CENTO SEMINAR ON

highway and administration

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FOREWORD

The CENTO regional countries, Iran, Pakistan and Turkey, share a need not only to renovate large portions of their already existing road systems, but to build new roads, thus bringing many benefits to people living in remote areas of their countries. In recognition of these needs, the 17th session of the Subcommittee on Communications and Public Works recommended that the Central Treaty Organization sponsor a Seminar on Highway Planning and Administration, the first of its kind. The recommendation was subsequently approved by CENTO Economic Experts and by the Economic Committee.

The Government of Pakistan offered to host the seminar, and the United States Government, through the Agency for International Development and the Office of the U.S. Economic Coordinator for CENTO Affairs, agreed to provide financial and organizational support. The seminar was held in Lahore, Pakistan from August 21 to 26, 1972, with the following objectives:

1) To bring about a greater realization of the importance of highways to the development of developing countries

2) To encourage the allocation of adequate resources to the construction and maintenance of highways

3) To assist in the formulation of comprehensive, long-range plans for the development of highway networks

4) To outline steps required in the planning and programming of individual projects

5) To evaluate the relationship between highways and other modes of transportation

6) To discuss various methods of financing highway projects, and of recovering funds invested in such projects.

7) To improve highway administration, with particular reference to the organizational setup of the agency entrusted with responsibility for this sector of the economy

8) To exchange information on methods being used, and results obtained, in the participating countries.

All papers presented by the delegates are included in this publication, although some of them have been edited to meet printing requirements. Also included is the CENTO report of the seminar, which contains the conclusions and recommendations of the participants. It was unanimously recommended that such seminars should be held as frequently as possible so as to provide an opportunity for highway planners to exchange views and discuss their problems and adopt a common approach towards planning and programming of highways in the region.

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INAUGURAL ADDRESS

by

His Excellency Mr. Ghulam Mustafa Jatoi,
Minister for
Political Affairs and Communications,
Government of Pakistan

It is indeed a great pleasure for me to welcome you to this Seminar on Highway Planning and Administration, which has been organized under the auspices of the Central Treaty Organization.

We are in a world of accelerating changes, brought about mainly by the mobility of men and materials from one place to another. The different modes of transportation, which are creations of human efforts aimed at mobility, are no doubt a major segment of our means to improve the world we live in. One of the major overland transportation systems, namely road transport, dictates in no small measure the quality of our environment, the development of our resources and the extent of our mobility.

These aspects of living demand our full attention and necessitate the development of the country's highway system so as to provide a stream of interchange, producing a balance of economic development and cultural understanding.

The process of development has many constituents, and no single factor is sufficient in itself to bring about the desired improvement. The creation of an infrastructure like transport is an essential prerequisite to development in regard to health, education, industry, agriculture and other fields of national endeavour. Transport in general, and roads in particular, have a special significance because of the role they play in getting land into production, marketing of commodities, exploitation of mineral sources, development of industry, expansion of trade and, last but not the least, the exposure of the less developed areas to the influence of progressive forces. In fact, they are a necessary ingredient of every aspect of economic and social development. Their significance lies in the fact that they are not an end in themselves, but a means to many ends. They derive their importance from the objectives they are set to achieve, namely, to facilitate production as well as distribution in all sectors of economy.

Highway planning and administration, which is the fundamental objective of this seminar, is a matter of special concern and attention to the developing countries, and the conclusions reached here will go a long way in the improvement and development of highways. The subject is of particular importance to a developing country like Pakistan where financial and technical limitations have prevented the development of a system of freeways or expressways which caters to high-speed cars, giant trucks and big trailers manufactured by developed countries. Whereas the developed countries of the world like the U.S.A. have succeeded in creating a system of high-speed roads with the high quality of their architecture and landscape environment, we are still struggling to rise up from one-lane roads, with animals grazing and pedestrians strolling freely along. Whereas the 20th century revolution in transport has changed the face of many countries, there are still many areas in our country which are not even accessible by road.

Pakistan is making an earnest endeavour to allocate as much money as possible for the development of roads in the country. Our main problem, however, is not only to renovate a major part of the old road system, which was designed for light traffic before the Second World War, but to extend the benefit of roads to as many areas as possible. Nevertheless, a beginning has been made to construct a network of limited-access highways of international standards, and the first stretch of 90 miles between Karachi and Hyderabad has already been opened. We propose to extend this network further to link it with Lahore and Peshawar.

The topics which the distinguished speakers are to discuss at the seminar are of utmost interest and importance, not only to Iran and Turkey, but to Pakistan as well, because we are concentrating on developing roads for penetration into rural areas, which are the backbone of the agricultural economy of our country. Apart from the purely technical and financial aspects of highway planning, in which, I believe, the contributions made by you have been no less significant, I am confident that you will give earnest attention to the social functions of a system of roads. Speaking of social functions, it goes without saying that a system of roads helps integrate a chain of countries, particularly those geographically contiguous; brings their inhabitants closer together; gives rise to an interchange of ideas and sharing of experience and, above all, promotes a sense of regional cohesion. It inspires participation in the achievements of, and makes possible the sharing of benefits with, areas having comparatively smaller economic potential and resources, irrespective of the countries in which they are physically located.

I am sure you will emerge from this seminar with new vistas in the application of a modern scientific approach to highway planning, and a wide range of ideas will come to the fore to enable you to assume greater responsibility in your field of activity.

In conclusion I would like to stress again that the subjects chosen for this seminar are of great importance to the CENTO region as a whole, and in opening this meeting on behalf of the Government of Pakistan, I express my best wishes for the successful attainment of the noble objectives you have set yourselves. I sincerely hope that your stay in this historical picturesque city of Lahore will be comfortable and enjoyable.

OPENING ADDRESS

by

Mr. Kiumars Sadigh Vaziri,

Ministry of Roads,

Tehran

It is the first time that my delegation and I have come to Pakistan. May I say how delighted we are to visit this historic city of Lahore. On behalf of the Iranian delegation, I should like to express my gratitude to the Government of Pakistan for the hospitality extended to us from the time we arrived in Lahore. Also, my delegation and I would like to thank the Secretariat for their efforts.

It is a well established fact that transport and communication are vital to the process of economic and social development. This is why every country has to pay particular attention to its transport and communication development programmes.

In this respect this seminar provides an opportunity for the delegates to exchange information and ideas, and to discuss problems in the field of highway planning and administration.

I should like to thank the Agency for International Development, which has arranged this seminar, and my appreciation should again go to our brother country, Pakistan, for having prepared the facilities for the running of the seminar.

OPENING ADDRESS

by

Mr. C. Cahit Yalgın,

Directorate of Highways,

Ankara

I would like to express my appreciation on behalf of my government and my organization, the General Directorate of Highways, to the host country, our Pakistani friends and the CENTO Secretariat.

The problems we are going to deal with in the coming days are the most important factors in the field of highway transportation, especially in the developing countries. I believe there is much to be done in this field, and it is my hope that the discussions, exchange of experience and ideas between the various groups and individuals during this seminar will be of great help in solving our problems. I believe that our problems in this region are very similar.

Again, may I express my delegation's appreciation to the Government of Pakistan and CENTO for their efforts in organizing this seminar.

OPENING ADDRESS

by

Mr. Harvey Klemmer,

U.S. Coordinator

The United States, as most of you are aware, has placed a high priority on transportation. This is particularly true of highway transport. Highway transport is largely responsible for what progress we have been able to achieve.

Highway transport is also contributing, and will continue to contribute, to the development of other countries, with particular reference to developing countries.

Highways, in and of themselves, will not produce development; however, it can safely be said that without highways development is not likely to take place.

The United States is happy to participate in this seminar and is hopeful that it will contribute to the objectives which all of us have in mind--prosperity, progress and peace.

IMPACT OF HIGHWAYS ON DEVELOPMENT OF DEVELOPING COUNTRIES

by

Dr. L. L. Waters,
Department of Transportation,
Indiana University

TRANSPORT IN THE ECONOMY

Transport is really the assembly line of any modern economy with its specialization and trade. Sometimes I think that transportation is one of the main differentiators of a complex society from that of a series of isolated producing and consuming units. In the United States roughly one-fifth of all

of our total economic efforts in terms of national income is devoted to transport of freight and passengers. Annual investment in transportation consistently runs above one-tenth of our total capital commitments. Figures for other countries are even higher. Indeed, the level in some nations during the post-World War II period has risen as high as 40 percent. Many of the assistance and investment programs of capital-exporting nations have been directed toward transport investment in other countries. We may not know for certain that transport investment makes for economic growth, but we certainly are behaving as if this were an absolute fact. Indeed, economists, governmental administrators and businessmen are so sure that transport investment makes for growth that little second guessing or auditing is ever done. Furthermore, as Wilson points out, transport analysts have approached the subject on an aggregative basis, so that we have simply poured money into transport in many nations without ever analyzing very specifically whether particular projects were good or bad. The thought seemingly was that if we just scattered funds broadside, a good harvest of abundance would ensue.

A certain number of failures occurred, but they did not get enough publicity to shake widespread beliefs until relatively recent years. Within our own country the academic world was shaken by a couple of essays written by Robert Fogel of the University of Chicago. He astounded railroad buffs and economists by asserting that the pioneering investments of the railroads of the United States during the 19th century really did not speed up settlement and economic development very much. He concluded that by 1890 the country would have been virtually as well off if it had relied upon rivers, canals, and wagons, and had not built an incredible array of steel trails. Some states in the Midwest had so much rail mileage that everyone was within a short distance of service. In the State of Iowa every person was within 7 miles of a railroad. Fogel also attached the Rostow thesis of railroad construction, and therefore transport investment, as the stimulator which catapaulted the American economy into its take-off of growth.

The bevy of investment projects which were launched in the 1950's and 1960's swallowed so much capital and created such a mixture of successes and failures that studies such as Wilson's were devoted to seeing what lessons could be learned. In the coming few minutes I will try to pass some of the findings on to you, together with my own observations and admonitions. Is transport investment a cause, a result, or simply an accompaniment of growth? We do not know the answer for sure. When an investment is made in a project or projects, the initial effect is to stimulate employment, not only directly but indirectly. Projects themselves require labor and materials. Many of these may be local, and it is good if they are, because this minimizes the requirements for scarce foreign exchange. Sometimes local

labor may not be stimulated as much as expected, depending upon the technology of construction. I have seen superhighways built with a small number of people, but an enormous number of colossal machines. Skills required to operate the equipment precluded employment of local individuals so that the initial impact of the project on employment was substantially less than might have been expected. In my cynical moments I sometimes think that I have witnessed two-lane highways made into four-lane highways in relatively low-income areas and the result was that two or three flagmen and a few waterboys were hired from the immediate area. The rest of the labor force was imported by the contractor who had the project.

SOME BENEFITS

Whenever a transport project is undertaken, it usually represents an improvement of existing facilities or means, rather than a wholly new project. For example, construction of a new railroad may simply be replacement of a previous network of roads. Again, a highway may be built to replace an abandoned railroad.

A goal is often set to reduce the cost of transport and improve communications. If I do not make any other point, I wish to stress that the ultimate or only goal of a transport project should not be to reduce the cost of transport. This may be the result, as a rule, but to establish this goal may well mean that the project is ill conceived from the very first. The purpose of transportation investment as typified by various rail, highway and water projects should be to make the economy more efficient and to achieve other goals which may be to acquire better transportation that may not be cheaper. This newly substituted form of transportation may be so superior that the net result at a higher cost is to reduce other production and distribution costs and ultimately improve the quality of life for much of the citizenry. Inherent in the rise of modern physical distribution management are logistics of interrelated items such as packaging costs, inventory costs, and warehousing. The goal of private enterprisers and managers of governmental business concerns is to work out optimal combinations of the component outlays. A manager may deliberately increase transport costs because of the economies possible in other parts of the undertaking. Furthermore, he may even elect to increase all of the costs and not strive for minimum costs if the resulting product or service gives greater utilities.

We are commonly familiar with the high cost of transport projects. I would remind you that sometimes the costs of particular projects may save enormous amounts of capital and this

is also true for equipment. When the Boeing 707 was introduced, we were all horrified at the cost of $5 million with a couple million dollars for spare parts, yet the carrying capacity of a 707 in full service on the North Atlantic run was roughly equal to the Queen Mary or the Queen Elizabeth, which obviously cost a couple hundred million dollars on a replacement basis. Some of the new facilities which are introduced are so much more efficient that they actually reduce the drain on resources.

I will not belabor many of the merits of transport investment which are familiar to you. It is certainly no news that transport may enlarge market areas and enable the producers, subject to economies of scale, to achieve lower unit costs. Better products may now be available and the benefits can take diverse forms. The same manufacturers who were enabled to enlarge their operations might employ more people. For each one engaged in manufacturing, one or more jobs might be created in affiliated service industries.

SOME ROADBLOCKS

On the other side of transport investment are some real shortcomings. Many of the benefit-cost studies with which we are familiar have so many estimates and guesses that errors may be parlayed to yield rather disastrous results. Cost overruns may be outrageously great. Traffic may not materialize as expected. User charges on transport improvements may reduce utilization. Moreover, most countries have urgent need for a host of social overhead commitments. A vigorous group in the transport realm may put an improper priority on transport jobs and get underway with the projects when higher uses of resources may have been called for in education, health, power development or land reclamation. The opposite can be true. In one country with which I was associated, the personnel in the realm of railways and related transport did not have the political power of leaders in the governmentally-owned electric industry. Not only did those in charge of the latter generate an enormous amount of income from power production, but they also were more adroit in getting capital grants from the central government. Transport lacked internal income and got very little from the central government.

One of the strongest arguments against regional transport projects, especially those intended to bolster distressed areas, is the protective element of high rates. Poor transportation protects local industry from strong competitors operating from a distance. During very recent years our Federal and state governments in the United States have been pouring almost $1 billion into roads in the distressed area of Appalachia. This north and south mountainous area between the prosperous Atlantic coastal states and the equally affluent Midwest has been charac-

terized by low incomes. Now that better roads are being built throughout Appalachia, manufacturers, bakers, and various wholesalers outside can run their trucks into the area and undercut prices of the local establishments. Better highways enable travelers to pass through without stopping overnight in the local motels and hotels. Thus the investments in roads may well turn out to yield mixed results. The local governmental units now have the burden of maintenance of these facilities, and unless more public revenues are generated, the new facilities will fall into disrepair and the area will be back where it started, or worse.

GENERAL OBSERVATIONS ON TRANSPORT INVESTMENT AND GROWTH

Much depends upon the particular mix of factors impinging upon an economy in order to know the outcome of investments. The Brookings study more or less concluded that resources must be present which offer promise for development. The study also concluded that there had to be enterprising people with a genuine will to develop the resources. The many case studies cited by Wilson demonstrated clearly that unless there were both resources and enterprise, the projects were not likely to yield impressive results. I suspect that, if given a choice, I would choose people of enterprise over the presence of other resources. Outside factors, such as other types of political support, investments in education, health, disease control and other items have to go together with a transport commitment. A nation cannot simply make an improvement without tying the development into every other aspect of economic, political and social life. We often build great thoroughfares in our cities to bring cars from the peripheral area to the middle and then forget to allot money for parking and have to use up our precious streets to house our vehicles. Railroads may need branchlines. A port development may need deepening of the inland water system back of it. A primary highway may need numerous secondary lines both to draw and distribute traffic.

HIGHWAY DEVELOPMENT

The case for highway development is becoming increasingly strong all over the world. Arguments are now advanced that highways have been overly developed in some countries, such as the United States, and that we run into the danger of becoming one large street and parking lot. Railroads have for the last 150 years been heavily relied upon throughout the world. Their role is no longer dominant. They are caught up in a technological sweep of history. The number of countries in which the rail-

roads are self-supporting can be counted on the fingers of one hand. Some individual lines may be very profitable, but the collective results are poor. On the other hand, railroads are generally governmentally owned, and are required to assist in solving a variety of social goals. No matter where one goes, the percentage of traffic hauled by rails is declining relative to pipelines, water carriers, motor carriers and airlines. High-cost traffic is shifted to water carriers and pipelines. No amount of legislation or governmental direction is likely to check this historical sweep.

Highways have much to commend them. They can be developed in stages. A single lane can become two or four or more. A gravel road can be covered with asphalt or macadam or some other surface or, finally, with concrete. Bridges can be built to fit short or long-run needs, heavy or light vehicles, and fat or thin purses. A highway can be traversed by everything from dogs and people to bullock carts, camel caravans, large trucks with two or more trailers, and fancy sports cars. Indeed, a highway is a versatile facility. The better it is built, the more dependable are schedules over it, the less goods are damaged, the fewer people are injured and killed, and the more it costs to maintain it. On the other hand, if a road is utilized a great deal, it may well generate sufficient traffic to be self-liquidating. When a highway project consists largely of an improvement, the results on a cost-benefit basis may be reasonably predictable. When a whole new road is contemplated and diverse freight traffic expected, the results can be a surprise. I have been involved in estimating flows of general commodities on many occasions, and must confess that the element of guessing is very great. Producers like to follow a wait-and-see policy. They do not have enough imagination to know how to use the new highway, or they may prefer to remain quiet lest they get involved in some sort of a commitment which would boomerang on them.

The same imprecision is true with regard to waterway projects. One can estimate the amount of some local bulk commodities which might move at assumed rates to a well established market, but there is great difficulty encountered in trying to figure out what local manufacturing firms will ship out or what wholesalers and retailers will ship in. Market surveys just do not seem to work very well. It is a little like estimating the demand for fertilizer in a new plant in a country or area that has not been using such chemicals. All sorts of tests can be run to show how much is needed to raise the fertility levels of arable land up to certain predetermined goals and to maintain them there, but that is quite a different matter than figuring out who will buy how much fertilizer and when. If one took the direct survey of the farmers seriously, he would probably not

build the plant at all, or make it small, whereas if it is made large and catches on, it may quickly be much too small.

Some countries that have simply gone ahead with certain road programs and fertilizer plants have done better than others that have studied and studied and procrastinated to the point that an old proverb comes to mind, "By the time a wise man is old enough to marry, a fool has children old enough to support him."

RISING INTEREST RATES

Money has never been cheap for low-income countries, and during the last 5 years we have witnessed a sharp rise in these costs. The capital-rich countries are confronted with levels of rates two and three times what they were three decades ago. Furthermore, there is no likelihood that these rates will decline. Indiana University will be host in September to a conference which I have organized for countries of Western Europe on the problem of prices and productivity. The papers went to press just before I left for this trip. Leaders in the various nations are seemingly unanimous in believing that prices will continue to rise and outrun changes in productivity and changes in the quality of goods. Charges for money will have to reflect its declining purchasing power and this adds up to high interest rates. The relevance to the topic under discussion here is that higher interest rates mean higher costs of roads and lower benefit-cost ratios. The effect of high interest rates and the counterpart of discounts is not only to reduce the present value of expected benefits but also to favor construction of roads with short lives as compared with those of long lives--for example, in areas where blacktop will be favored because it does not involve as much capital.

You are going to deal with high interest rates for the indefinite future. This would seem to make capital expenditures more difficult, but the observation can be made that the most construction occurs during periods of time when prices--including interest, the cost of money--are high; the least construction occurs when the prices are the lowest.

I shall not give you the very proper admonitions to buy ample land in undertaking highway improvements. We in the United States consistently underbuy, and subsequently have to pay exorbitant prices for acquisitions because of the enhancement of land values contiguous to new or improved roads.

SOME BYPRODUCTS OF HIGHWAY CONSTRUCTION

As indicated earlier, not all the costs and benefits lend themselves to precise determination by economists, engineers and accountants. Improved highways in low-income areas of the world afford an unusually good source for the development of entrepreneurial skills. The cost of buying a truck or a lorry in used condition is within the means of many. If a man buys a vehicle and engages in road haulage, he will in short order develop himself rapidly in all facets of business. This may be followed by a second vehicle and a first employee. With good luck, hard work, and resourcefulness he may enlarge the enterprise and come to own a fleet. Few avenues offer such a promising area for the development of managerial talent. This phenomenon has been observed all over the world and offers much hope for generating real dynamism within a country.

At early stages there should be little or no regulation of entry into the transport business. Some insurance and safety requirements may be imposed on all vehicles for hire. In due time regulation may be quite appropriate to keep the industry in good health and, simultaneously, promote the best interests of producers and consumers who use transport services. Enterprises may grow to astonishingly large size. At early stages there are no particular economies of scale, but later on these may emerge.

One aftermath of highway development in the motor carrier field is the probable appearance of extreme diversity in equipment. This is frequently a great handicap. Often, countries with exchange problems have to buy vehicles on an opportunistic basis. The ultimate result is a heterogeneous array of models which unduly complicates the maintenance problem and results in ineffective transport. Some time back I visited a neighboring country and noted 30 or 40 makes of trucks or lorries in 100 disabled vehicles. If exchange had been available and the nationalized transport unit had been able to concentrate on two or three models, then half of the disabled vehicles would probably have been in service.

Most of the studies I have seen of estimates of highway traffic divide the business into freight and passenger service. The latter is broken into movement in individual vehicles--whether motorized or not--and buses or the equivalent of mammy-wagons or even jeepneys. I have really never seen any discussion of the role of bus companies as conveyors of packages and light

freight. This is a mission which they regularly assume in many parts of the world and almost never are the statistics included in the national figures. I can still recall with some amazement when a bus in what was then East Pakistan picked up a few passengers who had various crates of chickens, vegetables, and some sheep and goats. It happened that one of the goats was interested in the others and I never saw such a commotion. The details I leave to your imagination. The serious point can be made that there are enormous services of highways and services of bus companies which are never evaluated in their role as conveyors of freight, as well as passenger service.

Figures are not available to show the volume and value of passenger hauling on trucks in many nations where incomes are low and transport facilities limited.

SUMMARY

Economic progress without highways in the years to come will be difficult. Gains can be made without having highways as forerunners, but roads must be built if commerce is to flourish. On the other hand, it is the height of fiscal irresponsibility to build roads on the assumption that this will automatically make for economic advancement. An entrepreneurial zeal on the part of ambitious people must be linked with resource potentials if advancement is to be made. Highway projects should be put in proper perspective in relation to all of the other claims for resources within the country. I have some bias in favor of transport investment, but this should not be indulged unduly.

Highway projects are best analyzed as a part of a total transport scheme and then broken down into units for particular evaluation. Furthermore, the highway project cannot be undertaken separate and apart from a total program of regional and local development. A major highway has to be supported with branches if distribution and concentration of freight on the main artery are to be efficient. The project should never be evaluated on a basis of comparative road transport charges versus other rates or costs. Rather, the highway project should be evaluated in terms of its total effect on physical distribution and the logistic systems of all of the users. Finally, there may be many goals beyond economic and business considerations which may warrant the construction of a road system. There are certain social, political and national aims which are just as worthy as any of the motives with which I usually deal. While we have de-

veloped some fairly logical and perhaps even sophisticated approaches to evaluation, let us not be too confident. About as much as we know is embodied in the publications I have called to your attention. May I close with the statement of a golfer, though, who remarked, "I'd really rather be lucky than skilled." Go out; do the best job of analysis that you can. This should tip the odds in your favor. Rely upon all the experience which you have acquired. Make a decision as much with your head and as little with your heart as you can. Then pray to your special God that you may be right.

CENTO REPORT OF THE SEMINAR ON HIGHWAY PLANNING AND ADMINISTRATION

INTRODUCTION

Under the auspices of the Central Treaty Organization, a Seminar on Highway Planning and Administration was held in Lahore, Pakistan, for the first time in August 1972. It was felt necessary, informative and useful to have an exchange of information among member countries, since within the region the planning and administration of roads are paid a great deal of attention in connection with national and regional economic development. Consequently, the proposal by the Subcommittee of Communications and Public Works of CENTO was welcomed by the Economic Committee. The United States gave the scheme their organizational and financial support.

OBJECTIVES OF THE SEMINAR

The seminar dealt with the following objectives:

1) To bring about a greater realization of the importance of highways to the development of developing countries

2) To encourage the allocation of adequate resources to the construction and maintenance of highways

3) To assist in the formulation of comprehensive, long-range plans for the development of highway networks

4) To outline steps required in the planning and programming of individual projects

5) To evaluate the relationship between highways and other modes of transportation

6) To discuss various methods of financing highway projects, and of recovering funds invested in such projects

7) To improve highway administration, with particular reference to the organizational setup of the agency entrusted with responsibility for this sector of the economy

8) To exchange information on methods being used, and results obtained, in the participating countries.

INAUGURAL SESSION

The seminar was opened on behalf of His Excellency Mr. Nassir Assar, the Secretary General of the Central Treaty Organization, by the Secretariat Officer, Mr. Mostafa Modjtahedi.

The inaugural address was delivered by His Excellency Mr. Ghulam Mustafa Jatoi, Minister for Political Affairs and Communications, Government of Pakistan.

The heads of delegations of Iran, Turkey and the United States responded to the address of the Minister.

The Chief Delegate of Pakistan introduced the keynote speaker, Dr. L.L. Waters, Chairman, Department of Transportation, Indiana University.

Installation of Chairman

In compliance with CENTO's customary procedures, Mr. Tajammal H. Hashmi, Joint Secretary, Transport, Ministry of Communications, Islamabad, as the head delegate of Pakistan was appointed to preside over the chair.

Special Commentary

In addition to the Minister of Political Affairs and Communications, dignitaries, officials from Islamabad and Lahore, experts and press representatives were present during the inaugural session. Due to timing difficulties and the nonavailability of experts, the Government of the United Kingdom could not be represented at this seminar by a delegation. However, the British Consul General, Lahore, attended the opening and closing sessions.

Discussion of Dr. L. L. Waters' Speech

Discussion of the keynote speech took place. The speech was entitled "Impact of Highways on the Development of Developing Countries." Highlights of the discussion on Dr. Waters' speech follow.

In response to a question raised by the delegate from Iran about toll roads, Dr. Waters stated that he was against toll roads in principle, but that they can be justified in countries where other means of financing are not available. The speaker added that tolls should be removed after facilities have been paid for. He also stated that tolls, like taxes, are seldom removed after they have been imposed.

The delegate from Pakistan asked for recommendations on procedures to be followed in planning a highway network. The speaker advocated "a balanced approach" to highway planning. It is sometimes better, he stated, to start with farm-to-market roads rather than with superhighways.

The delegate from Turkey asked for guidance on the extent to which highway plans should be projected into the future. In response, the speaker stated that he felt countries should not plan "too far ahead," but at the same time they should make ample allowance for expansion. He further suggested that as a rule, countries should endeavor to anticipate needs for a period of 10 years' capacity for future expansion, including the acquisition of rights-of-way in excess of minimum needs which should be built into a highway network.

The delegate from Pakistan asked what the criteria for toll roads and the recovery of capital investment should be. Dr. Waters replied that toll roads should not be so high as to affect the traffic using the toll facility, especially when there is no alternative route available.

He further stated that it should be kept in mind that tolls on passenger cars are to be paid by the individual, which affects him alone, while the rates which are imposed on trucks and buses are to be paid on a commercial basis. He also stated that if toll rates are too high it would ultimately increase the cost of the commodities subject to transportation. He rationalized that the toll rates should be fixed at the minimum possible level, and on commercial vehicles the rate should be levied by making appropriate assessments in consultation with commercial organizations beforehand.

The delegate from Pakistan asked why it is not possible to develop private companies for making roads. Dr. Waters replied that private companies can develop only toll roads while governments can develop both free roads and toll roads. As such, it should be kept in mind that it is very difficult to tell the public to travel on a toll facility even when a free route is not available.

The principle, in general, is that free roads should be constructed from public funds, and it is difficult to reconcile the public to the idea of private funds arrangements wherein they have to ultimately bear the cost of the facility. However, the final decision can more appropriately be made on detailed statement of individual cases. For private enterprise in this field, the financier must have tremendous confidence in the government.

Adoption of the Agenda

The seminar adopted the agenda.

COUNTRY SITUATION PAPERS

Iran

The delegate from Iran, Mr. Kiumars Sadigh Vaziri, Chief, Soil and Technical Laboratories, Ministry of Roads, Tehran, presented a paper entitled "Road Construction in Iran." In this paper Mr. Sadigh Vaziri informed the seminar that Iran has

built about 12,000 kilometers of paved roads in the past 15 years and the goal for the future is to be even higher. The highlights of the discussion on this paper follow.

The delegate from the United States inquired as to whether or not highway construction in Iran was being coordinated with construction of highways in the neighboring countries. In response, the delegate from Iran stated that there have been many regional meetings among the three countries, coordinating highway construction as well as standardization and unification of highway specifications, signs and signals.

The delegate from Pakistan inquired about the methods which are used in Iran for quality control. The delegate from Iran responded that there are laboratories to conduct field control tests in Iran which are compared with investigation tests carried out during the planning stages and specifications.

The delegate from Turkey asked what kind of bitumen is being used in Iran. The delegate from Iran said that because of the wide temperature variation in summer and winter they use 60/70 and 85/100 asphalt for road construction. He further stated that in his country they are still looking for a suitable additive which can take care of long-range temperature variation.

The delegate from Pakistan asked about the maintenance system of roads in Iran. The delegate from Iran said that they have about 60 divisions which are allocated appropriate mileages of roads for maintenance purposes. The engineer in charge has the machinery, and maintenance operations are generally done by hired workers and supervised by the engineer. The work is not let out to contractors, and at the present time they are acquiring more machinery.

Pakistan

The delegate from Pakistan, Mr. A.A. Jamal-ud-Din, Chief Engineer, Highway Department, Government of the Punjab, Lahore, presented a paper which was entitled "Highway Planning and Administration Practices in Pakistan." Mr. Jamal-ud-Din stated that Pakistan has set out to build more roads and to better the existing ones for improving the transportation of the country and ultimately helping the economic development of the country.

In a discussion of the Pakistan paper it was indicated that in regard to the need for highway construction there is only one kilometer of highway for each 2,000 persons in Pakistan.

This may be compared with a ratio of one kilometer for every 37 persons in the United States. It was further indicated that Pakistan is currently endeavoring to improve the position by expenditures which should represent a substantial proportion (7 percent) of its gross national product.

The seminar was also informed that although the present system of highways is modest and inadequate in Pakistan, the government is cautious on increased activity in this field. Expenditure on the communications system in Pakistan, i.e., road, rail and water, presently amounts to 18 or 19 percent of that country's GNP.

The delegate from Iran asked about the total length of highways in Pakistan. The delegate from Pakistan said that there are 15,000 miles of rural highways, not including highways under district councils, irrigation roads, central government roads, municipal roads and cantonment board roads. These are mostly single-lane roads, and out of this length, only 1,000 miles are two-lane.

Turkey

The delegate from Turkey, Mr. C. Cahit Yalgın, Deputy General Director, General Directorate of Highways, Ankara, presented a paper which was entitled "Highway Planning and Administration in Turkey." In this paper Mr. Yalgın emphasized that sound and good planning is a prerequisite for deriving maximum benefits from public funds in a developing country with limited resources at its disposal. The highlights of the discussion on this paper follow.

The delegate from the United States asked whether Turkey has adopted stage construction. The delegate from Turkey responded that most of the feeder and link roads are constructed in stages. He further stated that low physical and geometric standards are adopted to make more areas accessible by roads. In the first instance, earthen embankment is developed and surfacing done subsequently, according to priorities.

The delegate from Iran asked whether there is any coordination between road, rail and water transportation in Turkey. The delegate from Turkey said there is no inland water transportation worthy of the name in Turkey. The railroad is only 8,000 kilometers in length. Highways account for 75 percent, while the railways account for the remaining 25 percent.

The delegate from the United States asked whether there was any urban transportation in Turkey. The delegate from Turkey

said that the Highway Department is involved in comprehensive urban transportation studies in Turkey. He stated further that they have begun to conduct a study in Istanbul with the full cooperation of the Ministry of Reconstruction and Resettlement and Municipality of the City of Istanbul. Also he stated that a study in Ankara is in process. He further informed the seminar that the World Bank has allocated some funds to the study on Istanbul transportation. He said there has been an agreement in this regard for a loan of about $200 million for the infrastructure.

HIGHWAY PLANNING

The delegate from the United States, Dr. Louis Berger, President, Louis Berger, Inc., New Jersey, presented a paper which was entitled "Highway Planning." In a discussion on highway planning techniques, Dr. Berger pointed out that there has been a "revolution" in highway planning during the past 5 years. Study teams once composed almost entirely of engineers now include developmental economists, demographers, geographers, manpower specialists, systems analysts and sociologists. A team of eight persons, as described by Dr. Berger, consists of three engineers and five nonengineers.

The delegate from Pakistan questioned the wisdom of building superhighways in countries where resources are limited and people are clamoring for farm-to-market roads. The delegate from the United States responded by pointing out that there is a place for both types of construction, and that the type of facility to be provided in a given situation is all a matter of the volume of traffic.

The seminar discussed the nature of the interest rates which are currently being used in highway studies. The delegate from the United States informed the seminar that 10 to 15 percent for an average of 12 percent were the current rates.

The delegate from the United States discussed the claim which is sometimes made in developing countries that foreign consultants tend to favor "showcase projects" over less pretentious undertakings. In this regard it was stated that consultants should recommend only projects which promise a fair rate of return even at the cost of offending clients.

PROJECT PLANNING AND PROGRAMMING

The delegate from the United States, Dr. Louis Berger, also presented another paper which was entitled "Planning and Programming Highway Projects."

The delegate from the United States advised the developing countries, in response to a question from Iran, to stress variable design standards which can be improved on an incremental basis.

The delegate from the United States, in regard to the planning of highway construction networks, cautioned the seminar not to rely on the example of the United States. He stated that the United States has wasted billions of dollars but, unlike developing countries, can afford to make mistakes. In any event, the country is growing so fast that traffic eventually will develop for whatever facilities are provided.

The delegate from Turkey observed that most of the highways constructed in Turkey were justified on social rather than economic grounds. The speaker agreed that indirect benefits should be taken into account in the planning of highways. In this connection, the delegate from the United States pointed out that the developmental economists are using a "community of interest" theory in making traffic forecasts. He further stated that if there is a community of interest between points served by a highway, the highway eventually will pay for itself.

THE RELATIONSHIP BETWEEN HIGHWAYS AND OTHER FORMS OF TRANSPORTATION

The delegate from the United States, Dr. Virgil D. Cover, Professor of Transportation and Dean of Graduate Studies, University of Georgia, presented a paper which was entitled "The Relationship Between Highways and Other Forms of Transportation."

The delegate from Iran pointed out that the increase in car ownership has resulted in a substantial increase in travel time; for example, a trip in Tehran which formerly took 15 minutes now takes 35 minutes. In this regard a remedy is being sought. The delegate from the United States stated that unfortunately there is no easy answer for the said problem. He further stated that the streets of American cities, like the streets of foreign cities, are choked with automobiles, and it is difficult to find a place to park. He also said that the ultimate solution

will be to cut down on the use of automobiles. He went on to say that we must learn to use mass transport, and to pool with friends and neighbors. He further said that in the end we may have to leave our automobiles outside of the city.

The delegate from Pakistan asked the speaker whether the present system of permitting the operation of trucks and buses without control should be continued, or whether steps should be taken to regulate this mode.

The delegate from the United States responded that he was inclined to recommend that motor transport should be allowed to develop without controls. He stated that controls at some stage might be quite necessary.

The delegate from Turkey asked for suggestions for the improvements of coordination between transportation modes. The delegate from the United States thought that rail and highway carriers could cooperate to a greater extent than they do since it is easier for them to work together than with any of the other modes of transportation. He also said that at the opposite ends of the scale are air and domestic water carriers, which he said are not likely to interchange much traffic.

AN EXPANDED VIEW OF ROAD FINANCE IN DEVELOPING COUNTRIES

The delegate from the United States, Mr. Robert E. Burns, U.S. Department of Transportation, presented a paper which was entitled "An Expanded View of Road Finance in Developing Countries."

The delegate from Iran asked what should determine the level of charges to be made on a toll road. The delegate from the United States responded that toll roads should not be regarded as commercial projects which are required to pay for themselves; rather, he said, toll roads should be considered as a means of relieving the burden on the general budget.

The delegate from Pakistan inquired regarding the extent to which toll roads should be employed in developing highway systems. The delegate from the United States said he would not suggest that all major roads should be toll roads. By and large, he continued, the public will not accept toll roads unless a real service is rendered. He stated that the Karachi-Hyderabad expressway, which enables users to avoid many winding, difficult roads, represents a significant advance over previously available facilities.

The delegate from the United States pointed out that not all toll roads have been financially successful. The extent to which people use toll roads, he said, depends upon the value which they place on time.

The delegate from the United States suggested that developing countries might be able to pay for highway construction by purchasing excess land and then selling this land at higher prices, following the completion of projects.

The delegate from Turkey made the observation that when toll roads are provided, free roads also should be provided so that users have a choice.

The delegate from Pakistan said that the principal problem in highway planning is uncertainty in regard to the amounts of money available for construction, and highway trust funds, he thought, would eliminate some of this uncertainty. The delegate from the United States expressed misgivings about the feasibility of the trust fund approach in developing countries.

HIGHWAY ADMINISTRATION

The delegate from the United States, Mr. Charles E. Shumate, Executive Director, Department of Highways, Colorado, U.S.A., presented a paper which was entitled "Highway Administration."

The delegate from the United States stated that he had observed that after the Interstate and Defense Highway System of 42,500 miles was built, additional highways, called Junior Interstates, would be proposed. He further said that it is likely that such added roads will be proposed and constructed.

The delegate from the United States stated that it was possible that other roads, not all of which would have controlled access, would be added to the plan.

The delegate from Pakistan asked about the extent to which the State of Colorado coordinated highway construction, economic regulation, and highway police.

The delegate from the United States responded that Colorado has a Public Service Commission which is responsible for economic regulation. Highway construction is in the Department of Highways, as is the Colorado State Patrol.

The delegate from Pakistan asked why the Department of Highways employed consultants, even though it has expert engineers on its staff.

The delegate from the United States indicated that it was sometimes necessary to use outside personnel, because problems would arise with which Colorado had no expert to cope. He further said that Colorado is about to invite about five consultants to offer proposals on construction of a highway down a canyon. The locations of bridges and tunnels are the sort of questions on which Colorado needs guidance. He also said the consulting firms will offer proposals, and the Department will choose one of them, and it is likely that the successful firm will also get the construction contract.

The delegate from Turkey inquired as to Colorado's policy with regard to land speculators who buy land after learning that the Department is considering construction of a new road.

The delegate from the United States stated that every effort is made to avoid disclosure of projects, but that there is little that can be done to prevent speculation. He also said that proposals for new highways are on public record, and citizens have a right to study them. Colorado does much preliminary work by aerial survey to avoid having engineers doing survey on the ground in full view of the public.

The delegate from Turkey stated that a Turkish property owner participates in establishing the value of his land for tax purposes. At this point, the owner wants a low value. However, when a new land acquisition is involved and the land is to be evaluated, the value for taxation is prime evidence of the price the government should pay. He also stated that according to the lawyers' views, the tax values should be revised from time to time in order that the owner may benefit from a value increase.

ADMINISTRATIVE ORGANIZATION OF HIGHWAYS

The delegate from the United States, Mr. Charles E. Shumate, also presented another paper which was entitled "Administrative Organization of Highways."

The delegate from Pakistan asked a question regarding the extent to which the high officers of the Colorado Department of Highways consulted with each other.

The delegate from the United States responded that a chief engineer, two assistant chief engineers, and he, as Executive Director, conferred formally once each week.

The delegate from Turkey inquired about the Colorado plan for introducing new personnel to their jobs. The delegate from the United States explained that each new employee goes

through a one-year inservice training program. They are moved from one part of the Department to another. Each serves one month in the main headquarters. He further stated that 78 percent of the employees have been with the Department at least for 2 years. The speaker felt that this was evidence that the Department's personnel policy is sound.

The delegate from Iran asked how contractors are paid. The delegate from the United States stated that after contracts are let out they are administered by the district engineer. The district engineer reviews progress on the contract each month and the comptroller issues a voucher for payment.

The delegate from Turkey inquired as to the size of the Colorado State Patrol. What are their functions? What is the relationship between the patrol and the local police?

The delegate from the United States answered the above questions by stating that the functions of the patrol are varied; the patrol is expected to enforce all state laws. They may act as riot police; they enforce the traffic laws and offer aid to stranded motorists. There are 495 officers on the patrol force. The members are brought to headquarters each year for training and study.

The delegate from the United States further explained that their officers are given 6 weeks' training before they are given an assignment.

The delegate from Iran inquired about the methods of controlling overloads on Colorado highways and enforcing weight restrictions.

The delegate from the United States indicated that Colorado authorities believe that axle weight limits should be raised from 18,000 lbs. to 20,000 lbs. The rules are enforced, however, partly through the use of permanent and portable weighing stations. He stated that the problem of carrying very heavy loads is attacked scientifically and with the intention of making it possible for shipments to move. Analysis will be made of the load on the various structures of the highway. He also said that movement is timed to minimize inconvenience to traffic. He also said that a representative of the Maintenance Division and a representative of the State Patrol accompany the movement.

The delegate from the United States further stated that the companies responsible for moves are required to acquire substantial insurance policies to reimburse the state for any damage which may occur.

VISIT TO ROAD RESEARCH AND MATERIAL TESTING INSTITUTE

The seminar participated in a visit paid to the Road Research and Material Testing Institute, Lahore, on Friday, August 25, 1972, and observed the operation of the Institute.

CONCLUSIONS AND RECOMMENDATIONS

The 6-day Seminar on Highway Planning and Administration, the first of its kind held under the auspices of CENTO, was considered by the participants as a significant contribution to the planning and development of highways in the region. It was unanimously recommended that such seminars be held as frequently as possible so as to provide an opportunity to the highway planners to exchange views and discuss their problems and adopt a common approach towards planning and programming of highways in the region.

The seminar also recommended that in addition to holding such seminars, the CENTO Subcommittee on Communications and Public Works may consider the proposal to send a team of highway administrators from the region to the United States on a study tour to see highway development, research institutions and organizational setup.

The seminar reached the following general conclusions:

Roads are an infrastructure, and progress in other fields of national endeavor depends to a considerable extent on the development of roads. The choice before the developing countries is not to spend all the available budget on the construction of a few superior type highways, but to spread the resources to as large an area as possible, in order to derive maximum benefit.

The seminar noted that highway projects are best analyzed as a part of the total transport system, and the evaluation has to be done on the basis of comparative road transport charges, versus other rates or costs in terms of their total effect on physical distribution and the logistic system of all the users.

The seminar noted that in the planning and programming of a highway program, the relative merits of the various systems of analysis--internal rate of return, net present worth, benefit-cost ratio and first-year benefit--should be considered in detail, taking into account the advantages and disadvantages of each system.

The seminar, in considering the developing countries, noted that the appropriate approach is to devote more attention to the improvement of the existing system, based on the determination of such indirect costs as vehicle operating costs, savings in time and accident costs.

The seminar stressed that in highway planning, special consideration needs to be given to important aspects like the benefits and disbenefits, shadow costing, the opportunity cost of capital commensurability, residual value, mechanical versus manual methods of construction, inflation and planning inputs.

The seminar further noted that the execution of a planning program must be based on the identification of present and future transportation requirements; the extent to which inadequacy in the highway transportation field has inhibited the economic development of the country; relative priorities for making investments in the transportation sector and the adequacy of highway design standards.

The seminar also concluded that it would be desirable to design highway projects on the basis of 10-year traffic needs, but to acquire the right-of-way on at least a 20-year requirement basis.

The seminar noted that in the execution of long-range plans for a national transportation network, it is necessary to develop a network model that would identify present and future requirements; assess the adequacy of the existing network; identify and test the suggested improvement, and analyze the impact and economic benefits of improved design standards and improved construction materials. This would lead to the formulation of a national transport policy, expressing national goals in the transport field and economic impact of various policy options.

The seminar noted that regional countries may find it difficult to go in for containerization at this stage, but it is essential that they take note of this important development and be prepared to adopt this system if it is felt that further delay would have repercussions on their international trade and commerce.

The seminar noted that various methods of financing a highway program include general fund financing, bond financing, toll financing and trust funds. For developing countries, the establishment of trust funds by earmarking all or part of road-user taxes for highway development and placing it on a nonlapsable basis deserves special consideration. Toll financing has been used very successfully in many countries, and to a limited extent in the region also. This offers a possible approach for undertaking those projects which are needed immediately and for

which finances are not readily available. However, it is a prerequisite for any toll project to provide a free alternative choice for the users. The revenues from tolls must be put in a special fund, which should in turn be used for financing other highway projects.

The seminar also concluded that it would be appropriate for the regional countries to establish an organization like the American Association of State Highway Officials to coordinate highway policies, and to prepare uniform standards, specifications, etc., for adoption throughout the area. There was general agreement that central guidance was essential to bring about a coordinated and uniform approach towards highway development.

The seminar noted that the highway network of a country should be divided into various categories, with particular reference to primary highways which should be developed from central trust funds.

The seminar concluded that in the organizational setup, the survey, preparation of projects, programming, etc., should be centralized as far as possible. It is necessary that special design sections, traffic sections, etc., be established on a regular basis, so that normal development programs may be undertaken by highway departments. For special and large projects, the employment of consultants is considered more economical than expanding the regular establishment.

The seminar also concluded that research activities in the countries need to be coordinated at the national level, and regional countries may consider the possibilities of undertaking joint projects of mutual interest in highway research.

COUNTRY SITUTATION PAPERS

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ROAD CONSTRUCTION IN IRAN

by

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Chief, Soil and Technical Laboratories,
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INTRODUCTION

Iran is situated on a large plateau in the southwest of Asia between latitudes of 25° and 40°. It has an area of 1,648,000 square kilometres (628,000 square miles), is approximately three times the size of France, and has a population of about 30,000,000.

Apart from its northern and southern coastal areas it has cold winters and hot summers. The northern Caspian coast is green all the year round with almost tropical vegetation in some areas, enjoying a temperate climate throughout the year; in the southern coastal areas hot summers are succeeded by balmy, temperate winters.

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Almost 90 percent of the total area of Iran is formed of a high plateau. The Alborz range of mountains, with the nearly 19,000-ft. high Damavand as its highest peak, stretches across the north; the Zagros range extends from the northwest to the southeast, dividing the country into two parts. Only narrow strips in the north and south are off the plateau. Despite these natural obstacles, however, there have always existed close economic and social ties between the people of the coastal areas and the other regions. A large section of the central area of Iran is composed of arid desert, but there is rainfall in most parts of the country.

Because of the scattered centres of population the road system plays an important role in the country's development.

It is estimated that as much as 45 billion ton kilometres of freight and 15 billion passenger kilometres per year are transported over the present roads. Accordingly, motor vehicles are providing approximately 95 percent of the goods transport and about 95 percent of the country's domestic passenger traffic.

With the yearly increases in freight and passenger movement by motor vehicles, and the desire to connect villages and agricultural areas to arterial systems, the need to expand, improve and maintain the present road system becomes of prime importance.

The present road system is limited, and is insufficient to meet the current and growing demand. The total length of all roads is approximately 44,000 kilometres, of which 12,000 kilometres are first class roads, paved either with asphaltic concrete or a double-surface treatment. Most of the roads have a 7-metre paved carriageway with 1.5 to 2-metre shoulders on both sides.

ROAD HISTORY IN IRAN

From the very beginning, when the Aryan tribes established themselves in Iran, they constructed roads that permitted them to communicate with each other and which corresponded to their needs. The Aryans who entered Iran from the east and who established themselves to the south of the Alborz mountains and to the east of the Zagros range were the Medes. The date of their immigration is estimated to be about 1400 to 2000 B.C.

The Medes later crossed the Zagros range towards the west and, occupying the neighbouring lands, encountered on the

one hand the Assyrian power, and on the other hand, to the southeast, the powerful state of Elam. Meanwhile, another group of Aryans had established themselves in the northern valleys of the Zagros range; these were the Persians, who are mentioned in the Assyrian inscriptions. Regarding the Median and Persian roads, we must first say a word about the state of Elam. Elam had sprung up a few thousand years before Christ in southwestern Iran, that is, the area covering the present day Khuzistan, Luristan, the Bakhtiari mountain valleys, the mountainous area of northeastern Persia and the northern coasts of the Persian Gulf up to the present day Bushir. The Elamites possessed an advanced civilization and were in constant rivalry with their neighbours, the Summerians, the Babylonians and the Assyrians. It was at this time that these powerful states began to establish road systems to facilitate their conquests.

With the rise of Cyprus the Great in 655 B.C. and the conquest of Ecbatana, the Achaemenidian power replaced that of Medes. The roads in Media joined the other principal centres of the country to Ecbatana, which was the country's capital.

The roads of the Achaemenidian era include the roads constructed by the Medes. To the Median roads were added those of Eastern Iran, Asia Minor, Mesopotamia and other lands that were conquered by the Achaemenians.

During the reign of Cyprus the Great much was done in the way of constructing new roads and improving those that already existed. In fact, the efficiency of administration in the new empire depended on good roads which facilitated communication.

Herodotus, in his fifth book, describes the Imperial Achaemenid Road, the road which passed through safe and fertile localities, and from one end to the other it was studded with caravanserais.

From Lydia (Western Anatolia) to Phrygia (in Asia Minor), a distance of 94½ parsangs, there were 20 caravanserais, that is, one caravanserai for every 5 parsangs. From Sardis, capital of Lydia, to Susa, the Achaemenian capital, there were 121 caravanserais. The caravans covered this distance quite easily within 3 months.

Before the reign of Darius the Great (521 B.C.), parts of this road were already used by caravans. But with the increase of Persian power during Darius' reign, these sections were joined and gradually extended. In fact, the Imperial Road measured 2,500 kilometres, a cause of pride to the Persians. It was not only well planned, but was also a great feat of civil engi-

neering. It passed by numerous towns and this facilitated the task of guarding it and maintaining it in good condition. It also went through mountainous regions, and it is here that we observe great accomplishments in civil engineering.

The Silk Road

The Silk Road was the most important commercial route of the ancient world. It started from the northern and the western boundaries of China, passed through the Iranian plateau, and crossing Mesopotamia, continued through Syria to the port of Antioch on the Mediterranean. Large quantities of Chinese silk thus covered a distance of more than 10,000 kilometres to reach Rome.

Bridge Construction in Ancient Iran

In the dry steppes of Iran, where rivers are in general seasonal, bridge construction did not progress too much, as it had done in ancient Rome. Bridges were built only over those rivers which had water for at least 4 months of the year, and which were difficult for the caravans to cross. The most ancient bridges in Iran were named "Pole Dokhtar," which means "the bridge of the girl," and the remains of such bridges are still found in the various parts of this country. The reason for their particular name is that they were built in the name of Anahita, goddess of the waters. From the remains of these bridges it appears that they were at first built dry with blocks of stone and wood and later with a lime mixture

Road Construction after Islam

With the invasion by the Arabs, road construction programmes came to a standstill because of internal strife. After some period of crisis, the various dynasties which ruled Iran, realizing the importance of roads, paid special attention to road construction in Iran.

The historian, Harold Lamb, in his book *The Life of Tamerlane,* writes that during Tamerlane's rule, all the caravanserais and inns were repaired and the roads were leveled and kept open during all seasons, even in the coldest winters, and the gravel roads were kept in good repair.

During the reign of Nader Shah, once again great attention was paid to roads. One historian, in his book

Seyralmotakheria, writes that Nader Shah ordered the Khyber Pass to be so widened that 40 horsemen side by side in a line could pass through it with ease.

The appearance of the Safavid Dynasty marked the beginning of vast transformations in all social and political fields. The great Safavid monarch, Shah Abbas the Great, commanded the construction of a great number of roads and caravanserais, which are all named after him. After the Safavid era there were no great activities in road construction.

Road Construction in Modern Iran

Construction of motor vehicle roads in Iran began in 1926. Major roads were designated, connecting the capital at Tehran with the population centres throughout the country, usually following the old caravan trails.

In 1926 a modern programme under the title of Proposed Project for Road Construction in Iran was drawn up. The project proposed the construction of 17,021 kilometres of first, second and third class gravel roads.

In the construction of these roads, such technical factors as width, thickness of the pavement, maximum gradient, minimum radii of curves in the mountainous regions and the resistance of the bridges were all taken into account.

The instruments of road construction in those days were pick, shovel and other elementary tools, but gradually the Ministry of Public Works decided to found a civil engineering school, while at the same time a number of students were sent to Europe to study modern science and technology. These students returned home at the end of their studies and took over posts of great responsibility, including some at the Ministry of Roads.

The execution of the 9-year programme of road construction thus continued with success.

ROAD CONSTRUCTION UNDER FOUR DEVELOPMENT PLANS

Construction and improvement of roads were limited up to the time of World War II, when allied military forces invaded Iran; consequently all national projects came to a standstill, due to the chaos and lack of immunity.

In 1948 the government established development plans to be carried out over a certain period of time with definite objectives to be accomplished within this period.

Transportation occupied a major position in these plans with the development of a highway transportation system being of highest priority.

Under the development policies, foreign and Iranian consultants were retained to carry out the goals of the road programme with construction bidding open to qualified foreign and Iranian companies.

The First Development Plan

During the First Development Plan (1948 to 1955), about 1,000 kilometres of third class gravel roads in short lots were constructed, and 200 kilometres of roads were asphalted.

In the meantime, the Ministry of Roads also launched extensive training programmes for its technical cadre.

The Second Develepmont Plan

This plan was launched in 1955, and in 1962 came to its end. Along with the progress in all other social sectors, much progress was also made in the expansion of the country's road system.

During the Second Plan, the need to develop a system of gravel surface access roads or "feeder roads" became imminent, so planning was started for the location and construction of some 7,000 kilometres of this type of roads with construction to start in the Third Plan. To accelerate this programme limited construction works were started in the Second Plan.

Among the most important actions that were taken during the Second Plan were the mechanization of work on the main roads and the organization of a technical cadre by the Ministry of Roads for this purpose.

The roads constructed during the Second Plan were of the following types and characteristics:

1) About 2,580 kms. of first class asphalt roads with a total width of 11 metres (7 metres of asphalt and 2 metres of shoulders on each side)

2) About 2,800 kms. of first class roads and 480 kms. of second class gravel roads.

The Third Development Plan

This plan began in 1962 and lasted 5 years. It caused a profound transformation in all aspects of the country's life. As the country's economic needs increased, road construction expanded with the necessity of linking the villages to the towns. The plan provided more than 30,000 million rials for road construction. This figure is the largest in road construction in recent development programmes.

During the Third Plan 5,300 kms. of main roads and 1,800 kms. of gravel roads were constructed; also, particular attention was paid to new road construction techniques. The Ministry of Roads launched a wide range of actions, training technical cadres, purchasing road construction machinery and snow ploughs, establishing road stations for controlling the weight of lorries, carrying out the law concerning the limitation of axle loads, and finally the safety of the traffic on the roads.

On the whole, the most important part of the civil engineering activities, such as roads and airports, took place within this plan.

The following paragraphs describe the most important roads built in the Third Plan.

The Tehran-Karaj Freeway

As the Tehran-Karaj-Ghazvin road is one of the busiest roads in Iran and links a number of highways from north, west and south to Tehran, the Ministry of Roads decided to construct the Tehran-Karaj freeway to ease the congestion of traffic on this road.

The length of the freeway is 41 kilometres, and it measures 28 metres in width. Its construction cost about 620 million rials. Its extension to Ghazvin will be launched in October 1972.

Asian Highway Route No. 1

To extend the communications system between Iran and the neighbouring countries, the construction of the Asian Highway Route No. 1 was started during the Third Plan. The length of a portion of this highway, going from Pakistan via Tabriz to

Bazargan (Turkish border) is 700 kilometres. It was completed during the Fourth Plan, and is now open to traffic.

In the construction of this highway, all the technical principles of road construction have been employed It passes through a number of big tunnels and over numerous bridges and continues on to Ghazvin, Tehran, Amol, Ghuchan and Mashad, going from there on to Kal Galeh on the Afghanistan border. Its total length in Iran is 2,124 kilometres and it was completely opened to traffic in 1971.

Kirman-Sirjan-Bandar Abbas Highway

For long it had been felt that the port of Khorramshahr, in the west of the Persian Gulf, was not adequate to handle the country's ever-increasing import-export traffic. On the other hand, as the distance from Khorramshahr to the eastern regions of the country was too great, the port of Bandar Abbas in the east of the Persian Gulf was expanded.

Along with expansion of the facilities of this port, the extension of a first class asphalt road from Kirman to Bandar Abbas was approved and the Ministry of Roads started its construction at great cost and under the most unfavourable conditions, during the Third Plan.

This road measures 601 kilometres from Kirman to Bandar Abbas; the road then continues from Bandar Abbas to Rudan for 117 kilometres. The extension of the road from Rudan to Zahedan on the Pakistani border is planned for future development programmes.

The Shiraz-Bushire Road

The Shiraz-Bushire road had for long been considered one of the most difficult roads in the country. It was constructed during World War I for military purposes, and it passed through the most mountainous sections of the region.

This route measures 288 kilometres, and 161 kilometres of it were completed within the Third Plan. The remaining 127 kilometres are near completion. The construction of this road will help Fars Province and the southern coastal regions to enjoy greater economic importance and more communications facilities.

The Fourth Development Plan

The Fourth Five-Year Development Plan, which began in 1968, enabled the Ministry of Roads to complete the construction work that remained unfinished during the Third Plan.

The Shahpasand-Ghuchan Highway

This highway is the continuation of a section of Asian Highway Route No. 1, with construction having been continued from Shahpasand to Ghuchan, Mashad and then to the Afghan border. As was mentioned before, this route has been completed and is under traffic now.

The New Yazd-Kirman Road

The construction of 320 kilometres of Asian Highway Route No. 2, between Yazd and Kirman, started during the Fourth Plan, and its construction is still underway. Moreover, the reconstruction and asphalting of the Yazd-Isfahan road is underway also. With the completion of these roads, Tehran will be directly linked to the port of Bandar Abbas by a first class asphalt road.

Extensive reconstruction and widening of old roads was also carried out during the Third and Fourth Plans.

CLASSIFICATION AND TOTAL LENGTH OF IRAN'S ROADS

The following road design standards, established in the Second Development Plan, have been retained as the standards for the Third and Fourth Plans:

First Class Asphalt Road

11 metres, including shoulders
7 metres paved width consisting of 7 cm. asphalt concrete
Shoulders: 2 metres gravel

Second Class Asphalt Road

10 metres, including shoulders
6 metres paved width consisting of 4-7 cm. asphalt concrete or double-surface treatment
Shoulders: 1.8-2 metres gravel

Gravel Road (Arterial)

8 metres, including shoulders
6 metres gravel surface
Shoulders: 1.0 metres gravel or dirt

Gravel Road (Arterial)

6 metres width, local materials

The total length of roads till January 1972 is as follows:

1) First class asphalt roads	6,990 kms.
2) Second class asphalt roads	5,100 kms.
3) Gravel roads (arterial)	21,400 kms.
4) Feeder roads or local roads	9,030 kms.
5) New roads under construction	1,540 kms.
Total length of roads	44,060 kms.

Since the First Development Plan in 1948, an average of 10 billion rials ($132 million) per year has been spent for the construction and extension of roads.

MINISTRY OF ROADS

The Ministry of Roads was once called the Road Office and functioned as a Department in the Ministry of Public Works. The Road Office was transformed into the Ministry of Ways by a law passed in 1926.

The new Ministry of Ways was responsible for the construction, maintenance and guarding of roads, railways and ports. Finally, in 1936 it changed its name to the Ministry of Roads.

The Iranian State Railways was also a small office in 1925, and during 47 years has undergone extensive changes. This huge organization now functions as an affiliate organization of the Ministry of Roads.

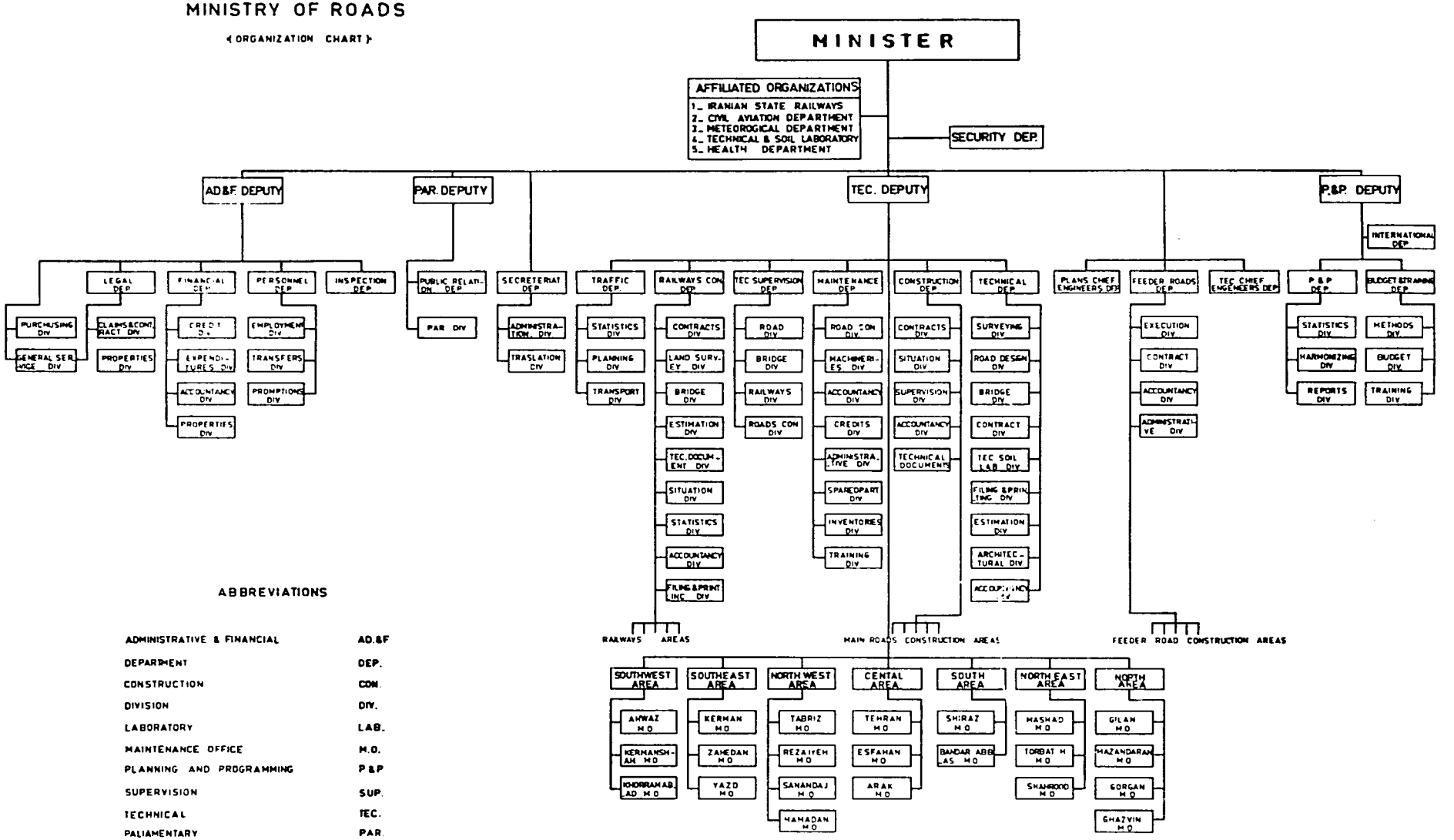
The Iranian Civil Aviation Organization was established in 1950, and is managed by a director general with the rank of deputy to the Ministry of Roads. This organization is responsible for creating the country's airports and the associated technical and aircraft handling facilities.

The Iranian Meteorological Organization was established in 1956 and functions as an independent organization within the Ministry of Roads and Communications and serves not only aviation, but agriculture, hydrology and shipping organizations.

In 1971 the Technical and Soil Mechanic Laboratories, an ex-affiliate of the Plan Organization, was entrusted to the Ministry of Roads. This organization has offices all over Iran, and together with the Ministry of Roads' own Soil Mechanic Laboratories, controls all construction sites throughout the country.

MINISTRY OF ROADS

(ORGANIZATION CHART)



ABBREVIATIONS

ADMINISTRATIVE & FINANCIAL	AD.&F
DEPARTMENT	DEP.
CONSTRUCTION	CON.
DIVISION	DIV.
LABORATORY	LAB.
MAINTENANCE OFFICE	M.O.
PLANNING AND PROGRAMMING	P&P
SUPERVISION	SUP.
TECHNICAL	TEC.
PALIAMENTARY	PAR.

Other departments of the Ministry of Roads have been shown in the attached chart. The Maintenance Department holds the responsibility of road maintenance throughout the country.

THE CHARACTERISTICS OF ROAD CONSTRUCTION IN IRAN

Taking into consideration the country's economic situation and the precedence of roads to be constructed, the Plan Organization of Iran indicates the programme of road construction, and after the required funds are allocated, they are entrusted to the Ministry of Roads for execution. The projects are carried out either by the Ministry of Roads or through a firm of consulting engineers.

If the proposed road should be constructed through the Ministry of Roads, the Technical Department of the Ministry of Roads is responsible for carrying out site and soil investigation, land surveying and preparation of all contract documents. When all the required plans concerning the construction of the proposed road are completed, they are transferred to the Road Construction Department for execution. Qualified contractors are invited by the Construction Department to bid on the road construction. The successful bidder then is entrusted to build the road on the basis of mutual agreement. The technical cadre of the Road Construction Department supervises all phases of construction, and the Technical and Soil Mechanic Laboratories of the Technical Department will run the required tests.

As the road construction activities have increased enormously since the commencement of the development plans, and as they were not harmonized with the fortification of the Ministry of Roads' technical cadre, the Plan Organization set up a commission of consulting engineering firms to undertake the study and construction of roads and airports in various parts of the country.

Consulting engineers have a great share in Iran's development plans, and most of the main roads of the country have been constructed through these firms. Nowadays, many Iranian and a few foreign consulting engineers are active in Iran, and they are graded by the Plan Organization.

With respect to the qualification of consulting engineers, the Plan Organization commissions them to execute the proposed projects.

When a consulting engineering firm is entrusted to handle a project such as road construction, the firm is responsible for the execution of all phases of the project such as site and soil investigation, land surveying, and preparation of all contract documents. In almost all projects, the same firm will supervise construction activities from the beginning to the day of handing over the road to the Maintenance Department of the Ministry of Roads. In the meantime, all phases of construction are controlled by the Plan Organization's Technical and Soil Mechanic Laboratories. (Recently, this organization was entrusted to the Ministry of Roads.)

The Ministry of Roads, in this case, acts as the high supervisor of activities of the consulting engineers through its department for execution of projects.

Sometimes, maintenance bureaus of the Ministry of Roads, on the basis of force account (direct labour), construct local roads and bridges on a small scale.

The Role of the Laboratory in Road Construction

Nowadays, the implementation of almost any major structural project depends on proper quality control of materials and sufficient supervision, which will justify and thus help to secure the necessary financial backing.

Moreover, if satisfactory results are to be obtained, it is imperative that all phases of construction, regardless of its nature, be controlled by a qualified and responsible body, from the beginning of the construction up to the day of handing over.

Therefore, the Technical and Soil Mechanic Laboratories in Iran takes care of these matters. There are *in situ* laboratories which will not only examine the quality of materials to be used, but also ensure that the job will be according to the specifications.

For nearly 20 years the Soil Mechanic Laboratories has been controlling construction sites throughout this country, and we have obtained significant results in this time. For instance, the Tehran-Karaj freeway is one of the projects which was controlled accurately by the Ministry of Roads' Technical and Soil Mechanic Laboratories, and in the 9 years that this road has been under traffic, also fortunately there has been no severe failure observed. It should also be mentioned that the road has not been retreated during this time.

The Technical and Soil Mechanic Laboratories of the Ministry of Roads consists of a central laboratory, which is located in Tehran, and site laboratories, controlling about 40 construction sites of these roads which are constructed through the Ministry of Roads. The central laboratory consists of soil, asphalt, aggregate-stone-concrete, and chemical sections.

Recently the Technical and Soil Mechanic Laboratories of the Plan Organization was entrusted to the Ministry of Roads. This organization controls all the construction sites of those roads which are constructed by the consulting engineering firms.

ROAD MAINTENANCE IN IRAN

All pavements require maintenance, as stresses constantly produce minor defects. Such stresses may be caused by changes in temperature or moisture content, by the traffic load, or by small movements in the underlying or adjacent earth. Cracks, holes, depressions, shoving, rutting and other types of distress are the visible evidence of pavement failure. They are simply the end result of the process of wear which begins when construction ends.

The Maintenance Department is responsible for the maintenance of 44,000 kilometres of roads, worth billions of rials. With the machinery and equipment (listed below) at its disposal, it looks after this great investment throughout the country, and keeps the roads in serviceable condition. The Ministry has at present 22 offices and 60 divisions which are responsible for the maintenance and repair of the roads.

MACHINERY BELONGING TO THE MAINTENANCE DEPARTMENT	
Graders	299
Bulldozers	171
Loaders	138
Rollers	139
Cranes	30
Scraper and Tractor Sets	17
Crushers	45
Snow Ploughs	88
Trailers	44
Water Tankers	134
Lorries	680
Mobile Repair Machines	24
Mechanical Brooms	14
Spreaders	46
Conveyers	25
Service Cars (Buses, Pickups)	415
Bitumen Distributors	16
Welding Machines	6
Total	2,331

ROAD PROBLEMS OF IRAN

Due to the varying natural conditions, road construction may encounter vital difficulties. These problems may be solved

during the construction process, but there are problems that may remain after the completion of construction also.

Like many other countries, Iran has had particular road problems, and the following paragraphs describe some of the current road problems in this country.

Landslides on Haraz Road

Haraz road is a paved two-lane road, built through the Alborz mountains in a generally northerly direction. The length of the road from Tehran to Amol is about 180 kilometres.

For the most part, beyond the village of Pulour, it follows the Haraz River. The highest point in the road occurs between Abe-Ali and Pulour, where the elevation is approximately 2,650 metres.

Construction was completed some 8 to 10 years ago. Normally the road is in sidehill, cut along the mountainside, forming one of the high river valley banks. In certain places, where a drainage gully crosses the route, the road is on a sidehill fill section, or is carried over by a bridge structure. There are also 14 tunnels, with the longest one being about 2 kilometres.

No large landslides were reported during construction, but since then, landslides consisting mainly of rockfalls and talus/debris flows have been a constant problem for about a 90-kilometre stretch of the road. This landslide-active portion of the road occurs from about Abe-Ali (some 55 kms. from Tehran) to a point about 40 kilometres south of Amol, where the Haraz River valley starts to become considerably wider.

A foreign firm, Consulting Geotechnical Engineers, has conducted an investigation on Haraz road. As stated before, landslides on this road are numerous and the causes are different, and will recur continually in the future.

In 1968 the Ministry of Roads began to construct more retaining walls, galleries, tunnels and fences (on mountain slopes) along this road. This programme will be continued until the road becomes immune and safe. The Ministry also plans to reclaim Firouzkouh road. Construction works have begun on this road.

Extreme Temperatures

The construction of roads in areas having very different types of climate has always been a problem, due to the different temperature conditions. In some areas the wide range in temperature in summer and winter, even between day and night, causes deterioration in the pavements. For instance, on the Tehran-Saveh road, which was studied by the Road Research Laboratory's expert in October 1971, we have formerly recorded temperature readings of 50° C. in summer and -28° C. in winter. This means that the pavement should be stable through a range of 80° C. Considering this situation, the selection of the right type of bitumen is always a problem. For example, in such an area, if a low penetration bitumen is used, which would keep the road surface stable in summer, it is likely to be subject to cracking in winter. If higher penetration bitumen is used, the pavement would be flexible in winter, but would start shoving in summer. In northern Iran, especially along the shores of the Caspian Sea, where it is humid and moderate, the foregoing problem is less severe.

HIGHWAY PLANNING AND ADMINISTRATION PRACTICES IN PAKISTAN

by

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OBJECT

The object of this paper is to briefly depict the evolution and present status of the highway planning and administration practices in Pakistan and to facilitate an exchange of views with the delegates of the participating countries in terms of the stated objectives of the seminar.

EXISTING ROAD SYSTEM

At the time of Independence in 1947, the area comprising Pakistan inherited about 5,050 miles of blacktop roads. Even these roads had not been designed to fulfill the requirements of the development needs of the country which had to be considered after Independence. Nearly all the roads were narrow single-lane pavement widths with a pavement thickness designed for low-intensity traffic. The bridges constructed were also generally of Class 10 or 12 loading. Further, this inherited network was burdened with heavy arrears of maintenance and replacement. Hence it was a major drag on economic development. At the time there was an immediate need of developing a larger network of road length to connect the district headquarters, tehsils and main market centres. All this required huge sums of money. Financial resources were limited and it was not possible to invest in a good highway system. A policy was therefore adopted to develop the maximum length of roads at a minimum cost with the available finances. Accordingly, single-pavement widths of 10 to 12 feet were adopted with a thickness of 6 to 8 inches. During the past 20 years this policy has served the short-term objective of opening a great part of the country to vehicular traffic, thus connecting important centres of the population. However, as the roads are of very low quality, they are fit for a traffic load of only 150 to 500 motor vehicles per day, and the present traffic load far exceeds this limit. According to the traffic data collected by the Highway Department in 1969, the position is roughly as follows:

Traffic Count Motor Vehicles Per Day	Length in Miles	Percentage of Total
Up to 500	7,200	52
500 - 1,000	4,500	32
1,000 - 2,000	1,800	13
Above 2,000	500	3
Total	14,000	100

Source: Highway Department traffic counts

It is apparent that the large amount of newly added road mileage has significantly increased the amount of traffic, an indication that these investments have been very fruitful. But since the roads have been running well above capacity, at present there is not only a problem of congestion and accidents, but also of fast deterioration of the pavement. The heavy traffic threatens to break down the surface of the established network. The roads in some areas have further been damaged by waterlogging and floods. The situation calls for immediate steps to be taken to widen, recondition and strengthen the existing roads. Timely strengthening is essential, because a total breakdown of the road surface would be relatively more expensive to repair. Widening alone, in most cases, would be insufficient to result in any appreciable investment gain in terms of vehicle operating costs, capacity and safety.

Similarly, a large number of road bridges, including some major river bridges, are too narrow, unsafe and old. Hence widening, replacement and upgrading of these bridges are necessary for the safe and speedy flow of traffic.

RELATIONSHIP BETWEEN HIGHWAYS AND OTHER FORMS OF TRANSPORTATION

The inadequacy of the newly developed network of highways manifested itself through many difficulties that we experienced in the recent past, involving the transport of inputs critical to the economy. The inadequate land transportation connections slowed down the distribution of raw materials as well as the finished products of industries, and restricted the timely supply of seeds and fertilizers to the farmers and in the delivery of the farmers' produce to the markets. With the structural changes in the economy experienced through the food self-sufficiency programme and export drive, with the growth of industries and increasing urbanization, the traffic pattern has in the past undergone a change, resulting in comparatively vigorous development of road transport.

However, since investment resources are scarce and have important alternative uses, it is imperative that transport investment and related policies be adopted with the utmost economy in view. Improvement in efficiency has to be sought before undertaking new investments, and coordinated development has to be attempted to avoid duplication. The long established railways and the recently developing road transport system are contrasting, yet complementary means of providing needed services. They have to be so combined as to minimize strains on resources while maximizing the quality, value and reliability of the services

offered, both now and in the future. Another means of transport, air transport, is growing fast, but as yet handles a small fraction of the total traffic. Pipelines are still another mode of transport, but quite insignificant, and mention can only be made of the natural gas pipeline. It is, therefore, important to establish the relationship of the proportion of investment required on the roads in comparison with the railways, with the end objective of deriving the maximum benefit out of the investment so made. For this reason, a Transport Coordination Study was undertaken in 1969-70. Its first phase was completed on 30 June 1971. In this phase, the quantitative part of the study was concentrated mainly on the most important part of the railway and highway transport systems, working out carefully the traffic forecasts, assessing the long-term requirements of each subsection, reviewing transport policies and operations and making recommendations about the optimum investment programme, keeping the long-term requirements in view. The above study, which was carried out on the basis of an integrated approach to Pakistan, embraced a detailed analysis of the following portions of arterial roads, compared with their related railway system parts:

1) Reti-Multan
2) Multan-Lahore
3) Lahore-Rawalpindi
4) Rawalpindi-Peshawar
5) Kabirwala-Lyallpur
6) Lyallpur-Lahore
7) Lyallpur-Sargodha
8) Sargodha-Rawalpindi (via Chakwal).

Passenger Traffic During the Third Plan Period

The above study brought out the following results in respect of traffic trends:

1) A major portion of the growth in demand for passenger transport that has occurred during the Third Five-Year Plan period has gone to roads.

2) Eighty percent of the railway passengers travel less than 50 miles, and since at this distance the buses can compete effectively with rail cost and offer more frequent service, the potential for further shifts of rail passengers to roads is great.

3) Rationalized rail passenger pricing would shift passengers to roads, because there is evidence that rail passenger traffic is underpriced.

This does not present a bright future for short haul rail passenger transport if buses are allowed to compete, roads are improved and an effective highway safety programme is introduced. The road passenger transport, on the other hand, will have to be expanded rapidly to cope with the increase in passenger transport demand during the Fourth Plan.

Freight Traffic During the Third Plan Period

1) Most of the growth in demand for freight transport that occurred during the last 5 years has gone to the roads. This expansion of freight traffic on roads is mainly the result of the change in government policy by which the barriers to entry into the trucking industry were removed.

2) Improved service characteristics and rationalized pricing policy would probably shift some freight traffic from road to rail.

3) With the implementation of the "agricultural revolution," the main line shipments on the railways are likely to continue to increase by a shift from rail to road on short and medium haul operations.

Traffic Forecasts for the Fourth Plan Period

While working out the traffic forecasts for the Fourth Plan period, two alternatives were assumed in respect of freight traffic. Alternative A assumes that the present methods of rail operation will continue. Alternative B assumes that these methods will be improved and accordingly estimates that 90 percent of the total short distance traffic (except the passengers in suburban areas) will go by road, and 10 percent by rail; whereas for long distances the reverse would apply, 90 percent by rail and 10 percent by road. This gives a more optimistic outlook for the railway than in alternative A.

The above estimates of passenger and freight traffic showed the following trends for the Fourth Plan period:

1) Low class passenger traffic shows a rate of increase by both transport means, but is relatively three times higher on the road side.

2) The high class passenger traffic will experience a slight decrease on the rail side and show a marked increase on the road side.

3) The freight alternative A shows a decrease of traffic on the rail side and a high rate of increase on the road side.

4) The freight alternative B shows a rate of increase by both transport means, but is relatively four times higher on the road side.

Thus, the result of the Transportation Coordination Study made with respect to the important system parts already mentioned brought out that:

1) The need for improvement in railway performance is considerable.

2) The increase in traffic during the Fourth Plan period, due to an increase in population and production, will be taken mostly by roads, hence the roads will have to play a very important role in coping with the demand of the coming period.

It is thus established that the need for rehabilitation and improvement of the existing road network is urgent. The basic criterion for allocation of funds within the sector is to consider the highest rate of return to the economy. The return on an investment in transport is heavily dependent on the amount of traffic using the facilities and the condition of the facilities. It has, therefore, been concluded that the investment in widening, reconditioning and strengthening of existing roads and widening and replacement of bridges is more productive than investment in new roads. In many cases, the existing traffic levels justify an investment in such improvements without even a speculation on future growth. Accordingly, this type of investment will receive major emphasis in the Fourth Plan. By the end of the Third Plan, the road network was 14,337.53 miles long, out of which a length of only 760 miles was widened and the rest had a metalled width up to 12 feet (single-lane) only. The traffic data already given, read in the light of future trends, discussed in the preceding chapters, broadly indicate that a minimum length of about 2,000 miles of roads must be widened and reconditioned/strengthened during the plan period. Out of the schemes for widening and improving roads, higher priority will be given to the highway from Reti to Attock, more especially to the G.T. Road from Lahore to Attock. It may, however, be added that construction of some new roads will be necessary to provide links to the new areas of production or effect substantial distance savings, thereby improving the economy. The schemes of superhighways for Lahore-Sargodha, Lahore-Lyallpur and Lahore-Multan, etc., are deferred for lack of adequate economic justification as compared to the schemes of widening and improving existing roads at this stage.

ALLOCATION OF RESOURCES

Provision for Communications Sector in the Fourth Five-Year Plan

The tentative latest version of the Fourth Plan prepared by the Planning Commission makes an allocation of Rs. 1,100 million for roads and bridges.

The programme for highway development in the areas under the central government includes a provision of Rs. 115 million for ongoing work and Rs. 585 million for a new scheme. The breakdown of this programme into different categories of investment is given below:

Sector Number	Province	Demand Proposal of the Sponsors (in million Rs.)		
		Ongoing	New	Total
1.	Punjab	115	585	700
2.	Sind	50	150	200
3.	N.W.F.P.	50	50	100
4.	Baluchistan	40	60	100
		255	845	1,100

The allocation proposed for ongoing projects of existing roads is Rs. 255 million, which is 23 percent of the total programme of the sector. With this allocation about 2,000 miles of existing roads are expected to be reconditioned/widened and improved. This will include improvement of the national highway from Reti to Attock to two-lane standards.

The allocation of Rs. 101.93 million has been proposed for construction of new roads, and about 500 miles of new roads are expected to be added with this allocation.

An allocation of Rs. 119.92 million has been proposed for bridges; seven new major bridges will be constructed, three existing major bridges will be redecked and four overhead bridges will be completed.

The above targets and allocations have been fixed at the minimum possible, keeping in view the overall financial resources of the country and the fact that a further cut in the

size of the programme would give rise to the inability of the transport system to cope with the growing traffic volume and consequential loss to the economic development in other sectors. The loss to the economy as a whole would be much greater than the savings made by application of a cut in the communications sector.

According to the current year budget, the provision for reconditioning/widening and improvement, new roads and bridges, etc., is as given below:

Sector Number	Province	Ongoing	New	Total
		(in million Rs.)		
1.	Punjab	77.57	17.43	95.00
2.	Sind	20.00	10.00	30.00
3.	N.W.F.P.	10.60	9.40	20.00
4.	Baluchistan	18.97	6.25	25.22
		127.14	43.08	170.22

Road Maintenance Mileage, Present Yardsticks for Maintenance Funds and Allocation

The maintenance of roads deserves greater attention. Better maintenance will not only postpone the time when new roads will have to be constructed, but will also reduce the operating costs of the vehicles. The yardstick for maintenance funds has been fixed and the funds have been allocated for the current financial year, keeping this objective in view. The information regarding the total length of roads, the yardstick for maintenance funds, allocation, etc., are given below:

1) The total actual length of roads existing in Pakistan at the end of June 1970 was 50,295.36 miles. Its breakdown in terms of metalled (blacktop) and unmetalled (shingle and earthen roads) is as follows:

Blacktop	Shingle	Kacha	Total
14,337.53	10,673.03	25,284.80	50,295.36

For facility of estimation, budgeting, etc., we observe a practice of converting the actual mileage of metalled roads to its equivalent in terms of a 10-foot pavement width.

2) Yardstick for maintenance funds:

Blacktop roads	Rs. 4,000 per mile of 10-ft. metalled width
Shingle	Rs. 2,500 per mile
Unmetalled (kacha) roads	Rs. 1,300 per mile

PLANNING

The policies underlying planning practices are briefly given below. Their relationship in terms of our present problems will be clear in the light of the picture of the problems and programme already given.

General

1) The efforts already made to increase Highway Department capabilities in planning, design as well as field level, will continue in order to keep pace with future challenges.

2) The ongoing projects will be kept under review with the object of consolidating the programme for the sake of efficiency and cutting out schemes of low economic priority for the purpose of deriving maximum benefits from successive investments.

3) The work will be carefully programmed in order to guard against spreading the resources too thinly and to ensure that all sections taken up during a year are completed within the yearly allotment as far as possible, and thus the investments made will start yielding economic benefits immediately. For this very reason, it will be necessary to provide adequate advance planning of the projects and to call the tenders of the works well before the beginning of the financial year; procedures for issuing sanctions of

projects and release of allocations will need streamlining, because the present resources result in shortening the actual work period to almost 8 months a year.

4) It is necessary to remove all difficulties and shortcomings in the smooth functioning of the Department. For this reason, the Department should be allowed more flexibility in determining the number of field charges for a given work load depending upon the circumstances and situation of the area in which the work is to be executed rather than the present practice of applying a fixed yardstick to all the charges of executive engineers and assistant engineers.

5) Keeping in view the magnitude and the importance of the improvement works which are underway and are to be taken up in future, it is extremely necessary that strict quality control measures should be applied, and a start has already been made towards this end by streamlining the organization of the Department at the headquarters of the Chief Engineer as well as improvement at the field level by laying down modern standards of practice for the field formation.

6) For the purpose of economy and self-reliance, greater and greater emphasis has been placed on the need for promotion and utilization of the local construction agencies.

7) Growth in traffic volume on the roads along with the improvement of existing and provision of additional facilities has in the past met with the conflicting phenomenon of increase in road accidents all over the world. This problem has given rise to new research and study in the field of traffic engineering for the purpose of safety of passengers and goods. All efforts will be made to make use of the lessons learned by the developed countries in this area in order to keep up the incentive of the road users. While designing for improvement works and new roads, special emphasis is, therefore, being given, within the limitations of our resources, towards improvement of geometric standards.

3) At present the schemes of strengthening and widening the existing roads are receiving the highest priority assigned to them as a result of the studies made. Such works will need no imported materials or advice.

They will be executed by domestic labour, and the responsibility for planning as well as execution will rest directly with the local engineering talent of the Highway Department.

Long - Range Planning

The long-term planning includes:

1) Classification of existing roads which has been done in three categories:

   a) primary roads
   b) secondary roads
   c) feeder roads.

   Provisions will be made for improvement of these roads to Class I and Class II standards, depending upon the traffic intensity. The details of this classification and improvement standards have been explained in a publication already issued by the Highway Department. The projected traffic for the classification has been taken as approximately 8 percent per annum for a period of 15 years.

2) The immediate proposition of a four-lane divided facility from Reti to Attock which, according to the traffic forecasts, is stipulated to be needed during the Fifth Five-Year Plan; otherwise there would be unwieldy congestion on many important sections of the two-lane facility being provided/improved during the Fourth Five-Year Plan period.

3) Review of the aided schemes for construction of highways on superior standards which have been temporarily deferred because of their nonjustification and the high priority of the schemes of strengthening and widening existing roads.

4) The designing, estimating and financial planning of some of the important costly bridge projects.

HIGHWAY FINANCING

Under the present system the income received from the road users goes to the general revenue.

It has been established as a result of the studies already made tha' the revenues collected from the road users taxes are far in excess of the expenditures being incurred on the roads. Hence there is ample justification for more liberal allocation to the roads in view of their pervasive importance for the developing needs of all other sectors of economy.

The experiment recently made with the construction of some bridges and return of the expenditure incurred thereon through the toll system, has proved quite successful and could be followed in the case of other bridge projects and important new roads.

In view of the above, it has been suggested that a greater quota of the collection of toll taxes, registration charges, licence fees, etc., should be given to the Highway Department.

PLANNING AND PROGRAMMING OF INDIVIDUAL PROJECTS

The following tasks constitute the planning and programming activities of this Department in respect of the individual projects:

Planning

1) Survey and mapping of the area, collection of traffic statistics for new or existing roads.

2) Fixing of design criteria, including speed, thickness of the pavement, vertical, horizontal curves, degree of curves, permissible ruling gradient, right-of-way, formation width, and blacktop width of the road, including fixing of the formation line with relation to natural surface, subsoil water and drainage data, intensity of rainfall, and high flood level in that portion.

3) Issue of detailed design plans for the projects including schedule of quantities, cost estimates, period of construction and maintenance, along with schedule of construction.

4) Provision of detailed drainage structures, culverts, bridges, etc.

Programming

The allotment of work is made to the prequalified Pakistani contractors selected to do these jobs on the basis of com-

petitive tenders. The contract conditions are defined and the quantities and quality to be executed are specified. The contractors are required to select the quarries and to make sure of the availability of suitable materials. The schedule of execution is agreed to and the completion period is fixed. Bitumen is normally issued by the Department, while all other materials are arranged by the contractor himself. The available machinery is also hired out to the contractors at a fixed rent, but efforts are being made to suitably equip the construction firms so as to make them independent. The contractors are required to maintain field test units and qualified engineering supervisory staff at the site of work for quality control, but the Department staff is also available at the site for guidance.

IMPROVEMENT IN THE HIGHWAY ADMINISTRATION WITH SPECIAL REFERENCE TO ITS ORGANIZATIONAL SETUP

Prior to September 1967, highway development was looked after by the Buildings and Roads Department. This organization was bifurcated with effect from 30 September 1967 into separate Buildings and Highway Departments in order to streamline operations, foster efficiency, increase specialization and to provide an effective structure for the introduction of operational improvements and better technical performance in both the sectors.

Under the above setup, the chief engineer, Highway Department, of each province, is responsible for all highway activity within his province. As the head of the Department, he is not only responsible for the efficient working of the Department, but also acts as professional adviser to the government in all matters relating to his charge.

The organization of the Department can be broadly classified into two categories in respect of its functions: 1) the headquarters office of the chief engineer and 2) the field formation.

In order to face the challenge of the future in terms of planning, programming and execution of the schemes in the communications sector, it was thought necessary to bring about some changes in the organization of the Department inherited after the breakup of One Unit, especially with regard to the headquarters office, which has been divided into six functional units to assist the chief engineer more efficiently. Such a change is expected to afford an opportunity to the engineering talents of the Department to demonstrate their skill in a much better way than before. Following are the functional units at the headquarters office of the chief engineer at present:

1) Planning programme and budgeting
2) Highway design
3) Bridge design
4) Road research
5) Highway operation, i.e. project and maintenance
6) Administrative, i.e. establishment and accounts.

The functional units, though separate, are knit together to form a well coordinated organizational structure to help the chief engineer in providing guidance and control for all highway operations, as well as for carrying out the functions which require province-wise perspective, establishing uniform procedure and practice for maintenance, introducing proper quality control measures and providing a training ground for the needed specialities.

In the field formations, the primary unit is in the charge of an executive engineer, whose jurisdiction generally coincides with the civil district. The unit in the charge of the executive engineer is called a division, and the executive engineer is therefore also called the divisional officer. He is finally responsible for the progress, quality and accounting of the works in his charge. He also participates in the planning and programming activities of the works by way of providing the necessary field data and estimates of costs, etc. He has the power to let out the works to the contractors up to a limit of Rs. 4 lacs. Above this limit he is assigned the duties of calling tenders and submitting them to the competent authority for allotment. Such tenders are, in some important cases, directly invited by the competent authorities themselves.

Above the executive engineer and below the chief engineer is the superintending engineer who is in charge of a circle which comprises of a civil division and is responsible for administrative and professional control of works in the charge of the executive engineers under him. Generally, there are three to five executive engineers under a superintending engineer. The superintending engineer is also responsible for providing technical guidance, arrangement and allocation of funds and approval of tenders within his competency which extends to a limit of Rs. 25 lacs.

Below the executive engineer are the assistant engineer and the assistant executive engineers, or the subdivisional officers who render assistance to the executive engineer in all matters relating to his responsibility spread over the area of jurisdiction in their charge. They also act as disbursing officers on behalf of the executive engineers for making payments to the contractors and labourers and for preparing the initial accounts of the works. The subdivisional officers are further

helped by the overseers, who are mainly responsible for rendering assistance to the subdivisional officers in the site supervision of the work, but they also help him in the verification of the bills of the contractor, making measurements, surveying and estimating, etc.

RESULTS OF THE ABOVE PLANNING AND ADMINISTRATIVE ORGANIZATION

The planning studies already made have brought about a greater realization of the importance of highways to the development needs of the country and have also set up a methodology for carrying out such studies in future. These have also been provided broad guidelines for suggesting/setting up criteria for the widening of roads.

The administrative changes made in the Department have increased the capability of the Department in the field of planning as well as execution. The organization of the local talent into the functional units at the headquarters of the chief engineer has made it possible for us to be more and more capable of being self-reliant in future for the planning as well as execution of the highway projects.

The above administrative changes have also facilitated collection and dissemination of the knowledge and experience of the engineers of the Department in the form of publications which set out the guidelines for the general design criteria of the new projects, maintenance practices, the latest research in various specialities of highway engineering, etc., and thus pave the way for facing the challenge of the future with greater and greater confidence.

CONCLUSION

We have made some efforts and wish to continue doing so, for achieving the much needed improvement in the communications sector for the welfare of our people and, therefore, we earnestly look forward to being enlightened by the valuable experience of the delegates of our friendly countries participating in the seminar on the basis of the studies made by them in the field of highway planning and administration in their countries and the results obtained therefrom.

HIGHWAY PLANNING AND ADMINISTRATION IN TURKEY

prepared by

the General Directorate of Highways, Ankara,

and

presented by

Mr. C. Cahit Yalgın,

Deputy General Director

BACKGROUND

The General Directorate of Highways was set up in 1950 to construct highways in the main traffic directions and was attached to the Ministry of Public Works. It is now responsible for the construction and maintenance of a highway network 60,000 kilometres in length, 35,000 kilometres of which are national roads and 25,000 kilometres provincial roads.

The General Directorate of Roads, Water and Electricity, attached to the Ministry of Village Affairs, takes care of the construction and maintenance of the village roads.

The General Directorate of Highways carries out the highway construction and maintenance works through 17 regional divisions. To this work 40,000 engineers, technicians and workers are employed.

The 1972 budget of the General Directorate of Highways is TL 1.5 billion (U.S.$100 million).[1]

HIGHWAY PLANNING

Continuous use of the scarce financing resources in developing countries to secure maximum advantage for the public is very important.

The share of the highways in meeting the transport requirements of Turkey is considerable. Therefore, it is necessary that the construction and improvement of highways should be realized according to the socio-economic needs and financial power of the country. Although it is appreciated that especially in developing countries the road system is the most effective means of speeding up development, the inadequacy of resources that may be assigned to highway investments increases the importance of highway planning. Highways in Turkey are classified as national roads, provincial roads, village roads, forest roads, etc. The choice of projects and the establishment of priorities for each of these classifications are made according to different methods. Since it is very expensive and time consuming to undertake studies necessary for planning, such as traffic counting, road inventory, etc., for roads in every highway network, it has been found necessary to make use of separate planning methods.

Efforts are made to calculate within a certain period the benefits and costs of road projects with the aid of economic analysis, and to establish benefit-cost ratios for projects. Certainly benefit-cost ratios play an important part in the establishment of priorities for investment projects. However, besides the criteria that are convertible into funds and are used for determining benefits (such as savings in operating costs, travel time, etc.), there are intangible socio-economic benefits of a road created by its construction, which cannot be expressed in terms of money, but which are at least as significant as the tangible criteria and sometimes even more so.

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1. 15 TL = U.S.$ 1.00.

Therefore, in the choice of highway projects, the results of economic analysis are only indicative for the executives. The executive is in a position to make alterations in the priorities of projects, depending, on the one hand, upon the results of economic analysis, and on the other, upon public opinion, the service of the road in general transport, social advantage and finally upon his past experiences. This is reasonable, of course, since economic analysis does not always yield faultless results because of erroneous data or incorrect evaluations.

Five - Year Plans

Five-year plans have been made in Turkey since 1962. Techniques for preparing plans are developed every planning period, taking advantage of the experiences of past periods. At present the final revision of the Third Five-Year Plan is being made.

The preparation of long-range plans as five-year plans within a perspective of 15 years has been provided. The desire to warrant that the daily traffic volumes served in the year when the roads are opened to traffic be at least 30 percent of the estimated design volumes, necessitated the restriction of the life of the project to 15 years. The fact that the traffic growth rate in Turkey is very high (12 percent annually) has played an important role in the acceptance of 15 years as the project life.

Another reason why the project life is restricted to 15 years is to avoid wasting investments for a road that will not be used at its full capacity for many years. On the other hand, the use of a 12 percent rate of interest per annum has been considered in the project evaluation by the State Planning Organization.

Both the restriction of the project life to 15 years and the use of a 12 percent rate of interest annually have increased the utilization rate in projects proposed for the plan.

National Highways Planning

National highways are important roads in main directions, connecting cities to one another as well as to railway stations and harbours. Therefore, their standards and construction costs are high, and they carry a dense traffic. A brief explanation of the studies and methods used in the planning of such roads is given below:

Traffic Surveys

Traffic volume counts are conducted to determine traffic composition on national highways. Origin-destination counts aim at establishing the movements of people and commodities. During origin-destination counts, types of goods are recorded and axle weight measured. Seventy-two counting stations fixed on the national highway network of 35,000 km. carry out counting continuously 24 hours each month, 483 counting stations 8 hours each season of the year and other necessary stations 8 hours once in a year. During these counts motor vehicles are recorded according to their types, such as car, bus or truck. The counts are calculated and classified with the aid of electronic computers as annual average daily traffic (AADT) volumes and the results are published every year.

From the traffic counts conducted in this way, AADT values are obtained for nearly 1,000 sections bearing similar traffic characteristics on the national highways. On the other hand, it is possible to establish the movement of people and goods by type on roads through the evaluation of origin-destination counts.

The use of these two types of information together gives the value of the main directions. Due to the fact that until recently traffic counts were not automatic and were often delayed, it was not possible to obtain very sensitive results. For this reason, automatic traffic counters have been provided and preparations made for new counts.

Road Inventories

Road inventory in Turkey has been carried out ever since the highway programme began. However, because of revisions made in the highway network and because of changing conditions, the old records lose their validity and are renewed by new road inventories made every 3 years. The main purposes of the inventory studies have been:

1) To possess general statistical records about highways

2) To give necessary information to the public on road conditions

3) To obtain the necessary data for road improvement programmes and for studies relating to road needs.

To achieve the three main targets mentioned above, the following data are compiled through road inventory:

1) Information regarding the identification of a road, such as the control number of a highway section, its region, province, name of the route to which it belongs and date of the inventory

2) Information on road conditions, such as platform width, lane width, shoulder width, surface type, shoulder type, type of terrain, drainage conditions and landslide conditions

3) Information regarding the geometry of the road, such as sections with restricted sight distance, radii of curves and critical grades

4) Information regarding structures, sites of bridges and tunnels, their lengths and geometric characteristics

5) General information on roadside installations, settlements, etc.

Traffic Estimation

Although it is difficult to forecast future traffic, especially in developing countries, it is necessary for economic evaluation. As mentioned before, the availability of traffic counts for the last 15 years facilitates forecasting. When determining the growth factors used in traffic forecastings, advantage has been drawn from these counts.

At first the traffic was classified as follows:

- Car (bus, minibus, pick-up, four-wheel drive)
- Bus
- Truck (light truck, truck, semi-trailer, trailer-truck).

As the growth of motor vehicle classes vary, different growth factors should be calculated for each separately.

The field organization of highways is divided into 17 regional directorates. (One division is temporary.)

On the basis of previous counts, traffic growth factors have been calculated for cars, buses and trucks on roads within the boundaries of each directorate.

TRAFFIC GROWTH FACTORS (in percent)			
Division No.	Cars	Buses	Trucks
1	12	5	8
2	12	5	7
3	12	8	8
4	14	8	5
5	10	6	8
6	10	7	8
7	14	7	7
8	11	4	8
9	12	6	8
10	14	8	8
11	12	6	8
12	10	8	8
13	9	5	6
14	13	6	8
15	10	8	7
16	9	4	8
Average for Turkey	12	6	8

These factors and the following formula have been utilized for the normal traffic growth on roads:

$$T = t_1 (1 + k)^n$$

T = future traffic volume

t_1 = the most recent average daily traffic known

k = growth factor

n = year of forecast

To forecast the future traffic volumes, the volumes of diverted and generated traffic are estimated separately, according to the characteristics of road and environment, and added to the normal traffic growth found in the above mentioned way. The future traffic values found are recorded on a map and subjected to a general control. Unreasonable estimates are reviewed, and if necessary, the traffic forecast is repeated.

Road Capacities

The geometric characteristics of highways are closely related to the traffic volume they carry. This relation has created the problem of "highway capacity," which is an expression of the traffic-carrying capacity of a road in figures. In other words, highway capacity is a concept which can be delineated in various ways according to the conditions of traffic flow and the sacrifices on the part of the road users. The latest description of highway capacity is as follows:

> *"Highway capacity is the maximum number of vehicles that can pass from a given section in an hour under existing road and traffic conditions."*

When traffic conditions (traffic composition, average speed, traffic volume) are kept constant, the rest is the road with its geometric characteristics.

With its geometric characteristics (number of lanes, lane width, shoulder width, percentage of total length of highway on which sight distance is restricted to less than 450 metres) a road has a calculable capacity of carrying traffic. This capacity serves the traffic according to the traffic volumes carried. Service levels of a highway having high standards are shown in between the free flow under low-traffic density and the restricted flow under high-traffic density. The service levels indicated as A, B, C, D, E, F are determined with the help of V/C ratios (V = traffic volume, C = road capacity). When controlling projects whether or not the road is adequate for the traffic, the service level E is used. This service level carries the traffic, though it be interrupted. Road capacities are calculated on the basis of passenger car unit. The following values are used as passenger car unit factors for heavy vehicles:

		TYPES OF TERRAIN		
Vehicle Type	Level of Service	Level	Rugged	Mountainous
Truck	A	3	4	6
	B, C	2.5	4	8
	D, E	2	4	6
Bus	A, B, C, D, E	2	4	6

Road capacities calculated with factors, such as lane width, shoulder width, grades, sections with restricted sight distance regarding existing roads are shown on a map and controlled generally.

Establishment of Highway Needs

The determination of highway requirements begins with the demands coming from three sources:

1) Demands from time to time by citizens, by public organizations and by politicians for the construction and improvement of roads

2) Requisitions by the field organization of the General Directorate of Highways with regard to the construction or improvement of roads under construction

3) Roads found, through inventory and traffic studies conducted by the General Directorate of Highways, to be unsuitable for carrying the future traffic, due to their geometric characteristics, causing an economic operation and unpassable roads which have to be constructed.

The latter is determined by the Directorate of Planning of the General Directorate of Highways. Thus road project proposals that are likely to be handled in the five-year plan period are obtained.

On the other hand, expenditures for each project are calculated. In these calculations the following road cost table is used:

ROAD COST PER KILOMETRE (TL/Km)					
Road Classes	Platform Width (m)	TYPE OF TERRAIN			
		Level	Rugged	Mountainous	Very Mountainous
Class I	13	650,000	900,000	1,750,000	3,900,000
Class II	10	500,000	700,000	1,400,000	2,600,000
	9	450,000	600,000	1,200,000	2,200,000
Class III	8	340,000	400,000	700,000	1,300,000
	7	210,000	300,000	520,000	1,000,000
Class IV (single lane)	5	150,000	200,000	350,000	650,000

1) These costs will be considered in the preliminary studies, such as survey and planning.

2) Every kind of construction expense is included in the cost, except asphalt surfacing and right-of-way.

3) The cost of widening the platform of an existing road, on condition that the plan and profile remain constant, will be taken as 1.20 times the cost difference of the two widths to be found from the table.

4) The cost of four-lane roads will be assumed as two times the values of the table.

5) This table does not apply to expressways.

6) Asphalt cost of surface treatment: 9.00 TL/m^2.

7) Concrete asphalt cost: 42.00 TL/m^2.

Obviously, the total cost of the projects proposed for the five-year plan exceeds the funds allocated to the General Directorate of Highways from the national budget.

To attain a reasonable level in the number of projects, the financing possibilities likely to be given to the General Directorate of Highways in the five-year plan period are examined also. The realizable projects can be selected roughly according to the most optimistic estimate of the five-year investment ceiling derived from this study. Only economic studies of the selected projects are made. Thus the number of the projects requiring economic study is decreased considerably.

Economic Analyses

The road investment projects proposed for the plan are first separated into two groups:

1) Projects costing not more than TL 10 million

2) Other projects.

Determining the Priorities of Projects Costing Less Than TL 10 Million

The priorities of the projects in this group are calculated simply according to the following criteria:

a) road length
b) average grade of road
c) construction cost.

With these criteria, priorities (P) are obtained from the following formula:

$$P = \frac{\text{Road length x average grade of road}}{\text{Construction cost}}$$

The priorities of the projects are fixed in descending order.

Determining the Priorities of Projects Costing More Than TL 10 Million

In the economic analysis of national highways where the project cost exceeds TL 10 million, the following common principles are to be used:

1) 1971 prices will be used in the benefit and investment calculations.

2) It will be assumed that the constructed road will be opened to traffic at the end of 1979 (middle of the plan period + average construction time = 1975 + 4).

3) The geometric standard will be established according to the traffic forecast of 1990.

4) In the calculation of benefits, the traffic volume of 1987 will be taken (average of 15-year analysis period).

5) 12 percent interest rate will be used.

6) The following values will be used for road users' cost (lubricant, fuel oil, tires, amortization, maintenance) on level, asphalt concrete surfaced road:

   - Light vehicle 0.35 TL/km.
   - Heavy vehicle 0.70 TL/km.

7) Increase in road costs due to different grade and surface conditions of the existing and new roads will be calculated according to the growth factors shown in the following tables:

GROWTH FACTORS OF ROAD USER COSTS ACCORDING TO LEVEL GRADE (0 %)		
Grade	Light Vehicle	Heavy Vehicle
0	0.00	0.00
1	0.02	0.23
2	0.04	0.50
3	0.06	0.75
4	0.09	1.00
5	0.14	1.25
6	0.18	1.50
7	0.24	1.75
8	0.32	2.00
9	0.40	2.25
10	0.49	2.50

GROWTH FACTORS OF ROAD COSTS ACCORDING TO ASPHALT CONCRETE SURFACING		
Surface Type	Light Vehicle	Heavy Vehicle
Asphalt concrete	0.00	0.00
Bituminous surface treatment	0.05	0.10
Stabilized	0.30	0.40
Unpaved	0.60	0.80

8) Annual benefits and costs will be calculated, excluding taxes.

9) In the feasibility calculation the following formula will be used:

$$F = \frac{\text{Annual benefit}}{\text{Annual cost}}$$

Economic analysis of all alternatives of road projects are made in compliance with the above mentioned criteria. At the

end of this analysis, the most economical route is selected. Then the second economic analysis of the existing road and the selected alternative project is made and the feasibility value, which will be the basis of priority, is found.

At the same time, the beginning and completion year of the construction of projects for improvement, as well as their necessary annual allowances, are fixed, taking into account the situation of machinery and technical personnel of the relevant regional divisions. In other words, the project is timed according to the construction period and allowances.

The priorities of projects are subjected to a general control. Adjustments are made in case the priorities of successive projects or of projects on the same main route are contradictory.

The projects, which are timed and for which priorities are fixed in this way, are programmed on the basis of their priorities and included in the programme for each year of the planned period, taking care not to exceed investment ceilings estimated for the five-year plan period mentioned above. This is a draft of a five-year plan.

Implementation of Yearly Programmes and the Five-Year Plan

The five-year plan draft of highways is reviewed at the State Planning Organization on a higher level in the light of the general development principles, together with other drafts coming from various sectors, adjusted and submitted to Parliament for enactment. In the five-year plan ratified by Parliament in its final form, probably the appropriations of the General Directorate of Highways will be different from those estimates in the draft. To eliminate these differences the draft of the five-year plan is reviewed and adjusted.

Taking into consideration the changes that have come about in the previous year in compliance with the five-year plan, as well as the situation of the investment projects, the programmes are revised for the next year. This is the draft of the annual investment programme of highways for the next year. It is examined by the State Planning Organization, and adjusted, if necessary, through mutual negotiations and submitted to Parliament, where it is enacted as an annex to the budget law. Then, the investments are carried out with budget allowances. However, the implementation of the investment projects may be interrupted by unforeseen events such as floods, landslides, strikes or administrative formalities. Amendment forms are prepared for these interruptions, with reasons. Upon the approval of the State

Planning Organization and the completion of formalities at the Ministry of Finance, the alterations in the programme are concluded and handicaps removed.

PROVINCIAL ROADS PLANNING

The provincial highway network consists, to a great extent, of local roads connecting towns to cities and to other roads. The daily traffic they carry is generally below 100 vpd. However, the traffic volume of some touristic roads increases in the summer months.

Formerly, provincial authorities were responsible for the construction and maintenance of provincial roads. This responsibility was shifted to the General Directorate of Highways a few years ago. The compilation of the data about road inventory and traffic on the provincial roads, 24,000 km. in length, has not yet been completed. In the planning of provincial roads which show a predominantly social character, it has not been necessary to make a comprehensive economic analysis, due to their low daily traffic volumes.

However, it was deemed necessary to fix some criteria regarding the construction and improvement priorities of these roads. These criteria are given below:

1) The physical and geometric adequacy of a road

2) Whether or not settlements connected by a road are linked by another road or another settlement

3) Construction and improvement costs of the road

4) Road length

5) Total population of the settlements it connects.

Population criterion has been considered as effective as traffic in bringing to light the importance of a road. Where population density is high, the traffic volumes tend to be higher than places having a lower population density. Therefore, population has been considered as an important factor. Another important factor is the cost of a road per km. Topographic situation, soil classes and the cost of road building materials are elements affecting road costs. Road construction costs on level and soft terrain are very low compared with those on rugged and rocky terrain. In other words, it is possible to construct more kilometres with the same amount of money on level and soft terrain than on rugged and rocky terrain. With the help of these

two factors and the use of the following formula the priorities of provincial roads have been calculated:

$$P = \frac{\text{Population}}{\text{Cost/km.}}$$

P values obtained with this formula have been put in descending order to fix priorities. Besides, having evaluated these priorities together with the criteria mentioned above, the final priorities have been established.

VILLAGE ROADS PLANNING

The construction and maintenance of village roads are not under the responsibility of the General Directorate of Highways. The Ministry of Village Affairs takes care of such work. Nevertheless it has been considered appropriate to give here some brief information about the planning of village roads.

It is estimated that our country requires 160,000 km. of village roads. One of the main aims of the above mentioned Ministry is to achieve this target in a short time through planned and programmed efforts, as village roads play an important part in the social, cultural and economic development of villages where 71 percent of our total population live. In Turkey villages are widely scattered. Generally the topography of the land is rough. For those reasons, road construction is expensive and difficult.

Moreover, it is impossible to build 160,000 km. of village roads in a short time with limited financial resources. The problem has been solved as follows:

Constructing Roads for Groups of Villages

Due to the difficulties mentioned above, instead of making a road for each village, it has been decided to construct a road with relatively good standards and to connect a group of villages to this road with feeder roads, so that five or six villages can make use of it. Thus the total length of the roads to be constructed has been considerably shortened. The following criteria have been used for fixing priorities for these roads:

Priority Criteria	Point
Population	25
Economic value	20
Health center	25
School	25
Touristic situation	25
Road cost	A negative point is given for every 5,000 TL.

Contribution of Villagers

The villagers are mindful of the importance of roads in the social and economic development of their villages, in meeting their requirements and in marketing their production. Therefore, they are ready to give every kind of assistance they can for road construction. Generally the contribution of villagers is as follows:

1) Donation of land for right-of-way

2) Financial aid to meet costs of fuel, explosives, cement, steel, etc.

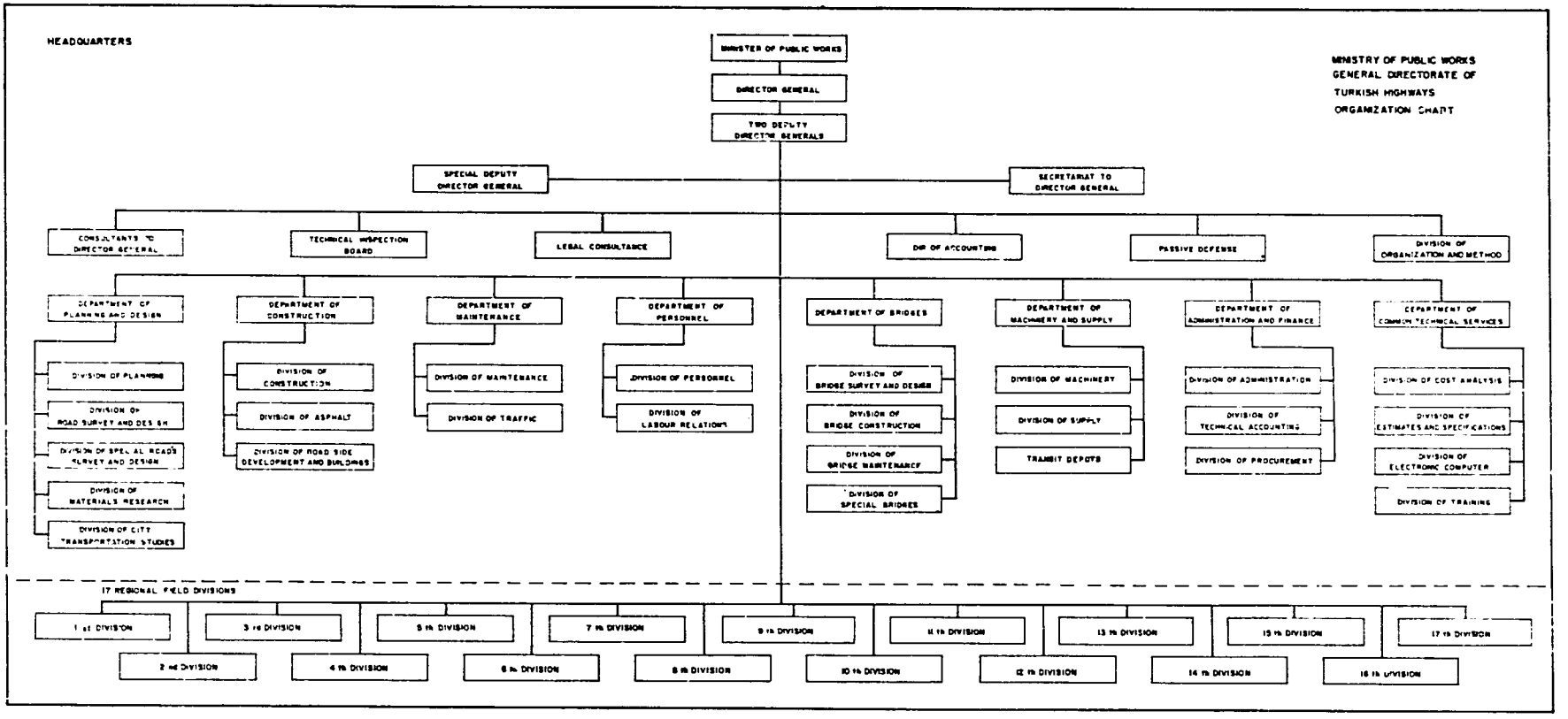
3) Corporal aid.

The priorities fixed according to the said criteria are reviewed and adjusted when making annual programmes, considering the contributions on the part of the villagers as well.

HIGHWAY ADMINISTRATION

Provision of highways and their operational control are predominantly a function of the Government of Turkey. The government intervenes economically in all transportation subsectors, through direct investment and support of operating deficits.

The Highway Law of 1950 and its amendments set aside certain revenues for highway purposes, whereby taxes are collected indirectly from road users and allocated to road construction and maintenance.


HEADQUARTERS
MINISTRY OF PUBLIC WORKS
GENERAL DIRECTORATE OF
TURKISH HIGHWAYS
ORGANIZATION CHART
MINISTER OF PUBLIC WORKS
DIRECTOR GENERAL
TWO DEPUTY DIRECTOR GENERALS
SPECIAL DEPUTY DIRECTOR GENERAL
SECRETARIAT TO DIRECTOR GENERAL
CONSULTANTS TO DIRECTOR GENERAL
TECHNICAL INSPECTION BOARD
LEGAL CONSULTANCE
DIR OF ACCOUNTING
PASSIVE DEFENSE
DIVISION OF ORGANIZATION AND METHOD
DEPARTMENT OF PLANNING AND DESIGN
DEPARTMENT OF CONSTRUCTION
DEPARTMENT OF MAINTENANCE
DEPARTMENT OF PERSONNEL
DEPARTMENT OF BRIDGES
DEPARTMENT OF MACHINERY AND SUPPLY
DEPARTMENT OF ADMINISTRATION AND FINANCE
DEPARTMENT OF COMMON TECHNICAL SERVICES
DIVISION OF PLANNING
DIVISION OF ROAD SURVEY AND DESIGN
DIVISION OF SPECIAL ROADS SURVEY AND DESIGN
DIVISION OF MATERIALS RESEARCH
DIVISION OF CITY TRANSPORTATION STUDIES
DIVISION OF CONSTRUCTION
DIVISION OF ASPHALT
DIVISION OF ROAD SIDE DEVELOPMENT AND BUILDINGS
DIVISION OF MAINTENANCE
DIVISION OF TRAFFIC
DIVISION OF PERSONNEL
DIVISION OF LABOUR RELATIONS
DIVISION OF BRIDGE SURVEY AND DESIGN
DIVISION OF BRIDGE CONSTRUCTION
DIVISION OF BRIDGE MAINTENANCE
DIVISION OF SPECIAL BRIDGES
DIVISION OF MACHINERY
DIVISION OF SUPPLY
TRANSIT DEPOTS
DIVISION OF ADMINISTRATION
DIVISION OF TECHNICAL ACCOUNTING
DIVISION OF PROCUREMENT
DIVISION OF COST ANALYSIS
DIVISION OF ESTIMATES AND SPECIFICATIONS
DIVISION OF ELECTRONIC COMPUTER
DIVISION OF TRAINING
17 REGIONAL FIELD DIVISIONS
1 st DIVISION
2 nd DIVISION
3 rd DIVISION
4 th DIVISION
5 th DIVISION
6 th DIVISION
7 th DIVISION
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14 th DIVISION
15 th DIVISION
16 th DIVISION
17 th DIVISION

85

The following are the various revenues allocated to the General Directorate of Highways for highway purposes:

	(Million TL)
Customs duties and production tax on fuel	450
Aids from the national budget	1,825
Other revenues	23
Project credits	100
Total	2,398

Revenues from fuel and custom duties constitute approximately 19 percent of the total budget of the General Directorate of Highways. Highways in Turkey are divided into five categories: 1) national highways, 2) provincial highways, 3) village roads, 4) forest roads and 5) urban roads.

The General Directorate of Highways construct and maintain the national and provincial highways. National highways are highways of primary importance that connect main regional and provincial centres, important railroad stations, seaports and airports. The national highway system is determined by the General Directorate of Highways and approved by the Council of Ministers.

Provincial highways constitute a system of highways of secondary importance within provincial borders, and connect towns, county and township seats to each other, to provincial capitals, to neighbouring county seats, to national highways, to nearby railroad stations, ports, airfields and other places of public facilities. The highways to be included in the provincial highways system are determined by the provincial general councils and approved by the Ministry of Public Works, through the General Directorate of Highways. (Total length of national and provincial highways is 60,000 km.)

The General Directorate of Highways is a semi-autonomous organization attached to the Ministry of Public Works.

The number of personnel employed by the General Directorate of Highways on August 1, 1972, including 17 regional divisions is given below:

Professions	Number
Engineers	653
Technicians	903
Permanent workers of all classes	28,878
Temporary workers	9,390
Total	39,824

Furthermore, 1,183 clerks are employed. Village roads are constructed by the Ministry of Village Affairs and responsibility for forest roads is granted to the Ministry of Forests.

Urban roads are constructed and passenger service is operated by municipal corporations under the control of the city government.

Policy making for highway transportation necessitates the coordination of several governmental units for a sound decision. The Ministry of Communications, the Ministry of Public Works, the Ministry of Interior, the Ministry of Customs and Monopolies, the Ministry of Finance, the Ministry of Industry and Technology, the Supreme Planning Council and the High Planning Council are directly related organizations. The final decision is given by the Council of Ministers and expressed by law. Besides this, some necessary operational and management policies can be determined by related governmental units and implemented without necessitating the approval of the Council of Ministers.

General policies for highway transportation in Turkey are:

1) To provide highways where necessary as far as social, economical, and military factors are concerned

2) To provide safe, speedy, comfortable and cheap service

3) To prevent ruinous competition between transportation modes by means of law and other governmental measures such as taxation and investment control

4) To make the necessary preparations and attempts for comprehensive transportation planning in densely populated urban areas.

Another area of overall highway policy concerns operation of the vehicles. Traffic and quality of service control on highways are administered by the General Directorate of Security within the Ministry of Interior. They have evolved working laws and policies concerning vehicle registration, operator licencing, rules of road operation and other traffic regulations. Law enforcement on all types of highways is applied by police and gendarmes. Some measures of national uniformity have been taken concerning vehicle standardization and axle loads which affect planning and design. Trucks with an axle load of more than 8 tons are not permitted to use highways.

Traffic law reform has long been necessary in connection with highway development because of high fatality rates. This was undertaken by an interministerial committee and studied for several years. The resulting proposed traffic law (a model of modern international regulations, driving and court practices) was submitted to the Grand National Assembly. Following the approval of this proposal, better administration on highways may be expected.

PAPERS PRESENTED BY THE DELEGATES

PLANNING AND PROGRAMMING HIGHWAY PROJECTS

by

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INTRODUCTION

Among the questions most frequently asked by senior government officers are these: How do you plan and program a highway project? How do you evaluate the quality of the product turned out by your staff or by consultants for its completeness?

In order to simplify my paper on this subject, I have divided my presentation into two parts:

Part One: The guidelines for administrators responsible for the overall policy questions.

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Part Two: The guidelines for field activities which are specifically directed to the evaluation of the projects themselves.

ADMINISTRATIVE GUIDELINES

In order to plan and program a highway project, certain critical questions of policy must be resolved in advance. These questions are: What is the scope of the project? How much time can be spent in preparing it? How many foreign experts are required? How much data can be furnished by the government? What kind of reports are needed, and in what form and frequency? How can we confirm that the project is on target and will fulfill the requirements of the lending agency, and will be completed on schedule?

Details concerning these questions include: 1) scope of work, 2) timing, 3) staffing, 4) data collection and 5) reports.

Scope of Work

In preparing a scope of work for transportation planning and engineering services, a judgement must always be made as to how explicit the terms of reference should be, and to what extent the consultant should be invited to comment or expand on the scope of work. It is essential that the administrators explicitly define in the terms of reference what technical areas may be left to the discretion, judgement, experience or imagination of the consultant. The importance of a clear exposition of purpose and objectives in the final report is important, so that those international lending agencies proposing and financing the study will have sufficient information upon which to base a decision as to financing of construction. The terms of reference should also provide guidance on the changes in scope which might be permitted once a study is underway and how requests for such changes can be expeditiously identified and procured.

Timing

Feasibility studies are normally of relatively short duration, and the client wants to determine as quickly as possible whether he should proceed to project design and implementation. Many of the advantages of feasibility studies can be negated if the administrative procedures for preparing the terms of reference, planning and monitoring the performance of the work and evaluating the results are unduly time consuming. Methods for

accelerating the administrative process and for phasing the critical steps and procedures and the time that should be allowed for each are critically important. The administrator must set up a simple method for reviewing proposed staffing, work plans, time required for execution of the study, and the advantages and disadvantages of combining economic feasibility with detailed engineering. CPM schedules or manpower cronograms are frequently developed to most efficiently utilize staff.

Staffing

The key to a successful project is a good technical staff. It is important to determine how many senior and junior staff are required for a study, and the reasonable amount of time one can expect a consultant to hold staff available for an assignment while reviews are being made. There is some merit in permitting the consultant to propose alternates for each position on the team, since permanent staff cannot be held for months while a project is being reviewed.

Data Collection

The administrator should clearly establish the types of generalized data inputs that his senior officials should make available to the consultant to minimize the consultant's field work. Too frequently, consultants, especially on short-term assignments, spend a great deal of their time obtaining information of a generalized nature which, although necessary, can be more readily provided by the Public Works Department. Data such as opportunity cost of capital, shadow-costing factors, vehicle operating costs, growth of GNP, and census statistics, should be identified in advance to insure savings which could be obtained by concentrating the consultant's work effort on analysis of data inputs and preparation of recommendations.

Reports

On short-term assignments, reporting requirements should be kept to the minimum necessary to insure that the consultant is following the terms of reference, and is not encountering unforeseen problems. Every effort should be made to keep to the schedule of the work plan, and to concentrate on a final report which will offer decision-makers clear alternatives and recommendations. The administrator should decide how progress reports would be used, who should monitor the work of the consultant, use of counterparts and the criteria for judging the quality of the draft or final report. He should also suggest a format for

such reports so that the report can most easily be incorporated in the project evaluation documents which the administrating or lending agency requires.

If the administrating agency is going to use the feasibility report as the basis for a loan or funding request or authority to proceed to a more detailed design, the consultant's report should be in such a form that a minimum of rewriting is necessary in order for the administrating agency to present it to its executive authority.

The administrator must develop a method for disseminating the report findings to his staff, and a system so that information and experience gained in each study may be placed on file for easy retrieval by other government organizations subsequently involved in similar type studies.

PREPARATION OF GUIDELINES

After the administrative decisions on scope, timing and reporting procedures have been made, other guidelines that describe the wide range of considerations that underlie project planning, programming and evaluation must be considered in order to define the specific methodology applicable to various types of highway projects.

The following paragraphs contain a summary of the guidelines required for the preparation of feasibility studies.

Economic Data

Basic data required include the following:

1) Population and employment by sectors and major branches

2) Gross national product by sectors and per capita income

3) Land bound foreign trade

4) Production and historic consumption by major commodities

5) Tourism by local and foreign guests, plus expenses

6) Regional interactions, including migration, product flows, commuting

7) Development plans and land use maps.

Economic Analysis

The economic analysis shall ascertain the most significant changes in economic and demographic patterns and the tendencies and conditions of growth.

Projections of Economic Development and of Traffic Demand

The following aspects shall be treated:

1) Review of existing projections

2) Completion of all future data

3) Establishment of a model for disaggregating figures from scale to level of zones

4) Determination of variables for zones such as active and inactive population, employment, gross domestic product

5) Determination of product flows, number of local and foreign tourists

6) Alternative projections such as net value added to industry, agriculture and tourism.

Traffic

Basic data required include:

1) Vehicle registration statistics comprising data on type and age of vehicles

2) Traffic counting systems with respect to location of counts, daily and seasonal variations, composition of traffic, etc.

3) Location, timing and required scope of O-D counts

4) Supplementary data to choose representative vehicle

5) Traffic data on competing modes of transport, such as railway, coastal shipping, air transport.

Traffic analysis deals with:

1) Recent growth and composition of vehicle fleet

2) Recent development and present situation of transport demand by modes of transport

3) Origin and destination of passengers and goods flows and their correlation to economic development

4) Influence of tourist traffic and weekend recreation traffic on design hour volumes

Traffic projection takes into consideration:

1) Projections of future growth and composition of road vehicle fleet

2) Forecast of future traffic demand

3) Forecast of future changes in modal choice (if any)

4) Division by normal traffic, diverted traffic, and generated traffic.

Engineering

Highway inventory data include:

1) Scope of data to be collected for a new highway inventory, comprising the following:

- mileage
- horizontal alignment
- vertical alignment
- width of road
- type of surface
- type of base
- type and condition of structures
- maintenance conditions
- traffic capacity

2) Appropriate organization of data collection

3) Suitable form of a new inventory by application of data processing services.

Highway Design Standards

The analysis of existing design standards is to be stressed. Too often unreasonable or impractical design standards are imposed on a project without proper analysis of their suitability to the project and the country in which the investment is to be made.

The guidelines should stress "variable" highway design standards, applicable to the specific area or capital project under consideration, probable traffic, nature of terrain and economic level of investment possible.

Preliminary Engineering Design

The scope of engineering requirements to determine the technical and economic feasibility of highway projects requires the following:

1) Field topographic surveys

2) Plan and profile studies

3) Drainage studies and erosion control

4) Soils and material studies

5) Pavement design, including the most advanced methods based on deflection theory

6) Structural design

7) Quantity estimation.

Cost Estimating

A system of calculating unit prices under different local conditions should be used, taking into account various parameters for topography, soils, climate, transport distance, local labor and local taxes. The relative merits of order-of-magnitude costing should be explored. Various warning areas should be flagged for the reviewer to show where the guidelines might not be applicable because of significant technical problems in order-of-magnitude costing. The problem of evaluating alternate solutions, sensitivity to project location and staging, and implications of inflation should be explored. The general theory of order-of-magnitude costing will explain in detail the strengths

and respective weaknesses of this procedure sector by sector. Where applicable, costing models should be introduced in detailed guidelines for preliminary costing.

Maintenance

The importance of maintenance should be stressed. The error too frequently made of comparing a poorly maintained or operated present highway facility with a well maintained or operated proposed facility should be explored. Shadow-costing techniques should be introduced for maintenance. Analytic procedure should be adopted to segregate benefits from improved maintenance operation and administration from those derived from new capital investments. Failure to properly evaluate and distinguish the source of benefits in this area is one of the major causes for overstating benefits from a new highway investment biasing investment in new facilities while discouraging more feasible if less dramatic annual investments in operations. The differences between marginal economic and gross financial maintenance costs should also be explored. Methods for identifying and incorporating such changes in annual project costs should be described in detail.

Project Evaluation

The relative merits and application of the Internal Rate of Return (IRR), Net Present Worth (NPW), Benefit/Cost Ratio (B/C) and First-Year Benefit (FYB) approach should be described in detail and recommendation made as to the most applicable procedures. The relative advantages and disadvantages of each system should be explored in detail (difficulty in establishing an opportunity cost of capital for the NPW, B/C and FYB and the theoretical limitations of the FYB and IRR). Discounted cash flow analysis should be described in detail and its application demonstrated. The project evaluation should focus on the areas of:

- Acceptance/rejection of overall project
- Preliminary analysis of alternate technical solutions
- Factors governing location of highways
- Optimum sizing of the road, design standards and possibilities of stage development

- Timing of schedule of benefits, including use of the First-Year Benefit approach to optimize return

- Evaluation and selection among available alternates and possible use of simplified network analysis to establish practices

- Analysis and measurement of the social consequences of a specific highway project, including the incidence and distribution of benefits and implications for broader popular participation in social, economic, environmental and political development.

- Probable revenues and revenue/debt coverage to owner, if toll facilities are considered as alternatives

- Specifically, the guidelines should suggest approved methods for determining direct and indirect costs related to highway improvements, such as:

  1) Vehicle operating costs
  2) Time costs of vehicle occupants
  3) Accident costs.

Special Aspects of Planning

The guidelines should give special attention to the following important aspects:

1) *The effects of a project:* The major effects of the highway project, both benefits and disbenefits, should be identified, defined and analyzed in the guidelines. The primary, secondary and tertiary (direct, indirect, and multiplier) implications of specific projects should be explored and examples offered. Care should be taken in describing the problems of identifying and analyzing both economic benefits and disbenefits, and detailed descriptions should be made of various potential areas of double counting (e.g., including the local construction expenditures as a temporary benefit, including both increases in land value and production, confusing gross and net benefits, etc.). The problem of assuming a market or competitive economy should be analyzed and the use of input-output analysis, where described.

2) *Shadow-costing:* A detailed description of the difference between financial and economic costs, in-

cluding a discussion of the problems of shadow-costing (i.e., foreign exchange, labor, interest rates, taxes, tariffs, etc.) should be offered. The implications of shadow-costing adjustments for both benefits and costs should be shown.

3) *Opportunity cost of capital:* The problem of establishing the opportunity cost of capital should be explored. The problem of market equilibrium should be analyzed and the pros and cons of the acceptance of the opportunity cost of capital vs. a social cost of capital should be analyzed. The problem of establishing the clientele for the opportunity cost of capital (i.e., this generation or future generations) should be explored. The practical limitations in obtaining an accurate opportunity cost should be described and reasonable ranges found in a number of developing countries offered.

4) *Commensurability:* The requirements for commensurability between various highway projects should be established. For development highways where benefits are difficult to analyze, sensitivity techniques should be introduced. Given the increased degree of uncertainty in these areas, procedures for forecasting the benefits should be described in detail.

5) *Residual value:* The implications for residual (scrap) values in highway projects should be carefully explored and the avoidance of double counting discussed. Methods and procedures for establishing scrap value should also be introduced and carefully defined for each type of highway in the guidelines.

6) *Man/machine trade-offs:* One of the critical areas in labor surplus countries that is open to a great deal of discussion is the trade-off for man/machine. Formulae and procedures based on the consultants' research in Brazil and Indonesia have indicated the importance of the analysis. The impact of man/machine decisions on national and republic employment policies and objectives should be analyzed, as this is an especially critical area in many countries. Shadow-costing techniques and the distinction between economic and financial decision-making in this area should be carefully described. Too often incorrect man/material decisions are made because of a confusion between economic costs and financial (stated wages) to the detriment of the national economy.

7) *Forecasting techniques:* In addition to the detailed suggestions in the guidelines, various other forecasting techniques should be explored, sensitivity, regression and probability analysis described, and the applicability of various methods of forecasting investigated. Where appropriate, the relative merits of a range of forecasts should be analyzed. Economic elasticity relationships should be described and introduced where applicable. Evaluation of generated traffic, urban planning, agricultural production, population forecasting, congestion analysis and other critical areas where model building is applicable should be described in detail. Sensitivity techniques should be offered to identify critical areas. The importance of utilizing sensitivity studies to focus analytic efforts on those areas to which the final answer will prove most critical and sensitive should be stressed. The significance of a high discount rate in emphasizing the early years of the forecast should be explained.

8) *Inflation:* The problems of inflation must be analyzed. Too often sound project analysis is frustrated by the failure to properly anticipate the effects of inflation. While economic analysis can rely on current costs and benefits and assume each will rise in proportion, successful project management must anticipate actual financial forecasts for budgeting. Procedures should be described for identifying inflationary situations and the pros and cons of alternate procedures explained (use of internal price indices, external measures of value and forecasting models) to insure reasonably prudent financial estimates.

9) *Planning aids:* The guidelines will present a practical checklist of the steps required in highway planning and project evaluation. The guidelines should include illustrations of the analytical framework, recognizing that the guidelines will not be a substitute for either the scope of work or careful consideration of the nature and structure of the individual project.

10) *Planning inputs:* Professional judgement and adequate knowledge of highway planning are a prerequisite for analyzing individual projects. Critical areas should be stressed and project staffing should be sensitive to these areas. The guidelines should be designed to minimize the detailed engineering inputs and minimize the overall time and cost of the study. The

guidelines will identify by type of highway project the actual relevant data inputs required in order to minimize the data to be collected in the field.

11) *Interdisciplinary approach:* For each sector the interdisciplinary requirements should be spelled out in detail together with the staff needed for the successful execution of each study. Efforts will be made to avoid "compartmentalized" study efforts where each discipline is dealt with in isolation.

HIGHWAY PLANNING

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HIGHWAY PLANNING

Highway planning can be more explicity expressed as the preparation of comprehensive, long-range plans for the development of a transportation network within a country.

Execution of a planning program requires certain essential basic data, including:

1) The identification of the present and future transportation requirements within the country.

2) The identification of the extent to which inadequate highway transportation facilities presently inhibit the economic development of the country; recommendations for improving and expanding these facilities to meet the future needs of the country.

3) The establishment of a list of relative priorities for making investments in the transportation sector during the next 10 years on the basis of a broad assessment of both the order-of-magnitude costs of construction and the economic benefits to be derived from the construction with consideration given to the effect of alternate modes--namely railroads, waterways, airlines, etc.

4) The assessment of the adequacy of the existing highway design standards and investment policies to meet these needs.

The preparation of a national transport development plan requires the coordination, collection, storage, and analysis of data on all modes of transport. These data must constantly be updated to meet the changing needs of the country. Such a program requires the availability of a central transport planning and coordinating group, geared in their thinking to long-range concepts and national goals.

In the execution of long-range plans for a national transportation network, it is beneficial to develop a network model that will achieve the following objectives:

1) Identify the present and future transportation requirements within the country, based on a detailed product flow and passenger movement analysis.

2) Assess the adequacy of the existing transportation network to meet these anticipated transportation requirements.

3) Identify and test suggested improvements to these facilities.

4) By means of a threshold analysis, analyze the impact and economic benefits of improved design standards and improved construction materials.

The computer network model should be operated in three phases.

Phase One: assumes that there is no improvement to the transportation network and no change in the national transportation policy and regulations. The perceived and economic costs are then obtained for each year in the next ten.

Phase Two: operates on the assumption that a certain amount of new investment in the highest priority transport projects is made and the perceived and economic costs to the economy of the country are determined as each investment in new facilities is made.

Phase Three: assumes that, in addition to the priority investments in transportation projects, certain changes are made in tariffs, rates and regulations, and the resulting perceived and economic costs are determined from each regulatory change.

The purpose of these computer analyses is to determine how much benefit can accrue to the economy of the country, not only from investment in each of the proposed highway projects, but also from changes in tariffs, transport rates, and changes in transport policy. If we compare the transportation costs with and without such improvements, the overall benefits to the economy of the country from various levels of improvement to the highway system can be clearly identified. These improvements should be costed out, and the benefits and costs compared to establish the Internal Rates of Return (IRR) and the Net Present Worth (NPW) for various proposed highway projects before establishing priorities. The priorities will then be ranked over a 10-year basis by the First-Year Benefit Approach (FYB) with recognition of financial constraints imposed by:

1) Government policy and programs

2) Recommended revisions to taxes, user costs, tariffs, etc.

3) Practical project constraints

4) Available manpower.

Once the economic user costs and product flow movements are established for the network--namely road, rail, and river--these economic costs should be compared with the perceived out-of-pocket costs to various users to estimate the extent to which "quality of service" consideration and government programs and policies are distorting current product and passenger movements in the country. Based on a comparison between the actual mode

choice and optimum economic mode choice, recommendations can be made as to possible changes in government policies, procedures, and tariffs to help the economy. It is often desirable, in accelerating development, that the most economic movement of goods and people accrue within the country.

The methodology proposed herein is not theoretical, but represents existing operational programs which have been used on many AID and World Bank projects throughout the world for comprehensive long-range planning. The organization of the data required for such a study is shown on the attached flow chart (Figure 1).

In the development of a high-priority planning program, the following order of priorities will be utilized to determine the economic level of improvement necessary to best serve the anticipated transportation demand:

First Priority: reconstruction or improved maintenance to restore it to the desired condition

Second Priority: expanding the existing road to increase capacity by upgrading standards, including stage construction

Third Priority: improvement of the existing road to increase capacity, safety, and comfort and to decrease operating costs

Fourth Priority: construction of a new or alternative route.

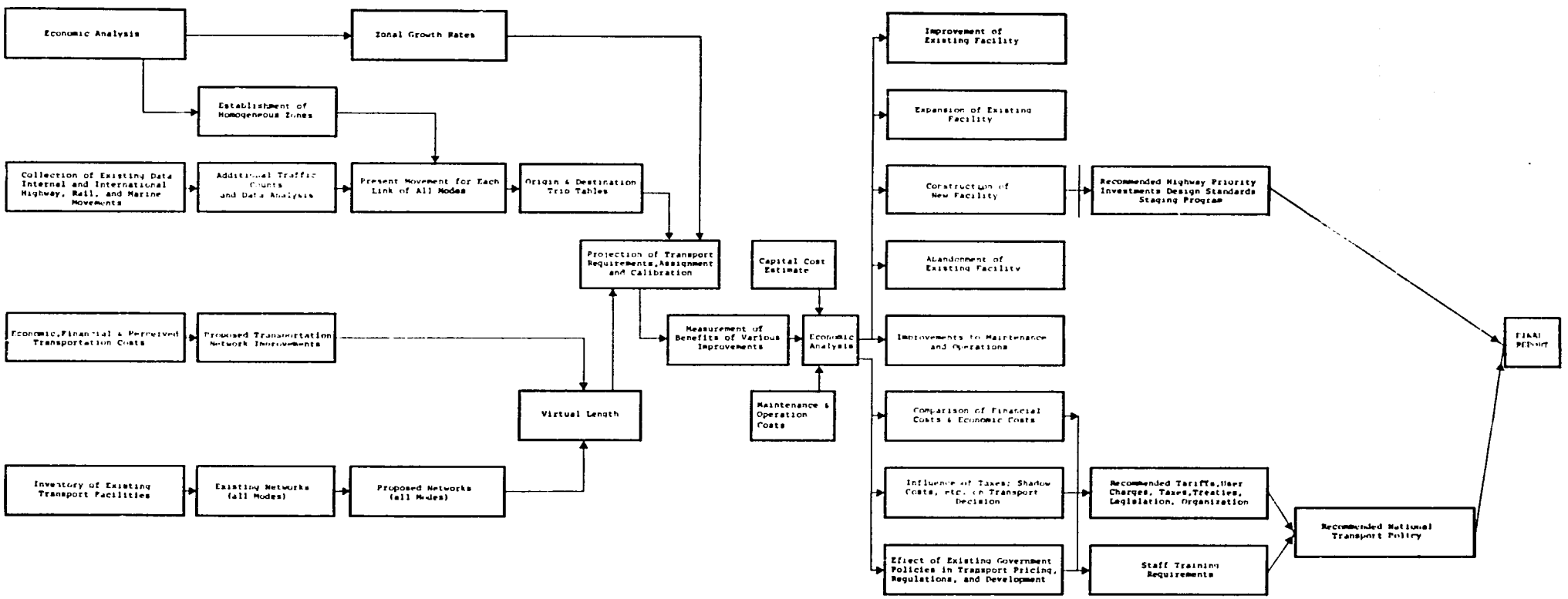
The critical inputs to this analysis, each of which will be described in some detail separately, will include:

1) Division of the country and its external areas of trade into homogenous zones, which serve as the basis for collection of economic data and forecasting of product and passenger movements.

2) A detailed economic analysis of each zone to establish the current and anticipated flow of passengers and cargo.

3) An inventory of the existing transportation network.

4) A detailed analysis of existing rail, air and ship product and passenger movements based on prior studies and additional supplementary data.


Economic Analysis
Zonal Growth Rates
Establishment of Homogeneous Zones
Collection of Existing Data Internal and International Highway, Rail, and Marine Movements
Additional Traffic Counts and Data Analysis
Present Movement for Each Link of All Modes
Origin & Destination Trip Tables
Projection of Transport Requirements, Assignment and Calibration
Capital Cost Estimate
Economic, Financial & Perceived Transportation Costs
Proposed Transportation Network Improvements
Measurement of Benefits of Various Improvements
Economic Analysis
Virtual Length
Maintenance & Operation Costs
Inventory of Existing Transport Facilities
Existing Networks (all Modes)
Proposed Networks (all Modes)
Improvement of Existing Facility
Expansion of Existing Facility
Construction of New Facility
Recommended Highway Priority Investments Design Standards Staging Program
Abandonment of Existing Facility
Improvements to Maintenance and Operations
Comparison of Financial Costs & Economic Costs
Influence of Taxes; Shadow Costs, etc. on Transport Decision
Recommended Tariffs, User Charges, Taxes, Treaties, Legislation, Organization
Effect of Existing Government Policies in Transport Pricing, Regulations, and Development
Staff Training Requirements
Recommended National Transport Policy
FINAL REPORT

5) The establishment of the economic, financial and "perceived transportation costs" for various links by mode in the network.

Economic Analysis

The economic analysis will determine potential flow of goods and people. Economic study objectives are stated as follows:

1) Analysis of the factors influencing cargo traffic growth for the 10-year period

2) Analysis of the elasticities influencing passenger and product demand and growth for private vehicles and public transport

3) Identification of potential traffic "generated" by each proposed road improvement.

Historical Trends

The historical demographic and economic trends in each zone must be analyzed to determine the principal flows at the zonal and sectoral level and to identify the effect of highway improvements on these flows. This analysis should cover at least the last 10-year period.

The major elements considered in the passenger traffic analysis are: 1) population and its distribution and 2) historical trend and level of per capita income.

The major elements considered in the cargo traffic analysis are: 1) historical trend and 2) volume of production. Basic statistical information should be compiled or estimated for population, agricultural, industrial, mineral and timber production by zone.

1) *Demography:* Statistical data should be compiled on population structure, trends, births, deaths, illness and on urban migration and colonization. Data sources include the national population census, civil registry, educational census, occupational statistics, etc. Based on this analysis, product surplus and deficit can be established.

2) *Production and Consumption:* The principal areas of activity (agriculture and livestock, mining and industry) in which production exceeds local consumption should be determined for each zone or group of zones, and the final destination of these surpluses should be determined. In addition, the identity and origin of goods consumed, but not produced in the zone, should be determined.

The data on existing surplus and deficits should then be calibrated to present-year traffic counts to establish the validity of the analysis.

Traffic Projections

The transportation model proposed by the consultant applies zonal growth rates to existing product and people movements.

Initial projections of existing traffic are based on the assumption that highway improvements under study are not yet constructed. Projections of generated traffic between each zonal trip pair, resulting from improvements, should also be included.

Growth rates for cargo and passenger traffic are calculated on the basis of elasticity of traffic demand.

The passenger traffic elasticity is a ratio established between population growth, per capita income, and generated passenger traffic in each zone. The elasticity coefficient should differ by private and public transport.

Economic forecasts should be used to establish the annual growth rates in production volumes, in population, and in per capita income for each zone. These studies should also determine the potential generated traffic due to improvements. From this analysis, future cargo surplus and deficit analysis should be prepared and compared with the forecasts developed by the elasticity and analysis.

Transportation Costs

The transportation cost calculation has two objectives:

1) Determination of the alternative financial and economic costs of each transportation mode for each possible path between each trip pair to establish the

"virtual" length of the links on the existing and improved networks.

2) Measurement of the economic savings in economic user costs resulting from proposed modal or policy improvements in order to quantify direct benefits.

For traffic assignment, the user should be assumed to make this selection based on the "perceived" financial costs involved by each transportation alternative. Tariffs and freight rates of the transportation mode are used, as well as loading, unloading and transfer costs, if more than one transportation mode is used. In cases where the user, whether passenger or cargo, provides its own transportation, mean costs instead of rates will define the selection. Quality and reliability of service estimates should be employed in calibrating the assignments.

Description of the Transportation Network

The most important element in a transportation study is establishing the network. Care should be exercised in network design in order to insure unbiased results in the assignment program. The network must provide a representative sampling of long distance trip alternatives and must consider route continuity between trip ends and intermodal transfers. The transportation network will be defined in two ways:

1) As it exists in the starting year of the study

2) As it will be in "x" years as a result of each group of improvements proposed in the study.

Discussion: The network is essentially a map on which cities and routes in the country are defined by nodes and links instead of place names and route numbers. A node is defined as a point where one or more of the following conditions occur: 1) a significant change in traffic volume, 2) change of the facility characteristics, 3) intersections and 4) a change in mode. A link is defined as the connection between two nodes.

Two types of nodes will be used in the network:

1) *Primary Nodes:* The primary node is defined as the trip generation node of a zone, and all trips to and from the zone will be assumed to start and end at the primary node. Political divisions should normally be used to define zones, but if because of lack of homogeniety this zone definition causes trip distortion, additional zones and primary nodes will be created to

simulate actual trip generation patterns. Each mode existing in a zone should have its primary node and will be connected to other modes by transfer links.

2) *Secondary Nodes:* These are nongenerating nodes used to define intersections and change of facility.

Existing railroad lines should be included. All stations, however, should not necessarily constitute nodes on the network. Those lacking a considerable movement of cargo or passengers will be omitted.

The existing highway network consists of the primary network, the secondary network and development roads. The major concern of the study should be to include as much of the primary and secondary network as possible. Development roads should be included in the network only if they are necessary to provide route continuity or to connect a potential traffic generating node to the system. Otherwise, they should be handled separately.

The water network should be defined by primary nodes at river ports where cargo and passenger traffic are significant. The links of the network should be the river connections between each port and extended zones.

The air network will be defined by primary nodes at commercial airports. The links should be the air lines between nodes.

Traffic assignment will be made on the network under two different conditions. The first assignment will be made on the existing network, based on perceived financial costs and then calibrated by traffic volume data. The second group of assignments on the network will include various improvements, as proposed after 10 years. Links will then be added or eliminated on the improved network and the virtual length of links may be modified to reflect the effects of the improvements on the operating conditions and consequently on transportation costs.

Traffic Projection and Assignment

Traffic projection should begin with the projection of trips generated in each zone, followed by the projection of flows within each origin and destination, and finally with the assignment of each traffic flow to each transportation mode and link of the network. Projection of trips generated by each zone

should be carried out simultaneously with the projection of traffic flows between each pair of zones.

Economic Analysis

1) Establish the optimum economic transport system (by net present worth analysis of alternate systems).

2) Determine the economic feasibility of highway priority improvements recommended by:

   a) establishing the best alternative for each improvement (IRR)

   b) determining the feasibility of the improvement within the context of system-wide requirements including an incremental net present worth and IRR analysis of each, based on estimated construction costs, projected traffic and associated benefits.

3) Establish the optimum design standards, starting year for construction, if required, by First-Year Benefits analysis (FYB).

4) Identify the needs for a unified transportation system.

5) Identify economic benefit from various levels of maintenance.

Financial Plan

The economic investment program, as discussed, assumes that no financial or human resource constraints will be imposed. In practice, such restrictions clearly exist in many countries and could hinder implementation of the plan.

The present methods of fund collection and distribution should be studied and projections prepared of anticipated revenues based on current changes.

The prospect of obtaining additional financial resources from local or foreign sources should also be analyzed and the anticipated new funds identified. Allocations to recommended programs and projects should be made based on economic priority.

The Investment Program

An annual investment program should be prepared for each high-priority highway project. The procedure to determine priority should be based not only on the results of the economic analysis, but also on the ability of the authority to organize and conduct planning, design and construction programs. The ability of the existing contractors to meet the requirements of the program, with or without foreign aid, should also be investigated.

Establishment of National Transport Policy

As final results of the analysis of essential elements of the national transport study become available, some thought should be given to long-range implications.

The national unified transport policy should express the aims and objectives of the nation to provide responsive and efficient transport of passengers and goods in accordance with the economic and social demands of the country. The policy should express national goals in the transport field and broad programs to achieve these goals. It should not, however, be inflexible or rigid, but should provide for changes in demands and economic conditions. The economic impact of various policy options should be tested on the computer model to establish their effect on the growth of the economy.

Using threshold analysis, benefits and costs associated with current and proposed design standards should be analyzed. This analysis will tell if local employment can be increased and use of expensive imported equipment minimized. From the analysis, design standards and construction staging practices can be recommended.

GLOSSARY

Shadow-Costing: The shadow-cost of a commodity or a service is the price which in an ideal market would bring demand and supply into balance. To suppliers, it would properly reflect the item's relative scarcity in the national economy, and to purchasers, the relative benefit that they gain from it.

Perceived Costs: These are the prices actually prevailing in the market, whether or not they bring demand and supply into balance.

Network Analysis: A mathematical procedure for determining the optimum organization of a system of interlocking activities. For instance, the network of roads, railways and waterways in a country or region can be analyzed, and recommendations made as to the mode of transportation and routing that traffic between any two points should take, to incur the lowest overall cost to the country.

Discounted Cash Flow (DCF): An investment project typically involves a large initial expenditure of capital (a cash outflow), and the receipt of revenues spread over subsequent years (cash inflows). Discounted Cash Flow measures the profitability of the investment by comparing the initial outflow and subsequent inflows to a hypothetical bank deposit the size of the initial investment, and the interest that could have been earned on it over the lifetime of the project. (The interest rate used in project analysis is usually equal to the opportunity cost of capital.) If the project promises a rate of return higher than the opportunity cost of capital, it is considered feasible.

Net Present Value (NPV): The net present value of a given investment is obtained by deducting the present worth of the stream of costs from the present worth of the stream of benefits. A project would be considered feasible if the present worth of total benefits exceeds the present worth of total costs ($B-C>0$). In the case of mutually exclusive projects, one would select that project which has the greatest net present value. In the case of nonmutually exclusive projects, one would execute initially that project which has the greatest net present value.

The NPV method enjoys increasing use in national investment decisions.[1] The problem in utilizing this method, as with the benefit-cost analysis, is the required assumption of a given discount rate.

Benefit/Cost Ratio (B/C): This method is the most widely recognized and used. The same procedure is followed as with net present value, except that the present worth of the benefits compared to the present worth of the costs is expressed as a ratio. Thus, the project is viable if $\frac{NPV\ (B)}{NPV\ (C)} > 1$.

The major shortcomings in the use of benefit-cost ratio are:

1) As with the net present value, it is first necessary to determine the discount rate.

2) In contrast to the net present value approach, the benefit-cost methodology develops a ratio without indicating the magnitude of the investment. Therefore, projects with higher benefit-cost ratios could be selected over those with lower benefit-cost ratios but higher absolute levels of benefits, which would be more desirable for maximizing the total growth of an economy.

Internal Rate of Return (IRR): The IRR of a given project is defined as the rate of discount at which the present worth of the stream of benefits and costs are equated (i.e., the economic rate of return of a project, expressed as a rate of interest over a given time period).

The IRR approach is widely used by industry in evaluating investment decisions. The major difference between the IRR method and the B/C and NPV approaches is that the IRR assumes no discount rate.

First-Year Benefits (FYB): The benefits that will accrue during the first year that a new road facility is opened are commonly used as a measure of the optimum year in which to open the facility, as well as the optimum year in which to initiate construction.

Once the opportunity cost of capital discount rate has been determined, the optimum year of opening is the first year in which benefits, expressed as a percentage of investment costs, are

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1. Harrall, Clell G., *Preparation and Appraisal of Transport Projects*, Brookings Institution, Washington, D.C., p. 116.

equal to or slightly greater than the discount rate. A project may be economically feasible over a 20-year period, and yet, during the initial years of operation, may not return benefits equal to the opportunity cost of capital. If investment in the highway facility were to be deferred until such time as the first-year benefits equalled the interest on the invested capital required for improving the road, the effective subsidy during the early years of operation of the highway would be eliminated.

The FYB approach is valid as an investment timing criterion, as long as other investment opportunities exist, yielding earlier optimum year returns. There is insufficient capital to fund all feasible projects. In such cases, it is of interest to maximize the return upon investment capital at the earliest possible time, in order to generate a larger capital fund for further investment. When feasible investment opportunities are scarce, capital improvements may be made in advance of their optimum year.

Opportunity Cost of Capital: The benefits accruing from projects being studied must be measured against benefits obtained through alternative investments. Although limits of choice and market failures will lead to imperfections, it is possible for public agencies to rationalize their investment decisions by utilizing the opportunity cost of capital in evaluating projects.

The opportunity cost of capital may be considered equivalent to the equilibrium rate of interest "...assuming optimum allocation of resources, for given resources, production possibilities, and preference scales."[2] Theoretically, the optimum allocation of capital will be attained if a price is charged for capital which insures that all capital is employed and that the last investment made yields a return equal to or higher than the return on any alternative investment. The optimum supply of capital will be obtained if the return obtained by capital is sufficient to draw from the economy just enough real savings to provide for all the investment opportunities which will yield a return equal to or higher than the price charged for capital.

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2. Schmedtje, Jochen K., *On Estimating the Economic Cost of Capital*, IBRD, Oct. 1965, which contains a discussion of some of the conceptual and practical problems of estimating the cost of capital.

THE RELATIONSHIP BETWEEN HIGHWAYS AND OTHER FORMS OF TRANSPORTATION

by

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This is a conference on highways, their impact in developing countries, their planning and administration, their financing, and in the case of my paper, their relationship with other forms of transportation.

This relationship must be viewed in the light of the functions which highway transport can perform, both as an isolated agency, and in cooperation with other forms of transport. It must be viewed in the light of the economic goals of a na-

tion, and also the social goals of that nation. It must be viewed in the light of what can be accomplished under ideal conditions so far as opportunity to perform is concerned, and under conditions which recognize the limiting factors imposed by availability of resources, by burdens dictated by national and local purposes, and by the willingness of the managements of the various forms of transport to work together for the efficient production of transport service.

It is important at the outset to recognize that highway transport has certain characteristics, which to a great degree, or to a lesser degree, distinguish it from other forms of transport. Failure to count these characteristics in your plans from the beginning will only lead to problems later on.

First, highway transport may take place, and even in the most highly developed nations does take place, under minimum conditions. Any trail is a highway and goods and people will move over any trail, and they may be moved by foot carriage, or moved on wheels. Highway transport is thus always available, even though in minimum form. Being constantly present, it represents either a partner to whatever other forms of transport are available, or a competitor of those other forms in the scramble for business that is to be moved.

Secondly, it is a volatile, irrepressible form of transport which admits to few restraints. It can be indulged in by nearly anyone, because its vehicles may be of the simplest sort and they are available to nearly anyone.

If you have been out on the street today you have seen some of these simple vehicles. They may be only push carts propelled by barefooted men. They may have steel tires or pneumatic tires. They may be oxcarts, which in nations in this area provide an astonishing amount of transport. A census of oxcarts in Burma a few years ago revealed that there were 1,750,000 oxcart teams in that country. One of the greatest contributions which could be made to general well-being under such circumstances would be to reduce the cost of oxcart wheels.

But this simple form of vehicle is found in places other than developing areas. On the front cover of the *Traffic World* of June 26, 1972, there appeared a picture of a three-wheeled, pedal-driven Emery Air Freight Corporation local delivery cart. It was moving down a congested street in what was probably New York City. It was slow, and of small capacity, but under the circumstances it represented the most efficient way of delivering the goods.

Although some vehicles in road transport may seem quite complex and expensive, in most societies they may be obtained

through far less investment than the vehicles of other forms of transport.

Thirdly, the people in the business are motivated by the spirit of free enterprise and private initiative. They are small business men, at least in the initial stages of development, and commonly they have a background of minimum economic circumstances. They can live on little, they are accustomed to taking risks, and the concept of the margin is much more realistic in analyzing their operations than is the case with other agencies.

As an example of the sort of man who became a road hauler in the United States, I cite the case of Lawrence E. Gerosa, who started in the trucking business in 1917, and who died recently at age 77. Like many of his fellows, he was of Italian descent. He came from a working man's background. *Transport Topics,* the "National Newspaper of the Motor Freight Carriers," recorded his death on July 3, 1972, and told of him:

> *"He once recalled that he often spent 18 hours at the wheel. He slept in a tiny office he had rented."*

It further related that in June 1953, he was proclaimed the "Outstanding Immigrant of the Month" by the American Committee on Italian Immigration.

Many of the successful American trucking companies got their start during the Great Depression of the 1930's. They started out with a borrowed truck, or one obtained with a very small down payment. They expanded to two trucks, still depending on other people's money. The capital of other people seldom came from banks, however. Bankers did not consider a man in rough clothing, with a hungry look, and with no income statement, a good credit risk.

But expansion took place, most often out of earnings reinvested in the business. These men lived on little, worked long hours, saved their money, and had what the economists would call a "low rate of time preference."

The trucking business has matured now and many companies have well established lines of credit, and have even "gone public," being listed on our stock exchanges. Even so, the folks who populate the trucking business are simply different from the railroad man or the airman. Expect anything to happen when you deal with them. In fact, they may even disappear, for they do live close to the margin. Although the long run may be quite long with other transport types, for example, with the railways, in highway carriage the long run may be short indeed.

Fourthly, and a composite of the characteristics mentioned above, is the ability of the highway industry to accomplish what it has no right to accomplish on the basis of any economic analysis. While we say that road haulage is best suited to the short haul, rapid transport of the more valuable commodities, let us not then suppose that its rail and water competitors will necessarily perform all of the long haul, mass movement of low valued goods. The world over, the trucking business has encroached on the domain of its competitors and the competitors find that business which "belongs to them" is moving by highway. If your competitor uses highways, beware of complacence.

Many examples may be given of the trucking industry's ability to perform beyond the capacity which a competent analyst might ascribe to it.

While ordinarily we say that goods of low value and great mass, and goods of substantial weight, ought to go by rail, many of these goods go by truck. For example, heavy machinery arrives at a seaport, and is placed on shore. It has substantial bulk and substantial weight, and is a candidate for rail movement to a point 200 miles inland over the coastal mountains. A rail line connects both points. But when the box of machinery arrives at the inland textile factory, it has been transported over the mountains by truck.

In the same way, bales of cotton are transported by highway from the plantations to the textile factory over winding mountain roads, even though baled cotton is a good candidate for rail movement.

You can doubtless cite more and better examples than I can, but I think the point is clear. The road haulage industry refuses to admit restrictions. If you are a competitor of road haulage, be certain you go beyond the limits of logical analysis in evaluating your competition. Do not be lulled into a feeling of security that you must contend with the lorry only over the short haul. That lorry will constantly run away with the longer and longer haul business which you know "belongs" to you. Do not feel secure behind protection which the laws or regulations may give you, for the managers of these ever-present, mobile, flexible vehicles will find a way to circumvent such restraints, sometimes through legal loopholes, but if it cannot be legally done, the trucker may even do it illegally.

If you are a lawmaker or a public planner who implements the laws with your regulations, do be informed of the nature of the road haulage industry. Again you will be betrayed if you rely on logical analysis. Go beyond such logic and count as factors the many ways in which the entrepreneurs of the highway

using transport industry differ from the entrepreneurs of their competitors. They are hungry and they live on little, but they move quickly, they seize opportunities, they are many in number, and they wage a sort of guerilla warfare in which it is often difficult for their competitors, particularly the railroads, to find the enemy and to meet them head on.

THE RELATIONSHIP OF HIGHWAY AND OTHER FORMS OF TRANSPORT

With this description of the highway industry as a background, let us examine the relationship which highways may have with other forms of transport. It is, of course, the goal in transport planning to get all transport at the least cost. We may modify this goal to say "least cost, admitting the accomplishment of certain social goals" but least cost is the proper starting point.

Proceeding from that basic point, we say that we should try to achieve a distribution of business between transport agencies under which each form performs those services which each can perform best. This statement has been made so many times, over so long a period of time, that one wonders if it is not a futile hope that should be discarded. Nothing better appears as an alternative, however, and in fact, unless one is a complete cynic, it is possible to find signs of the goal having been accomplished.

The word "relationship" in the title implies the act of working together. Do our transport agencies work together? There is more than one answer, ranging from yes to no, and involving all possibilities in between.

The simplest form of cooperation is the joint movement over two or more forms of carriers, when the originating carrier does not serve both origin and destination. It ought to be a simple matter to arrange for an interchange, but the problem may be complicated by unwilling persons on either side of the interchange, by problems which a railway may have in transporting a commodity for which truck transport is admirably suited, by lack of facilities for efficient transfer, and by differing legal conditions in transport by the different agencies.

When a shipment is transferred from road hauler to a railroad, an airline, or water carrier, what are the procedures for making such transfer possible? The plan is simple--merely move it by motor carrier from origin point A to interchange point B, where it will be taken by the rail or other carrier to destination point C. But what is the process by which it is transferred from the highway operator to the other carrier? What

persons are present at the interchange point to represent the two different transport agencies to arrange the transfer? How can we be sure that the ongoing rail or other carrier is willing to perform the ongoing portion of the haul? At what rates will it be performed? What documents are required to facilitate the transfer? Are these documents actually used, and are their terms understood by all parties, including the shipper and the purchaser of the goods?

I am a professor of transport, and I am a citizen of the United States. As a professor, I tell my students how things are done. As a citizen of the United States, I am likely to feel that we do things well. But it has been quite educational for me actually to become involved in some goods movements.

I am thinking of one occasion when I made an international move. I made plans with the carriers most carefully. I selected the carriers, I knew what interchanges would have to be made, I knew what it would cost, I was certain of my insurance coverage, and I knew approximately how long the journey would take.

At the end of the journey I had learned a great deal about transportation as it is actually performed. Almost no part of the transaction was carried out as I had planned it and paid for it. Even the insurance coverage, about which I had been so careful, was different. I had arranged for full value less a certain deductible factor, but when the papers arrived at destination I discovered I had been covered for "total loss only."

At destination my education continued in transport as it is actually performed. The representative of the delivering carrier insisted on unpacking my household goods at his terminal, with all the possibility for damage the extra handling might involve, and transporting the goods to my home where they were handled again. Why? Because he admired the packing boxes in which my goods arrived, and he wanted to use those boxes for an outgoing international shipment. You may be sure the new shipper paid him well for the cost of new packing boxes.

Thus you may be satisfied that things will be done in a certain way, but one of the characteristics of a carrier movement is that the shipper does not accompany his goods. He may see them on their way at origin, but along the way he is helpless. If interchanges are involved, he is at the mercy of the persons on either side of the interchange. And the ongoing movement may be under quite different circumstances than he had expected.

Thus the relationship between two carriers, be they of the same type--two road haulers--or of different types--road and rail--may turn out to be quite different from what a shipper expected. The conditions in the shipping documents may describe a transport movement quite different from what takes place, or there may be no description and the shipper must proceed on hope and faith, mostly the former.

Do not forget that people are involved--individuals who know more, or less, of their responsibilities, and who take their responsibilities more, or less, seriously. They, in turn, are dependent on their employees for the performance of whatever action takes place.

Sometimes in my more cynical moments I have been heard to say: There are no principles of administration. This statement, however, is a principle of administration itself. The principle is: Be prepared for anything. It might go on to say: Just because it might be logical for something to happen, does not mean it will happen. Further, just because someone tells you he will do something, does not mean he will do it.

It is that way in transportation, and it is easy to understand why it is. There are so many possible variations from any expected series of events, that some variation is almost certain to occur. And with the road haulage industry being what it is, the relationship of road haulers with other forms of transport might depart widely from the ideal.

But be we cynical or realistic, we know that cooperation between road haulers and other forms of transport is desirable, and indeed it is necessary. Interchange of goods between the different forms will result in a greater national product--a vital goal of any nation today when so many needs go unsatisfied.

The simple interchange of goods for joint hauls by road and rail, or by road and air, should not be left to the carriers themselves. The process should be facilitated by government encouragement. Although the government should be alert to arrangements which reduce competition between carriers, the government should make plain that common action is sometimes desirable. After all, road haulers are suspicious of their counterparts in the railroad industry and in other transport. Road haulers are so accustomed to going where free enterprise leads them that they are often reluctant to join others for a common goal.

Oftentimes the interagency movement of goods involves more than the transfer of goods from lorry to rail wagon, or from lorry to airplane, or from lorry to barge. For some years

now we have been working hard, and with some degree of success, in actually interchanging equipment between transport agencies.

This interchange of equipment has tremendous potential. It has been known for a long time, but unfortunately, it has been under more or less intense development for a relatively short time. Richard Colton described the development of one form of interchange in these words:

> *"The basic idea of piggyback is not new, having been used in one form or another for more than 100 years. Around 1850, some railroads were transporting small canal boats on flat cars along non-navigable portions of waterways, while in 1885, the Long Island Railroad placed into operation a so-called 'pickaback' plan whereby farmers' wagons loaded with produce were transported, four to a flat car, from outlying points on the island to Brooklyn, whence they were ferried to Manhattan. The transportation of loaded highway trailers on flat cars actually began in 1926 when the now defunct Chicago, North Shore and Milwaukee Railroad inaugurated a service between Chicago and Milwaukee. In 1936 and 1937 the Chicago Great Western and New York, New Haven and Hartford Railroads, and a bit later the Denver and Rio Grande Western, developed profitable trailer-on-flat-car operations for over-the-road haulers. But it was not until the later 1950's that development of the idea by the railroads and acceptance by the shipping public combined to make headline news on the subject. Since that time there has been a steady increase each year in the points at which this service is available and in the number of trailers handled. (The service) appears to offer excellent prospects for growth, judging from the sales effort devoted to it by most railroads, for they feel that at least they have a service with which they can meet the flexibility of motor carrier operation and successfully compete for the business of the smaller concerns and those which do not have railroad sidings. Shippers, on the other hand, find that piggyback provides fast, dependable schedules at charges which appear to be susceptible to far better control than those of motor carriers because labor costs are held to a minimum."*[1]

In the main, Colton's predictions have come true. Although piggyback loadings did, in fact, decline in 1970, they rose again in 1971. The 1970 decline has been attributed to the

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1. Colton, Richard C. and Ward, Edmund S., *Practical Handbook of Industrial Traffic Management*, Traffic Service Corporation, Washington, D.C., 1965, pp. 117-118.

business recession, and it was also in part due to a reduction in the quality of service the railroads performed. However, there can be little doubt that nearly all parts of the economy have profited from the cooperative effort by highway and rail.

In similar fashion highway trailers are moved onto ships for transport overseas in what is called roll-on, roll-off operation. In both this and in the piggyback operation described above, the whole trailer, including the wheels, is moved and the tractor power unit is needed only at origin and destination. But the wheels take up space, and the loader trailer rides high on the flat car, or on the deck of the ship. Better to leave the wheels behind, and thereby reduce the weight and the cubage, and lower the center of gravity. Let us move only the container and its contents. Let us transfer the container from truck to rail or truck to ship by crane, thereby speeding up the transfer and reducing time of the rail car in the terminal yards or the time of the ship in port.

The potential of containerization is virtually unlimited. One estimate reads:

> *"Containerization is expected to play a continually growing role in the transportation of goods across national and continental boundaries.... Containers, more than any single innovation since steam powered ships, have caused a significant acceleration in international trade."*[2]

Although the prediction for the container's future has been most optimistic, the development has been slower than one might expect considering the prediction. After all, although the ultimate cost of moving goods is expected to fall, there is an immediate cost in the very substantial investment in new equipment. Furthermore, what assurance is there that after we provide the containers and the loading equipment at the point of origin, there will be unloading equipment at destination? Some aid in getting such information is provided by numerous sources, including a comprehensive publication showing the world's facilities in Janes' *All the World's Containers*.

In addition, if we send the trailers away loaded, when they do return, will they be under load so that there will be economies of two-way transport? But can we be sure they will return at all? Containers have been known to disappear in remote parts of the world. They make excellent homes for some people.

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2. Fuchs, William F., *Marketing at a Crossroads*, American Trucking Associations, Washington, D.C., 1972, p. 70.

Then there is the problem of size. Can we standardize on sizes so that our containers will fit the other man's flat cars or ships? The tie down fittings should be standard between different companies of the same sort of transport, and between companies of different forms. Their construction for movement on and off by crane must likewise be standard. When they are on the ground in the terminals or on the docks, can they be stacked and retrieved with ease?

The answers to some of these questions must be "yes," for container terminals are being constructed the world over. If a study made for the United States Maritime Administration accurately estimates the future, it may be that the United States is overproducing in this area.[3] It is hardly open to question, however, that movement by container is the method of movement of the future, and no nation can afford to overlook the necessity of fitting its transport plant into the container system design.

This design is one which goes beyond any single nation. It may be that this seminar will be the basis for a comprehensive plan for Turkey, Iran and Pakistan, and indeed for other nations which might join them--a plan similar to that being proposed for nine countries of Europe. According to a news item of July 10, 1972,[4] the Organization for Economic Cooperation and Development, the Commission of the European Communities, and the European Conference of Ministers of Transport were planning a 3-year study "designed to assist member nations in the development of compatible transport systems for the 1980's and beyond." These nine European nations--Austria, France, Germany, Ireland, Italy, the Netherlands, Spain, Switzerland, and the United Kingdom--were described as "planning construction of new highways, rail and airport facilities and the development of advanced aircraft and high-speed tracked vehicle technology." It was said that "The main purpose of the joint program will be to assure the key planning, development and capital improvement decisions taken in individual countries are compatible with each other, and to foster the growth within Europe of a balanced and integrated transport system."

How we might hope that planning in any nation or group of nations might be coordinated in similar fashion. How unfortunate it is when resources are provided in the wrong form, in the

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3. "U.S. Share of Container Shipments Viewed in Study," *Traffic World*, July 10, 1972, p. 62.

4. "European Countries View Transport Systems," *Traffic World*, July 10, 1972, pp. 64-65.

wrong place, or at the wrong time![5] Planning may be difficult and involve many unknowns, but better to attempt it than to face the risks that go with no plan at all. Better to have some part of the design of a plan than to have one forced on you by outside nations who want to trade with you and who force upon you the manner in which they do trade with you.

Models for guidance on many of these problems are available. Recently the United States Maritime Administration and the United States Department of Transportation announced how the efforts of the two agencies, working with highway, railway, and maritime interests had resulted in "a standardized agreement for the interchange of equipment between different modes."

The two departments predicted that "The adoption of the agreement by the different modes would speed the flow of intermodal containers in the United States."[6]

Several years of work have preceded the production of the final forms of the agreement. I suggest that Turkey, Iran and Pakistan might well examine the finished product of the task force. While no one of the countries may feel that containers are going to dominate domestic transport, and the containers may simply end up at the port of entry, with no particular movement inland, knowing the nature of the trucking industry, the new technologies will be recognized as productive and they will be used. Entrepreneurs are alike the world over. They sense the opportunity for profit and they take risks. I am continually amazed at the operations I see, and I am moved to admiration of the courage of man on the economic front.

It is easier for interchange to take place between some types of transport than between others. Much of what originates on highway transport can be transferred to the rails. Other commodities that originate on the highway can be transferred to air. Transfer between rail and river may also occur easily. Transfer from rail to air occurs less often, and between water

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5. I have in mind an airplane of Russian manufacture which was given as a goodwill offering by the Russian people to the people of Burma, on the occasion of the visit of Khrushchev and Bulganin to Burma in 1955. The aircraft sat on the ramp at Min galadon Airport, unused, and requiring expensive protection. Today, in 1972, an executive jet airplane, purchased by Howard Hughes and delivered to him at the factory, sits on the ramp at *the* Lockheed plant in Marietta, Georgia. It is under guard, and remains unused. It is unfortunate it cannot be diverted so as to be a useful resource.

6. "An Intermodal Transportation Milestone," *Traffic World,* July 17, 1972, p.5.

and air even less often. Interchange between pipeline and the other agencies for anything more than local delivery is highly unlikely.

The range of the possibilities of coordination between the different transport modes is well described in a table which appears in one of our better works in the field of logistics. The authors set forth the possible interrelationships between transport modes as shown.

TRANSPORT COORDINATION POSSIBILITIES

Modes of Transportation	Highway	Rail	Water	Air	Pipe-line
Highway	x	Piggyback	Fishyback	Airtruck	N.D.
Rail	Piggyback	x	Trainship	(Skyrail)[a]	N.D.
Water	Fishyback	Trainship	Shipbarge[b]	(Airbarge)[a]	N.D.
Air	Airtruck	(Skyrail)[a]	(Airbarge)[a]	x	N.D.
Pipeline	N.D.	N.D.	N.D.	N.D.	x

N.D. Does not ordinarily meet the requirements of the definition of Coordinated Transportation Service.

a. These combinations do not exist at the present time, and it is unlikely that these combinations could be developed as regular commercial services.

b. Defined as ship-to-barge or barge-to-ship, *not* barge-to-barge or ship-to-ship.

From Hesket, J.L., Ivie, Robert M. and Glaskowsky, Nicholas A., "Management of Physical Distribution and Supply," *Business Logistics*, The Ronald Press Company, New York, 1964, p. 59.

However optimistic we may be about the future of methods which are under development, we must constantly be on the alert to the dangers of imposing new methods where they simply will not work. At the same time, we must be suspicious of previous analyses, because conditions may be present which make them null

and void. Air transport in one of the developing nations has been used for the movement of nearly every sort of commodity. Because a state of insurgency existed on the ground, the airplane was used to fly over the danger. The monetary cost was high, but the demand was that intense and the consumer was willing to pay what would ordinarily be a prohibitive rate.

At the same time, it is said that the railroad industry of Europe went to the United States, studied the American system of trailer-on-flat-car and container operations and then went home where "they put the best of American methods promptly to work." The Europeans went out ahead of the Americans, so the presumed leaders do not always lead. As it was put by the Port of New York Authority:

> *"Thus, while American railroads remain mired in indecision, aloofness, and regulatory stultification with respect to containers, their counterparts across the sea use American know-how. Little wonder then that Deputy Under Secretary of Transportation, Charles D. Baker, said: 'We've all inherited a regulatory and administrative environment that is archaic and out of step with technological change.' "*[7]

Fortunately for the Americans, change did come and the passage no longer describes the actuality.

WHEN SOCIAL OBJECTIVES ARE IMPORTANT

Economic analysis is useful, it is nearly always the starting point, but the question is always pertinent: What social goals are imposed on transport operations? The railway system is commonly owned by the government. Is protection from competition for the railways important? Should road haulage be limited to 25 miles as it was in Great Britain? On the other hand, should the nationalized railways be required to carry motor fuel at a substandard rate in order to provide cheap fuel for the automobiles of those few who have them, but who infiltrate remote areas of the country, as in Colombia? What is the nature of the rate system? Is it possible for rates to change without the agonizing process of commission review? Is rigidity of regulation merely the result of bureaucratic immobility, or does it result from consulting social desires? Is it necessary that the governmentally owned transport facilities produce profits to support other functions of the government, resulting in the rates of "cheaper" carriers being held to a high level?

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7. *Via the Port of New York*, November 1969, p.34.

CONCLUSION

Whatever the answers to the foregoing questions, all may be assured that a good highway system will produce great dividends. Because highways are so available to the large mass of the people, from the man with the cart to the man with the diesel powered lorry, the productivity of a unit of investment in highways will spread into more of the circulatory system of the country than will equal investment in any other agency. And because the people and the vehicles in highway transport simply do not submit to restraints on their operations, greater movement of goods and people will result.

AN EXPANDED VIEW OF ROAD FINANCE IN DEVELOPING COUNTRIES

by

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INTRODUCTION

The purpose of this paper is to present the basic elements of a reasonable approach to road finance with special emphasis given to the unique constraints faced by developing countries. An effort will be made to present the fundamentally different views held by road builders and economists, and to reconcile these differences to the extent that they can be reconciled. International experience with various financing mecha-

* The views expressed in the paper are not necessarily those of the U.S. Department of Transportation.

nisms will than be examined in the light of the economists' and the road builders' views, as well as the special constraints that a developing country may be laboring under. Finally, a synthesis is attempted, leading to what is hoped will be a set of useful suggestions for developing countries willing to consider a fresh approach to an issue as old as the highway mode itself.

THE FUNDAMENTAL ISSUES

Discussions over road finance usually follow one of two general threads of thought. The first is the oldest and most straightforward one of how to obtain enough revenues to build and maintain the roads that are "needed" in a country. This is the question that has traditionally been posed by those elements of government concerned with an adequate transportation system. In more recent years, a radically different view has been developed by the economists. This view is put forth in two stages. The first concerns the issue of what roads "need" to be built. In general, the answer is that a road needs to be built if the discounted benefits of doing so exceed the discounted costs of building and maintaining the road. The second stage of this line of thinking concerns the "price" that should be charged for using such a road in order to insure that the road is used efficiently. Charging a price will certainly produce revenues, but these need not be related to the immediate problem of financing the construction of the road. Indeed, that problem is assigned a low priority in the scheme of things. Good investment analysis and good pricing policies lead to economic efficiency, and that is the objective sought after. How the funds are obtained to build the road initially is not unimportant; it is simply not of primary concern. It isn't difficult to see how these two views might come into conflict; and an understanding of these two views is becoming more and more indispensible to present day discussions of road finance.

The Traditional View

The traditional view of road finance is very much bound up in the development of a country's views towards taxation in general. An early development in public finance principles was the idea that government services with "community" benefits should be financed by taxes, rather than by sale to users. National defense is the best example of such a service, and is, in the jargon of the economist, referred to as a pure public good. A private good, on the other hand, is sold to the user who has the exclusive use of that good and the benefits associated with it. When the government provides a private good, it usually imposes a user charge on the individual consumer under the general

rationale that he who benefits should pay. Some goods that are theoretically private goods are financed by taxation, due either to administrative problems of collection or larger issues such as regional redistribution of income.

Historically, roads have been treated as both private and public goods, some financed entirely by users and others entirely by revenues from general taxes; and frequently both user revenues and general taxation have been employed to finance road construction and maintenance. It is not difficult, therefore, to understand the attitude of road builders towards revenue sources. Almost any system will do, provided it is adequate for what they perceive as needs, and provided it is stable enough from year to year to allow for advance planning of implementation.

The Economist's View

Most engineers today are familiar with benefit-cost analysis as applied to road investments. The theory and practice is reasonably well developed. It is, however, safe to say that the decision to construct roads in virtually all countries of the world is still made the way it was several hundred years ago, a combination of obvious bottlenecks, political pressures, and financial constraints. The economist's reply to such an assertion is that we need not accept this state of affairs forever. Mankind has made some progress in the interim, and scientific investment analysis is here to stay. The International Bank for Reconstruction and Development has been the chief proponent of the use of investment analysis for road projects, and some progress is being made at their insistence. The developed countries of the world have not been subjected to such pressures. As a result, most of our experience with actual use of these techniques has been in the developing countries. We have then the novel experience of the developing countries leading the way in this area.

It appears that the developing countries will also be asked to be the first to implement road pricing policies, since none of the developing countries have been able to see their way to follow the advice of their economists. Again, the point is made that the developing countries need not repeat the mistakes of the developed countries, nor can they afford to. This argument would have some merit if the only reason that the developed countries have not adopted road pricing policies is that the concept was developed so recently that the changes required would be too painful at this stage of development of road transport in the advanced countries. Transitional costs, however, are only one of several stumbling blocks. The other major reasons

for lack of acceptance of road pricing schemes are administrative complexity and lack of public understanding.

In the idealized world of the economist, a road should be built if the discounted net benefits of doing so are positive. Assuming that this is the case, and the road is built, the road should be treated as a private good, and the users should be charged a price equal to the marginal cost of using the road. Marginal cost of use is an extremely elusive item to quantify, and subject to great variations over time. On a new road operating at less than capacity, the marginal cost is based on the wear-and-tear imposed on the road by a single vehicle. A rough estimate would be based on the use-related portion of the annual maintenance cost, divided by the number of vehicle trips, or vehicle miles, or ton miles, depending on the measure of output. On uncongested roads, the marginal cost is less than the average cost of maintaining the road, and none of the capital cost is recovered. From the point of view of road finance, this involves operating the road at a deficit. However, marginal cost becomes a very volatile thing the moment congestion enters the picture, and this is where the economist's approach becomes difficult to explain. Congestion costs are the costs an extra vehicle imposes on all other vehicles when it enters a stream of traffic. An extra vehicle in a congested stream slows down and imposes costs on all the other vehicles, and the sum of all these costs over all the vehicles is the marginal congestion cost. If this item is added to the wear-and-tear element of marginal cost to compute the price to use the road, then the price to use a congested road can easily exceed the average costs, including capital costs, and the road may yield a profit. Since all well designed roads experience some congestion over their useful life, a road need not yield a deficit over its useful life. Instead, it produces a stream of revenues that fluctuates greatly, generally low when the road is new and uncongested, but rising as it experiences more and more congestion. The price to use the road fluctuates during the day, the week and the year, according to fluctuations in the marginal cost. The road is expanded only when the benefits of removing the congestion exceed the costs. In the meantime, the fluctuating price rations the scarce road space during peak periods, insuring an efficient use of the road space and providing revenues for the government. In a properly designed and priced road system, some segments will be new and yield deficits, while other older, more congested segments will yield profits, and the system as a whole *may* be self-financing.

The above scenario is the articulation of a road system designed and priced with the objective of economic efficiency in mind. When an economist speaks of road pricing, it is with the general model above in mind. And when economists speak of financing roads, they invariably bring in the issue of road pricing, which invariably confuses engineers and annoys politicians

who must face the public and explain how and why road prices will fluctuate, and how they will be collected.

Congestion pricing is not a simple concept, nor for that matter is economic efficiency. Equity, on the other hand, means justice according to natural law, and that is reasonably well understood. Thus the user charge, based on the beneficiary-should-pay principle or the equity principle, is firmly established in the public mind. A fluctuating price based on the principle of economic efficiency is not.

User charges in general are fairly crude measures that are administratively feasible and fulfill the equity objective. They may not be very good prices because they depart from marginal costs. It is this departure that concerns economists, since it may lead to inefficient use of the road system.

Road builders might be able to accept the economist's view if a feasible way were devised to collect user charges based on marginal costs. If this were possible, both the equity objective and the efficiency objective could be met. So far this has not been accomplished.

ALTERNATIVE FINANCIAL MECHANISMS

Bearing in mind that the traditional view of road finance has dominated the scene, it is worth examining the financing mechanisms that have been developed under this philosophy, and scrutinizing them in the light of the economist's view. General fund financing, bond financing, toll financing, and road funds will be considered.

General Fund Financing

Financing the construction and maintenance of roads from general tax revenues is the most common road financing mechanism in existence. The government raises revenues from taxes on land, income, sales, imports and exports, and allocates these revenues for public investments in different sectors of the economy. The great virtue of this approach, at least in theory, is that government decision-makers must make intersectoral comparisons of investments, comparing, for instance, investments in hospitals and schools with those in roads. Since public investment needs will always exceed public revenues, the scarce public revenues can be allocated where political representatives feel the payoff in public benefits is the highest. Roads are not treated any differently than any other sector of the economy.

If benefit-cost analysis is employed to aid in allocating funds to the highest priority transportation investments, that is a desirable refinement that is, in general, supportive of economic efficiency objectives. Economists would further urge the implementation of cost-based road pricing that would encourage the efficient use of existing roads and provide correct incentives for intermodal choices facing transportation system users. Revenues accruing to such a pricing system would go to general revenues, as do excise taxes on motor fuel, tires, vehicles and spare parts.

Although no country has implemented anything approaching true road pricing policies, many economists support the general revenue approach to road finance on the grounds that it provides the greatest potential for phasing in good road investment and pricing policies, should a country ever decide to employ them. Both Germany and Great Britain use this method for financing roads. Road builders in both countries feel that such an approach invariably leads to less investments in highways than any other method of road financing.

Bond Financing

Bond financing of roads was particularly popular when it was thought that the provision of a basic road network was a one-shot effort, that a large sum of money would be needed over a relatively short period, and the need for finances for roads would reduce and level off. Since the pay-as-you-go approach from general funds would put an undue strain on the budget during the construction period, the cash flow could be smoothed out by borrowing the needed sum, and paying it back over a period of years with revenues from the general fund.

The virtues of this approach are that it assures the finances needed to put a "package" of roads in place, and if the bond issue is to be voted on by the public, it gives them a chance to support or oppose the package proposed by voting for or against the measure. Frequently, a package of tax increases accompanies the measure with revenues sufficient to retire the bonds. The public is then given the opportunity to participate in a limited way in both the investment and the financing decision. If passed, the road builders have a clear mandate and revenues to implement it.

Economists have no particular problem with bond financing. How the money is raised is not of primary importance, unless it has an impact on the investments to be considered, or on the prices charged for the use of the road. Indeed, they would find this method a minor departure from general fund financing.

The real issue is the selection of the projects that go into the package that is to be voted on by the public. In order to develop public support for the measure, the resources may be allocated for a wide geographical distribution of projects, which may not be the most efficient set. The real need may be for concentrated expenditures of money in a few places. This problem is related to the previous reference to equity issues in public finance. As long as public investments have obvious community benefits enjoyed by all, financing them with general tax revenues has been acceptable by the populace. However, when public investments confer benefits primarily on a subset of the tax paying public, then people begin to question the need for some members of the public to pay for the benefits that are enjoyed only by others. Out of this concern the concept of payment according to benefits has developed, leading to the general philosophy that underlies most user charge systems that exist today.

Toll Roads

The toll road is a considerable departure from general fund financing and has a very long history in road finance. In its purest form it treats the road as a private good and is run as a commercial venture. More recently, in Spain, Italy, France and Portugal, the toll road corporation has taken on the form of a joint public/private venture that has allowed a combination of general fund and specific user charge financing. Because of the great flexibility in the public/private levels of participation and the potential for something approaching real road pricing, this particular funding mechanism has considerable potential for reconciling to some extent the conflicts in views between road builders and economists.

Regarding levels of public and private participation, the use of general fund revenues or government guarantees of revenue bonds provides for the general level of benefits that special user groups derive from the road beyond the general level of benefits. This approach does not require the either-or choice and has the potential of addressing a major equity issue that general fund financing or purely commercial toll facilities cannot. It is possible then to concentrate expenditures in a specific area without incurring a taxpayers' revolt, since the users of that road pay a toll that covers all or a part of the cost.

From the point of view of the economist, the partially self-liquidating toll road has some very desirable features. In terms of the investment decision, the participation of a private corporation with a stake in the revenues to be collected assures some attention to realistic traffic projections. This is a great help in avoiding gross misallocations of investment.

In terms of road pricing, the public/private venture has more potential than any other approach. The toll charged on a new facility can be nominal, with funds from general revenues making up the deficit. The price in this case would be less than average cost, which is what it should be if the uncongested road is to be used efficiently. Should the road eventually become congested, there is nothing, at least in principle, that precludes tolls in excess of average costs with a subsequent profit for the state. In urban areas where early congestion is highly likely, the initial toll may be set high enough for the road to yield a profit almost immediately, requiring no general revenue financing. This is particularly desirable where large external costs of congestion and pollution are included in the price to use the road and the costs of eventual expansion are unusually high.

From the road builders' viewpoint, the great virtues of these arrangements are assured finances on a project-by-project basis and swift implementation of the project. The traditional reluctance of road builders to support this approach has been founded on the belief that few roads would get built if all had to be self-liquidating investments. This is certainly true if there is ever any real possibility of all road needs being met with general revenues. Since estimates of road needs in most countries are grossly unrealistic in terms of finances available, it might be wise to scale down the aspirations of the road builders and concentrate on implementing a few projects well. In addition, the use of partially self-liquidating toll roads removes the constraint of commercial criteria and allows roads to be built for national defense purposes or for purposes of regional income distribution.

Road Funds

The spectacular success of the Highway Trust Fund in financing the Interstate Highway System in the U.S. has intrigued road builders all over the world. It is one of the few cases where the needs were determined, and the mechanism for financing implementation of the resulting 42,000-mile package was set up at the same time. Congress earmarked certain Federal tax revenues specific to road users to be allocated to implementing the system designated. Debt financing or bond funding was not allowed, and a pay-as-you-go procedure was adopted.

The great merit of this approach is that it worked, and Congress got pretty much what it asked for in terms of a high-standard road system in a fairly short period.

It is important to recognize that the economist's view of road finance had little impact on the decision in the U.S. and that all of the elements of the traditional view were operating. To begin with, the assessment of road needs was never subjected to benefit-cost criteria. There was a general feeling that with the enormous increase in auto ownership and usage in the 1950's the existing road network was inadequate. There was also a feeling in Congress that a strong national defense required a higher standard road system than would otherwise be required. The national defense objective made it possible to justify projects in virtually every state of the union, regardless of traffic densities. By incorporating the defense objective, and by providing complete geographic coverage, the 42,000-mile package could be construed as having some characteristics of a public good with benefits accruing to all road users who, taken as a group, were not much fewer in number than all taxpayers.

Proponents of this approach indicate that rough group equity is achieved, in that road users as a group finance the Interstate System. They also point to the fact that fuel tax payments are a function of road use, and that those who use roads a great deal pay a larger user charge, and that this is in a sense a price for using the road. There is some merit in this contention, and the argument has been a persuasive one, not the least due to its simplicity.

The big problem that economists have with this approach is the selection of a package of projects based largely on regional equity issues rather than economic efficiency. Like the bond issue where the resources are spread to elicit public support, the system selected was quite different from what economic efficiency would dictate. One estimate made in 1954 of the number of new miles of potentially self-liquidating toll facilities in the U.S. indicated a range of 7,500 to 8,000 miles, rather than the 42,000 miles that was eventually designated in 1956. Defense considerations required more, but it is not clear that in the absence of the need to spread the investment throughout the 48 states, the defense needs would not have been so great.

The politically based preselected system approach also has the undesirable characteristic of discouraging the use of cost-benefit analysis of projects. If a project is in the system, it is by definition justified. It would be surprising indeed if a large package of preselected projects to be implemented over a 10-year period did not have a number of bad projects included. To continue to accept these projects even after subsequent events indicate they are a mistake is an unfortunate rigidity associated with this approach.

The fuel tax as a price for road use can work reasonably well for uncongested roads. However, once congestion sets in and marginal cost rises rapidly, the fuel consumption rates, and thus the user charge, do not rise as rapidly, and congested urban travel becomes underpriced with resulting inefficient use of urban road space. For those who do not view this situation with alarm, the fuel tax as an equitable and feasible user charge has great appeal.

Many countries have fuel taxes and treat them either as pure revenue measures or call them road user charges. A number of countries have also attempted to tie the revenue stream from fuel taxes and other taxes specific to road users to a road investment fund or trust fund, as it is called in the U.S., the idea being the provision of an assured annual stream of funds for road projects. This is the dream of many road builders, but success with this approach outside the U.S. has been very limited, and prospects look no better for the future. The successful earmarking of tax revenues is very much a function of the type of government of a country, its internal system of checks and balances, and the degree of centralized power. In the U.S. the legislative branch of the government approved of the Interstate Highway System configuration, and the earmarked Federal road user taxes. Should the executive branch of the government wish to use Federal fuel tax revenues for other purposes, it must persuade Congress to pass a new law allowing this. Thus the executive cannot raid the road fund for other domestic investments, no matter how desirable they are. It is much easier for the executive in a parliamentary form of government to do so. As a practical matter, road funds in most countries are more susceptible to diversion for other uses. The discipline imposed on road funds in the U.S., therefore, cannot be assumed to be feasible in other countries.

SPECIAL CONSIDERATIONS FOR DEVELOPING COUNTRIES

The developing countries of the world are different in a number of important ways from the developed, and these differences have a great deal to say about the relevance of the road financing experience of the economically advanced countries. The chief differences to be discussed here will be public finance institutions, foreign aid and exchange, and the domestic construction industry. Not all of these factors will be special concerns of all developing countries, but they are important enough often enough to be of general concern.

Public Finance Institutions

Most developing countries have fairly unsophisticated means of raising general revenues. Administration of an income tax, for instance, requires a large and well trained corps of civil servants, and a populace that is literate. For this reason, income taxes are rarely a major source of revenue in developing countries. The constraint of overriding importance is usually that of administrative feasibility, tempered by equity considerations. Questions of economic efficiency are rarely considered. Thus major domestic revenue sources usually take the form of indirect taxes that are easily collected. Taxes on imports, exports, and the sale of gasoline and diesel fuel are particular favorites as sources of general revenues. Imports and exports flow through well defined channels and are monitored relatively easily at the ports. Gasoline and diesel fuel can be stored in bonded warehouses and released for retail sale as the tax is paid. Excise taxes specific to road users are rarely imposed as a user charge; rather they are feasible ways to obtain money to run the government and finance public investments. It is not difficult to understand the lack of enthusiasm by Treasury officials when it is proposed that such taxes be redesignated as user charges and earmarked for public investment in roads alone. But that is precisely what many admirers of the Highway Trust Fund in the U.S. would have, forgetting that, unlike the U.S., income taxes and property taxes are not large revenue raisers. Any attempt to set up such a fund inevitably results in periodic raids when general revenues are in short supply, a not unusual happening in virtually all countries.

Raising general revenues through indirect taxation of the sale of certain products can lead to price distortions and inefficiencies. For instance, high taxes on gasoline and low taxes on diesel fuel serve as an incentive to use diesel engines when they would otherwise be inefficient. Similarly, taxes on energy used only by road transport provide an incentive to consume rail transport. Economists would, in general, prefer excise taxes that are neutral, providing no relative distortions leading to inefficiencies. Many European countries have sought to achieve distortion-free excise taxation through a tax on value added (VAT). However, this too is an extremely complex tax since there are inevitably a number of exceptions and different rates. Precise record keeping by all sellers is also required.

As a practical matter for most developing countries, the excise tax on motor fuel is usually too important a revenue raiser to earmark entirely for road building. Arguing for road trust funds where domestic revenue sources are scarce is unlikely to be a very fruitful exercise.

Foreign Aid and Exchange

Discussions of foreign aid and foreign exchange components of road projects sometimes obscure the entire road planning operation of a developing country. It is almost as though there were two highway departments in operation, the first building and maintaining roads to local standards with local materials and local technology, and the second building roads to Western standards with imported equipment and technology. Needless to say, the emphasis is usually on the latter, since the whole approach is quasi-scientific and more prestigious. Also, until recently most foreign aid for road building specified Western standards and international competitive bidding, which frequently led to Western technology and construction methods. Distortions of this sort are unique to developing countries, and make it difficult for them to work out an approach to road planning and implementation that suits them best.

There also appears to be some confusion in the minds of road builders as to the difference between loans and grants. Grants are a transfer of resources from one country to another that need not be repaid. They are, of course, highly desirable. Loans, on the other hand, must be repaid with future national resources. To the extent that the terms of a loan are better than what could be arranged on the commercial money manket, an element of such a loan can be considered a grant. Aid in the form of low-cost loans is similar to the bond financing schemes that many state governments in the U.S. used for road financing in the early part of the 20th century. Countries that float loans with international lending agencies are usually pledging repayment out of future export earnings. Since export earnings are predictable within some range, it is possible to predict the range of commitments that a country can make by doing a cash flow analysis. There is certainly a limit to such indebtedness if repayment is seriously considered.

The obvious question is whether or not the road system needs to be imported. It is possible to build functional roads in most countries with small foreign exchange components. However, this usually involves a radical change in methods, materials and standards. It also places greater responsibility on the shoulders of the local road builders, who must then work harder to build roads that to them often seem inferior to the Western product.

The alternative is to press for foreign financed roads on the grounds that their very existence will so stimulate national production and exports that the foreign exchange for repayment will literally be generated by the investment. To the extent that this is true, this approach deserves consideration.

Otherwise, the more difficult approach of making maximum use of domestic resources will be thrust upon the developing countries.

By placing control over foreign exchange allocations in a central body, as is usually the case in developing countries, the financing of roads with high foreign exchange components takes on a complexity unknown to Western road builders for whom a unit of currency is the same, whether in the form of toll revenues or earmarked excise taxes.

The Domestic Construction Industry

Parallel to the dual nature of highway departments in developing countries, the domestic construction industry in these countries has also developed along so-called modern versus traditional lines. This usually means that some contractors use capital-intensive methods of building roads to Western standards, while others use labor-intensive methods to build a different type of road. Economists frequently suggest that labor-intensive methods may be the most desirable, since labor is usually by far the most plentiful domestic resource. These methods also reduce pressure on export earnings and provide employment. On the surface it makes a good argument. Road builders usually reply that it takes longer to build roads in the traditional manner, and that the results are not up to Western standards. Behind this argument lie a number of assumptions. Among these are the assumption that Western standards are required, and that it is difficult to organize large groups of human beings into an effective and efficient team.

The question of appropriate standards is very much tied to the methods of construction, the density and composition of traffic, and the value of time in a country. It would be extremely unlikely for a careful study of appropriate road standards in a developing country to indicate that Western standards were the best under local conditions. The World Bank is presently engaged in making such a study and the results should be of considerable interest not only to the developing countries, but also to the international lending agencies and consultants that have such an impact on the highway planning function in developing countries.

The use of large groups of labor in constructing roads is not new on the subcontinent, and some very adequate roads have been built with large labor components and very little machinery. It is almost certain that some combination of labor and specially designed machinery, different from the Western model, is the most appropriate in both an economic sense and a public policy sense for road building in developing countries. The

World Bank is also in the process of making an exhaustive study of the substitution of labor for equipment in road construction. This concern by the World Bank over appropriate highway standards and methods of construction is almost certainly the forerunner of a much more flexible approach by the Bank to the question of standards and methods of construction for the road projects that they finance. Hopefully, it will mean the abolition of the dual highway departments and construction industries of developing countries and allow their engineers and planners to operate in a world no more complex than that of their Western counterparts.

As mentioned previously, the Italians, French and Spanish have instituted a unique form of toll road financing through carefully controlled private ventures. This method of toll road financing, construction, and operation is heavily dependent on the existence of domestic contractors with reasonably sophisticated approaches to management, planning and finance. They need not, however, have at their disposal the entire panoply of machinery available to Western contractors in order to have this sophistication. Indeed it will probably take more imagination and ability to run a labor-intensive operation. The great danger is that the engineers of the developing countries, many of whom have been Western educated, will be unable to see the merit in supporting the development of a domestic construction industry that is not as fully mechanized as that in the West.

ELEMENTS OF A REASONABLE APPROACH TO ROAD FINANCE

It is useful at the outset to dispose of the U.S. model of road finance for most developing countries. It has been a workable way to finance major new road construction in the U.S. The reasons for this success, however, are numerous and more complex than is usually recognized. Less appreciated than it should be is the excellent record of the State Highway Departments in implementing the 1956 mandate of Congress with little scandal or corruption, as many predicted would result from the Interstate program. The Bureau of Public Roads in the Federal Highway Administration put a great deal of effort into developing effective relationships between the state governments and the Federal Government. It was not a small task, but receives little recognition since it was by and large successfully accomplished.

The unique form of government based on separation of powers in the U.S. also lent itself to the trust fund approach. Finally, the very high levels of automobile ownership and usage provided a broad revenue base for the Interstate System.

The focus in the U.S. is now changing as the Interstate System nears completion. It has become increasingly clear that an open-ended unimodal program of this nature has its limitations, particularly for roads in urban areas, where air and noise pollution and community disruption have become important factors in highway investment decisions. The question now is how to maintain and operate the system and make further expansion, especially in urban areas, compatible with the environment. Definite moves have been made in the U.S. to make the Highway Trust Fund more flexible, particularly in matters concerning urban transportation, where the existence and environmental compatibility of other modes must be considered.

Few developing countries have a governmental structure like the U.S., and fewer still have auto ownership levels and income levels prevalent in the U.S. in the 1950's. Because of these factors and the importance of excise taxes as revenue measures in developing countries, it is unrealistic to attempt to emulate the experience of the U.S. with the trust fund approach to road finance.

It would be well to accept the fact that general revenues, tolls, and international lending agencies will remain the chief sources of financing for roads in most developing countries.

The argument is often made that the trust fund approach allows road builders to plan on an assured stream of revenues, unlike the general funding approach, which must be allocated annually. This is a bogus argument. What proponents of trust funds see is a much *higher* level of revenues for road building. The uncertainty of general financing is not as bad as opponents make it out to be, and governments can allow advance commitments of funds not to exceed the last year's allocation if they so wish. A perfectly reasonable estimate of next year's allocation for roads is one predicated on last year's, plus a small percentage increase based on realistic estimates of the growth in government revenues. Economists may not like this approach to the intersectoral allocation of public funds, but major divergencies from the past are rare, and projections based on a 4 or 5 percent annual compound rate of growth are as good as those resulting from the most sophisticated macro economic models. With this simple projection, a 5 or 10-year stream of finance can be estimated, and a package of road projects can be selected that exhaust that projected stream of financing. For all practical purposes this is the essence of the approach in the United States. The problem with this approach in most developing countries is that it is an unpleasant exercise, since the revenues projected inevitably provide for less than half of the minimum "needs" estimated by the road builders.

It is this dilemma that leads the road builders to cast about for new mechanisms to generate more funds, and the U.S. experience with trust funds is often viewed as a solution. The alternative of accepting realistic funding levels, and carefully planning their use, frequently for roads of lower standards, is rarely considered until the decision is forced and then it is usually hurriedly done. In fact, road planners would be doing their country a greater service if the bulk of the planning effort went into a careful look at what could be done within a realistic budget constraint rather than expending their efforts on a "needs" exercise that produces projects that rarely get funded. There is, of course, no reason why an optimistic alternative program should not be developed should allocations increase unexpectedly or should it be needed in the annual budget exercise so that the cut-back does not drop below the realistic level. However, the highway department of a developing country should have a clear idea of what their realistic objectives are, and these should not be affected by the needs estimates or those estimates employed in the annual budget exercise.

The major recommendation then is to organize a country's road program around a realistic core of projects funded by general revenues. The standards employed would be those appropriate for the specific country, and the responsibility for implementation would lie with the local engineers and the local construction industry.

The role of foreign aid financing should not be dominant unless the country in question is totally devoid of financial and technical resources, and that is an unusual case.

The role played by foreign aid financing is very much dependent on the requirements of the foreign lending agencies. The conventional project package of feasibility study, Western standards, and international competitive bidding must be examined very carefully, since such projects are unlikely to be in the core package of realistic projects unless Western standards are deemed appropriate and the domestic construction industry can achieve them. From time to time, a real bargain comes along in terms of willingness of a foreign country to finance, either through grants or low-interest loans, a road project in a developing country. The question to be asked then is whether repayment of this loan will reduce the allocations for the future realistic core of projects, and whether planning and implementation will take up all of the energies of the local engineers and planners, reducing resources and interest in the realistic program. If this is to be the case, a developing country might be wise in turning down such a bargain, foregoing the short-run improvement for the longer-term benefits of an orderly development of a road program based primarily on domestic resources.

One way to take advantage of such bargains and minimize adverse impacts on domestic institutions is to accept them only when the payoff is unusually high in terms of a rate of return, and when the high standard facility to be provided is a toll facility, the revenues to be used to repay the loan. This insulates the core projects from being displaced by the foreign financed facility that would not otherwise be built. This may be a large project that is not on the realistic list because of its scale, standards, and local benefits, such as an urban expressway joining a city with a satellite suburb. The bulk of the potential traffic may be affluent auto owners as opposed to transit and freight movements. Such projects are quite visible and usually built to high standards. In this case, it makes sense to take advantage of the foreign aid bargain and construct a toll facility. Such facilities already exist in the urban areas of some developing countries. Few users can object to paying for using a demonstrably superior facility not enjoyed by users elsewhere.

If, as it appears likely, the foreign lending agencies begin to take a more flexible position concerning standards and the role of the domestic construction industry, foreign aid financing begins to take on many of the characteristics of conventional bond financing, and a developing country may find this a very useful mechanism for getting a realistic road program going. Of particular interest would be the possibility of using such a mechanism to underwrite the financing of toll facilities built and operated by private/public consortia. It is unlikely that the potential for toll road projects would be that numerous in a developing country, and general fund financing will probably be the bulk of the road program. However, collection costs for toll facilities can be low in a country with low priced labor, and the toll mechanism is attractive both because it may generate revenues in addition to general fund allocations and because it is a user charge mechanism that could be employed for cost-based road pricing. It is an important mechanism for road finance in the U.S. and several European countries, and there appear to be no valid reasons why it cannot be utilized to good effect in the road financing arrangements of the developing countries.

HIGHWAY ADMINISTRATION

by

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The proper and successful administration of highway programs involves a multitude of disciplines, ranging from basic planning to more sophisticated planning, and eventually to the implementation of these planning efforts in the form of actual construction.

In achieving this end result, there are numerous tasks which must be performed, all of which must be performed accurately and with a minimum of delay.

The first element in the process is the establishment of an overall policy related to highway transportation. This policy must of necessity be determined at the highest governmental echelon and should define the objectives in general and broad terms.

With this policy firmly established and thoroughly understood, implementation of the policy and the programs is then turned over to those who have been charged with that responsibility.

The first essential element in the implementation of the established policy is the development of a broad long-range plan. To perform this task in a satisfactory manner it is necessary to study all facets of the economic structure of the nation and its subdivisions.

Another requirement is close contact with all segments of the governmental and private sectors such as agriculture, manufacturing, mining, air transport, rail transport, trucking operations, passenger bus transport and recreational development. From these sources will come basic information which will be essential in developing the long-range plan.

Following the development of the long-range objectives it then will be necessary to carefully review the financial resources necessary to implement the plan. This study will again require very close cooperation between the highway administration and those responsible for the financing of the entire governmental operations. In many instances this will be the Minister of Finance.

One of the more successful methods of financing highway construction and maintenance by establishing a separate fund in which taxes and levies imposed on the motor vehicles using the highways are deposited. This money is to be expended solely for construction and maintenance of the public highways. This procedure has proven quite successful in the United States, as evidenced by the fact that not only does the United States Federal Government have such a policy at present, but 38 of the 50 states have somewhat similar policies.

It is recognized that in some countries of the world, where the use of motor vehicles has not increased in proportion to others, it will be necessary to supplement the revenue generated from motor vehicle taxes with funds from other sources until such time as the revenue from the operation of motor vehicles can support the program.

It is, I believe, generally recognized that there are benefits which accrue to others than users from the construction and maintenance of adequate highways, and these benefits could properly be a charge against the general revenues of the country.

The establishment of a highway user "trust fund" to be used solely for the administration, construction and maintenance

of a public highway system does eliminate the need for competing with the many other needs for funding from general revenue sources.

One additional method of financing needed highway improvements is through the construction of toll roads. On these roads each vehicle is required to pay a toll for the privilege of using the road. This procedure is not new. History indicated that toll roads or tollways existed centuries ago in various parts of the world, and today there are numerous toll roads in many countries.

Most of the modern toll roads have been constructed as either public or quasi-public facilities, but there are a few that have been constructed and operated by the private sector. Some have proven to be highly successful ventures from a financial standpoint, while others have not been particularly successful financially.

The proposal for the construction of a toll road requires very intensive study to determine its feasibility, and should not be undertaken unless the studies clearly indicate that it is wholly feasible from all aspects. In several instances the governments have provided limited supplemental funds to insure the financial success of the toll facility.

The long-range plan for highway development should not be considered as the ultimate. It will require review and change from time to time as economic and other factors dictate; however, as change occurs the long-range plan will remain as the total objective.

Short-range plans must be developed within the framework of the overall long-range plan and national policy. Probably the ideal short-range plan should encompass a period of 5 years and should be revised at yearly intervals to reflect the accomplishments each year. Normally a short-range 5-year plan would define improvements over previously selected routes which would be improved with the financial resources estimated to be available within a particular 5-year period.

In developing a 5-year plan it is most important that provision be made for "stopgap" improvements. These are improvements which, in many instances, must of necessity be made outside the scope of the 5-year plan. For example, a bridge which had not been scheduled for replacement until midway in the 5-year plan may fail or be destroyed. Perhaps a major section of highway is rendered unusable from flood damage and must be replaced. These are but a few examples, but they do indicate the need for stopgap provisions in the planning process.

Every plan must be initially based on sound technical and economic analysis, together with consideration of the possible impact on social and environmental aspects of the area. However, it must be recognized that political and other influences may have some effect on purely technical and economic planning.

These influences can be disrupting, but their reality must be recognized. In many instances it may be possible to offset these influences if the long-range plans are thoroughly documented and can be satisfactorily explained. The administrator, however, should recognize that there may be instances where he will have to bow to these influences.

The allocation of available financial resources to individual construction projects, maintenance operations, administration and other elements of a highway program is a very responsible obligation, and in my opinion this responsibility should not rest solely with the chief administrator.

One suggestion would be for a small advisory board or commission, which would be appointed by the head of state to assist the chief administrator in the allocation of funds. This board or commission should represent various geographical areas of the country.

It should be emphasized, however, that this group should in no way be charged with any responsibility for the administration of the program. Their sole responsibility should be in the allocation of the financial resources to the various functions within the highway authority and within the limits of the national objectives. The chief administrative officer of the highway authority should have sole responsibility for the implementation of the program.

The responsible legislative body must enact legislation giving the administrator the necessary authority to implement the highway program, including, but not limited to, hiring employees, purchase of supplies and equipment, regulating traffic, regulating weight, licensing drivers, vehicles, establishing speed limits, policing motor vehicles and other traffic.

ADMINISTRATIVE ORGANIZATION OF HIGHWAYS

by

Mr. Charles E. Shumate,
Executive Director,
Colorado Department of Highways,
Denver, Colorado

There are numerous highway administrative organizations in operation throughout the world at present. The organizational structures of many of these have proven to be reasonably successful; others have failed to achieve the result which they were designed to accomplish. Legal and political decisions have in many instances dictated the organizational structure now being used in many countries. It is not the intention of this paper to analyze nor to discuss in detail the various forms of organizational structure.

However, it is my intention to outline what I believe are the basic principles of organization necessary to establish an administrative structure which will be capable of achieving the best results in achieving the end product; that is, the planning, administration, financing, construction, maintenance, and policing in the most efficient manner possible within a highway system.

Without doubt one of the most important considerations in any organizational structure is the determination and implementation of the two basic elements for satisfactory administration. These are *authority* and *responsibility*, which must go hand in hand.

Perhaps the most satisfactory approach to this phase is to first determine what the responsibilities will be of the multitude of individuals who comprise the organization, starting at the lowest level of each category of employees. For example, the responsibility of the individual engaged in the day-to-day maintenance of a section of highway must be determined. Also, the responsibilities of the lowest level of mechanical repair man, the junior technician engaged in survey work and drafting, must also be determined.

Above these levels there will be individuals who will exercise supervisory functions. The responsibilities of these individuals must also be determined.

It is, of course, not anticipated that each person's responsibility would be determined on an individual basis, except in a very few instances, but that the responsibility of all who are engaged in a similar endeavor would be determined. For example, all maintenance personnel in a specific grade would share similar responsibilities, as would junior technicians, subprofessionals, etc., throughout the entire organization.

Following the determination of these responsibilities, it then becomes necessary to determine the range of authority to accompany each of these groups. For example, even the individual engaged in the routine maintenance of a roadway, or the junior technician who is engaged in survey work or materials testing or drafting, must have authority to exercise his best judgment when direct supervision is not available for consultation.

As the organizational structure develops from the lowest level to the top level, there will be many places where the determination of responsibility and authority will of necessity

have to be established, and in each instance the responsibilities and authority reach greater magnitude.

This approach to the organizational structure working from the bottom toward the top may seem strange to many people, but I believe that most will agree that it is those individuals who perform the day-to-day tasks in maintenance, construction, design, etc., are the ones we depend on for the successful operation of the organization.

These various basic elements of the organization, of course, have great need for supervision from those who, through technical and operating knowledge, can provide the supervision and guidance to them.

As we work up from the lowest echelon through the district or division level (and these two words should be considered synonymous), we ultimately reach the office of the chief administrator and his staff. These are the people who must share the total responsibility for the satisfactory operation of the entire organization.

If the responsibilities and the authority of the various subelements of the organization have been thoroughly defined, and each individual has been informed of his or her responsibilities and authority, then the chief administrative officer and his staff can pinpoint with accuracy where failures have occurred and who was responsible. It then becomes their responsibility to take the necessary steps to correct the deficiency.

The question invariably arises as to what method is used to be certain that each employee understands his or her responsibility and authority. There is one method which has been used most successfully, and which I believe to be the most satisfactory, and that is a simple job description. While it may appear that this method would be a difficult task, in reality it is not.

There will be many employees engaged in the same task with the same responsibilities and authority, and one job description will cover hundreds of employees. The job description for the lower echelon is usually quite brief and simple in language. As the authority and the responsibility increase, the job description becomes somewhat more extensive.

The question has also been raised as to who writes the job descriptions. This is a task that must of necessity be done by those who have thorough knowledge of the various elements of the organization, and what is required from each group.

Graphic organizational charts and staffing patterns are an essential part of any organizational structure; however, all the little boxes and lines of authority are of little value unless they are understood by everyone, and are implemented.

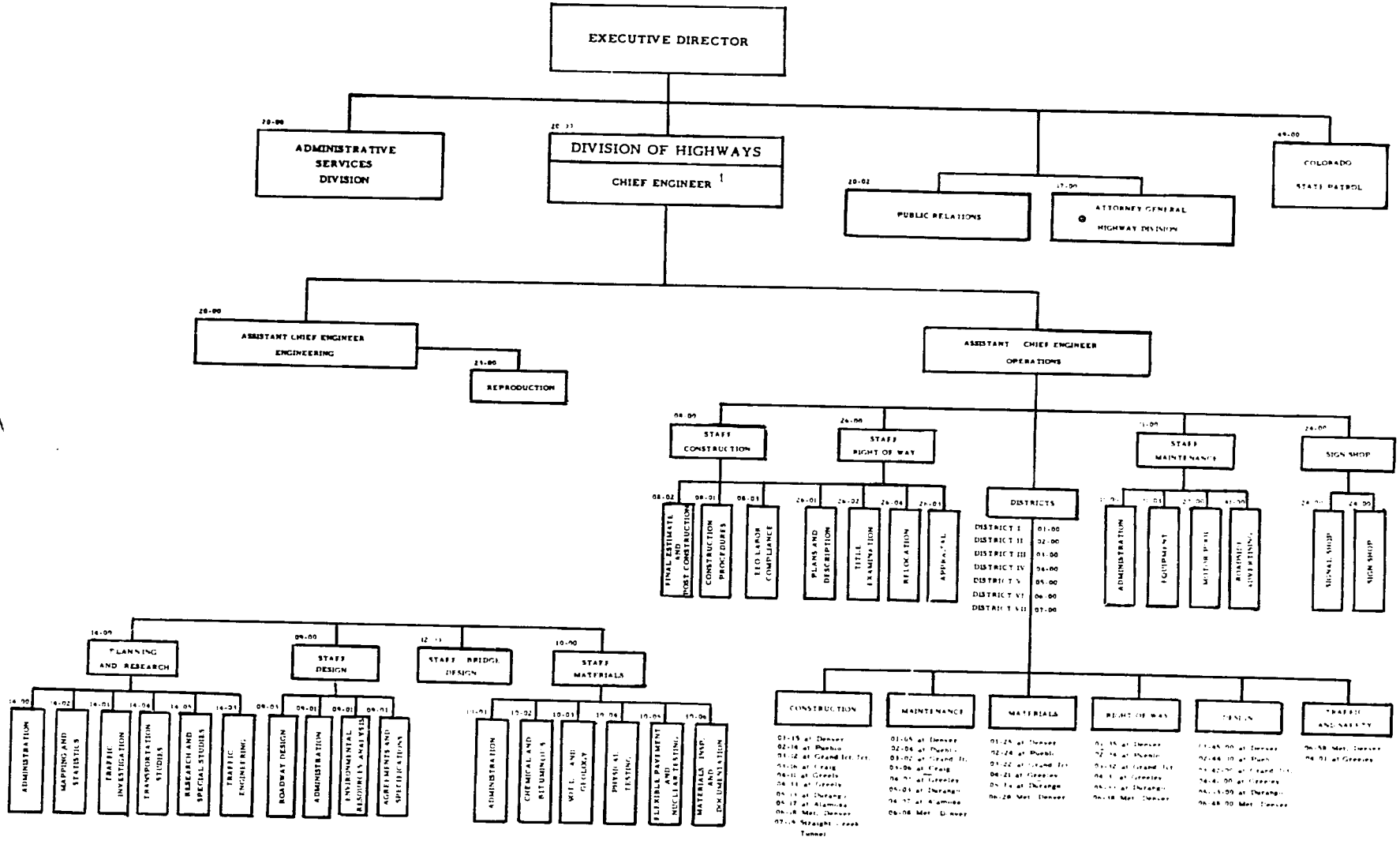
It is assumed that in every country there will be either districts or divisions within the highway organization, and again I would like to point out that the words division and district are synonymous. This district or division would be in charge of an engineer, who would be directly responsible to the chief administrative officer or his deputy.

The district or division engineer would be totally responsible for all activities in his district or division, including, but not limited to, engineering, design, construction, maintenance, right-of-way, fiscal accounting, reporting, etc., subject only to the standards and criteria established by the office of the chief administrator. The district or division engineer would also be charged with the accountability for all equipment assigned to his district and for the expenditures of all funds allotted to his district or division.

The staff of the chief administrator's office should be a *service organization* to the district offices. The chief administrator's office should have the responsibility of developing standards for design, construction, materials, right-of-way acquisition, maintenance, etc. In addition, the chief administrator must of necessity have close fiscal control of all funds expended by his organization.

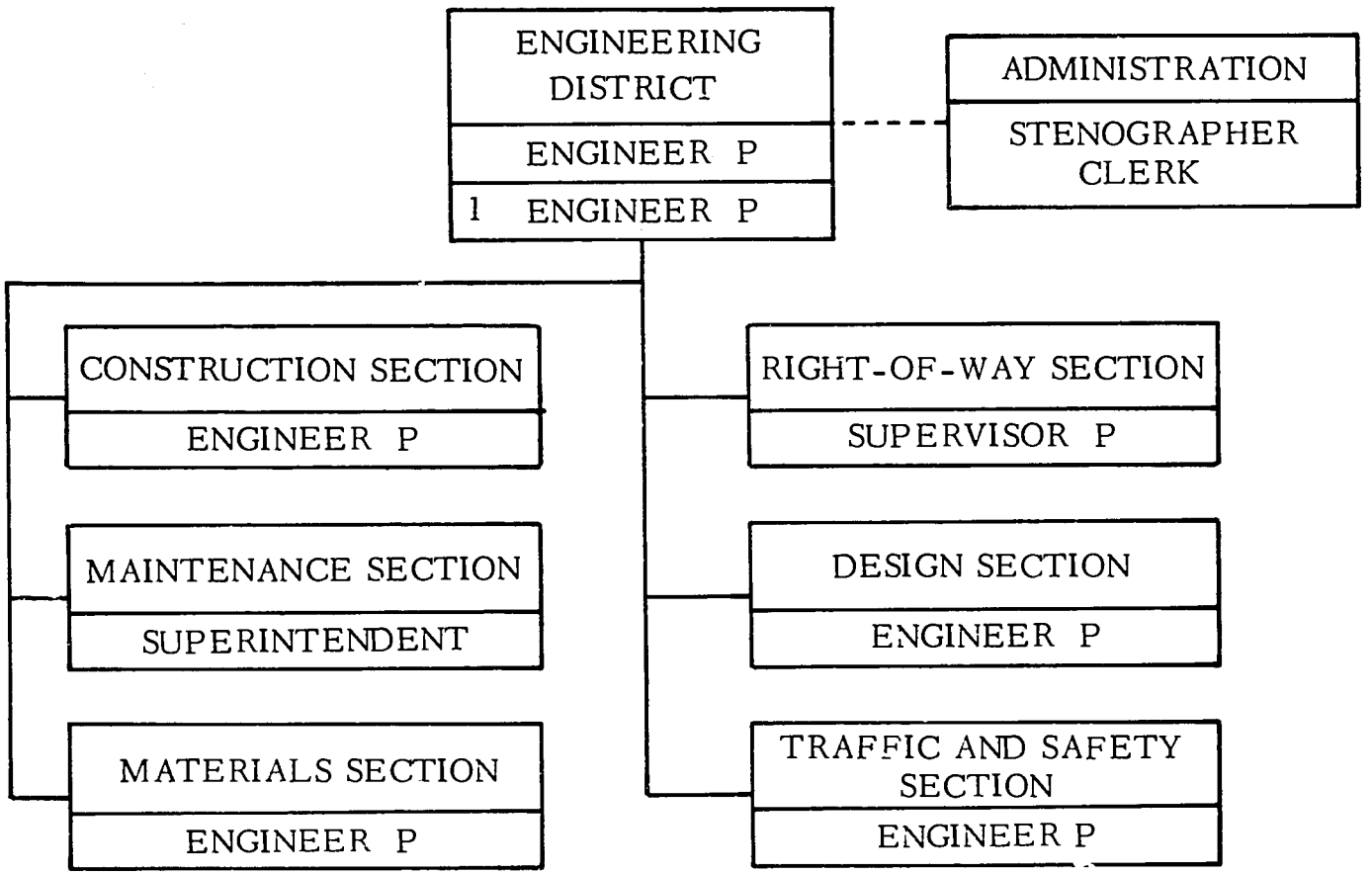
I have taken the liberty of attaching to this brief paper copies of organizational charts and a few selected job descriptions. I do not wish to leave the impression that these charts and descriptions are ideal in all instances, as there are undoubtedly many areas where legal and other constraints would prohibit a similar type of organization. I do believe, however, that a study of these items will indicate that it does outline authorities and responsibilities which are two of the most important elements in a functioning highway organization.

CHART 1


EXECUTIVE DIRECTOR
ADMINISTRATIVE SERVICES DIVISION
DIVISION OF HIGHWAYS
CHIEF ENGINEER
PUBLIC RELATIONS
ATTORNEY GENERAL
HIGHWAY DIVISION
COLORADO STATE PATROL
ASSISTANT CHIEF ENGINEER ENGINEERING
REPRODUCTION
ASSISTANT CHIEF ENGINEER OPERATIONS
STAFF CONSTRUCTION
STAFF RIGHT OF WAY
STAFF MAINTENANCE
SIGN SHOP
FINAL ESTIMATE AND POST CONSTRUCTION
CONSTRUCTION PROCEDURES
EEO LABOR COMPLIANCE
PLANS AND DESCRIPTION
TITLE EXAMINATION
RELOCATION
APPRAISAL
DISTRICTS
DISTRICT I 01-00
DISTRICT II 02-00
DISTRICT III 03-00
DISTRICT IV 04-00
DISTRICT V 05-00
DISTRICT VI 06-00
DISTRICT VII 07-00
ADMINISTRATION
EQUIPMENT
MATERIAL
ROADSIDE ADVERTISING
SIGNAL SHOP
SIGN SHOP
PLANNING AND RESEARCH
STAFF DESIGN
STAFF BRIDGE DESIGN
STAFF MATERIALS
ADMINISTRATION
MAPPING AND STATISTICS
TRAFFIC INVESTIGATION
TRANSPORTATION STUDIES
RESEARCH AND SPECIAL STUDIES
TRAFFIC ENGINEERING
ROADWAY DESIGN
ADMINISTRATION
ENVIRONMENTAL ANALYSIS
AGREEMENTS AND SPECIFICATIONS
ADMINISTRATION
CHEMICAL AND BITUMINOUS
SOIL AND GEOLOGY
PHYSICAL TESTING
FLEXIBLE PAVEMENT AND NUCLEAR TESTING
MATERIALS INVP. AND DOCUMENTATION
CONSTRUCTION
01-15 at Denver
02-10 at Pueblo
03-02 at Grand Jct. Tr.
04-11 at Greely
05-11 at Durango
06-28 Met. Denver
MAINTENANCE
01-04 at Denver
02-04 at Pueblo
03-02 at Grand Jt.
04-21 at Greeley
05-01 at Durango
06-08 Met. Denver
MATERIALS
01-24 at Denver
02-24 at Pueblo
03-22 at Grand Jct
04-21 at Greeley
05-14 at Durango
06-28 Met. Denver
RIGHT OF WAY
01-15 at Denver
02-14 at Pueblo
03-12 at Grand Jct
04-1 at Greeley
05-12 at Durango
06-18 Met. Denver
DESIGN
01-45-00 at Denver
02-44-10 at Pueblo
03-42-00 at Grand Jct.
04-4-00 at Greeley
05-13-00 at Durango
06-48-00 Met. Denver
TRAFFIC AND SAFETY
06-58 Met. Denver
04-01 at Greeley

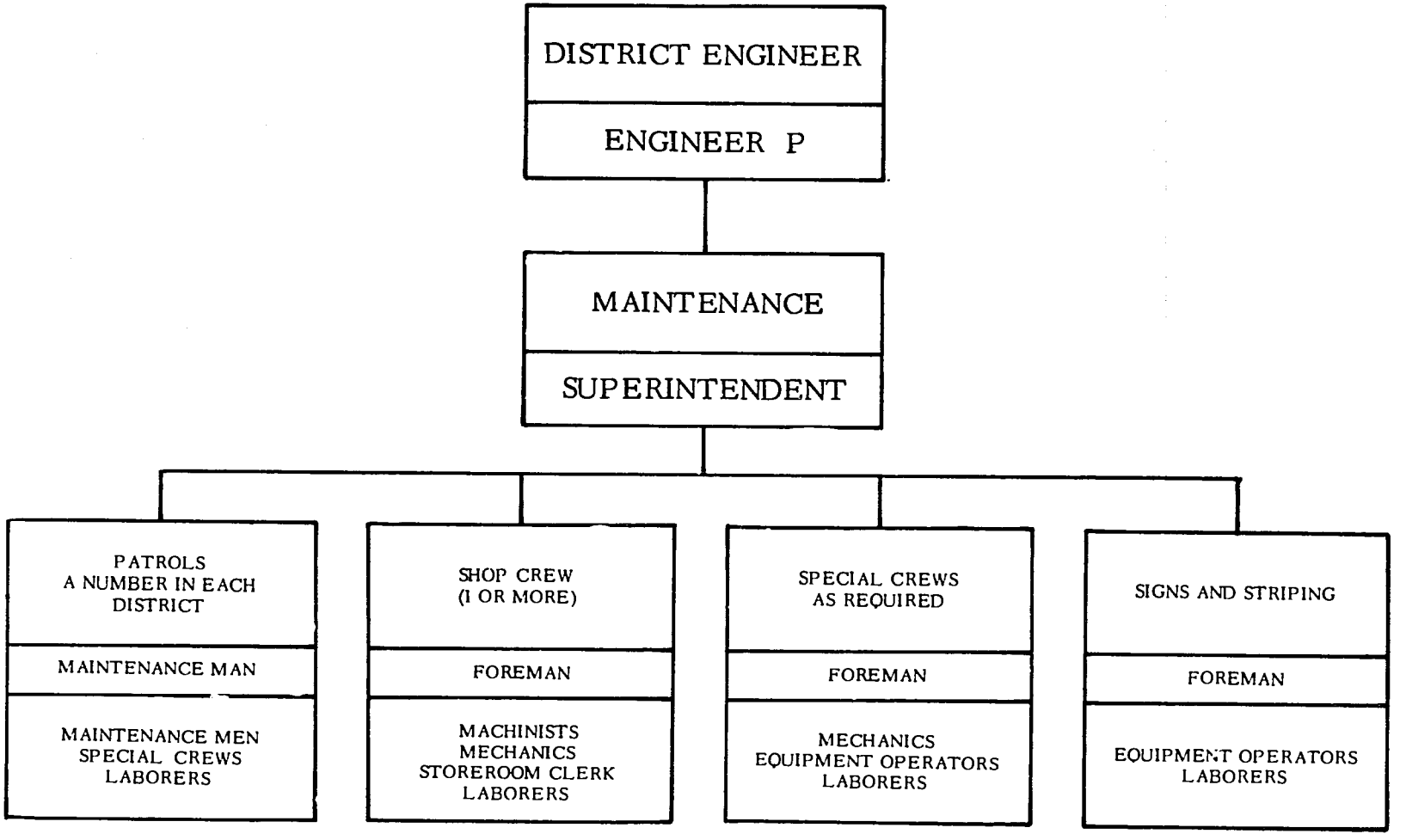
155

CHART 2



1. Also assistant district engineer in selected districts as assigned.

CHART 3


DISTRICT ENGINEER
ENGINEER P
MAINTENANCE
SUPERINTENDENT
PATROLS
A NUMBER IN EACH
DISTRICT
MAINTENANCE MAN
MAINTENANCE MEN
SPECIAL CREWS
LABORERS
SHOP CREW
(1 OR MORE)
FOREMAN
MACHINISTS
MECHANICS
STOREROOM CLERK
LABORERS
SPECIAL CREWS
AS REQUIRED
FOREMAN
MECHANICS
EQUIPMENT OPERATORS
LABORERS
SIGNS AND STRIPING
FOREMAN
EQUIPMENT OPERATORS
LABORERS

JOB DESCRIPTIONS

Colorado State Civil Service Commission

District Engineer

Definition

Plans, directs and administers all functions of a major highway division or district; does related work as required.

Supervision Received

General administrative directions are received in the form of policies, objectives or needs, and the employee proceeds independently in administering the assigned programs.

Supervision Exercised

Supervises a large staff of professional engineers, technicians and other employees.

Distinguishing Features

Class identifies a position having full technical and administrative responsibility for interpreting, organizing, executing, and coordinating a complex and comprehensive recognized major division or district of the Highway Department.

Examples of Work Performed

Plans, directs and administers a major highway division or district involving an extensive knowledge of all phases of highway engineering; programs, plans, and coordinates functions, formulating divisional operational policies and procedures; reviews and evaluates program process, developing budgetary and administrative plans; represents the Department in meetings and conferences, with delegated authority to speak and act for the Department; maintains liaison with other major divisions in conceiving, planning and executing projects.

Specialty Fields

I-A. Roadway Design
I-B. Bridge Design
II. Planning and Research
III. Materials
IV. General
V. Right-of-Way

Required Knowledges, Skills and Abilities

Extensive knowledge of the appropriate engineering principles and practices applied in highway engineering projects. Thorough knowledge of the principles of effective supervision and administration. Considerable knowledge of authoritative reference works in the general field of civil engineering. Considerable knowledge of state and Federal laws and regulations related to the applicable engineering option. Ability to plan and administer the work of a large staff of professional, technical, clerical and other employees. Ability to speak effectively in public. Ability to establish and maintain effective working relationships with associates, subordinates, consultants, public officials and contractors' employees.

Minimum Qualifications

Experience: One year of experience in the specialty fields as an assistant principal highway engineer; or 2 years of experience in the specialty field as a supervising highway engineer in the Colorado Department of Highways.

Necessary Special Requirements: Must be registered as a professional engineer with the Colorado Board of Registration for Professional Engineers.

Colorado State Department of Personnel

Highway Engineering - in - Training I

Definition

As a beginning level trainee in highway engineering, participates in a training program; performs related work as required.

Supervision Received

Work is assigned in detail, reviewed during progress and at completion to assure adherence to sound theories, principles and techniques of highway engineering.

Supervision Exercised

May supervise technicians while completing training assignments.

Distinguishing Features

This is a beginning trainee class, designed to acquaint potential professional highway engineers with the methods and procedures of the Highway Department. It is expected that after 2 years in this class an employee will be promoted to EIT II or be dismissed from the Department for failure to develop.

Examples of Work Performed

Incumbents participate in a training program and perform a variety of duties structured to the individual needs and interests of the trainee and the specific needs of the Department. Duties are such that they challenge and develop potential highway engineers and provide a solid background for the duties they will be assigned as professional highway engineers.

Required Knowledges, Skills and Abilities

Working knowledge of the theories and basic principles of physics, chemistry, engineering mathematics, strength and properties of materials, engineering economics and other courses included in a 4-year college curriculum in civil engineering; ability to apply required knowledges in practical work assignments; ability to establish and maintain effective working relationships.

Minimum Qualifications

Education: Graduation from college with a degree in civil engineering or closely related engineering degree.

Experience: None.

Substitution: Possession of an engineer-in-training (EIT) certificate will be substituted for the college degree.

Colorado State Civil Service Commission

Senior Highway Maintenanceman

Definition

As lead worker and/or patrol leader, supervises a variety of skilled highway maintenance work, which includes the operation of a variety of medium and heavy type maintenance and construction and/or traffic equipment; does related work as required.

Supervision Received

Works under general supervision of highway foreman. Work is assigned with instructions clearly outlining the scope of each project. However, little or no instruction is received on the techniques of operating the equipment or the method used in obtaining the specified results unless difficult problems arise.

Supervision Exercised

Supervises and trains maintenanceman and hourly workers assigned.

Distinguishing Features

An employee in this class is identified as lead worker and/or maintenance patrol leader. The employee is expected to train, supervise and coordinate the activities of lower level maintenanceman and/or hourly workers. At this level, the employee is normally held responsible for a designated stretch of roadway which includes the responsibility for equipment assigned, or supervises a small crew engaged in the specialized maintenance activities.

Examples of Work Performed

Option I: General Highway Patrol Maintenance

As lead worker or patrol leader, participates and supervises general maintenance activities for a designated patrol area; participates and supervises in snow and ice removal; sands and salts icy surfaces; patches breaks in bituminous pavements, repairs cracks in construction joints on concrete roads, fills washouts, grades slopes, installs and maintains snow fences; maintains guard rails and signs and performs related tasks; operates trucks, grades, distributors, heating equipment for bituminous material, snow removal apparatus, loaders, tractors, bulldozers, moving machines, compressors, cement mixers, weed sprayers, sand-cinder spreaders and other equipment used in normal highway maintenance operations; participates in and supervises care and maintenance of equipment; recommends equipment in need of overhaul. Installs and maintains minor drainage control structures; paints and makes minor repairs to bridges; keeps time books, equipment and materials records, and inventories; gives assistance to traveling public in emergencies; as requested supervises installations of private road approaches and utility facilities; prevents encroachment with right-of-way limits by any companies or individuals; acts in a liaison capacity with traffic section and local officials.

Option II: Highway Traffic Marking and Striping

As lead worker, supervises and participates in the operation of highway road marking machinery and equipment; lays out highway traffic marking and guide lines on highways; supervises and participates in painting, center striping, and other highway traffic markings; paints and refinishes highway signs, guard rails, posts, vehicles, road equipment and such highway structures as bridge wing boarding; performs special reflectorized center striping and inserts reflector buttons in guard rails and posts; maintains pressure lining and striping equipment; performs other striping and marking duties as required; maintains necessary reports and records.

Required Knowledges, Skills and Abilities

Knowledge of the practices applied to the care and safe operation of trucks and other medium to heavy construction and maintenance equipment; knowledge of the principles of operation of motor and road marking equipment sufficient to detect defective operation and to make minor repairs or adjustment; knowledge of the state laws and departmental policies pertaining to the operation of equipment upon highways; skill in the operation of assigned equipment sufficient to cover the variety of assigned maintenance and/or traffic marking and striping projects; ability to service and maintain and/or make on-site adjustments on the equipment; ability to maintain routine records and to understand and follow oral and written instructions; freedom from disabling physical defects, and sufficient physical strength to lift heavy objects and to work under adverse weather conditions for prolonged periods.

Minimum Qualifications

Education: High school graduation or GED certificate.

Experience: Three years as a highway maintenanceman, which includes one current year of experience in the option with the Colorado Division of Highways.

Substitution: Passing of an appropriate Civil Service Commission written examination may be substituted for the educational requirement.

Necessary Special Requirements: Must possess a valid State of Colorado driver's license.

LIST OF PARTICIPANTS

DELEGATES

Iran

Mr. Kiumars Sadigh Vaziri	Chief, Soil and Technical Laboratories, Ministry of Roads, Tehran
Mr. Masoud Ostovar	Chief, Road Division, Technical Inspection Department, Ministry of Roads, Tehran
Mr. Mohammad Sara'i Pour	Head, Asphalt Section, Technical Department, Ministry of Roads, Tehran
Mr. Arsalan Khajavi	Asphalt Expert, Maintenance Department, Ministry of Roads, Tehran
Mr. Ghobad Kakavand	Chief Supervisor, Road Construction Department, Ministry of Roads, Tehran

Pakistan

Mr. Tajammal H. Hashmi	Joint Secretary, Transport Ministry of Communications, Islamabad
Mr. A.A. Jamal-ud-Din	Chief Engineer, Highways, Government of the Punjab, Lahore
Mr. T. M. Sheikh	Secretary, Communications and Works Department, Government of Sind, Karachi
Mr. M. Yaqoob Khan	Chief Engineer, Public Works Department, Government of N.W.F.P., Peshawar
Mr. G. H. Baluch	Secretary, Communications and Works Department, Government of Baluchistan, Quetta
Mr. Sibtul Hasan Shah	Superintending Engineer, Highway Circle, Government of the Punjab, Rawalpindi

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Mr. Yalçın Alaybeyoğlu	Chief, Traffic Survey, General Directorate of Highways, Ankara
Mr. Aytekin Akdevelioğlu	Chief, Economic Analysis Section, General Directorate of Highways, Ankara

Mr. Nizamettin Atasayan	Deputy, Plan and Project Department, General Directorate of Highways, Ankara
Mr. Ahmet İlter	Chief, Planning, First Regional Division, General Directorate of Highways, Ankara

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Mr. Harvey Klemmer	U.S. Coordinator
Dr. L.L. Waters	Chairman, Department of Transportation, Indiana University
Dr. Louis Berger	President, Louis Berger, Inc., East Orange, New Jersey
Dr. Virgil Cover	Professor of Transportation and Dean of Graduate Studies, University of Georgia
Mr. Robert Burns	U.S. Department of Transportation
Mr. Charles Shumate	Executive Director, Colorado Department of Highways, Denver, Colorado

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Mr. Syed Fayyaz Ali Shah	Chief Engineer, Research
Mr. Mian Mohammad Shafi	Deputy Chief Engineer, Bahawalpur
Mr. A.H. Aslam	Chief, Housing and Transport, Lahore
Mr. Tajamal Hussain Qureshi	Superintending Engineer, Highway Circle, Lahore

Mr. Inam Bari Pervaize	Director, P & D, Highway Department, Punjab, Lahore
Mr. Mohammad Yunas Khan	Executive Engineer, B & R Division, Peshawar
Mr. Ghulam Mohammad Shah	Assistant Engineer, Field Test Unit, Peshawar
Mr. Asif Ali Sheikh	Executive Engineer, Highways, Karachi
Mr. Syed Riaz Hussain	Executive Engineer, Road Maintenance Division, Hyderabad

United Kingdom

Mr. W.F.M. Moris	British Consul General, Lahore

CENTO Secretariat

Mr. Mostafa Modjtahedi	Assistant Economic Secretary

U. S. - FINANCED CENTO ECONOMIC PUBLICATIONS

. Seminar on Cattle and Sheep Breeding, 1959
. Seminar on Land Classification and Soil Survey, 1959
. Seminar on Forestry, 1959
. Conference on Minerals, 1959
* 5. Progress Report, Coordinating U.S. Action for CENTO, 1959-60
* 6. Conference on Development Programming, 1960
* 7. Symposium on Chrome Ore, 1960
* 8. Conference on Teaching of Preventive Medicine, 1961
* 9. Conference on Industrial Development Banking (1), 1961
*10. Symposium on Coal, 1961
*11. Progress Report, Coordinating U.S. Action for CENTO, 1961-62
12. Traveling Seminar for Increased Agricultural Production, 1962
*13. Conference on Agricultural Development Banking, 1962
*14. Conference on National Income Accounting, 1962
*15. Conference on Development Planning, 1962
*16. Conference on Teaching Health Centers, 1962
*17. Conference on Industrial Development Banking (2), 1962
*18. Conference on Establishment of National Scientific Organizations, 1962
*19. Symposium on Industrial Rocks and Minerals, 1962
20. Seminar on Cost and Return Ratios for Major Agricultural Products, 1963
21. Conference on Teaching of Science, 1963
*22. Symposium on Rural Development, 1963
*23. Symposium on Iron Ore, 1963
*24. Symposium on Consumer Expenditures, 1963
25. Conference on Agricultural Development Policy, 1963
26. Symposium on Management Training in Public Administration, 1964
27. Conference on Nursing Education, 1964
28. Conference on Hospital Administration, 1964
29. Traveling Seminar on Range Management, 1964
*30. Conference on Manpower Needs and Training of Environmental Sanitation Personnel, 1964
*31. Symposium on Mining Geology and the Base Metals, 1964
32. Traveling Seminar on Agricultural Credit and Cooperatives, 1964
33. Symposium on Industrial Statistics, 1964
34. Symposium on Scientific and Industrial Research, 1964
*35. Second CENTO Veterinary Pathology Seminar, 1964
36. Symposium on the Role of Local Government in National Development, 1965
*37. Symposium on Tax Administration, 1965
38. Symposium on the Development of Capital Markets, 1965
39. Traveling Seminar on Veterinary Education and Animal Health, 1965
*40. Traveling Seminar on Fresh Fruit and Vegetable Marketing, 1965
*41. Seminar on Field Techniques for Mineral Investigation, 1965
*42. Progress Report, Coordinating U.S. Action for CENTO, 1962-65

43. Symposium on Hydrology and Water Resources Development,
44. Conference on Land Classification for Non-Irrigated Lands,
45. Symposium on Household Surveys, 1966
46. Summer Training Program in Geological Mapping, 1966
47. Traveling Seminar on Farm Tools and Implements, 1966
48. Symposium on Mine Health and Safety, 1966
49. Conference on Engineering Education, 1966
50. Conference on Agricultural Extension, 1967
51. Traveling Seminar on Processing and Marketing of Fruit and Vegetable Products, 1967
52. Summer Training Program in Geological Mapping, 1967
53. Conference on National and Regional Agricultural Development Policy, 1967
54. Symposium on Agricultural Statistics, 1967
55. Traveling Seminar on Marketing of Livestock and Livestock Products, 1967
56. Conference on Combating Malnutrition in Preschool Children, 1968
57. Symposium on Development and Utilization of Mineral Resources, 1968
58. Conference on Industrial Vocational Education, 1968
59. Conference on Earthquake Hazard Minimization, 1968
60. Report of the Ad Hoc Working Party on Fertilizers, 1968
61. Decade of Development, a Ten-Year Compendium, 1959-69
62. Symposium on Demographic Statistics, 1968
63. Progress Report, Coordinating U.S. Action for CENTO, 1965-69
64. Geology and Ore Deposits of the Lakan Lead-Zinc District, Iran, 1968
65. Symposium on Manpower Planning and Statistics, 1969
66. Conference on National and Regional Livestock Development Policy, 1969
67. Geology and Ore Deposits of the Sizma-Ladik Mercury District, Turkey, 1969
68. Conference Series on the Teaching of Public Health and Public Health Practice, 1970
69. Conference on Broadening Public Participation in Equity Investment, 1970
70. Traveling Seminar on Management and Financing of Marketing Cooperatives, 1970
71. Conference on Forestry Development Policy, 1970
72. Seminar on Veterinary Investigational and Diagnostic Methods, 1970
73. Traveling Workshop on Range Management, 1970
74. Symposium on Price Statistics, 1970
75. Workshop Series on Clinical and Applied Research on Family Planning, 1971
76. Workshops on Marketing of Livestock and Their Products, 1971
77. Symposium on Central Banking, Monetary Policy and Economic Development, 1971
78. Seminar on Agricultural Planning, 1971
79. Seminar on Agricultural Aspects of Arid and Semi-Arid Zones, 1971
80. Seminar on the Application of Remote Sensors in the Determination of Natural Resources, 1971
81. Seminar on Industrial Relations, 1972
82. Seminar on Public Health and Medical Problems Involved in Narcotics Drug Addiction, 1972

83. Workshop on Educational Responsibilities of Nurses and Midwives in Relation to Family Planning in Maternal and Child Health Services, 1972
84. Seminar on the Control and Eradication of Viral Diseases in the CENTO Region, 1972

* Out of print

The above list includes all publications financed by the Office of the U.S. Economic Coordinator for CENTO Affairs. Most of the older books are now out of print and are no longer available. However, copies of those still in stock may be obtained by writing to:

Public Relations Division,
Central Treaty Organization,
Old Grand National Assembly Building,
Ankara, Turkey