

韓-中 國際 學術會議  
發表論文

道路改良事業 效果測定：  
- 韓國의 事例 -

**Measures of Effectiveness for  
Road Improvement Projects：  
A case of Korea**

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## 1. Introduction.

Very little research has been conducted in Korea to examine the impacts and benefits which may result from the improvement of low level rural roads in terms of their social and economic implications. While many of these impacts cannot be quantified, they can and do have positive effects on the quality of life of rural residents. Other impacts can be quantified over time.

This paper is one of the first attempts to empirically establish social and economic impacts associated with rural roadway improvements specific to the Korean environment. These impacts can be both quantitative and qualitative and are separated from the normal analysis of user benefits and costs.

The impacts associated with the rural road projects are of many types. While most are quantifiable, they are not additive. For example, the impacts on population cannot be added to the agricultural crop value or the traffic volume impact. Instead, the impacts must be viewed as useful unto themselves: that is, they provide insights into what a rural project does for a village. As such, they are viewed in composite in making decisions.

Traditionally road projects have been evaluated in operation, cost and economic terms based on the direct impacts: that is, the traffic volumes derived and the economic efficiency gains achieved (vehicle operating costs, time saved, etc.) due to the act of trip making. However, it is believed that a road project, especially one in a rural setting, might do more than merely create transportation efficiency.

The direct vehicle operating cost and time saving impacts of roads projects are well documented elsewhere. Therefore, this study did not focus on such impacts. Rather, the study focused on other, possibly more indirect impacts such as agricultural production, tourism, freight rates, transportation services, public services, and various demographic and social impacts. By documenting these indicators of impact before construction, after construction and in the longer term, it could be believed that the wider role of the road projects can be understood. The purpose of this study is, therefore, the development of an understanding for the road investments in the future.

The methodologies appears in Section 2, which is followed by the study design in Section 3. The general findings for impacts of road pavement

projects will be discussed in Section 4, and the results of net impacts analysis of the projects will be shown in Section 5.

## 2. Methodologies.

### 2.1. Time Period.

Most of the impact types analyzed herein (population, value of agricultural production, etc.) do not occur immediately upon project implementation. Rather, they will occur gradually, and be most noticeable only 5 or even 10 years after project implementation. Others (freight rates, trip making, etc.) are shown to occur more quickly. In addition, most of these impacts do not vary significantly from one year to the next; therefore, the impact analyses are done in "blocks" of time, rather than annually.

In this study, therefore, we apply the following two time blocks to analyze impacts of road improvement projects.

Project Completion Period - This time period reflects the period during which the road projects were built. It could be expected considerable transportation impacts during the period, but the induced economic base (agriculture, other economic) and indirect (public services, demographic, social) impacts will take longer to develop. For this reason, the Project Completion Period monitoring phase seeks to establish a "baseline"; the baseline could be used to gauge the longer term impacts in the remaining blocks of observation time.

Full Development Period - It might be believed that the demographic, social and agricultural impacts will be noticeable several years after project completion.

### 2.2. Impact Types.

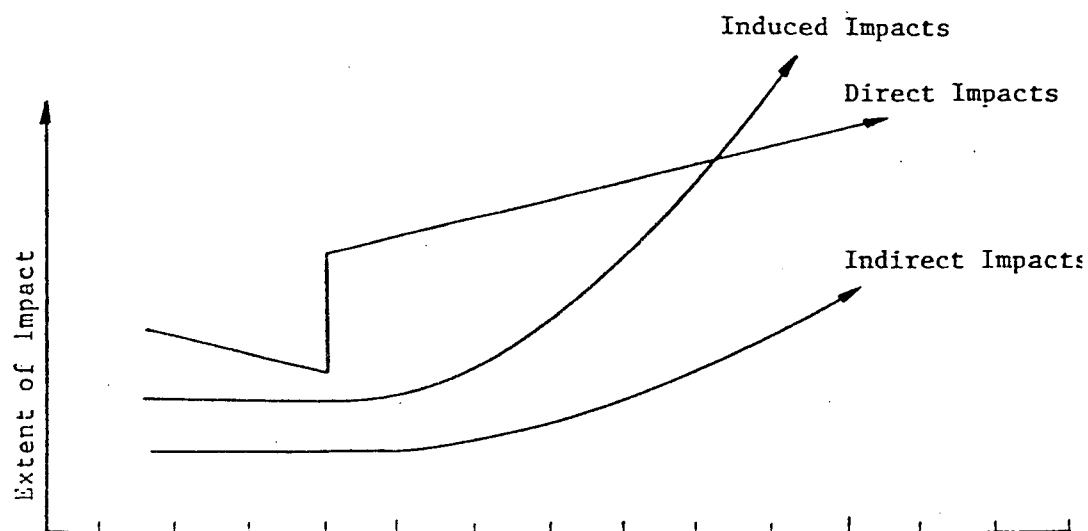
In this study, the impacts of the road projects are divided into three types: Direct, Induced and Indirect. These types are different from each other because they comprise very real impact differences, and occur at different points in time. For example, <Figure 1> presents a conceptual time series for the three impact types.

Direct Impacts- The "Direct" Impacts comprise the transportation services and efficiencies associated with each project. As shown in <Figure 1>, these efficiencies and impacts decline slightly during road project construction; then, upon project opening, they increase dramatically, e.g., average speed

increases from 25 km/hr to 50 or 75 km/hr. Thereafter, the composite value of the impacts increases gradually.

Indirect Impacts- The "Indirect" Impacts comprise the various public services, demographic and social changes that occur due to the road project. As shown in <Figure 1>, these are rather constant during the road construction phase, and then increase gradually as the longer-term benefits occur.

Induced Impacts- The "Induced" Impacts comprise the real long-term economic impacts of the roads, and comprise the inflow of monies into the service region due to increased value of agricultural production, expenditures by tourists, and other business activities that are encouraged by the road project. <Figure 1> indicates that these impacts occur gradually, but ultimately are extremely important.



<Figure 1> Conceptual Flow of Impacts over Time

### 2.3 Impact Categories.

In this study the impacts is divided into four categories. These impact categories represent a logical flow of road project implications, and data is developed to gauge the extent to which each impact actually occurred.

#### Transportation Impacts (Direct)

The first impact to be observed is "direct" impacts on transportation, including the costs of trip making or cargo shipping, the number of trips made, overall transportation efficiencies, safety, and transportation services provided.

#### Perceived Transportation Impacts by Residents

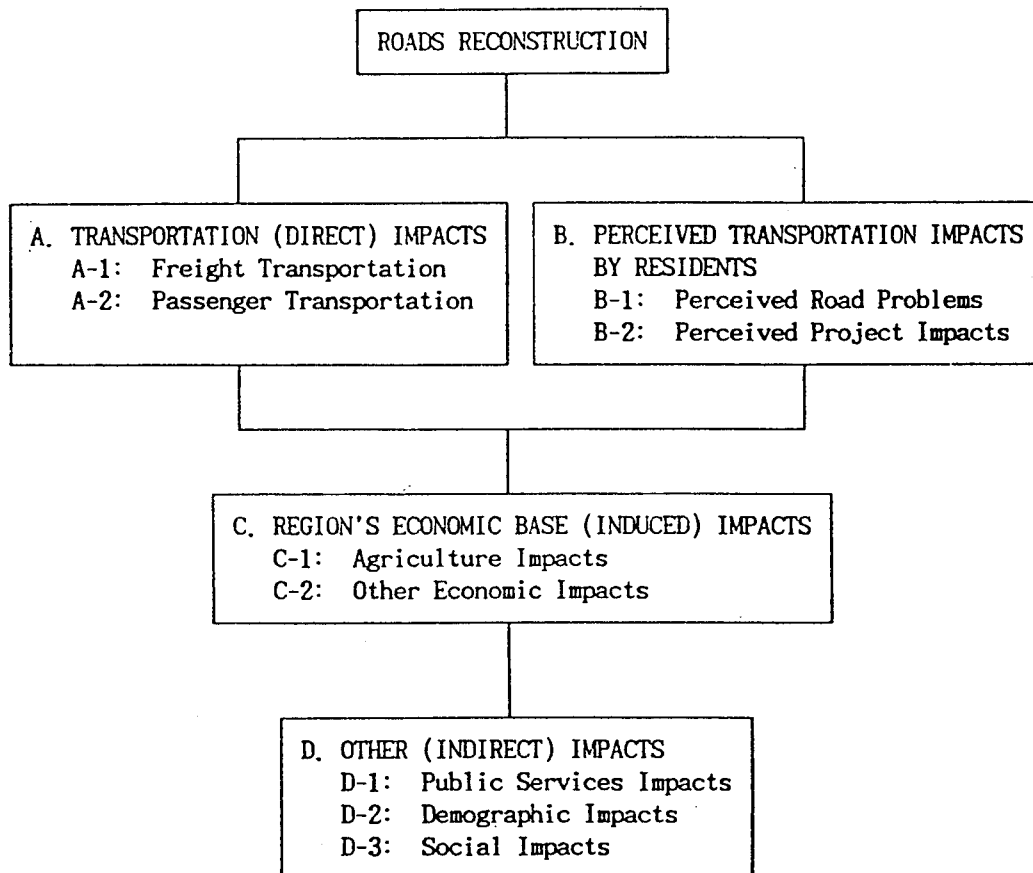
We discussed the road projects with people living in the road service areas both prior to the construction and after the completion of projects. The study sought to gauge how the residents view the roads, the road project itself and each project's impact on transportation services.

#### Region's Economic Base Impacts (Induced)

The road projects are ultimately intended to comprise the basic infrastructure upon which local economic development can be based. Therefore the study examined the economic base of the areas, to ascertain the extent to which the road projects lead to such (induced) economic development. The "full development" phase is important, since sufficient time has elapsed to make the most important economic impacts to be evident.

#### Other (Indirect) Impacts

Finally, the road improvement projects might lead to improve public services, which are intended to support the expanding local economy. The expanding economy, the availability of improved infrastructure and public services, and the other road project impacts then get reflected in "indirect" benefits to the area's residents-- in terms of increased income, improved housing conditions, and in other ways-- which in turn could cause an improved standard of living and quality of living in rural Korea.



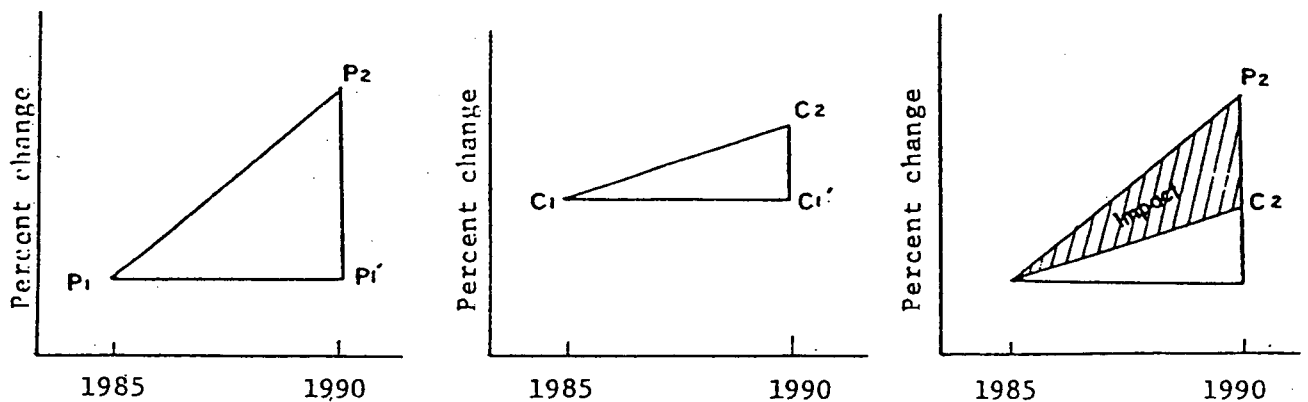
<Figure 2> GENERAL FLOW OF ROADS PROJECTS IMPACTS

#### 2.4. Project Area and Control Area

The impact analysis in each phase will find that changes have occurred during the preceding analysis period. For example, in 1985/86 the value of agricultural production was greater than in 1982, and traffic volumes were also higher. However, those increases might not occur due to the road project.

To ascertain the extent to which a change is due to a road project, we use both "Control" Road and "Project" Road areas. The control areas have major road improvements during the period; the project areas have road projects. If the road projects created any impact, the impact is observed if the project areas change at a rate of change that is different than in the past, and different from the control road areas changes (if other things remain equal).

The impacts of the road projects, therefore, are measurable only by comparing the areas served by the project roads with the areas served by the control roads. Furthermore, the control road areas are not identical to the project road areas, e.g., their populations are different, the value of their agricultural production is different, as are their historical rates of change. All of these differences must be recognized in the comparison process.



<Figure 3> CONCEPTUALIZATION OF IMPACT CALCULATION

To allow this recognition, the comparison should initially be made on a percentage change basis. This is the reason that the findings in this study are expressed in percentage change terms. As shown, if the project area increases by  $P_2 - P_1$  percent (percent change in agricultural production value, or population, or household income, or average daily traffic), and if the control area increases by  $C_2 - C_1$  percent, then the difference might be attributable to the road project (all other things being equal). This percentage difference, applied to the value of base year (crops value, or population, or income, or ADT) is the amount of the change (impact) that is due to the road project.

### 2.5. Impact Calculation

According to the above discussion, the net impacts of road project can be measured by the following expressions:

$$\left[ \begin{array}{l} \text{Net \% impacts of} \\ \text{road project} \end{array} \right] = \left[ \begin{array}{l} \text{Differences of \% change} \\ \text{in} \\ \text{project area} \end{array} \right] - \left[ \begin{array}{l} \text{Differences of \% change} \\ \text{in} \\ \text{control area} \end{array} \right]$$

$$\left[ \begin{array}{l} \text{Net amount of impacts} \\ \text{due to road project} \end{array} \right] = \left[ \begin{array}{l} \text{Net \% impacts} \\ \text{of Road project} \end{array} \right] * \left[ \begin{array}{l} \text{Amount of} \\ \text{project area} \\ \text{in base year} \end{array} \right]$$

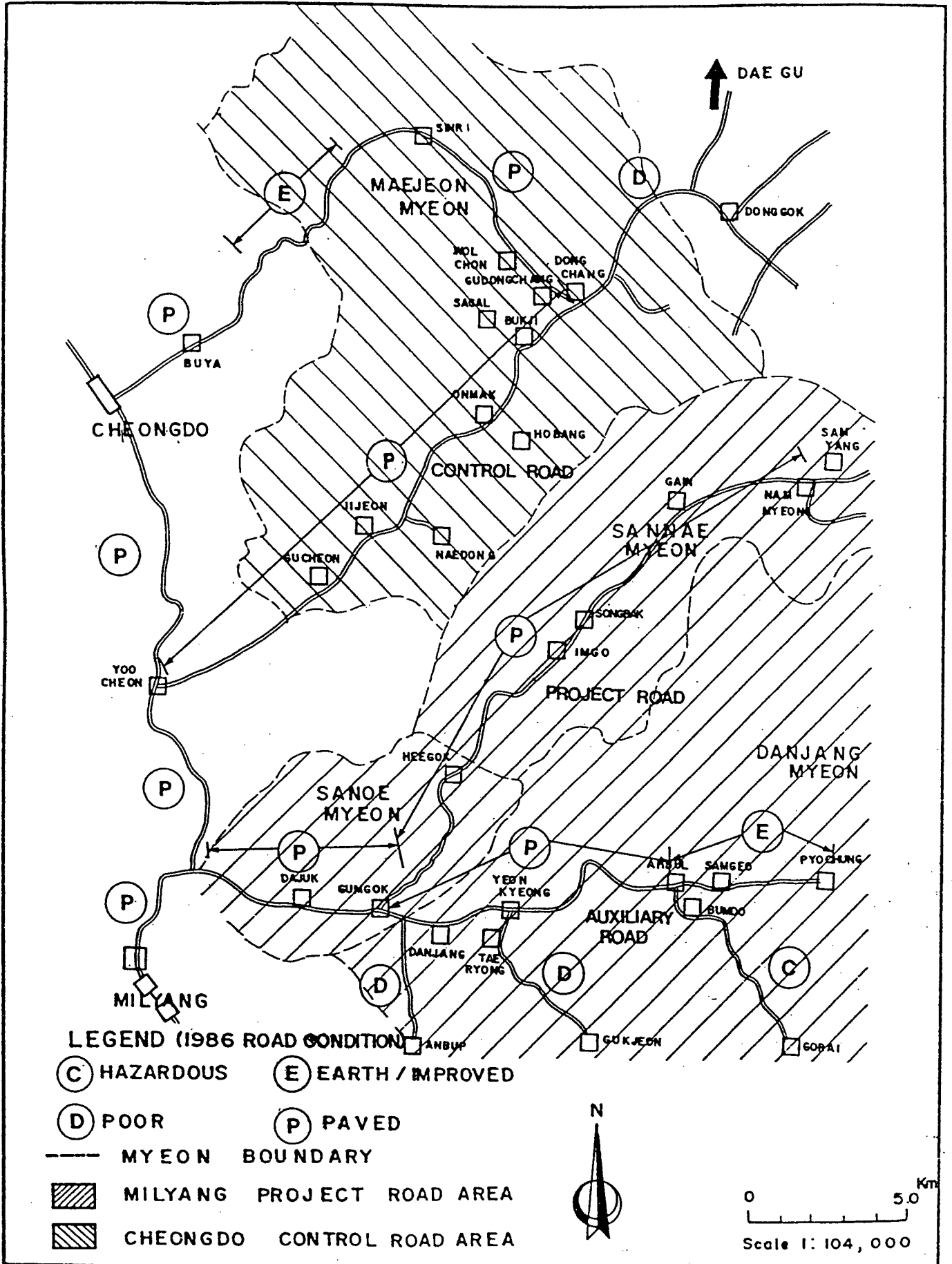
To apply above equations in order to calculate the net impacts of road project, we need at least three data points for both project area and control area.

## 3. Study Design.

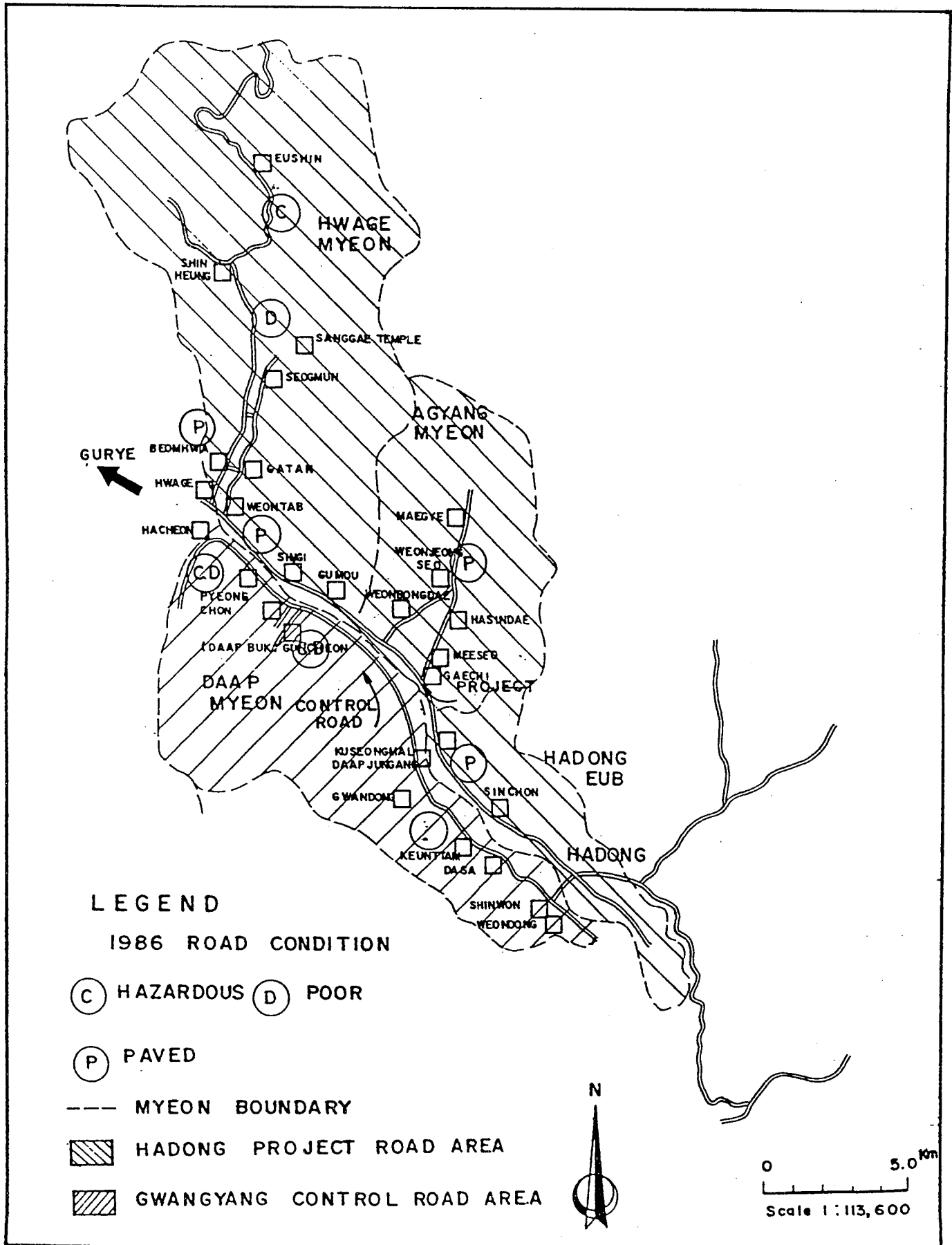
### 3.1. Areas

In this study, we select two project roads (areas) and two associated control roads (areas). The first project road, which had been paved in 1985 by MOC of Korea, is located in Milyang-Gun. This project road is to be studied in conjunction with the first control road located in Cheongdo-Gun. The second





<Figure 4> Milyang-Cheongdo Study Area and Road Conditions



<Figure 5> Hadong-Gwangyang Study Area and Road Conditions

project road in Hadong-Gun is paired with the second control road in Gwangyang-Gun. These project and control roads selected are as follows.

1st Project Road:	Milyang to Sannae, 25.7 Km
Control Road:	Cheongdo Gun, Maejeon Myeon; shown on topographic maps as Provincial Highways No. 987 and 996.
2nd Project Road:	Hadong to Hwagye, 19.2 Km
Control Road:	Gwangyang Gun, Da Ap Myeon, directly across the Seomjin River from the project Road.

### 3.2. Time Frame

As mentioned earlier, we apply two time blocks: "project completion." and "Full development." For the above selected roads, MOC of Korea performed a survey of before-road-improvement (so called, baseline survey) in 1983, and the project completion survey in 1986, the year of projection completion. In 1992, the authors and MOC conducted the follow-up survey for the areas to perform this impact analysis. The followings are details of these.

- ☒ Phase 1: Baseline - For the above selected project roads, improvement works initiated in early 1983. In April 1983 the Road Benefit monitoring study was initiated by MOC. In that year, the monitoring procedures and the "Baseline" conditions were established. The field survey data were collected in June through August 1983. These all data manifested the project areas' conditions that road improvement work had not implemented.
- ☒ Phase 2: Project completion - The road improvement works were completed in December 1985 through June 1986. In July 1986, the 2nd phase Road Benefit monitoring study was initiated. The data of Project Areas that road improvement work had not completed. Other data was collected by personal surveys with related government officials. The data of 1986 partially reflected the impacts and changes after road improvement project had completed. But the period was too short to reflect the full impacts.

- ☒ Phase 3: Full Development - This survey were initiated in December 1991 after 7 years of road improvement. The data reflects long-term effects of road improvement project because 5 to 7 years have been passed after road improvement work completed.

## 4. General Findings

The villages and rural areas served by the project roads (those that were reconstructed and surfaced) have incurred a variety of economic, social and demographic changes. Some of these changes would have occurred even if the roads projects had not been implemented.

To determine the extent to which the road projects caused (or contributed to) to the changes, we examined the areas served by the roads over time, and also observed other reasonably similar areas that had no road improvements. A comparison of these "project road areas" with the "control road areas" (no road projects) is used to determine which transportation, economic, social and demographic changes might be attributable to the road projects themselves.

### 4.1. Impacts on Freight Transportation

The comparison of cargo transportation in 1992 with that in 1986 finds that the road projects caused important improvements. <Table 1> summarizes these freight transportation impacts.

The trucking efficiency improved in Cheongdo control road as the case in project roads. In the project roads, the continuation of construction completion efficiencies are not found anymore. Truck registrations have increased about 100% in each area. More freight fares charged for shipping goods because of wage and consumer price increase.

<Table 1> Impacts on Fireight Transportation  
(1983, 1986, 1992)

	PROJECT AREAS				CONTROL AREAS			
	'83 - '86		'87 - '92		'83 - '86		'87 - '92	
	Milyang	Hadong	Milyang	Hadong	Cheongdo	Gwangyang	Cheongdo	Gwangyang
Number of Trucks	+91%	+36%	+	+137%	+85%	DS	+	+671%
Freight Fare:								
Short Distance	-30%	-16%	+150%	+114%	NC	-16%	-16%	+114%
Mid Distance	-15%	-15%	+36%	+23%	NC	NC	+40%	+23%
Long Distance	NC	+26%	+54%	+16%	NC	NC	+42%	+16%
Lode Factors	50%	+20%	-35%	NA	+30%	+30%	NA	NA
Truck Trips	+120%	+264%	NA	NC	+77%	+77%	NA	NA
Damage	+	+	NC	NC	NC	NC	+	+
Efficiency	30%	+15%	+10%	+10%	NC	+10%	+10%	+10%

"+" indicates an increase or improvement

"-" indicates a decrease

"NA" indicates "Not available" data

"NC" indicates "No Change" or very minor change

"DS" indicates "Data Size" so small as to be unreliable or not useful for comparison

"DU" indicates "Data Unreliable" for diverse reasons

SOURCE: Study Research

#### 4.2. Impacts on Passenger Transportation

Automobile ownership dramatically increased in all areas (project and control). Similarly, motorcycle ownership increased at a rapid percentage gain. The road projects made trips and auto ownership increase.

The long-term effects have appeared in all areas. In Milyang area, Myeon market opened every 5 days in 1986, but now disappeared. The residents of Milyang area purchase their necessities of living at Milyang city. In all project roads, tour trip dramatically increased.

The trend of bus ridership decreased, while auto and motorcycle ownership increased. The short term effect like decrease of vehicle operating costs can not be measured.

<Table 2> indicates that the road projects have resulted in increase in passenger trips.

<TABLE 2> Impacts on Passenger Transportation  
(1983, 1986, 1992)

	PROJECT AREAS				CONTROL AREAS			
	'83-'86		'87-'92		'83-'86		'87-'92	
	Milyang	Hadong	Milyang	Hadong	Cheongdo	Gwangyang	Chungdo	Gwangyang
<b>Mobility:</b>								
Accessibility Rating	+66	+60	NC	NC	+24	NC	+66	+24
Trips/Household/Week	+23	NC	-44	-34	+16	+13	-33	+23
Auto Ownership	+137	+71	+1,208	+128	+66	DS	+360	+428
Motorcycle Ownership	+104	+156	-267	+791	+123	NC	+178	+500
On-Project speeds	+150	+150	NC	NC	NC	NC	+150	+50
Typical Bus Trip Times	-29	-44	NC	NC	NC	--	+22	--
Typical Car Trip Times	-50	-50	NC	NC	NC	NC	--	-25
<b>Bus Transportation:</b>								
Fares	-6	-4	+75	+66	+4	+3	+66	+66
Frequency	+5	+27	+30	+16	+5	NC	+44	+11
Maintenance Costs	-30	-30	NC	NC	NC	NC	-30	-15
Load Factor	-32	+11	-20	-20	-23	NA	-25	NA
<b>Traffic Volumes:</b>								
Car	+153	+222	+476	+166	-37	+350	--	+824
Motorcycle	+204	+34	+21	+160	+18	+10	--	+131
<b>Others:</b>								
Taxi Fare	-30	NC	+8	NC	-15	NC	+10	+20

SOURCE: Study Research

#### 4.3. Perceived Road Problems and Impacts

We are also interested in how the residents of each area feel that they are impacted. The reason for this is that people might perceive themselves to be impacted in ways other than how the statistics indicate that they are actually impacted. Furthermore, the resident's perceptions are useful in understanding those road and transportation features which are important to the residents.

- ☒ Road Problems - In 1983 (prior to the road projects) the people served by the project roads were very concerned about length of travel time (low speeds), road dust, the "bumpy" nature of the road, and the difficulties associated with agricultural transport. In 1986 and 1992 (after road reconstruction), all of these concerns were reduced and speed danger arose as the major concern.
- ☒ Road Project Benefits - Most residents felt that they benefitted most by "travel being made easier," implying that mobility is perceived as the greatest single benefit. Crops transport is also an important perceived benefit, as is the reduction in dust and mud. Most of these perceived impacts have a "quality of life" value as well as an economic value. Tourist industry has grown rapidly, as the roads improved. But insufficient parking lot and sewage disposal arose as the major concern.
- ☒ Bus Service Problems - The residents apparently feel that bus frequencies improved after the road projects were implemented (actually the frequencies improved very marginally). However, bus frequencies also increased in the control road areas. Punctuality is also a perceived problem, as in 1986. One of the major problem is the overspeed of bus. And the residents expressed other various problem like over crowding, etc.

#### 4.4. Impact on Agriculture

The economic base of the areas served by the project roads, as well as the control road areas, is agriculture. The major items of products are vegetables, fruits, food grains and other crops. The ability of these crops to make farming worthwhile depends on the ability of the farmers to sell their products in the marketplace, and this sale requires that the products be transported to market as efficiently as possible.

〈Table 3〉 Observed Impacts on Agriculture

	VALUE OF AGRICULTURE CROPS (Thousand Won)			
	PROJECT AREAS		CONTROL AREAS	
	Milyang	Handong	Cheongdo	Gwangyang
Vegetables:				
1982	7,326,806	2,871,278	1,387,434	706,807
1985	8,316,802	3,038,155	1,951,658	531,048
1992	7,847,972	2,677,019	582,351	419,534
Fruits:				
1982	893,591	478,105	1,412,097	443,235
1985	1,272,115	480,704	4,370,822	25,234
1992	3,712,593	646,070	5,138,533	151,734
Food Grains:				
1982	11,196,681	9,397,191	6,284,191	2,762,483
1985	13,134,756	9,917,557	4,956,000	2,482,082
1992	9,611,875	7,767,325	978,250	2,096,975
Total Crops:				
1982	19,417,078	12,795,302	9,083,722	3,515,725
1985	22,723,673	13,484,416	11,278,480	3,041,564
1992	21,172,440	11,090,414	6,699,134	2,668,243
<u>CROP VALUE PERCENT CHANGE</u>				
Vegetables:				
1982-85	+13.5%	+5.8%	+40.7%	-24.0%
1985-92	-5.6%	-11.9%	-70.2%	-21.0%
Fruits:				
1982-85	+42.4%	+0.5%	+209.5%	-41.6%
1985-92	+191.9%	+34.4%	+17.6%	+501.3%
Food Grains:				
1982-85	+17.3%	+5.5%	+21.1%	-10.2%
1982-92	+26.8%	-21.7%	+80.3%	-15.5%
Total Crops:				
1982-85	+17.0%	+5.4%	+24.2%	-13.5%
1985-92	-6.8%	-17.8%	-40.6%	-12.3%

NOTE: Values expressed at October 1986 prices per ton. Therefore the values on this table reflect production variations, not price variations

SOURCE: Study Research



▣ Road Impacts- This study examined the relationships between the roads, the road projects and the agriculture situations. It was found instance wherein the road projects created four types of direct impact:

- i) Efficiency- It found cost savings in transporting agricultural goods to market. These cost savings are reflected in lower prices and more profits (incentives to raise crops, stay in farming and to remain in rural areas).
- ii) Time Saved- It found instances wherein transport time was saved sufficiently to reduce crops spoilage (in transit) and to enable crops to be carried to longer distant markets (same day service to new markets).
- iii) Damage Reduced- It found instances in which crops damage during transport was reduced, e.g., eggs, and wherein additional cargo could be carried per truck (less protective packing needed).

▣ Agricultural Implications- This potential agriculture implications associated with the above transportation improvements take time to develop. The expected agricultural impacts and results are as follows:

- i) Incentive to grow more crops, due to increased ability to sell them at profitable prices, but crop production decreased.
- ii) Incentive to switch from low value to higher value-added crops, and the switch to vegetables and fruits from other crops has occurred.
- iii) Greater efficiency and therefore more profits. But only a little efficiency could be found.

#### 4.5. Impacts on Service Sector

While agriculture is the dominant form of economic activity in the study areas, there are other economic industries or indicators that are also found to be influenced by the road projects. <Table 4> summarizes a number of these other quantifiable indicators.

It appears that the paving of the project roads had a very substantial positive impact on the number of tourists attracted, especially to the Hadong project area. This increased tourist road activity has induced a number of roadside businesses (retail shops, restaurants, services shops), especially in the Hadong area and especially in the community of Won Tap which is located at an intersection on the project road.

<TABLE 4> Impacts on Service Sector

	PROJECT AREAS		CONTROL AREAS	
	Milyang	Hadong	Cheongdo	Gwangyang
Tourism	+23	+47	NC	NC
Number of:				
Retail Shops	-29	+120	+46	-44
Restaurants	+127	+122	+25	NC
Services Shops	-7	-84	-16	DU
Factories	-5	+30	-32	-31
Retail Food Prices	+47	+15	+32	NC

"+" indicates an increase between 1986 and 1992

"-" indicates a decrease between 1986 and 1992

"NA" indicates "Not Available" data

"NC" indicates "No Change" or very minor change

"DU" indicates "Data Unreliable" for diverse reasons

SOURCE: Study Research

#### 4.6. Impacts on Public Sector

Another important impacts observed in this study comprises improvements in the availability of public services to the areas served by the roads. There improvements include the improved ability of governmental agencies to provided services into the areas, as well as the improved ability of residents to go outside of the area to the available public services the roads made available to the residents the services that already existed but were difficult to get to.

The major fire stations located outside of the road projects areas, with paved roads, effectively respond to fire calls: Previously, travel time had prevented the necessary response time. Access to health services, especially emergency medical services, has increased due to the paved roads. This could lessen the need for new medical services locally, yet increasing overall availability of more centralized health care.

Access to education was found to be an even more significant impact. Prior to the road projects, most high school students had to move from home to board at or near the schools, due to the lengthy travel time between home and school that precluded commuting. With paved roads, more students have found that they can live at home, and commute to school. This saves considerable money (commuting is less expensive than boarding) and enhances the preservation of the

family structure. Compared with 1986, commuting students decreased a little. Furthermore, teachers can also now commute, to more remote area by their own car.

#### 4.7. Demographic Impacts

The population of most rural areas in Korea has, in recent years, been declined. Such a trend is mainly due to reduced family sizes and net out-migration effects. It is expected in 1986 improved rural infrastructure, e.g., roads, will help to reduce out-migrations by making rural areas more attractive to live, by enabling access to jobs and to school, and for other reasons.

<TABLE 5> Demographic Impacts

Classification	PROJECTS AREAS				CONTROL AREA			
	'82-'85		'85-'90		'82-'85		'85-'90	
	Milyang	Hadong	Milyang	Hadong	Cheongdo	Gwangyang	Cheongdo	Gwangyang
Resident Population	-13	-16	-21	-17	-8	-10	-19	-7
No. of Households	+0.4	-4	-7	-2	-2	-1	-6	-10
Ave. Households Size	-13	-13	-16	-16	-6	-8	-14	+5
Farming Households	-1	-11	NA	NA	NA	-1	NA	NA

"+" indicates an increase

"-" indicates a decrease

"NA" indicates "Not Available" data

Source: Study Research

## 5. Analysis of Net Impacts.

The net impacts of the road improvement project has been calculated in six sectors : transportation, demographic, production, service, public and agriculture sectors. The net impacts on transportation sectors are measured by the net change (in terms of percentage and amounts) of the number of originated

trips and the car ownerships. Demographic impacts are measured by population and the number of dwellings, impacts on production sectors by the number of factories, impacts on service sectors by the number of buildings for service shops, impacts on public sectors by the number of buildings for public sector, and impacts on agriculture by the added value of agriculture products. The methodology used here was discussed at Section 2.5.

#### 5.1. Milyang-Cheongdo Area

<Table 6> shows the results of the analysis of the net impacts of the road projects. The most substantial impacts among all sectors from the road improvement project was automobile ownership with 418 percent, while the lowest impacts of the was found in housing with 1.5 percent, in terms of the net percentage change. In agricultural productions, the added value increased by 41 percent, in terms of the net percentage impacts, 9.3 billion won per annum, in 1986 price system.

It is found that the road improvement project in the Milyang-Cheongdo area has produced positive impacts in almost all sectors, with the most substantial being directly in the transportation sector including traffic volume and automobile ownership, etc.

#### 5.2 Hadong-Gwangyang Area

The results of the analysis of the net impacts of the project in the Hadong-Gwangyang area are found in <Table 7>. As is the case with the Milyang-Cheongdo area, positive impacts have been obtained in transportation, industrial, and agriculture sectors. In population and housing, however, the impacts are negative. This is because the changes in the condition of transportation, which have occurred due to the road improvement projects, have transformed the pattern of land use in the areas in the vicinity of the project locations, making former residential quarters into commercial and/or industrial areas. As was in Milyang-Cheongdo area, the most prominent net impacts was obtained in the car ownership which increased by 603 percent, in terms of net percentage impacts, and net impacts of growth of the tertiary industry and public service sector were 41 and 93 percent, respectively. In the added value in agricultural sector, the net growth benefit was 7 percent in terms of the net percentage or 930 Million won per annum, in 1986 price system.

&lt;TABLE.6&gt; Net Impacts in Milyang Area

population(milyang:unit=person)		
year	study area	control area
1983	21134.	9681.
1986	18384.	8903.
1992	14361.	7187.
percentage net effect =		2.37%
total	net effect =	435.

number of dwellings(milyang:unit=dwelling)		
year	study area	control area
1983	900.	510.
1986	894.	510.
1992	884.	500.
percentage net effect =		1.51%
total	net effect =	13.

trips(milyang:unit=trips)		
year	study area	control area
1983	541.	322.
1986	1374.	513.
1992	7911.	2227.
percentage net effect =		46.99%
total	net effect =	646.

number of factories(milyang)		
year	study area	control area
1983	14.	7.
1986	18.	8.
1992	17.	4.
percentage net effect =		30.16%
total	net effect =	5.

car ownership(milyang:unit=veh)		
year	study area	control area
1983	45.	16.
1986	87.	29.
1992	680.	102.
percentage net effect =		417.80%
total	net effect =	363.

number of service bldg(milyang)		
year	study area	control area
1983	115.	59.
1986	133.	57.
1992	254.	66.
percentage net effect =		56.15%
total	net effect =	75.

public sector(milyang:unit=bldg)		
year	study area	control area
1983	51.	15.
1986	47.	17.
1992	55.	13.
percentage net effect =		61.73%
total	net effect =	29.

value of agr-products(milyang:unit=million won)		
year	study area	control area
1983	19417.	9083.
1986	22723.	11278.
1992	21172.	6699.
percentage net effect =		40.92%
total	net effect =	9297.

〈Table 7〉 Net Impacts in Hadong Area.

population(hadong:unit=person)			number of dwellings(hadong:unit=dwelling)		
year	study area	control area	year	study area	control area
1983	27270.	4977.	1983	285.	240.
1986	28669.	4500.	1986	284.	230.
1992	23863.	4170.	1992	277.	286.
percentage net effect = -24.14%			percentage net effect = -30.63%		
total net effect = -6922.			total net effect = -87.		

trips(hadong:unit=trips)			number of factories(hadong)		
year	study area	control area	year	study area	control area
1983	567.	261.	1983	7.	4.
1986	1823.	564.	1986	3.	4.
1992	4841.	716.	1992	3.	3.
percentage net effect = 33.18%			percentage net effect = 82.14%		
total net effect = 605.			total net effect = 2.		

car ownership(hadong:unit=veh)			number of service bldg(hadong)		
year	study area	control area	year	study area	control area
1983	253.	5.	1983	19.	10.
1986	417.	34.	1986	48.	20.
1992	1399.	84.	1992	67.	9.
percentage net effect = 603.61%			percentage net effect = 41.95%		
total net effect = 2517.			total net effect = 20.		

public sector(hadong:unit=bldg)			value of agr-products(hadong:unit=million won)		
year	study area	control area	year	study area	control area
1983	16.	8.	1983	12795.	3516.
1986	20.	16.	1986	13484.	3042.
1992	26.	18.	1992	13090.	2168.
percentage net effect = 92.50%			percentage net effect = 6.94%		
total net effect = 19.			total net effect = 936.		

## 6. CONCLUSIONS

Many of the impacts of roadway improvement will become apparent only after a long period of time has elapsed. For instance, increase in marketability of and demand for agricultural products may take time before the farmers will react to them. It also takes time for migration trends to stabilize. It is for this reason that the impacts of the project have been monitored in the 3 stages: baseline study, project completion, and full development.

The following has been indentified through the 3rd stage of the impacts accomplished so far :

- The impacts in freight and passenger transport are apparent and very substantial.
- The impacts were negligible during the project implementation (1983-1985).
- The impacts become extensively apparent after completion of the project.
- The impacts are extensively apparant during the period for the last stage(1990-1995)
- In the analysis of the net impacts by sectors such as population, automible ownership, value of agricultural production, etc., positive effects are seen in almost all sectors.

It was regretted that reliable income data were not available in the study process. Another fact to be mentioned is that the function of the control roads is disappearing as, in the case of the Milyang-Cheongdo study area, paving of road in Cheongdo complete last year and, and with the Hadong area, the control road in Daap Myeon is now under paving.

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