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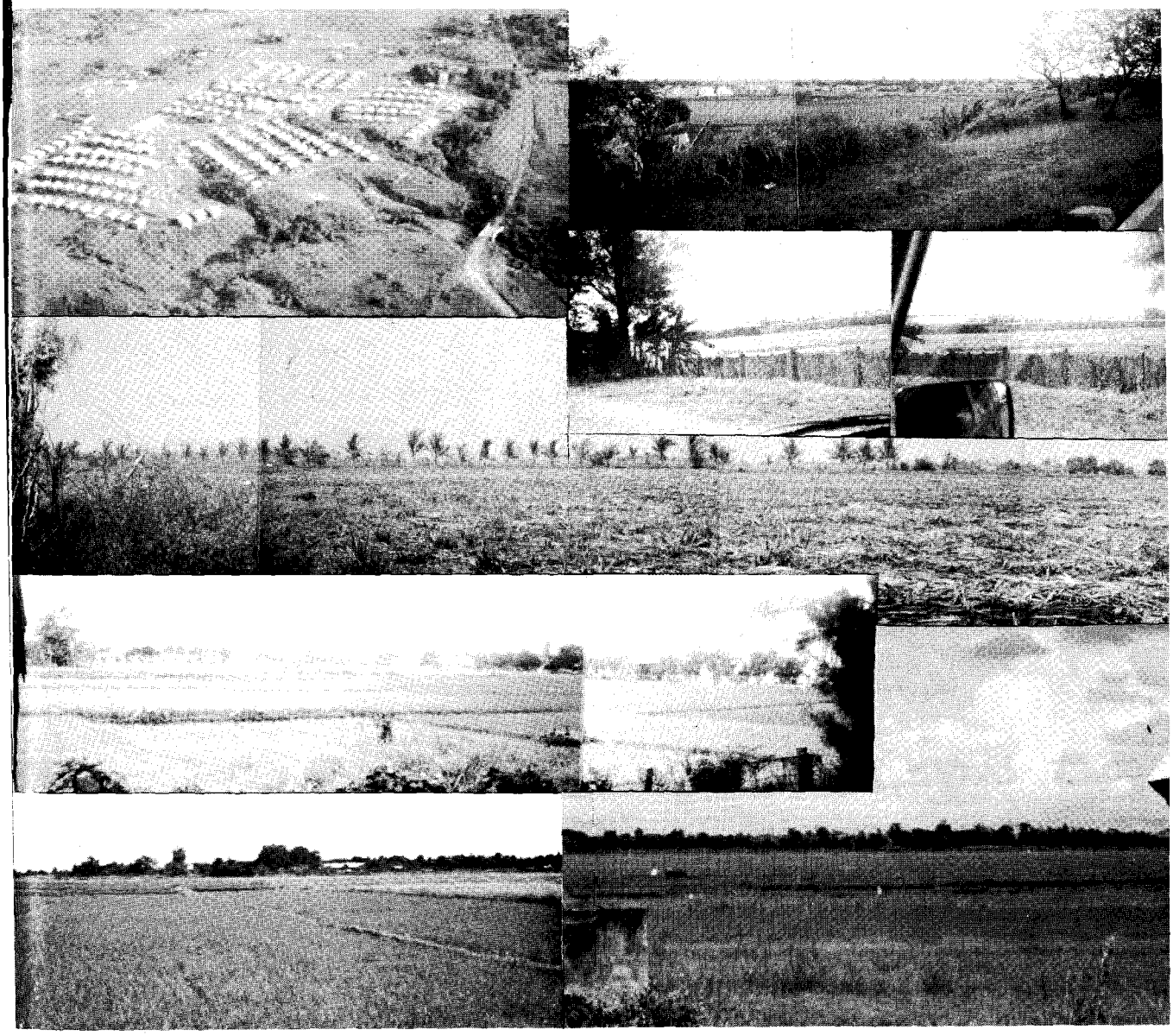

LAND USE CONVERSION

PHILIPPINE PLANNING JOURNAL

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TOWARDS AN EFFECTIVE LAND USE CONVERSION POLICY FOR SUSTAINABLE DEVELOPMENT

Gerardo S. Calabia

1.0 INTRODUCTION

The formulation of a rational land use conversion policy for sustainable development requires that consideration be given to certain key elements. Among these are the articulation of unified goals and priorities approach to land use conversion; the methods of analysis for a better understanding of the problem; and the implementation mechanism for carrying out the policy. There is a need to link land use conversion not only with physical-framework and detailed land use planning but with environmental management. It is within this context that the existing Department of Agrarian Reform (DAR) land use conversion policies and implementing rules and regulations are reviewed and critically analyzed in this study. The key elements are then presented, and the practical and methodological problems involved in formulating an effective land use conversion policy and program are discussed.

The lack of a unified goal/objective of the land use conversion policy has generally been attributed to the varying perceptions of its stakeholders such as the affected farmers, tiller-occupants, land developers and general public, as well as to the absence of techniques for the analysis of the complex problems of land use conversion. It is in response to this identified gap that the alternative methods of analyzing the land use conversion problems and the means by which conversion is inextricably linked with the comprehensive physical planning and environmental management is discussed in detail in this study. The existing mechanism and the specific measures for implementing land use conversion are critically examined and the directions for its improvement are presented.

This study focuses on the DAR land use conversion activities which took place during the post-Marcos or President Corazon C. Aquino's administration and partly during the administration of the incumbent President, Fidel V. Ramos. It was during the Aquino administration which adopted agrarian reform as an anchor program, that the problem of agricultural land use conversion became a critical national issue. The **Department of Agrarian Reform (DAR)** which has the mandate to approve/disapprove petitions for agricultural land use conversion experienced a series of leadership crises involving no less than four major changes in its top leadership within a span of six years. These may have directly or indirectly influenced the exercise of this agency's major mandate.

1.1 EVOLUTION OF DAR LAND USE CONVERSION POLICIES

The DAR land use conversion policies appear to have evolved from the following circumstances: **firstly,** from the reactions to the efforts of some landowners, especially absentee landlords to circumvent the agrarian reform laws under the guise of land use conversion. This reaction, however, also took cognizance of the need to provide space in these areas for residential, commercial, industrial and related non-agricultural land use purposes; **secondly,** the attempt to institutionalize the land use conversion function through an inter-agency arrangement for the processing, evaluation and approval/ disapproval of petitions for conversion; and **lastly,** the recent efforts to link the conversion activity with the broad socio-economic planning and indicative framework planning and land use planning at the national, regional and provincial levels,

The author is indebted to Prof. Asteya M. Santiago for editing the draft of the paper and for helpful comments and suggestions. However, the responsibility for ideas and errors contained in this article lies entirely with the author.

respectively. The various stages in the evolution of this DAR function has been covered by the appropriate legislation, presidential issuances and DAR administrative and other orders. These legal issuances affirm the authority of the DAR to approve or disapprove the conversion of agricultural land into residential, commercial, industrial and other land uses.

The agricultural conversion problem is not a recent phenomenon. However, the issue caught public attention only when landowners started to break up their landed estates into smaller parcels and create residential subdivisions in order to evade the implementation of Republic Act (RA) No. 3844, otherwise known as the **"Agricultural Land Reform Code of 1963".** To rectify the situation, subsequent amendatory laws and policy measures in the seventies prescribed penalties for the unlawful ejectment of tenants and lessees of corn and ricelands.

In order to implement its land use conversion function, the DAR on May 13, 1979, entered into a **joint Memorandum of Agreement** with the then **Ministry of Local Government and Community Development (MLGCD),** (now called **Department of Interior and Local Government (DILG));** and the then **Ministry of Human Settlements (MHS),** whose regulatory arm, the **Human Settlements Regulatory Commission (HSRC)** is the predecessor of the present **Housing and Land Use Regulatory Board (HLURB).** The three government agencies jointly promulgated a set of rules and regulations governing the conversion of agricultural lands into non-agricultural uses. This joint agreement recognized the lead role of the DAR in land use conversion. For the first time, it also extended the coverage of land use conversion regulations to all kinds of agricultural lands (U.P. PLANADES Report, 1990).

With the adoption of agrarian reform as the "centerpiece program" of the Aquino administration, the mechanics for land use conversion were covered in a sucession of administrative and general orders issued by the four former DAR Secretaries. These were the following:

1. Administrative Order (AO) No. 15 entitled **"Rules and Procedures Governing Conversion of Agricultural Lands to Non-Agricultural Uses"**, issued by Secretary Philip Juico on December 5, 1988;

2. AO. No. 15 entitled **"Procedures for Conversion of Untenanted Lands Located within Non-Agricultural Zones as Embodied in the Land Use Plans of Cities /Municipalities",** issued by Secretary Miriam Defensor Santiago on November 6, 1989;

3. AO. No. 16 entitled **"Rules and Regulations Governing Cutting of Coconut Trees and/or Change in Use of Lands Primarily Devoted to Coconuts",** issued by Secretary Miriam Defensor Santiago on November 6, 1989;

4. General Order (G.O.) No. 1 entitled **"Declaring Certain Agricultural Lands as Converted to Non-Agricultural Uses and Prescribing the Procedural Requirements Therefrom",** issued by Secretary Miriam Defensor Santiago on November 26, 1989;

5. AO. No. 18 entitled **"Revised Rules and Procedures Governing Conversion of Private Agricultural Lands to Non-Agricultural Uses",** issued by Secretary Miriam Defensor Santiago on December 14, 1989;

6. AO No. 1 entitled **"Revised Rules and Regulations Governing Conversion of Private Agricultural Lands to Non-Agricultural Uses"**, issued by Secretary Florencio B. Abad on March 22, 1990,

7. AO No. 2 entitled **"Rules and Procedures Governing the Processing and Approval of Applications for Land Use Conversion"**, issued by Secretary Florencio B. Abad on March 22, 1990; and

8. AO No. 5 entitled **"Clarificatory Guidelines and Amendments to AO No.9, Series of 1990"**, issued by Secretary Benjamin Leong on April 6, 1992.

The land use conversion rules and regulations covered in these orders sought to implement the broad legal mandate of several legal directives. These were RA 6657, dated June 15, 1988 which established the **Comprehensive Agrarian Reform Program (CARP)** of the **Aquino Administration; Executive Order (EO) No. 229** which provided the mechanism for the implementation of the CARP, dated July 22, 1987; **and EO No. 129-A** which modified EO No. 129, and reorganized and strengthened DAR dated July 26, 1987. In addition to reiterating their earlier concern for preventing the circumvention of the Agrarian Land Reform law, they also sought to promote the optimum use of agricultural land. More specifically, they intended to carry out the following mandates of the DAR:

a. **"To approve and disapprove applications for conversion, the restructuring, readjustment of agricultural lands to non-agricultural uses..."** (Section 4(K), E.O. No. 129-A, Series of 1987).

b. **"... to approve or disapprove applications for conversion of agricultural lands for residential, commercial, industrial and other purposes as may be provided for by law"** (Section 5(1), E.O. 129-A); and

c. **"... authorize the reclassification or conversion of land and its disposition"**, subject to the conditions embodied in Section 65 of RA 6657.

In essence, the changes introduced during the Aquino administration not only strengthened the authority of the DAR over land use conversion. They also expanded the coverage of the rules and regulations to link up land use conversion with local land use planning, including the exercise by the Housing and Land Use Regulatory Board (HLRB) of its function to issue development permits and industrial location clearances. This shift in perspective has taken into account the environmental/ ecological and broad socio - economic development considerations in making land use conversion decisions.

The Ramos Presidency has not only retained its support for the agrarian reform program of the Marcos and the Aquino administration. Through the **National Economic and Development Authority (NEDA)** and its **National Land Use Committee (NLUC)**, it has intensified its efforts toward the formulation of a **National Land Use Code** whereby land use conversion

issues and problems are addressed more decisively. An example of this is the issuance by the new DAR Secretary of AO No. 7 dated November 5, 1992 entitled **"Amendments to AO No. 8 Series of 1990"** which seeks to effect a more judicious action on all land use conversion applications.

1.2 SITUATIONS WHERE AGRICULTURAL LAND USE CONVERSIONS MAY BE ALLOWED BY THE DAR

The various situations under the existing **AOs, GOs and Joint Orders** where land use conversion from agricultural to residential, commercial, industrial and other land uses may be allowed are summarized in Table 1.

As may be gleaned from the table, the formulation of the conversion rules and regulations had gone through a trial and error process whereby certain rules/regulations were emphasized in the earlier AOs and GOs and then deleted afterwards for various reasons such as their impracticality and difficulty of enforcement. Eventually, the DAR narrowed down the scenario to three major situations where the conversion of lands devoted to or suitable for agriculture into non-agricultural uses may be allowed. (see Table 1)

1. **"When the land has been found to be no longer economically feasible and sound for agricultural purposes as certified by the Regional Director of the Department of Agriculture (DA) or the land or locality has become highly urbanized, and the land will have a greater economic value for residential, commercial or industrial purposes as certified by the Deputized Zoning Administrator of the HLRB".** This major criterion consistently appeared in AO 15 issued by former DAR Secretary Philip Juico and re-issued by former Secretary Miriam Defensor Santiago; repeated in AOs 18 and 1 issued by Secretaries Santiago and Florencio Abad, respectively.

2. **"When lands are classified as commercial, industrial and residential in the new or revised town plans approved by Inter-Agency Planning Task Forces Organized by the HLRB with the participation of the DA, the DAR, the NEDA, DENR, the DTI and in applicable cases, the DOT. In the town planning process, the communities effected and the concerned NGOs shall be involved".** This criterion originated from the DOJ opinion made in response to the former DAR Secretary Santiago's call for **"automatic land use conversion."** Under this concept, wherein applications for conversion were approved where lands were located in the commercial, industrial or residential zones of land use plans approved by HLRB prior to June 15, 1988. June 15, 1988 was the date of the effectivity of **RA 6657** or the **Comprehensive Agrarian Reform Law (CARL).** This original criterion was later modified in view of what were observed as the deficiency of some of the earlier formulated town plans. There was also the notion by the DAR decision makers that the new plans prepared following the HLRB

(continued on page 10)

TABLE 1. SITUATIONS WHERE LAND CONVERSION FROM AGRICULTURAL TO NON-AGRICULTURAL USE MAY BE ALLOWED

DAR Administrative or General Order	A. Where Application Complies with HLRB-approved Town Plan	B. Where Application does not conform with HLRB-approved Town Plan	C. Where there is no Land Use Plan and Zoning Ord. or Plan is not HLRB approved	D. Where Land has already been awarded under CARP and other situations
1.Administrative Order No. 15 entitled "Rules and Procedures Governing the Conversion of Agricultural Lands to Non-Agricultural Uses." Issued by Secretary Philip Juico on December 5, 1988	Proposed use conforms with the land use plan or the town development plan approved by the HLRB (Para. IV-A)	1. Land is intended for a housing or industrial project of the Government or is a joint venture (private-government) low-cost housing or industrial project. If for industrial purposes, locational clearance has to be issued by HLRB; or 2. Land has ceased to be economically viable and sound for agricultural purposes, supported by a written report and recommendation of the Department of Agriculture; or 3. Locality has become urbanized and the land will have a greater economic value for residential, commercial, industrial or memorial park purposes. The requirements of 1, 2 and 3 are: 1) approval through an ordinance of local council approved by the HLRB and 2) in a referendum by the inhabitants/ communities directly affected	Proposed use is similar to or compatible with the dominant use of the surrounding areas. Requirement: 1. Approval through an ordinance approved by HLRB and 2. Consent in a referendum by inhabitants directly affected	1. Land has ceased to be economically viable and agriculturally productive, or 2. Locality has become urbanized and land will have a greater economic value for residential, commercial or industrial purposes, provided that in 1 and 2 a) Obligation has been fully paid (Sec. 65, RA 6657) and b) Five years have elapsed, from award

2. Administrative Order No. 15 entitled "Procedures for the Conversion of Untenanted Lands located within the Non-agricultural Zones as Embodied in the Land Use Plans of Cities/Municipalities Issued by Secretary Miriam Santiago on November 6, 1989	1. Land is untenanted and located within the residential, commercial, or industrial zones as embodied in the land use plans of capital towns, cities and highly urbanized,/ industrialized municipalities already approved by HLRB as of date of Administrative Order No. 15	These are untenanted but outside the residential, commercial or industrial zones, where the land is intended as government project or joint venture government-private sector project, provided change of land use is supported by the city/town ordinance duly concurred by HLRB.		1. Land has ceased to be economically viable and sound for agricultural purposes; or 2. the locality has become urbanized and the land will have a greater economic value for residential or industrial purposes. Provided that in 1 and 2 a) Beneficiary shall have fully paid his obligation and b) Five years have elapsed from award. (Sec. 65 of RA 6557) 3. Land has not been applied under voluntary offer to sell (VOS), Stock Distribution Option and Voluntary Land Transfer (VLT) 4. Land has not been covered by a notice of compulsory acquisition except in case where the conversion applied for pertains to the landowners' retained area.

3. General Order No. 1 entitled "Declaring Certain Agricultural Lands as Converted to Non-Agricultural Uses and Prescribing the Procedural Requirements Therefore" Issued by Secretary Miriam Santiago on November 26, 1989	1. Land does not exceed 50 hectares*; has no tenants, farmworkers and located within the residential, commercial or industrial zone of the land use plan of an established metropolitan city, highly urbanized/ industrialized provincial capital, city or municipality approved by the HLRB as of June 15, 1988 (effectivity date of RA 6657) Intended use conforms with said land use plans. *The bases is the aggregate area to be utilized in the proposed residential, commercial, or industrial project, regardless of the number of landowners.	Even if located outside the residential, commercial or industrial zone of an HLRB approved land use plan, or even if there is yet no HLRB-approved land use plan, where the land subject of the application 1. has no tenants/farmworkers; 2. intended as a government project or a joint venture government -- private sector project; 3. change in land use is supported by a city/municipal ordinance duly concurred in by the HLRB. (Exactly the same as column 3 of A.O. 15, 1989, except that it adds the underscored clauses above, i.e., where there is no HLRB approved plan.)	1. Satisfies Sec. 65 of RA 6657 2. Lands not applied under Voluntary Offer to Sell (VOS), Stock Distribution Option and Voluntary Land Transfer (VLT) 3. Not subject to compulsory acquisition except in cases where the conversion applied for pertains to the landowners' retained area. 4. Lands shall be developed at the rate of not less than 5 hectares per year from the date of the issuance of the development permit by the HLRB (These are exactly the same requirements as those of AO 15, 1989, except for the addition of paragraph 4)

<table>
<tr>
<td>4. Administrative Order No. 18 entitled "Revised Rules and Procedures Governing Conversion of Private Agricultural Lands to Non-Agricultural Uses

Issued by Secretary Miriam Santiago on December 14, 1989</td>
<td>Proposed land use conforms with the land use plan or town development plan approved by the HLRB and validated by DAR</td>
<td>1. Where land is intended to be used as a government low-cost housing project as certified by the National Housing Authority (NHA) or is a government industrial project as certified by the Department of Trade and Industry (DTI) or the Department of Tourism (DOT)

2. Land has ceased to be economically feasible and sound for agricultural purposes, as certified by the Provincial Agricultural Officer of the Department of Agriculture (DA) assigned to the Province.

3. Locality has become urbanized and the land will have a greater economic value for residential, commercial, industrial or memorial park purposes as certified by HLRB deputized Zoning Administrator.</td>
<td>If proposed use is similar to or compatible with the dominant use of the surrounding area.</td>
<td>If proposed use is any those in column 3 and land has ceased to be economically feasible and agriculturally productive; and at least 5 years have elapsed since the award of the land to the beneficiary who has fully paid his obligations.</td>
</tr>
<tr>
<td colspan="3">4. Common Requirements:

A. Endorsement of the conversion through an ordinance passed by the city/municipal council

B. Concurrence by HLRB with the local ordinance

C. The consent in a referendum conducted among the inhabitants/ communities directly affected

D. Favorable endorsement of the government agency exercising supervisory or regulatory functions over the proposed project such as DTI and DOT shall be accorded weighty consideration.</td>
</tr>
</table>

5.Administrative Order No 1 entitled "Revised Rules and Regulations Governing Conversion of Private Agricultural Lands to Non-Agricultural Lands" Issued by Secretary Florencio B. Abad on March 22, 1990	Rules apply to lands devoted to or suitable for Agriculture 1. The land is classified as commercial, industrial and residential *in the new or revised town plans approved by Inter-Agency* Planning Task Forces as organized by the HLRB with the participation of the Department of Agriculture, Department of Environment and Natural Resources, Department of Trade and Industry, National Economic and Development Authority and Department of Tourism. 2. Land has ceased to be economically feasible and sound for agricultural purposes as certified by the Regional Director of the Department of Agriculture, or 3. The land or locality has become highly urbanized and the land will have a greater economic value for residential, commercial or industrial purposes as certified by HLRB Deputized Zoning Administrator. Common Requirements: In all cases, there shall be a certification from the DENR that the conversion is ecologically sound		Dominant use of the area surrounding the land applied for is no longer agricultural. If the proposed use is similar to, or compatible with the dominant use of the surrounding area. Basis for decision making: Regional Physical Framework Plan.	
6. Administrative Order No. 2 entitled " Rules and Procedure Governing the Processing and Approval of Application for Land Use Conversion" Issued by Secretary Florencio B. Abad on March 22, 1990				MARO's verification report that the land proposed for conversion is not devoted to or suitable for agriculture; falls within the appropriate zone in the town plan, or compatible with the dominant use of surrounding area. If tenanted, the tenants or farmworkers agreed to the conversion and to be paid disturbance compensation.
7. Administrative Order No.5 entitled "Clarificatory Guidelines and amendments to AO No.9, Series of 1990 Issued by Secretary Benjamin T. Leong on April 6, 1992				DAR may allow the withdrawal of a VOS or lift a Notice of Acquisition land use conversion where subject landholding has been determined by DAR to be *suitable for a townsite*, resettlement site needed to address a matter of national interest or concern in a calamity situation, provided that payment of disturbance compensation has been made.

Adopted from U.P. PLANADES report entitled "Review and Analysis of DAR Land Use Conversion Rules and Regulations and HLRB-Approved Town Plans", Volume I, submitted to FAO/DAR, December, 1990. This tabular summary was prepared by Professor Asteya M. Santiago for the said report.

(continued from page 4)

Guidelines on plan review, evaluation and approval/ disapproval process, had already complied with the national planning standards. This criterion appeared in AOs 15, 18 and 1, and GO 1.

3. **"When in the case of the city / municipality which does not have land use plans and integrated zoning ordinance duly approved by HLRB, the dominant use of the area surrounding the land subject of the application for conversion is no longer agricultural. If the proposed use is similar to, or compatible with the dominant use of the surrounding area, the petition for conversion may be given due course. Moreover, the Regional Physical Framework Plan as approved by the Regional Development Council (RDC) shall be used as a basis for decision-making".** This land use compatibility criterion appeared in AOs 15, 18 and 1.

On the other hand, there are rules and regulations allowing the conversion of agricultural lands to non-agriculture where more recent AOs, GOs and Joint Order are silent on, but are still enforced. The situations covered are the following:

a. where the obligation of the former tenant lessee has been fully paid (Section 65 of RA 6657), and/or five years have elapsed from the award of the land to the CARP beneficiaries;

b. where the land is intended for a housing or industrial project of the government, or is a government-private sector joint venture low-cost housing project and is covered by an HLRB locational clearance;

c. where the land is covered by an ordinance of the local council approved or concurred in by HLRB;

d. where a certificate has been issued by the DENR that the land conversion is ecologically sound;

e. where the land has not been included in any application for a Voluntary Offer to Sell (VOS), a stock distribution option, and a Voluntary Land Transfer (VLT), or by a Notice of Compulsory Acquisition by DAR;

f. where the land is not subject to compulsory land acquisition, being a retained land by its owner whose landholdings have been subjected to CARP; and

g. where no agreement has been entered into by the landowner and farmer beneficiaries (FBs) for voluntary land transfer/direct payment scheme (VLT/DPS).

2.0 THE KEY ELEMENTS OF DAR LAND USE CONVERSION

Despite the series of changes in the DAR guidelines to make them responsive in dealing with the problem of land use conversion, (henceforth, simply referred to as "conversion") there has been a host of reported cases of illegal or unauthorized conversion. These problems appear to stem from the following factors: *first*, the varying perceptions of the parties to a land use conversion decision (individuals, firm or groups) of their obligation or responsibilities; *secondly*, the absence of an approach/method of analysis of the problem; *third*, the inherent complexity and the implications of conversion problems with the overall land use and environmental development; and *fourth*, certain deficiencies in the mechanism for implementing a suitable conversion policy or policies. All of these problems reveal the key elements of an effective conversion policy which are presented in the succeeding sections. It is not the purpose of this paper to test each key element for its

effectiveness. Rather, it is to assess the existing problems and the possible role of each element in resolving these difficulties; and in formulating a suitable conversion policy and/or program.

2.1 THE PROBLEMS OF ADOPTING UNIFIED GOALS AND PRIORITIES OF LAND USE CONVERSION

As in any other development measure, clarity in the unified goals and priorities in the conversion policy that could be well understood by the implementors and by those to be affected is crucial. This requirement is not easy to meet because of two interrelated problems. One is the tendency to assume the nature and scope of the land use conversion policy framework. The other is the diverse assessment and interpretation of the issues involved in conversion given by the various concerned sectors, namely; the DAR and its inter-agency network of government departments/agencies and their officials, the landowners, the private developers, the agrarian reform beneficiaries and the general public. They also vary in their perception of the various aspects of conversion. The importance that each one places on the issues/problems depends on their particular interest or need, and do not necessarily correspond to an objective and sound assessment of such issues or problems.

As the lead department in charge of allowing or disallowing conversion, the DAR has the primordial task of determining the most suitable goals/objectives of a conversion policy and how these would be promoted and attained. There was a need for these goals/objectives to be well defined, evaluated or tested for their possible consequences, and then prioritized. This procedure is in sharp contrast to the usually highly political or judgmental exercise of selecting goals/objectives.

The highly controversial 1989 case involving the **National Development Company (NDC)**, an attached agency of the **DTI**, and the **Marubeni Corporation** concerning the conversion of a 230-hectare agricultural land into an industrial center in Barangay Langkaan, Dasmariñas, Cavite illustrates the problems arise in the absence of a clear policy in October 1989 conversion. The 230-hectare NDC property was recommended for compulsory acquisition under CARP and its eventual distribution and transfer of ownership to some 167 farmers who had been cultivating the area since 1940. The dispute arose, however, when this recommendation was blocked by the NDC which petitioned the DAR for the conversion of the property from agricultural to commercial-industrial use. The protest launched by the affected farmers against the conversion caught the attention of national media and led even to an open confrontation between two partners in conversion - the DAR and the DTI/NDC. The DAR sided with the protesting farmers, while the DTI/NDC stood pat on its decision for the conversion of the property, citing national economic interest as the primary reason.

This land use conversion controversy was later settled through the intervention of no less than President Corazon Aquino. She directed that the proposed Marubeni industrial estate be carried out, that the affected farmers who agreed to give up their farms be properly compensated; and that the lands be awarded to those who decided to continue to till the land. The settlement of the dispute therefore, came in the form of a compromise agreement, more to appease the affected land occupants and their supporters, rather than a decision based on clearly stated goals.

2.2 THE NEED TO LINK CONVERSION WITH PHYSICAL SOCIO-ECONOMIC DEVELOPMENT AND LAND USE PLANNING

At the present yearly rate of 0.42 percent (around 23,000 hectares overall) of agricultural land under CARP being converted nationwide into residential, commercial, industrial and other land uses. land use conversion may not appear to be as alarming as portrayed in some reports. The more serious concerns, however, arise from the following:

1. **The change in land use from agricultural to non-agricultural is occurring very unequally between regions and within regions, and between provinces and individual local units.**

   The regions in the forefront of agricultural land use conversion are Region IV (Southern Tagalog), Region III (Central Luzon) and Region X (Northern Mindanao). These three regions have accounted so far for nearly 90 percent (20,626 hectares overall) of agricultural lands under CARP that have been converted into urban and other land uses. However, in these regions, conversions have been concentrated in the already developed and rapidly urbanizing and agro-industrializing provinces and local areas.

2. **Some of the best quality agricultural lands, like irrigated ricelands, are the ones being sacrificed for urban and industrial development.**

   Paradoxically, the best agricultural lands are generally also the ones most suitable for urban and industrial purposes, for basically two reasons: One is their strategic location in relation to existing established settlements and markets, and the other is their better roads and highways, waterworks infrastructure, and community social facilities and services. A 1991 study by the Bureau of Soils and Water Management (BSWM) estimated that the area of irrigated ricelands being converted to residential subdivisions, industries and other land uses in the CALABARZON area in Southern Tagalog averaged around 2,267 hectares annually. In the absence of effective regulation, this aberration may be repeated in other regions where there are equally favorable locational conditions conducive to further urbanization and industrialization such as in Central Luzon.

3. **The steady decline in prime agricultural lands has adverse effects on the capacity of the country to sustain its agricultural food supply and other material requirements.**

   In the past, when extensive land frontiers still existed, the food and material resources requirements of the country were met by simply adding areas devoted to agriculture. This strategy is no longer tenable due to various circumstances. According to a study by Gareth Porter and Delfin J. Ganapin, Jr. (1988), the country's arable land is not only limited but is also on the decline. This is due to natural causes, like the extreme susceptibility to soil erosion, especially of the nearly 59 percent (17.6 million hectares) of the country's available land with slopes of 18 percent and above.

   Other causes are man-made, such as the farmer's failure to practice appropriate land conservation techniques. Another is the anticipated increase in conversion resulting from the grant of power to LGUs to reclassify agricultural lands to non-agricultural uses under the Local Government Code of 1991. With the increasing trend to convert prime agricultural lands located close to major population centers, attaining self-sufficiency in basic staples may become more difficult. This is because the infusion of modern agricultural technology could result in limited production and it may not be cost-effective if the technology is applied on sub-marginal agricultural lands.

4. **The continuous decline in both the area and the production capacity of remaining agricultural lands will have profound implications on the socio-economic plight of rural farm households.**

   Only an estimated 5.8 million hectares of the around 10 million hectares of cultivated land have been found suitable for intensive crop production; and only 2.8 million hectares of these are

capable of producing more than one crop per year (Porter and Ganapin, 1988). The CARP covers an estimated area of over 5.5 million hectares of cultivated lands, of which around 23 thousand hectares have already been converted to non-agricultural uses.

The farmers/tiller-occupants already displaced have been estimated at around 8795 or roughly 0.004 percent of an estimated over 2.54 million CARP-covered farmers or tiller-occupants (See Table 2). By any reckoning, the number of displaced farmers or tiller-occupants is not large. However, it is an important element of a conversion policy to anticipate the probable effects of a conversion decision on the affected farmers or tiller-occupants and to determined whether they constitute a big or a small number, or whether they are covered by the CARP or not.

A UPLB Agrarian Reform Institute Study (Peralba, 1979) provides some useful insights on the socio-economic impact of conversion decisions on the displaced farmers or tiller occupants. Of the 98 respondents, 58 percent were given disturbance compensation; 17 percent, homelots; 6 percent, farmland; 4 percent employment; and the rest stayed on as tenants in lands under retention by the landowner. Sixty three percent did not perceive any change in their socio-economic status but 26 percent felt they had become poorer while 11 percent claimed they were better off.

Another study which analyzed land use conversion applications was that done by W.P.T Silva in 1990 as part of his consultancy report with the FAO for DAR. His conclusions were consistent with the study of Peralba on the displacement compensation for the affected farmer or tiller-occupants. The study also touched on the non-CARP displaced farmer/tiller-occupants and it revealed that while 85 percent of CARP farmers received disturbance compensation of various types, only 15 percent of non-CARP farmers were compensated

Another study attempted to distinguish between corporate land use conversion and conversion by ordinary land owners (McAndrew, n.d.). He cited many instances to support his point that corporate land use conversion either for housing subdivisions or for industrial uses are disadvantageous to the displaced tenants or tiller-occupants. Compensation for their loss of tenure rights is usually minimal. Where a higher disturbance compensation rate is agreed upon through negotiation, in most cases the affected tiller-occupants are only paid partially. Moreover, because the corporate land use conversion does not always turn out to be economically viable, the property may be foreclosed by the bank, which places in jeopardy the settlement of the compensation of the remaining tiller-occupants. There were also instances where the affected tiller-occupants forfeited their rights to compensation due to threat on their lives, or where others who resisted the conversion were forced off the land without the benefit of full compensation.

The same study (McAndrew) pointed out that tenants or lessees in land under retention were usually better off in terms of compensation because of their more personal relationship with the landowner and his family. In any case, for one reason or another, this relationship turns sour, the tenants or lessees are familiar with their rights under the agrarian reform laws and the landowner may find it easier to meet their demands for equitable treatment.

It was observed by the author that there were cases where lessees or tenants of the farms covered by the retention limit in some Laguna lakeshore towns which are presently attracting residential subdivision developers and industrial firms chose not to be protected by the agrarian reform laws. They usually agreed with the landowner to have the land subdivided by asking for a fixed share as disturbance compensation which sometimes reached up to 25 percent of the proceeds of the sale (U.P. PLANADES Report, 1990). There were also cases where CARP beneficiaries readily disposed of the lands already transferred to them to cash-in on the generous purchase price offered them by developers and industrial business firms. The case of the CARP land

TABLE 2 ESTIMATED NUMBER OF FARM HOUSEHOLDS IN CARP COVERED AND OTHER AREAS BY REGION AND BROAD INDICATION OF THEIR SOCIO-ECONOMIC CONDITIONS

Region	Total No. of Households	Estd. No. of CARP Covered Households	Estd. No. of Displaced CARP Covered Households	Socio-Economic Indicators			
				Ave. Farm Size (has)	Ave. Agricl. Output/ Household (₱)	Ave. per Capita Income (₱)	Unemplyment Rate (%)
Philippines	3,478,600	2,254,352	8,795	2.63	15,030	1,370	9.2
1. Ilocos/ CAR	298,000	155,866	51	1.25	16,650	1,085	8.3
2. Cagayan	253,600	126,238	44	2.24	16,080	892	5.1
3. Central Luzon	235,900	224,578	997	1.99	13,650	1,407	11.3
4. Southern Tagalog	401,200	159,806	5,623	2.81	11,960	1,931	8.9
5. Bicol	314,100	269,038	9	3.01	8,050	772	6.9
6. Western Visayas	280,800	248,684	276	2.66	14,780	1,262	8.4
7. Central Visayas	342,300	205,183	75	1.55	7,200	1,662	6.2
8. Eastern Visayas	272,900	167,501	159	2.37	9,850	932	8.5
9. Western Mindanao	216,500	112,517	30	3.56	11,920	1,192	7.5
10. Northern Mindanao	265,500	195,740	1199	2.37	23,670	1,613	8.1
11. Southern Mindanao	289,100	211,404	279	2.44	33,650	1,731	8.1
12. Central Mindanao	254,800	177,797	53	3.18	23,220	1,444	5.9

awardees in the 114-hectare former Marcos-owned land in Biñan town which had been converted into the Laguna International Industrial Park (LIIP) is a good example of the latter case.

Disturbance compensation takes many forms which have not been envisioned or anticipated in the CARP implementation. Disturbance compensation is treated as a one shot arrangement by both the landowner/developer and the agency implementors of the agrarian reform program. But the longer-term effect on the socio-economic existence of the affected farmers/tiller-occupants (hereafter, refered to simply as farmers) is not given the attention that it deserves. The problem of the farmers does not end when he receives disturbance compensation in exchange for his loss of tenure rights. A fundamental consideration when a conversion decision is carried out is the preparation of the would-be affected farmers to till another farm or to prepare them for possible shifts to new occupation which demand skills/ entrepreneurship training or job apprenticeship.

Where the farmers are left on their own after they have been given disturbance compensation, they are not likely to apply their newly acquired financial resources in some investment, unless they were already engaged in some business while they were still farming. In most cases, the alternative has been to become farmworkers in other farms or intrude into available forests and openlands in the same municipality to engage in farming there. For the younger and more dynamic ones, the shift to non-agricultural occupation is effected by migrating to the regional population centers or Metro Manila.

Table 2 illustrates the possible socio-economic implications of conversion decisions to would-be displaced farmers or tiller-occupants. At present, the number of CARP-farmers is a minuscule 0.004 percent of the estimated total of over 2.25 million farmers covered by CARP. Assuming that the percentage was increased to 1, 2 or 10 percent, what would be the implication of this to the agricultural land resources and to the socio-economic welfare of the farmers to be displaced and to their households?

If this occurred in Region IV (Southern Tagalog) which now ranks first in the country in terms of the area of agricultural lands being converted to urban and other non-agricultural uses and the number of farmers that are displaced, then if land use conversion rate is allowed to reach 10 percent from the present 3.5 percent, one might be able to anticipate what could happen:

1. The number of farmers who would be displaced will increase from around 5,623 to 15,980. If an equal percentage of non-CARP farmers was added to this due to rampant illegal conversion (i.e. those which do not pass DAR's approval), then the number could very well reach over 40,120 displaced farmers.

2. Since each one of them is presumed to be cultivating an actual average of 2.81 hectares (which are less than the 3 hectare limit awarded to each CARP beneficiary), then one could estimate the area of land that will be withdrawn from agriculture and converted to non-agricultural uses. This would be around 112,737 hectares, most of which are prime agricultural lands located close to the urban centers.

3. In the loss of his tenurial rights, each affected farmer can be expected to lose for himself and his household an average worth of agricultural output of around ₱11,960 yearly. This comes up to around ₱479.84 million yearly loss to the households of the farmers and the regional economy. This is bound to happen unless *first*, the shift in land uses generates for him or the members of his household sufficient income to compensate this amount; or *second*, the farmers successfully place his lump sum compensation in worthwhile investments that will yield for him an income equivalent to his lost value of the average yearly agriculture outputs.

4. If the scenario in item 3 above does not take place, considering that Region IV is far from reaching full employment status with its 8.9 unemployment rate, then one could anticipate the difficulties of affected farmers in shifting to non-farming occupations. In the first place, they may not possess the skills necessary to land jobs in the urban/industrial sector that may become available with the conversion.

   In the light of these scenarios, it is useful to re-examine the existing premises underlying the current land use conversion policies and make them more responsive to the socio-economic realities which could confront the displaced farmers. The payment of the disturbance compensation may be the most acceptable way of helping the affected farmers, but the over reliance on this measure is a short-sighted approach. The many forms that disturbance compensation may take seem to indicate that a better alternative is needed to make the conversion policy more effective. Since the long-term socio-economic welfare of the displaced farmers can not be made the responsibility of any single sector of society, the problems of conversion should be placed as a sub-sector of the social sector within the broader context of overall socio-economic development With this perspective, the goals, objectives and priorities of land use conversion could be defined more clearly in its full socio-economic dimension.

5. The land use conversion of a parcel or tract of land bears some relationship with the other parcels and tracts and the activities carried thereon.

   This land use interrelationship is readily observable in rapidly urbanizing and industrializing areas such as along the main highway in the CALABARZON. At first, one observes that ricelands and the other prime agricultural lands along the highway are cleared, followed by the construction of houses or manufacturing plants. However, the full physical/ environmental impact of this does not manifest itself at once. The effects are felt when people occupy the houses and the manufacturing plants start to operate and emit pollution and create noise. These effects are aggravated by the development of ancillary activities and the emergence of transport problems. The movement of raw materials and people to and from the manufacturing plants generates traffic congestion.

   There are countless situations that illustrate the complex interrelationship of agricultural land use conversion with development activities within and outside particular areas. This matter should be considered among the key elements in the formulation of an effective conversion policy. Again, it points to the need to place this activity in the wider framework of the provincial/regional physical framework planning and the detailed land use planning and zoning at the municipal/city level.

2.3 THE NEED FOR NEW APPROACHES TO AND TECHNIQUES OF ANALYSIS FOR LAND USE CONVERSION

Like most government development policies, the DAR land use conversion policies evolved in response to felt needs or problems. Because the DAR was almost always pressed for time to act immediately, there was often no opportunity to examine in greater depth the fundamental basis of policies. As a consequence, the formulation and implementation of the policies went through a trial and error process. While the implementing guidelines had undergone various revisions to make them more effective, the latest versions have renamed inadequate.

The original rationale for regulating land use conversion was to prevent the circumvention by landowners of the application of agrarian laws by converting their lands into unauthorized uses. These policies later became concerned with the socio-economic plight of these farmers; the promotion of food security; and the need to conserve

prime agricultural lands. These various concerns suggested that a general welfare function could be assigned to a given area or community (in the particular case, the agrarian reform areas). In effect, this assumes that there are some variables which could be measured to indicate the level of satisfaction achieved for the various concerns. It assumes further that in order to maintain a satisfactory level of welfare which would be the gauge of the success of the policy, there is a need for other intervention by the government or the private sector.

These are not formal theories of land use conversion but may serve as the basic working assumptions on which the present policy may be re-examined and further improved upon. Any serious effort towards this end would require new techniques of analysis of the various concerns of land use conversion. Two related approaches may be given emphasis. These are *first*, the establishment of a databank system, and *second*, the improvement of available techniques in land use conversion policy analysis and formulation.

2.3.1 LAND USE CONVERSION DATABANK AS A COMPONENT ELEMENT OF A LAND USE CONVERSION POLICY/PROGRAM

An essential element in the continuous improvement of the conversion policy is the availability of data on all the essential aspects of the conversion of agricultural land resources to other land uses, and its effects on the socio-economic life of the people and on the community. The data must be sufficient, accurate and relevant. Moreover, they must be adequate for decision-making especially by the DAR, the DA and the other government agencies and local units and the private business sector. Presently, these government agencies have already collected various types of data related to agricultural land and its conversion to other uses, but these have mostly been piecemeal and lack a unified focus.

Some problems in establishing a unified databank on land use conversion is the divergence of concepts and the differences in definitions within these concepts. Thus, the first essential task in establishing this databank is to identify the major ideas and concepts about agricultural land use conversion and its manifold implications and interrelationships. Of utmost importance is the concept of agricultural land.

Basic to the data about a piece of agricultural land is its location and its relation to the growth pole and the overall national land mass. The locational aspect of a piece of agricultural land is vital in the indentification of political jurisdiction and for relating the activities of this proximate parcel of agricultural land with the other parcels or tracts (Clawson and Stewart, 1965). Hence, the activities on this piece of agricultural land need to be ascertained.

The next factor is the quality of agricultural land which may be measured through soils survey, topographic analysis, etc. The intensity of land uses, or the volume of activities per unit area; the improvements in the area; the land tenure; the land price or assessed values; and the interrelationships of the activities of this piece of agricultural land with those in the other tracts will be the important focus for the generation, storage and retrieval of data in the databank system.

2.3.2 THE TECHNIQUES OF ANALYSIS OF LAND USE CONVERSION

The formulation of new or updated land use conversion policies is a complex job for which there are the appropriate techniques. Most of these approaches are available in the related fields of land use and physical framework planning, while others may have to be evolved by the concerned agency planners. With the conversion databank as a component part of the formulation of the

needed policy and action program planning, opportunities for the efficient use of the techniques will be enhanced.

There are three critical areas within which these various techniques may be discussed. These are in 1) the formulation of unified goals/objectives; 2) the analysis of the land use conversion databank and the other available data and information; and 3) the formulation of the land use conversion policy and/or action programs. The implementation techniques will be discussed together with the mechanism and the corresponding measures for carrying out the land use conversion policy/program which is another key element.

2.3.2.1 TECHNIQUES OF GOALS/ OBJECTIVE DEFINITION

As may be observed, the goals /objectives of agrarian reform and land use conversion are interrelated and appear self-evidently desirable, e.g. promoting "social equity and sustainable development", "harmonizing the rights and the varied interests of every Filipino", "preserving and maintaining environmental integrity and stability", etc. It does not suffice, however, that goals/objectives be simply formulated without regard to concrete data supporting them and without explicitly stating the rationale for them.

For the above purpose, one simple approach is a "need analysis" which may be employed to ascertain the needs and demands of would-be affected farmers/tiller-occupants, especially in major agricultural conversion projects. Another is the "Delphi" technique which depends on experts opinion on a given problem-solving situation and "in-house scenario writing". These techniques may be used singly or in combination to deal with particular situations.

2.3.2.2 GENERAL APPROACHES AND TECHNIQUES OF ANALYSIS OF LAND USE CONVERSION CONCERNS

The approaches and techniques in analyzing the conversion concerns are quite varied and are considered more developed. There is, however, the need to use only those suitable for the particular conversion problem. For instance, in analyzing data and information that may be generated, classified and stored in the proposed databank, there are applicable techniques already developed. These techniques fall under the general category of "land studies". They make use of a text and general purpose and detailed maps as the means for presenting and analyzing the various types of data on land and land uses namely: physiographic features, land uses; vacant lands; hydrological and flood potential, land values and assessments for tax purposes; cost-revenues data, the aesthetic features of an area, and so on (Chapin, 1965).

Given the above data, a **sieve or over-lay map technique** may also be utilized, to determine whether or not a proposed conversion will intrude or aggravate already existing physical constraints and, therefore, should not be allowed. Another simple technique that may be considered useful is **land use accounting** which is the systematic semi-mechanical approach to the geographic distribution of land uses as well as to the preparation of an estimate of the total holding capacities of the subject land. The accounting process starts with an estimate of the total land area of a town/city. After the areas for protection land use, other committed lands, prime agricultural lands and existing built-up areas have been deducted from the total, the resultant residual area will be where land use conversion would be allowed.

Another area of equal importance relates to the socio-economic and environmental concerns of conversion decisions. The techniques for these are likewise varied and relatively well developed, particularly in the analysis of demographic data and projection. The general analysis to be conducted is intended primarily to provide background data as basis for policy formulation. However, insofar as the detailed processing, evaluation and recommending approval/disapproval process of conversion proposals are concerned, the individual project study approach/techniques are far more important. In most cases however, the background studies and analysis serve as the basis for carrying out these detailed individual project studies, especially of large agricultural conversion projects. They may also provide the decision-makers who do not have time to examine the detailed and voluminous data generated, to do a quick assessment of the problems in order to acquire a broader perspective of the likely consequences of the conversion decision.

2.3.2.2 THE PROBLEM-INDICATOR APPROACH

The socio-economic and environmental concerns which are pertinent to both the formulation of conversion policies and to comprehensive urban and regional development planning may be analyzed through three broad categories of problem-indicators (Bustamante and Torres, 1990).

These are: **the general physical problem-indicators; the problem-indicators affecting mainly rural towns and cities** (i.e. component cities and municipalities); and **the problem-indicators affecting mainly large cities and major population centers** (i.e. independent cities and highly urbanized municipalities and metropolitan areas).

This approach seeks to compile available data from various sources, using a data format developed specifically for each of the three categories of problem-indicators. These indicators will have a wide range of application in development planning, including conversion policy formulation. Furthermore, they lend themselves especially to descriptive analysis and other simple techniques.

Briefly outlined, these problems-indicators cover the following:

a) **General Physical Problem-Indicators.** These indicators provide the basis for setting physical limits on the area of agricultural lands that may be allowed for conversion. Such limits may be indicated by the following conditions:

   i. **Already-limited and declining arable land** - This is expressed in terms of hectarage and percent decline of agricultural lands over a given period, and an assessment of the causes of the decline such as natural or man-made causes.

   ii. ***Growing crisis of* population and land** - This is expressed in terms of hectarage of farm area by types of crops and production, in relation to existing human needs and actual consumption, and an analysis of population, its past trends present size, and likely future growth by area.

iii. **Extent of natural resources and environmental degradation** - This may be shown by mapped land and water areas to indicate the land degradation by causes and extent of degradation.

iv. **Climate change** including micro-climate that affects agriculture and the various aspects of the socio-economic life of the area and its causes, e.g. forest denudation, etc.

v. **Natural hazards** as indicated by the frequency of the incidence of drought, typhoons, earthquake, volcanic eruptions and other natural hazards, and the likely dangers from these phenomena.

b) **Problem-Indicators Affecting Mainly Rural Towns and Cities (Component Cities and Municipalities of Province).** This includes the physical-environmental and socio-economic factors that usually affect rural/ provincial settlements. The indicators reveal directly or indirectly the poverty problem in these areas and its implications on the existing and declining land and natural resources. These indicators are:

i. **Intrusion into and illegal occupancy of private/public lands such as public forests and mountain areas** - may be shown in terms of the location of public forest, forest reserves, parks and other lands, both public and private, which have already been intruded into; and the number and characteristics of households involved in each of these illegally intruded areas.

ii. **Extent of urban land use incursion into agricultural lands, especially in growing provincial population centers** - This may be shown in terms of the number, the area involved and the location of legal and illegal conversion of CARP and non-CARP areas over particular periods. These will include the data on the land uses before and after conversion, and the number and characteristics of the households displaced; the number, the area involved, the proposed land use change and the location of applications for the conversion of CARP and non-CARP lands under process; and the number, the areas involved, the proposed land use change and the location of applications for the conversion of CARP and non-CARP lands which have been disapproved over certain periods.

iii. **Soils and water degradation problems** - This is indicated by the mapped areas of serious soil erosion, leaching, salination and pollution of surface and underground water resources such as the point and non-point sources exemplified, respectively, by the waste dumped by factories or sewage plants, or polluted run off, respectively.

iv. **Natural hazards** - This is revealed by the frequency of the occurrence/incidence of drought, typhoons,

earthquake, volcanic eruptions and related natural hazards, and the likely dangers from these phenomena.

v. **Areas of critical environmental concerns** - This is shown by the mapped areas of wetland and flood prone areas, unsuitable soil, shallow bedrocks, soils with high water table, and clay soils with "shrinkswelling" properties. All of these areas should be avoided in conversion into urban uses since they will create serious and costly urban servicing problems for both the occupants and the community.

vi. **Committed lands** - These are mapped areas of lands designated by zoning or presidential proclamations for particular use such as public parks, forest reserves, wild life sanctuaries, protection land uses and other committed lands.

c. **Problem-Indicators affecting mainly cities and major population centers (i.e. independent cities and highly urbanized municipalities and metropolitan areas).** These problem-indicators which underscore the seriousness of urban agglomeration problems readily observable in Metro Manila and the other highly urbanized centers are:

i. **Incompatible land uses** as indicated in the land use maps and/or the aerial and satellite photos.

ii. **Limited and high-priced land** as shown in the records of actual land sales by area, price, location, types of land use, date of sale, etc.

iii. **High in-migration rates and problems of the urban poor** - This may be shown in the statistics of in-and-out-migration by origin; the employment and the other socio-economic characteristics of the in-migrating households; the number of households involved and the location and area of slums and squatter areas; and the condition of urban infrastructural facilities and services in the area.

iv. **Increasingly limited absorptive capacity of urban-based employment sector** - This may be shown by statistics on the types, the location and the employment absorptive capacity of the formal and informal business sector serving as sources of employment, especially for the urban poor and the unskilled and skilled workers; the capacity of the central area land to absorb basic employees and service employees; and the stringent locational and site requirements of the heavy industrial sector which have preempted the land necessary to accommodate the needs of this employment sector.

v. **Urban congestion** - This may be illustrated by the number of vehicles and trip generation statistics indicating the extent of traffic congestion; the problem of urban transportation services; and the congested

living environment due to the high intensity of development.

vi. **Air and water and noise pollution problem** - This may be indicated by the existence of severe water pollution of open canals and drainage basins; the noise and exhaust pollution from vehicles; the smoke from factories and the smog over the city.

vii. **Congested and deteriorated urban infrastructure facilities and services** - This may be shown by the statistics on the number of households served and unserved by the existing urban water supply system, the electric and telephone systems; the other utility systems and the adequacy or inadequacy of these services; the condition of roads and streets; and the presence and actual condition of open spaces, parks, playgrounds and recreational areas.

viii. **Waste disposal and management problems** - This may be reflected in the statistics on the tonnage of solid waste generated and disposed of per day and month; the location and the capacity of disposal areas; and the type and working efficiency of anti-pollution devices installed to prevent health problems.

ix. **Natural hazards, committed areas and critical environmental concerns** - (refer to earlier descriptions)

2.3.2.3 TECHNIQUES FOR EVALUATING POLICY ALTERNATIVES

The formulation of alternative land use conversion policies can be started once the policy environments have been well-analyzed and understood, and the relevant goals/objective, defined. These policy alternatives may be evaluated for their technical, economic and financial feasibility, as well as for their socio-political acceptability. The available techniques for accomplishing this are essentially the same as those in current use in the general area of public policy.

It is not the purpose of this paper to cover these general methods/techniques. However, one simple method may be mentioned which will find easy application because of its practicability. This is the "goal/objective achievement matrix". Under this method, the policy alternatives are evaluated for their positive(+), negative(-), or neutral(0) contributions to the achievement of the pre-defined goals or objectives. The best alternative will be determined on the basis of the highest total of positive scores. A resultant negative score would show that the particular policy is injurious or detrimental to the achievement of particular goals or objectives, while a neutral score would mean that the particular policy has no effect, one way or the other on such goals/objectives.

A possible further improvement to this method is to give weight to each goal or objective so that the specific policy or policies which contribute the most to the achievement of said goals/objectives would be the superior policy/policies.

2.4 MECHANISMS AND MEASURES FOR IMPLEMENTING LAND USE CONVERSION POLICIES AND PROGRAMS

The implementation of existing agricultural land use conversion policies and programs relies on an inter-agency network consisting of the DAR as the lead agency and the DA. HLRB, NEDA, DILG, DTI and DENR, among others, which have a stake on said policies and programs, as members. As the lead agency, the DAR's primary objective is the conservation of prime agricultural lands and, in general, the prevention of indiscriminate and haphazard conversion of agricultural lands. It is also concerned with the protection of the tenurial rights of affected farmers and the equitable settlement of their displacement compensation.

On the other hand, the HLRB's main interest relates to its review function over local government unit (LGU) ordinances reclassifying agricultural into non-agricultural lands. It also prescribes national guidelines and standards for the preparation of land use plans and zoning ordinance; issues development permits and locational clearances for major land development projects; and registers licensed real estate business practitioners. The NEDA, by virtue of Letter of Instructions (LOI) 1350, has assumed the physical planning function of the defunct MHS at the regional and national levels. It serves as the permanent Secretariat of the National Land Use Committee (NLUC), created under the same directive and is overseeing the drafting of the proposed National Land Use Code of the Philippines.

The Land Use Code is designed to promote and adopt land use allocation schemes and set a milestone in land use and physical framework planning for the entire country. The DILG's main concern in land use conversion may be gleaned from the broad development planning functions of the 73 provinces and the detailed land use planning and zoning functions of the more than 1500 cities and municipalities throughout the country. Moreover, the LGUs are allowed to reclassify agricultural lands into non-agricultural uses under the Local Government Code of 1991.

The DTI has a more specific mandate and this is with regard to the allocation of land for the development of around 19 regional agro-industrial Growth Center (RGCs) as a component program to bring the country to its Newly Industrialized Country (NIC) status by the year 2000. The DENR's focuses on the broader implications of agricultural land use conversion to the environment and to its plan for the establishment of protection land use areas (i.e. the National Integrated Protected Areas System (NIPAS) under RA 7586 and areas presently outside the NIPAS, requiring rehabilitation and protection).

This inter-agency relationship is built upon the fact that the concerns of the various agencies relate to and affect each other. The inter-agency participants support the land conversion decision through official/semi-official consultations and referral system on the relevant aspects. While the relationship may be cordial and largely informal, there are instances, such as in the NDC-MARUBENI land conversion case in Cavite which revealed where the agencies may differ drastically in their respective positions on conversion issues.

The DAR officials may have to contend more often with this same problem in the exercise of its mandate to approve or disapprove applications for agricultural land use conversion when the LGUs start to reclassify agricultural lands into non-agricultural purposes. Since abuse of this power granted LGUs will affect the physical framework and land use planning functions under Memorandum Circular No. 54, the concerned LGUs are required to consult the HLRB, DA, DTI, DOT and others for their comments on their proposed reclassification of agricultural lands to non-agricultural use. The NEDA is expected to issue the relevant implementing guidelines on local land use reclassification in excess of the limits set by the Local Government Code of a maximum 15 percent of total agricultural lands in highly urbanized municipalities and independent component cities; 10 percent in component cities and first to third class municipalities; and 5 percent in fourth to sixth class municipalities.

2.4.1 MECHANICS OF LAND USE CONVERSION

Another key element in the effective conversion process relates to the mechanics of processing, evaluating and deciding on applications for conversion which must be clear and simple and entail few but really vital documentary requirements. This need had been recognized in the earlier attempts of the DAR to "fast track" the approval or disapproval of conversion applications using approved town plans by HLRB as the basis for decision. This criterion has been retained with slight modifications in the present set of conversion criteria.

Overall, the present procedure in land use conversion entails cumbersome steps and lengthy documentary requirements which are far from simple. Table 3 provides a summary of the documentary requirements based on the latest available DAR documents. It shows that there are around 14 major requirements commonly applied to all applicant individual landowners including CARP farmers beneficiaries (FBs), land development firms and government or government-private sector joint venture firms. In addition to these, there are specific requirements which each of these major applicants will have to comply with in order that their application for land use conversion will be processed, evaluated and decided on.

The present procedure for the processing, evaluation and approval/disapproval of applications for land use conversion may be summarized as follows:

1. The applicant submits to the Municipal Agrarian Reform officer or MARO the duly accomplished application form with the required documents. The MARO reviews the documents and conducts a field investigation, posts notices, takes cognizance of any protest, prepares a Land Use Conversion Folder (LUCF) and transmits his findings and recommendations to the Provincial Agrarian Reform Officer (PARO).

2. The PARO evaluates the transmitted documents, endorses any protest and/or opposition to the application to the Provincial Agrarian Reform Adjudicator (PARAD), and then makes and submits his own recommendation to the Regional Director (RD).

3. The RD evaluates the recommendations, approves or disapproves the applications for land conversion covering five (5) hectares and less, and endorses to the central office the applications for lands above five (5) hectares.

4. The Undersecretary for Legal Affairs reviews the LUCF; signs orders for lands above five (5) hectares but less than fifty (50) hectares, and then reviews and recommends action on applications involving lands above 50 hectares. This is followed by a final review and evaluation by the DAR Central Office Land Use Conversion Committee (LUCC) which also drafts the order for approval/disapproval of the application.

5. The Undersecretary for Special Concerns and External Affairs (SCEA) has been authorized by the DAR Secretary in AO No. 7, Series of 1992, to approve conversions for lands, fifty (50) hectares or less but above five (5) hectares.

6. For applications covering lands above fifty (50) hectares, the Presidential Agrarian Reform Council (PARC) / Land Use Technical Committee (LUTC) reviews, evaluates and recommends its approval/ disapproval to the DAR Secretary.

TABLE 3. DOCUMENTARY REQUIREMENTS FOR LAND USE CONVERSION BY CATEGORIES OF APPLICANT OR PURPOSE

COMMON REQUIREMENTS FOR APPLICATION INVOLVING LAND FIVE(5) HECTARES AND BELOW	
COMMON REQUIREMENTS	1. Duly accomplished Application form (LUC Form No. 1, Series 1994 2. Certified photocopy of OCT or TCT 3. Location plan and Vicinity map of the subject land 4. Environmental Clearance Certificate (ECC) 5. Feasibility study showing the economic and social benefits of the project 6. Certification from MARO that there are no farmer beneficiary occupying the land proposed for conversion; if there is an agreement to pay the disturbance compensation. 7. Certification form NIA Regional Irrigation Manager that the area is not irrigated, within areas programmed for irrigation faculty rehabilitation or covered by irrigation projects with firm funding commitments. 8. Certification from HLRB Regional Officer that the proposed use conforms with the approved land use plan 9. Certification from DA Regional Director that the land has ceased to be economically feasible and sound for agricultural purposes. 10. Certification from HLRB Regional Officer that the land or locality has become highly urbanized and will have greater economic value for commercial, industrial or residential purposes. 11. Certification from DA Provincial Agricultural Officer concerned that there are no marginal lands in the locality which can serve as alternative site for the project

	INDIVIDUAL LANDOWNER INCLUDING QUALIFIED FBs	LAND DEVELOPMENT FIRM	GOVERNMENT/JOINT GOVERNMENT-PRIVATE SECTOR
SPECIAL REQUIREMENTS	If applicant is CARP farmer beneficiary: 1. Certification from DAR that the applicant is the actual awardee 2. Five(5) years have elapsed since the award of the land 3. Certification from the Land Bank of the Philippines that the FB has fully paid his obligations	Proof of financial and organizational capability to develop the land, such as 1. Contract for development of land 2. Profile of developer, including track records 3. Licenses, permits and other similar authorities granted by other gov't. agencies 5. Financial statements 6. Articles of Incorporation or other related document as applicable 7. Other relevant documents such as brochures	If land is intended for gov't use or for a joint gov't-private sector project: 1. City or municipal council ordinance endorsing the conversion 2. Approval of the project by the authorized gov't agency.

Source: Department of Agrarian Reform Documents

7. The DAR Secretary approves or disapproves the application for conversion of lands above fifty (50) hectares upon recommendation of the DARCO LUTC.There is a proposal in the DAR to change this procedure and make it more centralized, with the creation of the Land Use Policy Action (LUPA) Centers at the regional and the central offices of the DAR. These centers shall take over the review and evaluation functions of the Land Use Conversion Committee (LUCCs). Under this proposal, the applicants for conversion can submit their duly accomplished application forms to the regional LUPA for immediate processing. The regional LUPA will also conduct the final review of all applications involving five (5) hectares or less which are approved/disapproved at that level by the DAR Regional Director. The Central office LUPA, on the other hand, performs the final review and evaluation functions of application covering lands areas in excess of five (5) hectares.

Another significant feature of this proposed change in the mechanics of land use conversion relates to the monitoring of the applicant's compliance to the terms and conditions of their approved applications. This task has also been given to the LUPA Centers. The LUPA Centers which will also will apprise the DAR Central administration through the Undersecretary for Planning and Policy of the problems encountered in the policy and operational aspects of conversion.

The establishment of a monitoring and feedback system, together with the general characterization of the problems affecting rural and urban settlements earlier suggested where conversion is expected to take place will greatly improve the conversion decision-making process. With the information to be generated via these approaches, there will be a greater opportunity to identify and test certain variables that would provide the main criteria for approving/disapproving petitions for land use conversions.

2.4.2 THE MARO's STRATEGIC ROLE AND RELATED PROBLEMS IN IMPLEMENTING LAND USE CONVERSION

The mechanism for land use conversion assigns a strategically important functions to the MAROs who are among the frontline personnel of the DAR. These functions included 1) helping see to it that the documentary requirements of applications for land use conversion are complied with; 2) conducting field investigation and the evaluation of proposed conversion; and 3) monitoring compliance by the proponent with the terms and conditions of the conversion order of approval. These are not easy tasks for the MAROs because they are involved simultaneously with the other program thrusts of DAR, namely, the land transfer program and the provision of support services to its CARP-covered farmers/beneficiaries in order to increase their production. As observed by the author in his case study Land Use Conversion and Town Planning in the Laguna lakeshore towns, the MAROs appeared overburdened with the DAR programs which are considered as their primary functions, reducing conversion to a secondary function.

There are several possible explanations for this. Inasmuch as the DAR uses the number of land transfer certificates issued as a major gauge of accomplishment, then the field efforts will, accordingly, have to be concentrated on the land transfer and the agricultural improvement programs.

The other explanation relates directly or indirectly to the MARO's predominant academic background and experience which are in agriculture and agricultural extension services. Based on a study of the author of the MARO's academic background and in-service training

experiences in six provinces (Laguna, Cavite, Bulacan, Pampanga, Iloilo and South Cotabato), he came up in 1990 with the following findings: (U.P. PLANADES Report, 1990):

1. In 1990, there were 130 MAROs assigned in the LGUs (i.e. 17 in Bulacan; 16 in Cavite; 45 in Iloilo; 21 in Laguna; 18 in Pampanga and 13 in South Cotabato).

2. Ninety nine of these (or 76.2 percent) had their basic undergraduate education in agriculture, and the rest, in commerce, education, home technology, economics and arts subjects.

3. Their office in-service training and work experiences had concentrated in land reform and agriculture. This had given rise to the observation that the DAR, MARO's work experiences and training are, in general, not different from those of the municipal agriculturists and extension service workers.

4. It may be assumed, therefore, that with their predominant background in agriculture and land reform, they would have developed the knowledge and appreciation of rural and agricultural land uses and were possessed of a strong notion of conserving them.

5. However, for the MAROs to play a meaningful role in the DAR land use conversion policy or program implementation, they will need to undergo in-service training program or further studies in the field of community, urban and regional development planning and zoning, environmental planning and management, and develop an appreciation of the dynamics of urban and regional growth and development. In its personnel recruitment program, the DAR should seriously consider hiring directly from the land use and the physical planning professionals and from the new graduates with the same academic backgrounds.

2.4.3 INADEQUACY OF DISPLACEMENT COMPENSATION AS A MEASURE FOR COMPENSATING FARMERS/ TILLER-OCCUPANTS FOR THEIR LOSS OF TENURIAL RIGHTS

Legally, the disturbance compensation is computed based on the average gross value of production of the land during the last five years, multiplied by a factor of 5. In the earlier discussion, if the household annual average gross value of outputs from agriculture of P11,960 in Region IV is assumed, then multiplying it by a factor of 5 will give the displaced farmer/tiller-occupant's household with a total displacement compensation income of P59,800. This amount, if invested in the bank, will yield, at most, an annual income between P3,000 to P5,000. Assuming that by starting a rural business (like buy-and-sell), the displaced farmer/tiller-occupant could double or triple the yield from the said investment, then they stand to realize an annual income of P6,000 to P10,000 or P9,000 to P15,000, respectively.

A household with six members can not subsist on a P15,000 yearly income (NEDA estimates a family income threshold at P5,800 monthly as of 1993). Under this situation, there is a strong possibility that family needs will take priority and will demand the use of part of the principal investment in the family business to augment the family income. Consequently, without someone in the household taking other jobs, the family business enterprise may not survive. Its principal capitalization if steadily reduced by channeling it to consumption, could in an extreme case, lead to the family ending up with no business and no income.

Whatever formula is adopted to compute the disturbance compensation, the overreliance of the DAR on this measure of payment of affected farmers for their loss of tenurial rights in a conversion case appears to be inadequate and short-righted. The "Solomonic decision" of former President Aquino on the dispute between the farmers/tillers-occupants and the industrial estate developer in the Langkaan, Cavite case underscores an important working principle that may be incorporated in the notion of displacement compensation. This is to grant land either within or outside the area subject of the conversion, to the affected farmers who opt to continue farming as their main source of livelihood; and to give displacement compensation to those who choose otherwise. If this working principle is adopted, there will be a need to undertake "land banking" as a component part of the land conversion program. Likewise, there is a need to develop skills and business entrepreneurship training to the affected or would-be affected farmers to enable them to shift to non-farming occupations.

In actual conversion practice, several ways have been introduced to compensate the affected farmers/tiller-occupants for the loss of their tenurial rights. These new ways have unnecessarily widened the options which, however, may result in abuse. For instance, the payment of displacement compensation partly in cash and in land may result in the cash being channeled by the "one-day millionaires farmers" mainly to conspicuous compensation and in the creation of very small and uneconomic-size farms. Adhering closely to the two options--cash or land--in the payment of displacement compensation may contribute better to the protection of the security of tenure of the farmer; the maintenance of agricultural production; as well as to the provision of the real impetus for rural business enterprise development.

2.4.4 STRENGTHENING THE MULTI-AGENCY AND SPATIAL APPROACH TO LAND USE CONVERSION IMPLEMENTATION

The desirable features of this approach has been unvariably underscored in the earlier discussion. While the DAR has been empowered to approve or disapprove application for agricultural conversion it implements this mandate as the lead agency, relying on a inter-agency network to assist it. While, there are many problems encountered, mainly in the area of coordination, this is because there are no unified goals of and priorities incorporated in the land use conversion policy. However, there are signs that this gap is slowly being narrowed down through a better understanding of the nature and the scope of the problems of land use conversion and through the recent legislation and presidential issuances and efforts of the DAR officials to improve decision-making.

There is moreover, a growing recognition, of the need to treat land use conversion within the rural/regional and urban development framework, covering not only agricultural land use conservation and production but settlements and infrastructures development, industrialization, infrastructures and environmental/ ecological balance. This broadening of the perspective requires the further strengthening of the existing multi- or inter-agency institutional framework for implementing conversion policies or programs.

A pressing problem that needs resolution, however, is the lack of defined priority areas (i.e. regions, provinces or cities/municipalities) for the implementation of conversion policies or programs. This problem probably stems from the tendency to assume that conversion is occurring equally across regions, provinces or cities/ municipalities. But, as earlier

discussed, this is not the case and that the high rates of land use conversion correlates with the pace of the urbanization/industrialization of an area.

The need to convert agricultural lands into urban and other land uses may be viewed within the areas' undergoing various stages of urbanization and industrialization. In already well-established urban/industrial centers, conversion may be viewed mainly as a way of increasing the intensity of the use of an area to optimize its revenue generating capacity (e.g. urban redevelopment and renewal of the old city center). In areas where urban/industrial development is just starting, on-going or nearing a mature stage, the need for land use conversion varies by degrees, but the aim is always to shift from the less intensive use to the "highest and best use" of the land.

In the rural/agricultural areas undergoing urban/industrial development, land use conversion may take the form of a shift from the low-value to the high-value crops or livestock rather than merely a shift in land use from agricultural to non-agricultural. It is essential to consider the needs of the various regions, provinces and localities undergoing various stages of urban/industrial growth in the determination of the priority thrust or areas for land use conversion. Moreover, a conversion policy or program must perform the multiple roles of preventing the untimely and haphazard use of land, conserving prime agricultural lands, and promoting urban/industrial growth and development.

3.0 CONCLUSIONS

In its effort to carry out its mandate to regulate the conversion of agricultural lands into urban and other land uses, the DAR has evolved a succession of administrative, general and joint orders, enunciating its policies and determining the criteria and guidelines on land use conversion. The earlier land use conversion policies were predominantly designed not only to prevent landowners and absentee landlords from converting their lands into uses not covered by the agrarian reform law but also to prescribe penalties for the unlawful ejectment of the tenants of primarily rice and corn lands.

With the upsurge of town planning and zoning activities starting in the mid-70s, arising from the efforts of the then MHS, the DAR sought to align its land use conversion policy with the efforts in town planning and zoning by entering into a joint Memorandum of Agreement with the HSRC (now the HLRB) and the MLGCD, (now the DILG). Linking land use conversion with the detailed land use planning and zoning of the LGUs appears to be a logical approach. With the post-Marcos administration of President Corazon C. Aquino's, the adoption of CARP as its "centerpiece" program provided the DAR with another focus for its conversion policy. However, the upsurge of agricultural land use conversion especially in the core regions of Southern Tagalog and Central Luzon have made DAR realize that their policy is still inadequate. But the DAR's response remained unchanged, varying the thrust of its revised land use conversion policies in order to plug certain loopholes. Thus, the DAR formulated and applied in the field of various criteria and guidelines for the more expeditious processing, evaluation and approval/disapproval of conversion applications, only to discover later that the policy gaps had remained.

Presently, there is new basis for coming up with new guidelines on land use conversion. The first of these relates to the expected upsurge of efforts by individual LGUs to reclassify agricultural lands in their jurisdiction into non-agricultural uses by virtue of the Local Government Code of 1991. The other relates to the recent perceived problem of rampant illegal conversion of CARP- and non CARP - covered lands. It is not only the DAR but the other entities of government which can provide the motivation for establishing new conversion policies.

With regard to the problem of illegal conversion, the DAR has signed a joint administrative order with the Department of Justice for the creation of national and provincial task forces to monitor the cases of illegal conversion of agricultural lands and later file criminal cases against their perpetrators. This control-oriented approach to the problem appears to be the easiest response, but it will not necessarily improve the policy nor completely solve the problem.

This paper provides modified approaches in analyzing the problems of land use conversion from the more systematic, rather than mainly judgmental or emotional viewpoint. In brief, in formulating new or updated land use conversion policy, certain key elements should be borne in mind. As elaborated in the paper, these are: 1) a clear statement of unified goals/objectives and priorities of land use conversion; 2) the use of innovative methods of analysis and understanding of the land conversion problems; 3) strengthening the linkages between land use conversion and the physical framework and detailed land use planning and development, and with environmental management; and 4) the improvement of the mechanism and measures, including the use of land use control measures and the grant of positive economic and financial measures to carry out the policy.

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URBAN TRANSPORTATION MODELLING: THE ACTIVITY-BASED TRAVEL ANALYSIS APPROACH

Olegario G. Villoria, Jr.

1.0 INTRODUCTION

The field of urban transportation modeling is now roughly forty years old. From its early beginnings as a field dominated by engineers, it has grown and matured into a multi-disciplinary field of study. To date, researchers in this field have developed three general approaches to urban transportation modeling, namely, the classical, disaggregate, and activity-based approaches. The evolution of these approaches was influenced by the changing transportation planning issues, the participation of researchers from different academic disciplines, and breakthroughs in computer, electronics and other related technologies. The first half of this paper provides an historical review of the three approaches but the main focus is on the activity-based travel analysis approach. Besides being the latest to be developed, the activity-based approach has the most comprehensive analytical framework for building a theory of travel behavior. The last half presents in detail the fundamental elements of the approach and current research directions.

2.0 HISTORICAL CONTEXT

The evolution of urban transportation modeling approaches is described in this section in order to provide an historical perspective on the development of the activity-based travel analysis approach. The focus will be on the forces that shaped model development which include: (a) the changing planning agenda and policy issues; (b) advances in computer technology and software engineering; and, (c) infusion of ideas and techniques from other disciplines such as urban and regional science, economics, statistics, psychology, and geography. Through the years, these forces brought about changes in the theoretical framework, analytical techniques, data needs, and practicality of the various approaches to urban transportation modeling.

2.1 First Decade (Mid 1950's to Mid 1960's)

It is generally recognized that the first urban transportation models were developed more than forty years ago as part of the pioneering comprehensive transportation planning studies conducted in the United States, namely, the Detroit Metropolitan Area Traffic Study in Michigan and the Chicago Area Transportation Study in Illinois. These and other similar studies conducted during this decade were aimed at producing comprehensive land use and transportation plans to address highway expansion all over the United States. Planning and construction of the Interstate Highway System were in full swing. At the same time, metropolitan areas were growing fast and more and more roads were being built to accommodate the expected rapid increase in the number of motor vehicles. The main concern of transportation engineers was to design road network systems to accommodate rapid growth and an urban lifestyle centered around the automobile. From this mindset was born what we now know as the classical four-step transportation planning model.

The classical approach to transportation modeling consists of a sequence of four models, namely: (a) trip generation; (b) trip distribution; (c) mode split; and, (d) traffic assignment. Several variations from this basic sequence have been developed over the years. Examples include direct demand models which collapse all four models into one step; combined generation-distribution models; trip-end mode split models which alters the basic sequence by putting mode split before trip distribution. However, these four models have withstood the test of time by remaining to be the core components of most modeling packages being used today.

This paper was extracted from the author's Ph.D. Dissertation – "An Operational Measure of Individual Accessibility for Use in the Study of Travel-Activity Patterns." Ohio State University, 1989.

Since the analytical framework of the classical approach is based mainly on physical laws, Pas (1988) had called this decade as the Social Physics Era of travel demand modeling. Trip distribution models, for example, were formulated based on Newton's Gravitational Law. Another example is Howe's (1962) work trip model which was based on electrostatics theory. Most other models were purely empirical deductions and without much behavioral bases.

Data is organized according to traffic analysis zones. Being so, the classical approach has come to be popularly known also as the aggregate approach. Data requirements of classical models were so extensive that more than half of the total budget for typical transportation planning studies went to data collection, reduction, and analysis.

Model implementation was typically on main-frame computers, batch-mode, and with no graphics. Hence, data preparation and maintenance for model applications were extremely cumbersome, particularly for studies involving analysis of alternative transportation and land use scenarios. Data validation and model calibration became arduous tasks for transportation modelers since they had to sift through reams of textual output. With the level of computer technology at that time, model execution took inordinate lengths of time even for just a single pass of the four-step model. Consequently, very limited alternatives analysis could be done within any given time and budget. More importantly, accuracy of model results could not be sufficiently ascertained to some level of confidence and therefore were viewed with skepticism.

2.2 Second Decade (Mid 1960's to Mid 1970's)

When the transportation planning agenda shifted emphasis from the long-run, systems-level planning of the first decade to the short-run multi-modal planning and management of transportation systems, the classical approach proved to be inappropriate in addressing the wide range of policy issues that had to be analyzed because it was extremely cumbersome and time-consuming to apply, required too much data, and could only address very limited issues. Altshuler (1981) noted that the main policy issues in the U.S. in the mid-1960's were: (a) high energy requirements of auto-oriented urban systems; (b) air pollution; (c) high rates of fatalities and personal injuries due to road accidents; and (d) inadequate transportation for those without access to automobiles. Interestingly enough, these issues are no different from what we are now confronted with in Metro-Manila. The strategies to address these issues include improving public transportation services and encouraging automobile users to shift to public transportation modes. It became necessary to have models which are versatile and can quickly and inexpensively predict the impact of various policies designed to reduce automobile usage (e.g., through carpooling) and increase public transport patronage.

Consequently, a major innovation in travel demand analysis was developed using a disaggregate modeling approach based on discrete choice analysis methods. Stopher and Meyburg (1975) presented a comprehensive overview of the theory and practice relating to this approach. This approach is described as being behavioral primarily because its theoretical basis comes from the economics of consumer behavior and the psychology of choice behavior. The advantages of this approach are well-documented in the literature (e.g., Tye et al., 1982; Stopher and Meyburg, 1975; Hensher and Stopher, 1977). By mid-1970s, this approach had become widely accepted as a viable method for urban travel forecasting and as a tool for analyzing a wide variety of policy alternatives and transportation system management issues (Stopher, Meyburg and Brog, 1979). A brief sketch of the transportation applications of discrete choice analysis is described by Ben-Akiva and Lerman (1985). The initial successes in the application of this approach led to a series of U.S. Federal Highway Administration projects devoted to the refinement of the approach and its continued dissemination to practitioners (Tye et al.,1982). Lerman (1983) provides a state of the art review and Horowitz (1983)

provides a state of the practice review of this approach.

Since the analytical framework of this approach is based heavily on random utility maximization formulations which are calibrated using efficient statistical sampling and estimation methods, Pas (1988) had called this decade as the Econometric Era of travel demand modeling. The most popular models of this decade are those based on the multinomial logit formulation because of its reasonably accurate predictive ability and less cumbersome calibration. Although the disaggregate approach is very versatile that it can be used in a wide range of applications, it has been largely and most successfully used in mode choice analyses.

Data is organized at the individual or household level. That is why it is called the disaggregate approach. Disaggregate models significantly reduced the required data for model calibration and application, and made better use of data collected from traditional transportation surveys. New survey methods and statistical sampling techniques were also developed specifically for disaggregate modeling.

Meanwhile, the classical modeling approach continued to improve its analytical framework and computational methods as it also benefited from the research results obtained as part of the development of the disaggregate approach.

Furthermore, advances in computer technology enabled model implementation to take place on mainframe and minicomputers with limited graphics capability and interactive terminals (Lewis, et al, 1989). More sophisticated algorithms such as stochastic equilibrium models and more complex statistical calibration techniques could already be computed within reasonable time. Most transportation analysis packages were still made up of large integrated programs but some were beginning to be modularized. However, data preparation and maintenance for computer implementation were still as cumbersome as before.

Despite the fact that the disaggregate approach represents a considerable advance over the classical approach, some still believe that it has many fundamental limitations and that it is not truly behavioral (Jones, 1977; Heggie, 1978; Burnett and Thrift, 1977; Burnett and Hanson, 1979; Horowitz, 1983). These shortcomings, which were summarized by Recker et al. (1986a) spurred the development of the activity-based approach to travel demand analysis in the next decade.

2.3 Third Decade (Mid 1970's to Mid 1980's)

The development of the activity-based travel analysis approach started in the mid-1970's. Being the main topic of this paper, the activity based approach will be covered in greater detail in the last half of this paper. For now, a description of its evolution from a historical perspective and its significant developments in the transportation modeling field will be highlighted during this decade.

Criticisms against the classical and disaggregate approaches and arguments in favor of the activity-based approach have been documented extensively (see e.g., Damm, 1983; Jones, 1983; Kutter, 1981). Essentially, these arguments are derived from the notion that the activity-based approach is more behavioral than its predecessors and hence more theoretically appealing. On the practical side, the activity-based approach promises to be superior in that it can potentially address a wider range of policy issues and planning problems. Jones (1983) describes in detail these potential applications.

In addition to its theoretical appeal and practical applications, the development of the activity-based approach opened up new avenues for rethinking the whole process of transportation planning. The most significant of these is Hagerstrand's advocacy of the physicalist perspective from where his concept of time-space prisms was derived. It is expected that further development of the activity-based approach will yield new operational planning or analytical techniques embodying the philosophies of this approach.

During this decade, which Pas (1988) termed as the Human Activity Analysis and Psychological Measurement Era, many aspects of the classical and disaggregate approaches were enhanced due to the work of activity-based researchers and those involved in the use of psychological measurement techniques to quantify relatively abstract transportation system attributes (e.g., comfort, convenience, reliability, and safety) and users' perceptions, attitudes, and beliefs (Pas, 1988).

The prevailing planning issues also provided a big push towards the development of the activity-based approach. Most significant were the energy crisis brought about by the 1973-1974 Arab oil embargo and the fiscal crisis brought about by high levels of public spending. These crises shifted transportation planning focus from high-cost, capital intensive strategies to low-cost transportation system management strategies (Altshuler, 1981). Transportation planners began to realize that road expansion and investments in mass transit systems which normally requires large amounts of government subsidy to survive would not alleviate urban transportation problems. Instead, focus was directed towards better utilization of existing infrastructure through transportation systems management (TSM) techniques. With this change in focus, the emergence of the activity-based approach was indeed very timely as it afforded transportation planners with a rich source of new solution ideas and analytical methods.

Data requirements for modeling were still organized either at the zonal, household, or individual level depending on the application, but activity-based researchers began to realize that traditional transportation surveys which typically captured cross-sectional data were not adequate to address the activity-based research agenda. Hence, new survey methods had to be developed such as those for collecting panel (i.e., longitudinal) data and qualitative information.

We also witnessed significant developments in the computer implementation of urban transportation models. Microcomputers became accessible and transportation modeling programs on mainframes were being converted for microcomputer implementation. Database management systems, computer graphics, and interactive or menu-driven programming approaches also started to make their way into microcomputer-based transportation modelling systems.

2.4 Fourth Decade and Beyond (Mid-1980's to the Future)

In the mid-1980's to the present, the main transportation concerns were the ever-increasing traffic congestion in metropolitan areas, environmental degradation particularly air pollution, and road safety. These concerns are not really new. Traffic congestion and road safety are perennial issues and environmental concerns have been the subject of political movements during the early seventies. However, the difference lies in the greater resolve of governments to address these concerns and the use of advanced telecommunications, control, and information technologies to develop enhancements to traditional solutions and entirely new solution approaches. This decade is also marked by significant breakthroughs in computer technology and software engineering that are radically changing the way we view, analyze, and solve urban transportation problems.

The activity-based approach still remains to be the latest analytical framework for urban transportation modeling. Activity-based researchers have preoccupied themselves with developing techniques for dynamic analysis and modeling using panel data. Pas (1988) termed the fourth decade as the Dynamic Analysis Era. Meanwhile, the classical and disaggregate approaches were further enhanced with incorporation of more sophisticated algorithms which have become implementable with the advent of powerful computers.

Over the last five years or so, computer implementation of the classical four-step modeling approach has been greatly improved with the use of relational database management systems (RDBMS), graphical

user interfaces (GUIs), and programming techniques which enabled transportation modellers to setup, digitize, calibrate, and validate a large-scale urban transportation model within a very short period of time. Data management and model maintenance are easily done. The speed of model execution has increased markedly compared with previous implementations. For example, one complete pass of the four-step model for an 800-zone transportation model can be completed in less than thirty minutes on an AT (80286), 16 MHz microcomputer.

More recently, however, the emergence of geographic information systems (GIS) is beginning to further enhance the implementation of the classical four-step model. With GIS, urban transportation models will become seamlessly integrated with other urban models, particularly land use models, thus opening up a wider domain of potential solutions that transportation planners can test and analyze. An important benefit from using GIS as a platform for urban modeling is better and cost-efficient data management. This assumes a setup in which relevant government and private sector organizations share the cost of building up and maintaining a centralized GIS in a metropolitan or regional area. This setup would also improve data consistency and encourage effective communication and coordination among participating organizations.

Future directions in urban transportation modeling revolve around the need to develop models to support research in intelligent vehicle-highway systems (IVHS) technologies. IVHS research is concerned with the development and application of electronic, computer, and information technologies in promoting efficiency and safety in the use of road and rail-based urban transportation systems. Some of the modeling enhancements that need to be developed include: (a) dynamic assignment and endogenous departure times planning models; (b) simulation of complex operational strategies; (c) stochastic processes for introducing non-recurring congestion in typical weekday travel models; (d) choice models that are sensitive to the amount of information available to the traveler; (e) integration of planning and dynamic simulation models; and, (f) explicit representation of predicted operating characteristics in emissions and fuel consumption models (JHK & Associates, 1992). We can expect that urban transportation models of the future would be able to deal with the dynamic nature of urban traffic and predict impacts of strategies based on improved communications and vehicular control.

3.0 THE ACTIVITY-BASED TRAVEL ANALYSIS APPROACH

3.1 Origin and Development

The activity-based approach to travel demand analysis first evolved when social science researchers concerned with the understanding of human activity behavior undertook time allocation studies. Chapin (1974) traced the historical roots of time allocation studies and showed how perspectives from such studies, which emphasized the spatio-temporal aspects of human activity patterns, were eventually adapted in the analysis of urban activity systems and spatial structure. This led to the growth of a body of literature dealing with the time-space or time-geographic approach to the analysis of activity patterns. Much of the work in this field has been done by land-use planners, geographers and architects (Jones, 1977).

Jones (1977) identified two research groups who have contributed significantly to the development of the conceptual foundations of time-geographic activity research. The groups differ primarily in the importance they place on the role of choice and constraints in the understanding of activity behavior. Professor Chapin and his co-workers at Chapel Hill, North Carolina view human activity patterns from the sociological and anthropological perspective. They see these human activity patterns as a reflection of the choices made by individuals in their desire to satisfy their human needs and wants. In contrast, Professor Hagerstrand's group at Lund, Sweden views these activity patterns from a physicalist perspective emphasizing constraints that limit the individual's possible activity patterns. While Chapin is interested in people's preferences so that planning can

provide for them, Hagerstrand is concerned with the factors that constrain activity patterns so that planning can relax them. Combining both perspectives provides a potentially powerful approach for analyzing urban activity behavior.

When applied to travel behavior analysis, the time-geographic approach considers travel only as one of the various daily activities that individuals do in time and space. The focus is on what motivates individuals to perform activities, how they perceive the activity choices open to them, what value systems and choice processes they use to select and sequence the activities they perform, how the physiological, economic, cultural and spatial factors constrain the activities they can perform, and how they adapt their activity patterns to changes in their external environment. Hence, travel behavior is viewed from a broader perspective and deeper breadth than those taken by classical and disaggregate approaches.

3.2 Fundamental Perspectives

Recognition of the complexity of travel-activity behavior is a fundamental viewpoint of activity-based researchers. As such, many of the assumptions, theoretical frameworks, and analytical techniques of previous approaches to travel demand modeling have been critically assessed, and many issues have been raised concerning our basic understanding of individual travel behavior. The diversity of research directions and the multitude of analytical methods that exist within the field are indicative of the difficulty of achieving a comprehensive understanding of the intricate mechanisms governing complex travel-activity behavior. While researchers have suggested conceptual frameworks toward the development of a unified theory of travel behavior, much basic research needs to be done on aspects of the theory.

Travel is considered a derived activity. Travel activity only serves to enable individuals to undertake various urban activities. The focus of the analysis is on the nature of these urban activities and how travel activity organizes or links them in time and space. This view is considerably more complex than those taken by classical and disaggregate approaches. Lost in those approaches are dimensions such as sequencing and direction of travel activities which Hagerstrand argues to be the appropriate representations of the interwoven distribution of activities in space and time (Hensher and Stopher, 1977).

Along with this view of travel, the activity-based approach postulates that an individual's travel pattern is the result of his decisions on how he fulfills his needs to undertake a sequence of activities within the constraints of time and space (Burnett and Thrift, 1977). Other constraints are attitudinal, economic, psychological, physiological, informational, and transportation-related. Hence, travel activity is the result of an individual's decision-making under constrained activity choices.

The unit of analysis is either the individual or household. However, analysis done at the household level is more common due to pragmatic and theoretical reasons (Salomon, 1983). As early as the 1960s, the household has been used as the unit of analysis (e.g. Wooton and Pick, 1967), but it was only recently that most of the empirical work is being done at that level. Kostyniuk and Kitamura (1983) cited several works which describe sociological and economic justifications for household-level analysis. Salomon (1983) refers to studies which criticize household-level analysis due to aggregation problems, but he suggests that such problems can be remedied. Clarke and Dix (1983), on the other hand, refer to another study by Supernak and Talvitie which favor individual-level analysis because, aside from other criticisms they have for household-level analysis, they believe that the individual is the true decision-maker. Clarke and Dix (1983) suggest that a fairer description of behavioral reality would be that decisions are made by individuals in the context of their respective households.

At this stage of its development, the activity-based approach is primarily concerned with the understanding of complex travel behavior. Its interest is on the explanation

rather than the prediction of travel behavior. The understanding of complex travel behavior requires not only the understanding of individual behavior but also of the household interactions that influence activity behavior (Golob and Golob, 1983). With such ambitious aim, research on this approach has to draw upon knowledge from a wide variety of disciplines resulting in its interdisciplinary nature and diversity of analytical focus and techniques. Recker et al. (1986b) provide a review of this myriad of approaches which they characterize as fragmented and lacking sound methodological foundation. Realizing also that the behavioral hypotheses that have so far been developed are predominantly partial constructs, they propose a comprehensive framework for a theory of complex travel behavior built heavily upon the conceptual developments and empirical results of previous activity-based research.

3.3 Past and Current Research Directions

This section reviews the various theoretical and empirical studies on the development of the activity-based approach. The review is organized according to the three generic components of the approach, namely, generation of the activity program, formation of feasible activity sets, and selection of activity schedule.

The review of the literature on activity-based analysis revealed that studies on travel-activity behavior have been undertaken from two broad perspectives, namely, activity choice behavior and constraints to activity behavior. The former focuses on the decision processes and underlying factors that govern the choice behavior of individuals when faced with alternative activity patterns. The latter focuses on the various constraints (e.g., economic, social, informational, transportation, spatial, and temporal) that limit activity choices. Instead of predicting activity choices, the latter perspective deals with defining how constraints circumscribe potential activity patterns.

The review revealed that research has largely focused on understanding individual decision processes, and identifying the underlying factors that govern activity choice behavior, leaving very little attention devoted to understanding how various constraints influence the formation of travel-activity patterns.

While the activity-based approach is considered as distinct from its predecessors, many of its elements are similar or recast versions of analytical techniques and model formulations found in the classical and disaggregate approaches. This is not surprising since the activity-based approach was developed by building upon the strengths of its predecessors and expanding its conceptual and analytical framework towards a more comprehensive set of principles the could be that foundation for a theory of travel behavior.

3.3.1 Generation of Activity Program

All activities that an individual undertakes over a period of time constitute an activity program. The definition of an activity varies according to the level of detail required by the analysis. For example, Pas (1984) used a rather coarse definition by categorizing activities as either subsistence (i.e., work and school), maintenance (i.e., shopping and personal business), leisure, or return home. On the other hand Tomlinson et al. (1973), in their analysis of students' daily activity patterns, used a 12-category definition of activities: teaching, private study, eating, drinking, casual social activities, entertainment, private leisure, watching television, personal hygiene, domestic activities, shopping, and sleeping. While Pas aggregated all in-home activities into one category, Tomlinson, et al. defined several categories of in-home activities. The former approach focuses only on the out-of-home activities and is not able to look into possible trade-offs in performing an activity out of the home versus in the home to save on traveling; the latter approach can potentially account for this possibility.

The time period of an activity program usually covers the daily or weekly pattern of activities, although theoretically, longer periods such as monthly, seasonal or annual cycles may also be of interest. These temporal cycles are assumed to be

interrelated in that the decisions on what activities will be done in a particular day may be influenced by the activity programs which are of longer duration (Hemmens, 1970).

The activity-based approach defines travel as another activity category which mainly serves to link all other activities in the activity program separated in space and time. In this sense, travel-activity is viewed as a derived demand. The behavioral nature of this approach stems from its perspective of focusing directly on the underlying factors that generate activity programs, and on how travel-activity patterns are formed by individuals who undertake such programs.

In understanding how individuals generate activity programs, the activity-based approach follows Chapin's (1968) schema of the process of activity choices. The schema suggests a motivation--> choice--> activity framework in which the fundamental needs and desires of an individual serve as the motivations to perform activities, based on an examination of the alternatives open to him, his preferences and decision rules. Chapin argues that this is an evolutionary process in which activity choices and the urban environment constantly interact and shape each other through time. In order to develop this schema into a more operational form, several theories or hypotheses have been advanced to establish the link between the motivational component and the activity choices.

Most research dealing with the generation of activity programs hypothesize that urban activity behavior is stable with respect to individual role structures. Fried et al. (1977) suggest that activity behavior such as those involving work or occupation, household and family, extra-familial interpersonal interaction, and leisure and recreation have stable points of reference from the social role commitment of individuals. They further suggest that the variation in role and activity patterns is influenced by the following factors: (a) physical structure of the environment, (b) socio-cultural expectations, (c) individual socio-economic status, (d) life-cycle stage, and (e) residential location. In addition, the concept of life style, as suggested, for example, by Salomon and Ben-Akiva (1982), may be added to this list. The significance of studies on how these factors influence activity behavior cannot be overemphasized. Pas (1984) cites numerous authors who discussed the importance of such studies towards the understanding of travel behavior and the improvement of current practical approaches to travel demand prediction.

This hypothesis on the stability of activity behavior has been the subject of several empirical tests. Damm (1983) provides a comprehensive review of such work and finds great difficulty in comparing empirical results due to wide variations in the definition of activity behavior by different researchers. Nonetheless, he concludes that many well-founded inferences can already be drawn and incorporated into a coherent theory of activity behavior. Damm's study shows that: (a) gender and work status, and to a lesser extent age, occupation, and educational background are principal determinants of individual activity behavior; (b) the stage in the household's lifecycle and the characteristics of the family's children strongly account for the variation in household activity behavior; (c) the interdependencies among members of the household in the performance of their activities is not well understood; and (d) there seems to be fixed activities around which individuals schedule their non-fixed activities. Given these findings, he suggests that more work needs to be done on exploring the nature of the fixity of activities and on performing a systematic comparison of behaviors across types of activities. Studies of this nature can contribute significantly to our understanding of the individual's decision processes concerning activity behavior.

Hanson and Hanson (1981) also provide an extensive review of empirical research dealing with the relationship between socio-demographic variables and travel behavior. They observe, however, that the major shortcoming of this body of work is the inclusion of only a few travel behavior dimensions or socio-demographic variables. Also, most of these studies do not consider the spatial and temporal characteristics of travel behavior. No previous work has considered an extensive set of travel

behavior measures that can capture the interrelated temporal and spatial characteristics of activity patterns. This is a salient feature of activity behavior that needs further understanding.

Other studies used the hypothesized stability of activity behavior with respect to role structures as a basis for developing models to predict activity behavior or as a technique to improve current travel demand estimation procedures through market segmentation. Kutter (1973) developed the concept of typical or archetypal individuals based on socio-demographic variables. Pas (1984) related activity patterns with role, life style and life cycle variables in order to determine the likelihood of a population subgroup undertaking a particular activity pattern. Oppenheim (1975) used a typological approach to predict urban travel activity from socio-demographic and environmental characteristics. Knapp (1983) investigated the possibility of using national travel survey data to formulate life cycle variables for use in predicting activity patterns. Such approaches to predicting activity behavior are more associative than behavioral. Nevertheless, they can lead to new approaches to travel behavior prediction, market segmentation, and simulation of long-term impacts of demographic changes on activity behavior.

3.3.2 Formation of Feasible Activity Sets

As described in the preceding section, an activity program represents the activities that an individual seeks to pursue based on his or her needs and aspirations. These activity programs differ among individuals depending on their socio-demographic characteristics, particularly those related to their social or household roles. In undertaking an activity program, an individual is faced with opportunities as to where and when each activity can be pursued. All the activity sites and their opening and closing times constitute the totality of opportunities provided by the urban area.

However, there are several constraints which limit the opportunities open to an individual. There are temporal and spatial constraints imposed by the physical environment (e.g., the land use and transportation system); constraints imposed by the socio-economic status and psychological disposition of the individual; and constraints imposed by imperfect information (Burnett and Thrift, 1977). The set of all possible combinations of activity sites that can fulfill an individual's activity program is called the feasible activity set. It is important to understand the formation of feasible activity sets because it can provide insights on: (a) the nature of an individual's choice set when analyzing activity patterns using discrete choice modeling, and (b) the impacts of land use and transportation on activity patterns.

More importantly, constraints-based analytical approaches to planning and managing transportation systems as exemplified by Hagerstrand's pioneering work on time-space prisms may be further developed. These prisms represent the possible time-space paths that an individual can follow in the urban area given various constraints such as those imposed by the transportation system. The size of these prisms can be viewed as a measure of welfare or accessibility to opportunities provided by the urban environment. Hence, it appears that time-space prisms can be used in developing analytical tools for planning and managing transportation systems. An excellent example is the accessibility methodology developed by Burns (1979).

Hagerstrand argues that rather than predicting activity behavior directly, it could be more fruitful to focus attention on how constraints limit the individual's freedom of action. Due to the complex nature of activity behavior, it's prediction is an extremely difficult task. Therefore, rather than basing plans on behavioral travel predictions, it would be easier to develop plans aimed at relaxing the constraints that circumscribe individual movements, without having to predict individual travel behavior. Hagerstrand (1970) describes in detail his conceptual development of time-space prisms and how they are formed by what he calls capability, coupling, and authority constraints. He also suggests that although many constraints are formulated as general

and abstract rules of behavior, we can give them a physical shape in terms of location in space, areal extension and duration in time. In other words, the influence of constraints on activity behavior manifests itself in the spatio-temporal dimensions of activity patterns. Theoretical and empirical studies should be undertaken to understand the spatial and temporal characteristics of activity behavior. However, several authors (e.g., Burnett and Thrift, 1977; Kostyniuk and Kitamura, 1983; Holzapfel, 1986) observe that very limited research has been undertaken in this area.

Several authors hypothesize the existence of fixed activities around which discretionary activities are scheduled according to their flexibility or importance (see e.g., Cullen, 1972; Cullen and Godson, 1975; Kutter, 1973; Chapin, 1974; Oster, 1978). Some activities are believed to be intrinsically fixed in space (e.g., work activity in the short run) or fixed in time (e.g., eating meals). On the other hand, Damm (1983) refers to studies which assume that participation in other less fixed activities is influenced by subjective perceptions, preferences, and attitudes. By studying the nature of and the factors that influence the degree of fixity of activities, we can gain insights that are useful for modeling activity behavior and for managing transportation and the urban environment.

In studying the temporal fixity of activities, some have stressed the importance of looking into the variation of temporal constraints in time so that blocks of free and constrained times during a day can be identified (see, e.g., Heggie and Jones, 1978). A related issue is how this temporal fixity varies during a day, a week, or even during longer time periods. Certainly, there are day-to-day variations in activity behavior, but work in this area is limited by the scarcity of longitudinal data.

Spatial fixity also plays an important role in structuring an individual's daily activity. Depending upon the location of an individual's fixed activity, he or she is faced with different opportunities to participate in discretionary activities (Damm, 1983). Obviously, transportation services available to individuals is a major factor in determining their accessibility to activity opportunities. Damm further points out that we only partly understand how people use non-motorized modes when participating in out-of-home activities. To date, there has been no significant work done in exploring how various modes of transportation influence activity behavior.

There are also a few studies dealing with the effect of imperfect information on activity behavior. It has been suggested that the level of information that individuals have on the opportunities available to them expands or contracts their time-space prisms (see e.g., Parkes and Thrift, 1975). Furthermore, it has been posited that individuals undergo a dynamic learning process about their urban environment which influence their activity behavior (Horton and Reynolds, 1970).

Activity-based researchers are still in the dark about many dimensions of temporal and spatial constraints on behavior (Damm, 1983). In particular, the role that spatial, temporal and transportation constraints play in shaping travel-activity patterns is an important topic that so far has received relatively little attention. Examples of research issues pertaining to these constraints are as follows: (a) mechanisms followed by households in allocating scarce transportation supply among household members; (b) existence of threshold levels of mobility where significant changes in activity behavior occur; (c) extent of activity pattern choices perceived by individuals as a function of these constraints; and, (d) importance of including transportation supply or mobility-related variables as determinants of urban activity patterns in relation to widely known socio-demographic and spatial determinants. Burnett and Thrift (1977) also raised many issues that need to be explored regarding spatial and temporal constraints. They also refer to the developmental works of Brog, et al. and Lenntrop, who formulated mathematical and simulation models for assessing the impacts of transport and land-use policies on activity behavior. In contrast to conventional and disaggregate approaches to demand analysis, their approach uses environmental data (not diaries) and yields expected time-space budget of each individual's simulated path.

Their approach follows Hagerstrand's constraints-based planning philosophy.

3.3.3 Selection of Activity Schedule

Several theories have been proposed to explain the behavioral rules that govern the scheduling of activities in time and space. Fried et al. (1977) developed a microtheory which views travel behavior as a socially, psychologically, and economically constrained adaptation process to discrepancies between the person-environment fit. Their theory is essentially a broad conceptual framework dealing with the social and psychological forces that shape travel decisions and behavior.

Many others have modeled activity behavior based on random utility theory. Examples are Adler and Ben-Akiva's (1979) models of nonwork travel and Recker et al.'s (1986a) model of complex travel behavior. Though not yet fully operational, Recker et al.'s model is the most comprehensive and the one that integrates most of the significant developments in activity-based research. The underlying hypothesis in these models is that an individual selects the activity pattern which provides maximum utility.

An entirely different approach for modeling activity behavior builds upon the notion of urban travel linkages, particularly the mutual dependence between transport and land use (Mitchell and Rapkin, 1954). Rather than predict individual activity choice behavior, this approach assumes that activity patterns reflect the functional interdependence between urban land uses. Thus it focuses on the spatial arrangement and the strength of travel linkages between activity locations. Macroscopic regularities in these linkages are utilized in formulating stochastic models of activity patterns (see e.g., Hemmens, 1966; Marble, 1964; Horton and Shuldiner, 1967; and, O'Kelly, 1981). Hanson (1979) discuss the potential usefulness of this approach in analyzing the impacts of spatial constraints on activity patterns. This approach is neither behavioral nor microscopic. Its analytical nature is associative, as in the archetypal or typological approaches to predicting activity patterns discussed earlier.

Most empirical studies on urban travel linkages concentrate on measuring the strength of these linkages through an analysis of multiple-sojourn trips or trip chains. Many of these studies use Markovian models even though the time-homogeneity and memoryless assumptions of these models are too restrictive, considering the dependence of activity behavior on time of day and location in the urban area (Kitamura, et al., 1981). Moreover, these macroscopic approaches are basically atemporal and aspatial (Vidakovic, 1977). Very limited research has been devoted to the understanding of the fundamental time and space properties of activity patterns at the microscopic (individual) level. Noteworthy examples are Vidakovic's (1974) harmonic series model of trip chains; Vidakovic's (1977) analysis of the distance parameter of trip chains; Kitamura et al.'s (1981) theoretical development of the basic properties of time-space paths; and Kostyniuk and Kitamura's (1983) empirical work on household time-space paths.

4.0 SUMMARY AND CONCLUSIONS

The activity-based approach to travel demand analysis is rooted in the time allocation and the time-geographic studies of human activity. Its development is due to the efforts of researchers from many academic disciplines, thereby contributing to the rich, diverse and multi-disciplinary nature of this approach. With the changing agenda in transportation planning, the classical and disaggregate approaches to travel demand analysis can not adequately handle the complex issues that analysts face. For example, the impact of innovative non-transport solutions to urban transport problems is difficult to assess using existing methodologies. Non-transport solutions include land use controls, telecommuting, teleshopping, electronic data interchange, and other telecommunications-based solutions. The potential of the activity-based approach in addressing these issues became the major impetus for the development of this approach.

This review of past research showed a wide diversity in the focus and analytical approaches to modeling activity behavior. Research seems to be fragmented, and there is as yet no widely

accepted theory of activity behavior. There are recent efforts, however, to provide a more coordinated direction that can integrate the various approaches into a cohesive theory. Still, many believe that more theoretical and empirical work are needed so that the basic and fundamental elements of activity behavior are better understood. Operational activity-based models have not yet been fully developed for practical application. However, the approach has served to improve the application of existing approaches by enabling better model specification and market segmentation.

Most of the theoretical and empirical work in activity-based research has focused on understanding how individuals generate activity programs. The major hypothesis is the existence of a stable relationship between activity patterns and an individual's social role, household's lifecycle stage, and lifestyle. Using data on daily travel patterns, from conventional origin-destination studies, this hypothesized stability has been empirically investigated. Current research directions are focused on designing new survey methods to collect longitudinal data; developing interview techniques to gain insights into the motivation and decision processes of individuals; investigating the day-to-day variability of activity patterns; and developing new mathematical and non-mathematical models of activity participation.

The area that has received little attention is the understanding of how various constraints influence activity behavior. Attitudinal, economic, psychological, social, informational, physiological, transportation, spatial and temporal constraints have all been hypothesized to limit the activity choices perceived by the individual. Most of the work in this area is limited to theoretical or conceptual constructs and are focused on understanding the nature of the degree of fixity of activities in space and time; investigating the interrelationships between the time and space components of activity patterns; and identifying the factors, specially land use and transport factors, which influence activity patterns.

The underlying hypothesis in most activity scheduling models is that individuals are faced with activity choices and that they decide based on some rules of behavior, such as utility maximization. Models of activity choice behavior are mainly based on random utility theory. Stochastic techniques have also been used to model trip linkages at an aggregate, aspatial and atemporal level. At the individual level, mathematical models of trip chaining processes have been used to predict activity patterns or to investigate their fundamental time-space properties.

The activity-based travel analysis approach to urban transportation modeling is the result of a healthy cross-fertilization of ideas and techniques from various disciplines, namely, engineering, urban and regional science, economics, statistics, psychology, sociology, and geography. It has the most comprehensive analytical framework for building a theory of travel behavior. Its contribution to date is mainly on providing transportation modellers with conceptual bases from which practical models are developed. With the current trend towards seeking out novel urban transportation solutions, some of which may affect individual life styles and urban activity behavior, the activity-based approach appears to be the most logical starting point for analysis and modeling.

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THE ECONOMIC IMPORTANCE OF NON-MOTORIZED TRANSPORT AND ITS IMPACTS ON TRAFFIC CONGESTION MANAGEMENT

Brian Williams

1.0 INTRODUCTION

This paper is intended to make three simple points. First, the use of non-motorized transportation in many Asian cities is not a reflection of underdevelopment, but is a legitimate economic response to a set of public policies designed to constrain elite consumption and encourage savings and investment in order to promote economic growth. Dense cities with high levels of non-motorized vehicle and public transit use are, in fact, the spatial manifestation of the official export-oriented growth models adopted by many Asian Newly Industrializing Countries. In fact, our recent study indicates that higher levels of bicycle ownership and use are correlated with higher per capita income levels and higher growth rates lower per capita incomes and lower growth rates. Second, for many years, transportation planners believed that the best way to fight traffic congestion was to expand road capacity. But empirical evidence indicates that over the last twenty years expanding capacity has proven to be ineffective in slowing worsening motor traffic congestion, largely because the number of new vehicles on the road continually outstrips the amount of new road infrastructure that governments are able to build. Third, the economic importance of non-motorized transportation is extremely significant in some countries and is usually completely ignored by most cost-benefit procedures utilized by multilateral lending agencies and national governments in on-going transportation planning activities.

2.0 THE ECONOMIC IMPORTANCE OF NON-MOTORIZED TRANSPORT

The most dynamic region of the global economy in the past two decades has been East and Southeast Asia. In fact, it has been the successful economic rise of Japan, Korea, Taiwan and most recently China which has forced a reconsideration of traditional economic development theory. The nature of urbanism in East and Southeast Asia has played an important role in constraining consumption and encouraging saving and investment while simultaneously minimizing the cost of labor and maximizing the competitiveness of Asian exports. In other words, the higher levels of non-motorized vehicle use, lower rates of motorization, dense urban areas, cramped housing and congested streets typical of many Asian cities are not a sign of underdevelopment. In fact, this form of urbanism lies at the heart of the success of the so-called "Export-Oriented Growth Model."

Achieving rapid rates of economic growth requires that economic surplus is invested in new production rather than consumed by more elite segments of the population. Automobile consumption is a particularly onerous form of elite consumption. Not only does each purchase represent thousands of dollars of lost productive reinvestment but growing dependence on automobile transportation usually translates in to growing dependence on imported oil and vehicles and international debt. Dedicating road infrastructure to low-cost bicycles and buses instead to private cars and motorcycles encourages savings and investment rather than consumption which allows for higher growth rates in the long run.

In the U.S., 86% of the labor force has no alternative but to commute by private automobile and each employee must be paid an average of $4,500 for the purchase and maintenance of their vehicles (Facts and Figures, 1990). These expenditures are indirectly reflected in the market price of U.S. products. Meanwhile, in china, with the highest economic growth rates in the world, the majority of the population is able to commute by walking or bicycling. With bicycles consuming 1/12 of the road space of a private motor vehicle and about 1/20 of the space for parking, much less public infrastructure must be constructed to serve the country's transportation needs. If China were to have as many automobiles per capita as the United States, they would have to pave over 40% of their arable land. Moreover, the United States has sacrificed up to 60% of its

urban land to road infrastructure to accommodate motor vehicle traffic. Automobile-based transport systems tend to encourage low-density suburbanization, imposing important and costly inefficiencies in public service provision such as telecommunications, electricity, water, sewerage and postal service. Rail and bicycle based transport systems typical of Japan and other Newly Industrializing Countries have led to the development of cost effective higher density clusters both in central cities and other regional metropolitan centers. For example, because of the ability to rely on walking, bicycling and commuter rail systems, residents of Tokyo use 1/7 of the gasoline consumed by residents in many large United States cities. While many scholars have asked why the United States has lost the competitive edge in the production of automobiles, fewer have asked why the country consumes so many. It is indeed ironic that Japanese workers commute to work by bus in order to minimize company transport costs,. while in Detroit, auto plants located in distant suburbs are accessible only by private automobile, ensuring workers are also customers.

There are widely varying levels of bicycle and other non-motorized vehicle usage within and between both high and low-income countries worldwide. Using simple regression analysis, there is no statistically significant correlation between GNP per capita and the number of total trips made by bicycle. While there is an obvious positive correlation between the modeshare of the automobile and higher levels of GNP (.61), as auto use increases with income, it is not at all clear that trips by non-motorized modes are the first to be displaced. In Asia, countries with low per capita incomes, such as Bangladesh and higher per capita income countries such as Japan exhibit high levels of non-motorized trip-making. While per capita income tends to be the strongest indicator of motor vehicle mode share (explaining 59% of the variance), 41% of the residual is explained, in large measure, by differences in public policy applications. More interesting, perhaps from the perspective of economic development, is that there is a significant negative correlation between the level of automobile ownership and levels of economic growth (-.23) while there is a high positive correlation between levels of bicycle usage and faster growth rates (.36). This is likely due to the fact that motor vehicle consumption tends to be consumed by the wealthiest segment of the population – the same segment that possesses the ability to invest in other productive enterprises. Thus, there is a fairly significant negative correlation between automobile mode share and domestic savings rate. The importance of non-motorized vehicles from a micro-economic perspective is that they provide an environmentally friendly intermediate technology which can improve transport productivity levels at a cost affordable to a far greater percentage of the world's population than motorization alone.

3.0 THE ROLE OF MULTILATERAL DEVELOPMENT BANK COST-BENEFIT PROCEDURES IN TRANSPORT PLANNING

Currently, the only way that non-motorized vehicles enter World Bank cost-benefit analysis is as a negative externality on motorized traffic (Hoban & Archando-Callao, 1992). In other words, it treats slow-moving vehicles in the same way it treats low pavement quality, as a factor to be considered only with respect to the negative impact it has on the travel times of motorized vehicles.

While some have argued that travel time is not important in countries with high levels of underemployment (Addus, 1989), recent analysis of labor patterns in less-developed countries indicates that the problem is not "underemployment" but low-productivity employment. Historically, the level of an individual's production as generating a sufficient surplus to produce goods for trade in the market is the measure of individual productivity. However, the time that it takes to generate sufficient economic output for survival should at least have a value roughly equivalent to the subsistence wage. Therefore, with respect to transportation infrastructure improvements, whether the time any individual is saved by a transport improvement is actually remunerated or not, it has societal value and impact. Thus, the economic impacts of a change in road policy (such as segregating traffic into motorized and non-motorized lanes or banning all non-motorized traffic completely) or a road investment (e.g. widening), the economic impacts on all potential users of the investment must be taken into consideration when costs and benefits are weighed. If not, the economic impact of a policy such as banning non-

motorized vehicles will obviously have a higher rate of economic return than providing a slow-moving vehicle lane, as road-side friction would be reduced, measured as zero cost, and thereby ignoring the impact on alternative users who do not have access to a private vehicle.

It must be accepted that transportation services do not offer an infinite number of trade-offs between travel time, trip cost, trip convenience and trip safety. Transport consumers may only travel with respect to the options provided for them. As a result, people taking one mode may have actually been willing to pay more ore less to take a slower or faster mode where it is available as an option. Therefore, when calculating the economic costs and benefits of the impact of a projected road-infrastructure project and/or transportation policy application on non-motorized road users, the following must be considered:

a) the change could induce people to switch between bicycling, pedicab or walking to a more expensive mode (bus, para-transit) which may or may not be faster;

b) through traffic generation serving latent demand, the change could induce people to switch between bus, para-transit to bicycling, pedicab or walking which may or may not be faster.

For example, in the case where a slow-moving vehicle lane is added to a road, the benefit of such change can be measured by taking the net present value of a stream of benefits by adding:

- the money saved in any period by all generated non-motorized road users who used to use a more expensive mode less the value of any time lost related to switching, plus:

- the value of the time saved by all new non-motorized road users who used to walk, less the increased costs of the trip related to bicycle ownership and repair, plus:

- the value of increased or decreased travel time costs for all current non-motorized users.

Another reason why economic impacts on non-motorized users have long been ignored (although related to the above) is that many of the factors which significantly affect non-motorized vehicle use are demand-management techniques or policy applications and not infrastructure issues. Current methods (such as the World Bank's HDM III model) are not able to measure economic effects under a diversity of policy regimes. For example, it may be the case that increases in motorized traffic speeds discourage the use of road infrastructure by non-motorized users. For example, in the United States, which has one of the most bicycle-hostile environments in the world, there are now more than 100 million bicyclists and more than half of these are adults. This represents an astounding 33% increase in only 10 years. However, this increase in bicycle ownership has had little impact on actual mode share. This is not, however, due to the American's unwillingness to use the bicycle, but rather due to the urban environment's hostility to bicycling. Currently, 76% of the population commutes by private automobile, 25% would commute by some other means if it were available and 13% said they would take the bicycle or simply walk (Bicycle Reference Book, 1993). The United States Department of Transportation, long unsympathetic to bicycling, currently has plans to double the amount of total trip made by bicycle from 7.9% to 15.8%. Indeed, pedicabs have come back to the streets of New York City!

Bicyclists may fear for their safety in the absence of lanes to separate non-motorized vehicles from motorized vehicle users. Banning non-motorized vehicles from using or crossing high-speed roads will obviously have clear economic impacts on those without access to an automobile. Cost-benefit analysis, if it is to measure real economic costs, will have to be able to develop ways to measure the economic costs and benefits of various different policy options. There are many other policy decisions to evaluate besides a build and no-build scenario. Unless these economic impacts which are critical to the economic development potential of the vast majority of developing-country populations are given significantly greater value in cost-benefit procedures, the emphasis of World Bank lending or variations on these analyses adopted by developing country governments will continue to have minimal impact on the economic productivity of the majority of the population.

4.0 NON-MOTORIZED VEHICLES AND TRAFFIC CONGESTION MANAGEMENT

Among Organization of European Communities for Development (OECD) countries between 1970 and 1990 the miles of road infrastructure increased by between 4% and 9%, while the number of vehicle miles traveled increased by closer to 50%. In developing countries there is even less likelihood that road infrastructure expansion will be able to reduce congestion levels. With motor vehicle fleets expected to double by the year 2010 in developing countries, the cost of providing sufficient road infrastructure to accommodate this increase in traffic is likely to be prohibitive.

TABLE 1 CAPACITY/VOLUME RATIOS BY MODE

Mode or Type of Way	Capacity of Way (pax/meter/hour)	Speed (km/h)
Non-Motorized Modes		
Walkway		
Bikeway		
Rickshaw/Pedicab		
Motorized Road-Based Modes		
City Streets		
Motorbike with 1 occupant		
Cars with 1.5 occupants		
Cars with 4 occupants		
Minibus (10 passengers)		
Bus, Mixed Traffic (40 passengers)		
Bus in Separate Dedicated Bus Lane		
Expressways (without congestion)		
Cars with 1.5 occupants		
Cars with 4 occupants		
Minibus (10 occupants)		
Bus (40 passengers)		
Urban Rail		
Tram (15,000 passengers/line/		

Sources: Transportation Strategies for Human Settlements in Developing Countries 1984. UNHCS/Habitat. Wright, C. 1990 Fast Wheels/Slow Traffic (Philadelphia: Temple Univ. Press) Gallagher, R. 1992. The Rickshaws of Bangladesh, (Bangladesh: University Press Limited)

Congestion is a problem of insufficient road capacity to handle a given "flow" or the number of vehicles at a given speed per hour. The best strategy to control increasing traffic congestion in the long run is to encourage passengers to switch from single occupancy motor vehicles to alternative modes with higher capacity/flow capacities. In Table I capacity/flow ratios of different modes are estimated. Any combination of policies which increase the number of trips and vehicle miles traveled (vmts) on a mode with a higher capacity/flow ratio and decreases the number of trips and vmts on modes with a lower capacity/flow ratio will improve road traffic congestion.

It must be kept in mind, however, that the capacity/flow ratios in Table I are assuming a zero congestion scenario. If, for example, traffic speeds on expressways slow to the same

speeds as on city streets, then the capacity/flow ratios for motor vehicle travel on expressways will be the same as on city streets. For example, in many U.S. cities right now rush hour travel speeds are actually higher on surface streets than on expressways. Expressways in Japanese cities at rush hour have average travel speeds around 10-15 kilometers per hour. In other words, achieving the expressway travel speed levels listed below assumes that congestion has been mitigated, either by extensive capacity expansion, which is unlikely, or through congestion pricing, which is still relatively seldom used.

As is clear from the Table, the private motor vehicle with only one or two occupants in slow traffic such as on city streets is by far the most space-intensive means of transportation by order of magnitude. Thus, any shift from the single occupancy motor vehicle to a mode with a higher capacity/flow ratio will improve the congestion situation.

4.1 The Role of Non-Motorized Vehicles in Reducing Road Traffic Congestion

Non-motorized vehicles play an important role in providing an alternative to private automobile travel in many developed countries, most notably Holland, Japan, and Denmark. Non-motorized vehicles also play an important role in developing countries such as China, Vietnam, Indonesia, India, and Bangladesh. Walking and animal-drawn vehicles, of course, also play an important role in both developed and developing countries.

There are two important ways that non-motorized vehicles can improve the traffic situation for motor vehicles. First, because bicycles and pedicabs use less road space per person per lane per hour than private motor vehicles even with high occupancy levels, if passengers switch from private motor vehicles to bicycles or pedicabs it will have a positive impact on road traffic congestion. In countries where there is already a high level of non-motorized vehicle use, and they are being slowly displaced by increased motorization, policies promoting the use of non-motorized vehicles can at least slow the increase in the displacement of non-motorized modes.

The second and equally important role of non-motorized vehicles in reducing road traffic congestion is in expanding the catchment area for people using metros or other mass transit modes with very high capacity/flow ratios. In developed countries people are only willing to walk about .5-1 kilometers to reach a commuter rail or metro line, and only about .15 kilometers to reach an express bus line. However, they are willing to bicycle 2-5 kilometers to reach a metro, commuter rail or express bus stop. Thus, while the bicycle consumes more road space that walking, the use of the bicycle instead of walking increases the catchment area around mass transit station from about 1 square kilometer to some 25 square kilometers. (Replogle, 1983, p.33) By making the use of metros, commuter rail, and express buses more convenient to more people, non-motorized vehicles are playing an important role in increasing the use or at least stemming the decline in use of mass transit.

4.2 International Trends in Non-Motorized Transport Usage

There are only a handful of countries where the use of the bicycle is actually increasing as a share of total passenger trips nationally. In the Netherlands, for example, 30% of all trips are made by bicycle, and they plan to increase the bicycle kilometers traveled by 30% between 1990 and 2010. They have estimated that such an increase would account for 8.75% of the desired reduction of motor vehicle traffic (Netherlands, Ministry of Transport, 1990).

In China, the mode share of the bicycle is also increasing. Between 60% and 90% of all non-walking trips are currently made by bicycle, and the percentage of total trips made by bicycle is increasing. The economic reforms have made it easier for people to purchase bicycles, and many people are switching from the overcrowded buses to bicycles. Thus, for China, where the bicycle is already intensively used, the discussion in Shanghai are how to move people from the bicycle to vehicles with higher capacity/flow ratios, such as buses in dedicated bus lanes or to metros. In

Vietnam, as well, the mode share of the bicycle is also increasing for similar reasons.

In Manila, where pedicabs which had almost entirely disappeared re-emerged in the 1980s as an important mode in some areas. This contrasts sharply with recent trends in Indonesia and some other South Asian countries where the use of pedicabs has been sharply curtailed by government bans on their use. The pedicabs, primarily used for small residential streets in residential neighborhoods or kampungs, have been replaced by motorized tuk-tuks or mini-taxis which are not only more expensive and more polluting, they also take up more road space and thus have worsened the traffic congestion problem. On top of this, nearly 200,000 becak drivers lost their jobs.

While the bicycle is very critical to the Japanese transportation system, its role as a primary mode for a trip fell slightly. In most countries, however, including Japan, where bicycles are very extensively used, the bicycle as the primary mode for a trip is still falling. Some 50% of all trips in Japanese cities nationwide are made by either walking or bicycling. If we look just at Tokyo, walking accounted for 42.8% of total trips in 1968 and still accounted for 27% in 1988. In 1988, bicycling alone accounted for 18% of total trips. For commuting in Tokyo, bicycling and walking accounted for 25.8% of all commuting trips in 1968, and fell only slightly to 21.7% of all commuting trips by 1988. Rail accounted for 51.9% of all commuting trips in 1968, and still accounted for 46% in 1988. The automobile accounted for only 12.9% of all commuting trips in 1968, and now accounts for some 29.4% of all commuting trips (Replogle, 1992).

The role of the bicycle in reaching mass transit stations, however, has increased dramatically in many cities around the world, particularly in developed countries. In Denmark at least 25% of total trips to metros and commuter rail stations are now made by bicycle, and the numbers are increasing.

In Tokyo the use of the bicycle for reaching urban rail lines has increased dramatically. In 1975 there were only 300,000 bicycles parked at commuter rail stations throughout the country. By 1981, this figure had risen to 1.25 million, and is now closer to 3 million, with 1 million of them in Tokyo. In moderate and lower density suburban areas around major cities between 15% and 45% of rail station access is by bicycle. For Tokyo as a whole, bicycle access to rail lines rose from 4% in 1975 to 11% in 1980 to 13% in 1985 to closer to 15% today. This growth in bicycle use has not been exclusively in the lower income areas but has been at least as prevalent in higher income neighborhoods (Replogle, 1992).

The increased use of the bicycle to reach commuter rail lines is thus in part responsible for the fact that despite heavy subsidies to road-based transportation, the use of rail for commuting has fallen by only 5% over the past 20 years and remains at 46%, the highest rail use for commuting among Organization of European Communities for Development countries. The use of rail to reach the three central wards of Tokyo has actually increased from 88% to 91% in the past decade. In this way the use of the bicycle has been critical to traffic congestion reduction in Japan.

The increase in bicycle use for reaching commuter rail lines is primarily the result of two factors. First, increasing road traffic congestion is slowing the travel speeds of both automobiles and buses. Bicycles are actually able to maintain faster travel speeds in conditions of hyper-congestion because they can go around the cars. In Tokyo, where road travel speeds have slowed to around 7-10 km per hour, and on some New York streets traffic has slowed to around 5 km per hour, the bicyclist are able to make faster time than private automobiles.

The other phenomenon in many countries is, as housing becomes more widely dispersed, people are having to travel farther distances to reach transit nodes. Where most people used to walk to mass transit stations in Japan, increasingly people are living in new developments farther and farther from the rail station. With automobile parking prohibitively expensive, the bicycle has become the mode of choice.

4.3 *Economic Advantages of Increasing Non-Motorized Vehicle Use as a Congestion Mitigation Strategy*

The enormous cost required to provide the necessary road and parking infrastructure to accommodate a majority of commuters in low-occupancy private motor vehicles relative to modal mixes where non-motorized vehicles and urban rail modes predominate can be seen when looking at aggregate cost data from Japan and the United States. In Japan, where rail and non-motorized mode predominate, only some 10.7% of GNP is dedicated to transporting all of society's goods and people. In the United States, however, where 86% of the population is locked into commuting by private automobile, we spend 17.9% of our GNP on transportation. These enormous cost differences are reflected in all the products produced in the United States and may partially explain the United States' deteriorating competitive economic performance relative to Japan, particularly when it is noted that some 45% of the U.S. trade deficit is from automobile and oil imports.

Controlling traffic congestion by promoting the use of non-motorized vehicles makes particularly good sense in lower income countries. Over 80% of the world's population is able to afford a bicycle, while in many developing countries only 5% or 10% can afford a private automobile. This means that even in relatively economically successful countries like Mexico, in Mexico City where roads are congested to near gridlock, this gridlock is being caused primarily by the wealthiest 12% of the population which is able to afford a car.

5.0 NON-MOTORIZED VEHICLES AND TRAFFIC CONGESTION MANAGEMENT

5.1 *Improving Bicycle-Related Infrastructure and Facilities*

Actually increasing the amount of non-motorized vehicle use as a primary mode or for reaching transit stations requires a complex array of public policies. Clearly encouraging the use of the bicycle to reach urban transit stations requires a complex array of public policies. Clearly encouraging the use of the bicycle to reach urban transit stations requires a provision of proper parking facilities. In Japan, where bicycle use for reaching transit is growing rapidly, this process has been facilitated by several public policies, some promoting non-motorized modes with subsidized supporting infrastructure, others by constraining alternative modes such as low-occupancy automobile through pricing policies.

Japan's Bicycle Law, passed in 1977, first provided public funding and tax incentives for the construction of bicycle parking facilities. The 1980 Bicycle Law requires that newly constructed or enlarged department stores, supermarkets, and banks must provide bicycle parking. Japan has spent around $10 billion on bicycle-related infrastructure over the past two decades, which led to the construction of some 8,735 parking facilities holding some 2.77 million bicycles. About 75% of these are controlled by provincial or local governments, 13% by public authorities such as the railroad, and 12% by the private sector. Roughly 66% of these parking spaces were within 100 meters of a rail station entrance, and most hold from 500 to 1000 bicycles. One half to one third of the capital costs for construction can be paid for from public subsidies, and tax benefits and subsidized financing is available to the private sector from the development banks for bicycle parking provision. Once Japanese employees make it to a commuter rail line their rail fare is generally paid for by their employer, another important incentive to use the train system (Replogle, 1992).

The Netherlands has also dramatically increased bike parking space at metro stations. They now have a bicycle parking space for every 3 passengers boarding, and larger stations have guarded parking. In the United States, 47% of metro and commuter rail riders said they would consider bicycling to transit stations if facilities for bicyclist were improved.

In some countries security is a key issue. Theft rates are extremely high in the United States, at least five times higher than in Japan, and twice as high or more as in

Germany. Where theft is a significant danger, the importance of secure or guarded parking facilities increases, and this also drives up costs. In most cases, however, the costs of expanding road infrastructure to accommodate the extra motor vehicles or the costs of resulting road traffic congestion are higher than the cost of subsidizing secure parking facilities for non-motorized vehicles at mass transit stations.

Another solution to the security problem is to make rental facilities available. In Holland and Japan many train stations have rental facilities at train stations, which allows a person to commute and not worry about leaving their bicycles at a train station overnight. Permitting bicycles on trains also facilitates bicycling at both ends of a commuter rail journey. In France, bikes are put in a special freight car. Metro North in New York allows bikes with a bike pass but reserves the right to refuse access if the train is overcrowded. Berlin allows 48 bikes per every 8 car train. Bikes are permitted on many mass transit systems and rail systems around the United States usually with certain conditions. Trains built with special areas for bikes helps keep them out of the way of passengers. In countries where commuter trains are very congested, however, such strategies make less sense.

A network of safe and pleasant bikeways throughout the city and particularly around rail stations is also particularly important. In Japan most bicyclists share wide road-level sidewalks with pedestrians, although they are also allowed on roads. In Copenhagen, bicycle commuting increased by 50% in only 5 years when the city replaced curbside parking with curbside bicycle lanes. In Erlangen, Germany, the development of an extensive network of bicycle lanes doubled cycle trips to 30% over a 12 year period. Traffic calming on residential streets and bike paths through major parks also help to create a pleasant bicycling and walking atmosphere to encourage their use. Thus, networks of bike lanes and bike-friendly streets are important to increasing the popularity of bicycling, but this must not be used as an excuse to ban bicycling on normal roads.

Clearly banning non-motorized vehicles on major streets will do nothing to ease congestion. As pedicabs are four times as efficient users of road space as the low-occupancy motor vehicle, banning will probably only worsen the already nightmarish traffic congestion there. It is also important to avoid severing non-motorized vehicle and pedestrian ways with highways or other obstructions. Major highways without overpasses or underpasses can force non-motorized users miles out of their way without proper provision of overpasses or bypasses. Bridges without bicycle lanes and/or banned to bicycle traffic cam also be a major impediment. In New York City, which is on 3 islands, for example, bicyclists have considerable difficulty moving from one island to another because they are banned on the Verranzano, Throgs Neck, Whitestone and Outerbridge Crossing Bridges. Some bridge pedestrian ways and road overpasses which are available are only accessible by stairways, making them inconvenient for bicyclists.

5.2 Providing Dis-Incentives to Use Low-Occupancy Private Motor Vehicles

In countries where bicycling has become an important part of the transportation system and successfully reduced motor traffic congestion, apart from incentives to use the bicycle there have also been severe dis-incentives against using the private automobile. In Japan, for example, a car owner must prove that they own a parking space before they can register their car in Tokyo, and parking is enormously expensive. It can cost over $100 to park for a day in some areas in downtown Tokyo, in part because of taxes. Parking violations can result in fines of up to $1,500. Then, fuel taxes are very high, accounting for 47% of the price of gas in Japan, and with import duties on oil, the cost of gasoline is 3.1 times higher than in the United States. Meanwhile, a driver can pay the equivalent of $98 in tolls to drive from Osaka to Tokyo, about as far as from New York to Washington where the tolls will cost a United States driver from zero to $14 depending on the route. The total tax levy on a car in Japan is roughly $1,285 per year, compared to $232 per year in the United States.

Another crippling cost of driving in Japan is called "shocken." Every two years, drivers have their cars inspected. The cost of inspection is roughly $900, and if the car does not have the inspection sticker by the end of the year the cost is doubled. Above and beyond this, you have to pay the mandatory replacement costs on all sorts of vehicle parts (Ishi, 1989; Replogle, 1992; Newman & Kenworthy, 1989). Furthermore, most Japanese employers pay for the entirety of their employees commuting expenses if they commute by public transportation. As a result, families tend to only have one car and treat it as a luxury, using it for weekend outings, rather than as a means of commuting.

Holland has brought about the increase in bicycle and non-motorized transportation use by spending some 10% of its surface transportation budget on bicycle facilities, by increasing fuel and automobile purchase taxes by 50%, and increasing subsidies to mass transit by $5.7 billion a year. In Denmark, a similar result has been achieved by imposing a 200% sales tax on automobile purchases, increasing taxes on fuel to the point where a gallon of gas costs $3.79. These extra funds were used to underwrite the costs of expanding bicycle lanes and parking facilities.

Area pricing schemes as use in Singapore, and in the near future electronic congestion pricing will be able to more closely charge road users in relation to the amount of road space they consume. Revenues from congestion pricing could be an important source of funding for the sorts of low-cost infrastructure needed to support non-motorized vehicles.

6.0 CONCLUSION

Non-motorized vehicles can be part of a successful strategy at reducing road traffic congestion. While many people from developing countries may view environmentally-benign bicycles and other non-motorized vehicles as a sign of under development, the fact that they are increasing in importance in Japan, Denmark, Holland, and other highly industrialized countries indicates that they are actually an integral part of the most modern transportation systems in the world. The importance of non-motorized transportation lies mainly in the fact that its utilization addresses the mobility needs of the majority of the population and at a lower overall individual and societal cost. Overcoming obstacles to the use of affordable and environmentally-friendly technologies has the potential to yield economic rates of return much higher than current estimates for infrastructure projects currently reflect.

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