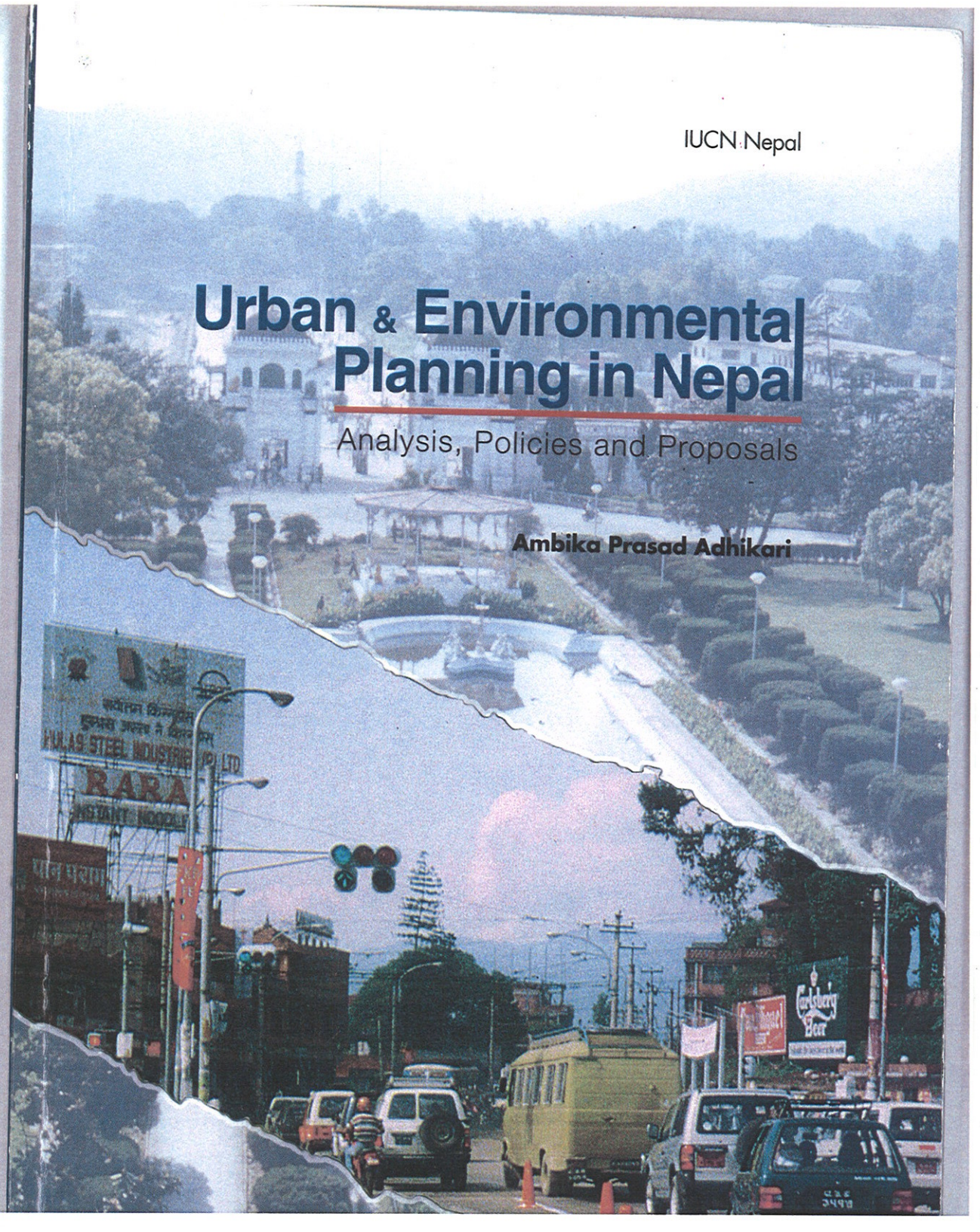
IUCN Nepal

Urban & Environmental Planning in Nepal

Analysis, Policies and Proposals

Ambika Prasad Adhikari



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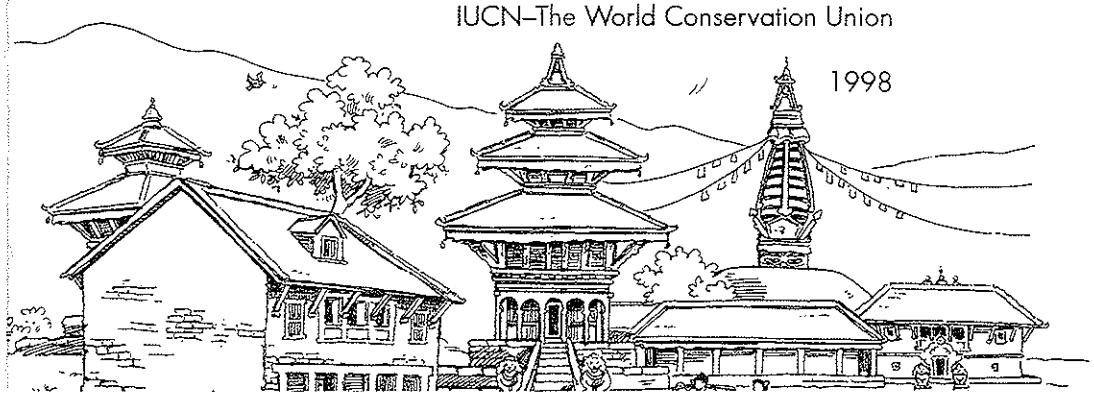
IUCN–The World Conservation Union

1998



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abbreviations

3R's	Reduce, Recycle and Reuse
AHS	Appropriate Housing Standards
APHA	American Public Health Association
BDP	Bhaktapur Development Project
BOD	Biological Oxygen Demand
CAC	Command and Control
CCME	Canadian Council of Ministers of Environment
CGI	Corrugated Galvanised Iron
DPC	Damp Proof Course
EMS	Environmental Management System
ERC	Emission Reduction Credit
FAR	Floor Area Ratio
FNCCI	Federation of Nepal Chambers of Commerce and Industry
FRG	(The then) Federal Republic of Germany
Ha	Hectare (10,000 sq. m.)
HMG	His Majesty's's Government (Nepal)
HUD	Housing and Urban Development (US)
ISO	International Standard Organisation
KVTDC	Kathmandu Valley Town Development Committee
KVTDP	Kathmandu Valley Town Development Project
KVTPT	Kathmandu Valley Town Development Team

MBI	Market-based Instrument (s)
MHPP	Ministry of Housing and Physical Planning (Nepal)
MOPE	Ministry of Population and Environment (Nepal)
NPC	National Planning Commission (Nepal)
OECD	Organisation for Economic Cooperation and Development
OSR	Open Space Ratio
PADCO	Planning and Development Company (US)
RBC	Reinforced Brick Concrete
RCC	Reinforced Cement Concrete
ROW	Right of Way
TIA	Tribhuvan International Airport
TSP	Total Suspended Particles
UNCED	United Nations Conference on Environment and Development
USAID	United States Agency for International Development
VOC	Volatile Organic Compounds
WHO	World Health Organisation

preface

This collection of essays deals with issues related to housing, and urban and environmental planning in Nepal. Specific focus is on the planning and environmental problems related to the towns of the Kathmandu Valley.

Nepal is facing several challenges in the areas of urban and environmental management and planning. Rapidly increasing population is exerting pressure in all aspects of urban infrastructure, services and housing. Traditional community support and planning systems are breaking apart due to several factors, such as changing societal values, urban consumption patterns and commercialization of traditionally household activities. On the other hand, Nepali society is not completely modernized and is not based on rational planning paradigm and industrial technologies. Consequently, environmental degradation is accelerating because of the inability of traditional planning systems to operate and because of the inadequacy of the modern planning systems to address the newly emerging problems.

The Nepali society thus is in a transitional phase were traditional systems are breaking down and modern systems have not totally prevailed. In this gap, solutions to many of the planning problems are missing. For example, problems of solid waste and drainage are mitigated by neither conventions nor modern management. The problems continue unabated due to the gap between the lack of old practices and inadequacy of new management.

The few attempts made to introduce new technology and modern management system in the urban management have not succeeded well. Local institutions have been weak and societal acceptance of new solutions has been only lukewarm.

These collected essays attempt to analyse the dichotomy of Nepali planning practices, that are torn between convention practices and rationalism. Some of these essays dwell on what traditional mechanisms can work and should be utilized as planning tools and how the modern planning system can be incorporated effectively.

IUCN Nepal has been primarily concerned with the conservation of the so called "green sector" in Nepal. As urbanization proceeds in a rapid pace in Nepal, conservation efforts will be incomplete without also addressing the so called "brown sector". This publication by IUCN Nepal is a recognition of the significance of the problems of this "brown sector". Further, this book also deals with the need for conservation of traditional built up environment, an areas of increasing interest to IUCN.

This book is intended for the reference of students, professionals and policy makers concerned with planning and the environment. Comments and suggestions for improvement will be greatly appreciated.

In the preparation of this book, I have received encouragement and assistance from various people, to whom I am thankful. In particular, I am grateful to Prof. Eduard Sekler, Prof. Wiliam Doebele, Prof. Peter Rowe and Prof. Carl Steinitz of Harvard University and Prof. Reinhard Goethert and Prof. Ralph Gakenheimer of MIT who provided helpful comments on some of the articles. In writing parts of this book I benefited from my discussions with Surhid Gautam, Jim Micak, Jibaraj Pokhrel and Shankar Nath Rimal.

I am specially appreciative of the support of my wife Durga and patience of my children Pratiksha, Prabidhi and Prajesh while writing this book.

I am thankful to Anand Aditya for editorial support and Dilip K. Munankarmi for the superior layout and design of this book.

Ambika Adhikari
Kathmandu
June, 1998

section one

introduction

It is common for any planning professional in Nepal to remark that the Kathmandu valley towns and other urban areas of Nepal face serious planning, environmental and management problems. In the sixties, the Kathmandu valley towns, in particular, appeared serene, idyllic, picturesque, intimate and even romantic in their atmosphere. Today, they have become severely congested, polluted and at times, even unworkable. One needs only experience the office-time traffic gridlock in Baneshwar, air pollution in the main roads of Kantipath and Putli Sadak, monsoons time waterlogging in inner city streets and shortage of water supply in most residential neighbourhoods of Kathmandu to appreciate the problems related to planning and environment in Nepal's urban centres.

This book contains essays which identify, review, analyse and propose some solutions to the problems related to housing and urban and environmental planning in Nepal. The emphasis and focus is mostly on the towns of the Kathmandu valley. As some of these essays were written during the past decade in course of my teaching and professional practice and studies in urban and environmental planning. Hence, the reader will get a feel of issues that cover the period of 80s and 90s. Further, because each essay is designed as self contained document, reader will find some repetition of ideas in this book.

Housing remains a stubborn problem in urban Nepal. Housing quality is generally poor, infrastructure is inadequate and it remains inaccessible and unaffordable to a large section of urban population. Housing problems are major contributors to Nepal's urban problems. Much pollution, congestion and overburdening of infrastructure are the result of inappropriate locations and poor planning and design of housing. For example, mostly single family housing units on small plots that do not allow high density, sprawling and scattered locations of housing and unavailability of housing in wide price ranges

contribute to increased traffic, lack of open spaces, inefficiency of water supply and drainage system resulting in poor sanitation and increased air pollution.

Appropriate housing standards have not been developed in Nepal. Housing built in arbitrary manners and construction and design that ignore indigenous systems create problems of cost, quality, aesthetics and maintenance. Further, as the construction technology is not well matched to the local requirements, opportunities for economies of scale are often missed.

Urban planning has not been practised in a comprehensive manner in Nepal. Primarily, Nepal's urban centres suffer from lack of proper land use planning. Road layouts are inefficient, open spaces are almost nonexistent, housing and services are not well located and infrastructure is poorly planned and deficiently maintained. Even basic and elementary norms of good subdivision planning and road layouts are not practised in Nepalese towns. Many areas of Kathmandu present a text book example of poor urban planning.

In the past three decades, environmental pollution and degradation has been accelerating in Nepal's urban areas. Pollution of land, water and air has seriously threatened the quality of life of urban residents. Four essays in this book address various aspects related to environmental planning in Nepal. Environmental problems related to pollution and resource degradation are reviewed and analysed and various regulatory, economic and voluntary practices of environmental management are discussed.

It is only recently that environmental problems are recognized as serious threats to the well-being of urban residents in Nepal. Some recent studies that document significant excess health costs of environmental pollution have been eye-openers for Nepali urban professionals and policy makers. Traditionally, Nepali planners concentrated only on economic development while the resulting adverse environmental implications were generally ignored. With the emergence of severe environmental pollution in urban areas, environmental degradation has now been recognized as a problem worthy of consideration.

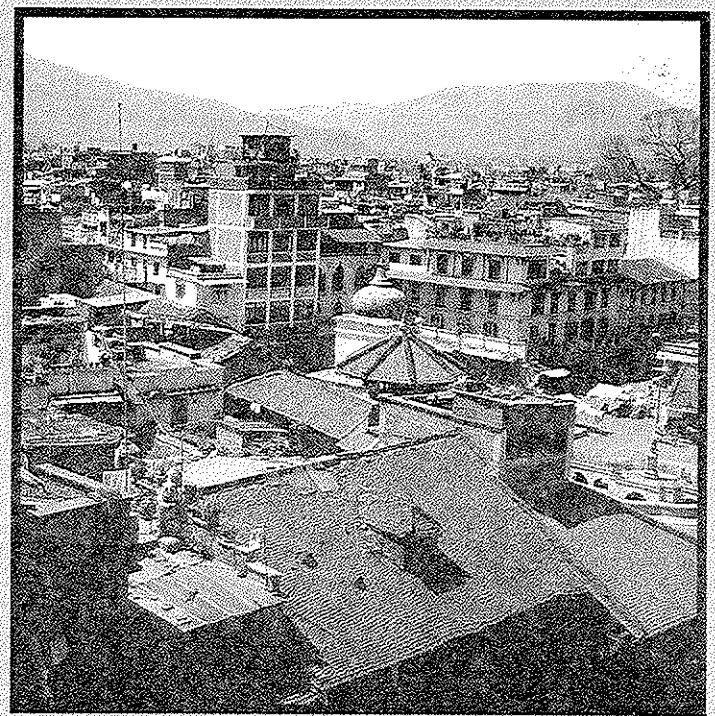
In this book is expected to contribute towards a better understanding of urban and environmental problems in Nepal and to help in the development and implementation of practical solutions to the problems of planning and the environment.

section two

urban planning and housing

"Ninety percent of the world's increased population will be located in urban areas, posing formidable problems of social and institutional change, infrastructure investment, and pollution control"

Ismail Serageldin, 1994



the process of "Baneshwarisation"

a challenge to Nepali planners

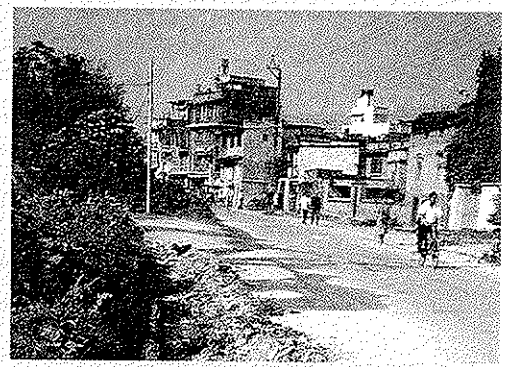
"The towns of the Kathmandu Valley with their intriguing parallels to the medieval cities of Europe are both an ideal field of study for the urban historian and a dramatic field of battle for the urban planner, designer and conservator".

Eduard Sekler, 1979

Background

Virtually all Nepali towns of recent origin have evolved unplanned, in the modern sense of the term. Although, the medieval towns of the Kathmandu valley and the surroundings followed strict religious prescriptions of unwritten rules, very few Nepali towns ever completely benefited from the modern rational planning processes. For example, Rajbiraj initially developed from an "official plan", but planning controls quickly disappeared. Dipayal, Birendranagar and Bharatpur were also initially planned, but soon began to take a haphazard route to growth. Tikapur town planning scheme, the only comprehensive effort to plan a new town in Nepal was never implemented as envisioned. Thus, the role of planning remained peripheral in the otherwise quick growth of Nepali urban development in the last two decades.

Nepal promulgated its first significant planning act in 1973. Many additional planning regulations, largely nominal, were subsequently devised. For example, building and



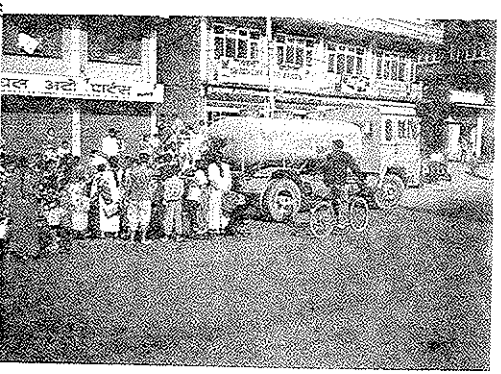
▼ *Poor infrastructure in Kathmandu's residential area*

construction regulations were enacted for Kathmandu valley in 1976, primarily as conservation efforts. Many other guidelines, studies, and minor regulations have steadily emanated from the numerous but transient government supported planning teams, especially for the Kathmandu valley. But these regulations are generally confined in paper and their operationalisation and implementation have been limited. Even today, urban Nepal continues to expand without comprehensive plans and without any significant municipal controls.

De facto planning, especially land use planning, in urban Nepal is largely carried out by private land brokers who subdivide and sell land into small single family parcels to maximise the total private value only, sacrificing common services as the trade-off. This erratic urbanisation process feeding only the individual economic interests has continued unabated.

Case of Baneshwar

Nowhere are the negative effects of the lack of planning better evident than in the sprawling landscape of the Kathmandu valley. Unregulated growth of its towns is rapidly eroding the quality of the urban living that was once a showpiece of coherent urban planning form in South Asia. Baneshwar, a precinct in Kathmandu, with its uncontrolled housing and commercial development epitomises this phenomenon. Road access is constrained making it difficult even for emergency vehicles to serve all residents. Water is in short supply and often contaminated. Loss of pressure in the water pipes that follow serpentine streets makes the services extremely inefficient. Electricity blackouts are routine and voltage fluctuations regular. The already minimal drainage facilities are further aggravated by the solid residential compound walls that interface the narrow roads. Seepage from individual septic tanks in the tiny residential plots - often as small as 60 square metress - severely contaminates ground water.



▼ *People lining up to obtain scarce drinking water from service truck.*

Large amount of solid waste is generated in the neighbourhoods, but no mechanisms for systematic collection and disposal exists. There is a severe shortage of public facilities, open spaces, green areas and urban amenities.

▲ *Process of suburbanisation in the Kathmandu Valley.*

Many other precincts of the Kathmandu valley towns exhibit similar characteristics. First, they are undergoing an unregulated growth of residential, commercial, and, to a lesser extent, institutional development. Second, the residential expansion consists largely of single family house, resulting into a relatively low residential density. Finally, due to unrelenting population pressure and unending urban expansion, all basic infrastructure and common public facilities are severely strained in the entire precinct.

This process can be termed "Baneshwarisation", which is being replicated in many other parts of Kathmandu and in urban areas in Nepal. What are its economic and social costs? What are the forces behind this process? Is it possible to retroactively rectify these problems - and how costly will it be in societal and economic terms? And ideally, can "Baneshwarisation" be altogether avoided? Nepali technocrats, policy makers, and especially urban planners have to urgently deal with these critical questions.

Thus urbanisation is a problem in many areas where Nepal increasingly faces formidable challenges in the process of its efforts for economic and social development. Although Nepal is at an early stage of urban development with barely 12 percent of the population as urban (1998)[1], certain regulatory interventions by the public authorities have already become imperative to check undesirable urban growth and to properly guide the physical developments.

If the basic infrastructure which constitutes the structural fabric of urbanisation is not correctly planned early on, the resulting problems will be difficult to manage in future. The upgrading of these areas, even now, is too costly both in material and social terms. The

[1] Percentage of urban population depends upon how it is defined. This is the author's estimate for 1998, taking settlements with more than five thousand people as urban.

problems arising from poor physical planning are also manifesting in increased environmental pollution and worsening sanitary conditions.

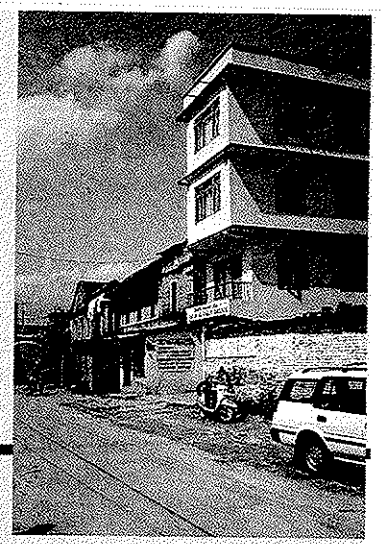
Some suggestions

The prevailing international opinions encourage governments to play a role of "enablers"[2] in the provision of physical facilities. Government's direct involvement in the production and building of facilities, such as urban infrastructure and housing, has proved inefficient. In Nepal, government does not have enough resources to subsidise these developments, or to offer such facilities just as "public goods", often free of cost to the users. Government can best facilitate private initiatives while providing effecting regulatory controls for physical planning in the urban areas.

Regulations for residential densities, land subdivisions, road layout and provision for drainage and other utilities are urgently needed in Nepal. Remembering that in many countries, standards that bore the foreign influence proved problematic, "appropriate planning standards" for Nepal should be contextually grounded and at the same time should also be capable of streamlining and upgrading urban developments.

Such standards should include: higher residential densities, higher proportion for circulation area and open space, lower land parcel sizes and a systematic land subdivision pattern in the new developments. For example, higher density than that of the existing precincts is desirable to conserve agricultural land, and to reduce infrastructure and land cost per dwelling unit. Similarly wider right-of-way for roads should be made mandatory in the new schemes as an insurance against future congestion and inaccessibility. Moderate open space ratio, affordable plots and geometric land subdivisions are also appropriate.

[2] For extended discussions, see the *Urban Edge* issue October 1988, the World Bank, Washington DC.



an approach to the designing of housing for Kathmandu

improving utility and facilitating the construction[3]

"Pursuit of the myth that industrially mass-produced housing modules can significantly lower costs, and can somehow reduce the deficit in the world's supply of safe and decent dwelling accommodations, has, in many instances, led directly to the opposite result – to a worsening of housing conditions."

I.A. Terner, 1972 (in *Freedom to Build*)

Introduction

Housing is an important indicator of a nation's economic level, developmental stage and the general social well-being. More developed societies are better housed, and have more efficient housing markets, where the developed stage of housing finance contributes towards the formation of wealth, increased personal mobility and enhanced individual productivity. An efficient and modern housing production technology at work is evident in such societies. In a very early stage of housing development, Nepal today is facing severe housing crisis especially in the towns of the Kathmandu valley.

The current international thinking encourages governments to improve institutional setting and facilitate financing, rather than be involved in the direct production of housing. This is in sharp contrast

[3] A version of this paper was published in *Habitat International*, Vol. II, No. 4, London, 1987.

to the governmental policies of the sixties and seventies, when governments in many countries built public housing. Even "sites and services", the major innovation of the seventies and eighties are now viewed more critically for their failure to provide housing to the common people especially to the low income households in the cities. Nepal needs more pragmatic and forward-looking housing policies and regulations that facilitate low income housing and protect social well-being of the urban residents. The uncontrolled growth of many areas in the valley towns, such as in Baneshwar, makes such regulations all the more urgent. It is also important to identify the building technologies which provide an appropriate foundation for such policies.

The housing problem in the Third World countries is aggravated by inappropriate design and planning of dwellings by architects, engineers and designers and sometimes by the owners themselves. Housing, both in institutional and private sector, exhibits similar problems. Their spatial design, layout, standards and specifications are all problematic, hindering execution of construction and reducing the dwelling unit's utility. The problems of standards and its implication on the cost and construction time have been dealt with in several works (Turner, 72; Gakenheimer, 85; Mayo and Gross, 86). The physical design itself has been generally studied only in terms of making a dwelling 'low cost' and not in the qualitative aspects of design. However, the values of designers as reflected in the physical design, whether consciously made or not, affect the utility and execution of housing.

Virtually in all new housing in Nepal, construction takes longer than scheduled, cost overtakes the estimate, and serious spatial incongruence and construction defects are seen even in the early periods of occupancy. Although factors like shortage of key materials and capital, and inefficient contract administration together with fluctuation in the labour supply contribute towards problems of execution, the purpose of this essay is to highlight the unsuitability of the presently practised design and planning methods. An implicit choice of technology of the modern system[4] is made in such design decisions whence problems in construction and utility inevitably

[4] "Modern System" (Interchangeably used with "Industrial System" in this essay) is the system of design and construction based on modern architectural design, favouring modern, and often imported materials and labour, and based on industrial technology.

follow. As proposed later in this paper, a more useful design approach would be a synthesis of the indigenous[5] and the modern systems of design and construction.

Choice of technologies

Various schools of thought regarding technology choice in the design and construction of housing in the Third World have been proposed by housing scholars, professionals and international development agencies. The following three categories represent the major ideas in the recent times.

Traditional: indigenous system based on local resources

Late Hassan Fathy (1973), Egyptian architect practised and promoted housing approach based on vernacular building design and construction. His experiment with this approach in the new settlement in Gourna, Egypt, has been well documented. Man other designers have applied the ingenuity of vernacular designers and have strongly advocated that many indigenous practices as worthy of revival. John Turner (Turner and Fichter, 1972) emphasised the process of informal, self-help and community building which is sympathetic to indigenous techniques, in order to achieve satisfactory and desirable housing.

▼ *Traditional housing in Lalitpur*

Some Nepali architects, planners and engineers also favour extensive utilisation of local materials and skills in the construction of present day housing. For example, the late Ramesh Manandhar championed the cause of reviving indigenous technologies with emphasis on use of mud domes, low technology buildings and other uses of indigenous materials. Deriving inspirations from the mud

[5] "Indigenous System" (Interchangeably used with "Traditional System" in this essay) is the system of design and construction that utilises traditional design patterns, local materials and labour, and primarily uses labour-based technology.

walls prevalent in Nepali housing, Manandhar experimented tirelessly to create workable mud domes, that can be constructed by the local workers. Certain prototypes of such domes were built in Gorkha, but its widespread application has not yet occurred. Although mud dome is not a traditional building form in Nepal, mud walls and roofs are common. With the abundance of mud, and their superior insulation quality, mud domes may provide an excellent roof construction technique that will be useful in Nepal's urban areas.

Modern: equipment-based and import-oriented

Virtually all architects and planners representing the mainstream of the profession, and policy makers in the Third World have explicitly or implicitly favoured the modern approach to housing. Specially, the designers of housing in the public sector have promoted this approach almost exclusively. The public housing projects of the sixties and seventies everywhere employed the modern way of design and construction. The designs are characterised by their universality, their arbitrary forms, based on the "rational" criteria of performance, and their use of mostly imported materials. Whether by the conscious intent of the designer or otherwise, every public housing project reflects the "Radiant City" image propagated by Le Corbusier more than sixty years ago. Large-scale public housing projects in Singapore, Hongkong, Malaysia and Korea exemplify such typologies. These projects require extensive use of imported materials as well as heavy equipment for construction. They are generally large in scale and exhibit uniformity in the design and construction of dwelling units. Singapore and Hongkong have experienced success in the modern approach (Yeh and Laquain, 1979), but in all the resource-poor countries, such as India, Bangladesh, Philippines and Nepal, a totally modern system of design and construction of housing has not been able to solve the housing problem.

Nepali architects have almost exclusively followed the international styles of architectural design that employ modern construction technology. Examples can be seen in the representative works of architects Gangadhar Bhatt, Shankar N. Rimal, Dhruba B. Pradhanang, Narayan P. Bhattarai, Bijaya B. Burathoki, Bhivuti Man Singh and others including previous works of the author. Bhatt

helped bringing the modern architectural movement in Nepal, with the design of the Kathmandu City Hall and Soaltee Hotel, and Pradhanang designed the modern Bishalbazar Supermarket. The headquarters of the Agricultural Development Bank designed by Bhattarai with curvilinear facade and rectilinear side elevations is strikingly modern. The construction in all these buildings consists of machine-made bricks, concrete columns, beams and floors, metal and glass windows and plywood doors. The construction system and materials are thoroughly modern. The author's designs of the Architecture Building and Library Building of the Institute of Engineering, Tribhuvan Memorial Hall, Bhaktapur College Campus, among others, also reflect the influence of the modern movement of architecture.

Rimal, more than any other designer, pioneered the era of modern building design and technology in Nepal. In his works, that include Royal Nepal Academy (RNA) and Janakpur Cigarette Factory (JCF) and his own residence, he has initiated extensive use of concrete, machine-made bricks, steel, glass and other modern materials. Prestressed concrete portal frames of more than thirty metre span were used for the first time in Nepal in RNA building while JCF building was the first major industrial complex in Nepal, designed in the international style, with extensive use of concrete, steel and machine-made bricks. In many residential buildings he used bold new designs such as hyperbolic paraboloid roofs, large concrete cantilevered beams and slabs and concrete and steel structures designed with advanced engineering methods and materials. Although, at times, he has utilised traditional forms, notably Pagoda roof (for instance, in the Nepal Council of World Affairs building), the structural basis of his designs has been truly modern.

Rimal has long remained the leader of the local building expertise in Nepal that is in tune with the contemporary international architecture.

Intermediate: midpoint between the traditional and the modern

During the late sixties and seventies, "Intermediate Technology" was seen as the alternative way of building, that could utilise traditional technology to solve housing problems in the Third World. By

1973 the movement of the "Intermediate Technology" was championed by Schumacher (1973) and was subsequently furthered by many other scholars. During the same period, many experts and agencies concerned with housing favoured pragmatic standards, often suggesting that the prevailing standards be lowered. They proposed extensive use of local resources and indigenous skills in the housing for the Third World. In certain countries, notably, in India, Pakistan, Sri Lanka, the Philippines, Thailand, Ghana and Egypt, various forms of low income housing utilised such an approach.

Since Schumacher's concept of intermediate technology - a technology in between the $1 traditional technology and $1000 imported technology - many proponents have attempted to promote and eulogise this idea. Numerous socially and culturally conscious architects have taken comfort in the idea of intermediate way of designing and building housing. In terms of user participation and the repeated use of an accepted vocabulary of "patterns", even Christopher Alexander (1969) indirectly favoured an intermediate approach in the housing design.

Because the concept of intermediate technology is derived from an assumption of an uni-dimensional and bipolar notion of technology, practitioners have been confused about hitting the middle point in the spectrum that extends between the traditional technology, on one hand and advanced technology, on the other. Designers of housing have attempted, through intermediate technology, to close the gap between the advanced technology and the traditional one.

In Nepal, combining modern technology and vernacular aesthetics has been popularised by some architects, among whom Ranjan Shah was a pioneer. Since the early seventies, Shah designed numerous residences in Katmandu valley, that incorporated sloping roofs with brackets, jali windows, carved doors and exposed brick walls. Examples in Kathmandu are Bista residence in Baluwatar, Sherchan residence in Tangal and Shah residence in Bishalnagar. Shah did not follow the construction technology and use of materials found in the traditional Nepali housing, but cleverly incorporated the traditional building forms and components in his new designs. His buildings utilise the vocabulary of traditional aesthetics to create nostalgia and symbolism of "Nepaliness". This approach is still popular in Nepal, but critics, especially fellow architects, complain

about the superficiality of his building forms, and deceptive use of materials in these houses. Shah, nevertheless, pioneered a new aesthetics and created a unique aesthetic vocabulary in the modern architecture of Nepal.

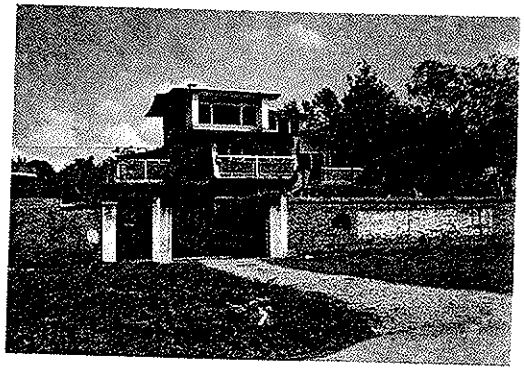
Policies recommended

Governmental housing policies at present favour the existing trend towards uncontrolled modernisation. Government has in the past established and supported materials factories that exclusively produce modern materials like cement, steel, machine- made bricks and tiles. While these ventures are important, complete apathy towards indigenous materials will not promote appropriate solutions to housing problems existing in Kathmandu. As outlined earlier, indigenous materials can be produced abundantly at lower cost. While governmental emphasis in the indigenous building materials is virtually nonexistent, new materials are widely encouraged. Government can make policies to encourage the research and production of indigenous materials and construction techniques. Such initiative will encourage a more suitable approach to housing design.

▼ *Juxtaposition of a traditional and a modern housing in Lalitpur.*

Although the domestic production of civil engineers started in Nepal in 1982, the engineering curriculum is geared totally towards modern approach of design and construction. Government should accelerate the program of training professionals locally simultaneously helping to modify the curriculum to be more sensitive to the local situation. Because engineering education is supported by the state, the government has effective leverage to influence the emphasis on courses.

The existing regulations control only superficial elements for housing and do not address substantive issues in design and construction that could facilitate the housing process. Guidelines on design continuity and regulations that facilitate the use of more suitable technology should be formulated. Standards and regulations on



▲ *A modern housing with new materials and traditional aesthetic vocabulary.*

building and urban design can be devised to encourage the blending of traditional and modern systems.

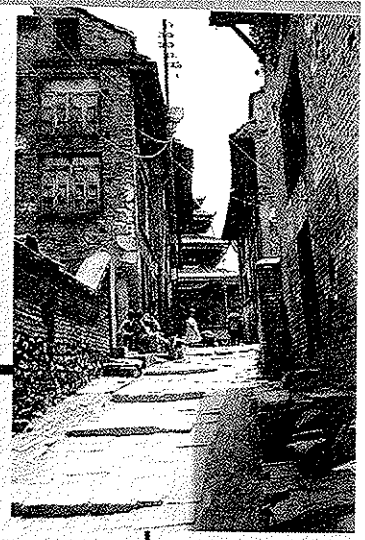
Conclusions

An approach to housing design that combines the best elements of both the traditional and modern systems is seen to be most suitable in Nepal. Spatial layout, aesthetics, building materials and construction techniques should be primarily based upon the traditional system. Technical details, such as moisture, water and environmental control and sanitary systems are best carried out through modern materials and technology.

Nepali government is in a position to reorient the education of building professionals in the country. It can redirect its own housing programs. Major building material factories can be influenced by the government and can be geared towards the production of indigenous and cheaper materials. Incentives can be provided to private building industry to adopt indigenous housing approach through materials production and construction. Finally, government should formulate zoning, land use and design standards that encourage the proper use of traditional practices, and facilitate the development of appropriate housing in Nepal.

the concept of housing standards

a perspective



"Although building codes have made great contributions to human welfare in countries with high per capita incomes, their rigidity often contributes to a shortage of safe and sanitary housing."

John F.C. Turner, 1972

What are the housing standards?

Housing standards are the recommended or (sometimes) mandated minimum levels of physical parameters or performance criteria that a safe and decent housing should have in a given context. Some forms of standards for the built environment have existed since the dawn of civilisation. Housing standards in particular have been historically used to achieve the broad objectives of public health and safety. They are the instruments of achieving good housing. Standards imply certain means of quality control, and thus are "An established criterion or recognised level of excellence used as a determinant of achievement" (Baer, 1977: 71).

Mood, in his seminal work on housing codes, outlines the objective of the minimum housing standards to be "Necessary to safeguard the health and welfare of the occupants of the dwelling and the persons residing in the vicinity of the dwelling." (Mood, 1969: 4).

A United Nations document defines housing standards as "measures of acceptability, at a given time and place and in a given set of cultural and economic conditions" (UN, 1968 : 9). The American Public Health Association states:

The primary intent of a housing code is to establish minimum standards essential to make dwelling safe, sanitary, and fit for human habitation by governing the condition and maintenance, the supplied utilities and facilities, and occupancy (APHA, 1971: 65)

Housing standards are also defined as consisting of two categories as official and cultural:

Official standards are those established by legislation, bye laws or other rules and regulations, while cultural standards are those derived from traditional practices or found tolerable and acceptable by a large number of people (Mabogunje et al., 1978:3).

Housing standards are recognised by many governments as normative guidelines that facilitate the continuous improvement of human-built environment especially in the provisions of shelter. They, in more desirable forms, are envisaged as dynamic so that one could start from the barest minimum level to ensure the public welfare while still making it possible to achieve commensurate upgrading in the future housing environment in the process of the overall development of the nation. Housing standards may be operational through a varying combination of public policy instruments, such as land use, zoning, building codes, design standards and other forms of regulatory controls. The following table (table 1) provides a view of various controls that generally make up the housing standards.

Table 1. Spectrum of controls covered by housing standards

CONTROL	ACHIEVEMENT TARGET	SAMPLE INDICATOR
Subdivision		
Zoning	Overall Living Environment	Types, e.g., Residential
Street Width/Intersection	Accessibility	Width, Turning Radius
Utility Easements	Provision and Maintenance of Infrastructure	Width, % of the Project Area
Overall Layout and Lot Design	Efficiency, Economy	Depth/Width Ratio, Block Length, Nodes/ha
Land Uses Commercial	Cross-Subsidy, Mixed Use	% of Uses: e.g.,
Density	Adequate Services	Persons or D.U./ha
Floor Area Ratio (FAR)	Traffic generation, Infrastructural Adequacy	Pure Number (Total Floor Area/Plot Area)
Open Space Ratio (OSR)	Light, Ventilation	% of Plot Area
Set-Backs	Lighting, Ventilation, Non-encroachment	Metres, Feet
Dwelling		
Design	Good Urban Design, Aesthetics	Samples, Proportions, Patterns, Scale, Height
Occupancy Rate	Health, Comfort	Area/Person
Structure	Safety	Codes
Light	Amenity	Set-backs, Openings
HVAC movement	Comfort, Amenity	Temperature, Air
Materials	Safety, Quality	Specifications

Characteristics of Housing Standards

Housing standards should be based upon the following fundamental criteria:

1) Health and safety. Adequacy and quality of space, proper hygiene, security from fire, structural integrity
2) Comfort and convenience and cultural validity. Climatic effectiveness, accessible public facilities, culturally responsive spatial organisation, pleasant environmental and dwelling aesthetics
3) Realistic norms and economic efficiency
4) Affordability, feasibility, low cost

Standards should promote these values with measurable effect in fulfilling them. Because housing in uncontrolled urban growth very often does not meet the above criteria, as is evident in the case of Kathmandu, standards become necessary to ensure a minimum level of acceptability.

Health and safety are the fundamental criteria for a shelter. A house should provide shelter from the sun, rain, wind, snow or other harsh elements of weather. It should protect the occupant from the insects and animals or from unwanted people. Structural integrity of a house guarantees that its occupants and neighbours will be safe from the possible collapse of the building. Adequate personal space,

ventilation, damp proofing, sun light etc. combine to promote health and can effectively retard contagious diseases and epidemics. This concern has always been the primary motivation in establishing housing standards.

The potential of fire hazards varies according to the popular way of building. In Kathmandu even the cheapest houses were generally constructed with raw bricks, or other noncombustible materials. As compared to the buildings made of wood or other combustible materials, the Kathmandu houses did not posses serious threat of fire. But more and more combustible materials are being now used in the construction of the squatter and informal houses in Kathmandu. Fire is becoming an increased concern as the density grows while services become strained. Historically, fire has been the major factor to push housing legislation in Europe and the United States. It appears that housing in Kathmandu is reaching a similar stage of problems.

Comfort and convenience have long been sought by mankind and home is a symbol for achieving the same. The thermal environment inside the house, the ease of movement within it and convenience of conducting other household activities are enormously important to make house a "home". The sizes of the rooms, doors and window, the design of staircase, work tables, storage and other facilities in the house are all based on the achievement of comfort. People become increasingly conscious of the need for comfort in dwellings as the society advances in its economic development.

The dweller's cultural values influence their use of a house. The concept of privacy, property, need to share and other cultural practices can substantially differ between societies. Spatial design of the house, room layout and interior configuration have to be culturally valid. Rapoport, who has pioneered the study of linkages between culture and housing, maintains that only the culturally responsive designs are "supportive environments" (Rapoport, 1979). Rapoport has convincingly established the desirability of using the traditional designs in any given society, as the starting point for housing design in the Third World. Housing standards should accommodate the sociocultural needs of the residents to bring about a successful housing.

For the low income families, the bottom line of any housing program is the affordability. As long as the people are unable to

afford housing, all other criteria become meaningless. Thus the housing as a package should be economically efficient so that it is cheap and affordable. Perhaps, resource constraints and economic limitations are the paramount factors in the housing problems in the Third World. Economically, decent housing for low income families is extremely difficult, and sometimes infeasible, without some corrective public policies. International prescriptions to overcome these problems has gone through different phases over the past four decades. Government-constructed housing projects, grants for housing, subsidies and cross-subsidies were practised in the fifties and sixties. Cost recovery made possible through innovative financing mechanism, and public private partnership, seem to be the current consensus as a desirable housing policy. Without going through the complexity of the subject, it can be said that economic viability should be the cornerstone for standard setting. This requirement dictates sizes of the plots, dwelling, construction materials, level of services and everything concerned with housing. Housing standards should be developed with constant awareness of affordability.

Strategically speaking, standards should be devised as:

1) Normative Propositions: defining what is good and desirable
2) Preventive Sanctions: to discourage problematic housing
3) Realistic and Feasible Targets: offering pragmatic and affordable solutions
4) Enforceable Policies: to facilitate implementation
5) Conventions: tacitly understood traditions when applicable

The basic philosophy behind standards is the level of desirability and acceptability. There is a conscious agreement by the society on what is good and worthy of achieving. Housing, if made according to standards, is supposed to achieve a desired performance. Thus standards, primarily, are normative statements based on the perception of what is "good". In the absence of any regulatory controls, construction of more unacceptable housing is likely to be continued. The idea of setting standards is based on preventing the building of undesirable houses in future.

The ideal housing, if not attainable by the poor majority of the society, is merely a utopia. Unrealistic standards that resulted from perception of ideal housing, have been unanimously blamed by the scholars as a constraint to decent low income housing. In the

numerous low income housing programs of cities ranging from Bangkok to Bogota, Calcutta to Caracas, Lusaka to Lima, and Kathmandu to Karachi, the experience has been the same: unrealistic standards don't work. Therefore, housing standards in any given context, should be based upon what is feasible. This criterion would automatically set realistic levels of requirements.

The standards have to be normative, in the sense of facilitating the improvement in the quality of built environment. Furthermore, they should be flexible to fit the present situation while making possible and , in fact, enabling the future upgrading. Examples of need to increase the standards, commensurate with the economic development, are evident in the historical evidence of increasing space standards in England and the Netherlands. More recently, the incremental standards can be seen in Singapore and Hongkong where many apartments built as per the prevailing standards in the sixties are now enlarged by combining two units to attain the more recent standards. Regarding the flexibility of the housing standards, a United Nations document proposes the following useful theme: "(Housing) Improvement programs must adopt standards which are realistic and flexible, and which assure health and safety while allowing for enhancement to a higher standards as resource permit" (UN, 1983: 5).

The standards should be culturally valid so that the liveability of housing remains high. Furthermore, they should be technically efficient to maximise the use of the given resources. They should also reflect the government's desire to assist the lower income people in obtaining the declared minimum standard of housing. Thus the willingness of authorities to implement the regulations are assumed inherent in the setting of standards.

Historical perspective on housing standards

Some form of regulatory controls including the concept of "housing standards" has been practised since the beginning of the organised human habitats. Measures to shape the human settlements were used in the early high civilisations of the river valleys from Tigris and Euphrates to Indus, and from the Inca and Maya cultures

to the Greek and Roman empires. The modern concept of housing standards is of more recent origin. Regulatory controls for housing were broadly initiated in Europe after the emergence of unhealthy and unsanitary conditions following the industrial revolution (Cherry, 1974: 6-7).

▲ *Row housing: staff housing at Institute of Engineering, Lalitpur.*

Evolution of housing standards in the West

The systematic evolution of housing standards occurred during the turn of the nineteenth century and in the early twentieth century. In central Europe, building codes were well developed by the mid-nineteenth century. In Western Europe, particularly in England, burgeoning urban slums and related epidemics, and frequent fires forced the authorities to formulate city planning as well as housing regulations during the late nineteenth century. The planners, approach to explicit housing standards, at least in terms of the environmental amenities, can be most clearly traced to the "Garden City" movement of that period. During that time physical visualisation dominated the perception of housing: with broad streets, large lots, generous open spaces, and plenty of greenery, sunshine and air.

The history of housing standards in the US is even more extensive. For example, scattered regulations prescribing materials and construction for buildings existed from the very beginning of the European settlements in the new land. As early as in 1626 Plymouth colony banned the use of thatch roofs for fire safety (Mood, 1969). However, the first significant laws requiring housing standards were devised only in the beginning of this century. The major push for the housing standards can be traced back to the work of Veiller, considered the father of modern housing codes (Veiller, 1910; 1914). At that time massive public intervention in housing was taking place in Europe as well as in the United States.

At the local levels, a comprehensive housing law was passed by the city of Columbus, Ohio, in 1911. Many other municipalities followed to enact housing laws. By the late thirties explicit housing standards were introduced in many cities of the United States for

promoting public health and safety. When the city of Baltimore legislated housing codes in 1941, it marked the birth of the modern housing standards in the United States. Interestingly, it was called "Ordinance on the Hygiene of Housing" and was performance-oriented.

Standards became common currency in the US after the Housing Act of 1949 enacted by the Congress proclaiming a goal of "a decent home and a suitable living environment for every American family". For about two decades afterwards, public and subsidised housing became major governmental interventions in the United States to make housing available to the low income people. Housing standards then were largely confined to the space and construction requirements.

Emergence of housing standards in the developing countries

During the colonial period, and after the second world war, most developing countries experienced the imposition of foreign standards, that came from the colonial connection and western influence. In many countries like India, Egypt or Nigeria, standards were borrowed directly from the colonial powers. The general feeling during that period about the superiority of the western standards is clearly expressed in the statement by the British Standards Institute in 1951: "If overseas governments will insist upon all materials bought by them being British Standards , they will know that they are receiving good design and high class materials in both of which they can have entire confidence". (BSI, 1951: 23)

However, in the developing countries such imported standards remained merely theoretical and could rarely be enforced. Only since the mid-fifties, the public authorities began referring to the existing housing standards to demonstrate the poor hygienic level of slums and squatter settlements. There were numerous attempts to suggest the minimum space and environmental standards in the developing countries, as housing achieved a higher profile in the public agenda during the seventies.

The notion of housing standards has been very controversial during the past two decades in the developing and developed world alike. Developed countries like the United States have virtually scrapped the housing standards per se. The health and safety issues

are met by the various layers of legislations, such as zoning, building "codes", and an array of local and state regulatory controls on residential development and construction.

The sixties saw the birth of anarchism and a sense of counter-culture among many architects and planners worldwide. Turner, Ward and others openly blamed the standards as the root cause of housing problems. In the highly influential work of Turner "Freedom to Build", Grenell declared that "The gap between dweller needs and resources on one hand and institutional standards and values on the other, is the root cause of the (housing) problem" (Turner, 1972: 121). Turner consistently attacked the standards as the enemy of low income housing: He wrote:

> *As long as these (housing) standards are enforced, the poor are dependent on the activities of the institutions to provide housing... the obvious solutions to the dichotomy is to reduce the minimum standards to a level which the mass of people through their own efforts can meet". (Turner, Ekistics, 1972)*

Enlightened planners and architects in the developing countries were fighting the unrealistic standards and were demanding that they be lowered. A representative country view from Nigeria was:

> *"...the density and general housing quality standards are too high for Nigerian conditions. It is suggested that the lowering of present standards will leverage the production of more housing units without necessarily negating the objectives". (Okpala, 1978)*

Still others (such as Grimes, 1976; Mayo, 1987) went further to generally establish the role of standards as obstacles in all the low income housing programs in the Third World. During this period scholars as well as agencies concerned with housing suggested the reduction of prevailing standards in the construction and design of housing all over the Third World. Mayo reminds us that,

> *Sites and services projects and slum upgrading projects that were undertaken by developing country governments involved lowering standards (zoning and building codes) from preexisting levels in order to meet affordability criteria (Mayo, 1987:61).*

For lowering the cost of housing, experts and agencies dealing with low income shelter proposed increased use of local resources, indigenous skills and materials (Laquain, 1983; Afshar, 1985).

To counter the connotation of setting standards with high cost and thus the incompatibility with low income housing, the concept of "performance standards" was introduced during the seventies. Performance standards were defined as the achievement of certain parameters in the performance of housing design, e.g., lighting, ventilation, fire resistance etc. by any means, thus allowing the designers and owners to choose the materials and methods of construction. They were initiated in the United Kingdom but the idea quickly spread to other countries as well. They were favoured by many as compared to the conventional "specification standards" to provide choice in the design and construction of housing and to reduce the rigidity of standards. The implicit hope was to achieve the same level of health safety and comfort with lower cost and easier construction methods. Performance standards were also intended to promote research on local materials and indigenous building techniques that could be used to achieve an acceptable level of quality in housing. In many Third World countries such research did proliferate during that period.

The recent approach on housing standards is more pragmatic internationally. In the developed world, housing standards have been largely internalised by the professionals and builders and are the routine part of design and construction. In the developing countries, housing standards are now accepted as necessary instruments of housing policies, in order to achieve the minimum level of public health. International shelter agencies are leading the way to ensure the appropriateness of housing standards. In the early eighties the World Bank mandated the use of "appropriate standards" to ensure replicability of the housing projects. Many other scholars have suggested the use of "appropriate and affordable standards" (Example: Mayo et al., 1986; Doebele, 1987; Gakenheimer et al., 1987) to achieve acceptable low income housing in the Third World.

Many studies agree that higher standards have been the major barriers blocking the provision of shelter for low income families, but point out that formulating appropriate standards remains a difficult task (Rodwin, 1987: 9). Gakenheimer and Brando (1987:135-42) argue, in most Third World countries the higher standards are the consequence of a series of past events and have been institutionally dictated. Taking the example of the infrastructure standards, they find the higher standards as an unintended but cumulative result of professional elitism, contractor's motives, colonial legacies and governmental policies.

Afshar (1985: 9, 13) maintains that the distinction between higher and lower standards could be misleading because very often higher standards imply imported technology, whereas some local construction may provide actually better physical standards. By extension, appropriate standards do not necessarily have to be lower than the prevailing official standards. Taking the case of Pakistan, he concludes that in the long run, the use of indigenous construction materials and technology is substantially more beneficial and cheaper in relation to the import-intensive construction, and such use could constitute appropriate standards.

Evolution of housing standards in Kathmandu

Traditional housing in Kathmandu was basically governed by cultural standards, albeit unwritten. The practice of housing in more recent times is changing rapidly, affected by the modernisation forces both social and material. Housing now is considered an individual's problem, and is mostly individually developed. Middle and upper income housing can often be served by the "conventional" market. For the low and lower middle income residents, the contemporary housing in Kathmandu can be categorised into two groups:

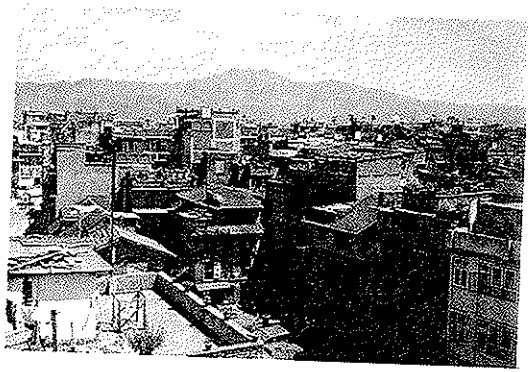
1) Institutional, which is mostly professionally designed; and
2) Unplanned, i.e., spontaneous and often informal.

Institutional housing. About a dozen site and services projects by the governmental agencies and many more employee housing constructed by various industries and colleges in Kathmandu exemplify the institutional housing mode. The individually developed or spontaneous and informal housing of the low and lower middle income residents is spreading everywhere in the city ranging from suburban developments to squatter housing and slums.

The institutional housing in Kathmandu prescribe geometric layous, relatively larger plots and low density. Many sites and services

schemes, industrial housing and staff housing built for industry and institutions represent institutional housing in Kathmandu. In such housing the forms are modern, rooms and facades rectilinear, densities low and general space standards high.

▼ *Spontaneous urban growth in Lalitpur.*



Unplanned housing: spontaneous and informal. The individually built housing mode adopted by the private sector supplies the bulk of present-day housing to all the income groups in Kathmandu. The higher income housing is relatively more formalised. The absence of standards in regulating this housing has brought about serious problems of health, safety, fire, sanitation, as well as continuity of the urban design. As the rate of construction in this mode of category is rapidly increasing, it has become urgent to regulate such housing.

Only a fraction of Kathmandu housing is institutionally sponsored by the government, industries and educational institutions and other agencies, as sites and services, or planned employee housing. Most houses in Kathmandu are built by the owners themselves who finance and manage the entire operation. The higher income families often use professional designers, and on some occasions employ contractors to build the house. Generally, the form of contract used is "labour contract", meaning that all construction materials are supplied by the owner, whereas the contractor organises the labour charging for units of item constructed, e.g., cubic metre of concrete, square metre of plaster etc. The lower middle and low income families do not use professional design services but build houses entirely by themselves, using their own labour or directly employing construction labour by paying them on a daily basis. This particular category of housing can be termed informal because except for obtaining a building permit there is no other institutional or professional involvement. There are no subdivision requirements, and the majority of the low income families do not even seem to obtain a building permit for constructing their house. As to the higher income housing category, the major problems of standards exist in the exterior housing environment, arena of shaped by the

sum total of the individual designs. In the urban design context, these housing forms are misplaced gobbling up much agricultural land and exhibiting entirely foreign aesthetics.

Low income housing in Kathmandu has problems on both scales: external environment as well as in the context of the dwelling unit itself. The problems in the external environment are similar to those of the higher income housing group. Furthermore, the building itself has serious problems affecting health, safety and fire and seismic protection. By itself, the individual initiative in the housing process is not a hindrance to housing quality. In fact, the total control of the housing process by the dweller themselves produces a lively form of housing by means of active participation by the residents. In one of his most famous works, Turner with R. Fichter and P. Grenell challenged the institutionally produced housing projects and declared :

> *When the dwellers control the major decisions, and are free to make their own contribution to the design, construction and management of their housing, both the process and the environment produced stimulate individual and social well-being. When people have no control, nor responsibility for key decisions in the housing process, on the other hand, dwelling environment may instead become a barrier to personal fulfilment and a burden to the economy. (Turner and R. Fichter, 1972)*

His opinions have, since then, profoundly affected housing policies of many governments and international institutions, where the practice of providing housing as "goods" to low income families has been reconsidered. However, there is a serious problem related to the totally resident-controlled housing, if such control is exercised only on an individual basis. The collective welfare is often sacrificed, in the absence of adequate regulations and lack of implementations, whenever some exist. Private housing in Kathmandu epitomises these problems. Whereas individual houses are carefully organised and maintained, the public spaces are totally ignored. Whenever any public or open spaces are available, they are there by default. All the available plots are subdivided unscientifically at the convenience of the owners and all of them are built up. The overall organisation of the new housing precincts is at best chaotic and at worst unlivable.

For the low income families, even at the dwelling level, safety and sanitary conditions are totally inadequate, and most buildings constitute serious fire hazards. There is a classic argument about the dwellers not being able to afford any housing at all, especially if the standards push the prices up. Although there is much truth in this, standards do not necessarily have to increase the cost. Appropriate housing standards have to marry the affordability, individual initiatives and public welfare.

Table 2 compares the salient features between traditional and modern approaches categorised between institutionally planned and spontaneous (private, sometimes informal) housing in Kathmandu.

Table 2. Comparative characteristics of different housing types

COMPONENTS	TRADITIONAL	PLANNED	SPONTANEOUS
Subdivision			
Overall Density	400-1000P/ha	150-300 P/ha	200-250 P/ha
Open Space	10-12%, But well linked	8% Centralised	<5% Low
Layout	Non-linear, Courts, But orderly	Geometric, Detached	Irregular, Disorderly
Plot sizes & shapes	Assembled, 100 m^2	Independent, 100-300 m^2	48-127 m^2 Unorganised
Orientation	To all sides, due to court	Arbitrary	Arbitrary, but mostly southern
Access	Pedestrian	Vehicular	Often unmotorable
Infrastructure	Communal taps, No sewerage	Sewer connection	Septic tank, Pit latrine
Dwellings			
Spatial Configuration	Vertically structured	Modern style	Modern style
Approximate Habitable Area	80 m^2	70 m^2	20-60 m^2
Typologies	Courtyard, Common wall	Detached, Row	Detached
Style	Traditional	Modern	Modern
Floor	Timber, Mud	Concrete, Brick	Brick
Wall	Adobe Brick	Brick on cement mortar	Brick on cement mortar
Roof	Clay tiles	RCC, CGI, Tiles	RCC, RBC, CGI
Openings	Timber	Timber, Metal, Glass	Timber, Metal, Glass
Insulation	Climatically effective	Climatically ineffective	Climatically ineffective

Note: RCC = Reinforced Cement Concrete; RBC = Reinforced Brick Concrete; CGI = Corrugated Galvanised Iron.

appropriate standards for low income housing for Kathmandu

guidelines and samples[6]

"For majority of the people, who can not avail themselves of governmental assistance in the provision of their accommodation, the set of standards operated by the local authorities constitutes the single most important obstacle to their settled existence in the urban areas to which they have migrated."

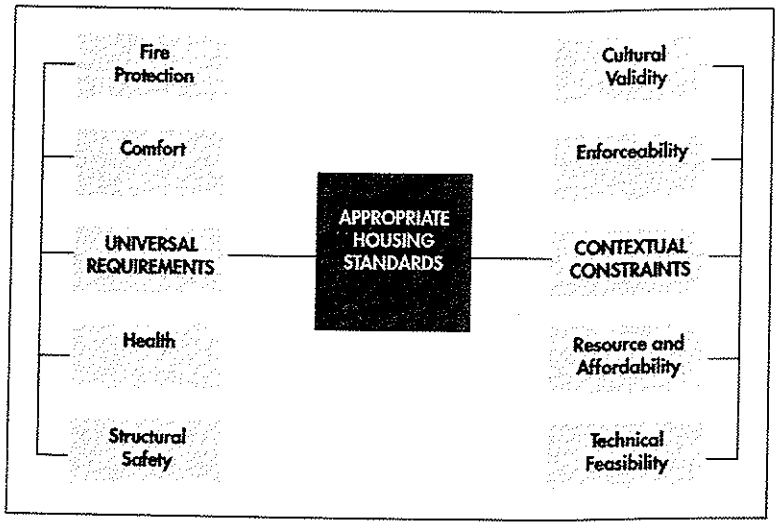
Mabogunje, A., et al., 1978

Housing ensures health, safety, fire and earthquake security, and cultural amenities. It should also facilitate day to day household and cultural activities, and be conducive to personal and social fulfilment. These very requirements of housing necessitate the formulation of appropriate housing standards (AHS).

The appropriate standards, in turn, depend both on the desirable universal requirements for housing, as well as on the existing housing conditions in a particular place. In other words, they should balance the "universalistic" and the "particularistic" nature of housing. The considerations of the universal need alone may prompt utopian and unrealistic standards, whereas, if the local constraint is the only guide, there is room for improvement in the existing housing standards. The universal shelter needs should be moderated by the constraints imposed by the existing levels of poverty, congestion and overcrowding. In particular, the AHS for Kathmandu, Nepal should draw from the richness of the urban tradition, and utilise the poten

tial provided by its indigenous design and construction technology. Finally, the standards should reflect local social and political commitment towards the achievement of decent housing (see figure 1).

Figure 1. Devising appropriate housing standards: a conceptual diagram



Standards can be formulated on two physical scales of housing: the dwelling unit or the "house" itself, and the residential environment that encompasses infrastructure, services and the plot of land. This paper is limited only to standards relating to the land subdivision and dwelling unit.

Although the requirement for health and sanitation is universal, local conditions have to be recognised and the indigenous traditions accommodated in devising housing standards. The most acute problem in Kathmandu housing is perhaps its unsanitary condition. Even here, the prevalent communal use of baths and latrine offers practical opportunities in the poorest sections of the city, e.g., communal stand pipes, in planning for improved health and sanitation, in light of the resource constraints.

The regulatory controls should be designed to achieve public welfare, a minimum dwelling quality, and more importantly, a "good" external housing environment. In the case of Kathmandu,

because the existing practice of unplanned housing has seriously undermined public welfare[7]. On the other hand, in the institutionally planned housing, the standards for external environment have been too high, pushing up the housing cost and creating the wastage of land and other resources. The government should take a major initiative in establishing comprehensive guidelines and norms, with priorities for housing standards.

It has been established that rigid and deterministic housing standards are inherently problematic, because the housing needs are constantly changing even in a given community. Certain ranges of numbers and parameters, rather than single fixed numbers, are more useful indicators of housing standard in any given context. The following guidelines and sample standards for Kathmandu are proposed as part of governmental policies to facilitate the housing process for low income residents. They attempt to combine selected aspects of traditional and modern housing practices of Kathmandu, while also meeting the minimum universal requirements.

Proper design guidelines in building and urban design levels are important in the context of new housing to incorporate the desirable aspects of traditional environment. The traditional architectural vocabulary of Kathmandu valley should be incorporated in the new housing, both for preserving the existing urban character and to make housing culturally relevant. For example, the Bhaktapur Development Project (BDP) for several years proposed, experimented and implemented a series of desirable and effective design standards in Bhaktapur, that were based on traditional aesthetics. Various manuals and publications of BDP can be readily referred in this regard[8]. Additional aspects of housing environment suitable for low income residents of Kathmandu are emphasised here.

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[7] Many residential neighbourhoods are characterised by haphazard development, narrow roads without adequate turning radius and consequent problems of accessibility and deficient infrastructure.

[8] BDP, established in 1974 as a joint effort of the FRG and Nepal government to preserve the town of Bhaktapur in the Kathmandu valley, published many design documents and manuals. Especially, *Planning Systems and Plan* (1978) provides

Subdivision scale

On the subdivision scale, standards become crucial to ensure communal welfare of residents. Lack of appropriate standards for access, open space, and plot layout are evident in all new developments in Kathmandu, where mobility is constrained, sanitation is inadequate, and urban design is discontinuous. Where the area already is built up in this manner, correction on the basic planning level is too costly and, in fact, virtually impossible.

Layout

Housing plots should be laid out to optimise access and infrastructure services, to achieve climatically effective orientation for buildings, and to create an economically efficient and culturally useful housing development. The layout of plots is an important determinant of the settlement structure. It has been observed that people retain these traditional configurations over a long period of time, even while new house forms continue to emerge. Abrupt changes in these layout systems will only disrupt the living environment. Settlement patterns are some of the "core cultural attributes" recognised by Scholars. Rapoport (1983: 259) notes: "It is found that house forms change rapidly and easily. Yet the settlement pattern seems much more central and significant".

The layout has to be built upon the basic principles of traditional housing, but at the same time it should be efficient for new infrastructure and overall economy. The cluster approach of housing rather than individual and independent units is preferable in Kathmandu. Traditional houses were not designed as self-contained dwellings on a plot, but utilised the common spatial amenities of the courtyard and semiprivate accesses. Urban dwellings, as exemplified in the Kathmandu city core, were physically related to each other and were constructed accordingly. As far as practicable, new housing layout should encourage

▼ *Agricultural land conversion to urban use in the Kathmandu Valley.*

box 1. physical design guidelines for housing

For low and lower middle income housing in Kathmandu, the following guidelines of physical design are recommended for new schemes.

1) Locate the project optimally in terms of accessibility to jobs and to town centres.
2) Select the site with low initial land cost. This will often be in conflict with accessibility criteria, requiring reasonable trade-offs between the two.
3) Select the site with manageable grade to facilitate drainage, sewerage and water supply but allowing ease of development.
4) Follow the traditional settlements patterns for house types, plot use, density standards and technology of construction and lifestyles of the prospective residents. Generally, traditional urban and dwelling design characters should be maintained.
5) Devise narrow and deep individual plots so that the length of infrastructure in the scheme is minimised. The specific housing type and design in the scheme will affect the actual depth/width ratio.
6) Organise the individual plots in large blocks to achieve the following standards. The efficiency of traffic movements has to be considered in order to derive the optimum size of the blocks[9]:
   - Higher density, as is traditionally prevalent.
   - Adequate open and communal spaces, following traditional patterns.
   - Low infrastructural network length per hectare.
   - Low number of road intersections per hectare.
   - High proportion of residential use.
   - Easy accessibility of communal services.
   - Maximum commercial opportunity.
7) Allow space for commercial potential which can be eventually sold for business. The surplus value can help to cross-subsidise the housing project.
8) Refine the layout to reflect cultural preferences, and to achieve privacy while controlling microclimate by means of proper orientation for breeze and solar control.

9 These efficiency [illegible] will also be consonant with the interests of

focal points - derived from the same principles as the location of temple squares in the traditional housing. Semiprivate open areas, common to a group of households are desirable. This can take the form of linear access to clusters of houses. The concepts of distinct housing precincts interlinked with one another offers another desirable pattern of layout for housing in Kathmandu. Expansion of a housing scheme should be planned on the basis of repeating an entire precinct.

For low income residents, row houses which can incorporate the flexibility of having courtyards or common open spaces at the centre of groups of houses are most economical. Such arrangements can be based upon traditional row housing patterns. The row houses, when staggered relative to the street, provide additional privacy for each family. Variations of this theme can be articulated as long as the focal point of open space, temples or other common spaces are planned in central locations. This arrangement is in keeping with the traditional housing vocabulary of Kathmandu, but can also satisfy the changing needs of the community.

Row housing is most suitable for residents with the lowest income whereas detached clusters are possible for the upper sections. In detached housing, side yards have to be minimal to maintain the slender plot shapes ensuring economy.

The present housing developments desperately lack open spaces. A courtyard for each single house is not feasible because of the slenderness of low cost plots. But different open space configurations in housing, often offering courtyard-like attributes, can be achieved in other ways. Firstly, a whole block in the housing scheme can be designed as a focal point, which acts as a common area for 20 to 30 surrounding houses. This arrangement, common in traditional Kathmandu housing, provides a focal point for communal use. Alternatively, a common open space inside a block can be provided. This type of open space, prevalent in traditional housing, is semiprivate, and is a combined pool of back-yards of individual housing units. Provision of access for outsiders is optional in this case. A semiprivate common space can also be combined with access function. This extended cul-de-sac form of communal space can be accessible by emergency and service vehicles, but is prefer-

can accommodate children's activities, and drying of clothes and vegetables. It is similar to traditional collective spaces prevalent in Kathmandu, and can be administered by a *Guthi* like cooperative composed of surrounding households. In modern terms, it can be a form of horizontal condominium space which the public authorities do not have to maintain. Finally, each housing unit can be designed with a small back court, which can be combined with other courts for creating a larger courtyard. The space, at the option of the abutters, can be subdivided with low fences to maintain its enclosed character.

Plot size and shape

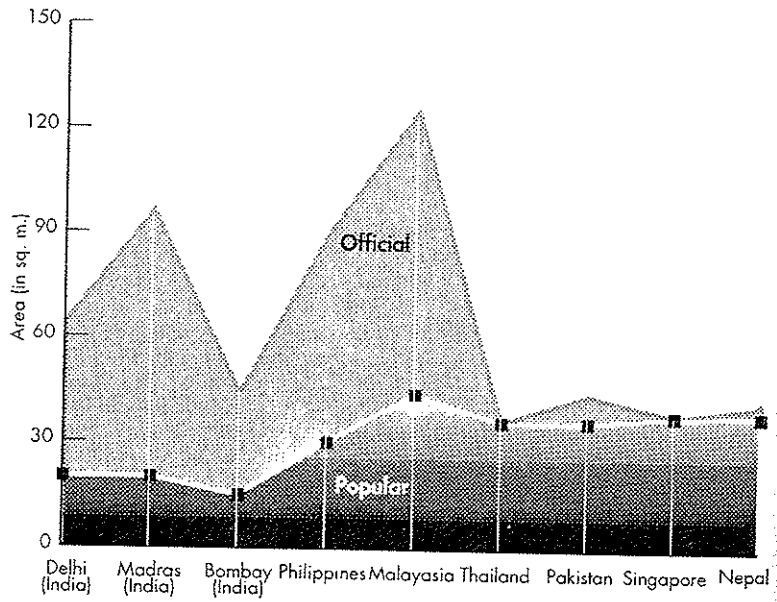
Size of plots is an important part of housing standards, especially for low income housing. It is a way to affect the housing density, to control cost, and to suggest the building location and its envelope on the plot. Selection of plot size affects the unit cost of housing, influencing both the cost of land and that of infrastructure. Standards for plot size are also important indicators of types of activities that are encouraged within a housing unit. Optimal housing plot should be able to accommodate dwelling unit, small yard, pit or exterior latrine and verandah.

A comparison of plot sizes used in many parts of the world including Kathmandu shows that there are no universally acceptable minimum plot sizes for low income housing. Official plot sizes are generally bigger, whereas people manage to do with much less. For example, a USAID/HUD (1966) document proposed 100 square metres in the context of Latin America. In reality, the *favelas*, *barrios*, and *bustees* utilise land plots that are as small as 20 square metres. A wide gap is observed between officially prescribed and popularly used residential plot sizes in Asian cities (figure 2). In most parts of the world, low income residents utilise extremely small plots of land for their dwellings that range from 15 to 45 square metres.

The most popular plot sizes generally used by the lower middle income residents of Kathmandu are found to vary between two and four *anas*[10] of land, i.e., between 63 and 127 square metres. The PADCO (1986: 93) study observes that the plot size most frequently

used by new home owners (by implication the new middle and lower middle income group) in Kathmandu is four *anas*, i.e., 127 square metres. The low income families, however, build on smaller plots that range from 20 to 60 square metres. Within the city core, where four or five stories construction is common, owners have effectively developed as little as 16 square metres of land for commercial and residential purposes. But such plot size is too small for new housing development, as it creates dearth of light inside rooms, problems in excavating separate foundations, lack of adequate separation from nearby structures and higher cost per dwelling unit construction. In the close proximity of Kathmandu's urban centre, land is relatively more expensive and a plot size in the range of 36-72 square metres is appropriate.

Figure 2. Official standards vs popular uses for minimum plot sizes



Source: Mabogunjee et al., 1978; PADCO, 1986; Yeh, Laquian, 1979.

The traditional urban dwellings in Kathmandu were integrated with one another, extending across several plots and often avoiding the need to have an individual plot for each housing unit. However, the author's calculation (in a multi-family unit) in some traditional

income housing, it is important to provide reasonably sized plots to ensure future flexibility, even at the cost of the present dwelling unit. In suburban areas of the city, plot sizes between 48 to 72 square metres appear suitable for the low, and lower middle income category. Larger plot sizes become feasible only at sites that are farther away from the central city area, where the land is cheaper.

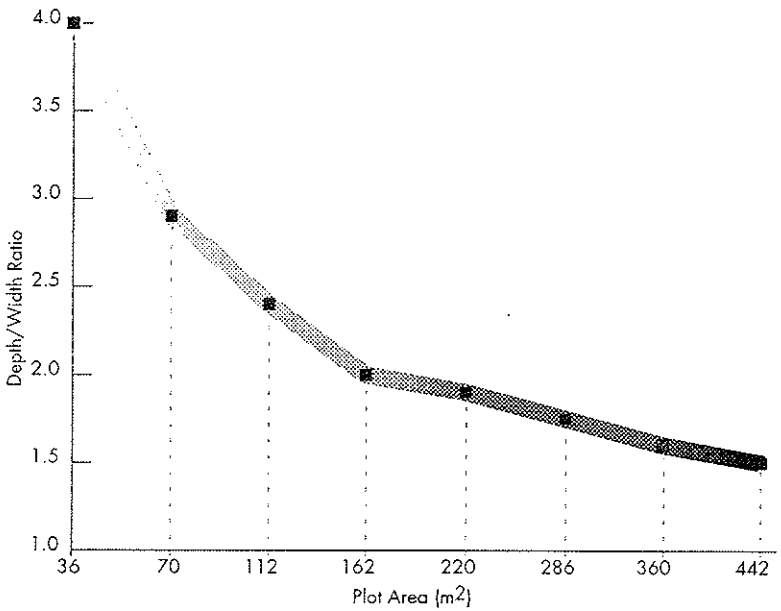
The existing vacant plots inside the Kathmandu city core are usually small, in the range of 16 to 64 square metres. Infill housing in these plots is a pragmatic way of housing some section of low income families. It is difficult to control plot shape, sizes, layout, access and other parameters in the case of infill housing as the context is already in place: only dwelling units can be regulated. Side yards are often not feasible nor desirable in these plots, because the land is extremely costly and the structures are of necessity tall. The existing street-side residences in the city core are essentially row housing and new infill housing should follow the same pattern.

The shape of a plot is a crucial indicator of efficiency in the housing schemes. The cost of utilities and roads is directly proportional to the total length of lot frontage. A high depth to width ratio is better for lowering the infrastructure and other common costs of housing, but can restrict the dwelling layout as well as limit interior lighting and ventilation. Conversely, a low depth to width ratio creates higher infrastructure costs but allows more flexibility in building layout. Thus there are trade-offs between design flexibility and infrastructural economy in selecting the right shape of building plots. Many new housing schemes in Kathmandu, e.g., Kisipiri, Kuleshwar, Ring Road projects etc., have incorporated wider shapes for plots, greatly increasing the overall development cost.

Caminos and Goethert (1978), after analysing the efficiency of plot shapes, recommend that, for smaller plots under certain conditions, a depth to width ratio of 4:1 is desirable for economy in circulation and efficiency in land utilisation. Davidson and Payne (1983) suggest that, for low income housing, an efficient plot shape should have the ratio between 2:1 to 5:1. Rabenau (1989) has proposed a depth to width ratio between 1:1 to 3:1 for Kathmandu housing plots for the sizes of 60-360 square metres. Smaller plots have to be more economically priced per unit area, to make them

unit area. They can have frontage as small as 4 metres, in which case the entire depth can still be utilised for rooms. On the other hand, larger plots can not be made too slender because the middle income purchaser would not be attracted, as such plots would have too much unusable area for the building at the rear. Thus the depth to width ratio is a hyperbolic function of plot size; an optimum shape of a plot will depend upon its size (figure 3). For the plot sizes in the range of 48 to 96 square metres, a depth to width ratio between 3.5:1 to 2.5:1 is preferable for Kathmandu. As observed in the figure, for small plots the desired ratio changes quickly with the plot sizes, whereas for larger plots of sizes more than 200 square metres, variation is insignificant. For large plots, a depth to width ratio of 2:1 is generally acceptable.

Figure 3. Plot size vs. desirable depth/width ratio



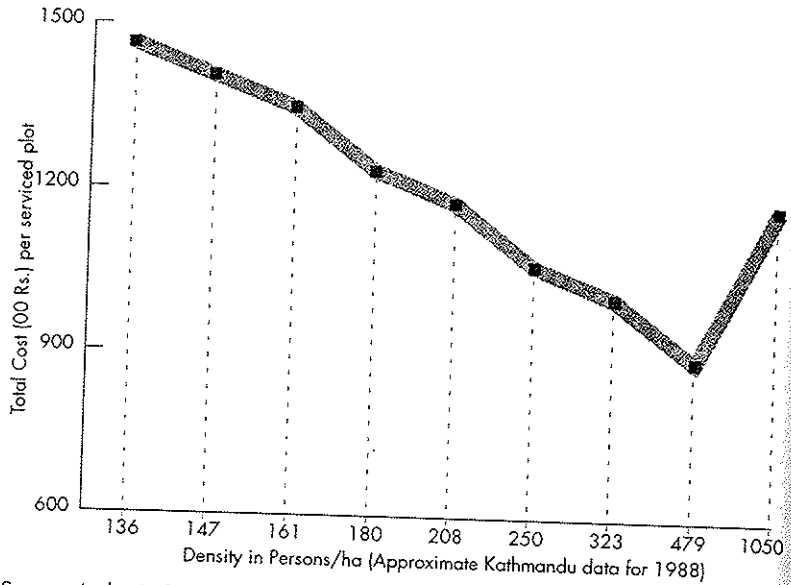
(Note: for rectangular plots)

Density

Density control has traditionally been the most visible component of housing regulations. Floor area ratio (FAR), open space ratio (OSR) and height limit are mainly directed in regulating the density of residential development. Density is also a function of occupancy standards, i.e., number of persons per room which relates to the recommended habitable space per person. Many scholars have argued that an acceptable level of density depends upon the cultural norm of any given society. Popular examples that show extreme and still locally accepted situations are the crowded neighbourhoods of Hongkong and almost lifeless suburbs of the USA. The gross residential densities in Hongkong easily exceed 4,800 persons/ha (Thai-Ker, and An, 1979: 154), whereas in some US suburbs gross densities of 10 persons/ha are not uncommon. In the new housing of Malaysia, gross density ranges from 400 to 2,000 persons/ha, and in Thailand it reaches up to 2,950/ha, (Thai-Ker, and An, 1979: 157, 58). In Hongkong and Singapore most of housing is in the form of high rise apartments, allowing increased densities. Only a limited increase in density can be achieved with one or two-stories houses, a more realistic scenario in Kathmandu.

In Kathmandu, the low income housing construction is generally limited to four stories. High and mid-rise buildings need a reliable electrical supply, water supply, and adequate services in sewerage, drainage etc., which are not currently available in Kathmandu, especially for low income housing. However, a high density in the range of 1,000 persons/gross ha has been achieved in traditional housing in Kathmandu, with three-and four-stories building typologies. Considering the normal costs for land, building construction and infrastructure in Kathmandu, it appears that the cost per dwelling unit decreases as net density increases but only up to a point. Initially, when density increases, cost of land per dwelling unit decreases, whereas, the unit cost of infrastructure and dwelling construction remains steady. But after a certain level of density, although the land cost per unit still decreases, the unit cost of infrastructure and housing construction starts to rise because of the complexity caused in the design, construction and management. For Kathmandu market prices, after crossing a gross density of about 600 persons/ha, the cost per unit increases again, indicating that a gross density of approximately 500/ha is economically optimum (figure 4). This level of density is achievable with buildings of one to three stories, and is feasible in the present technological context of Kathmandu.

Figure 4. Cost vs. density in Kathmandu housing (market prices)



Source: Author's Computation from Various Sources.

Floor area ratio (FAR), defined as the total allowable floor space area divided by the area of the site, is an important regulatory tool to control density and to achieve the desired allocation of open space. A wide range of FAR is used in various cities of the world. In large cities like New York, the residential areas permit FAR as high as 12[11], whereas in suburban USA, FAR rarely exceeds 0.25. Many low income housing schemes have used FAR of around 0.5 to 1. Unplanned housing units in Kathmandu show a FAR of 0.3 to 1.2, whereas the institutional housing has used FAR between 0.25 to 0.5. A FAR range of 0.5 to 1.5 is recommended for Kathmandu.

The traditional residential density in Kathmandu, taken on the basis of entire urban area, has been one of the highest in the world. As early as 1960, Karan (1960) observed that Kathmandu's urban area attained a high density, almost twice that of New York city. Ten of the twelve central wards (neighbourhoods) of Kathmandu have residential densities of above 400 persons/ha. The core wards of the city have gross residential densities above 1,200 persons per hectare (PADCO, 1986).

[11] City of New York (1975). *Zoning for Housing Quality*. New York

The net residential density in the traditional urban core often exceeds 2,000 persons/ha. Viewed in this light, the gross densities of institutionally designed new housing, averaging less than 200 persons/ha, are extremely low[12]. In the past, throughout the Kathmandu valley, housing was meticulously designed for compactness, saving precious agricultural land. In contrast, the new form of sparse housing development, both informal and formal, has gobbled up much agricultural land and created an environmentally disruptive land use practice. The proposed density standards for Kathmandu are inspired by the compactness of traditional housing and should be higher than the currently practised ones, to help conserve land, and also to lower the cost of land and infrastructure per dwelling unit. A gross density range of 400-600 (net 500 to 900) persons per hectare is recommended for low income Kathmandu housing. Buildings will range between one and two stories to achieve such density and satisfactory plot sizes. Such arrangement will result in plot sizes that will average 60 square metres.

Infill housing on the vacant lots inside the city core should be considered part of the strategy for facilitating low income housing in Kathmandu. Due to excessive land cost, such housing should accommodate much higher density. Four story construction is already a norm in these areas. Existing gross densities of more than 1,000 persons/ha are not uncommon in such precincts. Infill housing should allow gross densities of 900 to 1,200 persons/ha.

Open space

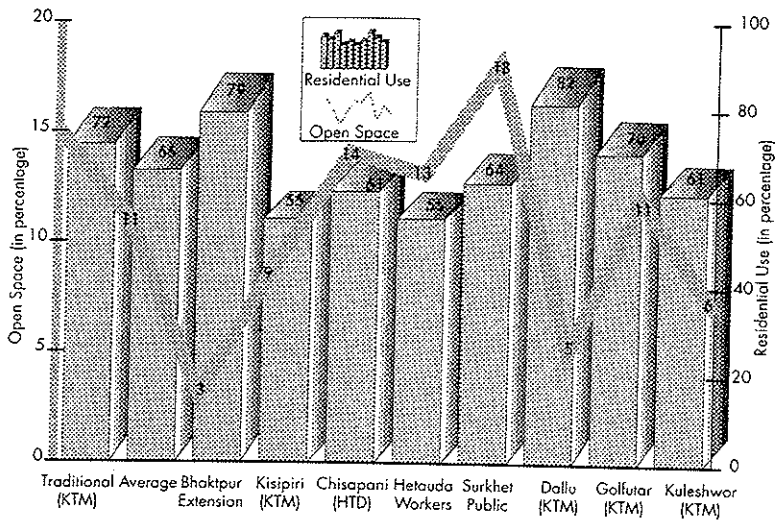
Traditional housing in Kathmandu exhibits a unique form of open spaces, different from what is generally found in present day housing. The open spaces in traditional housing are religious focal points, e.g., temple squares, palace squares and paved areas surrounding public water taps. Natural water ponds inside the city sometimes fulfil the open space function, although they do not provide usable ground surface. Park-like green open spaces and playgrounds did not form part of the built-up areas of the city, although one or two major open fields for multipurpose use have existed in Kathmandu towns. Immediately outside town boundaries,

and the wide open agricultural fields is clearly visible even today. As agricultural fields move farther away from housing precincts, provision of open spaces within the housing complex becomes more necessary. The current housing developments, in efforts to maximise individual land plots for the owners, and profitability for the land brokers, provide no open space at all. In the new housing precincts of Kathmandu, there are no provisions for communal meeting areas, such as children's playgrounds, and parks. Consequently, housing developments have become acutely congested, unhealthy and severely short of public facilities.

Open space arrangements, reflecting both traditional and modern practices, need to be incorporated in housing in Kathmandu. Among the various standards for establishing the amount of public open space in practice, open space as a percentage of the total housing land area is a commonly accepted indicator in the planning of housing schemes. If open space is defined to include parks, playgrounds, public spaces and community spaces, a total of about 5 to 10 percent of the total land area in the housing scheme would be allocated. In Nepal, various new institutional projects have provided between 5 to 10 percent of the housing development area as open space to be used for playgrounds, schools etc. For example, in Kisipiri 9 percent of the total area is provided for open space, whereas in Kuleshwar employee housing it is about 6 percent. The unplanned housing precincts have practically no open space at all. In traditional compact settlements, open space averages about 12 percent of the housing area (see comparative percentage in figure 5). In the new low income housing schemes in Kathmandu, open space at about 3 to 6 percent of the housing area is proposed, which should be divided into decentralised system of open spaces designed for specific uses throughout the housing scheme. But the number should be adjusted as required by affordability analysis, and also on the basis of overall density.

The traditional residential density in Kathmandu, taken on the basis of entire urban area, has been one of the highest in the world. As early as 1960, Karan (1960) observed that Kathmandu's urban area attained a high density, almost twice that of New York city. Ten of the twelve central wards (neighbourhoods) of Kathmandu have residential densities

Figure 5. Open space and residential space percentages in selected housing projects in Kathmandu



Source. Mathema, 1987; Malla, 1986.

Access

One of the most basic problems in unplanned and informal housing in Kathmandu has been the lack of adequate access, especially for motorised vehicles. A classic example of "Tragedy of Commons" is evident in Kathmandu due to the individual household's reckless efforts to maximise the private use of every square inch of their land — consequently choking the public roads. The suburban housing developments often retain excellent dwelling interiors, but the narrow and winding approach roads remain garbage yards as "No man's land". Worse still, all individual plots are secured by compound walls that turn the streets into landfills when dry, and into ponds when wet. In these housing precincts, most streets are barely 2.5 metres wide, as a result of unsystematic land subdivision. Land subdivisions and house plots are decided by the tug-of-war between the land-brokers and buyers — both trying to maximise the saleable "private" portion of the land by reducing the road size. Proper regulations for subdivisions do not exist, and even when some exist, they are not implemented. Consequently, the

are minimised by the homeowners, builders and brokers — the only actors on the housing scene.

The main reason for the construction of sturdy compound walls on the residential plots in Kathmandu is the owner's feeling of insecurity about the recognition of boundaries. Compound walls should be discouraged by strictly delineating private property and keeping good record of lot boundaries in the public files. Whenever compound walls are erected, they should be short, transparent (e.g., fence) at least at the turning segment of the road, and porous to increase visibility and help drainage.

Wide roads that are prevalent in the western suburbs, are inappropriate for low income housing schemes in Kathmandu. They consume too much land, increase the cost of plot and utility and the overall housing. In some countries, high standards for road width and set backs have severely constrained the supply of land increasing the cost of housing[13]. In low income housing schemes in Kathmandu, where vehicular ownership is practically nonexistent at present, road proper should be narrow, while providing a wider right-of-way. Considering the possibilities in future, when the standard of living may rise, the wider right-of-way can be translated into roads allowing increased vehicular movement and facilitating upgrading. However, adequate access is required for service and emergency vehicles even at present.

Among some sites and service schemes in Kathmandu, in the Kuleshwar project, 29 percent of the total area is taken up by circulation (for roads only), which is too high for such a scheme. In Kisipiri the percentage is 32, and in BDP East housing project, the circulation area is only 15 percent of the site area[14]. The numerical ratio of circulation area divided by total area, by itself, may not be the best measurement of the efficiency and cost-effectiveness of a housing development, but it certainly is a strong indicator of land use efficiency. Caminos and Goethert (1978), in their pioneering study-recommend 20 percent as desirable and 30 percent as maximum proportion for circulation (alternatively 150 metres/ha). The World Bank housing projects often use a 20 to 25 percent figure for

[13] One example is the case of Malaysia referred in *Urban Edge*, the World Bank, Washington DC, October 1988.

circulation area, whereas certain public housing scheme in Singapore have achieved a range of 12 to 16 percent[15]. For Kathmandu, inclusive of semiprivate access, circulation is proposed to range between 20 and 30 percent of the housing project area. This high circulation ratio is meant to accommodate a wider right-of-way, so that future upgrading would be possible.

For low income housing in Kathmandu, access should be provided to all the units for at least pedestrians and bicycles and emergency vehicles. The major roads should have adequate width and turning radius to be accessible by motor vehicles for emergency. As an example, in Kuleshwar sites and services scheme, 2, 3, 4, 5, and 7.5 metre-wide roads are used. The first one is basically for pedestrians and bicycles, the rest for vehicles. In Saibhu sites and services project road widths are 6 and 10 metres, whereas in Kisipiri, 5 and 10 metres-wide roads are provided. After observing various housing schemes in Nepal, it appears that the minimum acceptable vehicular road should be 4 metres wide. Roads inside the housing scheme should be categorised into three types: collectors, secondary and local roads. Respectively, these road types normally serve to, more than 150, less than 150, and about than 25 dwelling units. The minimum widths of the road proper in these categories should be 8, 6 and 4 metres respectively, with corresponding right-of-way of 10, 7 and 5 metres. This would allow passage of emergency vehicles at the outset while also enabling future upgrading of the development. A minimum of 2.5 metres is recommended for turning radius in the road, when the road width is minimal. The turning should be curved and visibility should be ensured at least 15 metres on all sides of an intersection. For wider roads of 6-8 metres, turning radius is less critical but is still desirable.

Dwelling scale

Design and dimensions

The design of the housing unit itself is a complex task, because each dwelling should fulfil the needs of a unique household. Many architects, designers and planners have attempted varieties of physical solutions for low income housing in different locations,

attempting to cut cost, increase functional utility, and refine aesthetics. Standardised prototype housing unit designs of different types are common in many housing schemes. As articulated by Habraken (1972) in "Supports", personalised designs are desirable in both the developing and the developed world alike. Although the idea of "Supports" has been around for more than two decades, no breakthrough has been made in its technical application. Nevertheless, it has broadened the designer's outlook, and has influenced the need to provide flexibility in housing schemes.

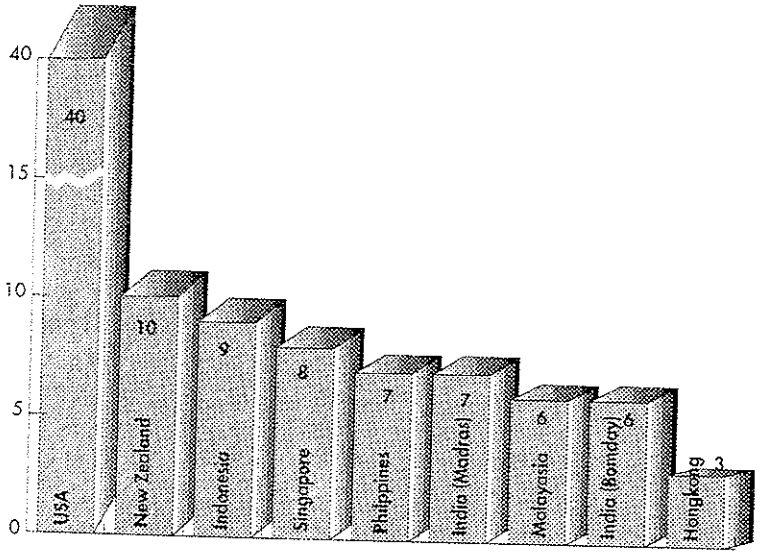
Some of the institutional housing in Kathmandu does offer prototype designs. But as argued before, imposed designs are not the most suitable solutions to the housing problems of the low income residents. Households devise unique functional solutions even in highly constrained situations. However, guiding principles for the design are useful to achieve a desired collective environment. While, the inferior configurations in the dwelling unit should be largely left to the owner's discretion, selected traditional aesthetic must be encouraged in the new buildings. Design guidelines, such as those of the Bhaktapur Development Project (BDP, 1978) are recommended in this regard.

Kathmandu's traditional practices of arranging residential spaces vertically are useful, but should depend on whether a single multi-story dwelling is used by an extended family. The traditional notion of privacy gradient in the interior spaces should, however, be maintained. Direct entry into the living room is acceptable when the dwelling size is limited. But whenever possible, some form of spatial transition at the entry into the house is recommended for improved privacy. Kitchen and dining functions should be combined avoiding separate dining rooms. Provision for worship room should be made somewhere near the bed room. Bathrooms should have a separate toilet and shower and preferably with a semi-exterior location. The water supply in Kathmandu is independent and inadequate making indoor toilets generally undesirable.

The habitable personal area varies a great deal depending upon cultural practices, economic levels and spatial preferences in the society. A great variation in the provision of personal space is observed among different countries (figure 6). A recent survey

rate of about 27 and 44 square metres respectively[16]. In Argentina, an occupancy rate of 8 square metres/person, accordingly 1.3 persons per room, occurs (Mabogunje et al., 1978). Thai-Ker and An (1979: 131) observe that "Outside Hongkong and Sri Lanka, countries generally take 35 square metres as the minimum dwelling area", giving about 6 to 8 square metres of space per person. In Santiago, Chile, minimal public housing units have an area of 36 square metres, providing an area of about 7 square metres per person[17]. A USAID/HUD document recommends personal space of 5 square metres18. A comparative tabulation for dwelling unit size and occupancy standards, based upon certain codes and the actual public housing projects, is shown in table 3.

Figure 6. Personal habitable area in selected countries



Source: Khalid, 1974; APHA, 1971; Yeh and Laquian, 1979.

In most developing countries the occupancy per room varies between two to four. In this light the International Labour Office (ILO) recommended occupancy rate of 1 person/room, which is highly unrealistic. However, another ILO recommendation that "Every household should have a self-contained dwelling unit, if it so desires" is a reasonable proposition.

16 Figures based on the article in Newsweek, February 27 1980

Table 3. Comparative DU size and personal spaces

COUNTRY	NET DU SIZE (M^2)	SPACE/PERSON (M^2)
Singapore	35-125	7-23.5
Malaysia	35-47	4.5-7.5
Philippines	27-39	5-6(est.)
Thailand	35-55	4.8-8
Indonesia	64	12
Sri Lanka	25-35	4-6
Average	49	8.3

Source: Thai-Ker and An, 1979.

From the available data for Kathmandu, the average number of household per dwelling unit is 1.3, whereas the average occupancy rate is 2.13[19], and the average household size is 5. In Nepal, planned housing for low income employees in Birganj, Janakpur and Gaidakot has provided minimum dwelling units of 20 to 24 square metres. Traditional Kathmandu houses, generally representing middle class ownership, provide a more generous area. Although the design principle inherent in these traditional houses is valid for today's construction and design technology, their occupancy standards have to be adjusted for low income housing. At the national scale, a wide margin exists in the dwelling size that ranges from building plinth (ground floor area inclusive of walls) area of 19 square metres to more than 110 square metres (table 4).

Table 4. Plinth area per household in Nepal

PLINTH AREA (M^2)	AREA/PERSON (M^2)	PERCENTAGE OF HOUSEHOLD
<19	3.2	27
20-37	3.3-6.3	46
38-74	6.4-12.7	18
75-111	12.8-19	4
111+	19+	5

Source. National Planning Commission, 1978.

[19] Based upon Kathmandu-Lalitpur housing survey, by DHBPP, Kathmandu, 1976 (unpublished document). The situation has, perhaps, worsened.

Most houses in Nepal are single and double-story units. Hence the upward range for the total floor space will be twice as much for two story houses. For Kathmandu, dwelling size is proposed to be at minimum 36 square metres, preferably 50 square metres.

Building elements in traditional Kathmandu houses use lower dimensions compared to the western practice. For example, a typical stair is only 60 centimetres wide and is at 40 degrees slope. Balconies are often only 60 centimetres wide; passages and doors are also similarly narrow. In the low income housing in Kathmandu, smaller dimensions than the western standards should be allowed if they are acceptable for safety. Rooms should be at least 2.1 metres wide, except for bath and store rooms, for which a minimum width of 0.9 metre is recommended. An intimate and human scale interior space is also recommended. This would translate into a low ceiling height of between 2.1 to 2.25 metres with the doors height between 1.95 to 2.1 metres. Northern and western windows should be smaller, which are compatible with the existing traditional types. Southern windows should be bigger with glass, and with overhangs for solar control. Personal habitable space of 6 to 10 square metres/person is recommended.

Suggested residential typologies

Traditional residential designs exhibit two significant characteristics: basic row housing concept with common side walls, and the integrated courtyard concept. Both these characteristics are recommended for revival in some form. Sociologically, the integrated court's character of traditional housing is very important for Kathmandu. The proposed housing standards should incorporate row housing and common courtyard concepts with modifications. This will help achieve a street aesthetic, characteristic of traditional Kathmandu housing.

Row housing, or forms close to row housing, would be feasible even in cases where sites and services or similarly land-pooled housing schemes are devised for low income residents. Minimum or no side yards at all are the design consequence of this typology. Such arrangement will reduce land cost, share structural cost when possible, and make extremely slender housing plots possible so that

infrastructure and utility cost is minimised. There are, of course, some penalties in terms of housing comfort. First of all, lighting and ventilation has to be provided from two sides, front and back only, unless the building is single storey, when clerestory lighting is possible. Row housing might also reduce the utility of certain interior spaces, and constrain design flexibility and expansion possibility of the dwelling.

Achieving individual courtyards is difficult in these forms of housing. The land plot is too small to accommodate a typical building with a courtyard. The linearity of the individual housing in slender plots also hinders the flexibility required to implement a layout incorporating a courtyard. However, as discussed earlier, a form of courtyard is possible when rear portions of the dwellings are combined. If individual privacy for each unit has to be maximised, then a semi-courtyard arrangement is possible. A staggered configurations of row housing is also recommended to maximise privacy. Courtyard designed as a focal and common space for a number of houses is feasible in the new housing scheme. Such space can accommodate temples, and is particularly desirable as it follows the traditional housing pattern.

In Kathmandu, it is common to build low and lower middle income housing incrementally. Virtually all the houses are constructed one storey at a time, with provisions to add floors. Thus the first floor has either a flat reinforced brick concrete (RBC) or reinforced cement concrete (RCC) upon which higher floors can be built, or a corrugated galvanised iron (CGI) sheet or similar roof can be dismantled and transferred to the highest floor after expansion. The new standards, while encouraging sloping roofs, should allow flat roofs in temporary construction with provision for a sloping roof at the final stage.

Building materials

Proper governmental policies and appropriate guidelines for the use of building materials are crucial in facilitating the housing process and insuring appropriate standards. After land, building materials are perhaps the most important inputs in creating housing in Third World. Many technical deficiencies, high cost and difficulty in execution of housing can be attributed to improper selection of building materials. In this regard the recommendation of an UN document relevant:

> *In determining the kinds of building materials, floor space and requisite services and facilities, the task involved is to strike a balance between health, cultural and safety requirements on one hand, and the financial resources available for housing construction, on the other (UN, 1976: 66).*

Housing in Nepal is still individually and uniquely built. The materials used are few, the construction is manual. Compared to the housing construction in developed countries, where varieties of manufactured components are available to be assembled on the site, construction in Kathmandu starts from the basics providing opportunities for creating specifically tailored details. Use of indigenous materials, such as bricks, *kacho int,* tiles, and bamboo etc. can be easily promoted.

Although provision of damp-proof course (DPC) is a routine practice in the developed countries, it is conspicuously absent in the traditional buildings of Nepal. This seemingly minor omission causes innumerable, often serious, damage to buildings such as efflorescence in bricks, dampness in floors and even structural cracks in entire walls. The importance of DPC for Kathmandu housing can not be overemphasised. Damp-proof courses are strongly recommended in each house. Preferably, DPC should be a bitumen-coated RCC beam, at least 10 centimetres deep, covering the entire length of structural walls. This arrangement serves three purposes, as a DPC, as a check against unequal settlements of the foundation, and also as a protection against seismic movements. For a cheaper substitute, membrane DPC of asphalt or bituminous felt can be used.

Cavity walls are strongly recommended for perimetre walls because they provide excellent insulation while economising the use of materials. A typical cavity wall, in cement mortar, suitable for Kathmandu is 40 centimetres wide with flanges of 23 and 12 centimetres and a cavity of 5 centimetres. Alternatively, a 37 centimetres-wide *kacho int*[20] construction also provides excellent

[20] Sun-dried local brick traditionally cast at building site.

insulation. Such construction has to be covered with cement plaster or traditional mud-rice husk plaster to protect it from rain. Interior and non-structural walls are recommended to be built with bamboo *jalis*[21] plastered on both sides.

Insulation, as prevalent in traditional construction, is also recommended for roof. In low income housing, roof construction is the most critical component because good roofing materials are expensive. For example, tiled roofs provide good insulation but their life-cycle cost is high, due to extensive maintenance needs. CGI roof is cheap but offers very low thermal resistivity. For better thermal control, timber boarding immediately below the CGI sheets, and felt insulation between the boarding and the plywood ceiling should be provided to achieve approximate U values of 1.5 to 2 $w/m^2/°C$.

Conclusions and summary of proposals

The perspective in proposing these standards has been that of the public authority. The proposed standards affect public agencies, developers, and residents in different ways. Depending on the relative ratio of public-private component of a particular scheme, the standards may be directly implemented or merely encouraged by the public authority.

Many of the proposed standards are overlapping and interdependent. For example, dimensions for road width and road turning radius are interlinked. To avoid the prevailing problems of inaccessibility, roads can be made wider where turning radius can be minimal. When the roads are narrow, e.g., 3 to 4 metres wide, proper turning radius is imperative for the smooth movement of vehicles. In Kathmandu, provision of roads with wider right-of-way (ROW) is a better approach to facilitate the upgrading potential of housing schemes. However, minimal turning widths are desirable, because even with wider ROW, only a portion will now be made motorable.

Similarly, layout of subdivisions is linked with the size and shape of plots. Thus, although traditional layout patterns are recommended for Kathmandu, the configuration will be modified by the use of smaller, deeper, and regularly shaped plots that are desirable for

economy and efficiency in the new low income housing schemes. Furthermore, higher density should be allowed in all housing schemes. They should be the standards for public sites and services projects, and are to be encouraged in the private developments too. As argued before, compact housing is an important tool to conserve land and economise housing. Higher net density naturally results from a high gross density when a similar ratio of residential use is maintained in the project. The ratio of publicly supported land such as circulation, and open spaces remains fixed in such projects. But whenever business potential is high, increased commercial land use is beneficial because it can provide cross-subsidy in the housing scheme. If a large commercial area can be developed in a housing scheme, it is desirable even at the cost of lower gross density

At the dwelling level, there are two main purposes of standards: public safety, and residents' convenience and comfort. Although, they are not mutually exclusive, the first is a priority concern for the public authorities, while the second affects the resident more directly. Standards on the details of the interior design and construction, although recommended, are best left to the households at present. However, the acceptable aesthetic character should be defined.

Numerical parameters of standards are better defined as a range, with the lowest number denoting the minimum acceptable and highest the desirable. Somewhere in between, lies a decent standard. The salient standards discussed above are summarised in Table 5.

Table 5. Summary of the recommended standards

HOUSING COMPONENT	CHARACTER, RELATIVE NUMERICAL LEVEL, MATERIALS	RANGE	REMARKS, UNIT	WHO IS MOST AFFECTED
Layout	Cluster, focal points, courtyard			Developer
Plot size	Small	36 to 72 sq m		Residents
Plot shape (depth/width)	Slender, geometric	2:1 to 4:1		Residents, city
Gross density	Compact, high	400 to 600	Persons/hectare	Developer
Net density	High	500 to 900	Persons/hectare	Developer
Infill net density	Very high	900 to 1,200	Persons/hectare	Developer
Open space	Low	0.2 to 0.3	Ratio to lot area	City, resident

Common area	Moderate	3 to 6%	% of project area	City, community
Circulation	High	20 to 30%	% of project area	City, developer
Collector road		8 to 10 m	10 m ROW (min.)	City
Secondary road		6 to 8 m	8 m ROW (min.)	City
Local access road		4 to 5 m	5 m ROW (min.)	City, resident
Road turning radius		2.5 m	Minimum	City, resident
Dwelling design, aesthetics	Traditional		See BDP guidelines	Resident, city
Dwelling configuration	Courtyard			Resident
Dwelling size	Intimate	36 to 50 sq m		Resident
Space/person	Medium	6 to 10 sq m		Resident
Ceiling height	Low	1.95 to 2.25 m	Resident	
Roof	Slooping/CGI, RBC			Resident
Exterior walls	Cavity, brick, *kacho int*, Mud	37 to 60 m	Thickness	Resident
Interior walls	Brick, bamboo	7 to 25 cm	Thickness	Resident
DPC (beam)	PCC (RCC)	4 (10 to 15) cm	Thickness	Resident
Floors	RCC, RBC, Timber	8 to 15 cm	Thickness	Resident
Doors	Woodpanel, plywood			Resident
Window	Traditional proportions: metal, timber, glass			Resident
Window overhang	Brackets, concrete, CGI	45 to 75 cm	South, west	Resident
Wall insulation	Cavity, *kacho int*	1.5 to 2 (U)	$w/m^2/oC$	Resident
Roof insulation	Mud, felt, plywood	1.5 to 2 (U)	$w/m^2/oC$	Resident

Note: Materials and sizes of building components are example specifications; other arrangements are possible to achieve similar performance.

ROW = Right-of-way

DPC = Damp-proof course

RCC = Reinforced cement concrete

Kacho int = Manually made and sun raw brick

RBC = Reinforced brick concrete

dried PCC = Plain cement concrete

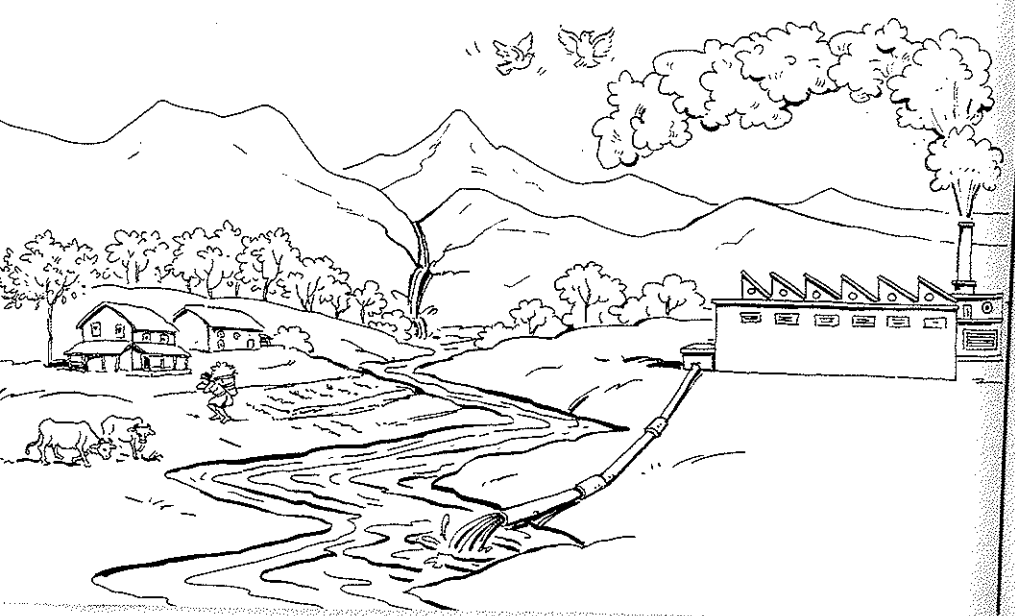
CGI = Corrugated galvanised iron

section three

environmental planning

"Without adequate environmental protection, development is undermined; without development, resources will be inadequate for needed investments and environmental protection will fail"

The World Bank, 1992



environmental problems in the Kathmandu Valley

some issues in planning and management[22]

"[Kathmandu Valley's] landscape with its rivers and terraced hills, compact villages and towns, and dominating sanctuaries is extremely appealing and harmonious, at times of overwhelming beauty."

Eduard Sekler, 1979

The problems resulting from rapid urban growth, haphazard development and general lack of planning have been apparent in the towns of the Kathmandu valley for more than three decades. During that period, Kathmandu routinely experienced serious lack of access, deficiency of infrastructure, traffic congestion and inadequacy of housing. These problems were compounded by the continuing damage of cultural heritage and the rapid loss of precious agricultural land to urban uses. In addition to these chronic deficiencies, severe environmental degradation is now threatening the quality of life in the valley.

Of late, Nepali government has recognised environment as an important agenda in the nation's development programmes[23]. For example, the seventh plan (1985-1992) for the first time treated environment as an integral component of development. Even the new constitution of Nepal (1991) mandates environmental protection and conservation as a national priority for the state policy.

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[22] A version of this article was published in *Contributions to Nepali Studies*, Kathmandu, Nepal, January 1995.

[23] See *Seventh Plan* and *Eighth Plan*, National Planning Commission (NPC), Kathmandu. The Ministry of Population and Environment was established by His Majesty's Government of Nepal (HMGN) in 1995. The Environmental Protection Council (EPC) was set up in 1992 under the chairmanship of the Prime Minister. An "Agriculture, Forestry, and Environment Division" is organised within the NPC. Most recently HMGN has published in 1997 an act to mandate EIA studies for selected development projects.

Nepal signed the 1992 UNCED Convention in Rio, and firmly put environmental considerations in its eighth plan (1992-1997). However, very little real action has been directed towards environmental protection so far. As a result, Kathmandu's environmental degradation continues unabated.

Since the publication of the Brundtland report, Nepal and the many international donors that support Nepal's development efforts have articulated environmental sustainability as a crucial objective in Nepal's development. This is evident from the numerous workshops, seminars and publications sponsored by the Nepali policy makers and external donors in Kathmandu over the past few years. However, because Nepal is still struggling to achieve the basic necessities of life, environmental issues are often ignored during project implementation. Given the country's delicate natural landscape epitomised by the fragility of the Kathmandu valley, it is critical to ensure that Nepal's development efforts are environmentally sustainable.

This paper provides an overview of the environmental problems in urban Kathmandu that are relevant from planning perspective, and suggests an approach to tackle them.

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Aspects of environmental problems

Environmental decay in the valley is reflected in all aspects of physical landscape and urban living: land, water, air and noise[24]. These problems are not mutually exclusive, and, in fact, combine to intensify their overall negative impact on the environment and quality of life in the valley.

[24] The Metropolitan Environmental Improvement Program (MEIP) in Asia, a World Bank-UNDP program, included Kathmandu valley in 1993 among its six projects. It identifies haphazard development, traffic congestion, and water, air, and solid waste pollution as priority planning areas for the Kathmandu valley. See MEIP booklet, The World Bank, Washington DC, 1993(?).

Land pollution

Land pollution is evident in the often found heaps of uncollected solid waste, illegal dump sites, open landfills and exposed human and animal excreta in the streets. Open latrines are common sights in the Kathmandu valley towns where many residents, especially children use the sidewalks for defecating.

Frustrated by the lack of public services, some business groups in Kathmandu have often taken up their own solid waste collection and disposal programs. However, in the absence of proper and adequate landfill facilities, part of the debris thus collected eventually ends up in urban river banks and vacant lands continuing the problems of land pollution on the residents.

Severe lack of greenery and open space[25] in the urban areas intensifies the impact of all these forms of land pollution.

Water pollution

Surface water in the Kathmandu valley is severely polluted by industrial effluence, waste dumping, and by the discharge of untreated sewage from residential areas. Rivers in the valley including Bagmati, Vishnumati, Manohara and Hanumante are all seriously fouled for this reason[26]. Because human and other waste are routinely discarded in the ponds, still water in the valley is even more polluted.

▲ *Highly polluted Bishnumati River in Kathmandu.*

Ground-water in most of the urban area is contaminated due to seepage from septic tanks. Private septic tanks are built by virtually all the Kathmandu homeowners in their generally tiny land plots - often covering just 60 square metres - without sufficient room for soak pits. The semi-treated effluent, which is still toxic, from the

[25] WHO recommends 11 m²/person of green open space in the cities. The city of Kathmandu (pop. 360,000) alone would require about 400 hectares of green open space. Although exact figures are not known, available open space in Kathmandu is significantly less.

[26] For an account of Bagmati's pollution, see Dixit, A., in *Himal*, Jan./Feb. 1992, Kathmandu.

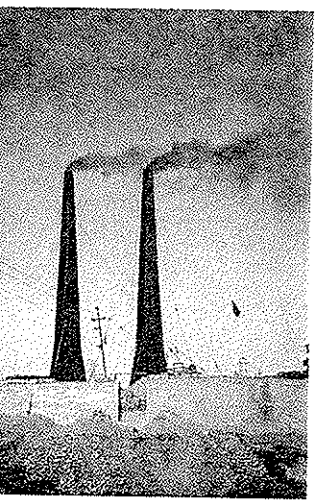
tanks can not find adequate area for dissipation, and becomes concentrated in the residential yards.

Piped drinking water in Kathmandu is also polluted due to various reasons. Firstly, the water at the intake storage itself is not properly treated. Secondly, because the urban water supply is intermittent (supplied only a few hours a day), suction is created in the water supply pipes during the run of water. Waste from ground sources and leakage from the sewage lines, which run side by side, frequently enter the water supply system, contaminating the drinking water.

Empirical studies of drinking water throughout Nepal have found that the fecal coliform contamination in the water consistently exceed WHO guidelines for water considered fit for human consumption.[27] A report by an international consultant concludes, "Kathmandu's drinking water is hosting disease causing microbes and hazardous chemicals". According to the same study, when tap water from representative locations of Kathmandu urban area was analysed in the laboratory, almost 90 percent of the sample was not potable[28].

Air pollution

Air pollution has so dramatically and visibly upsurged during the last few years that many people in the city areas wear face masks to protect themselves from the smog and dust. Increased levels of particulate matters, carbon mono-oxide, sulphur dioxide, hydrogen sulfide, nitrous oxide and lead have drastically reduced the quality of



Some 150 brick kilns are the source of air pollution in the Valley.

[27] See HMGN, EPC (1993), *Nepal Environmental Policy and Action Plan*, p. 51.

[28] Water samples from 5 treatment plants revealed that 38 percent was undrinkable, 22 percent contained excessive levels of chlorine, and 18 percent was polluted by pathogens, at the source itself. Thirty-four samples of tap water from representative areas of Kathmandu showed that 72 percent was undrinkable; further 16 percent did not meet WHO guidelines, and only 12 percent was drinkable. See *The Independent*, Kathmandu, Nov. 3, 1993.

[29] These reports are perhaps, technically inaccurate. According to a 1993 study done by US scientists, average carbon mono-oxide emissions by vehicles in selected Asian cities were: Kathmandu - 3.9 percent; Taipei - 1.49 percent; Bangkok - 2.2 percent; Seoul - 0.84 percent. (See *Himal*, Sept./Oct. 1993). As *Himal* asserts, comparing Kathmandu with more developed cities is unfair. However, Kathmandu's emission level is close to that of Mexico City (4.3 percent), widely considered the most polluted major city.

air in the valley. As a result, Kathmandu is now routinely compared to heavily polluted cities such as Calcutta, Santiago, Mexico City and Bangkok. Some reports have even claimed that Kathmandu is the second most polluted city in the world[29].

The increased air pollution is a consequence of rapid growth in the number of motor vehicles[30], inferior quality of automobile engines, adulterated fuel products and presence of polluting factories within the valley. The bowl-shaped physiography and the resulting inversion effect in the atmosphere heighten the air pollution by trapping the foul air within the valley's immediate atmosphere. Furthermore, lack of dust control mechanisms in construction, industrial and business activities, cumulative dirt in the side walks and household smoke, all contribute to air pollution. Congestion and severe shortage of public open space and greenery in the urban area further aggravate air pollution problems in the Valley.

Noise pollution

Because of outdated vehicular engines, increased air traffic at Tribhuvan International Airport (TIA) and the siting of industries near residential precincts, noise pollution is also fast becoming a major problem in urban Kathmandu. Weak transportation planning, and virtual lack of traffic discipline on the part of the drivers result in near continuous blaring of horns in the streets of Kathmandu.

There are many reasons for the growth of noise pollution from the aircraft in the Kathmandu valley. First, TIA is located in close proximity to the centres of population. Second, it is experiencing a rapid growth in air traffic[31], thanks to the increased economic and commercial activities in the valley and the nation. Third, the physiographic configuration of the valley does not allow much choice in the selection of flight paths for the aircraft. In fact, the outgoing jet planes have to encircle the valley at least once before they can gain enough altitude to surpass the surrounding mountains of the

[30] See Arya, R. in Dahal, M. and Dahal, D., ed. (1993), *Environment and Sustainable Development: Issues in Nepalese Perspective*, Kathmandu. For a baseline estimate of vehicular emissions in Kathmandu, see Dhamala, B. (1983), *Proceedings of Seminar on Environmental Management, Environmental Impact Study Project*, HMGN, Kathmandu.

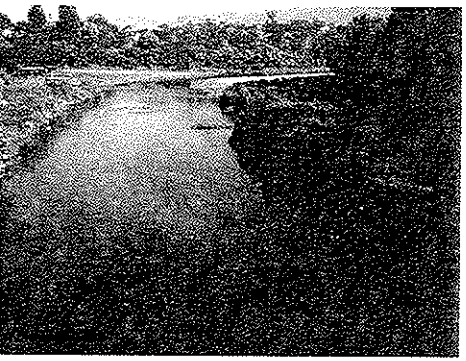
[31] According to Japan International Cooperation Agency (JICA) , the number of flights at TIA will grow at 3.4 percent per annum. See Halcrow Fox, PPK, Cemat consultants (1991), *Kathmandu Valley Urban Development Plans and Programs*, Kathmandu, p. 39.

Kathmandu valley. The incoming jet planes also encircle the valley before being able to land. Thus the flight paths at takeoff and landing are located immediately above the dense urban settlements of the valley, exposing the population to aircraft noise.

Effects of environmental degradation

Environmental degradation of urban area engenders numerous negative impacts on the residents. The following are among the significant effects being experienced in the Kathmandu valley.

Poor public health



urface water is ontaminated by pen sewer escharge, causing ublic health enace.

The first casualty of environmental degradation in the city is the health of its residents. Deterioration of public health, especially due to increase in the respiratory and gastro-intestinal diseases, has already become a concern in Kathmandu valley. A World Bank report confirms that the South Asian countries are facing increased health cost as a result of environmental degradation caused by industrial pollution, atmospheric emissions, land degradation, soil erosion and loss of biodiversity.[32]

Regarding solid waste, some reports have dramatically concluded that "the numerous uncontrolled waste heaps developed in close proximity to dwellings ... constitute a massive threat to public health"[33].

Although, water-borne and airborne diseases have long been prevalent in Kathmandu, lately, they have become widespread. Complaints by the residents of gastro-intestinal problems that are linked to contaminated drinking water are now commonplace in the valley. In addition, growing incidence of typhoid, cholera, diarrhoea and hepatitis "A" are attributable to the polluted drinking water[34].

[32] The World Bank (1993), *Annual Report*, Washington DC, p. 45-46.

[33] NPC/IUCN (1992), *Solid Waste Management in Urban Nepal*, Kathmandu, p. 7.

[34] Conversation with Dr. P. Pandey, practising internist in Kathmandu.

The severe air pollution in the valley has been reportedly linked to the increased incidence of respiratory diseases such as asthma and chronic bronchitis in Kathmandu. Dust pollution can cause frequent throat and bronchial infection, as well as other respiratory and skin allergies[35]. Further "Smog Ozone", formed by the reaction of ozone and other pollutants in the air, is known to irritate lung membranes reducing its ability to resist heart problems[36].

Although frequently accorded lesser significance than other forms of pollution, noise can have severe consequences on the health of the residents. Constant exposure to a high level of noise causes permanent hearing loss. Noise has also been linked to insomnia, ulcers and hypertension[37]. It can be safely inferred that increasing levels of noise pollution is already adversely affecting the health of many Kathmandu residents.

Decline in tourism

Tourism, the major foreign exchange earner for Nepal, has suffered directly as a result of environmental degradation. Whereas Kathmandu was once hailed as enigmatic "Shangri-La", numerous articles and news clips condemning its poor environmental quality now regularly appear in both the domestic and foreign press[38]. Such publicity deters potential tourists from visiting Kathmandu, the main tourist destination and the hub of travel activities in Nepal. According to a report, the number of foreign visitors in 1993 was down by 15 percent compared to 1992, and was further reduced by 30 percent in 1993/94[39]. Nepal's one honorary consul general in North America says: "After personally experiencing the filth in Kathmandu during my recent trip, I often feel uncomfortable in issuing visas to

[35] Conversation with Dr. B. N. Adhikari, physician at Tribhuvan University Teaching Hospital in Kathmandu.

[36] Gay, K. (1991), *Air Pollution*, Franklin Watts, New York, p. 18.

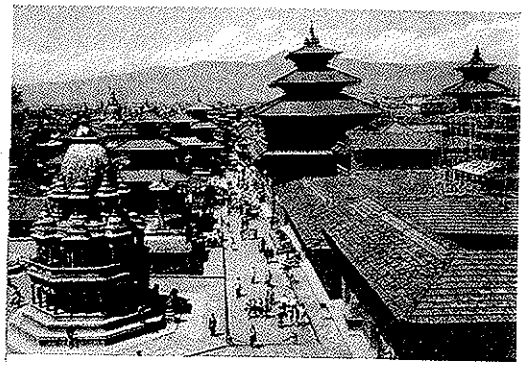
[37] See Finney, S. (1984), *Noise Pollution*, Franklin Watts, New York; and Stephen R., in Hartshorn T. (1992), *Interpreting the City: an Urban Geography*, John Wiley and sons, New York.

[38] For example, Kathmandu's dailies and weeklies frequently cover air pollution. Reputed magazines like *Himal* routinely carry articles about Kathmandu's increased filth, pollution and environmental decay. Similar articles and news clips have appeared in international press, including the, *Los Angeles Times*, *New York Times*, *Washington Post* and *Toronto Sun*.

[39] 1993 data from news item from Oxford Analytical Pacific Daily Brief, Nov. 25, 1994. It states that tourism has been badly hit by "pollution in Kathmandu". 1993/94 figures according to *The Independent*, Kathmandu, Jan. 12, 1994.

North American tourists wishing to visit there[40]." If the image of "dirty Kathmandu" continues to grow on the minds of the potential tourists, the lucrative tourism industry may suffer a big setback. The loss will have a direct and adverse impact on Kathmandu's economy, reducing jobs and income for its residents.

Decay of cultural heritage



▲ *Cultural heritage, such as Patan Durbar Square is under increasing environmental threat.*

Although the decay of the much cherished cultural heritage of Kathmandu, especially the built up environment, is not the exclusive consequence of environmental degradation, it is accelerated by this phenomenon. Corrosive chemicals in the polluted air attack the surface materials in buildings consequently disfiguring and sometimes even destroying the facades of historic landmarks. Additionally, water pollution has adversely affected brick and stone paving in the public squares, and stone water taps. Uncollected debris, and untreated liquid waste taint the visual and olfactory charm of the grand public spaces and palace squares, for which the three towns of the valley have long been famous.

Declining productivity

Labour productivity also declines as a result of poor environment. Increased absenteeism due to sickness, and failing health can significantly cut down worker's productivity. Residents of Kathmandu already spend more time treating drinking water at home by manually boiling and filtering. Furthermore, agricultural productivity of land deteriorates due to soil contamination caused by chemicals in the fields.

[40] Personal conversation. The consul made this comment specifically about Kathmandu, as a constructive suggestion for concerned planners. However, he strongly encourages tourists to see Nepal, especially beyond Kathmandu.

Loss of amenities

Public amenities such as, parks, public baths and play grounds are already severely limited in urban Kathmandu. When environmental degradation reduces their utility, these amenities are further curtailed for public use. For examples due to polluted water in Rani Pokhari and Bagmati, waste pile-up in Ratna Park and filth in parts of Tundikhel their public "amenity value" has been drastically reduced. Pollution has also diminished the beauty of the Valley's idyllic surroundings, and hindered the aesthetic quality of Nepal's famous traditional architecture and design. As one instance, the three palace squares of the Valley, Pashupatinath temple area, and old parts of the three major towns clearly exhibit the negative impacts of environmental degradation.

Additional hardship for poor

Rapid urbanisation has caused a proliferation in the number of poor residents in the Kathmandu Valley towns. Traditionally, poor residents have occupied town fringes, flood-prone lands and other environmentally fragile areas. The Valley's deteriorating environment has worsened the plight of these residents.

A recent World Bank study has found that environmental degradation in a city disproportionately torments poor residents[41]. For example, the poor have to pay an unduly high price for water and other basic services, depleting their already *meagre* earnings. Because the poor are often forced to live in the hazardous and most polluted areas of city, they are least served by environmental infrastructure and services. Poor residents are also more likely to become routinely sick, as they inhabit hazardous locations in the city.

Reduced property values

Parts of the city which are polluted or are in close proximity to landfill sites, polluted water and land are perceived by residents as "undesirable". Consequently, environmental degradation of an area causes decline in the property value of houses and land in the immediate vicinity. The perception of "undesirability" of the area for

[41] See Leitmann, J. (1994), *Rapid Urban Environmental Assessment*, the World Bank, Washington DC.

▲ *Inadequately managed solid waste transfer station at Teku.*

living and pleasure purposes can drastically reduce its commercial and residential potential and hence the real estate values in the surroundings. Some industrial countries have already experienced a dramatic reduction in the value of polluted land sites. Contaminated sites, in fact, can become liability to the owner because of their gigantic cleaning costs[42].

Framework for environmental policy

At present Nepal has limited legislation affecting environmental protection[43]. Appropriate public policies in national, regional and macroeconomic levels are required to provide a framework to reduce the environmental degradation of urban Kathmandu. Detailed regulations in the following areas can be devised to alleviate Kathmandu's environmental problems:

a) Decentralisation and regional planning
b) Macroeconomic policies, such as, privatisation, poverty alleviation and employment generation
c) Comprehensive planning for the valley

Decentralisation should be accompanied by proper regional planning, so that the pressure of the existing uncontrolled urbanisation in the Kathmandu Valley is reduced by creating other centres of attraction for prospective businesses and residences. It should start a process of devolution of real power to centres away from Kathmandu. This could include moving much of the heavy industrial activities, relocating services such as banking, educational institutions, and even the international airport to outside locations. Shifting important activities immediately to potential satellite towns such as Banepa,[44] Dhulikhel and Trishuli can help to relieve the current acute pressure in Kathmandu's environment.

Kathmandu's municipalities should undertake comprehensive planning to direct and control growth and development. All components of the plan such as transportation, business development, housing and urban design should explicitly incorporate environmental concerns. Although many valley-wide urban development and planning studies have been developed in the past, no "planning act" has come through. Furthermore, until recently, these plans have not been implemented and in all such efforts environmental concerns have remained marginal.

Macroeconomic policies have a significant impact on environment. Excessive environmental pollution has been linked to "market failures and policy distortions exacerbated by unemployment, landlessness, and poverty"[45]. Privatisation of certain services such as waste management, public transportation and operation of public amenities such as parks, picnic spots and sports facilities will help to maintain the environmental quality in urban area. For example, many residents in urban Kathmandu are capable and willing to pay for waste removal services. Private agencies under a contract from the municipality can profitably undertake such services on the basis of user charges.

Similarly, the few parks and open spaces that exist in the city have presently become the dumping grounds for solid and liquid waste, including animal and human excreta. In order to clean them up, municipalities may draw contracts with private providers for a sufficient period of time, allowing the agencies to charge the users on a commercial basis. International donor agencies such as the World Bank maintain that many municipal services can be efficiently and economically carried out by private contractors, under various schemes such as build-and-operate, long-term contract, subcontract and concessions. With such arrangement, private investors can undertake significant cleanup, improvement and maintenance of the facilities to reverse their environmental degradation. For example, Ratna park, Balaju park, Gokarna and Godavari picnic area and Sports stadium can be privatised in this manner.

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42 For instance, cost of cleanup for some building sites owned by the City of Toronto in Canada exceeded their land value, making them effective liabilities. (Author's personal experience while working for WoodGreen Community Housing in Toronto, 1992-93).

43 For a comprehensive account of the existing Nepali environmental legislation and regulations and their inadequacy for sustainable development, see Adhikari, R. (1994), *Sustainable Development through Environmental Regulation in Nepal: With Special Reference to Ecotourism*, Ph.D. Dissertation, Arizona State University, Tempe, Arizona.

44 See Bajracharya, B., in *Himal*, Jan/Feb, 1992, Kathmandu, for arguments to develop Banepa to counteract Kathmandu's growth.

45 See Munasinghe, M. (1993), *Environmental Economics and Sustainable Development*, The World Bank, Washington DC

Policy instruments for environmental protection

Various policy instruments and tools have been tried internationally to protect urban environment. They can be categorised into three types: "Command and Control", Economic, and Planning instruments. Each instrument has a specific utility, and they are most effective when applied in a proper combination that will be suitable for Kathmandu's situation.

"Command and control" instruments

These instruments attempt to protect environment by specifying environmental standards and regulations. Government gets more directly involved in the preparation and enforcement of command and control instruments. To effectively utilise these instruments, government requires highly skilled, and well trained manpower. Command and control instruments can manifest in various forms, most significantly as:

a) **Legislation.** Legislation can be passed to establish environmental standards. They are enforced through, national and local government regulations.

b) **Permits and licenses.** Permits and licenses are given to, for example, industries and businesses, and auto owners when the standards stipulated as above are complied to. Permits are periodically renewed or revoked on the basis of whether the standards are continually being met by the industry.

c) **Land and water use bylaws.** These controls are devised through zoning, subdivision regulations, density controls and other bylaws and regulations.

"Economic" instruments

These instruments attempt to influence the behaviour of polluters by offering economic incentives and punishments to achieve environmental protection. They can be highly effective in environmental protection if properly designed and implemented. Government is relatively less directly involved in the application of economic instruments. These instruments often manifest in the forms of:

a) **Pollution charges.** These are based on "polluter pays" principle, whereby polluters such as carpet industries, and other garbage generators, pay charges to the government, for each specified amount of pollution generated. Penalties for excessive generation of pollution can be levied to modify the behaviour of such industries.

b) **Deposit refund system.** Deposit is collected on items that, if disposed, can generate garbage. It is refunded when the empty containers are returned to authorised locations. The classic examples are deposits on the bottles and cans of soft drinks and beer and plastic containers of milk. Such deposits are already prevalent in Nepal in case of soft drink bottles. Residents sell other bottles and containers to recycling vendors. Given the present level of economy, there is not much room for expanding "deposit return" system in the Kathmandu Valley towns. But as the residents attain a higher level of income, it will have increased applicability.

c) **Taxes and subsidies.** Taxes on environmental externalities have been recognised as legitimate intervention by government. Tax increases or rebates can be devised to encourage clean production procedures and to discourage polluting technologies. According to the World Bank case study in Mexico and Indonesia, taxes on "dirty" fuels are the least cost instruments to reduce pollution efficiently.[46]

d) **Marketable permits.** In some advanced countries, tradable permits have been utilised to limit the total amount of pollution in a given geographic area. Each industry is given a permit for a prescribed amount of pollution, which can be freely traded in the market. If an industry produces less pollution than what is allowed to, it can sell the remainder of the permit. Similarly, industries may buy permits for "right to pollute" from the market, making the use of pollution reducing technologies in their own interest.

e) **User charges.** User charges raise revenue for public authorities, and also modify people's behaviour to reduce and limit the pollution. For example, charges for sewerage connection and garbage collection can be levied on residents utilising these services. A well designed charge

[46] The World Bank (1993), *Annual Report*, p. 91.

system can both generate municipal revenue and help reduce the production of waste by the residents. For instance, in some states of the USA, a system of pay-per-bag of residential solid waste has been effective in reducing the garbage generation[47].

Planning tools

Planning tools include regulations, guidelines, negotiation, education and public participation devised for the protection of the environment. In Kathmandu, the few planning tools so far available have largely remained ineffective.

Although traditional urban planning, building design and construction methods in Kathmandu followed environmentally sound practices in the past, they were always tacit. Given the gigantic scale of development in the Valley today, explicit planning guidelines promoting environmental conservation are likely to yield desired results.

For example, air pollution can be reduced by restricted use of automobiles[48], revised layout of residential areas and expanding the exclusive pedestrian zones. Effects of air pollution on residents can also be contained by proper orientation and layout of housing, adequate ventilation, solar access, and landscaping in building projects.

Similarly, education can be a strong tool for environmental conservation, especially in the long run. Environmental education both in public information level, and also as a part of school and college curriculum can help the environment. Such educational strategy was experimented in Nepal in the eighties for the conservation of cultural heritage[49]

Negotiation with stakeholders in urban development such as, developers, builders, and industrialists can be effective to minimise the negative environmental impacts of growth. For instance, developers may be willing to provide extra open spaces and public amenities in exchange for additional floor space or zoning variance granted by the authorities.

The role of public participation in the process of environmental protection can not be overemphasised. Traditionally, the decision-making process in Nepal's planning arena has been top-down, without hearings, consultations and negotiation with interested parties and the general public. Decisions made without such a mechanism have often been unrealistic and ineffective, and as a result, have generated public apathy for the entire process.

If environmental protection is made an explicit agenda for all development and urbanisation schemes, and the decision-making process is made participatory, Kathmandu's residents are likely to support the environmental protection measures proposed by authorities. They will also be aware of the environmental problems of development and will likely take initiatives in protecting the environment.

Comparative applicability of policy instruments

Table 6 provides an overview of the relevance, benefits, problems and suitability of various regulatory, economics and planning instruments that may be utilised in Kathmandu to achieve environmental protection.

[47] Bernstein, J. (1993), *Alternative Approaches to Pollution Control and Waste Management*, p. 55.

[48] In Santiago, Chile, personal use of vehicles in the city is restricted by allowing odd or even numbered plate, on alternate days of the week.

[49] In 1985-86, Nepal Heritage Society, a local NGO conducted a national essay competition for high school students in order to arouse awareness about heritage conservation. With attractive prizes, it was successful in drawing numerous entries from across the country.

Table 6. Comparative Applicability of Policy Instruments in Environmental Planning

INSTRUMENTS	RELEVANCE 1	2	3	4	ADVANTAGES	SUITABILITY AND RELATIVE PROBLEMS	PRIORITY FOR KATHMANDU
Command and Control							
Ambient ground and surface water quality standards	√	–	–	–	Define desired target levels and forms basis for evaluating implementation	Require advanced tools and technology for measurement and monitoring	A beginning has to be made to establish these standards; Moderate priority
Standards for the digging of shallow and deep tube wells	√	–	–	–	Provide locational criteria for obtaining safe water and to control ground water depletion	Difficult to verify compliance	Much needed area of regulation in light of prolific well digging activities; High piority
Minimum standards for housing plot size and shape	√	√	–	√	Provide open space, control density, and ground coverage for septic tanks	Inappropriate size will hinder affordability	Important to relieve congestion, and to control sprawl; Moderate priority
Effluent standards for sewage	√	–	–	–	Regulate hazardous effluent dumped in drainage system	Expensive to enforce	Regulations desired suggesting a time frame; Moderate priority
Effluent standards for industrial discharge	√	–	–	–	Regulate hazardous effluent in surface water and rivers	Require equipment and facilities to monitor	Important to reduce dumping by carpet, garment, and tanning factories; High priority
Product standards for cleaning chemicals such as detergents and disinfectants	√	–	–	–	Limit and decrease surface and ground water pollution	Safe products are not available in the local market	Hazardous products can be banned within a given time frame; Moderate priority
Emission standards from industries	–	√	–	–	Abundant international experience, proving effectiveness	Implementation is complex, and monitoring is expensive	Immediately applicable to selected industrie, viz., cement, and brick kilns; High priority
Emission standards for vehicles	–	√	–	–	Effective mechanism to control air pollution	High monitoring cost, costly inspection procedure	Already being tested, low enforceability; High priority
Product standards for petroleum fuel, kerosene and gas	–	√	–	–	Effective means of pollution control, relatively easy to enforce	Expensive for private auto owners, and transportation industry	Require negotiation with foreign suppliers; High priority
Standards for garbage storage, collection and disposal	–	–	√	√	Relatively simple procedure	Facilities and equipment are required	Feasible; High priority
Recycling regulations	–	√	√	–	Simple regulations, effective in controlling pollution	Facilities and equipment are required	Some mechanisms already exist; Priority
Product standards for containers: plastic bags, jugs, metal boxes etc.	–	–	√	–	Relatively simple, feasible in the given technology	Bio-degradable plastic bags may be expensive	Feasible; Priority
Standards on the burning of refuse	–	√	√	–	Effective especially for bio-hazardous materials	Non-polluting technology is expensive	Feasible for selective materials
Noise standards for industries, and aircraft	–	–	–	√	Establish targets, and educate industries	Monitoring and testing needs specialized equipment	A good start for the valley; Moderate priority
Economic							
Deposit return system for bottles, cans, containers	–	–	√	–	Very little government supervision required	Increased transportation cost for users, recycling facilities required	Existing for soft drink bottles, beer bottles and containers indirectly recycled; limited room for expansion
Marketable permits	√	√	–	–	Raise public revenue	Complex implementation and administrative system required	Not suitable at present
User charges	√	–	√	–	Raise revenue, and offset service costs	Charge collection mechanism has to be administered	Feasible for solid waste and liquid waste disposal; Moderate priority

... continued

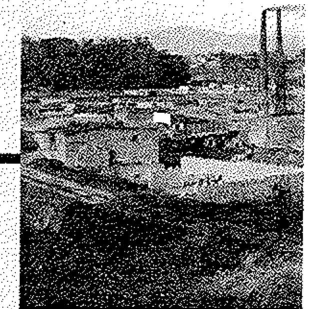
	1	2	3	4			
Tax increase and rebate	√	√	√	√	Relatively easy system to devise	Revenue lowered	Feasible; Moderate priority
Subsidies for "clean" products	√	√	–	–	Easy to administer	Loss in revenue	Can be tested in selected areas
Penalties and credits	√	√	–	√	Encourage compliance	Reliable implementation needed	Feasible, especially in case of excessive polluters, and clean industries
Zoning and land use regulations	√	√	√	√	Improve quality of life, and control pollution	Standards and regulations should be appropriate for Kathmandu; often difficult to enforce	Existing ones are tenuous; private influence hampers enforcement; High priority
Land use controls for siting of particularly high polluting industries	√	√	–	√	Provide advance warning to proprietors; effective in mitigating impact on residents	Require expansion of infrastructure and services; additional initial cost	Feasible; High priority
Transportation planning, especially exclusive pedestrian zones	–	√	–	√	Effective in reducing pollution and mitigating its effects on residents	Open spaces required; difficult in private developments	Desirable tool; Moderate priority
Guidelines for landscaping, open space, density and layout	–	√	√	√	Provide prototypes, and encourage desirable development, no public cost	Difficult to regulate	Desirable tool, High priority
Education, participation and negotiation	√	√	√	√	Effective approaches for environmental protection	Require skilled, trained public administrators, managers	Feasible; High priority

Note: 1. Ground & Surface Water Protection; 2. Air Pollution Control; 3. Solid Waste Management; and 4. Noise Pollution Control.

Source: Adapted from Bernstein, J. (1993), Alternative Approaches to Pollution Control and Waste Management, the World Bank, Washington DC.

air pollution in the Kathmandu Valley

problems and possible mitigation approaches[50]



"... we have put poisonous and biologically potent chemicals indiscriminately into the hands of persons largely or wholly ignorant of their potentials for harm. We have subjected enormous number of people to contact with these poisons, without their consent and often without their knowledge."

Silent Spring, 1962

Introduction

Air pollution has emerged as the most visible component of environmental degradation in Kathmandu.

Because of its adverse impacts on human health, environment and ecosystem, air pollution in Kathmandu is a serious concern to the residents and visitors. The air is routinely not clean enough to breathe and regularly obstructs the visibility levels. The number of clear days per year in Kathmandu has been consistently decreasing in the past two decades. According to a recent study the number of foggy days in Kathmandu has increased from about 38/yr in 1970 to more than 60/yr in 1994[51].

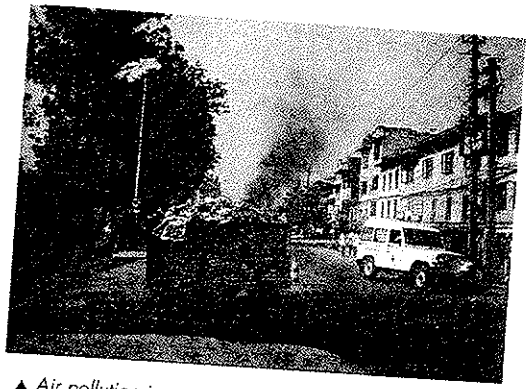
Various analyses have demonstrated that Kathmandu's air, especially in the vicinity of the main thoroughfares, exhibits unacceptable levels of suspended particulate, lead, sulphurous and nitrous gases and other pollutants that pose significant risk to human health.

50 Coauthored with Mr. Suhrid Gautam of the World Bank.

51 Shrestha, M. L. (1994), Kathmandu Meteorological Data and Assessment.

For example, tests in 1992 showed 24 hour particulate concentration in several locations in Kathmandu to be more than two times the WHO guidelines for acceptable air quality[52]. A further indication of Kathmandu's air pollution problems is the recognition by the Metropolitan Environmental Improvement Program (MEIP) of the World Bank which has identified the "deteriorating ambient air quality due to traffic and uncoordinated industrial expansion" as one of the six priorities for environmental improvement programs in the Kathmandu valley[53].

Effects of air pollution



▲ *Air pollution in the main streets causes adverse health impacts on residents.*

Smog ozone formed by the reaction of atmospheric ozone and various air pollutants is known to irritate lung membranes reducing the ability of human body to resist attack heart and related problems. Deterioration of public health, especially due to increase in the respiratory and skin diseases, has become a serious concern in the Kathmandu valley. The health costs for Kathmandu residents as a result of increased air pollution significant, is estimated to be around $4 million per year by some studies. A recent World Bank report also confirms that the South Asian countries (including Nepal) are facing increased health costs as a result of environmental degradation caused by industrial pollution and atmospheric emissions[54].

Air pollution in Kathmandu is also causing damage to many historical buildings that represent the cultural heritage of the Kathmandu valley. Acid formed as a result of various sulphurous and nitrous oxides reacting with water can damage fine wood carving, marble and metallic exteriors common to many historical buildings in Kathmandu. The damage to cultural heritage not only deprives the residents of a proud past, it also can negatively impact on tourist trade, an important contributor to the Valley's economy.

Air pollution also impacts negatively on the local environment and ecology. For example, acid rain resulting from air pollution is detrimental to plant and animal life.

52 Kathmandu Valley Vehicular Emission Control Project (KVVECP) (1994), HMGN/UNDP Joint Project.

53 The World Bank, Metropolitan Environment Improvement Program (MEIP), Brochure 1994(?).

54 The World Bank (1993), *Annual Report*, Washington DC, pp. 45-46.

Causes of air pollution

Industries

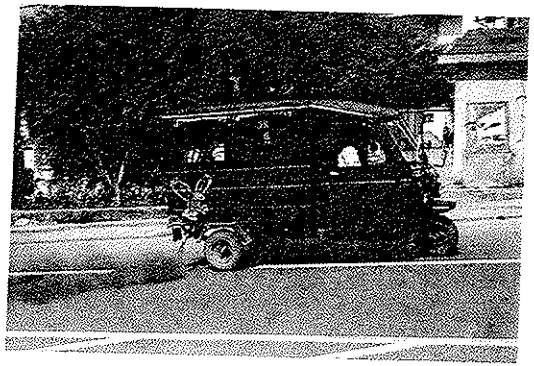
▲ *Himal Ceme Factory is a major contri to the air pollution in t Kathmandu Valley.*

Several industries in the valley, in particular Himal Cement factory and the hundreds of coal burning brick kilns, emit substantial quantity of smoke and dust into the atmosphere. Himal Cement Factory uses old technology of cement production and still does not utilise any significant pollution prevention mechanisms. Since its establishment, it is considered to be a major contributor to the amount of suspended particulates in the valley. In 1987, Himal Cement Factory was reported to produce 5 to 6 tons of dust in six hours, and the emission levels were reported to be significantly higher than in similar facilities in India[55].

In 1998 about 150 brick kilns are estimated to be in operation in the Kathmandu valley. Smoke emissions from these kilns are particularly high during the major brick production season from November to May - the driest months when the effects of air pollution are heightened. There are no wet or electrostatic scrubbers in these kilns, and consequently smoke, ash particles and brick dust are directly released to the atmosphere. An IUCN survey in 1990 found that more than half of all industrial units in Kathmandu had no pollution control measures. These industries included cement, textile, soap and chemicals, bricks, feed and foam plants in the valley[56].

55 "The valley chokes: then and now", *Himal*, Jan./Feb. 1992.

56 Sharma, P. (1993), "Urbanisation and Industrialisation" in Dahal, M. and B. R. Dahal (ed.) *Environment and Sustainable Development*, NEFAS, Kathmandu.



▲ *Three wheelers with two stroke engines in the street of Kathmandu are notorious for causing air pollution.*

Vehicles

Air pollution from vehicles is a complex function of fuel characteristics, extent of combustion, mixing with various other gases and the atmospheric conditions. The rapidly increasing vehicular traffic is a major contributor to air pollution in Kathmandu.

According to 1996 estimates, the number of vehicles in Kathmandu in 1996 was around 100,000[57]. Although this number is not large in absolute terms, their polluting effects are high as most vehicles of Kathmandu have old engines (often more than 15 years old), are not well maintained and do not even have a rudimentary mechanism to filter or contain the exhaust. Further, there is significant traffic congestion in Kathmandu contributing to air pollution. In 1992 there were only 325 kilometres of motorable road in the Kathmandu valley, of which 150 kilometres were considered to be in poor condition. Thus, there were more than 300 vehicles per kilometre length of total road in the valley[58] representing a heavy load of vehicles on road.

A study of vehicular exhausts estimated that in 1983 Kathmandu's motor vehicles emitted more than 22,000 tons of carbon monoxide, 4,000 tons of nitrous oxides and 333 tons of sulphur oxides[59]. A 1995 estimate by the Reuters news agency puts the total pollutant emissions at around 63,000 tons per year. This comprises of about 56,000 tons carbon monoxide, 5,000 tons of nitrogen oxides, 1,000 tons of hydrocarbons and 840 tons of sulphur dioxide.

Furthermore, the number of vehicles in Nepal, especially in Kathmandu, is expected to grow substantially in the years to come because of the increasing levels of personal income in the Valley. The economy of Kathmandu is growing rapidly as it is fuelled by the current economic reform programs, opening of the economy, privatisation and general increase in the cash economy. Studies have shown that the level of motorisation (vehicles per thousand population) is very closely related with income – as income rises, so does the number of vehicles[60]. Hence as the incomes are expected to continue to rise in Kathmandu, there will be increased vehicular ownership, and consequently more pollution unless appropriate measures are taken.

Only leaded gasoline, which is frequently adulterated, is available in Kathmandu, and a large percentage of heavy vehicles run on diesel. Dirty fuels (both adulterated and high sulphur in diesel) alone can cause substantial damage to health and welfare of people who are exposed to the resulting emissions. Fuel sold in Nepal is of very poor quality, perhaps, similar to that available in India and Pakistan. The current lead content in gasoline sold in India and Pakistan ranges from 0.42 grams per litre to 0.82 grams per litre, which is among the highest in the world. Leaded gasoline emits lead to the air resulting in a significant cause of decreased IQ among children, increased incidence of high blood pressure among adults, and can be highly detrimental to unborn children. Recent epidemiological studies have found that an increase in children's blood lead level from 10 to 20 microgram/dl was associated with a fall of 1 to 2 IQ points. Similarly high sulphur content in diesel contributes to environmental deterioration both directly and indirectly. Directly, it is emitted in the environment in the form of SO_2 and those not emitted as SO_2 is converted to various metal sulphates and to sulphuric acid both of which are emitted in particulate form. Diesel fuel normally contains between 0.1 to 0.5 percent of sulphur by weight (in the US, it is about 0.05) but those sold in India and Pakistan allow as high as 1.0 percent by weight - among the highest in the world. The diesel fuel sold in Nepal is similar to that sold in India and Pakistan, and thus is probably high in sulphur content.

Household smoke and other factors

Vast majority of households in Kathmandu still use biomass, particularly firewood, for cooking and heating. Some households

[57] Data supplied by the Ministry of Population and Environment in August 1996 was 97,500 vehicles in March 1996, out of which 35,737 were four-wheelers. The number of two-wheelers is estimated to be 55,000. *The Kathmandu Post*, August 9, 1996.

[58] Arya, R.C., (1993), "Trade, Transport and Tourism" in M. Dahal and D. Dahal (ed.) *Environment and Sustainable Development*, NEFAS Kathmandu.

[59] Dhamala B. (1983), *Pollution Problems in Nepal: Proceedings of Seminar on Environmental Management*, Environmental Impact Study Project, HMGN, Nepal.

[60] Faiz, A., S. Gautam, and E. Burki (1995) "Air Pollution from Motor Vehicles: Issues and Options for Latin American Countries" in *The Science of the Total Environment*, Vol. 169 (1995), pp. 303-310, Elsevier Science, B. V., The Netherlands. See also Onursal, B. and S. Gautam (1996), "Vehicular Air Pollution: Experiences from Seven Latin American Urban Centres" in *A World Bank Sector Study* (Forthcoming), the World Bank, Washington DC.

have started to cook with gas, a less polluting fuel. However, use of gas is limited to relatively high income families because of the large investment initially required to establish a gas stove and storage system.

In addition, the solid waste in the valley is regularly burned in an attempt to destroy waste at the source. These releases from all these sources have created a high level of air pollution in the valley, the pollution becoming increasingly severe in the past decade.

Lack of dust control mechanisms during the construction of buildings and physical infrastructure and small industrial and business activities and cumulative dirt in the sidewalks also contribute to air pollution. Traffic congestion and severe shortage of public open space and greenery in the urban area exacerbate the impacts of air pollution. The bowl-shaped physiography and the resulting thermal inversion effect in the atmosphere heighten the air pollution by trapping the foul air within the Valley's immediate atmosphere.

A framework for abating air pollution

Management of air pollution in the Kathmandu valley will require concerted, sustained and long-term programs both by public and private sectors. Because of the rapidly industrialising and modernising economy of the valley, increased air pollution levels are eminent in the foreseeable future. However, there is also a growing realisation among policy makers, planners, professionals and concerned citizens that air pollution has to be controlled to ensure the wellbeing of all the inhabitants in the Valley.

An assessment of the existing situation and procedure to develop a continuous data base is the primary requirement. Ambient air quality monitoring is a prerequisite for any air pollution abatement effort, because determination of air pollutant concentration is critical in devising, establishing, implementing and monitoring any air quality standards.

Air quality monitoring in Kathmandu can have a number of objectives that include the generation of spatial and temporal distribution of air pollution in the valley. These monitoring results can then be compared against established air quality standards to determine if potential risks to human health exist. The data indicating

high pollutant concentration in certain locations of urban area (e.g., business district) or during certain periods of the day (e.g., peak morning/evening hours) or certain months of the year (e.g., dry season) enable policy makers to take necessary measures aimed at reducing pollution at these locations or during these periods. Long-term monitoring data also help policy makers evaluate the effectiveness of control measures implemented. In addition, ambient air quality monitoring can also be used to inform the public on short notices about air quality, especially when pollutant concentrations reach high levels. Such warnings, which are routine in the United States and Canada, allow public to take necessary preventive measures against health related risks. Ambient air quality monitoring, if conducted over many years, can also be used to generate pollutant trends as input to medium or long-term policy decisions for air quality management.

At present Nepali institutions related to the environment have limited capacity to manage environmental problems. For example, the Ministry of Environment and Population has been established only recently in 1995. Institutional capabilities will have to be gradually built to design and implement various possible policy options for the management of air pollution.

The following paragraphs provide a description of possible mitigation approaches for containing the air pollution problem in Kathmandu.

Command and control instruments

CAC instruments consist of defining environmental objectives and delineating and implementing. CAC instruments primarily consist of permits and licenses, standards and land use controls.

Regulatory programs to contain air pollution can include programs that are targeted to the vehicle, fuel quality and land use controls and transportation planning schemes. These programs include the setting up of various standards like ambient air quality standards, vehicle emission standards (for both new and in-use vehicles), fuel standards, and transport and traffic management. The Government of Nepal has taken some initiatives in this regard. Recently, Nepal's Ministry of Environment and Population has begun vehicular emission tests for in-use vehicles. More than 10,000

vehicles were tested for their emission level by August 1996[61]. However, in the absence of any follow-up, the tests alone have failed to make any substantive impacts in the quality of the vehicles plying the streets of Kathmandu.

Despite the use of proper vehicles and fuels, the vehicular air pollution can only be abated through sound transportation management measures. Land use control and transportation management have a great potential in Kathmandu to reduce air pollution levels. Kathmandu's transportation system is still based on the narrow and winding roads that were converted from the walkways of the past when the city was primarily pedestrian. The resulting road configuration causes severe congestion especially during the rush hours. There are many opportunities to improve the transportation planning and traffic management in Kathmandu. The transportation management options are mostly directed towards the use of public transportation in lieu of private car driving thus suppressing extensive demand for road use, and promoting improvements in traffic flow coupled with infrastructure improvements.

Land use planning and modernising the transportation system is critical for Kathmandu to contain the air pollution problem. Roads have to be widened and straightened to allow smooth flow of traffic. Further, in several areas of the inner city vehicular traffic should be completely restricted like in the pedestrian malls of many North American and European cities. Proper orientation and layout of residential units, adequate ventilation, solar access and landscaping in residential districts can also reduce adverse effects of air pollution on residents.

Traffic management measures will also greatly help in reducing the total vehicular emissions in the air. These measures can be in the form of CAC regulations like on-street parking restrictions, various forms of dedicated bus-ways and traffic priority for buses, ride-sharing incentives, staggered work hours, enforcement of speed limits, synchronisation of traffic signalling, and in some cases outright driving bans in certain sections.

Intermittent ban on driving has been tried in Mexico City, Santiago, Athens and selected cities in Germany. In Santiago, car traffic is reduced by half each day by allowing only the cars with even number in their license plate on even days of week and odd-numbered license plates on odd days. In Mexico City, cars are given one of the five coloured stickers, and each colour is banned on a particular day of the week. During the days when the air pollution level exceeds the normal levels, more than one colour sticker could be banned from the road. This system of stickers was introduced in Mexico city after somewhat unsuccessful attempt to ban cars exclusively on tier license plate numbers. Santiago has introduced an outright ban on empty taxis to enter the city centre. This scheme has reduced traffic by over 30 percent. In Athens, the downtown area has been declared vehicle-free because of the excessive air pollution problems. Although programs in both Santiago and Mexico City have encountered several problems of implementation[62], they do offer a scheme to control the number of cars in the streets of Kathmandu, if properly enforced.

Market-based instruments

Nepal can harness the potential effectiveness of MBI to abate air pollution. Possible MBI for Nepal can consist of pollution charges, user charges, subsidies, and liabilities and tradable permits in future.

Pollution charges can include increased taxes and differential taxation on leaded, unleaded and diesel fuel, pollution charges for industries and businesses. A World Bank case study in Mexico and Indonesia has found that taxes on "dirty" fuels are the least costly policy instruments for efficiency in reducing pollution[63].

User charges are direct payments and fees levied by government to industries and consumers for the cost of air pollution control and management services. Such charges can be applied to cars entering restricted downtown areas at certain points. Singapore has successfully experimented with "area licensing program" in the downtown area, which is reported to have significantly reduced the air pollution levels in the city[64]. The program imposes a form of user charges to car drivers who enter the designated down town areas at restricted times.

[61] News item, *Kathmandu Post*, August 9, 1996.

[62] It is reported that several residents in Mexico City and Santiago are by-passing the restrictions by buying a second car that has a different license plate or a different colour sticker.

[63] The World Bank (1993), *Annual Report*, p. 91.

[64] See Panayotou, T. (1991), *Economic Incentives in Environmental Management and Their Relevance in Developing Countries*, OECD, Paris.

Road pricing can be used because congestion in urban road imposes costs not only road users but also on pedestrians, businesses and communities exposed to air and noise pollution from traffic. Road pricing involves charging a fee to motorists for the use of a road with an intent of inducing some changes in individual behaviour and driving pattern. Implementation of road pricing may lead to increased use of public transportation, ride sharing and driving on off-peak hours.

Subsidies can be devised to encourage people to choose public transportation over cars. They can also be initially devised to encourage people switch to cleaner fuels and energy. They can also be applied to encourage retrofitting of cars to control emissions, such as through catalytic converter.

Liabilities means holding concerned industries, firms and institutions liable for the cost of air pollution. Liabilities can serve as a deterrence - assigning liabilities for the cost of damage caused by air pollution can provide incentives to industries to abate air pollution. However, the assignment of liabilities and enforcement of penalties can be quite complex in the limited institutional capacity of Nepali environmental agencies.

Tradable permits is a system that allows industry to freely trade any unused portion of "emission credit" that has been assigned to it by regulatory agencies. Emission credits are distributed to industries within an overall cap (bubble) of allowable air pollution in a geographical area. The unused portion becomes "emission reduction credits" that are treated like asset of the firm. Several jurisdictions in the USA, such as Southern California, have successfully applied this system to manage the air pollution levels. Although an innovative concept in pollution abatement strategies, tradable permits system requires a strong public capacity for creating data base and verification abilities. In the current context of Nepal, tradable permits system may not be realistic. However, when future conditions become more favourable, it is potentially an effective policy instrument for combating air pollution.

Public awareness and voluntary programs

For the CAC policies to be effective in controlling air pollution, they should have the backing of public opinion. At present most residents in Kathmandu take air pollution as a mere inconvenience and nuisance. If they are made aware of the serious health effects of air pollution in children, pregnant women and general population (especially, the effects of lead pollution) there will be more political pressure and public support for programs that are initiated to contain air pollution.

Industrial sector that is responsible for the major share of pollution is represented by a relatively small number. For example, the major polluters are Himal Cement Factory, brick industry, metal foundries, chemical industry and hospital waste incinerators. In order to maintain their public image, these industries are likely to accept voluntary programs of controlling their emission, if the public officials negotiate the programs in a fair and equitable manner. The industries have to be told by the public authorities that in the event the voluntary efforts do not work, harsh measures of regulatory enforcement will become necessary. For example, many industries in the close proximity of the world famous Taj Mahal in India, suspected of being responsible for major air pollution and causing the damage to the historic monuments, were forced by Indian courts to close down.

Public information program can also help in the abatement of air pollution especially from the stationery sources. For example, in Canada and Indonesia publicly rating environmental performance of industry has caused major pollutions to cut their emission levels. As a result of this publicity in Canada the largest emitters have cut their emissions deeply[65].

The case of child labour in Kathmandu illustrates the power of public information in changing industry behaviour. In response to news reports of child labour in carpet factories, many factories have taken defensive position about the practice, and have promised to change their policies. When issues about air pollution are also made public, positive changes in the behaviour of industries can be expected.

Voluntary agreements by industries have been effective in pollution control in many countries. For example, Japanese public utilities have long adopted voluntary standards to reduce air pollution. Japanese private industries too regularly entered into agreements with local governments to adopt air quality standards significantly higher than what was required by national legislation[66].

[65] *The Globe and Mail*, Toronto, April 27, 1995.

[66] Metropolitan Environment Improvement Program (MEIP, 1994?), *Japan's Experience in Urban Environmental Management*, Washington DC, pp. 62 and 110.

Motivations to adopt voluntary programs in reducing air pollution may come from the industry's own realisation that consumer loyalty may be contingent upon their environmental behaviour. Further, if industries perceive that government will eventually enforce air pollution standards, they may be more inclined to adopt voluntary action. With proper strategy, Nepali government can encourage the adoption of voluntary initiatives by industries to reduce air pollution.

Conclusions

Kathmandu Valley currently has a serious problem of air pollution. The increasing air pollution level is adversely affecting human health and is damaging cultural properties. The economic cost of air pollution due to loss in human health potential loss in tourism, and damage to cultural heritage is significant, running into millions of dollars annually.

Only a small number of industries are responsible for the bulk of the air pollution in the Kathmandu Valley. In addition, old and ill-maintained vehicles, dirty fuels, haphazard land use and weak traffic management are contributing to the problem. The resulting high level of pollution is causing serious adverse impacts on the health of Kathmandu's residents.

Efforts in abating air pollution and mitigating its effects encounter several challenges in Kathmandu. First, there are only a few scattered and largely ineffective regulations to control air pollution. Second, public awareness regarding the negative impacts of air pollution is only recently emerging. Third, Nepal lacks adequate institutional capacity and human resources to develop and implement effective air pollution abatement policies.

Nepal urgently needs to prepare a comprehensive framework for policies to address the problems of air pollution. Nepal also needs to develop cost-effective policies that work together to contain air pollution and its impacts on human health, ecology and adverse impacts to cultural property.

A proper combination of command and control, market-based and voluntary approaches to pollution control is necessary for any meaningful abatement of Kathmandu's air pollution problems.

market-based instruments for environmental management

potential applications in Nepal[67]

"Market-based instruments are best in principle and often in practice. They encourage those polluters with the lowest costs of control to take the most remedial action, and they thus impose less of a burden on the economy."

The World Bank, World Development Report 1992

Governments can utilise three major types of policy instruments to achieve environmental objectives: regulatory, economic and voluntary. Although direct regulations, also known as "Command and Control" instruments (CAC), were the near exclusive policy instruments adopted by governments for environmental management and conservation, interest is growing in the economic tools, also known as market-based instruments (MBI). In addition, voluntary and persuasive policy instruments can also be effectively utilised for environmental management for application in Nepal. This section is limited to the discussions on the potential use of market-based instruments (MBI) for environmental management and conservation in Nepal.

[67] A version of this article was published in *Environmental Economics in Nepal*, proceedings of a workshop on environmental economics, IUCN Nepal, Kathmandu, 1998.

Market-based instruments

Lately, several economists and planners have advocated the use of economic of market-based instruments (MBI) as effective policy tools for environmental management. They claim that MBI can achieve the same or greater levels of environmental management at a fraction of the total cost that would be incurred if the traditional command and control instruments (CAC) alone were used[68].

Because of the perceived "built-in" incentives, MBI are believed to stimulate the development of pollution abatement technologies by industries at "least cost". Furthermore, MBI can provide flexibility, efficiency and cost-effectiveness in the environmental management for industries, households and regulatory agencies. For these reasons, there is now a growing interest in the potential role of MBI in the management of hazardous wastes.

Regulatory agencies, especially in the developing countries, such as Nepal, are often apprehensive of adopting MBI due to the fear of losing control of environmental management programs, uncertainty of the results and lack of direct experience. Harvard Professor Panayotou compares such reluctance to the fear of flying. Although flying is a safer and quicker means of reaching the destination, some people still insist on driving for the reason of psychological comfort. Similarly, MBI are viewed as safe, cost-effective and efficient; and potentially helpful in attaining environmental goals faster and more economically than through the policies of CAC alone.

Some OECD countries, notably France, Germany, Netherlands and the US have already accumulated two decades of experience on the use of MBI for waste minimisation and pollution control. By and large, they have found the MBI highly effective in attaining environmental objectives while also being cost-effective. However, the use of MBI as policy instruments for environmental management remains limited even in OECD countries, and is rare in developing countries.

Nepali planners can harness the potential effectiveness of MBIs towards its environmental objectives. The following instruments are potentially applicable to Nepal.

[68] This is documented by Baumol and Binder (1988), *Economics: Principles and Policies*. Proponents maintain that MBIs are extremely cost-effective.

box 2. some arguments for and against MBIs

Proponents have advanced the following points regarding MBIs[69].

- Advantages
  - Initiate and facilitate technological changes.
  - Are effective instruments of assimilating and processing information.
  - Provide flexibility to industry and regulatory agencies.
  - Bring quicker impacts of policies.
  - Offer savings to industries by providing options of trading.
- Disadvantages
  - Can be perceived as "extra charges".
  - Require adequate institutional set up for implementation.
  - Are relatively new ideas and are not readily accepted.

[69] Based on CEPA (1995?), "Potential Role for Economic Instruments," Environment Canada.

Pollution charges

Definition. Pollution charges are fees levied by a regulatory agency on industries and households for the generation of pollutant or waste (example: effluent, emission or solid waste). These charges are based on the volume and nature of the waste. They are designed as incentives to influence industry:

- to minimise and better manage waste;
- to assist public agencies for their actual cost of waste management programs; and
- to raise revenue for government to finance existing and future environmental programs.

Environmental programs typically include, waste treatment and disposal, ground and surface water protection and site cleanup and remediation.

Pollution charge can also be levied in advance as "Advance Pollution Charge."

box 3. clarification for some perceptions regarding MBIs

- *"MBIs such as environmental charges are additional taxes."*
  - "Environmental charge" actually means incentive for pollution abatement.
  - The word "charge" may be a misnomer.
  - Environmental charges are legitimate payment for the use of resources and services.
  - There is a cost of compliance with CAC s; charges, such as those incurred through tradable-permits offer alternatives to potentially costly compliance.
  - MBIs, such as deposit refund and performance bonds, are incentives for good environmental behaviour.
- *"MBIs are 'license to pollute.'"*
  - Command and control instruments also allow pollution up to a level - zero pollution is not achievable nor desirable.
  - MBIs help achieve similar environmental objectives as those through CACs.
  - In fact, MBIs help internalise the cost of pollution in an industry's decision-making.
- *"MBIs will erode industrial competitiveness."*
  - Countries where MBIs have been in use are among the most competitive.
  - MBIs encourage industries to find innovative ways to manage wastes.
  - Enhanced environmental image of industry greatly helps business.
  - Environmental management costs constitute only a small fraction of production cost.
- *"MBIs need sophisticated institutional set ups."*
  - MBIs are like any fees or charges in use even in the most rudimentary societies.
  - They are no different than bus fares, bridge tolls and payments for 'public goods'.
  - Monitoring and record keeping is required to administer the charges — but it is required for any environmental management program including the implementation of CACs.
- *"MBIs impose additional burden on top of regulatory requirements."*
  - MBIs offer alternatives ways of compliance.
  - For some industries, MBIs, such as paying environmental charges, may be cheaper than abating pollution to meet compliance.
- *"MBIs are unwelcome during hard economic times."*
  - MBIs are good instruments at any time if environmental objectives are to be met.
  - If regulatory requirements are relaxed because of uncertain economic times, charges also automatically drop.
  - Hard economic times do not diminish the value of environmental conservation.

Background, rationale and international experience.
Pollution charges are based on the "polluter-pays-principle" which was first adopted by the Organisation for Economic Cooperation and Development (OECD) in 1972. The principle states "the polluter should bear the expenses of carrying out the measures (... to reduce pollution and to reach better allocation of resources...) decided upon by public authorities to ensure that the environment is an acceptable state." [70] This principle is now accepted by many governments and international donors as a legitimate basis for devising environmental management policies.

Pollution charge can help to correct market distortions, by internalising the "externalities" into the cost of production[71]. By making industry pay for environmental resources that they freely consumed in the past, this instrument helps to correct market distortions. The charge also helps properly assign the cost of environmental damage to the corresponding products, equitably distributing the cost of pollution among the industries and consumers.

Pollution charges, especially for industrial effluents, have been widely used in the OECD countries[72]. For example, France, Netherlands and Germany have implemented such charges for more than two decades, and as a result, have experienced substantial reduction in the amount of pollutants[73]. Recently, China also has successfully instituted effluent and emission charges. Taiwan and Poland are among the other developing countries that have recently adopted pollution charges, as instruments of environment[1] management.

In the OECD countries, pollution charges h[illegible]een found to be highly effective in attaining the environmental goals. Industries seek more profitable ways to undertake in-house pollution abatement practices up to a point where the marginal cost of pollution abate-

70 See *The Polluter Pays Principle*, OECD, 1975, Paris, p. 12 The report argues that all charges for environmental protection should be based on this premise. However, in practice, polluters are also sometimes subsidised by the government to encourage pollution abatement.

71 Traditionally, environmental pollution was simply accepted as a "detrimental externality" of industrial production process. Its benefit in the form of the profit was concentrated in the owners, whereas the cost in the form of pollution was diffused to the entire community.

72 See EPAT, "Use of Economic Instruments for Environmental Protection in Developing Countries," in *Economic Instruments for Environmental Management in Developing Countries*, OECD, 1993, Paris, p. 72. According to the article all OECD countries use emission charges.

73 OECD (1981), *Economic Instruments in Solid Waste Management*, Paris.

ment equals the rate of charge, beyond which it is cheaper for the industries to pay the charges. Based on their demonstrated success in reducing solid waste generation[74], pollution charges offer a good potential to minimise the generation of pollutants.

Pollution charges offer a wide variety of options to industry in meeting the required environmental objectives. For example, an industry may save on pollution charges through process optimisation, material substitution, waste minimisation, adoption of cleaner technologies, or on site treatment.

Implementation methods. Theoretically, pollution charge should be equal to the cost of environmental damage afflicted by the polluters, both to the environment and the affected population. But accurate assessment of such costs, especially health costs, is difficult. In practice, charges are estimated on the basis of the cost of management and cleanup required to attain a defined environmental objective.

Pollution charge is based on the weight, characteristics and volume of actually generated pollutants or the number of employees, or the annual output of finished product. For example, models can be used to estimate waste generation on the basis of the number of employees or quantity of finished goods produced annually by a firm.

Only an optimum rate and proper basis of charge will help achieve the desired environmental objectives. If the charge is too low and inappropriately calculated, this instrument will be ineffective to influence industry behaviour, as was found in Yugoslavia[75]. On the other hand, too high a charge is likely to be politically unacceptable, especially if it erodes the comparative cost advantages enjoyed by firms, vis-à-vis their competitors or foreign counterparts.

An initial charge rate can be approximated by dividing the total annual cost of environmental management (including environmental protection and cleanup and regulatory costs) by the total volume of annual effluent generated by the industry. The effluent should be measured as the product of volume discharged and toxicity reflecting the total pollution load. The rate for effluent charge can also be calculated by summing the products of various indicators of toxicity (such as corrosivity, flammability and explosivity) and their respective charge rates.

It is critical to fix the rates of charges so that they reflect as closely as possible, the actual cost of environmental damage (which includes the cost of cleanup and management). Unrealistically low rates would not be effective in altering industry behaviour. Hence, the rates should be carefully designed and routinely revised.

Initially, the charges should be set at a level that is economically and technically feasible, but a schedule of escalation over time should be articulated. The schedule of rates should be regularly adjusted for inflation, and any changes in economic growth, and state of technology. It should also reflect the higher environmental objectives of Nepal over time. Such a policy instrument will help the existing as well as newcomer industries to undertake long-term planning in pollution management, and also provide the government with a known revenue stream for future environmental programs.

Application points. Pollution charge can be applied to solid, sludge, effluent generation and discharge; example: volume of hazardous waste or metered discharge to water-bodies or ground. It can also be applied on the basis of annual output of finished product, or the number of employees for defined items, such as printed circuit boards.

Applicability in Nepali context. Drawing from their success in environmental protection in developing countries such as China, it appears that pollution charges have high potential to be environmentally effective in Nepal.

Simple pollution charges based on the pollution load of one or more substances, for example, BOD, heavy metal or suspended solid would be desirable as they would allow industries to choose pollution abatement system of their preference.

However, if public information on the program is not adequate, pollution charges may be politically difficult to implement. Industries might portray them as "tax grab". On the other hand, the public may feel that, through pollution charges, the government is giving industries a "license to pollute."

74 When the states of New Jersey, Washington and Pennsylvania in the USA applied "pay-per-bag" charge system, the generation of domestic solid waste decreased by 25 percent to 40 percent (See Bernstein, 1993, p. 55) Somewhat similar effects may also be expected in the case of other wastes and emissions.

75 In Yugoslavia, effluent charges were set below the cost of pollution abatement. Charges were also not adjusted for inflation. Furthermore, as charges were based only on the toxic concentration, many industries got away with simply diluting the effluent. (Bernstein, 1993, *Alternative Approaches to Pollution Control and Management*, the World Bank).

User charges

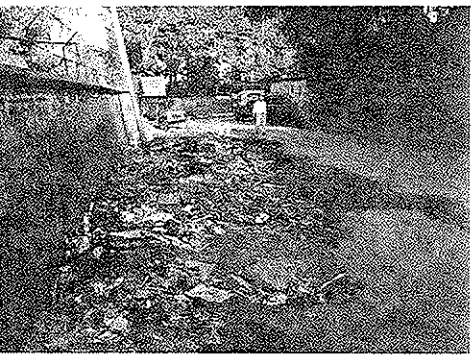
Definition. User charges are direct payments or fees levied by public agencies or private providers of environmental management services to industries (or consumers) for the costs of environmental management services; example: collection, transportation, disposal and treatment. It is designed to:

- provide incentives to industries to minimise and better manage their wastes;
- assist public agencies (and other providers) to recover their actual cost of environmental and waste management programs; and
- raise revenue for government to finance environmental management programs.

User charge is applicable when environmental management facilities such as landfill, incinerators and treatment plants and transportation facilities are available to provide services.

Background and international experience. User charge is based on the actual cost of services. Regulatory and public agencies have traditionally levied user charges for infrastructure services, such as water supply, garbage pick-up and domestic sewer connection. The adoption of user charges for managing pollutants, especially waste is a more recent concept.

User charges can be applied to manage solid waste disposal.



User charges can be designed to ensure cost recovery, thus helping to maintain the financial wellbeing and independence of service providers. Especially in developing countries, public or semi-public agencies traditionally provided waste management services free or at subsidised rates. This practice resulted in poor levels of services and threatened financial viability of the agencies. For this reason, international donor institutions, such as the World Bank, are increasingly promoting user charge as a cornerstone of infrastructure programs in the developing countries[76].

[76] The World Bank (1994), *World Development Report 1994: Infrastructure for Development*, Oxford University Press, New York, p. 37.

Private waste service groups charge fees to collect household garbage.

Most OECD countries have successfully adopted user charges for various components of environmental management[77]. User charges are relatively effortless to implement and economical to administer because simplified systems for calculating the charges can be easily devised. Consequently, for example, administration costs of user charges for solid waste management are low-estimated to be only around 2-5 percent of the cost of the overall scheme[78].

International experience also suggests that user charges can induce substantial reduction in the amount of pollutants generated. For example: dramatic reduction in air pollution has been obtained in Singapore through "Area Licensing Program." The program imposes a form of user charge for road use to car drivers who enter the designated down town area at restricted times[79]

About 20 percent of the municipalities in Japan charge for household waste by volume. Households can purchase prepaid plastic bags or stickers. Only waste in prepaid bags or with stickers is picked up by the city. This system has resulted in the reduction of solid waste by up to 50 percent[80]

In Canada, user charges are imposed in many forms, including extra strength sewer discharge fees, hazardous waste disposal charges, tipping fees at landfills, and charges for disposing contaminated soils at lake fills.

Implementation methods. User charge should be designed to cover the full cost of services required to manage the environmental pollution. For example, for solid and hazardous wastes, user charges can be based on their weight, volume and characteristics. Charges should also take into consideration the difficulty of handling, treat-

[77] User charges for waste collection and disposal, and sewer connection are quite common in OECD countries. See OECD (1994), *Managing the Environment: The Role of Economic Instruments*, p. 183.

[78] OECD (1981), *Economic Instruments in Solid Waste Management*, p. 42-45.

[79] See Panayotou, T. (1991), *Economic Incentives in Environmental Management and their Relevance in Developing Countries*, OECD, Paris.

[80] Metropolitan Environment Improvement Program (MEIP) (1994?), *Japan's Experience in Urban Environmental Management*, Washington DC.

ment and safe disposal of the subject waste. This means charges are a function of toxicity, corrosiveness, flammability, poisonous level, explosivity, reactivity, and biohazard of the specific waste.

As a starting point, the charges can be simply based on weight or volume of the pollutant or waste. Charge by volume can be easily implemented by selling prepaid containers to industries and households, and ensuring that only wastes in those containers are eligible for pick-up, disposal and treatment by the service agencies. This system can be compared to the cost savings attained through prepaid envelopes for film processing, that have been used in North America for many years.

Application points. User charge can be applied at any of the following points, or combination thereof:

- Waste collection location
- Connection to the utility service line, example extra strength sewer, and industrial drain connection
- Waste disposal or treatment location; example: tipping fees for dumping sites and landfill, treatment fees at incinerators.
- Metered use of water

Applicability in Nepali context. User charge is applicable whenever facilities and services are provided for environmental management by public, semi-public or private agencies. The existing municipal sewer lines currently provide waste water discharge options for some locations in Nepal. The Solid Waste and Resource Mobilisation Centre in Kathmandu charges user fees for removing septage from households.

All industries and households utilising the services for all or part of pick-up, transportation, treatment and disposal of wastes will be subject to user charges. Some industries might also undertake in-house waste management, including de-watering, treatment and disposal in the form approved by regulatory agencies. In those cases, user charges may not be applicable, except for the disposal of any residue in approved landfill.

Environmental management services might be provided by private firms or public agencies. International experience suggests that services provided by private firms will be more efficient and economical. Hence privatisation of services, and allowing the private

firms to impose service charge may be emphasised by creating innovative policies.

Details on possible systems of privatisation and commercialisation of environmental management services are beyond the scope of this paper.

▲ *Many recyclable, are still disposed in the solid waste of Kathmandu.*

Deposit refund

Definition. Deposit refund system involves a surcharge (deposit) when industry or consumers purchase products (or containers) and input materials that, if improperly disposed, may be detrimental to the environment. The surcharge is refunded when the item (spent product or container) is returned to approved locations for processing.

This instrument is applicable on relatively durable and reusable items. Deposit refund system diverts waste from traditional disposal paths into alternatives, such as, reuse, recycling and environmentally safe disposal.

Background, rationale and international experience. Deposit refund system is a well established approach in the OECD countries. It was commonly used in Europe for glass bottles even before the Second World War. Refundable deposits for soft drink and beer bottles and cans have been required in North America for decades.

The system has been effective in solid waste management. According to a study, upto 95 percent of the containers are voluntarily returned in the locations where deposit has been charged[81]. This system has been successful in Finland and Sweden too, where respectively 90 percent and 80 percent containers were returned to dealers (OECD 1989).

Even in some developing countries, deposit refund system for soft drink bottles is a common practice. For example, in Nepal and India deposits are generally required for soft drink bottles. Upon return of the bottles, refunds are provided by the shops from which the product was purchased. In another form, containers may also be

[81] Study by Moore, et al. (1989). See discussion by Bernstein (1993), p. 55. See also OECD (1994), *Managing the Environment: The Role of Economic Instruments*, Paris, p. 86.

sold to informal entrepreneurs who pay its market value, a practice quite common in Nepal.

Use of deposit refund system for waste items has so far been scarce. When adopted, its application has remained limited only to selected items such as automobile tires and batteries. For example, in the US, returnable deposits are levied only on car batteries and pesticide containers in several states.

In the case of soft drinks and beer bottles and cans, deposit refund system has been extremely effective in recollecting containers that would otherwise become municipal solid waste. The application of this instrument appears to be effective in inducing the return of the targeted products and containers. Drawing from their success in the management of specific solid wastes, they are likely to be effective in case of several types of waste.

Implementation method. Deposit refund system may be used for two main purposes:

- *Collection of items for reuse and recycling.* This category includes, tires, batteries, spent chemical such as anti freeze and lubricating oil. When there is a market value for the residual product the deposit refund system may work voluntarily — otherwise explicit deposits have to be collected to make this instrument effective.
- *Collection of products to prevent environmentally unsafe disposal.* Environmentally unsafe disposal occurs when toxic pollutants are discharged to land and water thus contaminating the ground and surface water. This category includes lubricating oil, industrial solvents, chemicals and pesticide containers.

Deposit refund system is easy to administer. Consumers or buyers pay a deposit to the dealer, who will keep an account and refund it when the container or product is returned. The dealer will eventually transfer any surplus funds to regulatory agencies every year. This system does not require any monitoring, as it is self-enforceable.

For the deposit refund system to work effectively, deposit required should be more than the residual market value of the item. The cost of recycling should be preferably lower than the value of the recycled item.

Application points. Deposit refund system can be applied at the following points:

- at the point of retail sale by industries or consumers, reusable or recyclable containers and products
- at the point of sale by bulk manufacturers to industries, containers or products that need to be safely disposed

Applicability in Nepali context. Deposit refund system appears to have a high potential for use in Nepal. It is possibly applicable on products and containers the industry and consumers purchase that may become pollutants when disposed improperly. It seems especially suitable on the potentially hazardous input materials used by households and industries.

Deposit refund is one of the simplest and most economical instruments that can be easily implemented in Nepal. Because the system works by rewarding good behaviour of the buyer, no monitoring or specific enforcement mechanism is required. The existing institutions, firms, and industries can easily implement the system.

Items that are potential candidates for this system have to be first identified. This is not a difficult task, as experience from other countries can be safely utilised in making a list of such items.

Tradable Permits

Definition. Tradable permit system is a system that allows industry to freely trade any unused portion of "emission credit" assigned to it by the regulatory agencies. Emission credits to industries are distributed within an overall cap (or bubble) of allowable pollution limit in a defined geographical area. The unused portion becomes "Emission Reduction Credit (ERC)" that is treated like asset of the industry.

Background, rationale and international experience. Tradable permit is an innovative concept with very limited actual application so far[82]. This policy instrument has been almost exclusively utilised in the US since 1976, primarily for air pollution control in certain geographic locations. The most recent program is Regional Clean Air Incentives Marker (RECLAIM) in the Los Angeles

[82] The concept was first propounded by John Dales, as "auction of pollution rights" in Dales (1968), *Pollution Property on Prices*, University of Toronto Press

region. According to RECLAIM brochure, "Business that beat their reduction targets (of emission) can trade their credits on the open market. Using market forces allows pollution to be cut in the most economical way. The more reductions, the greater asset." Implemented since January 1, 1994 the program has been viewed as successful[83].

Tradable permit system was also successfully utilised in the US to reduce the lead content in gasoline[84]. More recently, effluent trading for hazardous waste has also been established in some areas of the US including in Cherry Creek, Dillon Reservoir and Fox river areas.

Although on a limited scale so far, Canada has permitted trading of certain controlled emissions, such as ozone depleting substances. Canada is seriously contemplating applying tradable permits also to toxic oxides, VOC and ozone generation.

Thus, even in OECD countries, the experience with tradable permits as instruments of environmental management is limited. Tradable permits have not yet been used in the developing countries in any significant manner.

Implementation method. The most common approach to implement the emission trading program is through a "bubble" concept. Theoretically, industries are assumed to be enclosed within an imaginary bubble. The total emission allowed in the bubble is regulated by setting an annual emission target, which will shrink each year. Industries that reduce the emissions below the target receive "ERC" which can be sold in the market.

Many variations of this approach can be designed. The common forms include: offsetting — allowing new plant to obtain credits from existing; and banking which allows plants to store ERCs for future use or sale.

The principle used on emission trading remains valid also for effluent trading permits that may be used in the study area.

[83] According to Ms. Jill Whynot, program supervisor, "Emission Credits" are available in the market and are being traded. Industries are installing improved monitoring equipments to provide accurate data on emission as mandated by RECLAIM. Initial emission vouchers are free, but industries do pay the "pollution charges" according to the actual amount of emission generated-remaining within the limits provided by their own or traded vouchers. (Telephone conversation, March 23, 1995)

[84] OECD (1994), *Managing the Environment: The Role of Economic Instruments*, Paris, p. 122.

Application points. Tradable permits can be applied at the following points:

- Release of pollutant to water, ground or air
- In the case of input materials (quota trading) at the point of import, i.e., at the border customs

Applicability in Nepali context. Tradable permit can be a potentially effective policy instrument. Tradable permits for pollutants, i.e., trading of "pollution rights" may not be practicable in Nepal at present.

A system of trading water rights for extracting underground water may be applicable in Kathmandu. The assessment of their effectiveness needs to be undertaken.

Tradable permits for pollutants can be adopted at a future date when conditions become more favourable for its effectiveness. The conditions include:

- enhanced regulatory capacity with advanced data base and verification capability[85].
- mix of industries with different marginal abatement costs.
- existence of many sources of waste generation, each accounting for only a small fraction of the total.
- localised environmental degradation from effluents is not excessive, i.e., the total impact of specified "bubble" is acceptable.

Liabilities

Definition. Liability means holding concerned households, industries, firms and institutions responsible for the costs of environmental degradation. Liability can serve as:

- a deterrence since the cost of environmental damage provides industry incentives to abate pollution.
- a source of revenue that would compensate affected individuals and organisations, and provide funding for remediation and clean up programs.

Liabilities can be assigned by passing legislation and regulations, through common law or environmental statutes. Besides actual

[85] In the case of RECLAIM (cited above) in Southern California, the existing manpower had to be retrained to administer the tradeable emission program. The process for emission verification is still considered quite demanding.

litigation, liabilities can be enforced efficiently by requiring the potentially liable parties by requiring them to post bonds and purchase liability insurance.

Background, rationale and international experience. Environmental liability is the ultimate extension of the "polluter-pays-principle" The principle is stretched to ensure that the polluter pays for past as well as future actions that are detrimental to the environment and human health. Environmental liability also imparts sensitivity for insurance, banks and financiers and managers regarding environmentally harmful behaviours. These institutions, by charging higher insurance, interest and financing rates, will charge higher cost to industries that engage in environmentally risky behaviours.

Although the motivations that will make liability work are economic, this instrument transcends the boundary of economy and legality. In that sense, it can be considered a quasi-economic instrument.

Liability as a policy tool was one of the cornerstones of the US Superfund Program. The program held the firms, who were responsible for dumping waste in water bodies and land, liable for environmental damages. However, long litigation followed due to many unresolved issues, including the ownership of the lands where waste was dumped, and more importantly, the extent of liabilities on the health of affected residents. More time and resources were thus spent on litigation, and less on actual cleanup.

In Canada, liability has been used as a policy instrument in the remediation of contaminated sites. For example, in Ontario, the current owners of contaminated sites are liable for cleanup. However, the detailed extent of the previous owner's liability still remains unclear.

In the documented cases the implementation of liability as a policy instrument has been plagued by several problems in the form of "historic waste." These lessons have to be seriously reviewed, while designing new liability policies. Such an undertaking is not within the scope of the present task - and is recommended for future study.

Implementation method. Liability is primarily implemented through legislative requirements. Industries can be made liable for any impact that arises out of their failure to comply with the regulatory provisions. Liability requirements should mandate that households, firms and industry be directly liable to any damage caused by

the waste they generated. Other relevant parties, including creditors, insurers and professionals in the design and implementation of industrial process should also be liable.

The extent of liabilities should be defined as clearly as can be envisaged in advance. In order to operationalise this clarity, the present level of pollutant accumulation and its impact have to be duly recorded, so that incremental impact on the environment can be properly assessed at future dates.

Application points. Liability is applied at the following points:

- Industrial operation - waste and emission management practices; example: transportation, storage and treatment
- Financing for industries
- Insurance companies that underwrite industries

Applicability in Nepali context. Assigning liability requires a strong legal framework, clear delineation of property rights and existence of well developed legal, banking and insurance system. Nepal has only the basic structure of these institutions in place. Specialised knowledge will develop only when actual cases are tested. Thus Nepal can potentially implement liability policy as a backup means to environmental management.

Additionally, liability becomes a useful instrument only when clear links can be established between the pollution activities and their effect on the environment. Further study will be required to clearly establish the impacts of pollution on the environment.

The extent of the impact of pollution on human health is still an unresolved area. This is partly because the impact of pollution on human health is not always immediate. Because some effects may take years to show, establishing casual effects between human health and environmental damage becomes a complex task. In this light, limits of liability can be difficult to determine. However, liabilities for relatively simpler impacts on the environment can be established in Nepal.

Conclusions

The above discussion introduces the concept of market-based instruments for environmental management. MBI application and

international experience on the effectiveness of the instruments are discussed in detail. As MBIs are new to Nepal, their application in Nepal are still emerging.

With the passage of Environment Protection Act (1997), Nepal now has the initial regulatory framework towards environmental management. To complement the regulatory approach, and on the basis of such regulations, some MBIs may have a potential application in Nepal.

This paper describes some MBIs which may find appropriate use in Nepal. The experience of several other countries suggests that MBI may provide more cost-effective approaches to achieve environmental objectives if they are properly designed and used in conjunction with the regulatory approaches.

command and control, and suasive instruments

policies for environmental management in Nepal

"Laws too gentle are seldom obeyed; too severe, seldom executed."

Benjamin Franklin

"People are generally better persuaded by the reasons which they have themselves discovered than by those which have come into the mind of others."

Blaise Pascal

Among the policy instruments government utilise for environmental management regulatory instruments also known as "command and control" (CAC) are the most conventional. For the past several decades most governments have utilised them in one form or other. On the other hand, voluntary and suasive instruments of environmental policies are less conventional but are gaining acceptance. Voluntary instruments also seem to relate to the cultural practices of societies as some countries have practised them more extensively than others.

This section discusses major policy instruments in these two categories and assess their applicability for environmental management in Nepal.

Command and control instruments

Command and control instruments (CAC), i.e., direct regulations, monitoring and enforcement practices, have remained the predominant policy tools for environmental management in OECD

countries. In developing countries they continue to be utilised as near-exclusive policies for environmental management.

Command and control approach consists of adopting environmental objectives, designing required regulatory mechanisms and enforcing them. The objectives primarily seek to protect human health and the quality of the environment. To this end, governments devise specific regulatory frameworks and specify liabilities and penalties for any noncompliance.

CAC instruments offer governments legal authority and direct control to enforce defined environmental management programs. They also provide regulatory agencies a reasonable level of predictability about the outcome of adopting the policies. As CAC instruments have been the mainstay of their environmental policies, most countries, including Nepal, already have some experience with them. For these reasons, CACs remain attractive to most governments, and have a continuing applicability in Nepal.

At the early stages of environmental awareness, CACs made significant contribution towards environmental protection in most countries. But CACs have also proved hard to enforce, economically inefficient and relatively rigid in the rapidly changing technological, economic and social contexts. Furthermore, they have been ineffective in stimulating innovation and in controlling broader impacts of environmental degradation, such as acid rain and regional climatic changes.

During the last two decades, many European countries have moved away from sole reliance on command and control approach to an increasingly more balanced mix of market-based and regulatory instruments. However, the US and Canada so far have almost exclusively relied on CACs to meet their environmental objectives, and in this process have devised and implemented numerous regulations. It is only recently that market-based instruments are supplementing the traditional CAC in North America and Europe.

CACs have specific applicability in Nepal and their effectiveness can be enhanced if used selectively and in combination with market-based instruments. So far, Nepal has largely depended on CACs for environmental management. In that process, it has developed a basic legal and institutional framework to devise and enforce CACs. The most significant legislation is the 1997 Act on Environmental Protection which provides the legal basis for this regulatory authority. This act can be used for strengthening and expanding CACs towards the management of environment in Nepal. CACs are potentially relevant to the environmental management programs in Nepal.

Permits and licenses

Definition. Permits and licenses are the legal sanctions to industries to generate and discharge allowed levels of pollutants, under specified conditions and restrictions. They are tied to the fulfilment of conditions, such as prescribed reduction in pollution and approved waste treatment plans. They can be revoked if those programs are not met.

Permits and licenses are designed to:

- achieve environmental objectives, such as reduced levels of pollutants and waste generation;
- provide basis and authority to government to control industry's and public response to environmental management, and
- penalise for noncompliance.

Background and international experience. Permits and licenses are instituted on the basis of government's authority to protect public interest. Permits and licenses are relatively effortless to design, and in specific circumstances, have induced substantial reduction in the amount of pollutants generated. However, they have often proved difficult to enforce, and experience is mixed regarding their overall effectiveness.

▼ *Unauthoris settlement polluted B river, Lalit*

Since the inception of environmental programs, permits and licenses have been the centrepiece of government policies. All OECD countries have adopted permits and licenses for various components of environmental management.

Application points. Permits and licenses can be applied at any of the following points, or combination

thereof:

- Initial granting of right to establish industry firm and residential location
- Regular certification (usually annual) of approval of industry's right to operate
- Required procedures for environmental management, such as waste and effluent categorisation, storage, transportation, treatment and disposal

Applicability in Nepali context. Regulations to obtain and maintain permits and licenses by industries can be efficiently provided in a single document. But enforcement requires regular verification of compliance by industries, and monitoring and approval by government.

For pollutants and wastes, permits and licenses are devised to restrict weight, volume and hazardous characteristics of waste generated and discharged into the environment. Permits and licenses also specify an industry's responsibilities for waste categorisation, storage, hauling, treatment and disposal procedures.

Permits and licenses are already a part of Nepal's environmental management programs. Most new industries need to conduct environmental impact assessments to ensure that the negative impacts are contained and properly mitigated. Major industries need permits to discharge effluent. The Ministry of Industry now requires acceptable EIA reports before granting licenses for major industries. MOPE and Ministry of Transportation requires that only vehicles with an approved sticker are allowed to ply the roads of Kathmandu. However, the government currently has limited abilities to review EIA reports and to enforce the 1997 Environmental Protection Act.

Standards

Definition. Standards define environmental targets and establish allowable limits of concentration and quantity of polluting substances that can be discharged to the environment. Standards may take the forms of:

Environmental standards — that establish highest permissible concentration of specified hazardous substance in the ground, water or air where waste is discharged. For example, national ambient air quality objectives prescribe may maximum desirable, acceptable and tolerable concentration (e.g., in ppb) of specified gases and particulate, averaged over a period (e.g., 24 hours).

Product standards — Establish a ceiling on the total quantity or concentration of pollutants that can be discharged into ground, water or air per unit of product output. Product standards can also prescribe allowable chemical composition of potentially toxic substances in a finished product.

Technical and operational standards — Specify permissible technology, materials and operational procedure to be used by industries, e.g., mandatory use of scrubber to reduce sulphur oxide emissions. These standards also include acceptable procedures for categorisation, storage, transportation and disposal and effluent wastes.

Background, rationale and international experience. Standards provide reference points for regulatory agencies and industries to determine the level of compliance required to meet environmental objectives. They prescribe minimum level of acceptability for resulting environmental condition, production process, or product from industrial activities.

All OECD countries have instituted standards related to pollution especially to control surface and ground-water contamination. For example, in the US, environmental standards specify permissible levels of toxic substances and contaminants in surface water. The US Clean Water Act specifies allowable limits of pollutants, such as BOD, suspended solids and metals in water. For toxic pollutants, stricter criteria as achievable through "best available technology" are applied.

Canada Water Act includes the control of the amount of phosphorous in water softeners and cleaning agents. Countries of the European Community, among other requirements, prohibit or control the strength of non-biodegradable substances in detergents. In Belgium, water standards are specified according to the intended use of water. In Japan, ambient water quality standards are set according to the type of water-bodies, such as sea, river and lake, as well as by water use.

Brazil has established the permissible levels of identified toxic substances and pollutants in surface water. Similarly, in China and

Turkey, ambient water quality standards specify standards for various pollutants including BOD and concentration of toxic substances.

Application points. Standards are applied at the following points:

- Surface water, ground and air in the geographical region of targeted industries
- Finished output of products
- Input materials
- Industrial technology, equipment, process and performance

Applicability in Nepali context. In Nepal, MOPE is empowered to set standards regarding pollutants. Regulatory requirements about solid waste are already in place through the Solid Waste Management Act (1988). However, product and operational standards on pollutants are presently non existent.

The Municipal Act of Nepal (1992) also empowers municipalities to regulate the management of solid waste. However, in the absence of ambient air and water quality standards and given the limited capacity in the country for enforcement, Nepal needs to develop its capacity to develop and enforce standards.

Land use controls

Definition. Land use controls are regulations that specify type of use, density, development parameters (e.g., open space ratio, setbacks), bulk and floor area allowed on a site (including land and water). Land use controls are enacted mainly by the local authorities, and are administered through zoning, subdivision and building regulations.

Zoning — defines permitted use on a site, allowing compatible use and prohibiting conflicting use. It also establishes allowable built-up area or number of people per unit area. For example, zoning will prescribe minimum distance of industries from residential areas, and number of industries or people per hectare.

Subdivision and building regulations — control the open space ratio, size and yards required while developing a site as well as the bulk, floor area, height and design and construction specifications for buildings.

Background, rationale and international experience. Land use controls are the classical instruments of segregating incompatible uses and controlling densities in settlements. They can be designed to minimise the negative impact of pollution on human health and ecology. They also help in proper environmental management, by specifying locational and spatial criteria for industrial production, transportation, treatment and disposal of wastes.

All OECD countries utilise land use controls to regulate industrial activities that are likely to produce pollutants. For example, combinations of conventional zoning and performance standards have been utilised in industrial development so as to limit the discharge of pollutants within a given region. In the UK, "Smoke Control Areas" restrict smoke and may allow only prescribed fuels to be burnt in the area. In Germany, minimum distances are established between polluting industries and residential precincts[86].

Many developing countries have enacted several forms of land use controls to attain environmental objectives. For instance, Brazil has used comprehensive zoning to require pollution control equipment use or relocation by industries. The Brazilian city of Curitiba well known for its innovative environmental management-does not allow industries, roads or buildings along linear stretches parallel to rivers and streams. However, most developing countries have not devised, nor effectively enforced sufficiently strict land use controls related to pollution.

Stringent regulatory requirements should be developed especially for the location and siting of waste treatment and disposal facilities. Land use controls in combination with MBIs, such as taxes and subsidies, can also be utilised to create "waste exchange program" areas - where waste is swapped among industries to drastically reduce the final residual waste[87].

Failure to adopt land use controls restricting industries that produce hazardous waste, have resulted in serious public health

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[86] Bernstein J. (1993), *Alternative Approaches to Pollution Control and Waste Management*, the World Bank, p. 46.

[87] An excellent example is Denmark's Kalundborg's "Industrial Symbiosis" where closely located industries, such as refineries, chemical factories, electrical and biotechnical plants swap their wastes in a mutually beneficial manner. One industry's waste can be another's input, and as a result great reduction has been achieved in the quantity and toxicity of residual waste. See Ernest Lowe (1993), "Industrial Ecology-an Organising Framework for Environmental Management" in *Total Quality Environmental Management*.

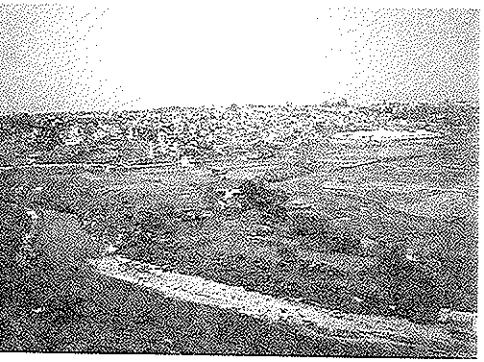
problems in many countries. For example, because carpet and tanning industries were allowed within the city areas, Kathmandu's ground and surface water has been severely contaminated by their hazardous discharge, making water pollution, according to some reports, "the most serious environmental problem" in the city[88]. Residents in some parts of Lahore, Pakistan have suffered serious health consequences because of dangerously high levels of mercury in ground water, apparently discharged from local tanning industries.

Application points. Land use controls can be applied at the following points or combination thereof:

- Location and siting and development of new industries, that may produce pollutants — this may also include encouraging the formation of "waste exchange program" sites
- Operation (and even relocation) of existing industries potentially producing pollutants
- Storage and transportation of solid, liquid and hazardous waste
- Sites of treatment and disposal of solid, liquid and hazardous wastes

Applicability in Nepali context. Land use controls are implemented by local governments, mainly by the municipalities or townships having jurisdiction on the industrial sites. Some land use controls are already in use in Nepal to explicitly or tacitly help in the environmental management. Land use controls are relatively easy to devise and implement. In fact, implementation mechanisms already exists through the industrial licensing and building permit system. The existing controls should be reviewed and whenever necessary revised, to enhance their effectiveness in the management of environmental pollution.

Uncontrolled and unplanned urban expansion encroaching on fertile agricultural land of the Valley.



Environmental Impact Assessment (EIA) can be a powerful tool to control and guide especially large scale industrial development. At present, EIA is required for all major development, which has to be approved by relevant government agencies.

[88] See Halcrow Fox and Associates, et al. (1991), *Kathmandu Valley Urban Development Plans and Programs*, Kathmandu, p. 48.

Voluntary and sausive instruments

Voluntary and suasive instruments allow government to achieve environmental objectives without devising legally binding regulations. They can complement and even substitute parts of "command and control" and market-based instruments for environmental management. The two instruments go hand in hand; suasive policies are often used to promote voluntary actions by stakeholders. Through such policies, government attempts to achieve environmental objectives by persuading industries, business associations, consumers and other stakeholders to modify their behaviour.

There are two types of voluntary action: unstructured and structured. Unstructured voluntary actions are non-formal and are the result of environmental education, training, and advisory services. Structured voluntary actions are in the forms of codes, standards and guidelines.

Voluntary agreements by industries have been effective in achieving environmental objectives in many countries. For example, Japanese public utilities have long adopted voluntary standards to reduce air pollution. In the mid 90's Indonesian government began releasing to public, information about the environmental performance of individual industries. This process is expected to cause many industries to voluntarily adopt stringent environmental standards to avoid embarrassment.

Suasive instruments attempt to convince stakeholders to act in an environmentally responsible manner by internalising environmental objectives in their decision-making process. Suasion is often achieved through education, training, moral persuasion and public pressure.

Industries often behave in an environmentally irresponsible manner due to ignorance. When appropriate information is available regarding the implications of their action on the environment, and when environmental programs are devised in consultation with the stakeholders, environmental objectives can also be met through voluntary compliance.

The worldwide growth in "green consumerism" is also forcing industries to undertake pro-active environmental management programs in order to maintain consumer loyalty and stay competitive.

Voluntary practices

Definition. Voluntary practices are initiatives that industries would willingly follow towards desirable environmental management. They provide guidance and methods for better environmental management, rather than create legal obligations to achieve specified environmental objectives.

Voluntary practices include:

- Agreements,
- Codes of Conduct,
- Multi-Stakeholder Protocols, and
- Guidelines and Standards.

Voluntary practices may cover the area of environmental management that are not covered by regulatory instruments. They may also set more stringent norms than prescribed by regulatory requirements.

Background and international experience. Since environmental awareness became prevalent in OECD countries, voluntary tools have remained important components of their environmental management programs. Many industry groups in these countries have taken up voluntary programs of better environmental management even when no regulations mandate such action. For instance, because of international protocols electronic industries in Canada have practically eliminated the use of ozone-damaging chemicals that were once the common cleansing agents in the manufacture of circuit boards[89].

National and international standards have played a major role in guiding industries towards responsible environmental management. The most comprehensive of such guide is the ISO 14000 series. ISO 14000 series is a set of voluntary standards designed to make industries more environmental-friendly by reducing pollution, managing waste and adopting preventive technologies. It offers systematic procedures for environmental management system to industries, with an emphasis on training, competency and awareness, while allowing them to set their own schedule for reaching the objectives. The main components of the standards are "Environmental Management System (EMS) Specification" and "EMS - General Guidelines on Principles, Systems and Supporting Techniques." These are supported by documents on environmental auditing (ISO - 14010-12) and environmental performance evaluation (ISO - 14031). It is expected that industries that declare their compliance to ISO 14000 would enjoy enhanced public image and derive benefit from consequent consumer support for their products.

The Canadian Standards Association (CSA) initiated a pilot program of Environmental Management System. The program was designed to enable participating industries to devise environmental programs that would be consistent with ISO 14000 series when it is available. The pilot program is considered a success as participating industries are voluntarily complying with EMS. Participating industries seem to anticipate that consumers will increasingly watch their environmental performance, which will greatly affect their future profitability[90].

Numerous guidelines and codes of practice regarding pollution control are available in Canada. Examples are codes of practice for the reduction in the emission of solvents, and VOCs and guidelines for Landfilling of hazardous waste. Concerned industries and facilities are expected to follow such codes of practice and guidelines on a voluntary basis. Although the actual effectiveness of such guidelines remains uncertain, industries seem to be willing to follow codes and guidelines to enhance their image in the public eye.

Environment Canada operates the "Environmental Choice Program", whereby firms can get their products tested for a fee. If specified environmental standard criteria are met, the products can display the certification and indicative logo from the program. According to a survey, such logo was found to have a positive impact on improving the business[91].

Among the significant reasons for Japan's startling success in environmental management are the many voluntary agreements large industries initiated and signed with the authorities to limit their emission levels. Japanese private industries regularly entered into

[89] MacEachern, K. (1995), "Canadian Companies Gain Competitive Edge with EMS Pilot Program" in *CSA Environment Update*, Toronto.

[90] MacEachern K. (1995), "Canadian Companies Gain Competitive Edge with EMS Pilot Program" in *CSA Environment Update*, Toronto. The article quotes Mr. R. Robitaille of Montreal Based Circo Crafts as saying: "In two or three years, customers will want proof that you take environment into consideration before they will deal with you. Environmental concerns can (thus) be a trade barriers".

[91] Canadian Environment Protection Agency, CEPA Review Tool Box and Interventions, prepared by RCGI, October 1993.

agreements with local governments to adopt environmental standards significantly higher than what was required by national legislation[92]. The overwhelming success of these voluntary programs may be unique to Japanese sociocultural norms where industries are extremely sensitive to community perception of their behaviour. However, even elsewhere motivations to adopt voluntary programs may come from firms' own realisation that consumer loyalty may be contingent upon their environmental behaviour. Thus the "pollution prevention pays" principle may become universally attractive.

Voluntary tools may become impressively effective in certain circumstances. If industries perceive that a government will eventually enforce environmental standards, they may be more included to adopt voluntary action. Environmental compliance may also be enhanced if independent third parties, such as Canada's Quality Management Institute (QMI), are available to monitor industries environmental performance. Furthermore, because industries are increasingly sensitive to consumers' perception, they are likely to adopt voluntary programs, especially where the community is vigilant.

One specific approach to increase voluntary compliance is "negotiated settlements". Negotiated settlements can be appropriate when a firm's violation of regulations is serious enough to demand a response stronger than simple warning but not deserving prosecution. In such cases, regulatory agency and the concerned firm reach an agreement for a mutually acceptable course of action. For example, negotiated settlements are being considered by Environment Canada for potential use in enhancing enforcement.

Application points. For environmental management, voluntary tools may specify:

- The best management or operating practices for environmental management
- The technologies and process recommended to reduce waste generation
- The standards recommended for product, process and emissions

Applicability in Nepali context. Voluntary tools are likely to be of significant value in environmental management programs in

[92] Metropolitan Environment Improvement Program (MEIP, 1994), *Japan's Experience in Urban Environmental Management*, Washington DC, pp. 62 and 110.

Nepal. It is expected that with the increasing environmental awareness in the country and with the increasing prevalence of ISO 14000 series, industries and firms would become more conscious of their public image and would undertake voluntary measures to improve their environmental performance.

Voluntary agreements are cost-effective instruments, because investment of resources required to draft, regulate and enforce them is minimal. Regulatory agencies basically facilitate the process by which industries themselves will adopt voluntary programs environmental management.

The government can facilitate the adoption of voluntary instruments through a number of policies. Among them are support and encouragement to chambers of commerce such as FNCCI, business associations, community groups and non-governmental organisations concerned with the environment.

Suasive instruments

Definition. Suasive instruments apply direct or indirect pressure to industries with the aim of internalising environmental awareness and responsibility into their decision-making.

Suasive tools include:

- Information,
- Education and Training,
- Social pressure,
- Consultation, and
- Negotiation.

Background, rationale and international experience. Many OECD countries have relied on suasive instruments as a part of their overall policies to motivate industries to act in an environmentally responsible manner. For instance, numerous community-based programs in Canada and the US have persuaded industries and consumers in the 3Rs (Reduce, Recycle, and Reuse), good environmental citizenship and leadership programs in environment. Some projects are often assisted by government, such as "Environmental Learning Program", funded under the Green Plan by Environment Canada. Others are operated by industry associations, citizenships, groups and public private partnership programs.

As a part of exhortation policies, public consultation and partnership have been important processes for governments to facilitate environmental management. For example, Canadian Council of Ministers of governmental forum outlines a continuum of stakeholder involvement as consisting of formal communication, consultation and partnership[93].

In the UK, "Environment Week" has been organised since 1984, when local authorities, business, schools, community groups and media meet to initiate and promote environmental improvement programs. Additionally, many environmental awards are organised by the professional and trade associations to recognise and encourage environmental leadership[94].

In the developing countries, communities sometimes have negotiated pollution reduction programs with local industries — an approach also known as "informal regulations." For example, one study in Indonesia found that "informal regulations" applied through public pressure can be effective in reducing pollution intensity in selected areas. However, such pressure seems to be less effective in the poor communities[95].

Indonesia has recently begun to experiment with a program called "The Business Performance Rating" (BPR). In this program, the environmental performance of industries is rated as excellent, good, adequate, inadequate and poor and this information is disseminated to the public by colour coding respective performance of industries. The designers of this program expect that participating industries will voluntarily improve their environmental management to maintain their image and avoid embarrassment.

According to a report in "The Globe and Mail", Canada also compiles a national inventory of polluters, which is available to the public. This inventory is considered a powerful tool to identify polluters in their communities. As a result of this publicity, the largest

93 CCME (1994), *Guidelines for Consultations and Partnerships*, Winnipeg, Canada. CCME's guiding principles are listed as Relevance, Effectiveness, Full and fair access, Prospect for diverse interest, Efficiency, Participant funding, Flexibility, Access to information, Accountability and Implementation and feedback.

94 OECD (1990), *Environmental Policies for Cities in the 1990s*, Paris, p. 57.

95 Pargal, S. and D. Wheeler (1995), *Informal Regulations of Industries in Developing Countries: Evidence from Indonesia*, the World Bank, Washington DC. The study concludes that "Informal regulations also have clear advantages over rigid formal systems... (Local communities) may also have more accurate sense of local pollution problems than new agencies whose monitoring capabilities are weak." p. 20.

emitter of a single compound made a deep cut in its emission. The Globe and Mail reported: "Ottawa hopes public accountability will reduce the need for government regulations" (regarding pollution control)[96]

Application points. Suasive tools are applied in the following ways:

- Ensuring that industries become aware of the environmental consequences of their action
- Facilitating the acquisition of knowledge, skills and values concerning environmental protection
- Utilising consultative and negotiation approach to reach win-win agreements
- Disseminating important information about the impact of polution on the environment and public health
- Facilitating community pressure to persuade industries to behave in an environmentally responsible manner
- Encouraging the concerned individuals and groups to meet the environmental objectives

Applicability in Nepali context. Suasive instruments are universally applicable for environmental management. There are no disadvantages in adopting this instrument, except for the opportunity cost of limited public resources. It is likely that suasive instruments will be cost-effective tools to bring about the desired environmental objective in Nepal.

The emergence of several NGOs in Nepal provides new opportunities to utilise suasive instruments for environmental management. Several NGOs are dedicated to environment and conservation and can easily provide the required infrastructure to persuade people and industry towards improved environmental management.

Conclusions

This section assessed the applicability of command and control and suasive instruments for environmental management in Nepal. Nepal is practising limited CAC policies in environmental management. Further, it is attempting to enhance its capacity to develop and

96 *The Globe and Mail*, Toronto, April 27, 1995.

implement CAC policy instruments. CAC will have continuing application in Nepal.

Nepal has not exploited the potential of voluntary and suasive instruments for environmental management. A study of the experience of several other countries suggests that voluntary and suasive policy instruments have potentially high applicability in Nepal for environmental management. Further, these instruments can be cost-effective, self enforceable and effective in meeting environmental objectives. In addition, promotion and application of voluntary and suasive instruments does not significantly increase government's burden and does not require a well developed public capacity to implement environmental management programmes.

references and bibliography

Acharya, B., "Housing and the Law: Prospects for Realistic Regulations in Nepal", in *Journal of Development and Administration*, Kathmandu, Nepal 1986.

Adhikari, A., *Strategy for Low Income Housing for Kathmandu, Nepal*, M. Arch. dissertation, University of Hawaii, Hawaii, 1980.

Adhikari, A., *Appropriate Standards for Low Income Housing for Kathmandu, Nepal*, Doctoral Dissertation, Harvard University, Cambridge, Massachusetts, University of Michigan Press, 1990.

Adhikari, A. (et al.) (ed.), *Environmental Economics in Nepal*, IUCN Nepal, Kathmandu, 1998.

Adhikari, R., *Sustainable Development Through Environmental Regulation in Nepal: With Special Reference to Ecotourism*, Ph. D. Dissertation, Arizona State University, Tempe, Arizona, 1994.

Afshar, F., *The Political Economy of Technology Choice: Construction Materials Production in Pakistan*, Ph.D. Dissertation, MIT, Cambridge, Massachusetts, 1985.

AIUS, *Review of the Residential Codes*, Australian Institute of Urban Studies (AIUS), October 1974.

Alexander, C., *House Generated by Patterns*, Centre For Environmental Structure, Berkeley, 1969.

American Planning Association, *Site Planning for Solar Access*, APA, Chicago, 1982.

American Public Health Association (APHA), *Housing: Basic Health Principles and Recommended Ordinance*, Washington DC, 1971.

Arnold, C. (et al.), *Building Configuration and Seismic Design*, John Wiley and Sons, 1982.

Baer, W., "Housing Indicators and Standards in the USA", in *Ekistics*, Athens, August 1977.

Baumol, W., and W. Oates, *The Theory of Environmental Policy*, Cambridge University Press, 1975.

BDP, *Bhaktapur Development Plan*, Bhaktapur Development Project (BDP), Kathmandu, 1979.

BDP, *Bhaktapur Planning Systems and Plans*, Bhaktapur Development Project (BDP), Kathmandu, 1978.

Becker, R., "The Restoration of Bhaktapur", in *UNSYLVIA*, Vol. 30, No. 121, FAO, Rome, 1978.

Benerjee, N.R., *Nepalese Architecture*, Agam kala Prakashan, New Delhi, 1980.

Bernstein, J., *Alternative Approaches to Pollution Control and Waste Management: Regulatory and Economic Instruments*, Urban Management Program (UMP), The World Bank, Washington DC, 1993.

Bjonness, H., *BAS*, University of Trondeheim and Norwegian Institute of Technology, KVTPT, Kathmandu, Nepal, 1987.

Blair, K., *Village Architecture in Nepal*, Craft and Folk Museum, Los Angeles, 1983.

Blomkvist, H., "Housing and the State in the Third World: Misperceptions and Non Perceptions in the International Debate", in *Scandinavian Housing and Planning Research 6*, pp. 129-141, 1989.

Boch-Issacson, J., *Architecture and Construction Management in the Highland and Remote Areas of Nepal*, Sahayogi Press, Kathmandu, 1987.

Brithsh Standards Institute (BSI), *50 Years of British Standards 1901 - 1951*, BSI, London, 1951.

Callander, J., *Time Saver Standards, Building Types*, McGraw Hills, 1987.

Caminos, H. and R. Goethert, *Urbanisation Primer*, The MIT Press, Cambridge, 1978.

Canadian Council of Ministers of Environment (CCME), *An Emission Trading Program for Sulfur Dioxide Sources in Canada*, Toronto, 1993.

Carson, D. and A. Scholtz, "Designing Pollution Market Instruments: Cases of Uncertainty" in *Economic Policy*, Vol. xii, October 1994.

Cherry, G., *The Evolution of British Town Planning*, Leonard Hill Books, 1974.

Chiara, J., *Manual of Housing Planning and Design Criteria*, Prentice Hall, N.J., 1975.

Dahal, M and D. Dahal, *Environment and Sustainable Development: Issues in Nepali Perspective*, Nepal Foundation for Advanced Studies (NEFAS), Kathmandu, 1993.

Dales, J., *Pollution, Property and Prices*, University of Toronto Press, Toronto, 1968.

Davidson, F. and G. Payne, *Urban Projects Manual*, Liverpool University Press, 1983.

Denzhen, E. (ed.), *Environmental Management in Developing Countries*, OECD, Paris, 1991.

Dhamala, B., "Pollution Problems" in *Proceedings of Seminar on Environmental Management*, Environmental Impact Study Project, HMGN, Kathmandu, 1983.

DHBPP, *A Physical Development Plan for Kathmandu Valley*, Department of Housing, Building and Physical Planning (DHBPP), Kathmandu, 1969.

Doebele, W., "Land Policy" in L. Rodwin (ed.), *Shelter, Settlement and Development*, Allen and Unwin, Boston, 1987.

Donna, J. and A. Deshpande, "Control Strategies and Costs of SO2 and NOx Reduction in Ontario Beyond 1994", in *Acid Precipitation in Ontario Studies*, Toronto, 1992.

Eckaus, R.S., *Appropriate Technology for LDCs*, NAS, Washington DC, 1977.

Ekistics, Athens, Nov. 1973.

Environmental Protection Council (EPC), HMGN, *Nepal Environmental Policy and Action Plan: Integrating Environment and Development*, Kathmandu, 1993.

Fathy, H., *Architecture for the Poor*, The university of Chicago Press, 1973.

Finney, S., *Noise Pollution: A Scientific and Psychological Look at New Hazard*, Franklin Watts, New York, 1984.

Gakenheimer, R., C. Brando, "Infrastructure Standards", in *Shelter Settlement Development*, Allen and Unwin, Boston, 1987.

Gauchat, U., "Housing Standards: Their Derivation and Rationale," *GSD Publication Series*, Harvard University, 1979.

Gay, K., *Air Pollution*, Franklin Watts, New York, 1991.

Goethert, R., "Tools for the Basic Design and Evaluation of Physical Components in New Urban Settlements", in *Ekistics* No. 312, Athens, 1985.

Government of Canada, *Assessing Regulatory Alternatives*, May 1994.

Grimes, O., *Housing for Low Income Urban Families*, John Hopkins University Press, Baltimore, 1976.

Gutschow, N., "Kathmandu, Historical Development, Spatial Structure, Social and Ritual Topography," in *Khumbu Himal* Vol. 13 No. 3, Kathmandu, 1979.

Gutschow, N. and B. Kolver, *Ordered Space Concepts and Functions in a Town in Nepal*, Nepal Research Centre, Kathmandu, 1975.

Gutschow (et al.), "Ritual as a Mediator of Space", in *Ekistics*, Athens, December, 1977.

Habraken, J., *Supports: An Alternative to Mass Housing*, The Architectural Press London, 1972.

Halcrow, Fox, PPK, Cemat Consultants, *Kathmandu Valley Urban Development Plans and Programs*, Kathmandu, 1991.

Hardoy, G. and D. Satterthwaite, "The Illegal and the Reasonable", *Development*, Rome, 4: 1986.

Hardoy, G. and D. Satterthwaite, *Shelter: Need and Response*, John Wiley and Sons, Bath, U.K., 1981.

Harrison, H., E. Keeble, *Performance Specifications for Whole Buildings*, Dept. of Environment, U.K., 1983.

Hartshorn, T., *Interpreting the City: An Urban Geography*, John Wiley & Sons, New York, 1992.

HMCC, *A Proposal for Planned Urban Extension in Nepal*, Housing Management and Construction Co. (HMCC), Kathmandu, 1986 (unpublished).

Hosken, F., *Kathmandu Valley Towns*, John Weatherhill, New York, 1974.

IFHP, "Housing Standards for Low and Lowest Income Groups in Relation to the National Level of Economic and Social Development", in *Proceedings of the International Federation of Housing and Planning*, Tokyo, 1966.

Joshi, J., "Peoples Participation in Housing Development", in *The Journal of Administrative Studies*, CEDA, Kathmandu, 1983.

Kaplan, M., *Planning Law in Nepal*, Dept. of Housing, Building and Physical Planning, Kathmandu, 1974 (unpublished).

Karan, P., *Nepal: A Physical and Cultural Geography*, University of Kentucky Press, Lexington, KY, 1960.

Khalid, A., "Housing in West Pakistan", in *Ekistics* No. 224, Athens, July 1974.

Kneese, A. and C. Schultze, *Pollution, Prices and Public Policy*, The Brooking Institute, Washington DC, 1975.

Korn, W., *The Traditional Architecture of Kathmandu Valley*, Ratna Pushtak Bhandar, Kathmandu, Nepal, 1979.

KVTDP, *Directives for Building Design and Construction*, Kathmandu Valley Town Development Project (KVTDP), Kathmandu, 1976.

KVTPT , *Kathmandu Valley Physical Development Concept*, Kathmandu Valley Town Planning Team (KVTPT) (Draft), 1984.

KVTPT (a), *Regulations for Land Use and Construction in the Kathmandu Valley*, Kathmandu Valley Town Planning Team (KVTPT) (Draft), 1988.

KVTPT (b), *Revised Land Use Plan for the Kathmandu Valley*, Kathmandu Valley Town Planning Team (KVTPT) (Draft), 1988.

Laquian, A., *Basic Housing Policies for Urban Sites and Services and Shelter in Developing Countries*, IDRC, Ottawa, 1983.

Leitmann, J., *Rapid Urban Environmental Assessment*, Urban Management Program (UMP), The World Bank, Washington DC, 1994.

Long F. (ed.), *Appropriate Technology and Social Values*, Ballinger Publishing Co., 1980.

Low, S. and E. Chambers (ed.), *Housing, Culture and Design*, University of Pensylvania Press, Philadelphia, 1989.

Mabogunje, A. (et al.), *Shelter Provision in Developing Countries*, John Wiley and Sons, New York, 1978.

Malla, U., *Low Cost Shelter Projects: Experience in Formal Housing Development*, DHBPP, Kathmandu, 1986 (unpublished).

Marga Institute, *Housing Development in Sri Lanka*, Marga Institute, Colombo, 1986.

Mathema, S., "Housing Problem in Nepal: Physical Planning Perspectives", in *Collection of Seminar Papers on Housing in Nepal*, Nepal University Teachers' Association (NUTA), Kathmandu, 1987.

Mayo, S. and D. Gross, "Sites and Services - and Subsidies: The Economics of Low Cost Housing in Developing Countries", in *The World Bank Economic Review*, Vol. 1 No. 2, Janaury 1987.

Mayo, S. and D. Gross, Shelter Strategies for Urban Poor in Developing Countries, in *The World Bank Research Observer* Vol. 1 No. 2, July 1986.

Metropolitan Environment Improvement Program (MEIP), *Japan's Experience in Urban Environmental Management*, Washington DC, 1994?.

Mills, E. and P. Graves, *The Economics of Environmental Quality*, W.W. Norton and Co., New York, 1986.

Mood, E. (et al.), *Housing Code Standards: Three Critical Studies*, The national Commission of Urban Problems, Washington DC, 1969.

Munasinghe, M., *Environmental Economics and Sustainable Development*, The World Bank, Washington DC, 1993.

Nagarajan, R., *Standards in Buildings*, Pitman Publishing, U.K., 1976.

National Planning Commission (NPC), *Kathmandu Valley Planning and Development Act*, Draft Proposal, NPC, Kathmandu, 1986 (unpublished).

National Planning Commission (NPC), *National Habitat Report of Nepal*, NPC, Kathmandu, 1976.

National Planning Commission (NPC), *Survey in Employment, Income and Consumption Patterns*, Kathmandu, 1978.

National Planning Commission/International Union for Conservation of Nature (NPC/IUCN), *Solid Waste Management in Urban Nepal*, Kathmandu, 1992.

National Planning Commission (NPC), *Seventh Plan*, His Majesty's Government of Nepal, Kathmandu, 1985.

National Planning Commission (NPC), *Eighth Plan*, His Majesty's Government of Nepal, Kathmandu, 1992.

National Planning Commission/IUCN, *National Environmental Impact Assessment Guidelines*, Kathmandu, 1992.

Neufert, E., *Architect's Data*, Halated Press, John Wiley and Sons, New York, 1980.

NUTA, *Proceedings of Seminar on Housing Problems in Nepal*, Nepal University Teachers' Association (NUTA), Kathmandu, 1987.

O'Conner, D., "The Use of Economic Instruments for Environmental Management: The Experience of East Asia" in *Economic Instruments for Environmental Management in Developing Countries*, OECD, Paris, 1993.

Oakley, D., *The Phenomenon of Architecture in Cultures of Change*, Pergamon Press, Oxford, 1970.

ODM, *Third World Urban Housing*, Building Research Establishment for Overseas Development Mission (ODM), Watford, 1977.

OECD, *Managing the Environment: The Role of Economic Instruments*, OECD, Paris, 1994.

OECD, *The Polluter Pays Principle: Definitions, Analysis, Implementation*, OECD, Paris, 1975.

OECD, *Pollution Charges in Practice*, OECD, Paris, 1980.

OECD, *Economic Instruments of Solid Waste Management*, OECD, Paris, 1981.

Okpala, D., "Housing Standards: A Constraint on Urban Housing Production in Nigeria", in *Ekistics*, Athens, June 1978.

PADCO, *Development Control and Enforcement Policies in Urban Planning Activities*, Lalitpur, Kathmandu Valley Town Planning Office (KVTPO), Kathmandu, 1987 (unpublished).

PADCO, *Kathmandu Valley Urban Land Policy*, HMG Nepal and USAID, Kathmandu, 1986 (unpublished).

Panayotou, T., "Economic Incentives in Environmental Management and their Relevance in the Developing Countries," in Denzhen Erocal (ed.), *Environmental Management in Developing Countries*, OECD, Paris, 1991.

Parajuli, Y., *Bhaktapur Development Project: Experiences in Presentation and Restoration in a Medieval Town*, BDP, Kathmandu, 1986.

Payne, G., *Low Income Housing in the Developing World*, John Wiley and Sons, Avon, U.K., 1984.

Pearce, D., "The Recent Experience of OECD Countries and its Relevance to the Developing World," in Denzhen Erocal (ed.), *Environmental Management in Developing Countries*, OECD, Paris, 1991.

Rabenau, B., *Nepal Land Development Issues*, MHPP/DHUD/UDLE, Kathmandu, 1988 (unpublished).

Rabenau, B., *Saibhu Sites and Services Project Summary*, MHPP/DHDD/UDLE, GTZ, German Technical Cooperation, Kathmandu, 1989 (unpublished).

Rapoport, A., "An Approach to Design of Third World Environment", in *Third World Planning Review*, London, Spring 1979.

Rapoport, A., "Development, Culture Change and Supportive Design", in *Habitat International* Vol. 7 No. 5/6, London, 1983.

Rapoport, A., *House Form and Culture*, Prentice Hall Inc., N.J., 1969.

Regional Clean Air Incentive Market (RECLAIM), *Executive Summary*, California, 1993

Rodwin, L. (ed.), *Shelter Settlement and Development*, Allen and Unwin, Boston, 1987.

Schumacher, E., *Small is Beautiful*, Harper and Row, 1973.

Sekler, E., *Summary of the Master Plan for the Conservation of the Cultural Heritage in the Kathmandu Valley*, Harvard GSD Publication Series, 1977.

Sekler E., "Use of Collective Spaces in Patan and Other Historic Towns of the Kathmandu Valley, Nepal," in *Monumentum* Vol. xviii-xix, 1979.

Serageldin, I. and A. Steer (ed.), *Making Development Sustainable*, The World Bank, Washington DC, 1994.

Sestini, V., *Sherpa Architecture*, UNESCO, Paris, 1978.

Shepard, J., *Symbolic Space in Newar Culture*, Ph.D. Dissertation, The University of Michigan, Ann Arbor, 1985.

Thai-Ker, L. and T. An, "Planning and Design", in Yeh S. and Laquian A. (ed.) *Housing Asia's Millions*, International Development Research Centre, Ottawa, 1979.

The World Bank, *World Development Report 1992: Development and Environment*, Oxford University Press, New York, 1992.

The World Bank, *Annual Report*, Washington DC, 1993.

The World Bank, *World Development Report 1994: Infrastructu and Development*, Oxford University Press, New York, 1994.

Tipple, A., *Towards a Culturally Acceptable Housing Strategy i Ghana*, Ph.D. Dissertation, University of Newcastle upon Tyne England, 1984.

Turner, J. and R. Fichter (ed.), *Freedom to Build*, MacMillan Co., New York, 1972.

Turner, J., "Housing Issues and Standards Problem", in *Ekistics*, Athens, March 1972.

Turner, J., *Housing by the People*, Pantheon Books, N.Y., 1977.

UN Department of Social and Economic Affairs, "Modular Coordination of Low Cost Housing", in *Ekistics*, Athens, February 1971.

UN, *Methods for Establishing Targets and Standards for Housing and Environmental Development*, United Nations (UN), New York, 1968.

UN, *The Improvement of Housing and Its Surroundings*, United Nations, New York, 1983.

UN Department of Economic and Social Affairs, *Housing Policy Guidelines for Developing Countries*, New York, 1976.

UN, Department of Economic and Social Affairs, *Climate and Housing Design of Low Cost Housing and Community Facilities*, N.Y., 1968.

UNDP, "Shelter for and by All", in *Development Forum*, UNDP, Jan.-Feb. 1987.

University of Trondheim and Norwegian Institute of Technology, *Project Kathmandu*, KVTPT, Kathmandu, Nepal, 1988.

USAID/HUD, *Proposed Minimum Standards*, No. 64, Washington DC, 1966.

Veiller, L., *A Model Tenement House Law*, Russel, Sage Foundation, New York, 1910.

WHO, "Expert Committee Report on the Public Health Aspects of Housing", WHO, 1961.

Woodford, G. (et al.), "The Value of Standards for the External Residential Environment", in *Ekistics*, Athens, Aug. 1977.

World Bank, *Housing Sector Policy Paper*, The World Bank, Washington DC, 1975.

World Commission on Environment and Development (WCED), *Our Common Future*, Oxford University Press, Oxford, 1987.

Yeh S. and A. Laquian, *Housing Asia's Millions*, International Development Research Centre, Ottawa, 1979.

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