6.6 Transport Demand Estimate in the Greater Mekong Subregion and Effect of CBTI on Regional Development (Trial Calculation)

By using data collected so far, transport demand in relation to CBTI development was estimated. It should be noted, however, that this estimate was based on some rough assumptions and hypotheses due to limited data availability and uncertain data accuracy.

In this trial estimate, population and GRDP by province were obtained from the official statistics of each country, while the OD tables and the transport network came from the ADB transport sector strategy study. The trial calculation is conducted for the present conditions in 2004 due to data availability.

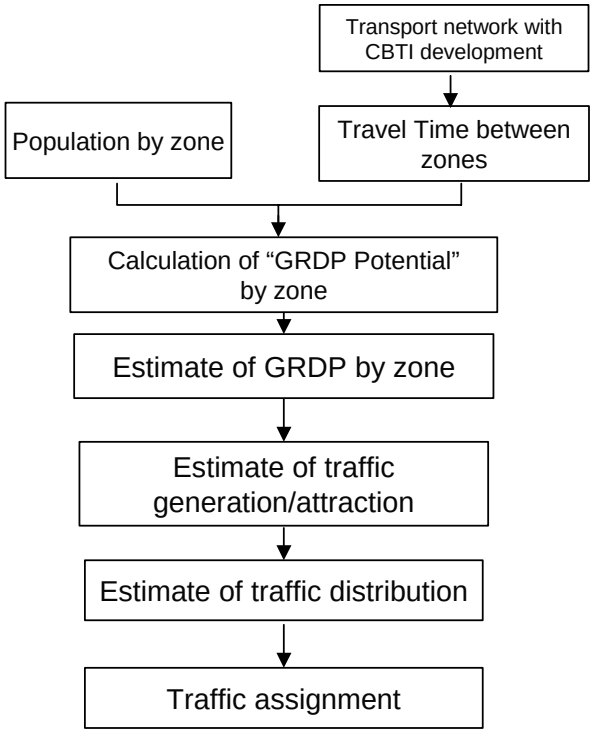
1) Traffic Demand Growth and Regional Development Impacts due to CBTI/CBTA Development

(1) Considerations to Demand Estimation

In this trial calculation, the impact of CBTI development was estimated by assuming that people in one area interact with those in other areas, thereby mutually influencing their respective socio-economies and cultures. This influence is latent and can be called the potential of the region. The potential increases when populations become larger and the distances between two areas shorten. In other words, the potential increases if travel time (time distance) decreases as a result of CBTI development. Higher potential results in the growth of the GRDP and traffic volumes. The process of this demand estimation is schematically illustrated in Figure 6.6.1.

As for zoning, the study area comprising 5 countries and some parts of China was divided into 190 zones according to the provincial boundaries of each country, as was done in the ADB transport sector strategy study. Zones outside the GMS and the ocean-going shipping lines were excluded just like in the ADB study.

Figure 6.6.1 Transport Demand Estimation with CBTI Development



(2) **Estimation Method**

GRDP Estimate

In order to estimate the GRDP, it was assumed that the potential grows as travel time shortens, as a result of CBTI development, and that zonal GRDP changes accordingly.

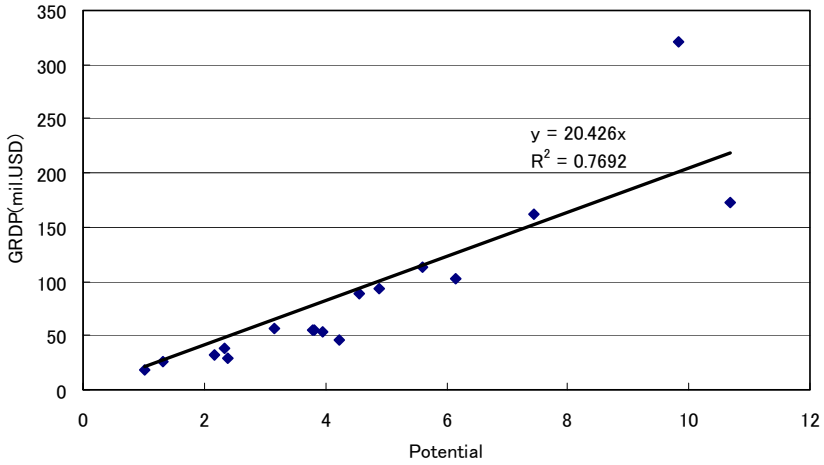
The potential of a zone could be expressed in the following formula:

$$P_i = \sum_n \frac{Pop^i \cdot Pop^j}{d_{ij}} \times 10^{-12} \qquad (1)$$

The advantage of zone i is proportionate to the population Pop^i in zone i and at the same time to the population Pop^j in its partner zone j. It is inversely proportionate to travel time d_{ij} (hour) between zone i and zone j. The potential of zone i is defined as the sum of these advantages for all partner zones. The growth of the potential is thus a result of shortened travel time between zones, which is brought about by CBTI development.

The interrelationship between the GRDP and its potential is almost linear, as exemplified in the figure below:

Figure 6.6.2 Relationship between GRDP and Its Potential in Lao PDR



Since the GRDP-potential interrelationship is markedly different by country, the respective GRDPs were estimated using a correction parameter calculated for each country. For a small number of zones deviating extremely from the average tendency, separate correction factors were applied.

The GRDPs were estimated using the following formula and parameters:

$$GRDP_i = \alpha \cdot P_i \qquad (2)$$

Country	Parameter
Lao PDR	20.426
Vietnam	10.163
Cambodia	17.704
Thailand	76.316
Myanmar	11.009
China	6.510

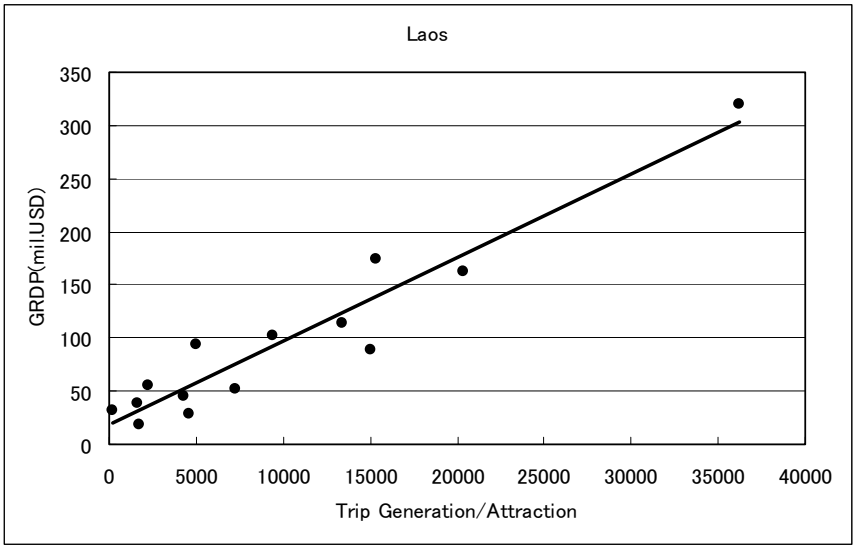
Estimate of Trip Generation/Attraction

The next step was to estimate generation/attraction of passenger and freight in each zone in the GMS.

The ADB transport sector strategy study classified passenger flow into OD tables of 5 modes: motorcycle, car, bus, railway, and inland waterway. Motorcycle use was limited to short-distance trips, and inland waterway was used only in some special areas since traffic volume is small. Thus, for these 2 modes, the present figures were taken without estimating the changes. Trip generation/attraction was estimated for the remaining 3 modes, namely car, bus, and railway. The current modal split shares of these 3 modes were also assumed. However, unlike in the ADB study, intrazonal traffic was not considered.

As for freight flow, the OD table consists of the 3 modes of truck, railway, and inland waterway. Although the freight flow by inland waterway is only between limited zones, the transported volume is large unlike the passenger volume. The total transport volumes in these 3 modes were estimated as the first step. Although the volumes of traffic generation and attraction tended to be generally different for freight, they are almost the same as a shown in the ADB study. Therefore, total generation and attraction volume was first estimated, then divided into generation and attraction using the current ratio of generation and attraction.

Figure 6.6.3 Relationship between Passenger Trip Generation/Attraction and GRDP for Lao PDR



As the relationship between trip generation/attraction and GRDP is almost linear as shown above, the GRDP was taken as an explanatory variable in the regressional equation. Such equation was prepared for each country using a correction factor, as was done in the GRDP estimate, to wit:

$$GA_i = \alpha + \beta \cdot GRDP_i \qquad (3)$$

The parameters by country are shown below.

Country	Passenger Traffic		Freight Traffic	
	α	β	α	β
Lao PDR	-1,193	115.61	2,331	77.30
Vietnam	105,846	189.76	62,652	169.78
Cambodia	0	143.22	3,118	26.43
Thailand	480,835	304.89	132,964	65.56
Myanmar	0	491.16	0	124.23
China	238,134	9.46	21,208	15.73

Trip Distribution

The Fratar method (present pattern method) was applied to estimate trip distribution. Although the gravity model may be suitable for estimating trip distribution to quantify the effect of completed CBTI, the present pattern method was instead adopted due to the lack of data.

While there are many zonal pairs set at zero in the OD tables, the zero was replaced by 1 in the OD tables when the Fratar method was used.

Traffic Assignment

This task assigns the traffic volume between zones onto the transport network. Unlike urban traffic, however, travel time between zones are very long and traffic congestions has little impact on modal choice. Therefore it is assumed that the minimum path in terms of the generalized cost shall be selected.

Traffic assignment was done using PCU (passenger car unit) after converting the passenger and freight flow using the average occupancy (passengers/PCU) and the average load (tons/PCU) as was done in the ADB study.

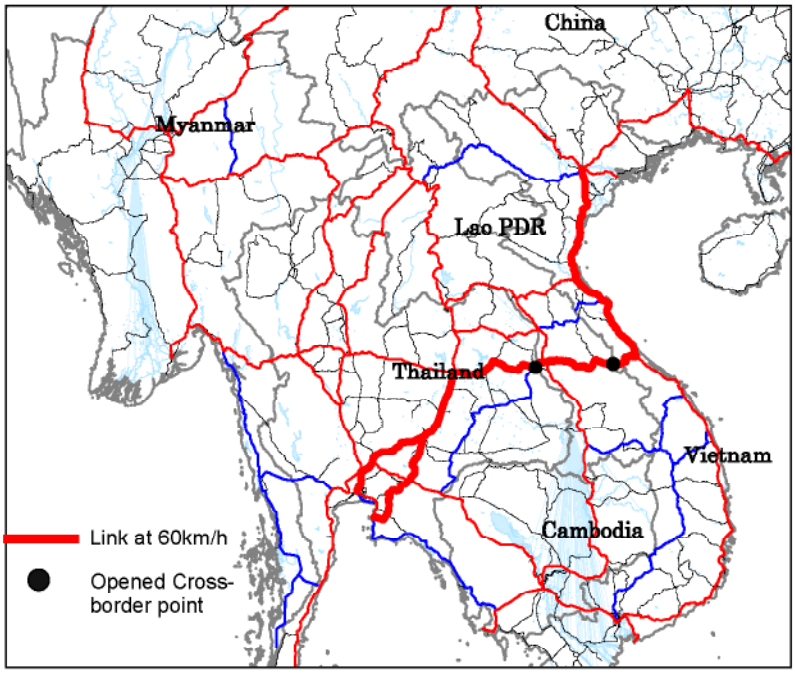
(3) Resulting Demand Estimates

Cases

Demand was estimated for 5 cases as explained below. "Development" means the lowest speed at 60km/h for the improved link (including cross-border point).

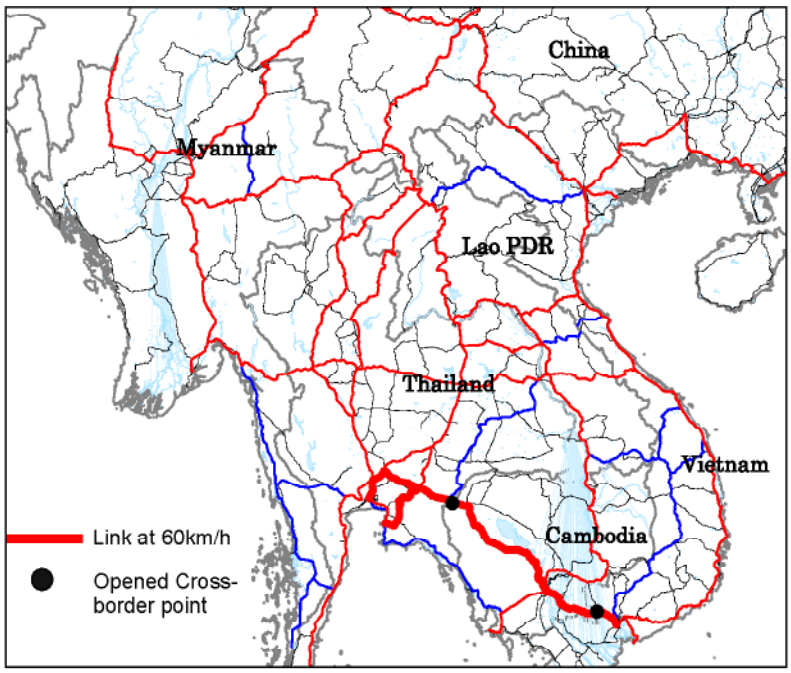
(a) CBTI development between Bangkok and Hanoi

Figure 6.6.4 (1) Demand Forecast Case 1



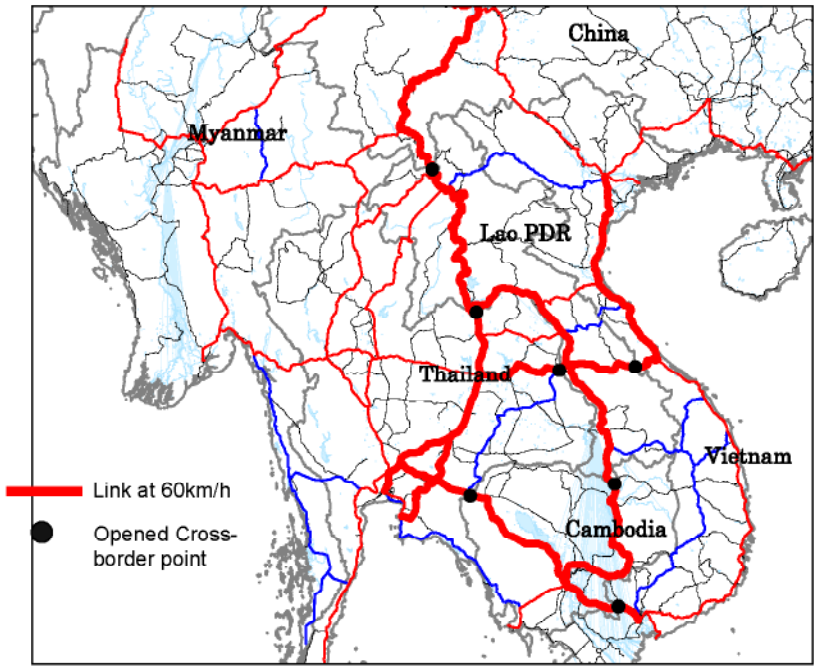
(b) CBTI development between Bangkok and Ho Chi Minh

Figure 6.6.4 (2) Demand Forecast Case 2



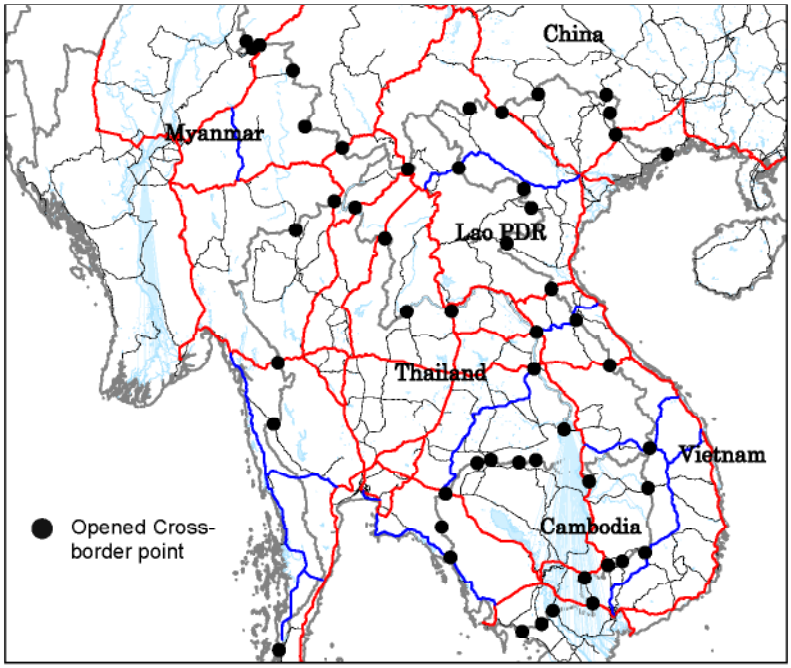
(c) CBTI development along the EW and NS economic corridors

Figure 6.6.4 (3) Demand Estimate Case 3



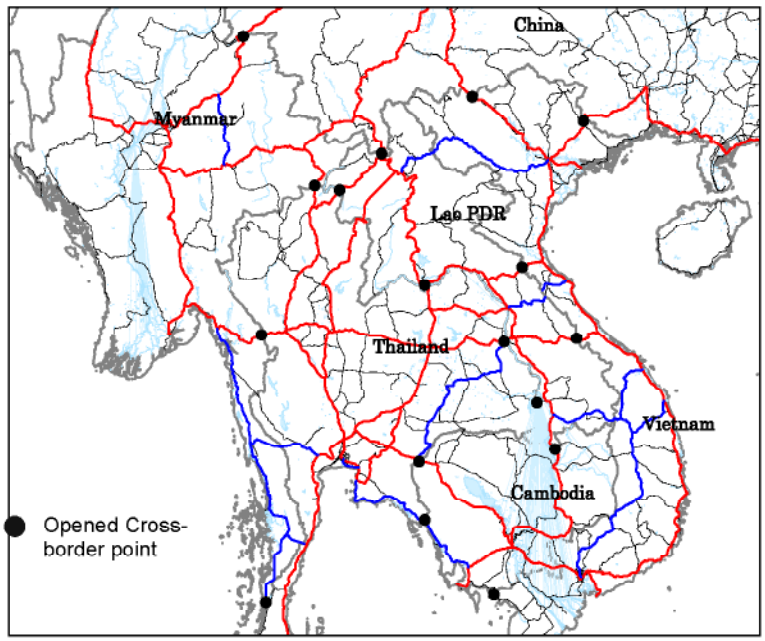
(d) Abolished border-crossing procedures in all cross-border points (no CBTI improvement)

Figure 6.6.4 (4) Demand Estimate Case 4



(e) 16 cross-border points passable within 30 minutes (with CBTA, but no CBTI improvement)

Figure 6.6.4 (5) Demand Estimate Case 5



Results of Estimate

(a) Changes in GRDP

The GRDP increased along with the increase of the potential, which was triggered in turn by the shortened travel time resulting from CBTI development. Table 6.6.1 shows the growth rates of GDP (total of GRDP) by country as compared to the present situation (Case 0: the do-nothing case).

This trial result delivers an important message: that it is highly possible for the GRDP (precisely GRDP Potential) to grow, when and if CBTI/CBTA are completed.

Table 6.6.1 Growth of GDP by Country (%)

	Case-1	Case-2	Case-3	Case-4	Case-5
Cambodia	102.4	155.7	226.5	249.9	237.1
Lao PDR	155.8	100.6	334.3	366.8	331.4
Myanmar	102.8	102.8	104.5	211.0	191.5
Thailand	123.5	119.1	181.6	197.7	189.4
Vietnam	108.1	110.2	137.7	210.9	204.1
China	100.2	100.1	101.7	104.5	104.1

As shown in the table above, the GDP growth rates of Cambodia and Lao PDR are remarkable, while those of China are minimal.

With regard to Case-1 and Case-2 wherein the corridors have improved, the GDP rates of Lao PDR and Cambodia grew sharply. In Case-4, which is based on an extreme assumption of a free cross-border traffic at border points within the Greater Mekong Subregion, all the countries except China grew more than twice (200%).

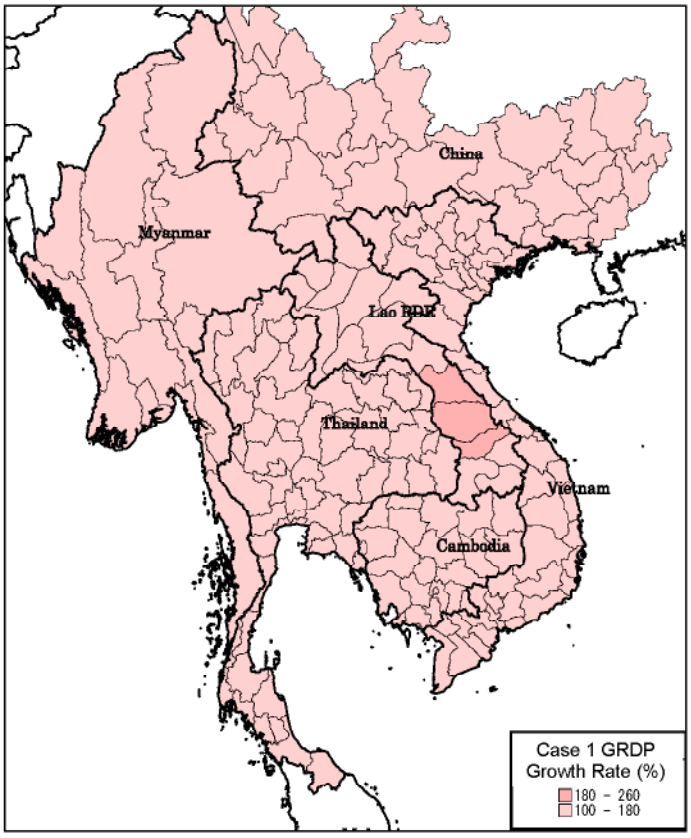
Case-5 shows an intermediate growth between Case-3 and Case-4, implying that "soft" infrastructure development (i.e. CBTA) may have a larger impact than "hard"

infrastructure development (i.e. CBTI) which was the basis for cases 1-3. Growth rates of GRDP by case and zone are shown in succeeding pages.

【Case-1】

This case assumed that the infrastructure between Bangkok and Hanoi through the Second Mekong International Bridge has been developed. GRDP growth could be seen in Lao PDR, where cross-border activities along the east-west economic corridor are promoted. This case assumed the development of roads only inside Lao PDR because on both sides (Thailand and Vietnam), road improvements have already been completed.

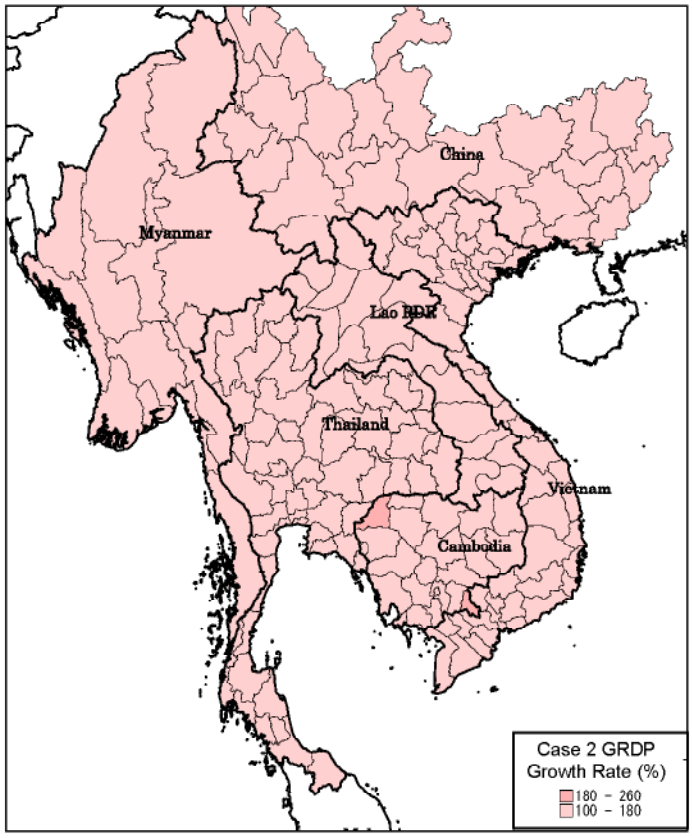
Figure 6.6.5 (1) Case 1: Growth Rates of GRDP



【Case-2】

This case assumed that the infrastructure between Bangkok and Ho Chi Minh has been developed. Increased GRDP could be observed in the border regions of Cambodia where the corridor runs through. This case assumed the development of roads inside Cambodia only.

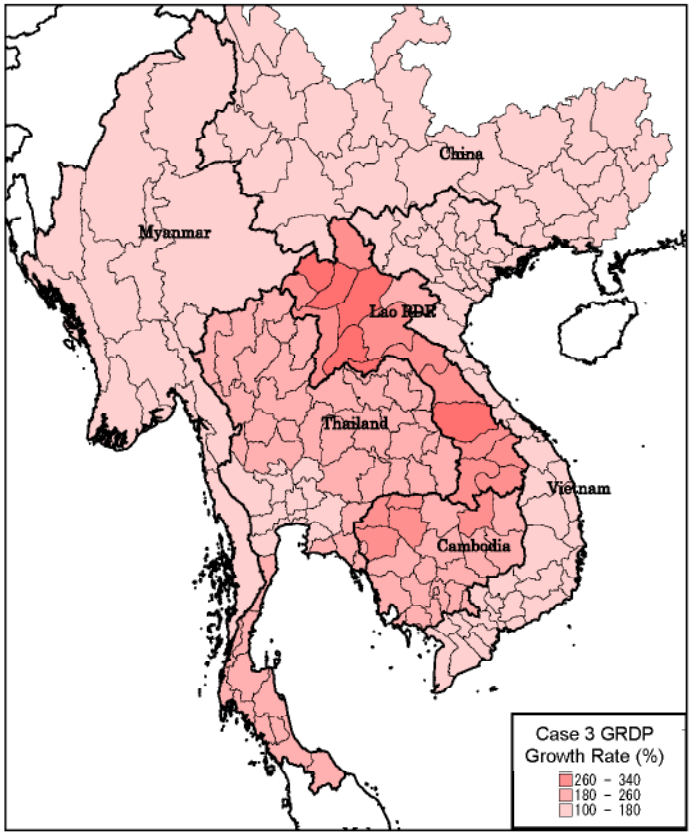
Figure6.6.5 (2) Case-2: Growth Rates of GRDP



【Case-3】

This case assumed that CBTI development in the east-west corridor (Bangkok-Hanoi and Bangkok-Ho Chi Minh) and the north-south corridor has proceeded. The regions where these corridors run through showed GRDP growth. Particularly, the growth rates are significant in northern and central Lao, western Cambodia, as well as in northern and eastern Thailand.

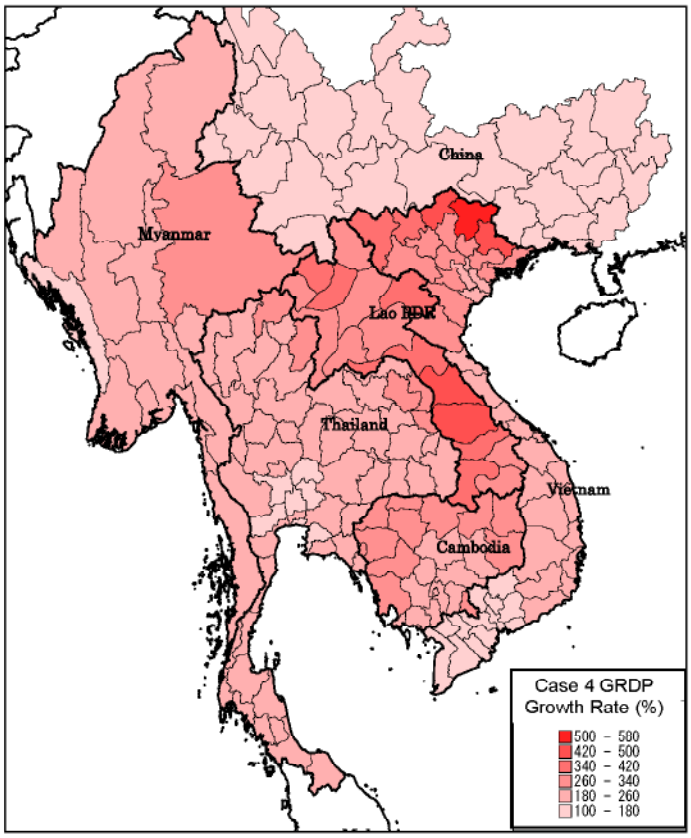
Figure 6.6.5 (3) Case-3: Growth Rates of GRDP



【Case-4】

This case assumed an absence of institutional impedance at all cross-border points within the Greater Mekong Subregion, but CBTI improvement was not taken into account. While GRDP grew all over the subregion, the growth in northern Lao under this case is not so high compared with that under Case-3. This is because CBTI improvement in the north-south corridor was not considered in Case 4, while it was in Case3. It is important to note the significance of developing the road network connecting with the cross-border areas.

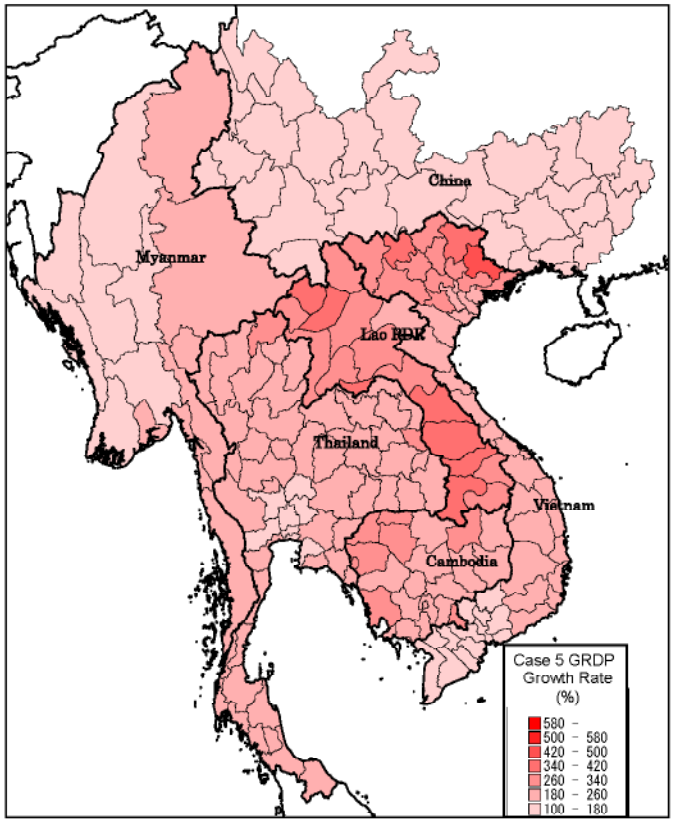
Figure 6.6.5 (4) Case-4: Growth Rates of GRDP



【Case-5】

For the 16 cross-border points covered by the CBTA, cross-border impedance was set at 30 minutes, which is the ADB's performance indicator. As in Case-4, Case-5 did not consider assume any CBTI improvement. The GRDP seemed to grow all over the Greater Mekong Subregion similar to the Case-4 results. Although the growth rates are lower than those in Case-4, the assumed CBTA at 16 cross-border points is considered effective.

Figure 6.6.5 (5) Case-5: Growth Rates of GRDP



(b) Changes in Trip Generation/Attraction

The trial estimates showed that subregional trip generation/attraction could increase together with GRDP growth. Changes in trip generation/attraction by country are shown in the table below for both passenger and freight flows.

Thailand, Vietnam, and China showed lower growth in passenger traffic than that of GDP as shown in Table 6.6.1, while other countries had higher growth rates than that in GDP. As for Cambodia and Lao PDR, freight flow showed lower growth than passenger flow. In other words, in countries with lower GDPs, passenger traffic would grow faster than freight in conjunction with GDP growth.

Table 6.6.2 Growth in Trip Generation/Attraction by Country (Passenger: %)

	Case-1	Case-2	Case-3	Case-4	Case-5
Cambodia	102.0	160.9	238.0	266.0	249.7
Lao PDR	168.4	100.6	365.1	414.7	370.4
Myanmar	102.7	102.7	104.2	209.0	190.3
Thailand	113.3	110.7	146.1	155.4	150.5
Vietnam	104.5	106.2	122.4	164.4	160.1
China	100.1	100.1	100.9	102.2	102.0

Table 6.6.3 Growth in Trip Generation/Attraction by Country (Freight:%)

	Case-1	Case-2	Case-3	Case-4	Case-5
Cambodia	101.5	139.9	185.6	198.3	192.1
Lao PDR	146.9	100.5	275.9	304.9	276.1
Myanmar	102.8	102.8	104.5	211.5	191.8
Thailand	112.7	110.9	144.6	153.1	148.7
Vietnam	104.6	105.4	120.8	176.1	170.0
China	100.2	100.1	101.5	104.3	103.8

The growth in trip generation/distribution by zone for passenger and freight is shown in the figures below. Growth rates differed between passenger and freight traffic. In this trial calculation, industries were taken as a whole without paying attention to the industrial structure. In reality, however, new industries would emerge if the regional potential increases, and freight movement would likely be stimulated as would passenger movement. In the future, it would be necessary to consider the industrial structure in the forecast.

While no changes in freight traffic were observed under Case-2, the figure below shows some traffic growth, about 150%, in Cambodia.

Figure 6.6.6 (1) Case-1: Growth in Trip Generation/Attraction by Zone

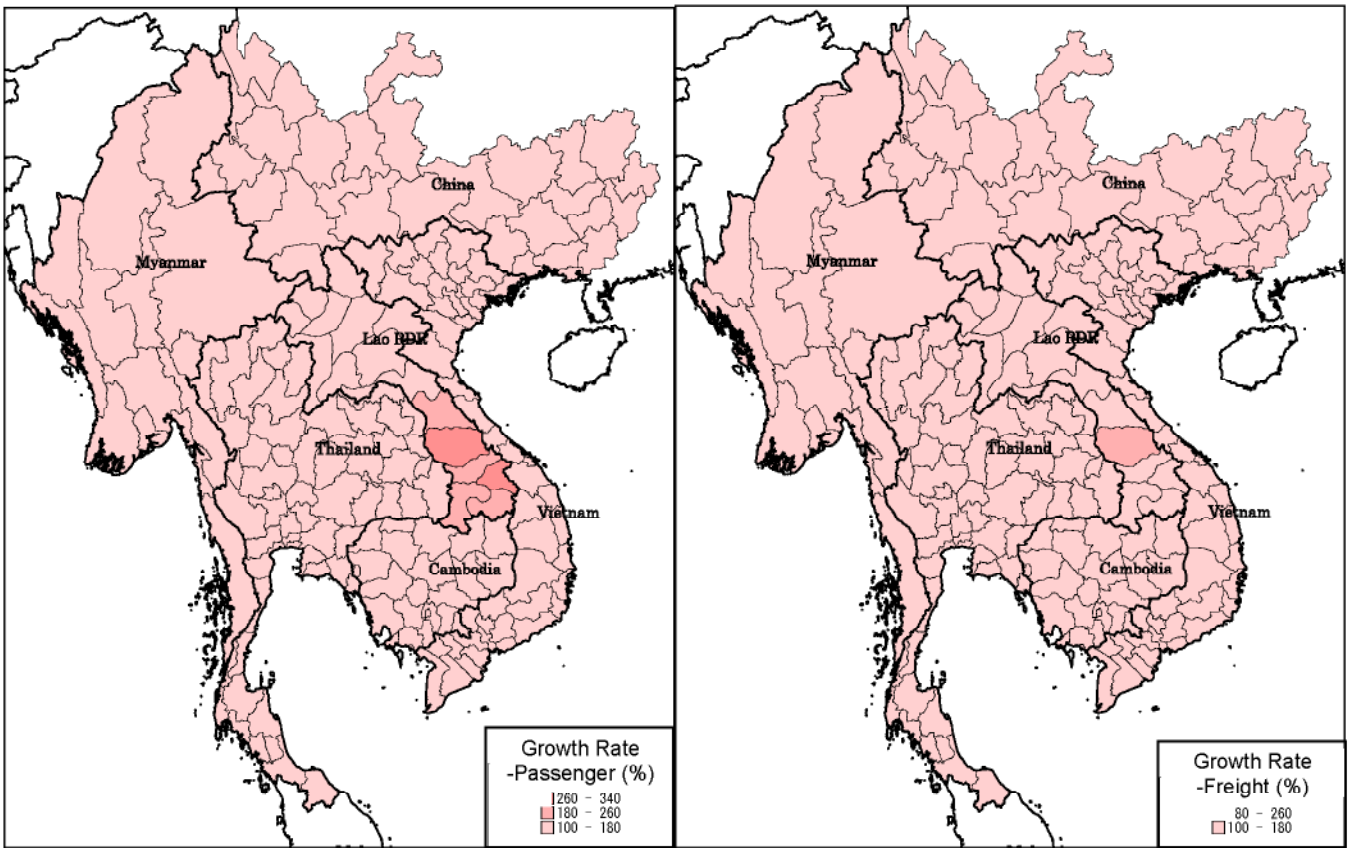


Figure 6.6.6 (2) Case-2: Growth in Trip Generation/Attraction by Zone

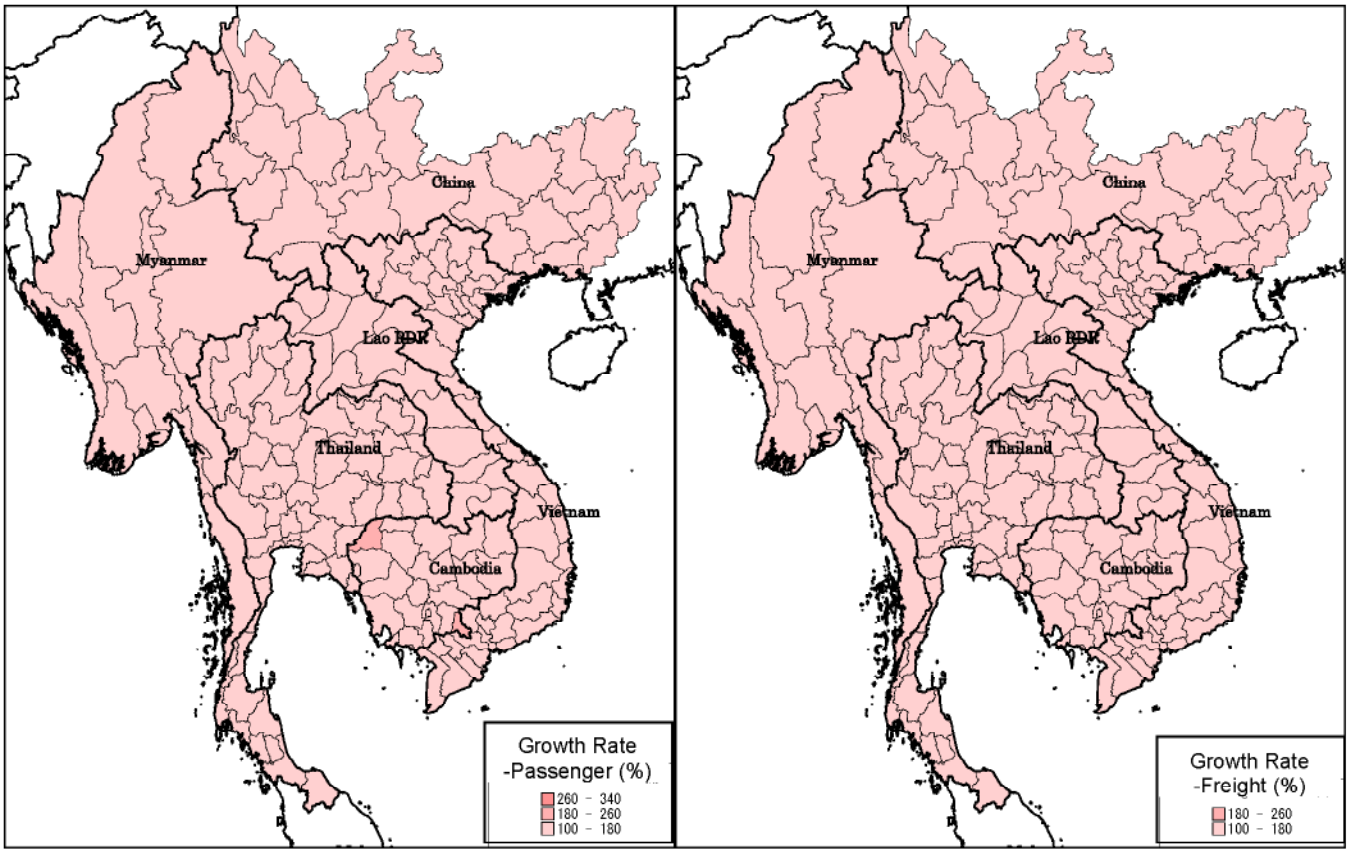


Figure 6.6.6 (3) Case-3: Growth in Trip Generation/Attraction by Zone

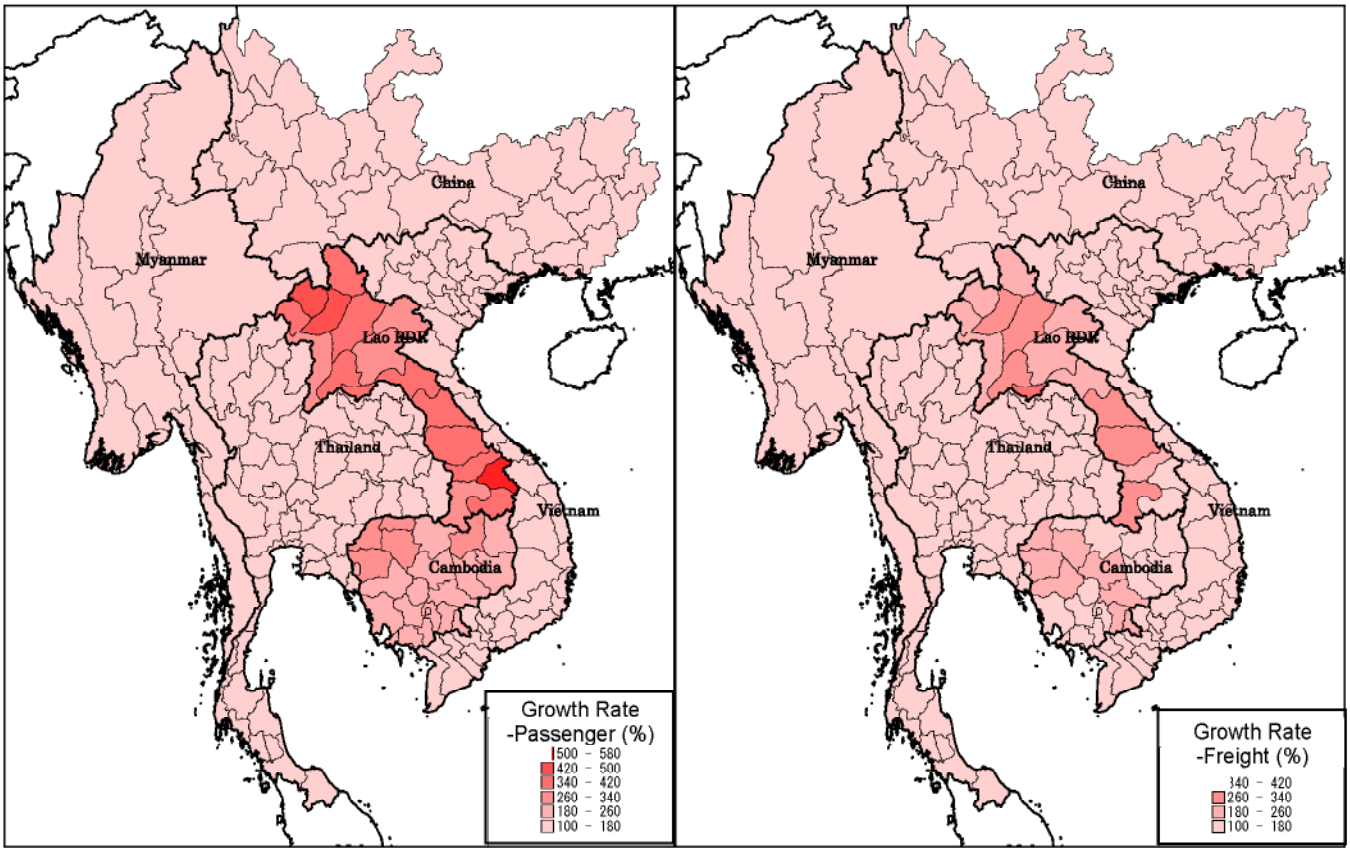


Figure 6.6.6 (4) Case-4: Growth in Trip Generation/Attraction by Zone

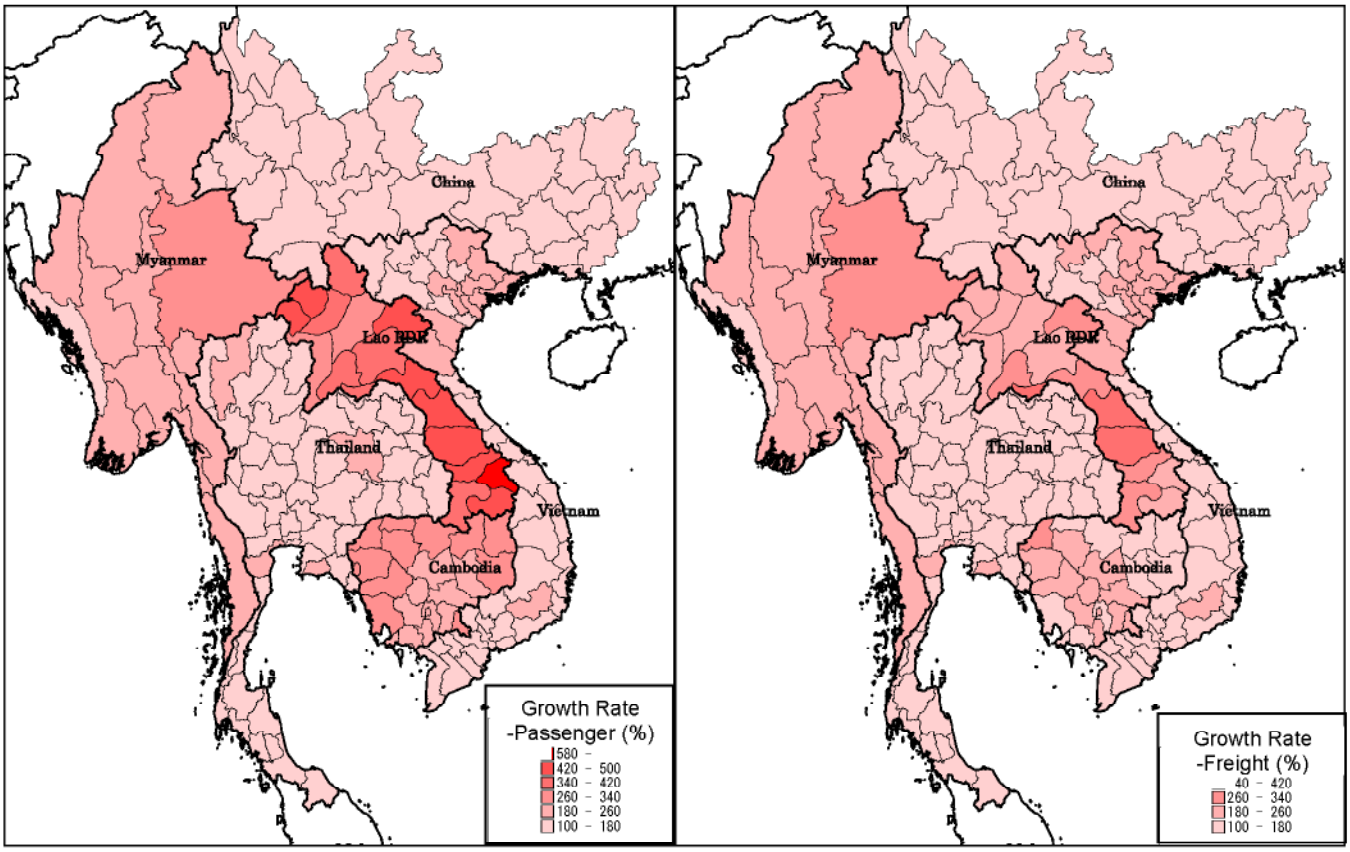
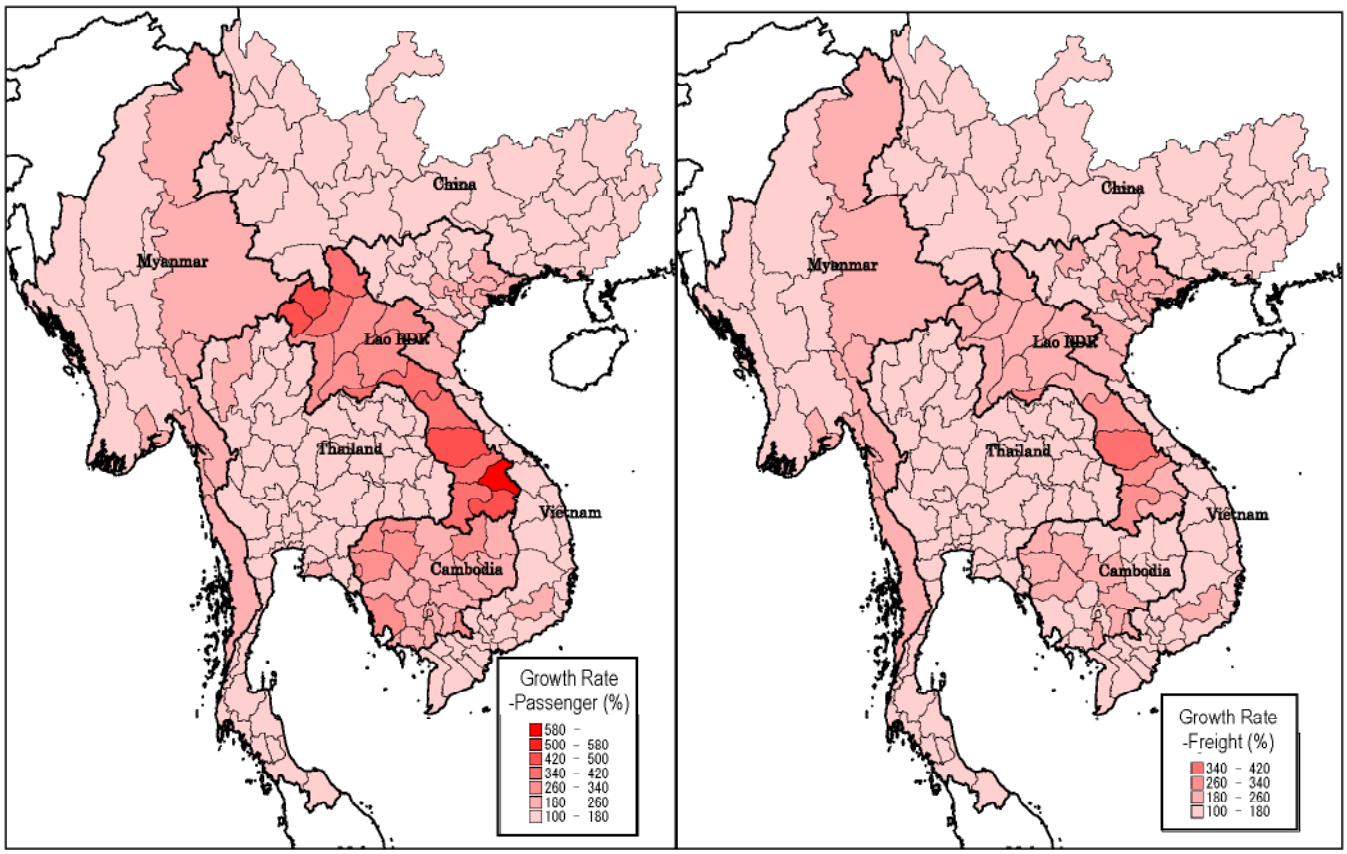


Figure 6.6.6 (5) Case-5: Growth in Trip Generation/Attraction by Zone



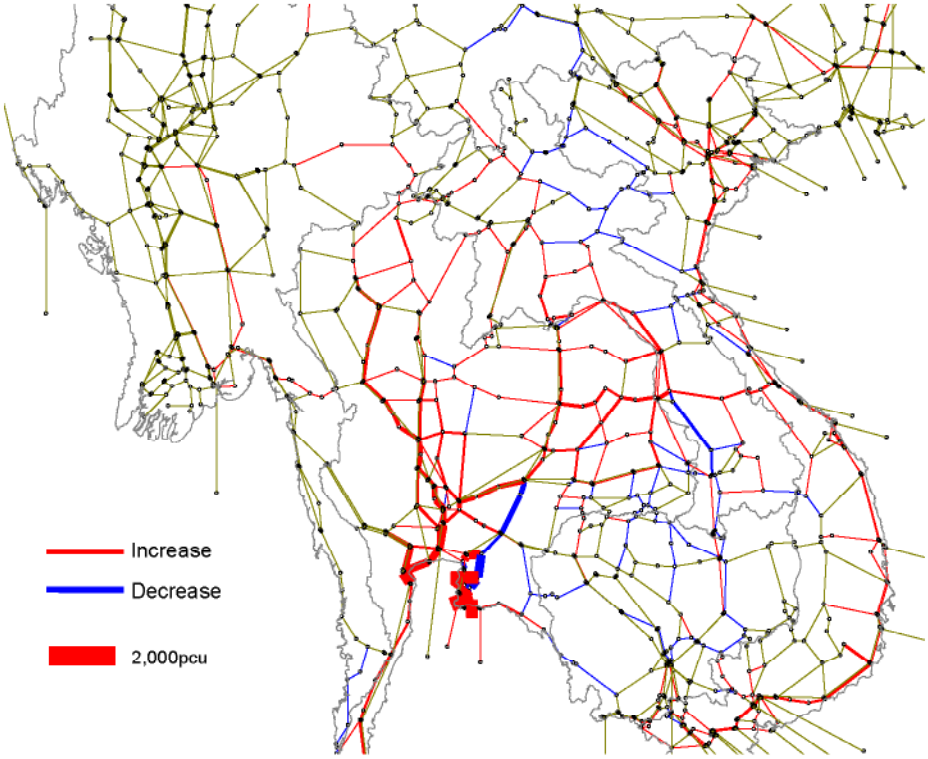
(c) Changes in Traffic Flow

Traffic assignment for each case was conducted using both the present and the estimated OD tables. Figures 6.6.7 (1)-(5) show the changes in traffic volume for each case which assumes varying levels of CBTI/CBTA development. These figures were prepared with this in mind and only indicate the induced traffic generated by CBTI/CBTA development, excluding the influence of route changes.

【Case-1】

This case assumed that CBTI development took place between Bangkok and Hanoi via the Second Mekong International Bridge. Traffic volume increased not only along the corridor but also in Bangkok and around north-eastern Thailand.

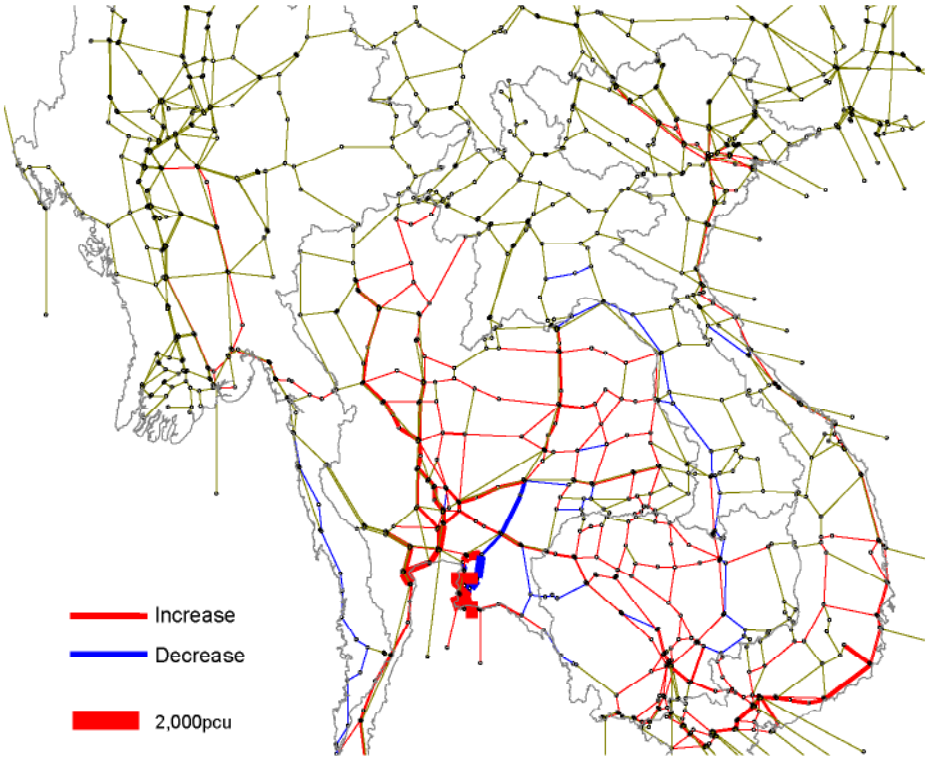
Figure 6.6.7 (1) Case-1: Changes in Traffic Flow (Induced Traffic)



【Case-2】

This case assumed that CBTI development occurred between Bangkok and Ho Chi Minh through Cambodia. Traffic volume increased in Cambodia and in eastern Thailand, in addition to Bangkok region.

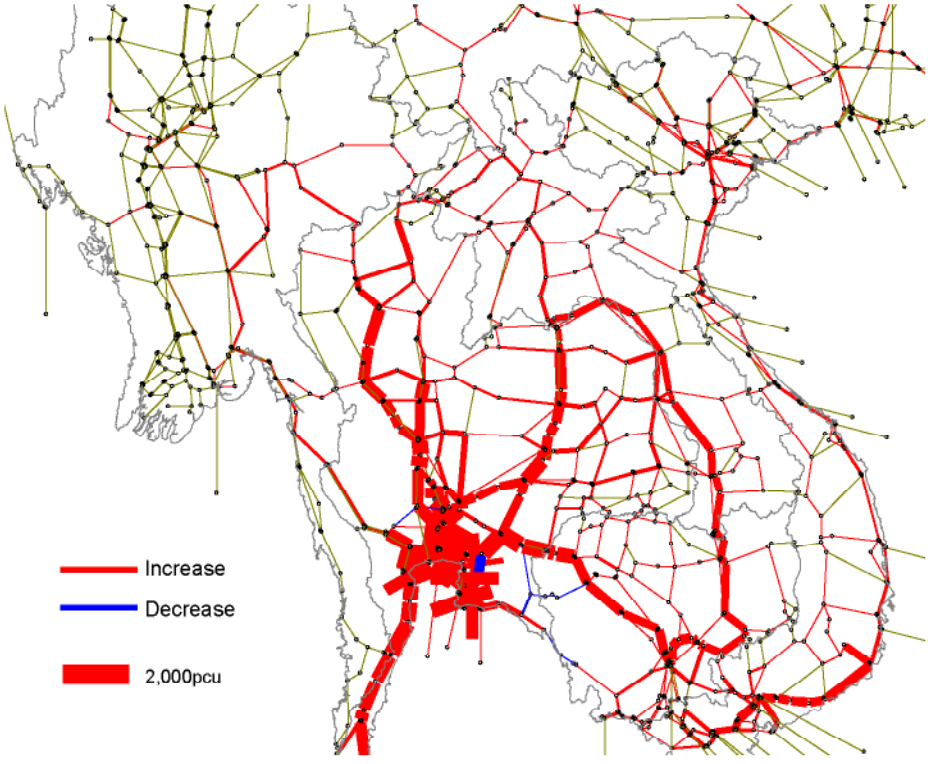
Figure 6.6.7 (2) Case-2: Changes in Traffic Flow (Induced Traffic)



【Case-3】

Under this case, it was assumed that the CBTI on the east-west (Bangkok- Hanoi and Bangkok- HCMC) and the north-south corridors improved. Traffic volumes in the outskirts of Bangkok remarkably increased, while significant increases could be seen as well in the north-south route between Vientiane and Phnom Penh and in the east-west route between Bangkok and Phnom Penh.

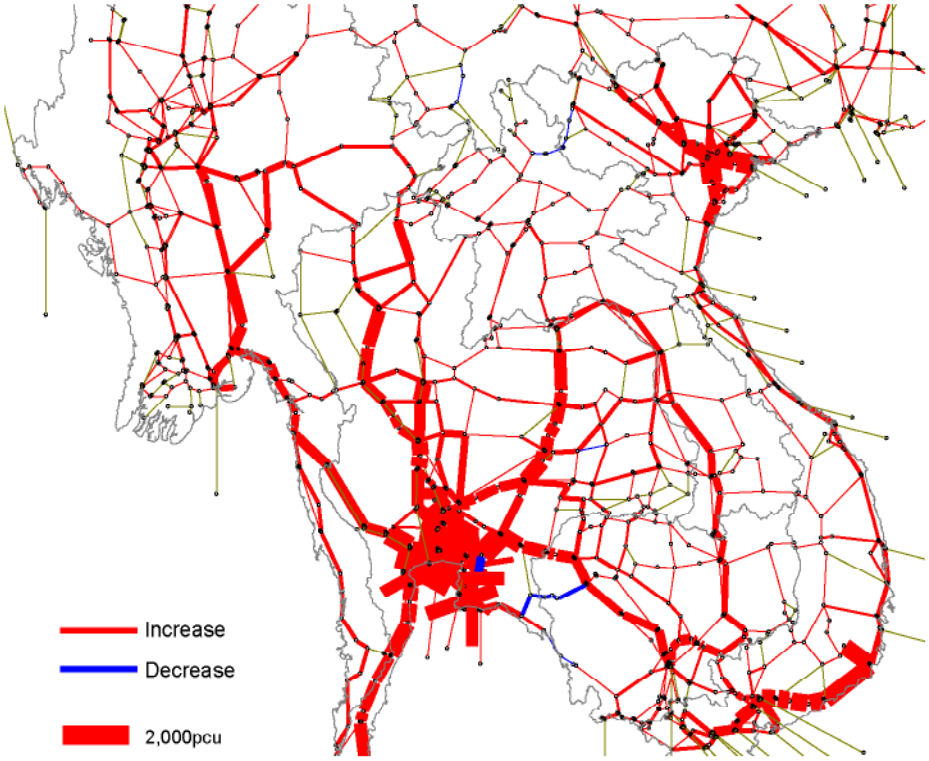
Figure 6.6.7 (3) Case-3: Changes in Traffic Flow (Induced Traffic)



【Case-4】

Under this case, border-crossing procedures at all cross-border points in the GMS were assumed to have been abolished and traffic could pass freely. As a result, traffic volumes increased in the outskirts of Bangkok, Hanoi, and Ho Chi Minh, as well as in the Vientiane-Phnom Penh, Bangkok- Phnom Penh, Bangkok-Yangon routes, among others.

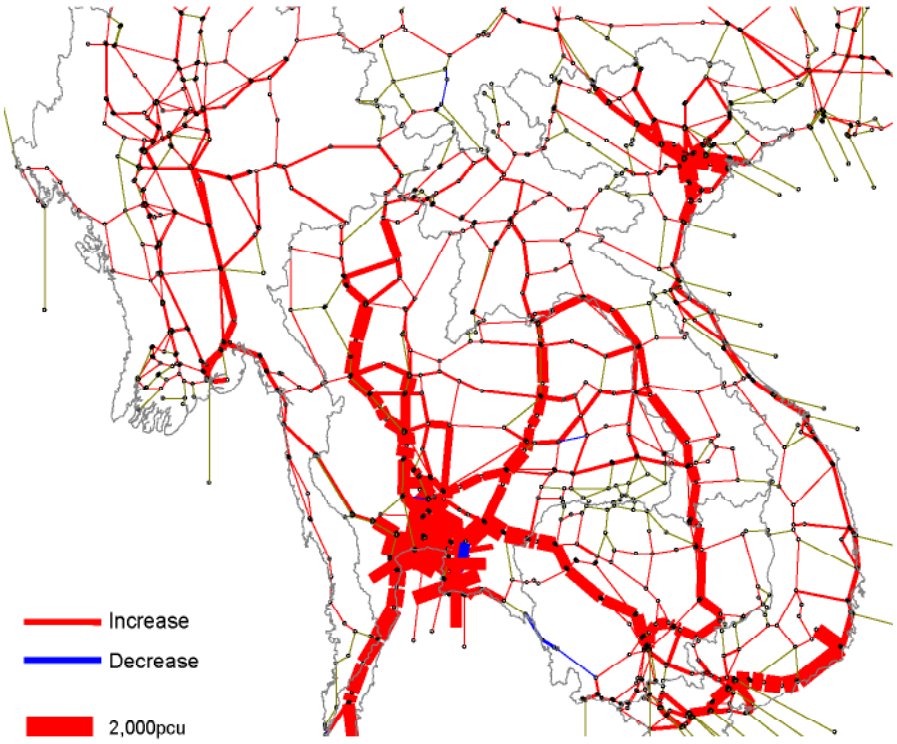
Figure 6.6.7 (4) Case-4: Changes in Traffic Flow (Induced Traffic)



【Case-5】

Under this case, it was assumed that CBTAs were implemented at 16 cross-border points, thereby reducing the institutional impedance to a mere 30 minutes. The pattern of changes in traffic flow would be similar to Case-4, although the increases would be moderate.

Figure 6.6.7 (5) Case-5: Changes in Traffic Flow (Induced Traffic)



2) **Increase in Traffic Demand and Regional Development Impact driven by Foreign Direct Investment (FDI) integrated with CBTI/CBTA Development**

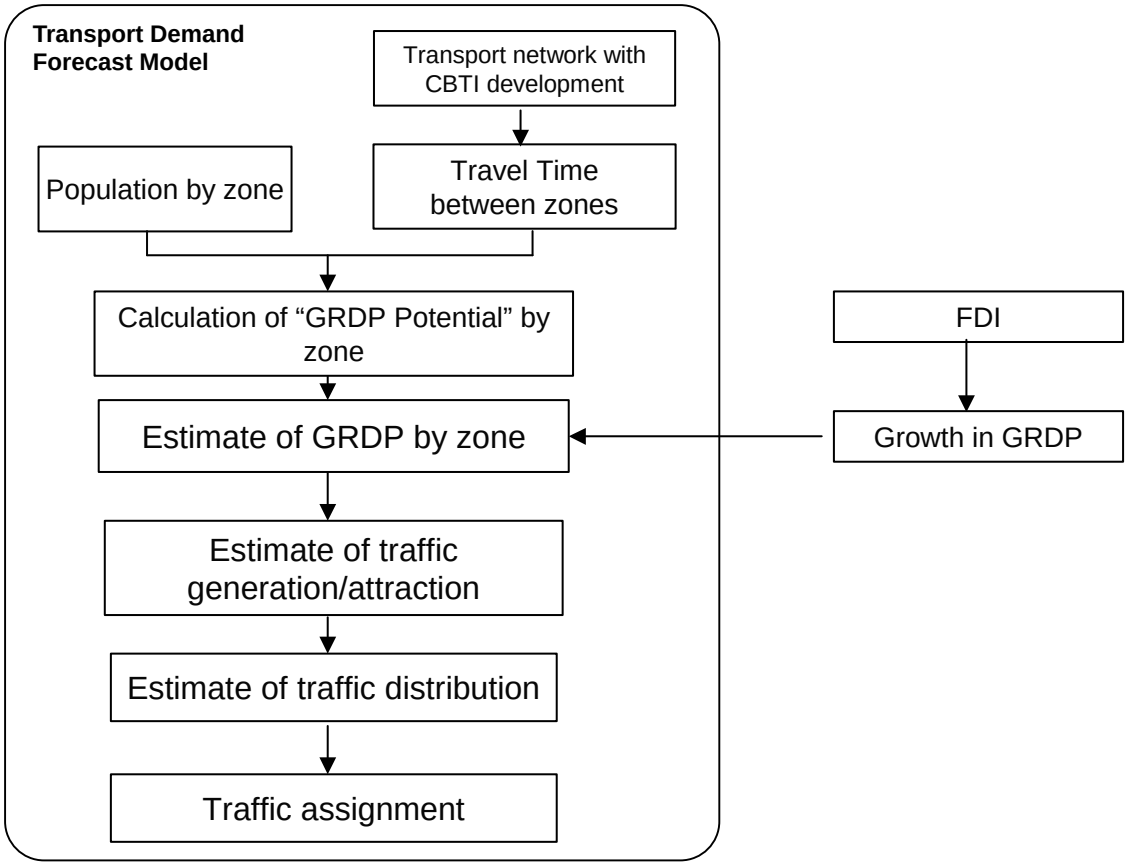
(1) **Estimate of FDI Impact and Scenario of Trial Calculation**

Estimation Process of FDI Impact

Trial calculation was conducted to estimate the impact of FDI in selected areas.

When FDI increases, the GRDP grows through interindustrial relationships. This increased GRDP is the input to the process of transport demand estimation explained in the previous section. The data used here is identical to that of transport demand estimate, and the process is almost the same. The process is shown in Figure 6.6.8.

Figure 6.6.8 Estimation Process of FDI Impact



FDI Impact Estimates

(a) Effect Estimated by Industrial Input-Output Table

Since the industrial input-output (IO) tables of Cambodia and Lao PDR have not been worked out, that of Thailand made in 2000 was used instead. The target industry of FDI was selected from past trends.

The investment effect in Thailand in 2000 was estimated by industry using the industrial IO table (see Table 6.6.4). The figures in that table reflect the sum of the effects on all industries when one unit of investment is made on a selected industry. For instance, a million-dollar investment in crops created a GDP growth estimated at 1.726 million dollars (1.726-fold increase from a million dollar) in the whole region.

Table 6.6.4 Investment Effect by Industry

Industry	Investment Effect Rate
Crops	1.726
Livestock and poultry; fishery	1.463
Forestry and logging	1.827
Mining and quarrying	1.638
Food, beverage and tobacco	1.225
Textiles, garments & leather products	1.200
Wood & paper products; printing/publishing	1.196
Chemical products; petroleum	0.918
Nonmetallic mineral products	1.214
Metal products, machinery, equipment., spare parts	0.701
Other manufactured goods	1.017
Electricity and water supply	1.432
Construction	1.061
Transportation	1.072
Post and telecommunication	1.830
Wholesale and retail trade	1.895
Banking, insurance, business services	1.760
Real estate & residential ownership	1.947
Public administration	1.502
Personal, social & community services	1.553

Source: Estimate by AREES, *Industrial IO Table of Thailand,* 2000

(b) Investment Effect of Bio-Fuel Plant

In recent years bio-fuel plant projects have drawn attention in the Greater Mekong Subregion including Cambodia and Lao PDR. Its investment effect was estimated as shown in Table 6.6.5. The result shows that the US$ 23.7 million investment brought about an economic effect of US$ 71.6 million dollars, comprising processed fuel, fertilizer as by-product, decrease of oil import, and so on.

Table 6.6.5 Investment Effects of Bio-Fuel Plants

Investment amount (US$ mil.)				Economic effect (US$ mil.)			
Total	Factory	Agri'l Land	Others	Fuel	Forex Saving	By-product	Total
23.7	15	8.7	0	19.8	19.8	32	71.6

Source: Estimated by the Study Team based on interviews with experts and field surveys.

Investment Amount

It was assumed that a total of US$24 million was invested in bio-fuel projects, as mentioned above. As for other selected industries, the investment amount was assumed to be half of the actual amount of FDIs in 2002, or some US$ 118.6 million in Cambodia and US$ 66.2 million in Lao PDR r (tables 6.6.6 and 6.6.7, respectively).

Table 6.6.6 Total Investment in Cambodia, 2002

Industry	Investment Amount (million US$)
Primary Industry	40
Energy	4
Textile	17
Plastic	1
Apparel	14
Wood Processing	1
Other Secondary Industry	15
Infrastructure	18
Telecom	64
Other Services	16
Tourism	47
Total	237

Source: Economic Growth Strategy of Mekong Basin Countries

Table 6.6.7 Total Investment in Lao PDR, 2002

Industry	Investment Amount (million US$)
Agriculture	6.40
Sewing	4.70
Craft	64.39
Wood Processing	5.47
Mining	0.75
Trading	10.07
Hotel/Restaurant	2.05
Consulting	0.72
Service	11.13
Electric Power	1,295.00
Construction	13.70
IT	12.94
Total	**1,427.32**
Sub-Total (Excluding Electric Power)	132.32

Source: Economic Growth Strategy of Mekong Basin Countries

Scenarios of Estimate

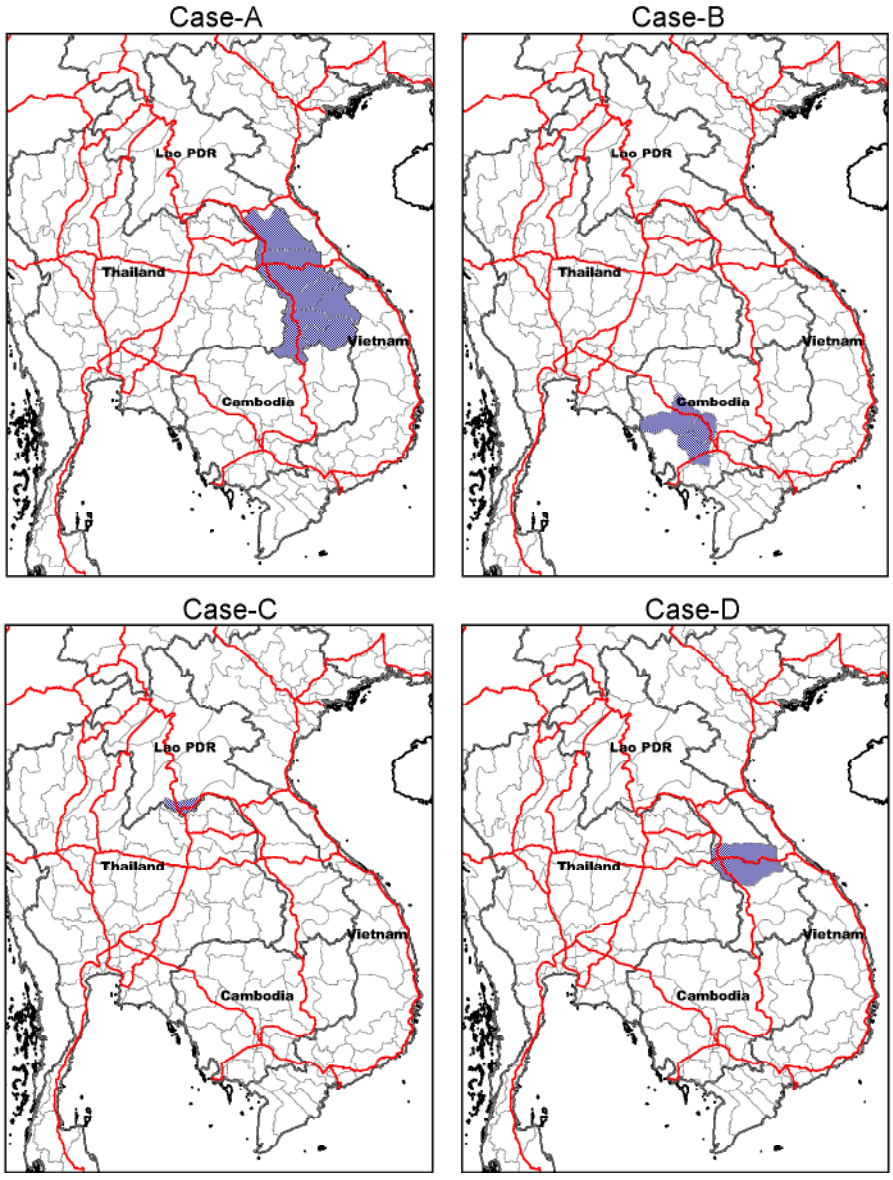
The trial calculation of the effect of investments was carried out for five FDI scenarios combined with the 5 CBTI/CBTA development cases examined earlier (see Table 6.6.8). It was assumed that the impact of FDI would be limited to within the province (zone).

Table 6.6.8 Investment Scenarios and CBTA/CBTI Development Cases

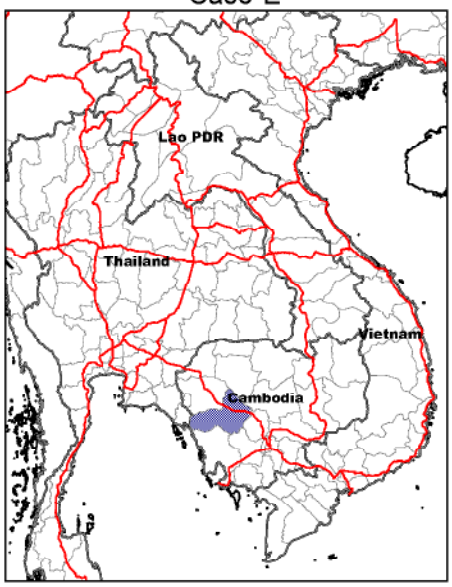
Investment Scenario					CBTI/CBTA Development				
Country	Area	Industry	Invest-ment (US$ mil)	Effect of investment (US$ mil)	Case-1 (Bkk-Han)	Case-2 (Bkk-Han)	Case-3 (East-West South-North)	Case-4 CBP-free [1]	Case-5 With CBTA[2]
Lao PDR	East-West Corridor	Mining	33.1	54.3	Case-1A	Case-2A	Case-3A	Case-4A	Case-5A
	Southern Area	Tourism	33.1	51.3					
Cambodia	South Corridor	Food processing	59.3	72.3	Case-1B	Case-2B	Case-3B	Case-4B	Case-5A
		Agri.	59.3	102.6					
Lao PDR	Vientiane Province	Bio-fuel	23.7	71.6	Case-1C	Case-2C	Case-3C	Case-4C	Case-5C
Lao PDR	Savannakhet Province	Bio-fuel	23.7	71.6	Case-1D	Case-2D	Case-3D	Case-4D	Case-5D
Cambodia	South Corridor	Bio-fuel	23.7	71.6	Case-1E	Case-2E	Case-3E	Case-4E	Case-5E

1) Cross-border traffic is unencumbered with the abolition of border-crossing procedures.
2) 16 cross-border points designated in CBTA are passable within 30 minutes.

Figure 6.6.9 Selected Investment Area by Case



Case-E



(2) Results of Trial Calculation

Changes in GRDP

GDP growth rates for each investment scenario (case) as compared with the present situation are summarized in Table 6.6.9. It was assumed that the impact of investment is limited only to within the province. Therefore additional GDP growth is seen only in the areas where the investments were made when compared to the cases with only CBTI/CBTA improvement, as presented in the previous section.

The results show that when the FDI is integrated with CBTI development in one area, that area's GDP growth becomes significant. For example, Case-1A (east-west corridor improvement plus investments in Lao PDR) and Case-3A (east-west and north-south corridor improvement plus investments in Lao PDR) resulted in a large GDP growth for Lao PDR.

When Case-3A up to Case-3E were compared with Case-3 (case wherein infrastructure development on the east-west and north-south corridors was assumed), the GDP further grew due to investments, as shown in Table 6.6.10. When the investment amount is larger or the investments are poured in higher GRDP areas, GRDP growth becomes higher.

GRDP growth by province is shown for Case-3A up to Case-3E, as shown in Figure 6.6.10. For these cases, investments in different areas were assumed in addition to CBTI/CBTA development assumed in Case-3. The growth occurred in invested provinces.

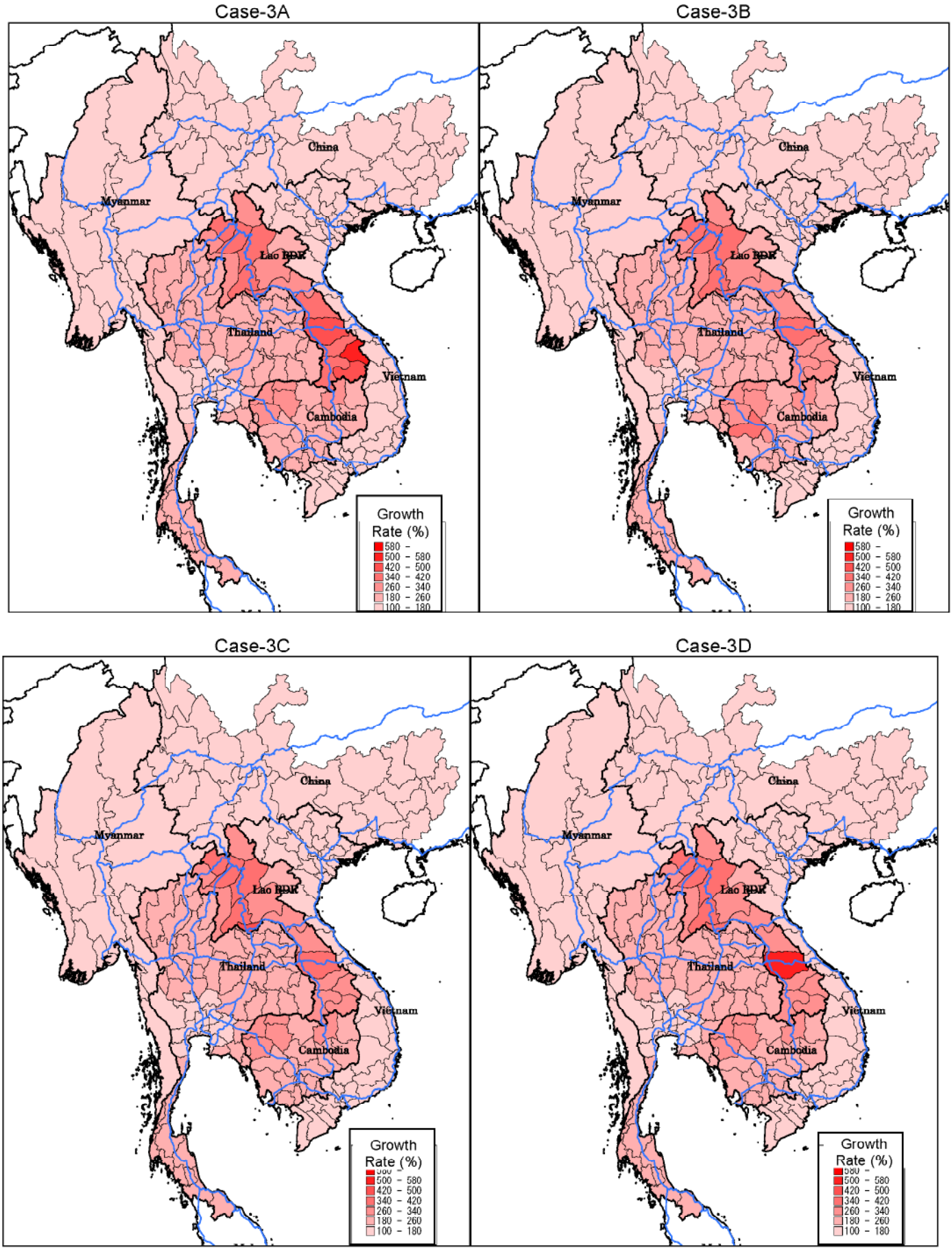
Table 6.6.9 Projected GDPs by Case and by Country (%)

	Case-1A	Case-2A	Case-3A	Case-4A	Case-5A
Cambodia	102.4	155.7	226.5	249.9	237.1
Laos	169.6	107.9	356.4	394.3	356.8
Myanmar	102.8	102.8	104.5	211.0	191.5
Thailand	123.5	119.1	181.6	197.7	189.4
Vietnam	108.1	110.2	137.7	210.9	204.1
China	100.2	100.1	101.7	104.5	104.1
	Case-1B	Case-2B	Case-3B	Case-4B	Case-5B
Cambodia	106.0	161.3	234.6	258.6	245.4
Laos	155.8	100.6	334.3	366.8	331.4
Myanmar	102.8	102.8	104.5	211.0	191.5
Thailand	123.5	119.1	181.6	197.7	189.4
Vietnam	108.1	110.2	137.7	210.9	204.1
China	100.2	100.1	101.7	104.5	104.1
	Case-1C	Case-2C	Case-3C	Case-4C	Case-5C
Cambodia	102.4	155.7	226.5	249.9	237.1
Laos	162.7	105.6	352.4	385.9	348.3
Myanmar	102.8	102.8	104.5	211.0	191.5
Thailand	123.5	119.1	181.6	197.7	189.4
Vietnam	108.1	110.2	137.7	210.9	204.1
China	100.2	100.1	101.7	104.5	104.1
	Case-1D	Case-2D	Case-3D	Case-4D	Case-5D
Cambodia	102.4	155.7	226.5	249.9	237.1
Laos	168.2	105.5	352.9	388.4	351.3
Myanmar	102.8	102.8	104.5	211.0	191.5
Thailand	123.5	119.1	181.6	197.7	189.4
Vietnam	108.1	110.2	137.7	210.9	204.1
China	100.2	100.1	101.7	104.5	104.1
	Case-1E	Case-2E	Case-3E	Case-4E	Case-5E
Cambodia	103.7	157.9	229.8	253.4	240.8
Laos	155.8	100.6	334.3	366.8	331.4
Myanmar	102.8	102.8	104.5	211.0	191.5
Thailand	123.5	119.1	181.6	197.7	189.4
Vietnam	108.1	110.2	137.7	210.9	204.1
China	100.2	100.1	101.7	104.5	104.1

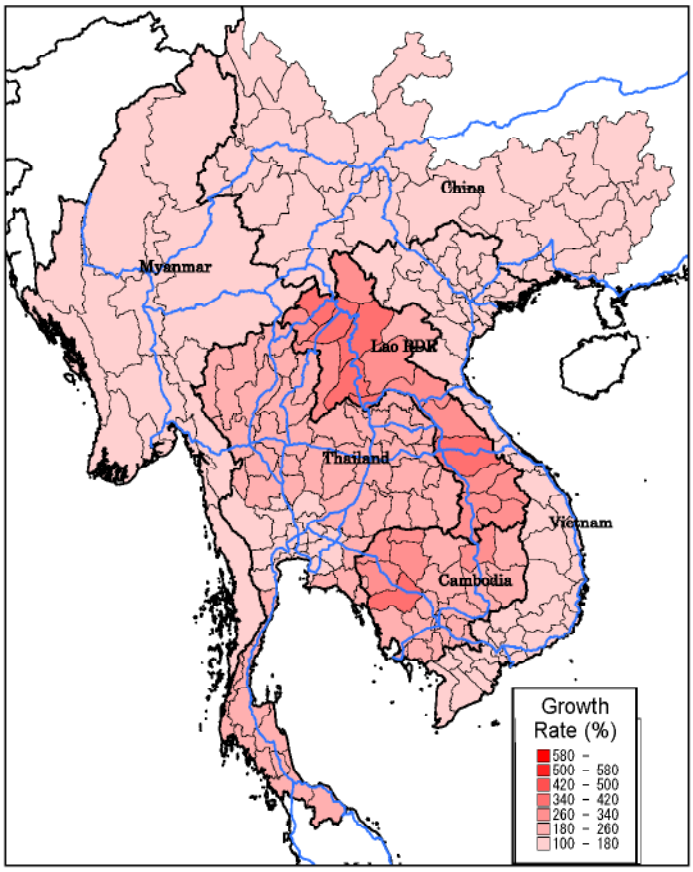
Table 6.6.10 Comparison of GDPs under Case-3 (CBTI Improvement Only)

Case	Country	Investment Area	Growth from Case-3 (%)
Case-3A	Lao PDR	East-West Corridor	22.1
		Southern Area	
Case-3B	Cambodia	South Corridor	8.1
Case-3C	Lao PDR	Vientiane Province	18.1
Case-3D	Lao PDR	Savannakhet Province	18.6
Case-3E	Cambodia	South Corridor	3.3

Figure 6.6.10 Projected GRDPs under Case-3A



Case-3E



Changes in Trip Generation/Attraction

Along with investment, trip generation/attraction will increase as well. Growth rates of trip generation/attraction by country and by case are shown in Table 6.6.11.

If the investment is done along with CBTI improvements, the growth rate of trip generation/attraction is higher, similar to that of the GRDP,

In a comparison of Case-3A up to Case-3E with Case-3 (CBTI development of east-west and north-south corridors), trip generation/attraction further grew due to investments, as shown in Table 6.6.12. When investment amount is large or done in areas with larger trip generation/attraction, its growth tends to be higher like in the case of the GRDP.

Three bio-fuel projects with the same investment amount were compared under Case-C, Case-D, and Case–E. Results show relatively larger passenger traffic, when investment is made in Vientiane, and relatively large freight traffic, when investment is made in the strategic border crossing point of Savannakhet.

Table 6.6.11 Changes in Trip Generation/Attraction by Country and by Case

	Passenger Traffic (%)					Freight Traffic (%)				
	Case-1A	Case-2A	Case-3A	Case-4A	Case-5A	Case-1A	Case-2A	Case-3A	Case-4A	Case-5A
Cambodia	102.0	160.9	238.0	266.0	249.7	101.5	139.9	185.6	198.3	192.1
Laos	197.9	117.4	412.6	473.0	425.6	158.9	106.6	294.9	328.2	297.6
Myanmar	102.7	102.7	104.2	209.0	190.3	102.8	102.8	104.5	211.5	191.8
Thailand	113.3	110.7	146.1	155.4	150.5	112.7	110.9	144.6	153.1	148.7
Vietnam	104.5	106.2	122.4	164.4	160.1	104.6	105.4	120.8	176.1	170.0
China	100.1	100.1	100.9	102.2	102.0	100.2	100.1	101.5	104.3	103.8
	Case-1B	Case-2B	Case-3B	Case-4B	Case-5B	Case-1B	Case-2B	Case-3B	Case-4B	Case-5B
Cambodia	104.3	164.4	243.0	271.4	254.9	103.2	142.5	189.4	202.4	196.0
Laos	168.4	100.6	365.1	414.7	370.4	146.9	100.5	275.9	304.9	276.1
Myanmar	102.7	102.7	104.2	209.0	190.3	102.8	102.8	104.5	211.5	191.8
Thailand	113.3	110.7	146.1	155.4	150.5	112.7	110.9	144.6	153.1	148.7
Vietnam	104.5	106.2	122.4	164.4	160.1	104.6	105.4	120.8	176.1	170.0
China	100.1	100.1	100.9	102.2	102.0	100.2	100.1	101.5	104.3	103.8
	Case-1C	Case-2C	Case-3C	Case-4C	Case-5C	Case-1C	Case-2C	Case-3C	Case-4C	Case-5C
Cambodia	102.0	160.9	238.0	266.0	249.7	101.5	139.9	185.6	198.3	192.1
Laos	174.3	104.8	380.6	431.0	384.9	152.0	104.1	289.5	319.1	288.7
Myanmar	102.7	102.7	104.2	209.0	190.3	102.8	102.8	104.5	211.5	191.8
Thailand	113.3	110.7	146.1	155.4	150.5	112.7	110.9	144.6	153.1	148.7
Vietnam	104.5	106.2	122.4	164.4	160.1	104.6	105.4	120.8	176.1	170.0
China	100.1	100.1	100.9	102.2	102.0	100.2	100.1	101.5	104.3	103.8
	Case-1D	Case-2D	Case-3D	Case-4D	Case-5D	Case-1D	Case-2D	Case-3D	Case-4D	Case-5D
Cambodia	102.0	160.9	238.0	266.0	249.7	101.5	139.9	185.6	198.3	192.1
Laos	177.0	104.0	377.9	429.5	384.1	162.0	106.4	298.6	331.1	300.3
Myanmar	102.7	102.7	104.2	209.0	190.3	102.8	102.8	104.5	211.5	191.8
Thailand	113.3	110.7	146.1	155.4	150.5	112.7	110.9	144.6	153.1	148.7
Vietnam	104.5	106.2	122.4	164.4	160.1	104.6	105.4	120.8	176.1	170.0
China	100.1	100.1	100.9	102.2	102.0	100.2	100.1	101.5	104.3	103.8
	Case-1E	Case-2E	Case-3E	Case-4E	Case-5E	Case-1E	Case-2E	Case-3E	Case-4E	Case-5E
Cambodia	102.8	162.0	239.7	267.9	251.7	102.0	140.7	186.8	199.6	193.4
Laos	168.4	100.6	365.1	414.7	370.4	146.9	100.5	275.9	304.9	276.1
Myanmar	102.7	102.7	104.2	209.0	190.3	102.8	102.8	104.5	211.5	191.8
Thailand	113.3	110.7	146.1	155.4	150.5	112.7	110.9	144.6	153.1	148.7
Vietnam	104.5	106.2	122.4	164.4	160.1	104.6	105.4	120.8	176.1	170.0
China	100.1	100.1	100.9	102.2	102.0	100.2	100.1	101.5	104.3	103.8

Table 6.6.12 Comparison of Trip Generation/Attraction under Case-3 (CBTI Improvement Only)

Case	Country	Region	Passenger (%)	Freight (%)
Case-3A	Lao PDR	East-West Corridor	47.5	19.0
		Southern Area		
Case-3B	Cambodia	South Corridor	5.0	3.8
Case-3C	Lao PDR	Vientiane Prov.	15.5	13.6
Case-3D	Lao PDR	Savannakhet Prov.	12.8	22.7
Case-3E	Cambodia	South Corridor	1.7	1.2

The growth in trip generation/attraction by province is shown for Case-3A up to Case-3E in Figure 6.6.11. These cases assumed that investment was made in different areas, in addition to CBTI/CBTA improvement on the east-west and north-south corridor. The growth is high naturally in provinces that received investments. The growth of freight traffic is comparatively lower than that of passenger traffic.

Figure 6.6.11 (1) Changes of Trip Generation/Attraction under Case-3A (as compared with present situation)

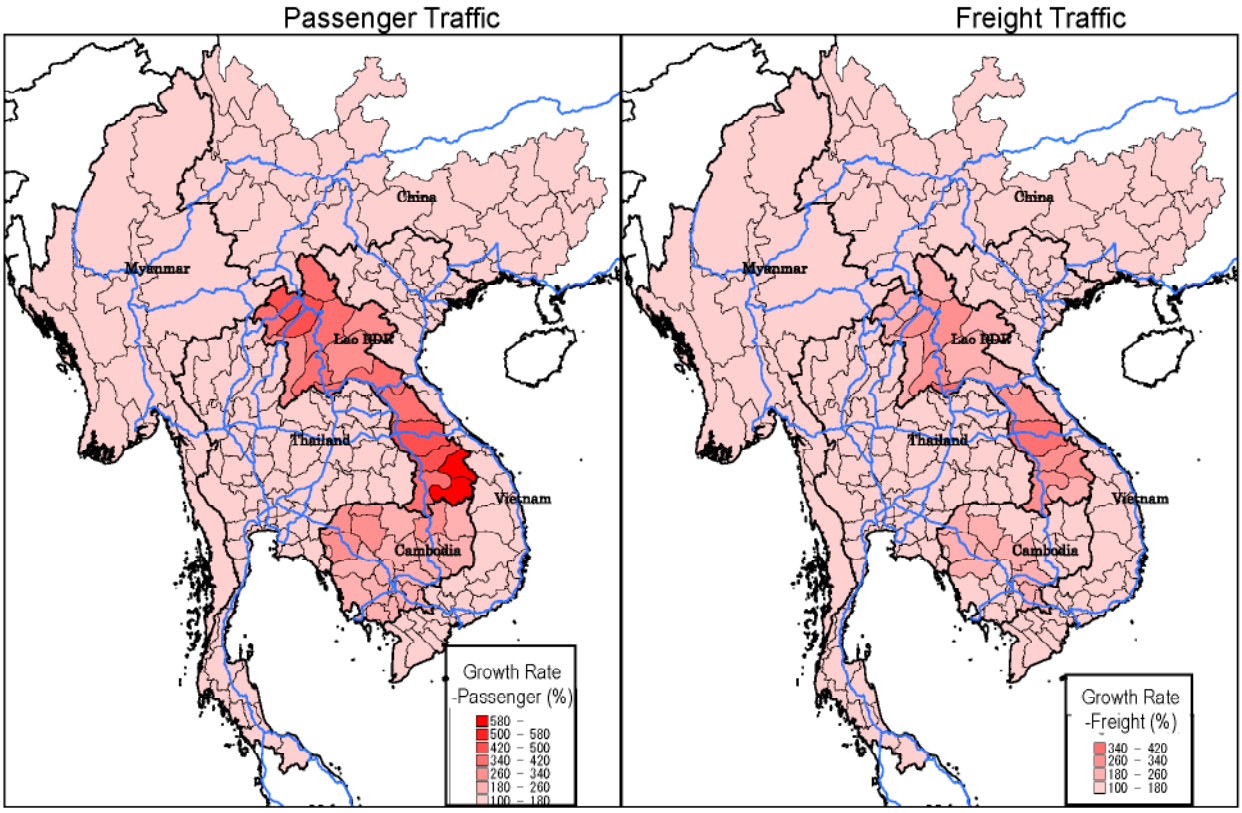


Figure 6.6.12 (2) Changes of Trip Generation/Attraction under Case-3B (as compared with present situation)

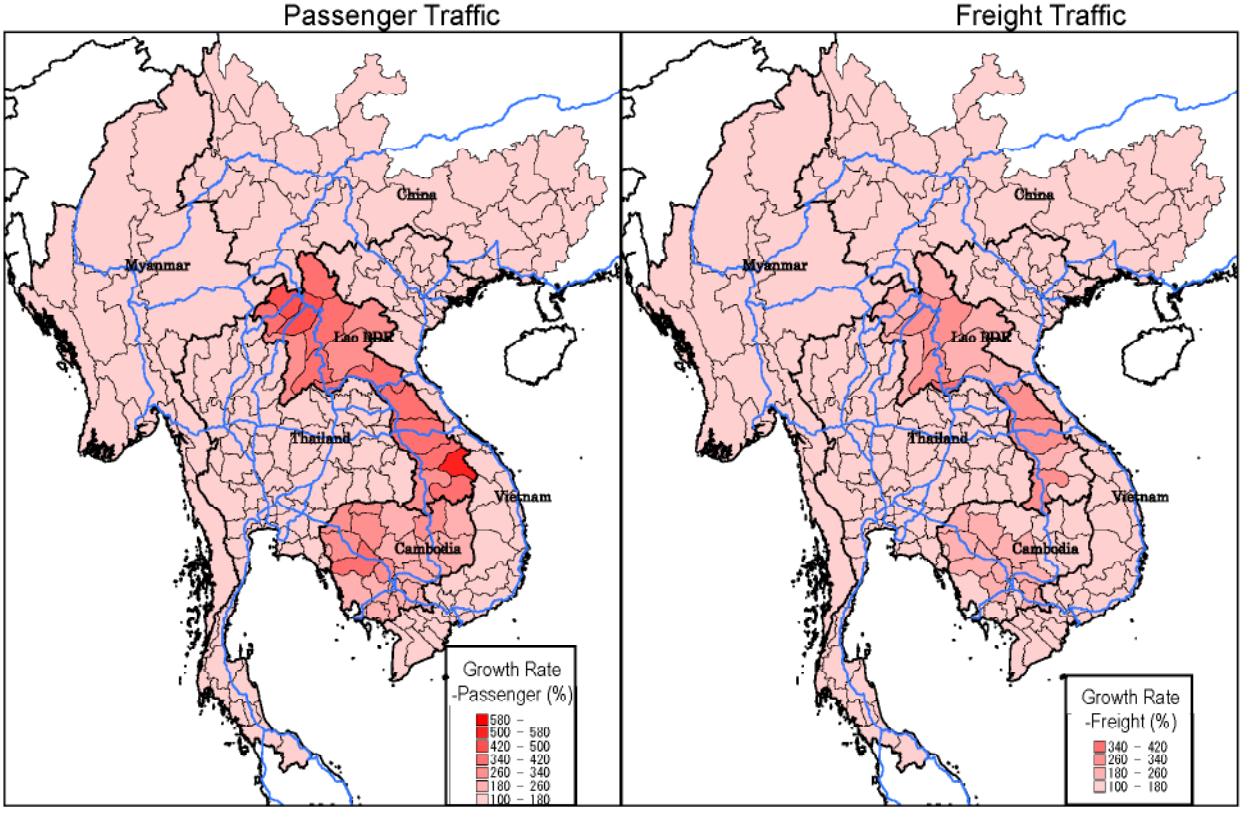


Figure 6.6.12 (3) Changes of Trip Generation/Attraction under Case-3C (as compared with present situation)

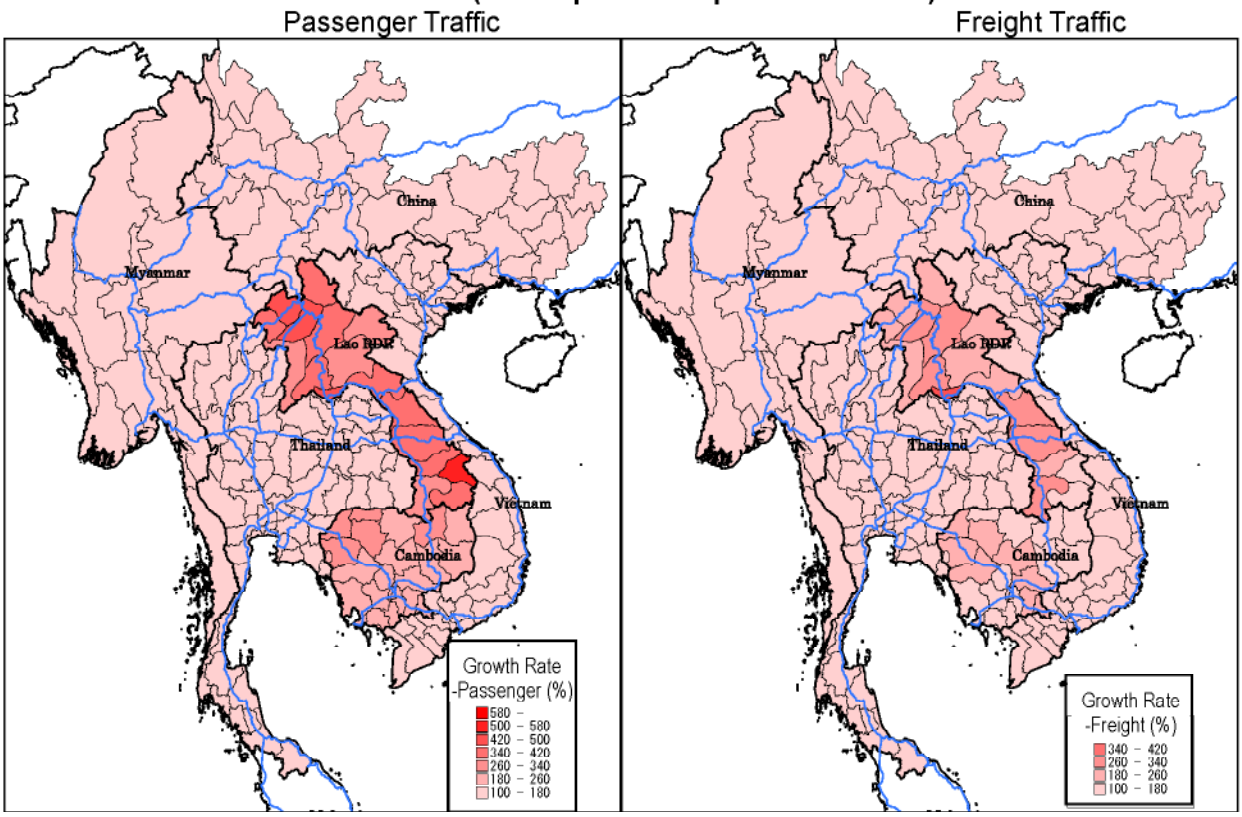


Figure 6.6.12 (4) Changes of Trip Generation/Attraction under Case-3D (as compared with present situation)

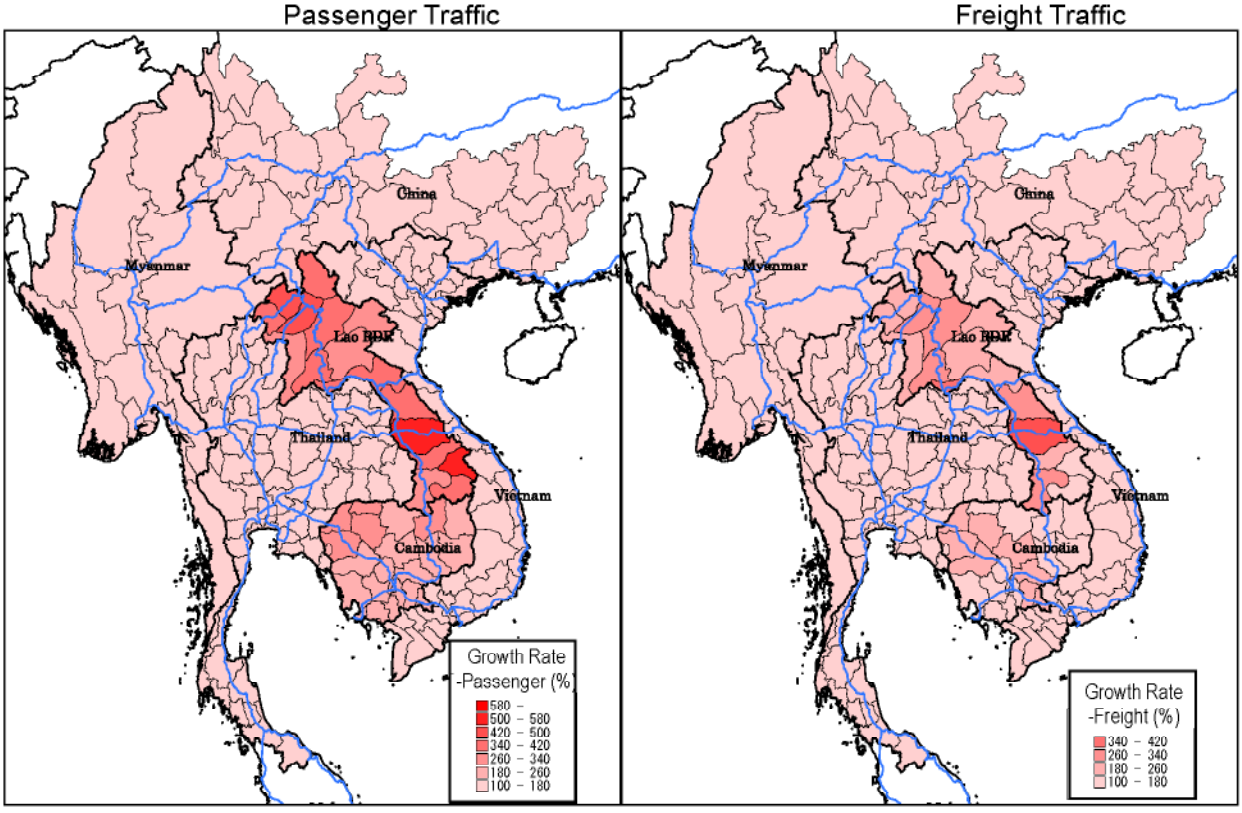
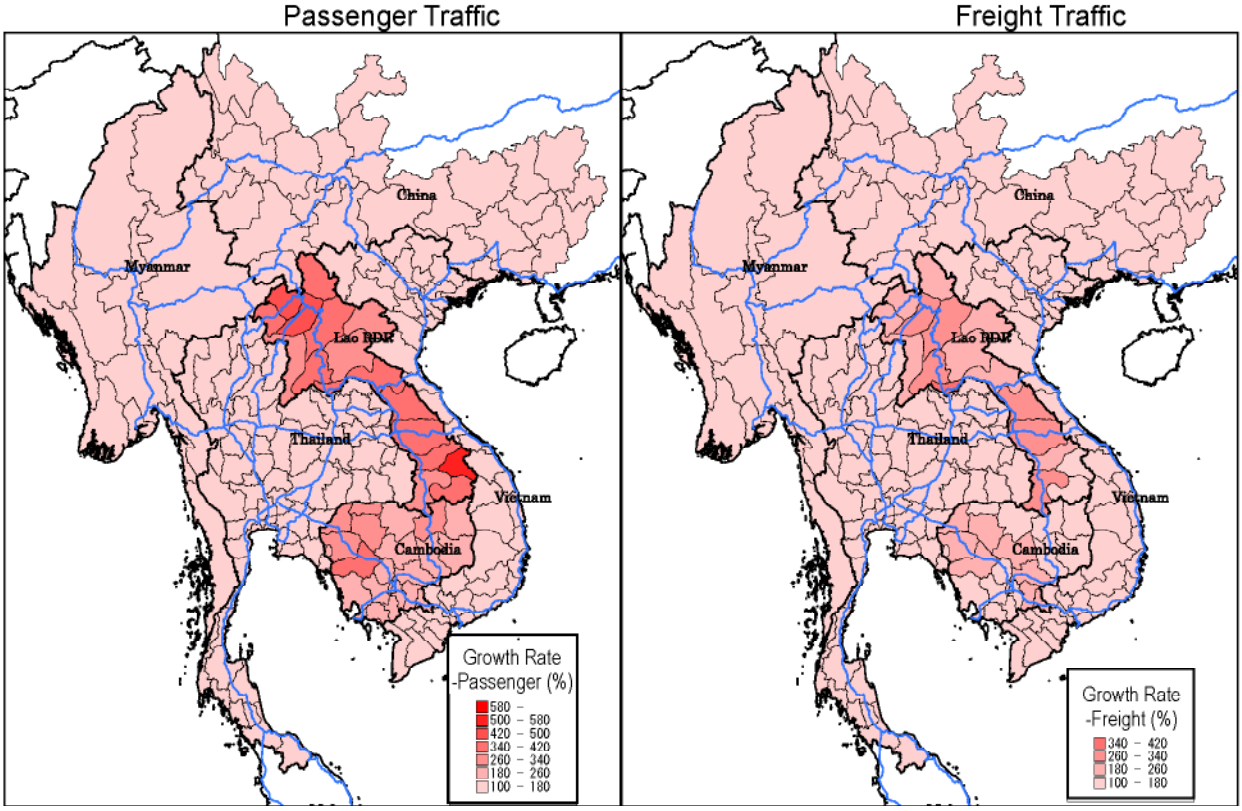


Figure 6.6.12 (5) Changes of Trip Generation/Attraction under Case-3E (as compared with present situation)



Changes in Traffic Flow

(a) Influence of FDI and CBTI Development

As previously described, the GRDP and trip generation/attraction showed remarkable growth if the investments and CBTI developments are implemented in the same area. With the comparisons made between "CBTI/CBTA development only" cases and "CBTI/CBTA development plus investment" cases, the importance of investment integrated with CBTI/CBTA development has become clear.

Figures 6.6.12 (1) and 6.6.12 (2) show the changes in traffic flow under different assumptions on CBTI/CBTA development for Case-A (Lao PDR) and Case-B (Cambodia), respectively. The comparison of Case-1A and Case-2A, for instance, shows that Case-1A is more effective in terms of economic activities (traffic flow) than Case-2A because of the appropriate location of CBTI developments.

In the same manner the comparison of Case-1B and Case-2B, shows that the latter is more effective in terms of economic activities (traffic flow) than the former, again because of the synergy between investment and CBTI development.

Figure 6.6.12 Changes of Traffic Flows under Case-1A and Case-2A

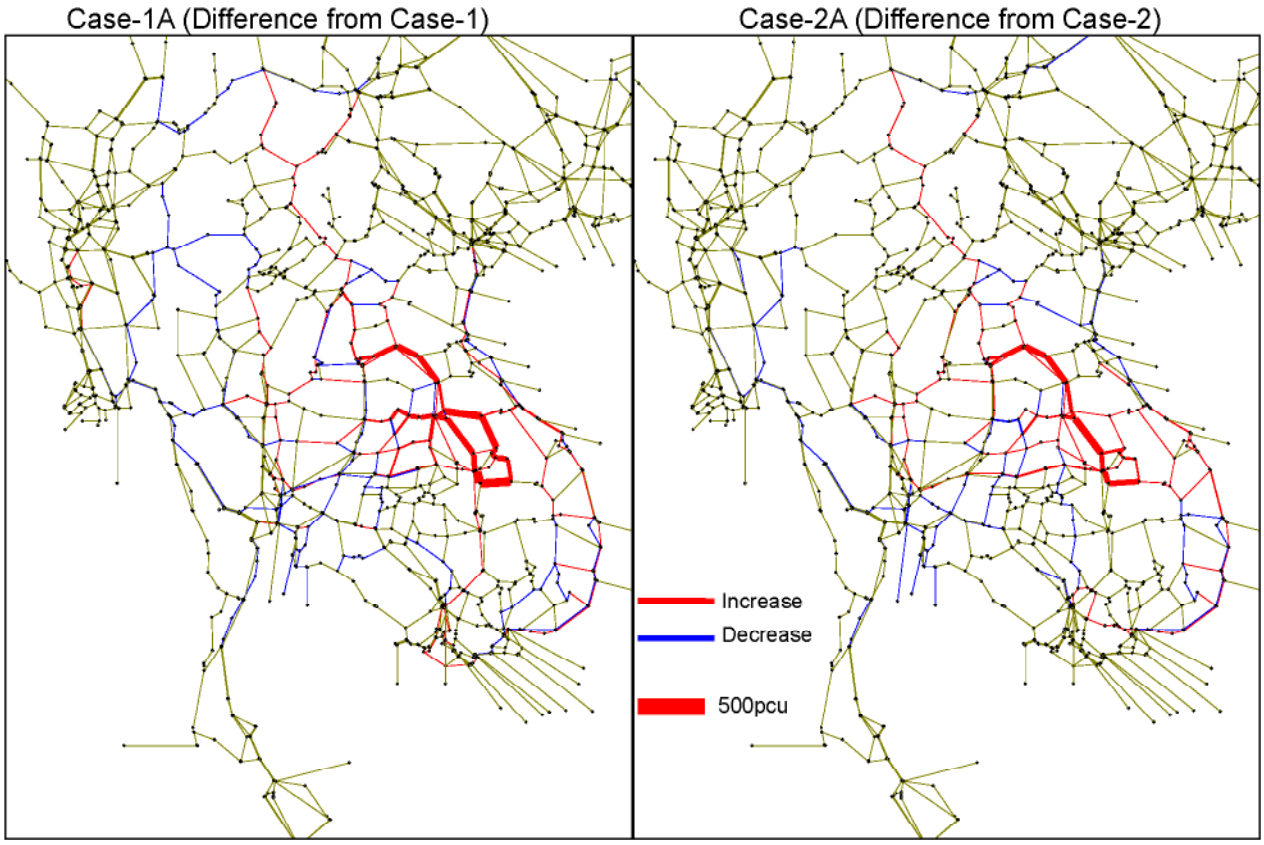
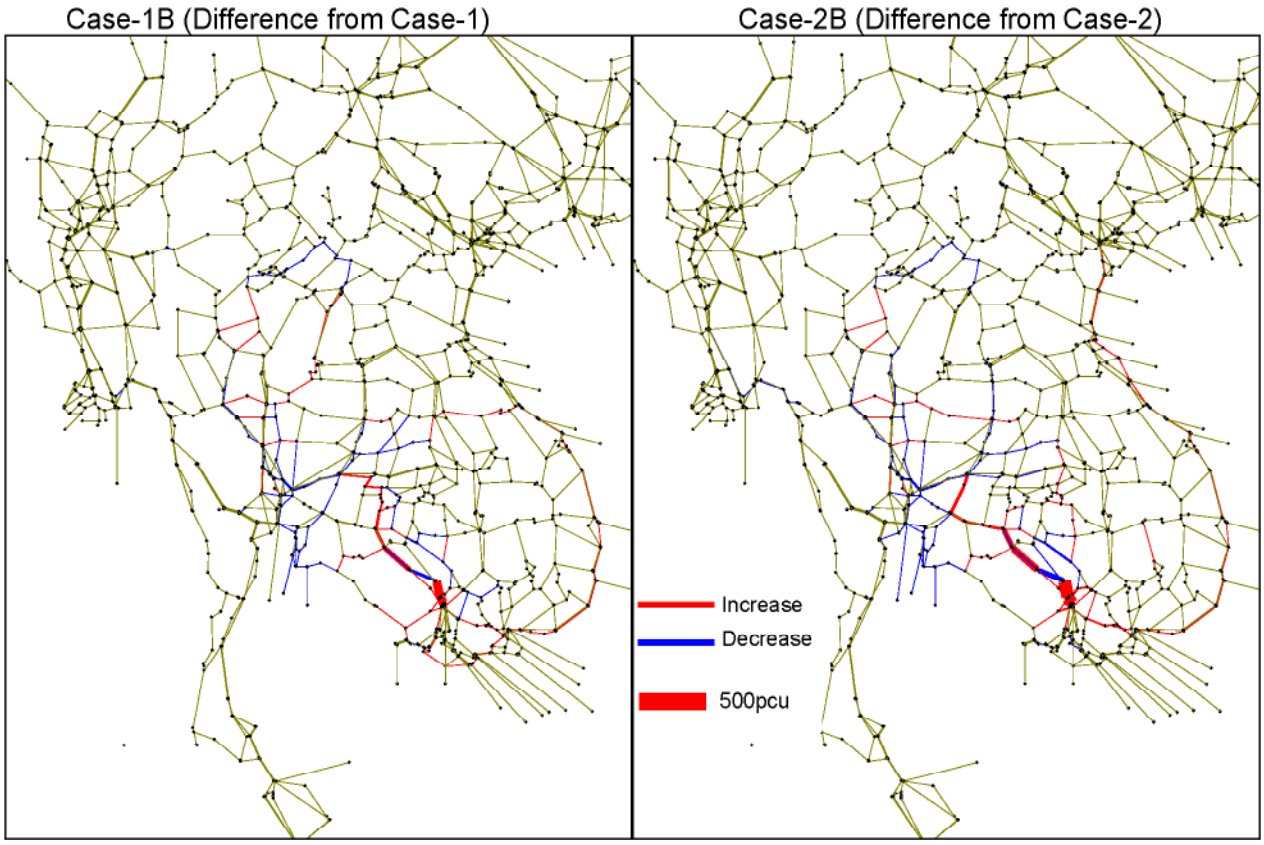


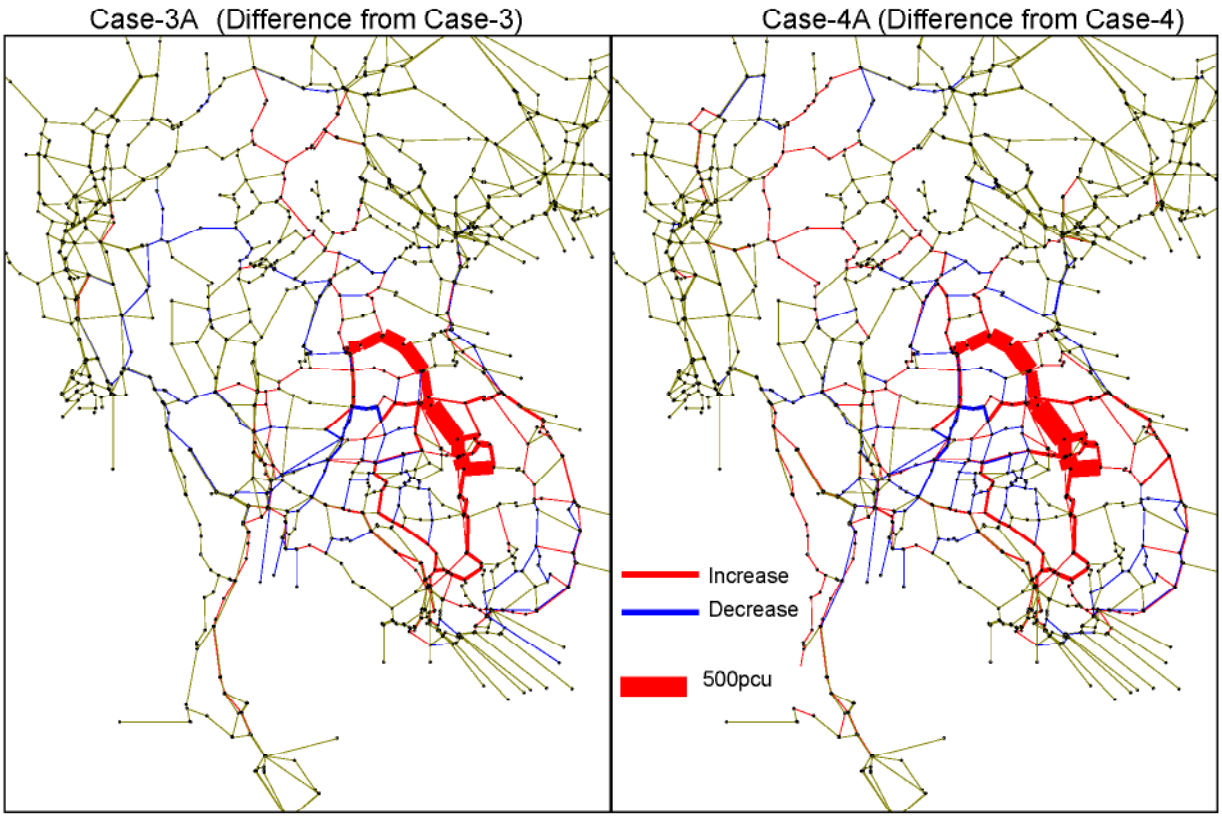
Figure 6.6.12 (2) Changes of Traffic Flows under Case-1B and Case-2B

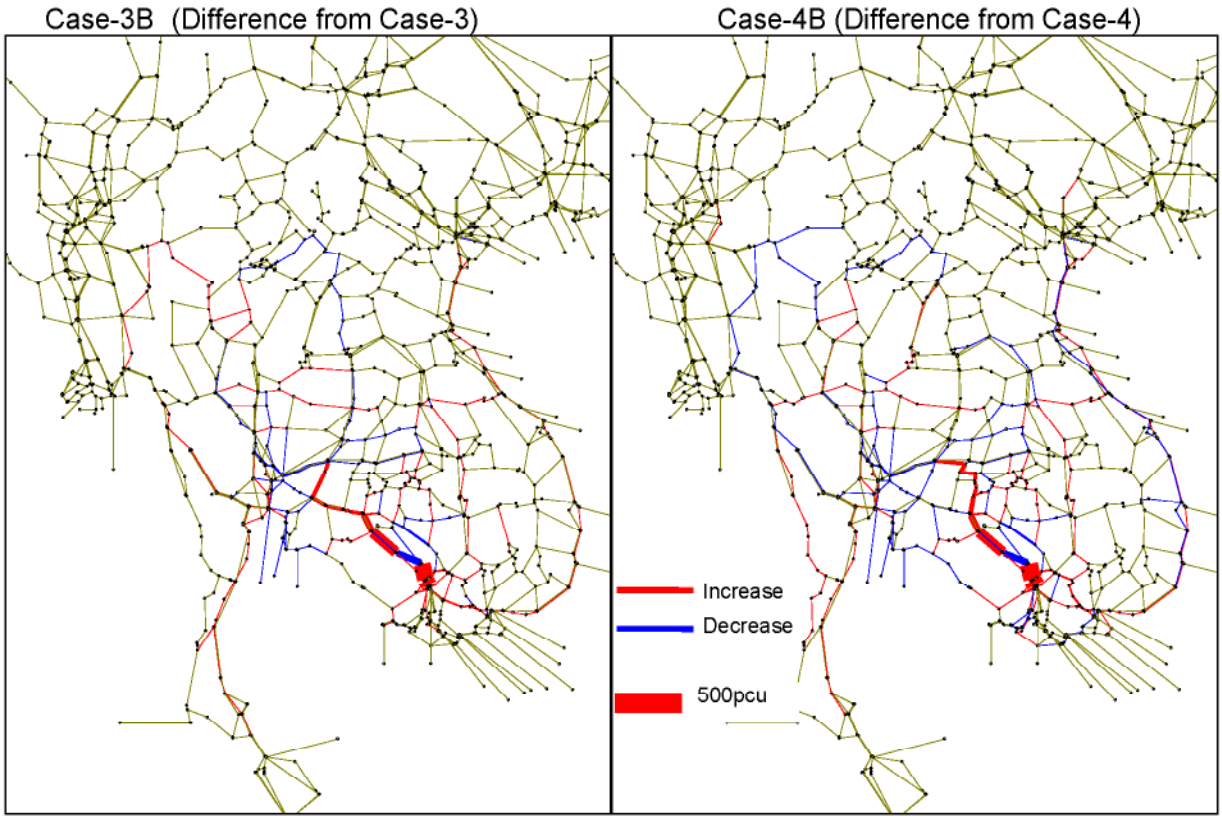


(b) Differences between CBTI+Investment and CBTA+Investment

The traffic volume of Case-3 (CBTI development along the east-west and the north-south corridors) and Case-4 (free traffic at all cross-border points) were compared under different investment scenarios: Case-A (Lao PDR) and Case-B (Cambodia). The results, presented in Figure 6.6.13, show that the effectiveness of CBTI and CBTA development is almost comparable. It may be concluded that both CBTI and CBTA are essential for the economic growth of the region.

Figure 6.6.13 Changes of Traffic Flows under CBTI+Investment and CBTA+Investment





(c) Differences by Investment Area

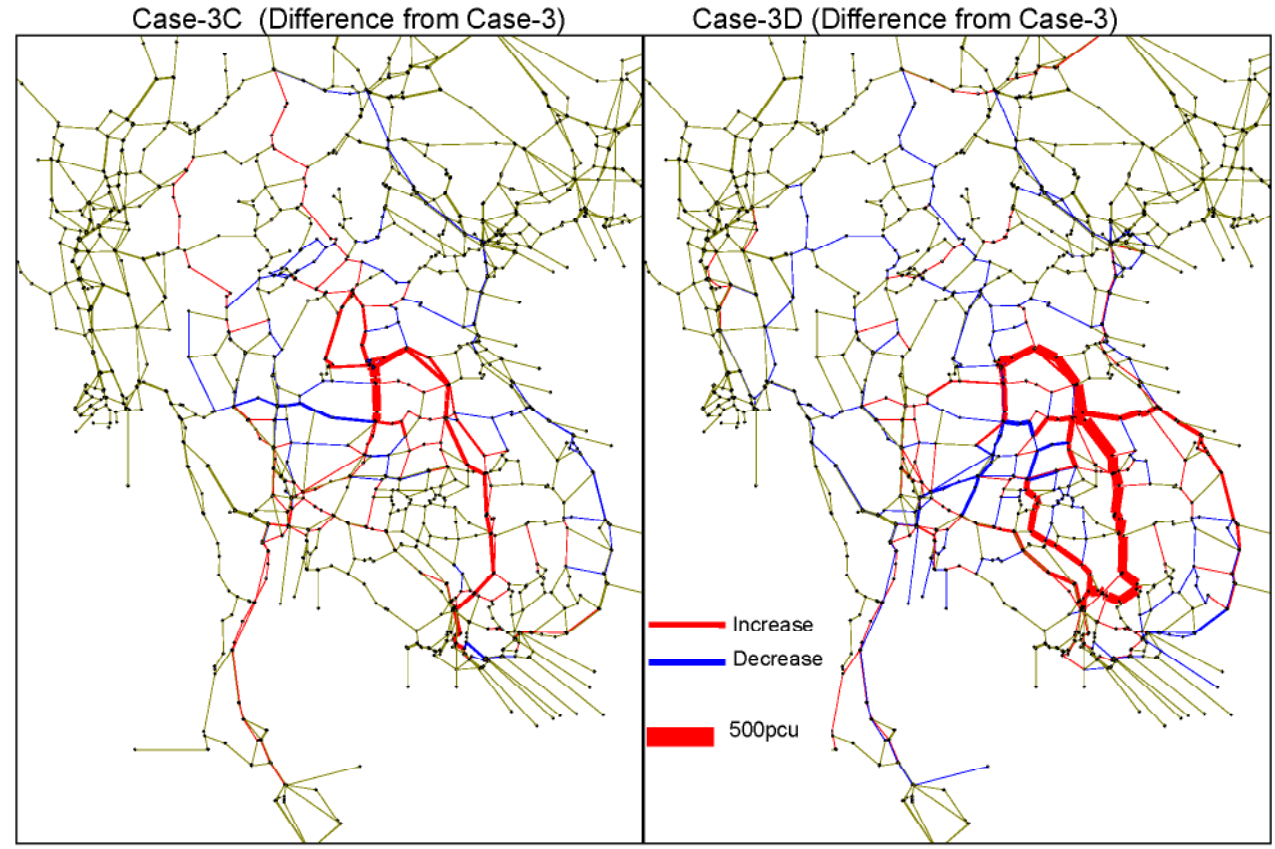
The estimated traffic flows under Case 3C and Case 3D were compared with that of Case-3 which assumed CBTI development along the east-west and the north-south corridors. Case–C, Case-D, and Case-E assumed a similar investment amount for the bio-fuel industry, but in different places. The results are presented in Figure 6.6.14.

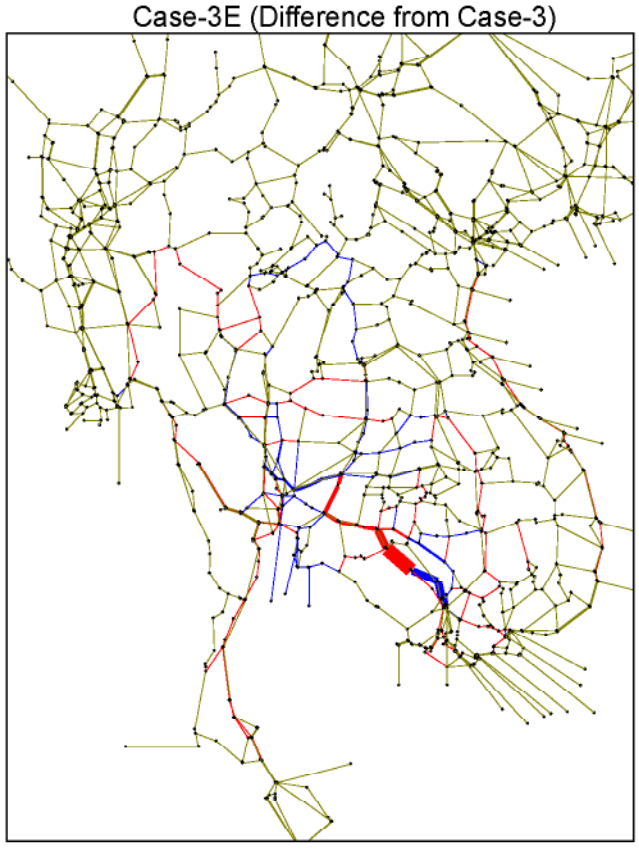
Under Case-3C, which assumed an investment in Vientiane, traffic increased around Vientiane and in the north-south direction toward Cambodia.

Under Case-3D, which assumed an investment in Savannakhet, traffic increased between Vientiane and Phnom Penh, and toward the east coast of Vietnam.

Under Case-3E, which assumed an investment in Pursat, traffic grew toward Bangkok and along the south corridor. Traffic moving toward Phnom Penh decreased. Although the reason for this cannot be clearly explained, the change in traffic flow is limited as compared to other cases.

Figure 6.6.14 Changes of Traffic Flow Due to Bio-Fuel Project (Case-3)





3) **Observations and Recommendations about the Current Database**

In the course of the trial calculations, problems and issues were identified in relation to the current database. Below are the observations or recommendations.

(1) Verification of existing transport network data

- For some links, travel speed is set at 100 km/h or more.
- For many links, toll is set, which seems to be unrealistic.
- The relationship between representative mode (OD table) and passable network is unclear (e.g. between road and inland waterway). Particularly for freight, the use of item-wise OD tables should be taken into account.
- It is necessary to investigate how to quantify the institutional cross-border impedance.

(2) Accuracy enhancement of existing OD tables

- Interrelationship between OD tables and socioeconomic indicators should be clear.
- The determinant factors of trip distribution should be clarified.
- Investigation is needed for goods classification; interrelationship between weight and value; time value (cost); and so on.
- Trade OD by shipping should be surveyed.

(3) Uncertain socioeconomic indicators

- The indicators related to trip generation should be surveyed in addition to the existing population and GDP/GRDP.
- Development status of the transport network should be investigated in a time series.
- Characteristics by province (zone) should be identified.
- Suitable regional development including the industries which are likely to grow in the future should be identified.
- Construction of industrial input-output table by province is required.

7. Further Research Issues and Recommendations

7.1 Further Research Issues

1) Building Strategic Cross-border Transport Planning Model

A strategic cross-border transport planning model is an essential tool for planning and evaluating infrastructure development projects (including not only transport infrastructure such as road, railway, and port but also facilities and equipment required for border crossing procedures and control such as customs) and regional development projects related to cross-border transport. Strategic models can improve effectiveness and efficiency of investment, as well as promote consensus building among stakeholders.

Nowadays, a number of researches on this issue have been done. A trial analysis was also done in this study, as described in Chapter 6. However, there are still many constraints to overcome, which include difficulties in modeling and accuracy of data.

Difficulties in Modeling: This study concludes that a strategic cross-border transport planning model should integrate the transport model and the regional economy model. Since both models are already available, a theoretical breakthrough is not required to formulate strategic cross-border transport planning model. The issue is more on how to integrate both models giving due consideration to the types and the coverage of available data and how to improve the strategic model's practicability[1)]. While this issue can be solved in the short term, a serious bottleneck is the availability of existing data, as described below.

Accuracy of Data: Various data in the GMS countries have been collected during the course of this study, but these are not sufficient to develop a model. Particularly, serious constraints are found in socio-economic indicators by province (such as GRDP), current conditions of infrastructure (such as road, railway, port, etc.), traffic volume data by section, OD table, and industrial input-output tables. These data are not available in most countries, or even if available, they are unreliable[2)]. Collecting or constructing these data with satisfactory accuracy would entail huge costs and a long time, all the more for time-series data. It is therefore recommended that JICA cooperation should concentrate on selected routes, and to collect data efficiently along these routes.

2) Detailed Analysis and Evaluation of Good Practice

Applicability to other countries was examined in Chapter 5. In these countries systematic and exhaustive guidelines have not yet been formulated partly due to the data constraints mentioned above. More fundamentally, it is because cross-border transport and CBTI development are rather new and there is little evaluation of their impacts. Although cross-border traffic or trade has long been active among the GMS countries, a strategic policy to promote cross-border transport along with regionalization and globalization has been crafted only in the last 10 years. In order to apply the results of this study on cross-border transport, specialization and generalization may be required. Specialization will evaluate each CBTI development project and regional development project in detail through a before and after monitoring survey. Generalization will aim to extract lessons learned from the results of evaluation. Although it may be difficult to evaluate CBTI

[1] Practicability means that how it can demonstrate the current conditions and how can be applied in future.
[2] For example, there is no GRDP by province in Myanmar, Lao PDR and Cambodia.

development and extract lessons learned in the Greater Mekong Subregion, a detailed analysis of selected projects to find out good practices can be done. It is expected that necessary information will be collected systematically by focusing on selected model routes recommended below.

7.2 Recommendations of the Study

1) **Public Information and Coordination with GMS Countries and International Donors**

It is recommended that the results of this study be shared with the GMS countries and international donors, such as the ADB, and to disseminate the future direction of JICA cooperation to them. It will further improve organic linkages and international cooperation.

2) **Focus on Human Resource Development and Institution Building**

The long-term development framework for the Greater Mekong Subregion has been formulated with the ADB's initiative, which includes CBTI development projects and soft infrastructure projects to facilitate cross-border transport. What remains to be done is its implementation. Particularly, CBTA implementation will require a huge effort on human resource development and institution building in each country. JICA is expected to conduct technical cooperation focusing on human resource development and institution building with its existing schemes and technology. Cooperation and coordination with international donors, such as the ADB, are also essential.

3) **Model Route Development in Lao PDR and Cambodia**

It is recommended that two model routes be selected, namely Thailand-Lao PDR-Vietnam and Thailand-Cambodia-Vietnam, and to focus on promoting regional development of intermediate countries, i.e. Lao PDR and Cambodia. A set of projects can be conducted. A policy to focus on Lao PDR and Cambodia is consistent with Japan's Basic Cooperation Strategy with ASEAN, i.e. reduction of disparities among GMS countries. Since JICA has good resources of knowledge on regional infrastructure policy, it is expected to provide technical assistance for the construction of a strategic transport planning model and the formulation of a regional development plan.

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