

CHAPTER V

The Impact of Integrated Land Transport Network on Population Agglomeration and Urban Development in Lao PDR

This chapter will try to link the time-series analysis of the integrated land transport network phase (chapter 3) to the changing in the population agglomeration and urban development (chapter 4) in order to analyze the impact of the integrated land transport network on the population agglomeration and urban development in each time frame.

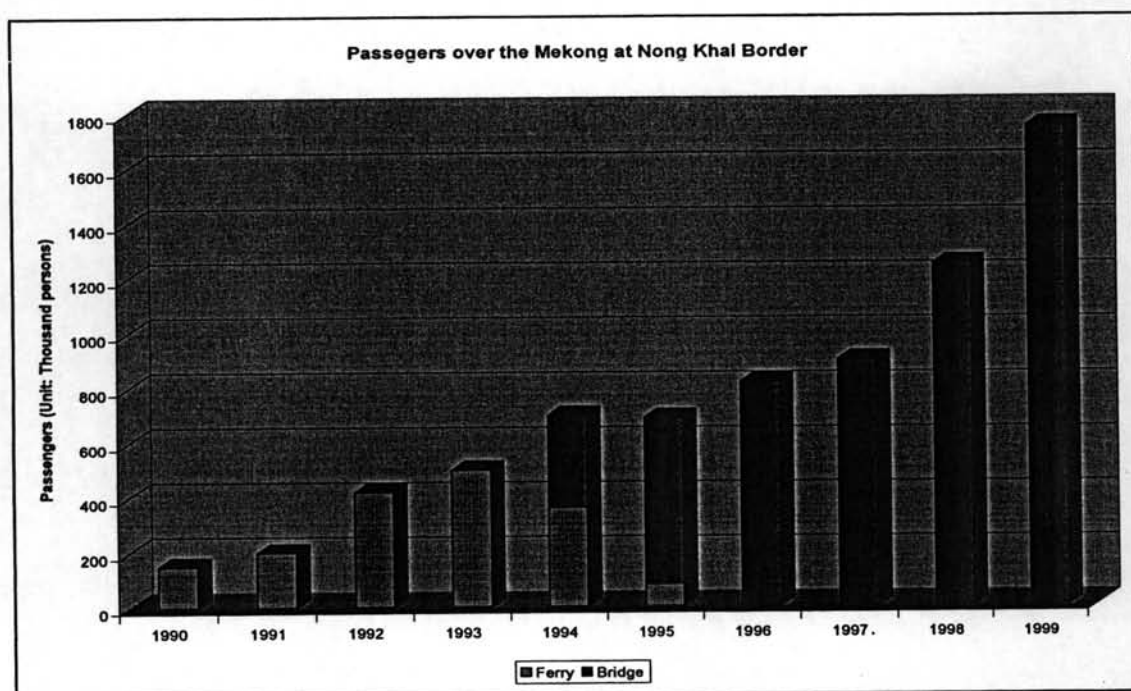
The Impact of Greater Mekong Sub-region Integrated Land Transport Network on urban development in the country can be best understood against the background of physical changes in the transport system. The evaluation of the improved transport system during the last three decades in Lao PDR, together with the government policy in improvement of the integrated land transport network to facilitate better access to international markets, reflected the better transport capacity, efficiency, reliability and level of service. It is clear that the improvement of the integrated transport have definitely brought about the reduction in transport distances and cost, hence an increase in transport volume and economic activities, resulting in the significant changes in both economical-social and physical conditions of the related areas of Lao PDR. Therefore in this chapter the phenomenon of the growth and declination of the population agglomeration and urban development in Lao PDR due to the improvement of the integrated land transport network in each time frame will be analyzed.

1 The Impact of the GMS Integrated land Transport Network on the Traffic and Transport Volume

1.1 Impact of First Mekong Bridge

Before the completion of the bridge, people could pass the Mekong by ferries for 30 minutes. The bridge reduced passing time dramatically. Figure 5.1 shows the passengers crossed the Mekong at Nong Khai – Vientiane Capital border. In average, the number of passengers grows at 30-40% recently. The bridge contributes to absorb this high growth of passenger movements. The traffic volume on the bridge decreased in 1996 and 1997 (figure 5.2). After 1997, the traffic volume increased gradually. In 1999, the total volume was recorded for 211,541 vehicles for both directions. The number was equivalent to 290 vehicles per day per direction.

Figure 5.1 Passengers over the Mekong at Nong Khai Border



Source: "Study on the usage and operations of the Mekong Bridge River Friendship Bridge (1997)" and "the study for improving of logistics for East-West Corridor in GMS (200)"

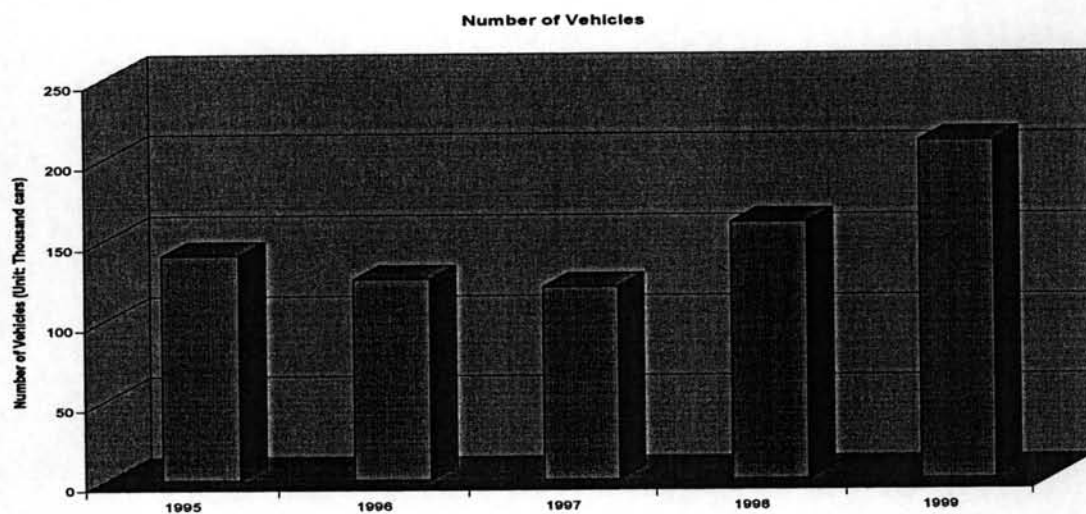


Figure 5.2 Traffic Volumes over the Bridge

Source: *Vientiane Capital*

1.2 Increased Traffic Volume within the Country

The traffic volume in Lao PDR has been significantly increased after 1995 due the expanded integrated land transport network throughout the country together with the opening of the first Mekong International Bridge as can see in the table 5.1

Table 5.1 Traffic Volume 2000 comparing with 1995 at junctions, with increase % (Day Time Traffic).

Location of traffic survey point	Average Dairy Traffic (two wheelers) 12 hours 7:00 Am – 7:00 Pm		Percent Increase
	1995	2000	
Junction and Straight			
Nateuy (Junction)	88	169	190.96
Pakmong (Junction)	43	199	469.41
Meungkham (Junction)	172	150	87.50
Pakhone (Straight)	43	82	190.70
Salaphoukhoun (Junction)	27	139	505.45
Namglap (Straight)	317	525	165.62
Namkading (Straight)	82	560	682.93
Hinboun (Junction)	170	444	261.18
Gnommalat (Junction)	156	198	127.24
Meung Phin (Junction)	67	246	367.16
Lak 35 (Junction)	158	422	267.41
Meung Phonthong (Junction)	112	705	629.91
Meung Pathoumphone (Junction)	82	290	354.27
Total	1,517	4,129	272

Traffic Volume 2000 comparing with 1995 at Junctions, with in-decreases % (Day Time Traffic)

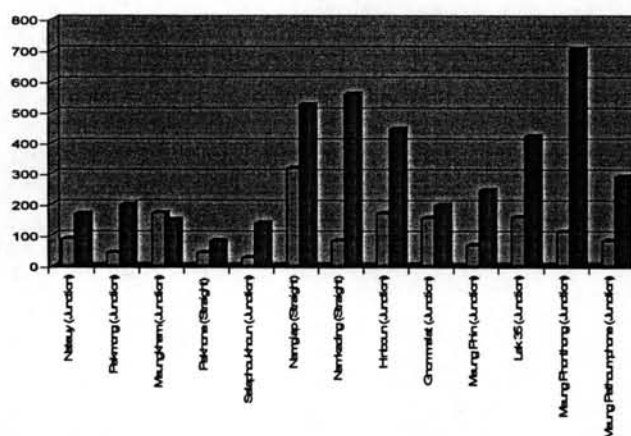


Figure 5.3 Traffic Volume 2000 Comparing with 1995 at Junctions, with in-decreases % (Day Time Traffic)

Source: Japan International Cooperation Agency & Ministry of Communication, Transport, Post and Construction (2000). Traffic Survey Lao PDR. Vientiane, Lao PDR.

1.3 Freight and Passenger Transport Development within the Country

As the improved and extended of the transport network within the country and the completion of the first Mekong bridge, has contributed to supply more convenient and reliable passing measures over the Mekong, it is therefore the freight and passenger transport volume within the Country has been increased dramatically. But it is notably that, the freight and passenger transport by ferries still are in places in many border provinces along the Mekong which accounts for large percentage of the transport volume as well.

Transportation sector is usually divided into two categories: freight and passenger transport. Shown in the Figures 5.4 and 5.5 are the growth of the freight transport and passenger transport respectively. Freight transport is expressed in terms of tons and the passenger transport is expressed in terms of persons.

Improved GMS integrated land transport network has significantly impacted the transport sector within the country during the past three decades. Transport growth rate, according to the historical patterns of the degree of integration, could be summarized as follows:

The above 3 decades trend analysis of the transport indicates the following main features:

- The *freight transport* (y_t) express in terms of *tons* increased exponentially over time (x) and the *passenger transport* (y_t) express in terms of *persons* increased exponentially over time (t). The long term trend fits with an exponential curve. The growth trend of freight and passenger transport has three distinctive phases: a slightly growth during 1975-1982; a moderate growth for the period from 1982 to 1995, and a rapid growth rate during 1995 - 2004. It is quite obvious that the land transport shows the highest growth, while the lowest growth rates are transportation by sea and by air.

1.4 Share of Freight and Passenger Transport within the Country

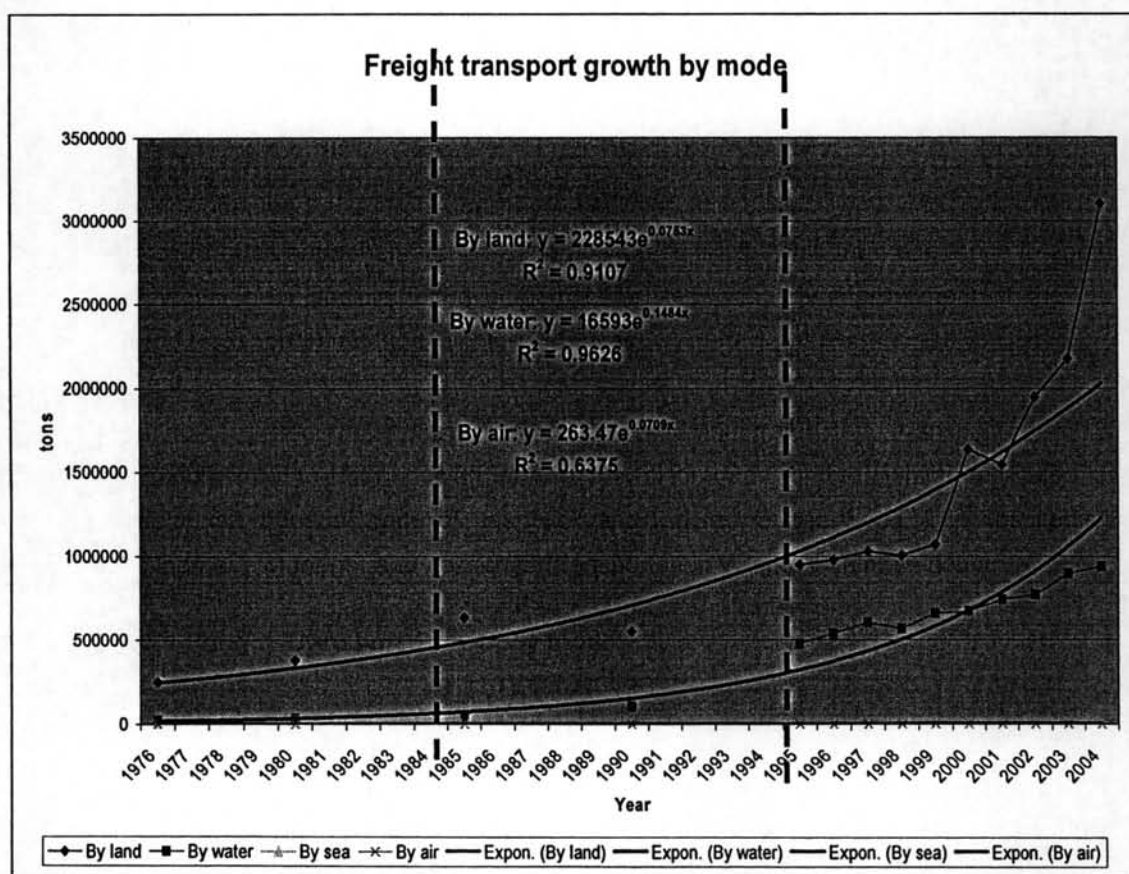
Shown in the figures 5.6 and 5.7 are the break downs of the freight and passenger by different modes of transportation used - covering land, water, sea and air transport. The majority share of the freight and passenger transport is by land, water and air transport respectively. The majority share of the freight by land transport has been increasing. The trend was up to 66% and continually trends up to 75% in 2004. The percentage share of the water and air transport has been decreasing and has been replaced by land transport. There is a similarity with the passenger transportation. The majority share of passenger land transport has been increasing up

to 66% and continually trend up to 75% in 2004, while the percentage share of the water and air transport has been decreasing and replaced by land.

Having observed this transport revolution, the discussion why and how the three distinctive growth rates happened and why and how these drastic shift from one mode to another occurred, it would be plausible to have them correlated with the improvement of the GMS integrated land transport in the 3 development phases.

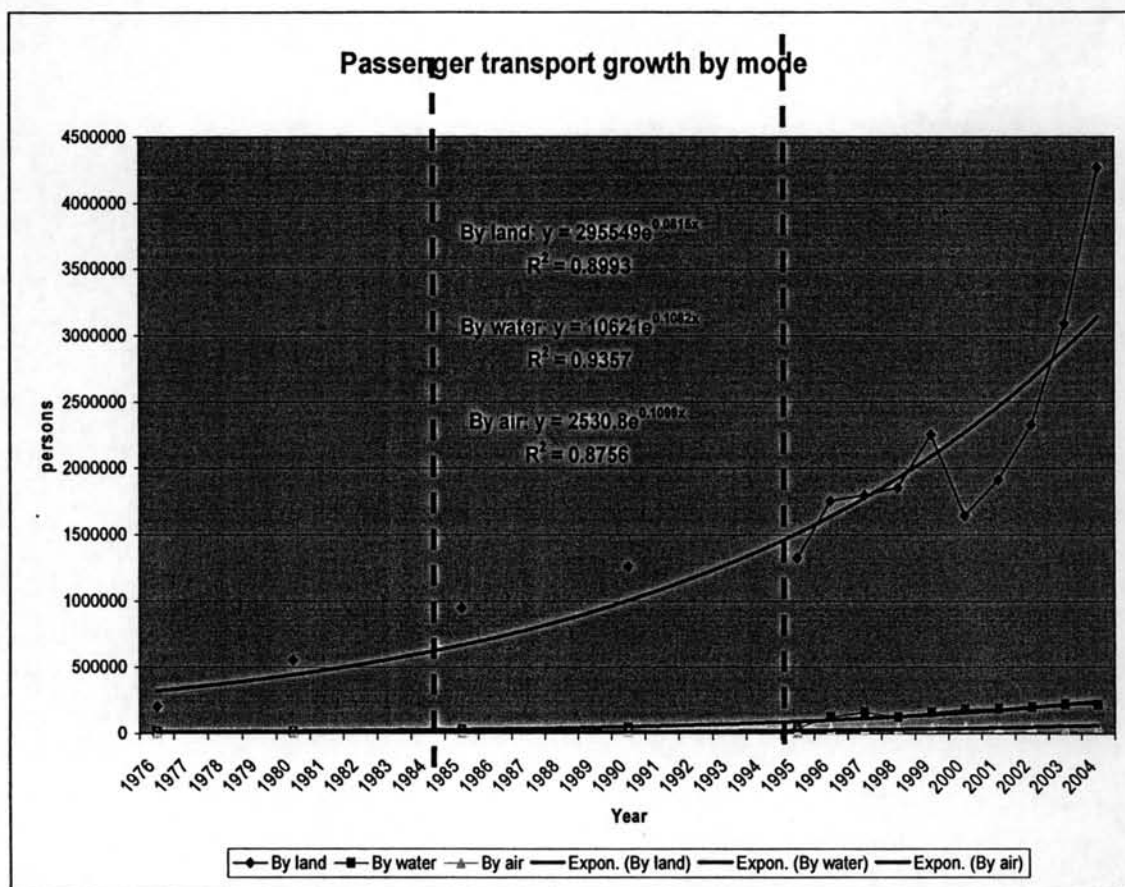
It is obvious that the improvement of the GMS integrated land transport after 1995 happened mainly due to the opening of the First integrated bridge, which facilitated and accelerated the international trade of Lao PDR and the rest of the world. This resulted in a tremendous increase of freight and passenger transportation volume within the country.

Figure 5.4 Freight Transport Growth by mode



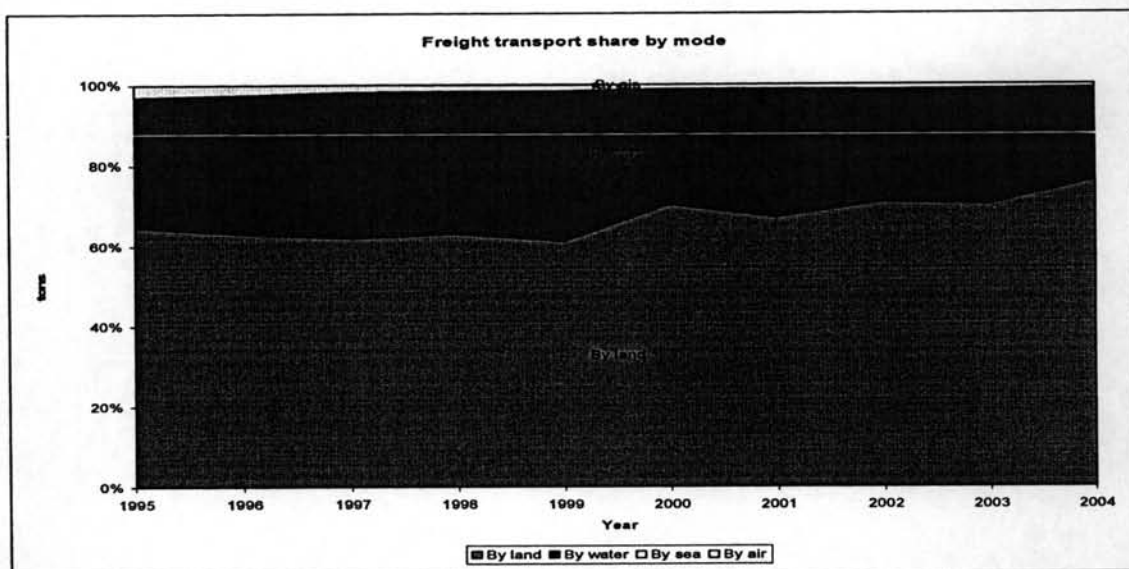
Source: National Statistic Center (2004), Lao PDR.

Figure 5.5 Passenger Transport Growth by Mode



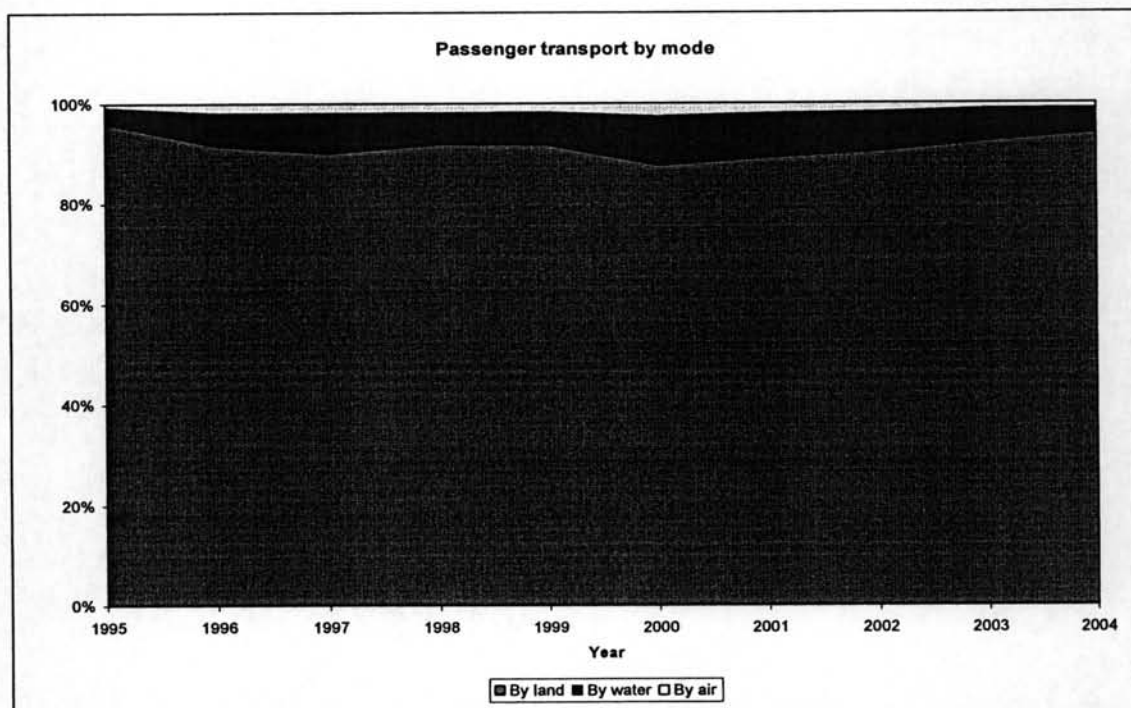
Source: National Statistic Center (2004), Lao PDR.

Figure 5.6 Freight Transport Share by mode



Source: National Statistic Center (2004), Lao PDR.

Figure 5.7 Passenger Transport Share by mode



Source: National Statistic Center (2004), Lao PDR.

2 The Impact of Integrated Land Transport Network on Population Agglomeration in Lao PDR

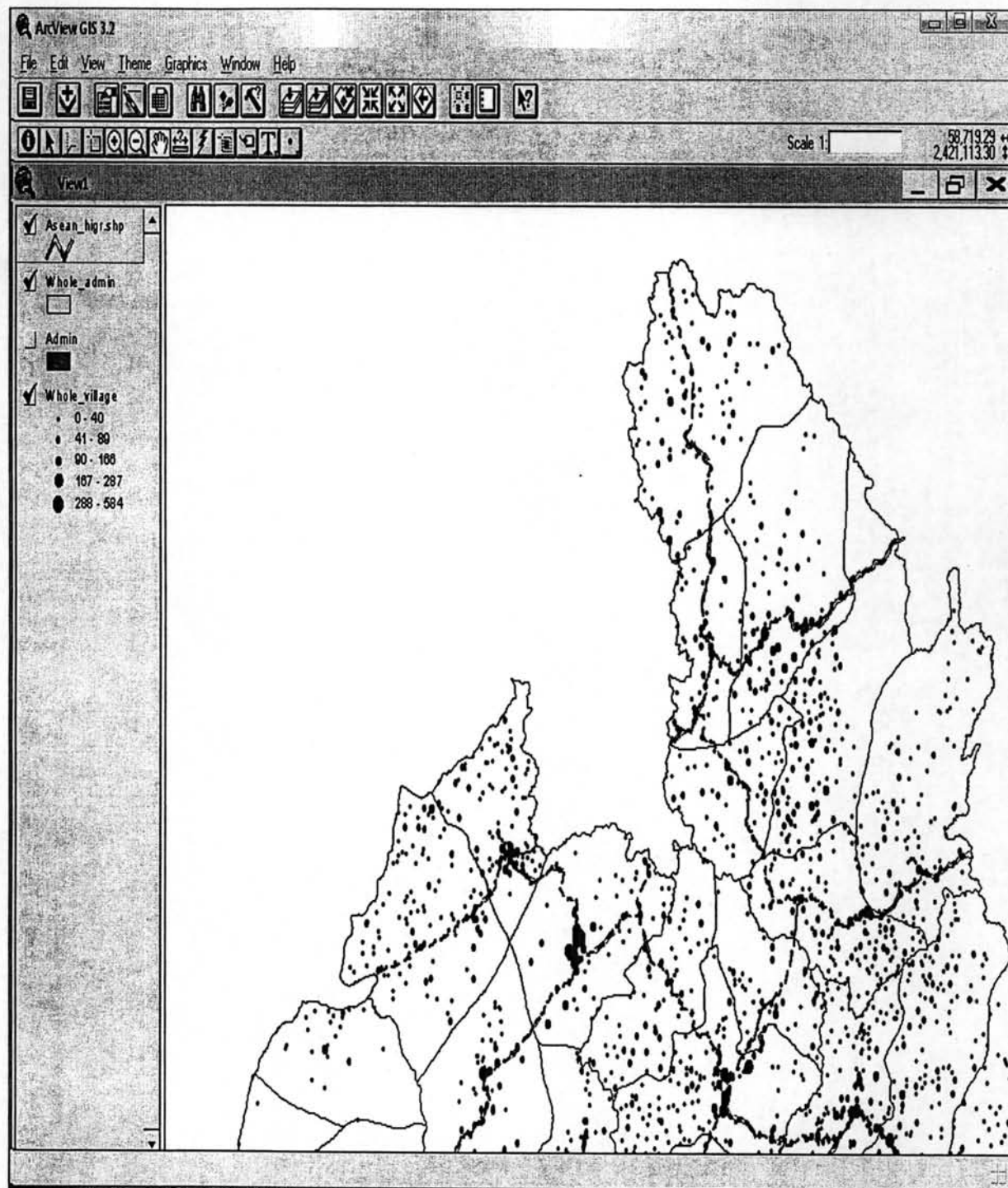
2.1 Identification of Population Agglomeration by Utilization of GIS Methodology

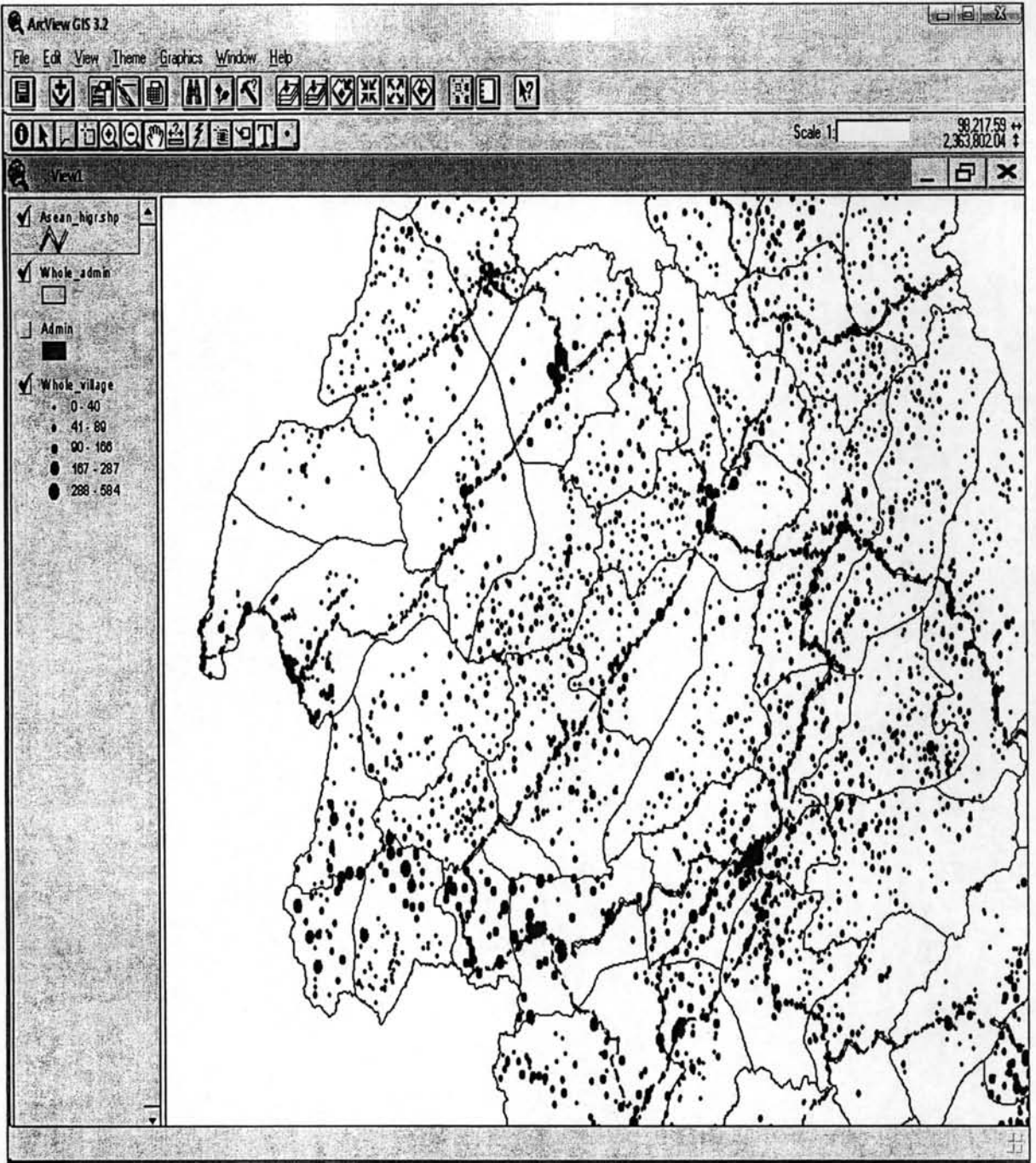
The research utilizes spatial statistical analysis function of GIS software i.e. MapInfo and Arc View to handle spatial attribute data in order to identify the location of expanded population agglomeration. In addition patterns and density of new settlement could also be distinguished i.e. linear branch, cluster branch, isolated, expansion and infill.

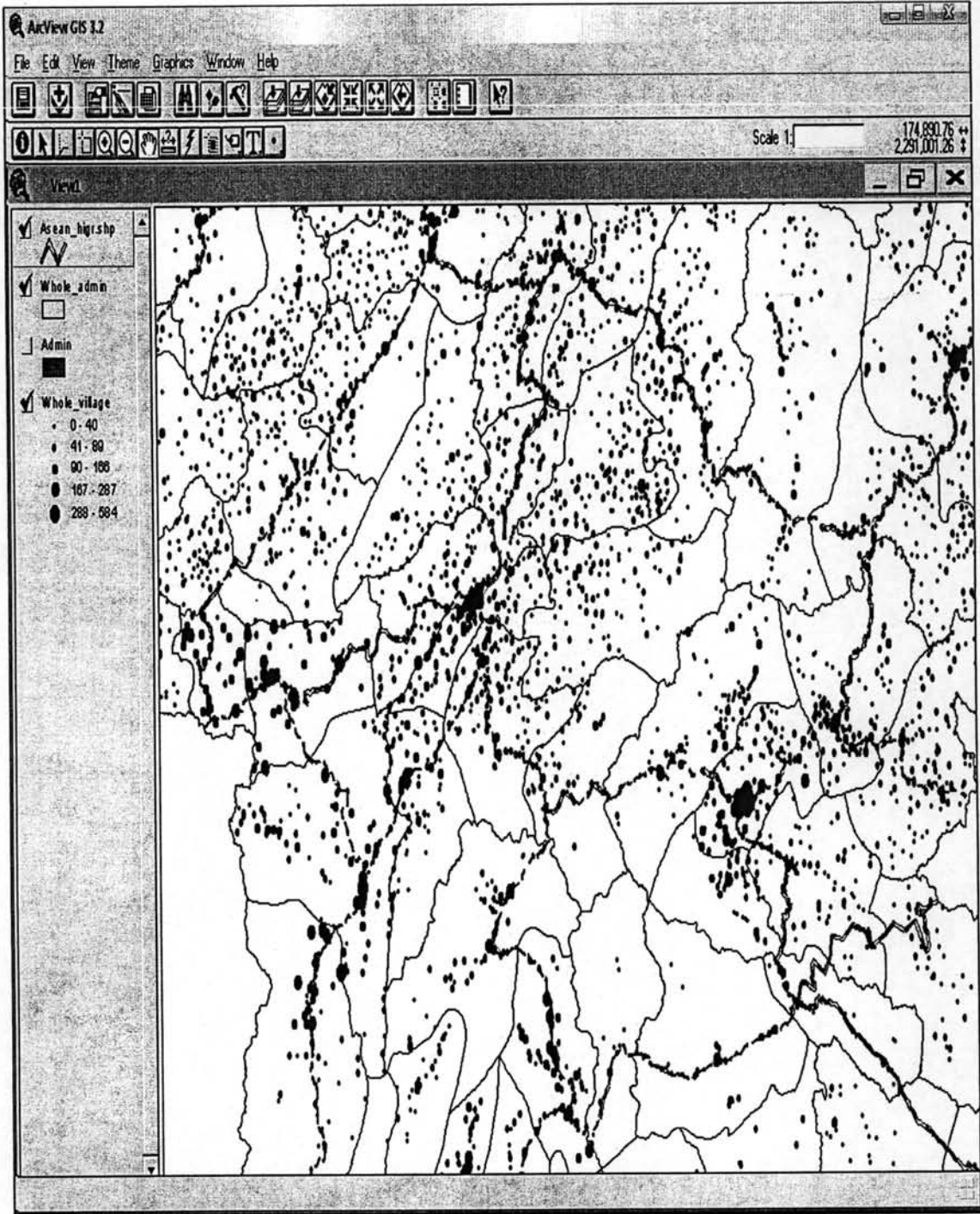
As a result of recent GMS initiatives and expansion of the national highway network and economic growth corridors, *a number of previously minor settlements are growing and new settlements forming at strategic locations along the main highway international border network and a border crossings areas, where the socioeconomic conditions have developed most rapidly* (figure 5.8). There is evidence that other new settlements are beginning to form along the national road network, in order to similarly exploit the potential for improved infrastructure and economic opportunity.

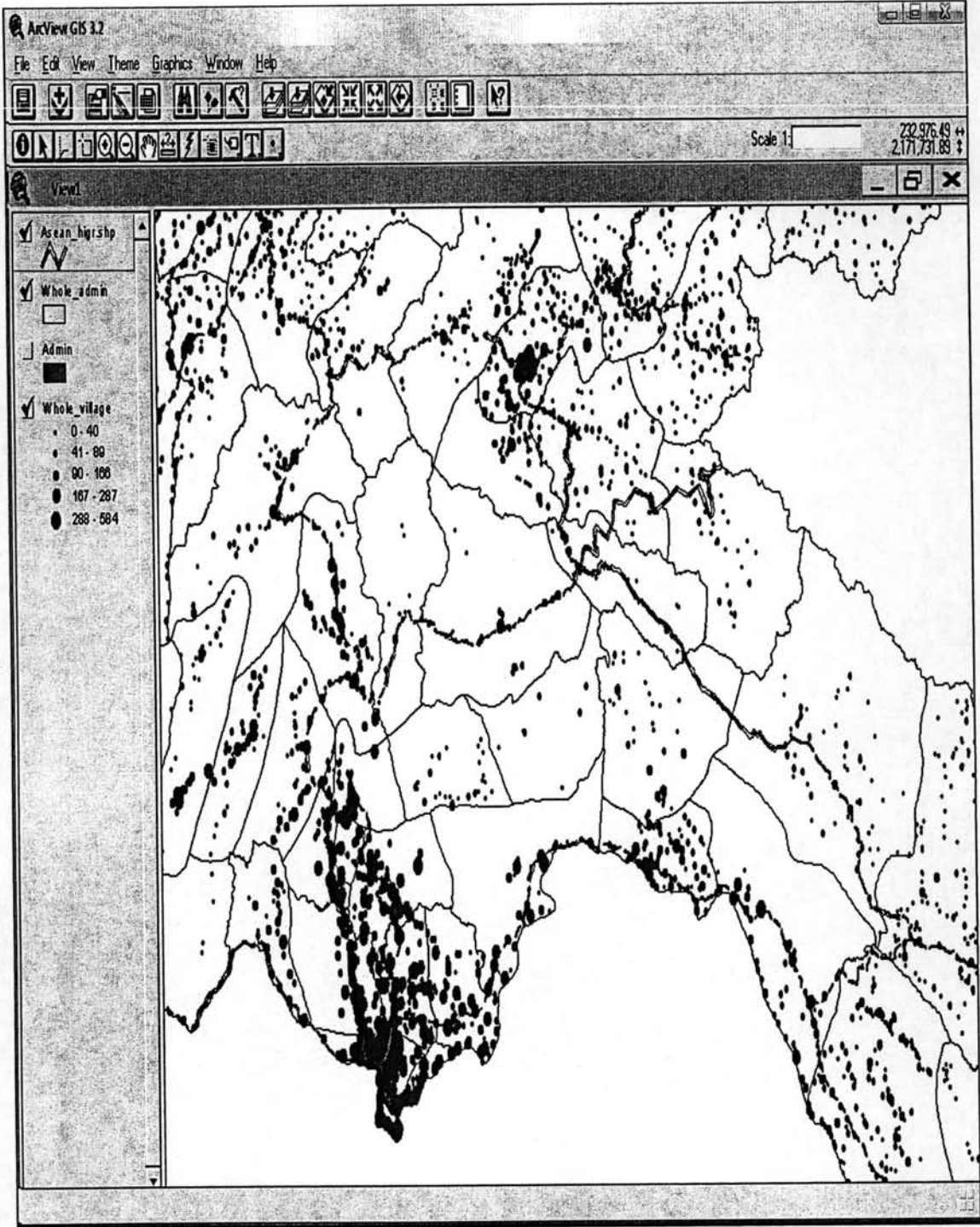
Figure 5.8 Identification of Urban Development by Utilization of GIS Methodology

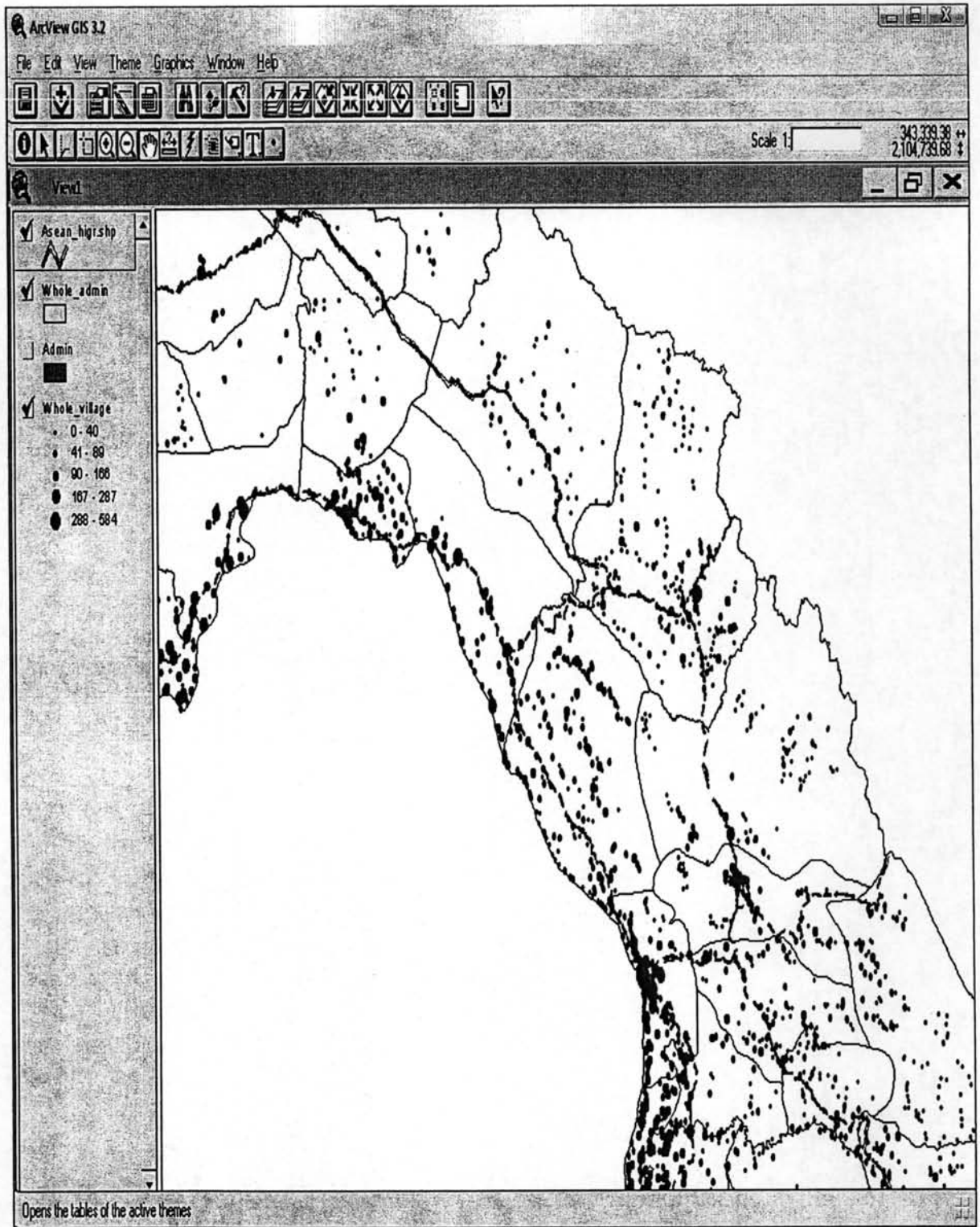
Source: Author's Compilation Based on Data from The Ministry of Communication, Transport, Post and Construction

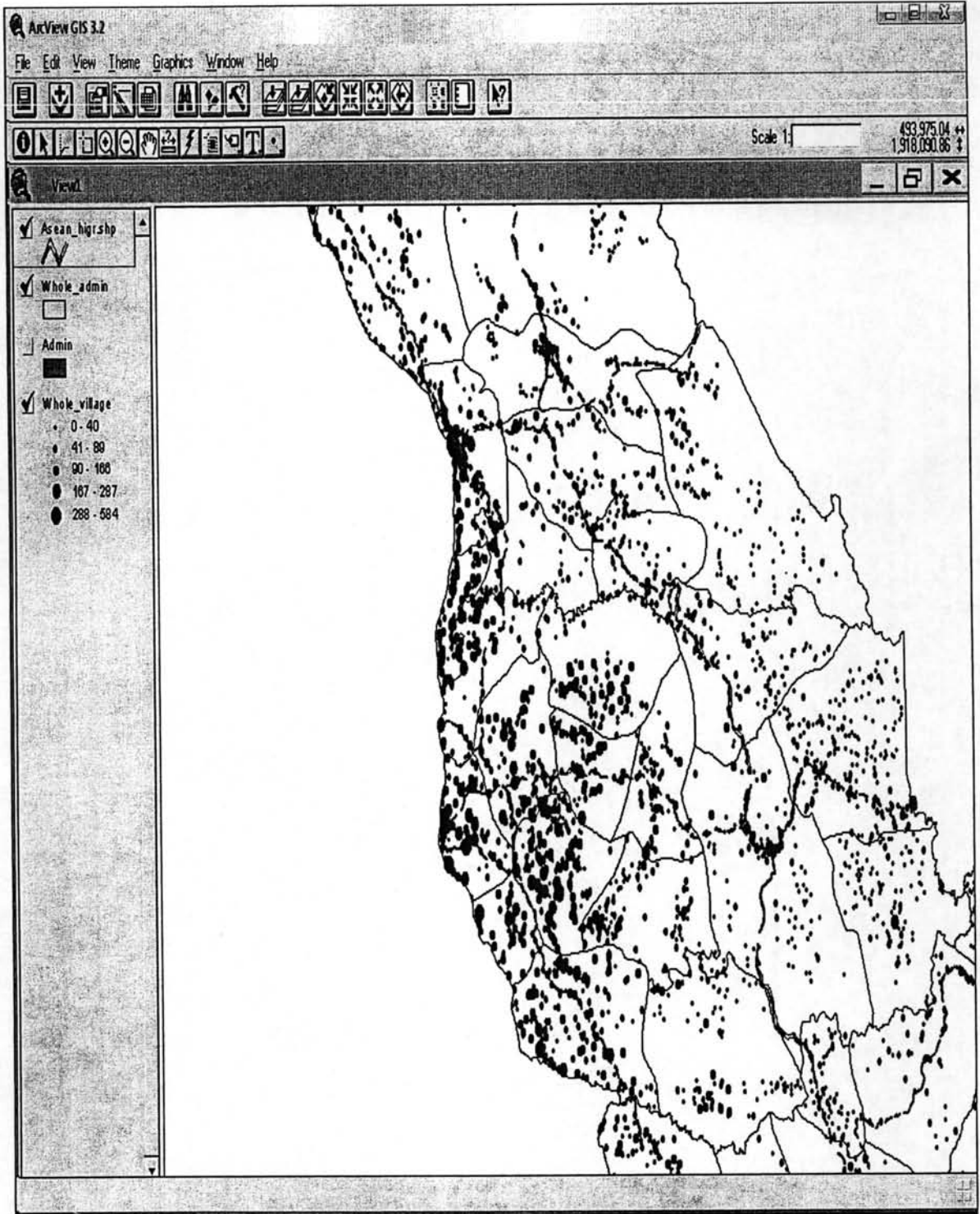












2.2 An Analysis of the Impact of Integrated Land Transport Network on Population Agglomeration in Lao PDR

The impact of integrated land transport network on population agglomeration in Lao PDR will be addressed by analyzing:

- (i) The changing in population distribution in the country at provincial level according to the three phases of the improved integrated land transport network and the increased/decreased annual population growth rate of each province in the three phases due to the impact of the improved integrated land transport network. The analysis will examine population annual growth rate of individual province and investigate the cause of such growth rate at each time frame. This aspect also includes the analysis of the shift of the size rank of each province in each phase describing the shifting of the importance of its role within the country;
- (ii) The extent and growth rate of the population agglomeration at district level within individual province. Based on the available data the analysis of the population agglomeration at district level can be made only in the time frame of 1995-2005. The comparison will be made not only among the district within the province itself, but also with other districts of the other provinces. The analysis will give us the deep understanding on where/how/to what extent the population growth has taken place. The analysis will lead us to see the various driving forces that shape the population growth, especially the factor of the improved integrated land transport network.

The database for the historical review depends much on the "Basic Statistics of the Lao PDR 1975-2005" of NSC; which was published in 2005. Other data and information obtained from "National Urban sector Strategy and Investment Plan, March 2005" of Department of Housing and Urban Planning, MCTPC Lao PDR. This provides the basis for analyses of the historical patterns of urban development for the last 3 decades.

(i) The Change in the Population Distribution, the increased/decreased annual population growth rate and the annual population growth rate distribution in Lao PDR during the Last Three Decades at Provincial Level

1) The Change in the Population Distribution

The changing in population distribution in the country at provincial level due to the impact of the improved integrated land transport network in 1976, 1985, 1995 and 2005 is shown in table 5.2 and figure 5.9. It should be noted here that after 1984 Vientiane was divided into Vientiane Capital, Vientiane Province, and Borikhamxay Province. Luangnamtha province was divided into Luangnamtha Province and Bokeo Province. Saravan province was divided into Saravan province and Sekong province. Xaysomboun SR was established after 1990, which its area partially taken from Vientiane province and Xiengkhuang province.

As can be seen in table 5.3 Savannakhet province with the largest area in Lao PDR (21774 km²) has accommodated the largest number of population since 1985 following by Champasak province and Vientiane Capital. However in 1995, the population in Vientiane Capital is higher than that in Champasak province. Luangprabang province has ranked number four in term of population agglomeration since 1985.

Table 5.2 Area and average mid-year population by provinces in 1976 – 2005

Area and average mid-year population by provinces in 1976 - 2005													
Unit : Th.persons													
Code	Name of provinces	Area (Km2)	1976	1980	1985	1990	1995	2000	2001	2002	2003	2004	2005
	Whole country	232 880	2 886	3 199	3 237	3 676	4 074	4 621	4 761	4 893	5 028	5 167	5 622
01	Vientiane Capital	3 920	-	-	381	464	532	598	616	633	651	669	698
02	Phongsaly	16 270	99	110	124	141	153	174	180	185	190	195	166
03	Luangnamtha	9 325	122	136	98	119	115	131	135	139	142	146	145
04	Oudomxay	15 370	151	167	189	283	211	240	247	254	261	268	265
05	Bokeo	6 196	-	-	56	64	115	130	134	137	141	145	145
06	Luangprabang	16 875	238	264	298	337	367	416	429	441	453	465	407
07	Huaphanh	16 500	169	187	212	220	247	279	288	296	304	312	281
08	Xayabury	16 389	180	200	226	185	293	333	343	352	362	372	339
09	Xiengkhuang	15 880	130	144	163	181	201	229	236	242	249	256	230
10	Vientiane	18 526	517	573	267	305	287	327	337	346	373	383	389
11	Borikhamxay	14 863	-	-	123	143	165	187	192	198	203	209	225
12	Khammuane	16 315	270	299	215	245	275	311	320	329	338	348	337

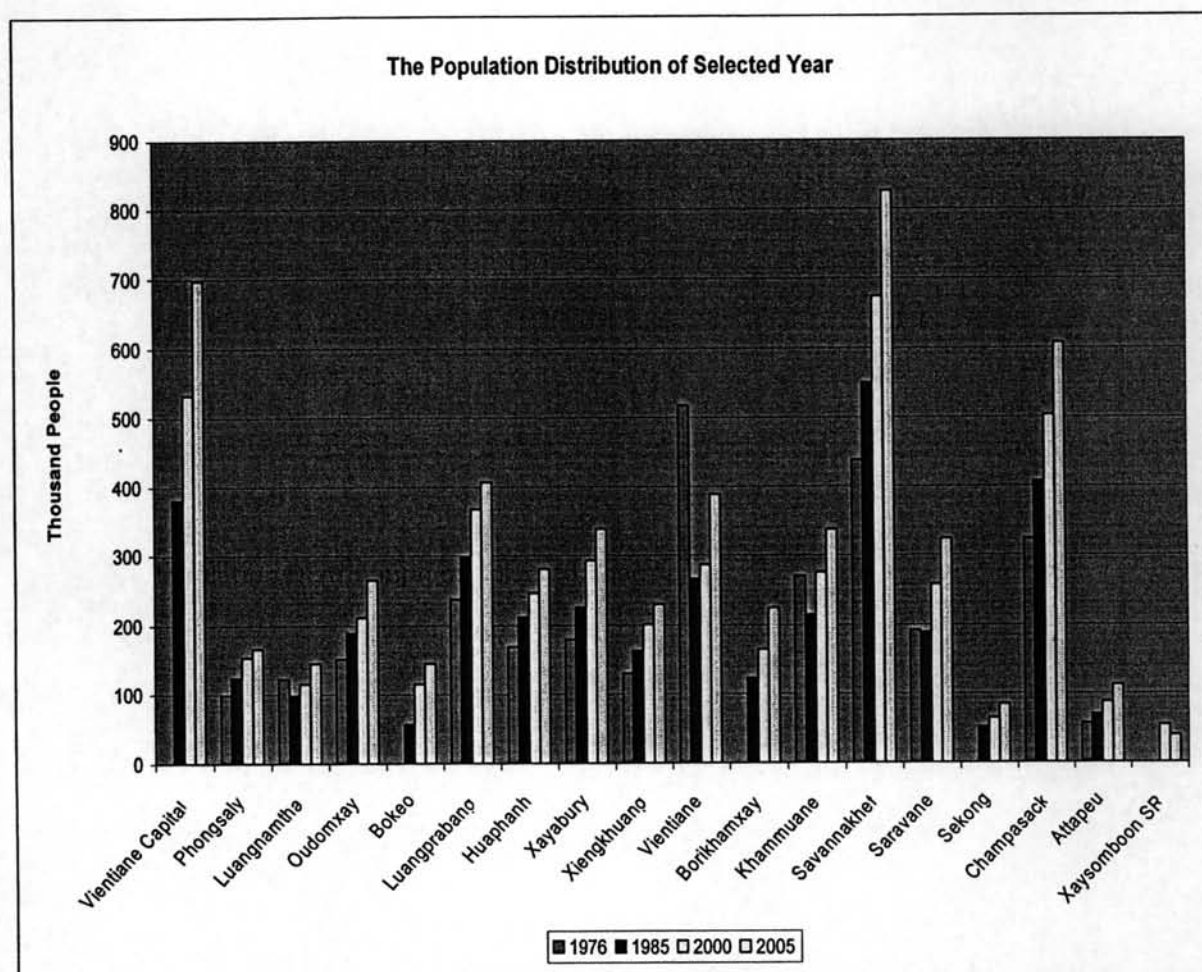
13	Savannakhet	21 774	438	485	549	639	675	766	790	811	834	857	826
14	Saravane	10 691	192	212	189	225	258	292	301	310	318	327	324
15	Sekong	7 665	-	-	51	57	64	73	75	78	80	82	85
16	Champasack	15 415	324	360	407	453	503	572	589	606	622	640	607
17	Attapeu	10 320	56	62	70	79	88	100	103	105	108	111	112
18	Xaysomboon SR	4 506	-	-	-	-	54	62	64	65	50	51	39
Source: NSC, CPI													
- Results from the Population and Housing Census 2005, NSC,CPI													
Remark: From year 2000-2004, Calculated base on Population Census 1995 structure and growth rate at year 2000													

Table 5.3 Population Change in Lao PDR in 3 Main Periods

Province	Population 1976	Rank	Rank	Population 1985	Province	% Growth rate per year (1976-1985)	Rank	Population 1995	Province	% Growth rate per year (1985-1995)	Rank	Population 2005	Province	% Growth rate per year (1995-2005)
Vientiane	517	1	1	549	Savanna khet	2.82	1	675	Savannakhet	2.29	1	826	Savanna khet	4.48
Savanna khet	438	2	2	407	Champasack	2.85	2	532	Vientiane Capital	3.96	2	698	Vientiane Capital	6.25
Champasack	324	3	3	381	Vientiane Capital	-	3	503	Champasack	2.37	3	607	Champasack	4.12
Khammuane	270	4	4	298	Luangprabang	2.80	4	367	Luangprabang	2.32	4	407	Luangprabang	2.17
Luangprabang	238	5	5	267	Vientiane	-5.37	5	293	Xayabury	2.98	5	389	Vientiane	7.13
Saravane	192	6	6	226	Xayabury	2.84	6	287	Vientiane	0.74	6	339	Xayabury	3.12
Xayabury	180	7	7	215	Khammouane	-2.26	7	275	Khammouane	2.81	7	337	Khammuane	4.47
Huaphanh	169	8	8	212	Huaphanh	2.83	8	258	Saravan	3.67	8	324	Saravane	5.09
Oudomxay	151	9	9	189	Saravan	-0.17	9	247	Huaphanh	1.67	9	281	Huaphanh	2.73
Xiengkhuang	130	10	10	189	Oudomxay	2.80	10	211	Oudomxay	1.18	10	265	Oudomxay	5.08
Luangnamtha	122	11	11	163	Xiengkhuang	2.82	11	201	Xiengkhuang	2.34	11	230	Xiengkhuang	2.86
Phongsaly	99	12	12	124	Phongsaly	2.81	12	165	Borikhamxay	3.41	12	225	Borikhamxay	7.29
Attapeu	56	13	13	123	Borikhamxay	-	13	153	Phongsaly	2.37	13	166	Phongsaly	1.64
Vientiane Capital	-		14	98	Luangnamtha	-2.19	14	115	Luangnamtha	1.76	14	145	Luangnamtha	5.17
Bokeo	-		15	70	Attapeu	2.78	15	115	Bokeo	10.52	15	145	Bokeo	5.22
Borikhamxay	-		16	56	Bokeo	-	16	88	Attapeu	2.53	16	112	Attapeu	5.54
Sekong	-		17	51	Sekong	-0.17	17	64	Sekong	2.59	17	85	Sekong	6.48
Xaysomboon SR	-		18	-	Xaysomboon SR	-	18	54	Xaysomboon SR		18	39	Xaysomboon SR	

Source: Author's Compilation Based on Data from National Statistic Center (Population and Housing Census)

Figure 5.9 Population Distribution of Selected Year



Source: Author's Compilation Based on Data from National Statistic Center (Population and Housing Census)

2) The increased/decreased annual population growth rate

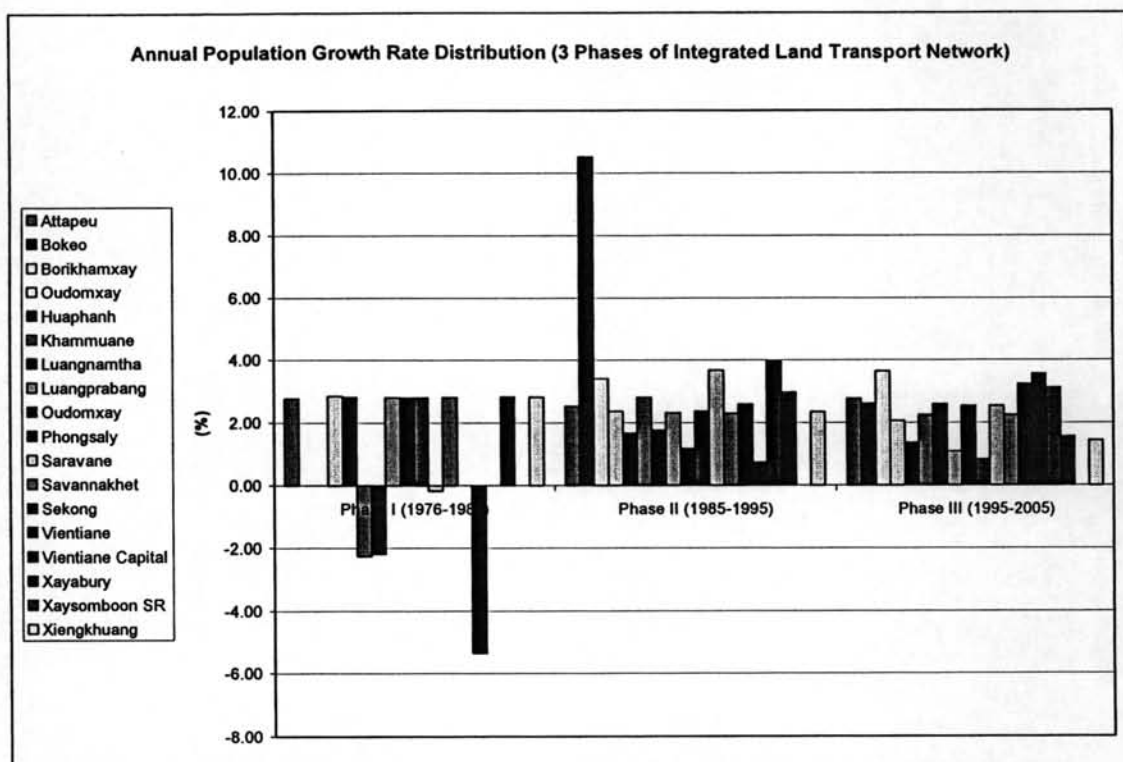
The increased/decreased annual population growth rate of each province according to the three phases of the improved integrated land transport network is shown in table 5.4 and figure 5.10 respectively. The population of Lao PDR in 1976 was 2.886 million comparing with compared with 5.785 million in 2005 implies an average annual growth rate of 3.2 percent. Based on the land integrated transport network development phase basis, the annual growth rate varied from 1.4 percent in the first phase (1975-1985) to 2.6 percent in the second phase (1985-1995) and in the third phase (1995-2005) the annual growth rate was 3.8 percent which is much higher than that in the first period.

Table 5.4 Annual Population Growth Rate by Provinces of Three Phases of the Improved Integrated Land Transport Network

Name of provinces	Phase I (1976-1985)	Phase II (1985-1995)	Phase III (1995-2005)
Whole country	1.35	2.6	3.8
Vientiane Capital	NA	3.96	3.12
Phongsaly	2.81	2.34	0.85
Luangnamtha	-2.19	1.73	2.61
Oudomxay	2.80	1.16	2.56
Bokeo	NA	10.54	2.61
Luangprabang	2.80	2.32	1.09
Huaphanh	2.83	1.65	1.38
Xayabury	2.84	2.96	1.57
Xiengkhuang	2.82	2.33	1.44
Vientiane	-5.37	0.76	3.55
Borikhamxay	NA	3.41	3.64
Khammuane	-2.26	2.79	2.25
Savannakhet	2.82	2.30	2.24
Saravane	-0.17	3.65	2.56
Sekong	NA	2.55	3.28
Champasack	2.85	2.36	2.07
Attapeu	2.78	2.57	2.73
Xaysomboon SR	NA	NA	NA

Source: Author's Compilation Based on Data from National Statistic Center (Population and Housing Census)

Figure 5.10 Annual Population Growth Rate Distribution of 3 three Phases of Integrated Land Transport Network)



Source: Author's Compilation Based on Data from National Statistic Center (Population and Housing Census)

As can be seen in the table 5.4 & Figure 5.10, during the *initial integrated land transport development phase* (1976-1980), the growth rate can be seen both in positive and negative figures, implies that there were both declination and growth of the population within the country. During this phase the equal growth rate population could be seen ranging from 2.09% - 2.84%. As mentioned above after 1984 Vientiane, Luangnamtha, Saravan provinces were partially divided, it is therefore showed the negative figures.

In the *second integrated land transport development phase* due to the opened door policy, the growth rate varied across the country. The highest growth rate occurred in Bokeo Province which is a town bordering with Thailand with the annual growth rate of 10.52%. The remaining provinces have a relative smaller growth rate in which the highest growth rate could be seen in Vientiane Capital, with the growth rate of 3.96%. The lowest growth rate could be observed in Vientiane Province, Oudomxay Province, Huaphanh Province and Luangnamtha Province, with the annual growth rate of 0.74%, 1.18%, 1.67% and 1.76% respectively.

During the *third integrated land transport development phase* (after 1995), with the competition of the first International Mekong Bridge, several observations could be seen as follows:

- The Highest growth rate could be observed in Borikhamxay province and Vientiane Province with the annual growth rate of 7.29% and 7.13% respectively. Borikhamxay Province owned RN8 (Road No. 8 which is the East - west corridor to connect Vietnam to Thailand), R13S (Road No. 13 which is the North - South corridor to connect China to Cambodia) which are the major GMS strategic integrated road networks: R13 connecting Paksane – Vientiane Capital and RN8 connecting Paksane (capital city of Borikhamxay Province) with Cua Lo port (near Vinh). Similarly to Vientiane Province which owned the major GMS strategic integrated road network namely, R13N and R10.
- During the second phase Bokeo Province accounted for the highest growth rate of 10.52%, however due to the expansion of the integrated land transport network together with the completion of the first international bridge, the land transport has been played an important role across the country. The migrants tend to follow opportunities for economic and social betterment at the core city. Hence, the growth rate of Bokeo province during the third phase is 5.22% which has been decreased sharply implies the reduction in the important role of border town functions at the Thai border in this time frame.
- Annual population growth rate of Vientiane Capital and Savannakhet increased by the similar growth rate of 2.29% and 2.28%
- The decreased annual population growth rate from second phase to third phase could be observed in border town i.e. Bokeo province and Phongsaly.

**Table 5.5 Population Annual Growth Rate during the Last Three Decades
(Sorting from the Highest Growth Rate to the Lowest Growth Rate)**

Name of provinces	Phase I
Vientiane Capital	NA
Bokeo	NA
Borikhamxay	NA
Sekong	NA
Xaysomboon SR	NA
Champasack	2.85
Xayabury	2.84
Huaphanh	2.83

Name of provinces	Phase II
Xaysomboon SR	NA
Bokeo	10.54
Vientiane Capital	3.96
Saravane	3.65
Borikhamxay	3.41
Xayabury	2.96
Khammuane	2.79
Attapeu	2.57

Name of provinces	Phase III
Xaysomboon SR	NA
Borikhamxay	3.64
Vientiane	3.55
Sekong	3.28
Vientiane Capital	3.12
Attapeu	2.73
Bokeo	2.61
Luangnamtha	2.61

Xiengkhuang	2.82
Savannakhet	2.82
Phongsaly	2.81
Oudomxay	2.9
Luangprabang	2.8
Attapeu	2.78
Saravane	-0.17
Luangnamtha	-2.19
Khammuane	-2.26
Vientiane	-5.37

Sekong	2.55
Champasack	2.36
Phongsaly	2.34
Xiengkhuang	2.33
Luangprabang	2.32
Savannakhet	2.3
Luangnamtha	1.73
Huaphanh	1.65
Oudomxay	1.16
Vientiane	0.75

Saravane	2.56
Oudomxay	2.56
Khammuane	2.25
Savannakhet	2.24
Champasack	2.07
Xayabury	1.57
Xiengkhuang	1.44
Huaphanh	1.38
Luangprabang	1.09
Phongsaly	0.85

Source: Author's Compilation Based on Data from National Statistic Center (Population and Housing Census)

3) Annual population Growth Rate Distribution (the variability of the annual population growth rate distribution during the last three decades)

In order to investigate the annual population growth rate distribution the variability of the annual population growth rate of all provinces is analyzed. The annual population growth rate of each province is compared to the average annual population growth rate (mean value) of all provinces to obtain the value of "ratio". The value of ratio equal zero (ratio = 1) implies the annual population growth rate of related province is equal to the average annual population growth rate. If the value of ratio lesser or greater than one (ratio <> 1) implies the annual population growth rate of related province is lesser or greater than the average annual population growth rate. The analysis shows that in phase three, the number of provinces which has the population growth rate closer to the average annual population growth rate is higher than that in the first and second phase. It is interpreted that the variability of the annual population growth rate distribution in phase three is less than that in the first and second phase.

Table 5.6 Variability of the Annual Population Growth Rate Distribution during the Last Three Decades (Ratio Analysis)

Phase I			
Province	Annual Growth Rate	Ratio	<=>
Vientiane Capital	NA	NA	
Bokeo	NA	NA	
Borikhamxay	NA	NA	
Sekong	NA	NA	
Xaysomboon SR	NA	NA	
Champasack	2.85	2.39	>>
Xayabury	2.84	2.39	>>
Huaphanh	2.83	2.38	>>
Xiengkhuang	2.82	2.37	>>

Phase II			
Province	Annual Growth Rate	Ratio	<=>
Xaysomboon SR	NA		
Bokeo	10.54	3.62	>>>
Vientiane Capital	3.96	1.36	>>
Saravane	3.67	1.26	>>
Borikhamxay	3.41	1.17	>>
Xayabury	2.98	1.02	>=
Khammuane	2.81	0.97	<=
Sekong	2.59	0.89	<
Attapeu	2.53	0.87	<

Phase III			
Province	Annual Growth Rate	Ratio	<=>
Xaysomboon SR	NA		
Borikhamxay	3.64	1.52	>>
Vientiane	3.55	1.48	>>
Sekong	3.28	1.35	>>
Vientiane Capital	3.12	1.30	>>
Attapeu	2.77	1.15	>
Bokeo	2.61	1.09	>=
Luangnamtha	2.59	1.08	>=
Oudomxay	2.56	1.06	>=

Savannakhet	2.82	2.37	>>	Phongsaly	2.37	0.81	<	Saravane	2.56	1.06	>=
Phongsaly	2.81	2.36	>>	Champasack	2.37	0.81	<	Khammuane	2.25	0.93	<=
Oudomxay	2.80	2.35	>>	Xiengkhuang	2.34	0.80	<	Savannakhet	2.24	0.93	<=
Luangprabang	2.80	2.35	>>	Luangprabang	2.32	0.80	<	Champasack	2.07	0.86	<
Attapeu	2.78	2.34	>>	Savannakhet	2.29	0.79	<	Xayabury	1.56	0.65	<<
Saravane	-0.17	-0.14	<<	Luangnamtha	1.76	0.60	<<	Xiengkhuang	1.43	0.60	<<
Luangnamtha	-2.19	-1.84	<<<	Huaphanh	1.67	0.57	<<	Huaphanh	1.36	0.57	<<
Khammuane	-2.26	-1.90	<<<	Oudomxay	1.18	0.41	<<	Luangprabang	1.09	0.45	<<
Vientiane	-5.37	-4.51	<<<<	Vientiane	0.74	0.25	<<	Phongsaly	0.85	0.34	<<<
Mean = 1.19				Mean = 2.06				Mean = 2.40			

Source: Author's Compilation Based on Data from National Statistic Center (Population and Housing Census)

Other method can be used to determine variability of the annual population growth rate distribution is the calculation of the variance and closely-related standard deviation. The standard deviation is the most common measure of statistical dispersion, measuring how widely spread the values in a data set is. If the data points are close to the mean, then the standard deviation is small. Conversely, if many data points are far from the mean, then the standard deviation is large. If all the data values are equal, then the standard deviation is zero.

Table 5.7 Variability of the Annual Population Growth Rate Distribution during the Last Three Decades (Statistical Dispersion)

Phase I (1975-1985)			Phase II (1985-1995)			Phase I (1995-2005)		
Annual Pop. Growth & Mean			Annual Pop. Growth & Mean			Annual Pop. Growth & Mean		
-5.37	-6.55	42.92	0.74	-2.17	4.72	0.82	-1.58	2.50
-2.26	-3.44	11.84	1.18	-1.73	3.00	1.08	-1.32	1.74
-2.19	-3.37	11.37	1.67	-1.24	1.54	1.36	-1.04	1.08
-0.17	-1.35	1.83	1.76	-1.15	1.33	1.43	-0.97	0.94
2.78	1.60	2.56	2.29	-0.62	0.39	1.56	-0.84	0.71
2.80	1.62	2.62	2.32	-0.59	0.35	2.06	-0.34	0.12
2.80	1.62	2.62	2.34	-0.57	0.33	2.24	-0.16	0.03
2.81	1.63	2.65	2.37	-0.54	0.29	2.24	-0.16	0.03
2.82	1.64	2.68	2.37	-0.54	0.29	2.54	0.14	0.02
2.82	1.64	2.68	2.53	-0.38	0.15	2.54	0.14	0.02
2.83	1.65	2.72	2.59	-0.32	0.10	2.59	0.19	0.04
2.84	1.66	2.75	2.81	-0.10	0.01	2.61	0.21	0.04
2.85	1.67	2.78	2.98	0.07	0.00	2.77	0.37	0.14
-5.37	-6.55	42.92	3.41	0.50	0.25	3.13	0.73	0.53
Mean = 1.19			Mean = 2.91			Mean = 2.40		
Variance = 7.08			Variance = 4.25			Variance = 0.67		
Standard Deviation = 2.66			Standard Deviation = 2.06			Standard Deviation = 0.82		

Source: Author's Compilation Based on Data from National Statistic Center (Population and Housing Census)

The statistical dispersion analysis above is shown that the standard deviation of the annual population growth rate tends to be decreased over time, implying that the variability of the annual population growth rate distribution has been decreasing gradually from initial integrated land transport development phase to third integrated land transport development phase. In other words, the more equal annual population growth rate distribution could be seen in the third development phase rather than in the initial and second development phase.

It could be concluded that tendency of the equalization of annual population growth rate distribution has been increased within the country during the last three decades. Due to the opened door policy, accompanying by the improved integrated land transport across the country has been provided the equal economic opportunities throughout the country; simultaneously the border town function has become less important. The migrants tend to follow opportunities for economic and social betterment at the core city, resulted in the increased population agglomeration in each individual province.

4) An Analysis of the Impact of Integrated Land Transport Network on Population Agglomeration and Urban Development in Lao PDR

To analyze the impact of integrated land transport network on population agglomeration and urban development in Lao PDR, the identification of the structure of the integrated land transport network needs to be done. The identification of the structure of the integrated land transport network includes the main routes and its' connected links. The starting and ending points which are considered as access locations are also defined to understand the direction of transportation flows into/out of the country. The figure 5.11 and 5.12 show the border entry point and the structure of the integrated land transport network of Lao PDR.

- Land Border Entry Points

Boten - Bohan in China

Huayxai - Xieng Khong in Thailand via river ferry

Vientiane - Nong Khai in Thailand via Friendship Bridge.

Thakek - Nakhon Phanom in Thailand via river ferry

Savannakhet - Mukdaharn in Thailand via Second International Bridge

Vangtau - Chong Mek in Thailand via road

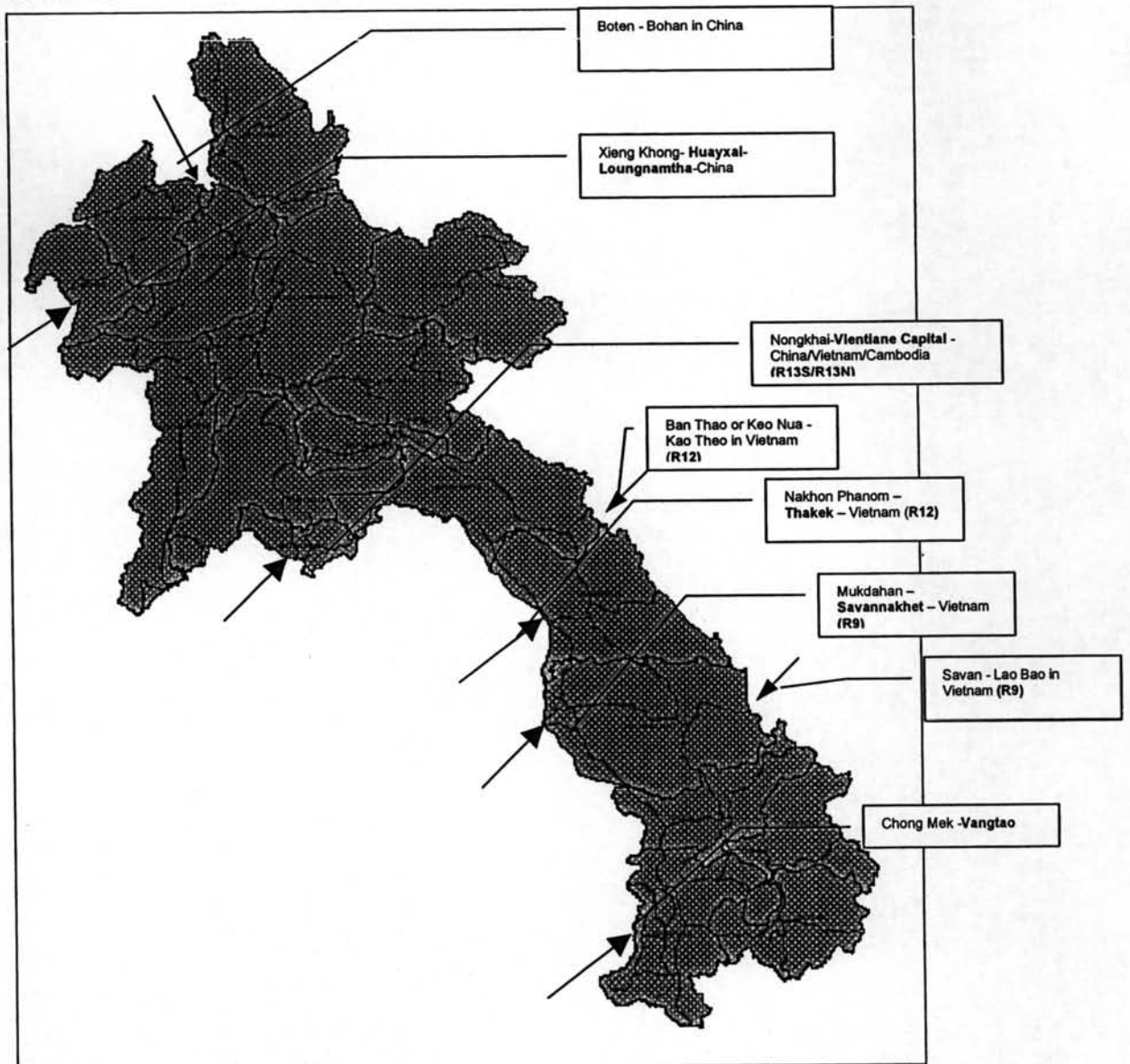
Ban Savan - Lao Bao in Vietnam via road

Ban Thao or Keo Nua - Kao Theo in Vietnam via road

- The integrated land transport network structure of Lao PDR.

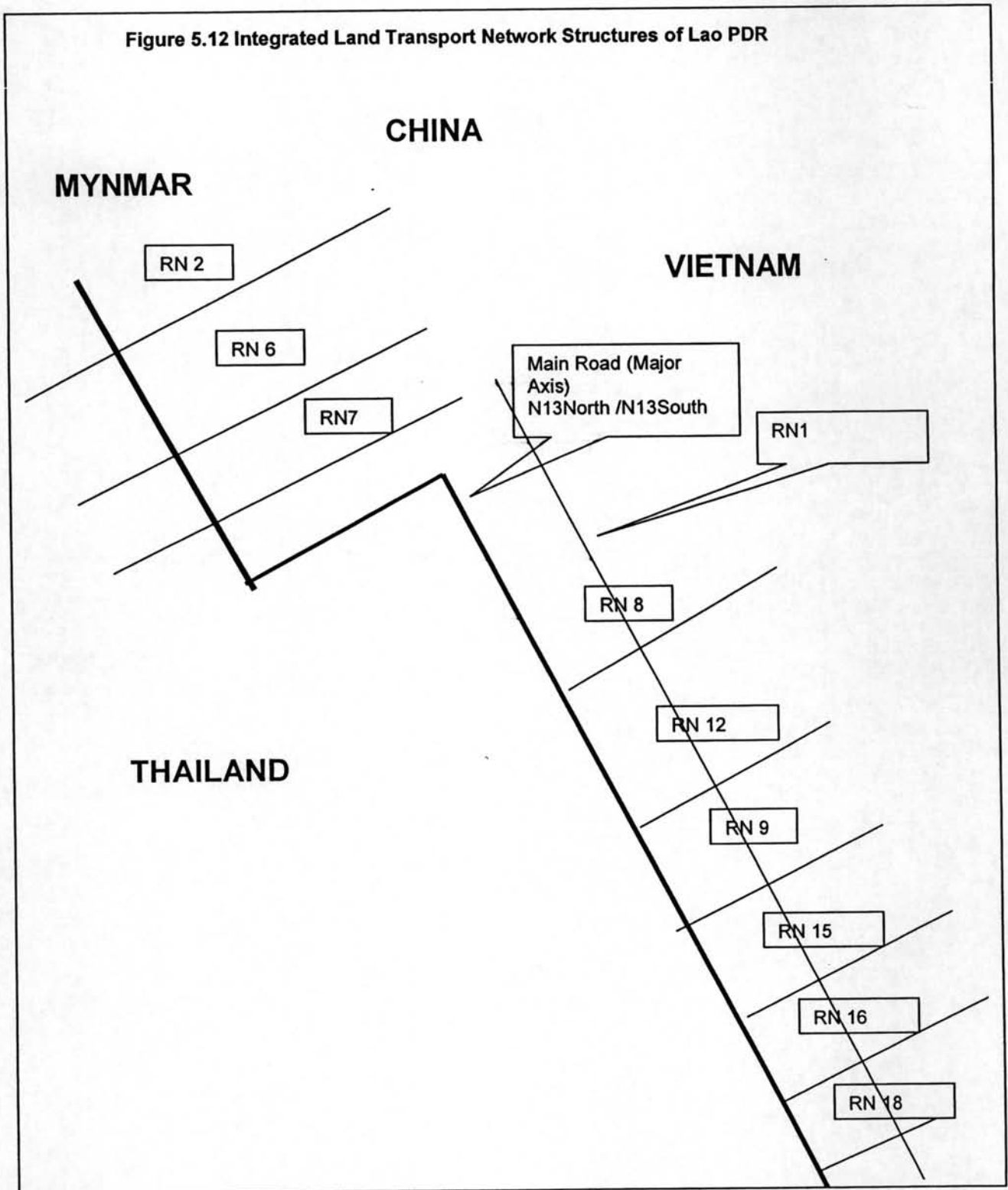
The main axis is in vertical direction along the Road Number 13 which goes in to northern and southern part of Lao PDR. The minor axis consists of series of roads go in a westerly and easterly direction.

Figure 5.11 Land Border Entry Points



Source: Author's Compilation Based on Data from The Ministry of Communication, Transport, Post and Construction (2005).

Figure 5.12 Integrated Land Transport Network Structures of Lao PDR



(A) An Analysis of the Impact of Integrated Land Transport Network on Population Agglomeration in Lao PDR at Provincial Level

(i) Annual Population Growth Rate:

During the *initial integrated land transport development phase* (1976-1980), the growth rate can be seen both in positive and negative figures, implies that there were both declination and growth of the population within the country. As mentioned above after 1984 Vientiane, Luangnamtha, Saravan provinces were partially divided, it is therefore showed the negative figures.

In the *second integrated land transport development phase* due to the opened door policy, the growth rate varied across the country. The highest growth rate occurred in Bokeo Province which is a town bordering with Thailand with the annual growth rate of 10.54%. The remaining provinces have a relative smaller growth rate in which the highest growth rate could be seen in Vientiane Capital, with the growth rate of 3.96%. The lowest growth rate could be observed in Vientiane Province, Oudomxay Province, Huaphanh Province and Luangnamtha Province, with the annual growth rate of 0.75%, 1.16%, 1.65% and 1.73% respectively. In this period, due to the poor condition and limitation of the land integrated transport network in the country, the towns with relied on water transport for border trade accommodated more population than the others since border area provided better job opportunities that attracted more population settlement.

During the *third integrated land transport development phase* (after 1995), with the expanded integrated land transport network and the competition of the first International Mekong Bridge, several observation could be seen as follows:

- The Highest annual population growth rate could be observed in Borikhamxay province and Vientiane Province with the annual growth rate of 3.64% and 3.55 % respectively. Borikhamxay Province is a starting node of R13S which is the main route directing to the Southern part of Lao PDR (*Road No. 13 which is the North - South corridor to connect China to Cambodia*) which is a major GMS strategic integrated road network. Similarly to Vientiane Province which owns the major GMS strategic integrated road network namely, R13N which is the main route directing to the Northern part of Lao PDR.

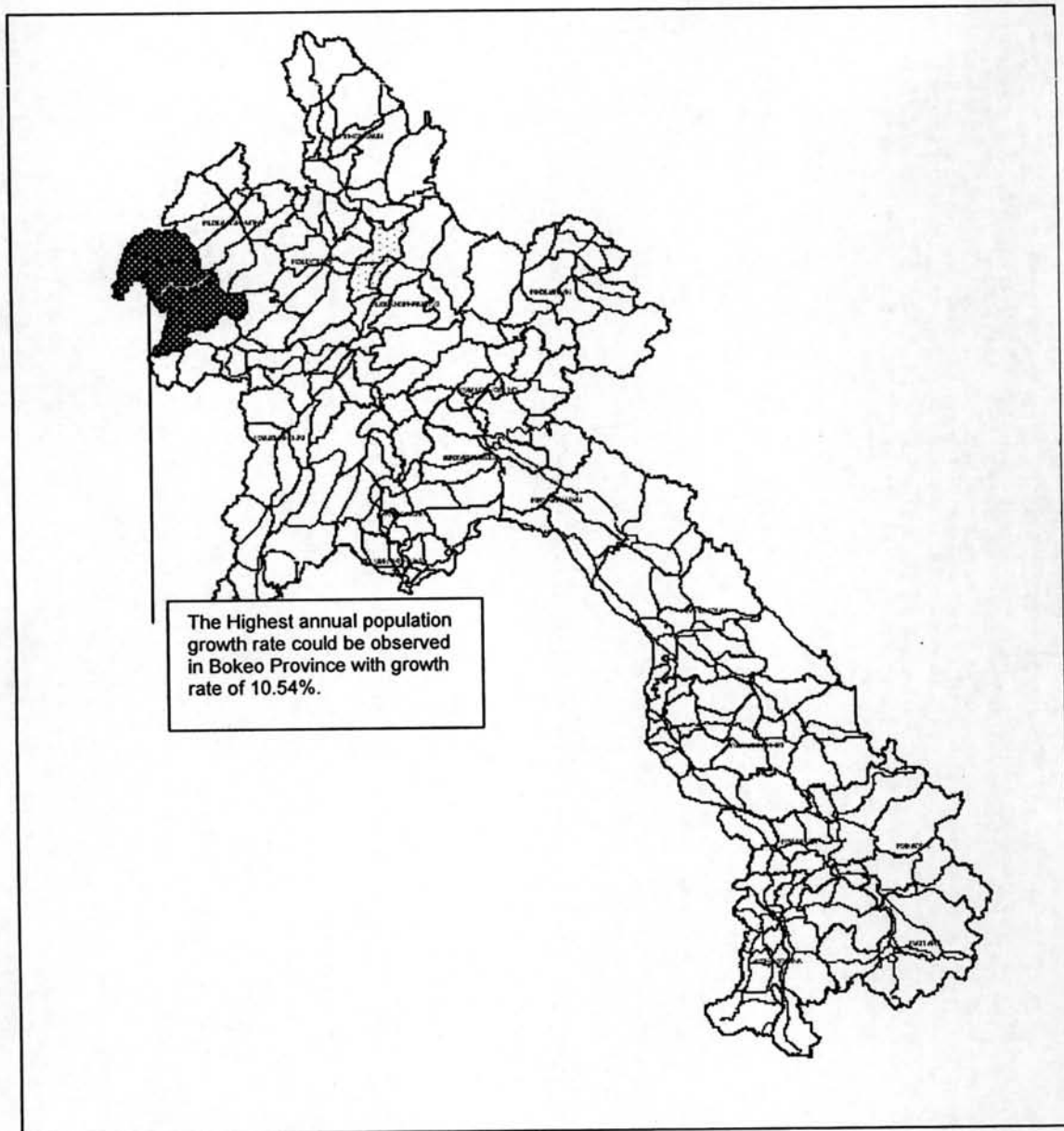
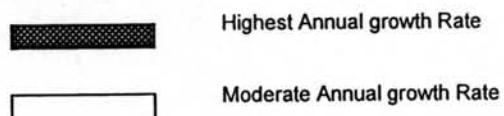


Figure 5.13 Population Annual Growth Rate during the Second Integrated Land Transport Development Phase



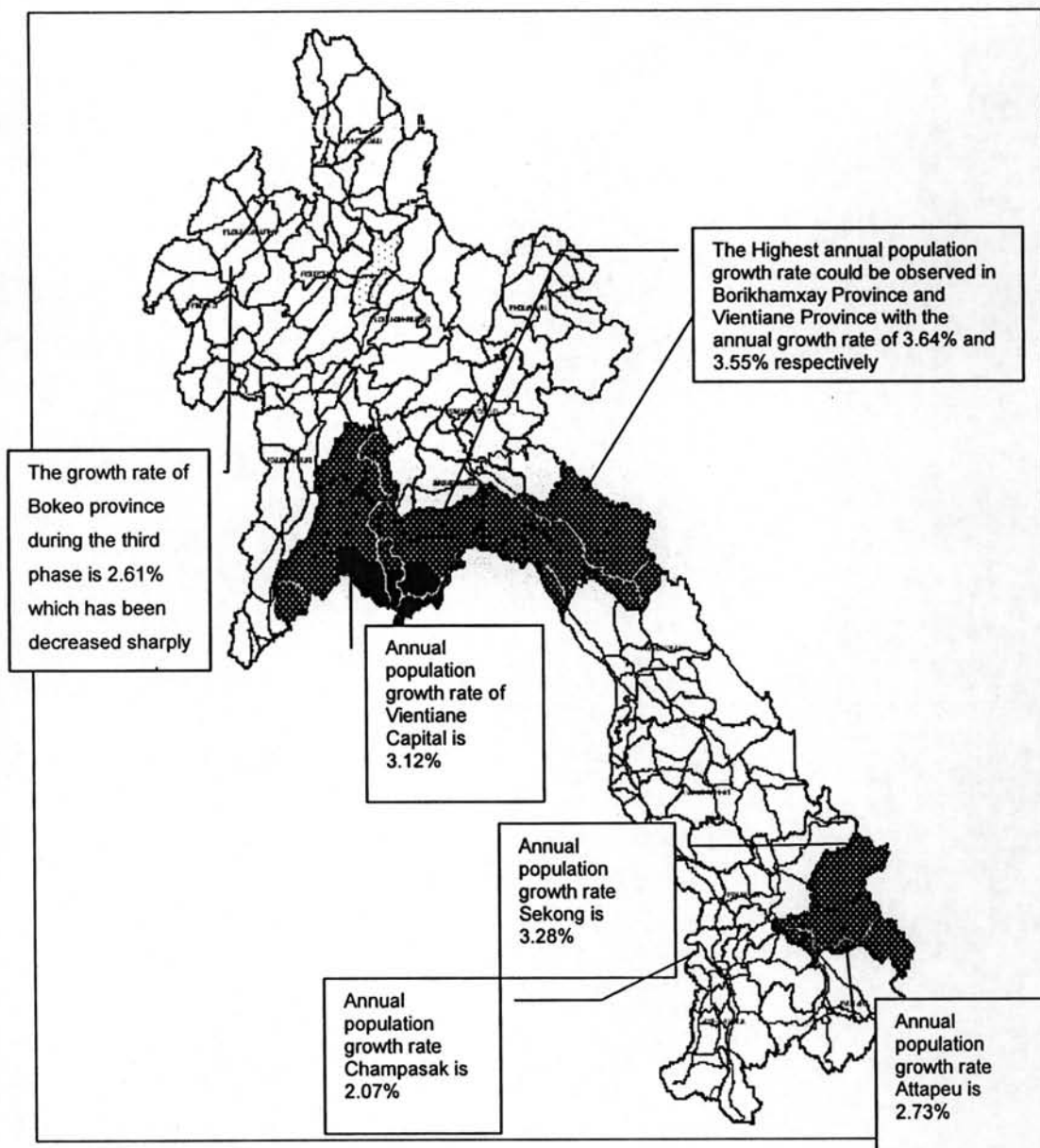
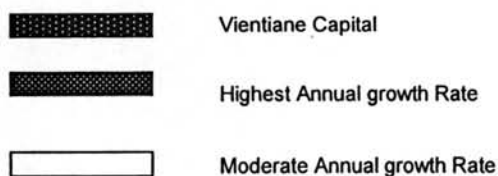


Figure 5.14 Population Annual Growth Rate during the Third Integrated Land Transport Development Phase



During the second phase Bokeo Province accounted for the highest growth rate of 10.52%, however due to the expanded integrated land transport network across the country and the completion of the first international bridge, the land transport has been played more important role. The growth rate of Bokeo province during the third phase is 2.61 % which has been declined sharply implies the reduction in the important role of border functions.

(ii) Increased and decreased annual population growth rate during phase II-III

The increased and decreased annual population growth rate during phase II-III illustrates the tendency of the growth of the province over time. By comparing of the Annual Population Growth Rate of two time frames, the tendency of increasing or decreasing in the annual population growth rate could be identified.

Table 5.8 Increased and Decreased Annual Population Growth Rate during Phase II-III

Name of provinces	Annual Population Growth Rate (Phase II)	Annual Population Growth Rate (Phase III)	Increased/decreased	Ratio	Increased/decreased
Vientiane	0.75	3.55	2.8	4.73	>>>
Oudomxay	1.16	2.56	1.4	2.21	>>
Luangnamtha	1.73	2.61	0.88	1.51	>
Sekong	2.55	3.28	0.73	1.29	>
Borikhamxay	3.41	3.64	0.23	1.07	>
Attapeu	2.57	2.73	0.16	1.06	>
Savannakhet	2.3	2.24	-0.06	0.97	<
Huaphanh	1.65	1.38	-0.27	0.84	<
Champasack	2.36	2.07	-0.29	0.88	<
Khammuane	2.79	2.25	-0.54	0.81	<
Vientiane Capital	3.96	3.12	-0.84	0.79	<
Xiengkhuang	2.33	1.44	-0.89	0.62	<<
Saravane	3.65	2.56	-1.09	0.70	<<
Luangprabang	2.32	1.09	-1.23	0.47	<<
Xayabury	2.96	1.57	-1.39	0.53	<<
Phongsaly	2.34	0.85	-1.49	0.36	<<
Bokeo	10.54	2.61	-7.93	0.25	<<<<

Source: Author's Compilation Based on Data from National Statistic Center (Population and Housing Census)

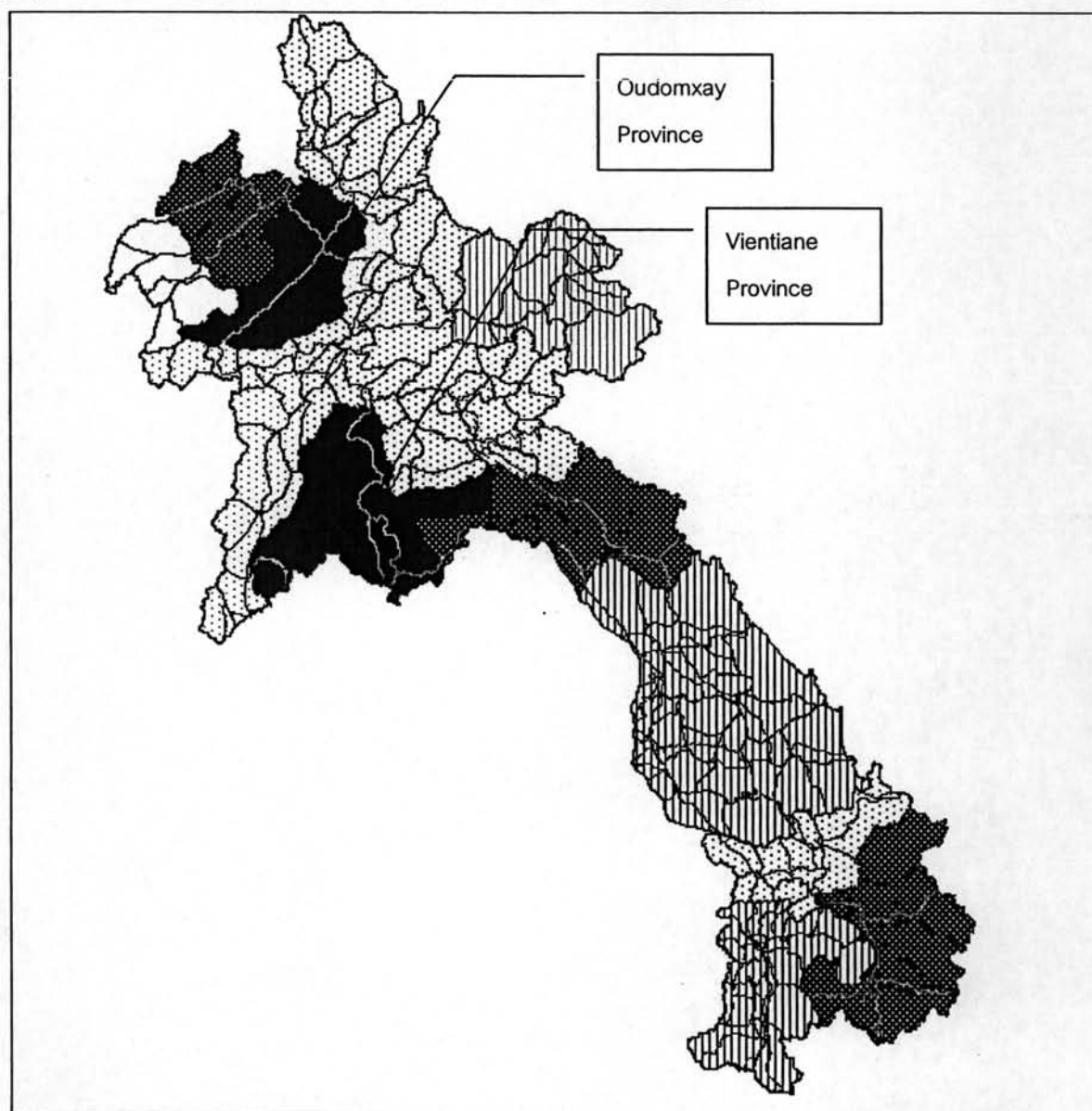
As can be seen from the from the above table, the increased annual growth rate during phase II-III could be observed in Vientiane province, Oudomxay province, Luangnamtha province, Sekong province, Borikhamxay province and Attapeu province. The decreased annual growth rate from during phase II-III could be observed in Savannakhet province, Huaphanh province,

Champasak province, Khammouane province, Vientiane Capital, Xiengkhuang province, Luangprabang province, Xayabury province, Phongsaly province and Bokeo province.

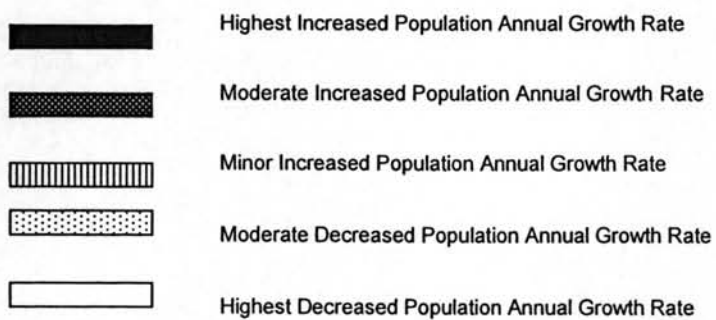
The following map shows the increased and decreased annual growth rate during phase II-III. The highest increased growth rate can be seen in Vientiane province (2.8%) and in Oudomxay province (1.4%). As shown in the map, Vientiane province and Oudomxay province locate at the starting and end node of the main road (R13N) linking Vientiane capital to China. As the completion of the first international bridge and the expanded road network to Northern, Southern, and Eastern part of Lao PDR, a freight and passenger transport along this road as well as the economic activities have been increasing significantly, resulted in the increased population agglomeration of these related areas.

The highest decreased growth rate during phase II-III could be observed in Bokeo province, which is a border town relying on the water transport for trading with neighboring country for last two decades. Since 1995 land transport of Lao PDR integrating with neighboring country has been continually increasing, the transport of goods among GMS countries faster and more reliable, therefore the share of freight and passenger by land transport in Lao PDR has been accordingly increasing, while the percentage share of the water transport has been decreasing - replaced by land transport. The population has been rather settled along the major road; hence the annual population growth rate in Bokeo Province has dropped sharply.

Figure 5.16 Increased and Decreased Population Annual Growth Rate



Source: Author's Compilation Based on Data from National Statistic Center (Population and Housing Census, 1995 & 2005)



(B) An Analysis of the Extent and Growth Rate of the Population Agglomeration and Urban Development at District Level

This section will examine the growth rate of the population agglomeration in general and specifically in urban area. An analysis of the extent and growth rate of the population agglomeration at district level is performed by looking at the percentage of the population agglomeration share of the district itself relevant to its own province within two periods i.e. 1995 and 2005 (for urban population will be based on data of 1995 and 2003) . The analysis at this level will figure out the area with has a larger population than others in a selected year, including the tendency of its increased/decreased percentage of the population agglomeration share. Further analysis of the equalization of the population distribution could be additionally performed by applying the statistical dispersion analysis methodology.

An analysis of the extent and growth rate of the population agglomeration at district level is performed in 5 Provinces as follows:

- Bokeo Province

In Bokeo province the Houxai District which is an important border town shows the highest percentage of the population agglomeration share of 38.91% of the total population in the province during phase II and of 39.06% of the total population in the province during phase III. Although the above figure has showed that presently Houxai District remains an important district with covers a largest number of the population, but the increased percentage of the population agglomeration share between two phases is not significant.

The analysis also showed that from phase II to phase III percentage of the population agglomeration share of two border towns i.e. Paktha District and Tonpheung District has been declined, in contrast to districts which are adjacent to neighboring provinces such as Pha Oudom District and Meung District has been increased. The observation indicates that there is a tendency of the increased percentage of the population share occurring in the directions to Vietnam and China border.

Table 5.9 Different of Population Share (Bokeo Province)

Province	District	Percentage Population Agglomeration Share (1995)	Percentage Population Agglomeration Share (2005)	Different of Population Share
Bokeo	Huoxai	38.91	39.06	0.15
Bokeo	Pha Oudom	23.24	24.39	1.14
Bokeo	Tonpheung	17.34	17.01	-0.33
Bokeo	Paktha	13.67	11.87	-1.79
Bokeo	Meung	6.84	7.67	0.84

Source: Author's Compilation Based on Data from National Statistic Center (Population and Housing Census)

To measure the variability of the population distribution in 1995 and 2005, the variance and closely-related standard deviation is used. The statistical dispersion analysis is shown that the standard deviation tends to be increased accordingly, implying that the dispersion of the population has been increasing gradually from 1995 to 2005.

Table 5.10 Increased and Decreased Percentage of Population Share (Bokeo Province)

District	Percentage of Population Share 1995			Percentage of Population Share 2005		
	Huoxai	38.91	18.91	357.51	39.06	19.06
Pha Oudom	23.24	3.24	10.52	24.39	4.39	19.23
Tonpheung	17.34	-2.66	7.06	17.01	-2.99	8.94
Paktha	13.67	-6.33	40.12	11.87	-8.13	66.06
Meung	6.84	-13.16	173.21	7.67	-12.33	151.91
	mean =		20	mean =		20
	variance =		117.68	variance =		121.86
	standard deviation =		10.85	standard deviation =		11.04

Source: Author's Compilation Based on Data from National Statistic Center (Population and Housing Census)

- Vientiane Capital

Among 9 districts in Vientiane Capital, a Xaythany District has had a largest population since 1985. The percentage population agglomeration share of Xaythany District has been increased significantly, while the other districts has been decreased or remained constant. This is due to it locates along the major axis RN13S and RN10, which is a main gate to northern and southern part of the country.

Table 5.11 Different of Population Share (Vientiane Capital)

Province	District	Percentage Population Agglomeration Share (1995)	Percentage Population Agglomeration Share (2005)	Different of Population Share
Vieantiane Capital	Xaythany	18.67	21.50	2.83
Vieantiane Capital	Sikhottabong	14.17	14.48	0.32
Vieantiane Capital	Xaysettha	14.36	13.89	-0.47
Vieantiane Capital	Hadxaifong	12.39	11.27	-1.12
Vieantiane Capital	Chanthabuly	11.23	10.58	-0.65
Vieantiane Capital	Sisattanak	11.10	9.81	-1.29
Vieantiane Capital	Naxaithong	8.42	8.42	0.00
Vieantiane Capital	Mayparkngum	6.48	6.50	0.03
Vieantiane Capital	Sangthong	3.19	3.55	0.36

Source: Author's Compilation Based on Data from National Statistic Center (Population and Housing Census)

The statistical dispersion analysis is shown that the standard deviation tends to be increased implying that the variability of the population distribution has been increasing during this two time frame.

Table 5.12 Increased and Decreased Percentage of Population Share (Vientiane Capital)

District	Percentage of Population Share 1995			Percentage of Population Share 2005		
	Xaythany	18.67	7.55	57.07	21.50	10.39
Sikhottabong	14.17	3.06	9.34	14.48	3.37	11.38
Xaysettha	14.36	3.25	10.55	13.89	2.78	7.71
Hadxaifong	12.39	1.28	1.65	11.27	0.16	0.03
Chanthabuly	11.23	0.12	0.01	10.58	-0.53	0.28
Sisattanak	11.10	-0.01	0.00	9.81	-1.31	1.70
Naxaithong	8.42	-2.70	7.27	8.42	-2.69	7.25
Mayparkngum	6.48	-4.63	21.48	6.50	-4.61	21.24
Sangthong	3.19	-7.92	62.72	3.55	-7.56	57.18
	mean =		11.11	mean =		11.11
	variance =		18.89	variance =		23.84
	standard deviation =		4.35	standard deviation =		4.88

Source: Author's Compilation Based on Data from National Statistic Center (Population and Housing Census)

- Savannakhet Province

In Savannakhet Province the decreased percentage population agglomeration share could be observed in Khanthabouly District, Songkhone District and Atsaphangthong District. This phenomenon could be explained by the migration of the population in these districts to other districts along EWEC. Therefore there are both increasing and decreasing of the population in

along EWEC. The districts along Vietnam border have shown the higher increased percentage population agglomeration share.

Table 5.13 Different of Population Share (Savannakhet Province)

Province	District	Percentage Population Agglomeration Share (1995)	Percentage Population Agglomeration Share (2005)	Different of Population Share
Savannakhet	Khanthabouly	18.59	15.04	-3.56
Savannakhet	Champhone	12.88	13.55	0.67
Savannakhet	Songkhone	12.19	11.01	-1.18
Savannakhet	Outhomphone	10.28	10.76	0.49
Savannakhet	Xaybuly	6.39	7.25	0.86
Savannakhet	Xonbuly	5.15	6.88	1.73
Savannakhet	Phine	6.10	6.77	0.67
Savannakhet	Atsaphone	6.12	6.73	0.61
Savannakhet	Sephone	5.32	5.71	0.39
Savannakhet	Atsaphangthong	7.26	5.22	-2.03
Savannakhet	Thapnangthong	3.57	4.20	0.63
Savannakhet	Vilabuly	3.66	4.05	0.39
Savannakhet	Nong	2.49	2.82	0.33

Source: Author's Compilation Based on Data from National Statistic Center (Population and Housing Census)

The standard deviation tends to be decreased indicating the increased equalization of the population distribution during this time frame.

Table 5.14 Increased and Decreased Percentage of Population Share (Savannakhet Province)

District	Percentage of Population Share 1995			Percentage of Population Share 2005		
Khanthabouly	18.59	10.90	118.81	15.04	7.34	53.92
Champhone	12.88	5.19	26.95	13.55	5.86	34.31
Songkhone	12.19	4.49	20.20	11.01	3.32	11.01
Outhomphone	10.28	2.58	6.67	10.76	3.07	9.42
Atsaphangthong	7.26	-0.44	0.19	5.22	-2.47	6.09
Xaybuly	6.39	-1.30	1.69	7.25	-0.44	0.19
Atsaphone	6.12	-1.57	2.47	6.73	-0.96	0.92
Phine	6.10	-1.59	2.53	6.77	-0.92	0.85
Sephone	5.32	-2.37	5.63	5.71	-1.98	3.93
Xonbuly	5.15	-2.54	6.46	6.88	-0.81	0.66
Vilabuly	3.66	-4.04	16.29	4.05	-3.65	13.30
Thapnangthong	3.57	-4.12	16.96	4.20	-3.49	12.17
Nong	2.49	-5.20	27.07	2.82	-4.87	23.74
	mean =		7.69	mean =		7.69
	variance =		19.38	variance =		13.12
	standard deviation =		4.40	standard deviation =		3.62

Source: Author's Compilation Based on Data from National Statistic Center (Population and Housing Census)

- Khammouane Province

Khammouane Province consists of 9 districts; the highest population is in Thakek District, a provincial capital. This might be because of its share border with Thailand which creates more economic opportunity in this area. However, the percentage population agglomeration share tends to be decreased since the population of the areas in the other border side has been increasing notably.

Table 5.15 Different of Population Share (Khammouane Province)

Province	District	Percentage Population Agglomeration Share (1995)	(2005)Percentage Population Agglomeration Share	Different of Population Share
Khammuane	Thakek	25.12	24.89	-0.23
Khammuane	Hinboon	18.64	18.40	-0.23
Khammuane	Nongbok	14.37	12.20	-2.17
Khammuane	Mahaxay	8.43	9.12	0.69
Khammuane	Nhommalath	7.93	8.20	0.27
Khammuane	Xebangfay	7.29	7.64	0.35
Khammuane	Bualapha	7.02	7.47	0.46
Khammuane	Xaybuathong	5.47	6.13	0.66
Khammuane	Nakai	5.74	5.94	0.21

Source: Author's Compilation Based on Data from National Statistic Center (Population and Housing Census)

The increased Equalization of the population distribution during this time frame could be seen as more population settlement at Vietnam border.

Table 5.16 Increased and Decreased Percentage of Population Share (Khammouane Province)

District	Percentage of Population Share 1995			Percentage of Population Share 2005		
Thakek	25.12	14	196.14	24.89	13.77	189.73
Hinboon	18.64	7.53	56.63	18.4	7.29	53.19
Nongbok	14.37	3.26	10.6	12.2	1.09	1.18
Mahaxay	8.43	-2.68	7.16	9.12	-1.99	3.95
Nhommalath	7.93	-3.18	10.12	8.2	-2.91	8.47
Xebangfay	7.29	-3.82	14.6	7.64	-3.47	12.06
Bualapha	7.02	-4.1	16.77	7.47	-3.64	13.24
Xaybuathong	5.47	-5.64	31.8	6.13	-4.98	24.78
Nakai	5.74	-5.37	28.87	5.94	-5.17	26.69
	mean =		11.11	mean =		11.11
	variance =		41.41	variance =		37.03
	standard deviation =		6.44	standard deviation =		6.09

Source: Author's Compilation Based on Data from National Statistic Center (Population and Housing Census)

- Champasak Province

Pakxong District continues to grow with the percentage population agglomeration share of 8.88% in 1995 and trends up to 10.60% in 2005. In contrast to Phonethong (Xongmek), Pakse which accommodated highest percentage population agglomeration share in 1995 has been declined recently.

Table 5.17 Different of Population Share (Champasak Province)

Province	District	Percentage Population Agglomeration Share (1995)	Percentage Population Agglomeration Share (2005)	Different of Population Share
Champasak	Phonethong (Xongmek)	14.70	13.95	-0.75
Champasak	Pakse	13.01	12.77	-0.24
Champasak	Khong (Khinak)	13.01	12.08	-0.93
Champasak	Sanasomboon	11.11	10.31	-0.80
Champasak	Champasak	9.82	9.19	-0.63
Champasak	Pakxong	8.88	10.60	1.72
Champasak	Pathoomphone	8.60	8.52	-0.09
Champasak	Sukhuma	7.59	8.21	0.63
Champasak	Bachieng Chaleunsuk)	6.85	7.98	1.13
Champasak	Moonlapamok	6.43	6.39	-0.04

Source: Author's Compilation Based on Data from National Statistic Center (Population and Housing Census)

The increased Equalization of the population distribution could also be seen in Champasak, due to the increased percentage population agglomeration share of the districts locate along Vietnam border.

Table 5.18 Increased and Decreased Percentage of Population Share (Champasak Province)

District	Percentage of Population Share 1995			Percentage of Population Share 2005		
	Phonethong (Xongmek)	14.70	4.70	22.09	13.95	3.95
Pakse	13.01	3.01	9.05	12.77	2.77	7.66
Khong (Khinak)	13.01	3.01	9.04	12.08	2.08	4.31
Sanasomboon	11.11	1.11	1.24	10.31	0.31	0.10
Champasak	9.82	-0.18	0.03	9.19	-0.81	0.66
Pakxong	8.88	-1.12	1.26	10.60	0.60	0.36
Pathoomphone	8.60	-1.40	1.95	8.52	-1.48	2.20
Sukhuma	7.59	-2.41	5.81	8.21	-1.79	3.19
Bachieng (Chaleunsuk)	6.85	-3.15	9.91	7.98	-2.02	4.07
Moonlapamok	6.43	-3.57	12.76	6.39	-3.61	13.06
	mean =		10.00	mean =		10
	variance =		7.31	variance =		5.12
	standard deviation =		2.70	standard deviation =		2.26

Source: Author's Compilation Based on Data from National Statistic Center (Population and Housing Census)

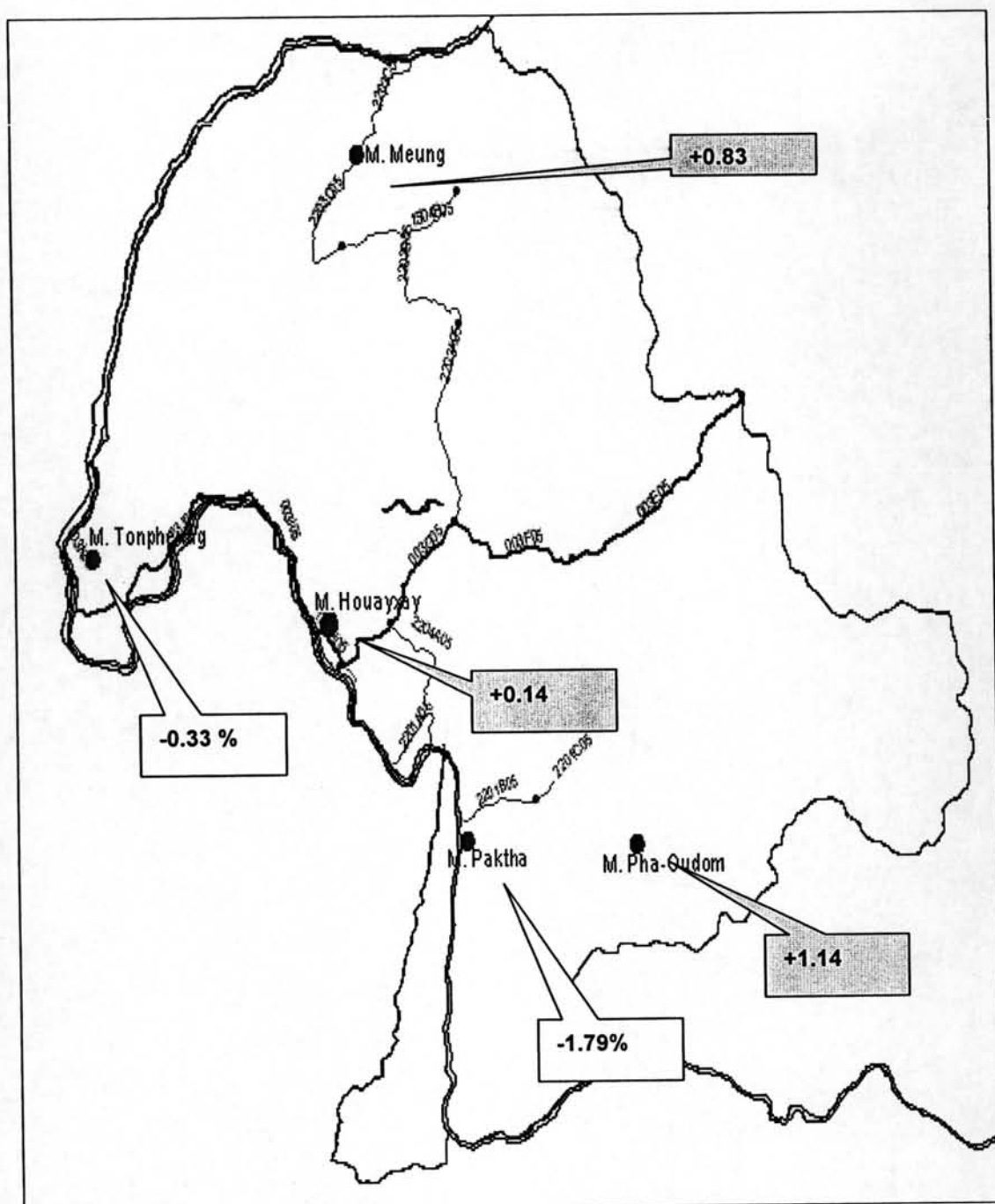


Figure 5.17 Increased/decreased Percentage Population Agglomeration Share of Bokeo Province

Source: Author's Compilation Based on Data from National Statistic Center (Population and Housing Census, 1995 & 2005)

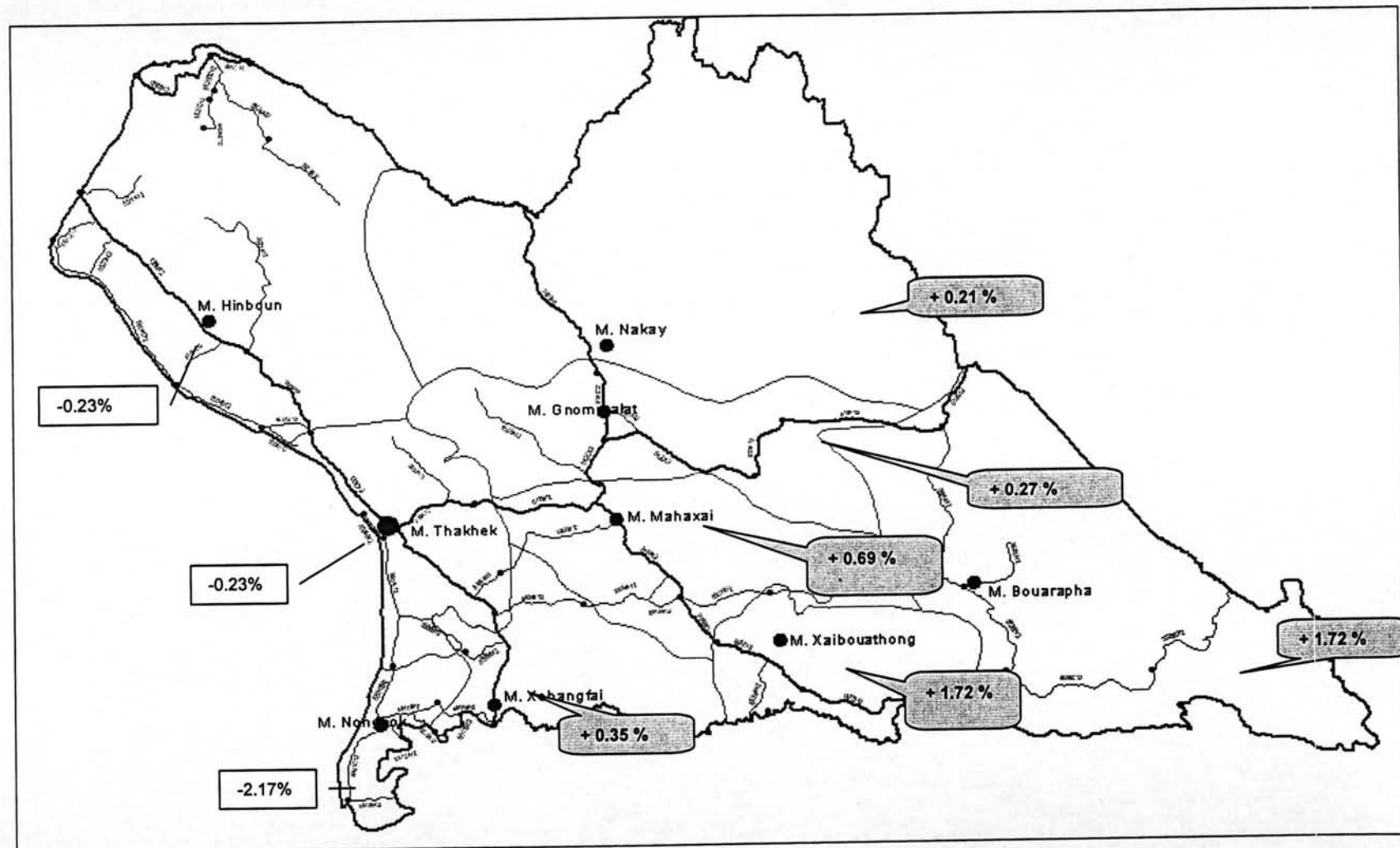


Figure 5.18 Increased/decreased Percentage Population Agglomeration Share of Khammouane Province
 Source: Author's Compilation Based on Data from National Statistic Center (Population and Housing Census, 1995 & 2005)

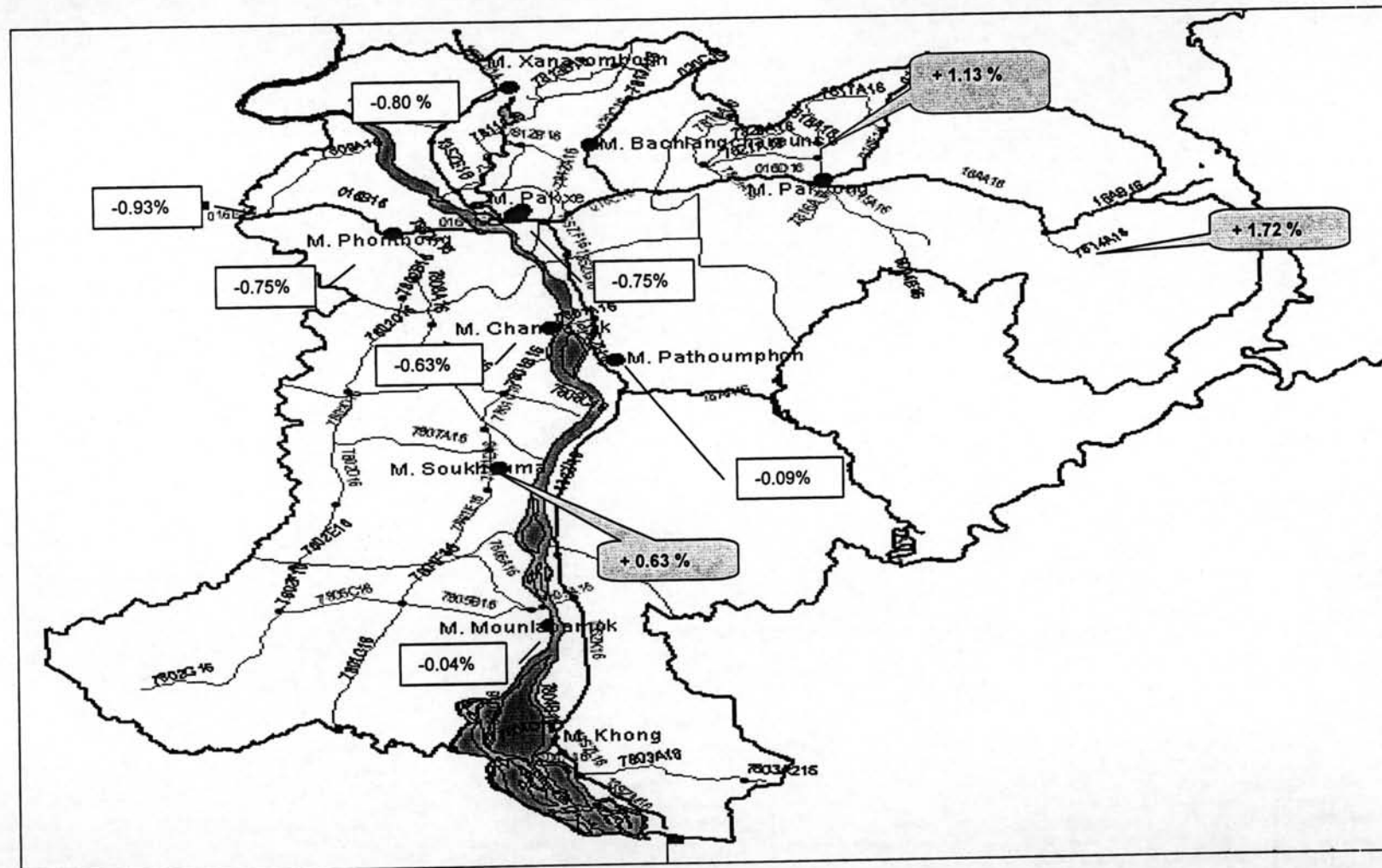


Figure 5.19 Increased/decreased Percentage Population Agglomeration Share of Champasak Province
 Source: Author's Compilation Based on Data from National Statistic Center (Population and Housing Census, 1995 & 2005)

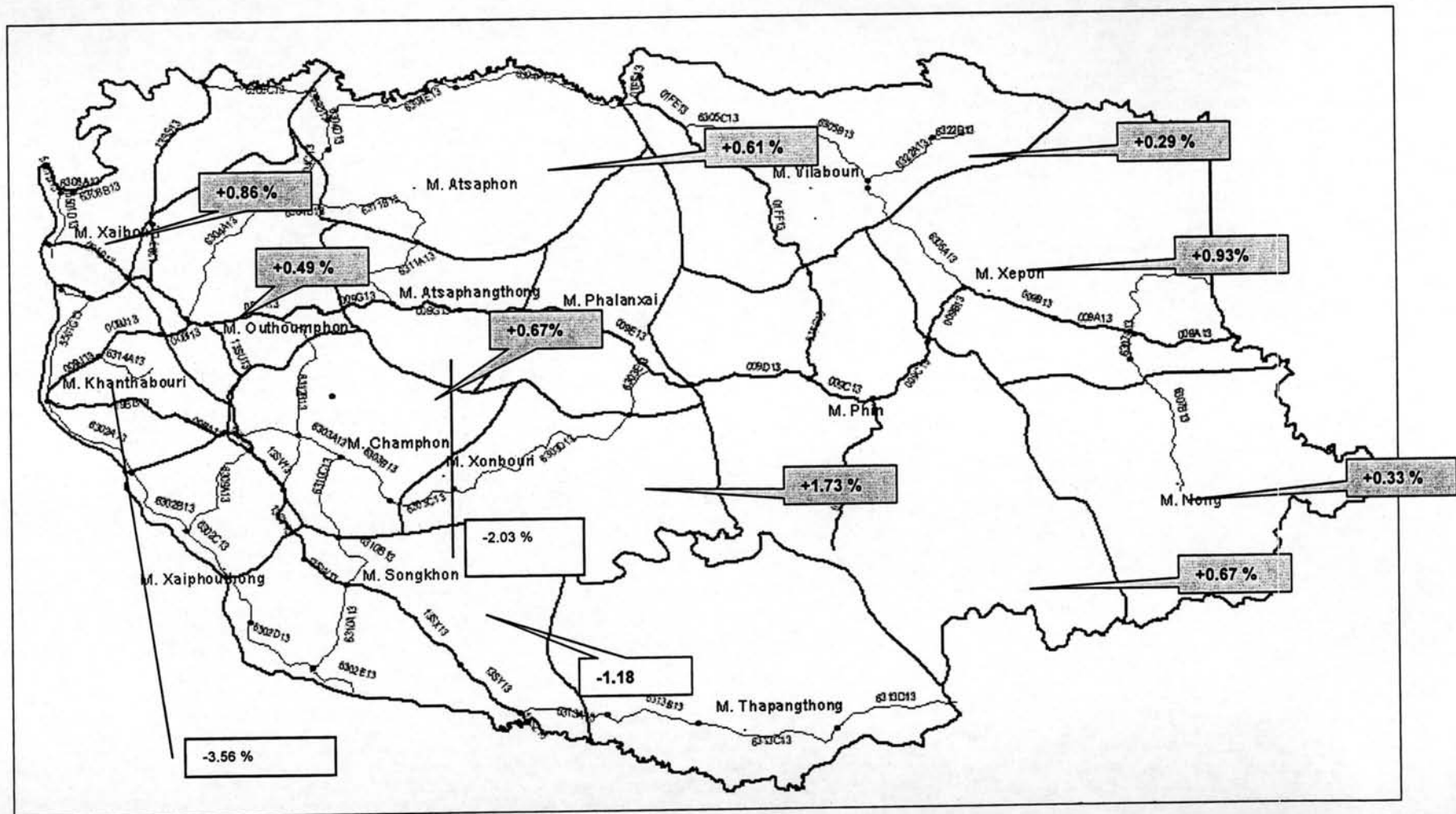


Figure 5.20 Increased/decreased Percentage Population Agglomeration Share of Savannakhet Province
 Source: Author's Compilation Based on Data from National Statistic Center (Population and Housing Census, 1995 & 2005)

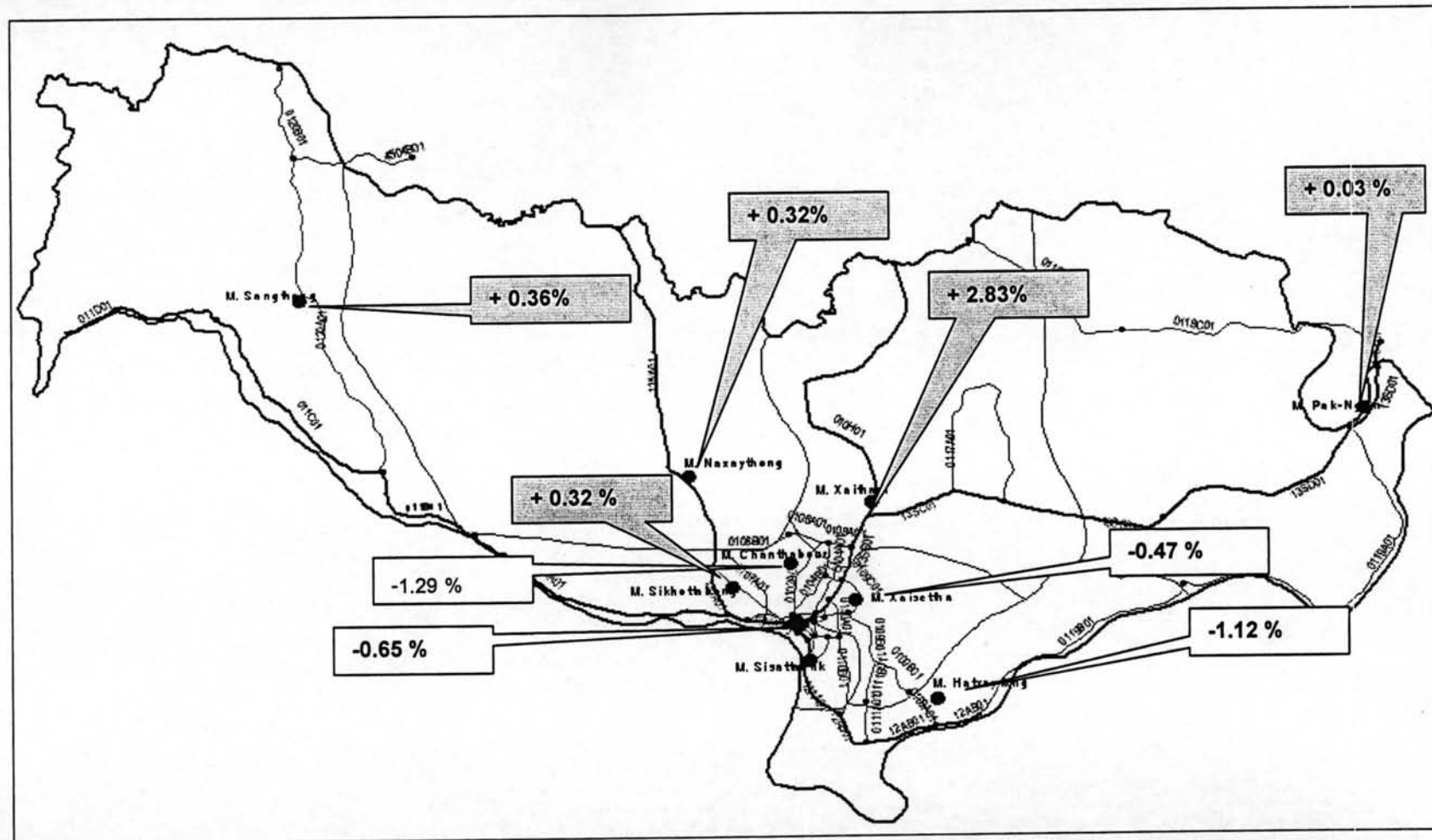


Figure 5.21 Increased/decreased Percentage Population Agglomeration Share of Vientiane Capital
 Source: Author's Compilation Based on Data from National Statistic Center (Population and Housing Census, 1995 & 2005)

The analysis at district level of 5 provinces which are border entry provinces i.e. Bokeo Province, Vientiane Capital, Khammouane Province, Savannakhet Province and Champasak Province during phase II and Phase III showed that since 1985, most of the districts of these provinces that locates along the Thai border has had the highest percentage of the population share. This is because of the fact that these districts have a long history of border trade with Thailand. However the calculation of the different of the percentage of the population share during 1995-2005 evidenced that there is a tendency of the population growth occurring at the other sides. The reason of these phenomena could be explained by the expansion of the integrated land transport network from the Thai border to Vietnam, China and Cambodia border over time. The completion of the first international bridge on the Thai side has further facilitated the movement of goods and passengers, resulted in the tremendous change in the economic activities and population agglomeration across the country. The analysis has addressed the fact that previously the most of the population growth has been taken place at the Thai border. Since the degree of the integration has been increased the population tends to settle in other side, implies the existence of the tendency of the equalization of the population in Lao PDR.

5) A Correlation of the Impact of Integrated Land Transport Network on Population Agglomeration in Lao PDR

A correlation of the impact of integrated land transport network on population agglomeration is conducted to verify the existence of the impact on population agglomeration. Various variables are chosen to represent the improved integrated land transport network overtime, while the value of the standard deviation is chosen to represent the feature of the population agglomeration in each time.

(i) The Increased Traffic Volume

Due to the improvement of the integrated transport network in terms of the construction of new alignment as well as upgrading of existing routes is resulted in the increased traffic volume across the country. Table 5.19 figures out the average dairy traffic in 1995 and 2000, including the percent increased traffic volume within two periods. The significant percent increased traffic volume could be seen in Pakmong (Junction), Salaphoukhoun (Junction) which locate along R13N (main axis road to northern part) and Namkading (Straight) which locates along R13S (main axis road to southern part). Other significant percent increased traffic volume could also be seen in Meung Phonthong /Xongmek (Junction) which is an access point to Champasak-Sekong-Attapeu. Moderate increased traffic volume could be observed in Hinboun (Junction), Gnommalat (Junction), Meung Phin (Junction) and Lack 35 (Junction) which locate along RN12, RN9.

Table 5.19 Percent Increased Traffic Volume and its location

Location of traffic survey point	Average Dairy Traffic		Percent Increase	District/Province
	(two wheelers)			
	12 hours 7:00 Am – 7:00 Pm			
Junction and Straight	1995	2000		
Pakmong (Junction)	43	199	469.41	R13N-R1C/ Luangprabang-Oudomxay Luangnamtha
Salaphoukhoun (Junction)	27	139	505.45	R13N-R7 Luangprabang –Oudomxay / Xiengkhuang, Huaphanh
Namgiap (Straight)	317	525	165.63	R10 Vientiane Capital/Northern Part
Namkading (Straight)	82	560	682.93	R13S/Borikhamxay- Southern Part
Hinboun (Junction)	170	444	261.18	RN12 Khammouane
Gnommalat (Junction)	156	198	127.24	R12-R1E/ Khammouane
Meung Phin (Junction)	67	246	367.16	RN9-R1G/ Savannakhet
Lack 35 (Junction)	158	422	267.41	N9 Savannakhet
Meung Phonthong (Xong Mek)(Junction)	112	705	629.91	R13S - RN16/ Champasak-Sekong-Attapeu
Meung Pathoumphone (Junction)	82	290	354.27	R13S- RN18/ Champasak

Source: Japan International Cooperation Agency & Ministry of Communication, Transport, Post and Construction (2000). Traffic Survey Lao PDR. Vientiane, Lao PDR.

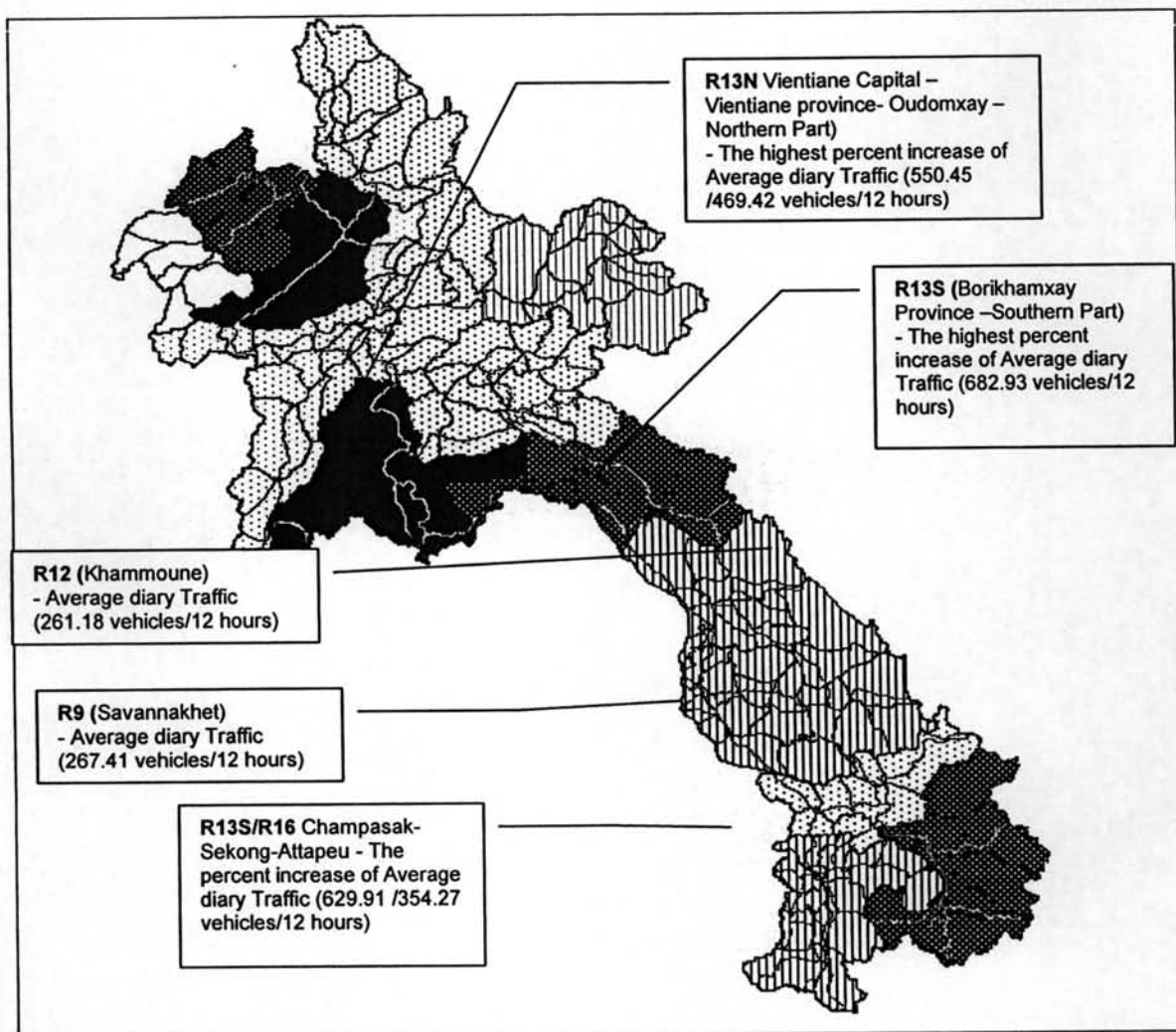
The correlation between the increased traffic volume and the increased annual population growth are drawn up in the figure 5.23

The analysis found that the areas which are starting and ending nodes of R13N (Vientiane province - Oudomxay province) which accommodate a highest percentage increase of average dairy traffic hold a highest increased annual population rate. Similarity to the areas which are starting and ending nodes of R13S (Borikhamxay Province and Champasak Province – Attapeu Province) also hold a highest increased annual population rate.

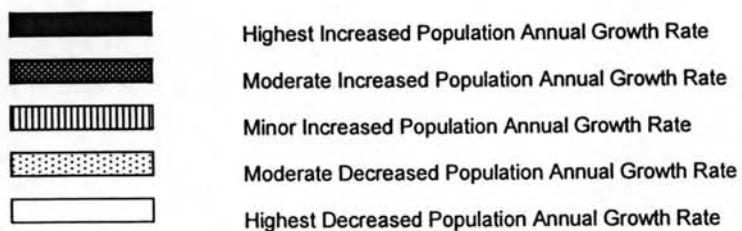
In Meung Phonthong /Xongmek (Junction) which is an access point to Champasak-Sekong-Attapeu Province have a large percentage increase of average dairy traffic; the annual population growth rate is significant high as expected.

At Hinboun (Junction), Gnommalat (Junction), Meung Phin (Junction) and Lack 35 (Junction) which locate along RN12, RN9 show a moderate percentage increase of average dairy traffic; the annual population growth rate is average as expected.

Figure 5.22 Percent Increase of Average Diary Traffic



Source: Author's Compilation Based on Data from National Statistic Center (Population and Housing Census, 1995 & 2005 and Japan International Cooperation Agency & Ministry of Communication, Transport, Post and Construction (2000). Traffic Survey Lao PDR. Vientiane, Lao PDR.)



(ii) The improved length of roads over time

The length of roads for the whole country reflected the degree of integration as it improves accessibility to remote areas. As a consequence of developed remote areas, the increased population agglomeration could be observed.

As discussed before, during the last three decades the length of the transport network have been expanded and upgraded gradually.

The development of the land-linked transport network over time resulted in increasing the total network length and degree of integration over time. The expanded road networks have brought about new population settlements along the new transport routes which reflected in the changing pattern of the population agglomeration. It is therefore feasible to examine the correlation of the improved integrated land transport network and the population agglomeration by looking at the relationship of two representing variables i.e. the length of the roads for the whole country and the standard deviation value which refers to the dispersion of the annual population growth rate.

Table 5.20 Length of the Roads for the Whole Country

Length of the Roads for the Whole Country										
Unit: Km	1976	1980	1985	1990	1995	2000	2001	2002	2003	2004
Total Length of the roads	11 462	12 223	12 383	13 971	18 363	25 090	25 090	32 625	31 204	31 209
Tarred roads	1 427	1 935	2 350	3 346	2 446	3 897	3 897	4 592	4 491	4 497
Graveled roads	4 371	4 174	3 253	4 775	5 138	5 315	5 315	9 661	10 097	10 097
Earthen roads	5 664	6 114	6 780	5 850	10 779	15 878	15 878	18 372	16 615	16 615
<i>Source: Ministry of Communication, Transport, Post and Construction</i>										

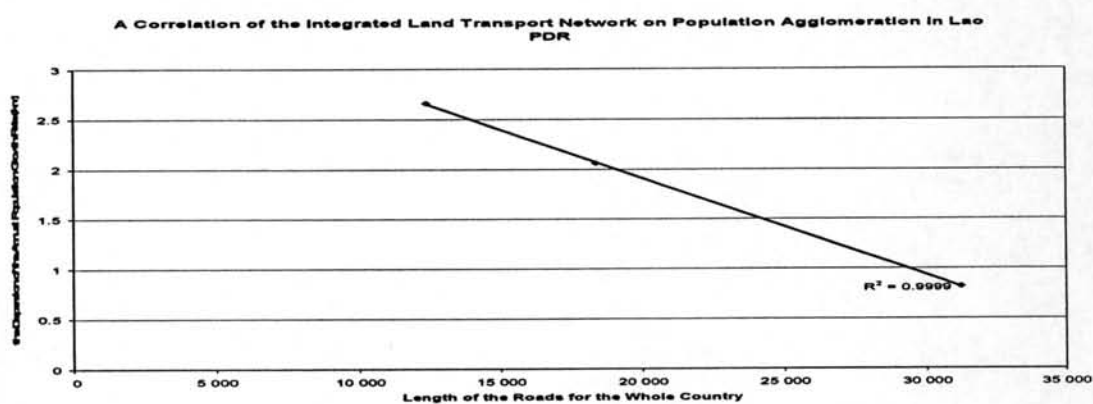
The correlation chart could be drawn up as follow:

The "x" axis refers to the length of the improved transport network which is increased gradually since 1976 and the "y" axis is the standard deviation value which refers to the dispersion of the annual population growth rate.

The results showed that as the lengths of the roads for the whole country has been increased the dispersion of the annual population growth rate has been decreased. This correlation illustrates the impact of the improved integrated land transport network to the equalization of the annual population growth rate. In other words, it can be simply said that since the spreading out of the transport network throughout the country leads to the growth and an equal growth rate across the country.

Figure 5.23 Correlation of the Integrated Land Transport Network on Population agglomeration In Lao PDR

(Length of the Road for the Whole country versus the dispersion Annual Population Growth)



Source: Author's Compilation Based on Data from the Ministry of Communication, Transport, Post and Construction (2005).

(iii) The Increased Freight and Passenger Transport

As the degree of integration has been increased, resulted in the increased in freight and passenger transport. It is therefore the correlation of integrated land transport network on population agglomeration in Lao PDR could also be verified by analyzing the correlation of the increased transport volume (freight and passenger) and population agglomeration. The following charts are drawn up to verify the existence of the two variables.

Table 5.21 Freight Transport by Categories of Transport

Years	Freight transport				
	(Th.tons)				
	By categories of transport				
	Total	By land	By water	By sea	By air
1976	271.1	249.0	22.0		0.1
1980	415.2	380.2	34.0		1.0
1985	685.8	635.0	50.0		0.8
1990	667.9	551.1	106.0	10.3	0.5
1995	1 470.2	950.0	476.0	43.0	1.2
1996	1 553.2	978.0	537.0	37.0	1.2
1997	1 663.2	1 029.0	604.0	29.0	1.2
1998	1 595.9	1 004.0	567.0	23.0	1.9
1999	1 754.5	1 069.7	657.2	25.4	2.1
2000	2 308.5	1 635.0	672.0	...	1.5
2001	2 283.4	1 543.0	739.0	...	1.4
2002	2 750.9	1 946.0	770.0	33	1.9
2003	3 068.5	2 174.0	893.0	...	1.5
2004	4 043.4	3 102.0	939.9	...	1.5

Source: Ministry of Communication, Transport, Post and Construction (2004)

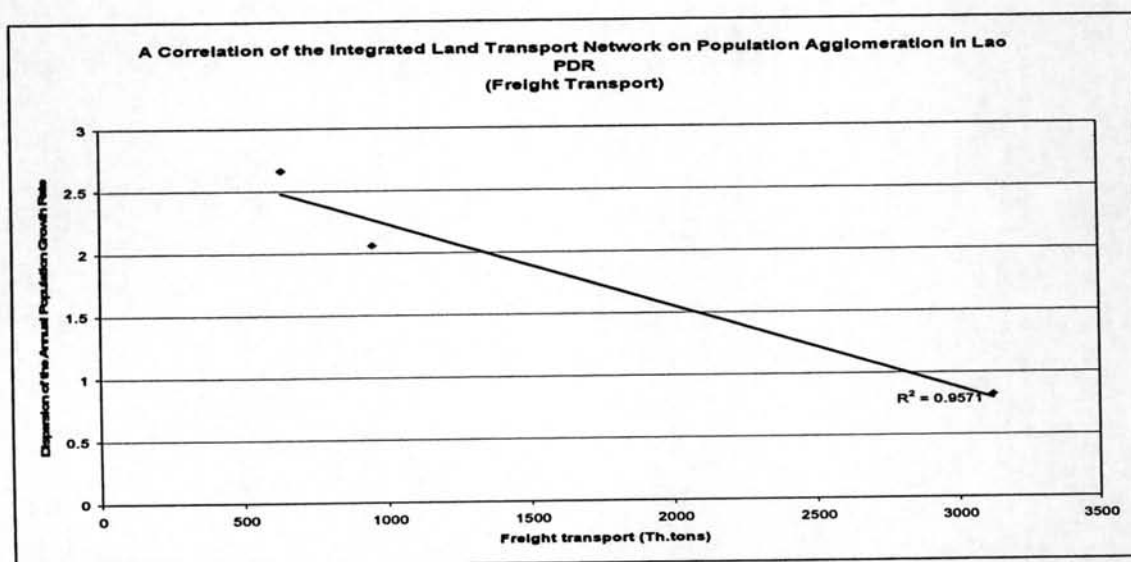
Table 5.22 Passenger Transport by Categories of Transport

Years	Passenger transport			
	(Th.persons)			
	By categories of transport			
	Total	By land	By water	By air
1976	2 196.0	2 046.0	134.0	16.0
1980	5 817.0	5 566.0	179.0	72.0
1985	9 884.0	9 470.0	320.0	94.0
1990	13 177.6	12 587.8	469.0	120.8
1995	13 789.0	13 242.8	436.4	109.8
1996	19 174.6	17 557.0	1 252.0	365.6
1997	19 995.9	18 009.0	1 599.0	387.9
1998	20 180.0	18 537.0	1 262.0	381.0
1999	24 554.0	22 518.0	1 603.0	433.0
2000	18 760.9	16 426.0	1 835.0	499.9
2001	21 455.6	19 124.0	1 885.0	446.6
2002	25 743.2	23 251.0	2 025.0	467.2
2003	33 509.0	30 932.0	2 203.0	374.0
2004	45 380.7	42 698.0	2 183.5	499.2

Source: Ministry of Communication, Transport, Post and Construction (2004)

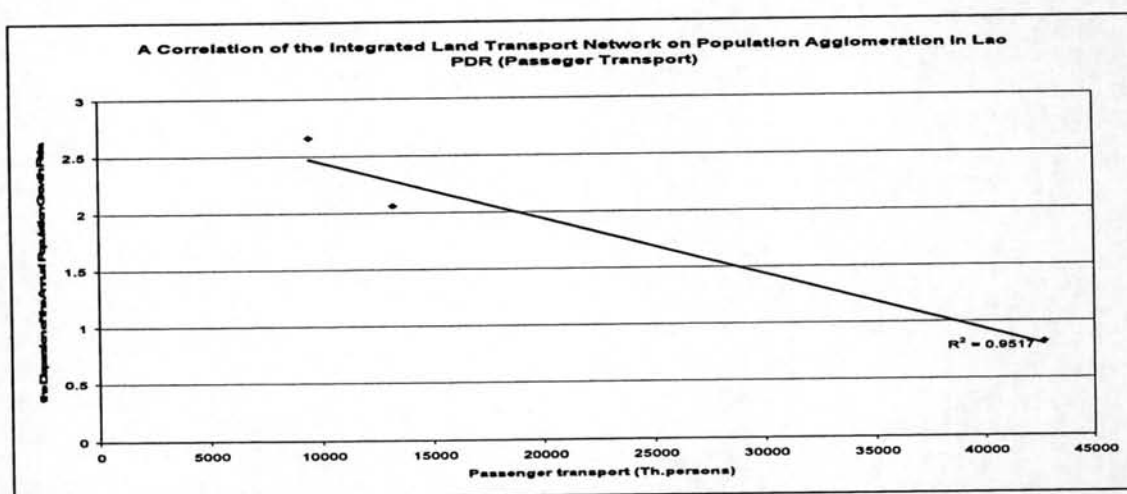
The "x" axis refers to the land transport volume (freight/ passenger) which is increased gradually since 1976 and the "y" axis is the standard deviation value which refers to the dispersion of the annual population growth rate.

Figure 5.24 Correlation of the Integrated Land Transport Network on Population agglomeration In Lao PDR (Freight Transport versus the dispersion Annual Population Growth)



Source: Author's Compilation Based on Data from the Ministry of Communication, Transport, Post and Construction (2005).

Figure 5.25 Correlation of the Integrated Land Transport Network on Population agglomeration In Lao PDR (Passenger Transport versus the dispersion Annual Population Growth)



Source: Author's Compilation Based on Data from the Ministry of Communication, Transport, Post and Construction (2005).

As the transport volume tends to increased, somehow reflected to the increased economic activities in the related areas, it brings about the new settlement of the population in related areas. As the results has shown that the increased transport volume is closely related to the decreased dispersion of population. In other words, it can be simply said that the more transportation volume implies more economic activities throughout the country leads to the growth and an equal growth rate across the country

(iv) Degree of integration

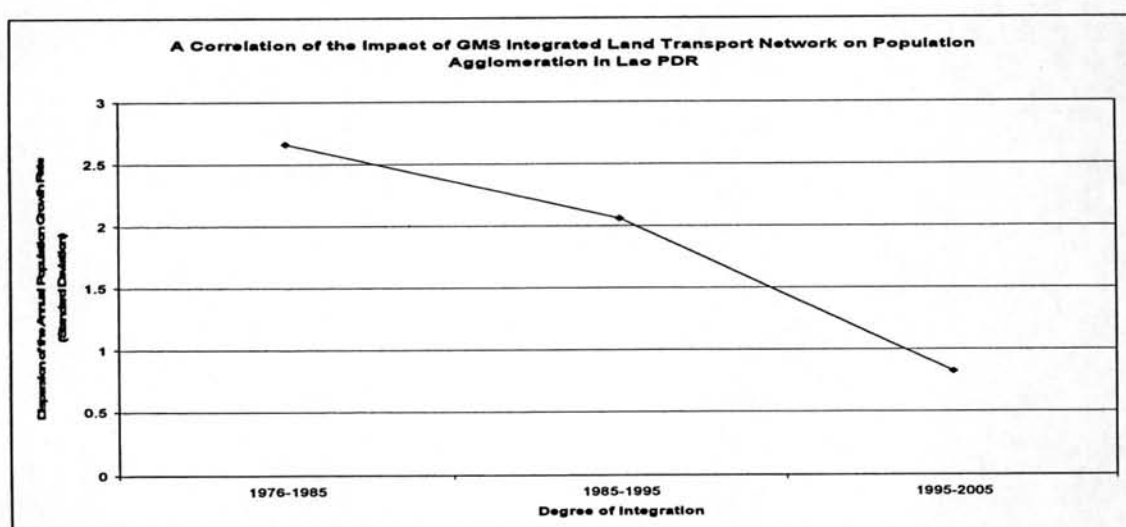
As the variability of the annual population growth rate in each time frame could be interpreted by the value of standard deviation and the improved transport network in each time indicates the degree of integration. Hence the correlation chart could be drawn up as follow:

The x axis refers to the degree of integration which is increased gradually since 1976 due to the improved integrated transport network and the y axis is the standard deviation value which refers to the dispersion of the annual population growth rate.

The results showed that during the last three decades as the degree of integration increased, more population equalization could be found.

Figure 5.26 Correlation of the Integrated Land Transport Network on Population agglomeration In Lao PDR

(Degree of Integration versus the dispersion Annual Population Growth)



Source: Author's Compilation

6) An Analysis of the Urban Population and in Each District Which Classified as Urban Area

(i) Percentage of Urban Population

The urban population in each district can be summarized as follows: the highest percentage of the urban population is in Vientiane Capital with 46.21% of the total population in its province. Similarly to, Attapeu, Champasak and Borikhamxay with have 32.69%, 26.84% and 25.81% respectively. These figures has shown that the highest urban development within the province itself can be found in Vientiane Capital, in contrast to Savannakhet province that has quite low percentage of this figure.

The following table shows the urban population in 2003 sorting by the highest to lowest figures. As can be seen in the table 5.23, the highest urban population mostly is in the urban area which is classified as a secondary town and provincial capital. Other observations are that most of these urban areas are located at the major nodes along the major roads namely, R13S/R13N and EWEC.

As explained in the previous chapter although Pek District, Xayabury District, Xay District have a low accessibility level, these districts are provincial capitals of the province which are supported by the urban planning policy and displayed functions as centers of economic-social and political activities, and therefore accommodate large urban populations. Regarding the border trade effect, most of the highest urban populations are in the areas bordering Thailand, rather than Viet Nam, Cambodia or PR China.

Table 5.23 Urban Development in Lao PDR in each province

Province	Urban Area	Urban Population 1995	Urban Population 2003	Increase Urban Population (1995-2003)	Road	Node	Border	Road/river	Status
Savannakhet	Savannakhet	62247	63,634	1,387	EWEC	Major	THAI	7228	Secondary towns
Champasack	Pakse	47625	48,218	593	R13S	Major		NA	Secondary town
Luangprabang	Luangprabang	31797	40,797	9,000	R13N			7359	Secondary town
Khammuane	Thakhek	25768	33,107	7,339	R13S		THAI	7394	Secondary town
Vientiane Province	Thouliakhom	21562	10,459	-11,103	R10			7069	
Oudomxay	Xay	15056	22,389	7,333	R13N	Major		22009	Provincial Capital
Luangnamtha	Namtha	14451	16,205	1,754	NSEC	Major		8821	Provincial Capital
Savannakhet	Outhoomphone	10957	19,794	8,837	EWEC	Minor		19058	
Saravane	Saravane	8732	13,651	4,919	R15/1H	Minor		6304	Provincial Capital
Sekong	Lamam	7243	9,112	1,869	R16F/11	Minor		12761	Provincial Capital

Khammuane	Nongbok	7154	5,832	-1,322			THAI	15261	
Oudomxay	Hoon	7146	9,664	2,518	R2W			14138	
Champasack	Phonthong	6892	9,360	2,468	R16		THAI	NA	
Phongsaly	Phongsaly	5703	5,183	-520	R19		PRCV	20719	
Vientiane Province	Keo Oudom	5629	6,216	587	R10			7438	
Xiengkhuang	Pek	5606	29,641	24,035	R7/R1D	Major		28675	Provincial Capital
Huaphanh	Xamneua	5423	15,391	9,968	R6	Minor		16322	Provincial Capital
Savannakhet	Songkhone	5223	8,032	2,809	R13S			10013	
Xayabury	Hongsavath	5202	5,490	288	R4A			13068	
Bokeo	Huotxai	4911	13,757	8,846	NSEC		THAI	8997	Provincial Capital
Luangprabang	Nambak	4441	5,393	952	R1C			15798	
Vientiane Province	Vangvieng	4115	11,803	7,688	R13N			21376	
Xayabury	Xayabury	4104	22,622	18,518	R4			21263	Provincial Capital
Borikhamxay	Khamkeuth	3833	12,774	8,941	R8		VTN	17642	
Saravane	Lao ngarm	3500	4,858	1,358	R20			10920	
Champasack	Sukhuma	3359	6,160	2,801				NA	
Savannakhet	Champhone	3131	10,404	7,273				24407	
Attapeu	Samakkhixay	3005	12,961	9,956	R11/18B	Minor		8,718	Provincial Capital
Luangprabang	Nan	2958	5,704	2,746	R4			11970	
Xiengkhuang	Kham	2934	8,664	5,730	R7			32966	
Oudomxay	Beng	2744	5,155	2,411	R2W			11160	
Champasack	Sanasomboon	2674	5,095	2,421	R13S			NA	
Luangnamtha	Sing	2573	6,158	3,585	R17			20072	
Borikhamxay	Pakxanh	2439	18,660	16,221	R13S		THAI	7036	Provincial Capital
Borikhamxay	Pakkading	2238	6,826	4,588	R13S		THAI	8896	
Huaphanh	Xamtay	2101	5,150	3,049			VTN	49792	
Borikhamxay	Bolikhanh	1708	7,833	6,125				17748	
Xayabury	Ngeun	1611	6,053	4,442	R4A			10942	
Attapeu	Sanamxay	1554	5,824	4,270			CAM	1,723	
Champasack	Paksong	450	6,564	6,114	R16E	Minor		NA	
Champasack	Champasack	0	4,996	4,996				NA	
Vientiane Province	Xanakharm	0	5,350	5,350	R11		THAI	10338	
Xayabury	Kenethao	0	5,526	5,526	R4		THAI	14355	
Luangprabang	Park Ou	0	5,668	5,668	R13N			8105	
Vientiane Province	Kasy	0	5,812	5,812	R13N			27776	
Xaysomboun	Saysomboun	0	6,009	6,009	R5			NA	Provincial Capital
Borikhamxay	Thaphabath	0	6,293	6,293	R13S		THAI	7970	
Vientiane Province	Km 52	0	6,967	6,967	R13N				
Champasack	Moonlapamok	0	7,116	7,116				NA	
Vientiane Province	Viengkham	0	8,991	8,991	R10			13040	
Xayabury	Parklai	0	9,358	9,358	R4			12179	
Xayabury	Xienghone	0	10,050	10,050					

Attapeu	Xaysetha	0	10,809	10,809			8,718	
Xayabury	Phiang	0	12,929	12,929	R4		21550	
Luangprabang	Xieng Ngeun	0	16,844	16,844	R13N		11095	
Attapeu	Phouvong		5,063	5,063			CAM	2,278

Table 5.24 Urban Population in each Province

Province	Urban Population	Total Population	% of urban population of the total Urban Population	Urban Population of the total Provincial population	Urban Population of (%) of the Country
Vientiane Capital	300,804	651000	28.15	46.21	11.46
Phongsaly	5,183	190000	0.49	2.73	3.35
Loungnamtha	22,363	142000	2.09	15.75	2.50
Udomxay	37,208	261000	3.48	14.26	4.60
Bokeo	13,757	141000	1.29	9.76	2.48
Luandprabang	74,406	453000	6.96	16.43	7.98
Xayyaburi	72,028	362000	6.74	19.90	6.37
Huaphan	20,541	304000	1.92	6.76	5.35
Xiengkhuong	38,305	249000	3.58	15.38	4.38
Vientane Province	55,598	373000	5.20	14.91	6.57
Borikhamxay	52,386	203000	4.90	25.81	3.57
Khammoun	38,939	338000	3.64	11.52	5.95
Savannakhet	101,864	834000	9.53	12.21	14.69
Saravan	18,509	318000	1.73	5.82	5.60
Xekong	9,112	80000	0.85	11.39	1.41
Attapeu	34,657	108000	3.24	32.09	1.90
Champasak	166975	622000	15.62	26.84	10.95
Xaysomboun	6,009	50000	0.56	12.02	0.88

Source: Asian Development Bank (2003). Lao Urban Data Book.

The urban population in each district can be summarized as follows: the highest percentage of the urban population is Vientiane Capital with 46.21% of the total population in its province. Similarly to, Attapeu, Champasak and Borikhamxay with have 32.69%, 26.84% and 25.81% respectively.

(ii) The variability of the urban population distribution

The variance and closely-related standard deviation is used to measure of the dispersion of the urban population in 1995 and 2005.

Table 5.25 Variability of Urban Population Distribution of Selected Year (1995 & 2003)

Urban Area	1995				2003			
	Urban Pop				Urban Pop			
Savannakhet	62247	17.3	14.8	219.05	63634	11.35	8.85	78.34
Pakse	47625	13.24	10.74	115.27	48218	8.6	8.6	73.98
Luangprabang	31797	8.84	6.34	40.16	40797	7.28	7.28	52.96
Thakhek	25768	7.16	4.66	21.73	33107	5.91	5.91	34.88
Thoulakhom	21562	5.99	3.49	12.2	10459	1.87	1.87	3.48
Xay	15056	4.18	1.68	2.84	22389	3.99	3.99	15.95
Namtha	14451	4.02	1.52	2.3	16205	2.89	2.89	8.36
Outhoomphone	10957	3.05	0.55	0.3	19794	3.53	3.53	12.47
Saravane	8732	2.43	-0.07	0.01	13651	2.44	2.44	5.93
Lamam	7243	2.01	-0.49	0.24	9112	1.63	1.63	2.64
Nongbok	7154	1.99	-0.51	0.26	5832	1.04	1.04	1.08
Hoon	7146	1.99	-0.51	0.26	9664	1.72	1.72	2.97
Phonthong	6892	1.92	-0.58	0.34	9360	1.67	1.67	2.79
Phongsaly	5703	1.59	-0.91	0.84	5183	0.92	0.92	0.85
Keo Oudom	5629	1.56	-0.94	0.88	6216	1.11	1.11	1.23
Pek	5606	1.56	-0.94	0.89	29641	5.29	5.29	27.96
Xamneua	5423	1.51	-0.99	0.99	15391	2.75	2.75	7.54
Songkhone	5223	1.45	-1.05	1.1	8032	1.43	1.43	2.05
Hongsa	5202	1.45	-1.05	1.11	5490	0.98	0.98	0.96
Huoxai	4911	1.36	-1.14	1.29	13757	2.45	2.45	6.02
Nambak	4441	1.23	-1.27	1.6	5393	0.96	0.96	0.93
Vangvieng	4115	1.14	-1.36	1.84	11803	2.11	2.11	4.43
Xayabury	4104	1.14	-1.36	1.85	22622	4.04	4.04	16.28
Khamkeuth	3833	1.07	-1.43	2.06	12774	2.28	2.28	5.19
Lao ngam	3500	0.97	-1.53	2.33	4858	0.87	0.87	0.75
Sukhuma	3359	0.93	-1.57	2.45	6160	1.1	1.1	1.21
Champhone	3131	0.87	-1.63	2.66	10404	1.86	1.86	3.44
Samakxixay	3005	0.84	-1.66	2.77	12961	2.31	2.31	5.35
Nan	2958	0.82	-1.68	2.82	5704	1.02	1.02	1.04
Kham	2934	0.82	-1.68	2.84	8664	1.55	1.55	2.39
Beng	2744	0.76	-1.74	3.02	5155	0.92	0.92	0.85
Sanasomboon	2674	0.74	-1.76	3.09	5095	0.91	0.91	0.83
Sing	2573	0.72	-1.78	3.19	6158	1.1	1.1	1.21

Pakxanh	2439	0.68	-1.82	3.32	19660	3.33	3.33	11.08
Pakkading	2238	0.62	-1.88	3.53	6826	1.22	1.22	1.48
Xamtay	2101	0.58	-1.92	3.67	5150	0.92	0.92	0.84
Bolikhanh	1708	0.47	-2.03	4.1	7933	1.4	1.4	1.95
Ngeun	1611	0.45	-2.05	4.21	6053	1.08	1.08	1.17
Sanamxay	1554	0.43	-2.07	4.28	5824	1.04	1.04	1.08
Paksong	450	0.13	-2.37	5.64	6564	1.17	1.17	1.37
Mean	Mean = 2.50				Mean = 2.50			
Variance	Variance = 12.08				Variance = 10.13			
Standard Deviation	Standard Deviation = 3.48				Standard Deviation = 3.18			

Source: Asian Development Bank (2003). Lao Urban Data Book.

The analysis has shown that in 1995, the value of standard deviation is 3.48 compared to 3.18 in 2003. The results indicate the tendency of the decreasing of the dispersion of the urban population since 1995. This evident prove that as the degree of integration of Lao PDR to the international community due to the impact of integrated land transport network has been increased, resulted in the proportional increase in the equalization of urban population.

7) Summary

The analysis of the population at provincial level found that the areas which locate at the starting and ending nodes of R13N (Vientiane province, Oudomxay province) has a highest increased annual population rate. Similarity to the areas which are starting and ending nodes of R13S (Borikhamxay Province and Champasak-Attapeu) have a highest increased annual population rate. The analysis has shown that the more equal annual population growth rate distribution could be seen in the third development phase rather than in the initial and second development. This is because of the fact that in the third phase the expanded integrated land transport network throughout the country together with the opening of the international bridge implies the increased integration degree resulted in the proportional increase in the equalization of annual population growth rate distribution. In other words, it could be said that the degree of integration is a variable which determines the equalization/dispersion of annual population growth rate of the population agglomeration. Therefore, it is proved the existence of the correlation of the impact of the integrated land transport network and the population agglomeration in Lao PDR.

The analysis of the population at *district level* in selected province also demonstrates the impact of integrated land transport network and the population agglomeration. The analysis of at the district level in five provinces which are border entry provinces i.e. Bokeo Province, Vientiane Capital, Khammouane Province, Savannakhet Province and Champasak Province during phase II and Phase III showed that since 1985, most of the districts of these provinces that locates

along the Thai border has the highest percentage of the population share. This is because of the fact that these districts have a long history of border trade with Thailand. However based on the calculation of the percentage of the population share in 1995 and 2005 is evidenced that the percentage of the population share of the districts at the Vietnam and China borders has been increasing. These phenomena could be explained by the increased importance role of the expanded integrated land transport network and the declination of the border function due to more road network have been constructed to connect to Vietnam in the western direction, China in the northern direction and Cambodia in the Southern direction.

The analysis of the equalization of the population agglomeration also performed, among five provinces Khammouane Province, Savannakhet Province and Champasak Province has shown the increasing of the population growth equalization in the province, while Bokeo Province and Vientiane Capital has shown the decreasing of the population growth equalization in the province.

The results of the analysis of the correlation of the impact of integrated land transport network on population agglomeration also had shown the existence of the impact on population agglomeration.

The analysis of the urban population showed that the highest urban population mostly is in the urban area which is classified as a secondary town and provincial capital. Other observations are that most of these urban areas are located at the major nodes along the major roads namely, R13S/R13N and EWEC.

As explained in the previous chapter although Pek District, Xayabury District, Xay District have a low accessibility level, these districts are provincial capitals of the province which are supported by the urban planning policy and displayed functions as centers of economic-social and political activities, and therefore accommodate large urban populations. Regarding the border trade effect, most of the highest urban populations are in the areas bordering Thailand, rather than Viet Nam, Cambodia or PR China. However the results indicate the tendency of the decreasing of the dispersion of the urban population since 1995. This evident prove that as the degree of integration of Lao PDR to the international community due to the impact of integrated land transport network has been increased, resulted in the proportional increase in the equalization of urban population

Table 5.26 Population Agglomeration in Lao PDR in each District

Province	District	Population 1995	Population 2005	Increase of Population (1995-2005)	Annual Pop Growth Rate	Access to Road/river -2005	Road	Border	Area (Km ²)	Population Density 1995	Population Density 2005
Attapeu	Samakhixay	18869	30024	11155	5.91	8718	R11/18B		279	68	108
Attapeu	Xaysetha	26153	28290	2137	0.82	8718	R18B		1370	19	21
Attapeu	Sanamxay	19627	26675	7048	3.59	1723	R18A	CAM	1926	10	14
Attapeu	Sanxay	12252	16514	4262	3.48	1291			2831	4	6
Attapeu	Phouvong	10328	10668	340	0.33	2278	R1j	CAM	3136	3	3
Bokeo	Huoxai	44204	56992	12788	2.89	8997	NSEC	THAI	1861	24	31
Bokeo	Pha Oudom	26408	35583	9175	3.47	31664			1870	14	19
Bokeo	Tonpheung	19704	24821	5117	2.6	3319		MYN	883	22	28
Bokeo	Paktha	15526	17324	1798	1.16	39032			893	17	19
Bokeo	Meung	7770	11199	3429	4.41	29032			1475	5	8
Champasak	Phonethong (Xongmek)	73704	84,267	10,563	1.43	R16		THAI	913	81	92
Champasak	Pakse	65220	77,097	11,877	1.82	R13S, R16			126	516	610
Champasak	Khong (Khinak)	65212	72,922	7,710	1.18	R13S		CAM	1552	42	47
Champasak	Pakxong	44518	64,008	19,490	4.38	R16E, R16A			3456	13	19
Champasak	Sanasomboun	55716	62,282	6,566	1.18	R13S			913	61	68
Champasak	Champasak	49242	55,493	6,251	1.27				893	55	62
Champasak	Pathoomphone	43142	51,436	8,294	1.92	R13S			2727	16	19
Champasak	Sukhuma	38051	49,608	11,557	3.04				1233	31	40
Champasak	Bacheng chaleunsouk	34354	48,205	13,851	4.03	R20			877	39	55
Champasak	Moonlapamok	32228	38,562	6,334	1.97				2276	14	17
Borikhamxay	Khamkheuth	47758	64556	16797	3.52	17642	R8	VTN	4388	11	15
Borikhamxay	Phakxane	35223	40649	5426	1.54	7036	R13S	THAI	757	47	54
Borikhamxay	Phakading	29374	40625	11251	3.83	8896	R13S	THAI	2409	12	17
Borikhamxay	Bolikhanh	14970	34152	19182	12.81	17748			2001	7	17
Borikhamxay	Thaphabath	19976	22731	2755	1.38	7970	R13S	THAI	1741	11	13
Borikhamxay	Viengthong	16288	22455	6167	3.79	24428	R1D		4399	4	5
Huaphanh	Xamtay	47084	57179	10095	2.14	97924		VTN	3942	12	15
Huaphanh	Xamneua	45836	54365	8529	1.86	16322	R6		2658	17	20
Huaphanh	Viengxay	32873	35272	2399	0.73	12289	R6	VTN	1616	20	22
Huaphanh	Huameuang	23665	28072	4407	1.86	31093	R6		2299	10	12
Huaphanh	Add	NA	26917	NA	NA	13872		VTN	771	NA	35
Huaphanh	Xiengkhor	74841	26814	-48027	-6.42	9804			1013	74	26
Huaphanh	Sopbao	NA	26487	NA	NA	8514	R6A	VTN	1058	NA	25
Huaphanh	Viengthong	20352	25674	5322	2.61	35172	R1C		4147	5	6
Khammuane	Thakek	68432	83848	15416	2.25	7394	R13S	THAI	979	70	86
Khammuane	Hinboon	50778	62011	11233	2.21	12179	R13S	THAI	2988	17	21
Khammuane	Nongbok	39144	41096	1952	0.5	15261		THAI	346	113	119
Khammuane	Mahaxay	22982	30737	7755	3.37	12892	R12		1403	16	22
Khammuane	Nhommalath	21607	27634	6027	2.79	13055	R1E		1572	14	18

Khammuane	Xebangfay	19862	25737	5875	2.96	11195	R13S		943	21	27
Khammuane	Bualapha	19115	25178	6063	3.17	43252		VTN	3249	6	8
Khammuane	Xaybuathong	14908	20664	5756	3.86	22794	R1F		887	17	23
Khammuane	Nakai	15635	20030	4395	2.81	32120	R1E		4341	4	5
Luangnamtha	Namtha	35408	44609	9201	2.6	8821	NSEC		2202	16	20
Luangnamtha	Sing	22467	30619	8152	3.63	20072	R17		1355	17	23
Luangnamtha	Long	21357	28635	7278	3.41	20081	R17		2578	8	11
Luangnamtha	Nalae	20638	22476	1838	0.89	31022			1424	14	16
Luangnamtha	Viengpoukha	14871	18892	4021	2.7	23013	NSEC		2036	7	9
Luangprabang	Luangprabang	63765	77522	13757	2.16	7359	R13N		835	76	93
Luangprabang	Nambak	47082	59492	12410	2.64	15798	R1C		2074	23	29
Luangprabang	Ngoi	39772	41026	1254	0.32	22559	R1C		2747	14	15
Luangprabang	Viengkham	38931	40118	1187	0.3	7359	R1C		3378	12	12
Luangprabang	Xieng Ngeun	34266	33487	-779	-0.23	11095	R13N		1616	21	21
Luangprabang	Phonxay	24525	29626	5101	2.08	41432			2392	10	12
Luangprabang	Chomphet	24859	28977	4118	1.66	10290	R4B		1258	20	23
Luangprabang	Nan	28321	28045	-276	-0.1	11970	R4		1403	20	20
Luangprabang	Park Ou	21242	23997	2755	1.3	8105	R13N		900	24	27
Luangprabang	Pakxeng	25889	23426	-2463	-0.95	39125			1643	16	14
Luangprabang	Phoukhoun	16188	20233	4045	2.5	19005	R13N	VTN	1704	10	12
Oudomxay	Xay	48197	67296	19099	3.96	22009	R13N		2178	22	31
Oudomxay	Hoon	48195	61960	13765	2.86	14138	R2W		2159	22	29
Oudomxay	Beng	26902	33384	6482	2.41	11160	R2W		1747	15	19
Oudomxay	Namor	25419	32786	7367	2.9	27791	R13N	PRC	1543	16	21
Oudomxay	Pakbeng	22731	26623	3892	1.71	18811	R2W		1125	20	24
Oudomxay	Nga	24198	26556	2358	0.97	28355			1894	13	14
Oudomxay	La	14565	16225	1660	1.14	29398	R2E		1137	13	14
Phongsaly	Nhot Ou	24133	27750	3617	1.5	44339	R1A	PRC/ V	3105	8	9
Phongsaly	Samphanh	25101	27483	2382	0.95	24968			2556	10	11
Phongsaly	Khua	28244	27381	-863	-0.31	14423	R2E		1619	17	17
Phongsaly	Phongsaly	25823	25287	-536	-0.21	20719	R19	PRC/ V	2725	9	9
Phongsaly	May	23005	23707	702	0.31	29661	R2E		2892	8	8
Phongsaly	Boon Neua	14083	18995	4912	3.49	23579	R19,1A		1259	11	15
Phongsaly	Boontai	12459	16578	4119	3.31	1994	R1B	PRC	1298	10	13
Saravane	Saravane	66096	86108	20012	3.03	6304	R15/1H		2360	28	36
Saravane	Lao Ngam	42938	58745	15807	3.68	10920	R20		914	47	64
Saravane	Khongxadone	46252	54269	8017	1.73	5678	R13S		798	58	68
Saravane	Lakhonephen	30480	37667	7187	2.36	9305			1287	24	29
Saravane	Vapy	26755	31542	4787	1.79	6593	R15		958	28	33
Saravane	Ta Oi	19799	22526	2727	1.38	9714	R15		2750	7	8
Saravane	Toomlan	16262	21787	5525	3.4	10626	R1E	VTN	623	26	35
Saravane	Samuoi	7649	11826	4177	5.46	12463	R15	VTN	463	17	26
Savannakhet	Khanthabouly	124896	112505	-12391	-0.99	7228	EWEC	THAI	682	183	165
Savannakhet	Champhone	86550	101390	14840	1.71	24407			1050	82	97
Savannakhet	Songkhone	81864	82392	528	0.06	10013	R13S		1636	50	50

Savannakhet	Outhomphone	69025	80530	11505	1.67	19058	EWEC		1082	64	74
Savannakhet	Xaybuly	42936	54286	11350	2.64	8562	R9A	THAI	896	48	61
Savannakhet	Xonbuly	34602	51466	16864	4.87	27697			1206	29	43
Savannakhet	Phine	40994	50679	9685	2.30	13037	EWEC		3372	12	15
Savannakhet	Atsaphone	41123	50371	9248	2.25	36555			1452	28	35
Savannakhet	Xayphoothong	NA	44564	NA	NA	11835		THAI	455	NA	98
Savannakhet	Sephone	35731	42735	7004	1.96	11192	EWEC	VTN	2267	16	19
Savannakhet	Atsaphangthong	48743	39094	-9649	-1.98	36555	EWEC		701	70	56
Savannakhet	Thaphalanxay	NA	31817	NA	NA	26592	EWEC		998	NA	32
Savannakhet	Thapnangthong	24011	31456	7445	3.1	24141			2116	11	15
Savannakhet	Vilabuly	24560	30276	5716	2.33	31697			1765	14	17
Savannakhet	Nong	16723	21101	4378	2.62	20572			1701	10	12
Sekong	Thateng	15238	27200	11962	7.85	9176	R16F		1841	8	15
Sekong	Lamarm	18237	26787	8550	4.69	12761	R16F/11		551	33	49
Sekong	Dakcheung	16949	18491	1542	0.91	2432	R16E		2704	6	7
Sekong	Kaleun	13746	12838	-908	-0.66	2510			3291	4	4
Vientiane	Phonehong	66420	59480	-6940	-1.04	6806	R13N		490	136	121
Vientiane	Fouang	37774	54545	16771	4.44	37728			931	41	59
Vientiane	Thoulakhom	57199	51929	-5270	-0.92	7069	R10		887	64	59
Vientiane	Vangvieng	44369	46839	2470	0.56	21376	R13N		1504	30	31
Vientiane	Xanakham	31821	38836	7015	2.2	10338	R11	THAI	2843	11	14
Vientiane	Kasy	28960	27510	-1450	-0.5	27776	R13N		2617	11	11
Vientiane	Hinherb	NA	26165	NA	NA	4241	R13N		1077	NA	24
Vientiane	Longxan	NA	18933	NA	NA	46377			995	NA	19
Vientiane	Keo Oudom	20021	18374	-1647	-0.82	7438	R10		520	38	35
Vientiane	Viengkham	NA	18188	NA	NA	13040	R10		141	NA	129
Vientiane	Mad	NA	17785	NA	NA	41090			1569	NA	11
Vientiane	Hom	NA	7974	NA	NA	31021			1335	NA	6
Vientiane Capital	Xaythany	97829	149507	51678	5.28	7171	R10		605	162	247
Vientiane Capital	Sikhottabong	74251	100738	26487	3.57	2262			126	589	799
Vientiane Capital	Xaysettha	75255	96589	21334	2.83	6194			139	543	697
Vientiane Capital	Hadxaifong	64962	78385	13423	2.07	4583		Thai	212	306	369
Vientiane Capital	Chanthabuly	58855	73595	14740	2.5	2604			45	1319	1650
Vientiane Capital	Sisattanak	58178	68195	10017	1.72	1386			36	1628	1908
Vientiane Capital	Naxaithong	44104	58551	14447	3.28	6001	R13N		915	48	64
Vientiane Capital	Mayparkngum	33945	45226	11281	3.32	7891	R13S		796	43	57
Vientiane Capital	Sangthong	16728	24687	7959	4.76	12160			710	24	35
Xayabury	Xayabury	60153	73874	13721	2.28	21263	R4		3153	19	23
Xayabury	Paklai	NA	62870	NA	NA	12179	R4		1865	NA	34
Xayabury	Phiang	NA	49812	NA	NA	21550	R4		2970	NA	17
Xayabury	Kanetao	NA	36844	NA	NA	14355	R4	THAI	1265	NA	29
Xayabury	Xienghone	17893	28043	10150	5.67	37795	R4	THAI	1187	15	24
Xayabury	Hongsa	24844	26484	1640	0.66	13068	R4A		1605	15	16
Xayabury	Khop	16007	18693	2886	1.68	58222		THAI	698	23	27
Xayabury	Botene	NA	17419	NA	NA	20835	R4	THAI	1001	NA	17

Xayabury	Nguen	12826	15187	2361	1.84	10942	R4A		728	18	21
Xayabury	Thongmyxay	NA	8818	NA	NA	47461			1050	NA	8
Xiengkhuang	Pek	57273	69081	11808	2.06	28675	R7/R1 D		1173	49	59
Xiengkhuang	Kham	39547	46672	7325	1.65	32966	R7		2133	19	22
Xiengkhuang	Nonghed	33354	36146	2792	0.84	37767	R7	VTN	2005	17	18
Xiengkhuang	Khoune	29060	31575	2515	0.87	21121	R1D		1783	16	18
Xiengkhuang	Phookood	20272	24445	4173	2.06	27644	R7		2546	8	10
Xiengkhuang	Morkmay	7766	10430	2664	3.43	22808	R5	VTN	2074	4	5
Xiengkhuang	Phaxay	13347	10333	-3014	-2.26	34957			988	14	10

Source: National Statistic Center (2003)

3 GMS Integrated Land Transport Network and its Impact in Case of Vientiane Capital and Savannakhet Province

3.1 GMS Integrated Transport Network in Case of Vientiane Capital and Savannakhet Province

The major ports in the region are Lam Chabang (Thailand), Hai Phone, Danang, and Vungtau (Vietnam), which are gateways to the global market; therefore the corridor should be connected to the gateway(s). The East-West Corridor in the eastern part is to be considered as a route from Bangkok to north and/or central Vietnam through the central and southern part of Lao PDR. The following routes are to facilitate commodity flow in the region.

- (i) Bangkok – Udonthani - (Friendship Bridge) – Vientiane - (Route 13, Route 8) Vinh – (Route 1/Route 10/ -Hanoi/Haiphong)
- (ii) Bangkok- Nakhon Phanom - (ferry) – Thakek - (Route 13/12, Route 8)- Vinh (Route 1/Route 10) - Hanoi/Hai Phong
- (iii) Bangkok – Mukdahan – (Second Mekong bridge) – Savannakhet (Route13/12, Route 8) – Vinh - (Route 1/Route 10) - Hanoi/Hai phong
- (iv) Bangkok – Mukdahan – (Second Mekong bridge) – Savannakhet – (Route 9, Route 1) – Danang
- (v) Bangkok – Ubon – Pakse – (Route 18) – Danang

Along the five routes, Vientiane Capital is related to one route; (i) and Savannakhet related to two routes, (iii) and (iv).

3.2 The Impact of GMS Integrated Land Transport Network in Case of Vientiane Capital and Savannakhet Province

1) The Shift in Transportation Route, Reduced Transport Distance/Cost

The completion of the first Mekong Bridge connecting Thailand and Lao PDR in 1994 has considerably facilitated transportation movement from Bangkok to Vientiane Capital and the surrounding provinces and to North Vietnam (*Route (i)*).

Cargo is generally transported from Bangkok to Vientiane Capital via a trans-shipment point at Nong Khai in Northern Thailand. Traffic from/to Bangkok to/from Nong Khai can follow one of two alternate modes of transport, road or rail. From Nong Khai, which is on the Thai side of the Mekong River, cargo is transported in Lao PDR by truck to the river port of Thanaleng, reached after crossing the *Friendship Bridge* over the Mekong River. The distance between Vientiane and Bangkok by road is 630 kilometers. The highway from Bangkok to Nong Khai is a four lane standard highway in good condition. It is heavily used by trucks carrying cargo to and from northern Thailand. The railway also has a connection between the transit warehouse at Klong Toey and Nong Khai. In Nong Khai, the track is extended close to the ramp and goods are transferred to trucks to cross the Mekong River.

The completion of the Mekong International Bridge and an improved Route 9, means that Savannakhet Province is the access point to connect Bangkok and north/central Vietnam. Subject to capacity expansion and fee reduction at Danang Port, the link from Savannakhet Province to Danang is expected to be a gateway to the East Asian Market (e.g., Taiwan, Korea and Japan) (*Route (iii) and (iv)*).

The concept of the East-West Economic Corridor proposed by ADB is to link major cities and towns located between Mawlamyine (Myanmar) and Danang (Vietnam) via Mukdahan (Thailand) and Savannakhet Province (Lao PDR). The corridor crosses the center of the Indo-China Peninsula. It forms a land bridge between the South China Sea and Andaman Sea.

The transportation components of the EWEC:

- The Second Mekong International Bridge
- Route 9 improvement
- Route 1 improvement from Dong Ha to Da Nang
- Da Nang Port upgrading

Table 5.27 The distance of Land Transportation (unit: km)

	Bangkok	Laem Chabang	Danang	Difference (Laem Chabang and Danang)
Lao PDR				
Vientiane	630	691	1060	369
Savannakhet	644	705	520	-185
Pakse	749	810	767	-43
Thailand				
Udon Thani	564	625	800	175
Khon Kaen	449	510	717	207
Kalasin	519	580	642	62
Sakon Nakhon	647	708	641	-67
Nakhon Phanom	740	801	626	-175
Mukdahan	642	703	522	-181
Roi Et	512	573	684	111
Ubon Ratchathani	629	690	633	-57
Nakhon Ratchasima	259	329	905	585

Source: JICA Study Team

Table 5.27 shows the distance from major city centers to Bangkok, Laem Chabang and Danang ports. The results of the comparison show that the distance from Mukdahan to Laem Chabang is 703 km, while the distance to Danang is 522 km, thus the distance via this route could be reduced by 181 km. It could be concluded that the transportation distance could be reduced by using Danang port from 5 provinces (Sakon Nakhon, Nakhon Phanom, Mukdahan and Ubon Ratchathani) and two provinces (Savannakhet and Khammouane (Pakse)) in Lao PDR. Those reductions of transportation distance would be reduction of the transportation costs and times. However, it should be noted that land transport costs do not depend on transportation distance only, but also need to consider other factors as well.

The following table shows the comparison of transport cost and time in order to clarify the advantages of the Da Nang port. The study was conducted by JICA team on September 2000, conditions for the comparison study are shown below:

- Transport goods: 20 feet container
- Land transportation cost:

Table 5.28 Land Transportation Cost

(Unit: US\$ Per 100 km)

Type of container	Thailand	Lao PDR	Vietnam
20 feet	92	71	100
40 feet	120	92	150

Source: Thailand and Lao PDR quoted by JICA study team on September 2000

Vietnam calculated based on the decision 36/VGCP-CNTDDV of May 8, 1997

- Transport speed: After the bridge opening, the road upgrading in Lao PDR and Vietnam also have been completed. The transportation speed for the container trucks are summarized as follows:

Table 5.29 Transportation Speed

Country	Classifications	Speed (km/h)
Thailand	National Highway one digit	60
	National Highway two digit	50
	National Highway three digit	40
Lao PDR	Route 13	50
	Route 9	40
	Other road	30
Vietnam	Road 1A	40
	Route 9	40

Source: JICA Study Team

Table 5.30 Results of Comparison

From	To	Unit	Thailand	Lao PDR	Vietnam	Total
LaoPDR Vientiane	Laem Chabang	US\$	621.9	8.5	-	630.4
		Hour	12	0.5	-	12.5
	Danang	US\$	-	553.8	280.0	833.8
		Hour	-	16.8	7.0	23.8
Savannakhet	Laem Chabang	US\$	648.6	-	-	648.6
		Hour	18.2	-	-	18.2
	Danang	US\$	-	198.8	280.0	478.8
		Hour	-	6.0	7.0	13.0
Pakse	Laem Chabang	US\$	634.8	85.2	-	720.0
		Hour	15.4	3.0	-	18.4
	Danang	US\$	-	345.8	280.0	625.8
		Hour	-	10.9	7.0	17.9
Thailand Mukdahan	Laem Chabang	US\$	648.5	-	-	648.6
		Hour	17.6	-	-	17.6
	Danang	US\$	-	171.8	280.0	451.8
		Hour	-	6.1	7.0	13.1
Sakon Nakhon	Laem Chabang	US\$	651.4	-	-	651.4
		Hour	16.1	-	-	16.1
	Danang	US\$	111.3	170.4	280.0	561.7
		Hour	3.0	6.0	7.0	16.0
Nakon Phanom	Laem Chabang	US\$	736.9	-	-	736.9
		Hour	18.4	-	-	18.4
	Danang	US\$	97.5	170.4	280.0	547.9
		Hour	2.9	6.0	7.0	15.9
Kalasin	Laem Chabang	US\$	533.6	-	-	533.6
		Hour	12.9	-	-	12.9
	Danang	US\$	112.2	170.4	280.0	562.6
		Hour	2.4	6.0	7.0	15.4
Konkaen	Laem Chabang	US\$	469.2	-	-	469.2
		Hour	11.2	-	-	11.2
	Danang	US\$	181.2	170.4	280.0	631.6

		Hour	3.9	6.0	7.0	16.9
Udon Thani	Laem Chabang	US\$	575.0	-	-	575.0
		Hour	13.1	-	-	13.1
	Danang	US\$	257.6	170.4	280.0	708.0
		Hour	5.6	6.0	7.0	18.6
Ubon Ratchathani	Laem Chabang	US\$	634.8	-	-	634.8
		Hour	15.4	-	-	15.4
	Danang	US\$	104.0	170.4	280.0	554.4
		Hour	2.8	6.0	7.0	15.8
Nakhon Ratchasima	Laem Chabang	US\$	294.4	-	-	294.4
		Hour	8.0	-	-	8.0
	Danang	US\$	352.4	170.4	280.0	802.8
		Hour	9.6	6.0	7.0	22.6

(Source: JICA Study Team, "Development Vision and Cooperation Programs for the cross Border region", September 2001)

The results show that the area along the Mekong River has improved access to the seaport in terms of costs and times. In Mukdahan, the difference is 4.5 hours or 26 percent of transport time reduction and US\$196.8 or 30 percent in transport cost reduction. It could be concluded that there are advantages to use Vietnamese port from three provinces (Mukdahan, Sakon Nakhon and Nakhon Phanom) in Thailand and two provinces (Khammouane and Savannakhet) in Lao PDR, yet those advantages are disappeared without the three government's cooperation on reducing no-tariff barriers. The study made by JICA could show that the land transportation would benefit to trade between or among three countries, especially Thailand and Vietnam. It could reduce transportation time from 2 weeks by ship to 2-3 days by truck and reduce transportation cost as well.

It is clear that the improvement of the integrated transport, especially the Second Mekong Bridge, have definitely brought about the reduction in transport distances, hence an increase in transport volume and economic activities, resulting in the significant changes in both economical-social and physical conditions of the related areas.

Before the completion of the Second International Bridge and the improvement of Route 9 the commodity flow is summarized as follows:

- The major route of commodity flow between Thailand and Lao PDR was from Nong Khai to **Vientiane**, followed by the route between Nakhon Phanom and Thakhek. The trade volume of Mukdahan – Savannakhet route is smaller than the above two routes, and
- The trade volume between Thailand and Vietnam via Lao PDR will gradually increase and the transportation route in Lao PDR will be via Route 8 and Route 9.

After the completion of the Second International Bridge and the improvement of Route 9 the commodity flow is summarized as follows:

- The New Mekong Bridge makes the transport route shift from the Nakhon Phanom - Thakhek route to Mukdahan – Savannakhet route.
- The commodity flow between Thailand and Vietnam via Lao PDR is shifted to utilize the two routes: Savannakhet - Vinh via Routes 13 and 8 to the north Vietnam, and Savannakhet - Danang via Route 9 to the central Vietnam and
- The domestic goods produced in the central and southern Lao PDR will be collected at Savannakhet and exported to Vietnam and to Thailand.

It can be seen that the role of Savannakhet Province has been increasingly important due to the improved GMS integrated land transport network during the last three decades.

- Shorter time-distance to Central Vietnam: improved Route 9 has shortened the time distance between Savannakhet Province and the central Vietnam. It has brought about an expansion of markets
- Junction of the north-south axis and east-west axis: in addition to the east-west connection, Savannakhet Province located at the junction of the east west corridor and the north south axis in GMS. Such a location of Savannakhet Province has provided various business activities (e.g. import – processing- re-export/sales to domestic market, collecting the domestic goods,-processing-export, etc)
- Dual directions to north and central Vietnam from Thailand. Savannakhet Province will develop multiple routes from Thailand to north/central Vietnam. If Savannakhet Province locates only on the route between Bangkok and Danang, it will be less attractive to transporters, exporters, and other investors. Direct access to Thailand through the New Mekong Bridge: The economic activities in the less developed area have been enhanced by directly connecting it to the advanced area. The Second Mekong Bridge has created business opportunities for all the economic sectors by connecting directly to Thailand.
- The Second Mekong International Bridge will reduce the traveling time to the Vietnamese port and improved land transportation between Thailand, Lao PDR and Vietnam. The land transport provides flexible and reliable services with cheaper costs and reduces transportation time. The change in transportation will open up the CBR area for new development opportunities. The promising industries include trade, transportation and manufacturing sectors, which could not be established in this area before. Those sectors will directly benefit from the bridge construction because of the efficient transport system.
- The mobilized goods and people will enhance rural development in the CRB. The people in rural areas have more opportunity to sell their products through markets and to buy goods at cheaper prices. Moreover, the job opportunities of the rural people will improve through the provision of commercial and service activities. The second Mekong bridge

will promote the establishment of new industrial activities, an accumulation of commercial activities and the provision of a new tourist route.

- The reduced transport costs and times will induce new industries to locate in the CRB area. This would include the service sector and those industries that handle commodities from other countries. Moreover, a new tourist route will be identified to connect Thailand, Lao PDR, and Vietnam through the bridge. The trade between Thailand, Lao PDR and Vietnam is expected to increase after the completion of the second Mekong Bridge.
- Since the bridge will reduce the transportation costs, the new commodities that could not be traded before the bridge construction, will start being traded. In addition, some commodities transported on the sea between Thailand and Vietnam will be switched to land transportation.

2) An Analysis on the Population Agglomeration of Vientiane Capital and Savannakhet Province at Provincial Level

Savannakhet Province has accommodated the largest population in the country since 1985. However the population growth rate of Vientiane Capital is higher than those of Savannakhet Province. The growth rate of Savannakhet Province from 1976-1980 is 2.82%, 1980-1995 is 2.29% and 1995-2004 is 2.24%, while Vientiane capital the growth rate is 3.96% and 3.13% in phase 2 and phase 3 respectively.

Table 5.31 Population of Vientiane Capital and Savannakhet Province

POPULATION (THOUSAND)	1985	1990	1995	1999	2000	2001	2002	2003	2004
Vientiane Capital	381	464	532	583	598	616	633	651	669
Savannakhet Province	549	639	675	748	766	790	811	834	857

Source: National Statistic Center (2004)

Table 5.32 Annual Growth rate of Vientiane Capital and Savannakhet Province

Annual Growth Rate (%)	1975-1980	1980-1995	1995-2004
Savannakhet Province	2.82	2.29	2.24
Vientiane Capital	NA	3.96	3.13

Source: National Statistic Center (2004)

3) An Analysis on the Population Agglomeration of Vientiane Capital and Savannakhet

Province at District Level

The analysis of the changing of the population of Vientiane Capital and Savannakhet Province at district Level during 1999-2005 at district level shows that in 2005 the highest population is found in Xaythany, which is a district along Road Number 13 & Road Number 10 Xaythany District also, has a highest increased population (1995-2005).

The highest population density can be observed in Sisattanak District with the figure of 1908 person/km², while in Savannakhet Province the highest population density is only 183 person/km² in Khanthabouly District.

In Savannakhet Province the highest population can be seen in Khantabury District as expected. This is because of the fact that Khantabury District is a provincial capital of Savannakhet province and a secondary town in addition to being a major node of EWC corridor and sharing border with Thailand. However, the increased population has shown the negative figure, implies the decreasing in the population agglomeration during ten years. The reason behind this phenomenon could be explained by the huge equally increasing of new settlement in other districts due to the improvement of the land transport network throughout the province.

4) An Analysis on the Urban Population and Area of Vientiane Capital and Savannakhet Province

Although Savannakhet Province has accommodated a large proportion of the total population, its urban population and urban area are much smaller than those of Vientiane Capital. The urban population and urban area of Savannakhet Province account for only 12.21 % of total population and 0.47% of total area. These figures imply that there are numerous dispersed settlements inside Savannakhet Province.

Table 5.33 Urban Population of Vientiane Capital and Savannakhet Province

Province	Urban Population 2003	Total Population 2003	% Urban Population
Vientiane Capital	300,804	651000	46.21
Savannakhet Province	101,864	834000	12.21

Table 5.34 Urban Area of Vientiane Capital and Savannakhet Province

Land Use Type	Vientiane Capital	Savannakhet Province
Dry Evergreen	0.98 %	1.93 %
Mixed Deciduous	19.70 %	20.59 %
Dry Dipterocarp	0.80 %	8.79 %
Gallery Forest	NA	0.55 %
Bamboo	9.01 %	1.38 %
Forest	29.11 %	20.26 %
Ray	4.76 %	8.95 %
Savannah	0.00 %	4.24 %
Scrub	0.05 %	1.80 %
Rice Paddy	26.37 %	26.09 %
Agricultural Plantation	NA	0.07 %
Other Agricultural Land	0.15 %	0.27 %
Barren Land and Rock	0.02 %	0.43 %
Grass Land	1.47 %	1.55 %
Swamp	2.50 %	1.66 %
Urban or Built up Area	2.80 %	0.47 %
Cloud or Cloud Effects	0.00	0.00
Water	2.27 %	0.98 %

Source: GIS Data from MCTP, 2004

VIENTIANE CAPITAL URBAN AREA



- Whole_built
- Urban Area
 - Rural Area
 - Admin_bnd.shp
 - P.ATTAPU
 - P.BOKEO
 - P.BORIKHAMXAI
 - P.CHAMPASAK
 - P.HOUAPHAN
 - P.KHAMMOUAN
 - P.LOUANGNAMTHA
 - P.LOUANGPHRABANG
 - P.ODOMXAI
 - P.PHONGSALI
 - P.SARAVAN
 - P.SAVANNAKHET
 - P.VIENTIANE
 - P.XANGNABOURI
 - P.XEONONG
 - P.XIANGKHOANG
 - S.R.XAISOMBOUN
 - VENTIANE MUN.



Figure 5.28 Vientiane Capital Urban Area
 Source: Author's Compilation Based on Data from The Ministry of Communication, Transport, Post and Construction

SAVANNAKHET URBAN AREA

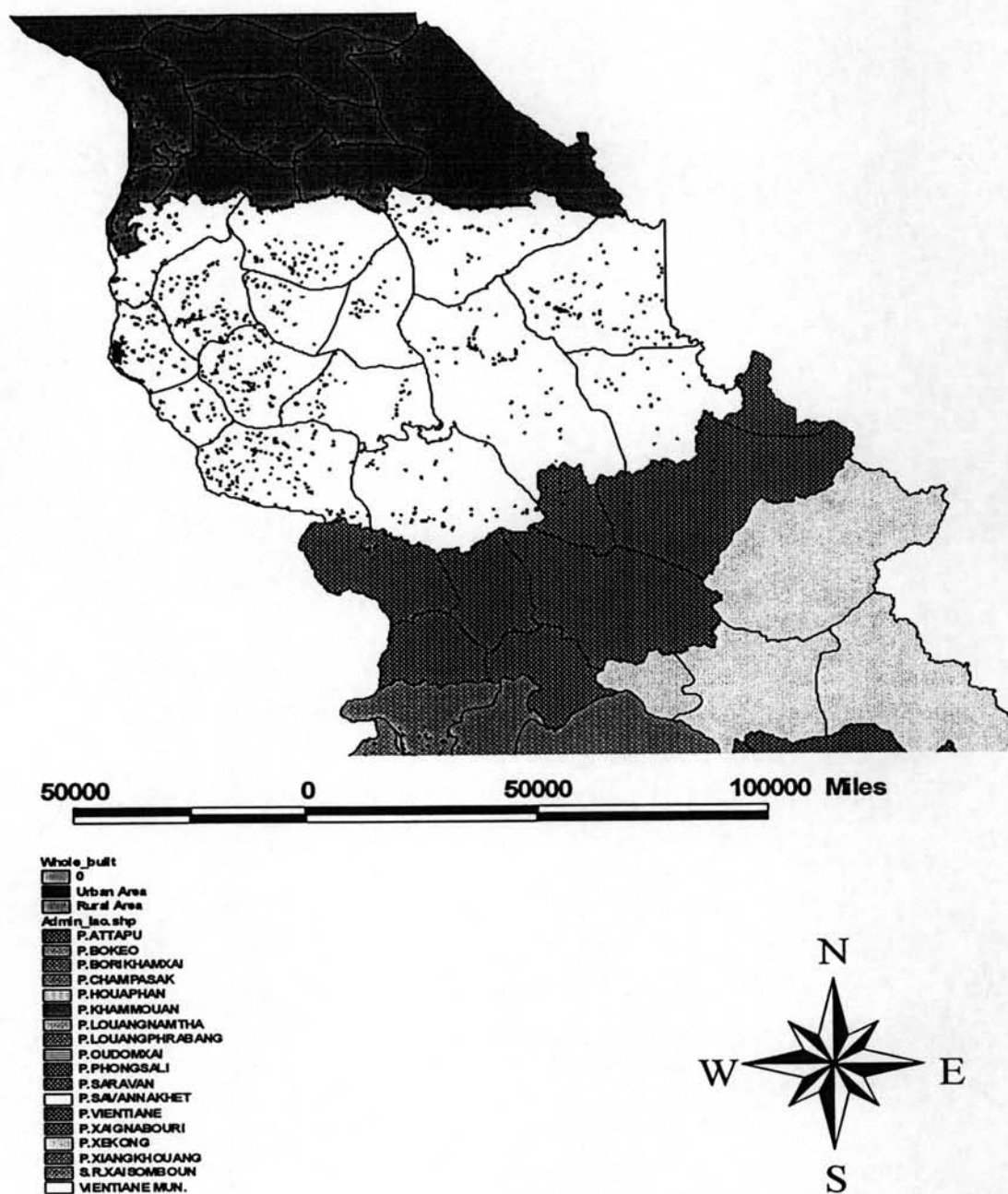


Figure 5.29 Savannakhet Province Urban Area

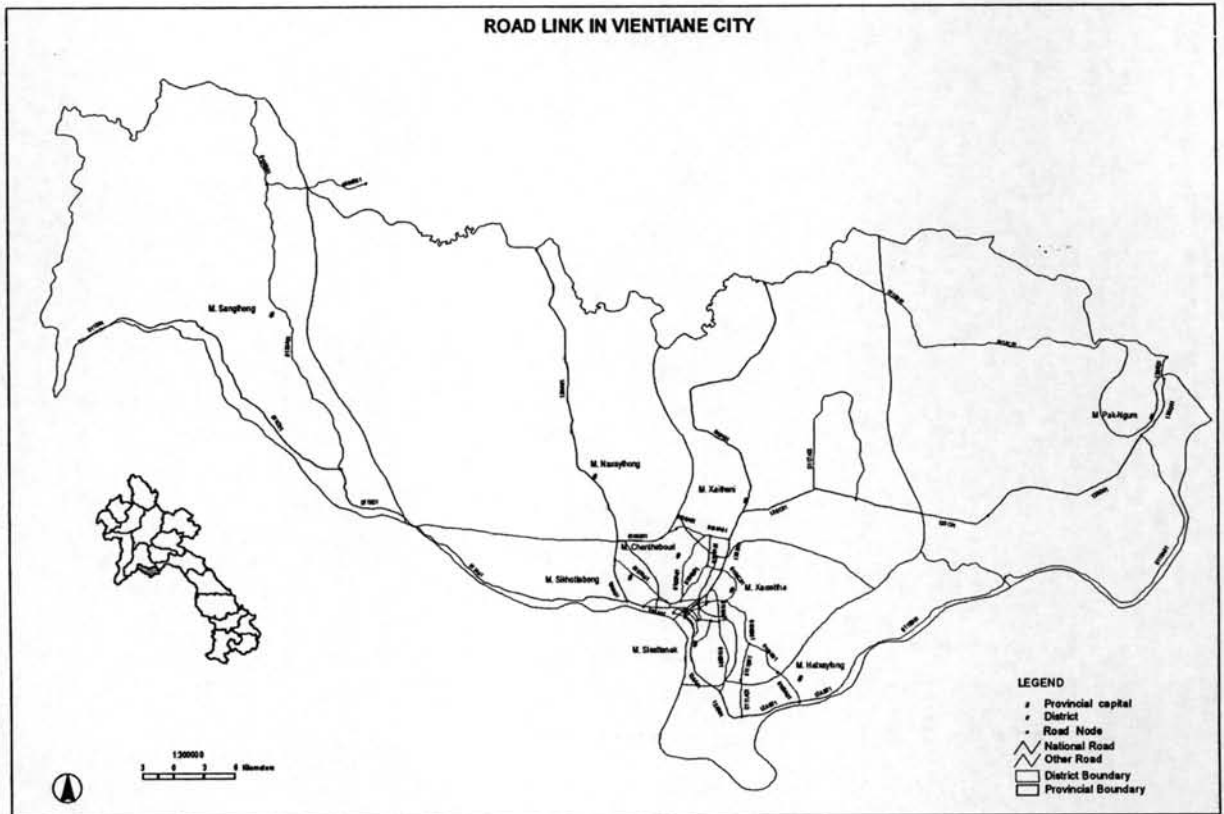
Source: Author's Compilation Based on Data from The Ministry of Communication, Transport, Post and Construction

Table 5.35 population Agglomeration of Vientiane Capital and Savannakhet Province at District Level

Province	District	Population 1995	Population 2005	Increased Population (1995-2005)	% Annual Growth Rate	Road/river Access	Road	Node	Border	Area (Km2)	Population Density 1999 Person/Km2	Population Density 2005 Person/Km2
Vientiane Capital	Xaythany	97829	149507	51678	5.28	7171	R10/R13S	Minor		605	162	247
Vientiane Capital	Sikhottabong	74251	100738	26487	3.57	2262				126	589	799
Vientiane Capital	Xaysetha	75255	96589	21334	2.83	6194				139	543	697
Vientiane Capital	Hadxaihong	64962	78385	13423	2.07	4583		Major	Thai	212	306	369
Vientiane Capital	Chanthabuly	58855	73595	14740	2.50	2604				45	1319	1650
Vientiane Capital	Sisattanak	58178	68195	10017	1.72	1386				36	1628	1908
Vientiane Capital	Naxaithong	44104	58551	14447	3.28	6001	R13N			915	48	64
Vientiane Capital	Mayparkngum	33945	45226	11281	3.32	7891	R13S			796	43	57
Vientiane Capital	Sangthong	16728	24687	7959	4.76	12160				710	24	35
Savannakhet	Khanthabouly	124896	112505	-12391	-0.99	7228	EWEC	Major	THAI	682	183	165
Savannakhet	Champhone	86550	101390	14840	1.71	24407				1050	82	97
Savannakhet	Songkhone	81864	82392	528	0.06	10013	R13S			1636	50	50
Savannakhet	Outhomphone	69025	80530	11505	1.67	19058	EWEC	Minor		1082	64	74
Savannakhet	Xaybuly	42936	54286	11350	2.64	8562	R9A		THAI	896	48	61
Savannakhet	Xonbuly	34602	51466	16864	4.87	27697				1206	29	43
Savannakhet	Phine	40994	50679	9685	2.36	13037	EWEC	Minor		3372	12	15
Savannakhet	Atsaphone	41123	50371	9248	2.25	36555				1452	28	35
Savannakhet	Xayphoothong	NA	44564	NA	NA	11835			THAI	455	NA	98
Savannakhet	Sephone	35731	42735	7004	1.96	11192	EWEC	Minor	VTN	2267	16	19
Savannakhet	Atsaphangthong	48743	39094	-9649	-1.98	36555	EWEC	Minor		701	70	56
Savannakhet	Thaphalanxay	NA	31817	NA	NA	26592	EWEC			998	NA	32
Savannakhet	Thapnangthong	24011	31456	7445	3.10	24141				2116	11	15
Savannakhet	Vilabuly	24560	30276	5716	2.33	31697				1765	14	17
Savannakhet	Nong	16723	21101	4378	2.62	20572				1701	10	12

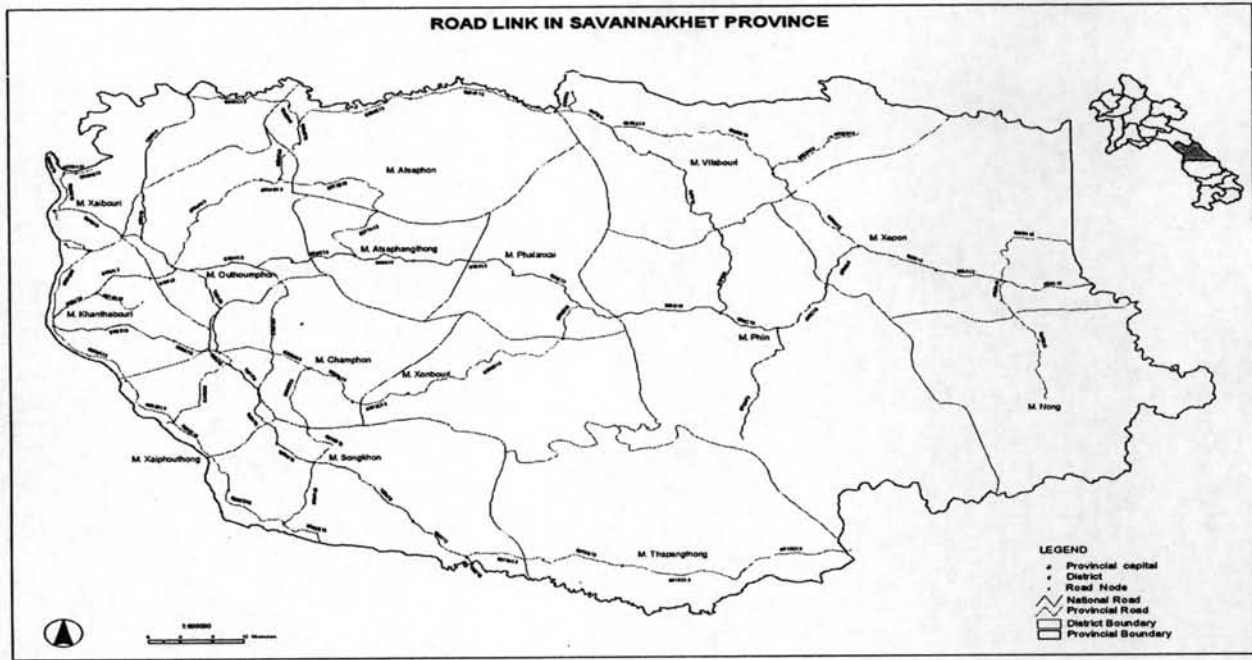
Source: Author's Compilation Based on Data from National Statistic Center (2004)

Figure 5.31 Road Link in Vientiane City



Source: Author's Compilation Based on Data from The Ministry of Communication, Transport, Post and Construction

Figure 5.31 Road Link in Savannakhet Province



Source: Author's Compilation Based on Data from The Ministry of Communication, Transport, Post and Construction