ASSESSING SPATIAL-TEMPORAL IMPACTS OF A TRANSPORT INFRASTRUCTURE POLICY IN BRAZIL

Andre Dantas, University of Canterbury, Private Bag 4800, Christchurch, New Zealand, Tel/Fax:+64 3 364-2238, email: andre.dantas@canterbury.ac.nz
Karisa Ribeiro, MWH New Zealand Ltd, 7 Deans Avenue, PO Box 13249, Christchurch, New Zealand, Tel:+64 3 3438792, email: karisa.m.ribeiro@mhwglobal.com
Yaeko Yamashita, University of Brasilia, Predio SG 12 Campos Darci Ribeiro, Brasilia, DF, Brazil, Tel: 55 61 3742714, email; yaeko@unb.br

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ABSTRACT

This paper examines the impacts of various policy interventions in the Presidente Dutra Highway (PDH), Brazil. Using a time-series database, changes in the highway's physical and operational characteristics are analyzed in conjunction with variations in socioeconomic and demographic indicators. A major outcome of this study is the realization that the infrastructure policy implemented in the highway has created short, medium and long term impacts of extreme complexity. These impacts are the result of a continuous development cycle in which transport infrastructure policies trigger changes in land use patterns (activities, location and density), socioeconomic and demographic indicators as well as operational conditions of the highway. The results of the case study indicate that the development cycle is only perceived because the analysis is based upon a time-series database, otherwise only operational changes could be detected. Based on the understanding of the development cycle in the PDH region, the recent implementation of the tolling system through a Public Private Partnership (PPP) scheme is assessed. It is concluded that the tolling system may create impacts in terms of initial limitations to development in all respects due to the increase in direct (user perceived) transport costs. The charging system may also result in saturation (land use and transportation) of those areas in between toll plazas.

INTRODUCTION

Transport infrastructure policies produce immediate and gradual changes in activity and transportation systems as well as population, economy and quality of life. It is widely acknowledged that any decision in altering the transport infrastructure has several implications to the daily movement of people and goods in countries, regions, urban areas, etc. Travel times and costs changes are almost immediately observed as travel patterns are adjusted to new conditions such as the provision of new or upgraded transport infrastructure. On the other hand, changes in land use patterns (density and diversification), demographic conditions and economic performance indicators are likely to occur very slowly.

Research efforts in this field have focused on the impacts that improvements in the transportation system may or may not cause on the social, economical and environmental systems *(1) (2) (3) (4)* (5); *(6).* For example, FHWA *(7)* presented a framework to guide the assessment process of land use and growth impacts of highway improvement. Others have attempted to assess how changes in the activity system have impacted in the transportation system. Greiving and Wegener *(8)* concluded that land use policies can overtime change the behaviour of the flow pattern and the performance of the transportation system. Badoe and Miller (9) concluded that several studies on activity system impacts and travel behaviour have had weaknesses either in data used or in the methodology, which has contributed to the lack of clarity in the analysis and evaluation of impacts. Others have recognized the lack of instruments able to conduct integrated modelling between transportation and activity systems to analyse and evaluate impacts *(10) (11) (12).*

In contrast to previous research efforts that have relied on the static representation of the interactions between transportation and activity systems, this research focuses on identifying evolutionary patterns and tendencies through the analysis of temporal variations in demographic, socioeconomic, land use and highway operational conditions. This approach follows recent research initiatives *(13) (14) (15)* that have incorporated the time dimension in the analysis and modeling of dynamic interactions between transportation and activity systems. The identification and understanding of evolutionary patterns and tendencies may be used in assessing the impacts of transport infrastructure policies, which have long term effects not only to the transportation system but also to the society, the economy and the environment.

This paper examines the impacts of various policy interventions in the Presidente Dutra Highway (PDH), Brazil. A time-series database was constructed in order to quantify the spatial-temporal changes in PDH's physical and operational characteristics and socioeconomic and demographic indicators. Based upon the understanding of the transportation-activity system interactions in PDH's study region, we are particularly interested in assessing the future impacts of the adoption of a Public Private Partnership (PPP) that has been operating toll plazas in exchange for maintenance and reconstruction services in the highway.

After this introduction, we present a description of the characteristics of the PDH and changes observed over time. The third section presents a spatial-temporal analysis of the policy interventions. Finally, the fourth section summarizes the findings of this study.

PRESIDENTE DUTRA HIGHWAY IN THE BRAZILIAN HIGHWAY NETWORK CONTEXT

Historically, the Brazilian Highway Network (BHN) has always been contributed to the development of the country *(16).* Most of the current BHN was constructed between the 1945 and 1975 *(17),* expanding 17 times in that 30 year-period. However, the growth situation subsequently changed drastically in contrast to the previous prosperous period, the 80's was a period of recession and shrinkage in infrastructure investments. During the transition from the

military to democratic regime (1986), maintenance and construction activities were significantly reduced.

In the 90's, the Brazilian government initiated efforts towards obtaining additional budgetary resources in order to support national growth through privatization of infrastructure assets. Infrastructure policies on public service decentralization were conceived and implemented mostly through PPPs. Among several types of PPP contracts, the highway sector has applied the concession model, which is a temporary transference of recuperation and maintenance services in exchange for exploration rights such as toll payment *(18)*. Since the beginning of the Brazilian Highways Concession Program (BHCP) in 1990, one bridge and four federal highway segments were transferred to private sector *(19)*.

Presidente Dutra Highway (PDH) can be highlighted as the largest highway segment being transferred as part of the BHCP. PDH is a strategic corridor, which connects the two most economically important cities in Brazil, Rio de Janeiro and Sao Paulo *(18)*. Located in the most developed region of Brazil, PDH has been narrowly related to regional and national development, contributing to a fundamental part of the Brazilian social and economic life. The corridor supports the area which concentrates the biggest industrial park in the country, which produces 45% of the total Gross Domestic Product (GDP) annually. It also provided the primary access to four major states in Southeast of Brazil, which is a region that accounts for up to 60 percent of the country's economy. The development generated by PDH has occurred in parallel to the Brazilian economic progress in the past. Moreover, for the next 20 years, the CNT *(20)* estimates that US$20 billion will be invested in the region in which the improvement of PDH has become an essential task to support this growth.

The government expected that private investment in infrastructure projects such as the PDH would become a new standard for future initiatives and highway services. The upgrading of the PDH was expected to provide a high quality highway with modern services compared to the previous poor level of service. In 1996, 5 toll plazas were installed and the charging scheme called "open system" is currently employed (*21*). In the "open system", users pay a toll fee for every 100 km, without any consideration of the total travel distance using the highway. Therefore, trips between the toll plazas are not computed nor charged because there is no control over them. Initial results have demonstrated that the improvement of roading conditions has reduced transportation travel time and costs in the short term, but it is also noted that several indirect effects have not been quantified *(22)*.

SPATIAL AND TEMPORAL CHANGES IN THE PDH

In the last 50 years, the PDH has contributed to the development of the region. Constructed in 1951, the PDH was designed to promote the trade between Rio de Janeiro and Sao Paulo. The high quality two-lane highway, with 405 Kilometers of extension and 115 special works of art (turnpikes, viaducts, bridges and lower crossings) reduced the travel time between Rio de Janeiro and Sao Paulo to 6 hours *(23)*. It was the most important infrastructure project in that period.

The investments in PDH have not only benefited economically Rio de Janeiro and Sao Paulo but also the cities along the highway. At the state level, the PDH has contributed to promoting development in 31 cities along the highway. These cities use the mobility provided by the PDH to attract industries and incentives to the region. Due to the increase of the transportation demand in the 60's, the government upgraded the PDH to a four-lane highway in 1969. The investment contributed to the reduction of 40% of the transport cost between Sao Paulo and Rio de Janeiro and induced more traffic flow between both cities *(18)*.

Taking for reference the boundaries of the Rio de Janeiro and Sao Paulo states, the study region was delimited. In the west and east, the municipalities of the metropolitan areas of Sao Paulo and Rio de Janeiro cities were considered. This region comprises 167 municipalities as shown in Figure 1. For each municipality census and administrative data sets were obtained.

Also, data was gathered from various transport organizations in order to describe the physical and operational characteristics of the PDH segments. Based upon the values summarized in Tables 1 and 2, the following sub-sections describe the Demographic, Socioeconomic, Operational and Land Use (LU) the change values are described.

Demographic changes in the PDH region

Initially, the PDH region's population had approximately 10 million people, which changed to 36 million people in 2000. The highest populations are situated in Rio de Janeiro and Sao Paulo cities. In Rio de Janeiro, it was approximately 2 million in 1950 and changed to 5 million in 2000. In Sao Paulo, the 1950 population was 2 million and it is now estimated to be 10 million. Many cities have also experienced population growth of up to 500%.

The spatial distribution of the population changes clearly shows that it depends on the distance between the cities and the major metropolis (Sao Paulo and Rio de Janeiro). It is observed that most of the population changes are within 75 Km of Sao Paulo and Rio de Janeiro. This spatial distribution pattern is reinforced by the results presented in the Figure 2, which shows the average population changes during the period between 1950 and 2000. Based upon the population change rates per municipality and the spatial separation from the two metropolis, three distinct groups in terms of changes in the population are identified. They are:

- Group I: high (100-200%) population changes influenced by the proximity to Sao Paulo city (comprising toll plazas number 1 and 2);
- Group II: very low (-20 to 0%) population changes in a few cities located approximately half the way between Rio de Janeiro and Sao Paulo cities (comprising toll plazas number 3, 4 and 5); and
- Group III: high (100-200%) population changes influenced by the proximity to Rio de Janeiro city.

The population growth pattern observed in the PDH region is similar to the population density changes. There has been a high concentration of people in Rio de Janeiro and Sao Paulo since the 1950's. The densities in Rio de Janeiro and Sao Paulo cities which were around 6000 people per km^2 in 2000 have risen six times between 1950 and 2000. Likewise Rio de Janeiro and Sao Paulo, cities close to them had also extremely high population density (over 10000 people per Km2) in 2000. On the other hand, it is noted that as the distance of the metropolis increases, population density declines to 100 people per km^2.

Socioeconomic changes in the PDH region

In the last 50 years, the PDH region has undergone a massive economic transformation expressed in terms of GDP variations. In 1970, the total GDP was US$ 50 billion and it increased to US$ 120 billion in 1996. The average GDP for the region was US$ 350 million per municipality in 1970, increasing to US$ 1 billion per municipality in 1996. As expected, Sao Paulo and Rio de Janeiro reached the highest GDP values (US$ 70 and 28 million, respectively).

Also, it is observed that most GDP changes occurred in the 1970 to 1980 period. The GDP growth between 1970 and 1980 was not followed by the same rates in the 1980-1996 period. This is mainly because of the industrialization process that took place in the early stages of the 70's.

Similarly to population changes, the spatial distribution of the GDP changes is also related to the distance between the cities and the major metropolis (Sao Paulo and Rio de Janeiro). It can be observed that most GDP changes are within a 140 Km range for Sao Paulo and 40 Km from Rio de Janeiro as shown in Figure 3, which shows the average GDP changes during the period between 1970 and 1996. Despite the similarities to population changes, a few exceptions in Group III are observed. Nearby the current location of toll plaza number 4, GPD changes in Barra Mansa, Resende and Volta Redonda reached over 100% in the 1970-1996 period. This is mostly because of the concentration of industrial activities related to the

Companhia Siderurgica Nacional (CSN) that produces and exports most part of Brazilian steel products.

Operational changes in the PDH

PDH has observed significant increase in demand since the early 1970's. The Average Daily Traffic (ADT) changed from 27,743 to 43,946 vehicles/day in the last 30 years. This is mostly related to traffic flow increase nearby Sao Paulo and Rio de Janeiro city. As observed in the population and GDP changes description, the proximity to the major metropolitan areas has clearly affected the traffic volume build up. As shown in Figure 4 (a) and (b), the highest levels of changes occurred in the highway segments near Sao Paulo (over 300% of ADT variation) and Rio de Janeiro (over 240% of ADT variation) cities. On the other hand, it is also verified that the lowest levels of changes (average -40%) happened half the way between toll plazas 2 and 5.

Although these findings are valid for a 30 year-period, a different picture arises from a 10-year basis description. The main highlights are:

- In the highway segment connecting Barra Mansa to Nova Iguacu (between toll plazas number 4 and 5) a 140% variation in the 1970-80 period was observed. In the subsequent 10 year period (1980-1990) a 120% reduction was experienced in the same segment; and
- In the 1980-1996 period, considerable reduction (-40%) in the traffic flows through toll plazas 1 and 5 nearby the metropolitan areas was observed. In contrast, these segments experienced an increase of over 60% in ADT numbers since 1996.

In addition to travel demand, accident numbers in the PDH experienced considerable variations over time. Since 1980, a general decline has been observed in the number of accidents (-17.24%), although there are still many segments of the PDH concentrating high levels of accidents. For instance, in the surroundings of the metropolitan areas a large number of events have been registered in recent years. In 1980, 84 accidents were observed in Sao Paulo metropolitan area (before the toll plaza number 1), which subsequently declined to 38 accidents in 2000. In many cases the reduction reached 90% in 20 years, but in others such as Guarulhos and Aruja accidents rates increased substantially (over 120%).

Nevertheless, these average values over the 1980-2000 period do not entirely reflect the real situation that took place in the PDH. In the 1980-96 period, a remarkable increase in accident numbers was observed. In certain parts of the PDH such as in Sao Jose dos Campos, where the accident numbers reached a 1710% increase. Fortunately, in the 1996 to 2000 period the accident numbers dropped sharply (94% in 2000).

Land use changes in the PDH region

The PDH region has experienced a great deal of transformation in terms of land use in the last 40 years. In 1960 the region had approximately 80% of its area dedicated to agricultural activities, 14% of urban use and 6% of industrial land use. However, this situation started to change since 1970. Currently, this percentage is around 47% of rural use, which is complemented by 33 and 20% approximately of urban and industrial activities, respectively.

Metropolitan growth in Sao Paulo and Rio de Janeiro has been the main driver for the observed land use changes. Over time, the fringe areas of Rio de Janeiro and Sao Paulo cities became predominately industrial and the nearby cities also developed urban and industrial areas, as shown in Figures 5 (a) and (b). Furthermore, rural areas dropped considerably near the metropolitan areas. On the other hand, industrial activities experienced considerable growth along the PDH. Despite the concentration of high a percentage of industrial land use near Sao Paulo and Rio de Janeiro, the highest industrial land use changes occurred in Resende, Volta Redonda and Sao Joao do Meriti (toll plazas number 3, 4 and 5). The average industrial land use changes in the fringe of the metropolitan areas reached 234% in the period between 1960 and 2000.

Although these findings are valid for the whole 40 year-period, a very different picture arises for specific time periods. For the 1960-1990 time interval, changes in industrial land use were smoothly distributed along the PDH region. Subsequently, the 1990-2000 period was characterized by the attenuation of changes, which did not follow past distribution. In the 90s, the land use average in the region was distributed as 18.3% industrial, 31.7% urban, 50% rural areas. In 10 years, industrial and urban areas increased in 3% and 2%, respectively, whereas a slight decrease in rural area of 3% (2000) was observed. The highest changes were concentrated in rural land use.

SPATIAL-TEMPORAL ANALYSIS OF POLICY INTERVENTIONS

This section assesses the development tendencies and impacts of infrastructure policy interventions in the PDH over the last 50 years. Developments tendencies and impacts are expressed in terms of the dynamic interactions between population, socioeconomic characteristics, transportation system and land use changes over time and space. The policy interventions are put together into three main categories, namely: capacity upgrade with federal government funding; minimum maintenance with federal government funding; and recuperation, upgrade and maintenance through PPP and toll charging scheme. Trade-offs between policy interventions and tendencies/impacts are examined in order to identify cause-consequence relationships that are used to assess the implementation of the tolling system.

The following sub-sections describe: the dynamic interactions between population, socioeconomic characteristics, transportation system and land use changes over time and space;

Dynamic interactions over time and space

A major development tendency and impact of the infrastructure policy interventions is the formation of Development Centers (DC) and Development Gaps (DG) in the PDH region. DC and DG are the result of completely different growth patterns, whereas significant changes in population, socioeconomic characteristics, transportation systems and land use patterns occurred in coincident areas that comprise of blocks of cities. In between the DC, DG (cities with low levels of changes) are observed. Figure 6 shows the spatial distribution of the DC and DG.

It is verified that all DC have the same growth tendency for all factors in the 1970-2000 period. The only exception is the number of accidents, which experienced a considerable reduction in the last 20 years. Another interesting aspect is the modification of the land use patterns. In almost all cities of the PDH region, there was a sharp tendency of industrialization and urbanization along the highway. On the other hand, three main gaps that have been affected with low change levels (Figure 6) are observed. Despite the proximity to the PDH, population, socioeconomic and the transportation characteristics changed less than other cities in the DG. The interesting and common aspect of these cities is that the land use (especially rural) has changed considerably, which can indicate modification of the development pattern in the near future.

The process of DC and DG formation is the outcome of the combined effects of each intervention. The initial intervention (Capacity upgrade with federal government funding) produced general changes in socioeconomic, population, land use and transportation features modified almost at the same level. As the PDH region had initially very limited number of activities and with the improvement of roading conditions, the 1970’s was a period of industrial activity booming, which is reflected in generalized increase in traffic flows, accidents and economic development.

Subsequently, the adopted policy of limited maintenance (1980-1990 period) associated with the economic and political crisis produced considerable deceleration of growth changes.

Although DC 1 and 2 still have achieved high values in terms of population, socioeconomic and land use characteristics changes, they were less intense than before. On the other hand, transportation characteristics experienced a huge decrease in growth changes, in which DC 1 and 3 dropped considerably.

Finally, the upgrade and maintenance through PPP and toll charging scheme (1990-2000) produced a slight increase in all DC in terms of population, socioeconomic and land use characteristics. As for the transportation changes, DC 1, 2 and 4 decreased, whereas DC 3 had a huge increase. In that period, the introduction of the toll system (concession of the PDH) altered the traffic behavior, which may have resulted in the modification of development patterns. However, after the implementation of this policy, this development pattern was altered. In those areas nearby the toll plazas, drastic changes in terms of growth were observed, generating the transference of development previously observed in DC 2 and 3 to the DC 1 and 4. Moreover, the travel demand in between the toll gate plazas increased considerably, which indicates that short-distance trips became more cost effective because there was no additional charging for those trips. Simultaneously, socioeconomic indicators demonstrated a sharp decrease in activities especially in DC 2 and 3, which is mainly due to the increase in the perceived additional costs (toll fees). This pattern was expected considering the Brazilian reality in which users are very sensitive to total travel costs. Initially, this has contributed to reducing the travel demand in the PDH, which is misleading because the upgrade of roading conditions such as regular maintenance reduce the vehicle operational costs and also travel time. This typical reaction of road users has been confirmed by other researchers *(24) (25)*.

Analysing the PDH highway traffic pattern and the changes in population, socioeconomic and land use characteristics of the cities along the highway, we can verify that there is a strong relationship among the factors. Generally, it is clear that before the infrastructure policy (concession of the PDH) there was a growth tendency without limits for all activity-highway system factors. Near the metropolitan areas, possibly the main conditions encouraging this development pattern and creating conditions for increasing in goods and people movement as well as a large variety of activities were the low level of transportation costs (provided a high standard of accessibility) and land use (or property) values.

Future development tendencies with the implementation of toll plazas

Long term prospects considering the current location of toll plazas indicate that future developments will reach saturation. Probably, there will be the relocation of new activities just beyond the boundaries of the toll gate areas in terms of activities and transportation capacity in the areas of DC 2 and 3, because transportation costs and land use values will increase considerably in the areas of the DC 1 and 4.

Clearly, a continuous cycle of development is observed, i.e., improvement (policy) in the transport infrastructure alters the land use pattern (activities location and density) that consequently affects the travel demand and influences the flow density and transport costs. Gradually, transport costs modify the land use values, which affect the land use patterns up to a point that infrastructure has to be upgraded in order to cope with a new spatial arrangement of activities and spatial interactions.

CONCLUSIONS

This paper analyzed the dynamic interactions between transportation and activity systems subject to policy interventions in the PDH. As policy interventions produce impacts not only to the transportation system but also to society, economy and the environment, we have conducted a diagnosis of the changes over time in the PDH region. We focused on understanding the evolutionary patterns and tendencies; instead of producing a detailed

operational assessment of the impacts of a specific intervention (e.g. implementation of toll plazas).

The infrastructure policy interventions have produced short, medium and long term impacts as the result of a continuous cycle of development over time. Interventions trigger changes in land use patterns (activities, location and density), socioeconomic and demographic indicators as well as operational conditions of the highway. The changes and their complex interrelationships were only perceived because the analysis was based upon a time-series database, otherwise only operational changes could be detected. It is verified that policy interventions will always create massive short-term benefits to the metropolitan regions (Rio de Janeiro and Sao Paulo), but in the medium and long-terms development tends to be localized in specific parts of the study region, depending on economic drivers and/or additional costs (toll fees).

Based on the understanding of the development cycle in the PDH region, the recent implementation of the tolling system through a PPP scheme was assessed. It is concluded that the tolling system may create negative impacts in terms of initial limitations to development in all respects due to the increase in direct (user perceived) transport costs. The charging system may also result in saturation (land use and transportation) of those areas in between toll plazas.

Further studies should be conducted in order to enrich the knowledge about highway projects and their impacts. Below, a suggestion list for future research is presented:

- Any change in the infrastructure policy should be made considering all the aspects related to economic, political and social issues and not only the highway operational reality. Also it is advisable that changes should be conducted according to a national strategic plan, which defines objectives, steps and efficiency measures that reflect on welfare of the nation;

- During the conduction of the case study, several difficulties were faced in organizing the database for the study region. It is imperative that planning agencies at all levels dedicate more effort to creating a unified data standard and collection process that will eventually contribute to form a data warehouse. This will be crucial to developing further studies and reaching new findings; and

- Create instruments to predict development scenarios based on initial estimates of population and economic growth in the region of the highway project. Such an instrument has to comprise of the spatial and temporal dynamic of all the involved variables. Currently, such an approach is not observed in the literature of transport-land use modeling.

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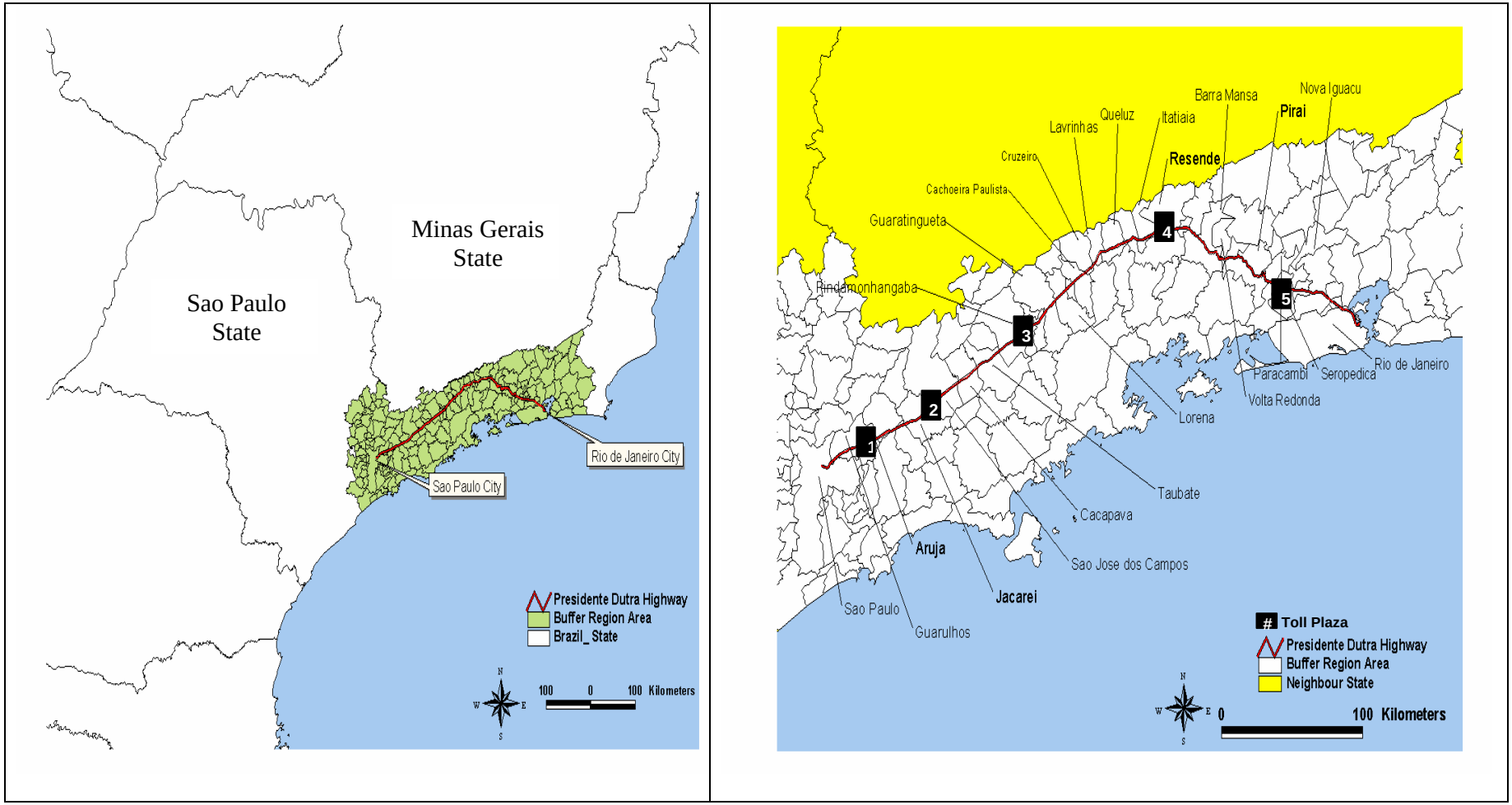

FIGURE 1 Study Region

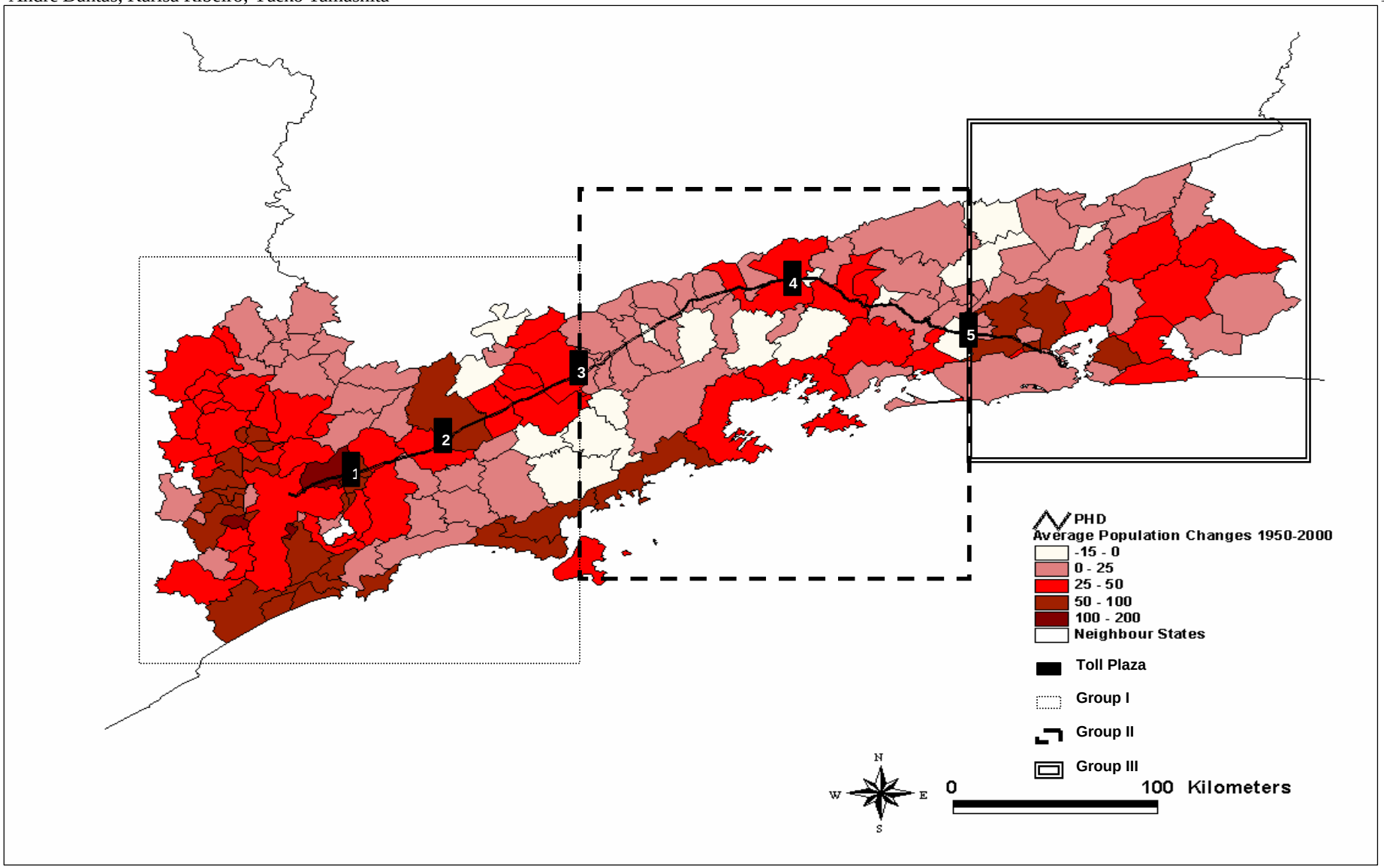

FIGURE 2 Population change groups

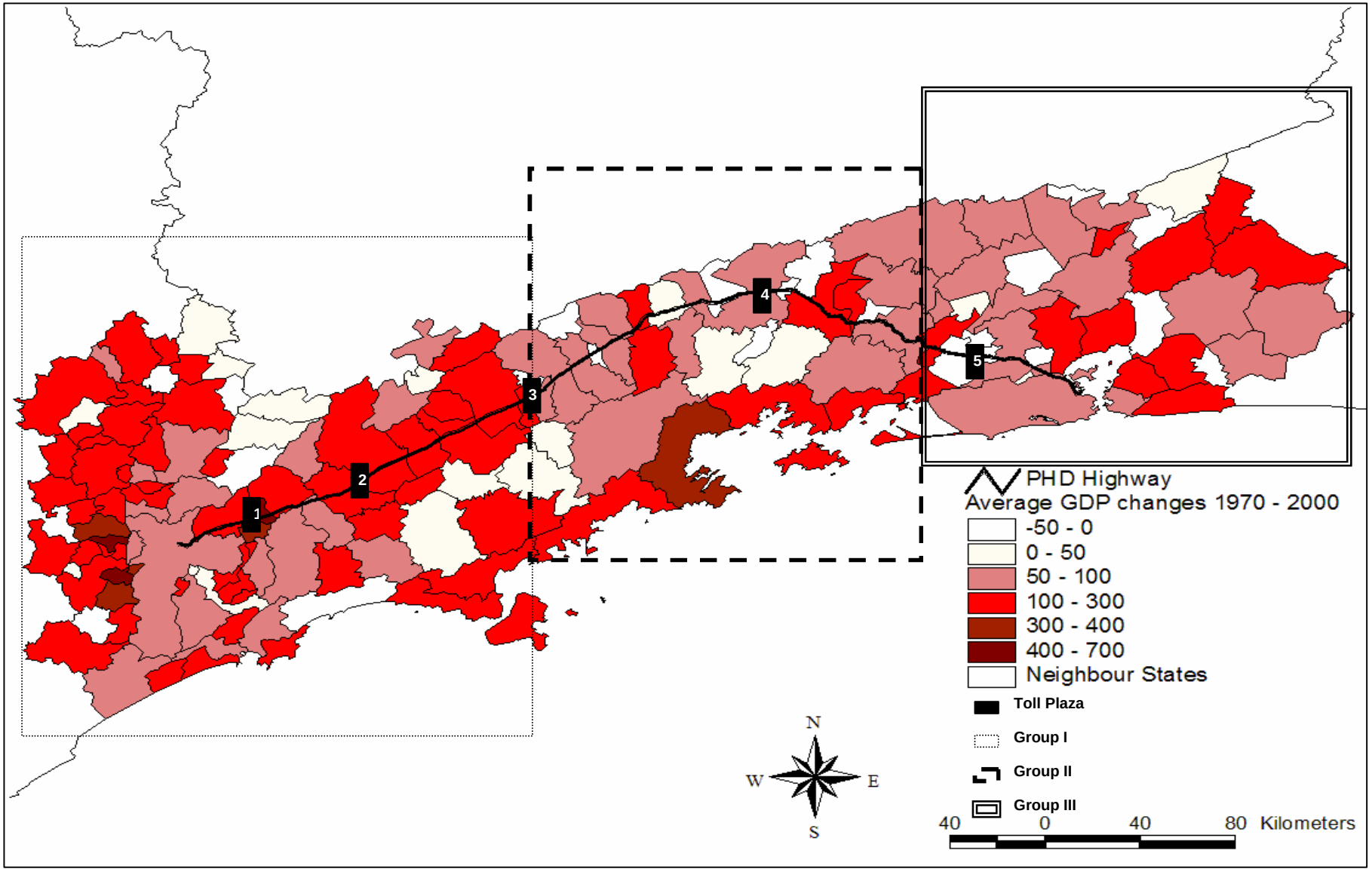

FIGURE 3 GDP change groups

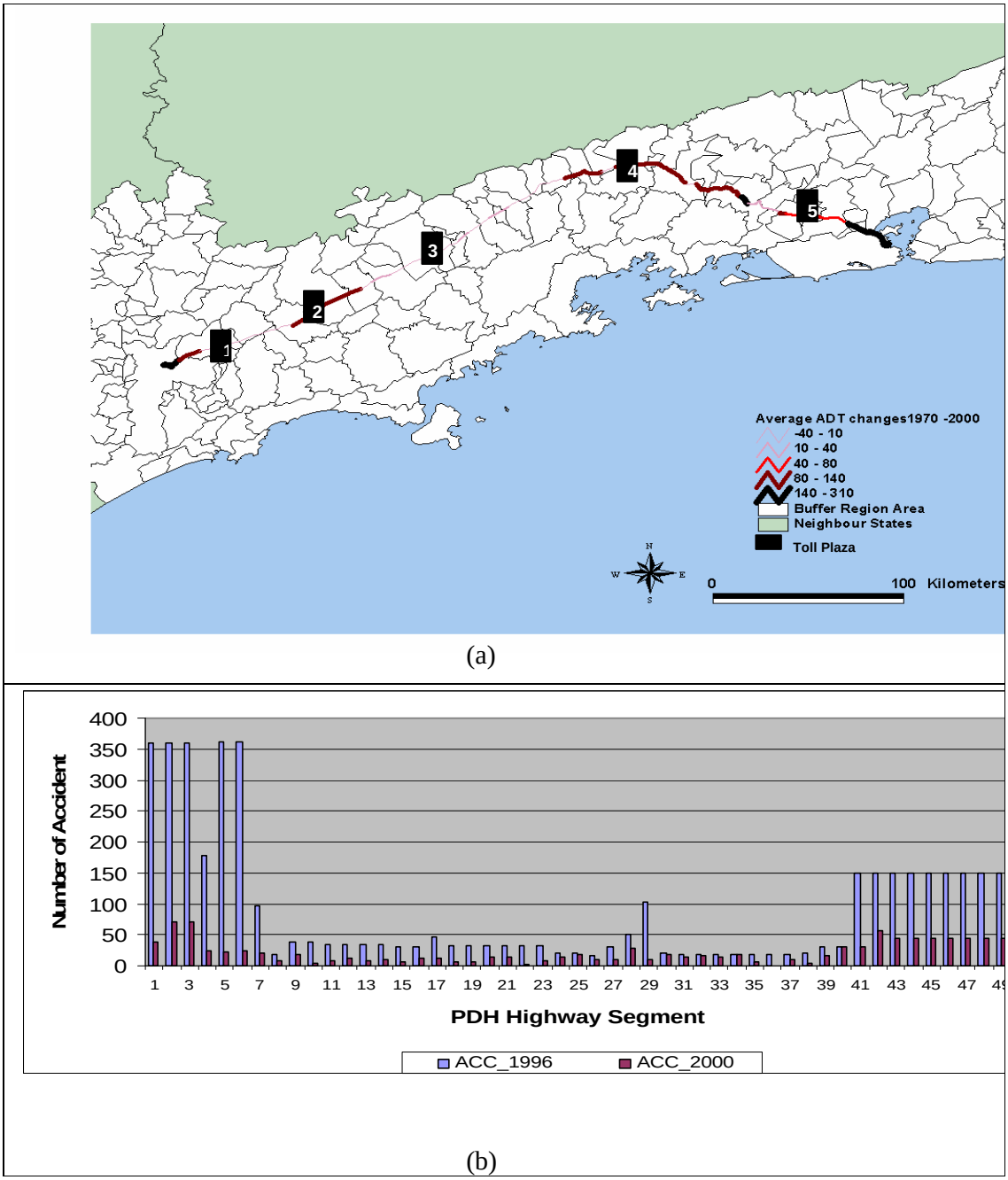

FIGURE 4 ADT changes average 1970-2000 (a) spatial distribution (b) profile per segment per period

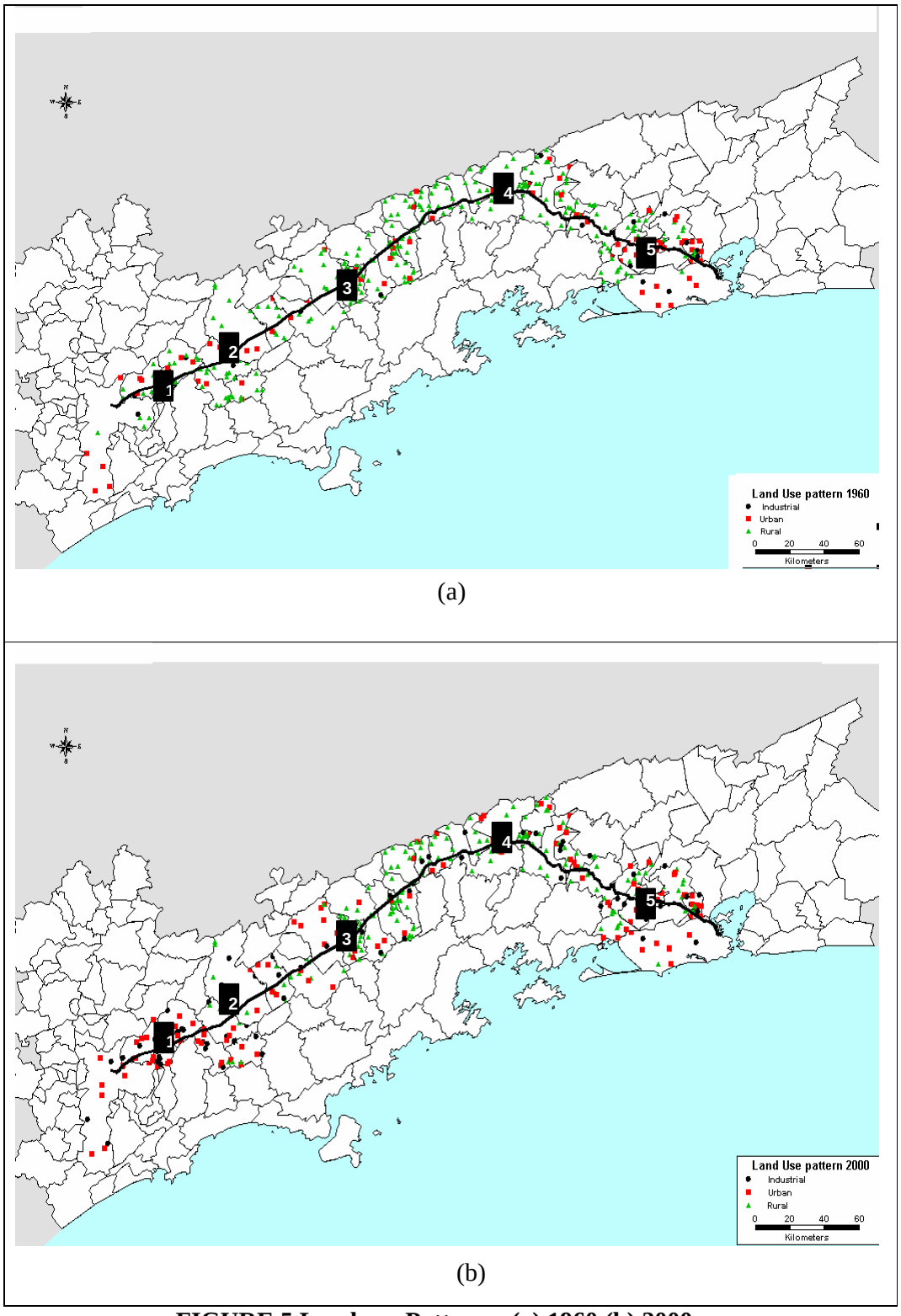

FIGURE 5 Land use Patterns: (a) 1960 (b) 2000

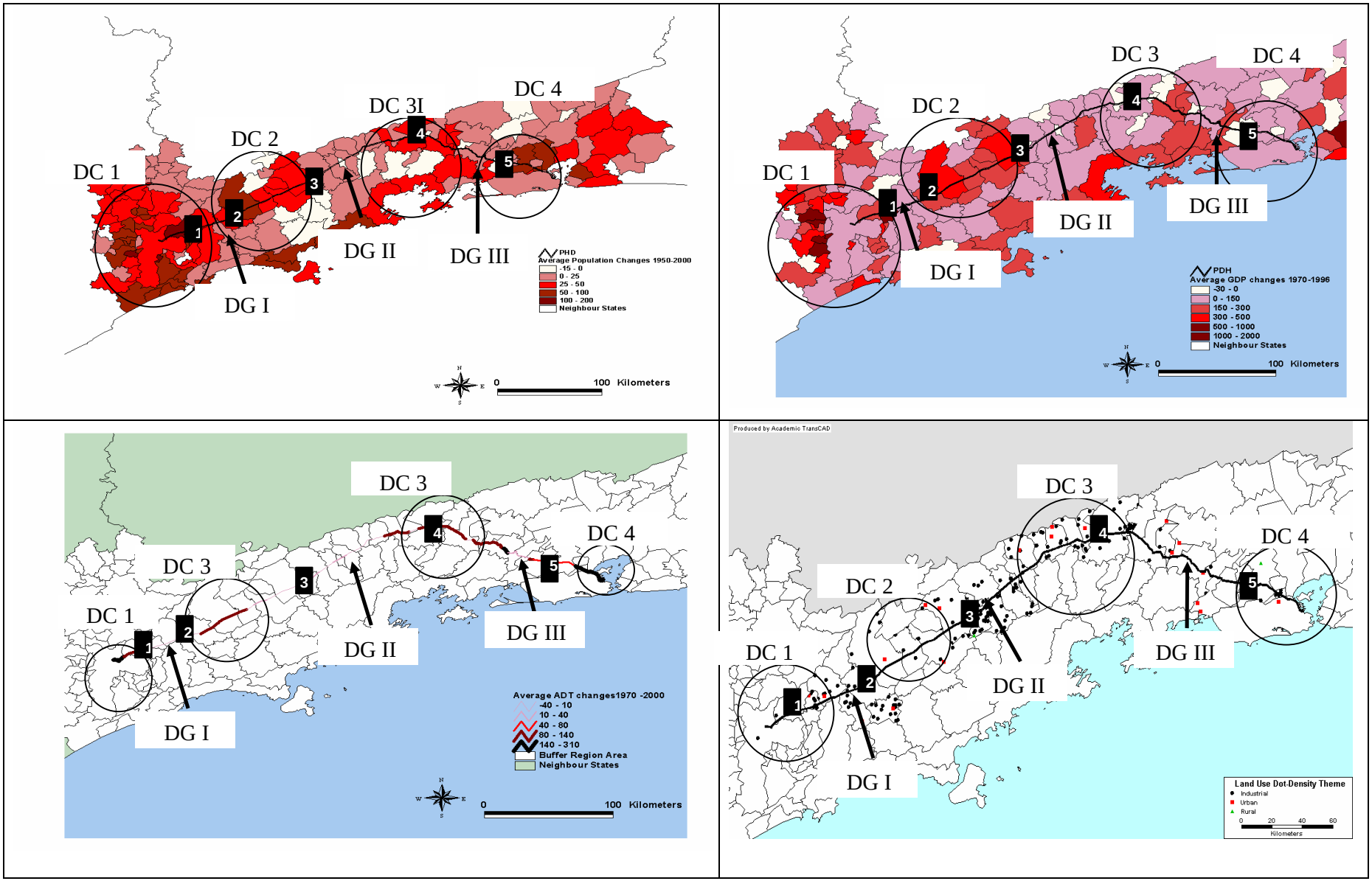

FIGURE 6 Outstanding changes along the PDH: (a) Population; (b) GDP; (c) ADT; and (d) Land Use

TABLE 1 Demographic, Socioeconomic and Land use change rates per group of cities along the PDH

	Cities	Population Change (%) 1970-80	Population Change (%) 1980-90	Population Change (%) 1990-2000	GDP Change (%) 1970-80	GDP Change (%) 1980-96	Industrial LU Change (%) 1960-90	Industrial LU Change (%) 1990-2000	Urban LU Change (%) 1960-90	Urban LU Change (%) 1990-2000	Rural LU Change (%) 1960-90	Rural LU Change (%) 1960-90
Group I	Sao Paulo	43	14	8	98	34	200	17	43	20	-64	-74
	Guarulhos	124	48	36	293	33	400	-20	60	40	-86	-100
	Aruja	83	114	47	724	119	700	0	400	20	-88	-100
Group II	Jacarei	89	42	17	207	40	100	200	400	-40	-64	33
	Sao Jose dos Campos	94	44	22	366	40	900	-40	40	0	-47	0
	Cacapava	67	29	14	101	132	300	40	100	100	-29	-33
	Taubate	43	22	18	192	124	100	0	400	-40	-43	40
	Pindamonhagaba	44	47	23	414	0	300	-40	400	60	-64	-67
Group III	Itatiaia	0	0	44	0	0	300	-40	300	-24	-43	40
	Resende	31	4	14	136	39	400	-67	200	-67	-43	100
	Barra Mansa	42	11	-1	137	69	400	-67	100	-33	-40	74
	Volta redonda	47	20	10	232	28	400	20	67	20	-38	-20
Group IV	Nova Iguacu	41	19	-29	90	26	100	0	-33	0	8	0
	Sao Joao de Meriti	32	7	6	76	77	100	300	133	-29	-69	-40
	Rio de Janeiro	20	8	7	93	27	0	100	100	0	-64	-40

TABLE 2 – Changes in operational conditions of PDH per highway segment

	PDH highway segments	ADT Change (%) 1970-80	ADT Change (%) 1980-96	ADT Change (%) 1996-2000	Accidents Change (%) 1980-96	Accidents Change (%) 1996-2000
Group I	Sao Paulo	67	77	39	322	-89
	Guarulhos	67	38	2	1022	-80
	Guarulhos/Aruja	67	-17	-49	1097	-80
	Aruja/Santa Isabel/Jacarei	63	-6	-32	790	-86
Group II	Jacarei/Sao Jose dos Campos	86	-60	142	1710	-94
	Sao Jose dos Campos/cacapava	86	-60	142	1710	-93
	Cacapava	36	-44	28	384	-79
	Cacapava/Taubate	36	-44	49	-4	-48
	Taubate/Pindamonhagaba	36	-44	30	104	-44
	Pindamonhagaba/ Roseira	11	-33	-16	0	-87
Group III	Resende	44	48	-2	60	-91
	Resende/Itatiaia	44	48	-2	60	-74
	Itatiaia	-36	48	0	0	-24
	Resende	-36	48	0	33	-10
	Resende	44	48	4	13	-34
	Barra Mansa	44	48	4	43	-67
	Barra Mansa	44	48	4	138	-42
	Barra Mansa	44	48	4	160	-89
Group IV	Barra Mansa/ Volta Redonda	169	-16	4	33	-10
	Seropedica	48	46	-9	20	-94
	Seropedica Queimados	4	46	-9	20	-39
	Queimados	31	46	-9	33	-74
	Nova Iguacu	4	46	-9	40	-47
	Nova Iguacu	4	46	-9	40	0
	Nova Iguacu/ Belford Roxo	79	12	66	640	-80
	Sao Joao de Meriti	79	12	66	329	-62
	Sao Joao de Meriti/Rio de Janeiro	44	30	66	329	-70
	Rio de Janeiro	87	30	66	233	-70
	Rio de Janeiro	79	12	66	329	-70