13.2 Effect on National Income Increase

(1) Basic Concept

With the opening of the Project Road, travel distances among regions in the nation are to be greatly reduced. Especially the travel distance between The Eastern Terai, the bread basket of the nation, and the Kathmandu Valley, capital of the nation, will be reduced to almost two-thirds of the present*. The reduction in travel time is expected to contribute to the level up of national income standard not only through the "direct effect" of the Project Road but also through the "indirect effect". Indirect effect in this respect means such changes in economic activities as below:

- Vitalization of input (material) - output (product) relation among the different industries in different regions, and resultant level up of national economy.
- Realization of more facilitated production - consumption relationship among the peoples in different regions.

(2) Amount of Income Increase

Accoridng to the model developed in 6.3.3, these changes in inter-regional accessibility will theoretically bring about additional NRs. 1,332 million in the year of 1995 (NRs. 1,644 million in 2000) as shown in Table 13.1. Although these figures are theoretical ones estimated under the ideal conditions, but with the carefully

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* With the opening of the Project Road the travel time between these two regions will be reduced to 5 hours from 9 hours at present.

designed program for regional development, in which the role of the Project Road is placed in the center, these figures are possible to be attained.

(3) Secondary Effect

Should these increase in regional income be realized, they would stimulate other factors in national economy, e.g. absorption of unemployment, prevention of incessant migration from the hilly area and amelioration of international trade unbalanceness, under the proper initiatives taken by the government.

Table 13.1 Impact on Regional Income by the Changes in Accessibility Among Regions*

(Unit: NRs. Million)

Region	1995			2000		
	Trend Type Regional Income (1)	Impact Type Regional Income (2)	Amount of Increased Income (2)-(1)	Impact Type Regional Income (1)	Impact Type Regional Income (2)	Amount of Increased Income (2)-(1)
C.D.R.	28,145	29,013	868	34,725	35,777	1,052
E.D.R.	18,619	19,083	464	23,799	24,391	592
Study Area	46,764	48,096	1,332	58,524	60,168	1,644

* This table is the rearrangement of Table 6.2 and 6.3.

13.3 Effect on Agriculture Sector

13.3.1 General

From the nature of Nepal's national economy which is mainly based upon agriculture, most of the increased income studied in the previous section is related to agriculture sector. From the above, more microscopic analysis about agriculture sector is to be conducted here. The study here consists of following sub-studies:

- Impact on agricultural land use
- Effect on the distribution of agriculture products
- Modernization in agriculture sector

13.3.2 Impact on Agricultural Land-Use

The Project Road is expected to expand the sphere of market for agriculture products. Reduced transportation time to the Kathmandu valley and Janakpur from the Hilly Region in C.D.R. will encourage the transportation of fresh agriculture products of the hill area to the places of great consumption, like Kathmandu. These changes in accessibility to the market or places of consumption will promote the change in agricultural land-use pattern in the areas nearby the Road. Transition in plantation from substantial crops (rice and other grains) to cash crops and crops with high value-added will be prevailed in these areas.

Experiences in the advanced countries in the world reveal that the transition in agricultural land-use pattern tends to be conducted according to a certain formula, in which

the distinct pattern in plantation emerges in accordance with the distances from the places of consumption.

Fig. 13.2 illustrates the above tendency in agricultural land use pattern. The lands near the urban fringe, say the lands within a radius of 10 km of the urban fringe are thought utilized for the planting of vegetables, intending the supply of these products to urban people.

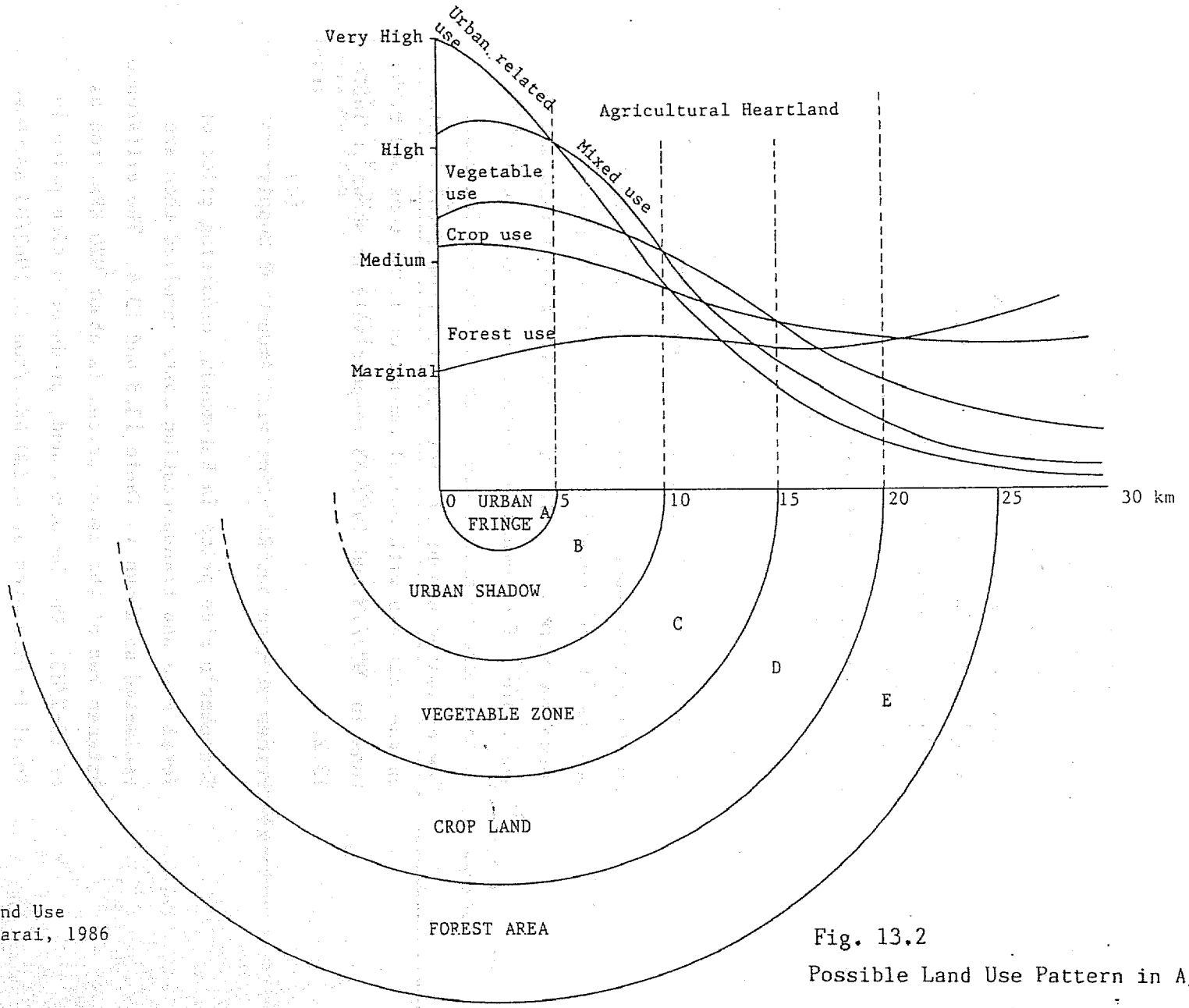
In the area along the Project Road, farm land, especially the flat land, is very limitted since most of the Project Road passes through very steep area in the hillsides, but in spite of these geographical constraints, the cropping pattern nearby the road is expected to transit from traditional planting of substantial crops to more profitable ones, such as vegetable and fruits.

The traditional style in agriculture, which has long been based on the plantation of substantial crops will be exposed to the mechanism of market economy.

13.3.3 Effect on the Distribution of Agricultural Products

(1) Background

Inadequate method of transportation sometimes forces great dis-economy to the whole nation. The economy of Nepal is typical one. In fact, in Nepal such a contradiction in national economy, as export of surplus rice in certain areas even at the time when the other parts of nation are in want of rice, is seen so often. This kind of dis-economy is mainly due to the lack of transportation facility and high prices of consumer goods resulted from it. The Project Road will greatly contribute to the



Source:
Integrated Land Use
Planning in Tarai, 1986

Fig. 13.2
Possible Land Use Pattern in Agriculture

amelioration of such contradictions in the national economy.

The study here aims at the understanding of the process in which the Project Road would contribute to the creation of better environment for the price formation of agriculture products and for their distribution, taking rice as an example. The study hereafter is conducted under a simplicity of real situations due to lack of sufficient information about them. But this kind of analysis will be helpful for the understanding of the changes in rice economy due to the Project Road.

(2) Nature of Rice Economy in Nepal

1) Demand of Rice in Kathmandu* and Supply from the Terai.

As statistics about rice is very limitted in Nepal, the amounts of rice demanded, supplied and transported in Kathmandu were estimated based on fragmental information available. The demand for rice in the Kathmandu area is on the increase mainly due to the population increase. The estimated amount of rice supplied from Terai is also on the increase with annual amount of 1,781 tons and 9,866 tons in 1977/78 and 1982/83 respectively as shown in Table 13.2.

2) Prices of Rice and Relation with Amount of Supply

Consumer's rice price in Kathmandu, exporting price of Terai rice and transportation costs involved them are estimated as shown in Table 13.3 and 13.4. The difference between two of the above prices is about 920 NRs./ton as of 1982/83. On the otherhand, producer's rice price in Terai is estimated at 4,230 NRs./ton in 1982/83 as shown in Table 13.4.

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* For statistical reason, "Kathmandu" here includes whole of the Bagmati Zone.

Table 13.2 Demand and Supply of Rice in Kathmandu* and Supply from the Terai

(Unit: Ton/Year)

Item	1977/78	1982/83	Remark
Demand for Rice in Kathmandu (1)	96,408	104,725	Per-capita rice consumption of 0.058 ton/year is assumed. (Source: Nepal Statistical Pocket Book 1984)
Amount of Rice Producted in Kathmandu (2)	94,627	92,545	Source: Nepal Statistical Pocket Book 1984
Amount of Rice Supplied from Terai (3)	1,781	12,180	(1) - (2)
Amount of Imported Rice (4)	-	2,314	. 1977/78: Zero . 1982/83: Rate of self-sufficiency of 0.81 is assumed.
Amount of Rice Supplied from Terai (5)	1,781	9,866	(3) - (4)

Table 13.3 Prices of Rice

(Unit: NRs./ton)

Item	1977/78	1982/83	Source
Consumer's Rice Price in Kathmandu	2,190	5,430	Nepal Statistical Pocket Book, 1984 and Rice in Nepal*
Exporting Rice Price to India	1,820	4,510	Rice in Nepal

* Rice in Nepal by R.N. Mallick, 1981

Table 13.4 Composition of Rice Prices (1982/83)

(Unit: NRs./ton)

	Final Prices	Distance of Trans-portation (km)	Trans-porta-tion cost 3)	Margin Gained by Nepal Traders 4)	Producer's Rice Price in Terai
Rice Exported to India	4,510	138[1)] km	280	-	4,230
Rice Consumed in Kathmandu	5,430	368[2)] km	740	460	4,230

1) Distance between Janakpur and Birganj along the Project Road

2) Distance between Janakpur and Kathmandu along the existing road

3) 2 NRs./ton*km is assumed.

4) It is assusmed that Nepal trader's margin is zero for the rice exported to India, on the other hand, one half of the balance between consumer's rice price and exporting price is regarded as the margin gained by Nepal's rice traders.

With the comparison between amount of rice transported from Terai (Table 13.1) and prices of rices estimated, elasticity of rice supply against the consumer's rice price in Kathmandu is roughly estimated as below:

$$Es = \frac{Q^2_{TK} - Q^1_{TK}}{0.5\,(Q^1_{TK} + Q^2_{TK})} \Big/ \frac{P^2_K - P^1_K}{0.5\,(P^1_K + P^2_K)}$$

$$= \frac{9,866 - 1,781}{0.5\,(1,781 + 9,866)} \Big/ \frac{5,430 - 2,190}{0.5\,(2,190 + 5,430)}$$

$$= 1.6$$

where,

Es : Elasticity of rice supply from Terai to Kathmandu

Q^1_{TK}: Amount of rice supplyed from Terai to Kathmandu in 1977/78 (Table 13.2)

Q^2_{TK}: Amount of rice supplyed from Terai to Kathmandu in 1982/83 (Table 13.2)

Q^1_K : Consumer's rice price in Kathmandu in 1977/78 (Table 13.3)

P^2_K : Consumer's rice price in Kathmandu in 1982/83 (Table 13.3)

Consumer's rice price in Kathmandu is relatively high compared to that of exporting due to large transportation cost and traders' margin involved in the distribution. This is the main reason behind the irrational demand-supply relationship of rice within one economy, in which the surplus rice of Terai is sometimes exported to

India even at the time when the other parts of nation is in serious want of rice.

(3) Effect of the Project Road on the Distribution of Rice

With the opening of the Project Road, the distance between Janakpul, assumed center of the Terai, and Kathmandu is expected to be reduced to 190 km from 368 km of present. This fact will result in the reduction of transportation cost to the level of 51% of the present one*.

The role of this transportation cost saving is quite significant. In conclusion, the reduction in transportation cost of rice is beneficial both to consumers in Kathmandu and to producers in Terai.

Fig. 13.3 illustrates the effect of reduction in transportation cost. Assuming Sp, Dp and Dr as the supply curve of rice for producer in Terai, demand curve of rice perceived by producers in Terai and demand curve of rice for consumers in Kathmandu respectively estimated based on the information explained in the previous section, present equilibrium points with the amount of rice transported (9,866 tons/year; as of 1982/83, ref. Table 13.2), producer's rice price in Terai (4,230 NRs./ton, 1982/83, ref. Table 13.4) and consumer's rice price (5,430 NRs./ton, 1982/83, ref. Table 13.3) are denoted by the

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* Applying unit transportation cost of 2 NRs./ton.km which is same as the assumption made in the Table 13.4, the transportation cost after the opening of the Project Road is estimated at 380 NRs./ton, which is equivalent to 51% of present level (240 NRs./ton).

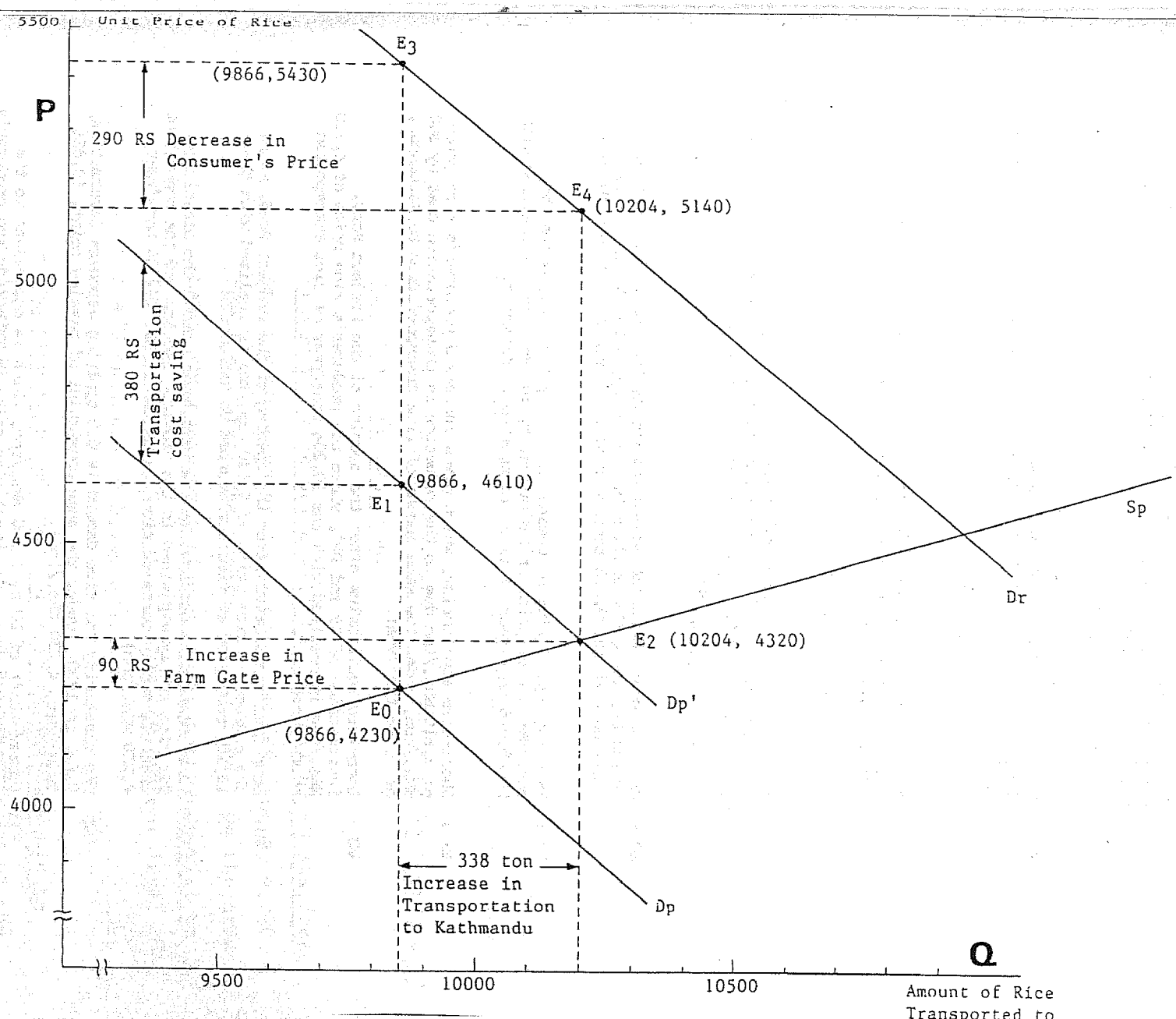

Fig. 13.3 Effect of Reduction in Transportation Cost on the Transportation of Rice

Explanation of Fig. 13.3

SP : Existing supply curve of rice from Terai to Kathmandu, which passes the point E0 (9,866 tons/year, 4,230 NRs./ton), defined by the following equation:

$P = 1587 + 0.2679Q$ *1)

DP : Existing demand curve of rice faced by Terai producers, which passes the point E0 (9,866 tons/year, 4,230 NRs.), defined by the following equation:

$P = 12689 - 0.8574Q$ *2)

DR : Existing demand curve of rice faced by Kathmandu consumers, which passes the point E3 (9,866 ton/year, 5,430 NRs.), defined by the following equation:

$P = 13899 - 0.8574Q$ *3)

DP': New demand curve of rice which will be faced by Terai producers after the opening of the project road, passing the point E1 (9,866 tons/year, 4,610 NRs.), defined by the following equation:

$P = 13069 - 0.8574Q$ *4)

EO : Existing equilibrium of demand and supply for rice, intersection of SP and DP, where the producer's rice price, 4,230 NRs./ton, is realized with the 9,866 tons/year of rice transported to Kathmandu.

E3 : Existing equilibrium of demand and supply for rice, where the consumer's rice price in Kathmandu, 5,430 NRs./ton, is realized with the 9,866 tons/year of rice transported to Kathmandu.

E1 : Short-term equilibrium, which gives increased producer's rice price of 4,610 NRs./ton due to the reduction in transportation cost by 380 NRs./ton, under the same amount of rice transportation to Kathmandu, or 9,866 tons/year.

E2 : Long-term equilibrium after the opening of the Project Road, intersection of SP and DP', where the producer's rice price of 4,320 NRs./ton is realized with the 10,204 tons/year of rice transported to Kathmandu.

E4: Long-term equilibrium after the opening of the Project Road, where the consumer's rice price of 5,140 NRs./ton is realized with the 10,204 tons/year of rice transported to Kathmandu.

*1) This relation is obtained by the information about the elasticity for rice supply explained in the previous section and the constraint that the supply curve of rice passes the point, (9,866 tons/year, 4,230 NRs./ton).

*2) The elasticity for rice demand is 0.5 applying Japanese information, 0.66, in 1960. Under the same constraint of passing point, (9,866 tons/year, 4,230 NRs./ton).

*3) Upward-shift of DP by 1,200 NRs./ton, which is equivalent to the defference between consumer's rice price in Kathmandu and producer's rice price in Terai.

*4) Upward-shift of DP by 380 NRs./ton, which is equivalent to the saved transportation cost by the Project Road.

points E0 and E3. But with the reduction of transportation cost by 380 NRs./ton by the Project Road, producers in Terai will face new demand curve (Dp'), which is the upward-shift of existing demand curve (Dp) by 380 NRs./ton. The point denoted E1 is a short-term equilibrium, in which 9,866 tons of rice are transported to Kathmandu at the unit cost of rice with 4,610 NRs./ton for the producers in Terai.

But E1 does not mean a long term equilibrium. The long-term equilibrium is to be realized at the point E2, where the new demand curve Dp' intersects with the supply curve Sp. At E2, 10,204 tons' rice are supplyed to Kathmandu at the unit cost of 4,320 NRs./ton for the producers in Terai. Corresponding consumer's rice price in Kathmandu is shown at the point E4, locating on the demand curve Dr, where 10,204 tons of rice are purchased at the unit cost of 5,140 NRs./ton.

In conclusion, the opening of the Project Road would bring about such advantage in Nepal's rice economy as follow:

- Transportation cost of rice from Terai to Kathmandu will be cut by 380 NRs./ton.

- Producer's rice price will be enhanced by 90 NRs./ton, or from the present level of 4,230 NRs./ton to 4,320 NRs./ton, after the opening of the road. On the other hand, the consumer's rice price in Kathmandu will be reduced by 290 NRs./ton, or from the present level of 5,430 NRs./ton to 5,140 NRs./ton.

- The rice supplied from Terai to Kathmandu would be increased by 338 tons/year due to the opening of the Project Road, or from present level of 9,866 tons/year to 10,204 tons/year.

It is expected that this increased flow of rice into Kathmandu would contribute to the eradication of such irrational behavior in national economy as export of Terai rice to India while the other parts of nation are in want of rice.

The above will be true of for many other agricultural products in Terai.

13.3.4 Modernization in Agricultural Sector

It is expected that the such improvements in agriculture cropping pattern and in circulation of agriculture products as mentioned above would encourage the further development in agriculture.

In effect, the opening of the Project Road would change the traditional agricultural style in the surrounding areas of the road into more modernized one in the following sense:

- Organized agriculture system:

  Establishment of agriculture cooperative associations, collection and delivery center of agriculutre products and agricultural items such as fertilizer, seeds and agriculutral chemicals.

- Introduction of new technology:

  New agricultural method, plantation of high-yielding spices, etc.

- Dissemination of market information:

  Information about agricultural products, fluctuation of price, demand and consumer's choice.

These modernizations in agriculture are to be attained with the carefully designed agricultural development plan taking advantage of the function of the Project Road.

13.4 Effect on International Trade

13.4.1 Stimulation of Exporting Industry

It is easily imagined that the Project Road will stimulate the nation's trade with foreign countries, especially trade with India. The Project Road will contribute to the amelioration of unbalanced international payment of this country in a long term. Although the sudden increases in construction material for the Project and consumption goods as the result of expanded expenditure might invite greater amount of import at the beginning, but in a long term, expansion of export will be achieved through the boost of domestic industry.

Recent trade balance with India is in favor of Indian side, and Nepal has to import even the daily commodities from India. At present the volume and range of export from Nepal to India is extremely limitted. But it is recommented, first of all, Nepal should pursue the way of vitalizing light industries utilizing the function of the Project Road as possible as she can. Vitalization in light industries would trigger the development of other exporting industries.

13.4.2 Vitalization of Jaleswor Border Customs

As far as the Central Development Region is concerned, most of the cargoes exported and imported to and from India are transported by way of Birganj Border Customs. But with the opening of the Project Road, it is expected that more cargoes are transported by way of Jaleswor Border Customs, especially the cargoes to and from Kathmandu are to be transported by way of this Border

Customs rather than by way of Birganj, because of better location of Jaleswor Border Customs with the Project Road.*.

As a matter of fact, the vitalization plan of Jaleswor Border Customs, function of which is very limitted now, involves many issues to be solved. Major of them may be need of consultation with Indian Government about the provision of access road and facilities in the Indian side, and political issues revolving around the plan.

But this kind of transfer of major role of Border Customs will result in a creation of rational transportation pattern not only for Nepal side but for Indian-side, since the distance between Jaleswor and Culcutta, the latter is the major industrial city and center of international trade, is shorter than that of between Birganj and Culcutta. Fig. 13.4 ascertains the above.

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* After the opening of the Project Road, travel time between Kathmandu and Jaleswor will be about 5 hours, which is shorter by 1 hours than that of between Kathmandu and Birganj, which is about 6 hours.

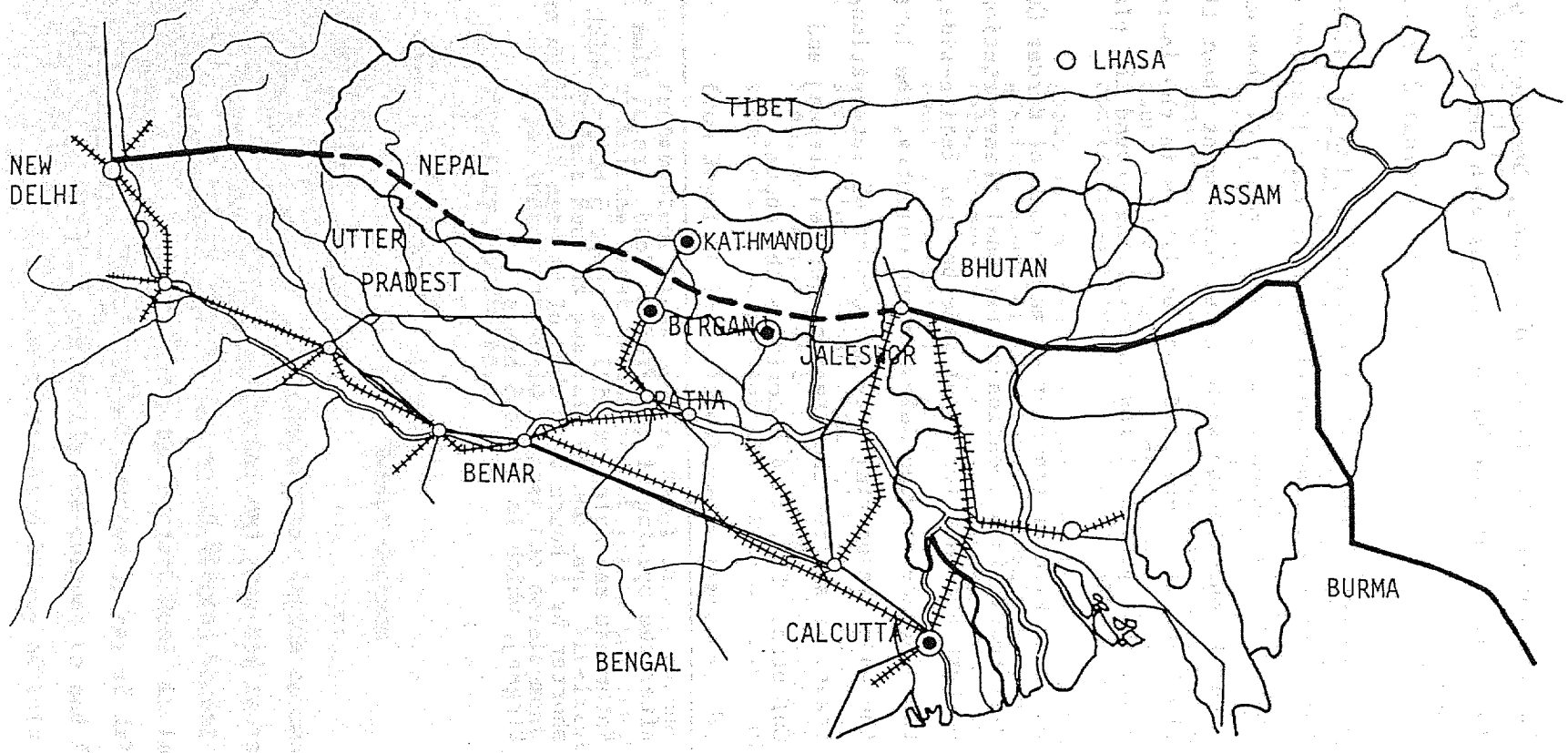

Fig. 13.4 Access to Culcutta, Major Trade Center in India

13.5 Promotion of Related Infrastructure Development Projects

The Project Road has another incentive role in encouraging other on-going and new regional foundation development projects. At present, there exist many development project in the area surrounding the Project Road, including irrigation projects and multi-purpose dam construction projects as shown in Fig. 13.5. It is obvious that the Project Road would promote early realization of these projects.

13.5.1 Functional Mutualism

The Project Road would contribute to the related infrastructure construction projects, especially those projects which exist nearby the Project Road such as Sun Koshi No.2, and No.3 dam and irrigation project in the East Terai, through the provision of easy access road to these sites. Construction materials, machinery and personnel involved are to be transported to these site by the Project Road. In addition, the Project Road would make it possible to apply the machinery and engineering technique, introduced for the construction of the Project Road, for these infrastructure construction projects.

13.5.2 Project Road as an Incentive to Integrated Regional Development

Besides the above, the Project Road would strengthen the organic interdependence among the projects and would widen the scope of regional development. For instance, increased yields of agricultural products, by a certain irrigation project or multi-purpose dam, might stimulate the demand for transportation on and around the Project

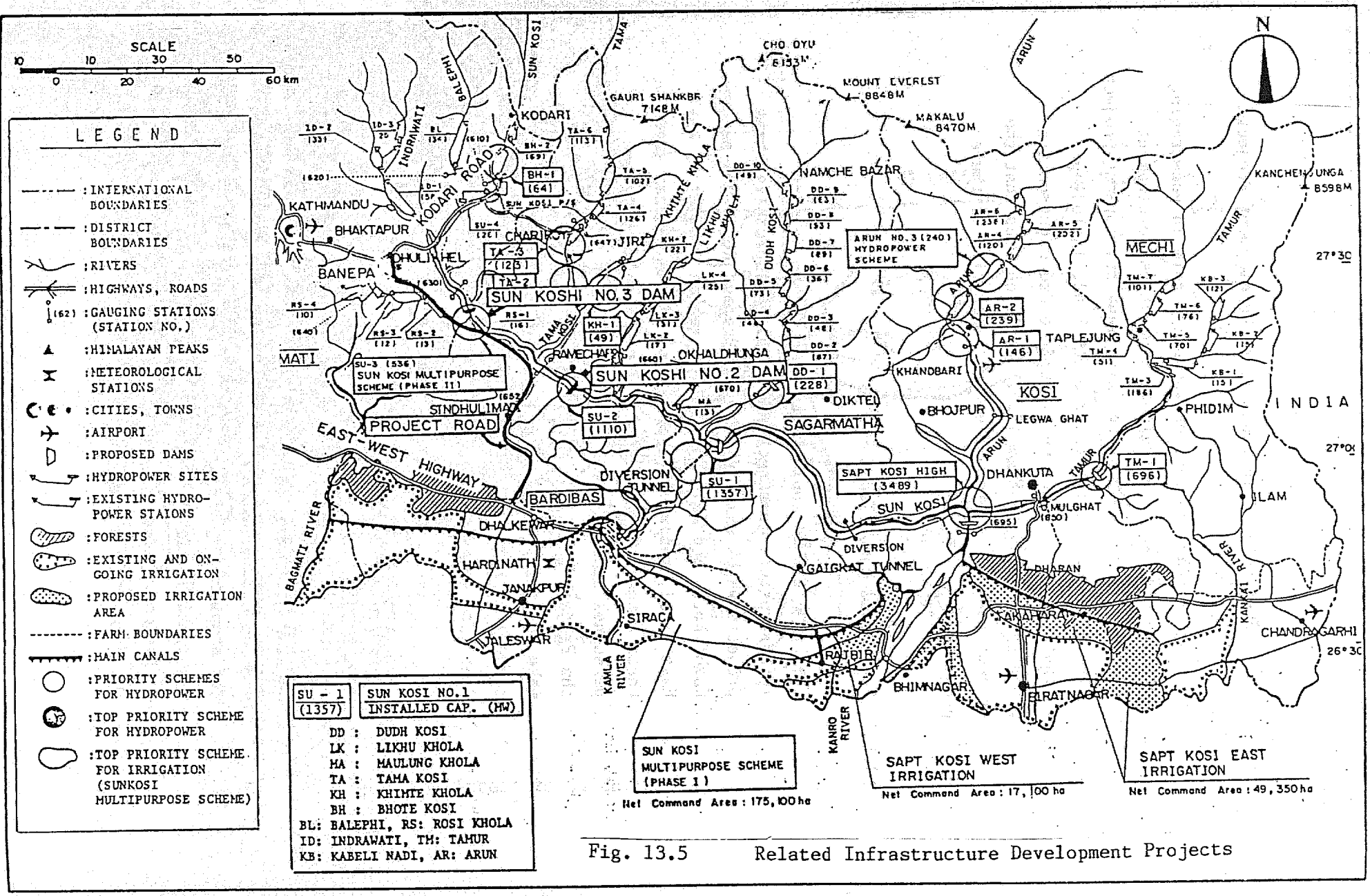

Fig. 13.5 Related Infrastructure Development Projects

Road, which in turn would induce another road construction and other infrastructure construction projects.

In a long term, it is imagined that the Project Road will play a key role for the compilation of comprehensive regional development plan in more wider area. Another comprehensive land use plan, like the Integrated Hill Development Plan (IHDP), surrounding the Lamosangu-Jiri road Project*, has a great chance to be proposed, pivoting around the the Project Road. It might not be exageration to say that the Project is an initial step for the possible comprehensive development in the Cnetral Hill Region.

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* Road Construction in the Nepal Himalaya: The Experience from the Lamosangu-Jiri road Project, ICIMOD, Kathmandu, Nepal, March, 1987.

13.6 Negative Impact

Negative impacts induced by the Project consists of two featurs (1) Impacts on natural environment (2) Impacts on socio-economy during and after the construction of the Project Road.

13.6.1 Negative Impact on Natural Environment

(1) General

Construction activity of the Project is inevitable to result in deterioration of natural landscape and geographical instabilization. In order to minimize or avoid the effect on natural environment due to mass wasting on the slope, mass movement of slopes and sedimentation in the river by construction of the Project Road, the location of route as well as slope protection and drainage structures should be designed properly. Deep slope cutting introduces serious mass wasting on the slope resulting in initiation of cycles of instability of slope, so that the cut slope should be minimized by provision of retaining structure.

(2) Basic Concept paid on the Project Planning and Design

It is quite sure that the project implementation induces on the imapct areas disruption and destruction of the natural landscape and environment, physically. Earthworks are probable to break slope stabilization inducing mass movement of slopes, surface erosions, soil and rock failures and other undesirable reactions. Moreover, such works denude the land surfaces stripping top soils and vegitation.

Some route seciton of the alignment unavoidably be set up on excessively weathered, metamorphosed and decomposed geological formation and on steep slope of hills and flanks showing cropping landslides or rock failure, slumps.

Numerous numbers of rivers and stream show tremendous volume of sedimental deposite aggravating river channels.

In order to conserve natural environmental circumstances from natural destructive actions and manmade ruinous activities, the planning of the project formulation and designing of the road structures were carefully conducted as drawn in the drawings, incorporated in the preceded chapter.

The budget allocated for slope protection work including retaining wall would be an ample amount which is approximately a quarter of total construction cost.

The drainage such as culverts, side ditches, cross drains and others are designed in concrete structures in order to preserve their durability and strength capable to unforeseen and unrelenting loads and forces due to such sheet and rill erosion and abrupt downpour, debris torrents and etc.

To conserve the natural landscape of the project area, keen interest and elaboration were paid for treatment and disposal of earth muck produced by earthworks. The ground surface and river channels are aggravated by uncontrolled muck dump or disposal. Even though the damages owing to the earthworks of the Project is negligible comparing with that of natural surface erosion, the Project may not accelerate the natural devastation. Some spoil banks can be utilized as play ground or other for public welfare.

There are many of places with splendid view of Himalayas along the alignment of the Project Road. Parking areas or resting spaces are desirable to be built as a subsidiary road structure, if allowed.

Reformation of landscapes damaged by the construction works such as uncontrolled felling done by the purposes of scantling, fuel, fire-wood and etc. will be constrained by means of reforestration or equivalent manners.

(3) Recommendation for the Protection of Natural Environment

Environmental impacts regarding animal and plant ecology in the influence area which may be affected by the construction of the Project were not studied in detail in this project. But it is required that utmost efforts are poured on this issue, as Nepal today is facing many of problems arisen from intensification of the human economic activities as other developing countries. Espeically, restoration, conservation and population of the country landscape and natural environment are the most significant tasks of HMG authorities concern.

In order to overcome such the difficulties, the followings are to be considered.

(i) Formulation and consolidation of "the Standards or Legislations" to control and constrain the man's economic development activities are to be worked out in the earliest time for enforcement.

(ii) Establishment of an authority appropriate to the role and task managing operation and maintenance of the Project and conservation of natural landscape and environment from progressive destruction and polution is to be considered. The organization is to be

consisted of specialists and experts well experienced accompanied with staffs competent to fulfil their role.

(iii) Monetary support sufficient enough to expenditure required for conservation of the environment is to be made.

(iv) In preparation of further detailed engineering services, technical measures for control and prevention of possible population and contamination by the implementation of the Project are to be provided carefully.

(v) Future plans envisaging further actions to conserve landscape and programmes and curriculum of training the personnels and perticipants mandated by the authority are to be prepared in advance.

13.6.2 Negative Impact on Regional Socio-economy

It is expected that the Project Road would bring aobut negative impacts as well on the socio-economies of the areas surrounding the Project Road. These negative impacts on socio-economy are expected to be brought about not only in the course of construction peirod but also after the opening of the Project Road. Possible impacts in this respect are itemized as the below:

- Disruption of traditional self-reliant structure or rural economy, due to sudden exposure to market economy.

- Inflation due to the increased consumption by the inflow of construction workers during the construction period and enhancement of economic activities resulted from the opening of the road.

- Disruption of traditional customs and social-activities for villagers due to the inflow of outsiders, and resultant deterioration in moral.

The above negative aspects, accompanied in the Project, are inevitable in some sense, but counter measures to cope with them are worth to be groped not only on community level but also on government level.

CHAPTER 14 CONCLUSION AND RECOMMENDATIONS

This chapter presents the conclusion of the Study Team based on the study result on Sindhuli Road Construction Project.

1. The Project is considered technically feasible with a scope of construction 2 lanes of paved road in a total length of 155 km from Bardibas on East-West Highway and Dhulikhel on Kodari Road.

2. The Project is considered economically feasible with a maximum internal rate of return of 9.88% (Case 4). Direct benefit, which is the sum of the saving in vehicle operating cost and time cost, is estimated to be NRs. 202 million annum in 1995, and NRs. 306 million annum in 2000.

3. Total project cost, excluding the contingency of price escalation, is estimated to be NRs. 3,884 million (equivalent to US$ 185 million or ¥ 24,040 million). It is recommended that the Project is implemented in two phases as follows:

   - Phase 1 (Section I & II-1) : NRs. 1,510 million
     (Equivalent to ¥ 9,346 million)

   - Phase 2 (Section II-2 & II-3): NRs. 2,374 million
     (Equivalent to ¥ 14,694 million)

   Note; Exchange Rate used for the cost estimation was:
   US$ 1.0 = ¥ 130.0 = NRs. 21.0 (As of January, 1988)

4. Traffic volume on the Project road in the year 2000 is expected to be about 1,200 ADT and 1,100 ADT in Section I and Section II respectively, of which about 30% of the vehicle are assumed to be the developed and induced traffic due to the regional development by the Project Road.

5. The Project is divided into four (4) construction section taking into consideration magnitude of the project scale as well as the characteristic of terrain conditions. Construction period of each section is estimated on the basis of the quantities of critical path work in each section, construction method, workable days, etc. as shown below:

Section I	(Bardibas - Sindhuli bazar	37 km):	4 years
Section II-1	(Sindhuli bazar - Khurkot	39 km):	5 years
Section II-2	(Khurkot - Nepalthok	30 km):	4 years
Section II-3	(Nepalthok - Dhulikhel	49 km):	5 years

6. Implementation Schedule

Four (4) alternative implementation schedules have been considered as follows:

Case 1

Case 1 is an alternative aiming at the shortest implementation of the Project with the construction period of 5 years. It requires large investment in the short term.

Case 2

This alternative is made in order to diversify an annual investment required.

Case 3

Case 3 is the longest implementation schedule among four alternatives with the construction period of 10 years in oder to minimize the annual investment.

Case 4

Case 4 is an alternative schedule taking the implementation schedule of Jiri-Ramechap Road into consideration. The

Project is scheduled to be constructed for 8 years and implemented in two phases, namely Phase 1 and Phase 2, with each construction period of 5 years.

Case 4 is recommended for the implementation of the Project, taking into consideration the implementation of Jiri-Ramechap Road which is under construction by DOR as well as the small scale of annual investment required for the Project.

7. Since the construction cost of the Project is considerably large, if there exist any difficulty in financial arrangement, it is recommended that the Phase 1 between Bardibas and Khurkot is initially implemented because of the following reasons:

(i) In addition to the existing route of Prithivi Highway via Muglin, Kathmandu Valley will have the alternative route connecting Terai Plain via Jiri Road, by implementation of Phase 1 of the Project as well as Jiri-Ramechap road although it is not all weather conditions road.

(ii) The Project Road will contribute greatly to the improvement of the basic human needs of the people living in remote hill areas by completion of north-south link in the Central Development Region.

(iii) The Project Road will form a part of Janakpur Highway connecting Jiri road and East-West Highway in Terai. Road network in Central Development Region will be improved by completion of Phase 1 of the Project.

Phase 2 (Section II-2 & Section II-3) between Khurkot and Dhulikhel should be implemented later stage after financial arrangement is made.

8. The economic analysis in term of IRR, B/C, NPV, has been carried out on the basis of the implementation schedule (4 alternative schedules) and cost estimate.

The analysis were conducted assuming that Jiri-Ramechap Road is implemented by DOR in accordance with the schedule and connected with the Project Road at Khurkot in 1993.

As the result of economic evaluation, Case 4 (construction period of 8 years) shows the highest economic indicators with 9.88% of IRR.

It is concluded that the Project is considered economically feasible and Case 4 of the implementation schedule is the most suitable from the economic point of view.

9. Maintenance & Training Center is recommended to implement in parallel with the construction of the Project Road, since a proper and timely maintenance is indispensable for such amountanous road as Sindhuli Road. The cost required for the Center is estimated to be NRs. 240 million equiuvalent to US$ 11 million or ¥ 1,500 million, however, it should be implemented separately with the Project Road.

10. At present most of the long distance traffic between Kathmandu and Calcutta are passing through mainly Birganji Customs Office. After the Project Road is opened to the public, one half of the long distance traffic would be shifted from Birganji to Jaleswor, therefore, it is recommended to strengthen the existing function of the Jaleswor Customs Office.