15. Environmental Analysis on Urban Transportation Problem of Developing Countries Arising from Model Reference Adaptive Theory

モデル規範適応理論に基づく途上国の都市交通問題の環境分析

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ABSTRACT; World trends of urban population growth are already high, but motorization growth trends are much worse. In developing countries motorization is not only high, but also its rate is uncontrollably high, reaching rate over 10% per year.　During the traffic jams, general average speed of all the vehicles is kept slow that the emissions of pollutant gases are evidences to be much higher than in a kilometer per person basis. Motorization tends are truly astonishing but also here the income-level distribution plays a key role in developing countries. The present study investigates features of sustainable transportation environment and future prospects for the adaptation policies of developing countries based upon Model Reference Adaptive Theory. In the case of La Paz City, Bolivia, the income-level distribution has a great influence on daily life citizens. The number of vehicles that cross each of the network on each peak period for each income level and trip purpose is estimated using GIS. The buses would provide service for the most congested routes and the current vehicles would feed the big buses system. Through this adaptive policy , the congestion would be significant reduced.

KEYWORDS; Urban transport environment, Developing countries, La Paz, Bolivia, Model reference adaptive theory

1 Introduction

Recounting the recent world trends of urban population growth and high motorization, the rule of responsibility of reference science are becoming increasingly more important. Yet actually, the government and people of world as well as companies are in great bewilderment as how, cope with these worldwide growth of urban population and motorization.

There is the urgent need for government, the people and companies of world to work together in the attempt to cope with these great worldwide environmental changes. It is required of all nations

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to try cope with various demands from each nation, and in line with that each nation should, voluntarily, promote the equilibrium between the development and environment.

Stated in detail, it is necessary to investigate the equilibrium between the development based an efficiency and stability in scientifically and the sustainable based on the reasonable value decision criteria (Yamamura,1999). What we intend to seek the sustainable environment based on the reasonable value decision criteria. It is therefore very important to investigate a number of paths which converge the sustainable environment and in investigate the adaptation policies of the system and its stability of motorization in developing countries. The present study investigates features of sustainable transportation environment and future prospects for the adaptation policies of developing countries based upon Model reference Adaptive Theory. In the case of La Paz City, Bolivia ,the income-level distribution has a great influence on daily life of the citizens. The number of vehicles that cross each node of the network on each peak period for each income level and trip purpose is estimated using GIS. The buses would provide service for the most congested routes and the current vehicles would feed the big buses system. Though this adaptive policy, the congestion would be significant reduced.

2 Model Reference Adaptive Model

What we intend to seek is the sustainable environment based on the reasonable value decision criteria. It is therefore very important to investigate a number of paths which converge the sustainable environment and investigate the adaptation policies of the systems and its stability based on Model Reference Adaptive Theory (Yamamura,1983,1985,1986,1989a,1989b,1990,1991a,1991b,1992a, 1992b,1993, 1998, 1999; Yamamura and Thirumurthy, 1996).

This model takes the sustainable environment that is based on the reasonable value decision criteria as a reference model and the actual environment as adjustable model.

According to the comparison of these two environments, these are four models of adaptation of the actual environment to the sustainable environment.

The primary model is a parallel model. this model considers the adaptation policy how which is adaptable environment in the environment by direct comparison between the two environments.

The second model is a series model. This model introduces a reasonable environment standard into the actual environment straightway, and in this model, considers the adaptation policy how which is adaptable to sustainable environment in the actual environment. The actual environment faces rapid collapse, and in this model, the stabilizing of actual environment must be immediately attempted by the introduction of reasonable value decision criteria.

The parallel series and series parallel models are in the middle of above-mentioned models.

The third model is parallels-series model. This model is based on the correction of adaptation policy with the maximization of development and environment by the sustainable environment. Moreover, this model is the case of adaptation's being possible to the sustainable environment into the actual environment with either adaptation policy with the maximization of development or

environment.

The fourth model is a series parallel model. In this model, both adaptation policies with the maximization of development and environment are defined as unstable. Moreover, this model is in the case of adaptation's being possible to the sustainable environment into the actual environment with both adaptation policies with the maximization of development and environment.

It is important to note that that the actual environment is to become the effective circulation when thinking of adaptation policies by these model.

Ineffective circulation criteria and environment can be follows (Fujikawa, 1994).

An illogical environment arises due the illogical value decision criteria. Within the context of such an environment, pride of residents is infringed, hate engendered, and nice ultimately rampant Moreover, it becomes like masochism and offensive with the in crease of mutual distrust, and extol environment becomes a disequilibrium and non-efficiency with the increase of sick and crime.

As the conditions of ineffective circulation are amplified the illogical value decision criteria became increasingly unreasonable.

Effective circulation criteria can be defined as follows. A reasonable environment develops based on reasonable value decision criteria. Within the context of this environments, the pride of nurtured, the internal environment stabilized. Moreover, through the establishment of mutual trust between the stabilization and the efficiency, it also possible to stabilize and improve the efficiency of the external environment.

A homeostasis maintenance mechanism with all creatures deeps the internal environment of residents under constant environments conditions. the internal environment maintains an equilibrium state, and is unified by government systems, which together maintain the harmony of each section of government and the interconnection between sections, and there by allow for value decision criteria in this place, the basis having to do with the recognition of interaction to development of environment.

3 Urban Transportation Analysis of Developing Countries

Among all income level groups, the middle-income ones are probably the ones with higher motorizations rates. In developing countries, they usually acquire second-hand cars that are much cheaper, but at the same time with inferior safety or environmental protection conditions. Motorization of the low-income classes is characterized by much worse quality of the cars acquired; they unsafe and with polluting conditions.

Income-level distribution has been included as part of several transportation network analysis approaches; such as part of the concepts discussed for the person movement research; consideration as part of the statistical approaches towards household location modeling; the income level distribution as part of the travel patterns for urban residents; one among other possible variables to use for the initial statistical analysis; income level as one of the concerned variables during the transportation planning. But none of the authors mentioned above included it further than for initial review or basic statistics approaches.

A deeper concern about other social classification variables like the race has lead other approaches such as a deep review on the impacts of transportation on different races; an analysis of the transportation situation for African Americans in Atlanta; the racial influence upon workplace and residential location; the need for deeper concern about different racial groups in the transportation planning process.

Another social variable to which a special concern has been applied is the gender, especially trying to show the privileges of men over women.

Some authors deepened more in the influence of income on transportation, especially in the sociological aspects, and mainly for the low-income groups; the growing poverty in the cities, and the need for special transportation programs headed for these people; a study about the different employment levels and their influence upon the daily transportation; a research about the travel patterns and how they express the truthfulness or not of the democratic political systems; the problems and disadvantages of population groups that could not be able to afford a car in car-oriented cities focused on the characteristics of the daily trips for people with low-incomes and minority groups.

Most of the works mentioned above, either with concern about income-level, race or gender, focused their attention in the initial steps of the analysis or on the sociological concerns. None of them included an OD matrix estimation based upon those parameters, and even further was the use of them for a network simulation. Also when the income level is taken in consideration, focus is done on poor income levels and no approach considers them all in the same proportion. The present study included the consideration of all income levels during all the analysis phases: the data collection, the statistical analysis, the OD matrices estimation and the network simulation.

The income level distribution was used in order to choose representative households in order to perform the trip survey. The data collection revealed an interesting particularity in La Paz City; the high-income level families prefer to live in the lower parts in the city, which is opposite to the common preference to live in the lower parts in the city, which is opposite to the common preference to lice in the higher parts. A qualitative review shows the environmental conditions influence, being much warmer and comfortable in the lower parts of the city, and therefore more attractive for living.

As a first step in the analysis, as part of the verification of the income level distribution influence upon the population's life, a statistical analysis of several socio-economic parameters included in the survey's questionnaire was performed. Remarkable statistical dependence was found for most of the parameters as it was expected from the qualitative research.

Trip attractions of each zone were analyzed according to the income level distribution and the main trip purposes and they revealed a remarkable difference among different income levels. School trips for example, with the low-income students attending schools more in the northern part of the city, while high-income students attend them in the southern parts of the city. Again the qualitative research, explained that most of the private schools are located in the southern parts of the city, where not only a better environmental conditions allow better comfort for the open areas, but also it is closer

to most students houses. The works trips attractions revealed a fascinating coincidence between the low high-income level workers, where the qualitative research revealed the difference between worker and owner of the businesses where they work together.

The matrices estimation was performed utilizing the nested tramsportation analysis, joining through in the influence of the income-level distribution, the trip purposes, the means of transportation and the period of the day during which the trips are performed.

Particularly for La Paz City, in the first simulation several network nodes displayed the great congestion generated. Though a simple policy measure, rather than an advanced expensive technology, proved in the simulation to be a very effective in reducing congestion.

The measure consists in introducing buses to complement the service that currently provide vehicles of several sizes that travel all along the city. The buses would provide service for the most congested routes and the current vehicles would feed the big buses system. Though this policy, no drivers would loose their jobs, the service will still have a wide range as it has now, but the congestion would be significantly reduced.

4 Conclusion

As a conclusion of La Paz analysis, a transportation improvement is proposed and its application was simulated. Rather than a technology intensive and highly expensive solution, a change of patterns and synchronization of services is proposed. Applying in reality this proposal would have no social cost for the drivers and consequently the power of drivers' syndicates wouldn't be threat. Also there wouldn't be a high price impact for the users and the coverage of the whole service would still be as extended as it is now.

As a global conclusion, the income level distribution proved to be a parameter of extensive impact. Taking it into such a consideration, allowed a deep interrelation between them. Nested transportation analysis, the tool that possible the introduction for the income distribution, proved to be a powerful tool for the combination of qualitative and quantitative analysis.

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