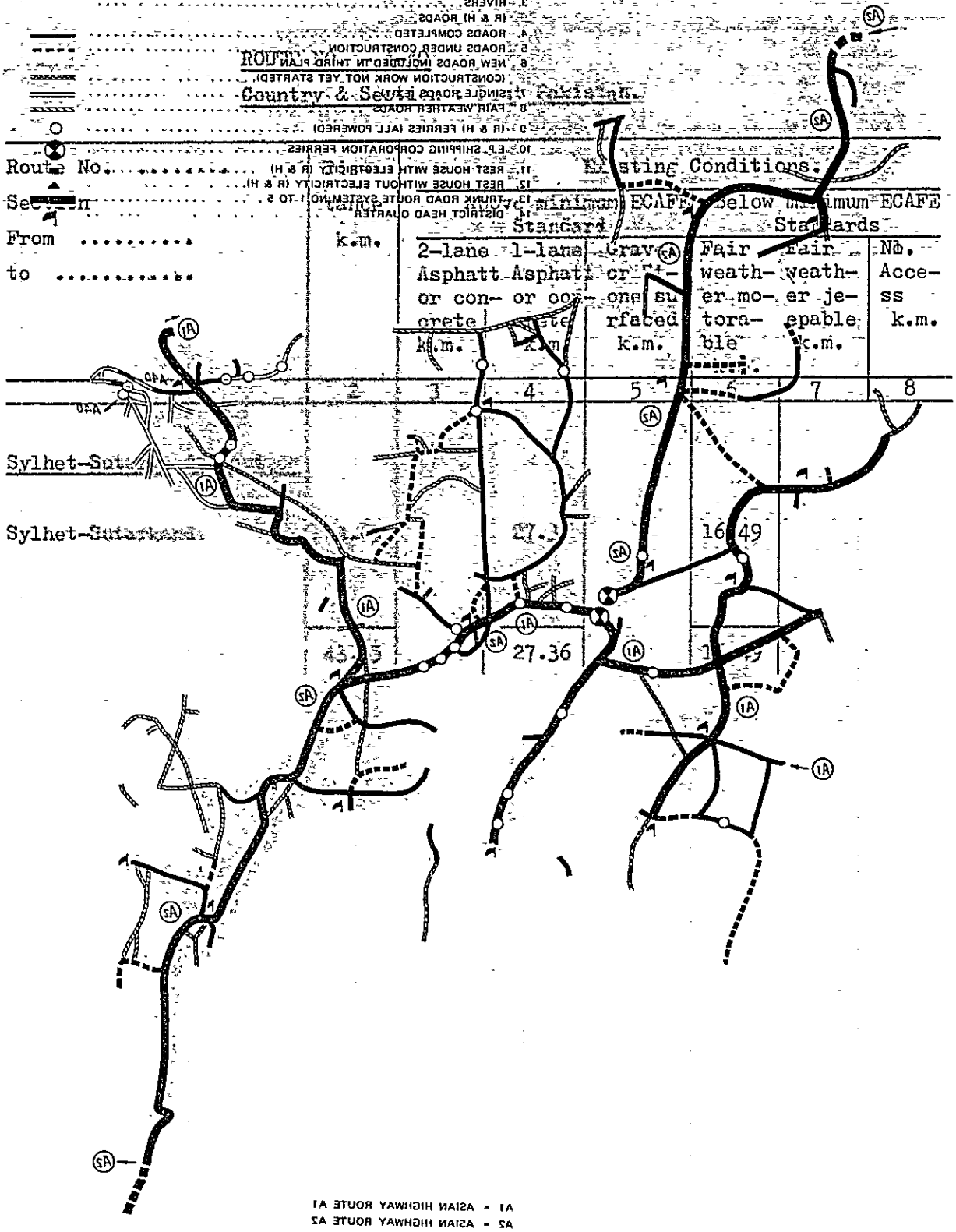
Section

From ..... k.m.

to .....

Existing Conditions.

Standard				Below minimum ECAFE Standards		
2-lane Asphalt or concrete k.m.	1-lane Asphalt or concrete k.m.	Gravel or one surfaced k.m.	Fair weather motorable	Fair weather jeepable k.m.	No. Access k.m.	
2	3	4	5	6	7	8



A1 = ASIAN HIGHWAY ROUTE A1
A2 = ASIAN HIGHWAY ROUTE A2
A40 = ASIAN HIGHWAY ROUTE A40

MAP 'B'

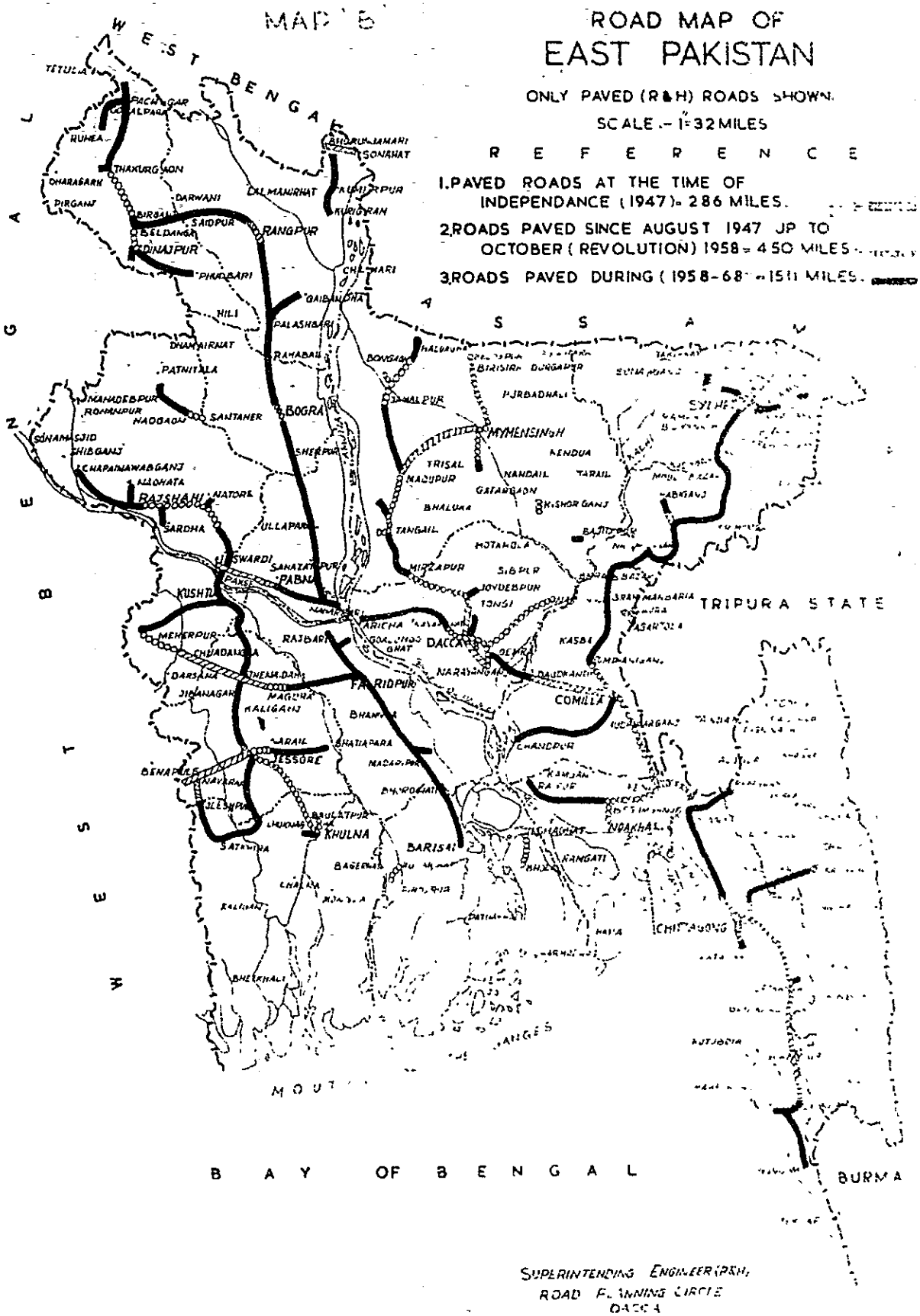
ROAD MAP OF EAST PAKISTAN

ONLY PAVED (R&H) ROADS SHOWN.

SCALE :- 1"=32 MILES

R E F E R E N C E

1. PAVED ROADS AT THE TIME OF INDEPENDANCE (1947) = 286 MILES.
2. ROADS PAVED SINCE AUGUST 1947 UP TO OCTOBER (REVOLUTION) 1958 = 450 MILES
3. ROADS PAVED DURING (1958-68) = 1511 MILES.



SUPERINTENDING ENGINEER (P&H)
ROAD PLANNING CIRCLE
DACCA

10. CONDITIONS OF ROADS IN WEST PAKISTAN

Mr. A.R. Chowdhury
Superintending Engineer
Road Planning Circle
Roads & Highways Diretorate
Government of East Pakistan
Pakistan

INTRODUCTION

Pakistan has two provinces, namely, West Pakistan and East Pakistan. West Pakistan has an area of 310,403 square miles and a population of about 45 million according to 1961 census. The land is mostly hilly and the weather conditions vary from place to place. The annual average rainfall varies from 15 to 20 inches. Winter temperature varies from less than 40° F on the northern region to about 60° F on the southern region. The summer temperature also varies, but average temperature of the province is about 90° F.

Soil is mostly rocky. The principal river of the province is the Indus which runs from north-east to south-west and finally discharges at Arabian sea along with the discharges of some other rivers viz. the Jelum, the Chenab, the Ravi, the Sultej.

In West Pakistan, the roads have variable widths of pavement. As per statistics, the West Pakistan Highway Department is maintaining about 12,700 miles of high type roads, 8,720 miles of low type roads and 1,040 miles of katcha road, in West Pakistan (the widths of pavement being variable, these mileages are in terms of 10' wide lane). At present several major Highway projects are being implemented.

They are:-

a) Hyderabad-Karachi Highway (under constructions)

b) Lahore-Multan Highway (Designs nearing completion).

c) Lahore-Lyallpur Highway (Designs nearing completion).

d) Sheikhupura-Khushab Highway, (Design nearing completion).

e) Karachi-Quila Highway (An R.C. D. Highway under execution).

In addition Lahore-Rawalpindi-Peshwar Highway and Multan-Hydrabad Highway have been planned for future construction.

Map A shows the location of these Highways and the standards that have been adopted.

A master plan of highways for the coming 20 years is presently under preparation with the West Pakistan Highway Department with assistance of foreign consultants under the agencies of the International Bank of reconstruction and Development.

ASIAN HIGHWAY DEVELOPMENT ROUTES A-1 & A-2

The Central Communication Ministry has already communicated the progress of works on Asian Highway routes to ECAFE separately and as such it is not dealt with here. However, when the present Lahore-Rawalpindi-Peshwar road is developed as a Highway it will make a great difference on Asian Highway route A-1 in West Pakistan as this road has been selected for the Asian Highway route A-1 in West Pakistan.

Construction of roads is easier in West Pakistan than in East Pakistan because of better soil, Hydrological and climatic conditions. Construction and maintenance of roads are also cheaper.

The growth of traffic is pretty high in West Pakistan. The number of motor vehicles stood at 121,000 in 1960. This number has increased to 260,000 in 1967. The annual increase is about 12% over the last seven years. To cope with these rapidly increasing requirements of traffic, it became necessary to take up improvement of the existing network. Construction of some Highways have been taken up and some have been planned from the future construction. These highways when constructed will improve the capacity of existing roads significantly.

During the last ten years some very important major bridges have been constructed.

These are:-

1. Bridge over river Jhelum near Jhelum	-	3,231 feet
2. Ravi bridge near Lahore ..	-	1,612 "
3. Bridge on river Ravi at Chichawatni	-	1,115 "
4. Mauripur bridge over river Lyari	-	1,150 "
5. Bridge over river Kabul near Jahangina	-	850 "
6. Bridge over river Sultej at Bahawalpur	-	1,920 "

All these bridges are double lane except serial 2 which has four lanes.

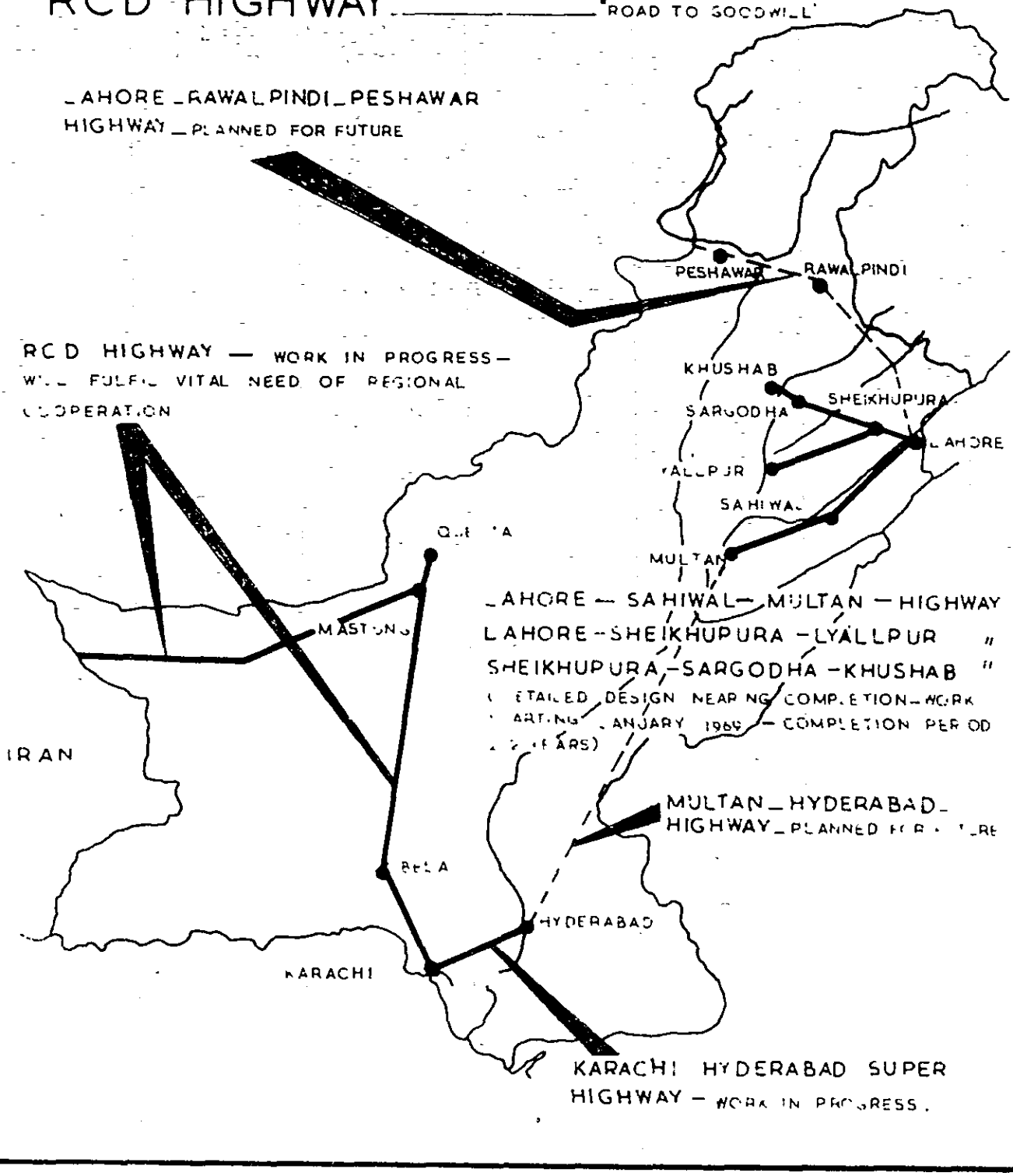
Map B shows the locations of the bridges where they cross the rivers.

To implement the schemes in hand and the projected schemes, large funds are needed and if this can be ensured road development in West Pakistan can proceed much faster as it is much easier to build roads in West Pakistan than in East Pakistan.

MAP – A

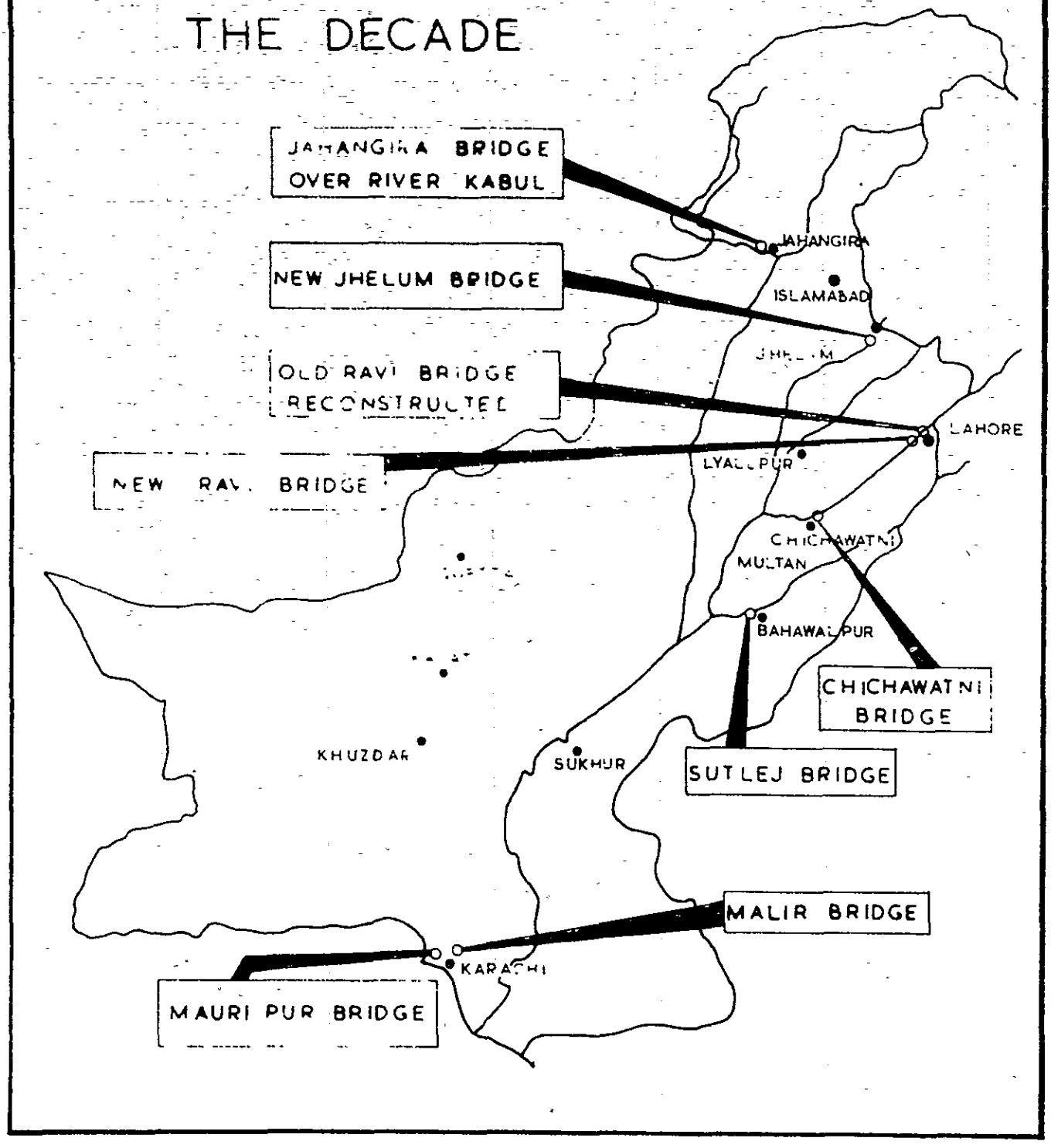
SUPER HIGHWAY ERA — HIGH SPEED, LIMITED ACCESS, DOUBLE LANE WITH PAVED SHOULDERS AND MODERN GEOMETRIC STANDARD.

RCD HIGHWAY — "ROAD TO GOODWILL"



MAP B

SOME OF THE MAJOR RIVER BRIDGES COMPLETED DURING THE DECADE



11. PRESET CONDITION OF ASIAN HIGHWAY PRIORITY ROUTES WITHIN INDIA

Mr. Rajinder Pal Sikka
Executive Engineer (Standards)
Ministry of Transport (Road Wing)
India.

Out of the 5 priority routes recommended by the Asian Highway coordinating committee for priority implementation, India is concerned primarly with only two routes, A-1 and A-2. The position for these two is indicated below:-

A-1

This route enters India from the West Pakistan border near Amritsar and passing through cities of Ambala, Delhi, Kanppr, Allahabad, Barhi, Calcutta and Barasat approaches the East Pakistan border near Bongaon. From there it takes off into East Pakistan and emerges again into India near Dawhi in the State of Assam. In Assam, it passes through Shillong, Jorhat, Golaghat and Imphal before reaching the Ind-Burma border near Pilel.

The length of A-1 within India is 2,860 Kms. The present condition of the road satisfies the minimums standards laid down by the ECAFE for Asian Highways. But for 50 Km of length near the Burma border the rest has a good surgace, either asphalt or concrete. Moreover about 45% of the length already has a 2-lane paved width.

The existing condition of the various sections is given in detail below:

Section	Distance (Kms)	Above Min. ECAFE Standards		
		2-lane asphalt or concrete	1-lane asphalt or concrete	Gravel or stone surface
1. W. Pak. Border - Delhi	472	472		
2. Delhi - Agra	200	200		
3. Agra - Allahabad	479	50	429	
4. Allahabad - Calcutta	803	307	496	
5. Calcutta - East Pak.	82	24	58	
6. East Pak. Border-Golaghat	427	177	250	
7. Golaghat - Burma Border	397	50	297	50
Total	2,860	1,280	1.530	50

A-2

This route starts in India from the Indo-West Pakistan border near Frozepur and touching Hissar, Delhi, Moradabad and Rudrapur reaches Nepal border near Tanakpur. After traversing Nepal it emerges again into India near Galgalia and passing through Naxalbari and Siliguni goes into East Pakistan. Total length of the route in India is about 900 Kms. The condition of the various sections is indicated in tabular form below:-

Section	Distance	Above Nih.ECAFE Standards			Indecessible
		2-lane As or Co.	1-lane As or Co.	Gravel or stone	
1. Indo-Dak. Border-Malout	111		111		
2. Malout - Kehli	342	158	184		
3. Delhi-Nepal Bordev	328	105	196	22	5
4. Nepal Border-East Pak. Bordev.	120	13	104		3
Total	901	276	595	22	8

It will transpire from the above table that only 8 Kms length of the route is substandard on which work is necessary to attain the minimum standards laid down by the ECAFE. The balance length satisfies the minimum ECAFE standards and only 22 Kms have a gravel or stone surface. About 30% of the road already possesses a two lane wide carriage way.

The substandard length of 8 Km mentioned above consists of two very short missing links, one on each side of the Nepal border. The missing link near Tanakpur (West of Nepal) is about 5 Kms and the other to the east of Nepal is about 3 Kms. The construction of these missing links to minimum international standards is estimated to cost roughly 400,000 US dollars. In addition the river Sarda on the Western missing link will have to be bridged which will require about 2 million US$. These works are expected to be taken up and completed by the time when pprtion of A-2 within Nepal which is under construction through joint efforts of Nepal, UK and India is through.

Besides the above deficiency, mention may also be made of a submersible bridge over the river Ghaggar in the Malout-Delhi section of this route where traffic gets suspended during high floods. The interruption is for as much as 10 days at a time. It is proposed to do away

with this bottleneck, by providing a high-level bridge, as soon as it becomes practicable (most probably in the next 5 year plan for Roads).

After completion of these works, the road (A-2) within India will come up to the minimum international standards.

The present condition of A-1 and A-2 has been described in the preceding paragraphs, but it is necessary to report or two other matters as well. The first concerns the shorting of route A-1 through completion of priority route A-40 between Silchar and Imphal. The second is about early upgrading of route A-44 within India so as to provide an access to Nepal as completion of A-2 within Nepal will yet take some time.

SHORTENING OF A-1

The Silchar-Imphal road within India is designated as Asian Highway route A-40. When developed, the road will provide a short travel distance by about 400 Kms. Therefore it is intended ultimately is made the road a part of A-1.

The length of this road is about 240 Kms and it is already through in some sections. In others, works have been taken up and are in varying stages of progress. But the completion is not within sight, very early, on account of various factors, principally the shortage of machinery. The special team sent by ECAFE to survey the route in A-1 had recommended that it will considerably expedite the completion of this road to motorable standards if assistance in the shape of heavy construction equipment worth 1 million US$ could be provided to India. An application has been made to the United Nations for this assistance, but is pending decision.

A-44

At the meeting of Experts on Asian Highway held at Bangkok in April-May 1965, it was recommended that in order to ensure a through route via Nepal, realizing that the entire route A-2 through Nepal was not expected to be ready within the target time, steps should be taken by India, as an interim arrangement, to bring route A-44 up to the minimum ECAFE standards as early as possible.

Starting point of this route is Delhi, from where the alignment runs along Aligarh, Kanpur, Lucknow, Faizabad, Gorakhpur, Kasia and Pipra before joing A-5, to give a connection to Nepal via that route.

The road's improvement to minimum ECAFE standards is now almost complete. The only bottle neck is completion of a major bridge over Gandak at Dumariaghat which is in progress. The construction of this bridge may take 2-3 years more. But since a ferry service is already existing at this site, the traffic should have no difficulty in going towards Nepal. The short length of A-5 in India, between pipra and Raxaul on the Indo-Nepal Border, which has to be traversed after getting off A-44 to reach Nepal, is already satisfying the minimum requirements prescribed by the ECAFE.

12. HIGHWAY CONDITIONS - NEPAL. NOVEMBER 1968.

Mr. Angur Man Tuladhar
Senior Engineer, Dept. of Comm., Water & Public Works, Ministry of Transport, Nepal

1.

The land locked Kingdom of Nepal, lying along the southern slopes of the Himalayas, is rectangular in shape, 800 kilometer from east to west and 170 kilometer from morth to south. The country has three distinct physical regions, each running laterally from east to west. In the south a flat plain, called the Terai, is part of the Gangetic Plain and shares its extreme heat. Roughly one third of the population of 10 million live in the Terai. North of the Terai is a region forming the foothills of the Great Himalaya Range. It is traversed by inumerable swift flowing mountain streams and rivers running between rugged mountain systems. The majority of the population live in this temperate region which included the Kathmandu valley, the focal point and site of the capital. The Great Himalayan Range, the world's highest mountains, runs the length of the northern boundary of Nepal. This region is sparsely inhabited and has frigid arctic winters.

2.

The toppgraphy of the country dictates the shape of the road metwork which must take the form of an east-west trunk system fed by north-south feeder roads. The east-west trunk system must run in the flat southern plain (the Terai) as this affords the only feasible continuous route from east to west. A subsidiary east-west trunk system, in the central portion of the country, serves to give better integration of the capital city, Kathmandu, with the rest of the country and takes advantage of the vallies of the major Trisuli and Sunkesi rivers which run in an east-west direction in their courses.

3.

The core of the trunk system is the Mahendra Highway, named after His Majesty King Mahendra, the King of Nepal. This highway runs from the Mechi river in the east, the boundary with the Indian State of West Bengal to the Mahakali river in the west, the boundary with the Indian State of Uttar Pradesh. The length of this highway is 1,040 kilometers. This highway forms part of the Asian Highway Route 2.

4.

The other Asian Highway route in Nepal is Route A-5 which connects the Mahendra Highway (Route A-2) with Kathmandu in a northerly direction and the Indian Highway network and Asian Highway Route A-1 in a southerly direction. This road, the Tribhuwan Rajpath, named after the late King of Nepal.

5.

These two Asian Highway Routes will be served by a network of Feeder roads which will extend some 5,400 kilometers when completed. The present situation with regard to existing roads and roads under construction is as follows:-

Route A-2 (East-West Highway) Mahendra Highway.

Total length:- 1,040 kms.

Location:- From sattighajta on the Mechi River, the eastern boundary between India (West Bengal) and Nepal traversing the whole east-west length of Nepal to Banbasa, the western boundary between Nepal and India (Uttar Pradesh).

Section Sattighatta - Adhabar 372 kms.

Under construction. 10 kms gravel surfaced.
44 kms fair westher motorable.
243 kms fair weather jeepable.
35 kms no access.
372

Section Adhabar-Narayangarh - 116 kms.

Improvement programme in hand.
24 kms 2 lane Asphalt.
92 kms gravel all weather

Section Narayangarh - Butwal 122 kms.

Planning in hand and construction expected to start in 1969.

Section Butwal - Banbasa - 430 kms.

Planning expected to commence in 1969.

Summary 2 lane Asphalt 24 kms.
Gravel all weather 102 kms.
Fair weather motorable 44 kms.

Fair weather jeepable 339 kms.

No access 531 kms

1040 kms

Route A-5 Raxaul - Kathmandu Road (incorporating Tribhuwan Rajpath)

Total length 204 kms.

Location:- From Raxaul/Birgunj on the southern boundary between India (Bihar) and Nepal in a northerly direction to Kathmandu. The capital city of Nepal.

Section Raxaul - Adhabar 39 kms. Single lane Asphalt. Improvement programme to 2 lane asphalt in hand.

Section Adhabar - Hetaura - 24 kms 2 lane Asphalt. This section consider with Route A-2 and in the same stretch of road as the 24 kms. 2 lane Asphalt shown in the Adhabar - Narayangarh section of Route A-2.

Section - Hetaura - Bhainse 11 kms.

2 lane Asphalt.

Section Bhainse - Kathmandu (Tribhuwan Rajpath) 126 kms.

Single lane asphalt. Improvement programme in hand.

FEEDER ROADS

Route A-2 Feeders.

1. Sunauli - Butwal 30 kms. Single lane Asphalt.
2. Butwal - Pokhara 179 kms. 2 lane Asphalt.
   Under construction - Expected to be completed 1969. Whole length truckable.
3. Dhangarhi - Dandeldbura - 145 kms.
   Planning in hand Construction due to start 1969. 23 kms. fair weather motorable.
4. Jaleswar - Janakqur - Dhalkebar (Route A-2) 30 kms.
5. Under construction gravel all weather 13 kms. fair weather motorable.
5. Kunauli - Fatehpur 36 kms.
   Under construction 1 lane asphalt.
6. Biratnagar - Dharan 50 kms. 1 lane asphalt.
7. Dharan - Dhankuta 73 kms.
   Under construction - fair weather motorable.
8. Ilam road 85 kms.
   Under construction fair weather motorable.

Route A-5 Feeders.

1. Naubise - Pokhara - 176 kms.

   Under construction 50 kms. fair weather motorable.

2. Kathmandu - Kodari - 116 kms.

   19 kms. two lane asphalt.

   69 kms. single lane asphalt.

   28 kms. gravel all weather.

   Planning in hand for improvement of Kathmandu.

   Bhaktapur section (12 kms) Construction expected to start 1969.

3. Birgunj - Kalaiya - 12 kms. Gravel all weather.

OTHER ROADS

Biratnagar - Rangoli - Jhapa	88 kms. Fair weather motorable.
Kathmandu - Trisuli	67 kms. Asphalt pavement work in hand.
Bhairahawa - Taulihawa	50 kms. Fair weather motorable.
Bhairahawa - Tribeni	64 kms. Fair weather motorable.
Nepalgunj - Jalkundi	72 kms. Fair weather motorable.
Rajbiraj - Kunauli	13 kms. 1 lane asphalt.
Taulihawa - Khunuwa	8 kms. 1 lane asphalt.
Krishana Nagar - Piuthan	24 kms. Fair weather motorable.
Nepaigunj - Surkhet	25 kms. Fair weather motorable.
Koilabas - Chorai	64 kms. Fair weather motorable.
Bhainse - Bhimphedi	12 kms. Cravel road.
Kaksahawa - Lumbini	8 kms. 1 lane asphalt.
Nepalgunj - Gularia	39 kms. Fair weather mototable.
Pokhara - Bhimad	48 kms. Fair weather motorable.

6. The Government of Nepal has made a request to the UN Special Fund for assistance in carrying out feasibility studies for a further 1,000 kms. of Feeder roads with a view to their construction in the 1972 period.

7. A 20 year Highway Plan has been drawn up and the Nepal Government has received considerable assistance in this connection from the Director of the Asian Highway, ECAFE. In Particular the services of a highway engineer, Mr. Sadai and a transport economist Mr. Chowdhury were made available in 1967 to assist the Nepal Government in assessing the priorities for the 20 year Highway Plan. Further institutional support is to be

provided in the form of highway laboratory equipment. This will enable us to make better use of the local material resources available to us.

13. HIGHWAY CONDITIONS IN AFGHANISTAN

Mr. Siad Mohammad Totakhil
Director, Department of Highway Maintenance, Ministry of Public Works, Afghanistan.

Afghanistan, as you know, is a land-locked country. Our Government is therefore greatly interested in, and willing to devote much time to the development of a transportation system which will ultimately result in the expansion of its cultural, economic and social activities. With this object in view, the Government of Afghanistan has given priority to the task of constructing and improving Afghanistan's highways and its feeder and farm-to-market roads.

Our Government plans to complete the circumfereneial route in Afghanistan. This route will pass through the Capital Kabul, Kandahar, Herat, Shibarghan, Maimana, Mazar-i-Sharif, Haibak and Pul-i-Kumri. The plan also calls for the construction of a direct route between kabul and Herat, which will serve as an alternate route.

The highways which connect the circumferencial highways to our neighbouring countries have been completed. These are: Kabul - Torkham with the eastern border; Kandahar - Spin Baldak with the south-eastern border; Herat - Islam Oala with the Iranian bordee; Herat - Tor Ghundai and Pul-i-Kumri - Sher Khan with the USSR frontier. The following roads will connect with the circumferencial highway: Mazar-i-Sharif - Keleft; Mazar-i-Sharif - Todg Gazar and Kabul - Khost.

In the first Five-Year Plan (1957 - 1961), the Government of Afghanistan allocated 49.5% of the total funds for communications and highways. For the second Five-Year Plan (1962 - 1967) the allocation for transportation and communications was 38.5% of the total amount. In the third Five-Year Plan, since most of the principal highways have already been built, more importance has been placed on agriculture, and consequently transportation has been allotted only 12.5% of the total sum. Thus, at the end of the third Five-Year Plan, there will be approximately 2,600 Kms. of modern road connecting the main centers of population and production and also connecting the main cities of Afghanistan to our ffontiers, and thereby to our neighboring nations.

The portion of the Asian Highway from the Iranian border through Kandahar (1,400 kms) to Torkham on our eastern frontier is now completed. With respect to the Kabul-Herat direct route, during the last two months the final design and survey of the two end sections, i.e., Maidon-Bamian (198 Kms) and Herat-Jesht-Sharif (152 Kms), has been conducted by Italconsult — an Italian firm.

The road Pul-i-Kumri - Marzar-i-Sharif - Shebarghan (330 Kms) is now under construction and 90 Kms of it are already completed. This highway is of a very high standard and by connecting the Capital to the northern part of the country, it will greatly facilitate transportation between Afghanistan and the USSR.

For the remainder of the circumferencial highway, i.e., from Maimana to Herat (627 Kms), surveying will be carried out during the period of the third Five-Year Plan. Preliminary surveying of the Mazar-i-Sharif-Tash-Gozar Port section connecting the city of Mazar-i-Sharif with the USSR frontier has been completed and the final phase of the survey and construction will be started soon.

38 Kms of the 127 Km Kabul - Gardez Highway connecting the Capital of Kabul with the southern city of Gardez, is finished and paved. The remainder is still under construction.

The Third Five-Year Plan also provides for the surveying of the entire length (118 Kms) of the road between Cardex and Khost on our south-eastern border, as well as for the construction of a part thereof.

During the next two years, it is planned to survey that portion Kunduz-Khan Abad - Faizabad (270 Kms) connecting the City of Kunduz to Faizabad in the north-east.

Maintenance of our highways is a major problem. Because of the variation in topography - valleys, dry wadies, high mountains and steep slopes - and due to high intensity floods during the rainy season, our highways are frequently threatened by floods and heavy landslides. This year, extensive damage has been experienced throughout the length of the Asian Highway.

Our Covernment has been in contact with the international Development Association (IDA) seeking assistance in the maintenance of our highways as well as assistance for the improvement and maintenance of 15,000 Kms. of

feeder roads. The IDA contracted the services of the Danish Engineering Consultants firm of Kampsax to conduct a full study on this maintenance project. The cost of the Study was $185,000 of which $155,000 was given by the IDA on a grant basis and $30,000 provided by our Government in local currency.

The Study covered the total Afghanistan roadway system consisting of:

680 Kms of concrete highway
1301 Kms of asphalt highway
3659 Kms of gravel roads
5837 Kms of improved unpaved roads
5815 Kms of unimproved unpaved roads

A total of 17,292 Kms.

The total amount needed for maintenance of the main highways and improvement of feeder roads was estimated at $24 million for three years; $16 million was in foreign currency for procurement of equipment, spare parts, materials and consultant staff and the remaining $8 million in local currency for improving the organization, for salaries and for the purchase of local materials.

The RGA has been in contact with the International Bank for Reconstruction and Development for a loan amounting to $5 million. This loan will be for the purpose of maintaining approximately 3,100 Km. of main highways and the construction of feeder and farm-to-market roads in the eastern region of Afghanistan. Up to date, this loan has not been consummated. The technical engineering report for this purpose was completed by the firm of Kampsax. This report is now available at the RGA, Ministry of Public Works.

The RGA hopes that the Transport Technical Bureau of ECAFE consider rendering technical assistance, through other doner countries, for the technician services for accomplishing the above work on a grant basis.

14. A PROGRESS REPORT ON ASIAN HIGWAY ROUTE A-1 & A-2 IN IRAN

Mr. Mahmood Hodjati
Division Engineer for Teheran Area
Ministry of Roads, Iran.

Rout A-1; Bazargan (Iran-Turkish border) Tabriz. Tehran. Gorgan. Shahpasand. Mashed. Tayebat. (Afghanestan border) 2,114 Km..

At the mean time from Bazargan (Turkish border) Via Tabriz. Tahran. Gorgan. Shahpasand. 1,334 Km. is completely paved as a first class highway (Except 15 Km. near Tabriz which due to mountainous crossing is still under construction and will be paved during next summer).

The road construction between Shahpasand to Ghouchan 389 Km. has been started recently in our fourth National plan and will be complete at 1971 as a first class asphalt.

From Ghouchan to Tayebat (Afghnestan border) 391 Km. is under construction. The pavement of first 131 Km. (Ghouchan -Mashed has been completed, and the remaining 260 Km. with %50 work executed will be completed at 1970.

TOTAL WORK EXECUTED ON THIS LINK IS %90

Route A-2: Khosravy(Iran - Iraq border) Hamedan. Tehran. Esfahan. Kerman. Zahedan. Mirjaveh (Pakistan border) 2,516 Km.

From Khosravy (Iraq border) Via Kerman. Hamedan. Saveh. Tehran. Esfahan. Nain 1,308 Km. is completely paved as a first class asphalt road (except 70 Km. between Saveh & Hamedan which is under pavement).

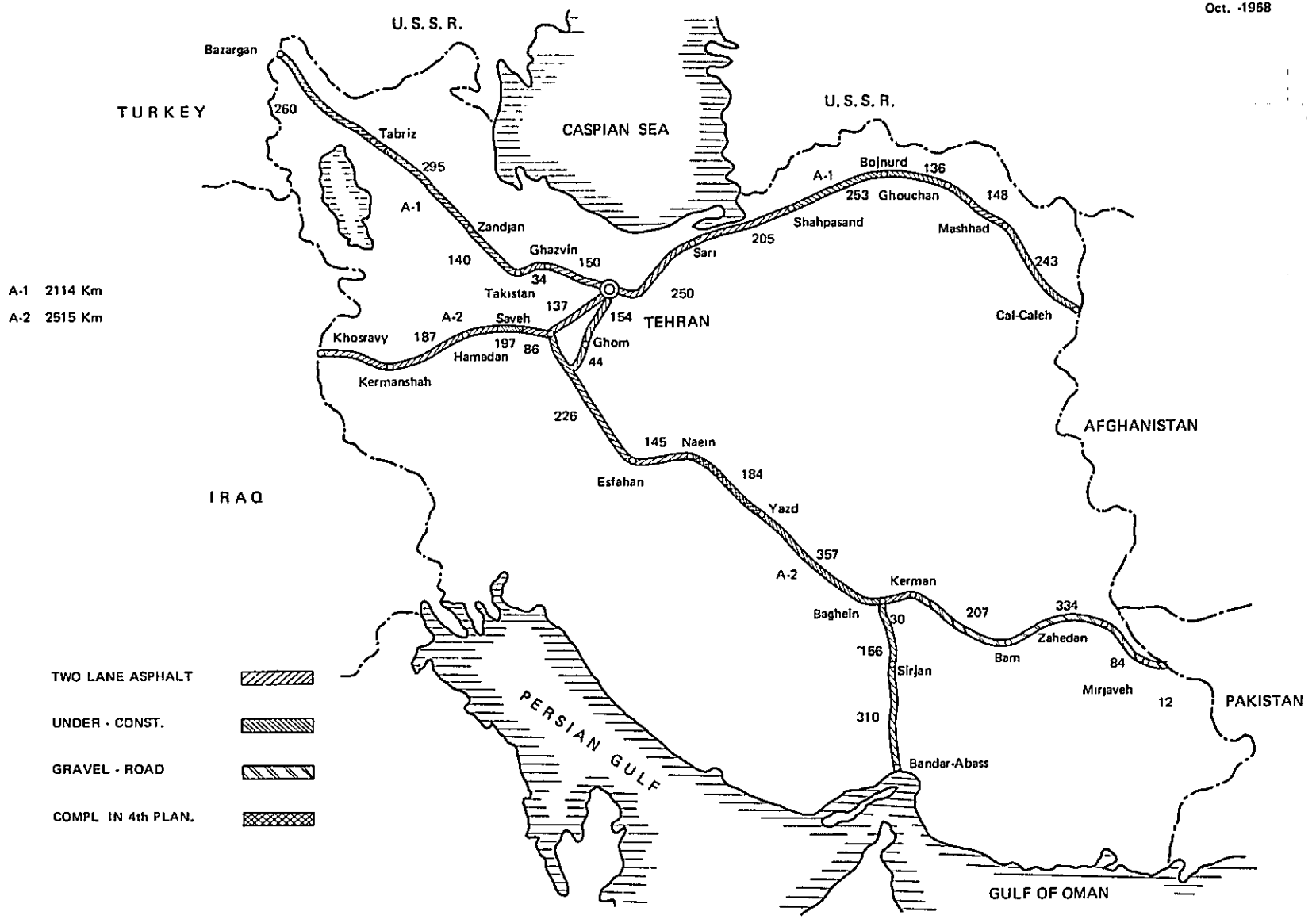
Design and preparation of plans from Nain to Pakistan border have been completed during 3rd National Plan. The road construction joining Nain to Kerman 571 Km. started recently and will be completed during fourth N. Plan (March 1973) as a first class asphalt road, and remaining portion up to Pakistan border 637 Km. will be improved during this period.

The construction of 500 Km. first class highway recently connect Kerman to the Bandarabbas (Persian Golf) and provide a new transportation facility.

IRAN Roads up to Sep. 1968

No.	Name of States	Paved	Und.Cons for Pave	Gravel	Dirt Rds.	Total
1.	Central St.	1308	10	656	122	2096
2.	St.1.Gilan	360	10	536	—	906
3.	St.2.Mazandaran	437	—	235	32	704
4.	St.3.East Azarbayodjan	556	45	996	91	1688
5.	St.4.West "	350	—	583	464	1397
6.	St.5.Kormanshahan	421	70	476	558	1528
7.	St.6.Khouzestan	955	90	581	269	1895
8.	St.7.Farss	535	325	955	1085	2900
9.	St.8.Kerman	131	70	542	1074	1817
10.	St.9.Khorasan	250	385	1420	327	2382
11.	St.10.Bofahan	1069	25	500	499	2090
12.	St.11. Sistan&Balouchostan	5	—	1346	2278	3647
13.	St.12. Kordostan	285	—	552	509	1346
14.	Ghazvin Rds. Dept.	362	—	246	—	608
15.	Arak " "	428	13	298	458	1197
16.	Hamedan " "	530	52	225	7	824
17.	Shahrood" "	—	—	499	564	1063
18.	Gorgan " "	130	—	394	341	855
19.	Kheramebad "	416	—	62	354	832
20.	Yazd " "	—	—	619	527	1146
21	Ttorbatheydarieh	—	—	574	804	1378
22.	Sea Coast Rds. South	419	—	15	1267	1701
		8944	1095	12331	11630	34000
	N.I.O.C. Pave Rds. (Khouzestan)	573				

E.C A.F.E. HIGHWAY PROGRESS CHART
(ROUTE A-1 & A-2)
Oct. -1968



A-1 2114 Km
A-2 2515 Km

TWO LANE ASPHALT
UNDER - CONST.
GRAVEL - ROAD
COMPL IN 4th PLAN.

IRAN
MINISTRY OF ROADS
P&P DIV.

15. PERSONS ATTENDED AT ASIAN HIGHWAY SEMINAR IN TOKYO, NOV., 1968 (No Special Order is Observed)

Country	Name	Present Post
ECAFE,U.N.	Mr. Tha Dok	Senior Engineer, Asian Highway Transport Technical Bureau, ECAFE, U.N., Bangkok
Thailand	Mr. Seree Suebsanguan	Deputy Director, Construction Division, Department of Highways
Malaysia	Mr. Ainuddin Bin Abdul Wahid	Senior Executive Engineer (Rodds), Public Works Department Heddqudrters.
Singapore	Mr. Joseph Thurairatnam Nallaiah	Senior Executive Engineer, Department of Public Works
Indonesia	Mr. Sudarsono	Chief, Road Division, Directorate of Road Construction, Directorate General of Highways, Department of Public Works and Power.
Vict-Nam	Mr. Tran-Van-Quinh	Chief of South District of P. W., Cantho, South Viet-Nam
Laos	Mr. Lytou Lyfoung	Chief, Subdivision of Public Works
Pakistan	Mr. Ayubur Rahman Choudhury	Superintending Engineer, Roads & Highways, Road Planning Circle, Govt. of East Pakistan.
India	Mr. Rajinder Pal Sikka	Executive Engineer (Standards), Ministry of Transport (Road Wing)
Nepal	Mr. Angur Man Tuladhar	Senior Engineer, Department of Communications, water & Public Works, Ministry of Transport
Afghanistan	Mr. Said Mohammad Totakhil	Director, Department of Highway Mainternance, Ministry of Public Works.
Iran	Mr. Mahmood Hodjati	Division Engineer for Teheran Area, Ministry of Roads
Japan	Mr. M. Shibusawa	Executive Director, Overseas Technical Co-operation Agency, Japanese Gov't.

Country	Name	Present Post
Japan	Mr. T. Kasai	Internal Operation Division O. T. C. A.
"	Mr. M. Morimoto	"
"	Mr. H. Kozuki	"
"	Mr. M. Fukushima	"
"	Mr. K. Minowa	Director Road Bureau, Ministry of Construction.
"	Mr. H. Namba	Director, Planning Division, Road Bureau, Ministry of Construction.
"	Mr. S. Watanabe	Deputy Director "
"	Mr. Y. Sadai	Auditor, Minister's Secretariate. "
"	Mr. Sakai	Planning Division "
"	Mr. M. Imai	Director, International Engineering Consultants Association, Tokyo
"	Mr. M. Funatsu	Secretary, " "
"	Mr. S. Asaeda	Director, Pacific Consultant Co., Ltd., Tokyo.