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EVALUATION STUDY ON RURAL ROADS AND BRIDGES PROJECT UNDER IBRD LOAN

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Post-Evaluation Studies of Rural Feeder Roads and Bridges

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Post - Evaluation Studies of Rural Feeder Roads and Bridges

Background

1. As A.T. Mosher adequately points out, building a good access road poses an essential pre-requisite to creating a progressive rural structure. Development of the road network brings about a wide range of economic and social benefits to rural residents. Such benefits include: increases in traffic flows, time savings in transportation, reduction in freights, better farm prices and terms of trade, accelerating transformation of traditional agriculture into commercial one, increases in agricultural productivity together with fast farm mechanization, farmland reclamation induced by easy access and increased land values, and broadening job horizons for rural residents affected. Non-economic effects comprise extension of social, cultural and administrative services into then-unexplored areas, upgrading the quality and social prestige of rural(village) life, facilitating communication between urbanites and villagers, and keen competition and cooperation among rural people toward modernization.

2. According to the MOHA Census of the national feeder roads and bridges, there are about 51,280 feeder roads with total length of 48,150 Km in the country, of which about 74 percent have been constructed by villagers as part of a Saemaul movement since 1971. At the end of 1977, there exist about 44,490 feeder bridges in rural areas with total length of about 377,540 meters, of which about 89 percent in length were built as a Saemaul Movement project since 1971. MOHA estimated that a total of about 7,270 Km of feeder roads and 94,100 meters of bridges would be further developed to give adequate access to all Korea's villages (See Annex Table 1).

Table 1. National Inventory of Rural Feeder Roads and Bridges in Korea, 1977

Year	Roads		Bridges	
	Units	Length (Km)	Units	Length (m)
Up to 1970	11,031	12,017.8	4,588	40,480.6
1971 - 76	38,098	34,655.0	37,297	304,172.0
1977	2,157	1,476.8	2,604	32,889.5
After 1978	8,812	7,270.5	6,788	94,108.8
Total	60,098	55,420.1	51,287	471,650.9

Source: MOHA Census Survey, 1977.

3. A total of 38,098 rural feeder roads existing in 1976 are categorized as follows: 13.9% located within the boundary of village; 47.6% connecting farm to village; 18.1% connecting farm to farm; 18.0% connecting village to village; and the remaining 2.4% connecting village to industrial or express highways. Re-classified by road classes, about 31% of the existing feeder roads are less than 3 meter wide, good for only carts and pick-ups; other 31.1% are for which truck can go in, but not turn around because of relatively narrow width of 3 to 4 meters; and 37.9% are more than 4 meter wide, so that truck can go in and turn around. Among 41,895 feeder bridges in 1976, approximately 36.3% are 3 meter wide; 34.5% for 4 meter wide; and remaining 29.2% are 5 meter wide or more. (See Annex Table 2-3). On the average, a typical feeder road in the country was estimated at 0.95 kilometer in length and a bridge was about 8.23 meters long.

Table 2. Classification of Rural Roads and Bridges by Functional Location, 1976

Classification	Rural Roads		Bridges	
	Units	Length	Units	Length
Within villages	13.9%	12.2%	27.6%	22.5%
Village to farmland	47.6%	43.1%	35.5%	34.0%
Farmland to farmland	18.1%	17.6%	17.7%	16.9%
Village to village	18.0%	24.1%	17.4%	23.5%
Connecting to larger road	2.4%	3.0%	1.8%	3.0%
Total (as of 1977)	49,129 units (100.0%)	46,673km (100.0%)	41,895 units (100.0%)	344,653m (100.0%)

Source: MOHA Census Survey, 1977

IBRD Project

4. The IBRD Rural Infrastructure/Saemaeul Project includes construction of 317 road subprojects (858.6 kilometers) and 211 bridges (6,826.8 meters) with total budgets of approximately 6.5 billion won for the period of 1976 to 1977. In its first implementation year, 197 roads and the whole bridges were constructed, and the remaining 120 roads (373 Km) have been

completed by the end of 1977. This component is believed to have benefited a total of 2,283 villages with 856 thousand residents and 84 thousand hectare of agricultural land. Road segments averaged about 2.7 kilometers in length and 5 or more meters in width. The average length of bridges was about 32.4 meters with more than 4 meters wide. Villagers provided about 45% of road construction costs and 16.4% of bridge segments in the form of land contribution and communal labor. The balance was provided by the government with cement, reinforcing steel, tools and equipment, and skilled labor plus professional services (For more details, see Annex Tables 4 & 5).

Table 3. Summary of IBRD-Sponsored Rural Roads and Bridges Project

Classification		Units	Length (Km)	Construction Cost (1,000 won)	Beneficiaries		
					Village (No. of Village)	Population (Person)	Farmland (ha)
Roads	76	197	485.7(km)	2,765,000	850	362,071	33,706
	77	120	372.9	2,579,549	606	222,833	20,137
	Sub-total	317	858.6 (2.7)	5,254,549 (16,576)	1,456 (4.6)	584,904 (1,845)	53,843 (169)
Bridges	76	211	6,826.8(m) (32.4)	1,291,649 (6,122)	827 (3.9)	270,895 (1,284)	29,741 (141)
Total		528	-	6,546,198	2,283	855,799	83,584

Source: MOHA Final Report of IBRD Projects, 1978.

Table 4. Selection Criteria for Feeder Road Subprojects: Agreed upon between ROKG and IBRD

Length	Beneficiaries	
	Farmland	Population
2 -2.5 km	Over 60 ha	Over 400 persons
2.6-3.0 "	Over 75 "	Over 450 "
3.1-3.5 "	Over 80 "	Over 500 "
3.6-4.0 "	Over 85 "	Over 550 "
4.1-4.5 "	Over 90 "	Over 600 "
4.6-5.0 "	Over 95 "	Over 650 "
5.1-5.5 "	Over 100 "	Over 700 "
5.6-6.0 "	Over 100 "	Over 750 "

Source: MOHA

Outline of Evaluation Study

6. This study aimed to yield empirical evidence of the impact of feeder roads and bridges on the rural economy and help to refine and test the sub-project selection procedures. The study in particular attempted: 1) to measure the benefits of the

road and bridge construction accrued to the rural and farm household economy, especially to the transportation conditions and the cropping pattern; 2) to study the socio-economic effects that the road project would have on the attitudes and living patterns of villagers affected: 3) to find out problematic areas along with the project selection parameters with an aim to draw recommendations for the future program.

7. Throughout the 2-year's evaluation study period starting from 1977, about 19 roads and 17 bridge subprojects in the field have been throughly surveyed. The survey has not been confined only to the IBRD project, for the impact of road development on rural economy has emerged for a prolonged time-period. For the first year of study, 8 road segments and another 8 bridges in 5 Guns were sampled from the MOHA Saemauel Comprehensive Evaluation Survey Areas in an attempt to develop adequate evaluation parameters and methodology for the road and bridge program. Out of each 8 samples, IBRD-loaned were three roads and two bridges. Thus, the 1st year survey included interviews with 5 Gun Saemaul officers, 19 village representatives, and 100 farmer-residents, for all road and bridge segments. In the second year of study, 11 feeder roads including seven IBRD subprojects

and 9 bridges (6 IBRD) were surveyed through intensive interviews with 20 county officers, 51 village representatives and 136 farmer-residents. At this stage of study, sampling of more IBRD subprojects was purposedly made out of the whole spectrum to include various characteristics of the IBRD-sponsored program (See Tables below).

Table 5. Sample Size & Classification of Rural Roads and Bridges, 1977: 1st Year Survey Samples

Classification	County	Feeder Roads Sample Size			Bridges Sample Size		
		Unit	Village	Farm	Unit	Village	Farm
Saemaul	Yongin	1	2	10	2	2	10
"	Iksan	1	2	10	1	1	10
"	Myongju	1	1	5	1	1	5
"	Chilkok	1	1	5	1	2	10
"	Cheongwon	1	1	5	1	1	5
IBRD	Myongju	1	1	5	1	1	5
"	Chilkok	1	1	5	-	-	-
"	Cheongwon	1	1	5	1	1	5
Total		8	10	50	8	9	50

Table 6. Sample Size and Classification of Rural Roads and Bridges, 1978: 2nd Year Survey Samples.

Classification	County	Feeder Roads			Classification	County	Bridges		
		Unit	Village	Farm			Unit	Village	Farm
IBRD	Icheon	1	1	4	IBRD	Gongju	1	2	4
"	Paju	1	3	9	"	Seosan	1	3	8
"	Gongju	1	3	9	"	Jecheon	1	2	4
"	Jecheon	1	2	6	"	Boeun	1	3	6
"	Boeun	1	3	9	"	Hongseong	1	3	6
"	Seosan	1	3	9	"	Yoncheon	1	2	4
"	Nonsan	1	3	9	Saemaul	Jecheon	1	2	4
Saemaul	Buyeo	1	3	9	"	Boeun	1	2	4
"	Hongseong	1	3	9	"	Nonsan	1	2	4
"	Jecheon	1	2	9					
"	Boeun	1	4	10					
Total		11	30	92	Total		9	21	44

8. The list of surveyed roads and bridges and their beneficiaries are shown in Annex Tables 6 to 9. A typical sample road segment has the following characteristics; 2.3-3.4 kilometers long, 2.4-5.4 beneficiary villages with 147-361 rural households and about 800-1,980 heads in population served, 194-238 hectare of cultivable farmland affected. An average bridge component surveyed has characteristics of 37.3-41.1 meters long, 2.9-4.8 villages with 1,168-1,237 residents served, and 118-163 hectare of farm land. Distribution of construction years of each segments are also shown in the above Tables.

Evaluation of Costs

9. The economic costs of road construction actually incurred to the sample areas were calculated to be 5,768 thousand won per Kilometer or US 11,890 dollars/km on 1977 prices, using an exchange rate of US$ 1.00 to ₩485. The same was estimated as 4,440 thousand won (US$9,155) for the 1st year survey on 1976 prices. Since most non-IBRD road segments were constructed prior to 1976, the original costs were revalued on the 1977 prices for the second year survey subprojects seven IBRD-sponsored road constructions costed 6,045 thousand won or US$ 12,460 per kilometer on the 1977 prices. The above two values

certainly far exceed the original IBRD estimates of the per Kilometer road costruction cost of US$ 7,575. This is due to sharp price increases during 1974-1977 and to most IBRD project areas being more difficult to build the road. Villagers contributed nearly 72% of total construction costs for non-IBRD Saemaul roads and about 49% of IBRD road construction costs in terms of land donation and unskilled labor services (See Annex Tables 10 & 11).

10. A typical bridge construction of 30 meters long was simulated to cost 6,335 thousand won or US$ 13,062 equivalent from the second year samples, which far exceeded the MOHA standard cost of 4,428 thousand won per bridge on the 1976 prices. It was estimated at 5,360 thousand won (US$11,015) for the first year survey bridges on 1976 prices. It was estimated at 5,360 thousand won (US$11,015) for the first year survey bridges on 1976 prices. In the meanwhile, IBRD-loaned bridges were constructed at the cost of 6,149 thousand won or US$ 12,677 equivalent for a second year 30 meter long bridge on 1977 prices. Elsewhere in the surveys, cost estimates made by MOHA or IBRD were found very low against the actual costs involved. The proportion of villagers' share of total construction costs was

25% for non-IBRD segment and 21% for IBRD-loaned bridges.

11. Primarily, maintenance for road and bridge has been taken care of by villagers. The annual cost per Km road maintenance was calculated as 1,078 thousand won (US$2,223), using the shadow wage rate of 1,500 won per man/day on the 1977 prices. A typical 30 m long bridge costed 86.3 thousand won (US$ 178) a year for maintenance.

Benefits of the Project

12. Benefits to be accrued from the road and bridge component were already hypothesized in the beginning (Para 1), and this study succeded to quantify some of the main benefits attached to the characteristics of roads and bridges surveyed. Direct benefits quantified in this report are time savings in traffic and a reduction in transportation costs of agricultural inputs and outputs. Also surveyed are such indirect benefits as increased farm income owing to a shift from low-value crops to high-value perishable produce, a general increase in agricultural production, increased land value, better access to off-farm employment opportunities and social services, and upgraded quality of rural life and prestige in general. Due to the

limitations of sample characteristics, off-farm employment effects and other social aspects were hardly quantifiable, since there were few industrially-oriented roads in the country and further a road opening alone did not bring off-farm job opportunities to villagers.

Time Savings in Traffic

13. In regards to time savings in traffic, all the sample roads and bridges were investigated into their average daily traffic flows by different transportation modes as shown in Annex Tables 12 to 15. And hours of time saved by different modes after the new road was multiflied by relevant traffics in order to obtain money values of time savings of rural residents travelling on the road. Rural resident's time was valued as 150 won per hours in 1976 and 187 won in 1977, using the shadow wage rate of 74% agreed among the IBRD Evaluation Study Team. Accordingly, the average annual traffic time savings of a kilometer new road was calculated as 1,088 thousand won for the first year surveyed samples and as 2,260 thousand won, a double, for the second year surveyed roads which were greatly affected by mass transportion services available following

the new road operation. Out of the first year's eight sample roads, bus services are available on two project areas, whereas six out eleven enjoy the mass transport services. Likewise, a typical 30 meter bridge has brought traffic time savings of 771 thousand won worth on 1976 prices, with more savings resulted in the second year's sampling areas with 1,210 thousand won on 1977 prices (See Tables 7 and 8).

Table 7. Traffic Time Saving After the Road and Bridge Projects, 1977: 1st Year's Survey Samples

(On 1976 prices)

Code No.	Annual Time Savings (Minutes)	Annual Time Savings (1,000 won)	Savings per km (1,000 won)	Name of Bridges	Annual Time Savings (Minutes)	Annual Time Savings (1,000 won)
01	1,949,100	4,872	1,218	Jubuk	346,750	867
02	562,100	1,405	936	Shinpyong	277,400	693
03	375,950	939	1,043	Jangdeok	536,550	1,340
04	764,675	1,911	910	Hyoncheon	308,425	771
05	1,032,950	2,581	1,290	Sangya	374,490	935
06	959,950	2,399	1,048	Deoksan	361,350	1,177
07	1,460,000	3,987	1,329	Undong	427,780	1,070
08	1,191,360	2,976	930	Chiljae	328,500	821
Average	1,037,010	2,634	1,088	Average	370,155	959

Table 8. Traffic Time Savings After the Road and Bridge Projects, 1978: 2nd Year's Survey Samples

(On 1977 prices)

Code No.	Annual Time Savings (minutes)	Annual Time Savings (1,000 won)	Savings per Km (1,000 won)	Name of Bridges	Annual Time Savings (minutes)	Annual Time Savings (1,000 won)
001	551,150	1,725	690	Godang	359,525	1,125
002	1,227,312	3,841	2,400	Whangrak	609,550	1,907
003	4,060,625	12,709	3,530	Songkye	562,100	1,759
004	2,826,925	8,848	3,949	Ewon	707,187	2,213
005	3,927,400	12,292	4,097	Seoryeok	1,056,675	3,307
006	2,728,375	8,539	3,371	Jungri	310,615	972
007	4,097,125	12,824	2,671	Shirim	579,620	1,814
008	3,622,625	11,338	944	Jangshin	182,500	571
009	360,437	1,128	2,820	Hangweol	388,725	1,216
010	529,250	1,656	1,104	-	-	-
011	616,850	1,930	1,286	-	-	-
Average	2,231,643	6,984	2,260	Average	528,499	1,653

Reduction in Transportation Costs

14. An empirical calculation was attempted to estimate a reduction in transportation costs attributable to the road and bridge development in rural areas. Before the project, the agricultural inputs and outputs used to be transported by an A-frame 'Jige' on man's back or by animal-draft cart. On 1976 prices, a ton of carload per kilometer costed 200 won, whereas the same (t/Km) would cost 750 won by 'Jige' and 410 won by cart[1]. With the project, the economic cost savings of transportation of 1 ton/Km carload would be 550 won when Jige was replaced by truck and 210 won when cart was substituted by truck. Likewise, on 1977 prices, the cost savings in freights in freights in national economy should be 685 won and 310 won, respectively.[2] By multiplying the relevant cost-saving bases by

1) On 1976 prices; by 'Jige' 1,000 kg ÷ 60kg ÷ 3.3 km/hr = 5 man-hours, therefore, 150 won X 5 man-hours = 750 won/t/km.
By Cart, 1,000 kg ÷ 80 kg X 33 won/80 Kg bag = 410 won/t/km
By truck; 2,000 won ÷ 2.5t ÷ 4 km = 200 won/t/km

2) On 1977 prices; by Jige, 187 won x 5 man-hrs = 935 won/t/km,
By Cart; 1,000 kg ÷ 80 kg/bag x 45 won/(80 kg bag) ≒ 560won/t/km
By truck, 2,500 won ÷ 2.5 t ÷ 4 km = 250 won/t/km

the annual carload tonnage transported and the effective road length, annual total amounts of reduction in transportation costs were calculated as shown in Tables 9 & 10 and Annex Tables 16 & 17. Thus the net cost savings per km of rural averaged 203 thousand won for the first year's samples and 300 thousand won for the second year samples. That of a typical 30 m bridge was about 96.5 thousand won for the former and 395 thousand won for the latter.

Table 9. Reduction in Transportation Costs of Agricultural Inputs and Outputs by Roads, 1977: 1st Year's Survey Samples

(On 1976 prices)

Code No.	Unit Cost Savings (km/t/won)	Distance to Market (km)	Road Length (km)	Effective Length (km)	Quantity of Agricultural Products Sold (M/T)								Total Cost Savings of Outputs (won)	Fertilizers Bought (t)	Cost Savings of Inputs (Won)	Total Transp. Cost Savings (won)	Per km Cost Savings (1,000won)
					Rice	Barley	Pulses	Potatows	Vegeta-bles	Fruits	Others	Total					
01	550	6	4	3	101	10	7	12	8.4	450	-	487	804,210	43.8	72,319	876,529	219
02	550	7	1.5	1	228	27	11	108	76	161	4.8	615.8	338.690	55.4	30,482	369,172	245
03	550	6	0.9	0.9	84	13	7	48	22	36	3.6	213.6	105,732	19.2	9,516	115,248	126
04	210	12	2	1	206	55	15	48	8.4	-	1.8	334.2	70,182	30	6,316	76,498	36
05	550	6	2	2.1	120	10	3	216	50	18	0.6	417.6	459,360	37.6	41,342	500,702	250
06	550	12	2	1.6	96	38	3	24	5.6	-	1.2	167.8	1,147,664	15	13,290	160,954	80
07	550	5	3	2.5	202	18	20	12	14	522	1.2	789.2	1,085,150	71	97,664	1,182,814	394
08	550	10	3.2	3	173	30	21	48	14	-	6	292	481,800	26.3	43,362	525,162	164
Average	507	8	2.34	1.89								416	436,598	37	39,286	665,565	203

Table 10. Reduction in Transportation Costs of Agricultural Products and Inputs by Road Construction, 1978: 2nd Year's Survey Samples

(On 1977 prices)

Code No.	Cost Savings (km/t/won)	Distance to Market (Km)	Road Length (Km)	Effective Length (Km)	Quantity of Agricultural Products Sold (M/T)								Total Cost Savings (₩)	Fertilizer & Feed Purchased (M/T)	Total Cost Savings (₩)	Total Savings (won)	Per Km Cost Savings (₩)
					Rice	Barley	Pulses	Potatows	Vegeta-bles	Fruits	Others	Total					
001	685	2	2.5	2.5	80	3.6	7.2	4.8	21.8	-	-	117.4	201,047	24.9	42,641	243,688	97,475
002	685	10	1.6	1.6	223	35.2	9.9	22.7	26.4	-	-	320.4	608,718	78.2	85,707	694,425	434,015
003	685	6.5	3.6	3.1	226.8	22.3	6.6	17.1	27.4	36	18	354.2	752,143	73.2	155,440	907,583	252,106
004	685	6	3.0	3.0	156.8	46	17.6	2.4	27.9	14	14.7	280.4	576,222	74.8	153,714	729,936	243,312
005	685	12	3.0	3.0	90	2.8	1.2	14	31.2	-	14	153.2	314,826	82.2	168,921	483,747	161,249
006	685	6.5	3.6	3.0	362	31.9	17.2	35	22.6	4.5	4.2	518.0	1,064,490	120.8	248,244	1,312,734	364,648
007	685	5	4.8	3.0	174.5	12.6	7.3	5.2	856.2	-		1,052.8	2,163,504	512.5	1,053,187	3,216,691	670,143
008	685	7	12	8	257	56.1	45.6	6.6	17.6	69	20	471.9	2,586,012	218	1,194,640	3,780,662	315,054
009	685	10	1.0	0.4	303	82	24.5	20.4	27.4	-	13.1	470.4	128,889	204.2	55,950	184,839	462,097
010	685	11	1.5	1.5	94.5	28.1	2.6	7.2	22.1	-	28	182.5	187,518	66.4	68,226	255,744	170,496
011	310	6	1.5	1.5	197.6	16.8	13.8	1.9	13.5	13.5	13.2	256.8	119,412	179.8	83,607	203,019	135,346
Total	650	7.4	3.4	2.8								401.2	791,161	148.6	300,934	1,092,096	300,540

Farm Income Increases Due to Cropping Pattern Changed: Indirect Effects

15. Throughout the survey areas it was observed that the cropping pattern has largely shifted from low-value crops (puleses in summer) to high-value vegetables and fruits. On the average, a rural road of 2.34 km development resulted in an increase of 10.08 ha for vegetables grown and 6.7 ha for fruits (See Annex Tables 18 & 19). Yet the acreage for cash crops are expected to increase with the years elapsed after the construction (Annex Tables 20 & 21). The economic net value increase of production per hectare was estimated as 137 thousand won on 1976 prices and 156 thousand won on 1977 prices both for the pulses-vegetables shift case.[3)4)] When such fruits as pear or

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3) Net Value of Production Increases on 1976 prices (NAERI Data):

i) Vegetables 291 thous. won/ha - Pulses 102 thous. won/ha = 189 thous. won/ha
ii) Economic NVP Increase = 189 thous. won/ha - Additional transport cost 52 thous. won = 137 thous. won/ha
iii) Pears: NVP 1,444 thous. won/ha - Additional transport cost 76 thous. won = 1,368 thous. won/ha
iv) Grapes: NVP 1,144 thous. won/ha - Add. Transport cost 59 thous. won = 1,085 thousand won/ha

4) NVP Increases on 1977 prices (NAERI & ORD Data):

i) Vegetables 340 thous. won/ha-Pulses 119 thous. won/ha = 221 thous. won/ha
ii) Economic NVP Increase = 221 thous. won/ha - Add. transport 65 thous. won = 156 thous. won/ha
iii) Pears: NVP 1,690 thous. won/ha - Add. transport 95 thous. = won/ha
iv) Grapes: NVP 1,339 thous. won/ha - Add. transport 73 thous. = 1,266 thous. won/ha

grapes were growing in the previously uncultivated slope lands, the economic NVP was 1,368 - 1,595 thousand won for pear and 1,085 - 1,266 thousand won for grapes, based on the two different year prices. In any case, deduction adjustments were made for the additional transport cost emerging from tonnage produced. The benefit buildup rate of vegetables was assumed to be 30% in Year 1; 65% in Year 2 and 100% in Year 3. That of pear was 35%, 65%, 85% and 100% from the 4th to 7th years and that of grapes was 30%, 65% and 100% from the 3rd to fith years. The social net value increases in the production shifts for survey roads and bridges were shown in Annex Tables 18 to 21.

Other Indirect Effects

16. Alongwith the shift in cropping pattern to high value crops, the utilization rate of farmland, on the average, has been increased from 115% to 134% in the survey areas. At the same time, the amounts of agricultural products marketed has increased by about 32% after the project. Also, marketing pattern in terms of sales place of major agricultural commodities has been conspicuously changed as shown in Table below.

Table 11. Marketing Pattern Cum Transportation Methods in Sales Place of Major Foodgrains After the Project, 1978

Distance to Market	At Farm	Jige or On foot	Carts	Tillers	Trucks	Total
4Km Within	4 %	23.5%	32 %	20 %	20.5%	100.0%
8Km Within	3 %	12.5%	27 %	27 %	30.5%	100.0%
12Km Within	8 %	3 %	15 %	34 %	40 %	100.0%
16Km Within	15 %	3 %	5.5%	34 %	42.5%	100.0%
16Km Beyond	22.5 %	0 %	3 %	16.5%	58 %	100.0%

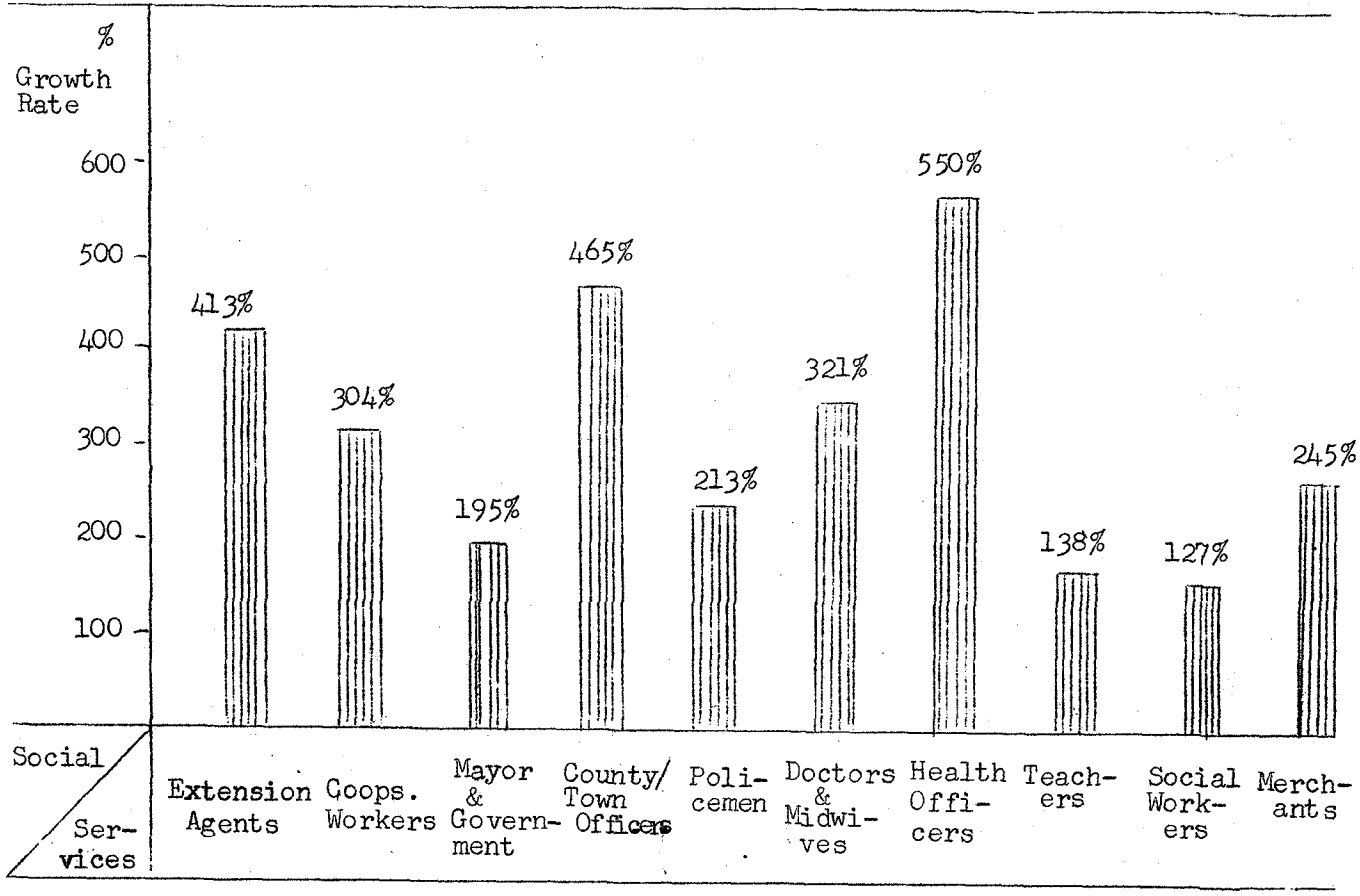
17. Increases in land value were also appreciable after the completion of the project. In most survey areas, the unit land prices have increased double and a substantial acreage of new land has been reclaimed since the project (Annex Tables 22 & 23). However, the land value increases were not included in the benefit-cost analysis because of difficult demarcation between road development effects and other social-economical effects. Also, not included were increased number of students and off-village workers communting to the outside. Those commuters certainly outgrew after the project as seen in Annex Tables 24 & 25.

18. After the project, the good accessibility to surveyed villages has resulted in an outpouring social services towards once-isolated rural residents. Extension agents visited a typical sample village more than 413 % compared with 'before-the-project'; health service officers including family planning workers paid the most frequent visits, a 550% increase; county/town officers made themselves available in the village more often by 465%, and so on (See Table 12 and Figure 1).

Table 12. Growth Indices of Social Services Inflow into Villages After the Project, 1978

Road Code	Extension Agents	Coops Workers	County Mayor/ Governer	County or Town Officials	Policemen	Doctors & Midwives	Health Officers	Teachers	Social Workers	Merchants
001	300%	250%	200%	450%	150%	330%	400%	130%	120%	200%
002	375	250	160	350	150	250	450	110	130	200
003	350	300	300	400	200	300	550	200	120	300
004	450	300	150	400	200	380	550	200	130	200
005	600	500	300	900	500	300	1000	100	110	300
006	350	200	120	340	130	200	250	120	120	200
007	470	200	110	430	150	350	600	100	100	200
008	350	200	100	400	150	300	500	130	170	200
009	400	250	210	430	220	330	610	200	200	200
010	600	500	300	470	200	500	600	100	100	500
011	300	400	200	500	300	300	550	130	100	200
Average	413%	304%	195%	465%	213%	321%	550%	138%	127%	245%

Figure 1. Growth Rate of Social Services Inflow into Villages After the Project, 1978



19. Consequently, villagers' attitudes after the project have been quite changed, too. Seventy percent of villagers interviewed replied that the project brought about a great deal of convenience both to farming and living conditions. Farmers were diligently studying on new crop pattern adjustable to the changes in environments. They were also seeking new jobs and employment in order to utilize surplus labor freed from poor transportation systems. Eighteen percent felt it was well-done even though they had to go through many difficulties and hardships. Not only their bargaining power and social prestige were considerably enhanced, but also there appeared a high spirit for cooperation among villagers and with adjacent villages. The remaining 12 percent mentioned about some unfair and bad aspects of the project execution, on which the latter section would discuss.

Project Post-Evaluation

20. Based on the per km cost/benefit survey data discussed up to now, an analysis was made of the economic viability of various road and bridge sub-projects as shown in Tables 13 and 14). In order to estimate IRR, only direct benefits such as traffic

time savings and transportation cost savings were counted, whereas farm income increases resulting from changes in cropping pattern were counted for the associate rate of return on investments (ARR).

Thus the internal economic rate of returns from a typical road development was computed to be in the range of 19 to 22% with ARR between 19 to 25%. A 30 meterlong bridge construction resulted in an average IRR of 14 to 28% with ARR of 27 to 30%, depending on the sample survey years.

In general, most IBRD-loaned subprojects have yielded relatively higher IRRs cum ARRs, except for Road Code No. 001 area for both indicators and Code No. 06, 07 and 08 exclusively for ARRs. According to this analysis, the number of people to be served by the subproject together with mass transport services is most influential in determining its economic viability. The above IBRD roads apparently failed to meet these requirements in the process of selection. The second important factor is the farmland acreage apt to shift in cropping pattern toward high-value crops, which is also heavily affected by accessibility to nearby urban markets.

Table 13. Computerized Results of Economic Viability Analysis of Rural Roads and Bridges, 1977: 1st Year's Survey Samples

Classification	IRR (Direct) Effect	ARR (Indirect)	Remarks
All Roads	18.9%	25.43%	Direct Effects B/C : 1.5 (10% D.R) " : 1.2 (15% D.R)
Road (01)	24.7	28.60	Bus Services + Cash Crops
" (02)	19.3	27.21	Largest Population plus Cash Crops
" (03)	17.5	17.05	Heavy traffic and Cash Crops
" (04)	15.4	6.24	Largest population but with alternative roads
" (05)	26.7	3.30	Bus Services available
IBRD " (06)	17.0	-1.52	Relatively small number of villages with small farm acreages
IBRD " (07)	21.1	7.95	Largest population served
IBRD " (08)	19.5	5.90	Heavy traffics
All Bridges	13.7	26.6	Direct Effect B/C: 1.2 (10% D.R) " : 0.9 (15% D.R)

Table 14. Economic Viability Analysis of Rural Roads and Bridges, 1978: 2nd Year's Survey Samples

Classification	IRR (Direct Effects)	ARR (Indirect Effects)	Remarks
All Roads	21.8%	19.2%	Direct Effects: B/C: 1.8 (10% D.R) B/C: 1.4 (15% D.R)
Road 001 (IBRD)	7.4	10.5	Small number of villagers affected
" 002 (IBRD)	23.5	15.4	Large Volume of traffics
" 003 (IBRD)	29.3	24.9	Bus services + Cash crops
" 004 (IBRD)	28.2	16.8	Bus services available
" 005 (IBRD)	23.7	13.8	"
" 006 (IBRD)	26.5	10.1	"
" 007 (IBRD)	29.7	33.5	Bus services+ Traffic center+ Cash crops
" 008	20.6	26.2	Multi-purpose road+ Cash crops
" 009	10.2	16.6	Large investment costs
" 010	11.9	12.3	Small no. of villagers served
" 011	17.6	20.5	Sizable traffic+ Cash crops
All Bridges	28.1	30.3	Direct Effects: B/C: 2.1 (10% D.R) B/C: 1.5 (15% D.R)

Problem and Recommendations

21. Major complaints rehearsed in the survey are low construction costs, no bus-line services after the project, poor maintenance system and low budget available, and unfair share-donations of rights of way for road development. It is, therefore, recommended that the budget for the construction cost should be realized, since the remaining projects are mostly located in construction-difficult areas; that the county government do every efforts to extend mass-transport system services into the newly connected road; that the road maintenance responsibility should not soly rely on villagers, for it sometimes requires a heavy financial burden which farmers cannot solve by themselves; that agricultural extension services should be reinforced in the project area in order to facilitate a smooth and speedy transformation of traditional farm economy into a commericialized farming; that a fair cost-sharing device in regards to land constribution may be studied along with the increased land value; that the government should prepare a road redevelopment plan such as broadening and asphaltizing of

existing rural roads in the near future; and that the project selection criteria and proceduces may be reformulated in accordance with the number of people to be served, availability of mass transport system and acreages of farmland convertible into a commercial one.

Annex Tables for Feeder Roads & Bridges

Annex Table 1. National Inventory of Rural Feeder Roads and Bridges

Year	Rural Roads		Bridges	
	Units	Length(Km)	Units	Length (m)
Total	60,098	55,420.1	51,287	471,650.9
Before'70	11,031	12,017.8	4,598	40,480.6
71	5,698	5,872.0	4,756	32,974.5
72	7,905	7,615.8	6,997	55,127.6
73	8,523	8,010.5	7,796	58,605.8
74	5,672	4,648.0	7,096	54,025.2
75	6,528	4,936.8	6,113	53,245.3
76	3,772	3,571.9	4,539	50,193.6
77	2,157	1,476.8	2,604	32,889.5
After'78	8,812	7,270.5	6,788	94,108.8

Source: MOHA Census Survey, 1977

Annex Table 2. Classification of Rural Roads and Bridges by Functional Location

Classification	Rural Roads					
	Total		Up to 1976		After 1977	
	Units	Length(Km)	Units	Length(Km)	Units	Length(Km)
Total	60,098	55,420.102	49,129	46,672.836	10,969	8,747.266
Within village	7,501	6,286.765	6,819	5,713.390	682	573.375
Village to farmland	28,583	23,419.184	23,372	20,127.934	5,211	3,291.25
Farmland to farmland	11,480	10,380.508	8,894	8,198.663	2,586	2,190.845
Village to village	10,367	13,531.446	8,881	11,227.0	1,986	2,304.446
Counecting to larger roads	1,667	1,802.099	1,163	1,414.843	504	387.250

Classification	Bridges					
	Total		Up to 1976		After 1977	
	Units	Length(m)	Units	Length(m)	Units	Length(m)
Total	51,287	471,680.9	14,895	344,252.6	9,392	126,998.3
Within village	13,047	93,106.9	11,554	77,686.2	1,493	15,240.7
Village to farmland	18,608	161,299.8	14,870	117,022.7	3,738	44,277.1
Farmland to farmland	9,505	80,293.1	7,435	58,358.8	2,070	21,934.3
Village to village	9,141	122,006.3	7,281	80,963.4	1,860	41,042.9
Counecting to large roads	986	14,944.8	755	10,421.5	231	4,523.3

Source: MOHA Census Survey, 1977

Annex Table 3. Rural Roads and Bridges by Length and Width

1) By Length of Road

	Total		Up to 1970		1971-1976	
	Units	Length(Km)	Units	Length(Km)	Units	Length(Km)
Total	60,098	55,420.102	11,031	12,017.825	38,098	34,655.011
LT 1Km	38,936	18,618.185	6,318	2,734.0	24,632	12,311.039
1 - 2 Km	15,089	19,031.338	3,001	3,800.440	9,914	12,504.573
2 - 4 Km	5,688	11,958.659	1,307	3,660.06	2,778	6,587.489
Over 4Km	1,385	5,811.929	404	1,822.950	774	3,251,266

1977		After 1978	
Units	Length(Km)	Units	Length(Km)
2,157	1,476.765	8,812	7,270.501
1,687	726.155	6,299	2,846.966
318	363.870	1,885	2,361.455
129	273.230	480	1,437,880
29	113,510	178	624.2

2) By Width of Road (1976)

Total	3 m	4 m	5 m	Over 5 m
49,129 Units	15,213 Units	15,289 Units	17,090 Units	1,537 Units
/16,672.836 Km	/10,836.942 Km	/14,191.806 Km	/19,157.718 Km	/2,487.365 Km

Source: M O H A , Same as Above.

3) By Length of Bridge

	Total		Up to 1970		1971 - 76	
	Units	Length(Km)	Units	Length(m)	Units	Length(m)
Total	51,287	471,650.9	4,598	40,480.6	37,297	304,172.0
LT 10m	38,220	200,274.0	3,559	19,723.1	28,690	144,446.4
10 - 20	8,649	104,536.6	740	9,313.3	6,065	71,635.2
20 - 50	3,470	91,493.8	239	6,934.0	2,065	52,570.3
Over50m	948	75,346.5	60	4,509.0	453	26,759.1

1977			
Units	Length(m)	Units	Length(m)
2,604	32,889.5	6,788	94,108.8
1,772	10,271.9	4,199	25,811.7
439	6,066.6	1,381	17,521.5
310	9,272.0	856	22,717.6
83	7,279.0	352	28,057.7

4) By Width of Bridge, 1976

Total	3m	4m	5m	Over 5m
41,895Units	15,187Units	14,452Units	10,906Units	1,350Units
/344,652.8 m	/107,592.0 m	/115,320.25 m	/101,857.05 m	/19,883.5 m

Annex Table 4. Achievements of IBRD-Sponsored Rural Road Construction During 1976-77

Province	Year	No. of Sub-projects	Total Length (Km)	Construction Cost (1,000 won)				Beneficiaries					
				Total	Residents' Share	By Land (pyong)	By Labor (prs)	No. of Villages		Population		Farmland (ha)	
Nation	76	197	485.7 (2.46)	2,675,000 (13,578)	44.4%	659,121	650,949	850	(4.3)	362,071	(1,838)	30,706	(171.0)
	77	120	372.9 (3.11)	2,579,549 (21,496)	42.8%	449,671	402,163	606	(5.1)	222,833	(1,857)	20,137	(167.8)
Gyeonggi	76	20	54.7 (2.73)	250,975 (12,548)	35.3%	67,924	38,707	68	(3.4)	37,234	(1,862)	2,172	(108.6)
	77	12	38.5 (3.21)	222,541 (18,545)	42.9%	46,664	17,939	46	(3.8)	16,618	(1,385)	1,830	(152.5)
Gangweon	76	16	63.6 (3.97)	310,961 (19,435)	29.0%	86,990	24,493	66	(4.1)	31,824	(1,989)	5,561	(347.5)
	77	11	38.0 (3.45)	229,293 (20,845)	34.6%	32,375	29,919	41	(3.7)	18,182	(1,653)	2,553	(232.1)
Chungbuk	76	17	40.5 (2.38)	222,979 (13,116)	57.2%	32,378	81,787	63	(3.7)	20,198	(1,188)	1,675	(98.5)
	77	10	23.7 (2.37)	156,219 (15,622)	41.0%	17,981	29,631	43	(4.3)	14,562	(1,456)	1,819	(181.9)
Chungnam	76	16	70.2 (4.38)	309,818 (19,363)	51.6%	76,011	83,917	115	(7.2)	43,389	(2,712)	6,333	(395.8)
	77	12	45.1 (3.76)	293,958 (24,497)	45.7%	58,773	40,559	55	(4.6)	24,412	(2,034)	2,035	(169.6)
Jeonbuk	76	23	42.1 (1.83)	253,813 (11,035)	32.5%	48,381	74,704	96	(4.2)	33,688	(1,464)	2,504	(108.8)
	77	12	34.9 (2.91)	248,842 (20,737)	41.7%	40,871	37,481	73	(6.1)	23,935	(1,995)	3,290	(274.2)
Jeonnam	76	32	74.4 (2.32)	435,751 (13,615)	50.4%	84,131	113,889	147	(4.6)	67,682	(2,115)	6,118	(191.1)
	77	19	68.5 (3.61)	586,342 (30,860)	43.1%	75,191	122,049	138	(7.3)	49,202	(2,590)	3,485	(183.4)
Gyeongbuk	76	27	78.4 (2.90)	449,818 (16,660)	45.9%	75,683	119,243	127	(4.7)	59,071	(2,188)	4,282	(158.5)
	77	17	60.8 (3.58)	433,715 (25,513)	42.8%	68,919	49,938	79	(4.6)	28,735	(1,690)	2,455	(144.4)
Gyeongnam	76	43	65.1 (1.51)	404,743 (9,412)	49.1%	179,719	107,570	164	(3.8)	61,172	(1,422)	4,777	(111.0)
	77	25	56.3 (2.25)	372,538 (14,902)	46.7%	98,001	71,555	121	(4.8)	38,093	(1,524)	2,335	(93.4)
Jeju	76	3	6.7 (2.23)	36,142 (12,047)	43.7%	7,904	6,637	4	(1.3)	7,813	(2,604)	284	(94.6)
	77	2	7.1 (3.55)	36,101 (18,051)	40.2%	10,896	3,092	10	(5.0)	9,094	(4,547)	335	(167.5)

Source: MOHA Final Report, 1978

*Figures in parantheses denote relevant values per unit road.

Annex Table 5. Achievements of IBRD-Sponsored Rural Bridges Constructions, 1976

Province	No. of Sub-projects	Length (m)	Construction Cost (1,000₩)			Beneficiaries		
			Total	Gov't	Civil	Villages	Population	Farmland (ha)
Nation	211	6,826.8(32.0)	1,291,649(6,121)	83.6	16.4	827(3.9)	270,895(1,283)	29,741(140)
Gyeonggi	16	511.4(31.9)	108,812(6,800)	84.6	15.4	69(4.3)	27,463(1,716)	1,608(101.0)
Gangweon	18	669.0(37.1)	147,061(8,170)	81.5	18.5	55(3.0)	31,048(1,725)	3,403(189.0)
Chungbuk	36	1,092.0(30.3)	209,807(5,827)	82.3	17.7	140(3.8)	4,527(125)	4,375(121.5)
Chungnam	22	826.0(37.5)	138,206(6,282)	83.2	16.8	106(4.8)	39,779(1,808)	4,348(197.6)
Jeonbuk	32	985.0(30.7)	177,086(5,533)	87.2	12.8	156(4.8)	45,352(1,417)	3,540(110.6)
Jeonnam	22	789.0(35.8)	159,844(7,265)	83.3	16.7	108(4.9)	41,251(1,875)	4,316(196.1)
Gyeongbuk	24	785.4(32.7)	136,716(5,696)	79.4	20.6	85(3.5)	37,179(1,549)	2,979(124.1)
Gyeongnam	37	1,089.0(29.4)	190,342(5,144)	85.6	14.4	110(2.9)	33,249(898)	3,733(100.8)
Jeju	4	80.0(20.0)	23,775(5,943)	89.3	10.7	8(2.0)	11,047(2,761)	1,439(359.7)

* Figures in parentheses denote those relevant values per unit bridge

Source: MOHA Final Report, 1978

Annex Table 6. Outline of the 1st Year's (1977) Surveyed Roads

Code-No.	Surveyed Roads: Location	Year	Length	Beneficiaries: Villages	Households	Population	Farmland [1]	Remark
01	Gyeonggi Yongin	71	4.0km	4	150	680	119ha	New
02	Gyeong-Bug Chilgog	74	1.5	2	208	1,172	452	Broaden
03	Chung-Bug Cheong-weon	75	0.9	2	72	425	60	New
04	Jeon-Bug Iksan	75	2.1	3	186	1,116	131	Broaden
05	Gang-weon Myeongju	75	2.0	1	98	470	96	Broaden
IBRD 06	Gyeong-Bug Chilgog	76	2.0	2	102	549	81	New
IBRD 07	Gang-weon Myeongju	76	3.0	2	208	1,071	170	Broaden
IBRD 08	Chung-Bug Cheong-weon	76	3.2	3	150	750	445	New
Average			2.34	2.4	147	779	194	

1) Farmland includes paddy field, upland and orchards.

Annex Table 7. Outline of the 1st Year's (1977) Survey Bridges

Name of Bridges	Location	Surveyed Bridges: Year	Length (m)	Villages	Beneficiaries: Households	Population	Farmland (ha) 1)	Remarks
Jubuk	Gyeong-gi Yongin	75	30	2	150	950	70	New
Shin-pyeong	Gyeong-gi Yongin	72	61	1	54	340	83	New
Jangdeok	Gang-weon Myeongju	75	48	2	232	1,325	110	Expansion
Hyeon-cheon	Jeon-Bug Iksan	75	14	3	84	542	65	New
Sangya	Chung-Bug Choong-weon	75	30	5	200	1,300	120	New
Deoksan	Gyeong-Bug Chilgog	76	35	3	219	1,190	176	New
Undong	Chung-Bug Cheong-weon	76	40	4	297	1,600	321	New
Chiljae	Gang-weon Myeongju	76	40	3	320	2,100	87	New
Average			37.3	2.9	195	1,168	118	

1) Farmland includes paddy field, upland and orchards

Annex Table 8. Outline of the 2nd Year's (1978) Survey Roads

Code No.		Surveyed Roads: Province/County	Year	Length	Width	Beneficiaries: Villages	Households	Population	Farmland	Remarks
IBRD	001	Gyeonggi, Yongin	77	2.5km	5m	1	33	204	81ha	New
"	002	Gyeonggi, Paju	76	1.6	5	7	167	911	228	Broaden
"	003	Chungnam, Gongju	76	3.6	5	3	137	1,336	106	New
"	004	Chungbuk, Jecheon	76	3.0	5	4	191	1,262	169	New
"	005	Chungbuk, Boeun	77	3.0	5	20	413	2,431	511	New
"	006	Chungnam, Seosan	77	3.6	5	3	326	2,048	367	Broaden
"	007	Chungnam, Nonsan	76	4.8	6	12	1,138	4,887	565	"
Saemaul	008	Chungnam, Buyeo	75	12.0	5	6	555	3,252	308	"
"	009	Chungnam, Hongseong	75	1.0	5	3	256	1,280	203	New
"	010	Chungbuk, Jecheon	76	1.5	5	2	87	525	66	New
"	011	Chungbuk, Boeun	76	1.5	5	19	670	3,645	16	Broaden
Average				3.4	5.1	5.4	361	1,980	238	

Annex Table 9. Outline of the 2nd Year's (1978) Survey Bridges

Code No. Classification	Surveyed Bridges		Beneficiaries						Remarks
	Province/County	Year	Length (m)	Width (m)	Villages	Households	Population	Farmland	
IBRD	Chungnam, Gongju	(76)	40	5	2	95	518	17	New
"	Chungnam, Seosan	(76)	36	6.5	3	369	1,850	141	"
"	Chungbuk, Jecheon	76	40	5	3	183	1,429	154	"
"	Chungbuk, Boeun	76	30	5	17	485	2,541	561	"
"	Chungnam, Hongseong	(76)	50	5	6	496	2,713	35	"
"	Gyeonggi, Yeoncheon	76	50	4.8	2	100	846	201	"
Saemaul	Chungbuk, Jecheon	77	36	5	2	65	320	65	"
"	Chungbuk, Boeun	77	40	5	6	185	176	245	"
"	Chungnam, Nonsan	78	49	5.3	2	126	743	48	Expansion
Average			41.1	5.1	4.8	233.8	1,237	163	

Annex Table 10. Investment Costs of the 1st Year's (1977) Surveyed Roads and Bridges

(1,000 won on 1976 Prices)

	Code No.	Roads				Bridges			
		Length (km)	Construction Cost[1] Total	Per km	O&M[2]	Name of Bridges	Length (m)	Construction Cost[1]	O&M[2]
NON-IBRD	01	4.0	17,246	(4,311)	1,140	Jubuk	30	5,510	72
	02	1.5	5,839	(3,892)	452	Shinpyong	61	7,600	120
	03	0.9	3,968	(4,409)	262	Jangdeok	48	10,864	96
	04	2.1	7,112	(3,386)	630	Hyoncheon	14	3,001	30
	05	2.0	8,514	(4,257)	632	Sangya	30	5,040	96
IBRD	06	2.0	9,493	(4,746)	744	Deoksan	35	6,293	60
	07	3.0	18,436	(6,145)	962	Undong	40	6,994	108
	08	3.2	10,222	(3,194)	1,081	Chiljae	40	7,957	108
Average		2.34	10,104	4,440	738	Average	37.3	6,657	86.2

1) All costs converted into 1976 prices.
2) " " "

Annex Table 11. Investment Costs of the 2nd Year's (1978) Survey Samples

(1,000 won on 1977 prices)

	Code No.	Feeder Roads					Bridges				
		Length (km)	Construction Cost		O & M		Name of Bridges	Length (m)	Construction Cost		O & M
			Total	Per Km					Total	Per m	
IBRD	001	2.5	12,370	4,948	830		Godang	40	8,035	280	112
	002	1.6	10,987	6,866	975	I	Whangrak	36	7,064	196	135
	003	3.6	26,870	7,463	1,230	B	Songkye	40	9,869	246	120
	004	3.0	19,248	6,416	1,075	R	Ewon	30	6,161	205	215
	005	3.0	22,930	7,643	1,155		Seoryok	50	7,471	149	82
	006	3.6	15,140	4,205	1,150	D	Jungri	50	11,816	236	90
	007	4.8	22,907	4,772	1,970		-	-	-	-	-
SAEMAUL	008	12.0	41,023	3,418	1,050	S	Shirim	36	5,538	153	75
	009	1.0	8,226	8,226	715	A	Jangshin	40	7,188	179	120
	010	1.5	7,133	4,755	760	E	Hangweol	49	14,780	301	117
	011	1.5	7,125	4,750	870	MAUL					
Average		3.4	17,632	5,768	1,070		Average	41	8,658	207	118

Annex Table 12. Average Daily Traffic of Rural Roads After Construction, 1977: 1st Year's Survey Roads

Surveyed Project	On foot (prs)	Bicycles & Motorcycles (units)	Carts & Tillers (units)	Trucks (units)	Cars (units)	Bus (units)
01	140	65	35	8	15	10
02	190	40	50	4	-	-
03	160	30	40	2	2	-
04	180	60	50	6	8	-
05	220	40	16	2	7	8
06	200	36	10	2	6	-
07	280	60	20	2	16	-
08	210	55	30	2	2	-

Annex Table 13. Average Daily Traffic of Rural Roads After Construction, 1978: 2nd Year's Survey Roads

Code No.	On foot (prs)	Bicycles (units)	Motorcycles (units)	Carts & Tillers (units)	Trucks (units)	Cars (units)	Bus (units)
001	15	40	5	10	1	1	-
002	160	100	15	15	15	10	-
003	60	80	25	30	5	10	8
004	110	80	10	4	8	4	2
005	130	38	15	13	6	8	4
006	150	150	30	20	10	10	4
007	200	300	45	90	60	65	10
008	190	160	20	70	8	12	4
009	190	180	20	35	5	3	-
010	80	48	2	4	2	2	-
011	60	24	6	2	1	-	-

Annex Table 14. Average Daily Traffic of Rural Bridges After Construction, 1977: 1st Year's Survey Bridges

Name of Bridges	On foot	Bicycles Motorcycles (units)	Carts & Tillers (units)	Trucks (units)	Cars (units)	Bus (units)
Jubuk	150	80	50	6	10	-
Shinpyong	110	70	23	10	10	-
Jangdeok	200	60	30	30	30	10
Hyoncheon	120	25	10	-	8	-
Sangya	200	70	20	4	4	4
Deoksan	90	40	40	2	5	-
Undong	190	60	20	8	4	8
Chiljae	300	60	20	30	20	-

Annex.Table 15. Average Daily Traffic of Rural Bridges After Construction, 1978: 2nd Year's Survey Bridges

Name of Bridges	On foot (prs)	Bicycles (units)	Motor-cycles (units)	Carts & Tillers (units)	Trucks (units)	Cars (units)	Bus (units)
Godang	144	40	1	2	1	0	-
Whangrak	310	90	16	24	1	8	-
Songkye	160	30	14	10	10	6	4
Ewon	350	25	5	26	5	12	2
Seoryok	250	160	30	16	8	25	-
Jungri	350	70	4	50	10	2	-
Shirim	200	30	20	10	2	4	-
Jangshin	126	12	1	7	3	2	-
Hangweol	200	20	0	20	0	1	-

Annex Table 16. Reduction in Transportation Costs of Agricultural Outputs and Inputs by Bridges, 1977: 1st Year's Survey Samples

Name of Bridges	Unit Cost Savings (won/km/t)	Distance to Market (km)	Bridge Length (m)	Effective Length (km)	Agricultural Products Sold (M/T)								Total Cost Savings of Outputs (won)	Fertilizers Bought (t)	Cost Savings of Inputs (won)	Total Transp. Cost Savings (won)
					Rice	Barley	Pulses	Potatoes	Vegetables	Fruits	Others	Total				
Jubukkyo	550	4	30	0.6	72	22	22	60	9	-	4	189	62,370	17	5,610	67,980
Shinpyongkyo	550	4	61	0.6	79	27	11	48	28	-	13	206	67,980	18.5	6,105	74,085
Jangdeokkyo	210	6	48	0.8	192	22	9	84	8.4	216	1.8	533	89,544	48	8,064	97,608
Hyoncheonkyo	550	7	14	0.7	120	25	2.8	48	5.6	-	1.8	203	78,155	18	6,930	85,085
Sangyakyo	550	18	30	0.5	132	34	19	96	50	-	11	342	94,050	30.7	8,443	102,493
Deoksankyo	550	2	35	0.6	348	53	5.7	60	11	72	2.4	552	182,160	49.7	16,401	198,561
Undongkyo	550	5	40	0.7	280	67	15	72	8.4	-	1.8	444	170,940	40	15,400	186,340
Chiljaekyo	550	2	40	0.8	98	20	2.8	96	16.8	72	1.2	307	135,080	27.6	12,144	147,224
Average		6	37.3	0.66								347	110,035	31	9,887	119,922

Annex Table 17. Reduction in Transportation Costs of Agricultural Products and Inputs by Bridge Construction, 1978: 2nd Year's Survey Samples

(On 1977 prices)

Name of Bridges	Cost Savings won/km/t	Distance to Market (Km)	Bridge Length (m)	Effective Length (Km)	Quantity of Farm Products Sold (M/T)								Total Cost Savings (won)	Fertilizer Feed Bought (t)	Total Cost Savings (w)	Total Savings (won)
					Rice	Barley	Pulses	Potatoes	Vegetables	Fruits	Others	Total				
Godang	685	3.5	40	0.5	61.0	4.4	3.8	3.5	3.1	-	1.5	77.3	26,475	62.1	21,269	47,744
Whangrak	685	2.5	36	1	343.2	107.6	1.6	4	16.1	-	-	472.5	323,662	700.3	479,705	803,367
Songkye	685	8	40	1.5	91.8	31.2	11.5	5.2	30.7	-	72	242.4	249,066	66.4	68,226	317,292
Ewon	685	4.6	30	0.2	328.8	32	1.2	3.1	9.1	16.6	5.5	386.3	52,923	223	30,551	83,474
Seoryeok	685	3	50	1.8	330.4	46.4	7.6	24.9	41.6	-	4.6	455.5	561,631	1,446.6	1,783,657	2,345,288
Jungri	685	10	50	1.3	196	9	1.4	0.1	9.8	-	-	216.3	192,615	36	32,058	224,673
Shirim	685	8	36	0.5	89.6	67.2	8	1.4	8.5	-	-	174.7	59,834	37.2	12,741	72,575
Jangshin	310	0.5	40	0.5	134.4	37.8	-	3.1	6.8	-	-	182.1	28,225	436.2	67,611	95,836
Hangweol	685	4	49	2	372.6	6.3	8.8	1.9	260.4	-	-	414.8	568,276	233.1	319,347	887,623
Average	643.3	4.9	41.2	1.0									229,189	360.1	249,551	541,985

Annex Table 18. Increases in Acreages for Vegetables and Fruits Cultivation After the Road and Bridge Project, 1977: 1st Year's Survey Roads & Bridges

Road Code No.	Vegetables		Fruits 1)		Name of Bridges	Vegetables		Fruits 1)	
	Acreage	Production	Acreage	Production		Average	Production	Average	Production
	(ha)	(t)	(ha)	(t)		(ha)	(t)	(ha)	(t)
01	6.7	94	23	439	Jubukkyo	4	17.6	-	-
02	13	182	2	36	Shinpyongkyo	4.4	61.6	-	-
03	4	56	1	18	Jangdeokkyo	-	-	6	118
04	9.3	130	-	-	Hyoncheonkyo	-	-	-	-
05	8	112	-	-	Sangyakyo	-	-	-	-
06	8	56	-	-	Deoksankyo	6	84	2	46
07	17.6	246	-	-	Undongkyo	-	-	-	-
08	14	196	-	-	Chiljaekyo	8	112	3.3	59.4
Average	10.08		6.7		Average	5.6		3.8	

1) Mostly pear and grapes

Annex Table 19. Increases in Acreages for Vegetables and Fruits Cultivation After the Project, 1978: 2nd Year's Survey Samples

Road Code	Vegetables		Fruits		Name of Bridge	Vegetables		Fruits	
	Acreage	Production	Acreage	Production		Acreage	Production	Acreage	Production
	(ha)	(t)	(ha)	(t)		(ha)	(t)	(ha)	(t)
001	3	42	-	-	Godang	0.3	4	-	
002	5	70	-	-	Whangrak	3.3	46	-	
003	3	42	2	30	Songkye	2	28	-	
004	8	112	1	14	Ewon	3	42	1.1	19
005	1	13	-	-	Seoryeok	2.5	35	-	
006	4.9	68	1.1	15	Jungri	1	14	-	
007	66.7	933			Shirim	1.5	17	-	
008	1.7	23	6.3	169	Jangshin	0.8	11	-	
009	2.2	30	-	-	Hangweol	3	25		
010	0.5	7	-	-					
011	-	-	1.1	17					

Annex Table 20. Net Increases in Farm Income Owing to Shift of Cropping pattern to High-Value Crops [1], 1977: Ist Year's Survey Samples

(On 1976 Prices : 1,000Won)

Road	Vegeta-bles	Fruits[2]	Total	Per km	Name of Bridges	Vegeta-bles	Fruits	Total
01	1,161	26,364	27,525	6,881	Jubukkyo	714	-	714
02	2,222	2,150	4,372	2,914	Shinpyongkyo	786	-	786
03	694	1,085	1,779	1,976	Jangdeokkyo	-	7,323	7,323
04	1,467	-	1,467	698	Hyoncheonkyo	-	-	-
05	1,388	-	1,388	694	Sangyakyo	-	-	-
06	1,266	-	1,266	633	Deoksankyo	1,088	-	3,921
07	3,076	-	3,076	1,025	Undongkyo	-	2,833	-
08	2,284	-	2,284	713	Chiljaekyo	1,470	3,747	5,217
Average	1,694	9,866[3]	5,394	1,942[2]	Average	1,014	4,634[3]	3,592

1) Deducted additional transportation costs of increased production tonnage
2) Pear and grapes
3) Average of 3 areas was made to apply to other feasible areas and for an economic viability analysis

Source : Survey data and NAERI Standard Income Data, 1976

Annex Table 21. Net Increases in Farm Income Owing to Shift of Cropping Pattern to High Value Crops[1] 1978: 2nd Year's Survey Samples

(1000won on 1977 Prices)

Road Code No.	Vegeta-bles	Fruits[2]	Total	Per Km	Bridges	Vegeta-bles	Fruits[2]	Total
001	468	-	468	187.2	Godang	46	-	46
002	780	-	780	487.5	Whangrak	514	-	514
003	468	2,860	3,328	924.4	Songkye	312	-	312
004	1,248	1,430	2,678	892.6	Ewon	468	1,573	2,041
005	1,056	-	1,056	352.0	Seoryeok	390	-	390
006	764	429	1,193	331.3	Jungri	156	-	156
007	10,405		10,405	2,167.7	Shirim	234		234
008	265	9,009	9,274	772.8	Jangshin	124	-	124
009	343	-	343	847.5	Hangweol	4,290		4,290
010	168	-	168	250.0				
011	-	1,573	1,573	1,048.6				
Average	1,677[3]	3,060[3]	2,915	761.8	Average	726[3]	1,573[3]	900

1) Deducted additional transportation costs of increased production

2) Pear and grapes

3) Averages of those villages introduced vegetable and fruit production after the project.

Annex Table 22. Increases in Land value After the project: 1st year's Survey Samples.

Road Code	Const Year	Paddy Field (Medium:won) Before Project	Paddy Field (Medium:won) 1977	Name of Bridges	Const. Year	Paddy Field (Medimiwon) Before Project	Paddy Field (Medimiwon) 1977
01	71	1,500	3,500	Jubukkyo	75	3,000	3,500
02	74	1,000	2,500	Shinpyongkyo	73	1,000	4,000
03	75	1,200	3,500	Jangdeokkyo	75	1,000	3,500
04	75	1,300	3,000	Hyoncheonkyo	75	1,500	2,500
05	75	1,500	2,500	Songyakyo	75	3,000	5,000
06	76	800	2,000	Deoksankyo	76	2,700	3,400
07	76	1,000	2,000	Undongkyo	76	3,000	4,000
08	76	4,000	5,000	Chiljaekyo	76	2,200	3,500

Annex Table 23. Increases in Land Value After the Project: 2nd Year's Survey Samples

Road Code .No	Year	Paddy Field (medium, won)		Name of Bridges	Year	Paddy Field (medium, won)	
		Before Project	1978			Before Project	1978
001	77	4,000	3,000	Godang	76	1,500	3,000
002	76	2,000	3,000	Whangrak	76	2,500	3,500
003	76	2,500	5,000	Songkye	76	2,300	3,500
004	76	2,500	4,000	Ewon	76	2,500	4,000
005	77	2,000	4,000	Seoryeak	76	3,000	3,500
006	77	2,500	3,000	Jungri	76	2,500	4,500
007	76	2,500	4,000	Shirim	77	3,000	3,300
008	75	2,000	4,000	Jangshin	77	4,000	4,500
009	75	1,200	3,500	Hangweol	78	4,000	4,500
010	76	1,500	3,000				
011	76	2,500	4,000				
Average	-	2,290	3,680	Average		2,800	3,811

Annex Table 24. Increases in Number of Commuting Students and Workers After the Project, 1977: 1st Year's Survey Samples

Road	No. of Students Increased			No. of Workers	Bridge Code	No. of Students Increased			No. of Workers
	Primary	Middle	College			Primary	Middle	College	
01	-	75	3	2	001	-	-	-	-
02	-	2	-	-	002	15	5	-	10
03	10	10	-	-	003	20	30	-	-
04	-	10	-	-	004	-	-	-	-
05	50	50	-	-	005	-	-	1	1
06	2	-	-	-	006	5	3	-	2
07	100	30	-	30	007	-	-	-	-
08	-	-	-	-	008	-	-	1	2

Annex Table 25. Increases in Number of Commuting Students and Workers After the Project, Sanples 1978: 2nd Yeąr's Survey

Road Code	No. of Students Increased			No. of Workers	Name of Bridges	No. of Students Increased			No. of Workers
	Primary	Middle	College			Primary	Middle	College	
001	1	5	-	-	Godang	2	5		-
002	-	-	-	15	Whahgrak	12	40		6
003	17	36	-	-	Songkye		71		-
004	0	7	-	1	Ewon		32		-
005	-	12	-	14	Seoryeok	50	21		13
006	10	22	-	1	Jungri	1	20		-
007	52	50	-	8	Shiram	10	15		-
008	-	80	-	1	Jangshin	-	8		-
009	59	62	-	5	Hangweol	-			-
010	-	13	-	-					-
011	-	27	-	9					-